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Title: PRAD0376: Buttler RMI into Neon Shot Report

Author(s): Alexander Saunders

Intended for: Archiving, public release

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Form 836 (7/06)

Bainbridge, Joseph	188457	DE-3
Bitteker, Leo	111476	LANSCE-NS
Brooks, Bethany	188462	P-25
Buttler, William	105916	P-23
Campos, Eduardo	188791	P-25
Dominguez, Jose	169395	P-25
Espinoza, Camilo	092843	P-25
Fait, Jeremy	225839	P-25
Grieves, Brian	none	AWE
Grim, Gary	188779	P-23
Hammerberg, James	100959	X-1-SMMP
Hogan, Gary	089987	P-25
Hollander, Brian	172536	P-25
King, Nicholas	023852	P-23
Lewis, Douglas	152683	NSTEC
Lopez, Julian	176436	P-25
Lopez, Robert	086557	DE-3
Lovro, Luke	235719	P-25
Mariam, Fesseha	094970	P-25
Marr-Lyon, Mark	113973	DE-3
McNeil, Wendy	196665	HX-4
Meidinger, Alfred	182754	NSTEC
Merrill, Frank	105671	P-25
Morley, Deborah	085596	P-25
Morris, Christopher	081720	P-25
Murray, Matthew	083303	P-25
Nedrow, Paul	089364	P-23
Rigg, Paulo	170311	DE-9
Rightley, Paul	118629	DE-3
Saunders, Alexander	133578	P-25
Schwartz, Cynthia	197376	P-25
Tainter, Amy	230139	P-25
Thompson, Neil	101120	P-25
Tupa, Dale	104583	P-25
Tybo, Joshua	182458	NSTEC
Vidisheva, Aleksandra	235952	P-25
Williams, Robin	none	AWE
Youngs, David	none	AWE
Zellner, Michael	216107	DE-9

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PRAD0376-Billy Butler-RM1 in Neon Gas

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- ☑ LANSCE APP. Form
- ☑ DE Shot Plan
- ☑ VAA App.
- ☑ Contained Shot Request
- ☑ Safety and Security Review
- ☑ Drawing
- ☑ Cartoon of Shot Set-Up
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Cast of Characters

Shot number: 376
Buttler RMI into Neon

Experimenter in Charge: Alexander Saunders
Principle Investigator: William Buttler
High Explosives Person in Charge: Mark Marr-Lyon
Firing Site Leader: Robert Lopez
Secondary FSL: Joe Bainbridge
Laser Person in Charge: Dale Tupa
Camera Point of Contact: Paul Nedrow
Analysis Lead: Chris Morris
Safety Watch: Eduardo Campos
Data Acquisition System Point of Contact: Neil Thompson
Experimental Area Manager: Leo Bitteker

PRAD Core Team

Joe Bainbridge, Bethany Brooks, Eduardo Campos, Jose Domingez, Camilo Espinoza, Jeremy Fait, Gary Grim, Gary Hogan, Brian Hollander, Nicholas King, Kris Kwiatkowski, Douglas Lewis, Julian Lopez, Robert Lopez, Luke Lovro, Fesseha Mariam, Mark Marr-Lyon, Wendy McNeil, Alfred Meidinger, Frank Merrill, Deborah Morley, Christopher Morris, Matthew Murray, Paul Nedrow, Paul Rightley, Alexander Saunders, Cynthia Schwartz, Amy Tainter, Terry N. Thompson, Dale Tupa, Joshua Tybo, Aleksandra Vidisheva

Experiment Team

William Buttler, Brian Grieves (AWE), James Hammerberg, Christopher Morris, Paulo Rigg, Cynthia Schwartz, Robin Williams (AWE), David Youngs (AWE), Michael Zellner

Proton Radiography Proposal Form

Submit to: Los Alamos National Laboratory, LANSCE User Office, Los Alamos, NM 87545
UNCLASSIFIED materials to MS H831, CLASSIFIED materials to MS H803

Title:	***(To be completed by LANSCE)***	
Richtmyer-Meshkov Instabilities into Gasses and Vacuum: Transport	**Number**	**Date Received**

Name of Shot Series
Number of shots previously fired in this series: 1 Classification level: U
Number of dynamic shots proposed: 4-8 Needs proofing [ ] Has been proofed [X]

Number of static measurements proposed (describe):
Static measurements may be needed to extract relevant densities and parameters with enough precision for successful modeling of the acquired data. We need enough static measurements of to fulfill the above.

Principal Investigator: William T. Buttler Citizenship: US
Institution & Address: LANL, MS H803, Los Alamos, NM 87545
Phone: 505-665-1071 Fax: 505-667-4121 E-mail: buttler@lanl.gov

Co-Investigators (attach additional sheets if necessary)	**Institution**	**Citizenship**	**E-mail Address**
Cynthia Schwartz (P-25)	LANL	US	cschwartz@lanl.gov
Paulo Rigg (DE-9)	LANL	US	prigg@lanl.gov
Chris Morris (P-25)	LANL	US	cmorriss@lanl.gov
Jim Hammerberg (X1-SNMP)	LANL	US	jch@lanl.gov
Michael Zellner (P-23)	LANL	US	mzellner@lanl.gov
David Youngs (AWE)	Atomic Weapons Establishment	UK	david.youngs@awe.co.uk
Robin Williams (AWE)	Atomic Weapons Establishment	UK	robin.Williams@awe.co.uk
Brian Grieves (AWE)	Atomic Weapons Establishment	UK	brian.grieves@awe.co.uk
other pRAD team members			

Primary pRAD Team **Kris Kwiatkowski (P-23)**

Estimated amount of beam time for static and dynamic experiments: **one week in 2nd run cycle**
Dates Desired: Impossible Dates:
Milestone requirements from external programs (describe):
C1 and C2 are supporting this FY08 effort. We are seeking continued funding for FY09.

For statistical purposes, please categorize your proposal:

RESEARCH AREA (check all that apply)	**FUNDING AGENCY (check all that apply)**
[ ] Defense Science	[X] DOE/DP (campaign) C1, C2
[ ] Engineering	[ ] LDRD (title)
[X] Materials Science	[ ] DOD
[ ] Medical Applications	[ ] Industry (describe)

☐ Nuclear Physics	☐ Other US Gov't: _____
☐ Other: _____	☐ Other: _____

PROTON RADIOGRAPHY SAFETY & EXPERIMENTAL DETAILS

Shot Configuration

[x] Explosive Experiment
Forest Flyer (P100 + _ inch 9501 booster)

[x] Gas handling systems (specify):
Being designed

HE weight (TNT eqv.) _____ (<____ lbs) Type:

Fire set requirements (specify proposed detonator and special fire set needs):

Firing Temperature (specify acceptable range):

Inert Materials

Material:
Aluminum, Tin, phenolic, copper, and possibly other

Quantity:

Radiographic Configuration

Minimum Field of View: ~4cm

Minimum # of Frames: 30

Timing requirements Explosive: **TNT, PBX 9501** Spacing: **200ns and 1-2 _s at later times**

[ ] 4' vessel, -I system, two planes ~14-21 radiograph times, 120 mm FOV

[X] 6' vessel, x3 Magnifier, two image planes ~32 radiograph times, 40 mm FOV

[ ] 4'vessel, -I X3 system, one image plane, 5-7 radiograph times, 40 mm FOV

Optical magnification (specify):
X1 and x3

Scintillator requirements (specify):
LSO mosaic

Static Measurements: possible static tomographic measurements on one of the recovered target

Motion Control:

Alignment:
Standard transit alignment is adequate

Describe Radioactive Materials:
LSO scintillators in the image planes

KHKIJ

PROTON RADIOGRAPHY SAFETY & EXPERIMENTAL DETAILS (Continued)

Diagnostics

[X] VISAR with a large stand-off distance (6cm) or PDV (minimum number of measurement points): **one or two**

[ ] Pins (specify material, type number and readout requirements):

[ ] Other:

Safety

[ ] Proposed experiment known to be outside existing authorization basis (if yes, explain):

[ ] Proposed experiment introduces known hazards outside existing HCP (if yes, explain):

Status

[ ] Parts have been designed.

[x] Parts have been designed, **some** not fabricated. Specify expected fabrication date: by mid May 2008

[ ] Parts have been fabricated, ready for proof or experiment.

Pre-shot Calculations

[x] Pre-shot calculations have been completed (describe):
AWE has performed calculations. X-1 is performing calculations. Models are being validated in X-1 and elsewere.

[ ] Pre-shot calculations have not been completed (expected completion date):

I certify that the above information is correct to the best of my knowledge. **E-mail submission by the Principal Investigator constitutes signature. Do not follow up with a hard copy.**

William T. Buttler **23 January 2008**

Signature

Printed name
Date

DETAILED DESCRIPTION OF THE EXPERIMENT OR ACTIVITY

(Describe the science of engineering research being addressed, importance, and a description of how this experiment campaign will contribute to the progress of this research.)

Richtmyer-Meshkov Instabilities into Gasses and Vacuum: Transport

W. T. Buttler, C. Schwartz, P. A. Rigg, C. Morris, J. E. Hammerberg, and M. B. Zellner, Los Alamos National Laboratory

G. Bazan and R. Minich, Lawrence Livermore National Laboratory

B. Grieves, R. Williams and D. Youngs (Atomic Weapons Establishment)

We propose continuation of the FY08 Richtmyer-Meshkov instability (RMI) experimental series in FY09. The campaign is characterized by a set of first- and second-shock RMI experiments, both into gasses and into vacuum to investigate ejecta formation, ejecta transport, and particle break-up models (LLNL is investigating five different particle break-up models and they need data to validate their transport model).

One RMI experiment was previously fielded at pRAD [1] with the Forest flyer (FF) [2], and two more are planned this year. The initial experiment was characterized by a single sinusoidal mode (SM) on a Sn target shocked to near 600 kbar by an Al FF. Those pRad data are presented in Fig. 1. The Sn melted on shock and a SM RMI formed. That experiment was successfully modeled by the AWE [1]. The experimental data proved an excellent code validation for AWE. Their latest-time image is seen in the lower right corner of Fig. 1.

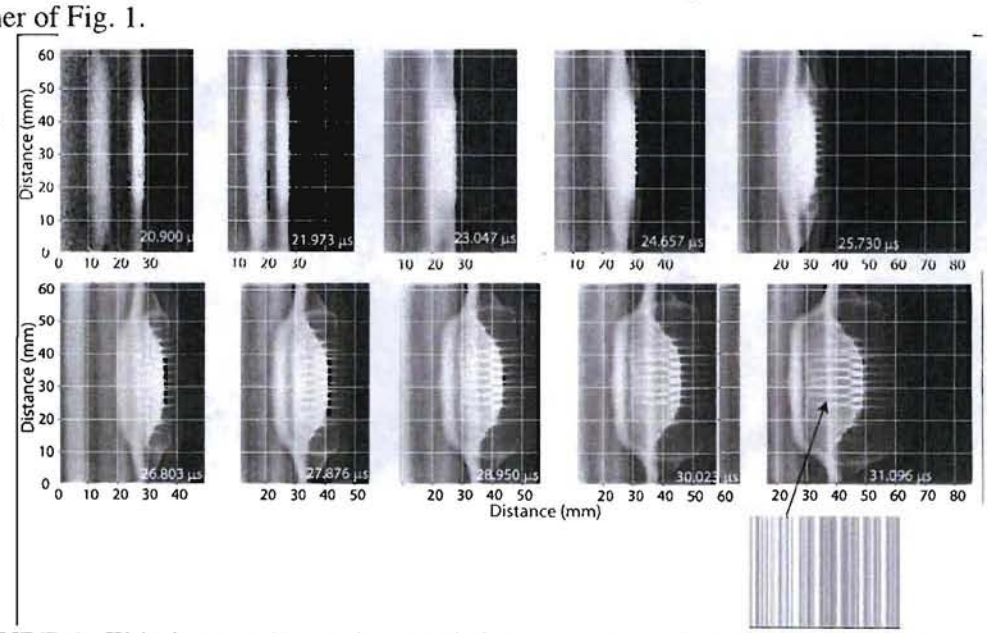


FIGURE 1: This image shows the pRad time-sequence of the flyer and target prior to impact, as well as the RMI growth after impact. The first three images are of low resolution display the Al impactor in flight and up to impact with the Sn target. The final images show the RMI evolution and growth. The images are nominally separated in time by 1-1.3 µs.

This effort supports current Los Alamos National Laboratory (LANL) experimental activities to understand ejecta formation and transport. The present working model for Sn is notionally seen to the left in Fig. 2. The model is extended from early works by Asay from the 1970s [3]. Asay worked from supported shock data, or gas gun measurements. He also typically worked with materials that shocked and released to a solid material phase, such as Cu, for the accessible pressures in the materials just prior to release, or what we call P_{SB}. The accessible pressures were limited by the guns available to him. He also typically worked with what we refer to as *classical* grooves, or materials with deep trenches carved in their surfaces. His observation was that these materials ejected the mass associated to defect volume. Buttler et al [4] extended this work to HE drives on roughened finishes, or finishes typical of tooling marks left by the machining process.

The figure on the right in Fig. 2 presents Taylor wave ejecta studies of Sn shocked with PBX-9501 to a variety of P_{SB}s. We have data with $P_{SB} \approx 160$- and 185-kbar, for Sn below melt-on-release. These jetting factors show $R(\theta) << 1$, in contradiction with Asay's early works depicted on the left in Fig. 2. These data are from samples prepared with a single finish, or tool that gave a roughness of $R_a \approx 32$ μin. ≈ 0.8 μm. The nominal peak to valley depth for this finish is $h \approx 4R_a = 3.25$ μm; this is not a *classical* regime.

As seen in Fig. 2, the data support the notional model. We have a gap in a relevant pressure regime and it is of interest to acquire data there. However, the data we have collected support the conclusion that ejecta production are an RMI process with and without strength when the release state is partially liquid.

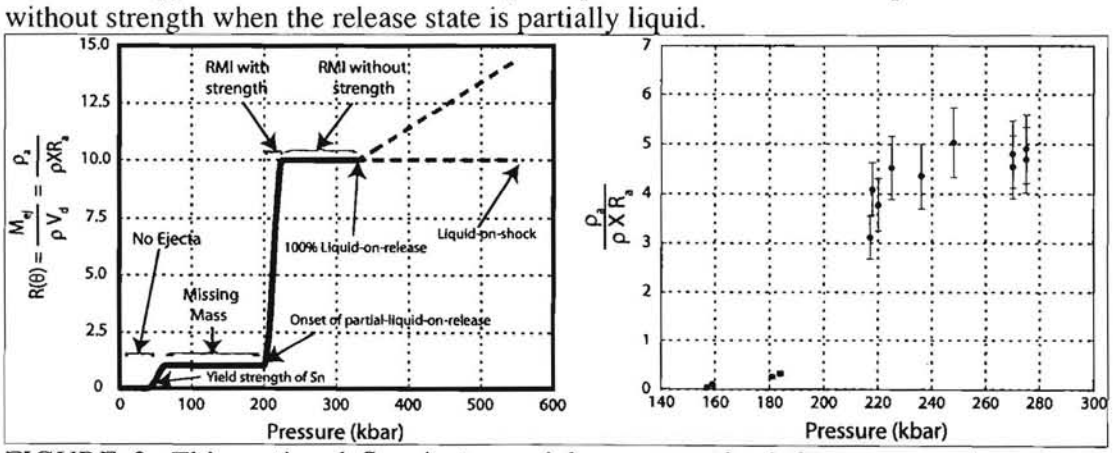


FIGURE 2: This notional Sn ejecta model, seen on the left, assumes ejecta are a phenomena tied to surface defects and material strength. If the yield strength Y is exceeded, it is thought that the ejected mass relates the defect volume mass. When the material releases to liquid, it is thought that ejecta physics are linked to RMI formation without strength beyond simple surface tension, and it is thought that there is a transition region in which the ejecta physics are an RMI with strength beyond simple surface tension. The figure on the right presents measured ejecta jetting factors.

Current efforts at LANL to support ejecta model development and fragmentation theory is broad, including theoretical support from Jim Hammerberg (X-1-SMMP), Guy Dimonte (X-1), Ann Kaul (X-1-PTA), Dean Preston (P-22) and Jimmy Fung (X-3-LGRN). Hammerberg and Preston have developed the present LANL model and are working with Fung to implement the model into LANL codes. Dimonte has demonstrated a strong correlation between our complete Sn ejecta data set and the RMI hypothesis [5]; Kaul is modeling the RMI data we have with current X-Division codes. Experimental efforts are also broad, including William Buttler (P-23), Mike Zellner (P-23), Paulo Rigg (DE-9) and Russ Olson (P-22). Other collaborators on the RMI effort include AWE and LLNL personnel.

Above the melt-on-release pressure of nominally 200 kbar, material ejection is thought to be characterized by a RMI process where the material has residual strength above simple surface tension, followed by a region of RMI without strength beyond simple surface tension. We have not sampled this RMI with strength region well, but we see differences or phenomena in the data that infer this region exists. The data with $215 \leq P_{SB} \leq 225$ displayed residual strength as evidenced by regions of low and high volume densities beyond the free surface (data not shown here).

It is also widely thought that second shock, or re-shock, ejecta phenomena are important. We have demonstrated a capability to form second shock ejecta with gas guns. The initial second shock experiment on roughened surfaces accessed first shock pressures below 180 kbar with a second shock on the order of 90 kbar. Another second shock experiment accessed a first shock pressure of 215 kbar with a second shock of about 110 kbar. These second shock regimes are of interest with the RMI studies as we can access a first shock above Y, but below the critical pressure where Sn begins to melt on release, a first shock above the critical pressure of melt on release, and in both cases the first shock is followed by a second shock that should drive the material near or to a full liquid release state. These again are relevant experiments that allow us to develop ejecta formation and transport models, as well as allow us to validate current models with wel studied materials.

The current FY08 effort is in the development stage and will include one RMI experiment into vacuum and one into gas. Targets have been designed and are being manufactured in MST-7.

In considering other relevant code validation experiments, after discussions with AWE and LLNL we propose the following continuation experiments:

1) Utilizing the pRad powder gun, both single and double shock experiments into vacuum and gas on SM targets. A complete set of experiments requires fielding experiments with the first shock below melt-on-release ($P_{SB} \approx 180$ kbar), and with the first shock above melt-on-release ($P_{SB} \approx 215$ kbar), both with the second higher kick of ~100 kbar. We may use the x3 magnifier.

2) Same as above experiments, but with multi-mode (MM) Sn targets into gas and into vacuum. The MM target has been designed. The target incorporates varying wavelengths, and varying amplitudes and wavelengths in a single target. We may use the x3 magnifier.

Experimental set 1) is also not difficult to accomplish. These experiments include MM targets into vacuum and gas, with both first and second shock conditions on a material with strength where the strain rate is dominant, in contrast with the melt-on-shock experiments that are dominated by surface tension. A full suite of experiments will include: (a) SM experiments with first shock below melt-on-release and the second shock of an additional ~100 kbar into vacuum and gas, and (b) SM experiments with first shock above melt-on-release and the additional ~100 kbar on second shock, both into vacuum and gas. (This would be about four total experiments.)

Experimental set 2) is a repeat of 1), but with MM Sn targets. The MM-target has been designed and would utilize the same Forest Flyer drive; the experiments are into gas and vacuum, and includes the full spectrum of below melt-on-release ($P_{SB} < 200$ kbar), above melt-on-release ($P_{SB} > 220$ kbar), and above melt-on-shock ($P > 550$ kbar). (This would be about four experiments.)

The double shock experiments in principle are not difficult. PA Rigg, RT Olson and WT Buttler are presently engaged in double shock source term measurements on a DE-9 powder gun [4,6]. One experiment was fielded last year and targets for about four double shock experiments are being prepared in MST-7 at this time (not instability targets, but rough-finish targets [7-9]). The difference in the current double shock ejecta work and these proposed experiments are the large sinusoidal modes of these targets (the DE-9 work is with rough surfaces with wavelengths on the order of a hundred microns, whereas the instability work has wavelengths on the order of a millimeter). A difference between instability experiments on the pRAD powder gun and FF is the accessible pressures: with the FF we melt on shock, but on the powder gun we either release-to-solid or release-to-melt on 1st shock, and the 2nd shock is on that released state, i.e., these experiments would be RM instability with strength. These experiments will provide a strong challenge of our best codes.

Data will be delivered to X-1, X-4, LLNL (G. Bazan and R. Minich) and AWE collaborators (Robin Williams, Brian Grieve and David Youngs). The data will be reduced and analyzed by the pRad team (C. Schwartz, C. Morris and W. T. Buttler processed and analyzed the first RMI data fielded with the FF). W. T. Buttler and C. Scwhartz will report on the data for X-Division. Every effort will be made to publish the data as allowed.

In out years, we would transition to other materials and look at corrosive gasses. The costs go up for those shots as the procedures and requirements become more complex. Realistically it makes sense to pursue the corrosive shots in parallel with this effort.

Relevant publications and reports:

[1] W. T. Buttler, C. L. Schwartz, C. Morris, J. E. Hammerberg, R. S. Hixson, G. E. Hogan, F. Mariam, F. E. Merrill, K. B. Morley, P. Nedrow, K. P. Prestridge, A. Saunders, D. Shampine and D. P. Smitherman, "2D Richtmyer-Meshkov instability growth in liquified tin," LA-UR-06-4998 (Manuscript in preparation).

[2] C. A. Forest, R. L. Rabie, L. Bennett and J. Vorthman, "A novel explosively driven flyer plate system," Proc. 11th International Detonation Symp., Snowmass, Co (USA), 30 Aug to 4 Sept 1998; Office of Naval Research Publication, ONR 33300-5 (2000).

[3] J. R. Asay, "Ejection of material from shocked surfaces," Appl. Phys. Lett **29**, 284 (1976); J. R. Asay, "Effect of shock breakout rise time on material ejection from aluminum surfaces," SAND-77-0731 (1977).

[4] W. T. Buttler and M. B. Zeller, "Tin ejecta data review: toward a statistical material fragmentation model," LA-UR-07-6522, Milestone 2478.

[5] Personal communication and collaboration.

[6] W. T. Buttler, R. S. Hixson, N. S. P. King, R. T. Olson, P. A. Rigg, and M. B. Zellner (from LANL) and N. Routley and A. Rimmer (from AWE), "Method to separate and determine the amount of ejecta produced in a second-shock material-fragmentation event," Appl. Phys. Lett. **90**, 151921 (2007).

[7] W. S. Vogan, W. W. Anderson, M. Grover, J. E. Hammerberg, N. S. P. King, S. K. Lamoreaux, G. Macrum, K. B. Morley, P. A. Rigg, G. D. Stevens, W. D. Turley, L. Veeser and W. T. Buttler, "Piezoelectric characterization of ejecta from shocked Sn surfaces," J. Appl. Phys. **98**, 113508 (2005).

[8] W. T. Buttler, M. B. Zellner, R. T. Olson, P. A. Rigg, R. S. Hixson, J. E. Hammerberg, A. W. Obst, and J. R. Payton (from LANL), and A. Iverson and J. Young (of NSTec), "Dynamic comparisons of piezoelectric ejecta diagnostics," J. Appl. Phys. **101**, 063547 (2007).

[9] M. B. Zellner, M. Grover, J. E. Hammerberg, R. S. Hixson, A. Iverson, G. Macrum, K. B. Morley, A. W. Obst, R. T. Olson,J. R. Payton, P. A. Rigg, N. Routley, G. D. Stevens, W. D. Turley, L. Veeser and W. T. Buttler, "Effects of shock breakout pressure on ejection of micron-scale material from shocked Tin surfaces," J. Appl. Phys. **102**, 013522 (2007).

RMI Design Review: Ejecta Model Development
William T. Buttler

Ejecta Working Group:

- Working Group Lead, customer: G. Dimonte (X-1)
- DE-9: M. B. Zellner
- P-23: W. T. Buttler and D. Oro
- X-1: J. E. Hammerberg
- X-3: Alan Harrison
- X-4: G. Terrones
- T-1: T. Germann
- T-4: B. Plohr
- Others: pRad core team, NSTEC-STL

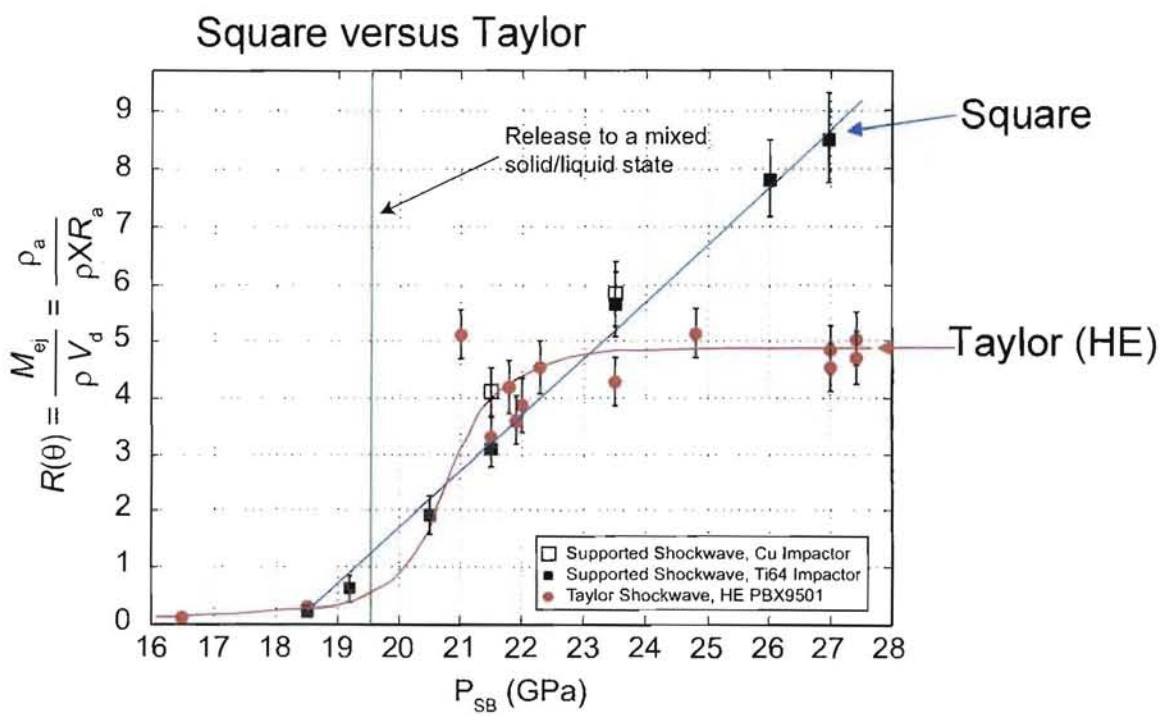
Effort integrates theory, modeling, model development, and experimental HE and gun data.

Diagnostics includes Proton and X-radiography, velocimetry, Asay Barriers, Piezoelectric-probes, Optical shadowgraphy, others in development.

KEY ASSUMPTION: EJECTA ARE FORMED AS A RICHTMYER-MESHKOV INSTABILITY

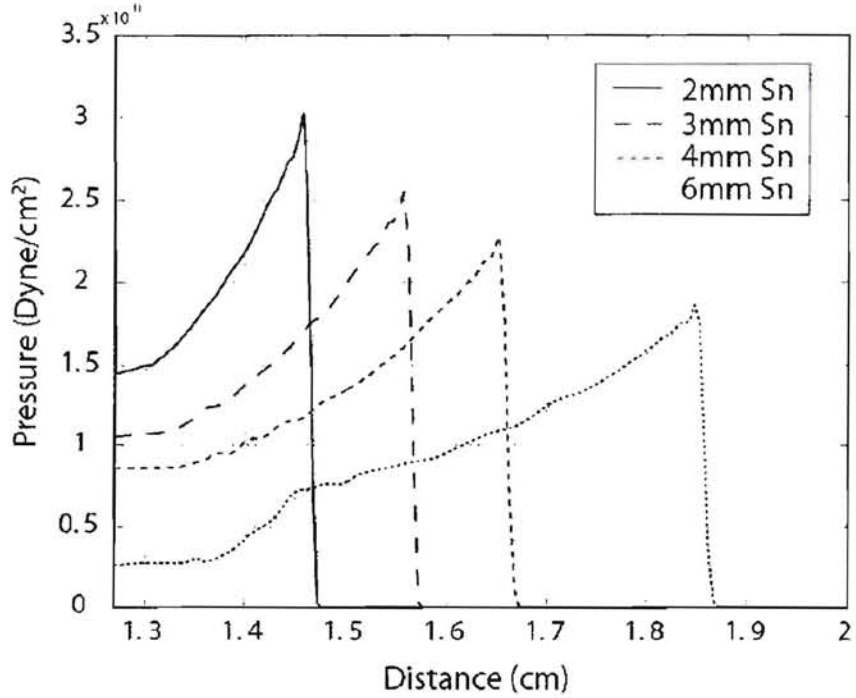
Remarkable differences seen in measured ejecta production for supported vs. Taylor shockwave loading ($18.5 \leq P_{SB} \leq 27.5$ GPa)

- Pressure Variation
- Taylor
  - Varied target thickness: 2 to 7.5 mm (varies release strain-rate)
  - HE Thickness: 0.35 or 0.5 inches (also varies strain rate)
- Gun
  - Varied sabot velocities (fixed release strain rate)
  - 2 mm thick targets.
- Recent investigations measured release strain rates with VISAR on Sn surfaces under LiF windows at STL.

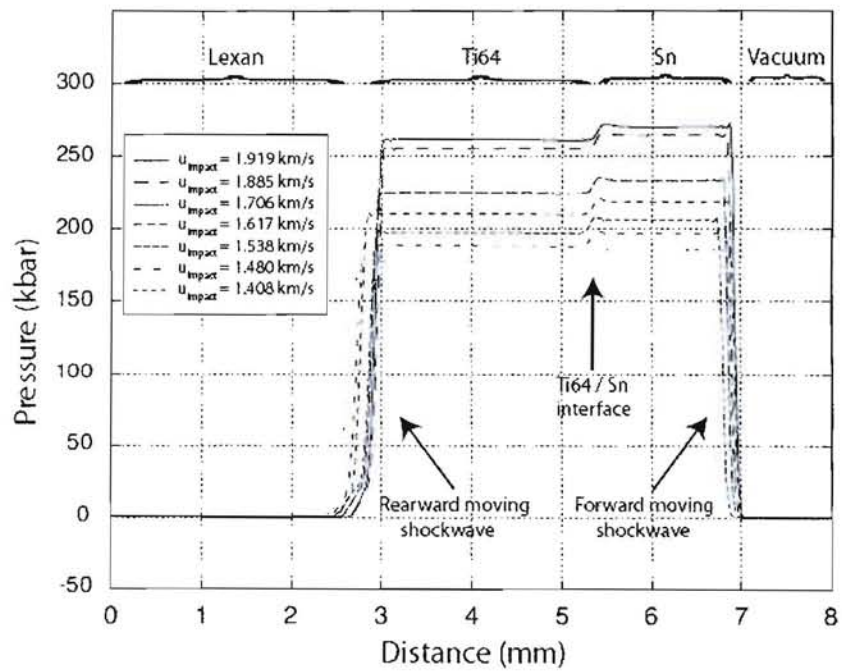


Taylor Wave vs. Supported shockwave dynamics

Calculated Taylor Profiles for varying Sn thicknesses



Calculated supported profiles for varying Sn impactor velocities

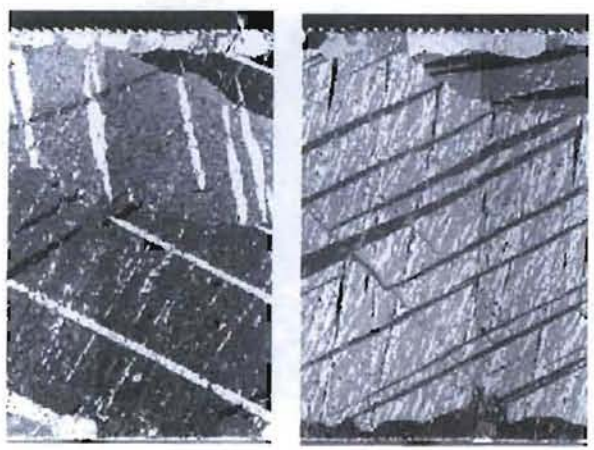


KEY ISSUE: Do large scale RMI finishes (single mode sine waves), scale to smaller scale roughened surfaces.

Sn (ESPI, 0.99995 purity)

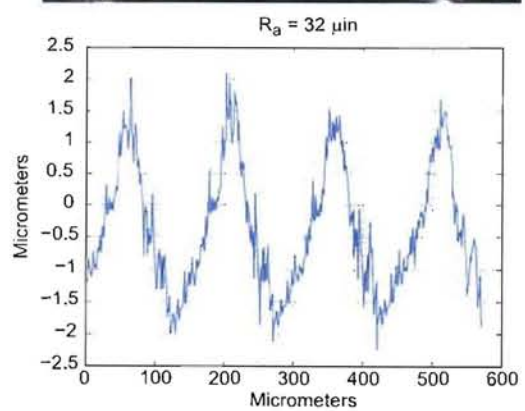
- Machine finishes (Fly-Cut grooves, R_a = 16 to 250 μin.)
  - Same rotation angle/feed rate/fly-cut radius, rake angle
  - Most experiments done with a single tool
  - Same machine and tool holder
  - Felix—Machinist with MST-7

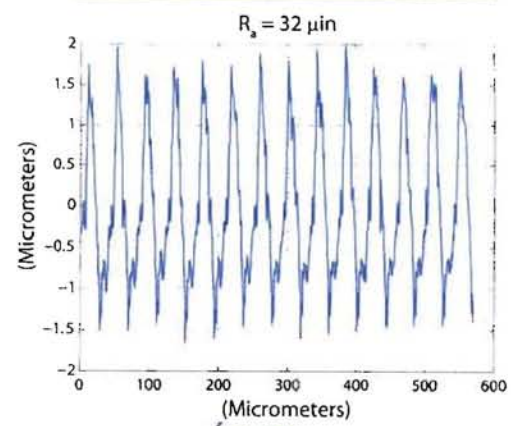
R_a = 200 μin.



1 mm 1 mm

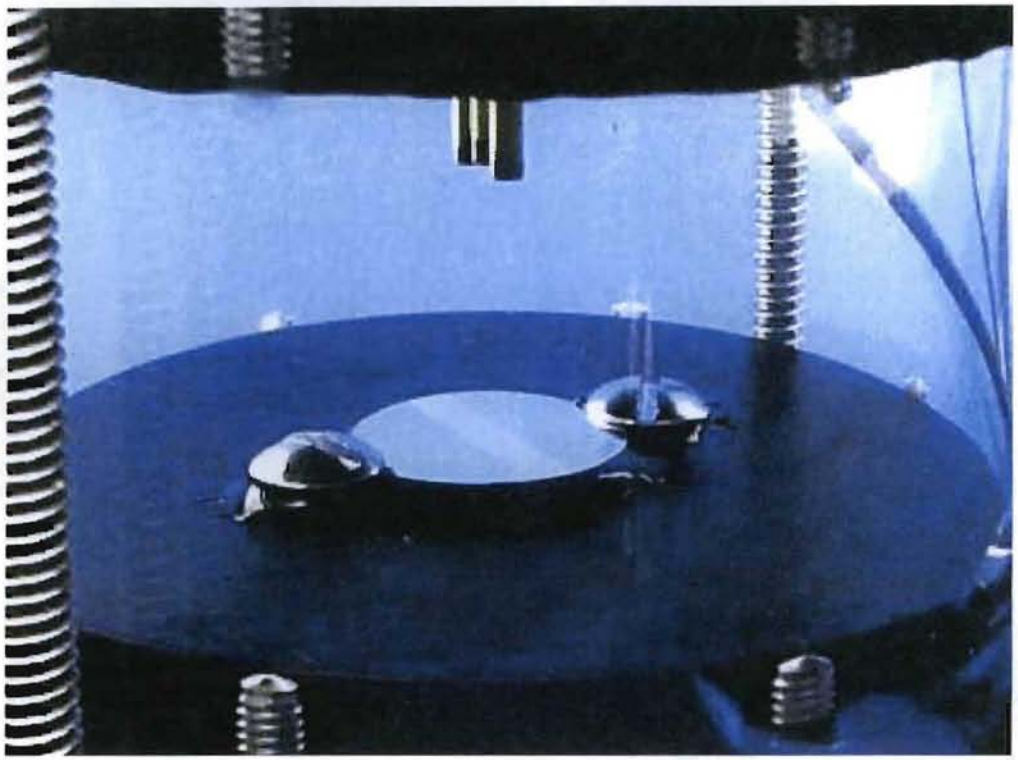
R_a = 32 μin.

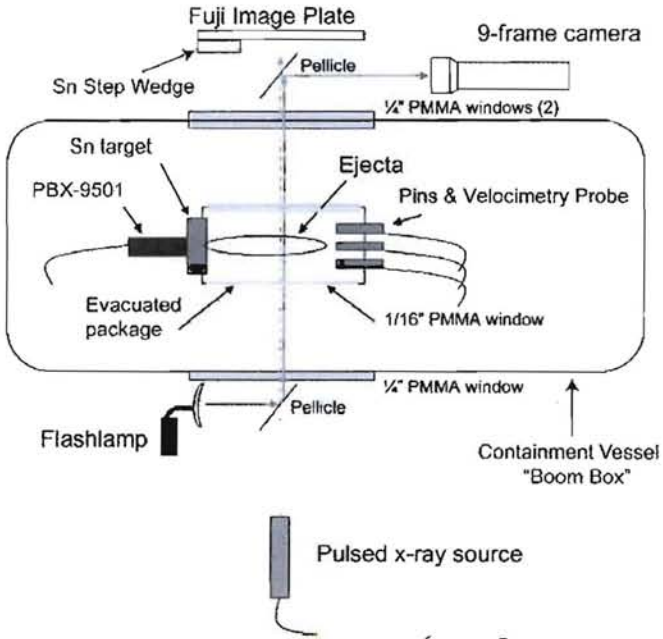




Transport Experiments at STL: HE experimental setup

Transport: 5 bar He, Particle Sizing





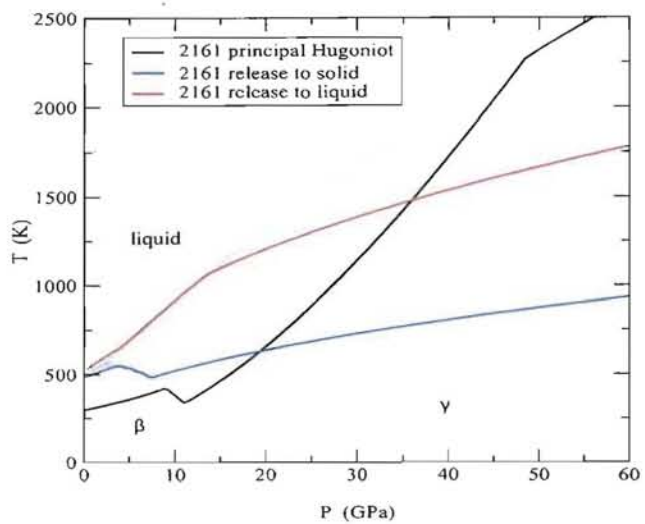
Ejecta (HE source term) Physics Based Model

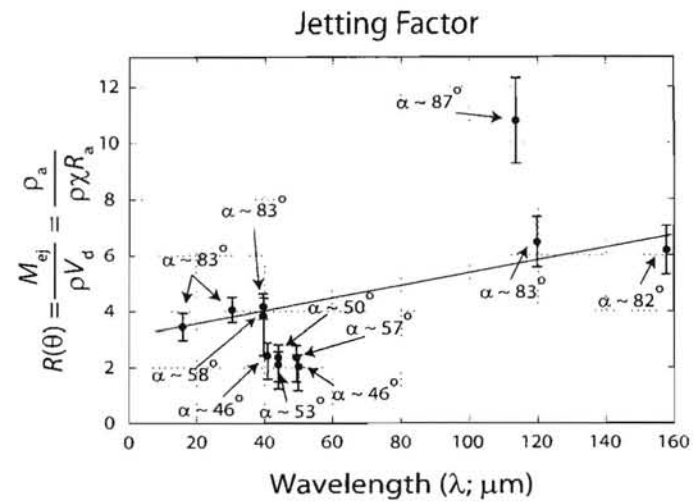
Fig.1: Multiphase Sn EOS (SESAME 2161)

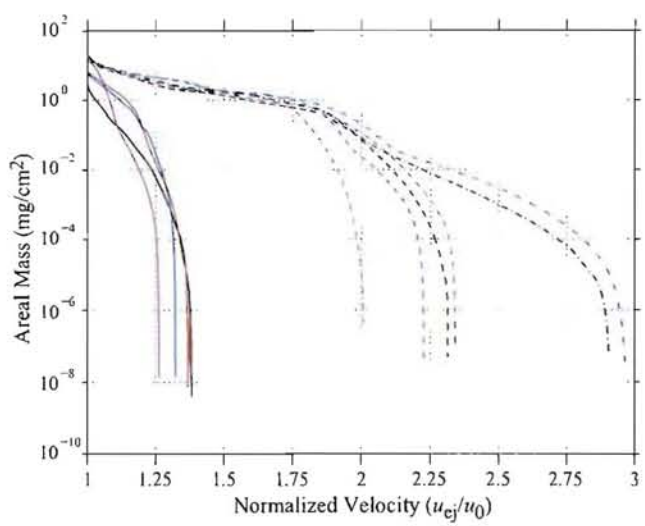
Fig. 2: Jetting factors vs. wavelength and ½ angle, 22.5 < P < 29.0 GPa

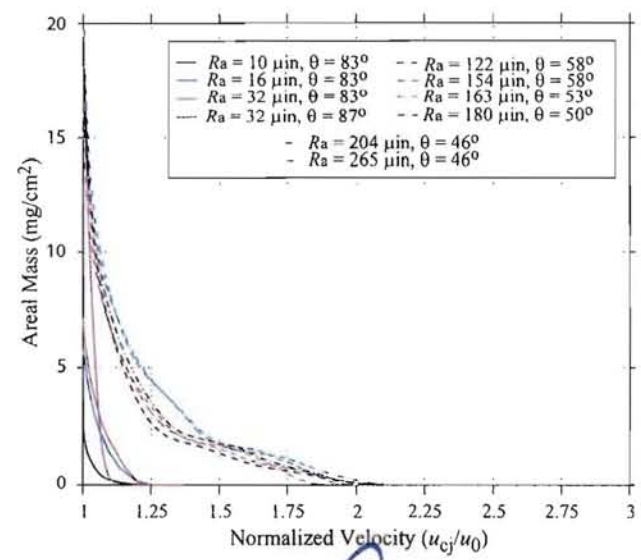
Fig. 3: Semilog of Accumulative areal mass vs. ejecta velocity normalized to free-surface velocity

Fig. 4: Accumulative areal mass vs. ejecta velocity normalized to free-surface velocity





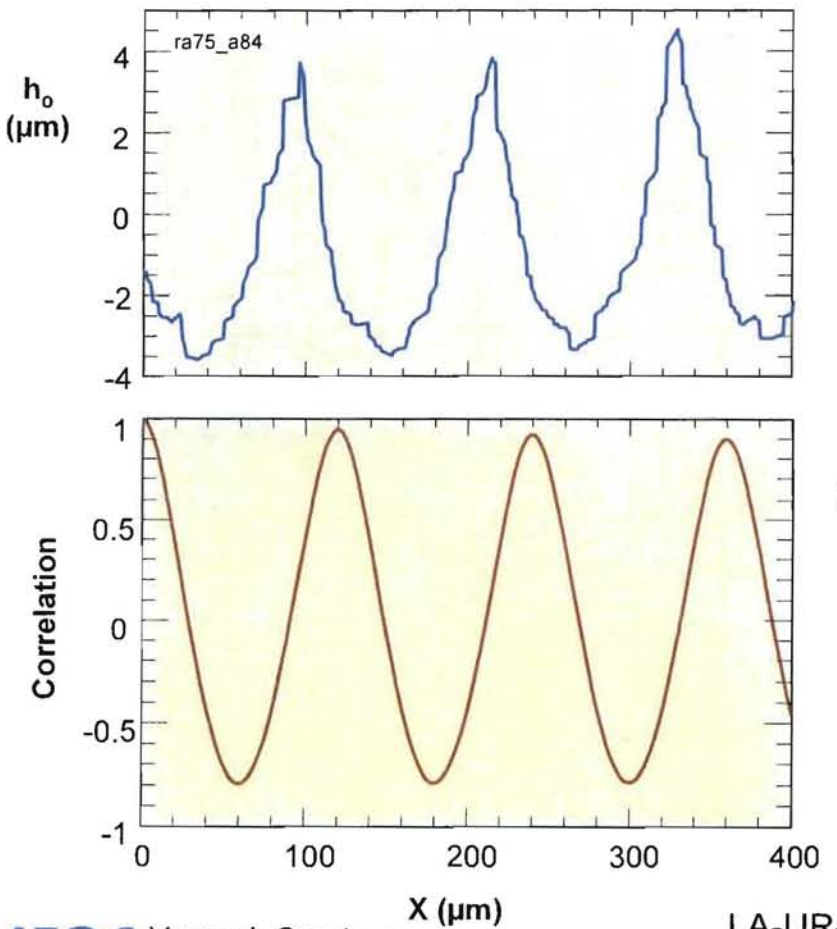




Ejecta is produced by RM instability with saturated bubble at $k\Delta h_b \leq 2$

Most initial perturbations are nearly single mode, and are obtained from auto-correlation with a sine function: $C(\Delta x) = \int h(x)\, h(x+\Delta x)\, dx \,/\, \int h^2(x)\, dx$

λ = 120 μm

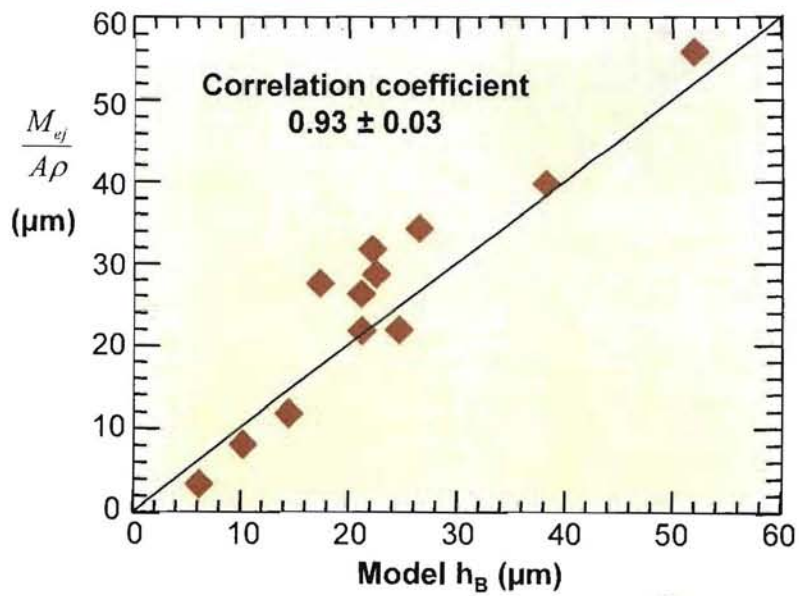


Evolve to t = 1 μs or saturation

$$h_B = h_o + \frac{1}{F_B k}\ln\left(1 + F_B V_{MB} k t\right) \leq h_o + \frac{2}{k}$$

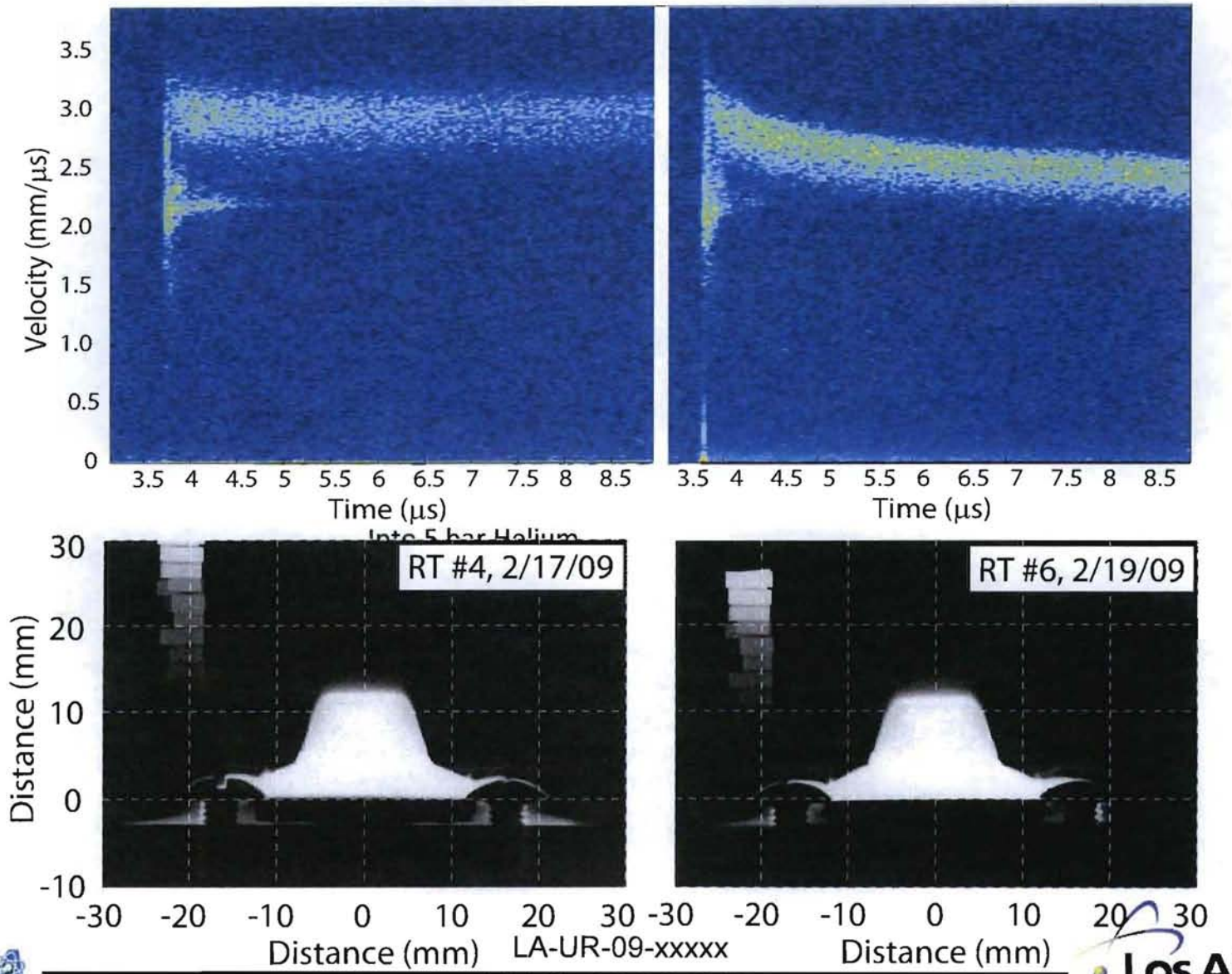
$$V_{MB} = 0.6 U k h_o = 1.14\, k h_o \ km/s$$

$$F_B(A=-1) \sim 2$$



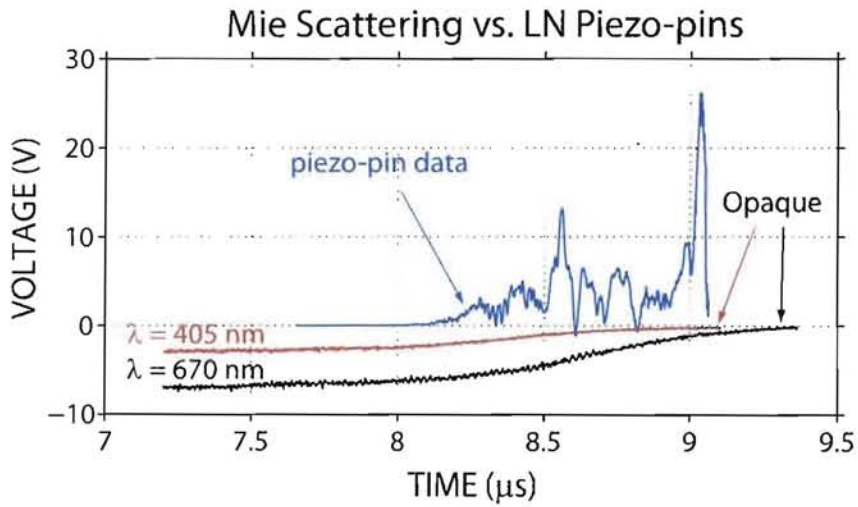
Vugraph Courtesy Of Guy Dimonte

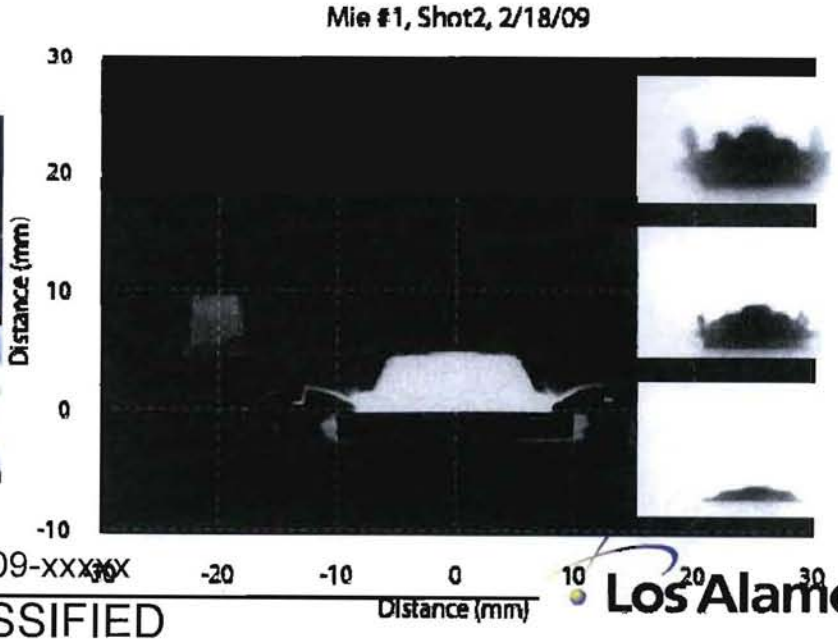
Transport: Olson Finish



Particle sizing proof of principle : Multi-λ Mie scattering

- Develop a particle sizing diagnostic
  - Mie scattering using 2 wavelengths (405 and 670nm)
- Prove target geometry useful for ejecta particle sizing measurements
- Future measurements could incorporate many wavelengths and/or holography
- Results being modeled by X-division collaborators





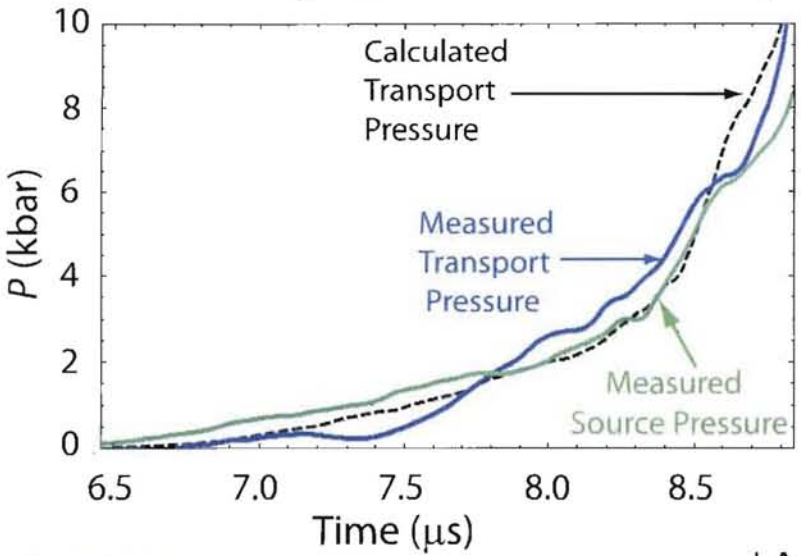
Modeling Vacuum and Gas Ejecta Distribution Function Evolution

- The experimental piezo-pin response gives information about the source distribution function $f_0(v,m)$
- Initial results for Sn in Vacuum and He gas may indicate the influence of mass velocity correlations in $f_0(v,m)$

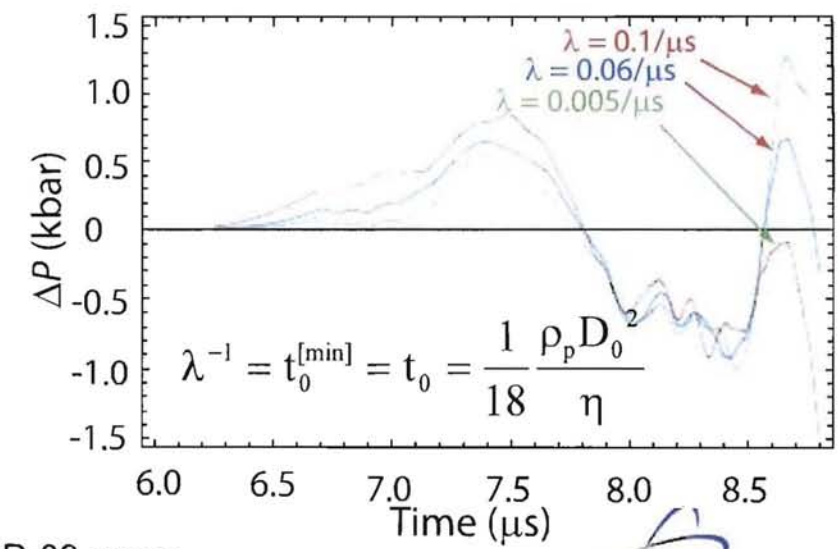
$$\rho(z;t) = \frac{1}{A}\int \frac{1}{\tau(t)} f_0\left[v_{fs} + \frac{(z - v_{fs}t)}{\tau(t)}, m\right] m\,dm$$

$$P(t) = \frac{1}{A}\int \frac{1}{\tau(t)} f_0\left[v_{fs} + \frac{1}{\tau(t)}(z - v_{fs}t), m\right]\left(v_{fs} + \frac{1}{\tau(t)}(z - v_{fs}t)e^{-1/t_0}\right)^2 m\,dm$$

Olson Finish: Ejecta Source and Trasnport



Calculated - Experimental Pressure



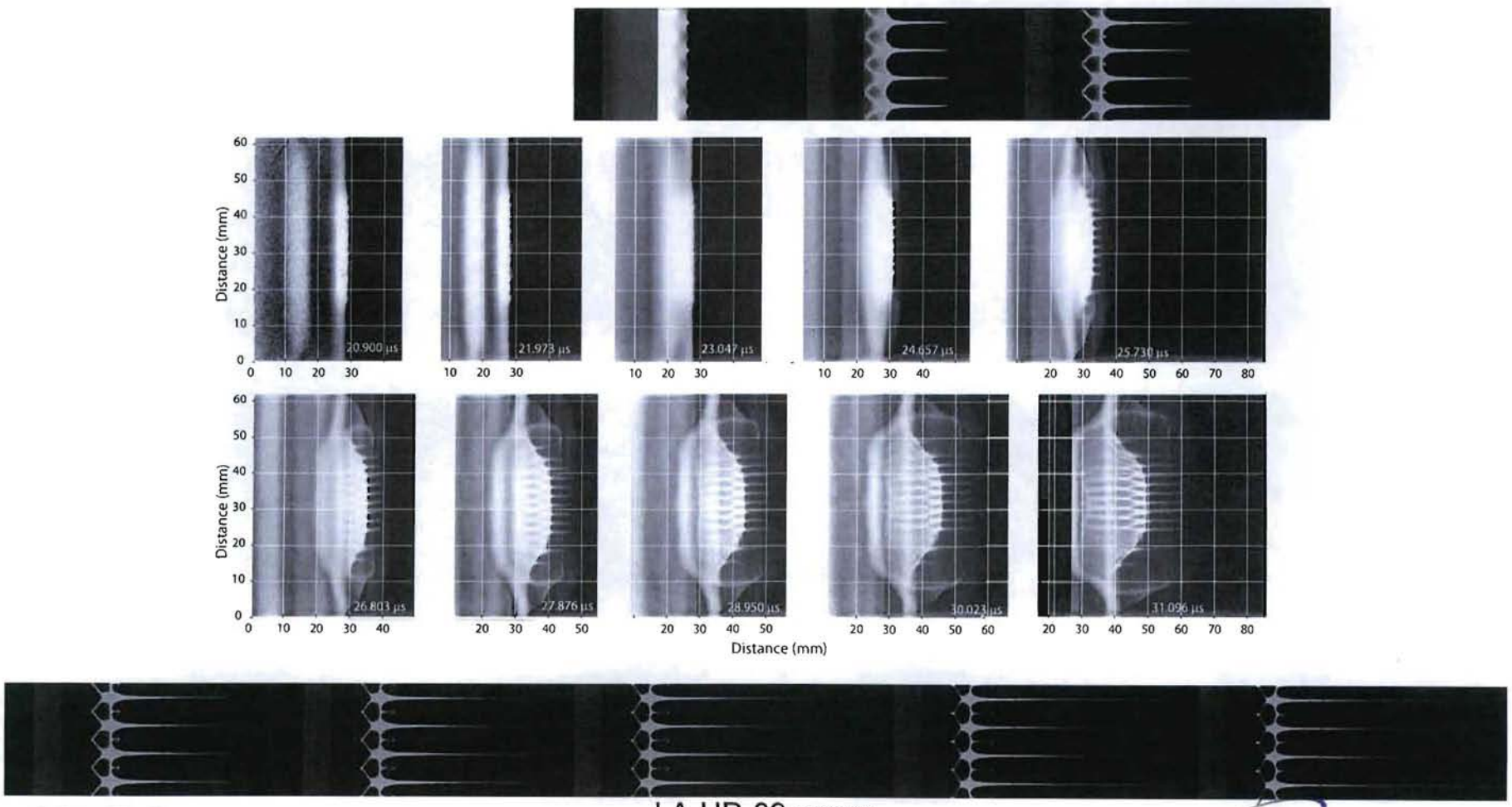
J. E. Hammerberg (X-1)
B. J. Plohr (T-4)

pRad RMI Experiments: Goal is to Acquire RMI data for use in code and model validation and ejecta source term model development

- pRad images are unique.
  - AWE has used RMI data for hydro-code validation
  - Ejecta are thought to be RMI phenomena
  - Using past experimental results with hydrodynamic modeling to inform experiment design and to target RMI questions relative to ejecta model development and transport

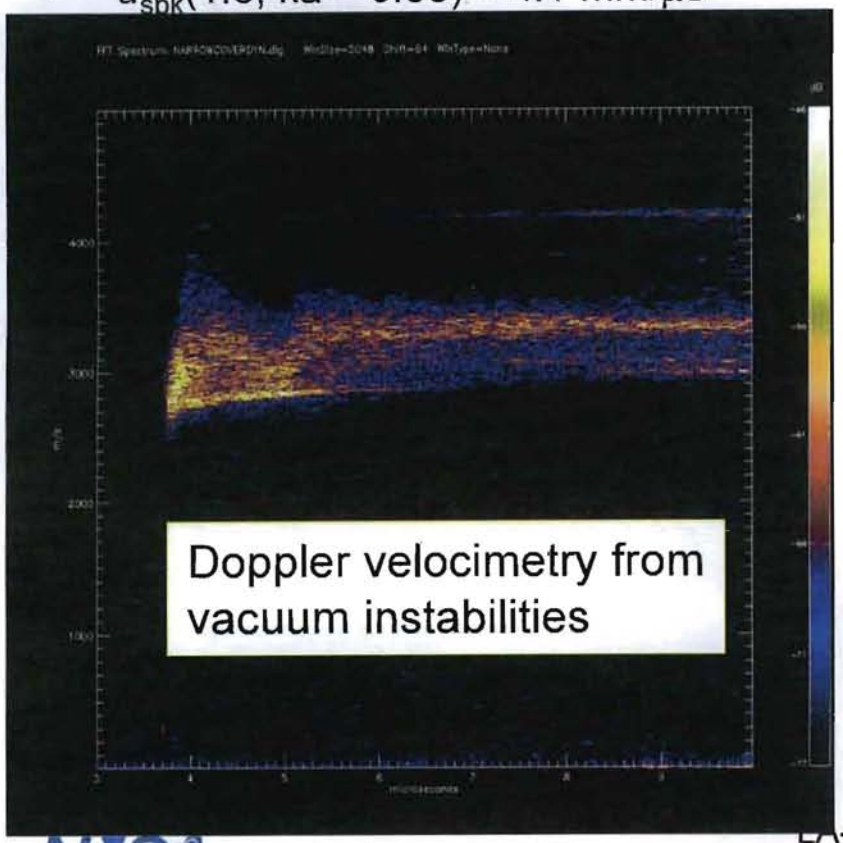
2004 pRad Data with AWE Calculation

- Guillermo Terrones presently calculating this experiment in X-Division

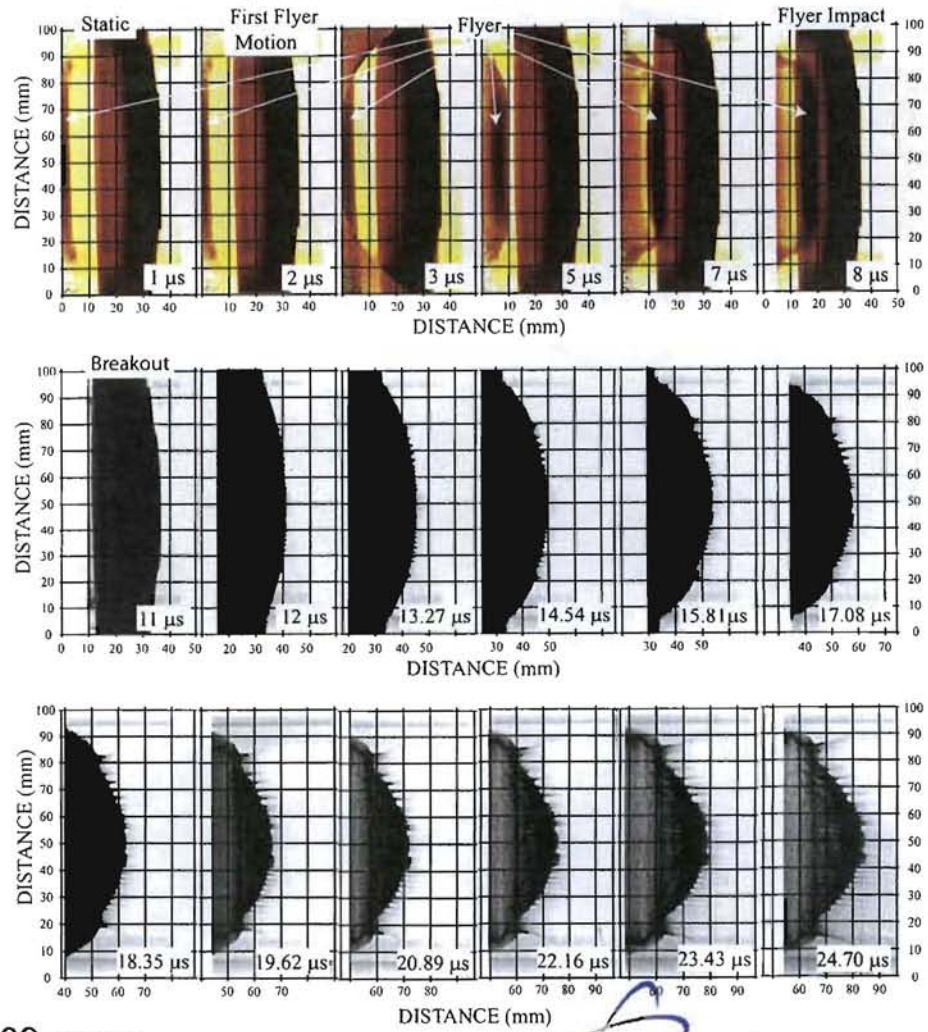


RMI (vacuum) source at pRad (2008 Data)

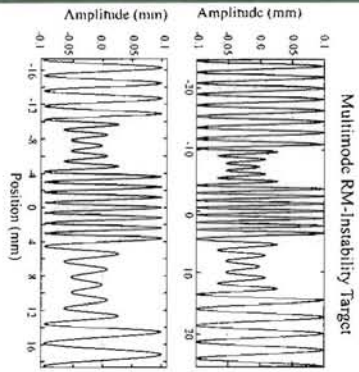
- u_{flyer} ~ 4.0 mm/μs
- u_{bbl} (2.7, ka = 0.23) = 3.0 mm/μs
- u_{bbl} (1.2, ka = 0.52) = 3.5 mm/μs
- u_{bbl} (21.8, ka = 0.35) = 3.0 mm/μs
- u_{spk}(2.7, ka = 0.23) = 3.7 mm/μs
- u_{spk}(1.2, ka = 0.52) = 4.7 mm/μs
- u_{spk}(1.8, ka = 0.35) = 4.1 mm/μs



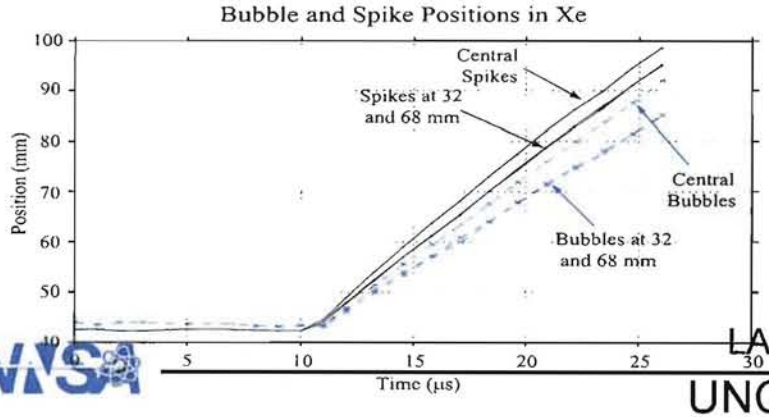
Richtmyer Meshkov: Liquified Tin into Vacuum



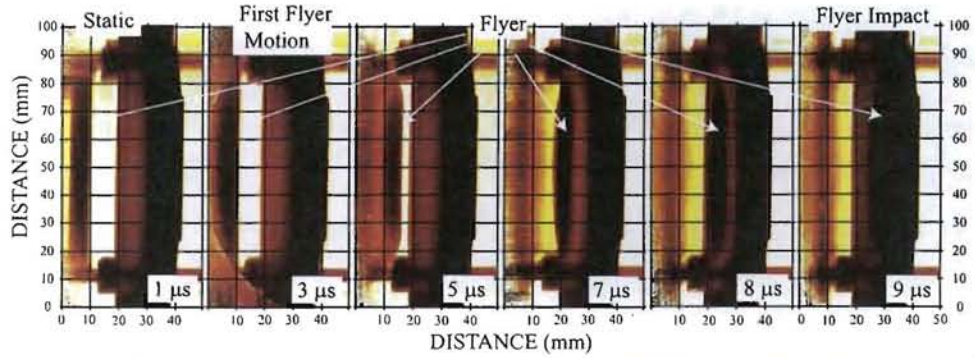
RMI transport at pRad (2008 Data)

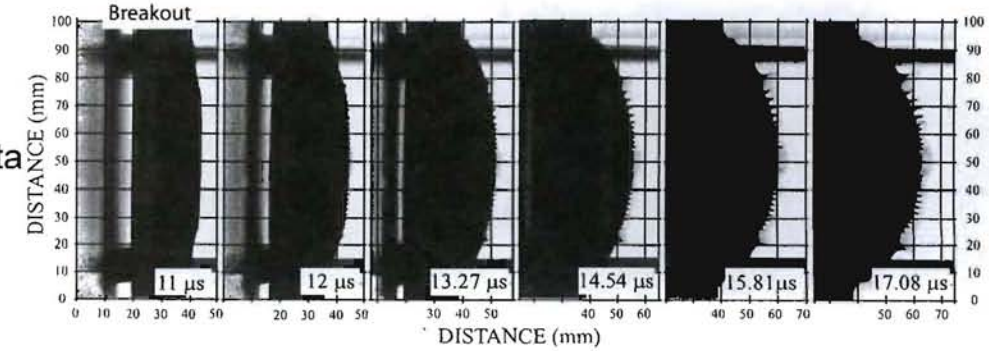


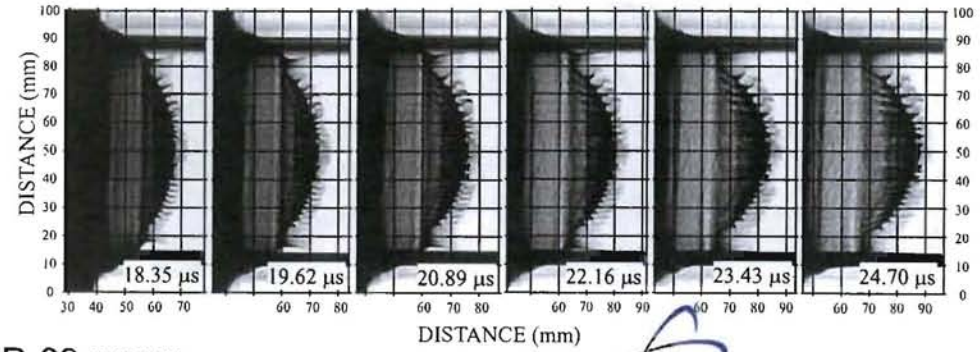
- u_{flyer} ~ 4.0 mm/ms.
- u_{bbl} = 3.4 mm/ms decreasing to 3.1 mm/ms.
- u_{spk} = 4.1 mm/ms decreasing to 3.3 mm/ms.
- $u$gas ~4.0 mm/ms.
- Future
  - Design RMI targets to address specific ejecta physics issues
  - x3 magnifier at pRad, Diagnose flyer with Doppler velocimetry (initial conditions)
  - Diagnose bubble-spike velocities with Doppler



Richtmyer Meshkov: Liquified Tin into 5 Bar Xe

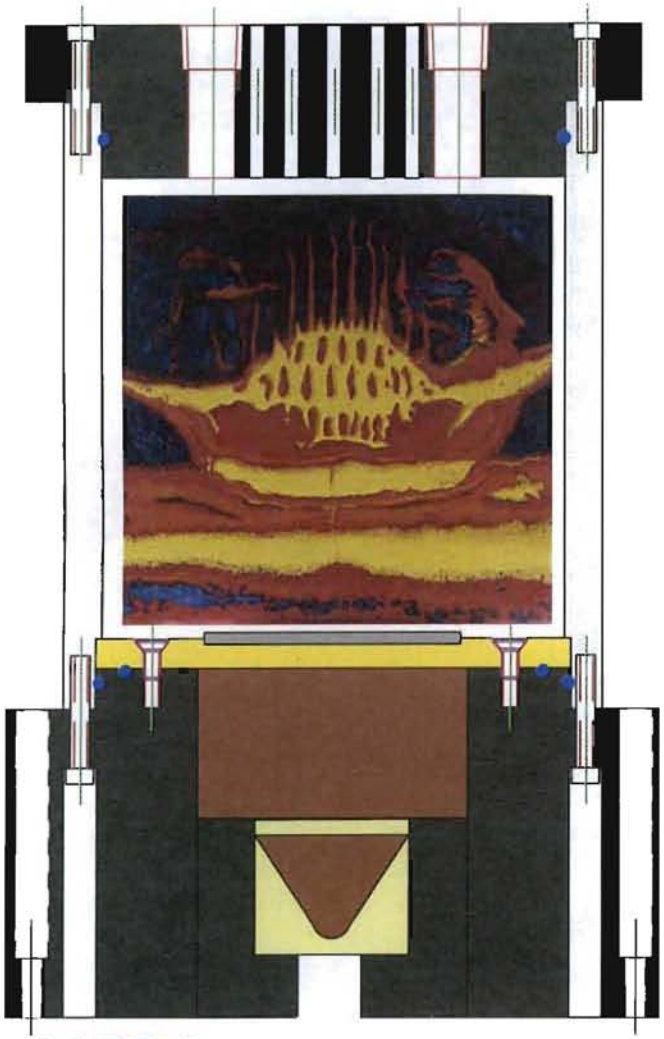


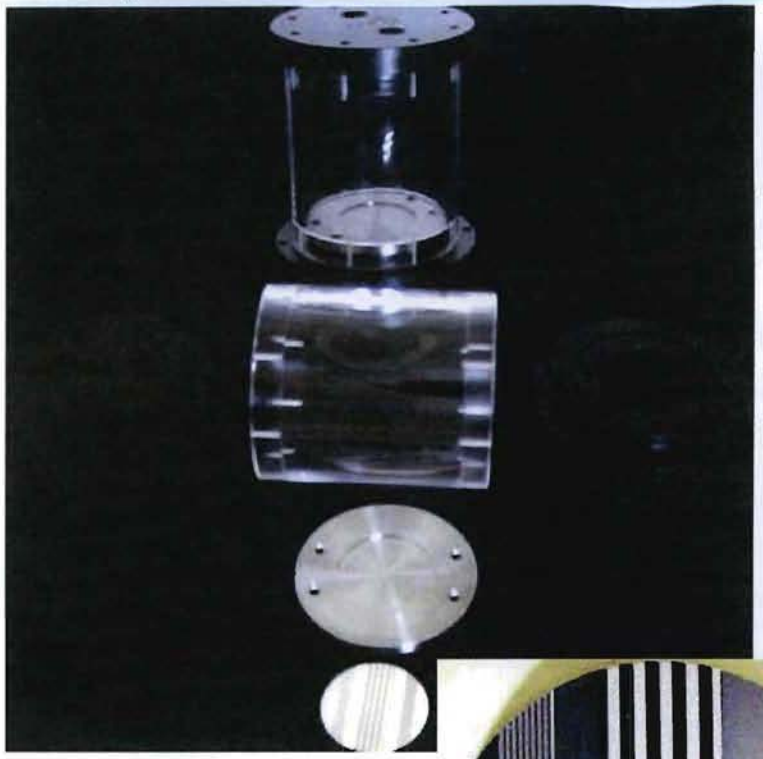


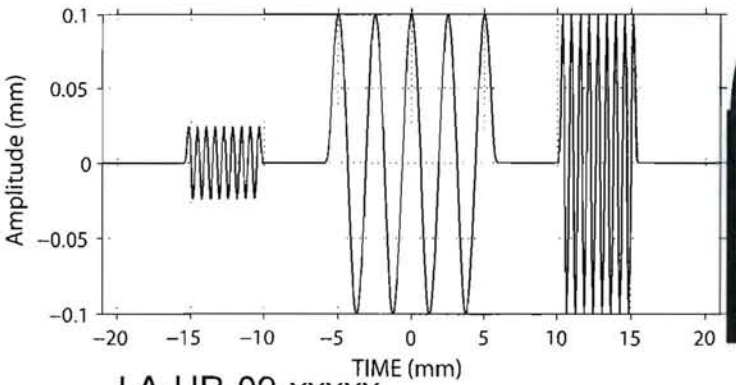


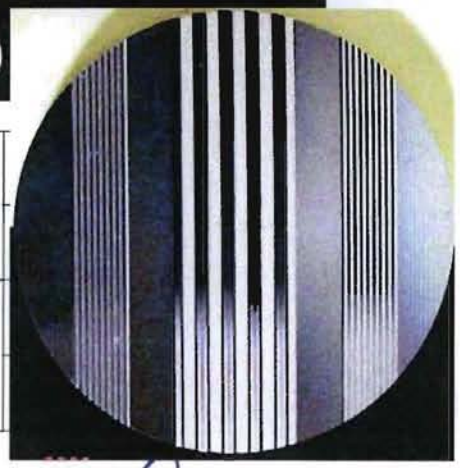
pRad RMI FY 09 Experiments

Painting by J. L. Beguin (2008)







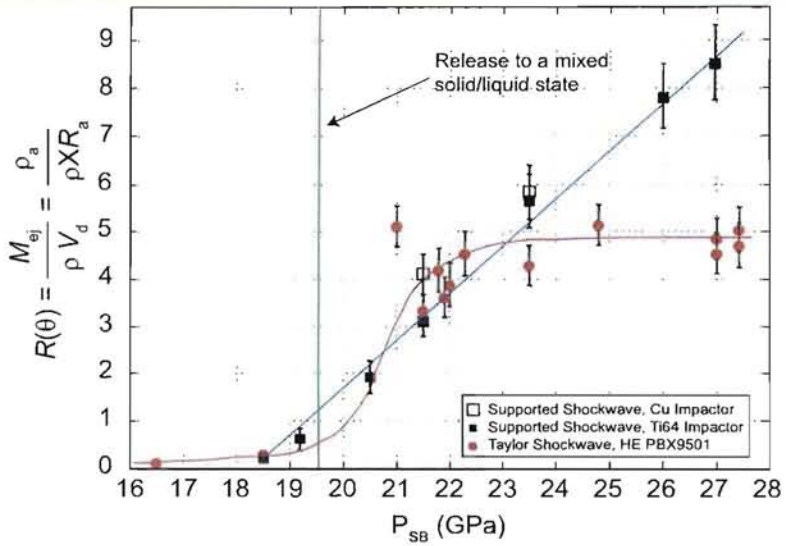


pRad RMI Efforts

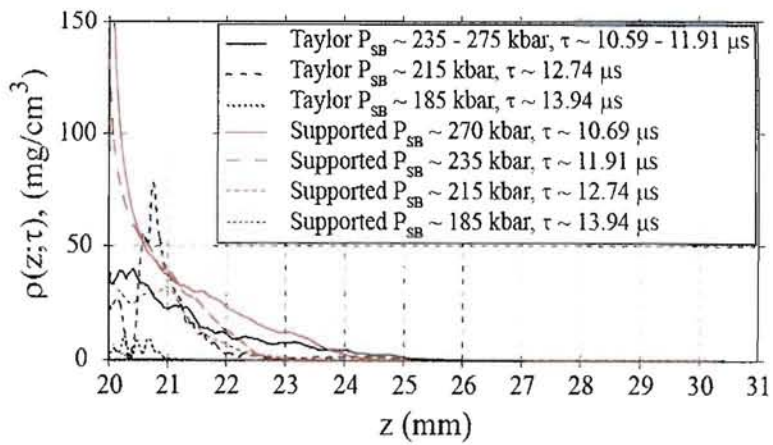
- RMI Theory and Model Development: G. Dimonte, B. Plohr
- Code framework: A. Harrison (Developing hooks for physics based models into LANL hydro codes)
- Source Term Modeling: G. Terrones (Continuum), T. Germann (MD-simulations), M. Zellner (working with T. Germann)
- Transport Theory and Modeling: J. Hammerberg and B. Plohr
- RMI Experiment and data analysis: W. Buttler and D. Oro

- Focus of Efforts
  - Understanding differences in ejecta production and mass distributions (Taylor vs. Square)
  - Understanding single mode RMI (Taylor vs. Square)
  - Understanding Second Shock (Taylor vs. Square)

Benefits: A physics based ejecta soure term and transport model



Mass Distribution at z = 20 mm



Painting by J. L. Beguin (2008) LA-UR-09-xxxxx

LANSCE Approval Form
Explosives Operations in Area C

Starting Date of Activity: 23 July 2009
PRAD Proposal Number: 20081908
PRAD Shot Number: 376
HE Shot Plan Number: H3855 / LNSC-10624-DE3
Description: Butler RMI

Vessel Experiment:
VAA approved vessel: Yes
HE ≤ 10-lbs TNT-equivalent: Yes

Powder Gun Experiment:
Propellant ≤ 350-g Class 1.3: NA

Dynamic MAR Experiment:
Requirements of ASE 3.5.2 met: NA

Experiment Technical and Safety Review complete: Yes

PRAD EIC Authorization:

Signature _____ Date: 23 July 2009*

Print A. Saunders

DE-3 HE PIC Authorization:
(HX-4)

Signature _____ Date: 23 July 2009*

Print Morgan Morgil

LANSCE Area B/C AM Authorization:

Signature _____ Date: 23 July 2009*

Print Leo Bitteker

* Signatures were provide after the shot date due to computer issues. All approvals were provided verbally prior to shot.

Shot Plan - DE3

WFO Shot Number:	LN5C-10622-10624	**Release Date:**	7/8/2009		
Shot/Series Title:	RMI	Originator's shot # (optional):	H3853, 3854, 3855		
Estimated Number of shots:	3	Past shot reference (optional):			
Lead Experimenter(s):	Mark Marcellus	**Group:**	DE-3	**Phone:**	4-0841
Experiment Program Code/Cost Account:					
Firing Lead (s):	Robert Lopez / Joe Bambridge	**Group:**	DE-3	**Phone:**	7-0393 / 7-5495
Firing Site:	pRad	**Owning Group:**	DE-3	**Phone:**	7-3225
Max. Quantity HE per test:	100g				
Clearance Plan:	N/A				
Desired Test Date(s):	7/13/09 - 7/17/09				
IWD# and WPF# : Specify applicable document # (s) & expiration date(s) or note as NEW and in progress:	IWD: IWD-DE3-53-008-P100-DC01 WPF: N/A P25 is responsible for waste at pRad				
Classified Shot: ☐ YES ☒ NO	If YES create classified shot addendum per classified document requirements				
☐ After Hours Contingency Plan	Required for shots executed after normal working hours. (defined as 4:30 PM)				

WFO Services Requested:	☐ RCT ☐ HI ☐ WMC ☐ Fire Department ☐ Heavy Equipment ☐ Fire Mitigation Review ☐ Other (Specify): ☐ Access Control ☐ Environmental

Brief Shot Description/Objectives: Attach sketches and drawings as necessary.
SE-1, P25 lens, 75g PBX9501 cylinder driving a Ti (6,4) target into vacuum or gas.

High Explosive Operations Safety Officer (HE OSO): Shot Plan fire mitigation review. Provide comments as appropriate:
(pRad) Exempt

HE OSO approval for shot setup to proceed _____ Date _____

Firing Site Leader (FSL): The FSL is the final authority on all operations of safety and procedure during firing site operations. The FSL ensures safety and technical aspects for executing the shots are complete.

FSL approval _____ Date 7-8-09

Classification Review: (**IF REQUIRED BY TSM LEAD EXPERIMENTER,** refer to K. Jones e-mail of 5/2/05)

☒ Unclassified	☐ Restricted Data	**Authorized Derivative Classifier:**
☐ Confidential	☐ Formerly Restricted Data	Signature _____
☐ Secret	☐ National Security Information	Name: Mark Marcellus Date: 7/7/09
☐ Unclassified Controlled Nuclear Information (UCNI)		Title: TSM
		Derived From: N/A

Line Management (or Designee) Signature _____ **Date** _____

Firing Site Leader is responsible for keeping original record with Site records
WFO makes, distributes and keeps copy of completed form

From: "Paul M. Rightley" <pright@lanl.gov>
Subject: VAA approval for final RMI shot
Date: Wed, July 22, 2009 8:27 pm
To: mmarr@lanl.gov
Cc: lbj@lanl.gov,vogan@lanl.gov,dallman@lanl.gov,turner_thomas_p@lanl.gov

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I approve firing the next RMI shot in vessel 6-2-5-1 at pRad this week. I understand that the last EOS shot again did not produce damage to the vessel. Also, this RMI shot is essentially the same as the previous two except for the substitution of neon instead of xenon or vacuum. This does not change the confinement requirements.

I do not have all of my information at my current location and so I cannot remember the precise H# of this shot. It is on number higher than the last RMI shot fired last week.

Paul

Paul Rightley
HX-3 Hydrodynamics, MS P940
Los Alamos National Laboratory
Los Alamos, NM 87545
Phone: (505)667-0460
Fax: (505)665-3359

CONTAINED SHOT REQUEST
Buttler RMI (File name: Buttler_RMI_07152009.pdf)

DATE: 15 July, 2009

REQUESTOR: Mark Marr-Lyon, DE-3, 4-0841

LOCATION OF OPERATIONS: Area C/LANSCE/pRad

VESSEL TO BE USED
6 feet in diameter, 5 port, 2" thick walls (6-2-5-1)
Over-pressure Test: Shot H3841 was 6.83 kg TNT equivalent and had 0.25" aluminum windows
Visual inspection since last shot: See separate e-mail on 7/15/2009
Date of last magnaflux: 24 March 2009 with no relevant indications.
Number of shots since last magnaflux: 4
HE Mass since last magnaflux: 6.5410 kg (14.4229 lbs)
TNT Equivalent since last magnaflux: 7.2890 kg (16.0723 lbs)
Another Phase Change experiment will be fired before the first Buttler RMI shot.

SHOT TO BE FIRED
Explosive: PBX-9501 (75 g), P-25 plane wave lens (25 g), SE-1 detonator
Metal weight: Ti-6Al-4V (140 g), Tin coupon (20 g)
Configuration: A P-25 plane wave lens, initiated with an SE-1 detonator, drives a 1 3/4 inch diameter by 1 inch long cylinder of PBX-9501. Surrounding the explosives is a 1 3/4 inch ID delrin cylinder with approximately 3/4 inch thick walls. A smaller delrin cylinder fills the space between the P-25 and the outer delrin cylinder and holds the explosives in place. A Ti-6Al-4V plate with the tin target attached is driven by the PBX-9501 cylinder into a plastic container. The target will be fired downward. For the first shot, the container will be at vacuum, and the second shot will have 5 bar of xenon in the container. A third shot is available in the event of problems with either of the first two.

Fragment protection: Our usual amount of RHA and aluminum plates will be placed on the bottom of the vessel for protection. Additional RHA or aluminum armor will be placed around the delrin cylinder attached to the 1" nylon threaded rod, as it will be out of the field of view.

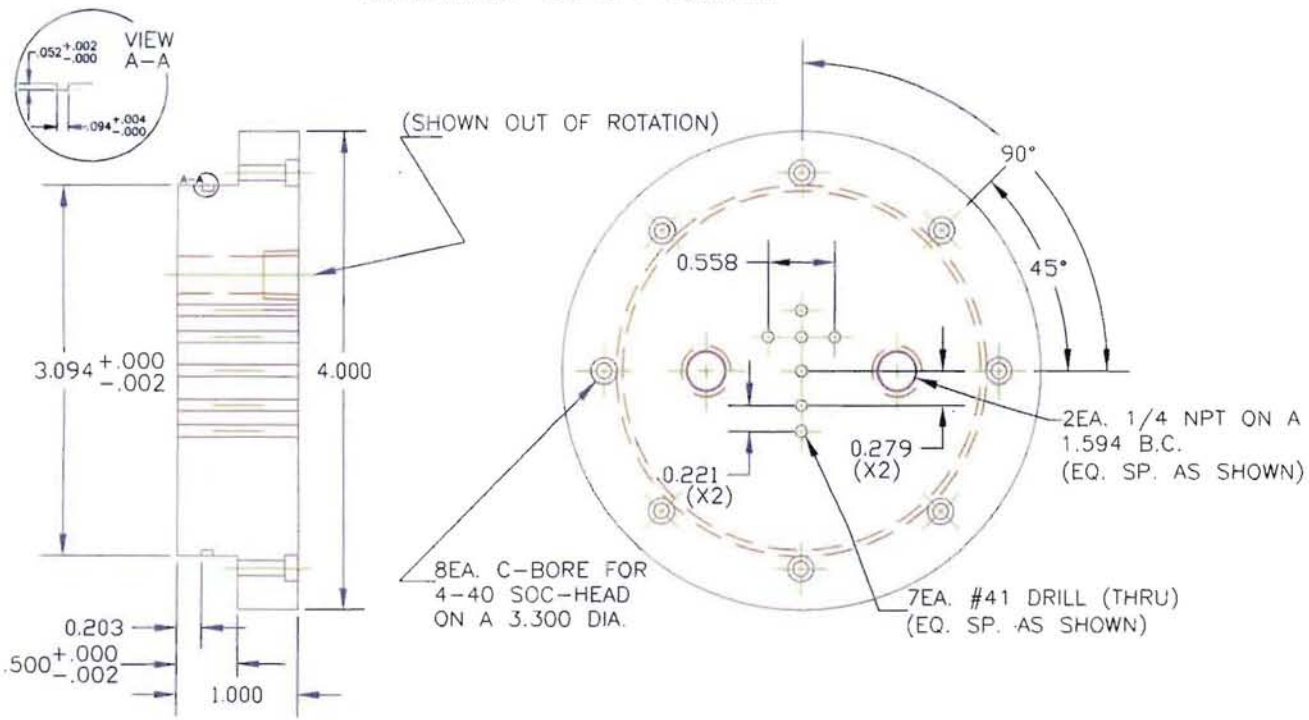
Beamline windows: Either 1/4" thick aluminum or 1/8" aluminum with 1/8" glass windows will be used on the beamlines.

PROOF TEST
Shot number(s): H3116-H3117,H3639-H3640
Results of proof: Similar shots to these were fired in 2004 and 2008. These shots used a Forest Flyer driver, which has considerably more HE in it than the proposed shots. Some damage was caused to the vessel by some steel threaded rod that extended above the pressure chamber and near the P-89. These shots do not have the threaded rod and will have more mitigation around the explosives.

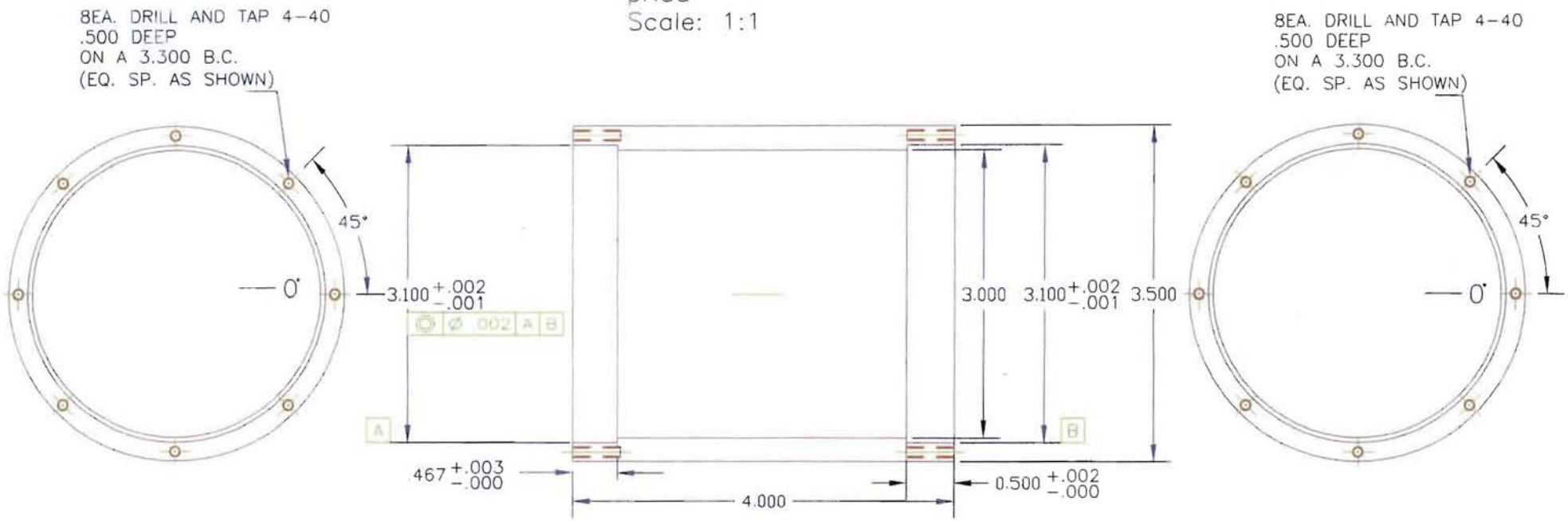
REQUESTED SHOTS
Number of shots: up to 3
Shot numbers: H3853-H3855
Proposed shot dates: 7/15/2009 – 7/24/2009

CONTAINED SHOT REQUEST CLASSIFICATION REVIEW
Classification Level: Unclassified
Authorized Derivative Classifier: Mark Marr-Lyon, DE-3

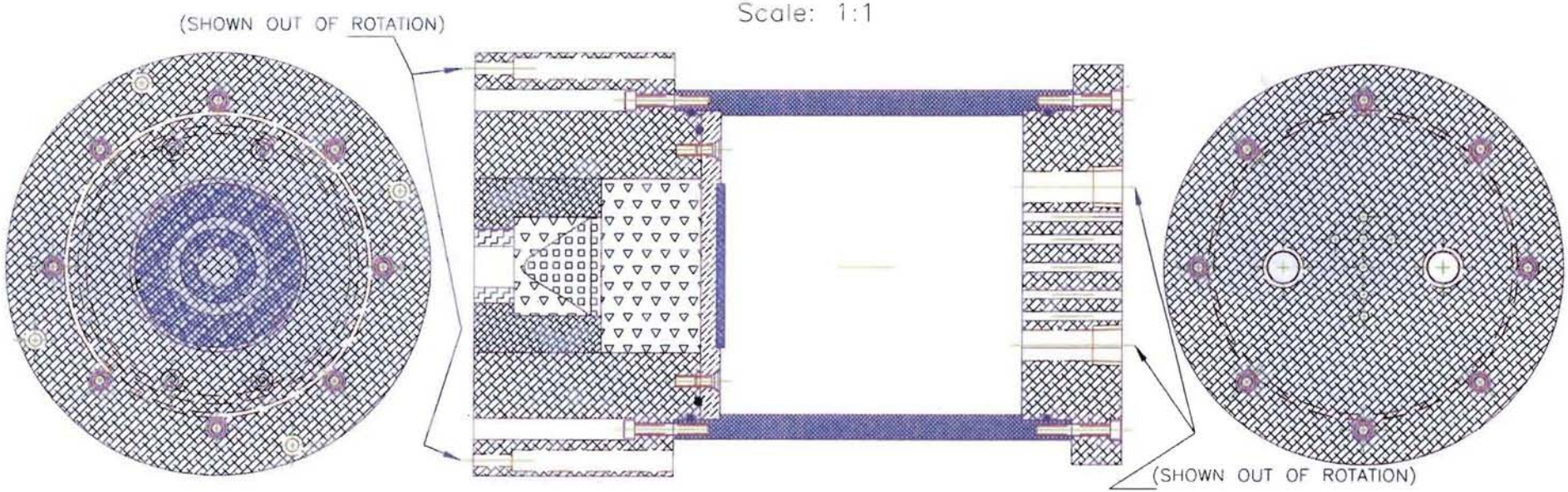
Buttler BDPH
pRad
Scale: 1:1
MATERIAL: BLACK DELRIN



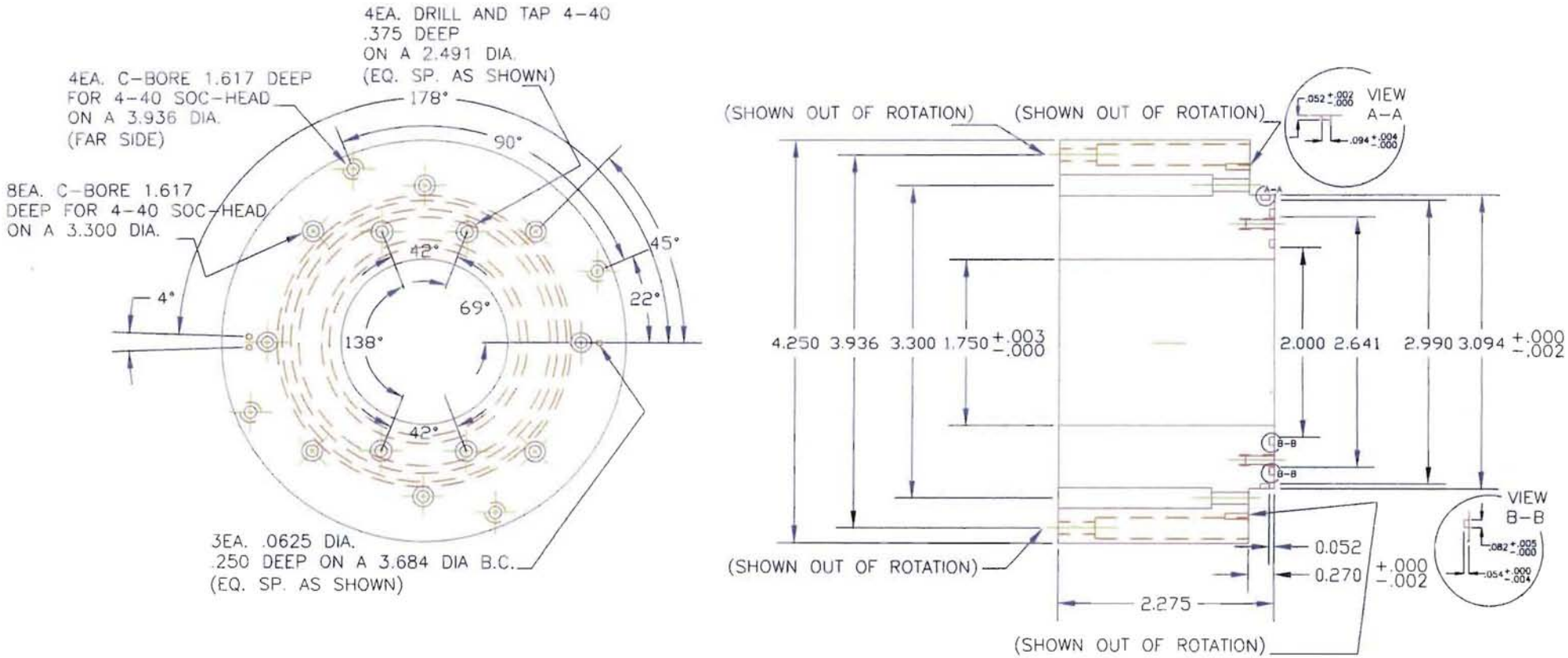
Buttler ACRYLIC TUBE
pRad
Scale: 1:1



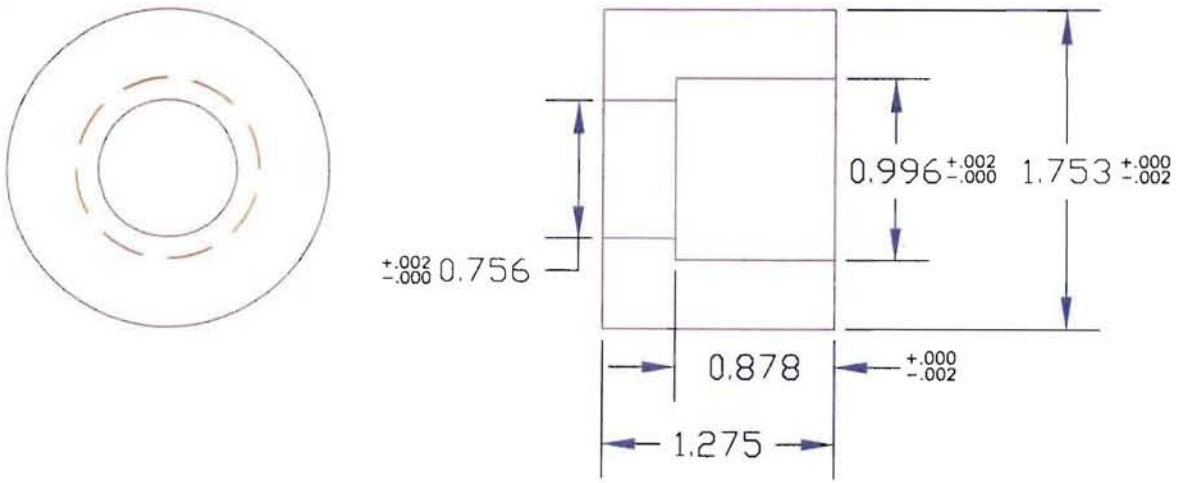
Buttler 42mm X 2mm Booster
.250 Acrylic Wall
pRad
Scale: 1:1



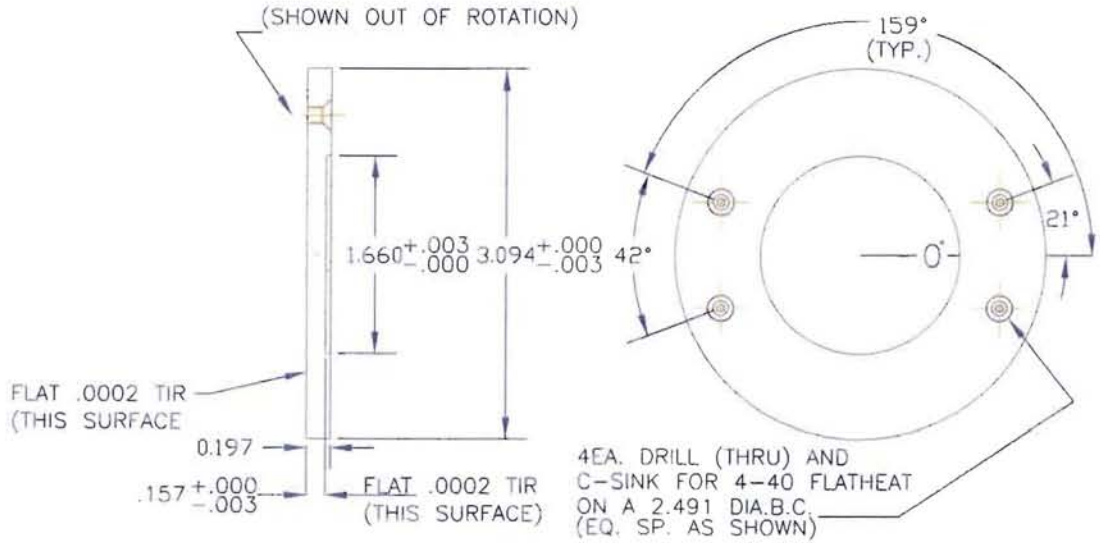
Buttler1.75 Booster
pRad
Scale: 1:1
MATERIAL: BLACK DELRIN



Buttler 1.75 Booster Plug
pRad
Scale: 1:1
Material: Black Delrin



Buttler TI 64
pRad
MATIERIAL: TI 64
Scale: 1:1



Proton Radiography Experiment Safety and Security Review Checklist V2, 16 July 2009

PRAD shot number 371tt Title RMI Butler

Review Date 7/15/09 Shot Date 7/15/09

Review must be performed within two weeks of shot date.

Table 1: Requirements of the Accelerator Safety Envelope (ASE): Require USI to violate or modify

Table 2: Requirements of the Safety Analysis Document: Require USI to violate or modify

Table 3: Requirements of LANL Safety Documents: Require Hazard Analysis and Management Approval to violate or modify

Table 4: Requirements of LANL Security documents: Require Management Approval to violate or modify

Brief Unclassified Description of experiment, including sample material, form, and quantity, and non-PRAD diagnostics:

P-25, 9501 cylinder driving a Ti + 6% Al + 4% Vanadium plate with a tin coupon attached. The tin has perturbations machined into the surface to create ejecta driven into both vacuum and xenon

Required Facility Configuration (e.g. magnifier vs. –I lens; powder gun vs. 6-foot vessel):

X3 Mag. 6' vessel

Required Beam parameters (e.g. standard PRAD; video mode):

Standard PRAD

All SMEs participating in review:

Table 1a: Requirements of Accelerator Safety Envelope (ASE):

Number	Question	Yes	No	Requirements if NO	SME Inits.
1	ASE section 3.1.1.5 "Line X/B/C Beam Delivery Mode" will be satisfied?	X		Outside of Safety Envelope: USI to proceed	
2	Outer vessel qualified to 150% of HE load in this shot?	X		Outside of Safety Envelope: USI to proceed	
3	Outer vessel qualified for this dynamic shot by Vessel Approving Authority?	X		Outside of Safety Envelope: USI to proceed	
4	Total HE load less than or equal to 10.0 lbs TNT equivalent?	X		Outside of Safety Envelope: USI to proceed	
5	Total propellant load in powder gun less than or equal to 350 g Class 1.3 propellant?	X		Outside of Safety Envelope: USI to proceed	
6	Total Material at Risk (MAR) of less than or equal to 12.0 Plutonium-Equivalent Grams (PEG)?	X		Outside of Safety Envelope: USI to proceed	

Table 1b: Additional requirements of ASE if MAR >= 0.1 PEG and experiment is dynamic

Number	Question	Yes	No	Requirements if NO	SME Inits.
1	Total MAR in target assembly less than or equal to 11.0 PEG?	X		Outside of Safety Envelope: USI to proceed	
2	All MAR in metallic form, including no powders, for this shot?	X		Outside of Safety Envelope: USI to proceed	
3	Total HE in target assembly including Pu less than or equal to 30 g?	X		Outside of Safety Envelope: USI to proceed	

Table 2: Requirements of Safety Analysis Document (SAD):

Number	Question	Yes	No	Requirements if NO	SME Inits.
1	Experiment configuration covered by existing SAD?	X		Outside of Safety Analysis: Hazard Analysis and USI to proceed	
2	All changes to building design consistent with SAD?	X		Outside of Safety Analysis: Hazard Analysis and USI to proceed	
3	All explosives and detonators approved by Laboratory Explosives Review Committee?	X		Outside of Safety Analysis: Hazard Analysis and USI to proceed	
4	Firing circuits and any firing circuit test equipment approved by Explosives Instrument Review Committee?	X		Outside of Safety Analysis: Hazard Analysis and USI to proceed	
5	Any flammable gases insufficient to result in greater than 50% of flammability limit if released into vessel and backfilled with air?	X		Outside of Safety Analysis: Hazard Analysis and USI to proceed	
6	There are no low voltage detonators on this shot.	X		Outside of Safety Analysis: Hazard Analysis and USI to proceed	
7	Dynamic shot is contained?	X		Outside of Safety Analysis: Hazard Analysis and USI to proceed	
8	No new hazards due to materials or equipment inside containment vessel?	X		Review for new hazards	

Table 3: Requirements of LANL Safety Documents

Number	Question	Yes	No	Requirements if NO	SME Inits.
1	Dynamic shot contains less than or equal to 100 lbs of DU?	X		Hazard analysis and management approval required	
2	Dynamic shot contains no hazardous materials other than lead, silver, DU, or transuranics?		X	Hazard analysis, management approval, and waste profile required	AS
3	This dynamic shot contains no lead, silver, or DU materials?	X		Hazard analysis, management approval, and waste profile required	
4	All lasers required for this shot covered by VISAR IWD?	X		LSO Review required	BH
5	Any required pins approved by EIRC?	X		EIRC approval required	
6	No flammable gasses required in vessel?	X		Hazard analysis and management approval required	
7	Will all HE be burned after dynamic event?	X		Hazard analysis and management approval required	
8	No new chemicals required for this shot?	X		Hazard analysis required	
9	No internal pressure vessel?		(8) X	Test pressure vessel to 110% for remote fill or 150% for manual fill	FHM
10	Will any hazardous waste generated have an identified disposal path?	X		Submit waste profile to Waste Coordinator before experiment	
11	All electrical equipment is inspected or listed?	X		ESO review	
12	Will any radioactive materials produced be stored in radioactive materials cabinet in Area C?	X		RP-1 review required	
13	All hazardous work is covered by P25-IWD-07-42 (PRAD IWD) and IWD-DE3-53-003-P100-0001 (HE IWD)?	X		Assess uncovered work and implement controls	

@ 7/06/09: The shot on 7/16/09 does not ~~require~~ have an internal pressure vessel.
The next shot is with an internal vessel and requires that we verify that the pressure test has been done.

Table 4: Security Review

Number	Question	Yes	No	Requirements if NO	SME Inits.
1	No special handling due to security concerns?	X		DC Review; Activity Security Plan	
2	Has experiment been DC or SAFE-7 reviewed?	X		DC review	
3	Does experiment involve no cleared or uncleared foreign nationals?	X		Escort and computer use requirements	
4	Does this shot not require overnight classified supervision?	X		Arrange for overnight supervision	

Any new hazards or vulnerabilities not listed above?

Summarize requirements from tables above, including new training requirements:

- Waste profile form attached
- IH support required for post-shot activities due to Vanadium.
  - IH reqmnts:
    - Tyvek suit booties
    - Resp. during post shot cleanup (Full APR P 100, HEPA)
    - Double gloves
    - Slow vent
    - 1/2 hour pause after vent

7/16/09

JF TA 53 INDUSTRIAL HYGIENE

6 2148

Approval by Experiment Safety Review Committee

EIC _____ Date 7/16/09
Experimenter in Charge A. Saunders

HE PIC _____ Date 7/16/09
High Explosives Person in Charge

EAM _____ Date 16 July 2009
Experimental Area Manager

New review required if initial review is more than two weeks before activity:

Approval of this Experiment Safety and Security Review Checklist

This checklist complies with the requirements of LANSCE document LANSCE-ST-101-001.R3 "Technical and Safety Review of User Experiments at LANSCE".

P-25 RLM_____ Date_____

FOD Designee_____ Date_____

WASTE PROFILE FORM
WPF #: 38685

For rapid processing, complete all sections in black or blue ink and mail to:
SOLID WASTE OPERATIONS GROUP at MS J496.
For assistance with completing this form, call SOLID WASTE OPERATIONS GROUP at 5-4000

Contact(if other than given below)

Generators Z Number	Waste Generators Name(print)	WMCs Z Number	WMCs Name(print)
092843	Camilo J Espinoza	121998	GARCIA, RONNIE

Camilo J Espinoza	Generators Mail Stop	Waste Generating Group	Waste Stream Technical Area	Building	Room	WMC Phone #
6679981	H846	P-25	53	000000	SECTOR P	6672210

Waste Accumulation (Check only one)

- ☐ Satellite Accumulation Area Site no: ____
- ☐ Less-than-90-days Storage Area Site no: ____
- ☐ TSDF Site no: ____
- ☐ Universal Waste Storage Area Site no: ____
- ☐ Used Oil for Recycle Site no:
- ☐ PCBs Storage Area Site no: ____
- ☐ NM Special Waste Site no: ____
- ☐ Rad Staging Area Area Site no: ____
- ☐ Rad Storage Area Area Site no: ____
- ☒ None of the Above

ER Use Only ER Site SWMU/AOC #:

Method of Characterization (Check as many as apply.)

- ☒ Chemical/Physical Analysis ☐ Attached Samp#: 05SWRC217-220
- ☐ Radiological Analysis ☐ Attached Samp#: ____
- ☐ PCB Analysis ☐ Attached Samp#: ____
- ☒ AKD ☐ Attached Doc#: HCP/SHOT SHEET
- ☐ MSDS ☐ Attached

Section 1 - Waste Prevention/Minimization (answer all questions)

Can hazard segregation, elimination, or material substitution be used?	☐ Yes*	☒ No	
Can any of the materials in the waste stream be recycled or reused	☐ Yes*	☒ No	
Has waste minimization been incorporated into procedures or other process controls?	☒ Yes	☐ No	
Can this waste be generated outside a RCA?	☐ Yes*	☒ No	☐ N/A

*Provide Comment

Section 2 - Chemical and Physical Information

Waste Type (Check only one.)

- ☐ Unused/Unspent Chemical
- ☒ Process Waste/Spent Chem/ Other
- ☐ Green is Clean Waste

Radiological Information

Was Waste Generated in an RCA?
☒ Yes ☐ No

- ☒ Non-rad
- ☐ Radioactive-LL
- ☐ Radioactive-TRU

Waste Destination (Check only one)

- ☐ SWWS (Complete Attach 1)
- ☐ RLWTF(Complete Attach 2)
- ☐ RLWTP(Complete Attach 3)
- ☐ TA16/HE(Complete Attach 4)

Classification Information

- ☐ Unclassified
- ☐ Classified/Sensitive

Waste Category-Chk all that apply

- ☒ Inorganic
- ☐ Organic
- ☐ Solvent *
- ☐ Degreaser *
- ☐ Dioxin
- ☐ Electroplating
- ☐ Treated Hazardous waste or residue
- ☐ No Longer Contained-In
- ☐ Explosive process
- ☐ Infectious/Medical
- ☐ Biological
- ☐ Beryllium
- ☐ Empty Container
- ☐ Battery

Asbestos ☐ friable ☐ non-friable

PCB ☐ PCB < 50 ppm ☐ PCB >= 50 - < 500 ppm ☐ PCB >= 500 ppm

- ☐ Hazardous Waste Contaminanted Soil
- ☐ Untreated Hazardous Debris
- ☐ Commercial Solid Waste
- ☐ Other

*See instructions

Waste Source-Check only one

Waste Source A

- ☐ Decon
- ☐ Materials Processing/Production
- ☒ Research/Development/Testing
- ☐ Scheduled Maintenance
- ☐ Housekeeping - Routine
- ☐ Spill Cleanup - Routine
- ☐ Sampling - Routine Monitoring
- ☐ Other (Describe below)

Waste Source B

- ☐ Abatement
- ☐ Construction/Upgrades
- ☐ Demolition
- ☐ Decon/Decom
- ☐ Investigative Derived
- ☐ Orphan/Legacy
- ☐ Remediation/Restoration
- ☐ Repacking (Secondary)
- ☐ Unscheduled Maintenance
- ☐ Housekeeping - Non-routine
- ☐ Spill Cleanup - Non-routine
- ☐ UST - Non-petroleum
- ☐ UST - Petroleum
- ☐ Other (Describe below)

Waste Matrix-Check only one

Gas

- ☐ Gas <= 1.5 Atmospheres pressure
- ☐ Gas > 1.5 Atmospheres pressure
- ☐ Liquified compressed gas

Liquid

- ☐ Aqueous
- ☐ Non-aqueous
- ☐ Suspended Solids / Aqueous
- ☐ Suspended Solids / Non-aqueous

Solid

- ☐ Powder/Ash
- ☒ Solid
- ☐ Sludge
- ☐ Absorbed Liquid
- ☐ Debris

Matrix Type (check only one.)

- ☐ Homogeneous
- ☒ Heterogeneous

Estimated Annual Volume (m3)

2

WASTE PROFILE FORM
WPF #: 38685

Section 3 - Process and Waste Descriptions

Process Description:

Non-Hazardous shot debris generated during Bennett, Flyer, Hockey and routine explosive shot tests in PRAD. Waste stream primarily consist of metal, ceramics, glass, plastics, cellulosics, PPE, rags, rubber gloves, tape, and wood fragments generated during testing and clean-up activities. Acceptable knowledge documentation includes P-25 HCPs/IWDs: prad hcp 05116 Proton Radiography in Area C and DX shot

Waste Description:

Section 4 - Characteristics

Ignitability (Check only one.)	Corrosivity (Check only one.) pH	Reactivity (Check as many as apply.)	Boiling Point (Check only one.)
☐ <73 F <22.8 C	☐ <= 2.0	☐ RCRA Unstable	☐ <= 95 F <= 35 C
☐ 73 - 99 F 22.8 - 37.2 C	☐ 2.1 - 4.0	☐ Water Reactive	☐ > 95 F > 35 C
☐ 100 - 139 F 37.8 - 59.4 C	☐ 4.1 - 6.0	☐ Cyanide Bearing	☒ Not applicable
☐ 140 - 200 F 60.0 - 99.3 C	☐ 6.1 - 9.0	☐ Sulfide Bearing	
☐ > 200 F >99.3	☐ 9.1 - 12.4	☐ Pyrophoric	
☐ EPA Ignitable - Non-liquid	☐ >= 12.5	☐ Shock Sensitive	
☐ DOT Flammable Gas	☐ Liquid corrosive to steel	☐ Explosive	
☐ DOT Oxidizer	☒ Non-aqueous	☒ Non-reactive	
☒ Not ignitable			

Identify for all contaminants listed.	Characterization Method			Concentration of Contaminants				Regulatory Limit
	AK	TCLP	Total	None or Non-detect	Contaminant present at Minimum		Maximum	
Toxicity Characteristic Metals					(10,000 ppm=1%)			
ARSENIC	☐	☐	☐	☐		to	ppm	5.0 PPM
BARIUM	☐	☒	☐	☐		to	ppm	100.0 PPM
CADMIUM	☐	☐	☐	☐		to	ppm	1.0 PPM
CHROMIUM	☐	☒	☐	☐		to	ppm	5.0 PPM
LEAD	☐	☒	☐	☐		to	ppm	5.0 PPM
MERCURY	☐	☐	☐	☐		to	ppm	0.2 PPM
SELENIUM	☐	☐	☐	☐		to	ppm	1.0 PPM
SILVER	☐	☐	☐	☐		to	ppm	5.0 PPM
BENZENE	☒	☐	☐	☐		to	ppm	0.5 PPM
CARBON TETRACHLORIDE	☐	☐	☐	☐		to	ppm	0.5 PPM
CHLOROBENZENE	☐	☐	☐	☐		to	ppm	100.0 PPM
CHLOROFORM	☐	☐	☐	☐		to	ppm	6.0 PPM
O-CRESOL	☒	☐	☐	☐		to	ppm	200.0 PPM
M-CRESOL	☒	☐	☐	☐		to	ppm	200.0 PPM
P-CRESOL	☒	☐	☐	☐		to	ppm	200.0 PPM
CRESOL - MIXED	☐	☐	☐	☐		to	ppm	200.0 PPM
1,4-DICHLOROBENZENE	☐	☐	☐	☐		to	ppm	7.5 PPM
1,2-DICHLOROETHANE	☐	☐	☐	☐		to	ppm	0.5 PPM
1,1-DICHLOROETHYLENE	☐	☐	☐	☐		to	ppm	0.7 PPM
2,4-DINITROTOLUENE	☐	☐	☐	☐		to	ppm	0.13 PPM
HEXACHLOROBENZENE	☐	☐	☐	☐		to	ppm	0.13 PPM
HEXACHLOROBUTADIENE	☐	☐	☐	☐		to	ppm	0.5 PPM
HEXACHLOROETHANE	☐	☐	☐	☐		to	ppm	3.0 PPM
METHYL ETHYL KETONE	☒	☐	☐	☐		to	ppm	200.0 PPM

WASTE PROFILE FORM
WPF #: 38685

Identify for all contaminants listed.	Characterization Method			Concentration of Contaminants					Regulatory Limit
	AK	TCLP	Total	None or Non-detect	Contaminant present at Minimum		Maximum		
Toxicity Characteristic Metals					(10,000 ppm=1%)				
NITROBENZENE	☐	☐	☐	☐	_____	to	_____	ppm	2.0 PPM
PENTACHLOROPHENOL	☐	☐	☐	☐	_____	to	_____	ppm	100.0 PPM
PYRIDINE	☐	☐	☐	☐	_____	to	_____	ppm	5.0 PPM
TETRACHLOROETHYLENE	☐	☐	☐	☐	_____	to	_____	ppm	0.7 PPM
TRICHLOROETHYLENE	☒	☐	☐	☐	_____	to	_____	ppm	0.5 PPM
2,4,5-TRICHLOROPHENOL	☐	☐	☐	☐	_____	to	_____	ppm	400.0 PPM
2,4,6-TRICHLOROPHENOL	☐	☐	☐	☐	_____	to	_____	ppm	2.0 PPM
VINYL CHLORIDE	☐	☐	☐	☐	_____	to	_____	ppm	0.2 PPM
CHLORODANE	☐	☐	☐	☐	_____	to	_____	ppm	0.03 PPM
2,4-D	☐	☐	☐	☐	_____	to	_____	ppm	10.0 PPM
ENDRIN	☐	☐	☐	☐	_____	to	_____	ppm	0.02 PPM
HEPTACHLOR (& ITS EPOXIDE)	☐	☐	☐	☐	_____	to	_____	ppm	0.008 PPM
LINDANE	☐	☐	☐	☐	_____	to	_____	ppm	0.4 PPM
METHOXYCHLOR	☐	☐	☐	☐	_____	to	_____	ppm	10.0 PPM
TOXAPHENE	☐	☐	☐	☐	_____	to	_____	ppm	0.5 PPM
2,4,5-TP(Silvex)	☐	☐	☐	☐	_____	to	_____	ppm	0.5 PPM

WASTE PROFILE FORM
WPF #: 38685

Section 5 - Additional Constituents and Information

Additional Constituents and Contaminates. Please account for 100% of waste. Ranges should be given within guidelines of LIG 404-00-03 of individual constituents. List all other constituents (including inerts) not identified above and attach any applicable analysis. No chemical formulas allowed in this field. Continue in Section 3 Additional Information as necessary. CAS Numbers are needed for all chemical constituents, for material without a CAS Number enter "No CAS Number." Contact Waste Services at 5-4000 for assistance.

CAS No.	Name of constituent	Minimum		Maximum	
740-36-0	ANTIMONY	0	to	.01	%
7440-70-2	CALCIUM	0	to	.76	%
7440-48-4	COBALT	0	to	.002	%
7440-50-8	COPPER	0	to	.046	%
7439-89-6	IRON	0	to	1.8	%
7439-95-4	MAGNESIUM	0	to	.13	%
7439-96-5	MANGANESE	0	to	.033	%
7440-02-0	NICKEL	0	to	.02	%
9-7-7440	POTASSIUM	0	to	.06	%
7440-21-3	SILICA	0	to	.035	%
7440-23-5	SODIUM	0	to	.05	%
7440-62-2	VANADIUM	0	to	.0008	%
744-66-6	ZINC	0	to	.055	%
90-12-0	1-METHYLNAPHTHALENE	0	to	.00011	%

Additional Information

(Use additional sheet if necessary.)

If additional information is available on the chemical, physical, or radiological character of the waste not covered on this form, provide it below:

Section 6 - Work Control Documentation (answer all questions)

Do the procedures for this process cover how to manage this waste? ☒ Yes ☐ No

Do the procedures for this process cover controls to prevent changes to waste constituents and concentrations or addition or removal of waste? ☒ Yes ☐ No

Section 7 - Package and Storage Control

Describe how the waste will be packaged in according to the applicable WAC:

WASTE WILL BE BAGGED, TAPED AND PACKAGED IN APPROVED DRUMS

Identify the storage management controls that will be used for this waste stream: (check all that apply)

☐ Tamper indication devices:
☐ Limited use locks with log-in for waste
☒ Locked cabinet or building
☐ Other (describe)

Section 8 - Waste Certification Statements (check only one)

☒ Waste appears to meet WAC of:

17

☐ Waste needs exception/exemption for treatment, storage, or disposal at:

WASTE GENERATOR CERTIFICATION: Based on my knowledge of the waste and/or chemical/physical analysis, I certify that the waste characterization information on this form is correct and that it meets the requirements of the applicable waste acceptance criteria. I understand that this available to regulatory agencies and that there are significant penalties for submitting false information, including the possibility of fines and imprisonment for knowing violations.

Signature Date

WASTE CERTIFYING OFFICIAL: I have reviewed this form and any associated attachments and the characterization information provided appears to be complete and accurate. I certify, to the best of my knowledge, that the waste characterization information provided by the waste generator meets the requirements of the applicable WAC.

Signature Date

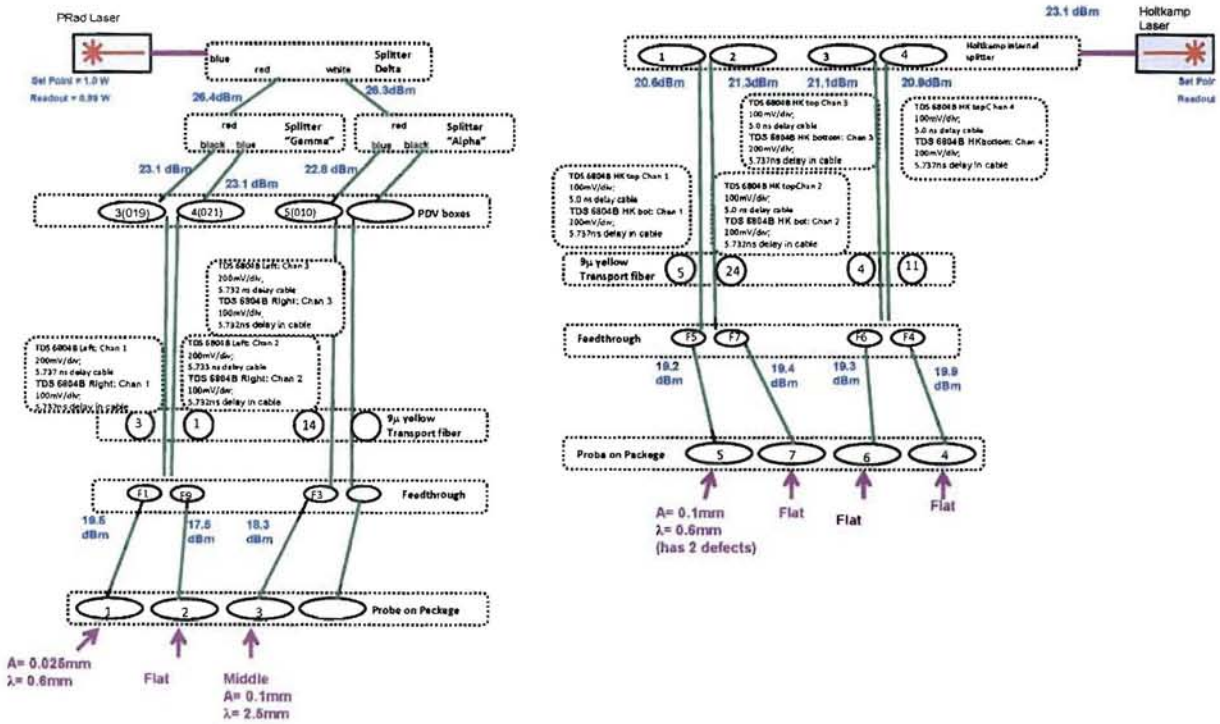
WASTE PROFILE FORM
WPF #: 38685

Section 5 - Additional Constituents (continued)

CAS No.	Name of constituent	Minimum	Maximum
91-57-6	2-METHYLNAPHTHALENE	0	.00013
94-48-7	2-METHYLPHENOL	0	.00026
108-39-4	3+4 METHYLPHENOL	0	.00014
93-32-9	ACENAPHTHENE	0	.00014
208-96-8	ACENAPHTHYLENE	0	.00115
120-12-7	ANTHRACENE	0	.00044
56-55-3	BENZO (A) ANTHRACENE	0	.00018
50-32-8	BENZO (A) PYRENE	0	.0003
205-99-2	BENZO (B) FLUORANTHENE	0	.00018
207-08-9	BENZO (K) FLUORANTHENE	0	.00022
117-81-7	BIS (2-ETHYLHEXYL) PHTHALATE	0	.336
85-68-7	BUTYLBENZYLPHTHALATE	0	.002
218-01-9	CHRYSENE	0	.0002
132-64-9	DIBENZOFURAN	0	.00011
84-66-2	DIETHYLPHTHALATE	0	.00028
131-11-3	DIMETHYLPHTHALATE	0	.00049
84-74-2	DI-N-BUTYLPHTHALATE	0	.00168
117-84-0	DI-N-OCTYLPHTHALATE	0	.0516
206-44-0	FLUORANTHENE	0	.00132
86737	FLUORENE	0	.00077
91-20-3	NAPHTHALENE	0	.0004
86-30-6	N-NITROSODIPHENYLAMINE	0	.00026
85-01-8	PHENANTHRENE	0	.00216
108-95-2	PHENOL	0	.0684
120-0-0	PYRENE	0	.00156
108-67-8	1,3,5-TRIMETHYLBENZENE	0	.00001
78-93-3	2-BUTANONE (MEK)	0	.00002
108-10-1	4-METHYL-2-PENTANONE (MIBK)	0	.00029
67-64-1	ACETONE	0	.00037
107-13-1	ACRYLONITRILE	0	.00002
71-43-2	BENZENE	0	.00001
108-90-7	CHLOROBENZENE	0	.000007
75-09-2	METHYLENE CHLORIDE	0	.00004
100-42-5	STYRENE	0	.00001
108-88-3	TOLUENE	0	.00011
79-01-6	TRICHLOROETHENE	0	.00003
	WOOD/CABON RESIDUE	85	90
	SCRAP METAL	0	5
	CELLULOSICS/PLASTICS/PPE/WIPES/RUBBER GLOVES/GLASS	5	10
	Total of ranges from this section	**85.0000**	**90.0000**

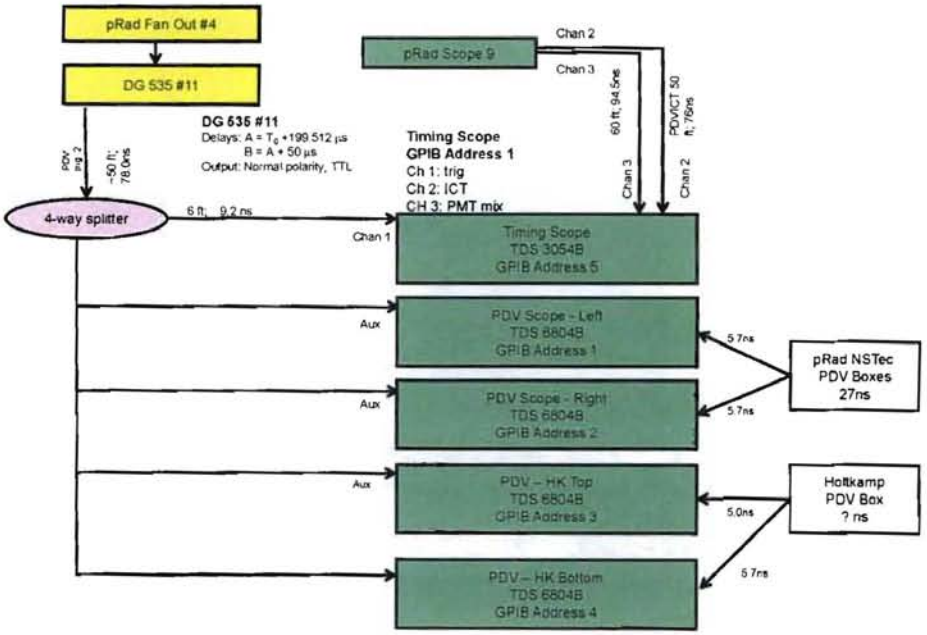
Prad 376 RMI_Neon

RMI Neon #1 - 7/22/2009



Prad 376 RMI_ Neon

RMI_ Neon #1 - 7/22/2009



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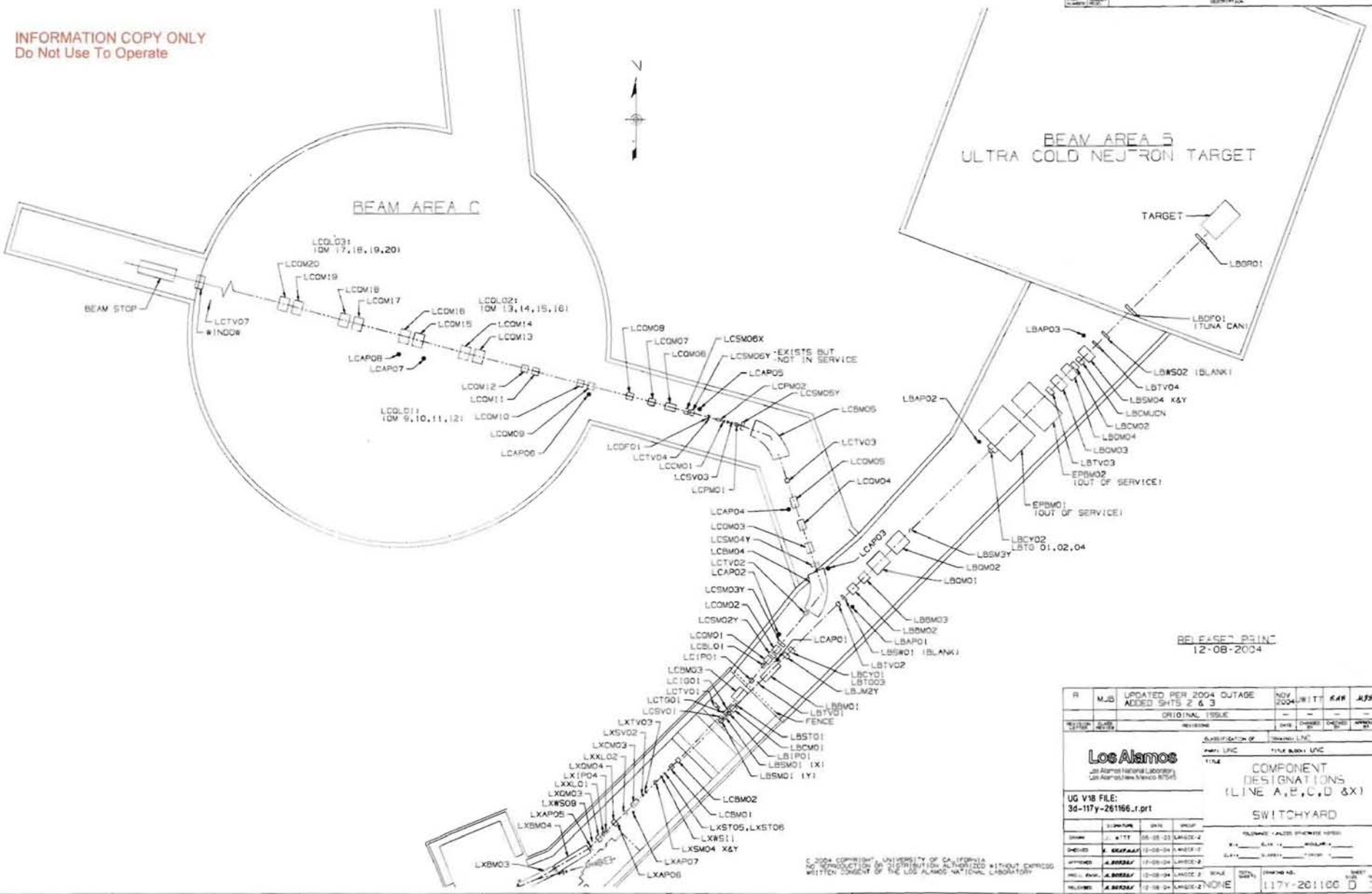

R	MJB	UPDATED PER 2004 OUTAGE ADDED SHTS 2 & 3	NOV 2004	WITT	KAR	JJS
		ORIGINAL ISSUE	—	—	—	—
REVISION LETTER	CLASS REVISION	REVISIONS	DATE	CHECKED BY	CHECKED BY	APPROVED BY

Los Alamos
Los Alamos National Laboratory
Los Alamos, New Mexico 87545

UG V18 FILE:
3d-117y-261166_r.prt

TITLE: COMPONENT DESIGNATIONS (LINE A,B,C,D &X)

SWITCHYARD

	SIGNATURE	DATE	GROUP
DRAWN	J. WITT	06-05-03	LANSCE-2
CHECKED	K. KRAFCAK	12-08-04	LANSCE-2
APPROVED	J. SOSSAI	12-08-04	LANSCE-2
REL. ENG.	J. SOSSAI	12-08-04	LANSCE-2
RELEASED	J. SOSSAI	12-08-04	LANSCE-2

SCALE: NONE

DRAWING NO. 117Y-261166 SHEET 3 OF 3

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Proton Radiography
Science Based Stockpile Stewardship

43968 | 7/23/2009 7:47:09 AM | **EIC** | Edit PRAD0376 - BillyButler - RMI in Neon Gas

Beam Line Change

Beam Line Changed to PRAD0371-RMI PRAD0376

```
Beam Line Title: PRAD0371-RMI PRAD0376 - 07/16/2009 - 6 Foot [117]
Comment: PRAD0371-RMI PRAD0376
Mode: Perm Mag X3
Vessel: 6 Foot
Collimator IL0: None
Collimator IL1: 10 mr Straight
Collimator IL2: None
Window IL0: 250 mill Al
Window Object Up: N/A
Window Object Down: N/A
Window Up IL1: 250 mill Al
Window Down IL1: 20 mil Kapton
Window IL2: 62.5 mil Al
Converter IL0: None
Converter IL1: 1.9 mm LSO, 2x3
Converter IL2: 2.2 mm Mosaic, LSO, black
Location: LANSCE, Line C, Cave
Key: 117
Date Created: 7/16/2009
```

Refresh Show Filters New Entry

PRAD Home > Logbook Home

PRAD On-Line | Logbook | PRAD Off-Line | Run Status | Beam Status | Phone

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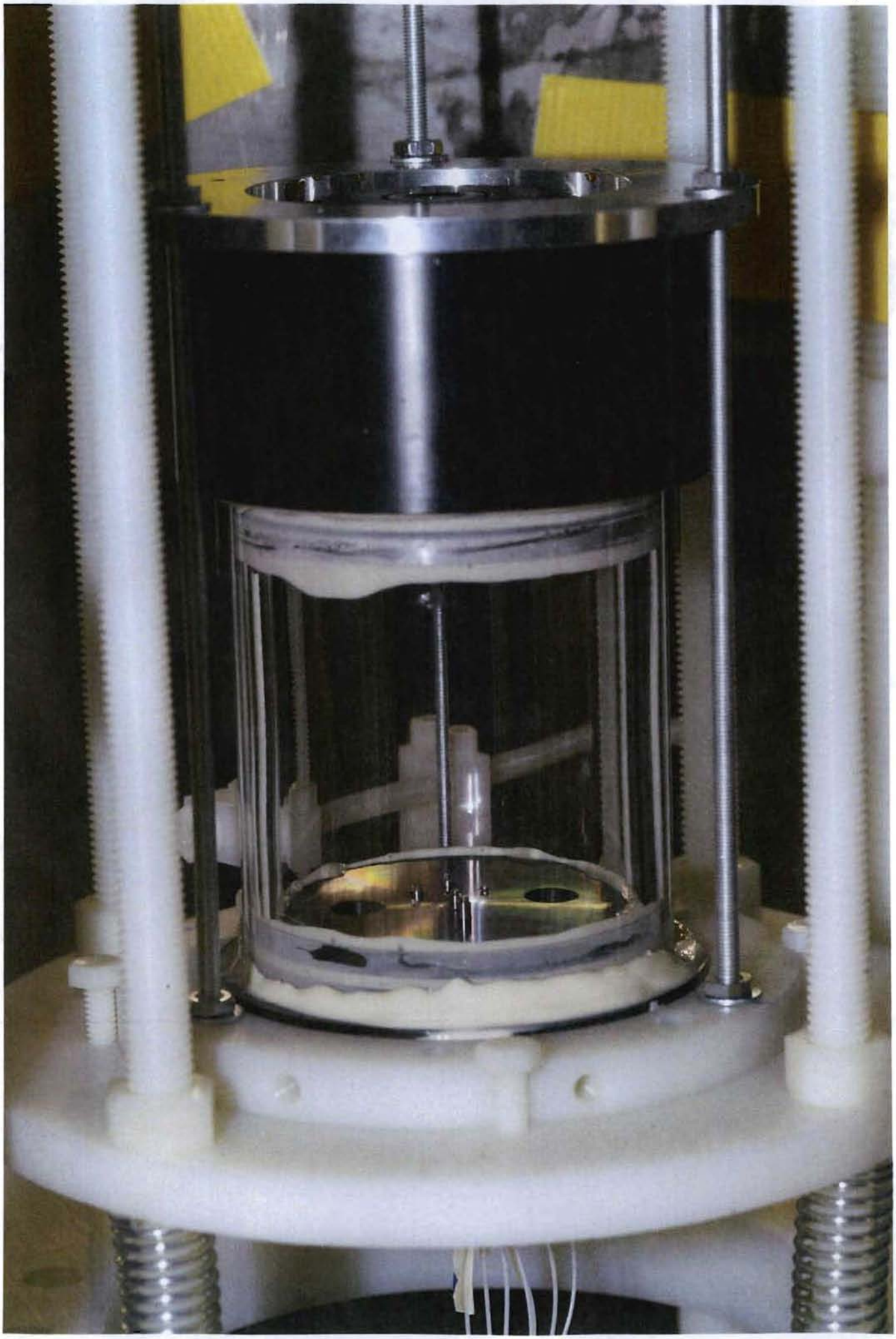

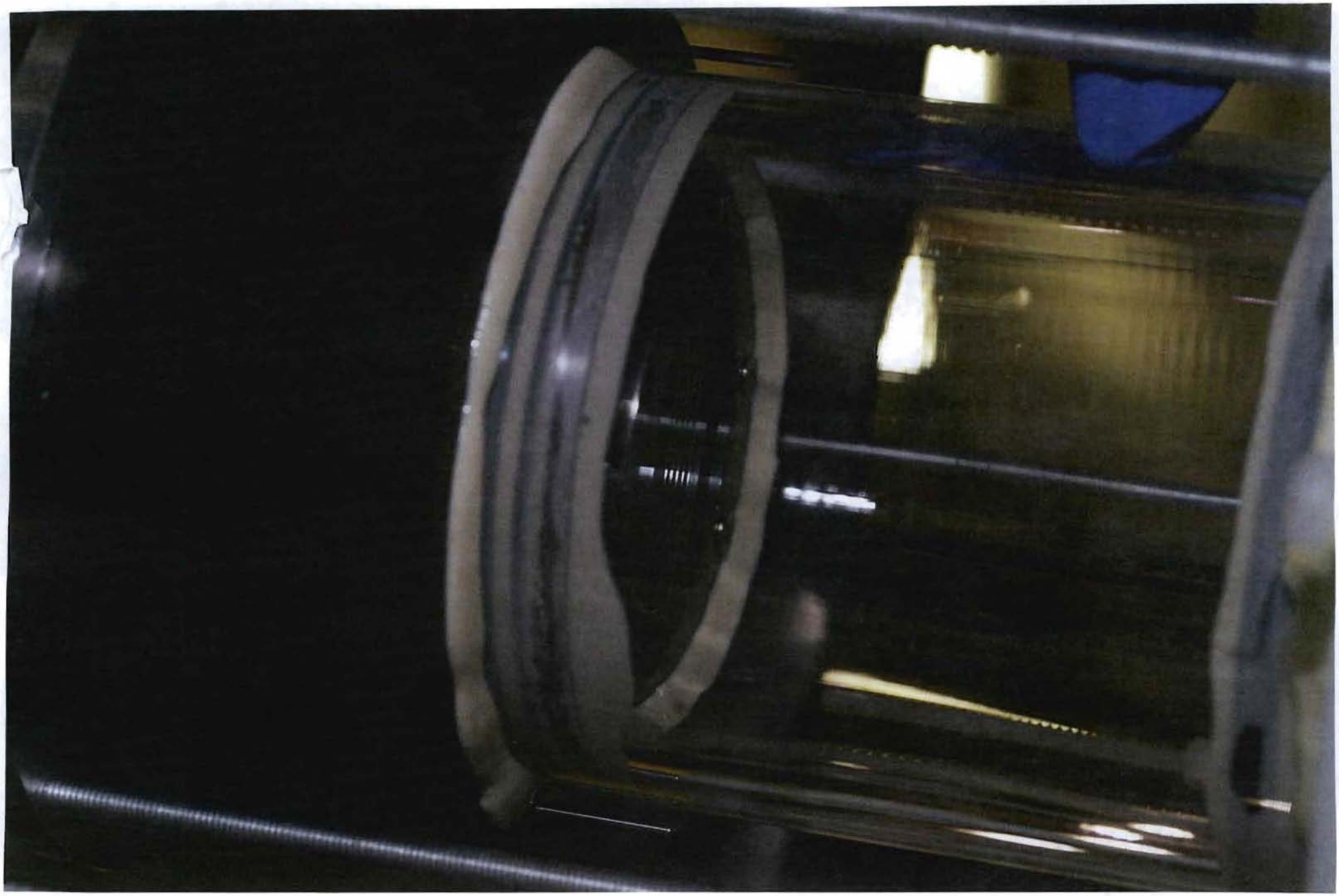

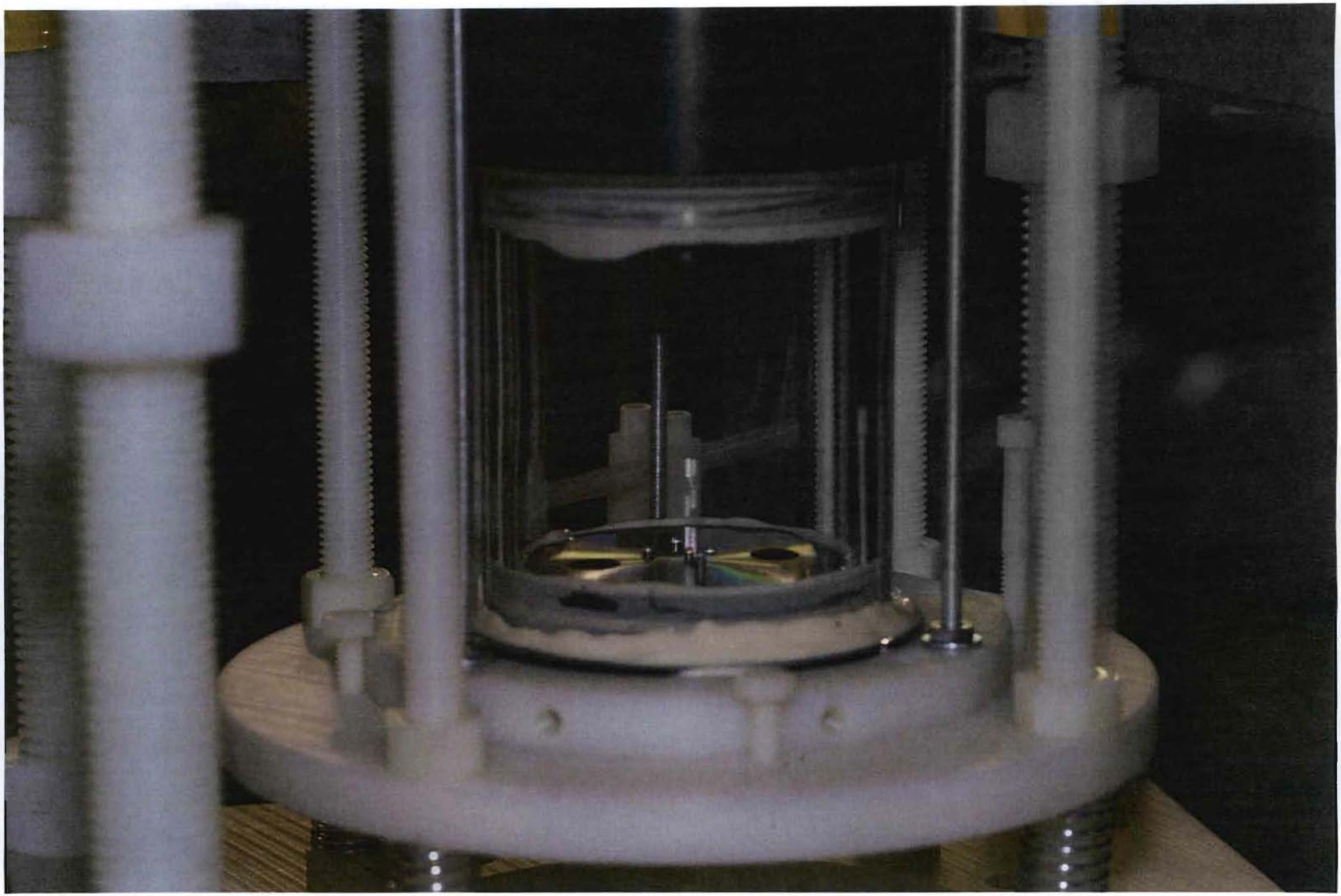

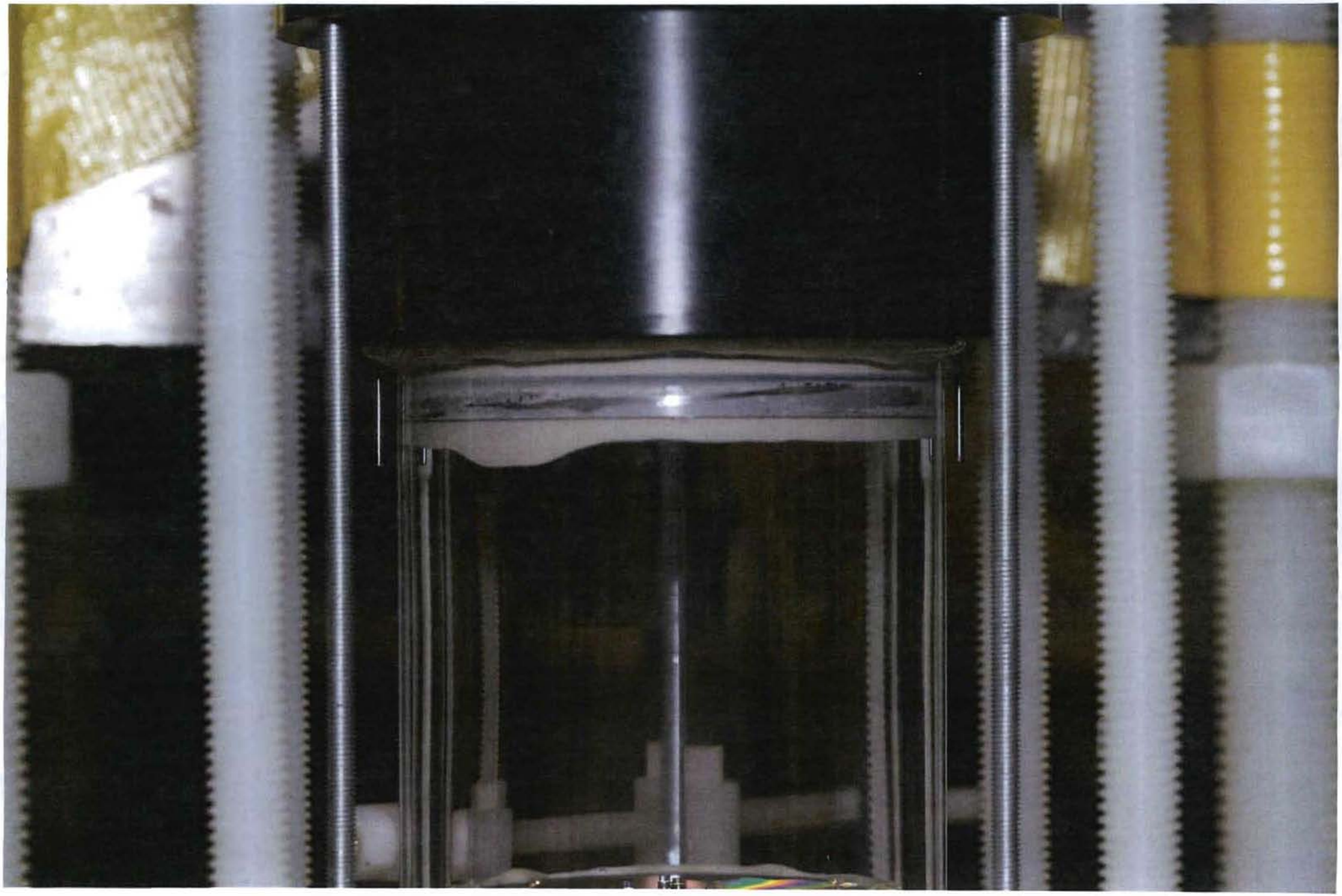

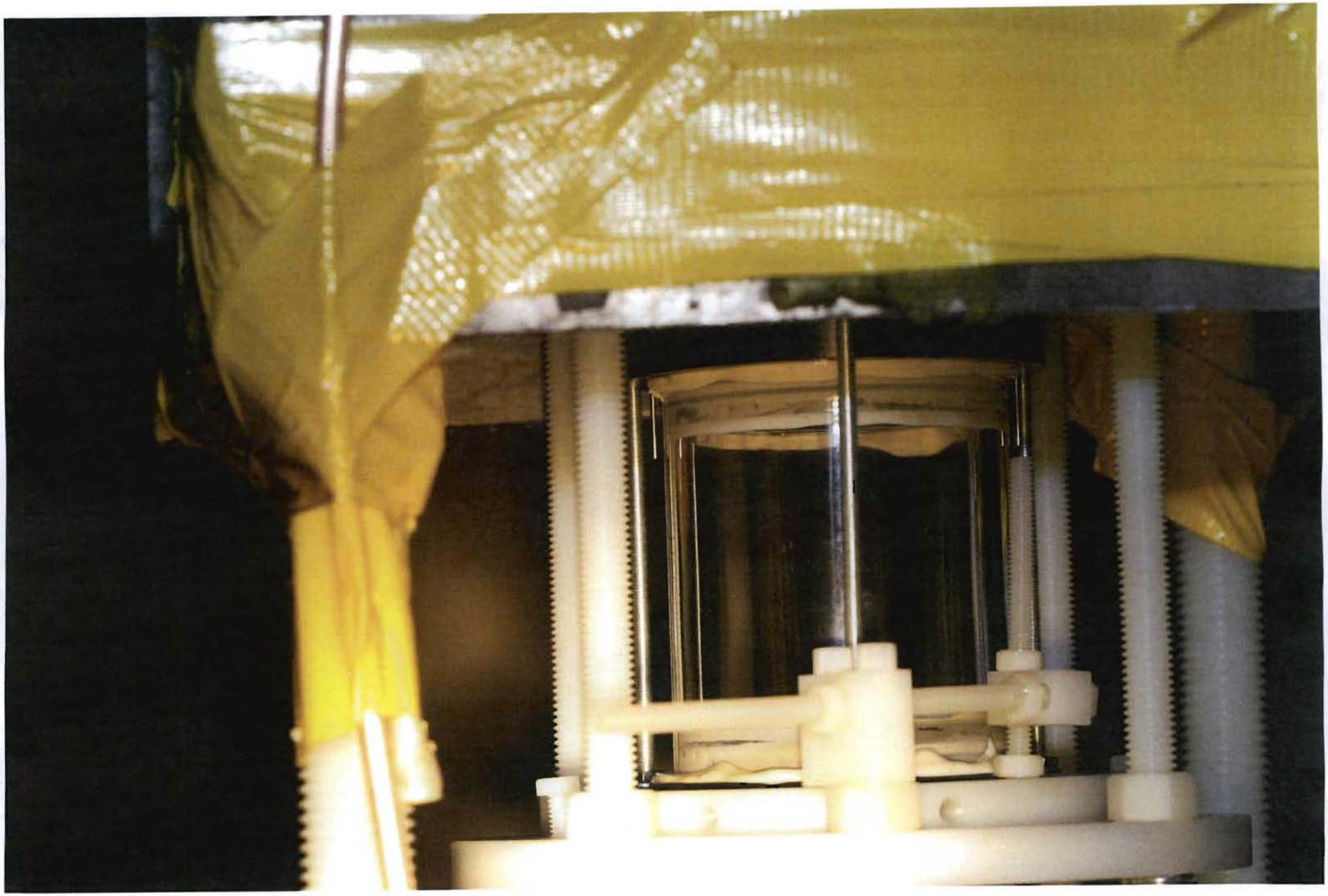

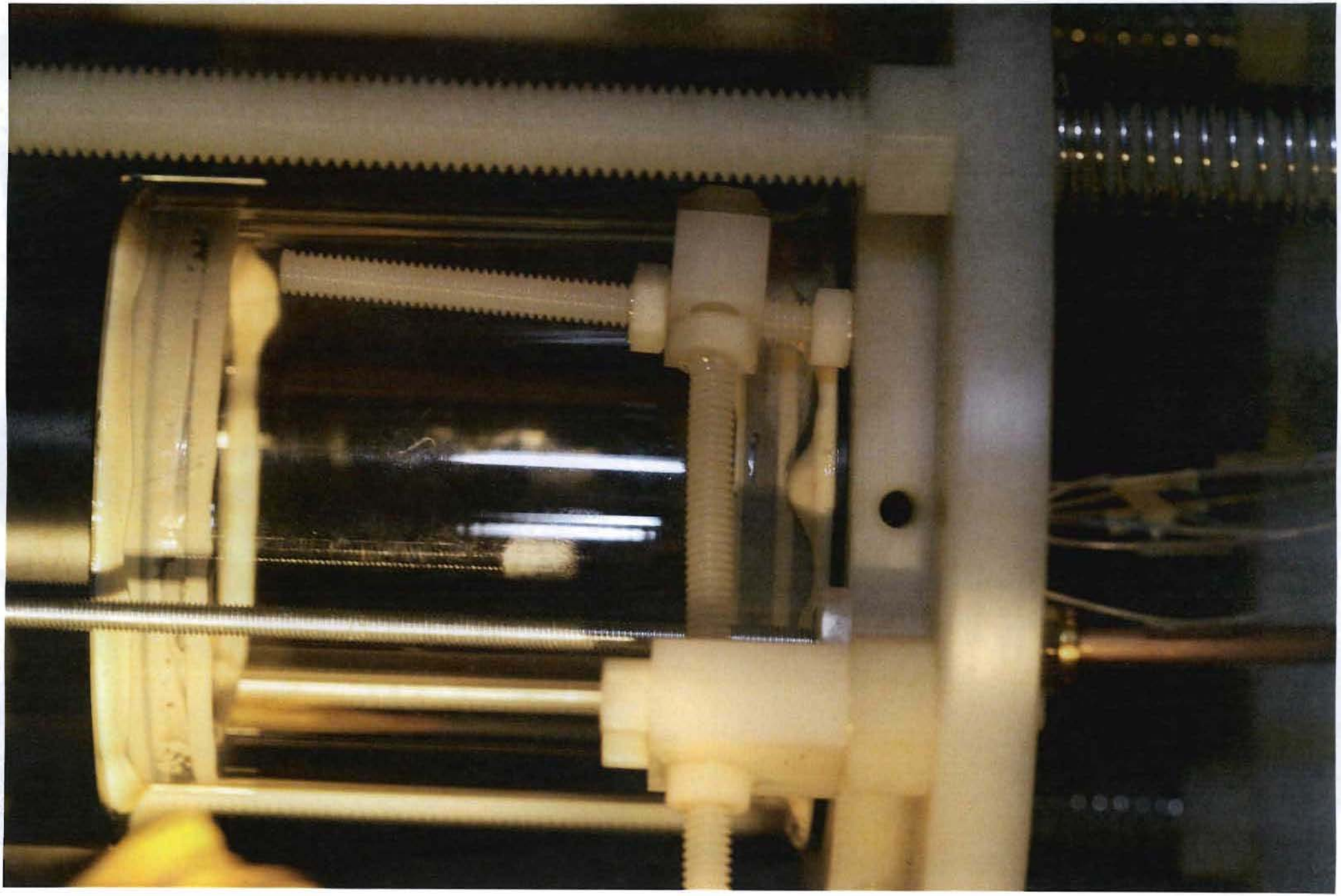

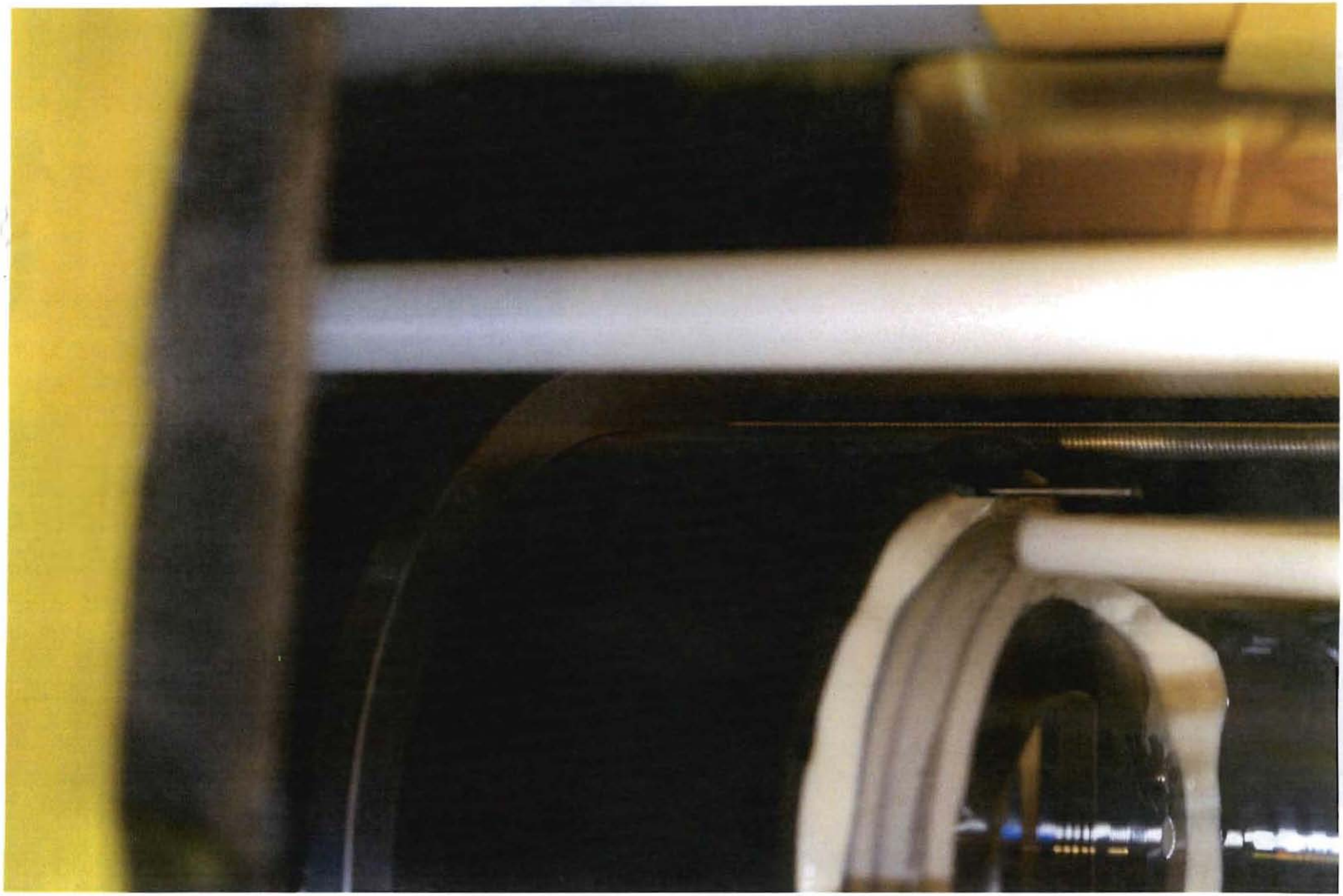

Proton Radiography
Science Based Stockpile Stewardship

43967 | 7/23/2009 7:42:13 AM | **EIC** | Edit PRAD0376 - BillyButler - RMI in Neon Gas

Activity Change

Activity Changed to PRAD0376 [488]

43968 | 7/23/2009 7:47:09 AM | **EIC** | Edit PRAD0376 - BillyButler - RMI in Neon Gas

Beam Line Change

Beam Line Changed to PRAD0371-RMI PRAD0376

Beam Line Title: PRAD0371-RMI PRAD0376 - 07/16/2009 - 6 Foot [117]

Comment: PRAD0371-RMI PRAD0376

Mode: Perm Mag X3

Vessel: 6 Foot

Collimator IL0: None

Collimator IL1: 10 mr Straight

Collimator IL2: None

Window IL0: 250 mill Al

Window Object Up: N/A

Window Object Down: N/A

Window Up IL1: 250 mill Al

Window Down IL1: 20 mil Kapton

Window IL2: 62.5 mil Al

Converter IL0: None

Converter IL1: 1.9 mm LSO, 2x3

Converter IL2: 2.2 mm Mosaic, LSO, black

Location: LANSCE, Line C, Cave

Key: 117

Date Created: 7/16/2009

43969 | 7/23/2009 7:52:07 AM | **EIC** | Edit PRAD0376 - BillyButler - RMI in Neon Gas

Beam Line Configuration

43970 | 7/23/2009 7:53:08 AM | **EIC** | Edit PRAD0376 - BillyButler - RMI in Neon Gas

Run: Picture: Type: HV Off

Picture Type Change

Picture Type changed to HV Off [13]

43971 | 7/23/2009 9:14:37 AM | **DAQ On-line** | PRAD0376 - BillyButler - RMI in Neon Gas

Edit

Run: Picture: 31705 Type: HV Off

Independent Picture

07/23 09:14 *Picture* **31705**, HV Off, Cameras X, Y, Z, T, U, V, Q, R, S, N, O, P, K, L, M, H,

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43972 | 7/23/2009 9:15:30 AM | **DAQ On-line** | PRAD0376 - BillyButler - RMI in Neon Gas

Edit

Run: Picture: 31706 Type: HV Off

Independent Picture

07/23 09:15 *Picture* **31706**, HV Off, Cameras X, Y, Z, T, U, V, Q, R, S, N, O, P, K, L, M, H,

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43973 | 7/23/2009 9:16:05 AM | **DAQ On-line** | PRAD0376 - BillyButler - RMI in Neon Gas

Edit

Run: 36884 Picture: 31707 Type: HV Off

Start Run

07/23 09:16	*Start Run* **36884**	PRAD 376, Butler RMI in Neon
07/23 09:16	*Arm*	
07/23 09:16	*Info*	**Manual Trigger** from PCPRAD307
07/23 09:16	*Trigger*	
07/23 09:16	*Picture* **31707**	HV Off, Cameras X, Y, Z, T, U, V, Q, R, S, N, O, P, K, L, M, H, I, J, E, A, B, C, D, G, F
07/23 09:17	*End Run*	

43974 | 7/23/2009 9:17:52 AM | **DAQ On-line** | PRAD0376 - BillyButler - RMI in Neon Gas

Edit

Run: 36885 Picture: 31708 Type: HV Off

Start Run

07/23 09:17	*Start Run* **36885**	PRAD 376, Butler RMI in Neon
07/23 09:17	*Arm*	
07/23 09:18	*Info*	**Manual Trigger** from PCPRAD307
07/23 09:18	*Trigger*	

07/23 09:18	*Picture* **31708**	HV Off, Cameras X, Y, Z, T, U, V, Q, R, S, N, O, P, K, L, M, H, I, J, E, A, B, C, D, G, F
07/23 09:19	*End Run*	

43975 | 7/23/2009 10:50:54 AM | **EIC** | Edit PRAD0376 - BillyButler - RMI in Neon Gas

Run: Picture: Type: Dark Field

Picture Type Change

Picture Type changed to Dark Field [1]

43976 | 7/23/2009 10:50:58 AM | **DAQ On-line** | Edit PRAD0376 - BillyButler - RMI in Neon Gas

Run: 36886 Picture: 31709 Type: Dark Field

Start Run

07/23 10:50	*Start Run* **36886**	PRAD 376, Butler RMI in Neon
07/23 10:51	*Arm*	
07/23 10:51	*Info*	**Manual Trigger** from PCPRAD307
07/23 10:51	*Trigger*	
07/23 10:51	*Picture* **31709**	Dark Field, Cameras X, Y, Z, T, U, V, Q, R, S, N, O, P, K, L, M, H, I, J, E, A, B, C, D, G, F
07/23 10:52	*End Run*	

43977 | 7/23/2009 10:53:55 AM | **ASaunders** | Edit PRAD0376 - BillyButler - RMI in Neon Gas

376			cvr to db		db to foi		FOI Camera		DB to 1st camera (		
Buttler RMI Neon					2.75		H		9.45	300	10
	Camera	Daq Timing		seperation between pulses (ns)				CCPG pattern start			CC
1	B	0	0	300000	300100	100		9.45	-0.60	6.7	
2	F1	0	0	300000	300100	100		9.45	-0.60	6.7	
3	A	300	300	300300	300400	100	X=gone	9.75	-0.30	7	
4	G1	300	0	300300	300400	100	X=gone	9.75	-0.30	7	
5	H	600	300	300600	300700	100		10.05	0.00	7.3	
6	F2	600	0	300600	300700	100		10.05	0.00	7.3	
7	K	900	300	300900	301000	100	X=gone	10.35	0.30	7.6	
8	G2	900	0	300900	301000	100	X=gone	10.35	0.30	7.6	
9	N	1200	300	301200	301300	100		10.65	0.60	7.9	
10	F3	1200	0	301200	301300	100		10.65	0.60	7.9	
11	Q	1900	700	301900	302000	100		11.35	1.30	8.6	
12	G3	1900	0	301900	302000	100		11.35	1.30	8.6	
13	T	2600	700	302600	302700	100		12.05	2.00	9.3	
14	F4	2600	0	302600	302700	100		12.05	2.00	9.3	
15	X	3300	700	303300	303400	100		12.75	2.70	10	
16	G4	3300	0	303300	303400	100		12.75	2.70	10	
17	I	4000	700	304000	304100	100		13.45	3.40	10.7	
18	F5	4000	0	304000	304100	100		13.45	3.40	10.7	
19	L	4700	700	304700	304800	100		14.15	4.10	11.4	

20	G5	4700	0	304700	304800	100		14.15	4.10	11.4
21	O	5400	700	305400	305500	100		14.85	4.80	12.1
22	F6	5400	0	305400	305500	100		14.85	4.80	12.1
23	R	6100	700	306100	306200	100		15.55	5.50	12.8
24	G6	6100	0	306100	306200	100		15.55	5.50	12.8
25	U	6800	700	306800	306900	100		16.25	6.20	13.5
26	F7	6800	0	306800	306900	100		16.25	6.20	13.5
27	Y	7600	800	307600	307700	100	X=gone	17.05	7.00	14.3
28	G7	7600	0	307600	307700	100	X=gone	17.05	7.00	14.3
29	J	8400	800	308400	308500	100	X=gone	17.85	7.80	15.1
30	F8	8400	0	308400	308500	100	X=gone	17.85	7.80	15.1
31	M	9200	800	309200	309300	100	X=gone	18.65	8.60	15.9
32	G8	9200	0	309200	309300	100	X=gone	18.65	8.60	15.9
33	P	10000	800	310000	310100	100	X=gone	19.45	9.40	16.7
34	F9	10000	0	310000	310100	100	X=gone	19.45	9.40	16.7
35	S	10800	800	310800	310900	100	X=gone	20.25	10.20	17.5
36	G9	10800	0	310800	310900	100	X=gone	20.25	10.20	17.5
37	V	11600	800	311600	311700	100	X=gone	21.05	11.00	18.3
38	Z	12400	800	312400	312500	100	X=gone	21.85	11.80	19.1
39	E	13200	800	313200	313300	100	X=gone	22.65	12.60	19.9
40	C	14000	800	314000	314100	100	X=gone	23.45	13.40	20.7
41	D	14800	800	314800	314900	100	X=gone	24.25	14.20	21.5

File uploaded: ***Prad376.xls*** of type ***application/vnd.ms-excel***

Click to open uploaded file

43978 | 7/23/2009 10:55:09 AM | **DAQ On-line** | PRAD0376 - BillyButler - RMI in Neon Gas

Edit

Run: Picture: 31710 Type: Dark Field

Independent Picture

07/23 10:55 *Picture* **31710**, Dark Field, Cameras X, Y, Z, T, U, V, Q, R, S, N, O, P, K, L, M

43979 | 7/23/2009 10:55:59 AM | **DAQ On-line** | PRAD0376 - BillyButler - RMI in Neon Gas

Edit

Run: Picture: 31711 Type: Dark Field

Independent Picture

07/23 10:55 *Picture* **31711**, Dark Field, Cameras X, Y, Z, T, U, V, Q, R, S, N, O, P, K, L, M

43980 | 7/23/2009 10:56:49 AM | **DAQ On-line** | PRAD0376 - BillyButler - RMI in Neon Gas

Edit

Run: Picture: 31712 Type: Dark Field

Independent Picture

07/23 10:56 *Picture* **31712**, Dark Field, Cameras X, Y, Z, T, U, V, Q, R, S, N, O, P, K, L, M

43981 | 7/23/2009 10:57:05 AM | **DAQ On-line** | PRAD0376 - BillyButler - RMI in Neon Gas

Edit

Run: 36887 Picture: 31713 Type: Dark Field

Start Run

07/23 10:57	*Start Run* **36887**	PRAD 376, Butler RMI in Neon
07/23 10:57	*Arm*	
07/23 10:57	*Info*	**Manual Trigger** from PCPRAD307
07/23 10:57	*Trigger*	
07/23 10:57	*Picture* **31713**	Dark Field, Cameras X, Y, Z, T, U, V, Q, R, S, N, O, P, K, L, M, H, I, J, E, A, B, C, D, G, F
07/23 10:58	*End Run*	

43982 | 7/23/2009 10:57:26 AM | **ASaunders** | Edit

PRAD0376 - BillyButler - RMI in Neon Gas

7 MeV down on permanent magnets
lens 1 at 1755
lens 3 at 1527

43983 | 7/23/2009 11:02:14 AM | **EIC** | Edit

PRAD0376 - BillyButler - RMI in Neon Gas

Camera Delays

PRAD Trigger Settings - PRAD 376, Butler RMI in Ne

Walk Offset: 0

Camera	Delay	Total Delay	Width
E	13.2	261.63	0.3
A	0.3	248.78	0.3
B	0	248.46	0.3
C	14	262.46	0.3
D	14.8	263.26	0.3
F1	0	248.72	0.2
F2	0.6	249.32	0.21
F3	1.2	249.92	0.21
F4	2.6	251.32	0.21
F5	4	252.72	0.21
F6	5.4	254.12	0.21
F7	6.8	255.52	0.21
F8	8.4	257.12	0.21
F9	10	258.72	0.21
G1	0.3	249.02	0.2
G2	0.9	249.62	0.21
G3	1.9	250.62	0.21
G4	3.3	252.02	0.21
G5	4.7	253.42	0.21

G6	6.1	254.82	0.21
G7	7.6	256.32	0.21
G8	9.2	257.92	0.21
G9	10.8	259.52	0.21
H	0.6	249.29	0.2
I	4	252.69	0.2
J	8.4	257.09	0.2
K	0.9	249.6	0.2
L	4.7	253.4	0.2
M	9.2	257.9	0.2
N	1.2	249.91	0.2
O	5.4	254.11	0.2
P	10	258.71	0.2
Q	1.9	250.59	0.2
R	6.1	254.79	0.2
S	10.8	259.49	0.2
T	2.6	251.29	0.2
U	6.8	255.49	0.2
V	11.6	260.29	0.2
X	3.3	251.99	0.2
Y	7.6	256.29	0.2
Z	12.4	261.09	0.2

43984 | 7/23/2009 11:28:00 AM | **Visar** | Edit PRAD0376 - BillyButler - RMI in Neon Gas

Layout for PDV for shot 376

File uploaded: ***PDVlayoutPrad376.jpg*** of type ***image/jpeg***

Click to open uploaded file

43985 | 7/23/2009 11:28:24 AM | **Visar** | Edit PRAD0376 - BillyButler - RMI in Neon Gas

Timing Layout for PDV for shot 376

File uploaded: ***PDVtiminglayoutPrad376.jpg*** of type ***image/jpeg***

Click to open uploaded file

43986 | 7/23/2009 11:37:40 AM | **EIC** | Edit PRAD0376 - BillyButler - RMI in Neon Gas

Run: Picture: Type: Focus

Picture Type Change

Picture Type changed to Focus [3]

43987 | 7/23/2009 11:38:07 AM | **DAQ On-line** | PRAD0376 - BillyButler - RMI in Neon Gas

Edit

Run: 36888 Picture: 31714 Type: Focus

Start Run

07/23 11:38	*Start Run* **36888**	PRAD 376, Butler RMI in Neon
07/23 11:38	*Arm*	
07/23 11:38	*Trigger*	
07/23 11:38	Lens 1	1755
07/23 11:38	Lens 1	125.717
07/23 11:38	Lens 2	-2.477
07/23 11:38	Lens 2	4.49
07/23 11:38	Lens 2	-4.765
07/23 11:38	Lens 3	1527
07/23 11:38	Lens 3	1551.536
07/23 11:38	Diffuser	1218
07/23 11:38	*Picture* **31714**	Focus, Cameras X, Y, Z, T, U, V, Q, R, S, N, O, P, K, L, M, H, I, J, E, A, B, C, D, G, F
07/23 11:39	*End Run*	

43988 | 7/23/2009 11:57:45 AM | **ASaunders** | PRAD0376 - BillyButler - RMI in Neon Gas

Edit

revised timing for 376

376			cvr to db	db to foi		FOI Camera	DB to 1st camera (		
Buttler	RMI Neon			2.75		H	10.05	300	10
	Camera	Daq Timing		seperation between pulses (ns)			CCPG pattern start		CC
1	B	0	0	300000	300100	100	10.05	-0.60	7.3
2	F1	0	0	300000	300100	100	10.05	-0.60	7.3
3	A	300	300	300300	300400	100 X=gone	10.35	-0.30	7.6
4	G1	300	0	300300	300400	100 X=gone	10.35	-0.30	7.6
5	H	600	300	300600	300700	100	10.65	0.00	7.9
6	F2	600	0	300600	300700	100	10.65	0.00	7.9
7	K	1000	400	301000	301100	100 X=gone	11.05	0.40	8.3
8	G2	1000	0	301000	301100	100 X=gone	11.05	0.40	8.3
9	N	1300	300	301300	301400	100	11.35	0.70	8.6
10	F3	1300	0	301300	301400	100	11.35	0.70	8.6
11	Q	2000	700	302000	302100	100	12.05	1.40	9.3
12	G3	2000	0	302000	302100	100	12.05	1.40	9.3
13	T	2700	700	302700	302800	100	12.75	2.10	10
14	F4	2700	0	302700	302800	100	12.75	2.10	10
15	X	3400	700	303400	303500	100	13.45	2.80	10.7
16	G4	3400	0	303400	303500	100	13.45	2.80	10.7
17	I	4100	700	304100	304200	100	14.15	3.50	11.4
18	F5	4100	0	304100	304200	100	14.15	3.50	11.4
19	L	4800	700	304800	304900	100	14.85	4.20	12.1

20	G5	4800	0	304800	304900	100		14.85	4.20	12.1
21	O	5500	700	305500	305600	100		15.55	4.90	12.8
22	F6	5500	0	305500	305600	100		15.55	4.90	12.8
23	R	6200	700	306200	306300	100		16.25	5.60	13.5
24	G6	6200	0	306200	306300	100		16.25	5.60	13.5
25	U	7000	800	307000	307100	100	X=gone	17.05	6.40	14.3
26	F7	7000	0	307000	307100	100	X=gone	17.05	6.40	14.3
27	Y	7800	800	307800	307900	100	X=gone	17.85	7.20	15.1
28	G7	7800	0	307800	307900	100	X=gone	17.85	7.20	15.1
29	J	8600	800	308600	308700	100	X=gone	18.65	8.00	15.9
30	F8	8600	0	308600	308700	100	X=gone	18.65	8.00	15.9
31	M	9400	800	309400	309500	100	X=gone	19.45	8.80	16.7
32	G8	9400	0	309400	309500	100	X=gone	19.45	8.80	16.7
33	P	10200	800	310200	310300	100	X=gone	20.25	9.60	17.5
34	F9	10200	0	310200	310300	100	X=gone	20.25	9.60	17.5
35	S	11000	800	311000	311100	100	X=gone	21.05	10.40	18.3
36	G9	11000	0	311000	311100	100	X=gone	21.05	10.40	18.3
37	V	11800	800	311800	311900	100	X=gone	21.85	11.20	19.1
38	Z	12600	800	312600	312700	100	X=gone	22.65	12.00	19.9
39	E	13400	800	313400	313500	100	X=gone	23.45	12.80	20.7
40	C	14200	800	314200	314300	100	X=gone	24.25	13.60	21.5
41	D	15000	800	315000	315100	100	X=gone	25.05	14.40	22.3

File uploaded: ***Prad376_0.xls*** of type ***application/vnd.ms-excel***

Click to open uploaded file

43989 | 7/23/2009 11:59:30 AM | **DAQ On-line** | PRAD0376 - BillyButler - RMI in Neon Gas

Edit

Run: 36889 Picture: 31715 Type: Focus

Start Run

07/23 11:59	*Start Run* **36889**	PRAD 376, Butler RMI in Neon
07/23 12:00	*Arm*	
07/23 12:00	*Trigger*	
07/23 12:00	Lens 1	1755
07/23 12:00	Lens 1	125.794
07/23 12:00	Lens 2	-2.456
07/23 12:00	Lens 2	4.49
07/23 12:00	Lens 2	-4.792
07/23 12:00	Lens 3	1527
07/23 12:00	Lens 3	1551.375
07/23 12:00	Diffuser	1218
07/23 12:00	Perm Mg 2	80.134
07/23 12:00	Perm Mg 3	113.175

07/23 12:00	Perm Mg 4	136.287
07/23 12:00	Energy Loss	7
07/23 12:00	Energy Cal	0.0268
07/23 12:00	*Picture* **31715**	Focus, Cameras X, Y, Z, T, U, V, Q, R, S, N, O, P, K, L, M, H, I, J, E, A, B, C, D, G, F
07/23 12:01	*End Run*	

43990 | 7/23/2009 12:03:44 PM | **EIC** | Edit PRAD0376 - BillyButler - RMI in Neon Gas

Camera Delays

PRAD Trigger Settings - PRAD 376, Butler RMI in Ne

Walk Offset: 0

Camera	Delay	Total Delay	Width
E	13.4	261.83	0.3
A	0.3	248.78	0.3
B	0	248.46	0.3
C	14.2	262.66	0.3
D	15	263.46	0.3
F1	0	248.72	0.2
F2	0.6	249.32	0.21
F3	1.3	250.02	0.21
F4	2.7	251.42	0.21
F5	4.1	252.82	0.21
F6	5.5	254.22	0.21
F7	7	255.72	0.21
F8	8.6	257.32	0.21
F9	10.2	258.92	0.21
G1	0.3	249.02	0.2
G2	1	249.72	0.21
G3	2	250.72	0.21
G4	3.4	252.12	0.21
G5	4.8	253.52	0.21
G6	6.2	254.92	0.21
G7	7.8	256.52	0.21
G8	9.4	258.12	0.21
G9	11	259.72	0.21
H	0.6	249.29	0.2
I	4.1	252.79	0.2
J	8.6	257.29	0.2
K	1	249.7	0.2
L	4.8	253.5	0.2
M	9.4	258.1	0.2

N	1.3	250.01	0.2
O	5.5	254.21	0.2
P	10.2	258.91	0.2
Q	2	250.69	0.2
R	6.2	254.89	0.2
S	11	259.69	0.2
T	2.7	251.39	0.2
U	7	255.69	0.2
V	11.8	260.49	0.2
X	3.4	252.09	0.2
Y	7.8	256.49	0.2
Z	12.6	261.29	0.2

43991 | 7/23/2009 12:06:11 PM | **DAQ On-line** | PRAD0376 - BillyButler - RMI in Neon Gas

Edit

Run: 36890 Picture: 31716 Type: Focus

Start Run

07/23 12:06	*Start Run* **36890**	PRAD 376, Butler RMI in Neon
07/23 12:06	*Arm*	
07/23 12:06	*Trigger*	
07/23 12:06	Lens 1	1755
07/23 12:06	Lens 1	125.836
07/23 12:06	Lens 2	-2.482
07/23 12:06	Lens 2	4.49
07/23 12:06	Lens 2	-4.797
07/23 12:06	Lens 3	1527
07/23 12:06	Lens 3	1551.348
07/23 12:06	Diffuser	1218
07/23 12:06	Perm Mg 2	80.134
07/23 12:06	Perm Mg 3	113.175
07/23 12:06	Perm Mg 4	136.287
07/23 12:06	Energy Loss	7
07/23 12:06	Energy Cal	0.0268
07/23 12:06	*Picture* **31716**	Focus, Cameras X, Y, Z, T, U, V, Q, R, S, N, O, P, K, L, M, H, I, J, E, A, B, C, D, G, F

07/23 12:07	*End Run*

43992 | 7/23/2009 12:40:26 PM | **EIC** | Edit PRAD0376 - BillyButler - RMI in Neon Gas

Run: Picture: Type: Timing Check

Picture Type Change

Picture Type changed to Timing Check [24]

43993 | 7/23/2009 12:44:40 PM | **DAQ On-line** | Edit PRAD0376 - BillyButler - RMI in Neon Gas

Run: 36891 Picture: 31717 Type: Timing Check

Start Run

07/23 12:44	*Start Run* **36891**	PRAD 376, Butler RMI in Neon
07/23 12:44	*Arm*	
07/23 12:44	*Trigger*	
07/23 12:44	*Picture* **31717**	Timing Check, Cameras X, Y, Z, T, U, V, Q, R, S, N, O, P, K, L, M, H, I, J, E, A, B, C, D, G, F
07/23 12:45	*End Run*	

43994 | 7/23/2009 12:46:54 PM | **EIC** | Edit PRAD0376 - BillyButler - RMI in Neon Gas

Run: Picture: Type: PreShot

Picture Type Change

Picture Type changed to PreShot [6]

43995 | 7/23/2009 12:46:58 PM | **DAQ On-line** | Edit PRAD0376 - BillyButler - RMI in Neon Gas

Run: 36892 Picture: 31718 Type: PreShot

Start Run

07/23 12:46	*Start Run* **36892**	PRAD 376, Butler RMI in Neon
07/23 12:47	*Arm*	
07/23 12:47	*Trigger*	
07/23 12:47	MP Width	60
07/23 12:47	MP Countdown	9999
07/23 12:47	*Picture* **31718**	PreShot, Cameras X, Y, Z, T, U, V, Q, R, S, N, O, P, K, L, M, H, I, J, E, A, B, C, D, G, F

07/23 12:48	*End Run*

43996 | 7/23/2009 12:48:23 PM | **DAQ On-line** | PRAD0376 - BillyButler - RMI in Neon Gas

Edit

Run: 36893 Picture: 31719 Type: PreShot

Start Run

07/23 12:48	*Start Run* **36893**	PRAD 376, Butler RMI in Neon
07/23 12:48	*Arm*	
07/23 12:48	*Trigger*	
07/23 12:48	MP Width	60
07/23 12:48	MP Countdown	9999
07/23 12:48	*Picture* **31719**	PreShot, Cameras X, Y, Z, T, U, V, Q, R, S, N, O, P, K, L, M, H, I, J, E, A, B, C, D, G, F
07/23 12:49	*End Run*	

43997 | 7/23/2009 12:50:07 PM | **DAQ On-line** | PRAD0376 - BillyButler - RMI in Neon Gas

Edit

Run: 36894 Picture: 31720 Type: PreShot

Start Run

07/23 12:50	*Start Run* **36894**	PRAD 376, Butler RMI in Neon
07/23 12:50	*Arm*	
07/23 12:50	*Trigger*	
07/23 12:50	MP Width	60
07/23 12:50	MP Countdown	9999
07/23 12:50	*Picture* **31720**	PreShot, Cameras X, Y, Z, T, U, V, Q, R, S, N, O, P, K, L, M, H, I, J, E, A, B, C, D, G, F
07/23 12:51	*End Run*	

43998 | 7/23/2009 12:51:41 PM | **DAQ On-line** | PRAD0376 - BillyButler - RMI in Neon Gas

Edit

Run: 36895 Picture: 31721 Type: PreShot

Start Run

07/23 12:51	*Start Run* **36895**	PRAD 376, Butler RMI in Neon

07/23 12:51	*Arm*	
07/23 12:51	*Trigger*	
07/23 12:51	MP Width	60
07/23 12:51	MP Countdown	9999
07/23 12:51	*Picture* **31721**	PreShot, Cameras X, Y, Z, T, U, V, Q, R, S, N, O, P, K, L, M, H, I, J, E, A, B, C, D, G, F
07/23 12:52	*End Run*	

43999 | 7/23/2009 12:53:07 PM | **DAQ On-line** | Edit PRAD0376 - BillyButler - RMI in Neon Gas

Run: 36896 Picture: 31722 Type: PreShot

Start Run

07/23 12:53	*Start Run* **36896**	PRAD 376, Butler RMI in Neon
07/23 12:53	*Arm*	
07/23 12:53	*Trigger*	
07/23 12:53	MP Width	60
07/23 12:53	MP Countdown	9999
07/23 12:53	*Picture* **31722**	PreShot, Cameras X, Y, Z, T, U, V, Q, R, S, N, O, P, K, L, M, H, I, J, E, A, B, C, D, G, F
07/23 12:54	*End Run*	

44000 | 7/23/2009 12:54:37 PM | **EIC** | Edit PRAD0376 - BillyButler - RMI in Neon Gas

Run: Picture: Type: Dynamic

Picture Type Change

Picture Type changed to Dynamic [7]

44001 | 7/23/2009 12:56:19 PM | **DAQ On-line** | Edit PRAD0376 - BillyButler - RMI in Neon Gas

Run: 36897 Picture: 31723 Type: Dynamic

Start Run

07/23 12:56	*Start Run* **36897**	PRAD 376, Butler RMI in Neon
07/23 12:57	*Arm*	
07/23 12:57	*Trigger*	

07/23 12:57	Lens 1	1755
07/23 12:57	Lens 1	126.187
07/23 12:57	Lens 2	-2.493
07/23 12:57	Lens 2	4.49
07/23 12:57	Lens 2	-4.684
07/23 12:57	Lens 3	1527
07/23 12:57	Lens 3	1551.367
07/23 12:57	Diffuser	1218
07/23 12:57	H-GX Gate Delay	200
07/23 12:57	H-GX Gate Length	625
07/23 12:57	MP Width	60
07/23 12:57	MP Countdown	9999
07/23 12:57	Perm Mg 2	80.134
07/23 12:57	Perm Mg 3	113.175
07/23 12:57	Perm Mg 4	136.287
07/23 12:57	Energy Loss	7
07/23 12:57	Energy Cal	0.0268
07/23 12:57	Beam Line Title	PRAD0371-RMI PRAD0376 - 07/16/2009 - 6 Foot [117]
07/23 12:57	Comment	PRAD0371-RMI PRAD0376
07/23 12:57	Mode	Perm Mag X3
07/23 12:57	Vessel	6 Foot
07/23 12:57	Collimator IL0	None
07/23 12:57	Collimator IL1	10 mr Straight
07/23 12:57	Collimator IL2	None
07/23 12:57	Window IL0	250 mill Al
07/23 12:57	Window Object Up	N/A
07/23 12:57	Window Object Down	N/A
07/23 12:57	Window Up IL1	250 mill Al
07/23 12:57	Window Down IL1	20 mil Kapton

07/23 12:57	Window IL2	62.5 mil Al
07/23 12:57	Converter IL0	None
07/23 12:57	Converter IL1	1.9 mm LSO, 2x3
07/23 12:57	Converter IL2	2.2 mm Mosaic, LSO, black
07/23 12:57	Location	LANSCE, Line C, Cave
07/23 12:57	Key	117
07/23 12:57	Date Created	7/16/2009
07/23 12:57	*Picture* **31723**	Dynamic, Cameras X, Y, Z, T, U, V, Q, R, S, N, O, P, K, L, M, H, I, J, E, A, B, C, D, G, F
07/23 12:58	*End Run*	

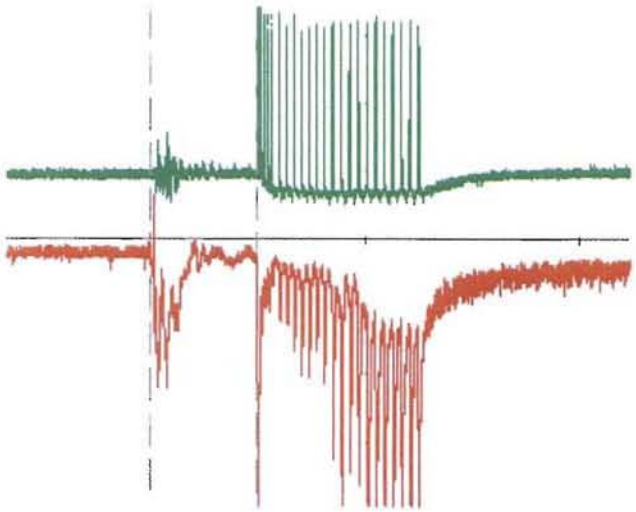
44002 | 7/23/2009 1:06:03 PM | **JDLopez** | Edit PRAD0376 - BillyButler - RMI in Neon Gas

```
CVR to 1st Camera
Target: 10.05 uS
Actual: 10.04 uS

Markers: Scope 9, LeCroy LT584M

Time Markers
        1        2
1       0.0000E+00       -1.0043E-05
2       1.0043E-05       0.0000E+00

Value   2.3994E-04       2.4998E-04
```



File uploaded: ***P376.bmp*** of type ***image/bmp***

Click to open uploaded file

44003 | 7/23/2009 1:11:10 PM | **EIC** | Edit PRAD0376 - BillyButler - RMI in Neon Gas

Run: Picture: Type: Small Fiducial

Picture Type Change

Picture Type changed to Small Fiducial [11]

44004 | 7/23/2009 1:11:23 PM | **DAQ On-line** | PRAD0376 - BillyButler - RMI in Neon Gas

Edit

Run: 36898 Picture: 31724 Type: Small Fiducial

Start Run

07/23 13:11	*Start Run* **36898**	PRAD 376, Butler RMI in Neon
07/23 13:11	*Arm*	
07/23 13:11	*Trigger*	
07/23 13:11	Lens 1	1755
07/23 13:11	Lens 1	126.081
07/23 13:11	Lens 2	-2.491
07/23 13:11	Lens 2	4.49
07/23 13:11	Lens 2	-4.449
07/23 13:11	Lens 3	1527
07/23 13:11	Lens 3	1551.453
07/23 13:11	Diffuser	1218
07/23 13:11	Perm Mg 2	80.134
07/23 13:11	Perm Mg 3	113.175
07/23 13:11	Perm Mg 4	136.287
07/23 13:11	Energy Loss	7
07/23 13:11	Energy Cal	0.0268
07/23 13:11	*Picture* **31724**	Small Fiducial, Cameras X, Y, Z, T, U, V, Q, R, S, N, O, P, K, L, M, H, I, J, E, A, B, C, D, G, F
07/23 13:12	*End Run*	

44005 | 7/23/2009 1:16:49 PM | **DAQ On-line** | PRAD0376 - BillyButler - RMI in Neon Gas

Edit

Run: 36899 Picture: 31725 Type: Small Fiducial

Start Run

07/23	*Start Run*	PRAD 376, Butler RMI in Neon

13:16	**36899**	
07/23 13:16	*Arm*	
07/23 13:17	*Trigger*	
07/23 13:17	Lens 1	1755
07/23 13:17	Lens 1	126.054
07/23 13:17	Lens 2	-2.473
07/23 13:17	Lens 2	4.49
07/23 13:17	Lens 2	-4.921
07/23 13:17	Lens 3	1527
07/23 13:17	Lens 3	1551.468
07/23 13:17	Diffuser	1218
07/23 13:17	Perm Mg 2	80.134
07/23 13:17	Perm Mg 3	113.175
07/23 13:17	Perm Mg 4	136.287
07/23 13:17	Energy Loss	7
07/23 13:17	Energy Cal	0.0268
07/23 13:17	*Picture* **31725**	Small Fiducial, Cameras X, Y, Z, T, U, V, Q, R, S, N, O, P, K, L, M, H, I, J, E, A, B, C, D, G, F
07/23 13:18	*End Run*	

44006 | 7/23/2009 1:19:10 PM | **Visar** | Edit PRAD0376 - BillyButler - RMI in Neon Gas

Preliminary Results for PDV data shot 376 probe 1

File uploaded: ***Probe_1_Preliminary_FFT_4.jpg*** of type ***image/jpeg***

Click to open uploaded file

44007 | 7/23/2009 1:19:35 PM | **Visar** | Edit PRAD0376 - BillyButler - RMI in Neon Gas

Preliminary Results for PDV data shot 376 probe 2

File uploaded: ***Probe_2_Preliminary_FFT_4.jpg*** of type ***image/jpeg***

Click to open uploaded file

44008 | 7/23/2009 1:19:43 PM | **DAQ On-line** | PRAD0376 - BillyButler - RMI in Neon Gas

Edit

Run: 36900 Picture: 31726 Type: Small Fiducial

Start Run

07/23 13:19	*Start Run* **36900**	PRAD 376, Butler RMI in Neon
07/23 13:19	*Arm*	
07/23 13:19	*Trigger*	
07/23 13:19	Lens 1	1755
07/23 13:19	Lens 1	125.983
07/23 13:19	Lens 2	-2.477
07/23 13:19	Lens 2	4.49
07/23 13:19	Lens 2	-4.594
07/23 13:19	Lens 3	1527
07/23 13:19	Lens 3	1551.484
07/23 13:19	Diffuser	1218
07/23 13:19	Perm Mg 2	80.134
07/23 13:19	Perm Mg 3	113.175
07/23 13:19	Perm Mg 4	136.287
07/23 13:19	Energy Loss	7
07/23 13:19	Energy Cal	0.0268
07/23 13:20	*Picture* **31726**	Small Fiducial, Cameras X, Y, Z, T, U, V, Q, R, S, N, O, P, K, L, M, H, I, J, E, A, B, C, D, G, F
07/23 13:20	*End Run*	

44009 | 7/23/2009 1:19:53 PM | **Visar** | Edit PRAD0376 - BillyButler - RMI in Neon Gas

Preliminary Results for PDV data shot 376 probe 3

File uploaded: ***Probe_3_Preliminary_FFT_4.jpg*** of type ***image/jpeg***

Click to open uploaded file

44010 | 7/23/2009 1:20:13 PM | **Visar** | Edit PRAD0376 - BillyButler - RMI in Neon Gas

Preliminary Results for PDV data shot 376 probe 4

File uploaded: ***Probe_4_Preliminary_FFT_4.jpg*** of type ***image/jpeg***

Click to open uploaded file

44011 | 7/23/2009 1:20:40 PM | **Visar** | Edit PRAD0376 - BillyButler - RMI in Neon Gas

```
Preliminary  Results for PDV data shot 376 probe 5
```

File uploaded: ***Probe_5_Preliminary_FFT_1.jpg*** of type ***image/jpeg***

Click to open uploaded file

44012 | 7/23/2009 1:20:52 PM | **Visar** | Edit PRAD0376 - BillyButler - RMI in Neon Gas

```
Preliminary  Results for PDV data shot 376 probe 6
```

File uploaded: ***Probe_6_Preliminary_FFT_0.jpg*** of type ***image/jpeg***

Click to open uploaded file

44013 | 7/23/2009 1:21:07 PM | **Visar** | Edit PRAD0376 - BillyButler - RMI in Neon Gas

```
Preliminary  Results for PDV data shot 376 probe 7
```

File uploaded: ***Probe_7_Preliminary_FFT_0.jpg*** of type ***image/jpeg***

Click to open uploaded file

44014 | 7/23/2009 1:21:14 PM | **EIC** | Edit PRAD0376 - BillyButler - RMI in Neon Gas

Run: Picture: Type: Beam

Picture Type Change

```
Picture Type changed to Beam [2]
```

44015 | 7/23/2009 1:21:47 PM | **DAQ On-line** | Edit PRAD0376 - BillyButler - RMI in Neon Gas

Run: 36901 Picture: 31727 Type: Beam

Start Run

07/23 13:21	*Start Run* **36901**	PRAD 376, Butler RMI in Neon
07/23 13:21	*Arm*	
07/23 13:22	*Trigger*	
07/23 13:22	Diffuser	1218
07/23 13:22	MP Width	60

07/23 13:22	*Picture* **31727**	Beam, Cameras X, Y, Z, T, U, V, Q, R, S, N, O, P, K, L, M, H, I, J, E, A, B, C, D, G, F
07/23 13:23	*End Run*	

44016 | 7/23/2009 1:23:45 PM | **DAQ On-line** | PRAD0376 - BillyButler - RMI in Neon Gas

Edit

Run: 36902 Picture: 31728 Type: Beam

Start Run

07/23 13:23	*Start Run* **36902**	PRAD 376, Butler RMI in Neon
07/23 13:23	*Arm*	
07/23 13:24	*Trigger*	
07/23 13:24	Diffuser	1218
07/23 13:24	MP Width	60
07/23 13:24	*Picture* **31728**	Beam, Cameras X, Y, Z, T, U, V, Q, R, S, N, O, P, K, L, M, H, I, J, E, A, B, C, D, G, F
07/23 13:25	*End Run*	

44017 | 7/23/2009 1:25:13 PM | **DAQ On-line** | PRAD0376 - BillyButler - RMI in Neon Gas

Edit

Run: 36903 Picture: 31729 Type: Beam

Start Run

07/23 13:25	*Start Run* **36903**	PRAD 376, Butler RMI in Neon
07/23 13:25	*Arm*	
07/23 13:25	*Trigger*	
07/23 13:25	Diffuser	1218
07/23 13:25	MP Width	60
07/23 13:25	*Picture* **31729**	Beam, Cameras X, Y, Z, T, U, V, Q, R, S, N, O, P, K, L, M, H, I, J, E, A, B, C, D, G, F
07/23 13:26	*End Run*	

44018 | 7/23/2009 1:27:05 PM | **DAQ On-line** | PRAD0376 - BillyButler - RMI in Neon Gas

Edit

Run: 36904 Picture: 31730 Type: Beam

Start Run

07/23 13:27	*Start Run* **36904**	PRAD 376, Butler RMI in Neon
07/23 13:27	*Arm*	
07/23 13:27	*Trigger*	
07/23 13:27	Diffuser	1218
07/23 13:27	MP Width	60
07/23 13:27	*Picture* **31730**	Beam, Cameras X, Y, Z, T, U, V, Q, R, S, N, O, P, K, L, M, H, I, J, E, A, B, C, D, G, F
07/23 13:28	*End Run*	

44019 | 7/23/2009 1:29:37 PM | **DAQ On-line** | PRAD0376 - BillyButler - RMI in Neon Gas

Edit

Run: 36905 Picture: 31731 Type: Beam

Start Run

07/23 13:29	*Start Run* **36905**	PRAD 376, Butler RMI in Neon
07/23 13:29	*Arm*	
07/23 13:29	*Trigger*	
07/23 13:29	Diffuser	1219
07/23 13:29	MP Width	60
07/23 13:29	*Picture* **31731**	Beam, Cameras X, Y, Z, T, U, V, Q, R, S, N, O, P, K, L, M, H, I, J, E, A, B, C, D, G, F
07/23 13:30	*End Run*	

44020 | 7/23/2009 1:31:03 PM | **DAQ On-line** | PRAD0376 - BillyButler - RMI in Neon Gas

Edit

Run: 36906 Picture: 31732 Type: Beam

Start Run

07/23 13:31	*Start Run* **36906**	PRAD 376, Butler RMI in Neon
07/23 13:31	*Arm*	
07/23 13:31	*Trigger*	
07/23 13:31	Diffuser	1218
07/23 13:31	MP Width	60
07/23 13:31	*Picture* **31732**	Beam, Cameras X, Y, Z, T, U, V, Q, R, S, N, O, P, K, L, M, H, I, J, E, A, B, C, D, G, F

07/23 13:32	*End Run*

44021 | 7/23/2009 1:32:34 PM | **DAQ On-line** | PRAD0376 - BillyButler - RMI in Neon Gas

Edit

Run: 36907 Picture: 31733 Type: Beam

Start Run

07/23 13:32	*Start Run* **36907**	PRAD 376, Butler RMI in Neon
07/23 13:32	*Arm*	
07/23 13:32	*Trigger*	
07/23 13:32	Diffuser	1218
07/23 13:32	MP Width	60
07/23 13:32	*Picture* **31733**	Beam, Cameras X, Y, Z, T, U, V, Q, R, S, N, O, P, K, L, M, H, I, J, E, A, B, C, D, G, F
07/23 13:33	*End Run*	

44022 | 7/23/2009 1:33:52 PM | **DAQ On-line** | PRAD0376 - BillyButler - RMI in Neon Gas

Edit

Run: 36908 Picture: 31734 Type: Beam

Start Run

07/23 13:33	*Start Run* **36908**	PRAD 376, Butler RMI in Neon
07/23 13:33	*Arm*	
07/23 13:34	*Trigger*	
07/23 13:34	Diffuser	1218
07/23 13:34	MP Width	60
07/23 13:34	*Picture* **31734**	Beam, Cameras X, Y, Z, T, U, V, Q, R, S, N, O, P, K, L, M, H, I, J, E, A, B, C, D, G, F
07/23 13:35	*End Run*	

44023 | 7/23/2009 1:35:14 PM | **DAQ On-line** | PRAD0376 - BillyButler - RMI in Neon Gas

Edit

Run: 36909 Picture: 31735 Type: Beam

Start Run

07/23 13:35	*Start Run* **36909**	PRAD 376, Butler RMI in Neon

07/23 13:35	*Arm*	
07/23 13:35	*Trigger*	
07/23 13:35	Diffuser	1218
07/23 13:35	MP Width	60
07/23 13:35	*Picture* **31735**	Beam, Cameras X, Y, Z, T, U, V, Q, R, S, N, O, P, K, L, M, H, I, J, E, A, B, C, D, G, F
07/23 13:36	*End Run*	

44024 | 7/23/2009 1:36:37 PM | **DAQ On-line** | PRAD0376 - BillyButler - RMI in Neon Gas

Edit

Run: 36910 Picture: 31736 Type: Beam

Start Run

07/23 13:36	*Start Run* **36910**	PRAD 376, Butler RMI in Neon
07/23 13:36	*Arm*	
07/23 13:36	*Trigger*	
07/23 13:36	Diffuser	1219
07/23 13:36	MP Width	60
07/23 13:36	*Picture* **31736**	Beam, Cameras X, Y, Z, T, U, V, Q, R, S, N, O, P, K, L, M, H, I, J, E, A, B, C, D, G, F
07/23 13:37	*End Run*	

44025 | 7/23/2009 1:38:18 PM | **EIC** | Edit PRAD0376 - BillyButler - RMI in Neon Gas

Run: Picture: Type: Dark Field

Picture Type Change

Picture Type changed to Dark Field [1]

44026 | 7/23/2009 1:38:26 PM | **DAQ On-line** | PRAD0376 - BillyButler - RMI in Neon Gas

Edit

Run: 36911 Picture: 31737 Type: Dark Field

Start Run

07/23 13:38	*Start Run* **36911**	PRAD 376, Butler RMI in Neon
07/23 13:38	*Arm*	
07/23 13:38	*Info*	**Manual Trigger** from PCPRAD307

07/23 13:38	*Trigger*	
07/23 13:38	*Picture* **31737**	Dark Field, Cameras X, Y, Z, T, U, V, Q, R, S, N, O, P, K, L, M, H, I, J, E, A, B, C, D, G, F
07/23 13:39	*End Run*	

44027 | 7/23/2009 1:39:48 PM | **DAQ On-line** | PRAD0376 - BillyButler - RMI in Neon Gas

Edit

Run: 36912 Picture: 31738 Type: Dark Field

Start Run

07/23 13:39	*Start Run* **36912**	PRAD 376, Butler RMI in Neon
07/23 13:39	*Arm*	
07/23 13:39	*Info*	**Manual Trigger** from PCPRAD307
07/23 13:39	*Trigger*	
07/23 13:40	*Picture* **31738**	Dark Field, Cameras X, Y, Z, T, U, V, Q, R, S, N, O, P, K, L, M, H, I, J, E, A, B, C, D, G, F
07/23 13:40	*End Run*	

44028 | 7/23/2009 1:41:01 PM | **DAQ On-line** | PRAD0376 - BillyButler - RMI in Neon Gas

Edit

Run: 36913 Picture: 31739 Type: Dark Field

Start Run

07/23 13:41	*Start Run* **36913**	PRAD 376, Butler RMI in Neon
07/23 13:41	*Arm*	
07/23 13:41	*Info*	**Manual Trigger** from PCPRAD307
07/23 13:41	*Trigger*	
07/23 13:41	*Picture* **31739**	Dark Field, Cameras X, Y, Z, T, U, V, Q, R, S, N, O, P, K, L, M, H, I, J, E, A, B, C, D, G, F
07/23 13:42	*End Run*	

44029 | 7/23/2009 1:42:17 PM | **DAQ On-line** | PRAD0376 - BillyButler - RMI in Neon Gas

Edit

Run: 36914 Picture: 31740 Type: Dark Field

Start Run

07/23 13:42	*Start Run* **36914**	PRAD 376, Butler RMI in Neon

07/23 13:42	*Arm*	
07/23 13:42	*Info*	**Manual Trigger** from PCPRAD307
07/23 13:42	*Trigger*	
07/23 13:42	*Picture* **31740**	Dark Field, Cameras X, Y, Z, T, U, V, Q, R, S, N, O, P, K, L, M, H, I, J, E, A, B, C, D, G, F
07/23 13:43	*End Run*	

44030 | 7/23/2009 1:43:33 PM | **DAQ On-line** | PRAD0376 - BillyButler - RMI in Neon Gas

Edit

Run: 36915 Picture: 31741 Type: Dark Field

Start Run

07/23 13:43	*Start Run* **36915**	PRAD 376, Butler RMI in Neon
07/23 13:43	*Arm*	
07/23 13:43	*Info*	**Manual Trigger** from PCPRAD307
07/23 13:43	*Trigger*	
07/23 13:43	*Picture* **31741**	Dark Field, Cameras X, Y, Z, T, U, V, Q, R, S, N, O, P, K, L, M, H, I, J, E, A, B, C, D, G, F
07/23 13:44	*End Run*	

Basic Filters	Content Filters
○ By Date ○ Last 10 ○ Today ○ This Week ○ This Month ○ This Year ◉ All	Date Range Start 7/1/2009 / 7/30/2009 End ☐ Name ASaunders ☐ Text Entry *trigger* ☑ Activity No PRAD0376 - BillyButler - RMI in Neon Gas ☐ Expt Family Miscellaneous ☐ Pic Type Other ☐ Run No ☐ Pic No

Check checkboxes to select content filters ("" , * , ? chars allowed).

Refresh | Hide Filters New Entry |

PRAD Home > Logbook Home

PRAD On-Line | Logbook | PRAD Off-Line | Run Status | Beam Status | Phone

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376			cvr to db	db to foi	FOI Camera	DB to 1st camera (us)	CVR TO 1ST CAM	FC TIME REL TO	CVR to FOI	
Buttler RMI Neon			2.75		H		10.05	300	10.65	
	Camera	Daq Timing	seperation between pulses (ns)	CCPG pattern start	CCPG pattern stop	width	X=gone	Rel To CVR	REL to FOI	Rel to DB
1	B	0	0	300000	300100	100		10.05	-0.60	7.3
2	F1	0	0	300000	300100	100		10.05	-0.60	7.3
3	A	300	300	300300	300400	100	X=gone	10.35	-0.30	7.6
4	G1	300	0	300300	300400	100	X=gone	10.35	-0.30	7.6
5	H	600	300	300600	300700	100		10.65	0.00	7.9
6	F2	600	0	300600	300700	100		10.65	0.00	7.9
7	K	1000	400	301000	301100	100	X=gone	11.05	0.40	8.3
8	G2	1000	0	301000	301100	100	X=gone	11.05	0.40	8.3
9	N	1300	300	301300	301400	100		11.35	0.70	8.6
10	F3	1300	0	301300	301400	100		11.35	0.70	8.6
11	Q	2000	700	302000	302100	100		12.05	1.40	9.3
12	G3	2000	0	302000	302100	100		12.05	1.40	9.3
13	T	2700	700	302700	302800	100		12.75	2.10	10
14	F4	2700	0	302700	302800	100		12.75	2.10	10
15	X	3400	700	303400	303500	100		13.45	2.80	10.7
16	G4	3400	0	303400	303500	100		13.45	2.80	10.7
17	I	4100	700	304100	304200	100		14.15	3.50	11.4
18	F5	4100	0	304100	304200	100		14.15	3.50	11.4
19	L	4800	700	304800	304900	100		14.85	4.20	12.1
20	G5	4800	0	304800	304900	100		14.85	4.20	12.1
21	O	5500	700	305500	305600	100		15.55	4.90	12.8
22	F6	5500	0	305500	305600	100		15.55	4.90	12.8
23	R	6200	700	306200	306300	100		16.25	5.60	13.5
24	G6	6200	0	306200	306300	100		16.25	5.60	13.5
25	U	7000	800	307000	307100	100	X=gone	17.05	6.40	14.3
26	F7	7000	0	307000	307100	100	X=gone	17.05	6.40	14.3
27	Y	7800	800	307800	307900	100	X=gone	17.85	7.20	15.1
28	G7	7800	0	307800	307900	100	X=gone	17.85	7.20	15.1
29	J	8600	800	308600	308700	100	X=gone	18.65	8.00	15.9
30	F8	8600	0	308600	308700	100	X=gone	18.65	8.00	15.9
31	M	9400	800	309400	309500	100	X=gone	19.45	8.80	16.7
32	G8	9400	0	309400	309500	100	X=gone	19.45	8.80	16.7
33	P	10200	800	310200	310300	100	X=gone	20.25	9.60	17.5
34	F9	10200	0	310200	310300	100	X=gone	20.25	9.60	17.5
35	S	11000	800	311000	311100	100	X=gone	21.05	10.40	18.3
36	G9	11000	0	311000	311100	100	X=gone	21.05	10.40	18.3
37	V	11800	800	311800	311900	100	X=gone	21.85	11.20	19.1
38	Z	12600	800	312600	312700	100	X=gone	22.65	12.00	19.9
39	E	13400	800	313400	313500	100	X=gone	23.45	12.80	20.7
40	C	14200	800	314200	314300	100	X=gone	24.25	13.60	21.5
41	D	15000	800	315000	315100	100	X=gone	25.05	14.40	22.3

Count Down	
LR to First	10.05

Camera	Pulse No.
1	#N/A
2	#N/A
E	13400
H	600
I	4100
J	8600
K	1000
L	4800
M	9400
N	1300
O	5500
P	10200
Q	2000
R	6200
S	11000
T	2700
U	7000
V	11800
X	3400
Y	7800
Z	12600
A	300
B	0
C	14200
D	15000
F1	0
F2	600
F3	1300
F4	2700
F5	4100
F6	5500
F7	7000
F8	8600
F9	10200
G1	300
G2	1000
G3	2000
G4	3400
G5	4800
G6	6200
G7	7800
G8	9400
G9	11000

B		0
F1		0
F2		0
F3		0
F4		0
F5		0
F6		0
G3		0
G4		0
G5		0
G6		0
H		0
I		0
L		0
N		0
O		0
Q		0
R		0
T		0
X		0
A	X=gone	
C	X=gone	
D	X=gone	
E	X=gone	
F7	X=gone	
F8	X=gone	
F9	X=gone	
G1	X=gone	
G2	X=gone	
G7	X=gone	
G8	X=gone	
G9	X=gone	
J	X=gone	
K	X=gone	
M	X=gone	
P	X=gone	
S	X=gone	
U	X=gone	
V	X=gone	
Y	X=gone	
Z	X=gone	

Summary of Run 36897, 12:58:35 PM, Thursday, July 23, 2009
Replay done 1:10:02 PM, Thursday, July 23, 2009

Batch Protons

	Group 1	
	N	Integral
Trigger 1	24	1.28424E+11
Run 36897	24	1.28424E+11
Batch started at 36897	24	1.28424E+11

Total Protons

RUN	Time	N	Group 1
36897	12:58 07/23/09	24	1.28424E+11

Protons per Peak

Run	Scope	Channel	# Peaks	Sum V-S	Sum P	Peak	Time	Peak V-S	Peak P	Rel Error
36897	9	2	24	5.03822E-06	1.28424E+11					
						1	1.34195E-08	2.20584E-07	5.62269E+09	9.30253E-03
						2	2.50012E-04	2.14247E-07	5.46114E+09	9.36594E-03
						3	2.50312E-04	2.26018E-07	5.76119E+09	9.27960E-03
						4	2.50613E-04	2.06187E-07	5.25571E+09	9.73202E-03
						5	2.51011	2.13088	5.43160E+	9.62979

	E-04	E-07	09	E-03
6	2.51314 E-04	2.12850 E-07	5.42554E+ 09	9.64056 E-03
7	2.52014 E-04	2.13864 E-07	5.45139E+ 09	9.59485 E-03
8	2.52715 E-04	2.06173 E-07	5.25534E+ 09	9.95278 E-03
9	2.53416 E-04	2.12115 E-07	5.40682E+ 09	9.46004 E-03
10	2.54116 E-04	2.03793 E-07	5.19467E+ 09	9.84638 E-03
11	2.54817 E-04	2.05872 E-07	5.24767E+ 09	9.96731 E-03
12	2.55518 E-04	2.04355 E-07	5.20900E+ 09	1.00413 E-02
13	2.56218 E-04	2.09442 E-07	5.33867E+ 09	9.79742 E-03
14	2.57013 E-04	2.17026 E-07	5.53200E+ 09	9.24597 E-03
15	2.57813 E-04	2.10507 E-07	5.36583E+ 09	9.74783 E-03
16	2.58613 E-04	2.04267 E-07	5.20678E+ 09	9.82349 E-03
17	2.59412 E-04	2.08373 E-07	5.31142E+ 09	9.62995 E-03
18	2.60212 E-04	2.06767 E-07	5.27049E+ 09	9.70474 E-03
19	2.61013 E-04	2.10380 E-07	5.36257E+ 09	9.53809 E-03
20	2.61812 E-04	2.07215 E-07	5.28192E+ 09	9.68373 E-03
21	2.62612 E-04	2.10337 E-07	5.36149E+ 09	9.54003 E-03
22	2.63413 E-04	2.05237 E-07	5.23149E+ 09	9.77708 E-03
23	2.64213 E-04	2.06112 E-07	5.25380E+ 09	9.73558 E-03
24	2.65013 E-04	2.03413 E-07	5.18499E+ 09	9.86476 E-03

DG535 Timing

Run	DG Tag	A Delay	B Delay	C Delay	D Delay
36897	8	2.571200000000E-02	3.000000000000E-04	5.000000000000E-03	0.500000000000
36897	9	5.100000000000E-03	1.000000000000E-04	5.150000000000E-03	5.000000000000E-08
36897	10	4.000000000000E-05	4.500000000000E-05	5.000000000000E-05	6.000000000000E-08
36897	11	1.995120000000E-04	5.000000000000E-05	0.00000000000	0.00000000000
36897	13	2.500000000000E-02	5.000000000000E-07	0.00000000000	1.010000000000E-04
36897	14	5.000000000000E-12	1.300000000000E-05	5.000000000000E-12	5.000000000000E-12
36897	16	2.378550000000E-04	2.000000000000E-07	1.521500000000E-05	5.000000000000E-06
36897	23	9.100000000000E-06	3.000000000000E-04	6.750000000000E-07	1.000000000000E-06

Camera Walk/Timing File

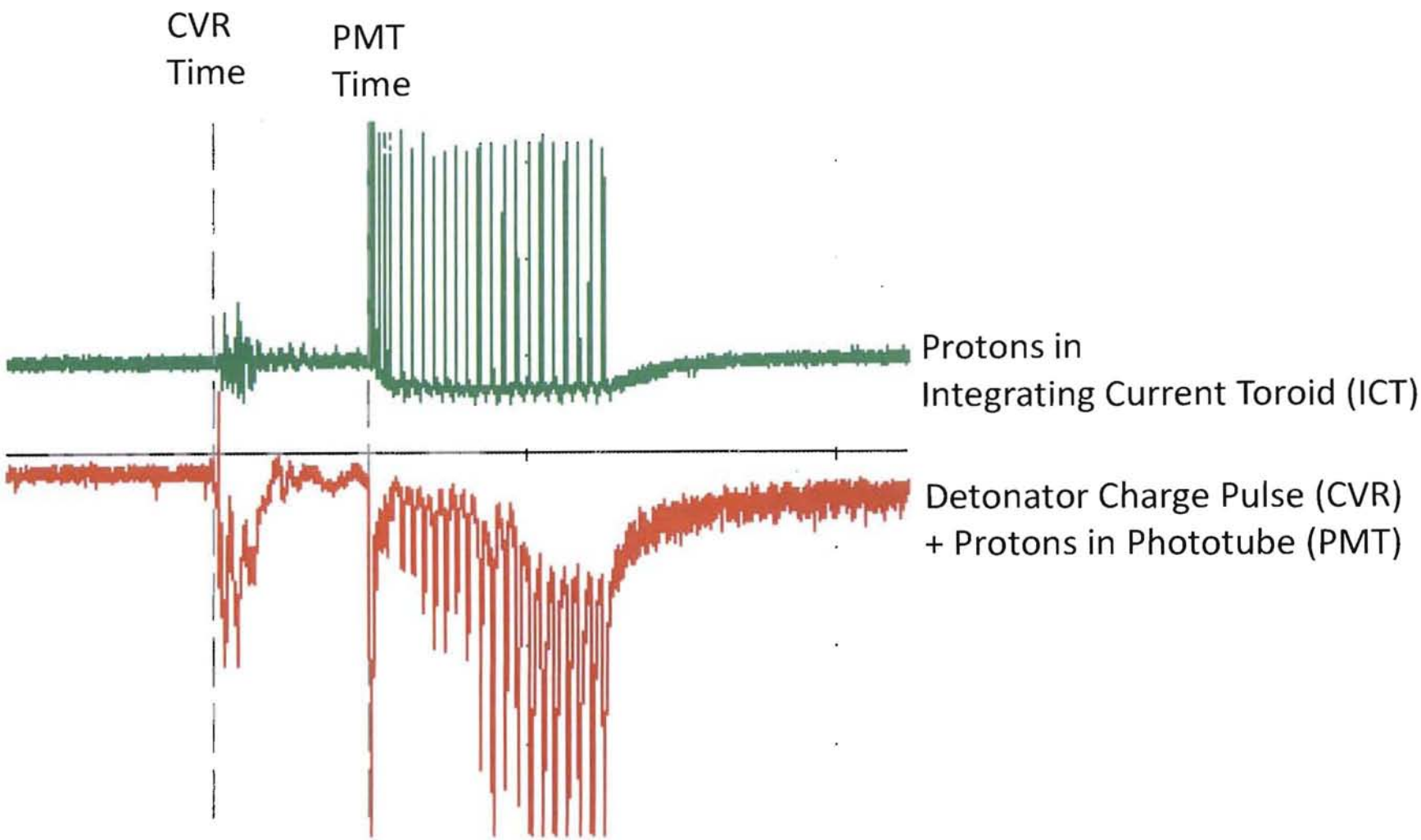
RUN	Time 1	Camera 1
36897	0.000	1.05549E-01,

Beam Line Status

Run	36897		
Time	7/23/2009 12:57:34 PM		
LCQM006V01	134579417	-364.019989013672	OK
LCQM006L06	1	OFF	OK
LCQM007V01	134579417	285.048004150391	OK
LCQM007L03	1	REV	OK

LCQM008V01	134579417	-952.286010742188	OK
LCQM008L03	1	OFF	OK
LCQL001P01	134579417	1755	OK
LCQL001V01	134579417	126.186996459961	OK
LCQL002I01	134579417	-2.49300003051758	OK
LCQL002P01	134579417	4.48999977111816	OK
LCQL002V01	134579417	-4.68400001525879	OK
LCQL003P01	134579417	1527	OK
LCQL003V01	134579417	1551.36694335938	OK
LCDF001E01	1	1218	OK
CCTM006D02	1	200	OK
CCTM006D03	1	625	OK
TBBC002D07	134579417	60	OK
TBBC002D06	134579417	9999	OK
TBMX001L01	134579417	NORM	OK
TBBC022D01	134579417	1500000	OK
TBBC022D02	134579417	1500000	OK
TBBC022D03	134579417	1500000	OK
TBBC022D04	134579417	1500000	OK
TBBC023D01	134579417	1500000	OK
TBBC023D02	134579417	1500000	OK
TBBC024D03	134579417	1500000	OK
TBBC023D04	134579417	1500000	OK
TBBC024D01	134579417	1500000	OK
TBBC024D02	134579417	1500000	OK
TBBC024D03	134579417	1500000	OK
TBBC024D04	134579417	1500000	OK
LCQM017I01	1	5	OK
LCQM020I01	1	74.5	OK
Perm Mg 2	0	80.134	OK
Perm Mg 3	0	113.175	OK
Perm Mg 4	0	136.287	OK
Energy Los	0	7	OK
Energy Cal	0	0.0268	OK

PRAD0376 Proton Timing Measurement



Operational Guide and Safety Control Check List

The following is to be used as an operational guide and as a safety checklist to allow for recording of implementation of controls.
This document is to be completed by the Experimenter In Charge or his designee. This document will be retained for 2 years after completed.

Shot Name: RMI with Gas ; **PRAD #** 376 ; **HX #** LNSC-10624 ; **Originator's #** H 3855
Dates of Shot: 7/23/2009 ; **Experimenter in Charge (PRAD PIC):** Alexander Saunders
HE PIC: Marr Lyon ; **Firing Leader:** Lopez ; **Secondary Operator:** Bainbridge
Checklist & Safety Watch Campos ; **Laser Diagnostics PIC** Tupa

Operational Guide	Safety Control Checklist	Initials	Date	Checked
Mark list for all N/A (Non/Applicable) items before EIC review. Classified shots; Call Richard Harford 5-0060 and Tim Olinger 5-6363 http://ptla.lanl.gov/cgi-bin/mailform/staff_form.htm	◦ EIC reviews & signs check list • PRAD safety/security review for this series within 2 weeks • Guards scheduled for night watching of classified shots	AS AS NA	*	✓ ✓ NA
Rope stays up until after shot has been completed.	◦ Rope off truck access entrance, at north end of counting house - Label rope with "No Parking Fire Lane" sign	AS		✓
RWP = Radiation Work Permit – NOT expired Uranium, Pu, and other unusual materials/conditions	• RWP for dynamics – date is current & posted on shield door • RWP for extras (U/Pu) - date is current & posted on shield dr	NA NA		NA NA
1) HE Category (Orange Octagon) 2) Experimenter In Charge permission required for entry	• Signs - Line C tunnel entrance station (PACS) • Signs - Line C shield door – small door	AS		✓ ✓
Lightning Detector – Display NM. Full Zoom out - verify speaker volume	• Lightning computer speaker volume turned up & verified • LANSCE electric field mill displayed and indicating • Lightning Strike program displayed and updating	Broken Use AS	access	Broken control ✓
	◦ CCR notified EIC for the HE shot.	AS		✓
Gun shots do not normally have a "confined space". NOT for DU/Pu!	• Confined Space Permit 07-8037; effective 7/20-7/24	AS		✓
Respirators are required by the IWD.	• HE workers available with current confined space training • Respirators with canisters available – expiration date verified • Level II Anti-C clothing available (U/Pu) • (U/Pu) RCT available with respirator and canisters in date	AS AS NA NA		✓ ✓ NA NA
Experiment Design - HE = High Explosive (Less than or equal to 10 pounds of HE or 300 grams of black powder)	• Depleted Uranium less than 100 pounds • HE load within Authorization Basis <10 lb HE <300gr powder	NA AS		NA ✓
	• HE on LANSCE Approved List	AS		✓
Some experiments do not use detonators, like electrically heated Cook-Off	• Detonators on approved list, if required.	AS		✓
Some Powder gun shots require conductive surfaces for handling powder	• Conductive surfaces available if required by shot sheet or PIC	NA		NA
EIRC = Explosives Instrumentation Review Committee Power Supply, CDU, DCU, fiber optics trigger, etc.	• Firing Circuit & firing circuit test equipment, if used, have been reviewed by the EIRC for this specific use.	AS		✓
	• Corresponding Proof/Overpressure Tests Completed	AS		✓
Shot sheet specifies the approved HE load for this shot in this vessel/gun	• Vessel Approving Authority - Approval Received	AS		✓
LANSCE = Los Alamos Neutron Science Facility	• Notification to LANSCE Experimental Area C Manager			
Tested within past 30 days.	• Emergency Lighting in Line C dome	AS	7/17	✓
Portable gantry - Each structural member is attached by a removable pin. Not usually required for gun shots.	• A-frame crane – Official Daily Check – qualified operator	AS		✓

Operational Guide	Safety Control Checklist	Initials	Date	Checked
Braided grounding strap connects ground block on dome wall south side east.	• Electrical bonding connection to dome wall ground plate • Vessel or gun target box • Crane • 6' vessel top door (sitting a top assembly stand) or gun barrel	AS AS AS AS	 *	✓ ✓ ✓ ✓
Module 9 – select "Normal" & push reset. Place "S1 test" switch in "test" and run unit for 10 minutes. Place "test" switch back into "normal". Check automatic transfer valve is not pointing to empty bottle. If the stand-by tank is not open, the generator will fail when #1 empties.	• Backup generator enabled – Module 9 "Normal" and "Reset" • Backup generator tested (not usually required for gun shots) • Propane automatic selection valve – NOT RED • Both propane tank valves OPEN • Work-Stand light in dome hooked to generator and tested	AS AS AS AS AS	*	✓ ✓ ✓ ✓ ✓
CO = Carbon Monoxide – Zero ITX model after 15 minute warm-up. NOTE: Some CO monitors should not be ON when in their charger. NOTE: TV picture must be readable when dome lights are turned off. NOTE: The ITX models can be left on all day if no blower is installed.	• CO monitors – Two available and tested (includes zero reset) • Calibration memo current • One installed in dome with a TV picture in the counting house • Turn units off, including blowers, to preserve batteries	 AS		✓ ✓ ✓ ✓
Turn amplifier power on and select "phono" Amplifier can be turned off after test.	• Microphone is placed on vessel or gun catch tank and audio can be heard in counting house.	AS		✓
GFCI – Ground Fault Circuit Interrupter – Use circuit tester w/trip button Not usually required for gun shots. Power cords on floor can be electrical hazards during flooding caused by a cooling hose rupture. Check 208 V crane and laser cords also.	• GFCI receptacles for vessel tested within 30 days • Vessel drop light(s) hooked to GFCI • Vessel extension cord for impact wrench hooked to GFCI • No 120V or 208V power cord connections on floor	AS NA AS AS	7/17	✓ NA ✓ ✓
House air line drives a venturi pump in the vertical run of the PVC exhaust pipe to the LANSCE radioactive exhaust stack system	• Vacuum pump exhaust booster pump hooked up and working • Radiation Portal Monitor – Green status & bottles have gas	AS AS		✓ ✓
	• Laser setup check list started – if lasers will be used	NA		NA
Uranium and Plutonium – Vacuum system Pressure after the shot is supposed to be less than atmospheric. First filter layer is 2.0 microns. Second layer is 0.2 microns. Check valve prevents U dust going out into dome during venting. Venting must be done slowly so as to not ignite U dust. TV picture in counting house for vacuum gage.	• U/Pu – Calculated post shot pressure is below atmospheric • Filter pack between containment & vacuum sys – 0.2 micron • 2 psig check valve installed on vent valve • Flow restrictor installed in vent line • Remote reading of post shot pressure in counting house • Valves operate OK – containment isolation, vent, purge • Remote reading of primary container pressure in CCH	NA NA NA NA NA NA NA		NA NA NA NA NA NA NA
Uranium and Plutonium - Continuous Air Monitor	• CAM or Giraffe near vessel – Checked today by a RCT • Remote indication in counting house	NA NA		NA NA
Uranium and Plutonium – Contamination Control Areas	• Contamination area around vessel • Contamination area around HE assembly area • Contamination buffer area near portal monitor • Radioactive Materials Balance area (safe) posted correctly	NA NA NA NA		NA NA NA NA
Gas cooling/heating system could overpressure vacuum pumping system; so, a "conflat" blank is placed on a tee by the pressure gage. The LN2 dewar connections are easily confused – check the correctness.	• Gas filled, cooled, or heated shots • Zero pressure relief installed for upstream vacuum valve • LN2 dewar inlet & outlet connections double checked	 AS ~~NA~~ NA	 * *	 ✓ ~~NA~~ NA
Vacuum pump exhaust system to radioactive exhaust system – white PVC piping system – Big gray valves (usually without their red handles)	• Vacuum fore pump exhaust valve open – Upstream of vessel • Downstream of vessel • Second Lens system	 AS		✓ ✓ ✓
Both gage controllers in blue racks	• Vacuum gauge TV picture in CCH with separate illumination	AS		✓

Operational Guide	Safety Control Checklist	Initials	Date	Checked
Remove dust/gases falling out of front door	• Portable HEPA system rigged/tested under vessel front door	AS		✓
The type and thickness required is specified in the "Contained Shot Request Form" under "Shrapnel Protection". Windows must be checked for damage from previous shot every time, including checking the glass for cracks.	• Containment system beam windows • Glass thickness required = ~~1/8"~~ 0 inch; downStream ~~1/8"~~ 0 • Metal type = Al, thickness = ~~1/8"~~ 1/4"; dwnStr = ~~1/4"~~ • Upstream checked for damage after previous shot and installed • Downstream checked for damage and installed	 AS AS	 * *	 ✓ ✓
Key & reset at IL0; Power ON = green LEDs on controllers in blue racks	• Dalek - Key IN, Reset, and power ON	AS	*	✓
Beam Line vacuum pump-out valve – The containment system isolation valves to the pumping stations. Tested from CCH. CCH = Line C Counting House TV picture requires separate illumination to be seen when the dome lights are out.	• Containment isolation vacuum valve actuator operation • Upstream of vessel • Downstream of vessel • TV pictures can be viewed in CCH • Illuminators available (flashlight or equivalent) • Vacuum valves OPEN	 AS AS AS AS AS	 * * *	 ✓ ✓ ✓ ✓ ✓
No bolts can be left out. Broken bolts must be reported to the HE PIC and EIC. Not required after the first shot in a series.	• Vessel/gun and containment pipes installed and checked for loose and missing bolts – every bolt installed and tight.	AS		✓
Door check for is for the doors installed at this time, like beam line doors.	• Vessel/gun installed doors checked for loose/missing bolts	AS		✓
	• Beam Line Setup entered into DAQ program	EC		✓
Exclusion Threshold Temperature is the temperature above which the HE might be unstable; so, people are excluded. LANSCE requires all Lock Out Tag Outs to be entered into their log. Thermocouple Meter or DVM with temperature scale	• Cook-Offs: • Shutter illumination available • TV picture of laser blocking shutter in counting house • Four lock boxes & padlocks available • Laser shutter tested – Fails safe (closed) upon loss of power • Heater cables locked by FL in CCH and FL has the key(s) • Heated shot - Portable thermocouple meter available and tested	 NA NA NA NA NA NA	 * 	 NA NA NA NA NA NA
	• Exclusion Threshold Temperature = _____ • Temperature readout working in counting house	NA NA	* *	NA NA
CDU = Capacitive Discharge Unit	• Firing Leader in direct charge of HV connection box key and charging key for CDU Power Supply • Cook-Off laser shutter power locked off and FL has the key • Secondary operator has trigger key	AS NA AS	* * *	✓ NA ✓
For ribbon cables, to support "slappers", this test is performed off site.	• High Pot testing of vessel feed-throughs completed	AS	*	✓
DCO – Detonator Checking Ohmmeter	• DCO available, if needed – Charged up or charging	AS	*	✓
Signature in CCR (Central Control Room) for today's shot	• LANSCE Experimental Area C Manager Approval Received	EC	7/23	✓
Use Lightning Computer to Check for Lightning.	• Weather status – start a Weather Watch	AS		✓
	• HE starting transport to TA-53 at time = 0820	EC	*	✓
HE staff and P-25 have agreed that asking CCR to not open the line B tunnel door is sufficient control to prevent violation of the HE exclusion area. The EIC knows that the authorization basis requires firing leader approval before permitting line B entries. CCR line-by-line for Line B PACS = LBSS1L1 and/or 1L2 NTOF door – Exclusion Area – Red light ON and door Locked (pull on it)	• Notify CCR – "CCR, high explosives are being shipped to TA-53. Please do not allow entries into the line B and C tunnels without the permission of the Experimenter-In-Charge until after HE operations are completed." • Line B tunnel PACS secured • NTOF cave 202 key exclusion area secured	EC EC EC	*	✓ ✓ ✓
Orange Octagon with a "1" on it.	• Post large sign outside truck roll-up door – HE Category	EC	*	✓

Operational Guide	Safety Control Checklist	Initials	Date	Checked
Post 2 signs - HE Orange Octagon & EIC – **after** HE is on its way. HE octagon clips onto exclusion area box over top of keyed lock.	• EIC Sign for Line B tunnel - NTOF maze outside door • HE octagon – NTOF Exclusion area box	EC EC		✓ ✓
The experimenter in charge will notify CCR when the HE arrives on site.	• HE arrival time: 0838 • CCR Notified that the HE has arrived	EC	*	✓

******* Move HE into Line C Dome **********	**Move HE to Dome** * recheck all items for multiple shots		*	
Laminated Badge "I am guarding classified (SRD) High Explosives"	• Bomb Badge issued	NA		NA
Use Lightning Detector to Check for Lightning. Moving the HE out of the delivery truck begins HE operations at TA-53	• Lightning/weather status • Firing Site Leader gives permission to off load HE	EC EC	* *	✓ ✓
A custom terminator is placed on the end of the cable.	• CDU output detonator cable is terminated – not open ended	EC	*	✓
	• Pathway for HE movement cleared of obstructions and HE area is free of combustibles	EC	*	✓
	• HE moved into Line C dome inside D.O.T. container	EC	*	✓
Door cannot be re-opened until after shot fired or returned to DOT container – AC20 page 83 Explosives Operations at LANSCE	• Area C shield door closed and air pads deflated before opening HE shipping container	EC	*	✓
	• Firing Leader holds keys: • Dome access keys (PACS) • VISAR control box • PDV Laser key • Cook OFF laser control key OR laser ignition fiber lock box	 EC NA EC NA NA	 * * * *	 ✓ NA ✓ NA

HCP = Hazard Control Plan
IWD = Integrated Work Document
EIC = Experimenter In Charge
VISAR – Laser system
Velocity Interferometer System for Any Reflective surface
Uranium, Beryllium, Lead, etc. all require additional training and may require a special IWD
PIC = Person in Charge – must be consulted about work which comes under their responsibility before the work starts, as per the IWD.

Only one briefing per day is required if all the days shots are discussed at the first briefing and if there are no significant changes from shot to shot.

HE heated above its Exclusion Threshold Temperature may go off without warning.

• Pre-Job Briefing by EIC			
• Has anyone NOT read and signed the PRAD security plan?			NA
• ---- Dynamic RWP?			NA
• ---- Area C hazard overview?			✓
• ---- Dynamic IWD? ----------→	------→	------→	✓
• ---- Special IWD and/or training (U, Be, Ca, Pb, etc.)			NA
• Does anyone NOT have current TA-53 site specific training?			✓
• Experimenter In Charge is ----------→	------→	------→	✓
• No dome PACS entries after HE load, without EIC approval			✓
• HE PIC is …			✓
• Firing-Leader is …			✓
• Secondary firing leader is ----------→	------→	------→	✓
• Ignition sources prohibited in dome – no lighters, no matches			✓
• Absolutely no entries after HE exceeds exclusion temperature			NA
• Safety Watch is ----------→	------→	------→	✓
• Forklift operations are halted in the dome and truck entrance			✓
• Laser Diagnostics PIC is ----------→	------→	------→	✓
• VISAR/LASER system status is …			✓
• Laser Keys – Clarify the times when FL needs to hold keys			✓
• MSDS sheets available via counting house computers -------→	------→	------→	✓
• Flammable gases in detectors, cameras, and vessel?			✓
• Are there any other issues?			✓
• _____			
• _____			
• _____			
• _____			
• _____			

******* Load HE into Vessel **********	Loading HE * recheck all items for multiple shots		*	✓
	• Laser setup check list completed	NA		NA
U/Pu containment system not opened until after venturi pump disconnect. No air flow through containment system for U/Pu.	• U/Pu – Vacuum system venturi disconnected before opening	NA	*	NA
	• CAM & CAM exhaust pump turned on and verified by a RCT	NA	*	NA
Cook-off laser ignition fiber locked after fiber is through the vessel door.	• Cook-off laser ignition fiber locked in box and FL has key	NA	*	NA
HE procedures limit the number of persons in the area to 5. Access Control or Meteorologist if local indications broken.	• Assign a door watch for HE exclusion area and to watch the lightning detector – reports to firing leader	EC	*	✓
No one is in the dome without the firing leader's approval.	• HE Exclusion Area established	EC	*	✓
Door watch asks each new person if they have ignition sources.	• HE team has NO ignition sources – no matches, no lighters	EC	*	✓
Team going in is in radio contact with a person outside.	• Radio Check – entry team - door watch from inside shield door	EC	*	✓
epending on the meter, the DCU check is done before or after the vessel is secured. The detonator cable is protected from sparks.	• Detonator Checking Ohmmeter – check completed	EC	*	✓
	• Shorting cap on detonator cable connector	EC	*	✓
U/Pu - venturi pump air line was previously disconnected.	• U/Pu – Vacuum system venturi pump ReConnected	NA	*	NA
Blast containment system All bolts must be installed. No broken or missing bolts. All bolts must be re-checked for tightness after the system is under vacuum.	• Vacuum less than 25 torr and Vessel is secured (fully bolted steel doors) (25 torr = 25mm-Hg: = 25,000 microns)	EC	*	✓
	• Beam line bolts are all installed and tight (after vacuum)	EC	*	✓
	• Vessel door bolts are all installed and tight (after vacuum)	EC	*	
	• Gun breech – all holes plugged (pressure transducer)	NA	*	NA
Vessel and/or containment system leak too much for good pictures? 5 min **DO NOT Exceed 25 Torr! HE exclusion area required for >25 torr!**	• Leak check - Vessel pressure start ____ Finish ____ **DO NOT Exceed 25 Torr!** Time start ____ Finish ____		*	
Gas cooled/heated shots only – "zero pressure relief valve"	• Pop-off disk clamp ring OFF prior to gas cooling/heating shot	NA	*	NA
U/Pu - The inner chamber is the "Thermos" or other containment vessel holding Pu, U, Be, etc. The "Vessel" is the containment vessel attached to the beam line (6' or 4' vessel).	• 15 minute vacuum check < 1 Torr change – close blast valves	NA	*	NA
	• Inner chamber pressure start ____ finish ____	NA	*	NA
	• Vessel chamber pressure start ____ finish ____	NA	*	NA
Minimize radiation damage to CAM electronics during beam tuning.	• CAM **OFF**	NA	*	NA
Cook-offs - First testing of thermocouples and electric heaters.	• Two thermocouples reading OK in counting house	NA	*	NA
	• Heater Cables still locked up in counting house	NA	*	NA
	• Laser blocking shutter CLOSED and laser ignition fiber locked	NA	*	NA
	• Cook Off heater test – Permission to hookup – HE PIC, EIC	NA	*	NA
	• HE exclusion area is established	NA	*	NA
PACS must be secured for heater test. HX takes credit for PACS.	• Heater cables hooked up by FL in dome	NA	*	NA
	• Line C dome PACS secured	NA	*	NA
	• Permission to unlock & perform heater test – EIC, FL, HE PIC	NA	*	NA
	• Thermocouples tested by raising temperature 5 degrees	NA	*	NA
	• Heater cables locked by FL in CCH and FL has the key(s)	NA	*	NA
IL = Image location Thin vacuum windows have protective covers to guard against blowouts when the beam line is under vacuum.	• Remove vacuum window covers			
	• IL0 upstream		*	✓
	• IL1 downstream		*	✓
	• IL2 upstream and downstream	EC	*	✓

Go back inside vessel/target box with HE inside	Vessel Re-entry * recheck all items for multiple entries		*	
CDU may have been fired into a short to test timing signal synchronization	• Detonator high Voltage cables are **AGAIN** connected to grounding block on CDU power supply rack	_____	*	_____
	• Cook-off heaters locked off in CCH and the FL has the key(s)	___NA	*	___NA
	• EIC permission	_____	*	_____
	• Firing Leader & HE PIC permissions	_____	*	_____
	• HX-3 Radio checks with entry team	_____	*	_____
	• FL has key(s) – CDU, laser(s), cook off keys (shutter&heaters)	_____	*	_____
	• Door & weather watch assigned	_____	*	_____
	• HE team has NO ignition sources – no matches, no lighters	_____	*	_____
	• HE Exclusion Area established	_____	*	_____
Inside dome	• U/Pu – Vacuum system venturi disconnected before opening	___NA	*	___NA
	• CAM & CAM exhaust pump turned on and verified by a RCT	___NA	*	___NA
	• Cooling/heating system shut off – if required by firing leader	___NA	*	___NA
	• Laser blocking shutter CLOSED and laser ignition fiber locked	___NA	*	___NA
	• Detonator cables disconnected from CDU & shorted	_____	*	_____
Exiting dome	• U/Pu – Vacuum system venturi Re-connected	___NA	*	___NA
	• Vacuum less than 25 torr and Vessel is secured (fully bolted steel doors) (25 torr = 25mm-Hg; = 25,000 microns)	_____	*	_____
	• Vessel door bolts are all installed and tight (after vacuum)	_____		_____
	• Gun breech – all holes plugged (pressure transducer)	___NA	*	___NA
	• Detonator Checking Ohmmeter – check completed	_____	*	_____
	• Shorting cap on detonator cable connector	_____	*	_____
	• Leak check - Vessel pressure start _____ finish _____	_____	*	_____
	• U/Pu - CAM OFF	___NA	*	___NA
	• 15min double vessel check < 1 Torr change – close valves	___NA	*	___NA
	• Inner chamber pressure start _____ finish _____	___NA	*	___NA
	• Vessel chamber pressure start _____ finish _____	___NA	*	___NA
	• Cooling/heating system turn ON if required	___NA	*	___NA

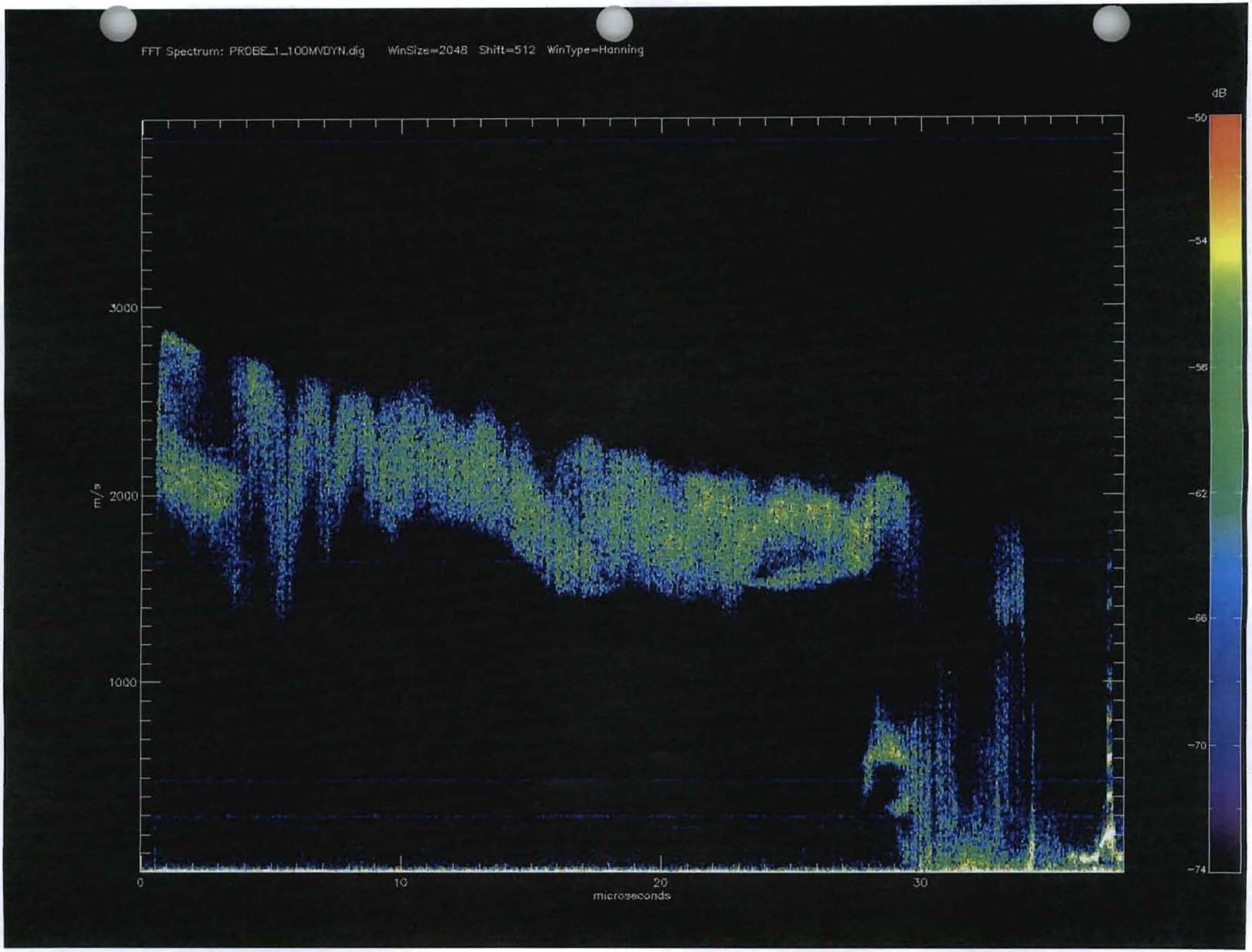
FINAL ENTRY before FINAL SWEEP	Final Entry * recheck all items for multiple shots		*	✓
Verify Pins signal path has been checked	• Pins operation verified	NA	*	NA
CDU may have been fired into a short to test timing signal synchronization	• Detonator high Voltage cables are **AGAIN** connected to grounding block on CDU power supply rack	EC	*	✓
	• Cook-off laser shutter power locked off by FL and FL has key	NA	*	NA
Radio operator stays outside the shield door	• Weather check with access control	N/A	*	N/A
Needed for initial re-entry	• CO monitor located outside the dome (second unit)	EC	*	✓
	• Vacuum gage unit 1 on channel 6 • Vacuum gage unit 2 on channel 2	EC EC	* *	✓ ✓
Carbon Monoxide detector – Call the line C counting house to verify picture of Co monitor before exiting dome.	• CO monitor in Line C dome turned ON with picture in CCH • Illumination turned on for CO monitor • Illumination turned on for vacuum Gauge • Illumination turned on for vacuum Valve	 EC	* * * *	✓ ✓ ✓ ✓
Uranium and Plutonium U/Pu - Venturi pump air line was previously disconnected. CAM - Continuous Air Monitor	• U/Pu – Vacuum system venturi pump connected and working • CAM turned ON and working verified by a RCT • CAM exhaust pump turned ON	NA NA NA	* * *	NA NA NA
Usually for gun shots	• Turn on PIN power supply in Dome if required	N/A	*	NA
Post shot classified traces not visible to L-cleared RCT or operator	• Classified O-scopes are covered or displays disconnected	NA	*	NA
Amplifier power ON; select "phono".	• Microphone audio ON and in PHONO	EC	*	✓
Tap on vessel with metallic object.	• Microphone audio tested again	EC	*	✓
Note that the sign at the line B tunnel door is a long way away; so, this step is done in parallel with the final sweep with detonator hook-up. With UCN exclusion area, this is now the NTOF maze entrance door.	• Post sign "Special Re-Entry Procedure In Effect" • Line C key bank • Line B tunnel entrance door (NTOF maze door)	 EC EC	 * *	 ✓ ✓
FINAL SWEEP before Firing	**Final Sweep**		*	✓
	• EIC **AND** HE PIC give permission to hook-up shot for firing	EC	*	✓
	• Cook-off laser shutter power locked off by FL and FL has key • Heater cables locked by FL in CCH and FL has the key(s) • TV picture in counting house or control wires disconnected	NA NA NA	* * *	NA NA NA
HE operation - Team going in is in radio contact with a person outside. Lightning is Checked using Lightning Strike Computer	• Door/weather watch assigned • Weather/Lightning status OK	EC EC	* *	✓ ✓
The detonator conductivity is usually checked again before hookup	• DCO meter	EC	*	✓
Team going in is in radio contact with a person outside	• Radio Check – door watch to access control • Radio Check – entry team - door watch from inside shield door	EC EC	* *	✓ ✓
Health Physics Technician, Central Control Room Operator, Firing Leader, and Firing Team Members as needed by the Firing Leader. The gun catch tank and target chamber may have vacuum valves. Gas cavity fill is different from gas target fill valve – different shot types.	• Detonator(s) connected to firing circuit or fiber to laser • DCO check completed • Gas cavity fill valve ~~OPEN~~ Closed • Target/shot gas fill, cooling, or heating valves CLOSED • Gun catch tank/target vac. valves – Both closed, if applicable	EC EC ✓ NA NA NA	* * * * *	✓ ✓ ✓ NA NA NA
Lights are turned out for beam pictures. A containment system breach can release large quantities of CO.	• Lights OUT – dome • Notify CCR, " Line C Cave is ready for Firing. Special re-entry procedure is in effect due to possible carbon monoxide".	EC EC	* *	✓ ✓

HE heated above its exclusion temperature may go off without warning.	• Cook offs - EIC and HE PIC and FL agree to start heating HE • Laser trigger OK • Laser blocking shutter enabled inside dome • Permission by EIC and FL to exceed exclusion temperature	NA NA NA NA	* * * *	NA NA NA NA
U/Pu - Room 53-3-S207, Motor Control Center T14G – HVA-1 and FE-1	• U/Pu - Lock fans OFF - Line C dome supply and exhaust fans	NA	*	NA
FIRING	**FIRING**		*	✓
Gun and vessel shots are fundamentally different when requesting beam	• LXP timing check – verify gate relationship to shot need	EC	*	✓
DG-535 on top of firing rack. Same one used for firing detonators.	• Cook-off laser - gate generator in external trigger mode	NA	*	NA
Powder gun projectile detection pin(s) are jumpered for pre-shot testing.	• Gun shots – Disconnect short from Beam Request Pin	NA	*	NA
Lights may have been turned on to watch something.	• Lights OUT – dome – again check	EC	*	✓
Some vessel shot have a gas cavity with two valves. The manual isolation valve is opened during final entry and the remotely operated valve is opened for the gas fill and then closed again before firing. Some vessel shots use timing pins powered from the counting house.	• Gas Fill valve OPEN • Gas fill pressure equalized • Gas fill valve CLOSED • PINS power supply ON, in counting house, if applicable	NA NA NA NA	* * * *	NA NA NA NA
	• VISAR ready, if applicable • PDV ready, if applicable	NA EC	* *	NA ✓
Shift data taking mode from statics to dynamics. If in classified mode, camera computers are mode switched separately. If line X is lined up to the 1X or 2X beam stops, beam will not go to LC.	• DAQ in "Dynamic Mode" • Classified Camera computers in "Dynamic Mode" • CCR – "Is the line X beam lined up to send beam to line C?"	EC NA EC	* * *	✓ NA ✓
"Status" display from CCR is checked by EIC – right hand dash is green	• H- injector is ready and enabled to send beam – rt. green dash	EC	*	✓
Usually for cook offs.	• Movie Mode – Cameras in Movie Mode • Stand alone mode • 999 Frames • Acquire mode	NA NA NA NA	* * * *	NA NA NA NA
The radiation safety system **MUST** be secured for HX to fire. Absolutely no talking by anyone, except as required by the EIC	• PACS secured • Announcement – "Attention! Final firing sequence. Absolutely NO unnecessary TALKING!"	EC EC	* *	✓ ✓
Beam Line vacuum pump-out valves – Valves from pumping station to beam pipe.	• Close beam line vacuum pump-out valve remotely – upstream • Close beam line vacuum pump-out valve remotely downstream	EC EC	* *	✓ ✓
CDU – Capacitive Discharge Unit – This energy storage box, located next to the HE, fires the detonator. DG-535 MUST be in external trigger mode before shutter is opened.	• EIC gives permission to charge CDU OR open laser blocking shutter AFTER gate trigger = external • CDU charged or laser shutter open	EC EC	* *	✓ ✓
	• CCR – "Is beam available?" If yes, "CCR, standby for firing!"	EC	*	
	• Cook offs – Start DAQ run WITHOUT arming cameras • Beam ON in continuous mode (like 2 or 3 Hz)	NA NA	* *	NA NA
	• EIC gives permission to Arm systems • Cameras ready • CDU trigger key enabled • PDV ready	EC EC	* * * 	✓ ✓ ✓ ✓
	• EIC called for beam or triggered laser at 1258 hours	EC	7/23	✓

Post Shot	After Firing		*	✓
	• CDU discharged - high Voltage meter indicates zero	EC	*	✓
Detonator high Voltage cables are **AGAIN** connected to grounding block on CDU power supply rack	• Detonator High Voltage cables connected to grounding block • Pin Power Supply OFF (in counting house)	EC NA	* *	✓ NA
	• CDU keys removed or cook-off laser blocking shutter closed	EC	*	✓
Beam line upstream of containment system. Unit 1 channel 6.	• Post shot beam line pressure = $1e^{-3}$ torr	EC	*	✓
TV picture of CO monitor	• Line C - CO before initial re-entry = 0 ppm CO	EC	*	✓
Firing Leader determines the apparent shot status after evaluating the microphone audio, vacuum, and camera pictures.	• Apparent status • Successful • Partial (detonator fired) • Misfire (detonator did not fire)	 EC	*	✓
Write "N/A" if there is no misfire.	• Misfire/partial-fire procedures started if shot not successful	NA	*	NA
24/7 numbers = PTLA scheduling 7-4438, shift commander 5-1279	• Notify PTLA of need /no need for overnight guards	NA		NA
Photon Doppler Velocimeter – Laser system in counting house	• PDV laser, if used – shutdown and key REMOVED	EC	*	✓
Shut down = Laser Power supply turned OFF and key removed.	• VISAR shut down, if applicable, and key(s) removed	NA	*	NA
Firing Site Access Control 7-6742	• Access Control notified – Shot status • Cook off locks removed	EC NA	* *	✓ NA
Line C dome radioactive exhaust must be ON before pumping. EIC console, Apps, right click, LXL, XAEF1L3 FLOW and 1L97 ON	• Area A radioactive exhaust stack fan is ON Do not rely upon Run Permit Ready - check line-by-line display	EC	*	✓
Uranium and Plutonium	• Inner container pressure _____ Torr • Vessel pressure _____ Torr	NA NA	* *	NA NA
Read post shot pressure remotely. **NOTE: Three pump downs and two vents are a MUST for industrial health safety no matter how small the shot. After the first pump down to remove the HE products, two more air fills must be pumped out to ensure industrial safety.** **Uranium, Vanadium, etc.** need to cool before venting to reduce fire (**Uranium**) and/or slower oxidation (toxic **Vanadium** oxide).	• Upstream pressure .06 Close Upstream Pump Valve • Open Upstream blast valve - post shot pressure = 10 torr • Open Upstream pump valve to begin pumping • Open Downstream blast & pump valves to help pumping • Pump down (1) to less than 5,000 microns (**5 torr**) • Fiducial plate beam picture to verify collimators are clear • Flammable materials (like U) - 30 minutes before venting	EC EC EC EC EC EC NA	* * * * * * *	✓ ✓ ✓ ✓ ✓ ✓ NA
Normally, the first two vents are fast to blow out the collimators. For shots with potentially flammable post shot debris, like U, all venting is slow. **Venting is not required before an entry.**	• Vent 1 – Close Pump Valves & Open Atmosphere Vent valves • Pump down (2) to less than <5,000 microns (**5 torr**) --------→ • Vent 2 – Close Pump Valves & Open Atmosphere Vent valves • Pump down (3) to less than <5,000 microns (**5 torr**) • Vent 3 – Slow – Close both pump valves • Open slow vent valve	EC EC EC EC EC EC	* * * * * *	✓ ✓ ✓ ✓ ✓ ✓
The initial entry team should always be minimized.	• EIC and firing leader both agree that Line C can be entered	EC	*	✓
	• Notify CCR that the Line C dome CO is <25 ppm. before entry	EC	*	✓
	• Portable CO monitor in the hands of the entry team		*	
Uranium and Plutonium	• Level II Anti-C on both the firing leader and RCT • Respirators for both • CAM reading OK	NA NA NA	* * *	NA NA NA

Until after the firing leader has checked for a breach, dome entries after a shot are a high explosives operation. Lightning/ field level – local indication, Access Control, or Meteorologist PPE includes tyvek suits, respirators, gloves, etc.	• Door/weather watch assigned for HE operations • Weather/Lightning status OK • Workers briefed on PPE requirements and waste segregation • Firing leader is controlling dome PACS keys • U/Pu – Reminder - disconnect venture pump before opening	EC EC EC EC NA	* * * * 	✓ ✓ ✓ NA
HE operation - Team going in is in radio contact with a person outside.	• Radio Check – door watch to access control • Radio Check – entry team - door watch from inside shield door	NA EC	* *	NA
Uranium and Plutonium	• Giraffe air monitor checked for contamination	NA	*	NA
	• Cook off laser key removed	NA	*	NA
	• Breach procedures implemented if a breach has occurred	NA	*	NA
The dome area is a HE exclusion area.	• Firing Leader releases Line C for additional access	EC	*	✓
The EIC makes this decision after the firing leader agrees	• Notify CCR that special re-entry procedures NOT in effect • If HE is still present - Notify CCR "Line C continues to be an HE exclusion area due to unburned HE. Please do not permit entries into the line B tunnel without EIC approval."	EC NA		 NA
Classified shots only	• Bomb Badge returned	NA	*	NA
	• Sign removed – Special Re-Entry Procedure - Line C key bank	EC		✓
The dome area has been a HE exclusion area.	• Microphone – Turn OFF amplifier	EC	*	✓
	• Gas cooling/heating system disconnected from vessel	NA	*	NA
Upstream vacuum station bypass ensures vessel fresh air via venture. **Uranium and Plutonium** – No air flow through vessel! Hazardous materials exclusion areas are normally 10' in front of the vessel and bags on the windows. Samples must be sent out for analysis.	• Remind vessel clean up crew to open vacuum bypass valve • Venturi pump air line disconnected • Establish exclusion areas prior to opening vessel and pipes • Samples taken from vessel for analysis of contamination	EC NA NA NA	* * * *	✓ NA NA NA
	• CO Monitor in dome – Turn OFF	EC		✓
Prior to removing vacuum windows	• Beam Window covers installed at • IL0 upstream • IL1 downstream (after camera station removed)			
Plutonium – Put it back in the safe	• Container stored inside Radioactive Materials Balance Area	NA		NA

???? LAST SHOT of the day ????	• LAST SHOT of the day?			✓
	• TV Cameras and lights OFF • CO monitor & vacuum gauges at blue racks • Upstream valves • Downstream valves			
	• VISAR status signs = Green	NA		NA
The one in the dome usually stays in the dome with its charger in the blue rack. The other one charges on the bench west of the VISAR room.	• CO monitors in chargers	EC		✓
The EIC and Firing Leader must both agree.	• Notify CCR that HE operations are completed for this day	EC		✓
Locking out is preferable to log off.	• Lightning Detector Computers – Lock out	EC		✓
	• After HE operations are completed, remove signs • Large orange HE octagon – truck door • Small signs for HE and EIC • Line C Shield door • Line C access station (PACS) • Line B tunnel access (NTOF maze door) • Special Re-Entry - Line B tunnel access (NTOF maze door)	EC		✓ ✓ ✓ ✓ ✓
Run out of propane - starter cranks until battery dies or starter fails	• Disable generator – Module 9 in "STOP"	EC		✓
Uranium and Plutonium	• CAM turned OFF • Dome Fans unlocked	NA NA		NA NA
	• Remove parking lot rope to truck access for "Fire Lane"			
	• RWP – General RWP is current and posted	NA		NA
http://pwcnv02.lanl.gov/arakfram.htm?7:0 – Username/PW = APC/apc http://praddalek02/arakfram.htm?7:0 Dalek can also be turned off by cycling key switch in dome without Reset.	• HV to beam line data taking cameras – Turned Off • Dalek OFF – Look in the back of HS-R02 • No 120V or 208V power cord connections on floor	EC EC EC		✓ ✓ ✓
	• CCH doors locked			
Install vacuum window covers IL = Image location Thin vacuum windows have protective covers to guard against blowouts. CanNOT be required if additional beam operations are scheduled.	• IL0 (upstream side) • IL1 (downstream side) • IL2 (both sides)			
Master transfer key removed from transfer block and locked in PACS box	• Dome PACS keys locked in key bank	EC		✓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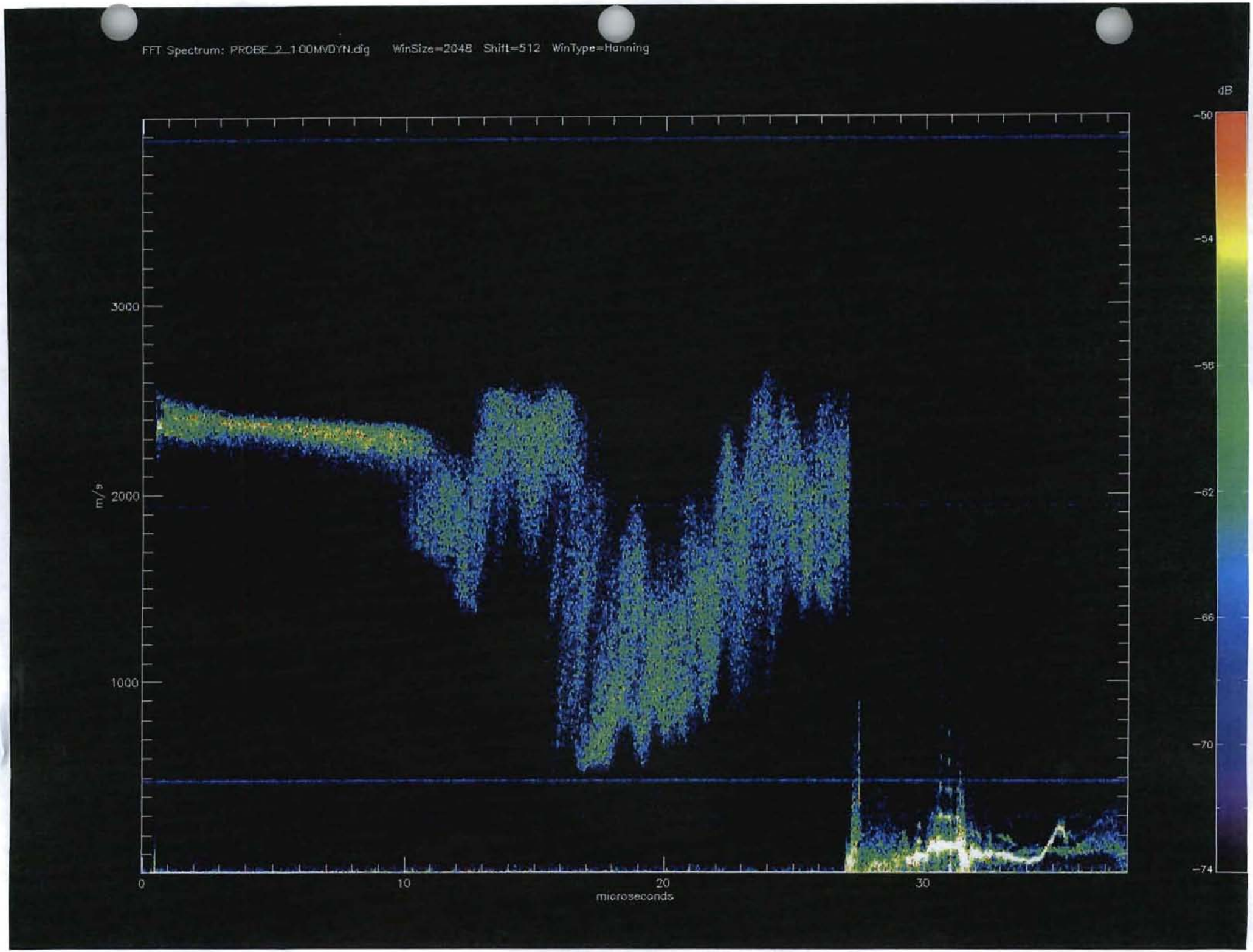
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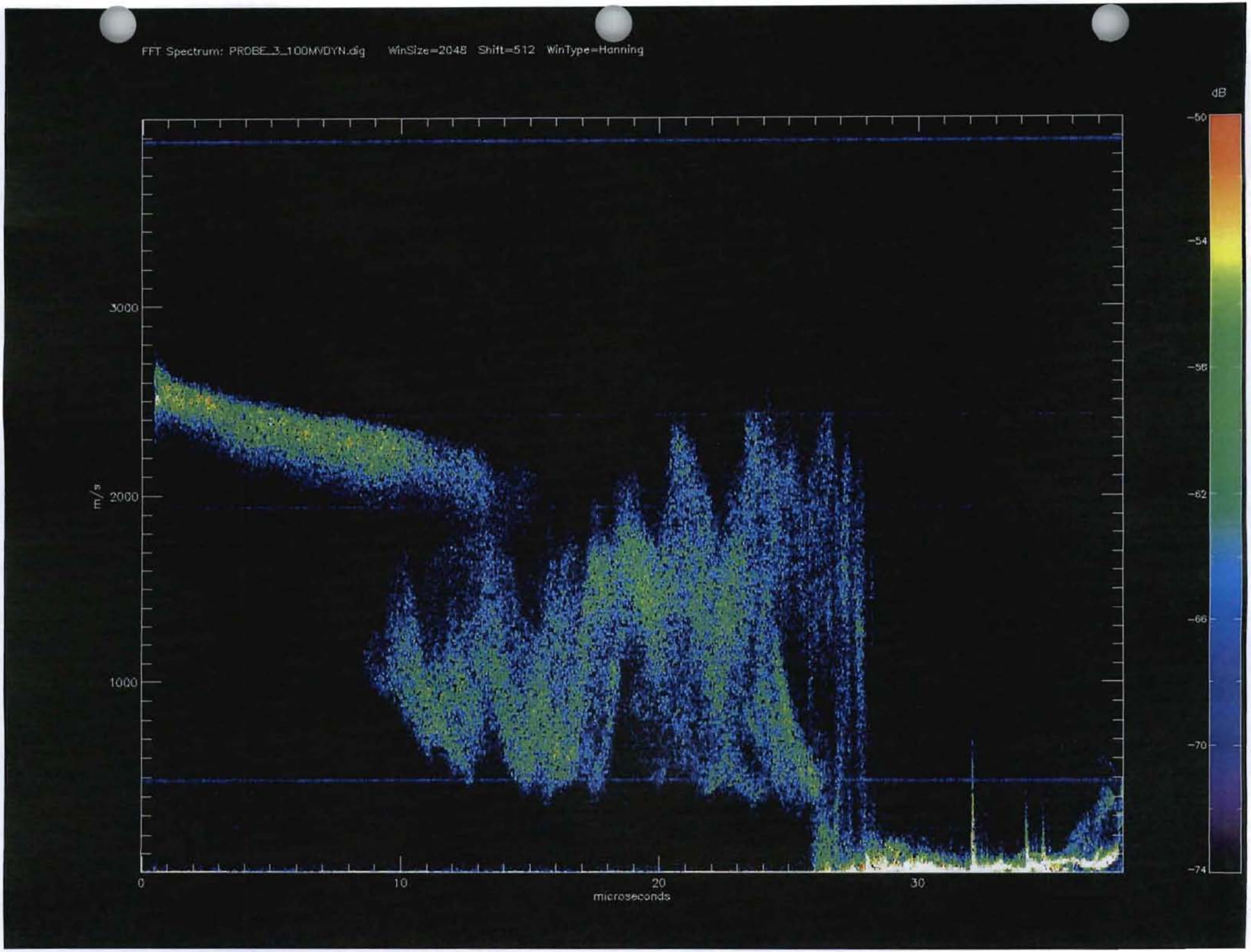
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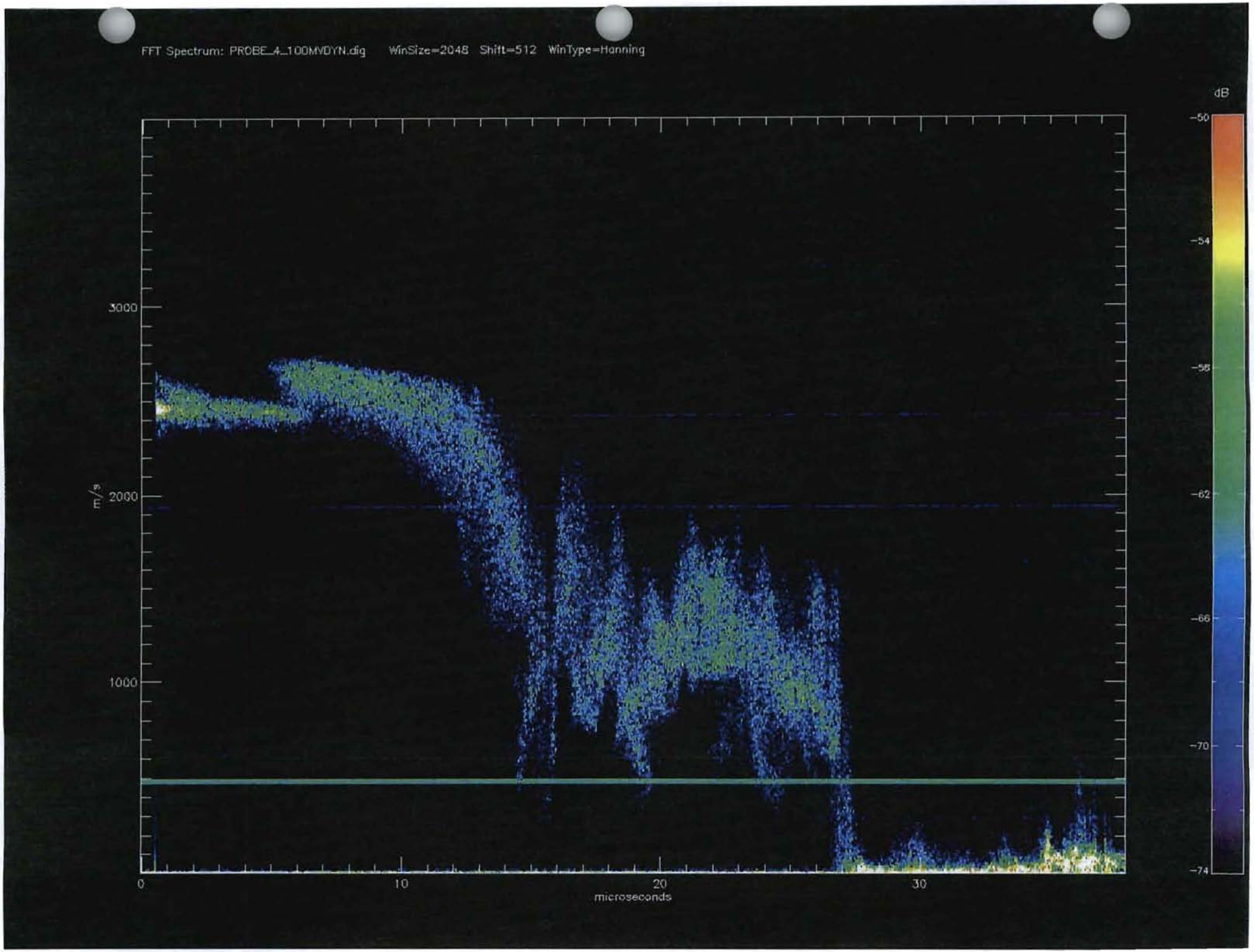
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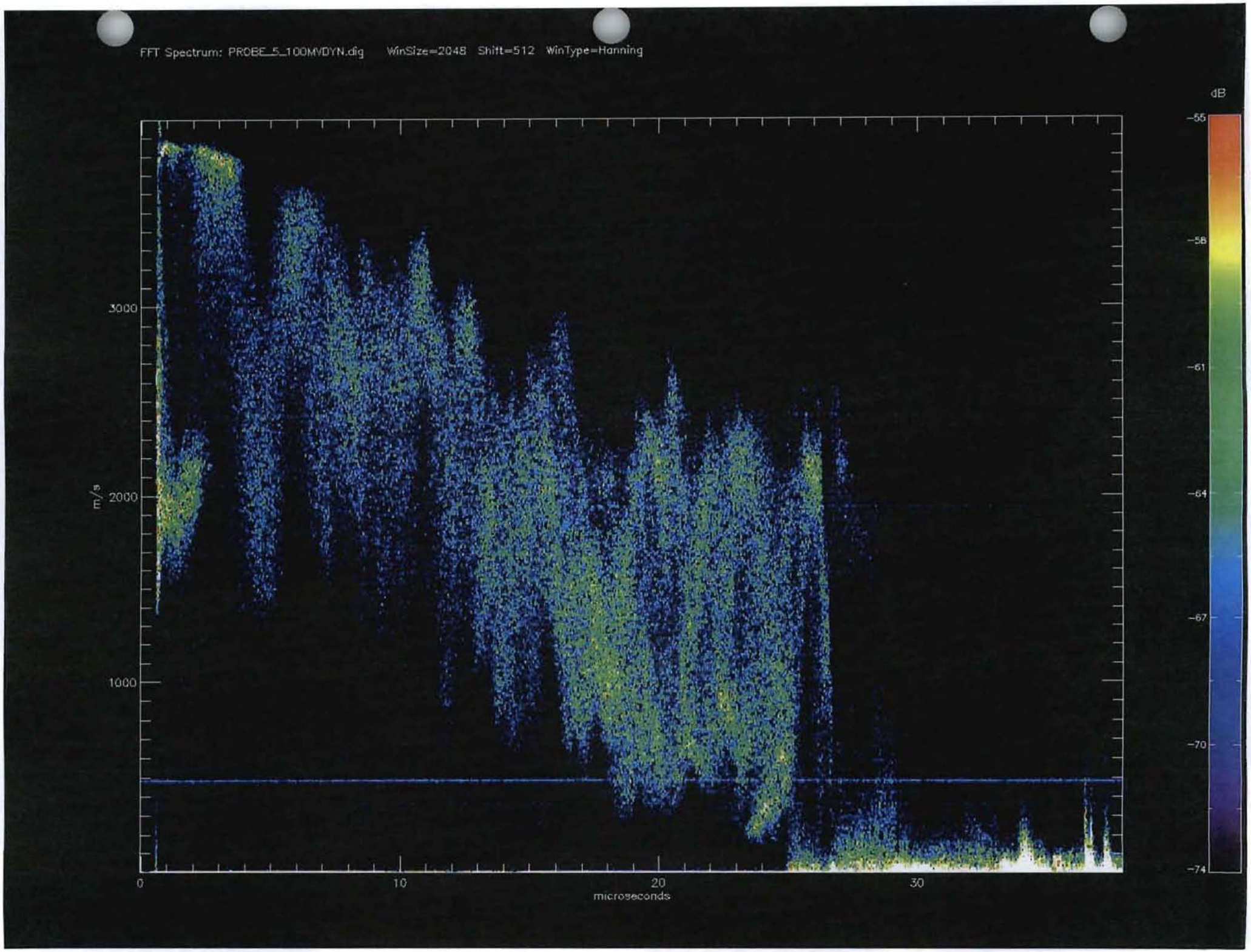
30
microseconds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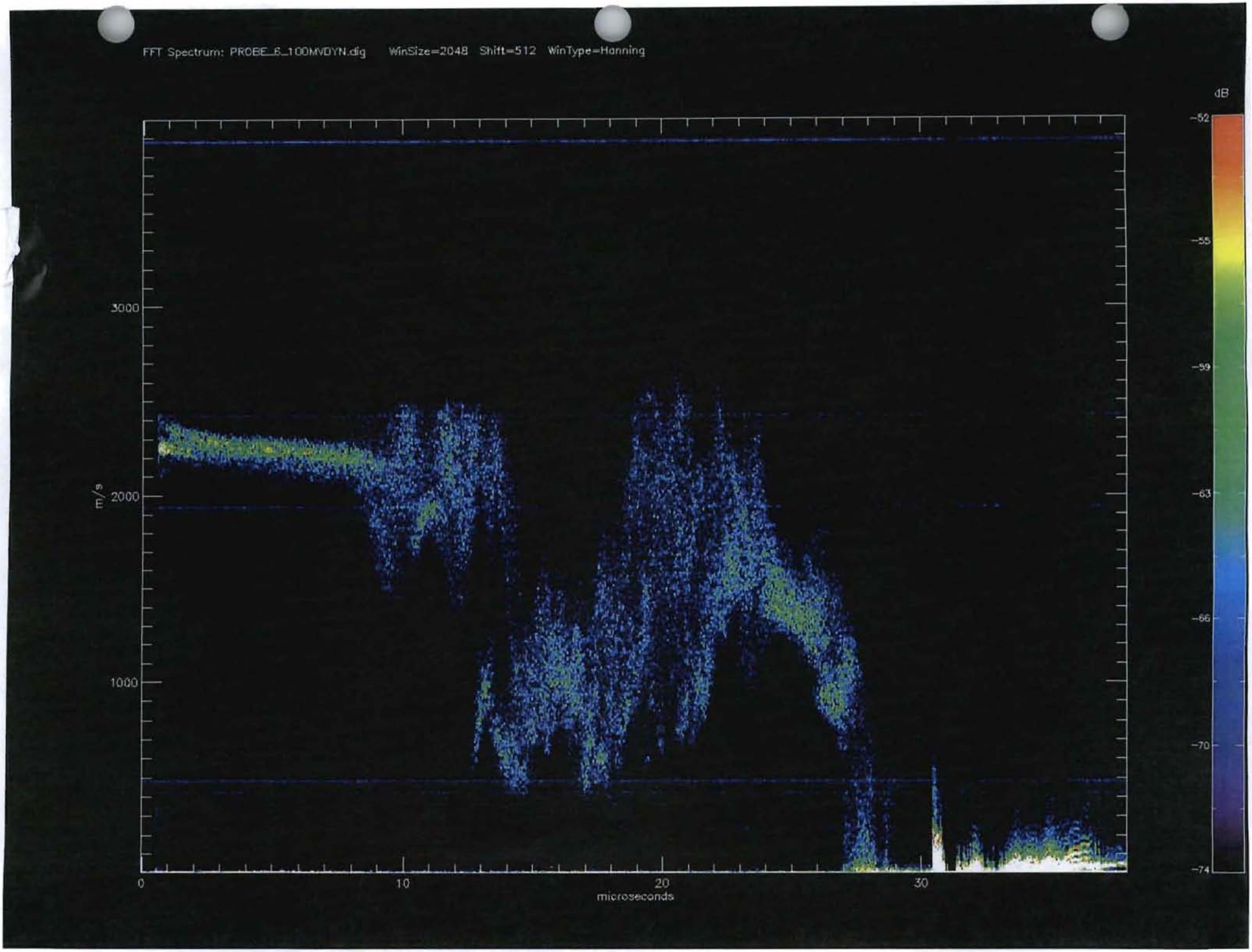
m/s
3000
2000
1000
0
10
20
30
microseconds
dB
-55
-58
-61
-64
-67
-70
-74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dB
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-63
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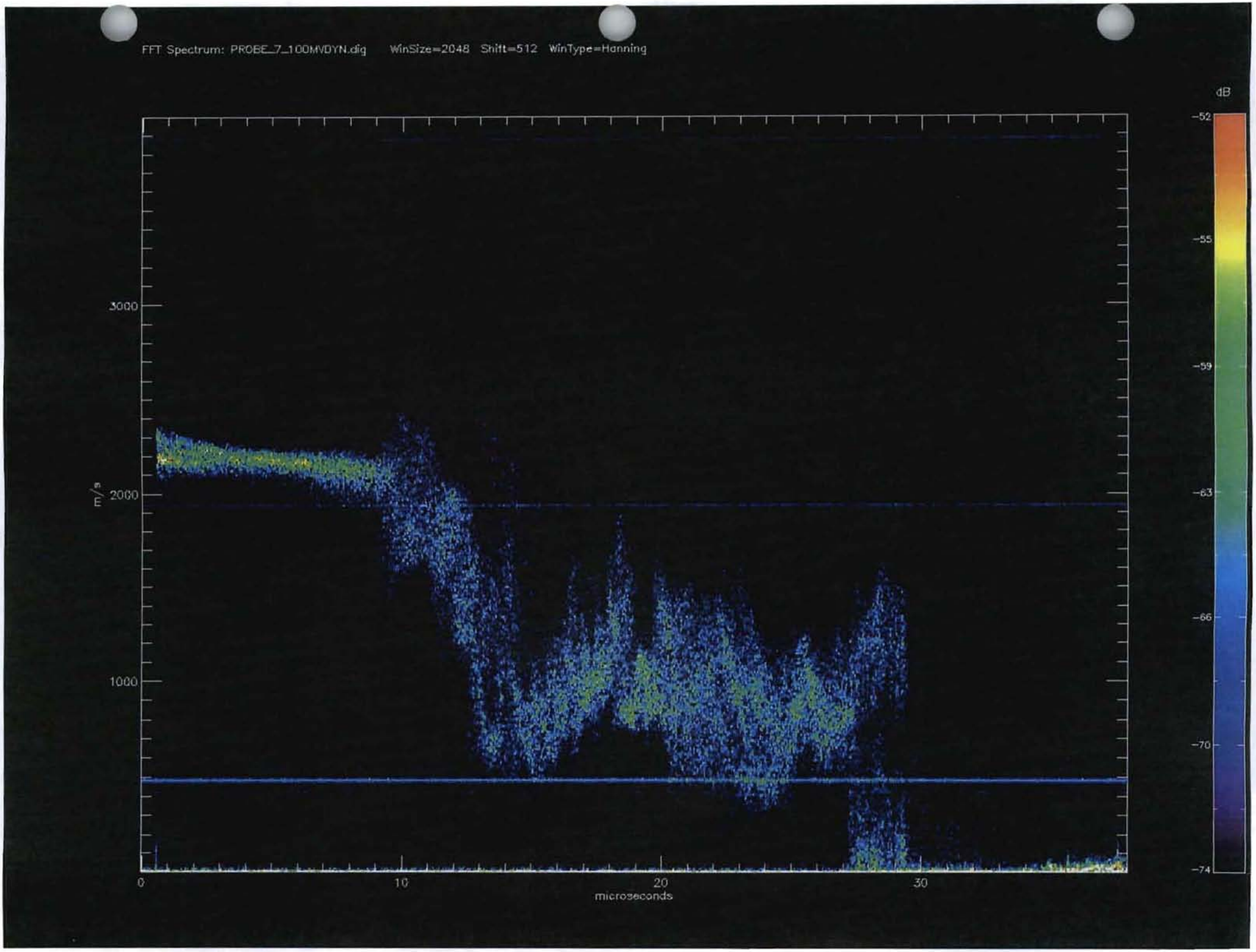
-70
-74
3000
2000
1000
m/s
0
10
20
30
microseconds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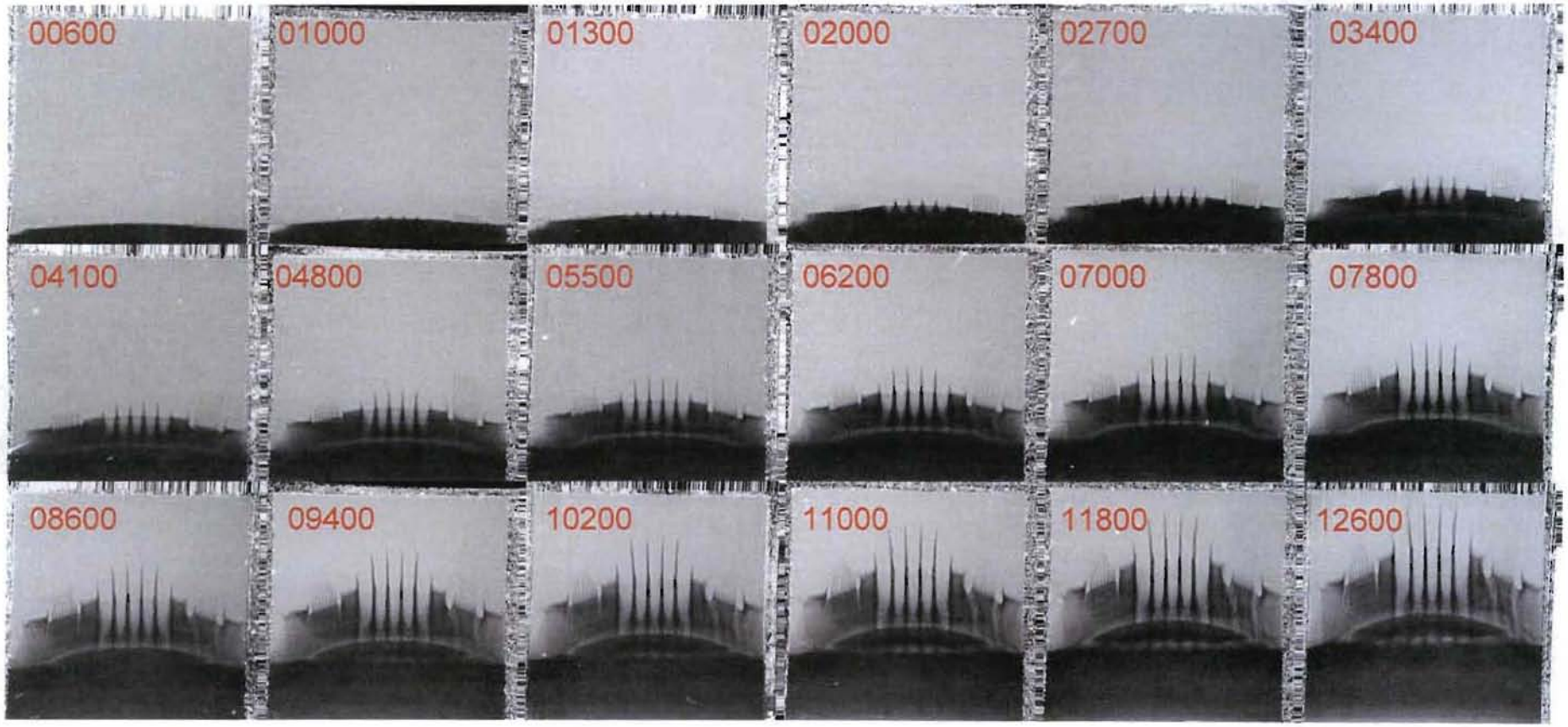
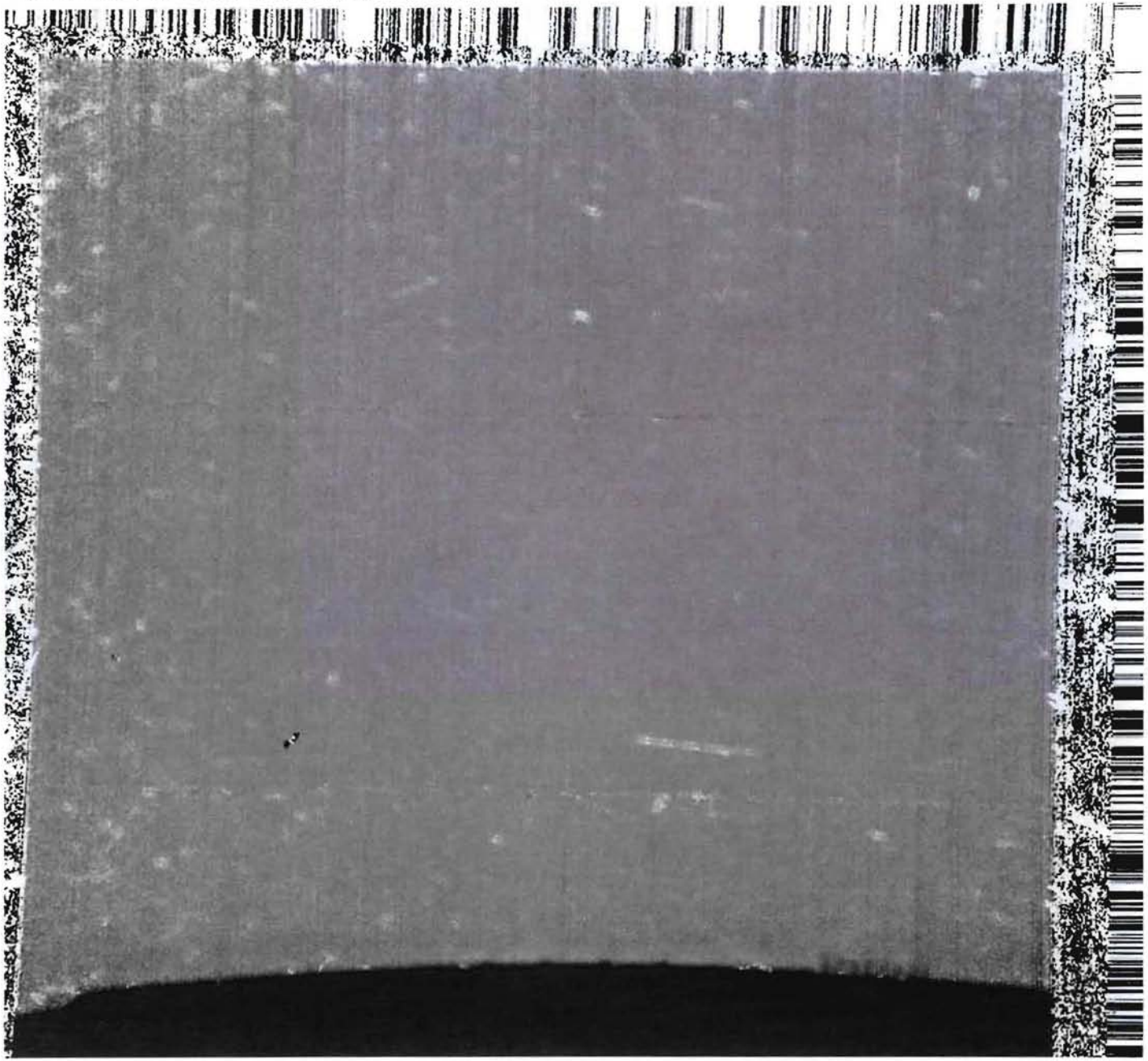
m/s
3000
2000
1000
0
10
20
30
microseconds
dB
-52
-55
-59
-63
-66
-70
-74

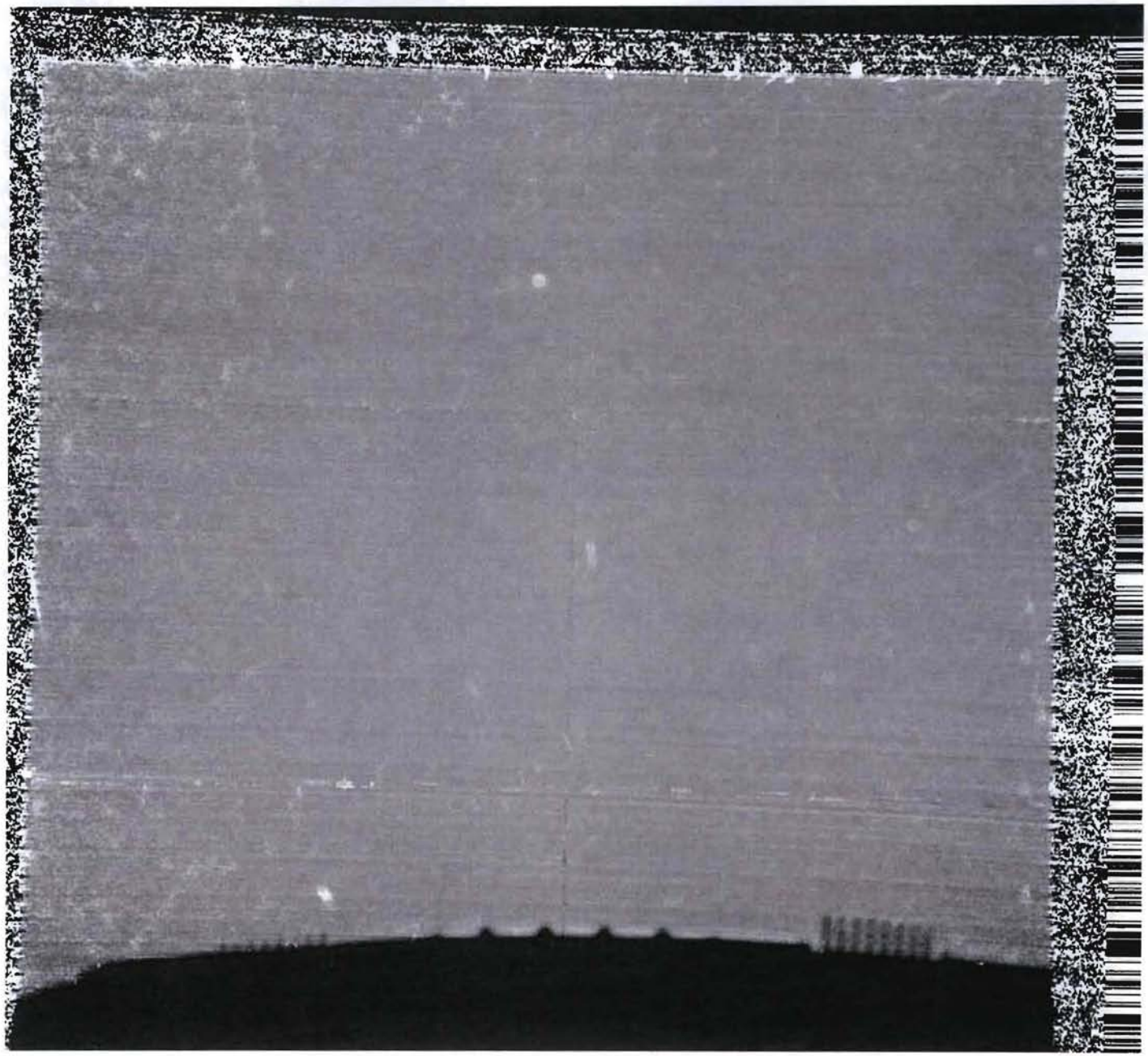
PRAD0376: Buttler RMI into Neon Shot Composite



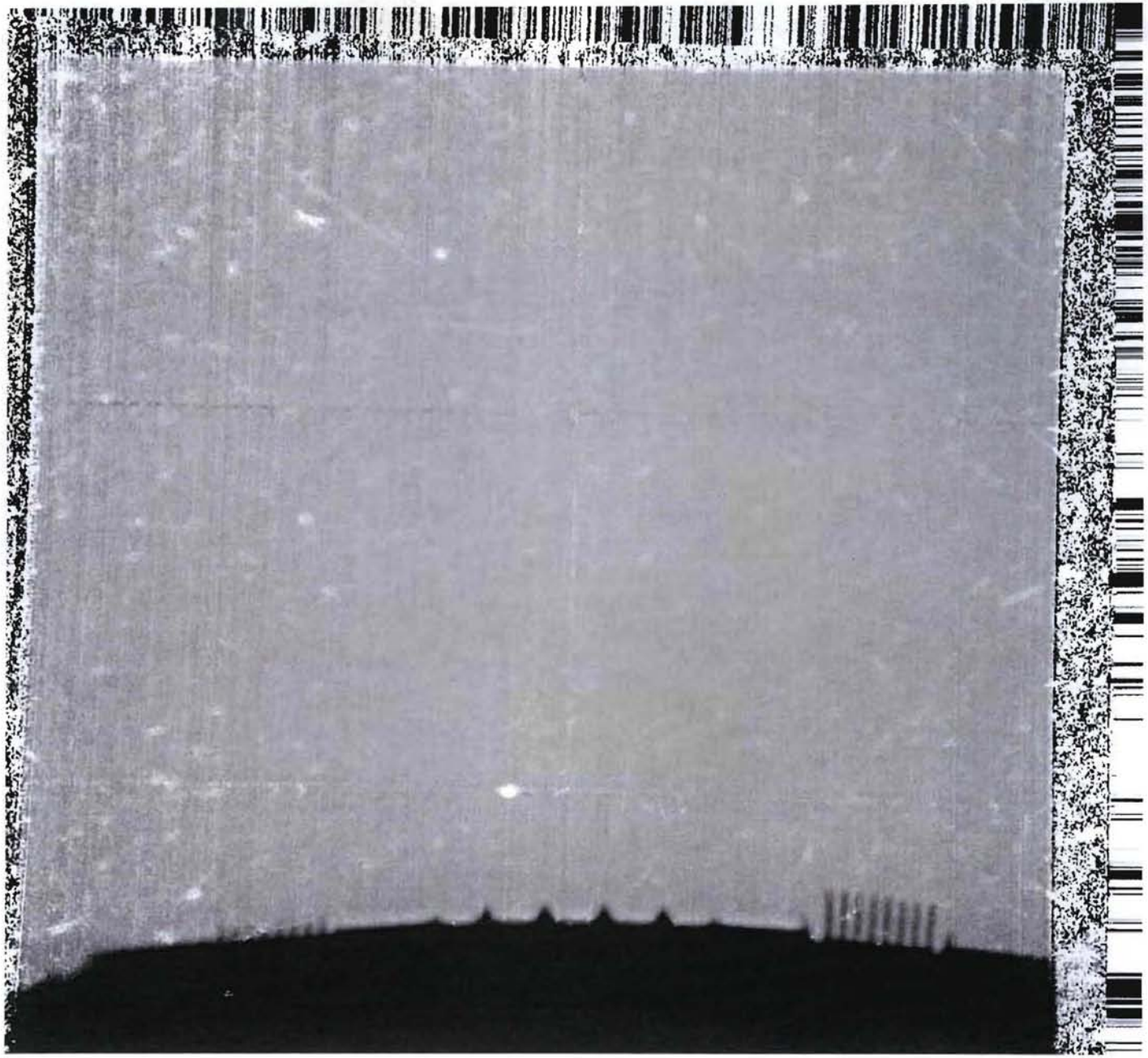
00600 PRAD0376 RMI into Neon Shot H



01000 PRAD0376 RMI into Neon Shot K



01300 PRAD0376 RMI into Neon Shot N



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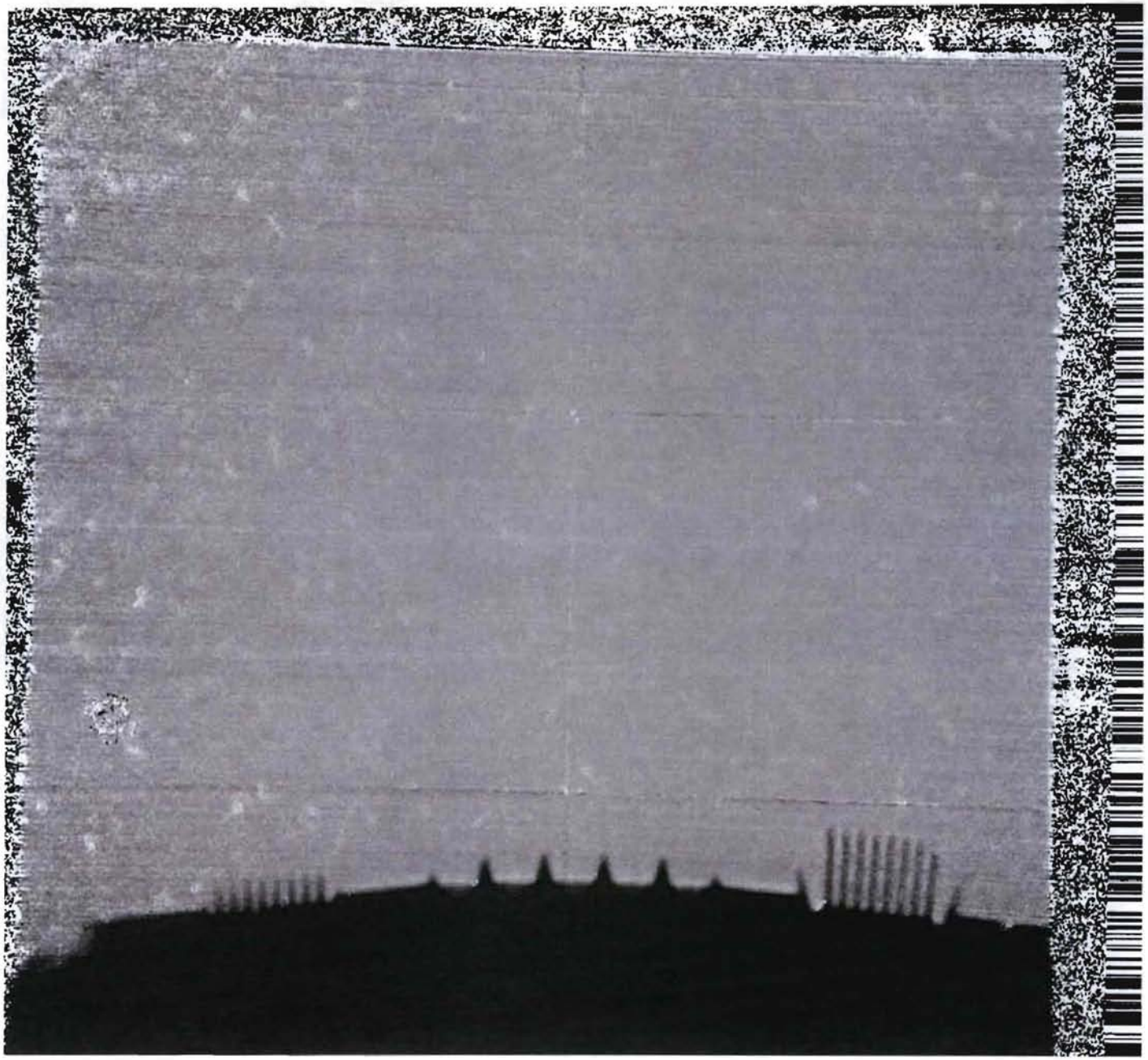
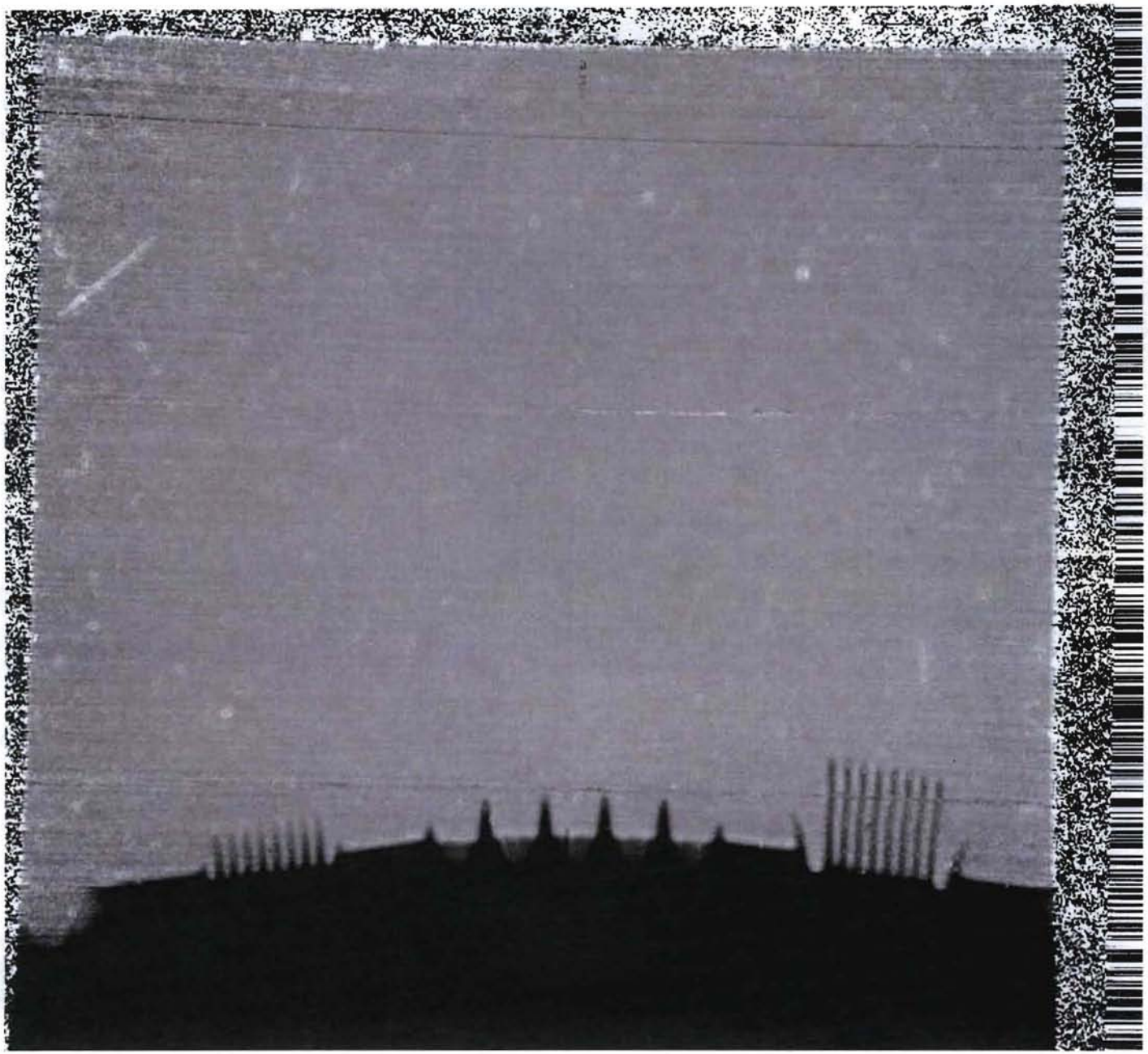
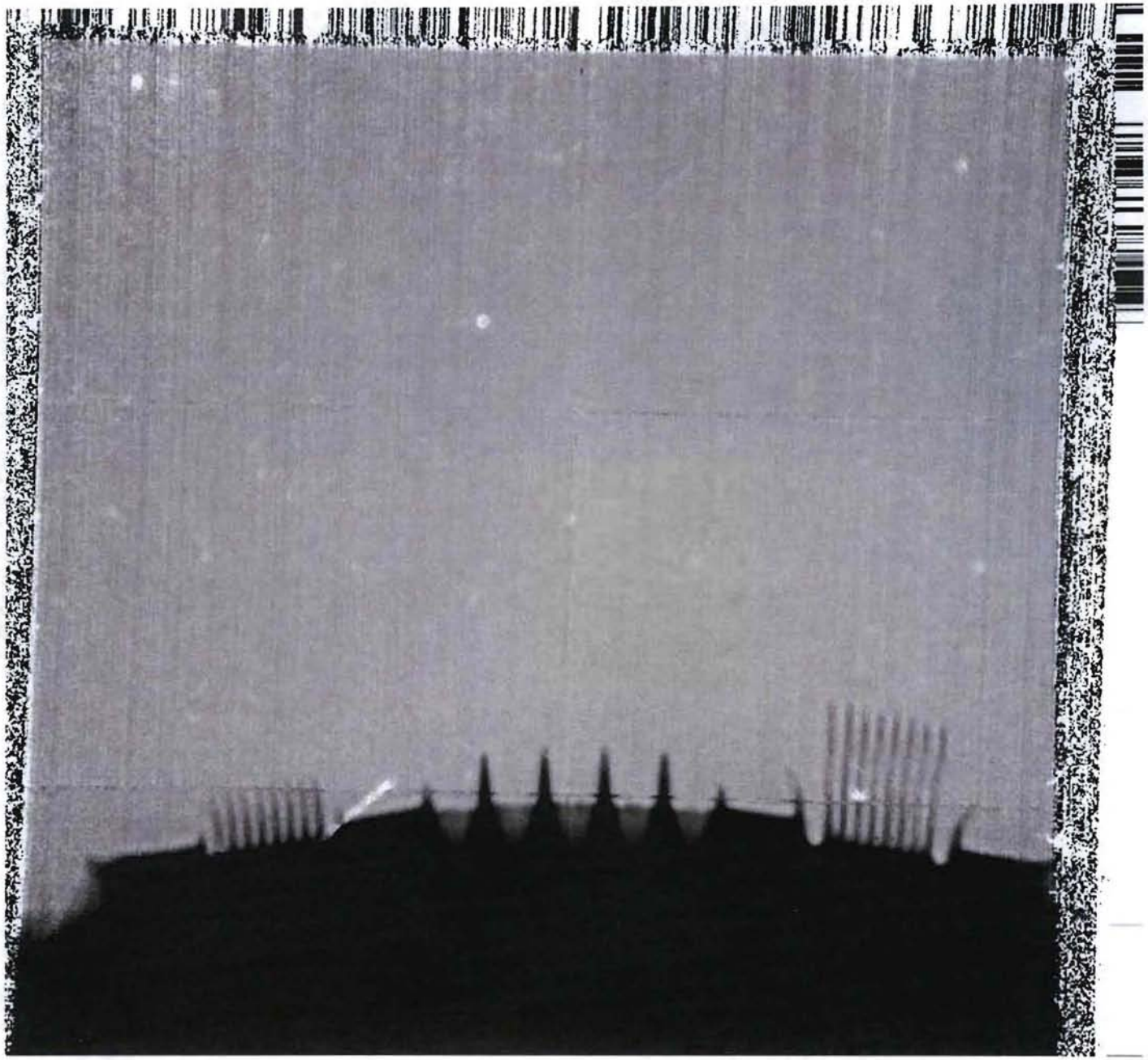


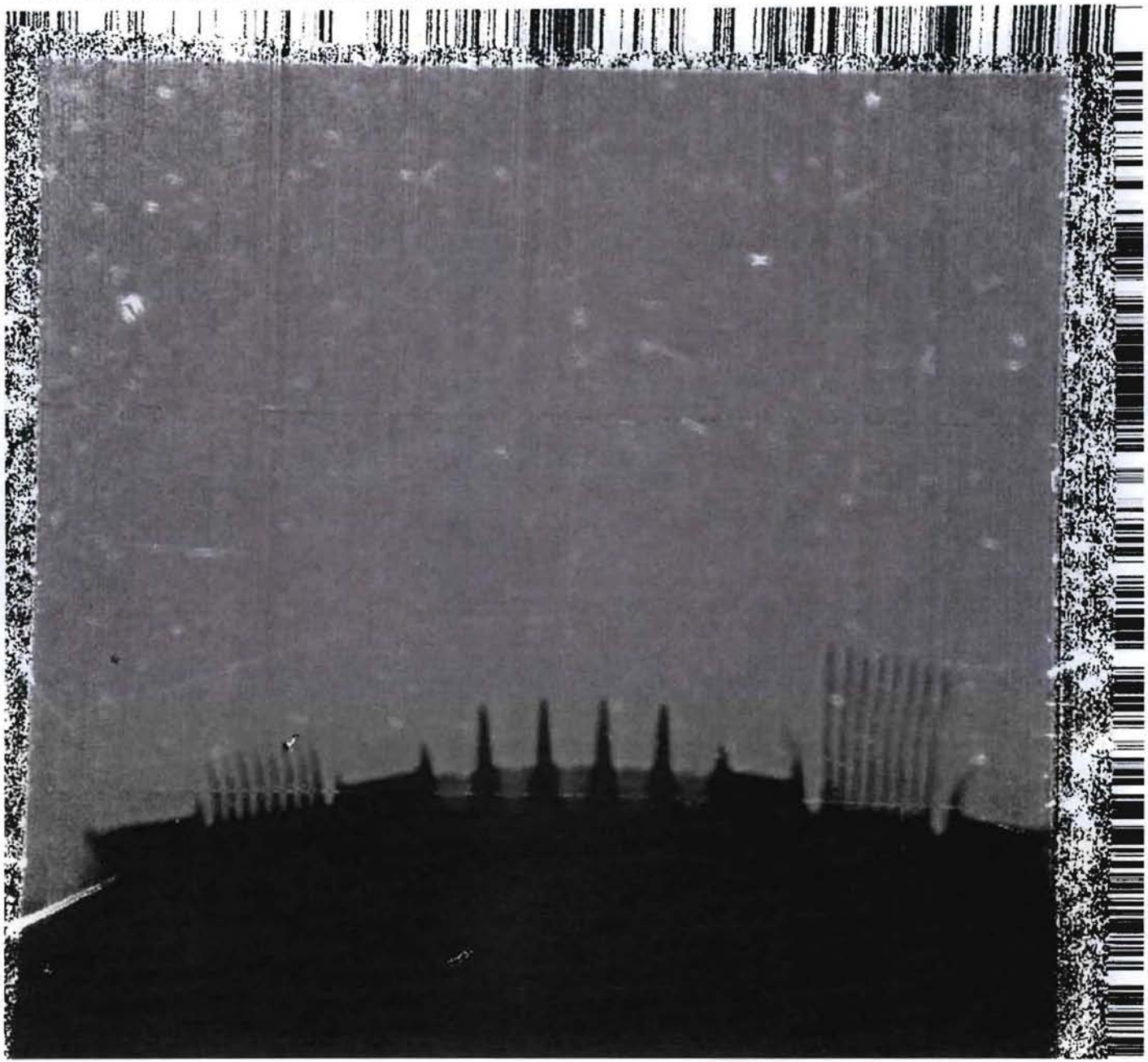
02700 PRAD0376 RMI into Neon Shot T



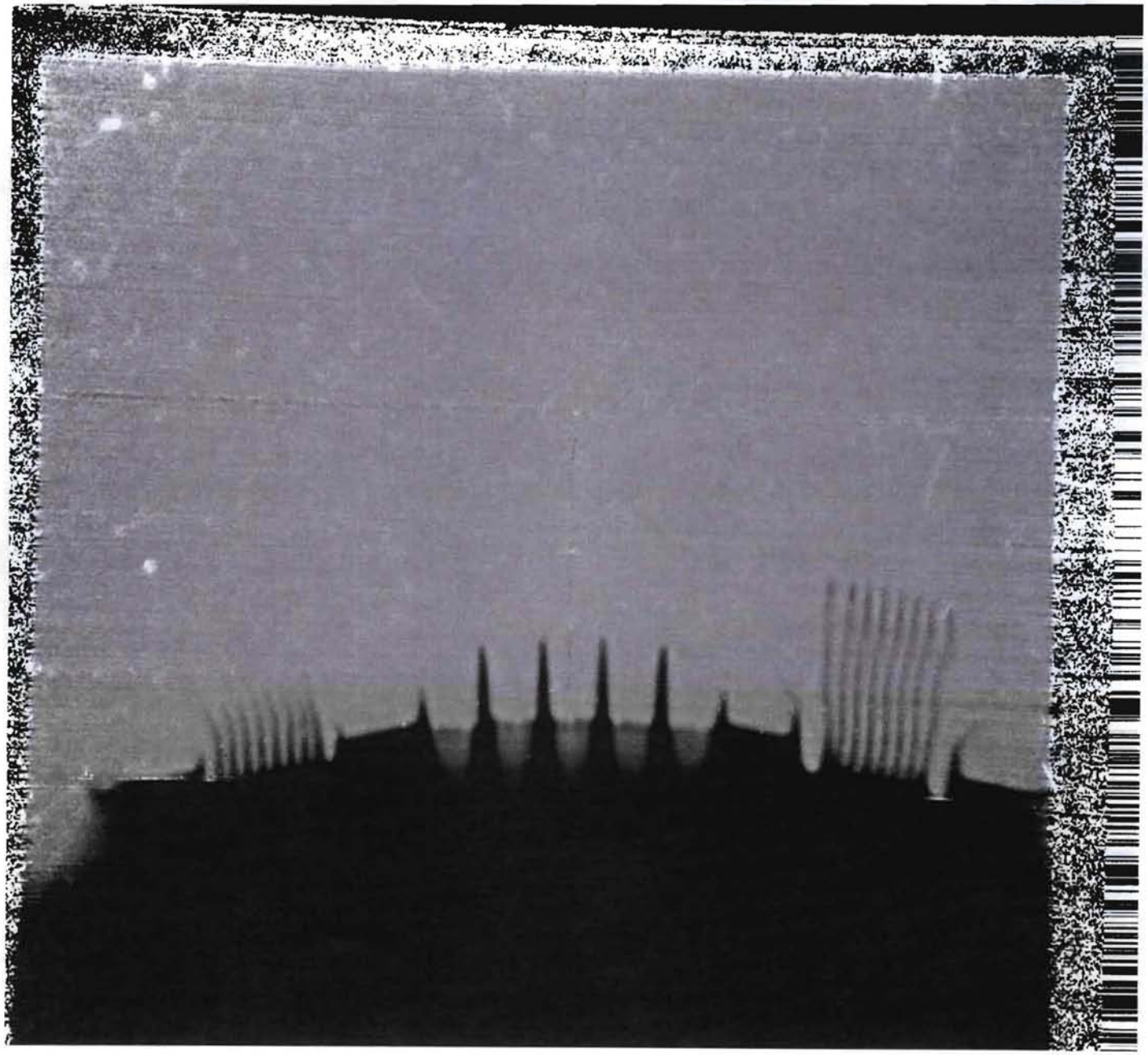
03400 PRAD0376 RMI into Neon Shot X



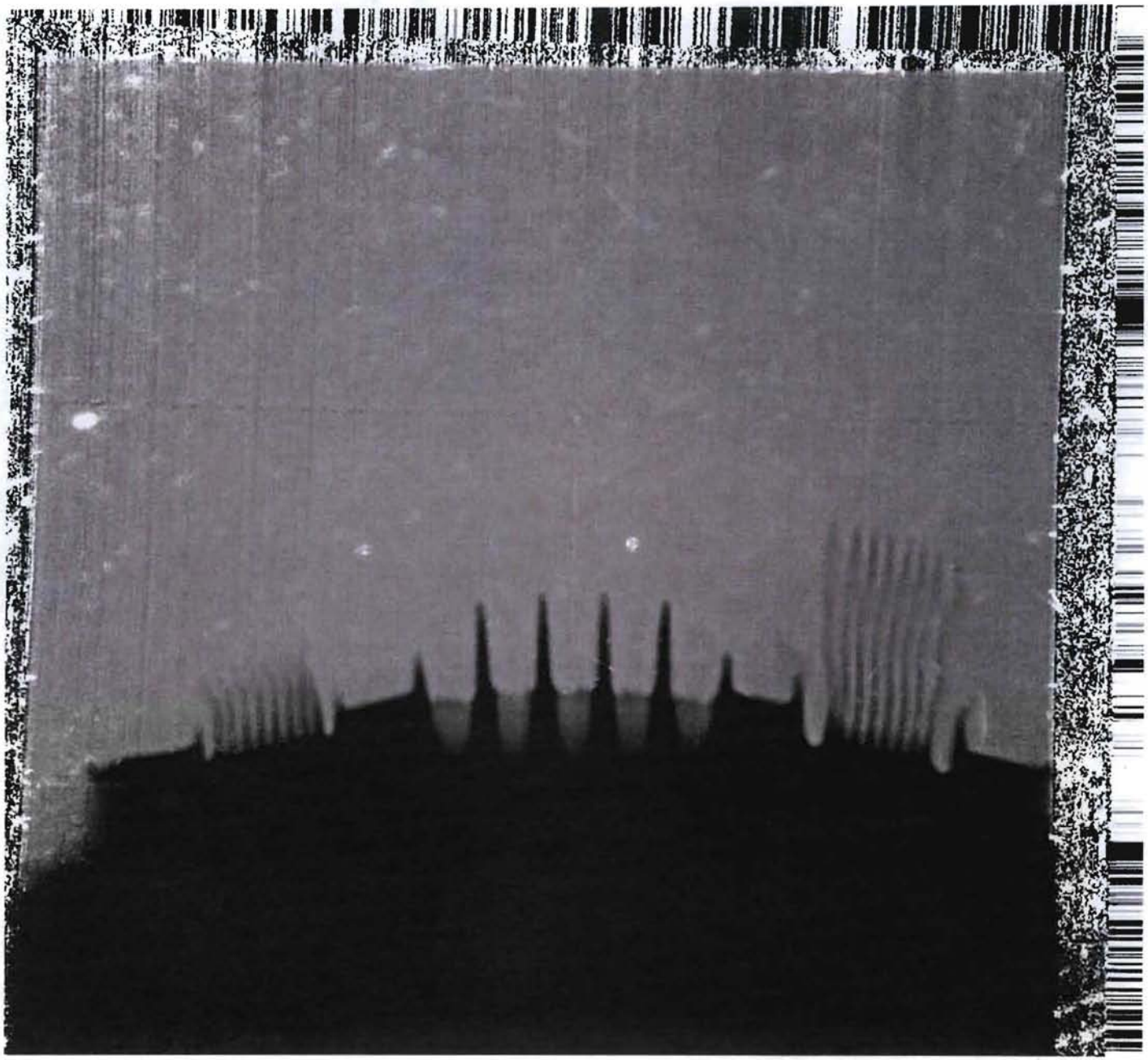
04100 PRAD0376 RMI into Neon Shot I



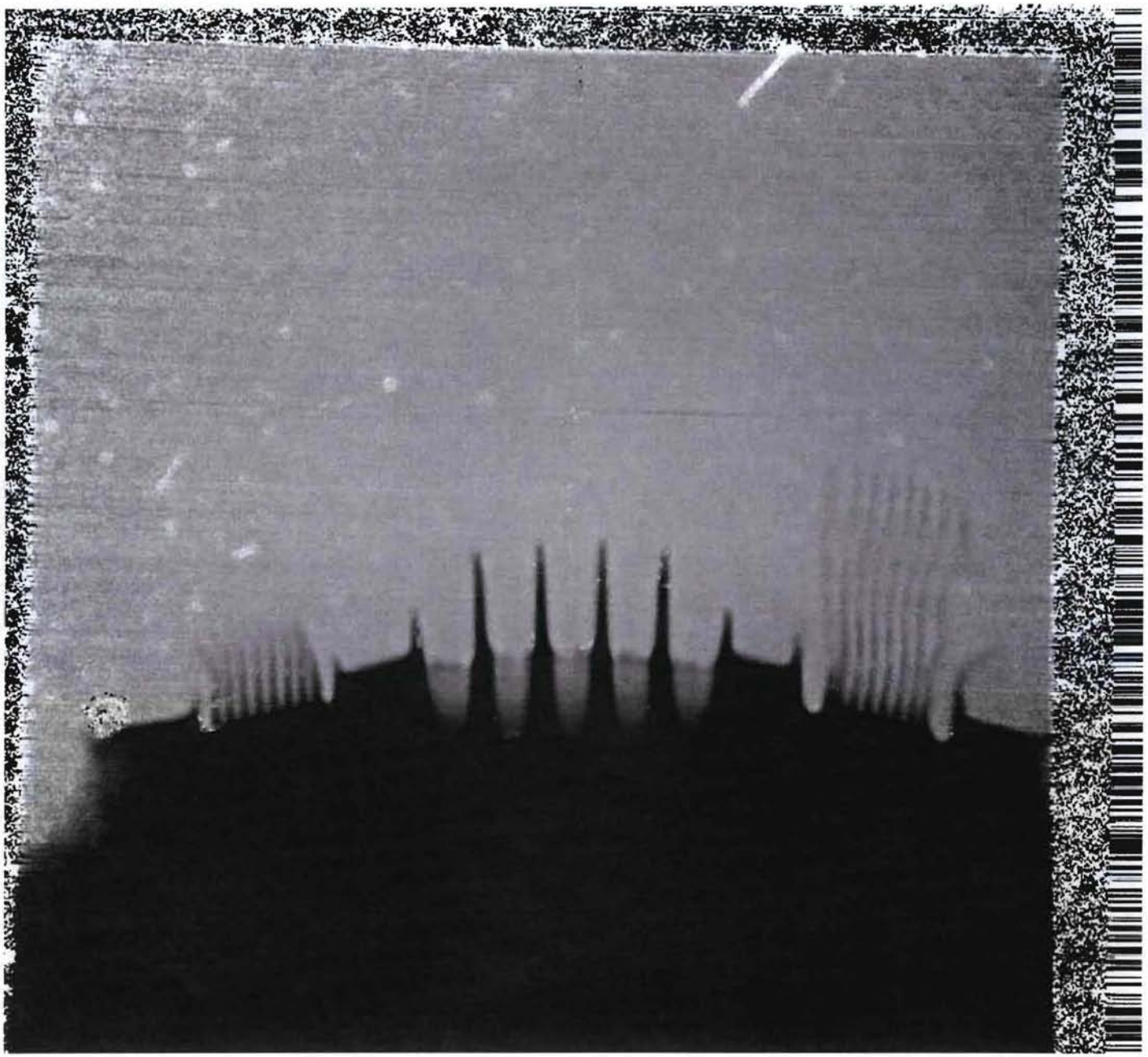
04800 PRAD0376 RMI into Neon Shot L



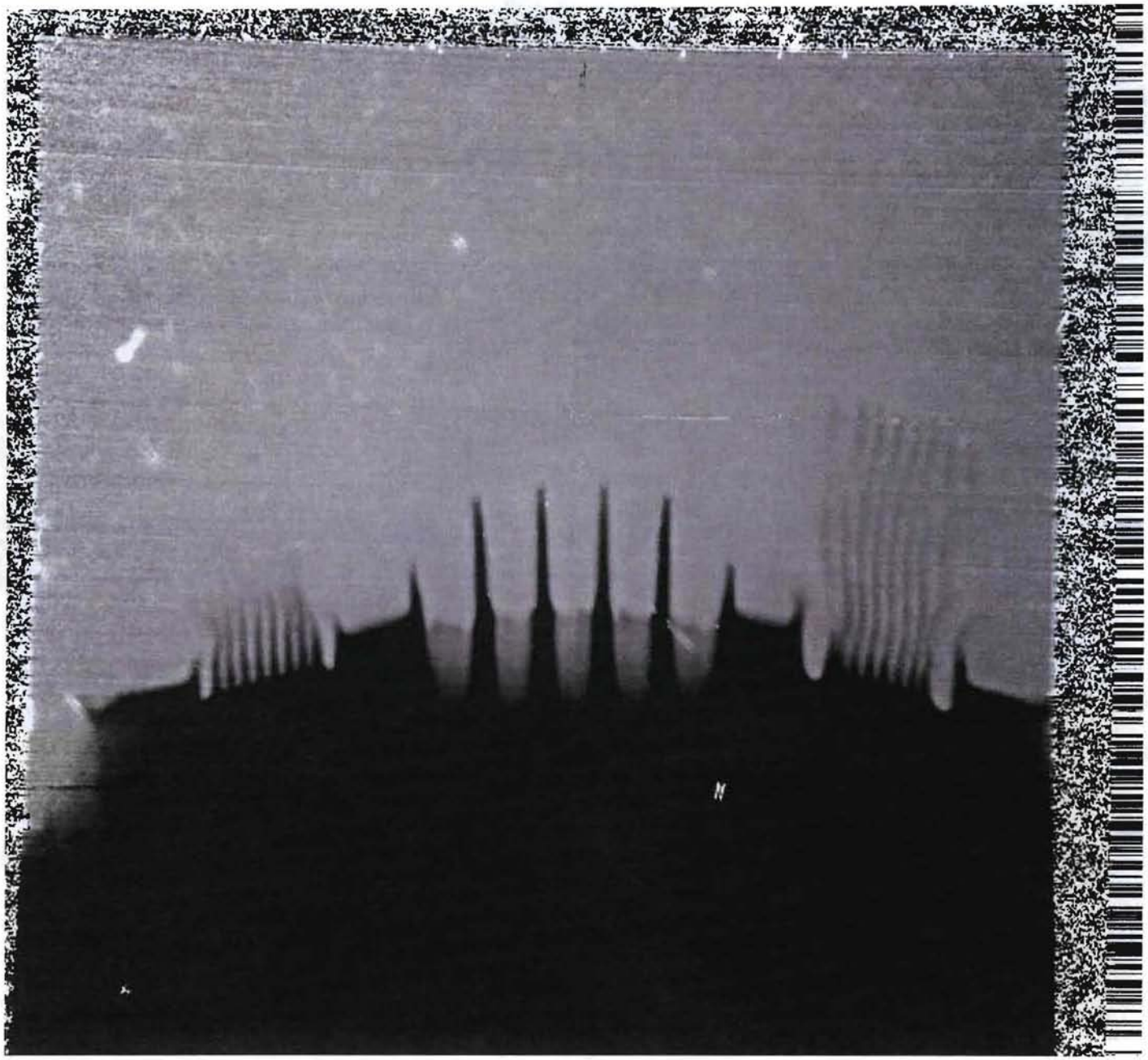
05500 PRAD0376 RMI into Neon Shot O



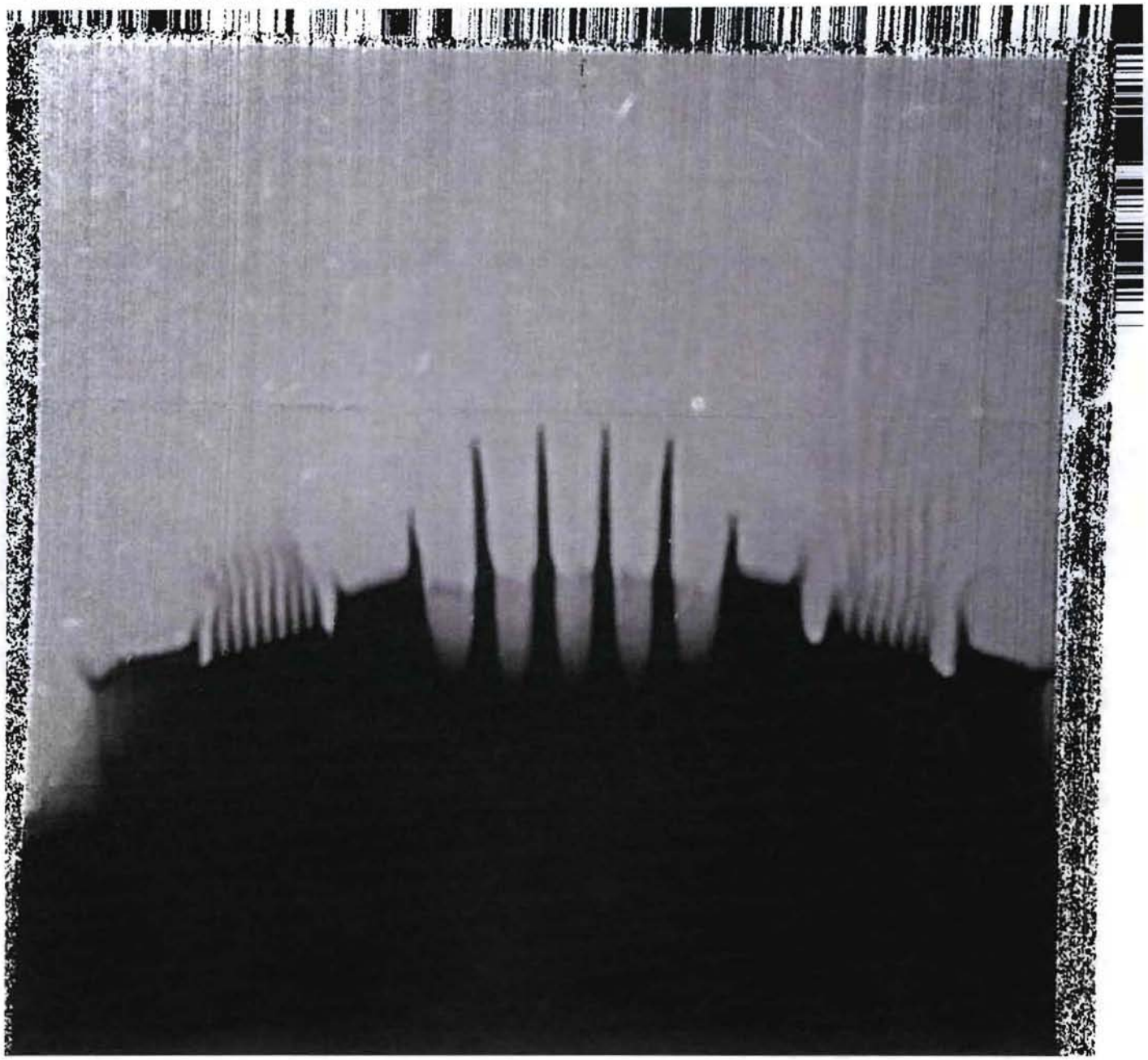
06200 PRAD0376 RMI into Neon Shot R



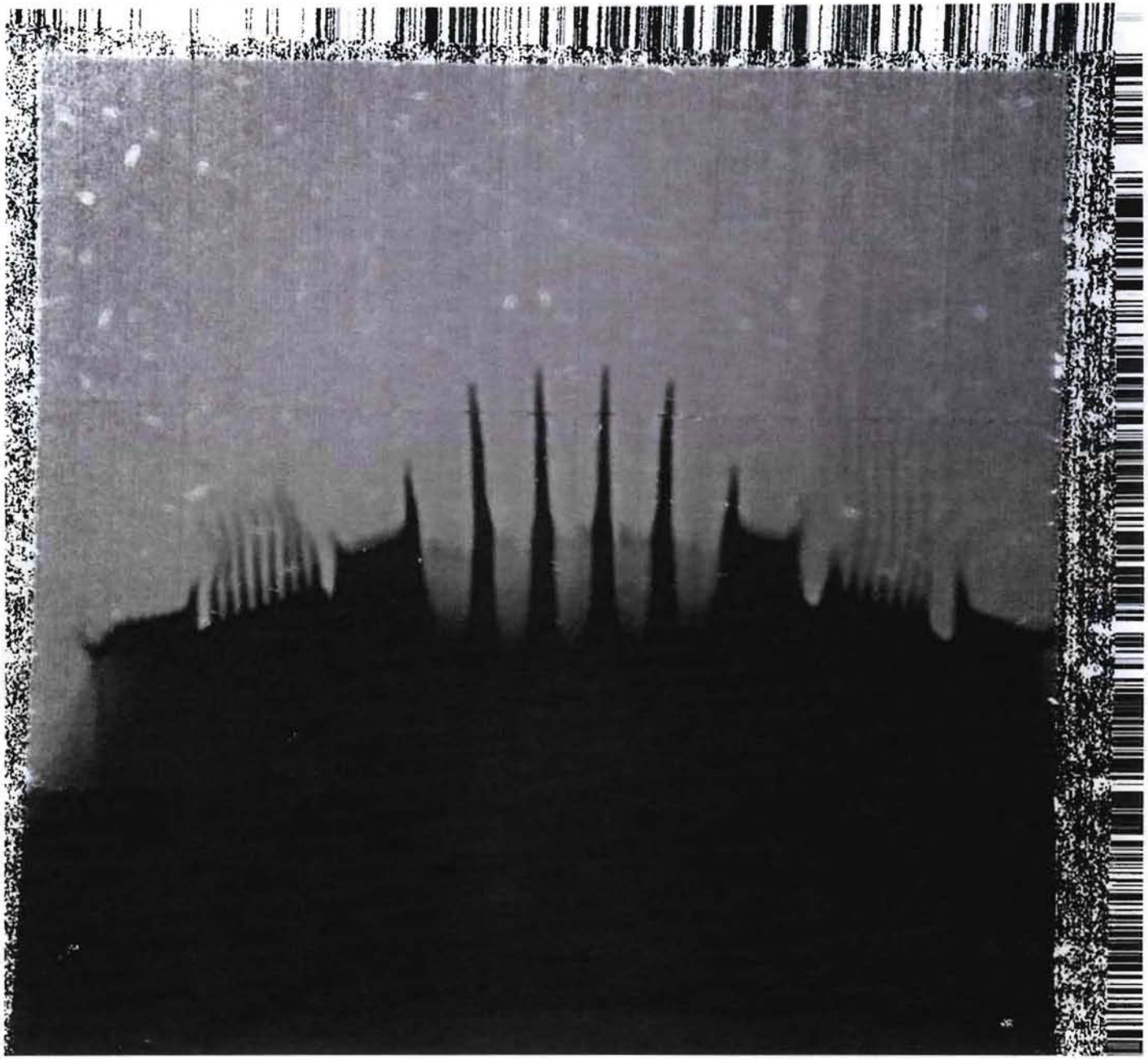
07000 PRAD0376 RMI into Neon Shot U



07800 PRAD0376 RMI into Neon Shot Y



08600 PRAD0376 RMI into Neon Shot J



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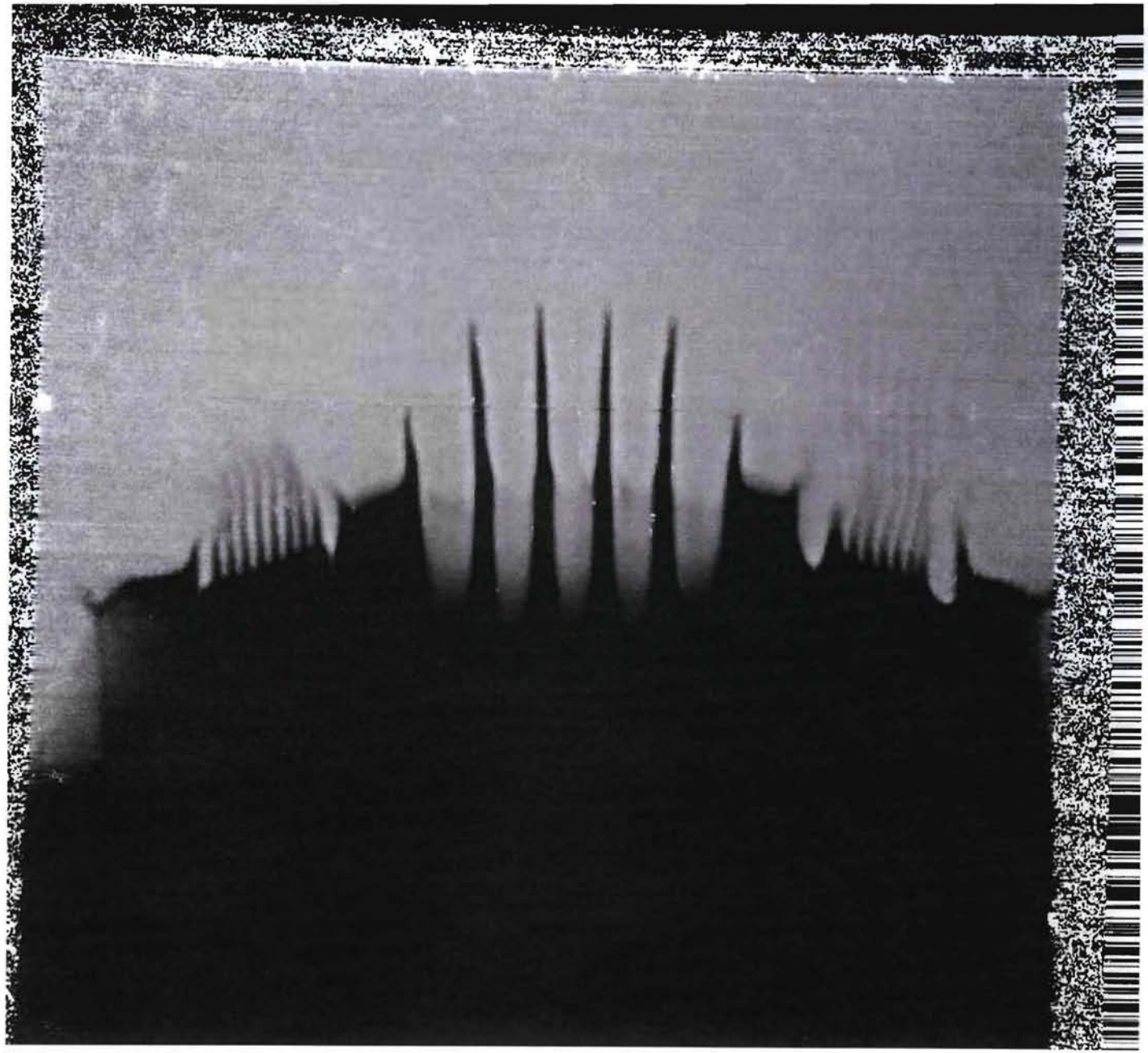
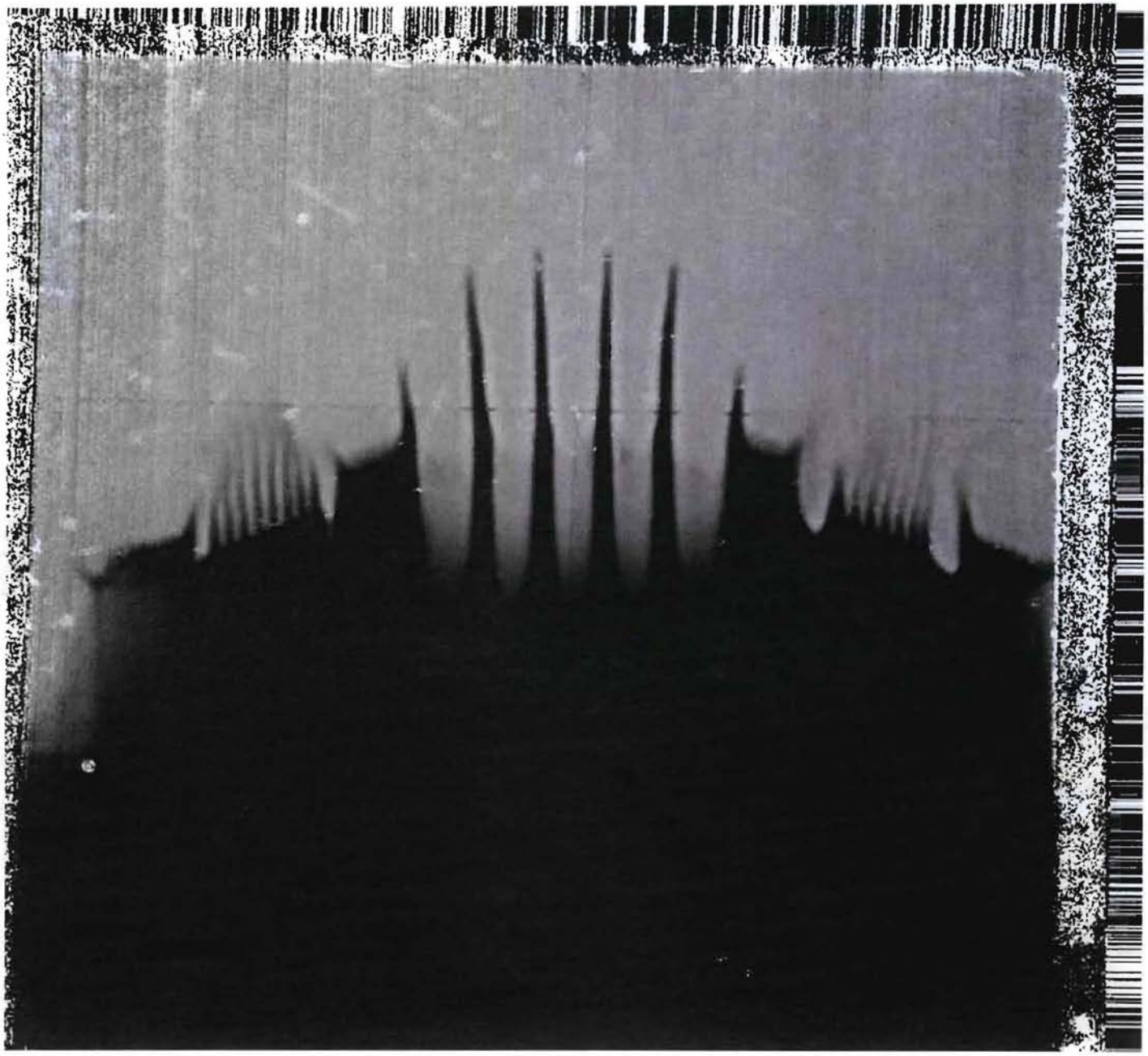
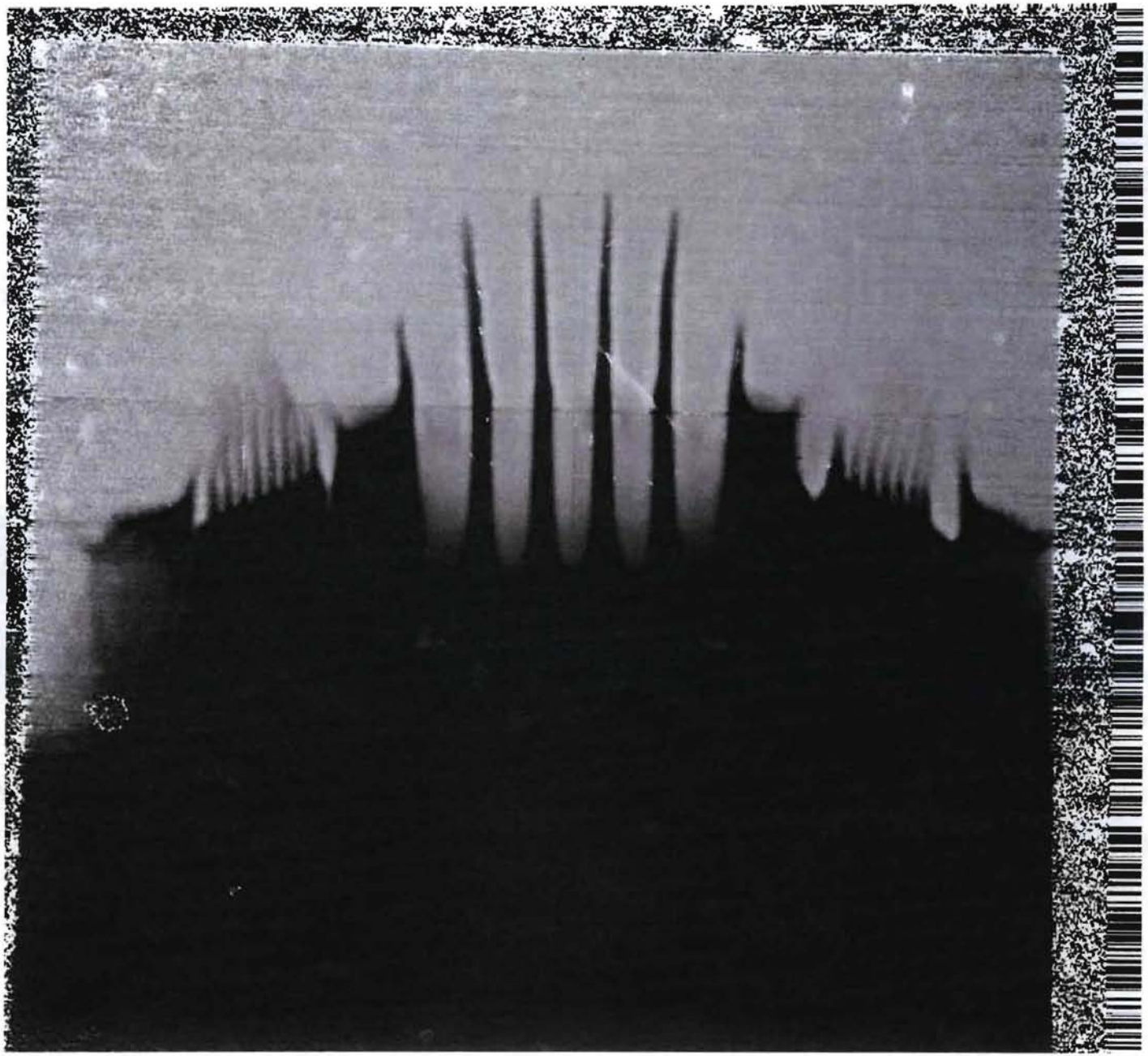


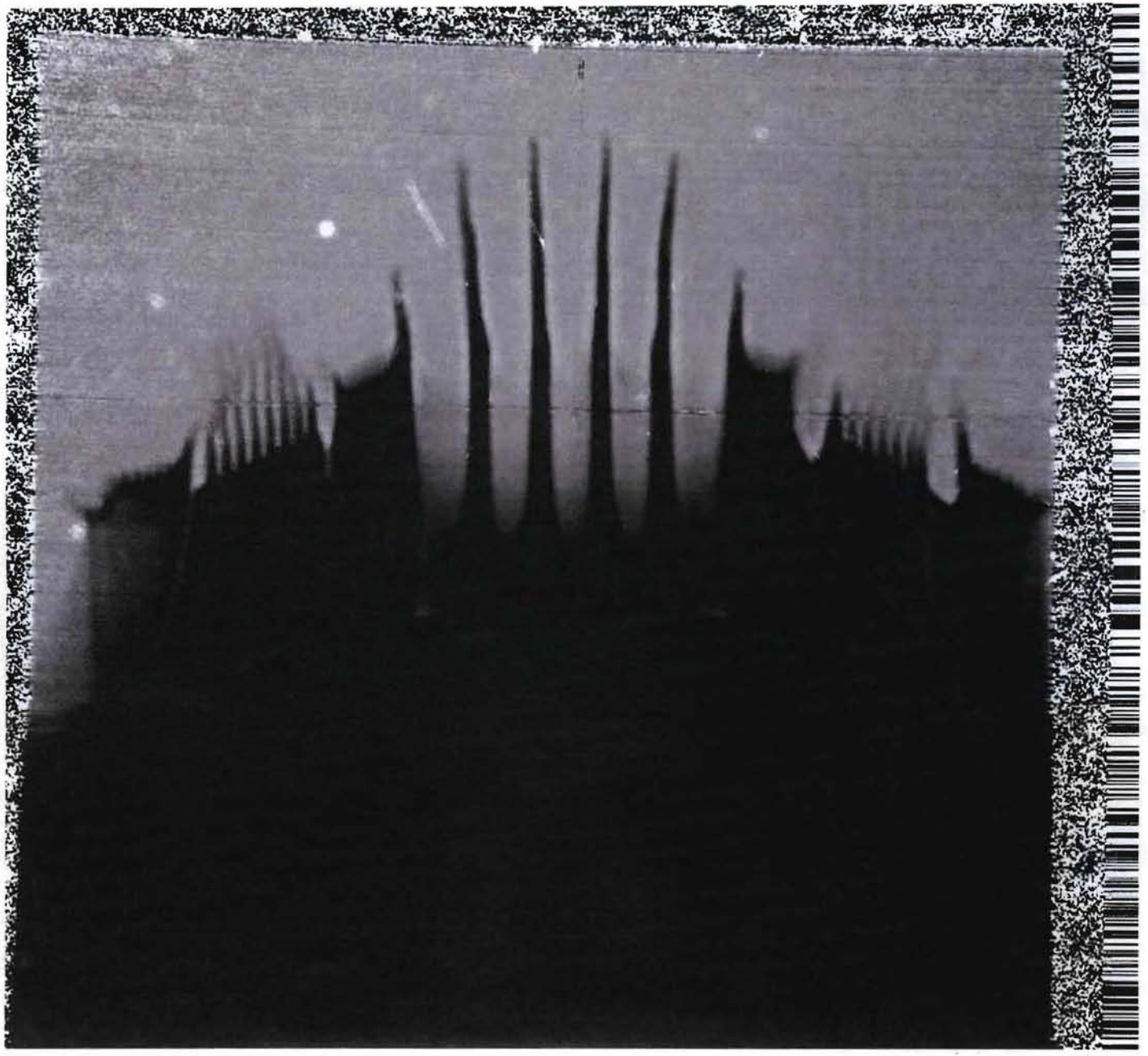
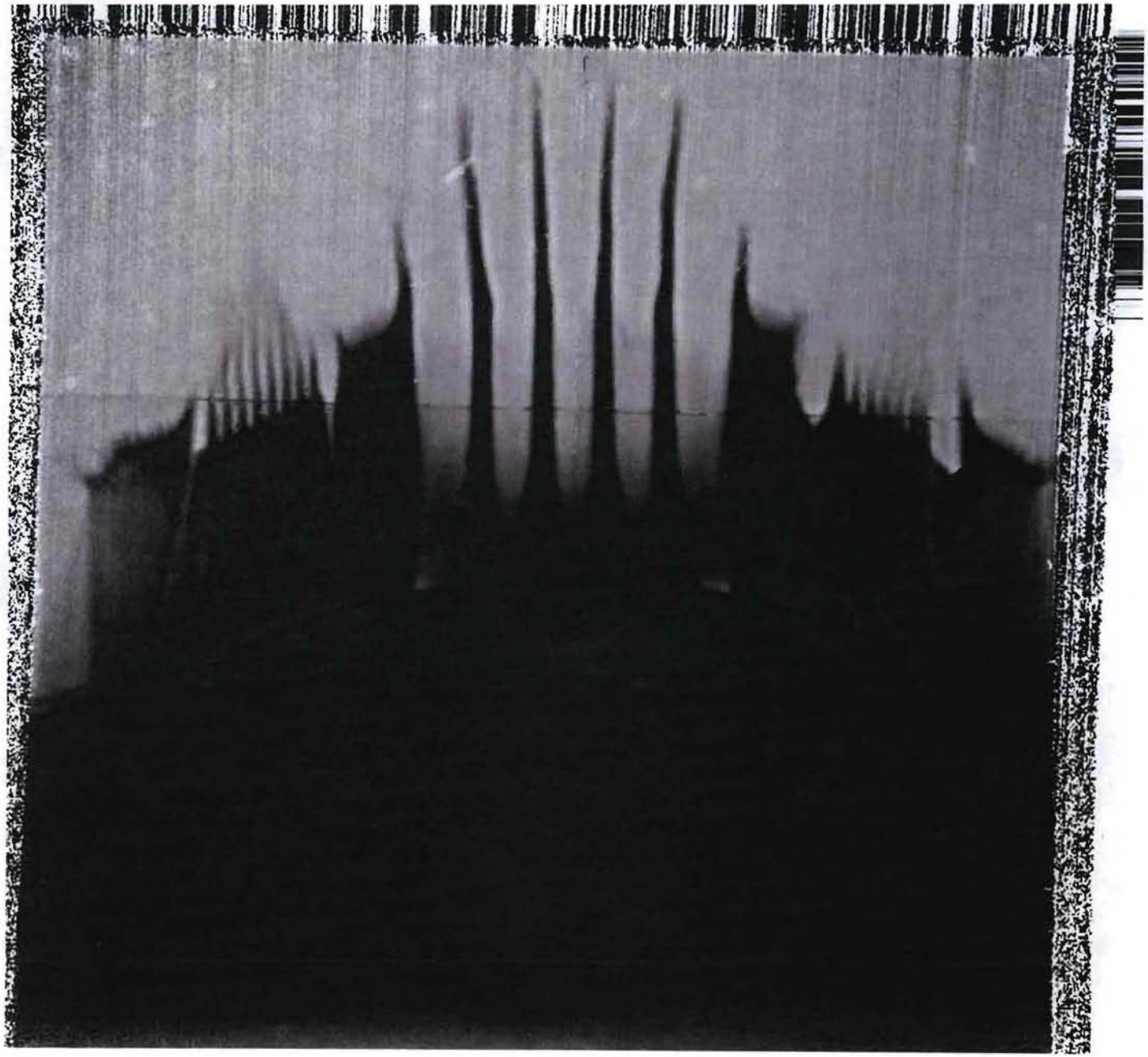
10200 PRAD0376 RMI into Neon Shot P



11000 PRAD0376 RMI into Neon Shot S



11800 PRAD0376 RMI into Neon Shot V



12600 PRAD0376 RMI into Neon Shot Z