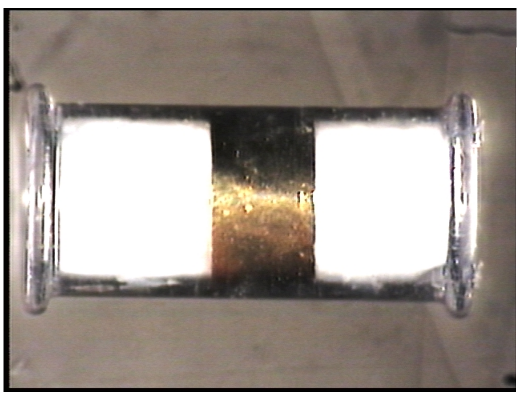
LA-UR-00-4391

ICF and Radiation Physics Program

Pre-Shot Report for OMEGA Shots September 19-21, 2000



DDCYLMIX 00-2 and High-Yield Shots for Neutron Diagnostic Development

Los Alamos
ICF and Radiation Physics

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LANL Experimental Week on OMEGA September 18-22, 2000 (DDCYLMIX 00-2 and High-Yield Neutron Diagnostic Development)

Super PI: Cris Barnes (505)665-5687, cbarnes@lanl.gov
Lead Tech: Scott Evans, (505)667-2094, evans_s@lanl.gov

Tuesday, September 19, 2000: DDCYL Mix
PI: Steve Batha, (505)665-5898, sbatha@lanl.gov (Steve Rothman, AWE, 011-44-1189-827199 or 827512 steve.rothman@awe.co.uk)
PD: Glenn Magelssen, (505)667-6519, grm@lanl.gov (Mike Dunne, AWE, 011-44-1189-824258, mdunne@awe.co.uk)

Wednesday&Thursday, September 20-21, 2000: High-Yield Neutron Diagnostic Development
PI: Cris Barnes, (505)665-5687, cbarnes@lanl.gov
PD: Doug Wilson, (505)667-6154, dcw@lanl.gov
Diagnostic Responsibility:
Gas Cerenkov: Joe Mack*, (505)667-3416, jmmack@lanl.gov
Neutron Imaging: George Morgan, (505)667-1137, glmorgan@lanl.gov

OMEGA will be configured for direct drive (SG3 distributed phase plates [DPPs]), with the new distributed polarization rotators (DPRs) in place and 1-THz SSD to be used. For the first day the beams will be pointed for the direct drive cylinder experiments. Five beams around Pent 7 will be used for area backlighting, with SG3 DPPs in as usual and a delay in their timing. The timing of the backlighters are expected to be moved once during the day.

At the end of Tuesday all the beams will be repointed to target chamber center (TCC) for spherical direct drive implosions, with the 5 backlighter beams also timed to t0. DPPs, DPRs, and the SSD driver (but with SSD bandwidth OFF to allow maximum energy) will continue to be used.

Targets for these types of experiments have been shot before (with the H2 TPS) and alignment procedures already exist.

* Steve Caldwell, (505)667-2487, scaldwell@lanl.gov, is principal contact for the Gas Cerenkov but will be in Sydney Australia in September.

Diagnostic List for Week

	Campaign Segment	
TIM	**DDCYL Mix**	**High Yield Neutrons**
1 (Pent 3)	SSC1 @ Fe	
2 (Hex 7)	SSC-A @ Cl	
3 (Hex 18)	XRFC3 @ 6X	**Gas Cerenkov**
4 (Pent 6)	**XRFC4 @ 12X**	GXI-T @ 12X
5 (Hex 14)		
6 (Pent 7)		**LANL NIS**
Pent 2b	Henway	
	Pinhole Cameras	Pinhole Cameras
	P510s	P510s
	Backscatter Calorimetry	Backscatter Calorimetry
	Prepulse monitors	Prepulse monitors
	IXRSC	IXRSC
		GMXI
		KB XR 1 and 3
		Fusion Products:
		Scintillators
		Cu and In Activation
		NTOF
		Bang time (LLE)
		NTD
		CPS 1 and 2

CYLMIX: Richtmyer-Meshkov Induced Mix

PI: **Steve Batha** sbatha@lanl.gov
Date: **September 19, 2000**

Goals

1. Measure the mix width of a marker layer at two times during the implosion of a directly driven cylinder.
2. Compare results with gold-on-mandrel manufacturing to previous gold-on-foam.
3. Initiate double shell experiments.

Bibliography

LA-UR-99-2180	LANL Campaign DD-99-1, May 1999 preshot report
LA-UR-99-6446	LANL Campaign DD-99-1, May 1999 postshot report
LA-UR-99-6286	“AWE Experiments on Laser-Driven Mix in Planar and Convergent Geometry”
LA-UR-00-0113	“Pre-Shot Report: Direct Drive Cylinder Mix (DDCYLMIX) 00-1 and Backlighter Studies, January 17-21, 2000”
LA-UR-00-4187	Post-Shot Report: Direct Drive Cylinder Mix (DDCYLMIX) 00-1 January 18 & 19, 2000
P-24: 00-U-091	“Final Target request for September, 2000 CYLMIX experiments at Omega”

Shot Plan

	Shot Plan: September 19, 2000	
Seq #	"A"	"B"
1	Pointing	
2	Pointing	
3	high mix - late BL	
4	double shell - late BL	
5	low mix - late BL	
6	double shell - late BL	
7	high mix - late BL	
	Do we have late BL data?	
	Yes	No
8	Move BL/change Timing	high mix - late B
9	low mix - early BL	low mix - late BL (optic
10	high mix - early BL	Move BL/change Timing
11	low mix - early BL	low mix - early B
12	high mix - early BL	high mix - early B

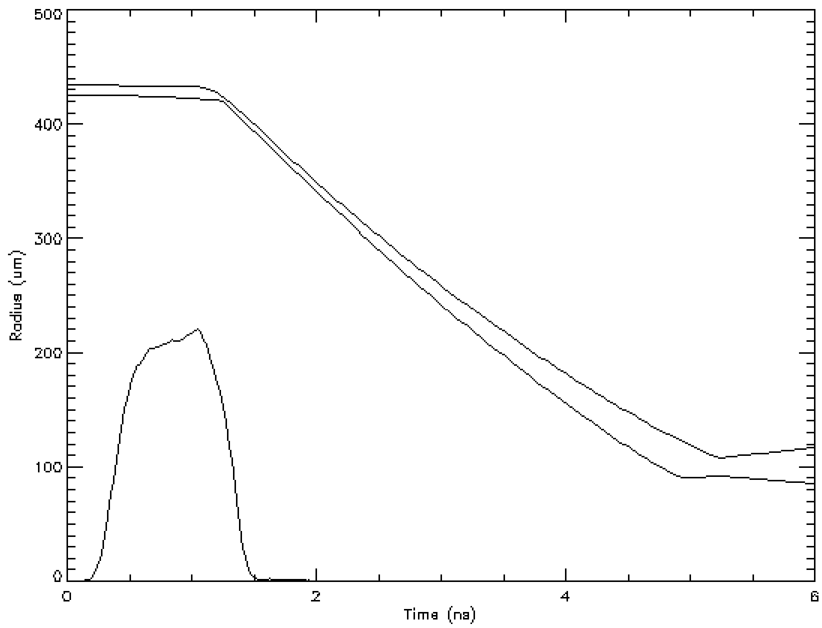
Shot Request Forms

8283 – Pointing Shot A, Sequence #1
8284 – Pointing Shot B, Sequence #2
8192 – Typical drive shot, Sequence #3 and following

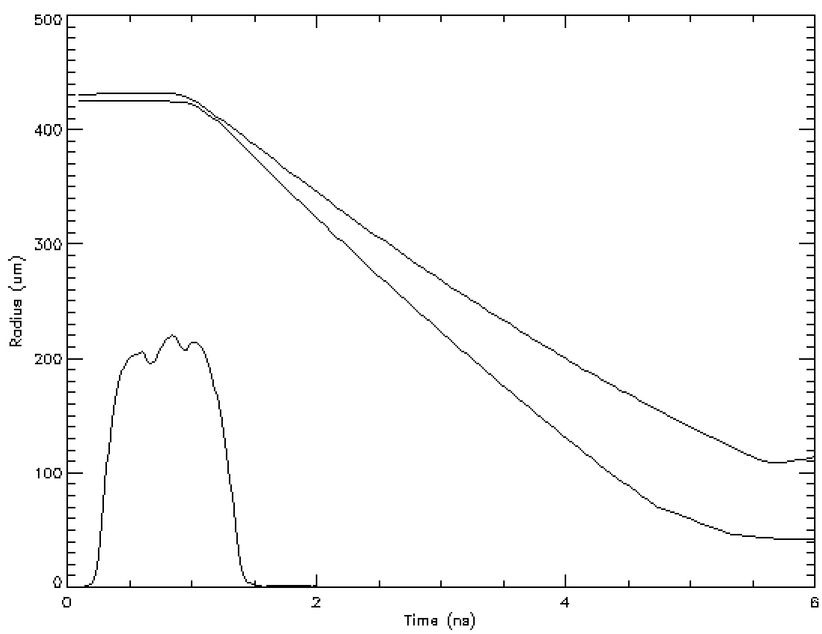
Diagnostic List

TIM	Port	Diagnostic	Priority	Function
1	P3	SSC-1	Secondary	BL monitor
2	H7	SSC-A	Secondary	Burnthrough monitor
3	H18	XRFC3	Secondary	Side-on imaging
4	P6	XRFC4	Primary	Mix imaging
5	H14			
6	P7			
	P2b	IXRSC	Primary	Symmetry/burnthrou
		Henway	Secondary	BL monitor
		HXRD	Secondary	Hot electron produ
		Plasma Cal	Secondary	Absorption
		FABS	Secondary	Energy balance
		Static PHC	Secondary	Beam pointing

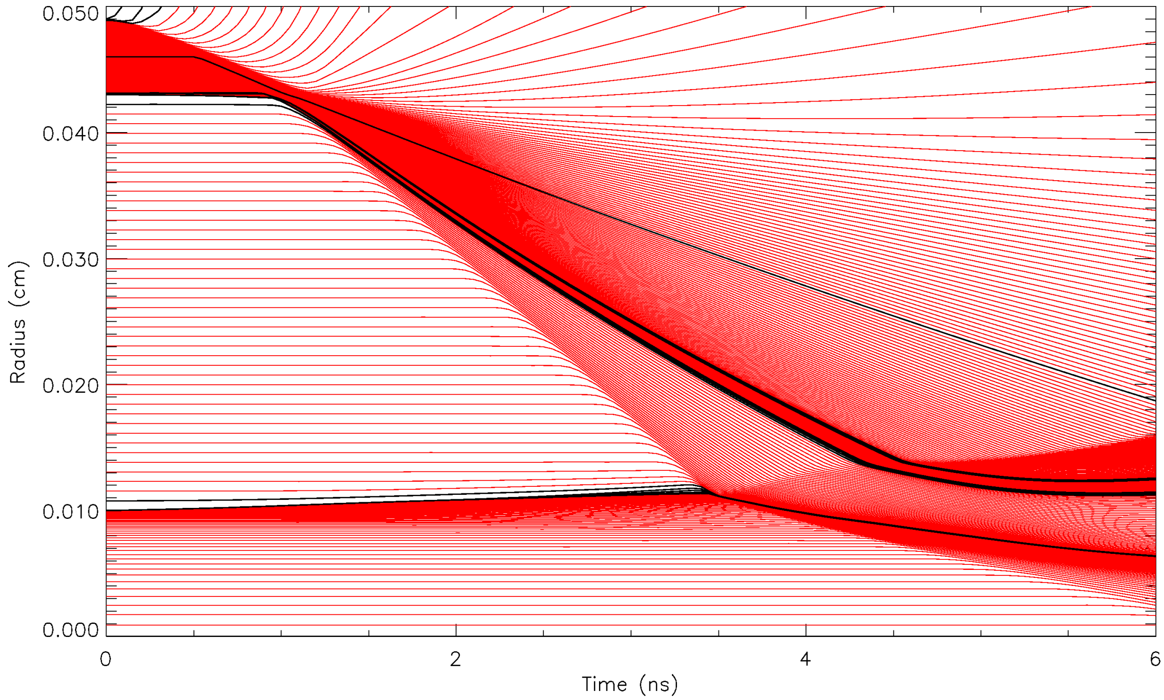
Mix Calculations



NYM calculation of the low-mix target using as-shot pulse shape for shot 18689 (run ddcyl154).



NYM calculation of the high-mix target using as-shot pulse shape for shot 18687 (run ddcyl153).



NYM calculation of the double-shell target show that there is about a 50 µm region for imaging mix at 4 ns. The targets for this series of experiment have a 250-µm diameter Al wire.

Laser Conditions

Pulse shape SG1014

SG3 distributed phase plates (DPPs) in all beams.

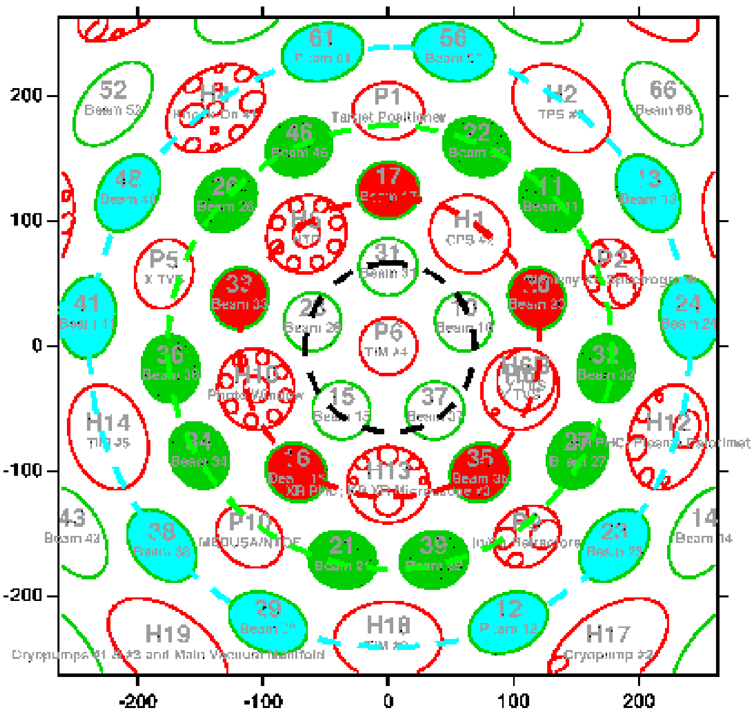
Distributed polarization rotators (DPRs) in all beams.

1 THz SSD (smoothing by spectral dispersion) on.

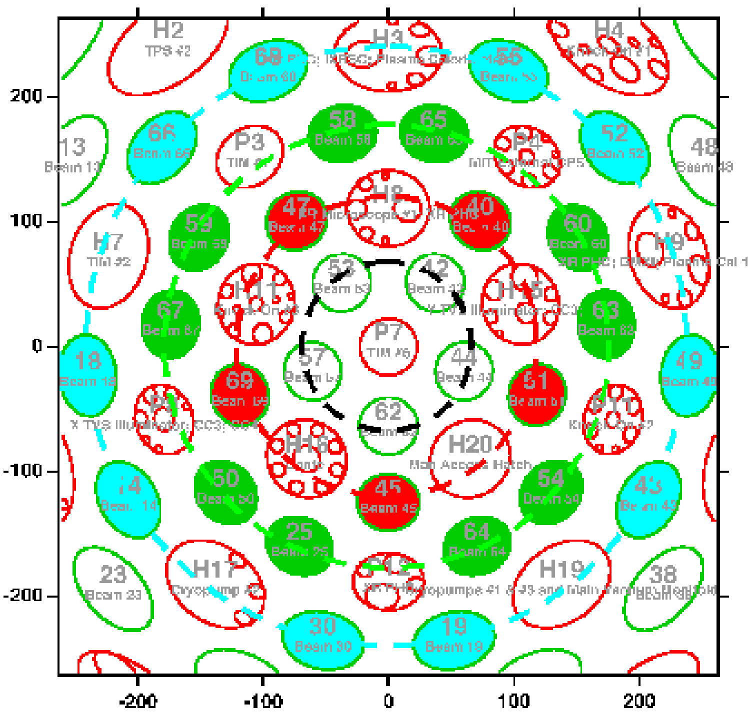
50 drive beams and 5 backlighter beams, each with a requested energy of about 410 J/beam UV on target.

Laser Pointing: The beams are divided into 4 cones around the P6 ports (Cones 1-4). Each ring strikes the target at the same angle of incidence. Cone 1 is reserved for the backlighter beams. There is a symmetric set of 4 cones around the P7 port labeled with primes (Cones 1'-4').

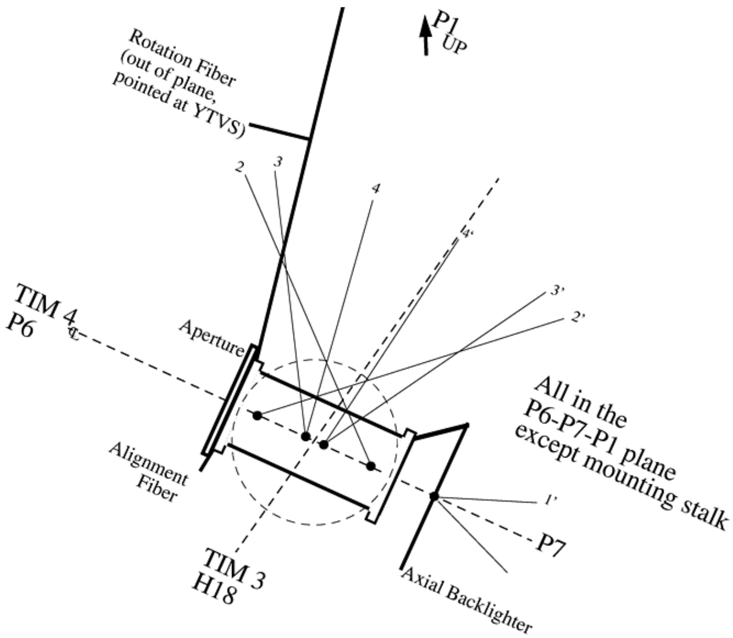
Beam Pointing by beam groups CYLMIX Experiments: September 19, 2000							
Group #	**Beams**	**Focus**	**Direct-ion**	**R (mm)**	**Theta (deg)**	**Phi (deg)**	**Delay (ns)**
2'	40,45,47,51,69	0.0	P6	0.720	63.4	342.0	0.0
2	16,17,20,33,35	0.0	P7	0.720	116.6	162.0	0.0
3	11,21,22,26,27,32,34,36,39,46	0.0	P6	0.108	63.4	342.0	0.0
3'	25,50,54,58,59,60,63,64,65,67	0.0	P7	0.108	116.6	162.0	0.0
4	12,13,23,24,29,38,41,48,56,61	0.0	P6	0.108	63.4	342.0	0.0
4'	14,18,19,30,43,49,52,55,66,68	0.0	P7	0.108	116.6	162.0	0.0
BL1	42,44,53,57,62	0.0	P7	1.625	116.6	162.0	4.0 / 2.5



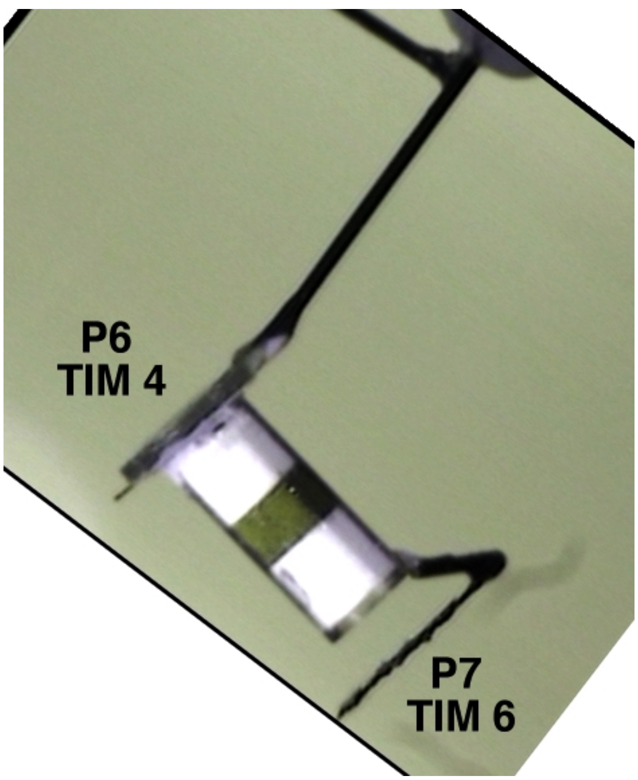
View from P6. The rings show which beams are in which cones: Backlighter 2 (black, not used in this experiment), Cone 2 (red), Cone 3 (green), and Cone 4 (cyan).



View from P7. The rings show which beams are in which cones: Backlighter 1 (black), Cone 2’ (red), Cone 3’ (green), and Cone 4’ (cyan).



Target orientation in the chamber showing TIM directions, stalk position (note that this picture is in the P6-P7-H2 plane), and beam focussing positions.



Mounted target placed in chamber. Stalk points to port H2. Can see rotation flag at top. Backlighter foil is on P7 end, leaded acrylic washer and XYZ fiducial on P6 end.

Pointing Shots

The first two shots of the day will be pointing and alignment shots onto a 4-mm-diameter Au ball. To prevent overlap of the spots on the static pinholes, certain beams must be turned off so that only 35 beams are fired on each shot.

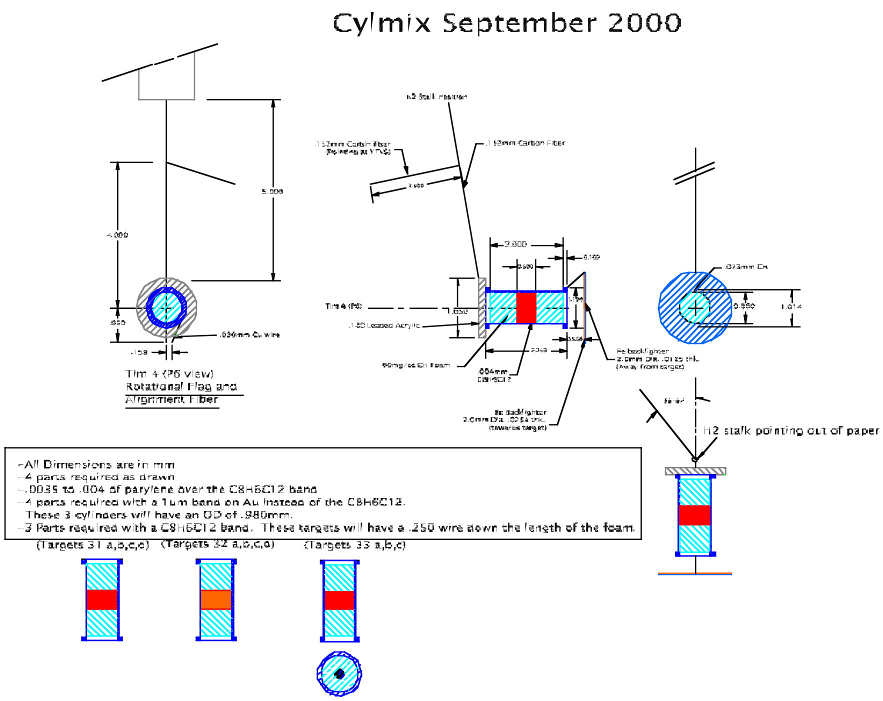
Table showing which beams are fired on the pointing and drive shots.

Tuesday, September 19, 2000 CYLMIX System Configuration														
							Pointing			Pointing Shots			Drive Shots	
Beam	Group #	Group Type	PLAS (ns)	DPP	DPR	Direct-ion	R (mm)	Theta (deg)	Phi (deg)	"A"	"B"	Focus	Drive	Focus
10	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
11	3	Drive	0.0	SG3	in	P6	0.108	63.4	342.0	11	OFF	-1 R	11	0.0
12	4	Drive	0.0	SG3	in	P6	0.108	63.4	342.0	12	12	-1 R	12	0.0
13	4	Drive	0.0	SG3	in	P6	0.108	63.4	342.0	13	13	-1 R	13	0.0
14	4'	Drive	0.0	SG3	in	P7	0.108	116.6	162.0	14	14	-1 R	14	0.0
15	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
16	2	Drive	0.0	SG3	in	P7	0.720	116.6	162.0	OFF	16	-1 R	16	0.0
17	2	Drive	0.0	SG3	in	P7	0.720	116.6	162.0	OFF	17	-1 R	17	0.0
18	4'	Drive	0.0	SG3	in	P7	0.108	116.6	162.0	18	18	-1 R	18	0.0
19	4'	Drive	0.0	SG3	in	P7	0.108	116.6	162.0	19	19	-1 R	19	0.0
20	2	Drive	0.0	SG3	in	P7	0.720	116.6	162.0	OFF	20	-1 R	20	0.0
21	3	Drive	0.0	SG3	in	P6	0.108	63.4	342.0	21	OFF	-1 R	21	0.0
22	3	Drive	0.0	SG3	in	P6	0.108	63.4	342.0	22	OFF	-1 R	22	0.0
23	4	Drive	0.0	SG3	in	P6	0.108	63.4	342.0	OFF	23	-1 R	23	0.0
24	4	Drive	0.0	SG3	in	P6	0.108	63.4	342.0	24	24	-1 R	24	0.0
25	3'	Drive	0.0	SG3	in	P7	0.108	116.6	162.0	OFF	25	-1 R	25	0.0
26	3	Drive	0.0	SG3	in	P6	0.108	63.4	342.0	OFF	26	-1 R	26	0.0
27	3	Drive	0.0	SG3	in	P6	0.108	63.4	342.0	OFF	27	-1 R	27	0.0
28	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
29	4	Drive	0.0	SG3	in	P6	0.108	63.4	342.0	29	29	-1 R	29	0.0
30	4'	Drive	0.0	SG3	in	P7	0.108	116.6	162.0	30	30	-1 R	30	0.0
31	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
32	3	Drive	0.0	SG3	in	P6	0.108	63.4	342.0	OFF	OFF	-1 R	32	0.0
33	2	Drive	0.0	SG3	in	P7	0.720	116.6	162.0	32	33	-1 R	33	0.0
34	3	Drive	0.0	SG3	in	P6	0.108	63.4	342.0	33	OFF	-1 R	34	0.0
35	2	Drive	0.0	SG3	in	P7	0.720	116.6	162.0	34	OFF	-1 R	35	0.0
36	3	Drive	0.0	SG3	in	P6	0.108	63.4	342.0	35	36	-1 R	36	0.0
37	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
38	4	Drive	0.0	SG3	in	P6	0.108	63.4	342.0	38	38	-1 R	38	0.0
39	3	Drive	0.0	SG3	in	P6	0.108	63.4	342.0	OFF	39	-1 R	39	0.0
40	2'	Drive	0.0	SG3	in	P6	0.720	63.4	342.0	40	OFF	-1 R	40	0.0
41	4	Drive	0.0	SG3	in	P6	0.108	63.4	342.0	41	41	-1 R	41	0.0
42	BL1	Backlighter	4.0	SG3	in	P7	1.625	116.6	162.0	OFF	OFF	-1 R	42	0.0
43	4'	Drive	0.0	SG3	in	P7	0.108	116.6	162.0	43	43	-1 R	43	0.0
44	BL1	Backlighter	4.0	SG3	in	P7	1.625	116.6	162.0	OFF	OFF	-1 R	44	0.0
45	2'	Drive	0.0	SG3	in	P6	0.720	63.4	342.0	45	OFF	-1 R	45	0.0
46	3	Drive	0.0	SG3	in	P6	0.108	63.4	342.0	46	OFF	-1 R	46	0.0
47	2'	Drive	0.0	SG3	in	P6	0.720	63.4	342.0	47	OFF	-1 R	47	0.0
48	4	Drive	0.0	SG3	in	P6	0.108	63.4	342.0	48	48	-1 R	48	0.0
49	4'	Drive	0.0	SG3	in	P7	0.108	116.6	162.0	49	49	-1 R	49	0.0
50	3'	Drive	0.0	SG3	in	P7	0.108	116.6	162.0	50	OFF	-1 R	50	0.0
51	2'	Drive	0.0	SG3	in	P6	0.720	63.4	342.0	OFF	51	-1 R	51	0.0
52	4'	Drive	0.0	SG3	in	P7	0.108	116.6	162.0	52	52	-1 R	52	0.0
53	BL1	Backlighter	4.0	SG3	in	P7	1.625	116.6	162.0	OFF	OFF	-1 R	53	0.0
54	3'	Drive	0.0	SG3	in	P7	0.108	116.6	162.0	54	OFF	-1 R	54	0.0
55	4'	Drive	0.0	SG3	in	P7	0.108	116.6	162.0	55	55	-1 R	55	0.0
56	4	Drive	0.0	SG3	in	P6	0.108	63.4	342.0	56	56	-1 R	56	0.0
57	BL1	Backlighter	4.0	SG3	in	P7	1.625	116.6	162.0	OFF	OFF	-1 R	57	0.0
58	3'	Drive	0.0	SG3	in	P7	0.108	116.6	162.0	OFF	58	-1 R	58	0.0
59	3'	Drive	0.0	SG3	in	P7	0.108	116.6	162.0	OFF	59	-1 R	59	0.0
60	3'	Drive	0.0	SG3	in	P7	0.108	116.6	162.0	OFF	60	-1 R	60	0.0
61	4	Drive	0.0	SG3	in	P6	0.108	63.4	342.0	61	61	-1 R	61	0.0
62	BL1	Backlighter	4.0	SG3	in	P7	1.625	116.6	162.0	OFF	OFF	-1 R	62	0.0
63	3'	Drive	0.0	SG3	in	P7	0.108	116.6	162.0	63	OFF	-1 R	63	0.0
64	3'	Drive	0.0	SG3	in	P7	0.108	116.6	162.0	OFF	64	-1 R	64	0.0
65	3'	Drive	0.0	SG3	in	P7	0.108	116.6	162.0	OFF	65	-1 R	65	0.0
66	4'	Drive	0.0	SG3	in	P7	0.108	116.6	162.0	66	66	-1 R	66	0.0
67	3'	Drive	0.0	SG3	in	P7	0.108	116.6	162.0	67	OFF	-1 R	67	0.0
68	4'	Drive	0.0	SG3	in	P7	0.108	116.6	162.0	68	68	-1 R	68	0.0
69	2'	Drive	0.0	SG3	in	P6	0.720	63.4	342.0	OFF	69	-1 R	69	0.0
Not used: beams 10, 15, 28, 31, 37														

Coordinates of beam positions on pointing sphere.

Beam	Theta	Phi		Beam	Theta	Phi
11	41.80	50.07		40	69.64	-166.74
12	135.38	15.70		41	79.94	-99.76
13	57.57	74.69		43	122.43	-105.31
14	122.43	69.31		45	172.43	162.00
16	110.37	-49.26		46	21.85	-82.95
17	7.57	-18.00		47	69.64	130.74
18	100.06	80.24		48	57.57	-110.69
19	161.10	-59.00		49	100.06	-116.24
20	61.33	45.79		50	138.20	93.93
21	118.58	-29.41		51	118.67	-134.21
22	21.85	46.95		52	60.77	-140.79
23	119.23	39.21		54	138.20	-129.93
24	79.94	63.76		55	44.62	-164.30
25	158.15	97.05		56	18.90	121.00
26	41.80	-86.07		58	61.42	150.59
27	97.11	28.46		59	82.89	115.54
29	135.38	-51.70		60	82.89	-151.54
30	161.10	23.00		61	18.90	-157.00
32	80.11	39.05		63	99.89	-140.95
33	61.33	-81.79		64	158.15	-133.05
34	97.11	-64.46		65	61.42	173.41
35	110.37	13.26		66	60.77	104.79
36	80.11	-75.05		67	99.89	104.95
38	119.23	-75.21		68	44.62	128.30
39	118.58	-6.59		69	118.67	98.21

Targets



CYLMIX target assembly drawing for September 2000.

Target List

Single-Shell Cylinders

Target	Target Name	Ablator	Tracer	Foam Fill
31 a, b, c, d	low-mix 1 Blue 1-4 Yellow	73 µm CH (1014 µm OD, 860 µm ID)	4 µm $C_8H_6Cl_2$	60 mg/cc CH
32 a, b, c, d	high-mix 1 Red 1-4 Yellow	60 µm CH (980 µm OD, 860 µm ID)	1 µm Au	60 mg/cc CH

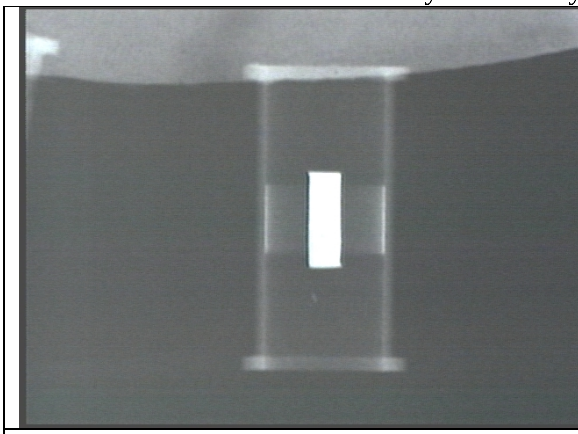
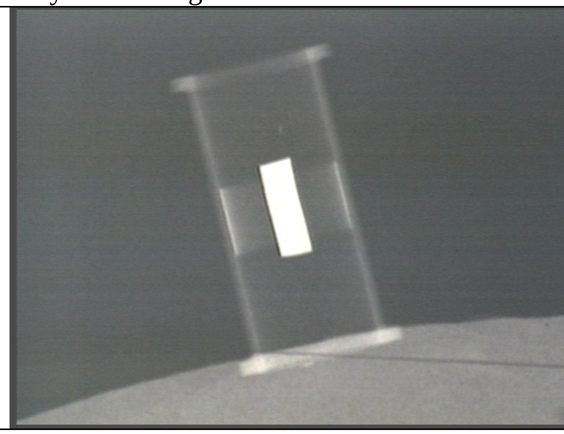
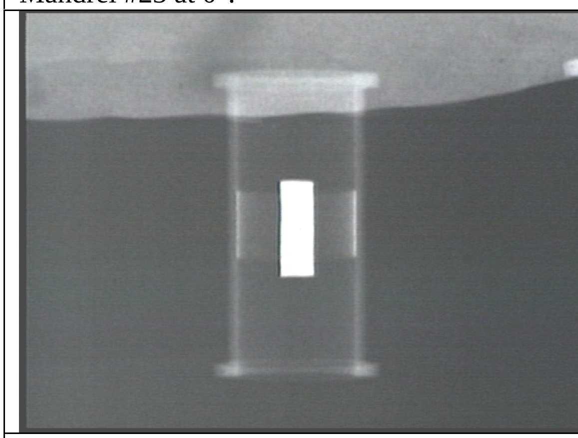
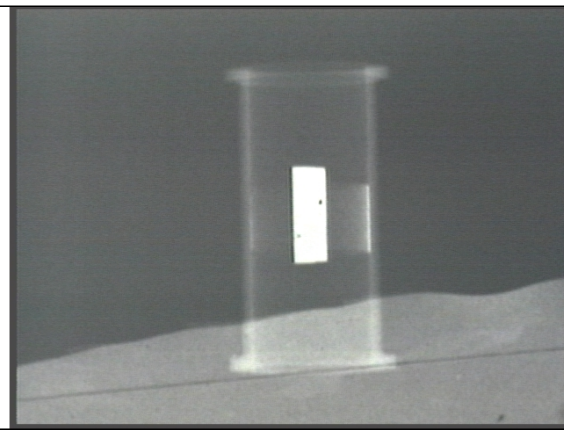
Double-Shell Cylinders

Target	Target Name	Outer Shell (OD, ID, mat'l, length)	Tracer (thickness, mat'l, length)	Intershell Fill	Inner Shell (OD, ID, mat'l, length)
33 a, b, c	double-shell 1 White 1-3 Yellow	1014 µm OD 860 µm ID CH, 2.250 mm	4 µm, $C_8H_6Cl_2$, 500 µm	60 mg/cc CH foam	250 µm OD 0.0 ID (solid) Al, 0.70 mm

Note: The inner-shell wire was shortened so that the extra length would not interfere with the radiographs.

Wire in foam radiographs

There was concern that the Al wire in the double shells would either be bent or not centered under the marker layer. Radiographs were taken of two targets at two different rotations so bends in the wire could be identified. The slightly more opaque dichloropolystyrene marker layer is clearly visible. The Al wire is seen to be well center axially and radially. They have no significant bends.

	
Mandrel #23 at 0°.	Mandrel #23 at 90°.
	
Mandrel #31 at 0°.	Mandrel #31 at 90°.

List of targets, color codes, and mandrel numbers.

Type	Target #	Color Code	Mandrel #
Low Mix	31A	1Blue 1Yellow	2
Low Mix	31B	1Blue 2Yellow	6
Low Mix	31C	1Blue 3Yellow	72
Low Mix	31D	1Blue 4Yellow	42
High Mix	32A	1Red 1Yellow	13
High Mix	32B	1Red 2Yellow	20
High Mix	32C	1Red 3Yellow	1
High Mix	32D	1Red 4Yellow	17
Double She	33A	1White 1Yell	23
Double She	33B	1White 2Yell	31
Double She	33C	1White 3Yell	58

Henway Spectrometer Configuration (v 2.0; J. Workman)

Changes from version 1.0 include removing the standard prefilters. Leaving these filters in would lead to difficulties with the Cl emission. Changes are highlighted in red.

We would like the configuration of the crystals in the Henway setup as follows:

Channel	Prefilter	Crystal Mount	Crystal	Spectra
A	None	A	RAP	Cl
B	None	A	PET	Fe
C	None	P	KAP	Cl
D	None	Q	PET	Fe

I believe that the only change from the current configuration would be placing the Q/PET into channel D and removing the current pre-filters.

This configuration is designed to look at the Fe Backlighter at energies of 6.7 keV-8.5 keV using the B and D channels. This configuration has been used previously by LANL. The remaining two channels are configured to look for Cl emission from the target marker layer. This is to be a null test to make sure that the Cl marker has not leached into the target or ablator. Recording of Cl emission will indicate that the marker has leached. A streak camera will be the main diagnostic looking for this. As we have not recorded Cl (2.79 keV) before with the Henway we will try to look for the first time with two channels touted to measure ranges from 1.6-4.9 keV and 0.7-inf. keV using the A/RAP and P/KAP crystals, respectively. We know that these ranges are not correct, as we have recorded Ti on the

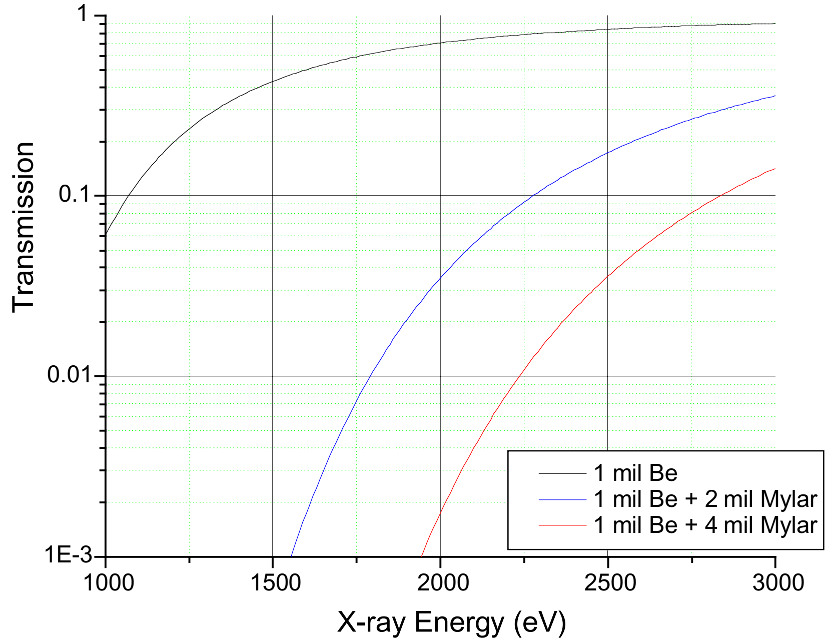
A/RAP with the 4.75 keV emission lying in the middle of the recording range.* This may allow the Cl to be recorded near the edge of the record. We add the P/KAP to extend this range to lower energies.

There will be prefilters supplied by LANL in order to increase the dynamic range of the instrument. The prefilters will consist of three equal size channels oriented along the width of the crystal.

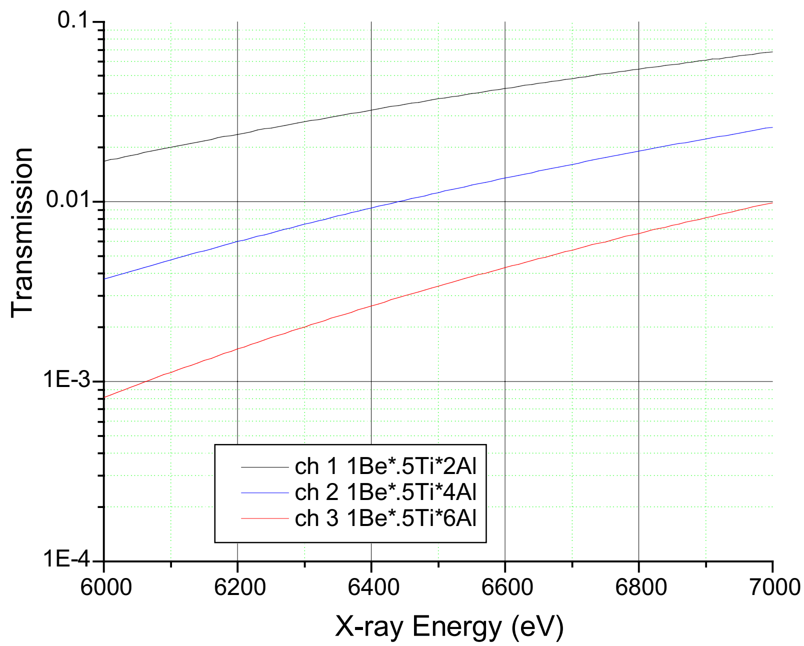
Henway channel	Filter channel #1	Filter channel #2	Filter channel #3
A	1 mil Be	1 mil Be + 2 mil Mylar	1 mil Be + 4 mil Mylar
B	1 mil Be +2 mil Al +1/2 mil Ti	1 mil Be +4 mil Al +1/2 mil Ti	1 mil Be +6 mil Al +1/2 mil Ti
C	1 mil Be	1 mil Be + 2 mil Mylar	1 mil Be + 4 mil Mylar
D	1 mil Be +2 mil Al +1/2 mil Ti	1 mil Be +4 mil Al +1/2 mil Ti	1 mil Be +6 mil Al +1/2 mil Ti

The filter holder is 3/4" x 1/2". Therefore, each filter channel should be ~ 1/4" x 1/2".

* The specs on crystals for the Henway are based on NOVA configurations. The move to the OMEGA chamber has changed the geometry. There is also no way to point the Henway. This means that an emitter not located at TCC will enter the Henway (and thus the crystal) at different angles.



Filter transmission in Henway for Cl channels

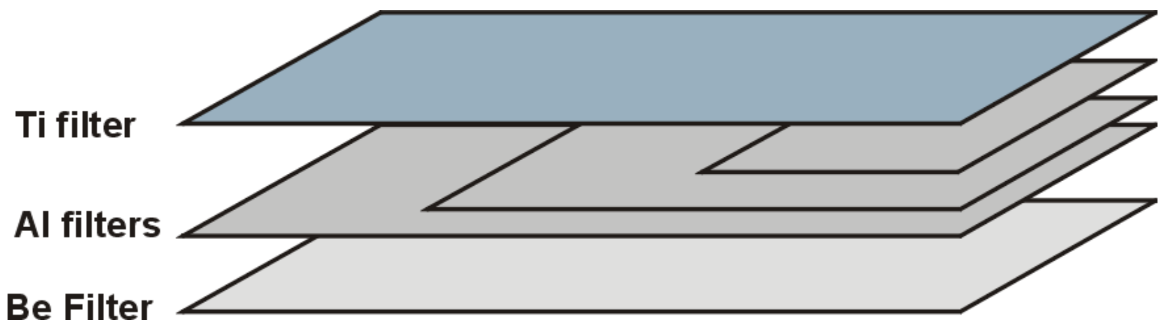


Filter transmission in Henway for Fe channels

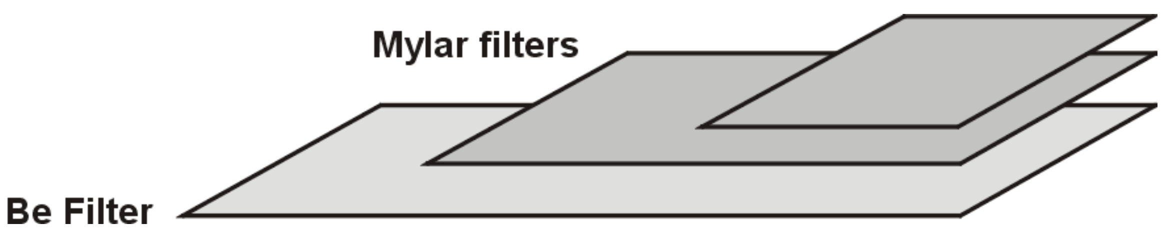
Filter Stacking

Filters will be stacked and mounted on 1 mil Be. This structure will be in place of the current pre-filters. All filters are placed at the entrance to the spectrometer. There are no filters inside the spectrometer, either before or after the crystals. There are no filters in front of the film.

Fe recording filters



Cl recording filters



HIGH-YIELD SHOTS FOR NEUTRON DIAGNOSTIC DEVELOPMENT

Experimental Proposal Template

I. Experiment title, principal investigator's name, and, if related to LLE direct-drive experimental program, which category (i.e., ISE, RTI, etc.) the experiment falls under, and planned shot dates.

High-Yield Shots for Neutron Diagnostic Development

PI: Cris Barnes, (505)665-5687, cbarnes@lanl.gov
PD: Doug Wilson, (505)667-6154, dcw@lanl.gov
Diagnostic Responsibility:
Gas Cerenkov: Joe Mack*, (505)667-3416, jmmack@lanl.gov
Neutron Imaging: George Morgan, (505)667-1137, glmorgan@lanl.gov

Related to LLE ISE campaign. Shot dates September 20-21, 2000.

II. Summary of the experiment's objectives.

1) Gas Cerenkov:
- Primary: Determine source of observed gamma-rays in Gas Cerenkov Burn History diagnostic (whether they are d(t,γ) or (n, γ) from the capsule shell or from other target or diagnostic material).
- Secondary:
  - Better determine system timing
  - Scan Cerenkov threshold in energy by varying the CO_2 gas pressure
  - look for $d(^3He, \gamma)$ as well.

2) LANL Neutron Imaging System
- Primary: field and align new TIM-based diagnostic, and get a pinhole aperture image we are happy with.
- Secondary: Compare pinhole image from plastic and glass capsules, and from plastic capsules at different pressures (20 atm and 5 atm)
- Determine signal to background ratios
- At end of Wednesday run, if sufficiently successful, we will consider switching to French CEA penumbral imaging system for Thursday.

III. Laser conditions required for the experiment:

- Pulse shape

SG1014 1 ns sq

* Steve Caldwell, (505)667-2487, scaldwell@lanl.gov, is principal contact for the Gas Cerenkov but will be in Sydney Australia in September.

- SSD, DPP, and DPR conditions

SSD driver, SSD OFF, SG3 DPPs and DPRs in.

- Power/energy balance

Maximum energy (30-31 kJ) with good energy balance

- Number of beamlines and target pointing summary requirements

All 60 beams at TCC

- Backlighting requirements and beam timing delays

No backlighters, all beams on target at t0.

- Special laser conditions

None.

IV. Diagnostics required and target chamber port assignments (indicate any non-LLE-provided diagnostics).

The LANL Gas Cerenkov Burn History Diagnostic will be in **TIM3**.
The LANL Neutron Imaging System will be in **TIM6**, using the French CEA detector system but with different scintillator.
We will use GXI-T in **TIM4** at 12 X under these DT conditions to see x-ray images.
GMXI will also be used for timed images, and IXRSC for time history (I assume both can be used on DT shots, although neutron noise on the IXRSC CCD may be an issue).
KB XR #1 and #3 will provide static images, as will the static pinhole cameras.
The usual entire **neutron diagnostic suite** is requested, including the scintillators, activation, NTOF, bang-time, but NOT Medusa. We would like NTD run on as many high-yield DT shots as possible to help constrain modeling. We welcome CPS 1 and 2 to ridealong as they have expressed interest, and in particular would need their proton yield data on any D^3He shots taken.

V. Type and number of targets including number of spares (this section must be completed even if using non-LLE-provided targets). NOTE: if special targets are required, they must be specified more than two months in advance. Additionally, special target geometries may require metrology prior to delivery to LLE and verification after arrival at LLE using LLE's Powel scope.

We are have ordered from GA 30 (thirty) 920 micron OD 2.2-2.8 micron thick glass capsules, 5 (five) 920 micron OD 4 micron thick glass capsules, and 20 (twenty) 920 micron OD 20 micron thick GDP plastic capsules. The glass capsules will be filled at LANL to 20 atm DT and shipped on ice to LLE along with the plastic capsules and the mounting stalks we will prepare (discussions under way between Art Nobile/Tim Pierce here and David Hardings/Steve Noyes at LLE). The plastic capsules will have 10 filled to 20 atm DT, 5 filled to 5 atm DT, and 5 filled to 20 atm D^3He and then the targets mounted. Some of the mounts will have extra stalk material about 1 cm from the capsule attached along the stalk to increase possible (n, γ) background.

VI. Number of required laser shots.

We are planning on 10 shots per day for each of two days.

VII. Special shot schedule considerations associated with experiment.

We may choose to delay shot operation to allow time to align neutron imaging systems.

Shot Plan

	Wednesday, 9/20	**Thursday, 9/21**
1	2.5 micron glass 20 atm DT (timing on Gas Cerenkov)	2.5 micron glass 20 atm DT
2	2.5 micron glass 20 atm DT (timing on Gas Cerenkov)	2.5 micron glass 20 atm DT
3	2.5 micron glass 20 atm DT	2.5 micron glass 20 atm DT with extra material
4	2.5 micron glass 20 atm DT	4.0 micron glass 20 atm DT
5	2.5 micron glass 20 atm DT with extra material	20 micron plastic 20 atm DT
6	4.0 micron glass 20 atm DT	20 micron plastic 20 atm DT
	now repeat shots 3-6 until "ready" for plastic targets	*do plastic earlier in day to aid LLE target fabrication personne*
7	20 micron plastic 20 atm DT	20 micron plastic 5 atm DT
8	20 micron plastic 20 atm DT	20 micron plastic 5 atm DT
9	20 micron plastic 5 atm DT	20 micron plastic 20 atm D3He
10	20 micron plastic 5 atm DT	20 micron plastic 20 atm D3He
11	*Repeat of earlier conditions*	*Repeat of earlier conditions*
12	*Etc.*	*Etc.*

Shot Request Form Template (SRF)

Campaign Template is SRF RID 8177.

Standard report for RID 8177

General / 8177

Campaign	LANL	**Planned Date**	20-Sep-2000 00:00:00
Series Name	ISE High-Yield	**Shot Series**	1
First PI	Barnes///12-3598	**Yield**	Type 7b
Second PI	Glebov/Vladimir/57454/12-3528	**Primary Objective**	High Yield Neutron Diagnostic Development
Third PI	Disdier/Laurent/011-33-1-69265151/	**Secondary Objective**	Gas Cerenkov
Special Instruction	Highest possible energy on target		

Driver / 8177

Driver	Status	Pulse Shape	Time Shift/Leg	X/Y Modulation
Backlighter	OFF		/ LEG1	
SSD	ON	SG1014		OFF
Main	OFF			
Fiducial	ON			

Target / 8177

	Target 1	Target 2
Model-Serial	-	-
Type	DT(20)SiO2[2.5]	
Diameter	920	
Shape	Spherical	
Hazards	TRITIUM	
Instructions		

Beams / 8177

60 beam(s) are configured

Beams	Energy	DPP	DPR	Focusing	PLAS Delay (ns)	Termination	Group Name	Pointing
11-60	28 kJ (UV-Target)	yes	Yes			target		tcc

TIM / 8177

Location	Priority	Description
TIM 3	Primary	Cerenkov Gas Detector
TIM 4	Secondary	Gated XR Imager-TRITON - 1
TIM 6	Primary	Neutron Imaging System - 1

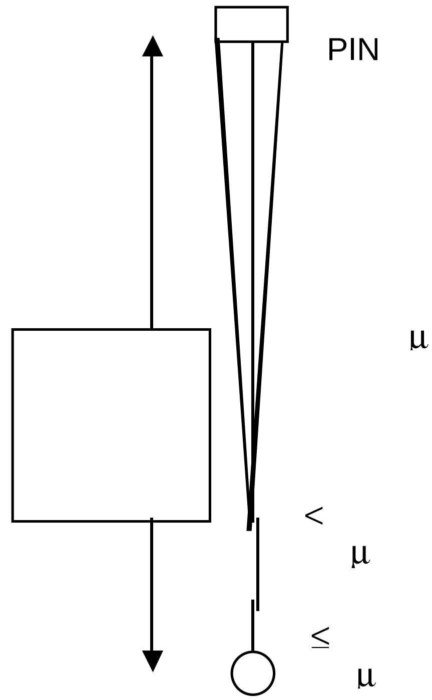
Fixed Diagnostics / 8177

Port	Priority	Description
P4H	Secondary	Charged Particle Spectrometer (1)
H1	Secondary	Charged Particle Spectrometer (2)
P9C	Primary	Copper Activation Retractor (1)
H9F	Secondary	Gated Microscope XR Imager (1)
H3F	Secondary	Imaging XR Streak Camera (1)
P9A	Primary	Indium Activation Retractor (1)
H8F	Secondary	Kirkpatrick Baez XR Microscope (1)
H13F	Secondary	Kirkpatrick Baez XR Microscope (3)
H15D	Ride Along	Neutron Bang-Time Detectors (LANL)
H51	Primary	Neutron Temporal Diagnostic (1)
H10	Primary	Neutron Time of Flight (1-3)
H3C	Secondary	XR Pinhole Camera (1)
H8C	Secondary	XR Pinhole Camera (2)
H9C	Secondary	XR Pinhole Camera (3)
H12C	Secondary	XR Pinhole Camera (4)
H13C	Secondary	XR Pinhole Camera (5)

Targets

We have 6 types of targets planned:
1. Thin wall (2.2-2.8 micron) glass capsules filled to 20 atm DT as the standard, highest yield targets available that gave results in June
2. Thin wall glass 20 atm with extra material on stalk to assess (n,γ) contributions from such material [MORE ON THIS BELOW!]
3. Thicker wall (4 micron) glass capsules filled to 20 atm DT to assess (n,γ) contributions from the glass in the capsule

4. 20 micron thick plastic capsules filled to 20 atm DT to provide smaller, brighter, neutron image (and also to compare (n,γ) from plastic instead of glass)
5. 20 micron thick plastic capsules filled to 5 atm DT to provide even smaller and brighter images
6. 20 micron thick plastic capsules filled to 20 atm D3He to look for the d-3He gamma and for our CPS colleagues



Mounting of direct-drive spherical targets (from drawing by M. Bonino, 8/28/00)

Thus we are asking to be ready:

8	2.5 micron 20 atm DT glass
4	2.5 micron 20 atm DT glass with extra material [SEE BELOW!]
4	4.0 micron 20 atm DT glass
8	20 micron 20 atm DT plastic
4	20 micron 5 atm DT plastic
4	20 micron 20 atm D3He plastic

The targets with "extra material" will be mounted directly on a 70 μm SiC fiber, with 6 or so other 70 μm SiC fibers ~10 mm long bundled around the mounting fiber.

The glass microballoons were filled at 360 C go a final pressure of 631.8 psia; this is a density equivalent to 20.15 atm (296 psiz) at 25 C (from message of Peter Ebey, 29-AUG-2000).

DIAGNOSTIC VARIANTS

Gas Cerenkov

1. Material Effects (ME) Scan of different target types
2. D^3He shots (both background and to look for γ-ray
3. Foil and no foil on photo-detector (preferably paired targets)
4. Change timing of background gammas by pulling TIM back ~10 cm
5. CO_2 gas pressure scan to vary Cerenkov threshold
6. Switch in Photek photomultiplier in place of Hammamatsu

These variations will be done as conditions warrant.

Preshot Calculations for Sept 20-21, 2000 Experiments.

Four types of DTcapsules will be shot during the series. Below is a table of calculated performance for each type. All calculations are 1D using the 30kJ of laser energy in the 1ns pulse shape measured during the DT shots on the week of June 20. The degradation model used for the mixed performance depends on a mass diffusion velocity limit of either 0.1 (Mix 1) or 1.0 (Mix 2) of the local sound speed.

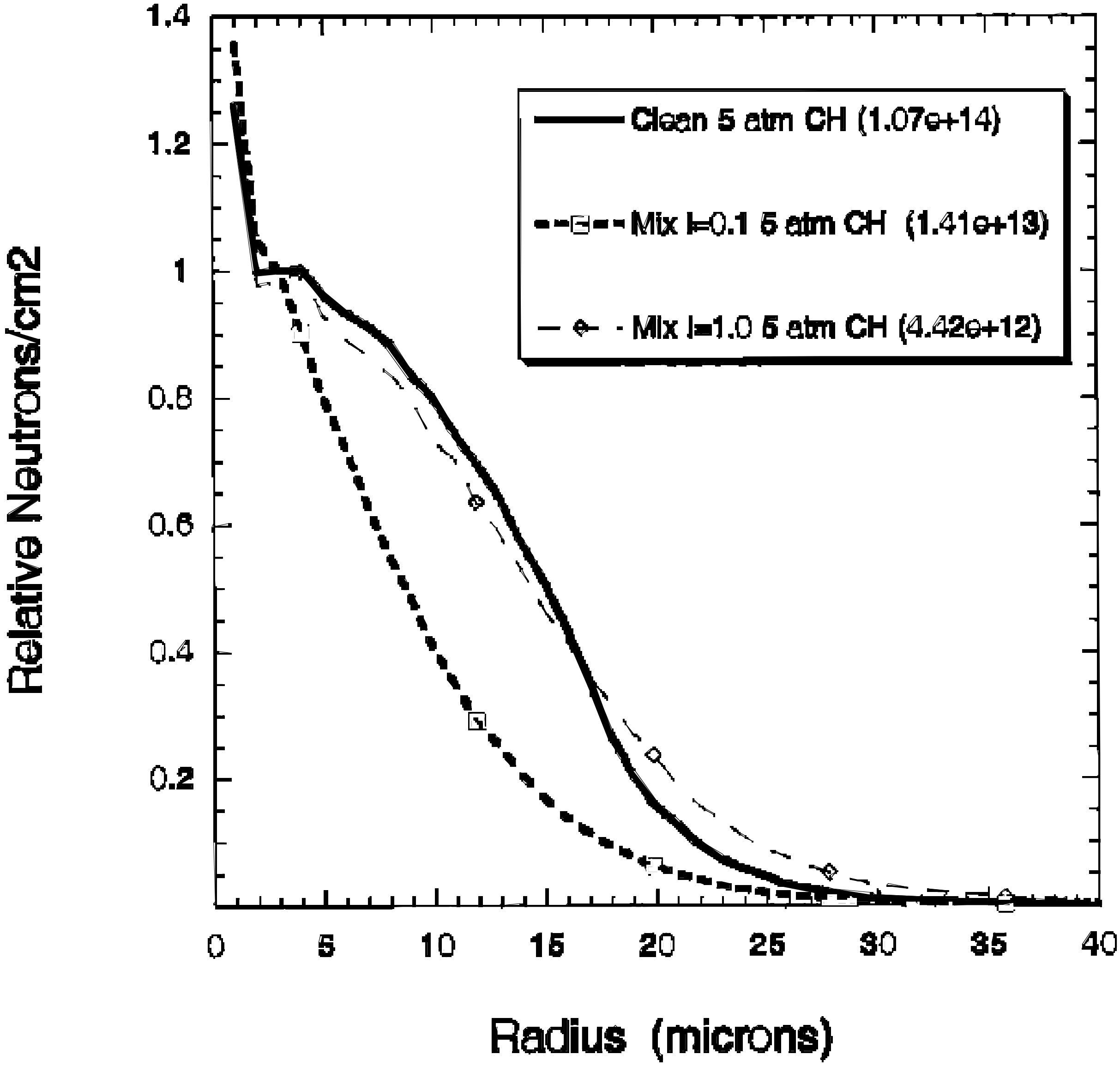
Shell	DT Fill	Wall Tk	Clean Y 10^{13}	Mix 1 Y 10^{13}	Mix 2 Y 10^{13}	Tion clean	Tion Mixed 1	Tion Mixed 2
Glass	20	2.5 +1CH	11.4	9.13	1.64	11.56	14.53	20.97
Glass	20	4.0 +1CH	20.9	15.2	2.59	7.43	11.0	10.76
CH	20	20	8.38	3.75	2.08	4.17	4.80	4.14
CH	5	20	10.7	1.41	0.442	5.62	6.30	4.39

It is a good possibility that the performance will be severly degraded by 2D asymmetry. Fred Marshall's 5-8 keV images of glass microballoons in the June 2000 series showed asymmetries. Thus I do not expect the glass capsule yields to be as high as the Mix 1 yields. I suspect that the asymmetry comes from P1 or other asymmetry in the glass shell thickness. The variation is typically 0.3 microns out of 2.5 micron wall thickness. Experience from the June series suggests the 2.5 micron thick glass target should give 6 10^{13}, and the 4.0 micron thick target ~8 10^{12}. Since I do not expect the CH shells to be as asymmetric, I expect the yields to be those listed in the table, if the capsules are filled.

The neutron images have been calculated assuming perfect resolution. Figure 1 shows the expected neutron image shapes on a linear scale. The figures should be interpreted as traces starting at the center of a 2D pinhole image with 1:1 magnification. The calculations plotted here represent my best estimate of the expected yields. The y axis values are normalized such that a 2D integral of the simulated image would give the total capsule yield. Figure 2 is the same calculations on a log scale. Figure 3 shows the effect of mix degradation on the 5atm CH capsule. Here the traces are normalized by their value at a 4 micron radius to see the relative shape change as mixing is increased (l=0.1 going to l=1.0). Note that the heavily mixed image is the same shape as the unmixed one. Figure 4 shows the same calculations on a log scale including the absolute yield degradation.

Time gated X-ray images with filter chosen for an ~ 5-8 keV band will be attempted on these capsules. The camera will effectively use an 80 ps exposure at 60 ps intervals. Figures 5-8 6 show expected traces through separate images, both clean and mixed (Mix 1) for the 20atm CH capsule. Note that the 5-8 X-ray images will be brightest near 1.6ns. Note also that the mixed images are smaller near peak brightness and the center of the image is more filled in (by mixed material emission).

Figure 1.


1.4
1.2
1
0.8
0.6
0.4
0.2
Relative Neutrons/cm2
0
5
10
15
20
25
30
35
40
Radius (microns)
Clean 5 atm CH (1.07e+14)
Mix l=0.1 5 atm CH (1.41e+13)
Mix l=1.0 5 atm CH (4.42e+12)

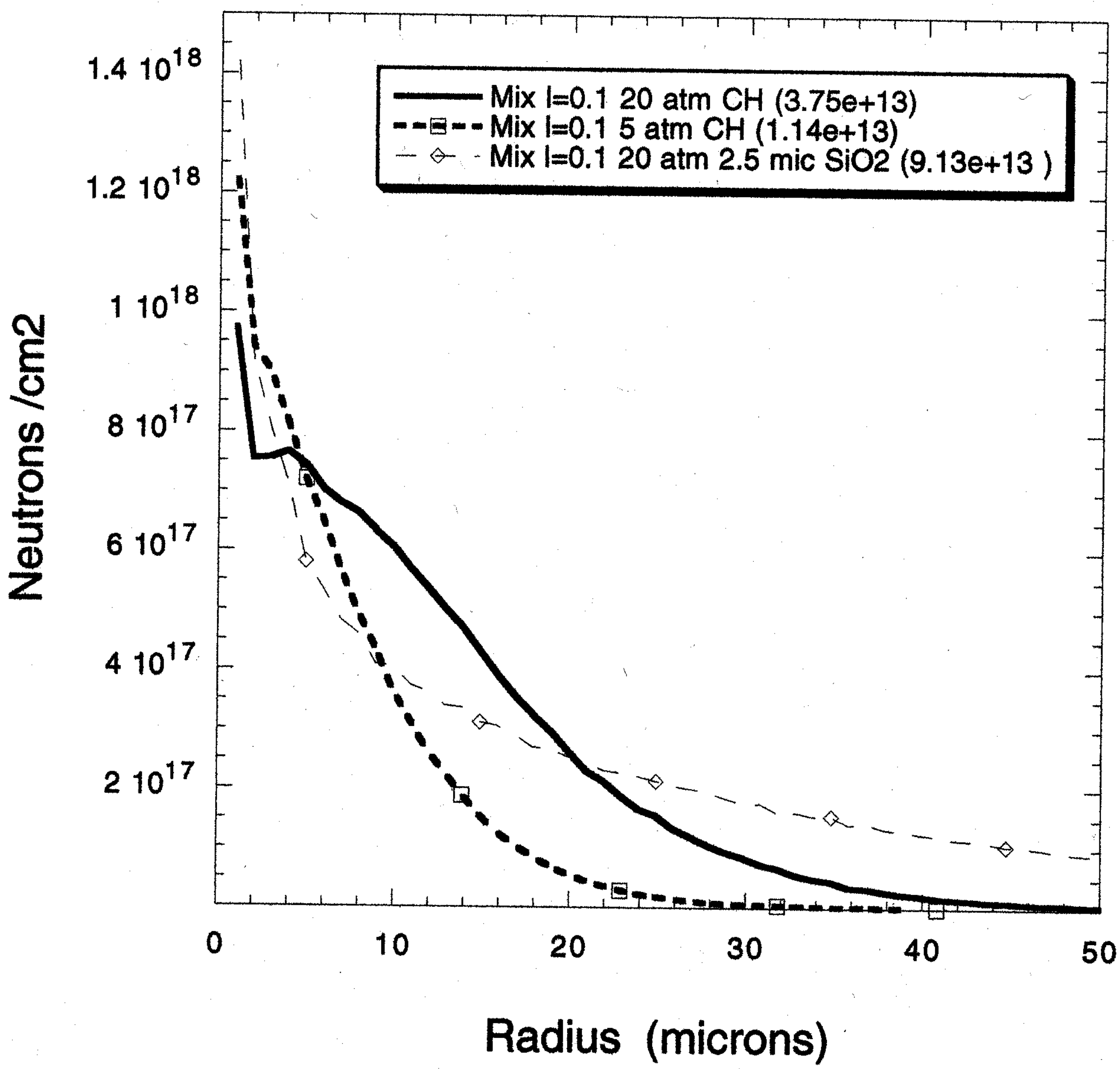

Mix l=0.1 20 atm CH (3.75e+13)
Mix l=0.1 5 atm CH (1.14e+13)
Mix l=0.1 20 atm 2.5 mic SiO2 (9.13e+13)
1.4 10^18
1.2 10^18
1 10^18
8 10^17
6 10^17
4 10^17
2 10^17
Neutrons /cm2
0
10
20
30
40
50
Radius (microns)

Figure 2

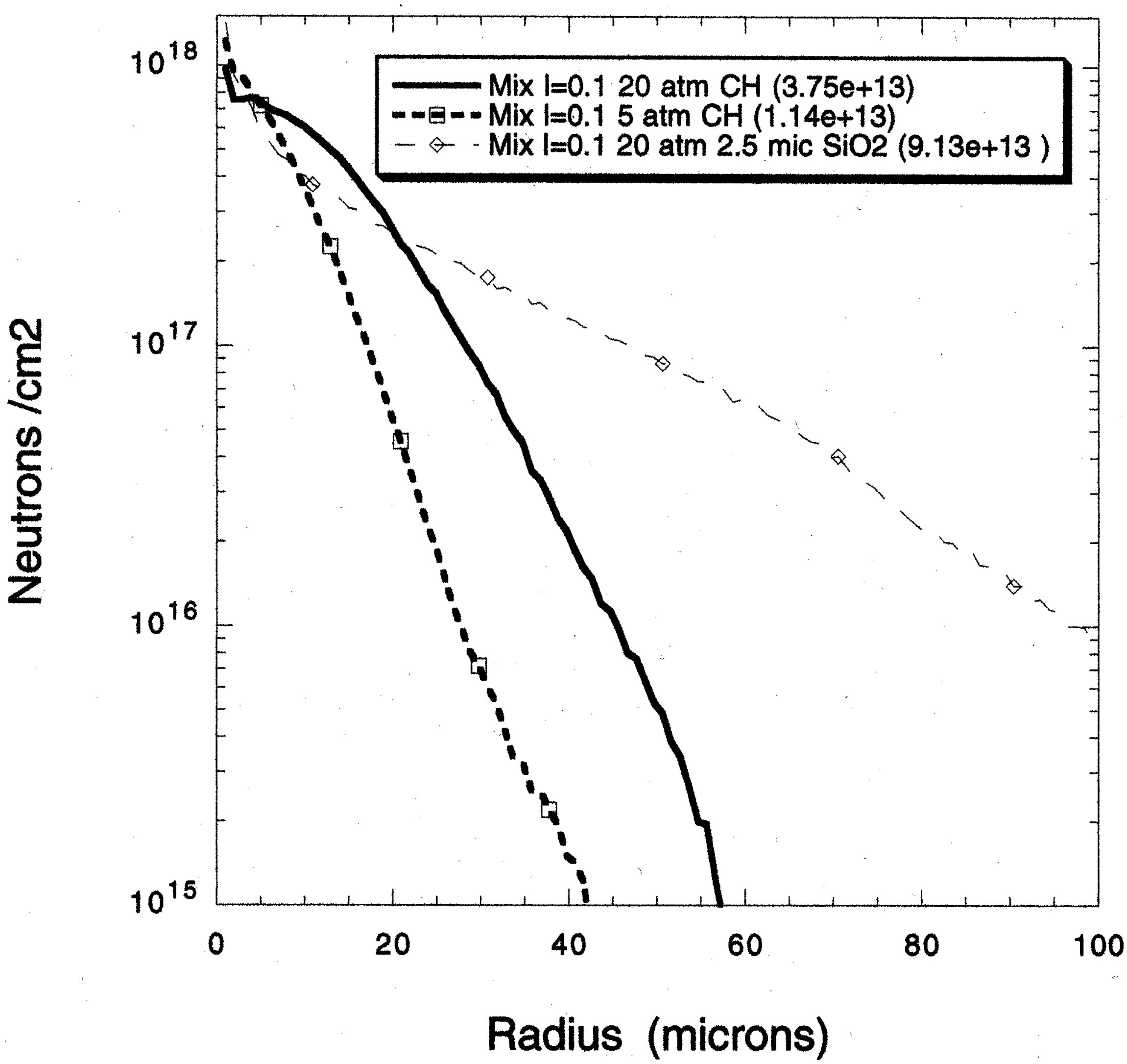

Mix l=0.1 20 atm CH (3.75e+13)
Mix l=0.1 5 atm CH (1.14e+13)
Mix l=0.1 20 atm 2.5 mic SiO2 (9.13e+13)
Neutrons /cm2
10^18
10^17
10^16
10^15
0
20
40
60
80
100
Radius (microns)

Figure 3

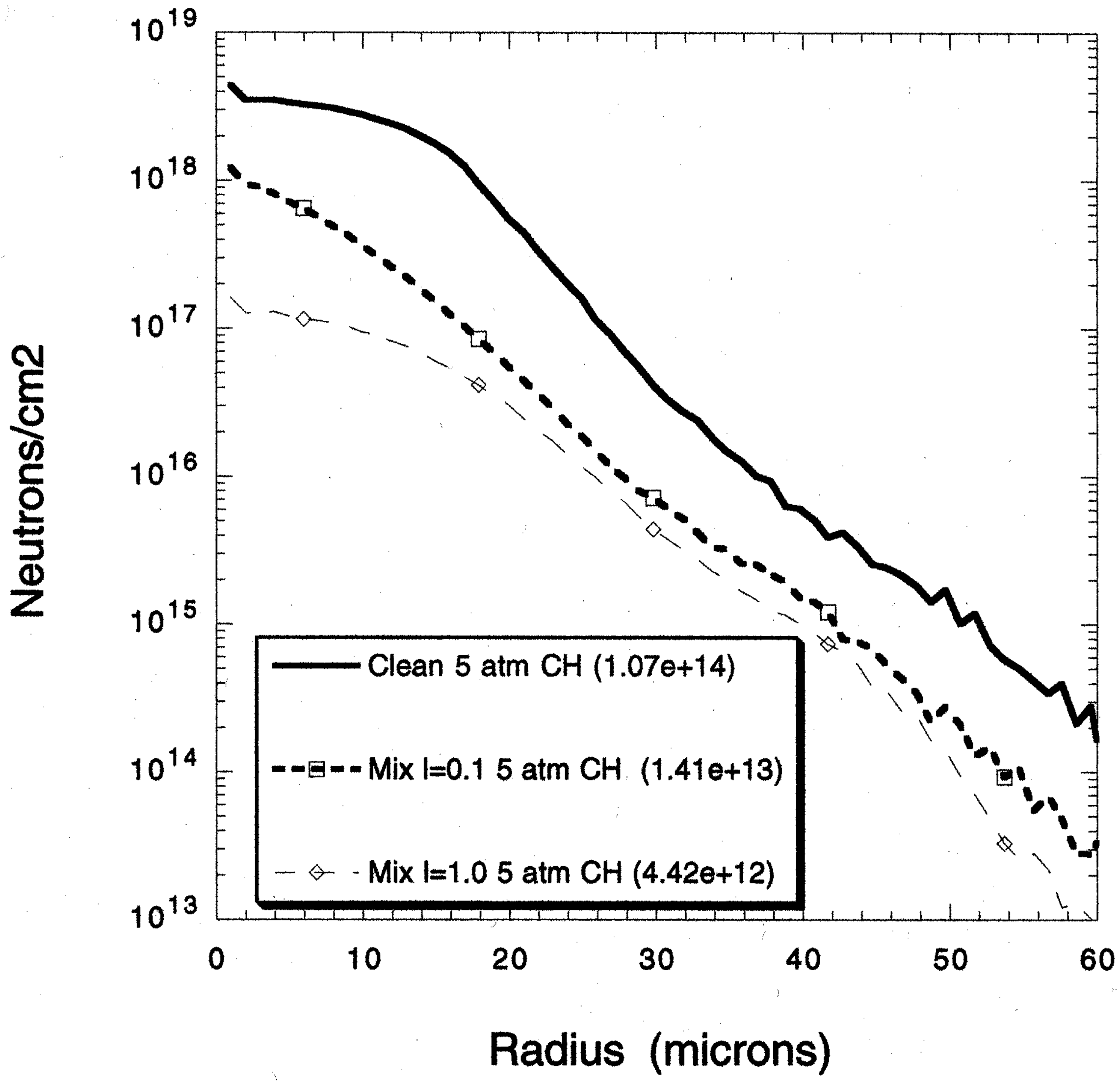
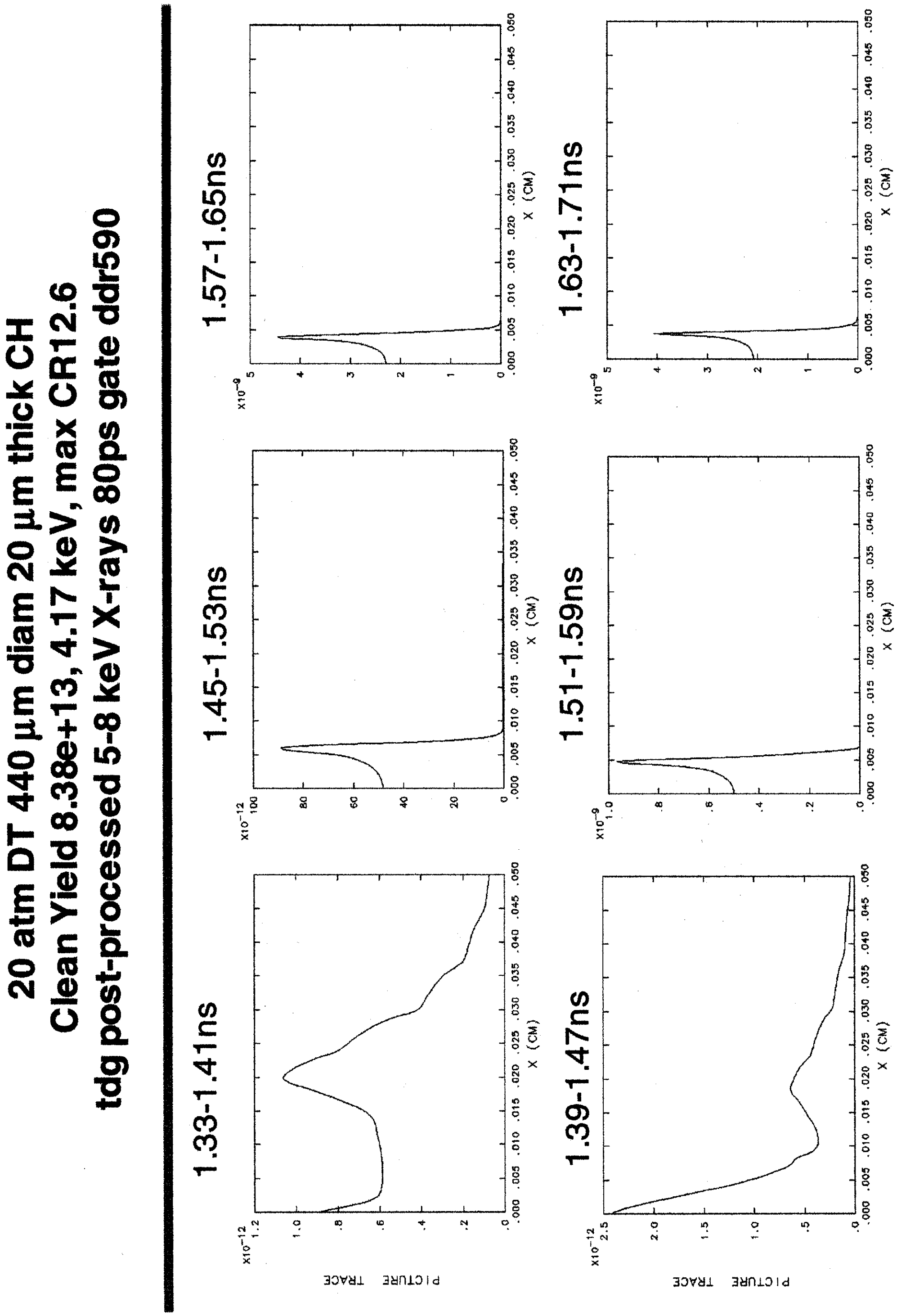

Neutrons/cm2
Radius (microns)
Clean 5 atm CH (1.07e+14)
Mix l=0.1 5 atm CH (1.41e+13)
Mix l=1.0 5 atm CH (4.42e+12)
10^{19}
10^{18}
10^{17}
10^{16}
10^{15}
10^{14}
10^{13}
0
10
20
30
40
50
60

Figure 4

Figure 5


20 atm DT 440 μm diam 20 μm thick CH
Clean Yield 8.38e+13, 4.17 keV, max CR12.6
tdg post-processed 5-8 keV X-rays 80ps gate ddr590
1.33-1.41ns
1.45-1.53ns
1.57-1.65ns
1.39-1.47ns
1.51-1.59ns
1.63-1.71ns
X (CM)
PICTURE TRACE

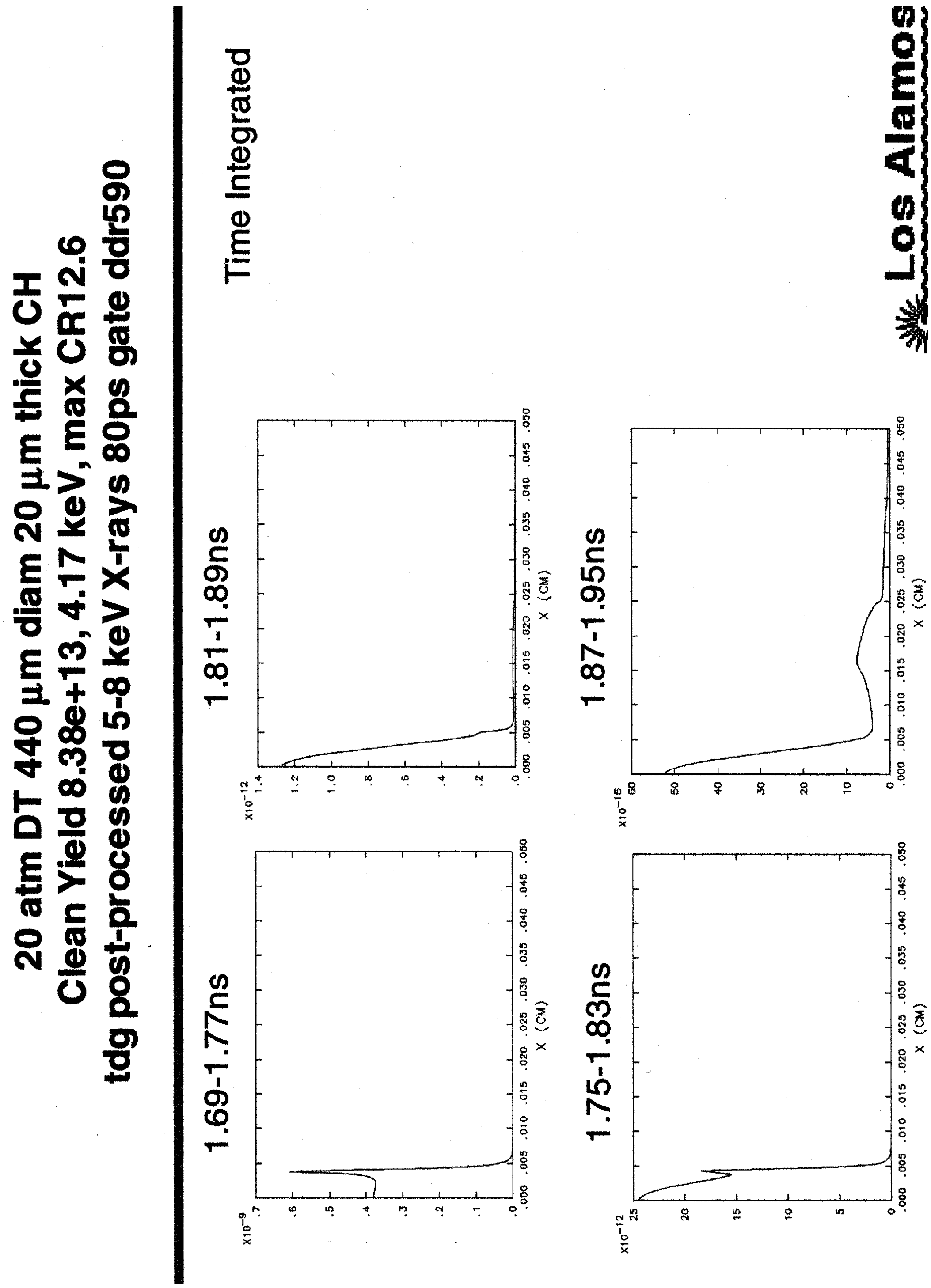

20 atm DT 440 μm diam 20 μm thick CH
Clean Yield 8.38e+13, 4.17 keV, max CR12.6
tdg post-processed 5-8 keV X-rays 80ps gate ddr590
Time Integrated
1.69-1.77ns
1.81-1.89ns
1.75-1.83ns
1.87-1.95ns
X (CM)
Los Alamos

Figure 6

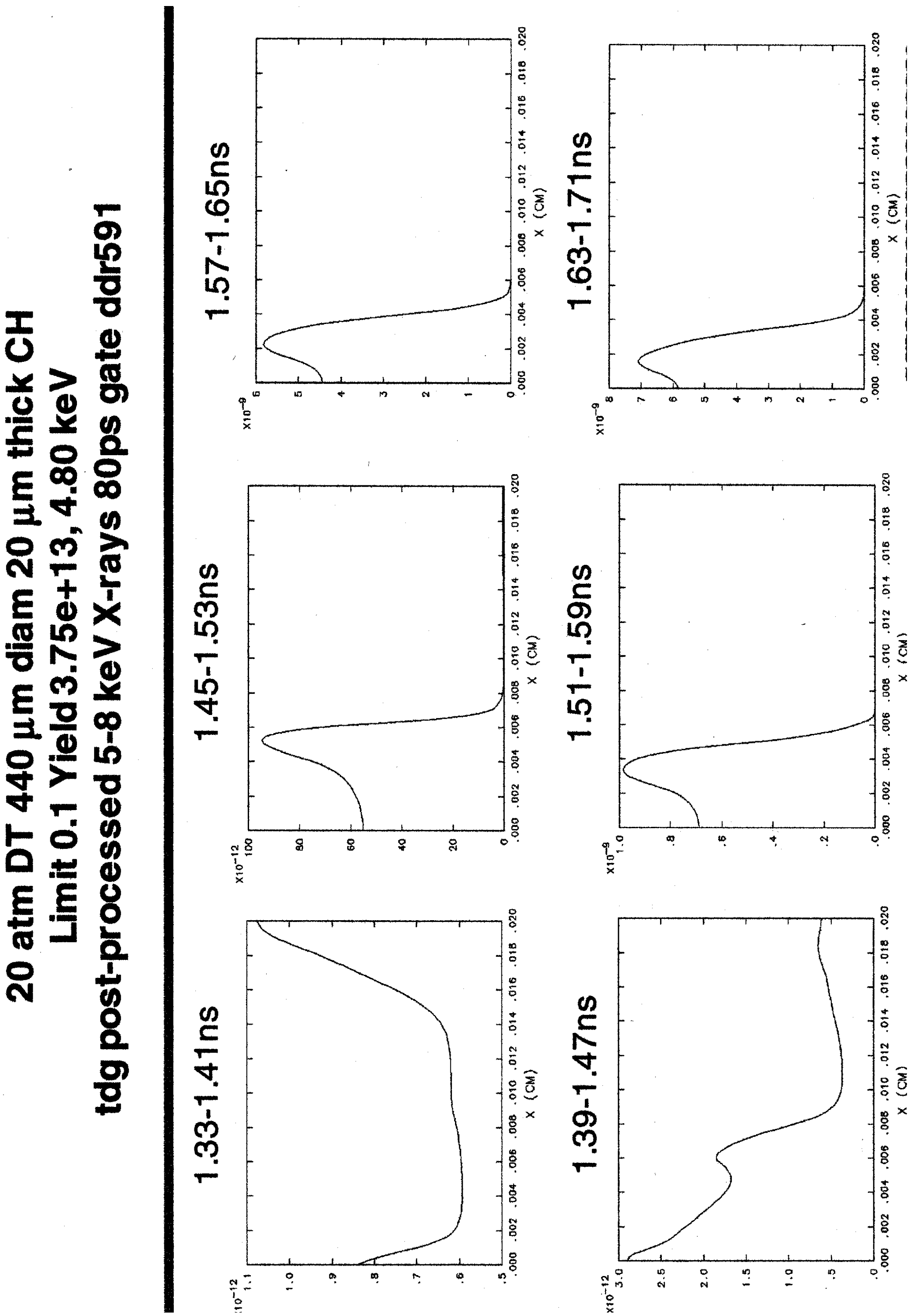

20 atm DT 440 μm diam 20 μm thick CH
Limit 0.1 Yield 3.75e+13, 4.80 keV
tdg post-processed 5-8 keV X-rays 80ps gate ddr591
1.33-1.41ns
1.45-1.53ns
1.57-1.65ns
1.39-1.47ns
1.51-1.59ns
1.63-1.71ns
X (CM)

Figure 7

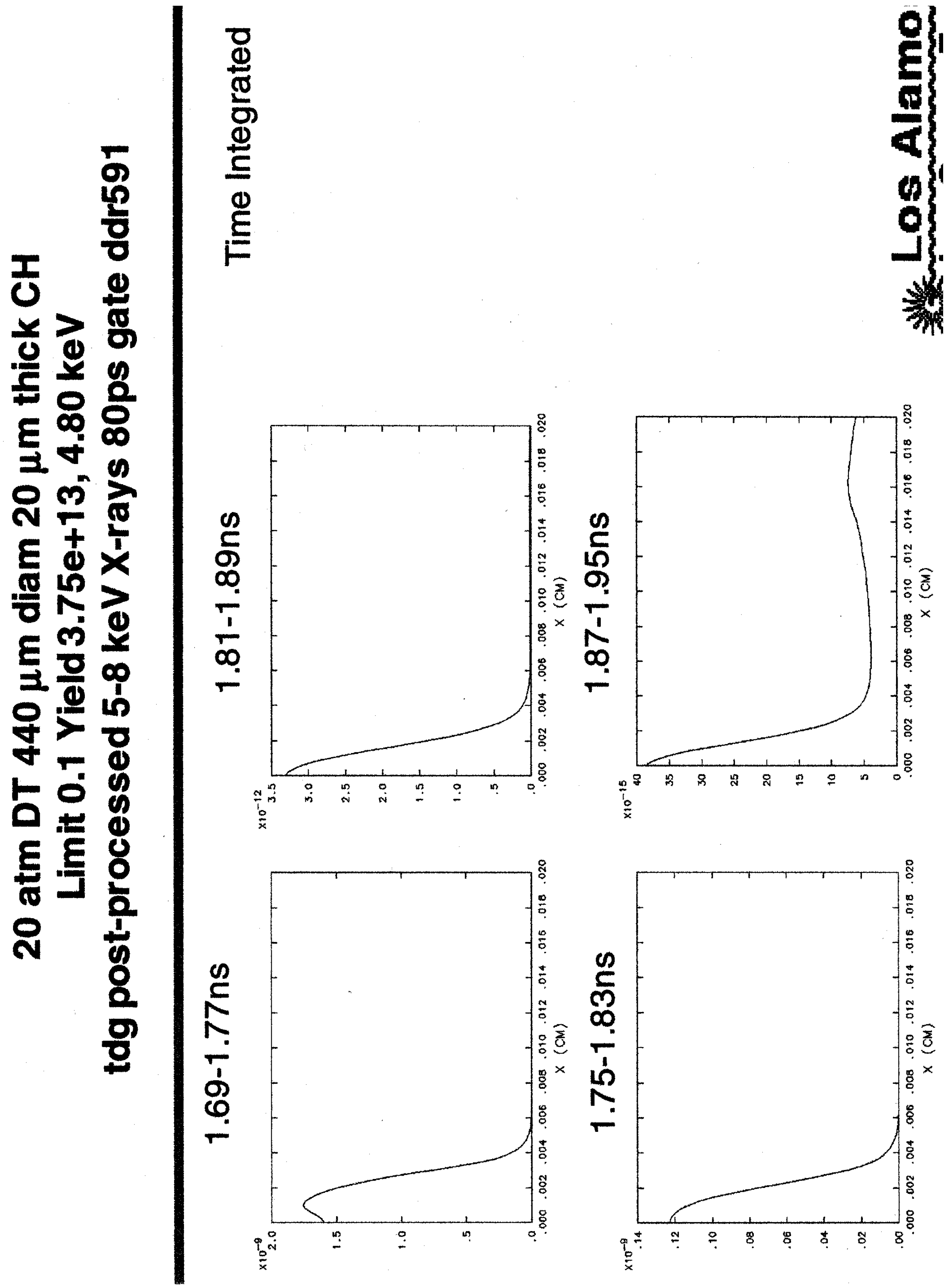

20 atm DT 440 µm diam 20 µm thick CH
Limit 0.1 Yield 3.75e+13, 4.80 keV
tdg post-processed 5-8 keV X-rays 80ps gate ddr591
Time Integrated
1.69-1.77ns
1.81-1.89ns
1.75-1.83ns
1.87-1.95ns
X (CM)
Los Alamos

Figure 8

Contact List of Key Personnel

LLE (716)275-5101

War Room	-8360
WarRmComputers	-7663
Ray Bahr	-9443
Tom Boehly	-0254
David Bradley	-5769
Paul Jaanamagi	-5515
Jim Knauer	-2074
Pat McKenty	-3865
Sam Morse	-9672
Greg Pien	-5848
Wolf Seka	-3815
John Soures	-3866
Jean Steve	-5286
Keith Thorp	-7603

Marriott Courtyard Brighton (716)292-1000

Cris Barnes	pager 12-3598 (Exp. Div. Visitor)
Steve Batha	pager: (505)996-1824 1841547@pagemart.net cell: (505)670-2851
Nick Lanier	
Scott Evans	cell: (505)699-1581
Steve Rothman	
Tom Archuleta	pager: (505)996-1384
Tom Sedillo	pager: (505)996-3004
Ron Perea	
Glenn Magelssen	

Marriott Residence Inn (716)272-8850

Marriott Thruway (716)359-1800

Frank Cverna
Joe Mack
Carl Young
George Morgan

Hampton Inn (716)272-7800

Jim Faulkner, Doug Wilson, Dick Lerche, Laurent Disdier, and Benoit Canaud are undetermined.