

Proton Plan
Booster Dump Relocation
Director's Review
August 23 -25 2005

William Pellico

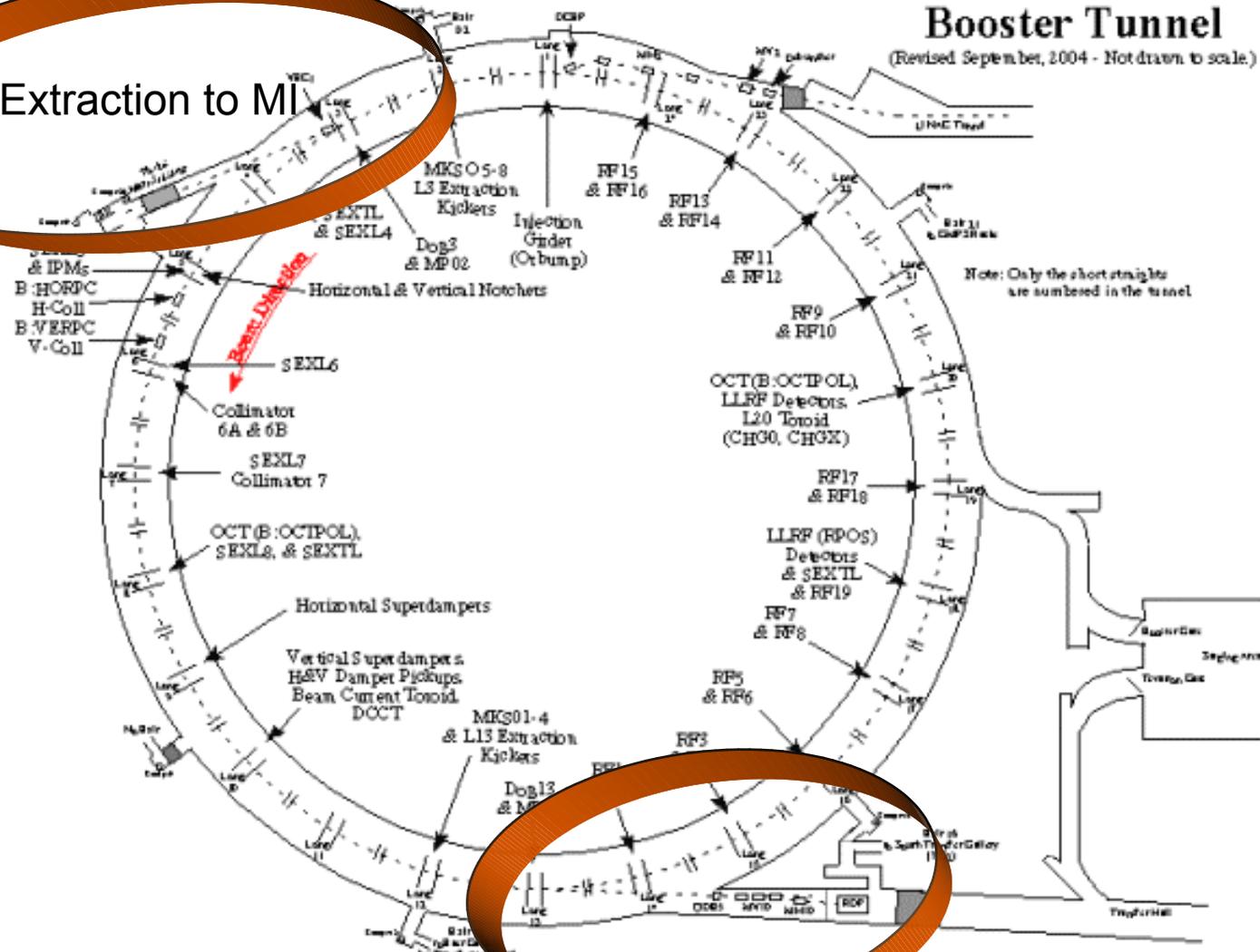
- Move the Booster L13 beam dump to MI-8 Line
 - Move Power Supplies and Magnets (4 Kickers, Septa)
 - Run Power to BWT
 - Run Cooling Water to BWT
 - Install Cable penetrations
 - Pull Cables
 - Install Kicker support and Septa mounting hardware
 - Move people in BWT
 - Move Electronics (Wire, BLM's, BPM, Toroid)
 - Re-install MiniB/ MI-8 Commissioning Dump
 - Reconfigure Booster/MI-8 Radiation Safety
 - Power V803 (two magnet dogleg) through a switch
 - Reconfigure MI-8 Radiation
 - Install Beam Stop
 - Possibly install secondary wall

Purpose

- Remove an Aperture Restriction
 - Low Energy Scraping (about 2-3 % efficiency)
- Improve Booster Lattice Function
 - Edge Focusing removed when Doglegs off
- Improve Booster Reliability
 - Kicker, Cables, Electronics, Caps etc Rad Damage/failure
- Reduce Operational Tuning issues
 - Tuning of Bex bumps, Bump ratios, Losses
- Improved L3 extraction
 - MP01 pulse, Extra L12 Kicker, Vertical Tune

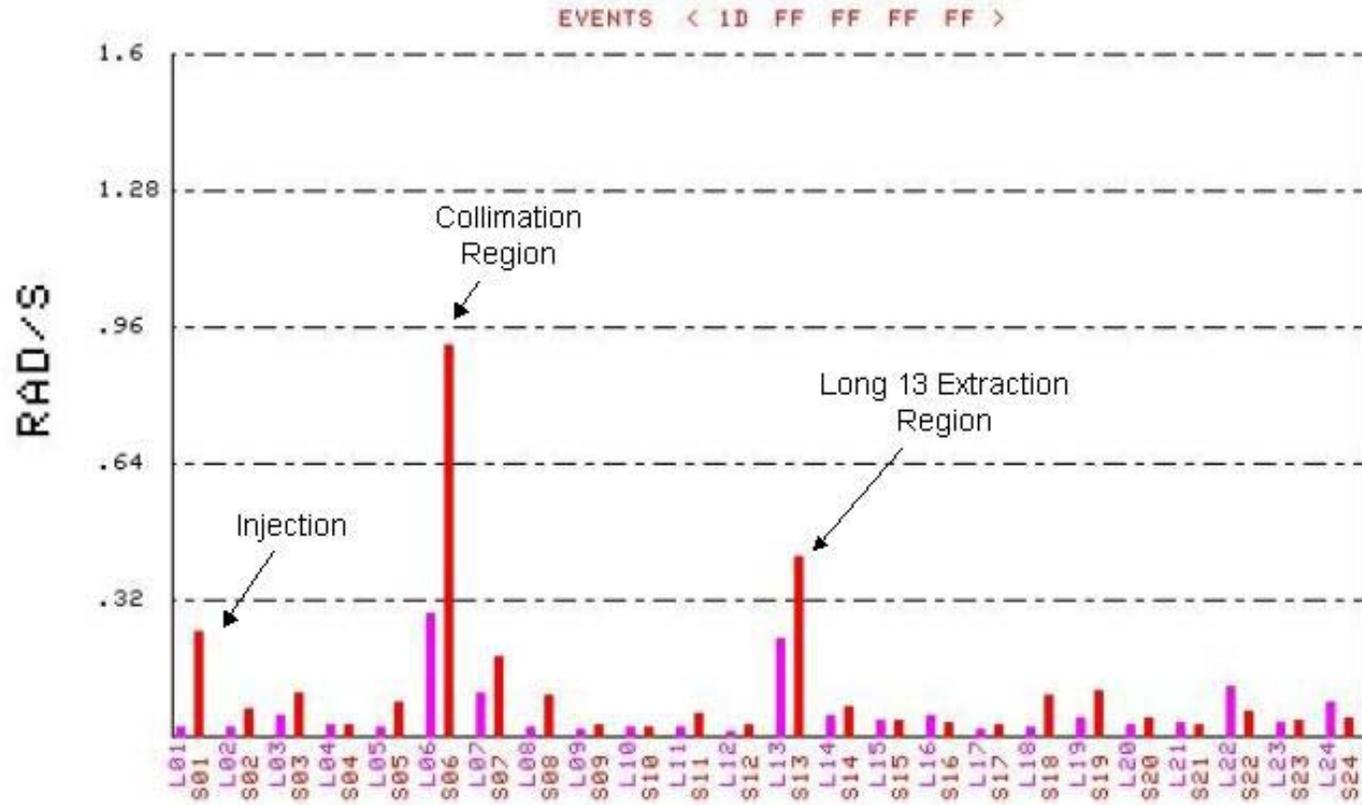
- Clear out L13 Dump
 - Septa is moved up
 - Magnet will remain and allowed to cool down
 - Doglegs are turned off
 - Magnets will remain and allowed to cool down
 - Bex Bumps are turned off
 - Dump line BLM's, Toroid, BPM(?) will be moved to MI-8
 - Electronics will be moved to BWT
 - May reconfigure RDF radiation back to Booster
 - 3 Kickers at L12 will be moved to MI-8

L3 Extraction to MI



L13 Extraction Dump

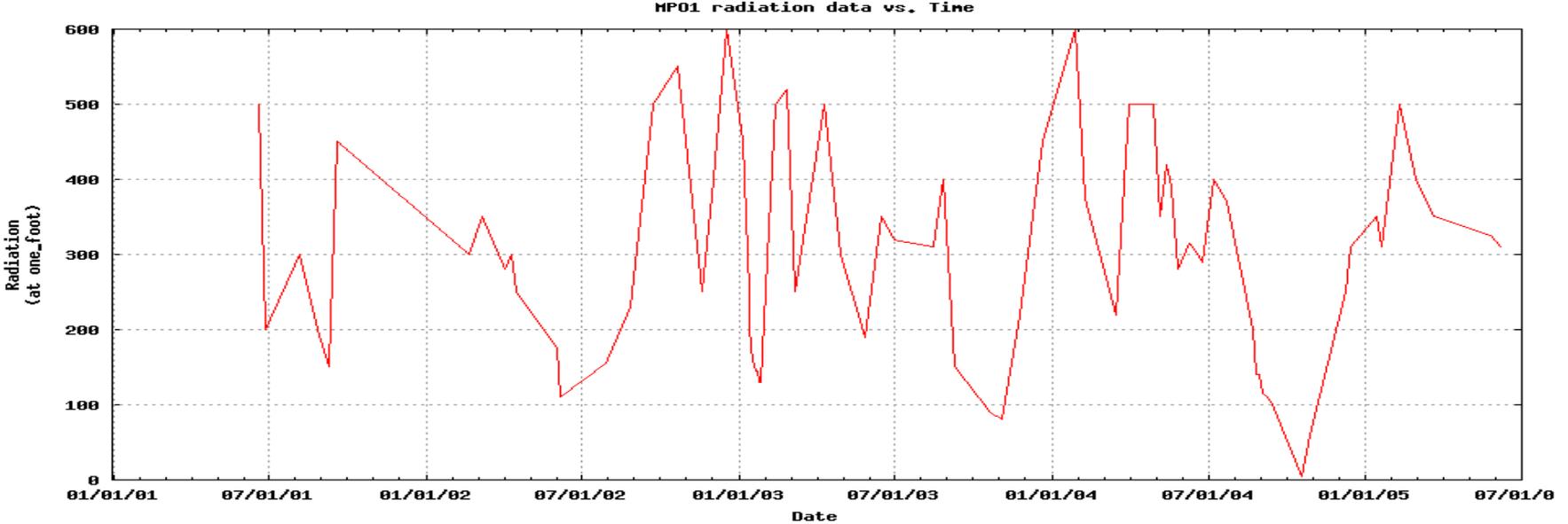
Typical Beam Loss Profile



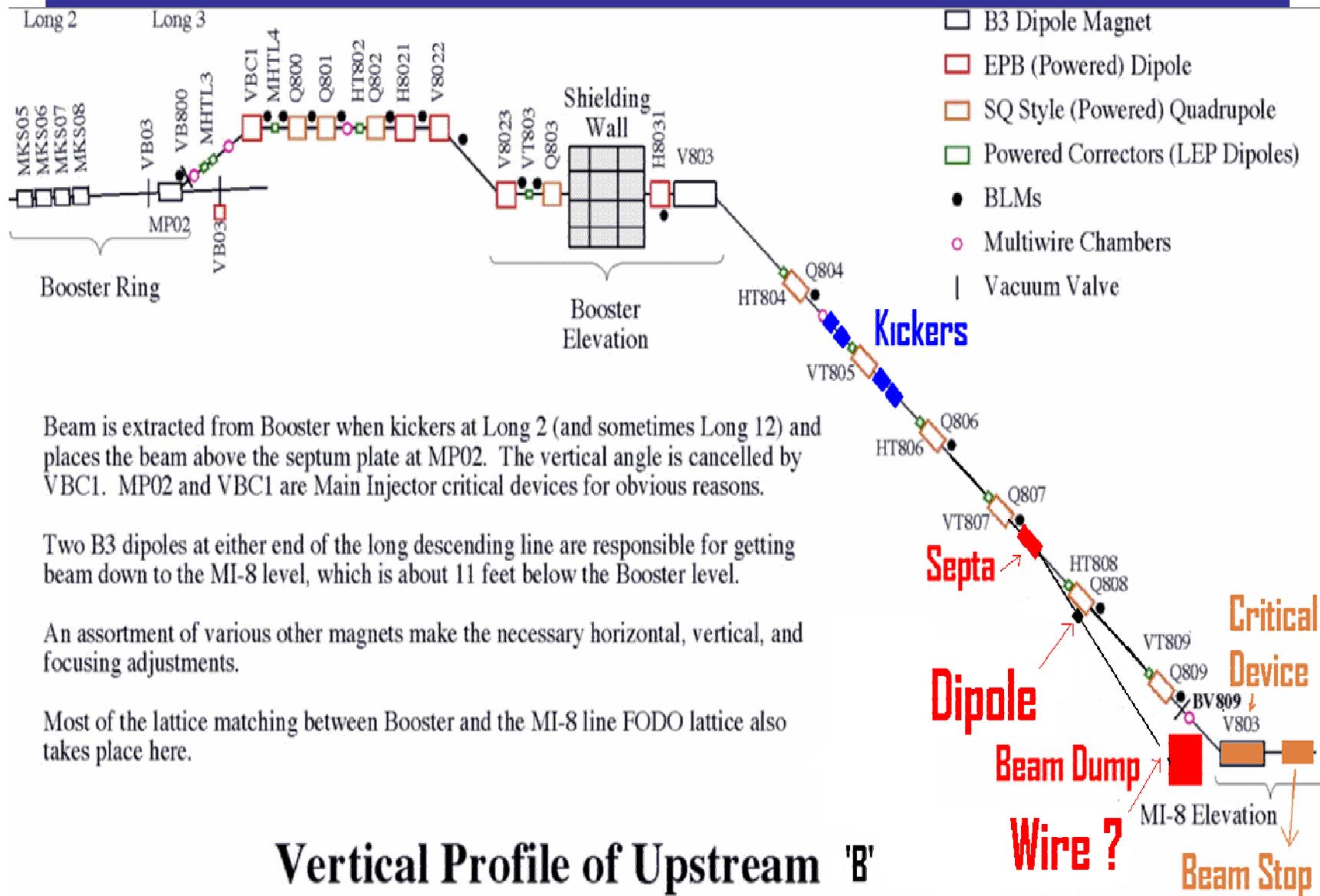
Booster Beam Loss

.034 SECONDS

07/12/05 1628



- Component failure in this region has been high. We have made improvements (peek water tubing) but other systems are still vulnerable.
- Caps, Correctors, Cables, Ion Pump....etc



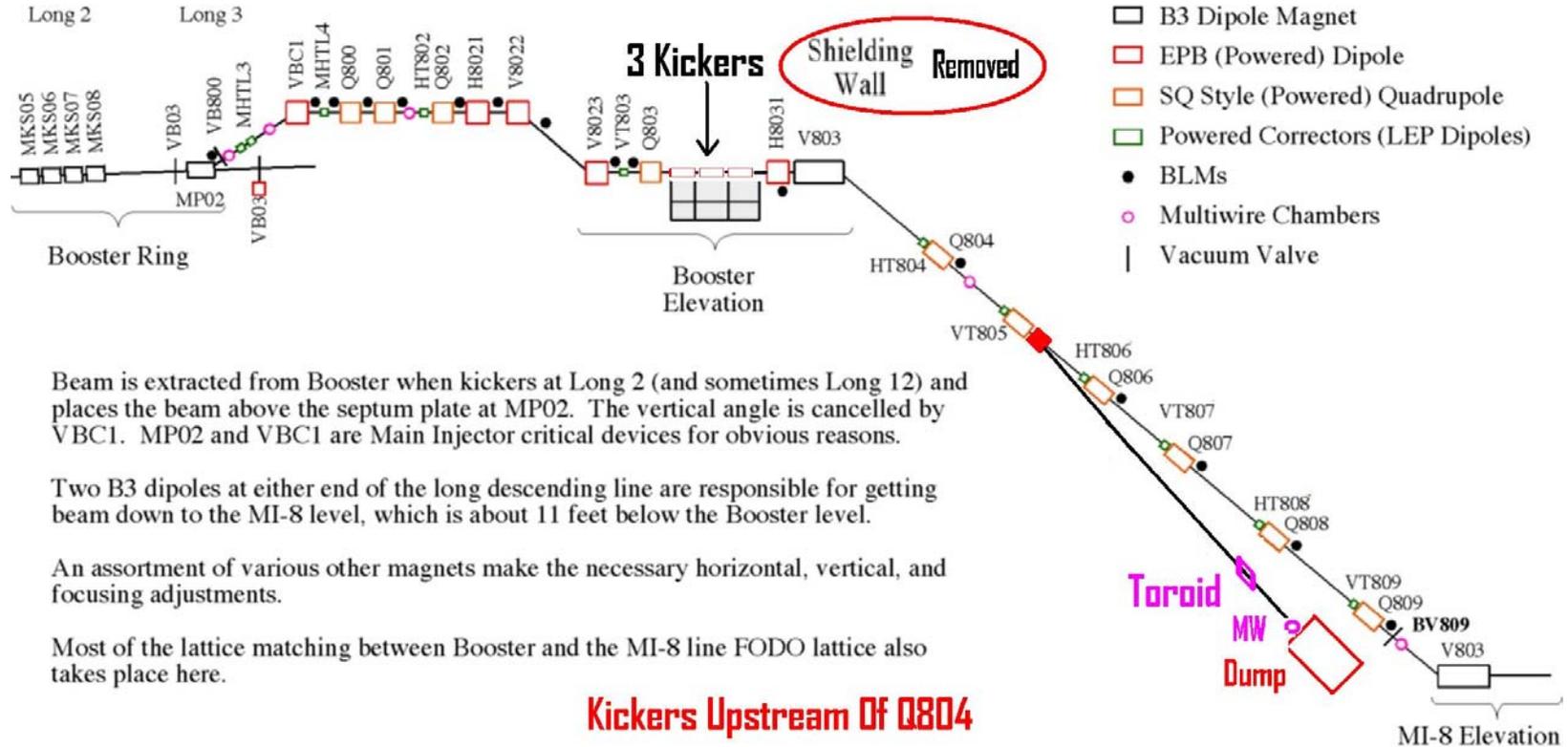
Beam is extracted from Booster when kickers at Long 2 (and sometimes Long 12) and places the beam above the septum plate at MP02. The vertical angle is cancelled by VBC1. MP02 and VBC1 are Main Injector critical devices for obvious reasons.

Two B3 dipoles at either end of the long descending line are responsible for getting beam down to the MI-8 level, which is about 11 feet below the Booster level.

An assortment of various other magnets make the necessary horizontal, vertical, and focusing adjustments.

Most of the lattice matching between Booster and the MI-8 line FODO lattice also takes place here.

Vertical Profile of Upstream 'B'



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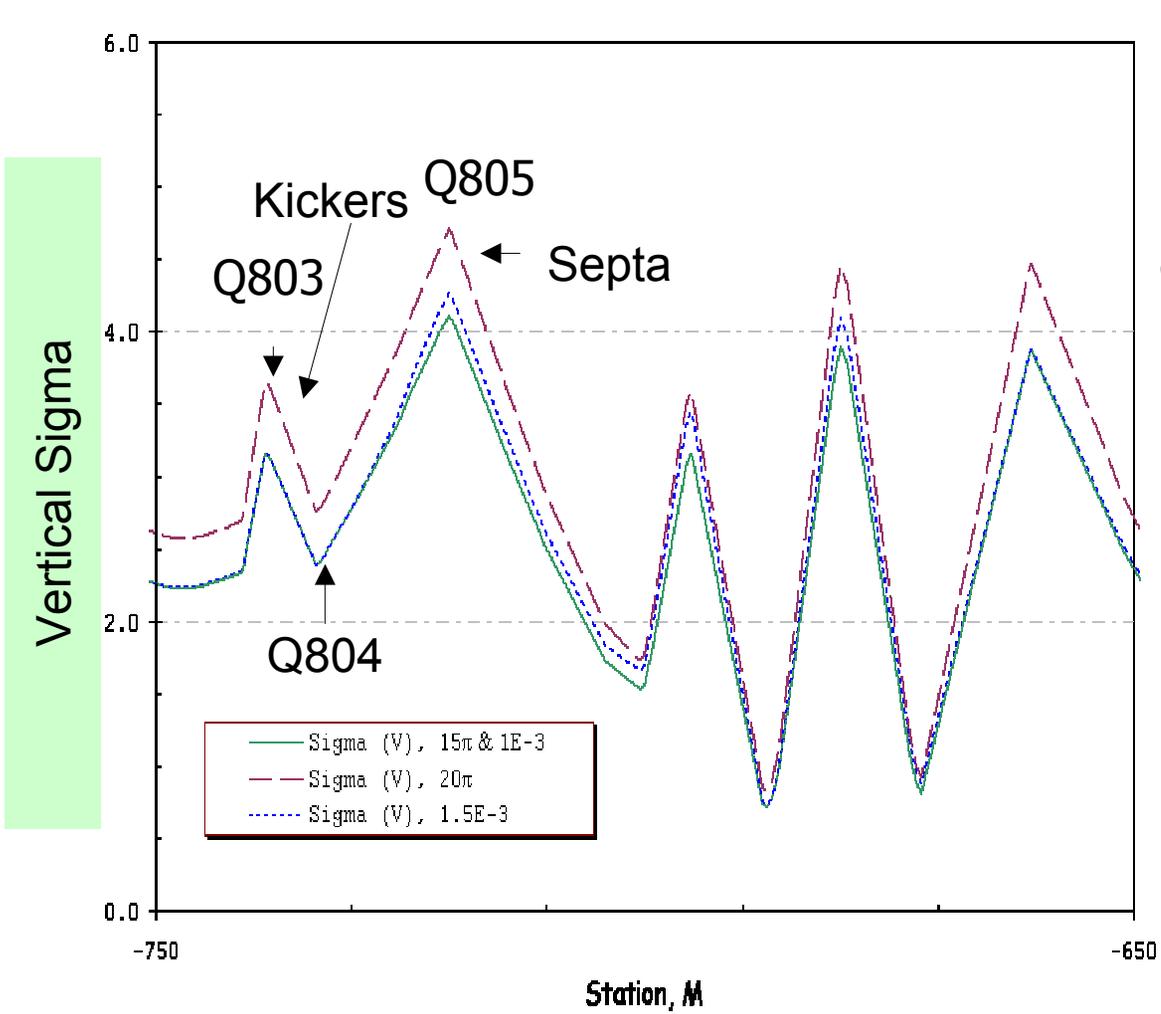
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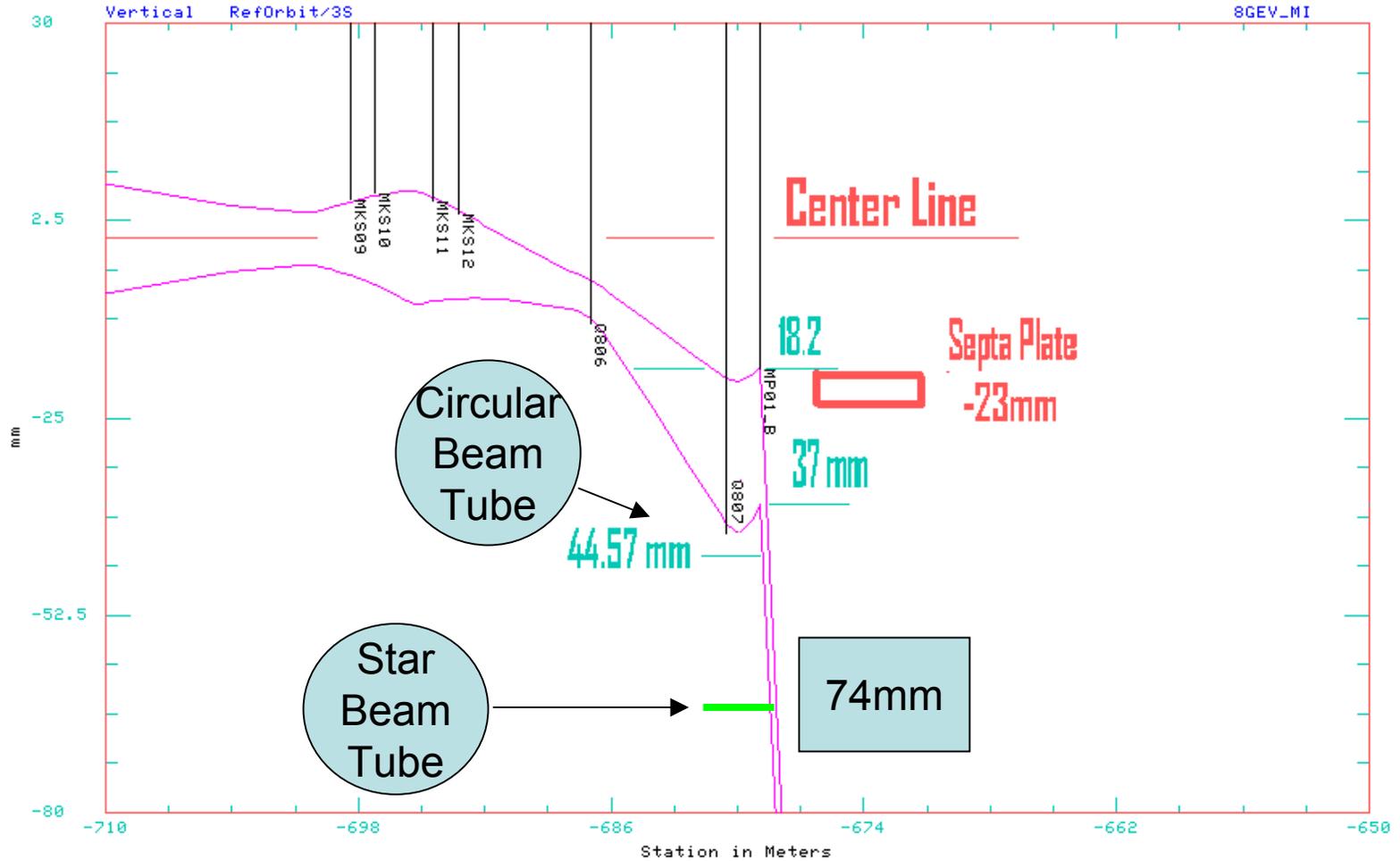
Kickers Upstream Of Q804

Vertical Profile of Upstream of MI-8 Line

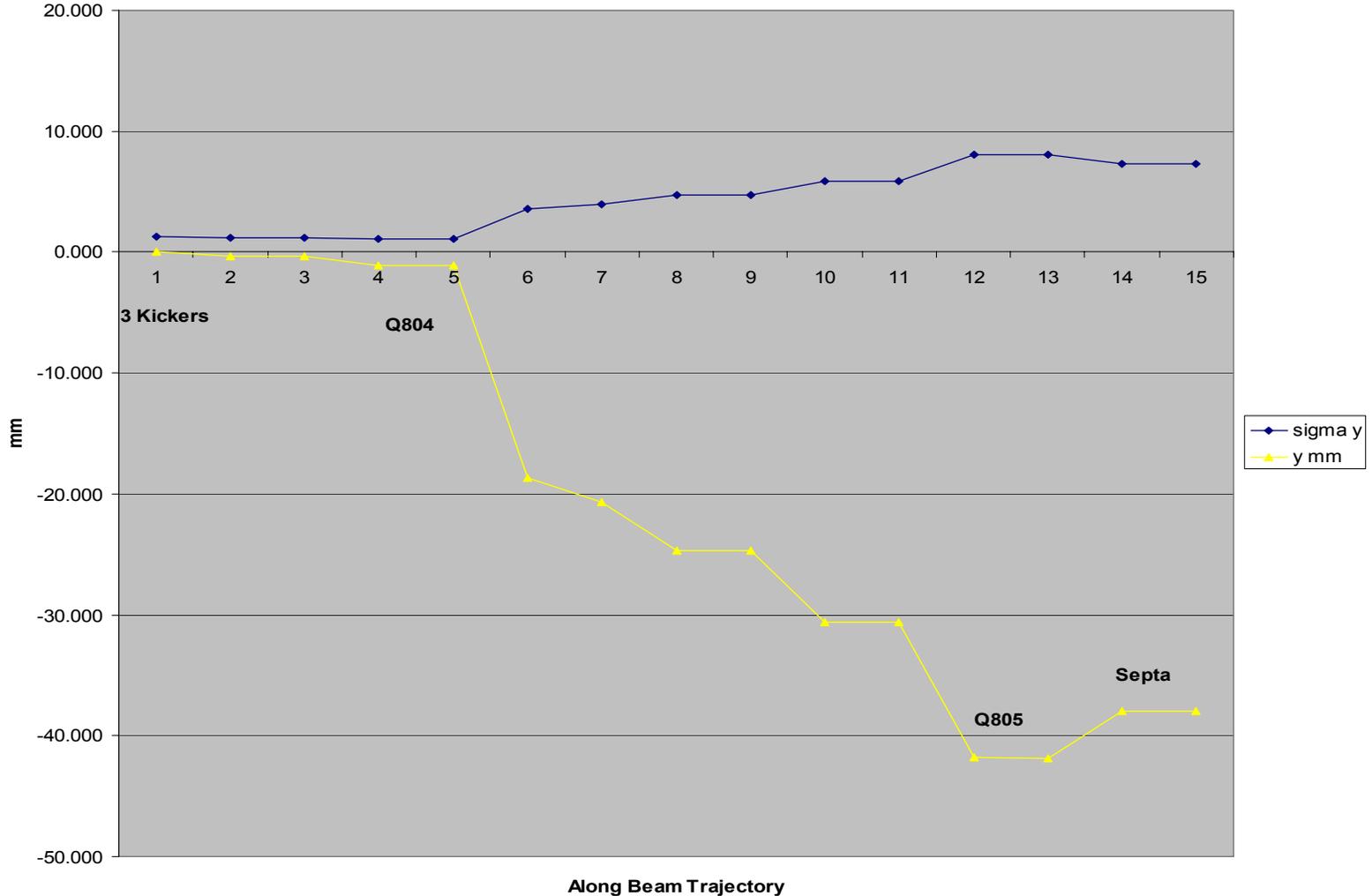


	β_x	β_y	Dx	Dy
	(meters)	(meters)	(meters)	(meters)
	44.058	7.321	-1.491	0.000
DS				
Q803	44.058	7.321	-1.491	0.000
	46.852	6.232	-1.624	0.000
	46.852	6.232	-1.624	0.000
	50.187	5.581	-1.775	0.000
Q804	45.018	6.298	-1.725	0.000
	32.321	8.541	-1.518	0.000
	32.321	8.541	-1.518	0.000
	17.408	12.801	-1.210	0.000
	17.408	12.801	-1.210	0.000
	2.019	23.905	-0.628	0.000
Q805	0.827	24.031	-0.499	0.000
	1.132	19.875	-0.396	0.000

Vertical Beam Placement



MI-8 Dump (Vertical Param)



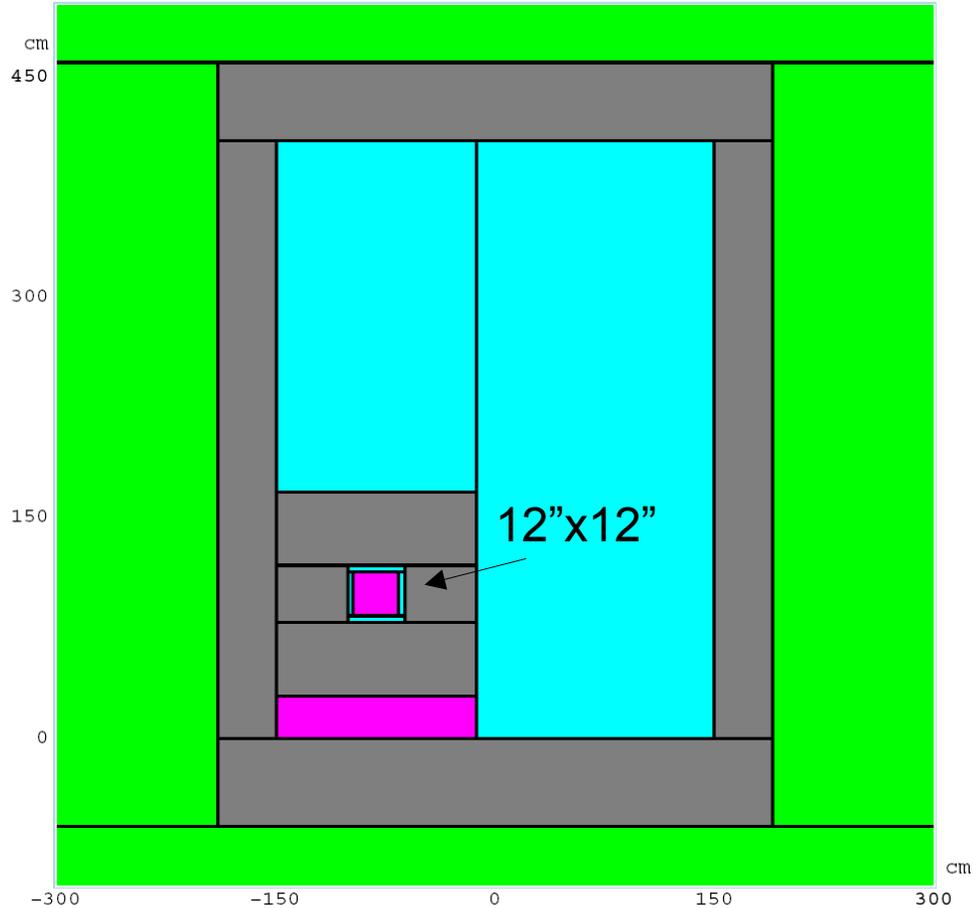
Dump Intensities

- L13 Dump takes about $3E18$ protons/year
- MI-8 Dump is expected to take about $5E19$ p/yr
- Peak intensities of $7E12$ /pulse for studies
- Colliding beam operational mode require $<5E12$ /pulse
 - 2 pulses / 60 secs for colliding beam operations
 - The colliding beams mode setup is ~ once/day for 1 hour
- Fixed Target operational mode require $<1E12$ /pulse
 - 1 event/super cycle or 1event/60 secs
 - The Fixed Target intensity is at 1 or 2 turns /30 bunches
- Booster Studies requires the ability to run full intensity at limited rate.
- Average power = ~ 1KW
 - Ang Lee is running simulations on heating effects
- Beam Size
 - Igor is running Mars simulations
 - Horizontal ~ 20mm
 - Vertical ~ 10mm
- Using previous radiation shielding assessment as starting point
 - Radiation assessment allowed for $\sim 4E18$ p/yr

MI-8 Dump - Front View

MI-8 Beam Absorber

Cross Section view



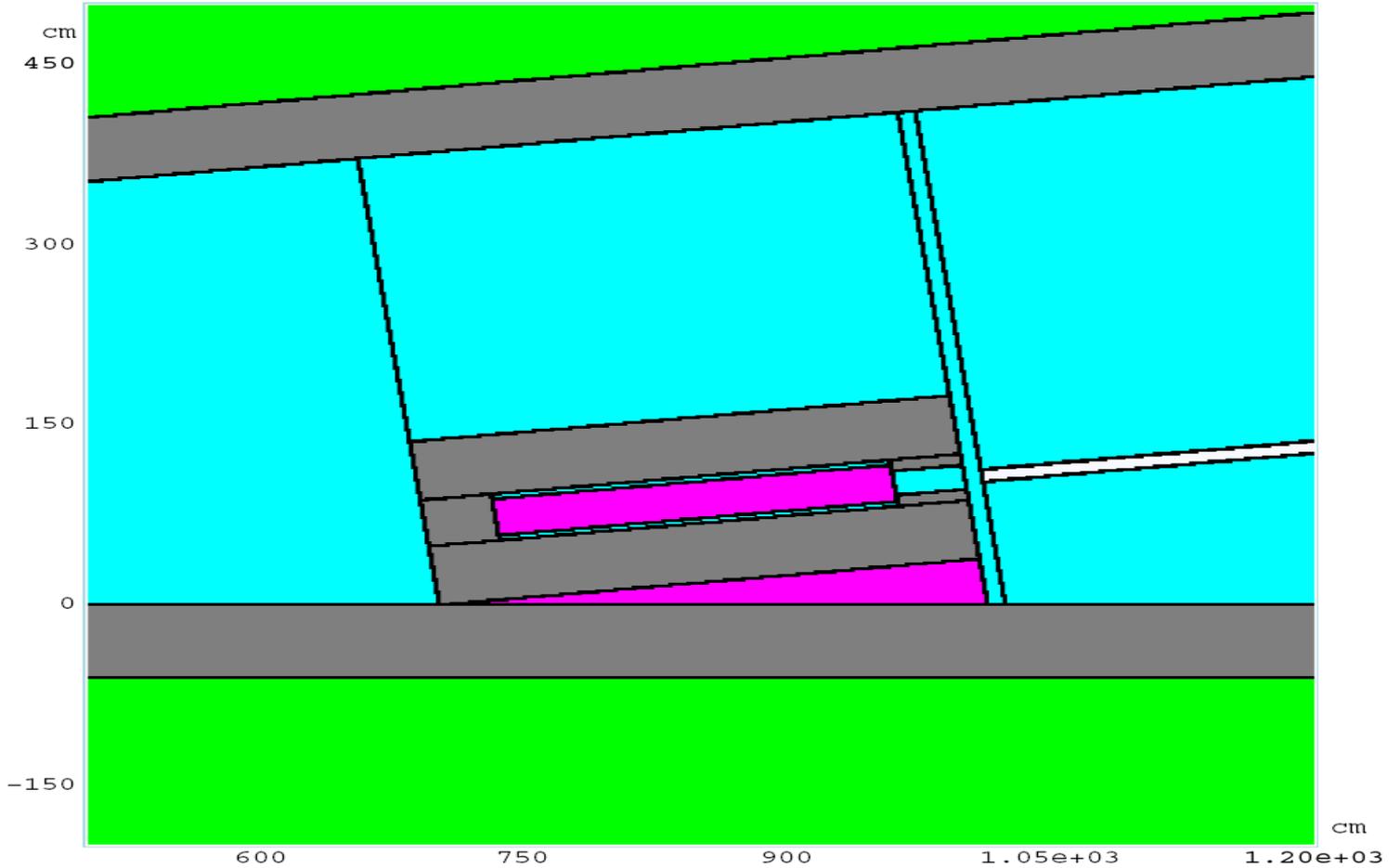
Aspect Ratio: X:Y = 1:1.0

Data Provided by Igor Rakhno

MI-8 Dump Side View

MI-8 Beam Absorber

Elevation view

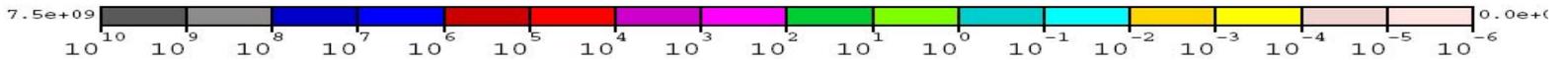
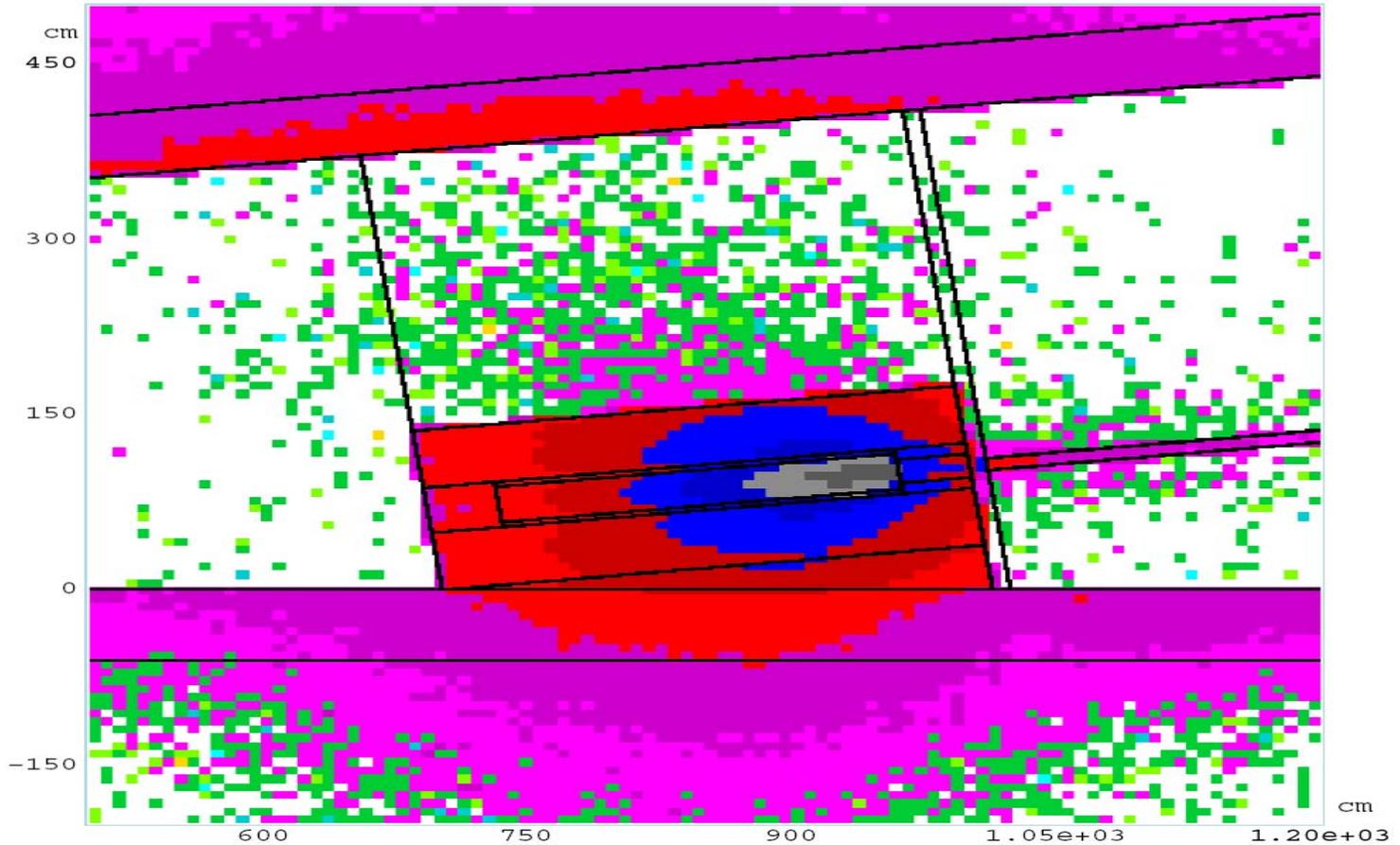


Data Provided by Igor Rakhno



MARS15 (2005)

MI-8 Beam Dump / Elevation view



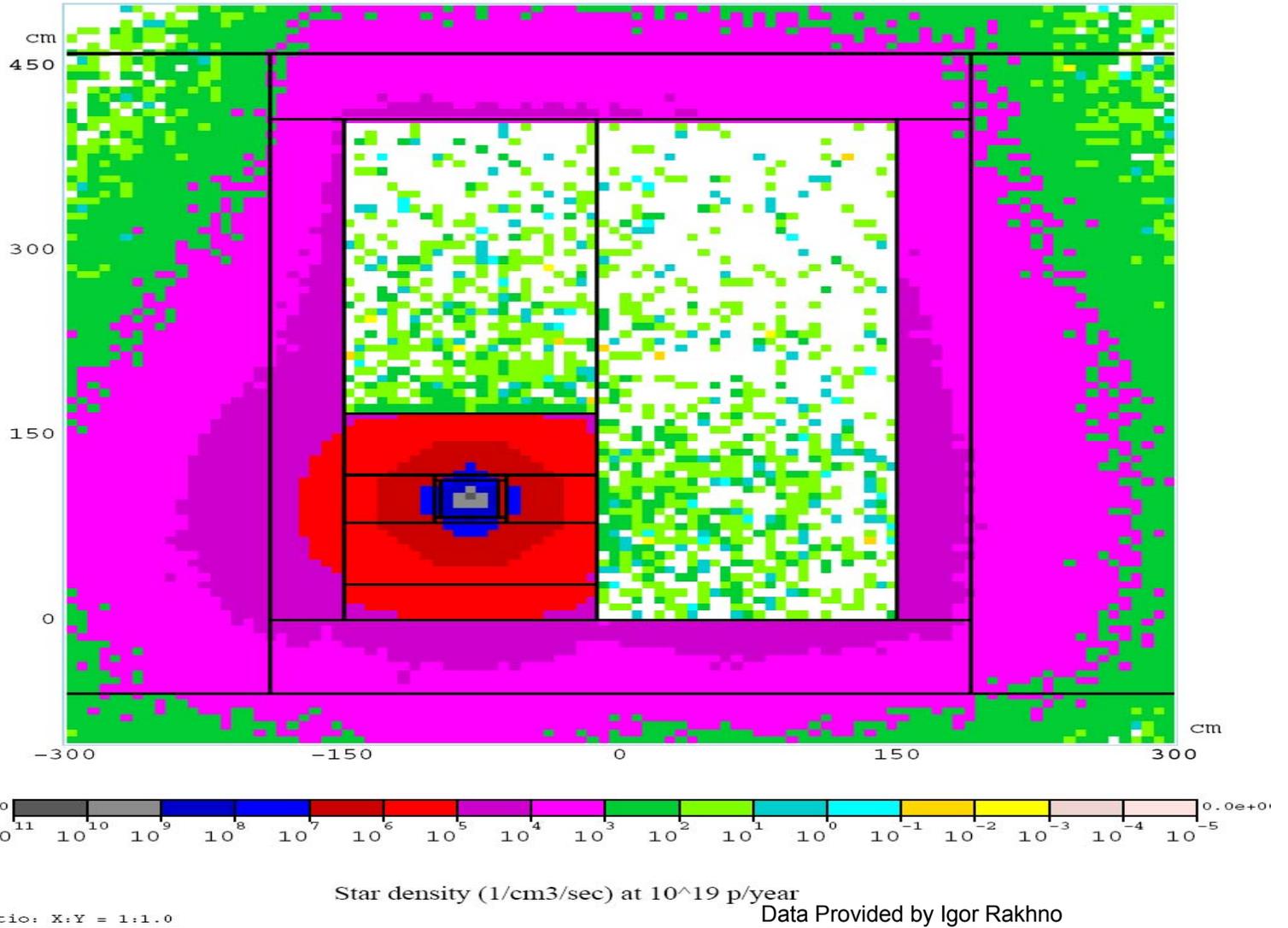
Star density (1/cm³/sec) at 10¹⁹ p/year

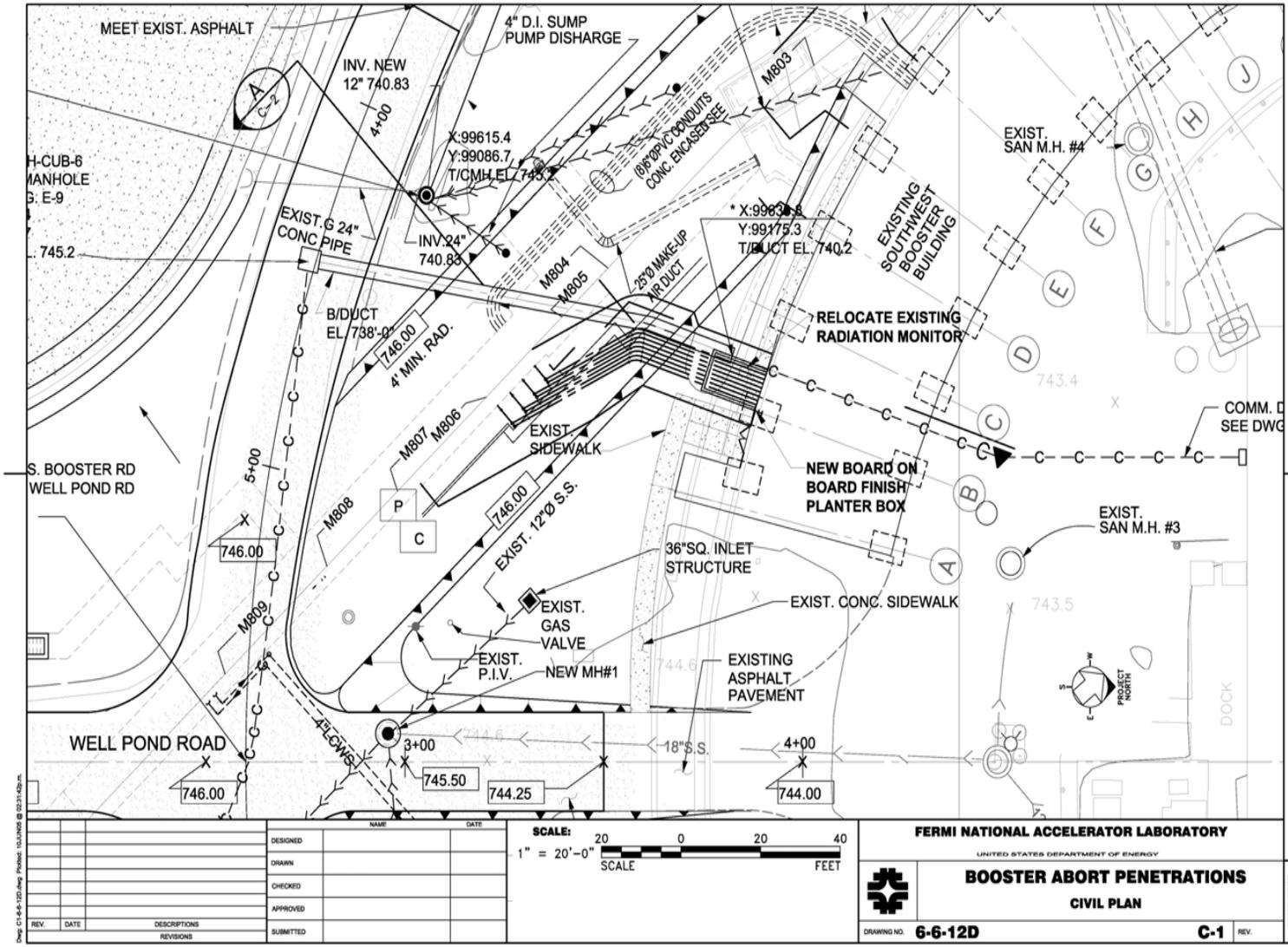
Aspect Ratio: X:Z = 1:1.0

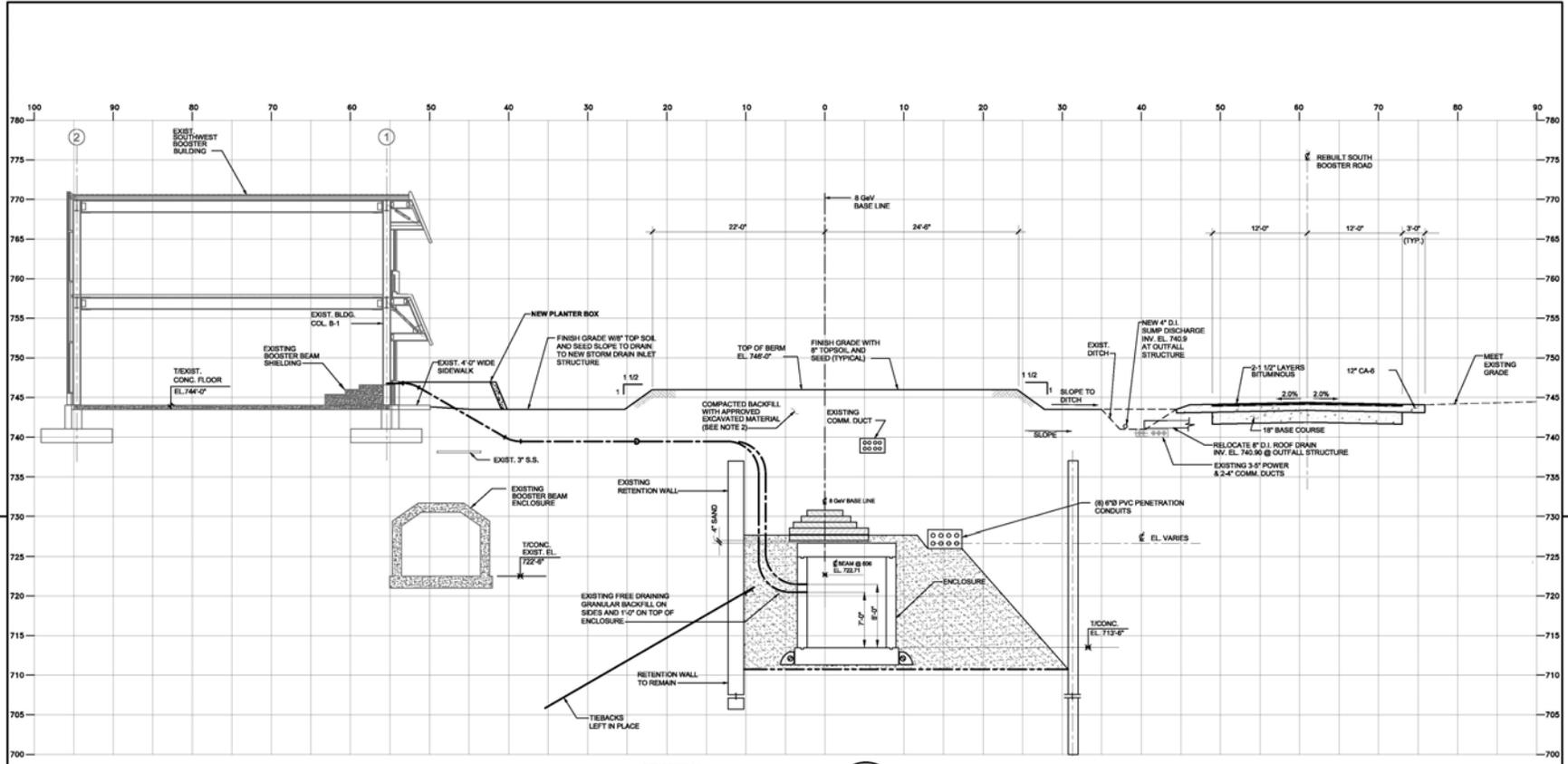
Data Provided by Igor Rakhno

MARS15 (2005)

MI-8 Beam Dump / Cross Section







SECTION A-C-1

Dwg: C2-6-12D-Amp Plns: 10/10/05 @ 02:32:39m.

<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <th>REV.</th> <th>DATE</th> <th>DESCRIPTIONS REVISIONS</th> </tr> <tr> <td> </td> <td> </td> <td> </td> </tr> </table>		REV.	DATE	DESCRIPTIONS REVISIONS													<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <th>NAME</th> <th>DATE</th> </tr> <tr> <td> </td> <td> </td> </tr> </table>		NAME	DATE			<p>SCALE:</p>	<p>FERMI NATIONAL ACCELERATOR LABORATORY <small>UNITED STATES DEPARTMENT OF ENERGY</small></p> <p>BOOSTER ABORT PENETRATIONS CIVIL SECTION</p>		<p>DRAWING NO. 6-6-12D</p>	<p>C-2 REV.</p>	<p style="writing-mode: vertical-rl; transform: rotate(180deg);">MAY, 2005</p>
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Booster Abort
Relocation
Conduit Routing

May 23, 2005



- Complete Contract Documents 15, July 2005
- Issue for Lab Wide Review 15, July 2005
- Issue for RFP 1, AUG. 2005
- Receive Proposal 22, Aug. 2005
- Issue NTP 12, Sept. 2005
- Start Excavation Shutdown + 1 Day
- Complete Required Backfill Shutdown + 28 CD
(accounts for working through holiday season)
- Project Complete Shutdown + 45 CD (includes time for punch list and seeding) Have assumed shutdown is late Nov. Or early Dec.

Cost Projections

Uniq	WBS	Name	Start	Finish	% Compl	Esc/Burd Labor	Esc M&S	Cont %
3	1.2	Booster Upgrades (Dump Relocation Only)	9/30/04	12/7/07	13%	\$11,682	\$75,506	52%
284	1.2.11	Booster Dump Relocation	5/2/05	12/1/05	22%	\$11,682	\$75,506	43%
286	1.2.11.1	Booster Dump Relocation Design	5/2/05	7/7/05	80%	\$11,682	\$5,000	40%
427	1.2.11.2	Review Booster Dump Relocation Design	7/7/05	7/7/05	0%	\$0	\$0	0%
288	1.2.11.3	Misc Fabrication	7/8/05	11/18/05	0%	\$0	\$28,358	40%
730	1.2.11.4	Remove Shielding Wall	10/31/05	11/11/05	0%	\$0	\$42,148	40%
287	1.2.11.6	Booster Dump Relocation Install	5/16/05	12/1/05	21%	\$60,280	\$176,260	45%
289	1.2.11.6.1	Remove Existing MP01 Septum	11/30/05	12/1/05	0%	\$1,704	\$0	40%
290	1.2.11.6.2	Install Replacement MP01 (Old MI-8) Septum	11/21/05	11/29/05	0%	\$4,260	\$0	40%
383	1.2.11.6.3	Run Power to MP01 Septum	6/1/05	7/7/05	40%	\$0	\$4,000	40%
384	1.2.11.6.4	Run Cooling Water to MP01	6/1/05	8/15/05	20%	\$0	\$4,000	40%
291	1.2.11.6.5	Remove Booster Kickers	11/7/05	11/7/05	0%	\$852	\$0	40%
292	1.2.11.6.6	Install Booster Kickers	11/8/05	11/14/05	0%	\$4,260	\$0	40%
293	1.2.11.6.7	Relocate Power Supplies	10/31/05	11/11/05	0%	\$11,360	\$0	40%
369	1.2.11.6.8	Remove Beam Pipe @Conduit Core Location	10/31/05	10/31/05	0%	\$568	\$0	40%
294	1.2.11.6.9	Install Conduit/Cable Pulls	11/1/05	11/21/05	0%	\$4,352	\$130,840	60%
368	1.2.11.6.10	Terminate/Splice Cables/Controls	11/22/05	11/28/05	0%	\$2,556	\$0	40%
295	1.2.11.6.11	Install Dump	10/31/05	11/1/05	0%	\$2,272	\$7,196	40%
296	1.2.11.6.12	Radiation Safety Modifications	5/16/05	11/11/05	25%	\$17,533	\$30,224	40%
418	1.2.11.6.12.1	New PS for V803B	7/1/05	8/2/05	0%	\$817	\$14,000	40%
419	1.2.11.6.12.2	Pull Cables for V803	10/31/05	11/11/05	0%	\$11,604	\$4,112	40%
420	1.2.11.6.12.3	Beam Stop Fabrication	5/16/05	7/29/05	50%	\$0	\$8,000	40%
421	1.2.11.6.12.4	Install Beam Stop	10/31/05	11/11/05	0%	\$852	\$2,056	40%
422	1.2.11.6.12.5	Recable Interlock Chassis & Test	10/31/05	11/11/05	0%	\$4,260	\$2,056	40%
297	1.2.11.6.13	Alignment	11/28/05	11/29/05	0%	\$10,564	\$0	40%
322	1.2.11.6.14	Booster Dump Relocation Installation Complete	11/29/05	11/29/05	0%	\$0	\$0	0%

- Removal of L13 extraction will be a noticeable improvement to Booster operations.
- Cost of relocation is small.
- Risk of relocation is small.
- Reduction in Booster activation levels

Risk

1. Activation of Upstream MI-8
2. Reduced usage of beam dump due to Activation
3. Position errors in MI

For More info visit Booster Web Site - Dump Relocation Presentation

Thanks to AD mechanical, FESS, AD Safety