

NuStorm Implementation at Fermilab



Michael Geelhoed
Fermilab AD/EBD

3/27/2013

Photo by Marty Murphy

Focus on Fermilab specific aspects

- Location
- Primary Beamline
- Main Injector Specifics
- Components
- Cost
- Safety Considerations

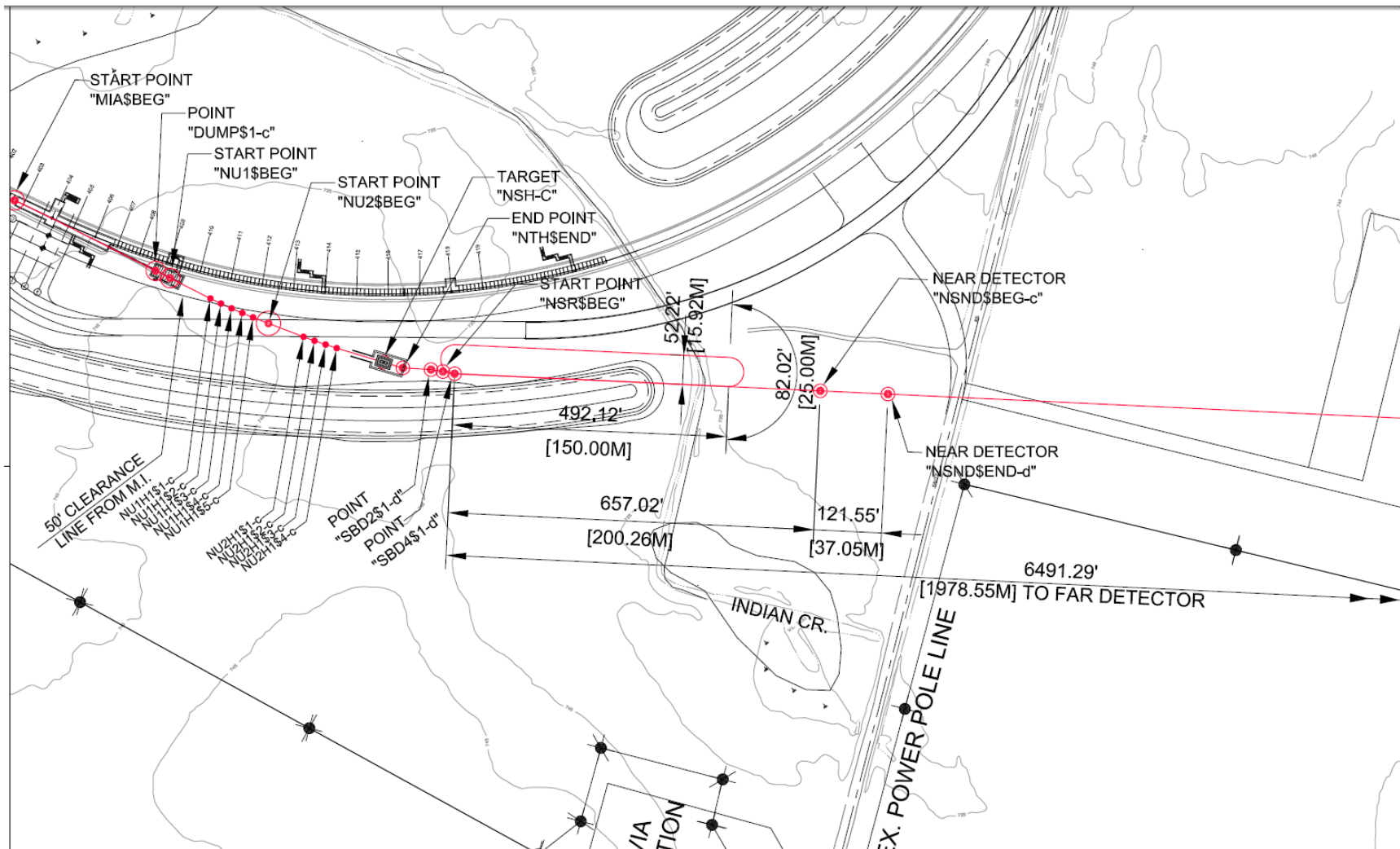
Topics covered yesterday:

Target Module	Decay Ring
Pion Capture	Far Detector
Special Magnet Design	Near Detector

Location of Facility

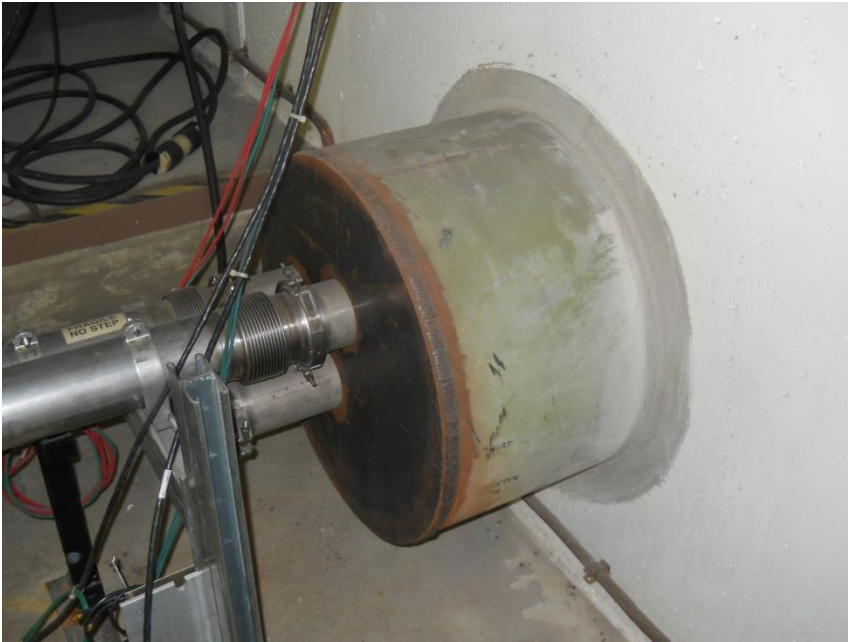


Location of Facility

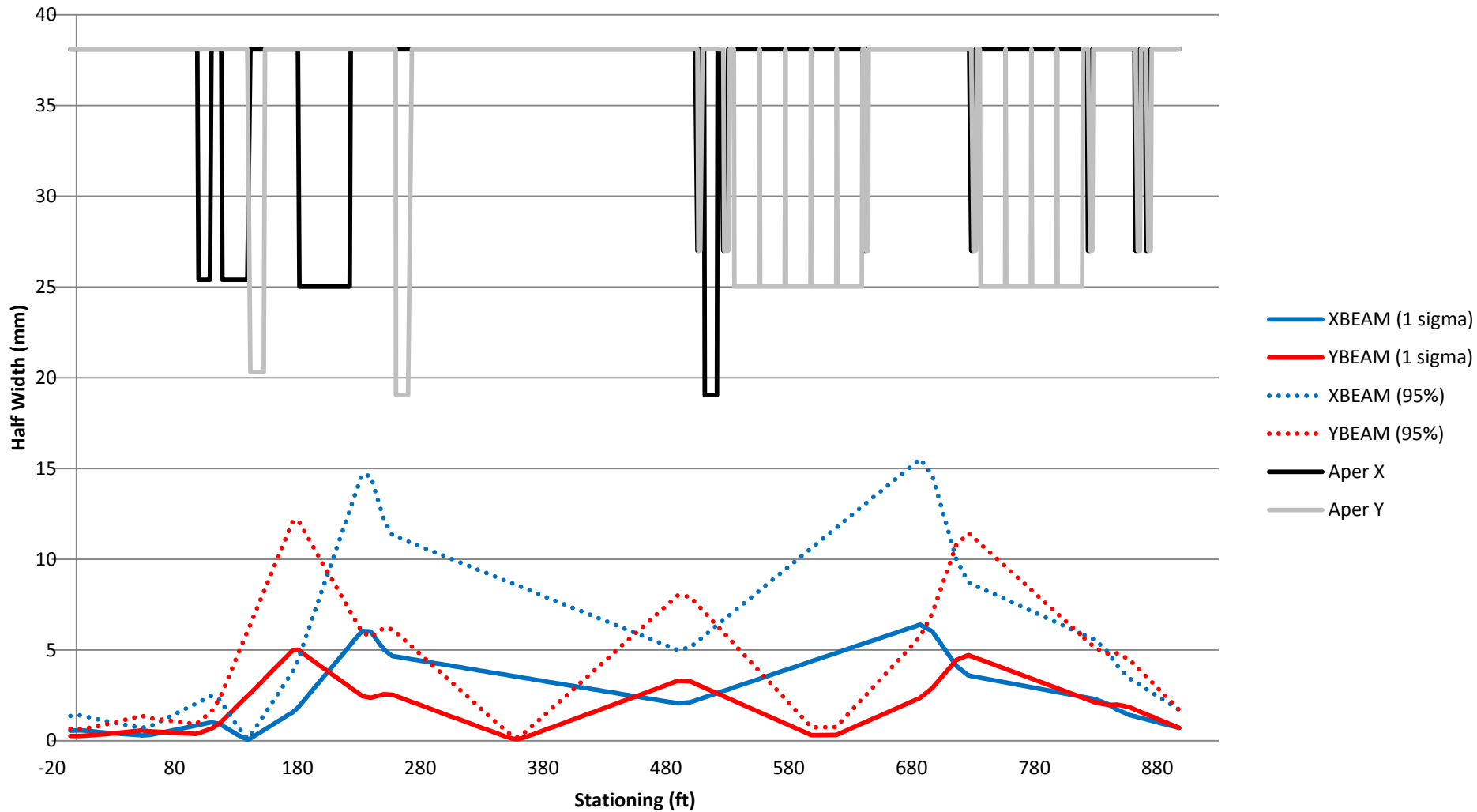


Location of Facility

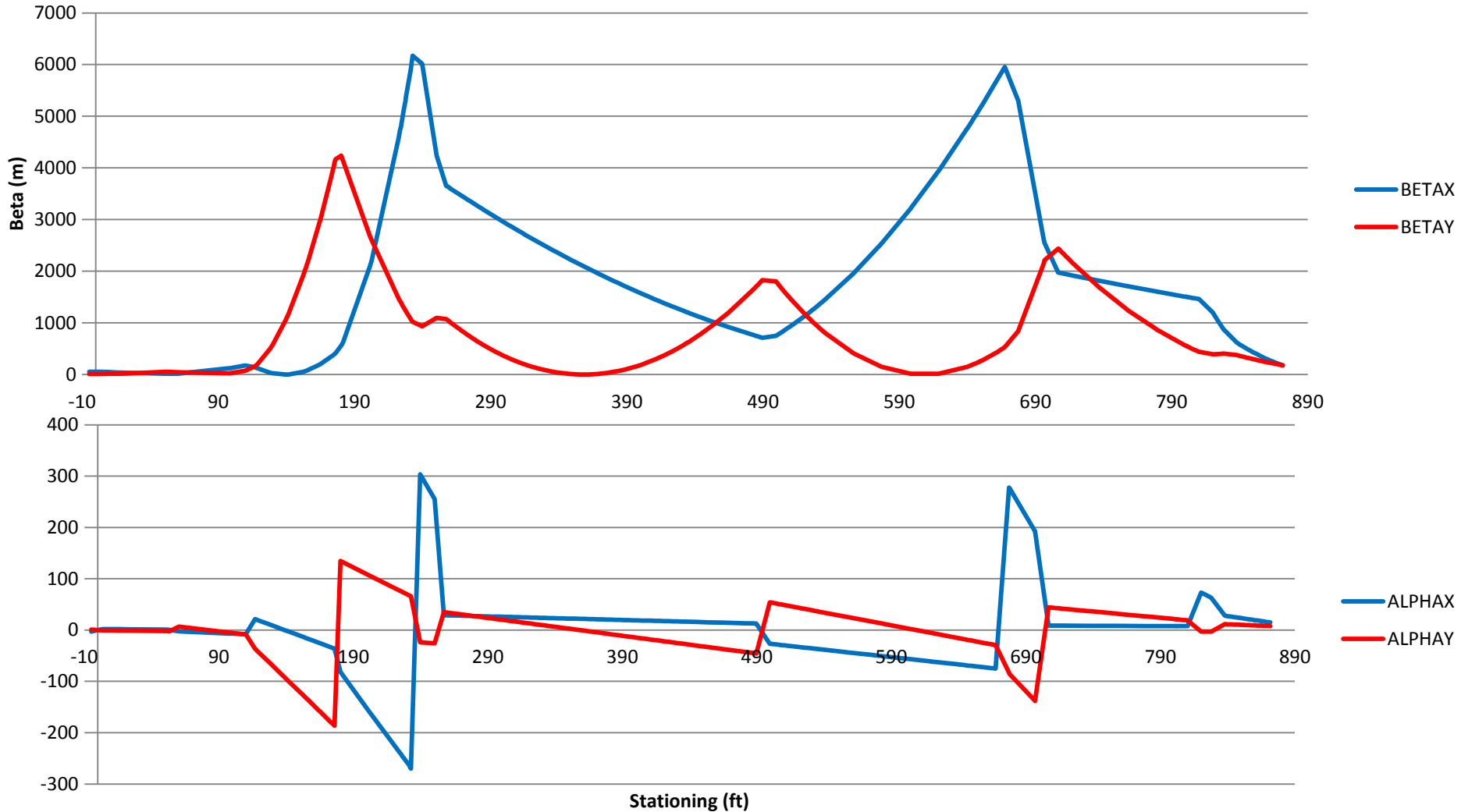
Main Injector Absorber Area



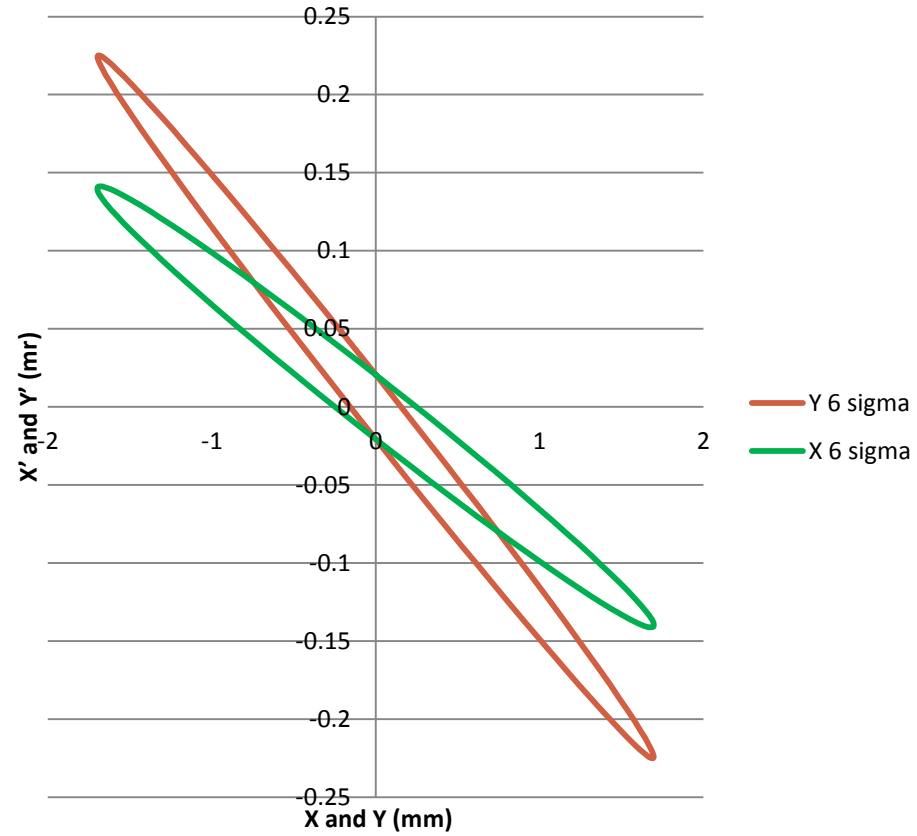
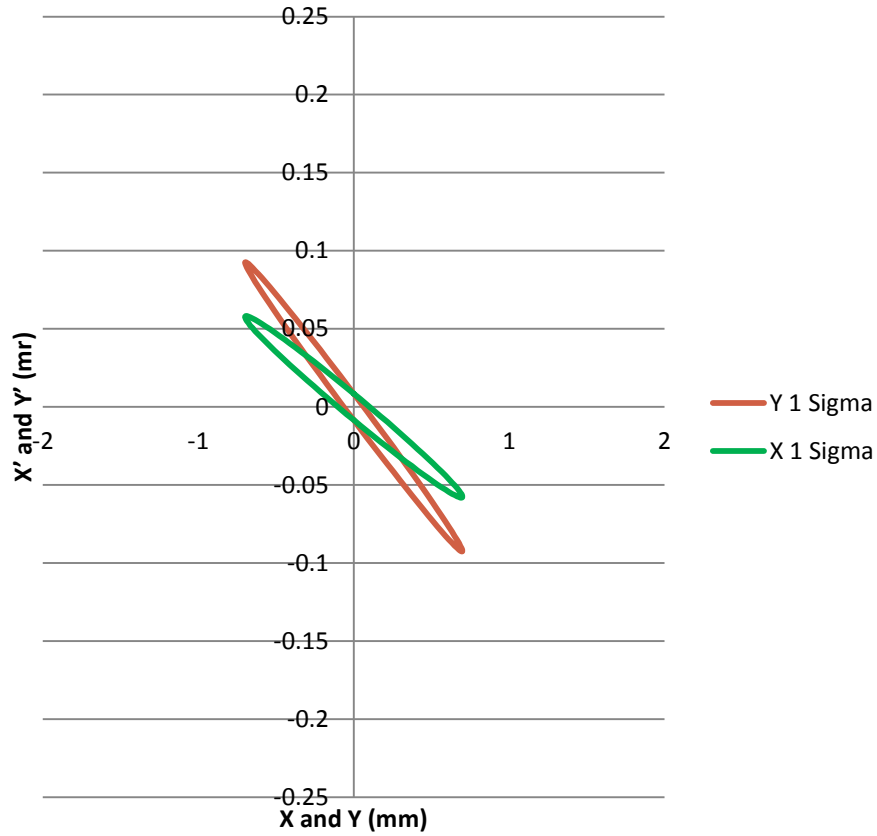
NuStorm Primary Beamline



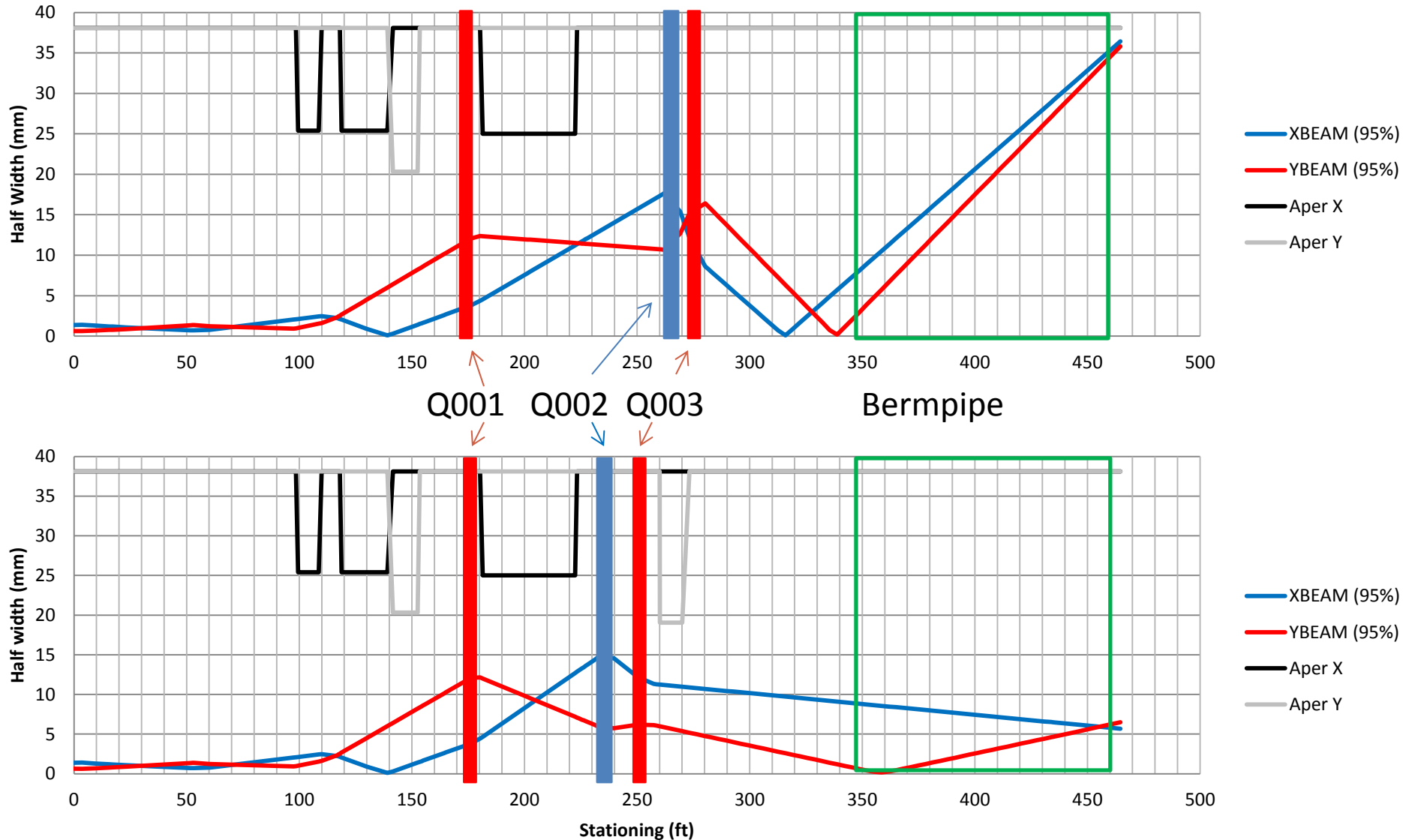
NuStorm Primary Beamline



Beam on Target



MI Abort line Reconfiguration

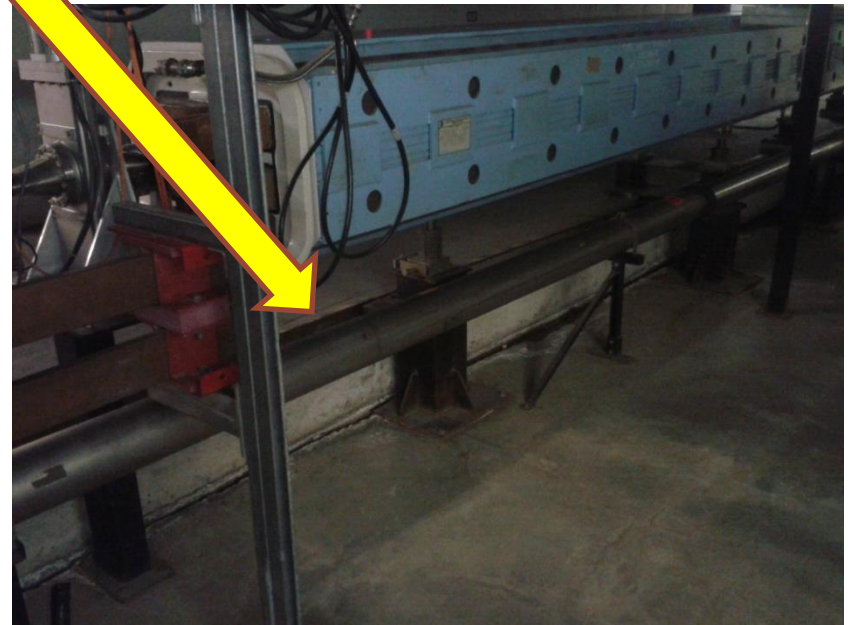


MI Abort line Reconfiguration



Current (Amps)	Present	Future
Q001	2770.5	1883.2
Q002	2828.0	1423.9
Q003	2770.5	853.0

Move Q002 and Q003 upstream by 30' and 23', along with different currents, NS/Abort beam reduces in size through the berrmpipe



Possible MI Capabilities

Find a suitable proton beam
(Energy, pulse length, structure, etc.)

Beam Parameters:

120 GeV/c protons*

1.33 second cycle time**

1.57 μ s pulse length per “batch”

7.0E12 protons per pulse

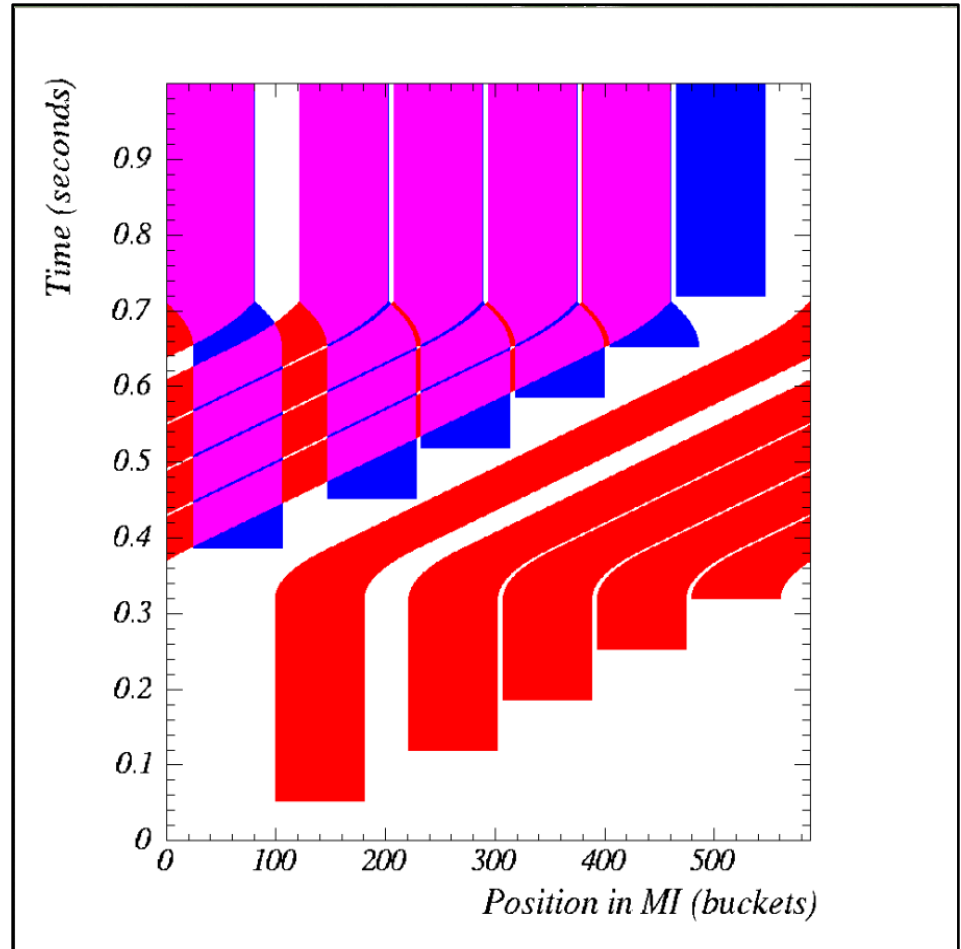
100 kW Beam Power

Available “Now”

Shielded for 400 kW

* Primary Beamline can be converted to 60 GeV/c

** Post 2013 Shutdown

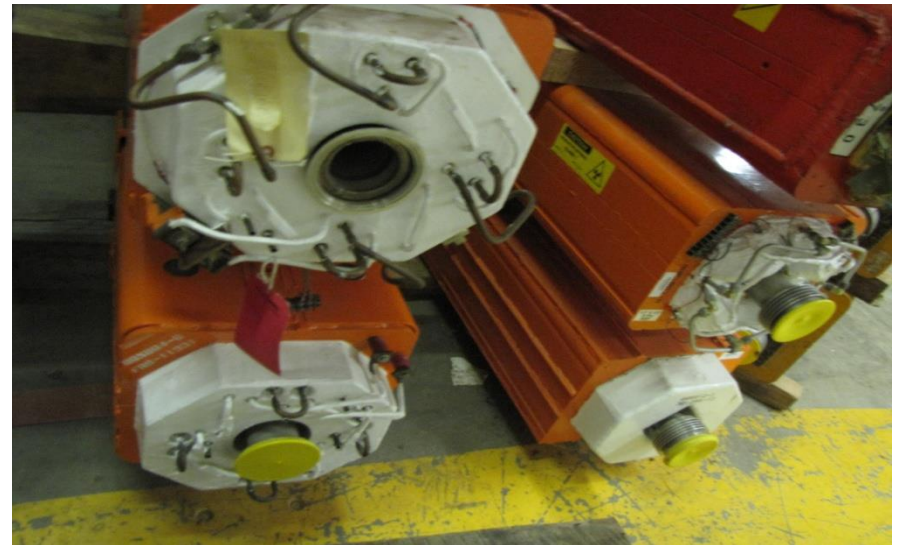


Beamline Components

Cost	Quantity	Cost (\$M)
Dipoles	11	1.10
Quads	5	1.30
Trims	18	0.26
BPMs	12	0.08
Multiwires	11	0.22
Toroids	3	0.06
Enclosure length	432 ft	4.32
Total		7.34
Total x 3.2 (Contingency + Escalation)		23.50

Estimates provided by Fermilab Technical Division Project Coordinator
 Estimates given by Fermilab AD/Instrumentation Dept. for LBNE
 Estimates provided by Fermilab's FESS Engineering
 Estimate based on Project X Management data

Magnet Images



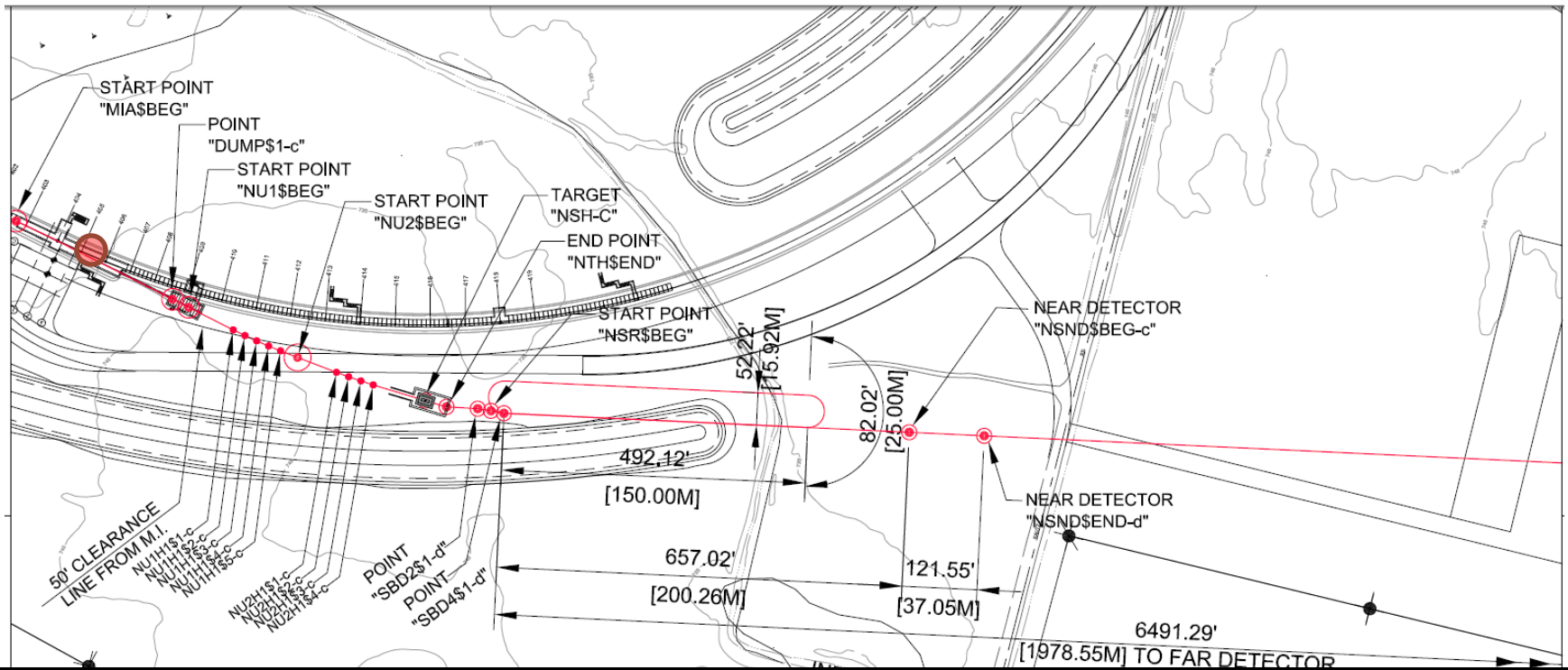
Magnet costs

Escalated values

Magnet style	Series	Date	Escalation	Labor ea	Materials ea	Total ea	Qty	Extended Total	Comment
B2 Dipole	BDM	2008	1.0958	\$ 102,523	\$ 11,287	\$ 113,810	9	\$ 1,024,288	Est for LBNE Job 440: Burn, clean-up, reconstruct
3Q-120	QQQ	2009	1.0711	\$ 90,958	\$ 170,313	\$ 261,271	5	\$ 1,306,356	Est for LBNE Job 465 Build new
EDB	EDBC	2012	1	\$ 5,200	\$ 2,700	\$ 7,900	2	\$ 15,800	Recently rebuilt with PEEK and 4 lg power flags (assumes existing magnet)
IDH	IDH	2004	1.2112	\$ 10,780	\$ 4,481	\$ 15,261	8	\$ 122,089	(23) were built in 2004 Job 188
IDV	IDV	2004	1.2112	\$ 10,780	\$ 5,490	\$ 16,270	8	\$ 130,160	(same as IDH but 22.5% larger M&S)
								\$ 2,598,694	

* Estimates provided by TJ Gardner TD Project Coordinator

Safety Consideration



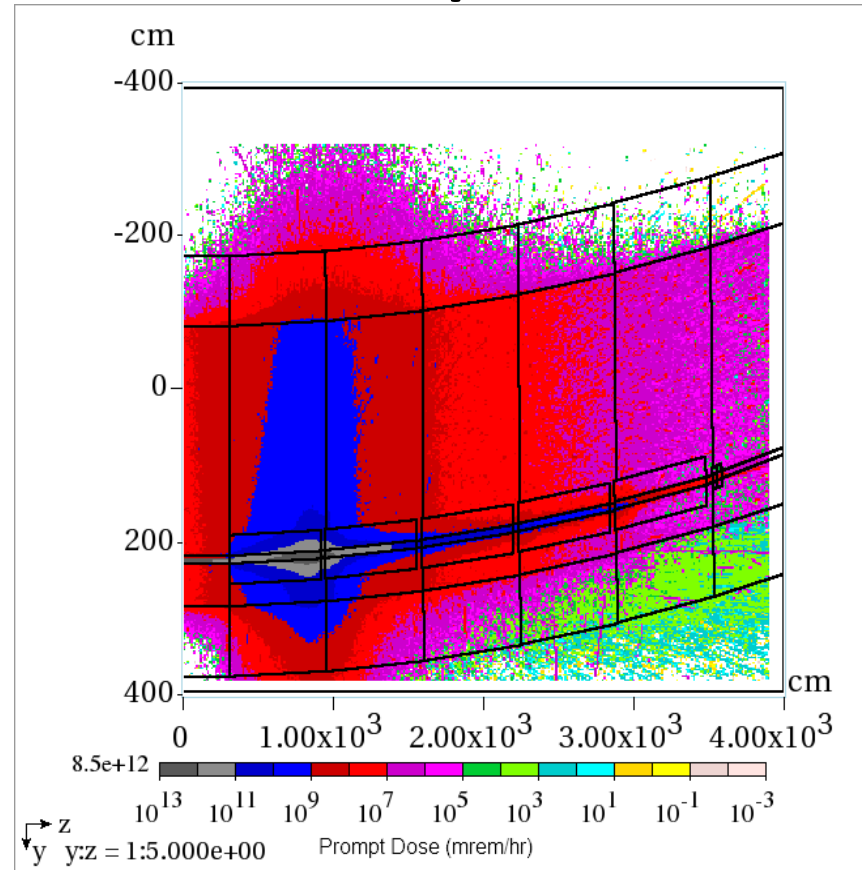
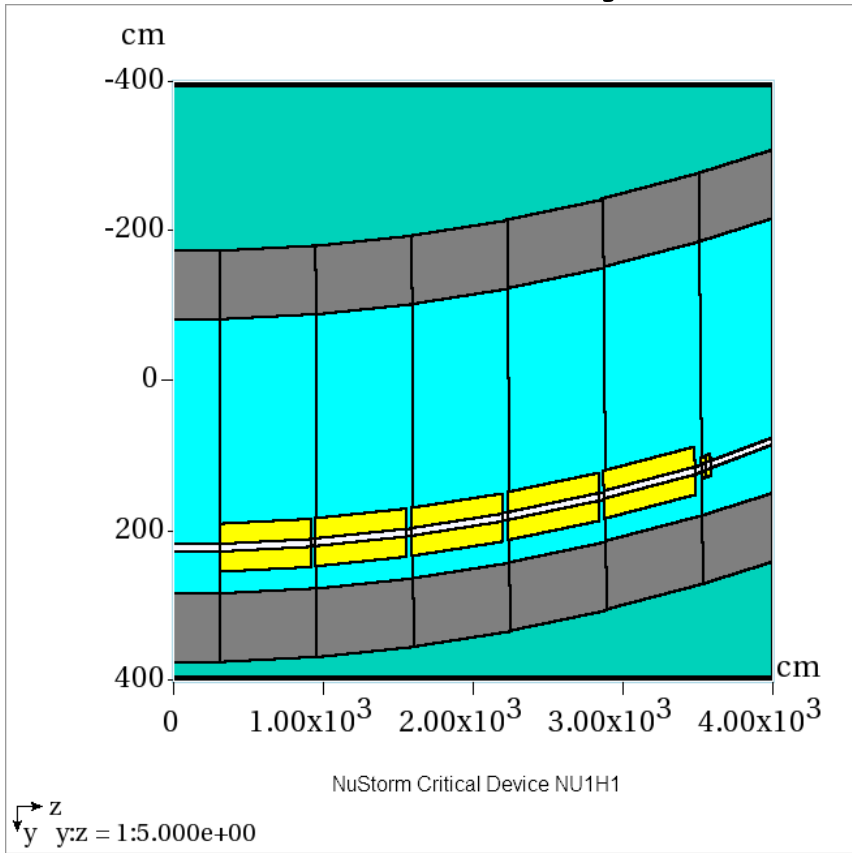
Critical Devices include:

NSHV1- Single EDB magnet bends beam away from MI Absorber to NS notch

NU1H1- 5 B2 magnet string in NU1

Consideration taken: 50' away from MI beamline center offers protection for construction installation and access

Safety Beamline Map



MARS15 simulation run for Critical Device Justification

N.V. Mokhov, "The MARS Code System User's Guide", Fermilab-FN-628 (1995); N.V. Mokhov, O.E. Krivosheev, "MARS Code Status", Proc. Monte Carlo 2000 Conf., p. 943, Lisbon, October 23-26, 2000; Fermilab-Conf-00/181 (2000); N.V. Mokhov, "Status of MARS Code", Fermilab-Conf-03/053 (2003); N.V. Mokhov, K.K. Gudima, C.C. James et al, "Recent Enhancements to the MARS15 Code", Fermilab-Conf-04/053 (2004); <http://www-ap.fnal.gov/MARS/>. MARS was developed in part with Government funding provided under DOE Contract DE - AC02 - 76CH03000.

Thank You

Special thanks to:

Steve Dixon

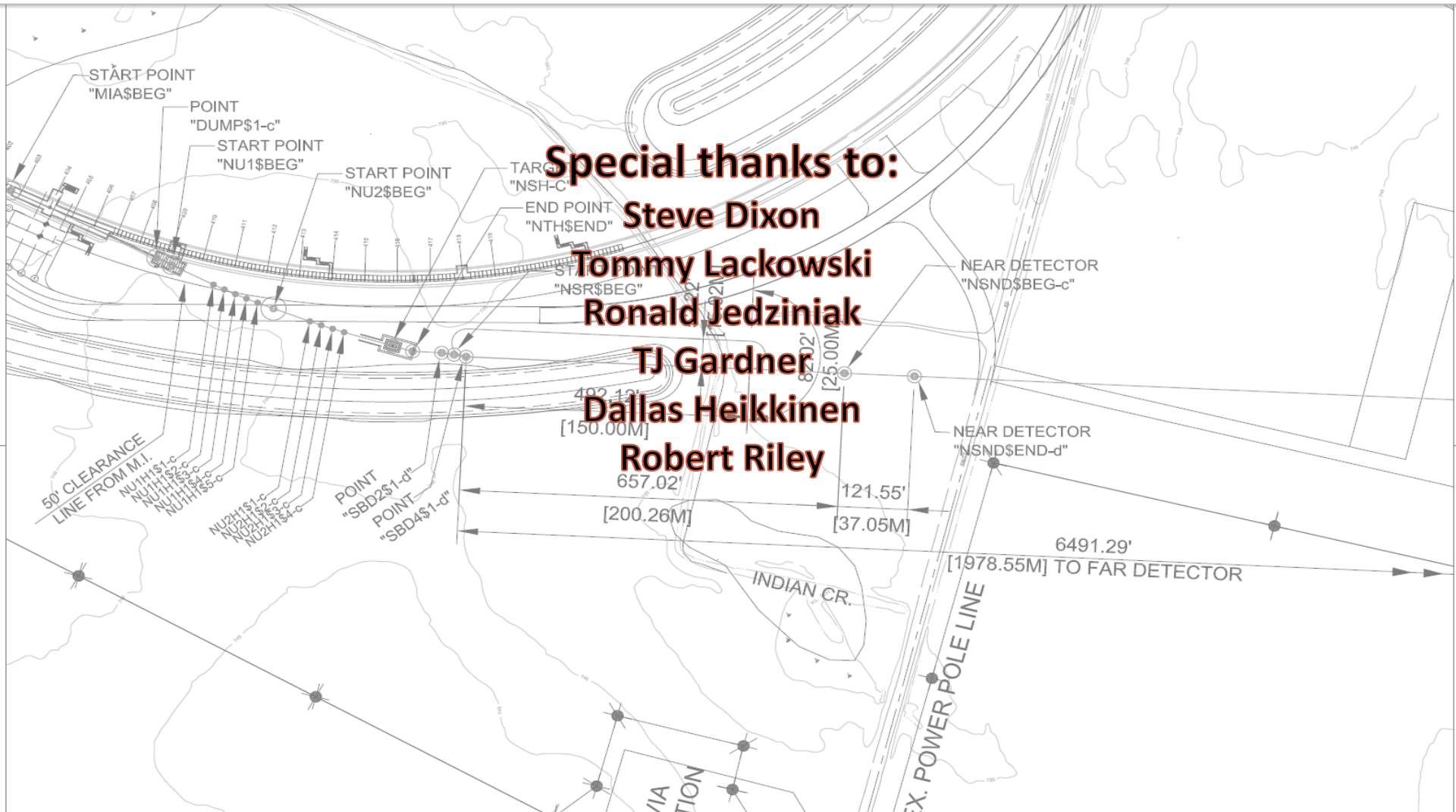
Tommy Lackowski

Ronald Jedziniak

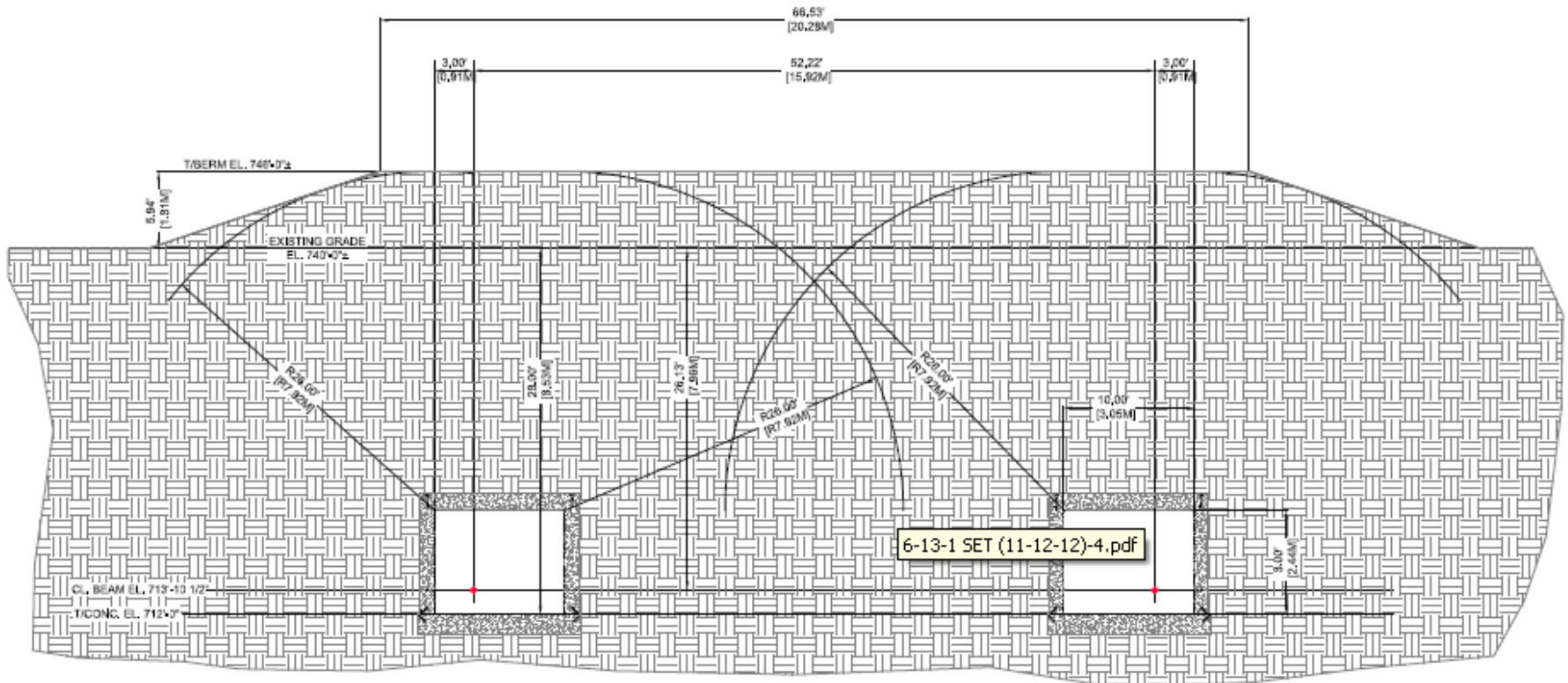
TJ Gardner

Dallas Heikkinen

Robert Riley



Backup Slides



SECTION AT DECAY RING

Backup Slides

