SiD MDI Report

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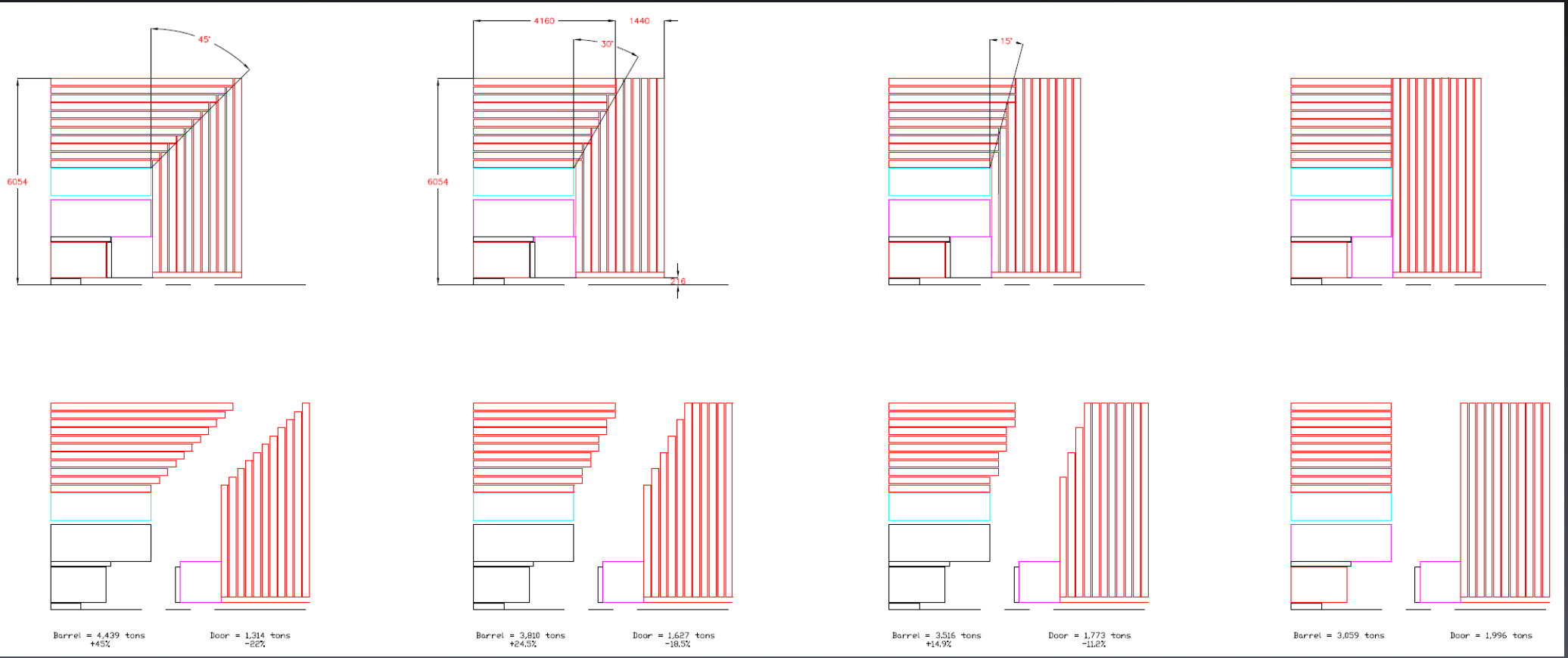
DESY

Changes to SiD

- Changing from Octagon →Dodekagon
  - Driven by Site &Engineering Requirements
- L* Change
  - Moving from 3.5 m to 4.1 m
  - Driven by ADI (Common L*) and ILD (too big to shrink further)
- HCAL
  - Switching from RPC-DHCAL to SiPM-Scintillator HCAL
  - Driven by Performance and System considerations

Barrel-Door Partitions



45 deg
Heaviest Barrel
Lightest Doors

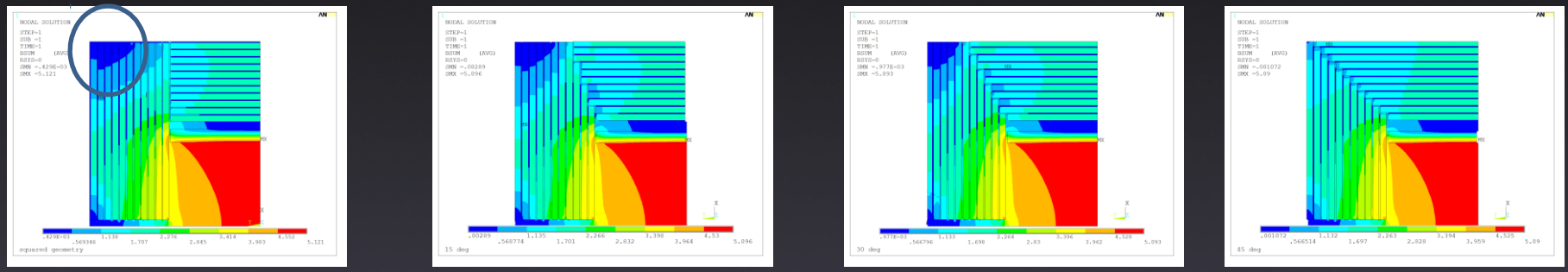
30 deg
Barrel < 4000 t
but will need 5kT
gantry

15 deg

0 deg
Baseline

B Field – 11 plates, each 200 mm thick

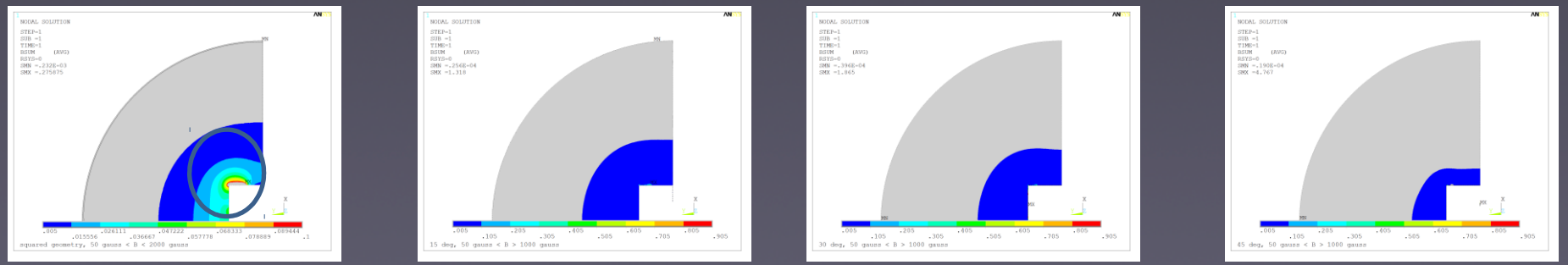
0° Baseline | 15° | 30° | 45°



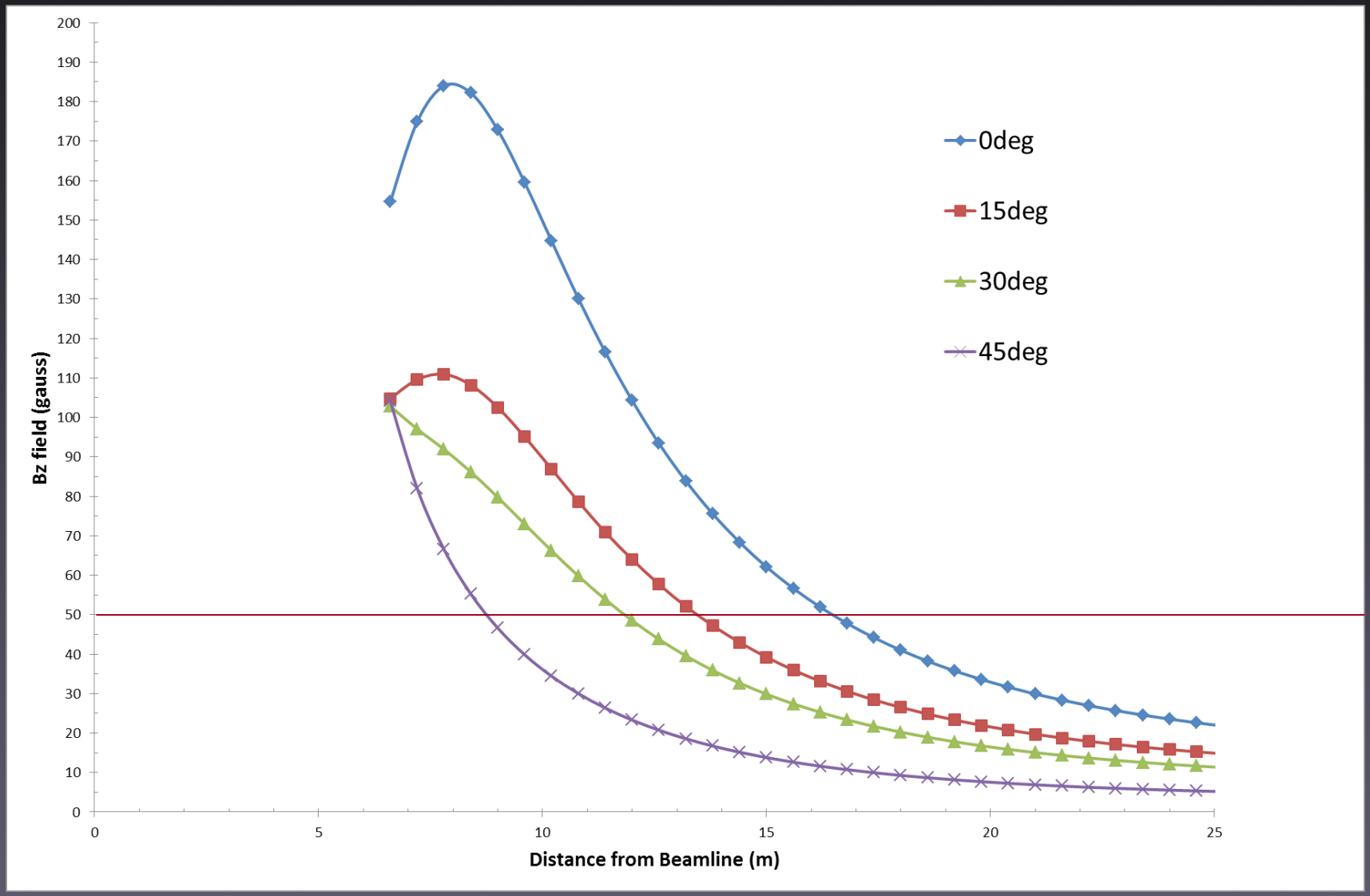
Red=5.1 Tesla; Blue=4.3Gauss: More efficient use of iron at 45°

Red=1kG; Blue=50 Gauss; Gray ends at 30m:

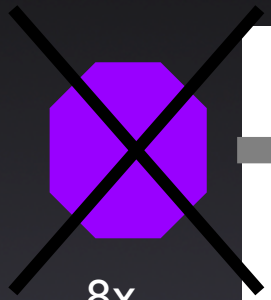
- 50G fringe field extends less
- Lower field on surface of yoke where electronics will reside as interface goes from 0 to 45°

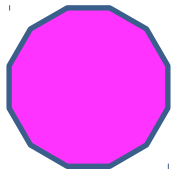


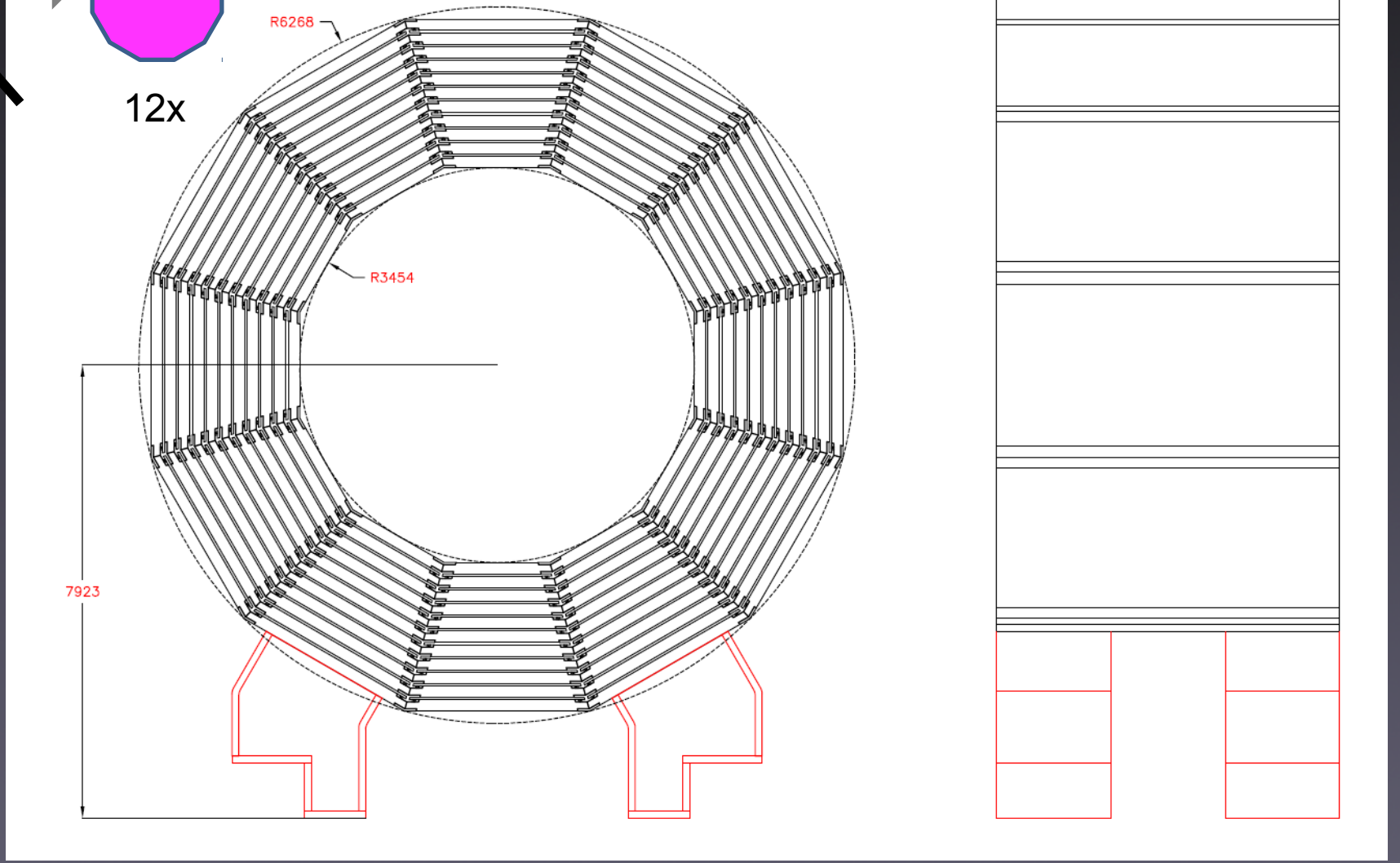
Bz- Outside Detector at z=0 – 11 plate yoke



New Iron Design – Higher Phi segmentation

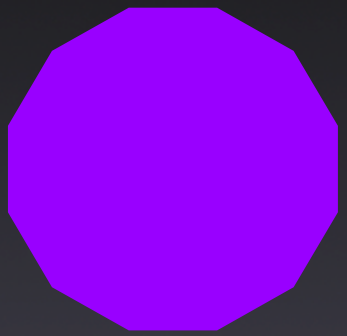






All Plates < 30 t in 12 Sided Design

				R (m)	Width (mm)	Weight (tons)	Accrued Sector Weight	Accrued Barrel Weight
L	5900		Plate 1	3454	1851	17	17	204
Thickness	200		Plate 2	3694	1980	18	35	423
Gap	40		Plate 3	3934	2108	19	55	656
			Plate 4	4174	2237	21	75	903
			Plate 5	4414	2365	22	97	1164
			Plate 6	4654	2494	23	120	1440
			Plate 7	4894	2623	24	144	1729
			Plate 8	5134	2751	25	169	2033
			Plate 9	5374	2880	27	196	2351
			Plate 10	5614	3009	28	224	2684
			Plate 11	5854	3137	29	253	3030



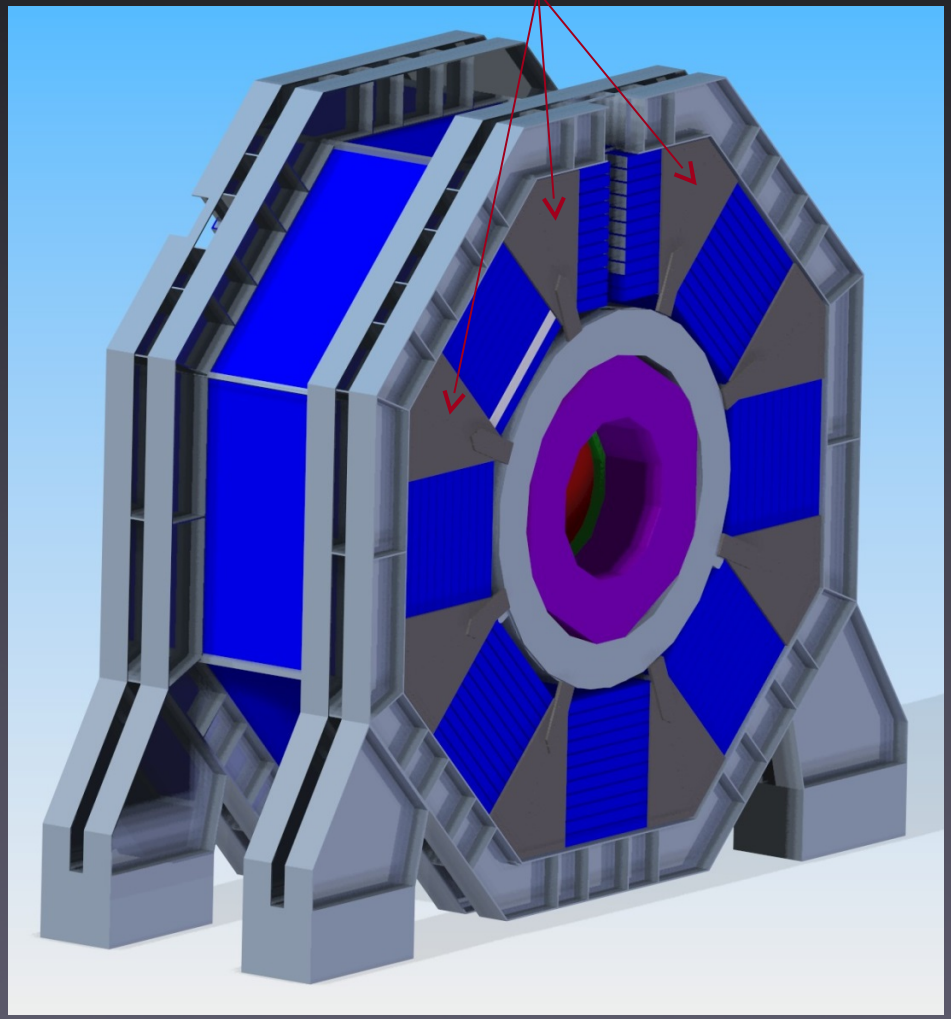
12 edges

				R (m)	Width (mm)	Weight (tons)	Accrued Sector Weight	Accrued Barrel Weight
L	5900		Plate 1	3454	2861	26	26	211
Thickness	200		Plate 2	3694	3060	28	55	436
Gap	40		Plate 3	3934	3259	30	84	676
			Plate 4	4174	3458	32	116	931
			Plate 5	4414	3657	34	150	1200
			Plate 6	4654	3855	35	185	1484
			Plate 7	4894	4054	37	223	1782
			Plate 8	5134	4253	39	262	2095
			Plate 9	5374	4452	41	303	2423
			Plate 10	5614	4651	43	346	2766
			Plate 11	5854	4850	45	390	3123

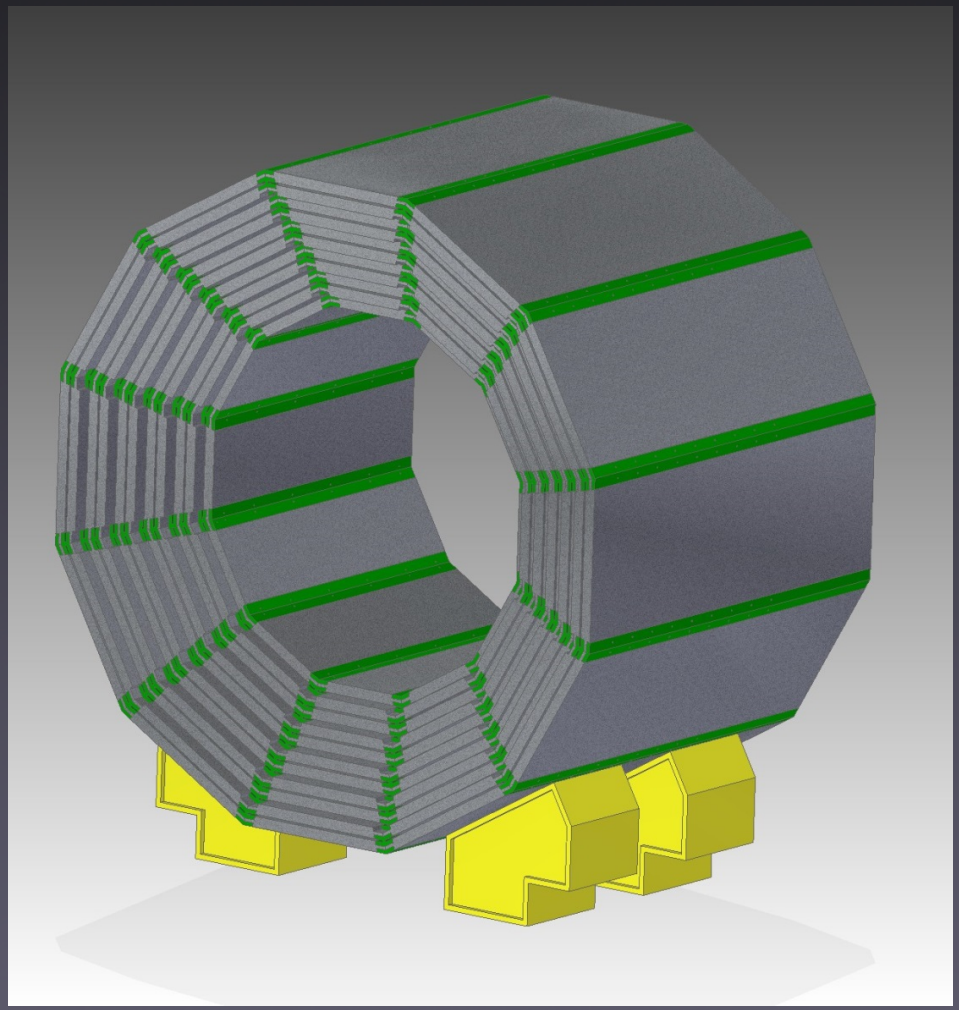
8 edges

Feet Instead of Arches
Edge-Edge Connectors in Phi to Handle Changing Plate Lengths

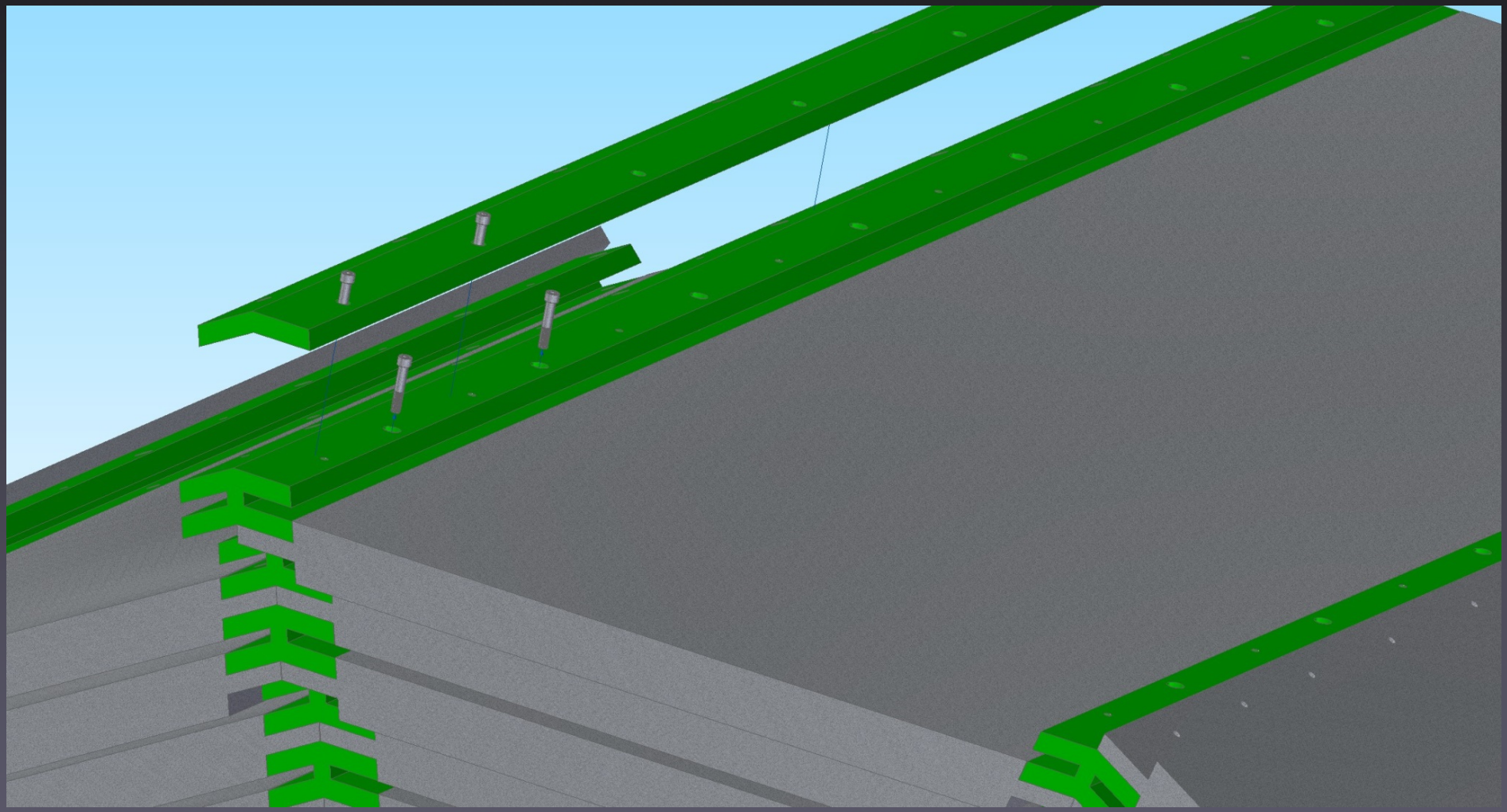
DBD Arches with Plates Joining Layers



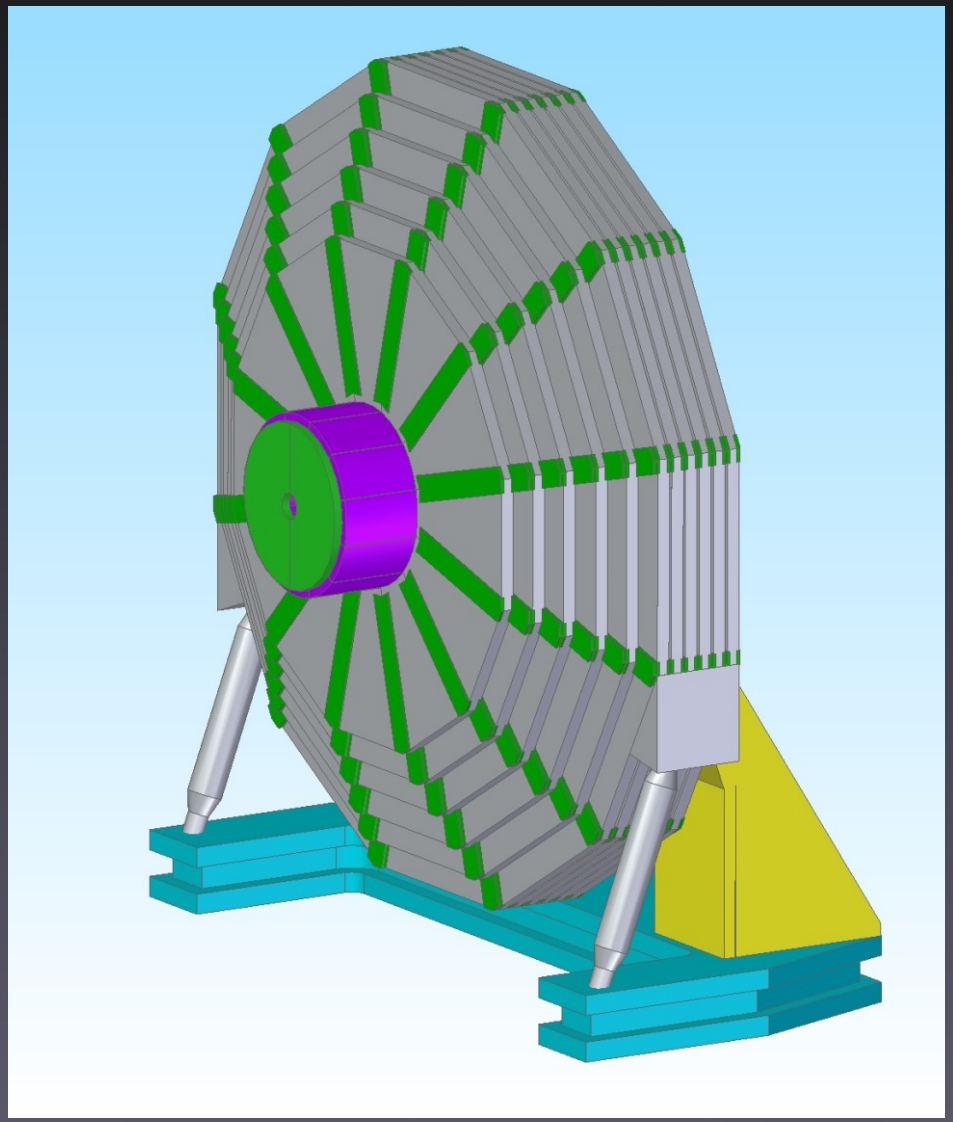
Support Feet & Plates with Connectors

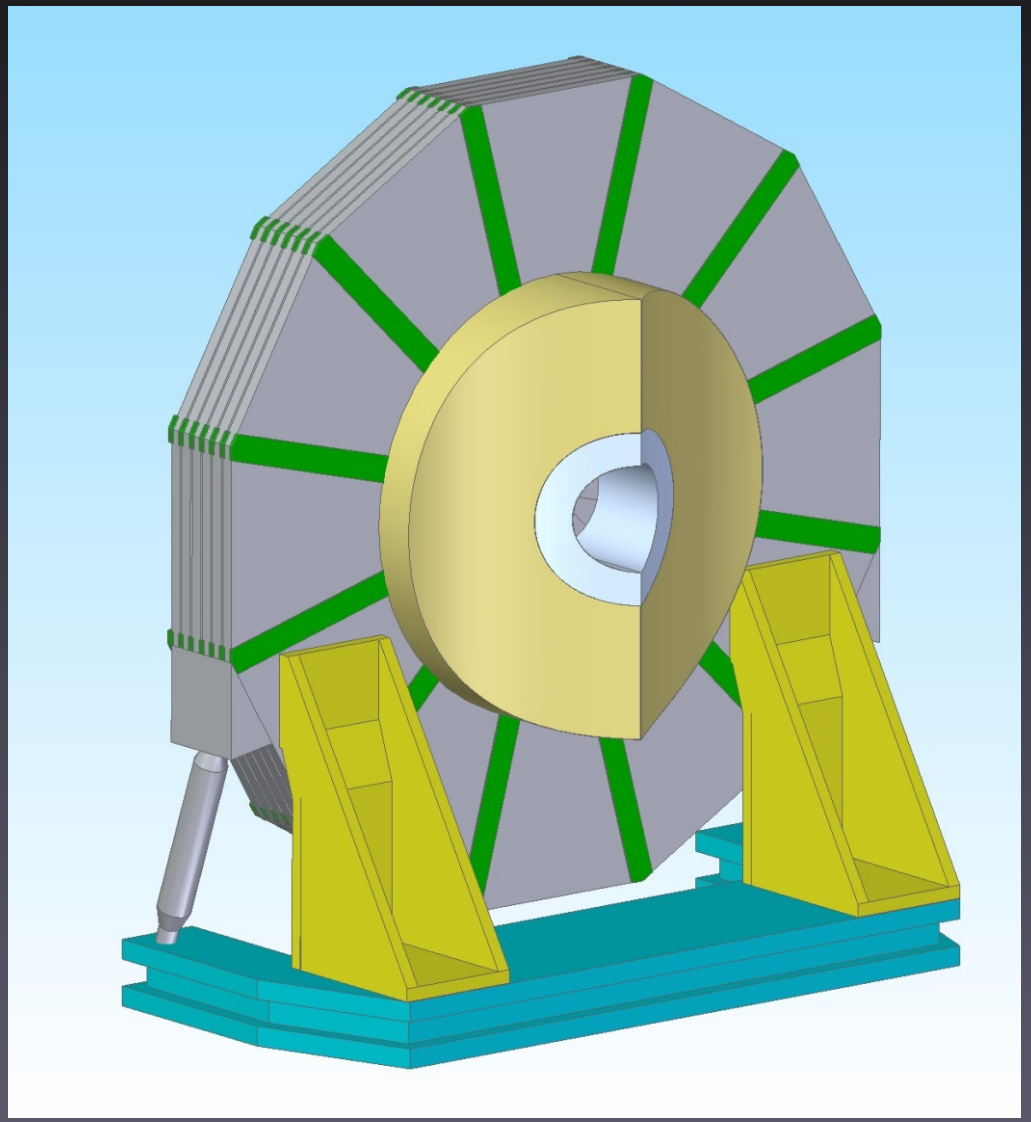


Connector Detail

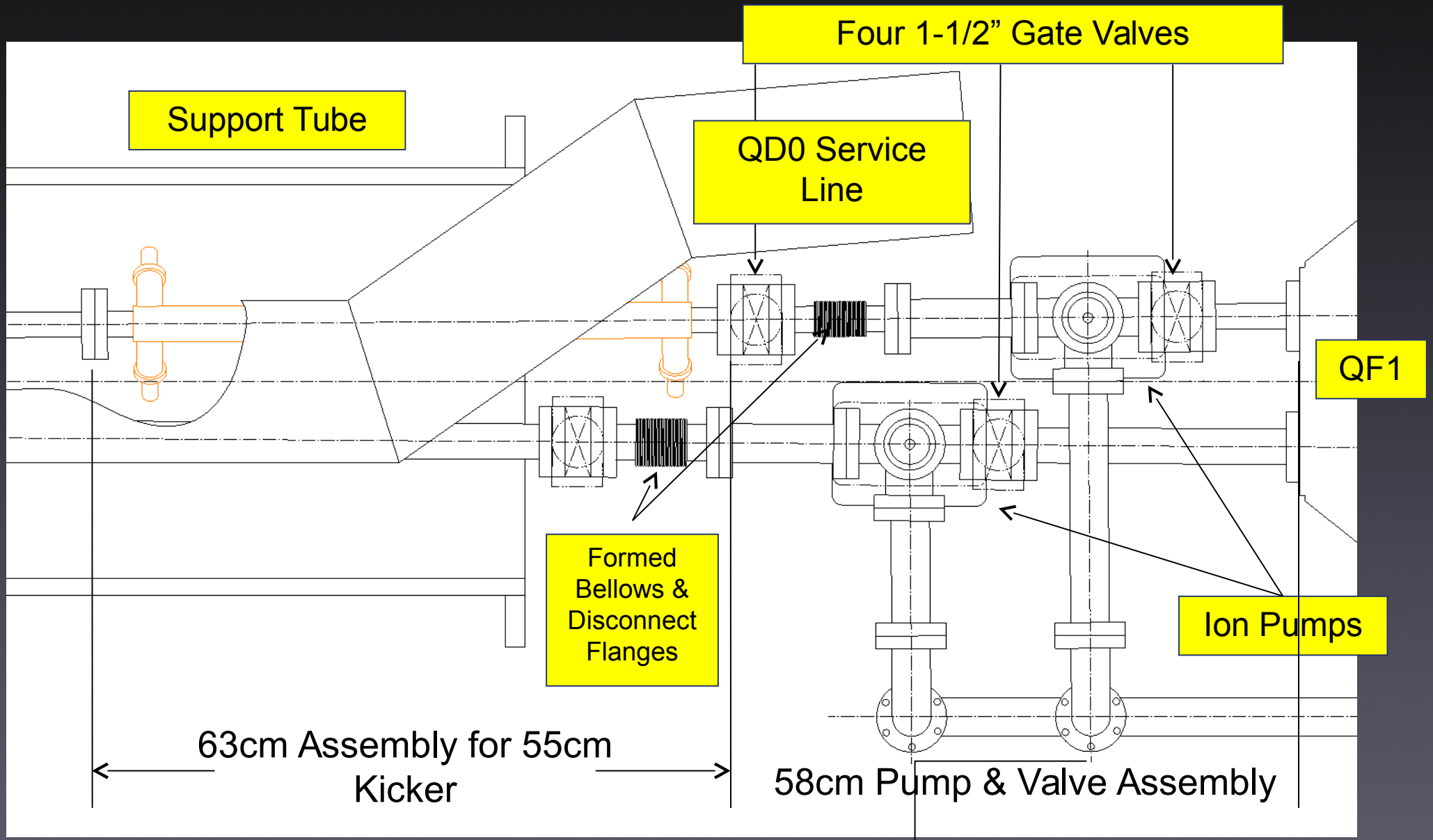


Doors with New Supports and Interplate Connectors

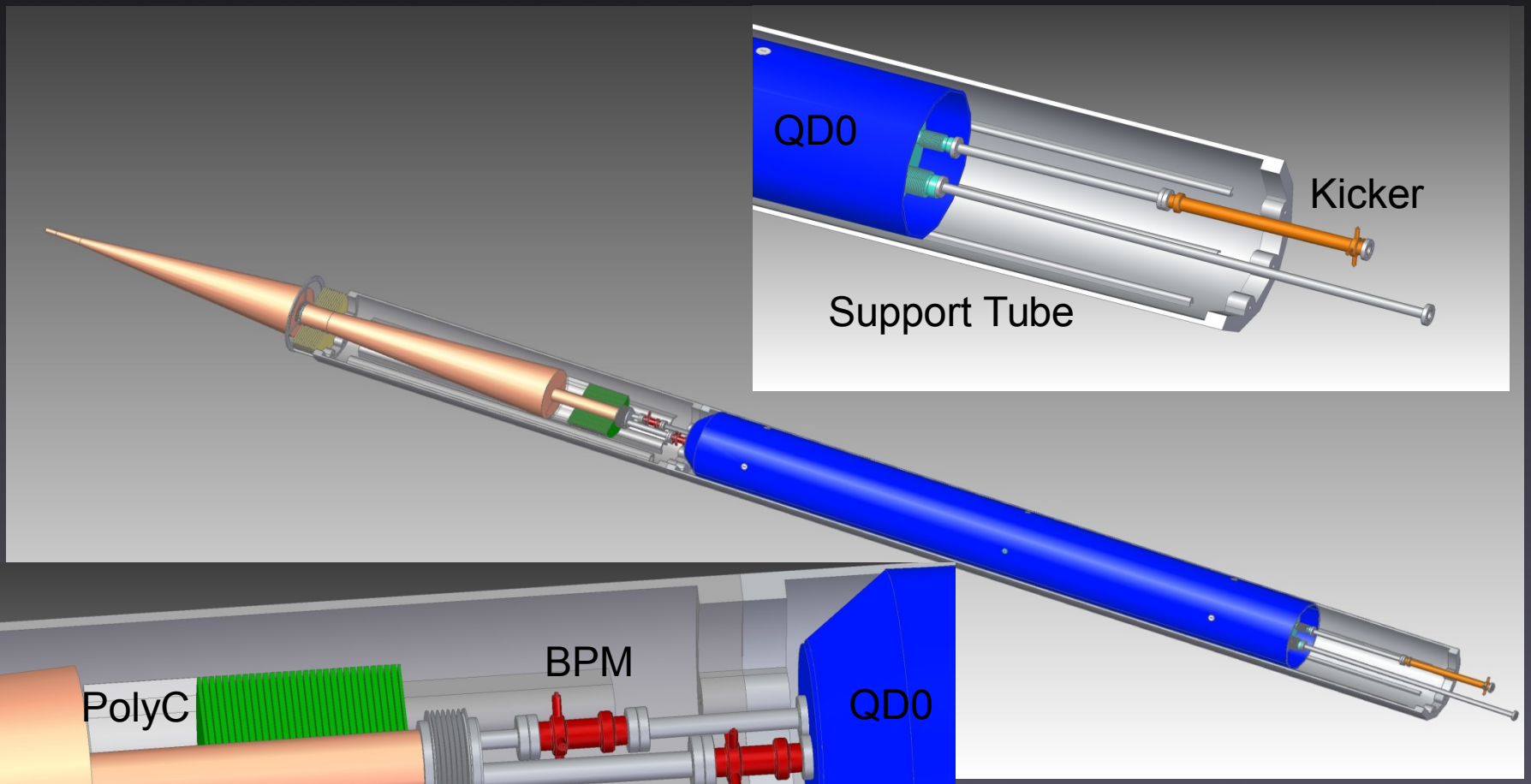


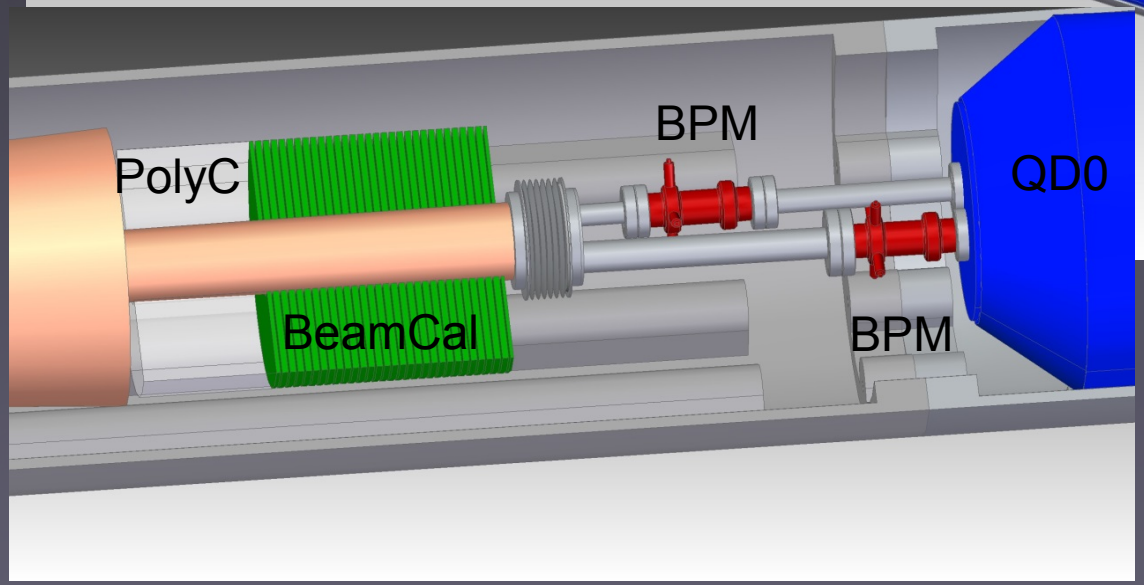


Backend Services Needed for Either L*

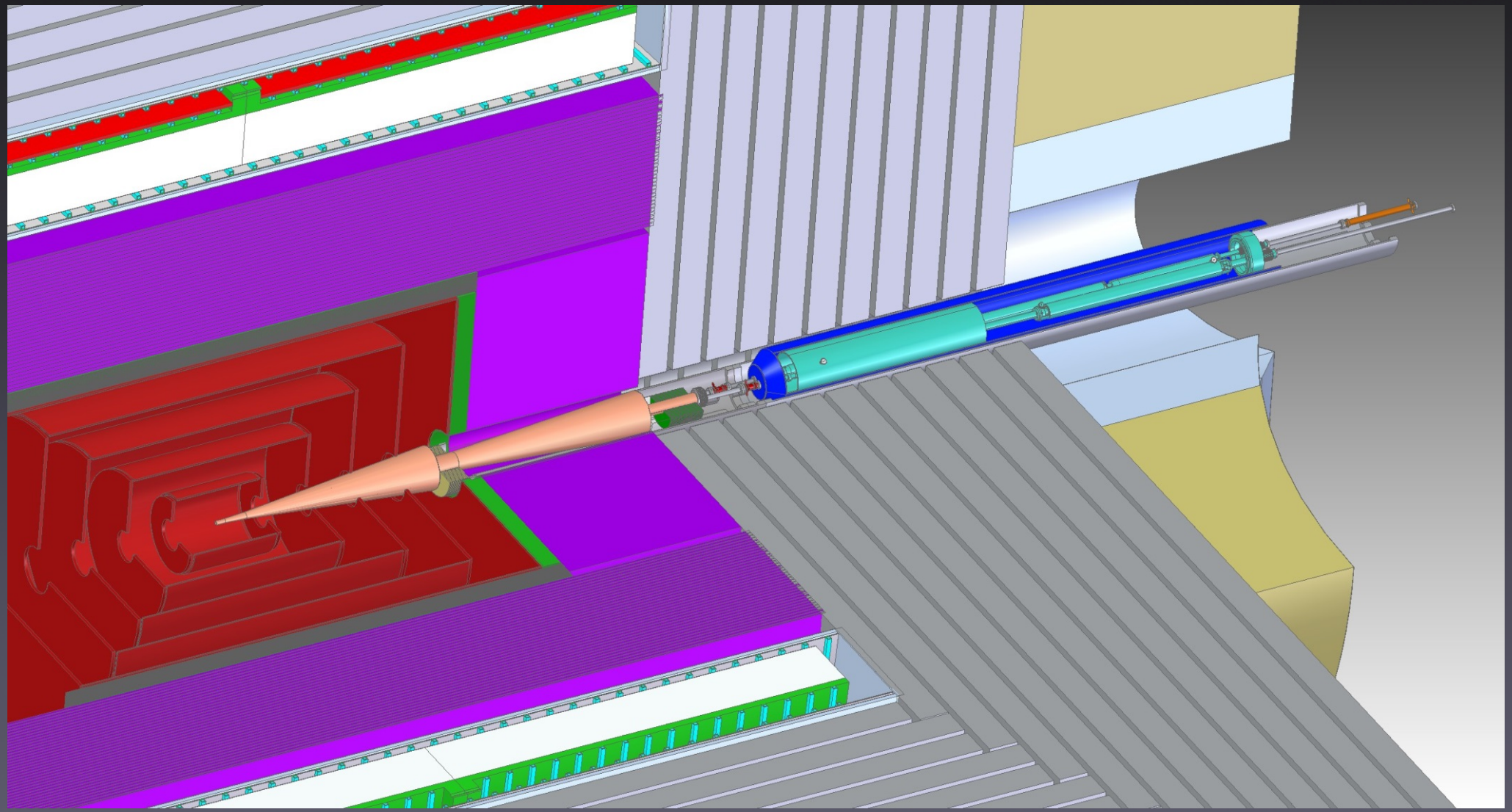


New 4.1m Layout in 3D





Isometric View

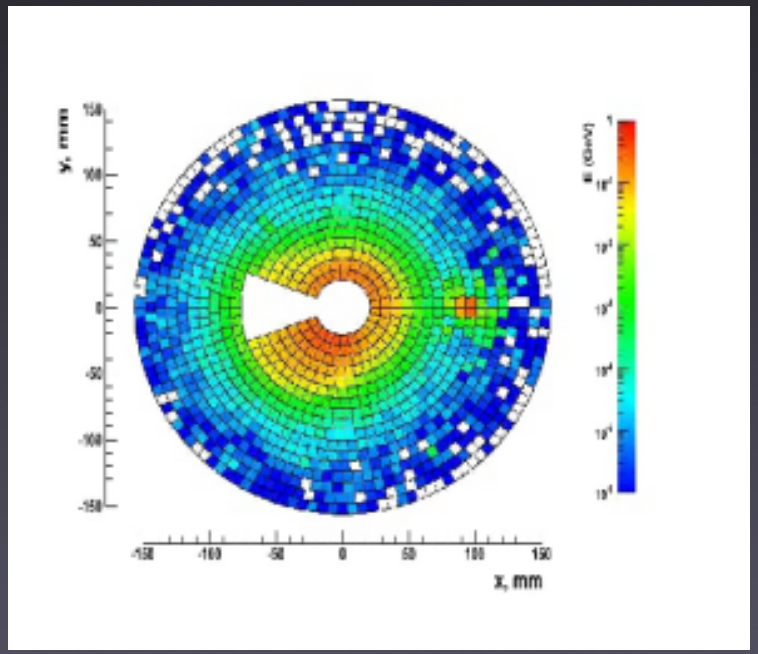


Other studies

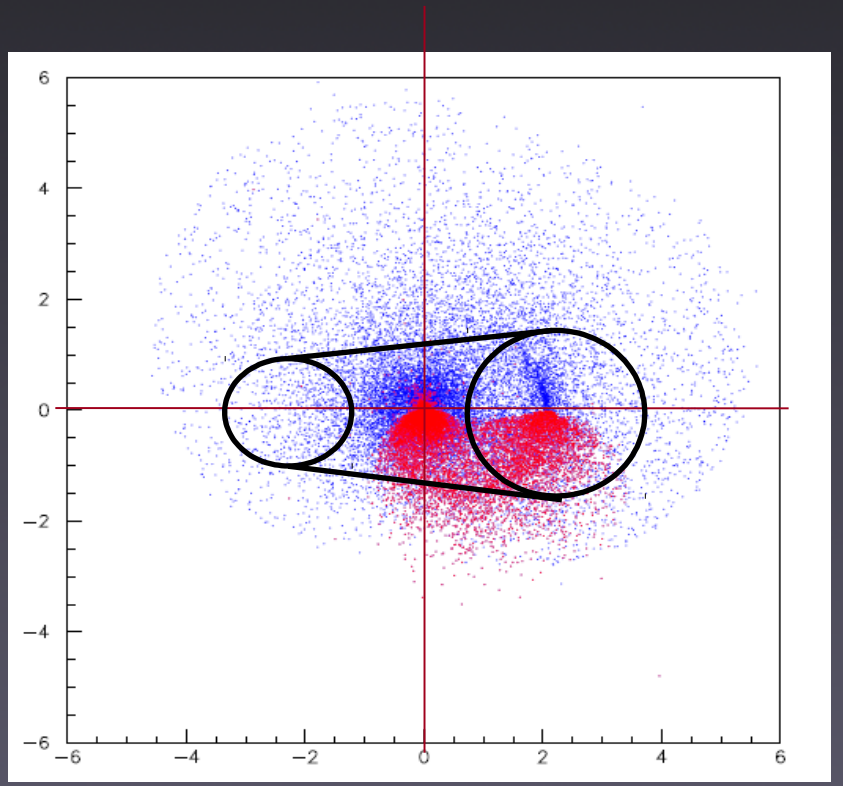
- Beam Pipe Studies
  - Ongoing
- Pair Backgrounds
  - Concluding and write & Up
- Muon Backgrounds
  - Just started

Proposed BeamCal Beampipe

ILD BeamCal Beampipe

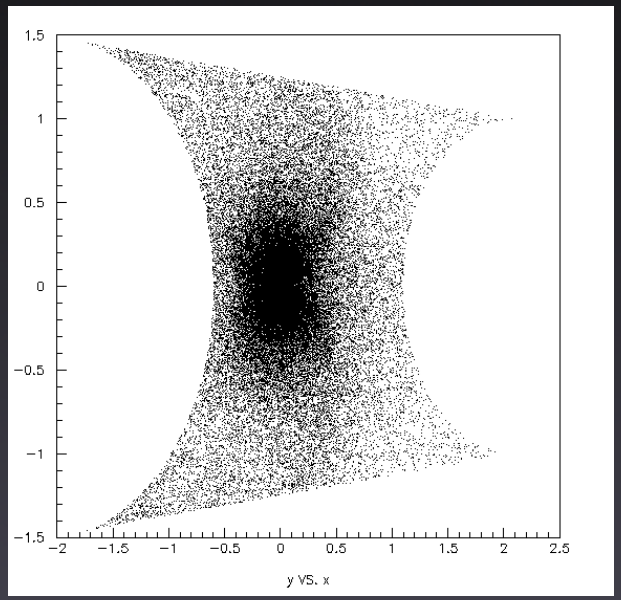


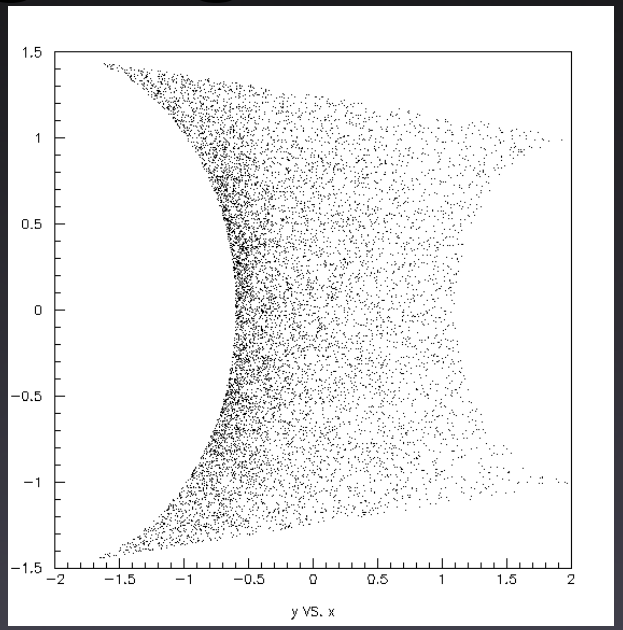
Proposed SiD BeamCal Beampipe



Do We Really Need a Anti-DID Coil Hits in the Plug Region

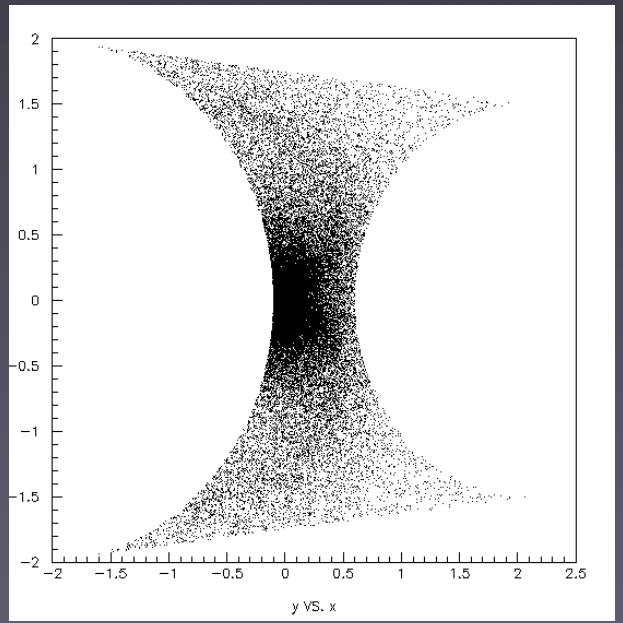
AntiDID OFF 15,10mm

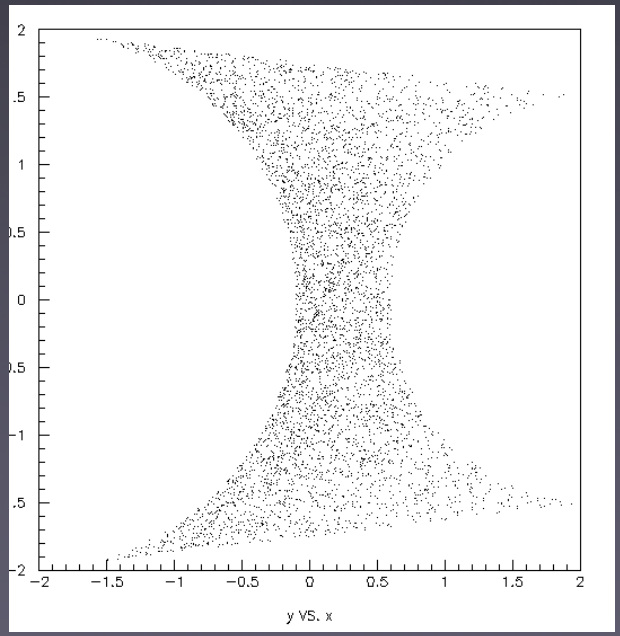




AntiDID ON 15,10mm

AntiDID OFF 20,15mm



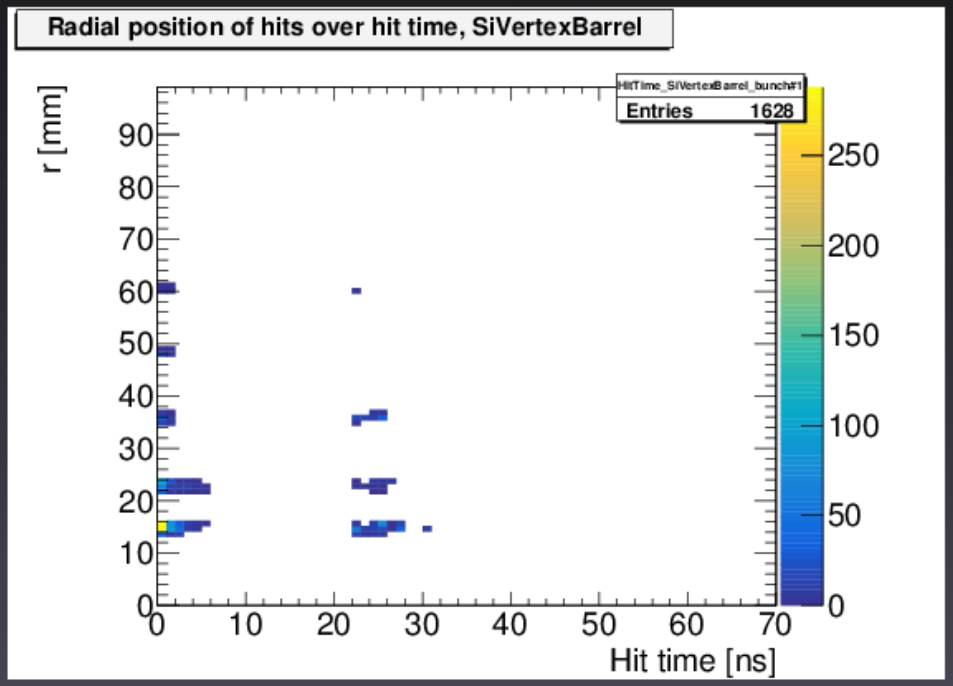


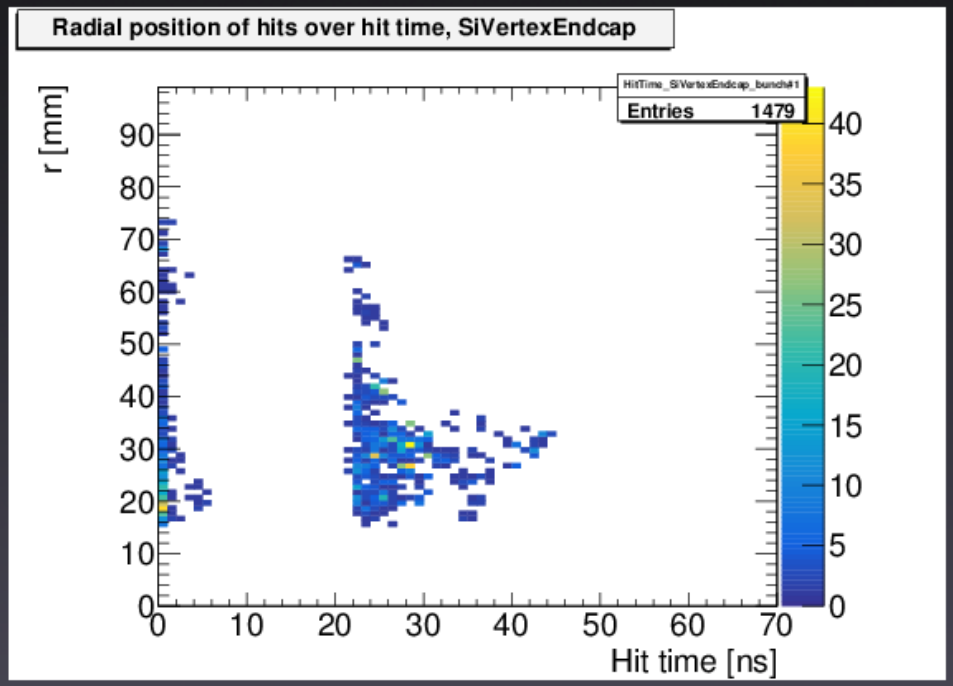
AntiDID ON 20,15mm

Current Status

- In terms of backgrounds in the BeamCaL
  - Elimination of DID & Plug
- Backgrounds in the Vertex Detector
  - Eliminate DID
- Impact on physics
  - Re-studying this
  - Significant loss of acceptance for certain SUSY processes

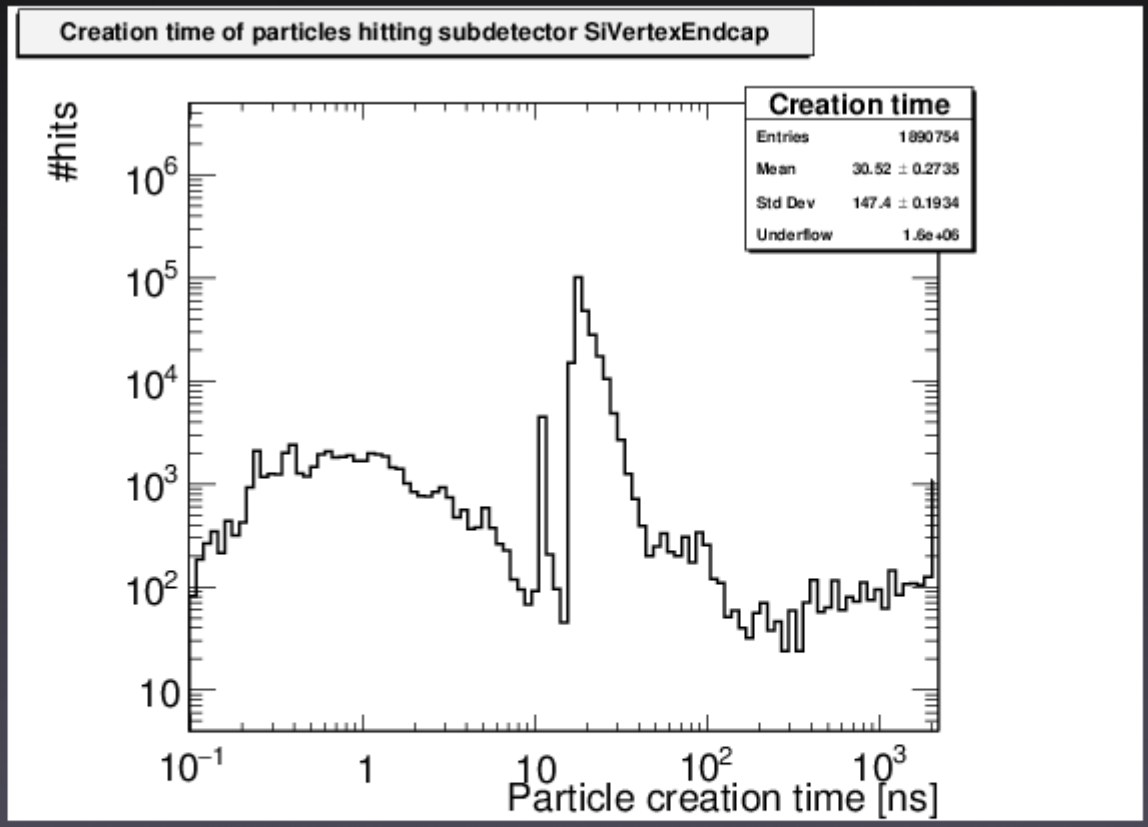
Pair Backgrounds





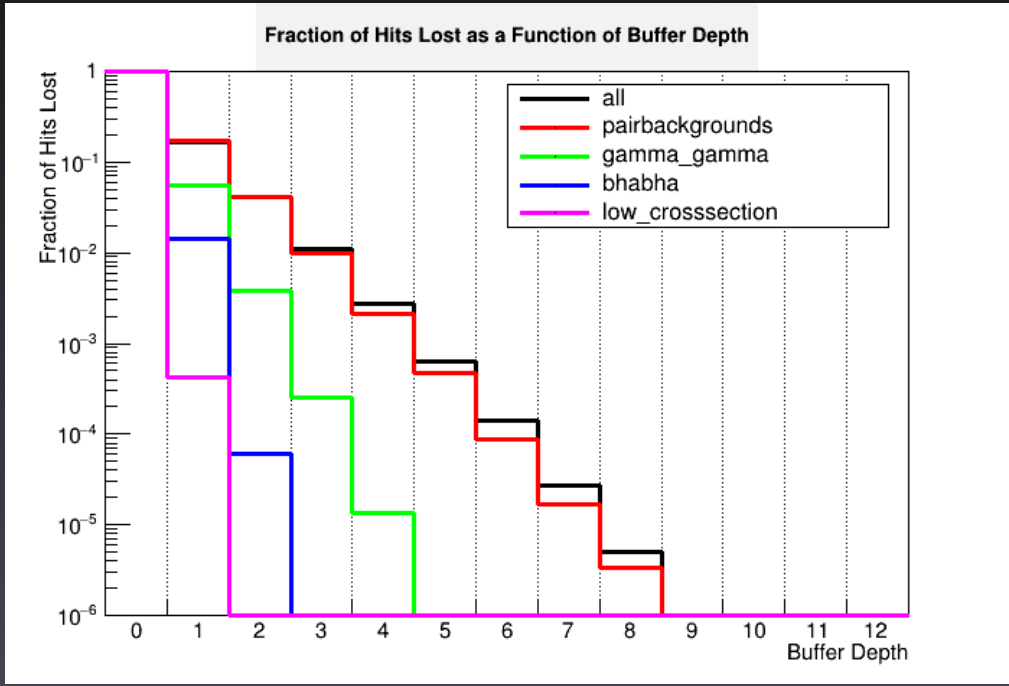
- The time distribution of the hits from the pair background in the vertex detector suggests a reduction of background by applying electronic/digital time gates.

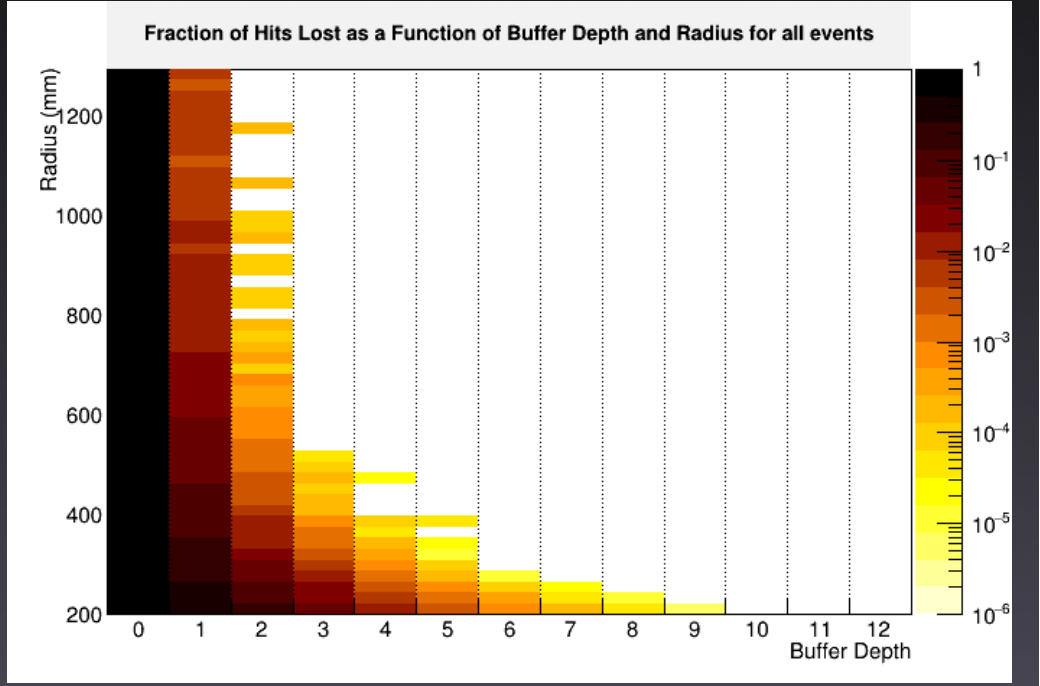
Time distribution of hits in the Vertex Detector



- The distribution of the creation time of particles hitting the vertex end-caps and arising from the pair background shows that about 15% of the pair background is not created instantaneously at the time of the bunch crossing!

Buffer Usage

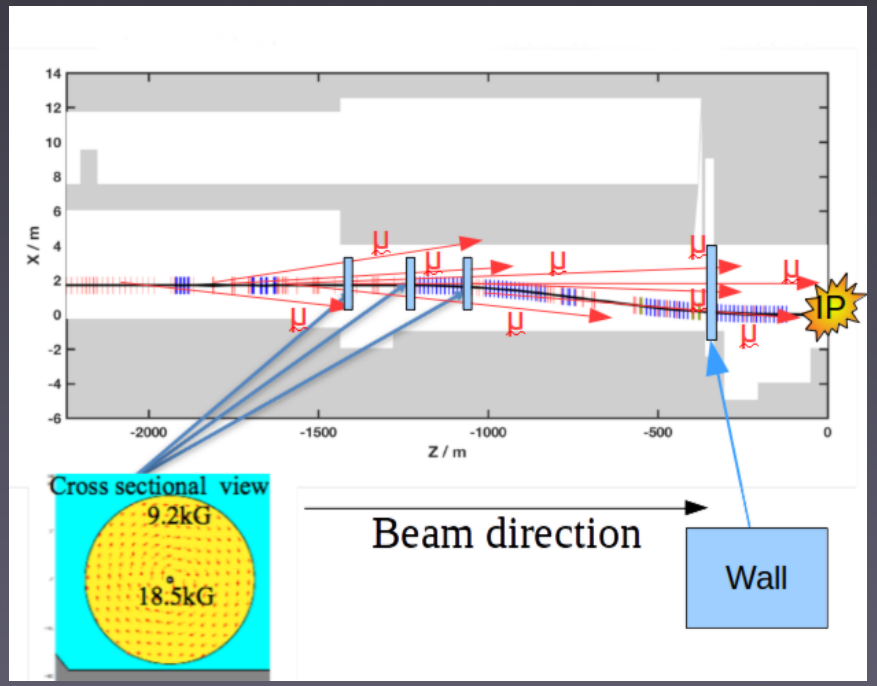


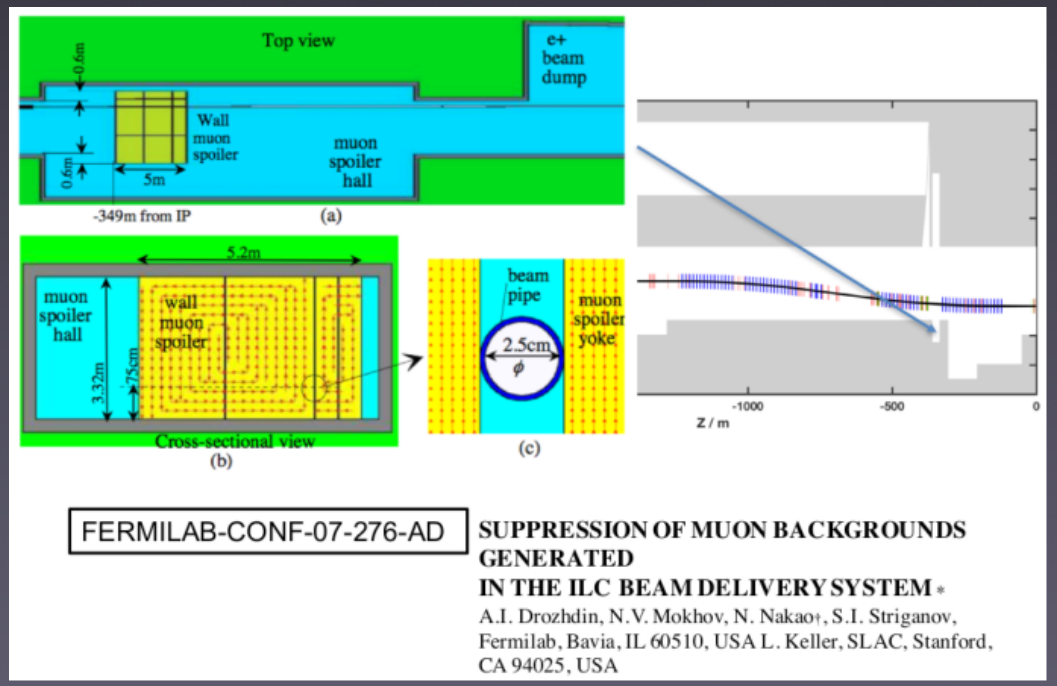


- The pair background dominates the FCAL occupancy.
  - The study of the dependence of the fractional loss of hits on the buffer depth and the transverse distance from the beam line shows that six buffers in the kPiX would reduce the fractional hit loss to below10−3 at any radius.

Muon Spoiler Scenarios

- To stop the muons from reaching the IR, there are two spoiler scenarios under discussion:
  - 3 donut spoilers (magnetized iron (~10-19 kG), 70 cm radius, 5 m long)
  - 3 donut spoilers + Wall (magnetized iron (~16 kG), 5 m x 3 m, 5 m long)





FERMILAB-CONF-07-276-AD

SUPPRESSION OF MUON BACKGROUNDS GENERATED IN THE ILC BEAM DELIVERY SYSTEM*

A.I. Drozhdin, N.V. Mokhov, N. Nakao†, S.I. Striganov, Fermilab, Batavia, IL 60510, USA L. Keller, SLAC, Stanford, CA 94025, USA

MuCarlo Overview

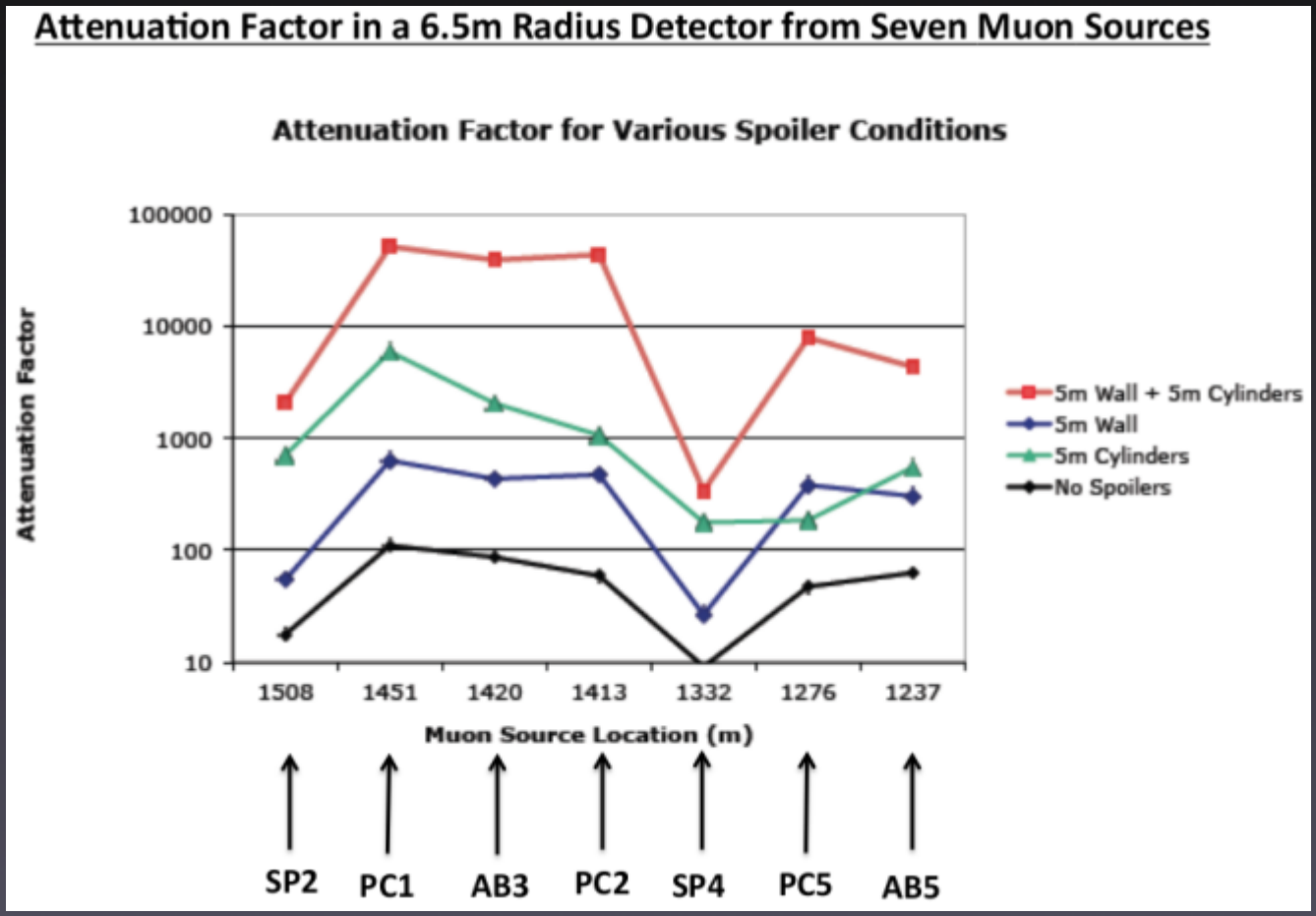
- BDS backgrounds with muon collimation system modelled with MUCARLO [Lewis Keller, SLAC] and Geant4 [Glen White,SLAC]
- Halo particle tracking:
  - Turtle with MUCARLO
  - Lucretia with a built-in Geant4 model interface
- Using TDR baseline machine parameters for the ILC500
- Muon production processes:
  - Predominantly: Bethe-Heitler process: $\gamma + A \rightarrow A' + \mu^+ \mu^-$
  - Few % level: direct annihilation of positrons with atomic electrons: $e^+ e^- \rightarrow \mu^+ \mu^-$
- Files with the 4-vectors of the muons from the spoilers were provided to the SiD and ILD groups.
- TASK: Do we need the muon wall at all?!

Muons in the Detector

Tunnel Condition	#/bunch in 6.5m radius detector	#/200 bunches in 2.5m radius TPC
1. No spoilers	138	9648
2. Two 5m magnetized spoilers (z = 344-349m) fill tunnel	25	1008
3. Three 5m toroid spoilers	3.3	273
4. Three 5m toroid spoilers and two 5m spoilers (z = 344-349m) fill tunnel	0.5	17

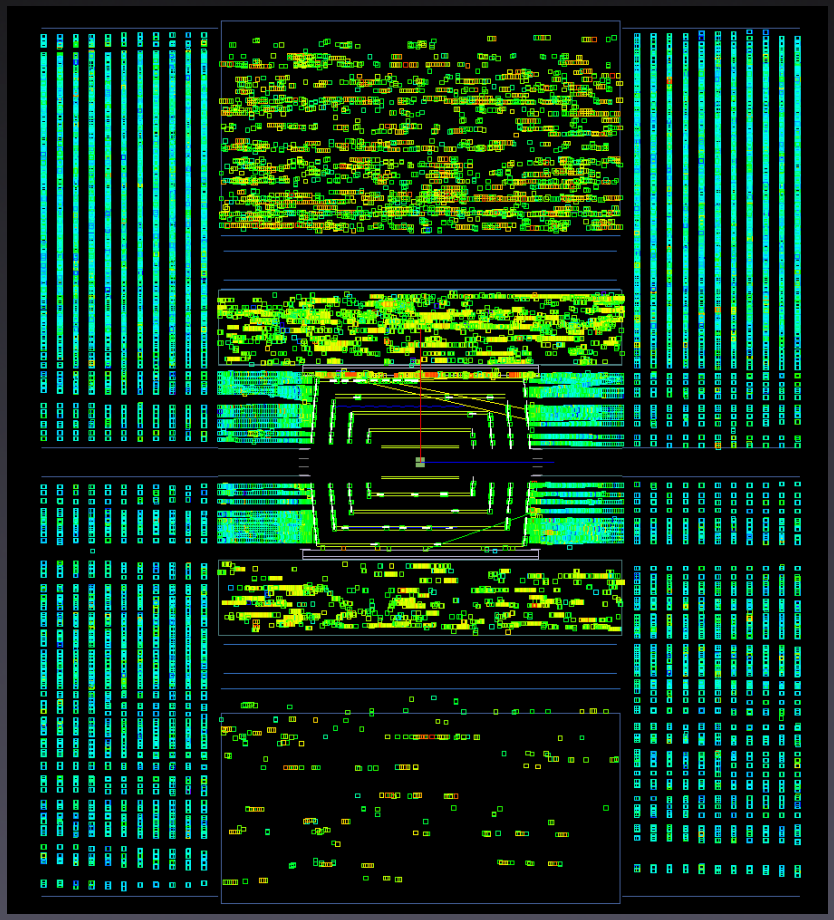
- *(1) GEANT4 Preliminary: ~156 / bunch in 6.5m radius detector*

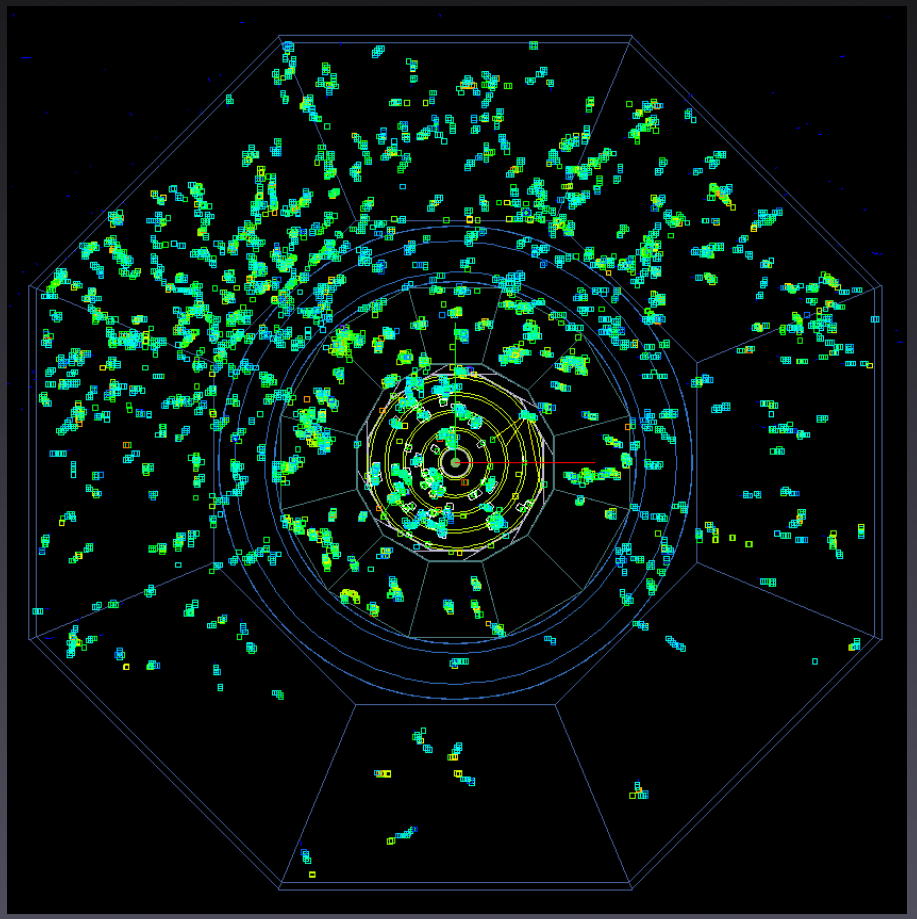
Cont'd



- The ratio of muons produced over muons which reach the detector, for different spoiler conditions and different source locations.

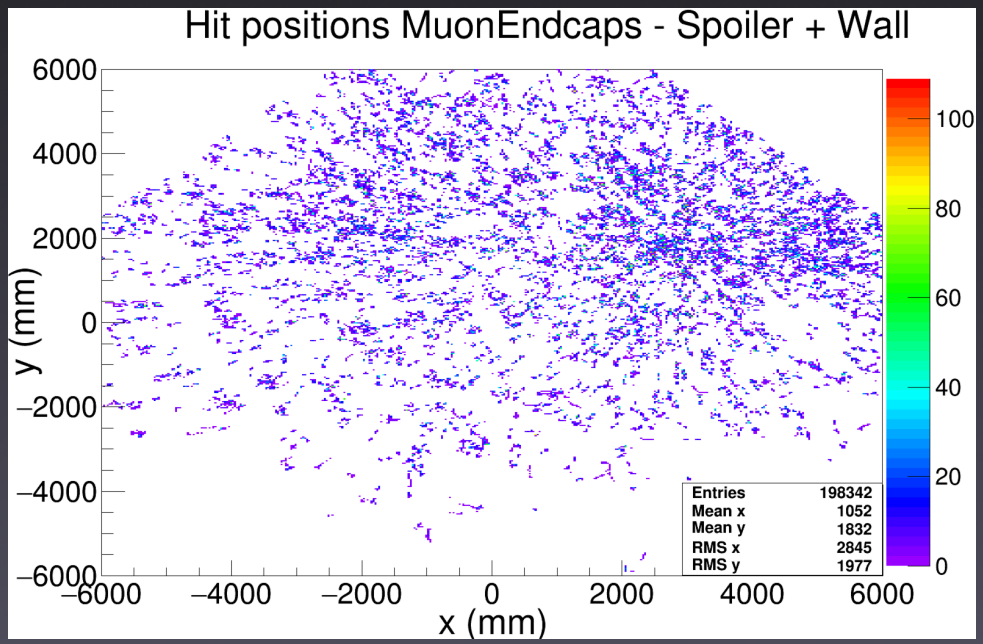
Muons in SiD

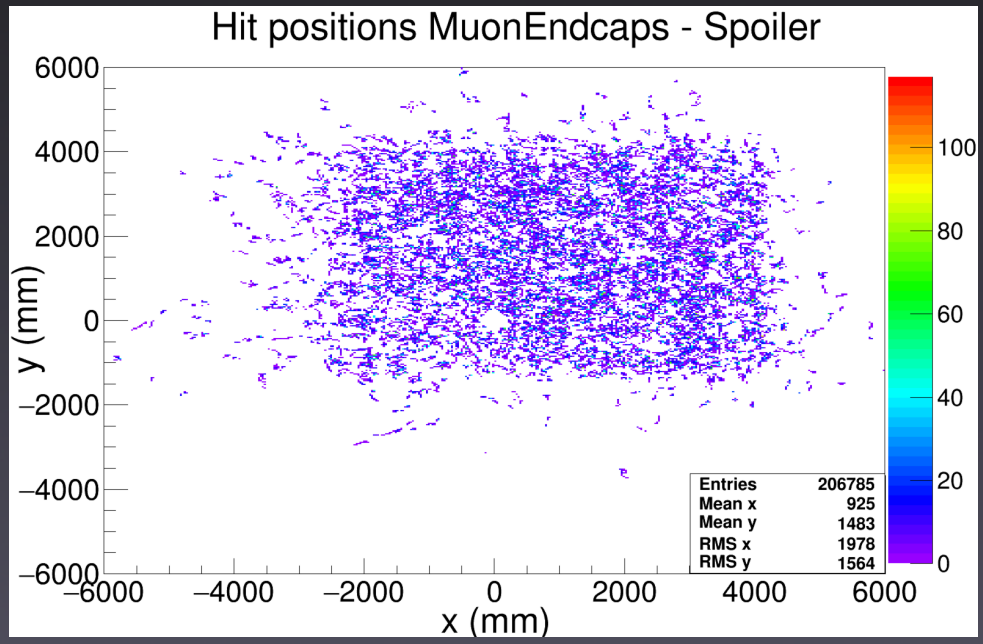




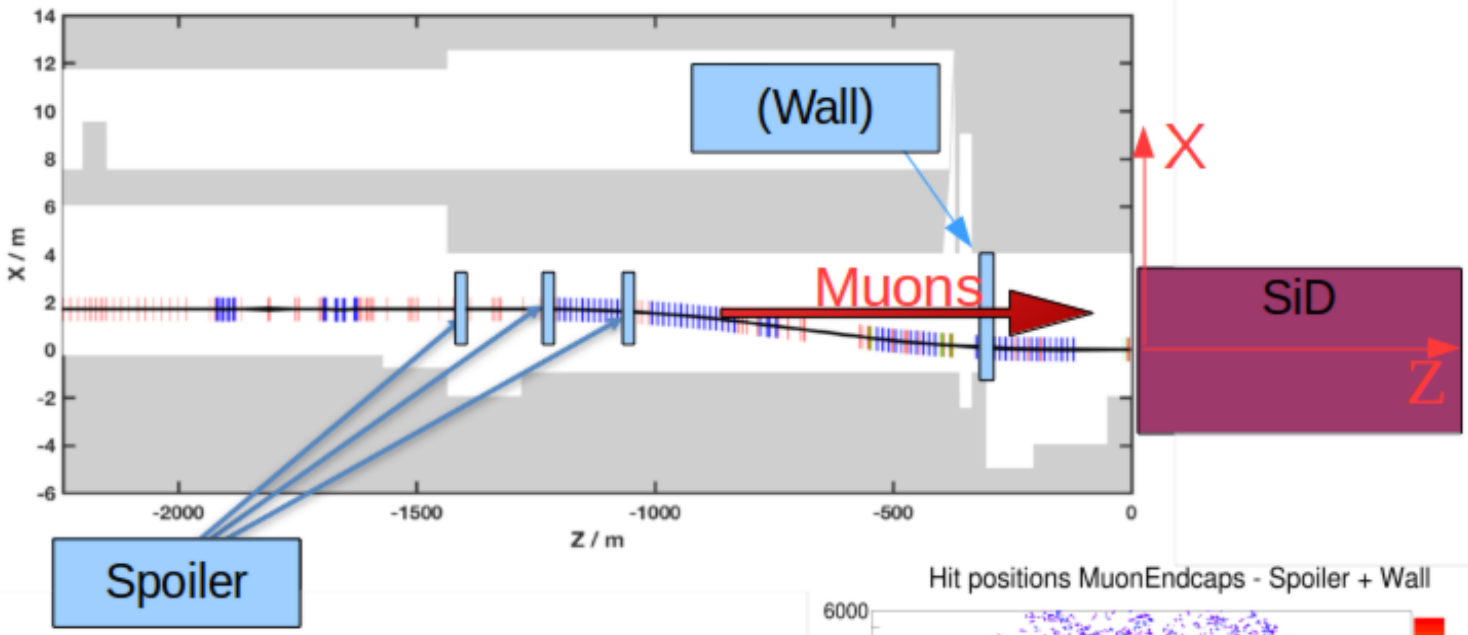
- 1 train's worth of muons (~ 650 muons):
- The asymmetry in the xy plane was already predicted by the MUCARLO simulation output, and is clearly visible also in the SLIC simulation.

Impact of the Wall

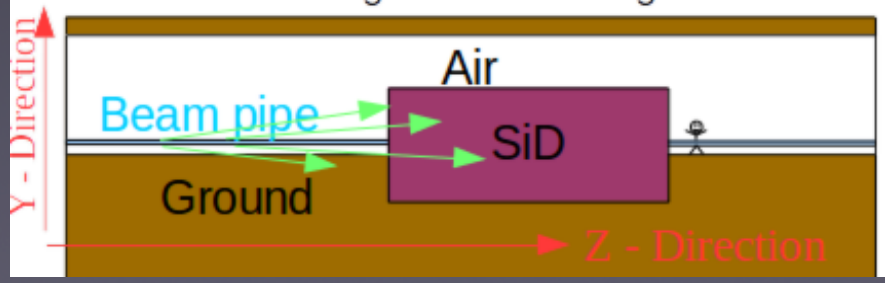


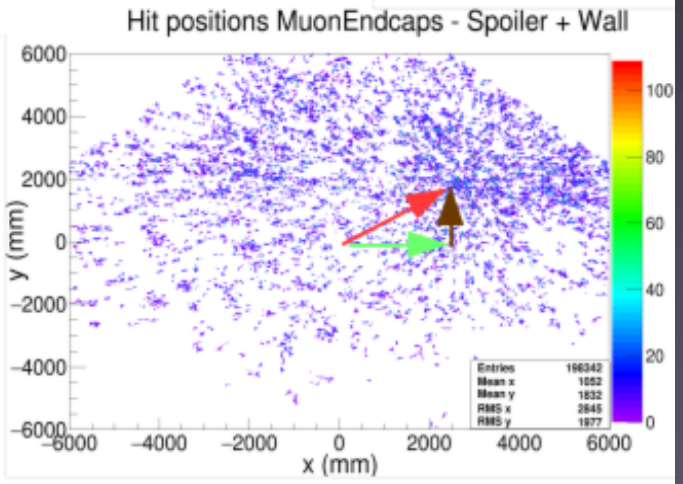


Understanding the Wall



- Beam pipe is curved
- Beam pipe close to floor
  - High tunnel ceiling





Status

- First round of studies complete
  - Awaiting a higher statistics sample
- Further refinements discussed
  - e.g. Impact of shielding in the hall
- Tool chain in place
  - No problem to process MuCarlo events

Simulation Status

- Just in the process of moving to DD4HEP
  - New geometry system
- New detector model has all the changes
  - HCAL
  - Dodekagon
  - 4.1 m L*
- Successful Optimization Workshop at PNNL

ILD/SiD Interface Issues

- A small joint MDI group should agree on the precise valve, disconnect flange, pump & RGA system in front of QF1 that will be common to both experiments.
  - ILD is cordially invited to consider SiD's approach and comment
- We have not been serious enough about the PACMAN
  - PACMAN interface to the hall
  - PACMAN interface to ILD & desired QD0 support system
  - PACMAN interface to SiD

Raised in March at KEK

Summary

- Lots of studies are happening
  - Dedicated group of people
- Engineering progress
  - Hampered by lack of funding
- Waiting for the green light from Japan !