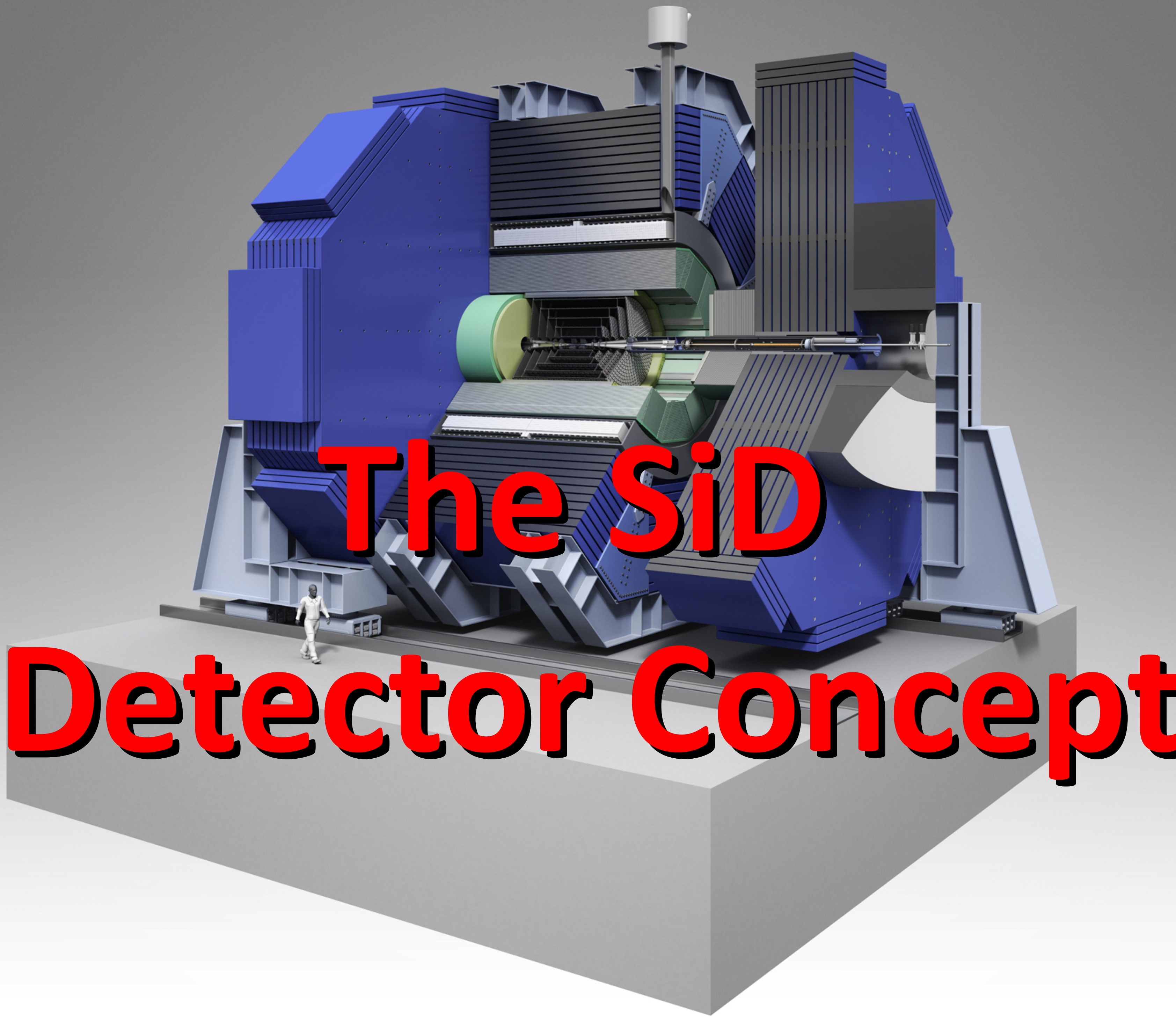
SiD

Status Report

21/November/2016

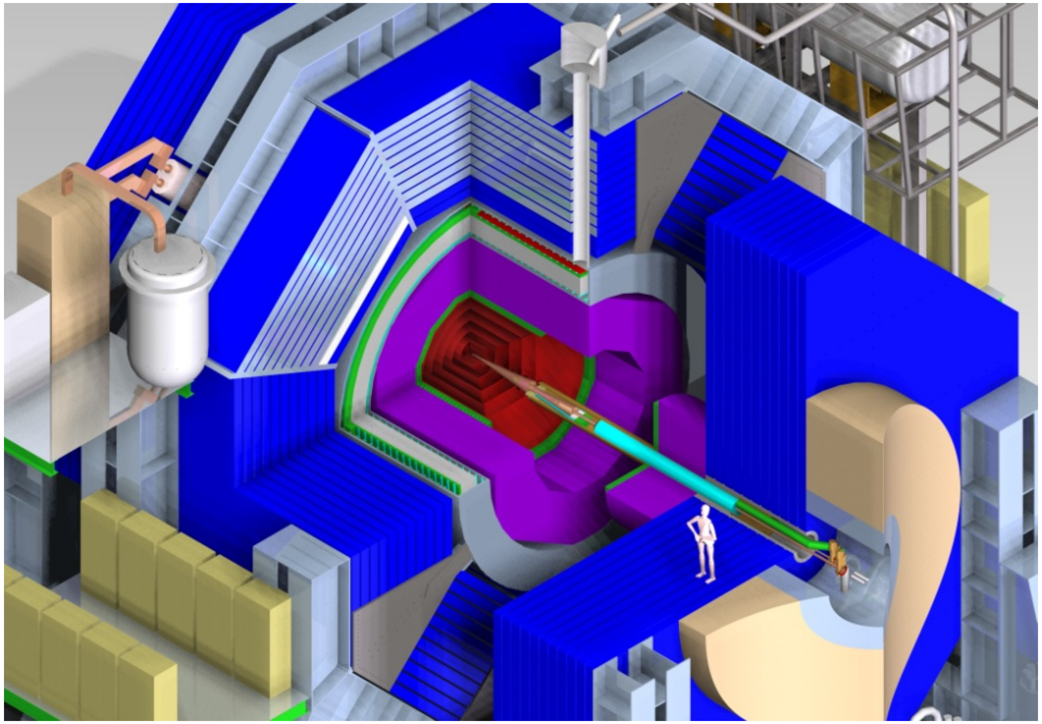
Marcel Stanitzki

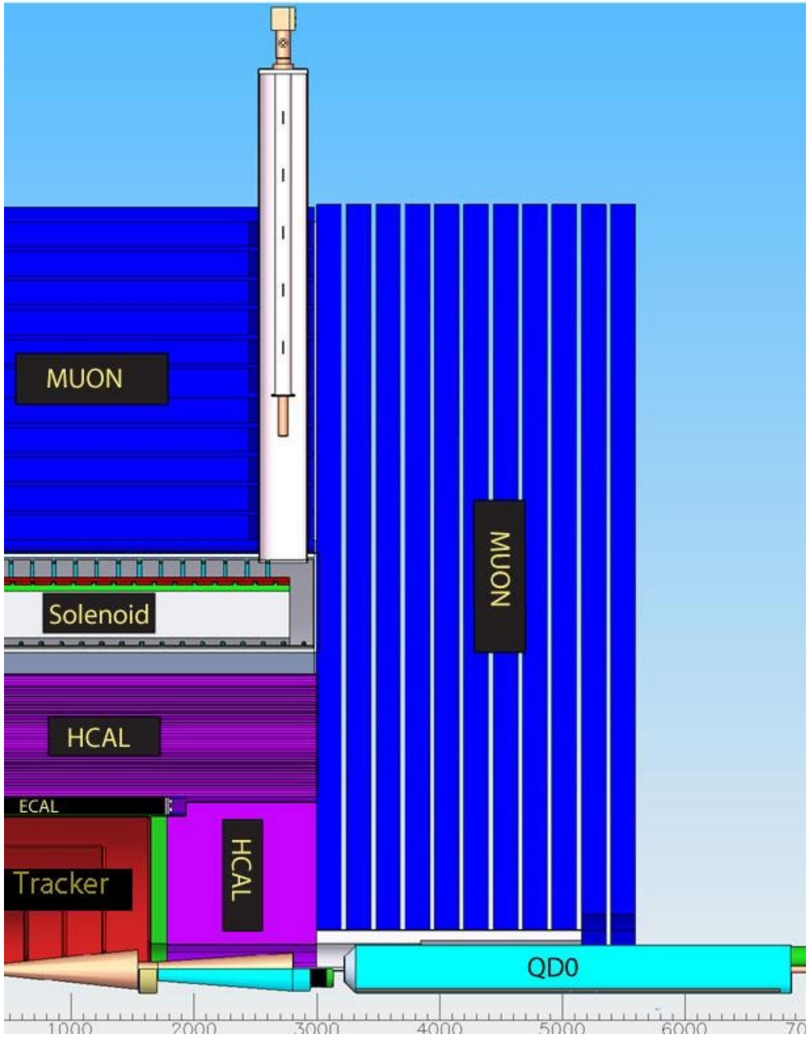
DESY



The SiD Detector Concept

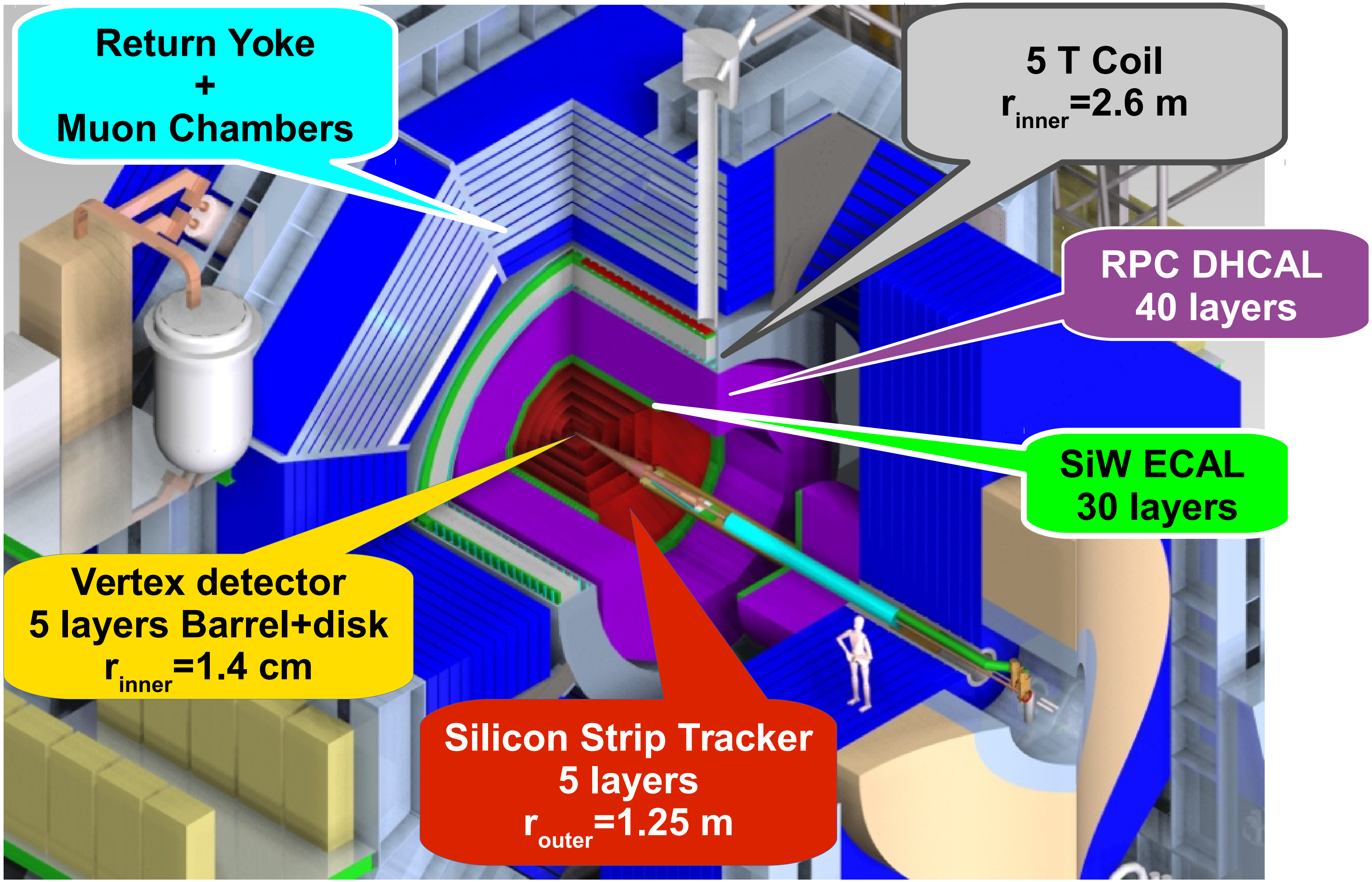
SiD Detector Rationale





A compact, cost-constrained detector designed to make precision measurements and be sensitive to a wide range of new phenomena

Subsystem Overview

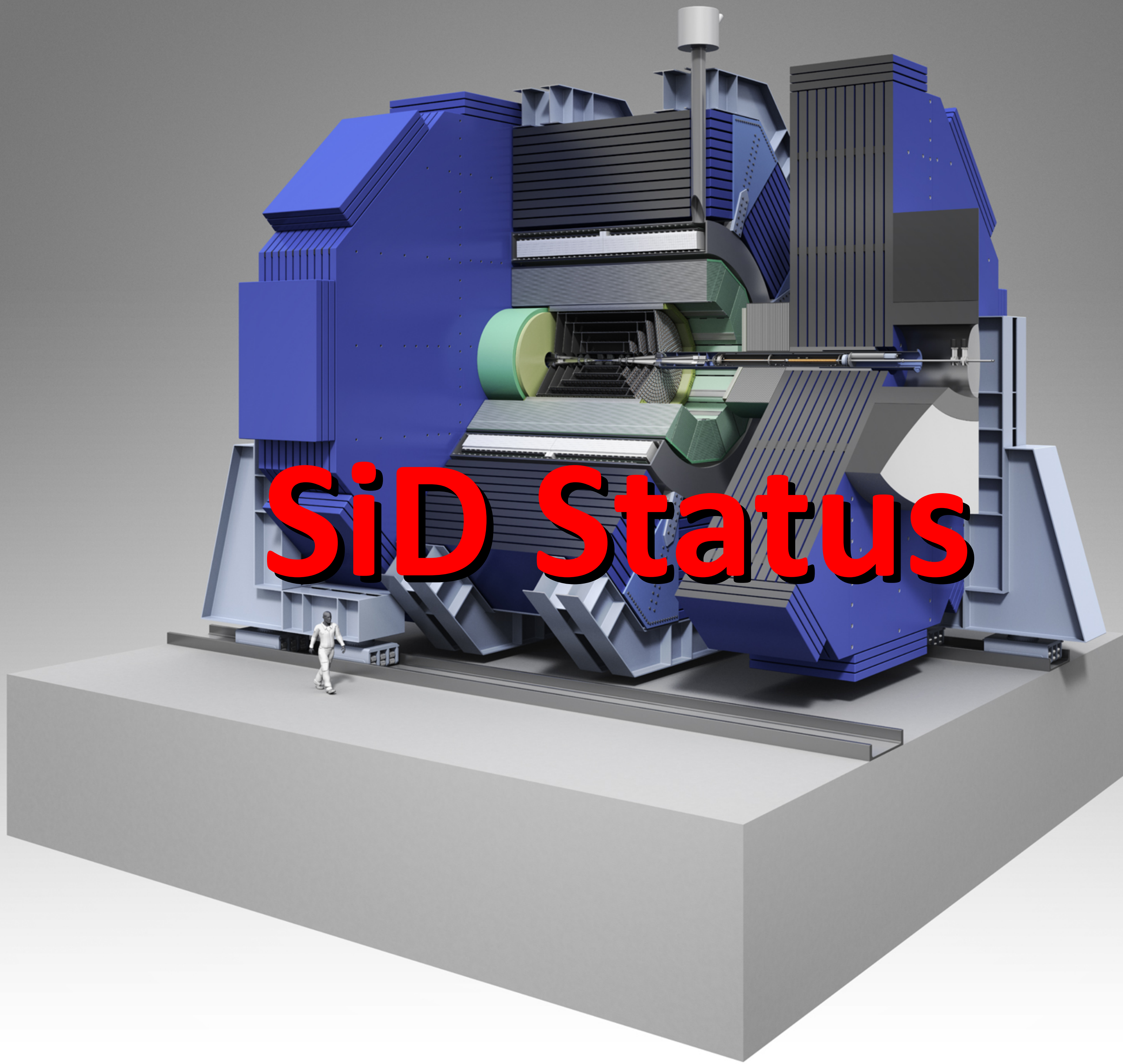


DBD baseline parameters

SiD BARREL	Technology	Inner radius	Outer radius	z max
Vertex detector	Silicon pixels	1.4	6.0	± 6.25
Tracker	Silicon strips	21.7	122.1	± 152.2
ECAL	Silicon pixels-W	126.5	140.9	± 176.5
HCAL	~~RPC-steel~~ AHCAL	141.7	249.3	± 301.8
Solenoid	5 Tesla	259.1	339.2	± 298.3
Flux return	Scintillator/steel	340.2	604.2	± 303.3

SiD ENDCAP	Technology	Inner z	Outer z	Outer radius
Vertex detector	Silicon pixels	7.3	83.4	16.6
Tracker	Silicon strips	77.0	164.3	125.5
ECAL	Silicon pixel-W	165.7	180.0	125.0
HCAL	~~RPC-steel~~ AHCAL	180.5	302.8	140.2
Flux return	Scintillator/steel	303.3	567.3	604.2
LumiCal	Silicon-W	155.7	170.0	20.0
BeamCal	Semiconductor-W	277.5	300.7	13.5

SiD Status



Making Technology choices

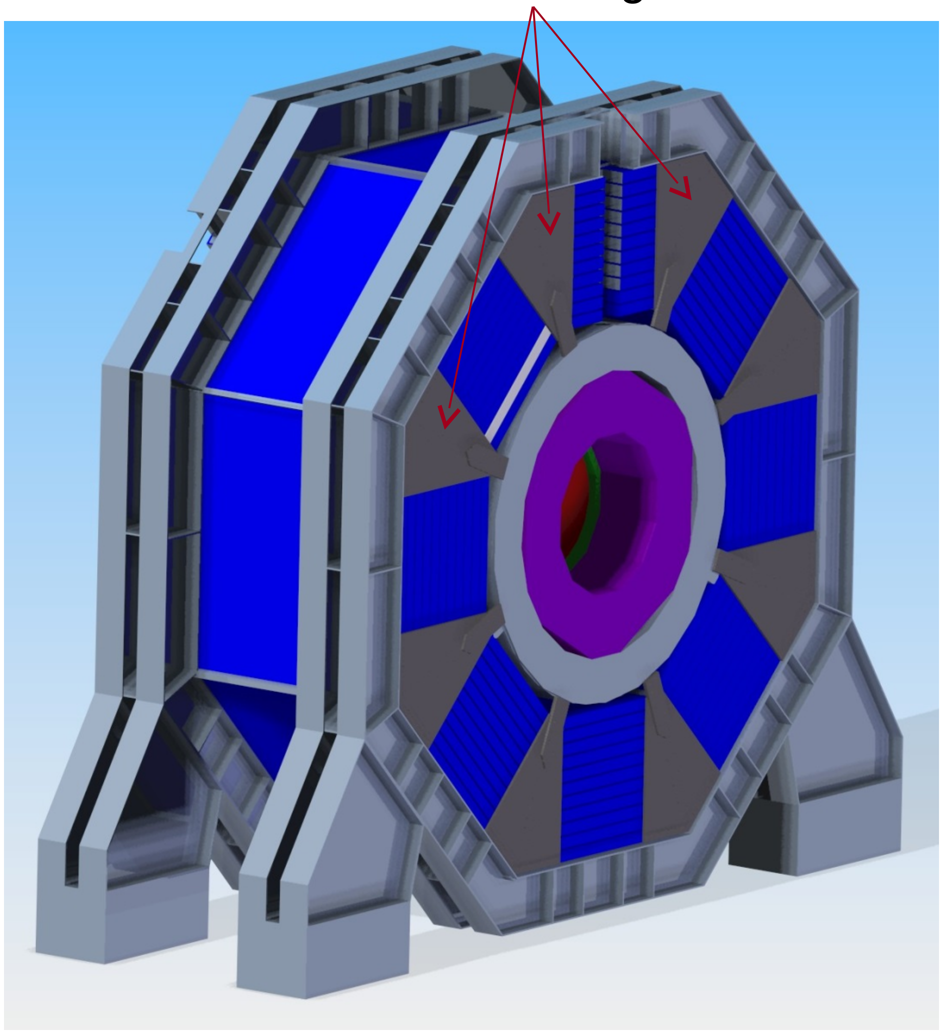
- SiD has established a clear process for changing baseline choices
- Change get proposed by SiD members
- SiD Spokespeople assemble task force
  - Look at benefits and disadvantages
  - Produce a written report with a recommendation
  - Technology proponents can comments
  - Presented to Exec Board, IB,and SiD in general
  - Spokespeople accept change based on recommendations
- This has been exercised for the HCAL
  - Decision to change from a DHCAL to AHCAL

Why changing ?

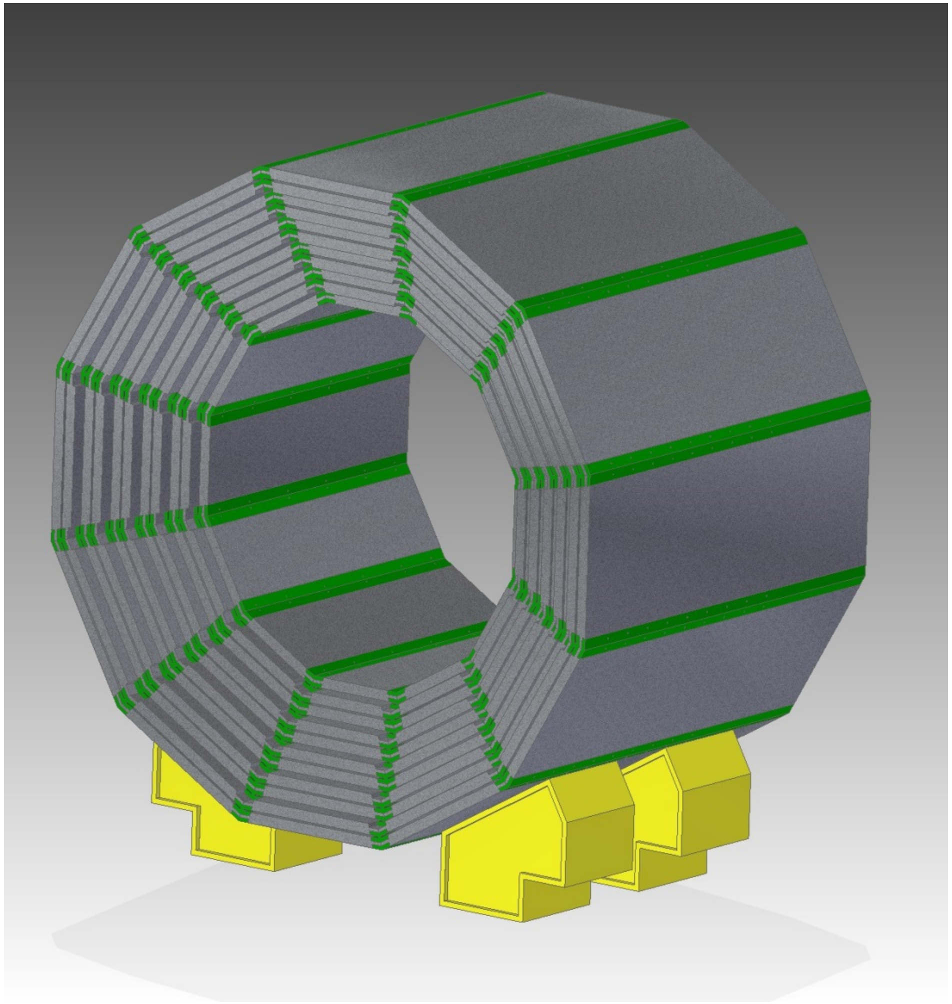
- DHCAL
  - Tremendous effort to design 1 m^3 DHCAL prototype and lots of interesting results
  - But no convincing evidence of superior performance of such a highly granular system
  - Lots of system issues (Gas, HV, Calibration)
- Switching to AHCAL
  - SiPM technology has made huge progress
  - System issues much more benign
- Overall assement: baseline change to AHCAL

Next Change -Final review

DBD Barrel Design

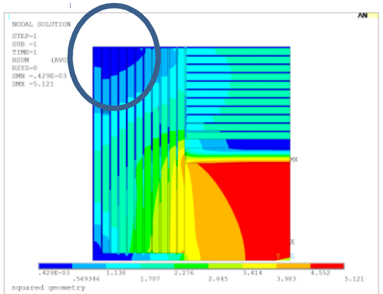
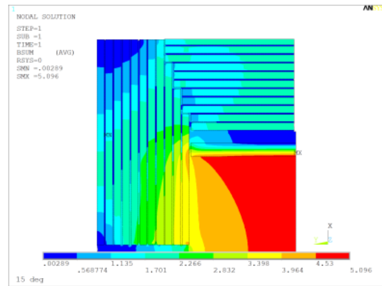
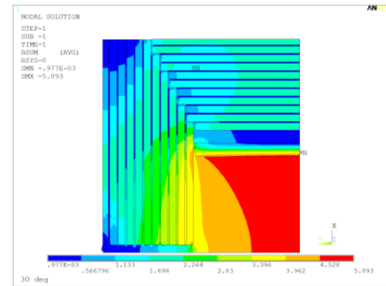
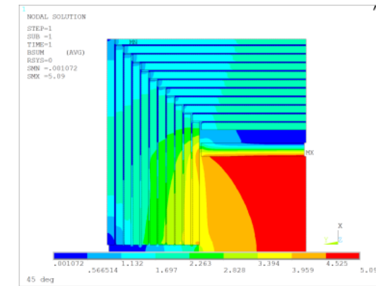


New Design



B Field – 11 plates, each 200 mm thick

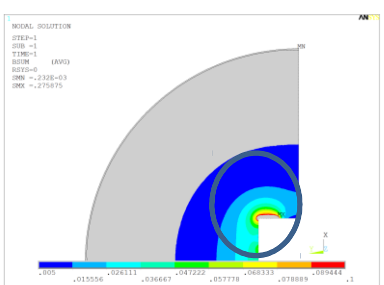
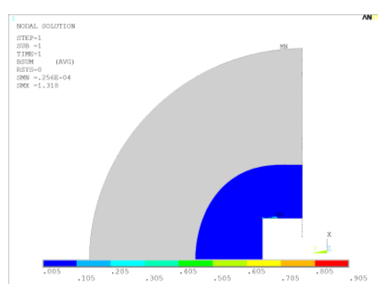
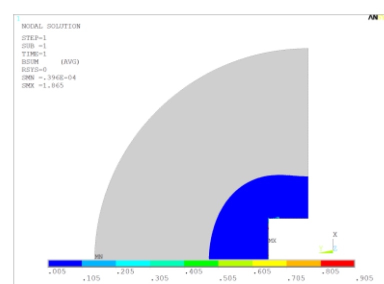
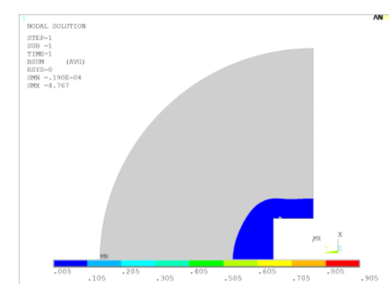
0° Baseline | 15° | 30° | 45°

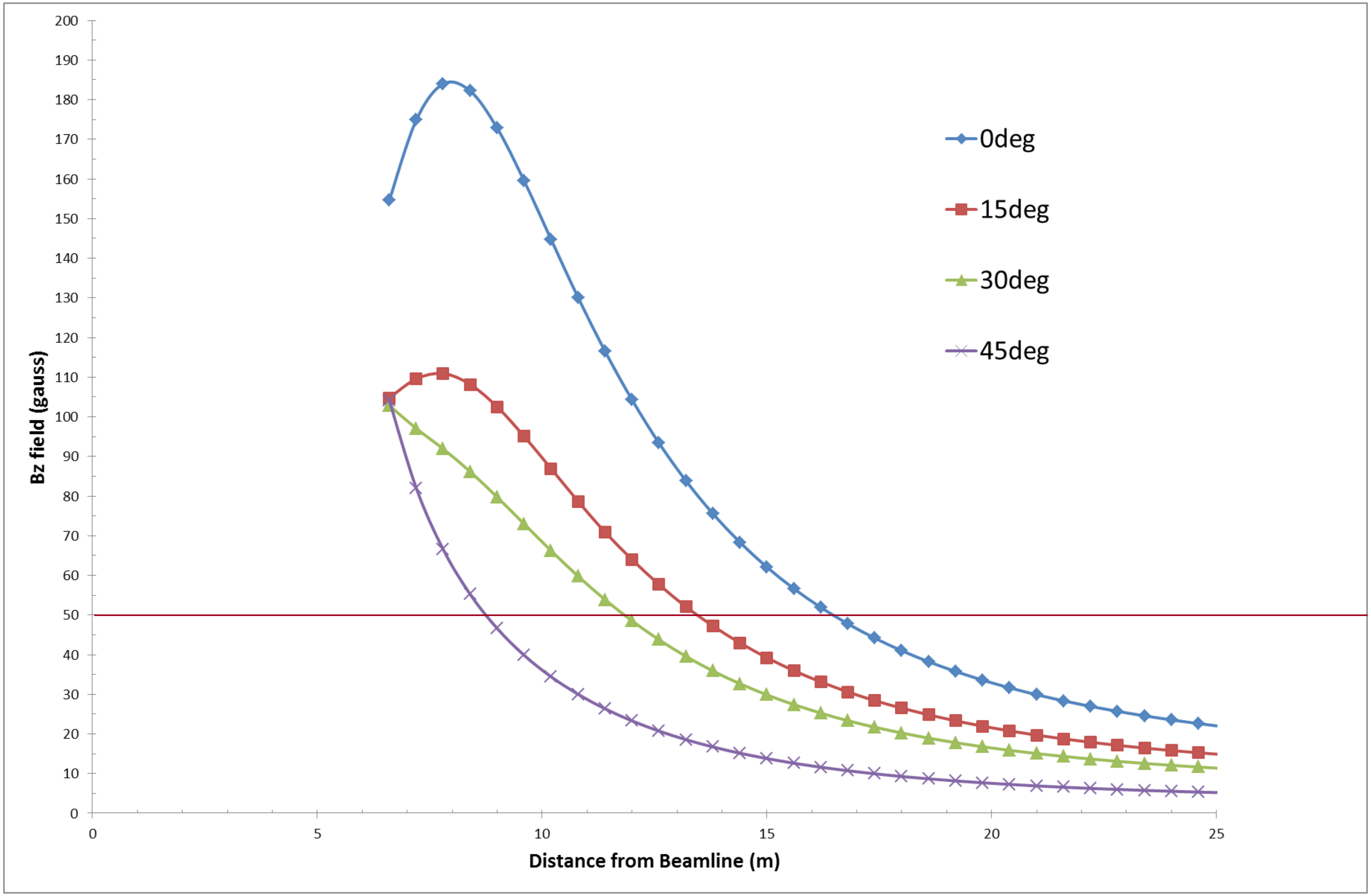
Red=5.1 Tesla; Blue=4.3Gauss: More efficient use of iron at 45°

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°

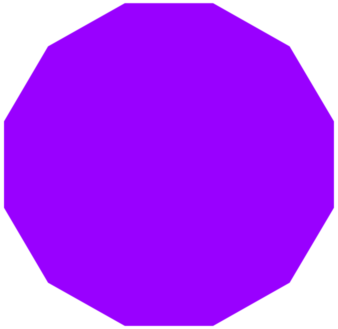





Bz- Outside Detector at z=0 – 11 plate yoke



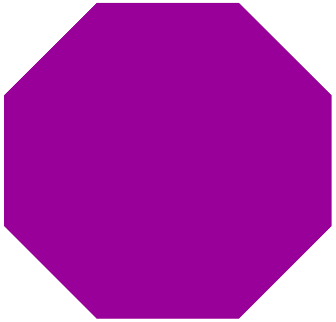
All Plates < 30 t in 12 Sided Design

				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

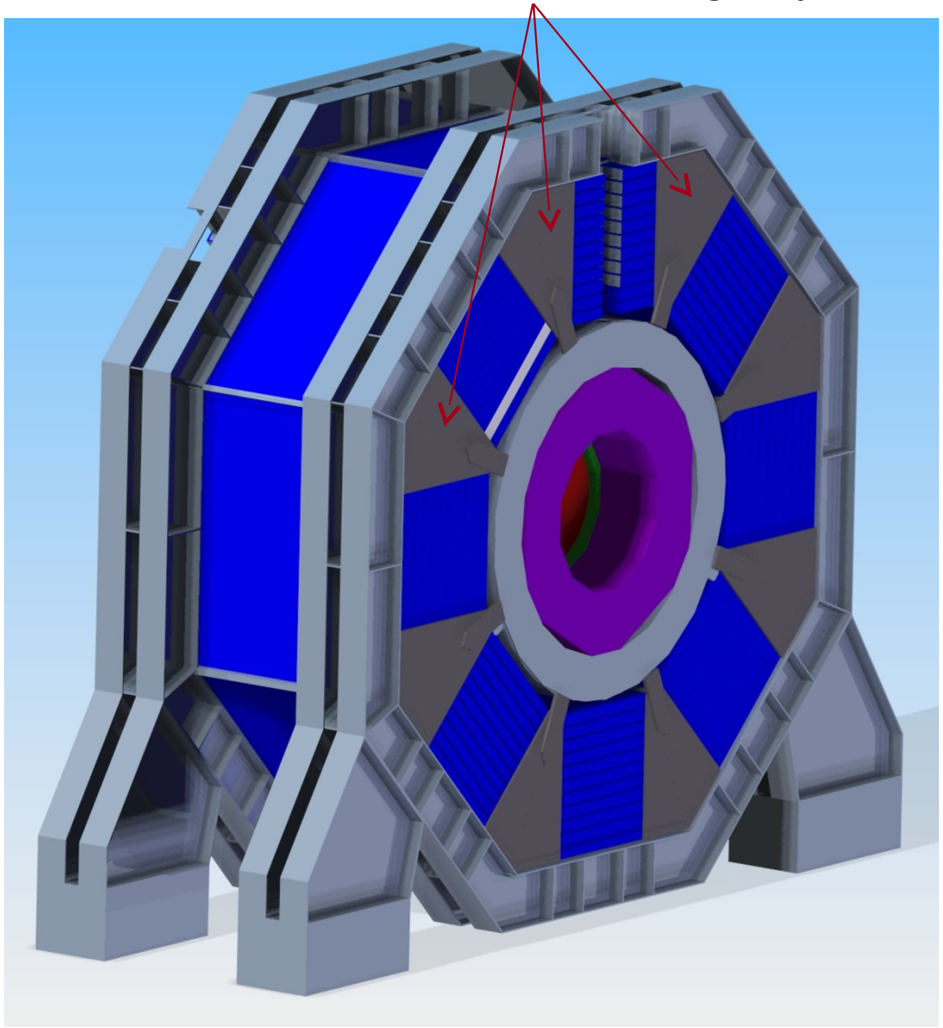
				R (m)	Width (mm)	Weight (tons)	Accrued Sector Weight	Accrued Barrel Weight
L	5900		Plate 1	3454	2861	26	26	211
Thickness	200		Plate 2	3694	3060	28	55	436
Gap	40		Plate 3	3934	3259	30	84	676
			Plate 4	4174	3458	32	116	931
			Plate 5	4414	3657	34	150	1200
			Plate 6	4654	3855	35	185	1484
			Plate 7	4894	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



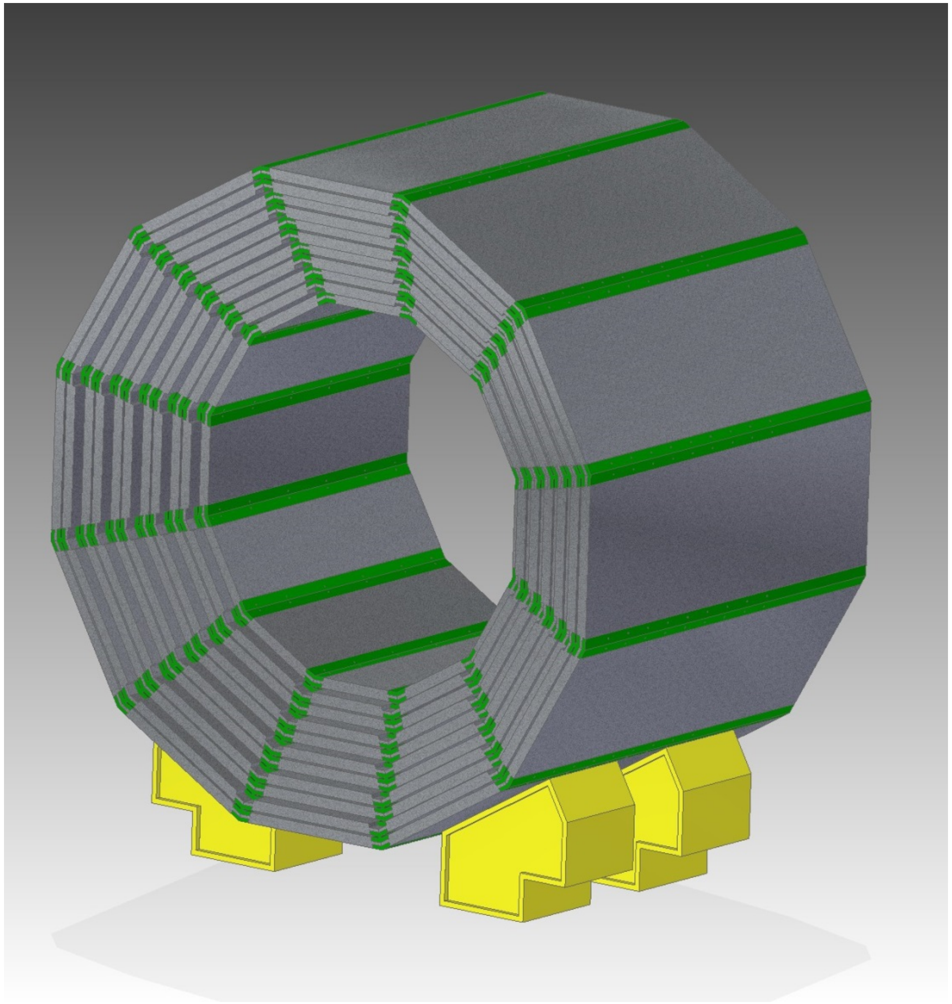
8 edges

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

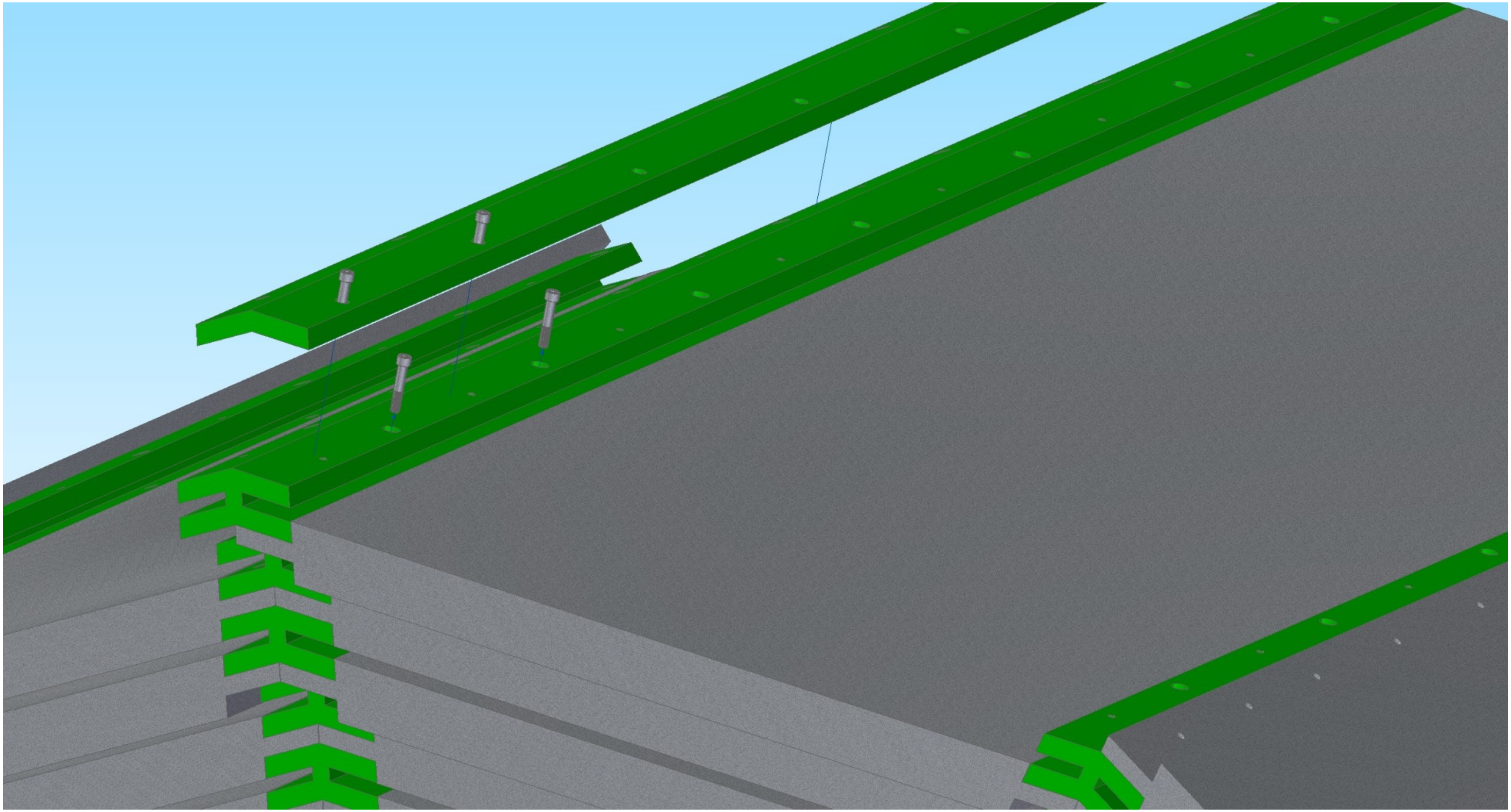
DBD Arches with Plates Joining Layers



Support Feet & Plates with Connectors

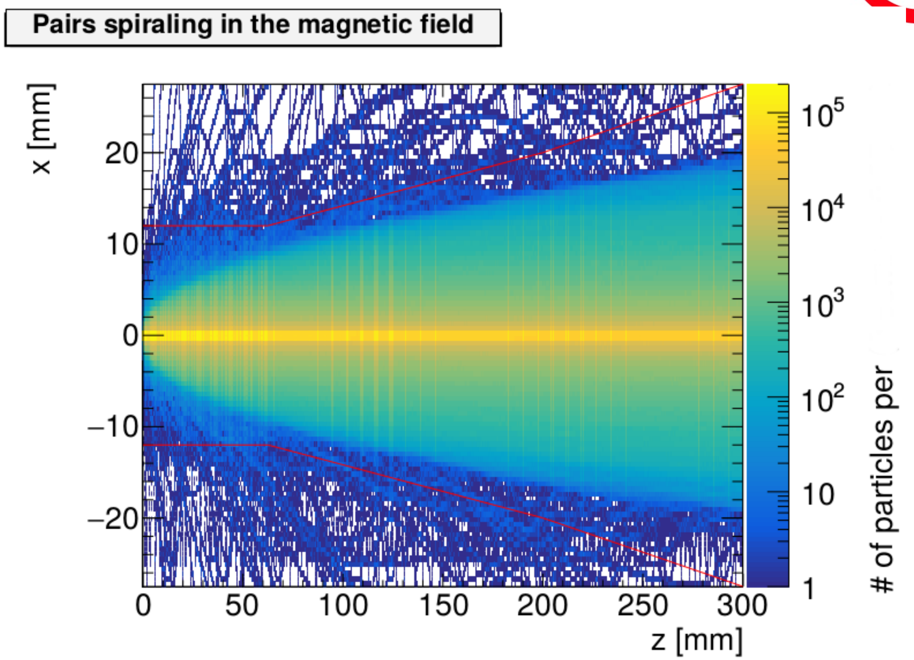


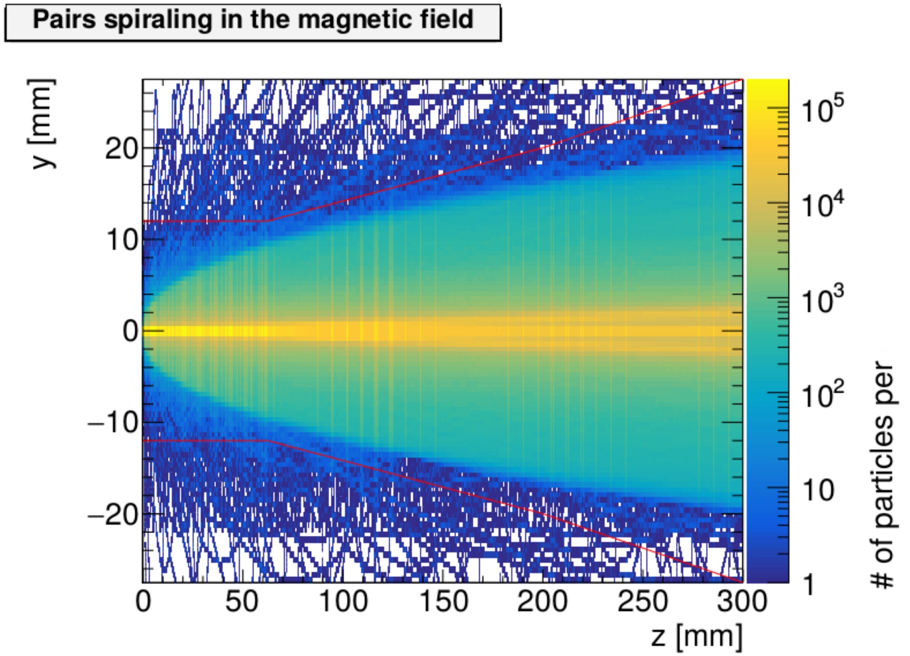
Connector Detail



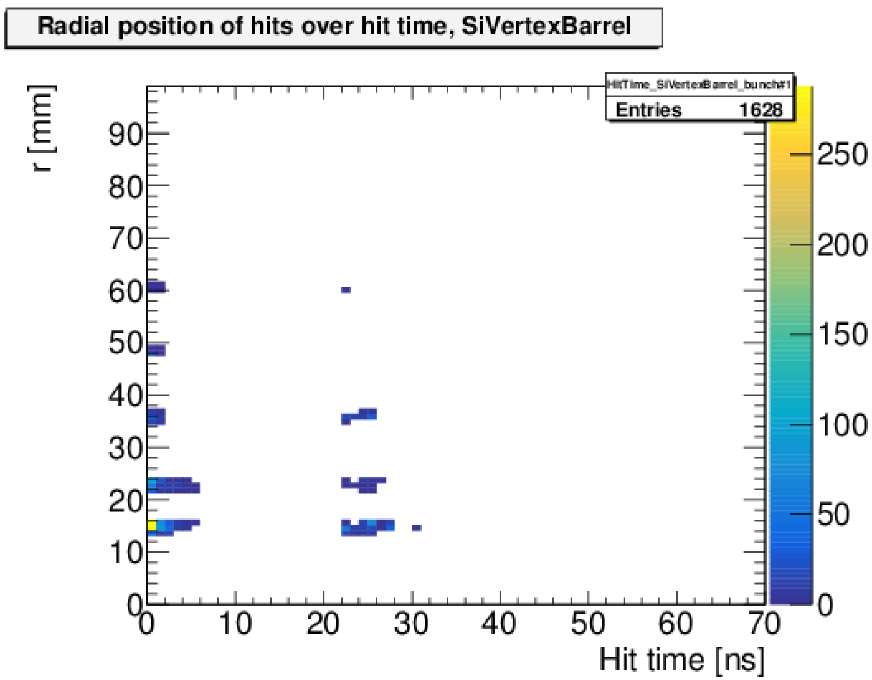
Beam Backgrounds

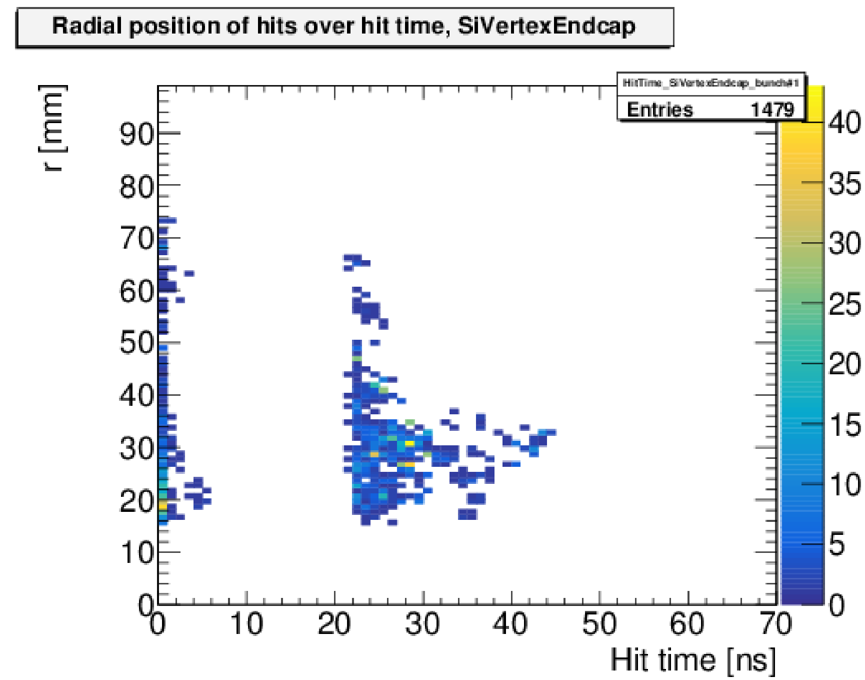
- Simulating ILC beam backgrounds
  - using the latest machine parameters
- Major occupancy driver
- Impact on detector design
  - Inner radius, location of End-caps
- Impact on Electronics
  - Buffer depth
  - Granularity





Pair Backgrounds

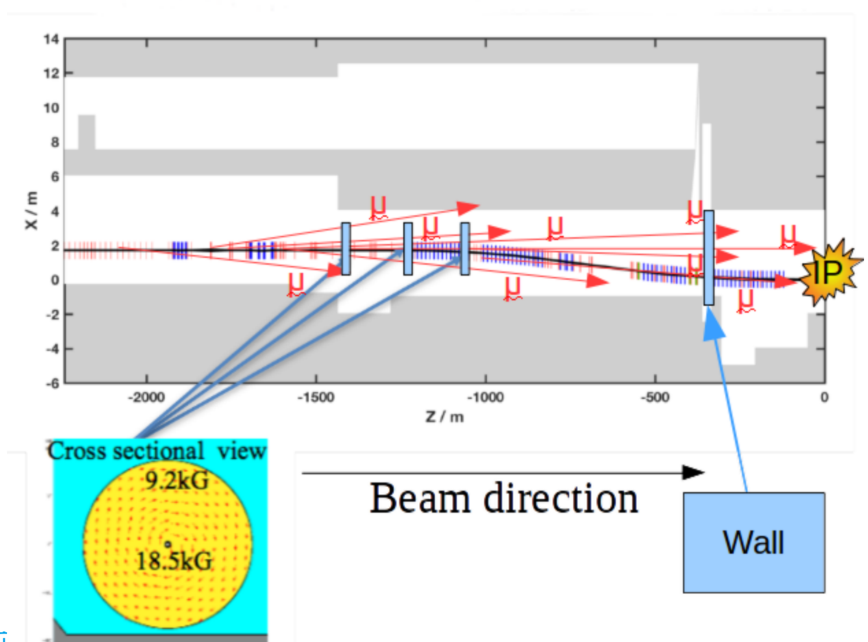


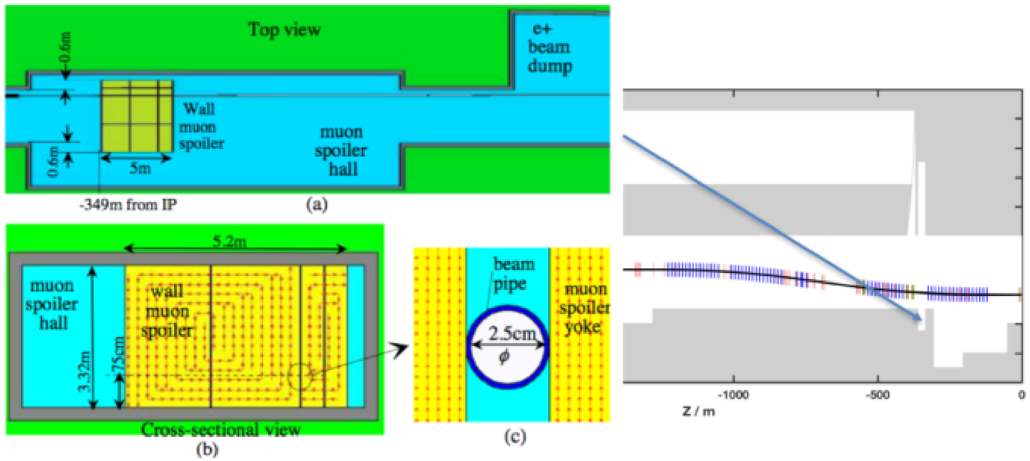


- The time distribution of the hits from the pair background in the vertex detector indicates the possibility of background reduction by applying a timing gate.

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)





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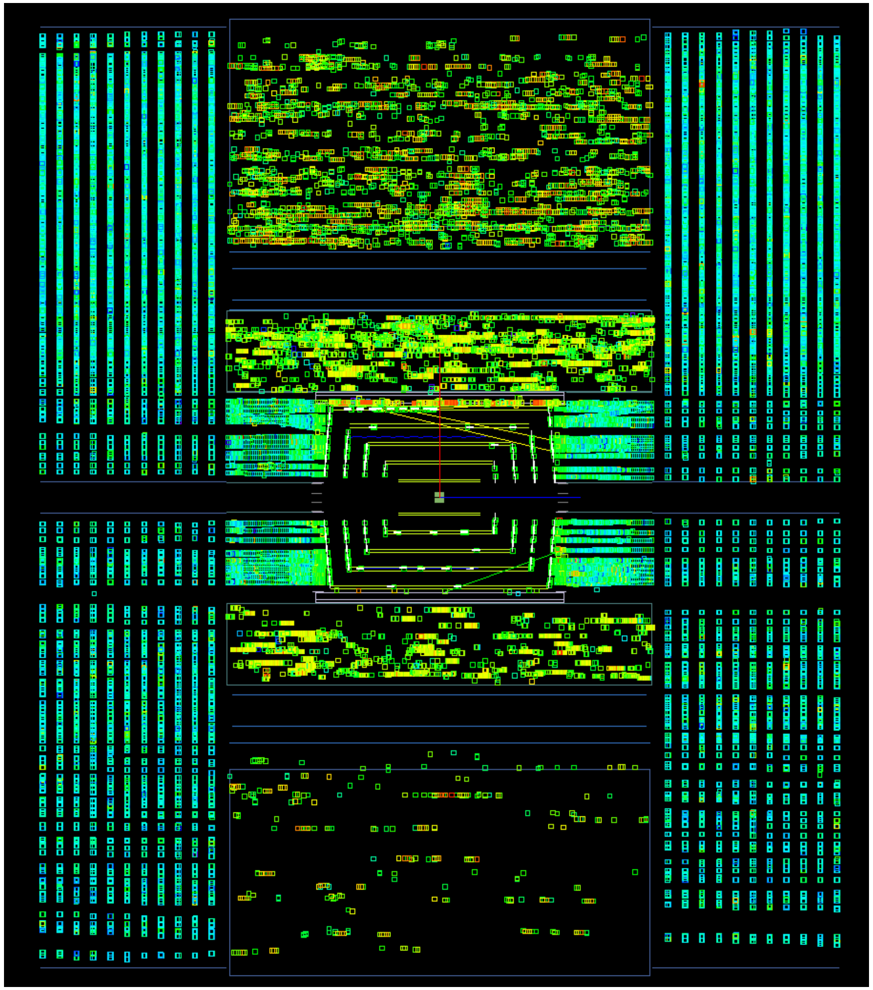
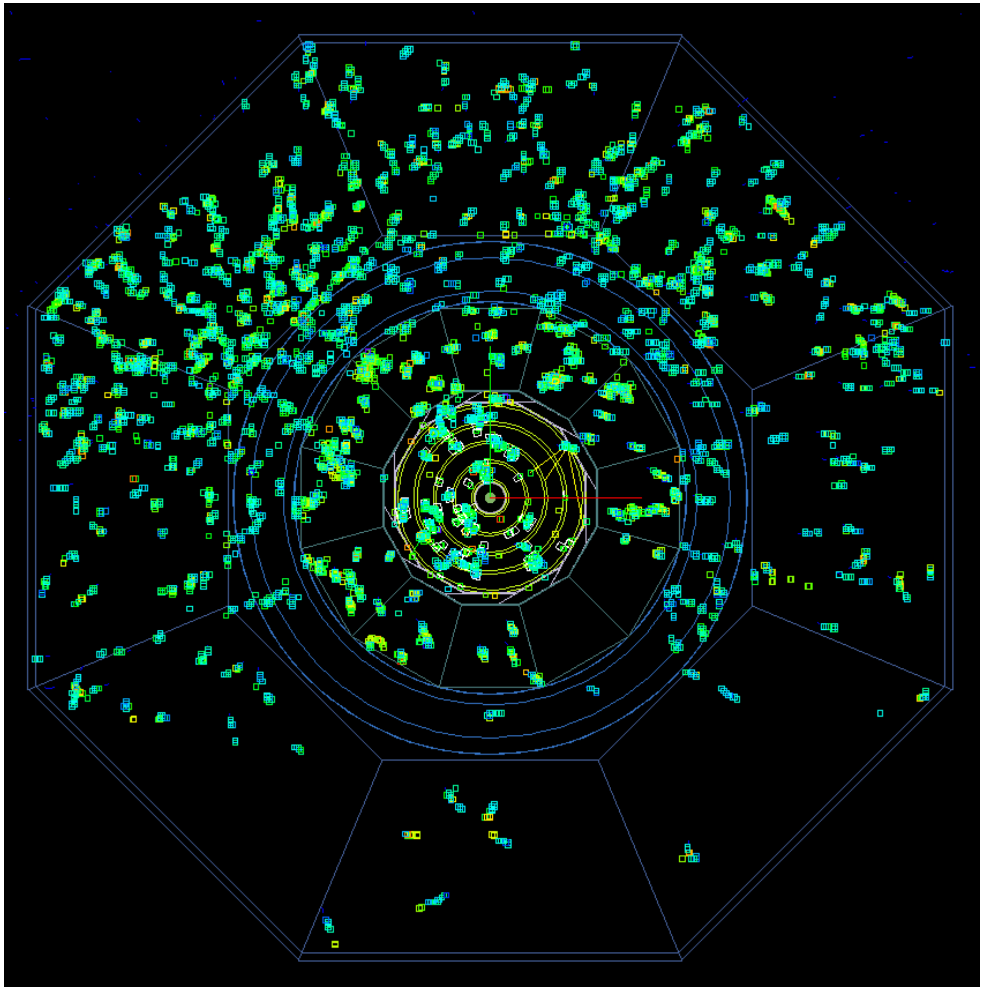
SUPPRESSION OF MUON BACKGROUNDS GENERATED IN THE ILC BEAM DELIVERY SYSTEM *

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

Muon Halo Backgrounds

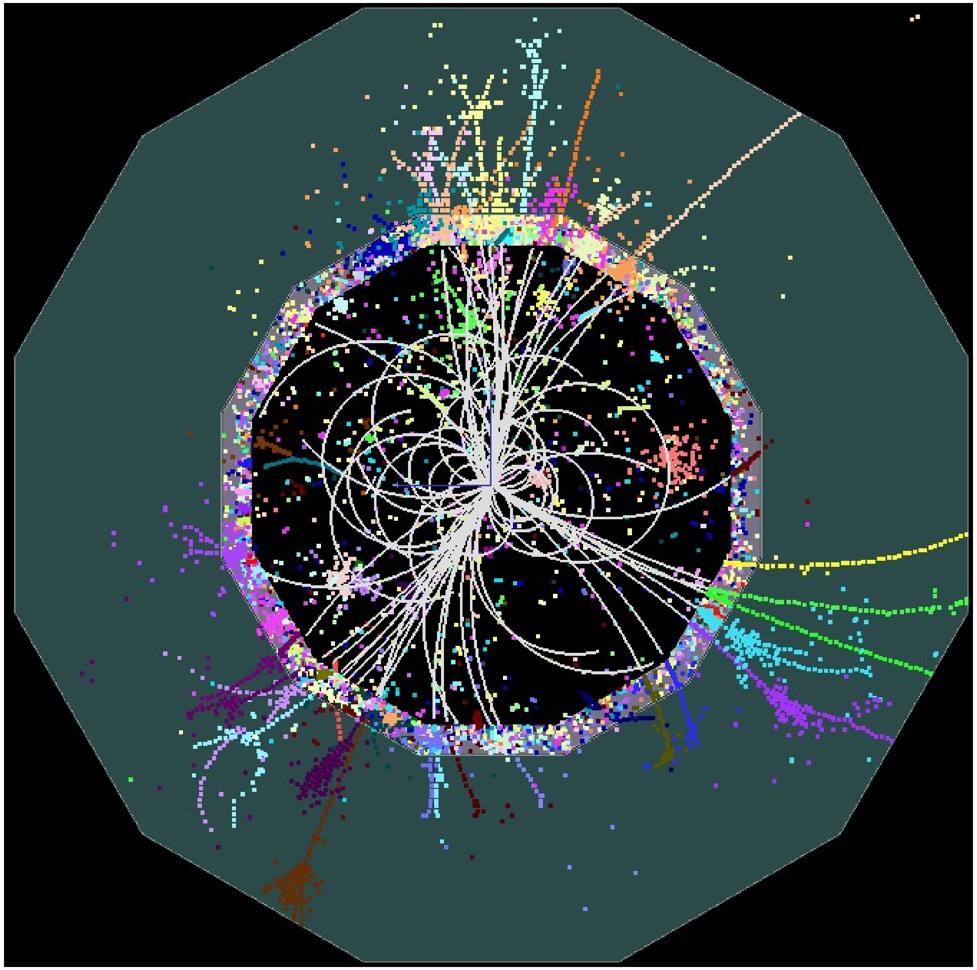




Background Hits from upstream muons generated in the Final Focus over the entire bunch train

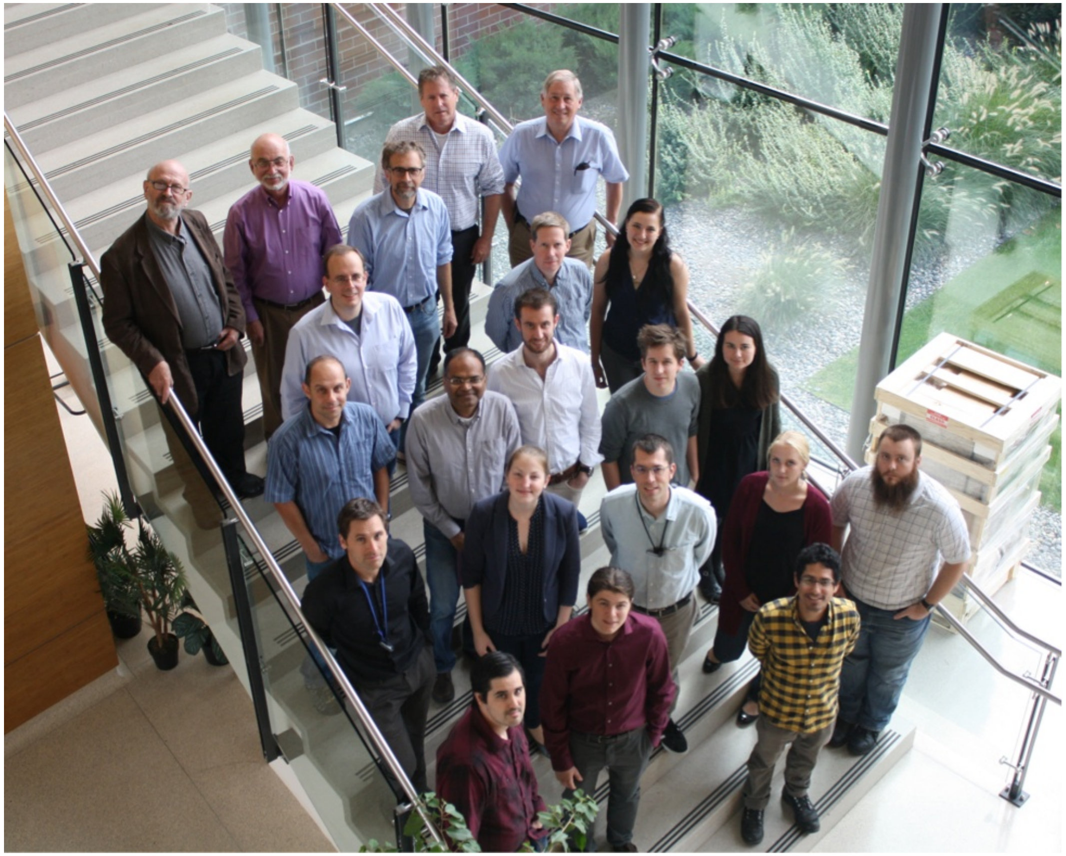
Common Software work

- We continue to move towards using the DD4HEP-based software tools
  - LCIO as Common EDM really facilitates this
- Update Detector Models
  - Reflect engineering refinements
- SiD goal:
  - Migration finished in early 2017



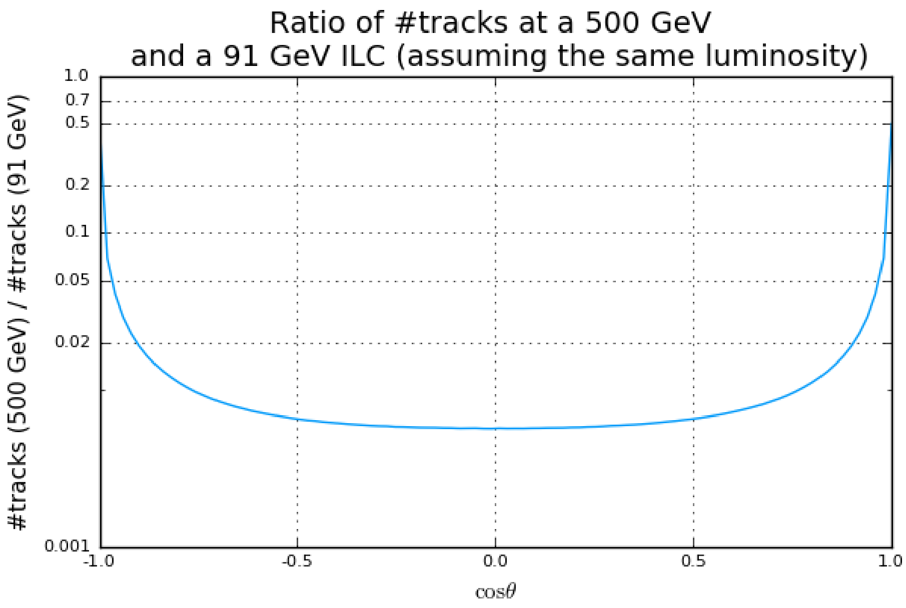
Dedicated Software Workshop

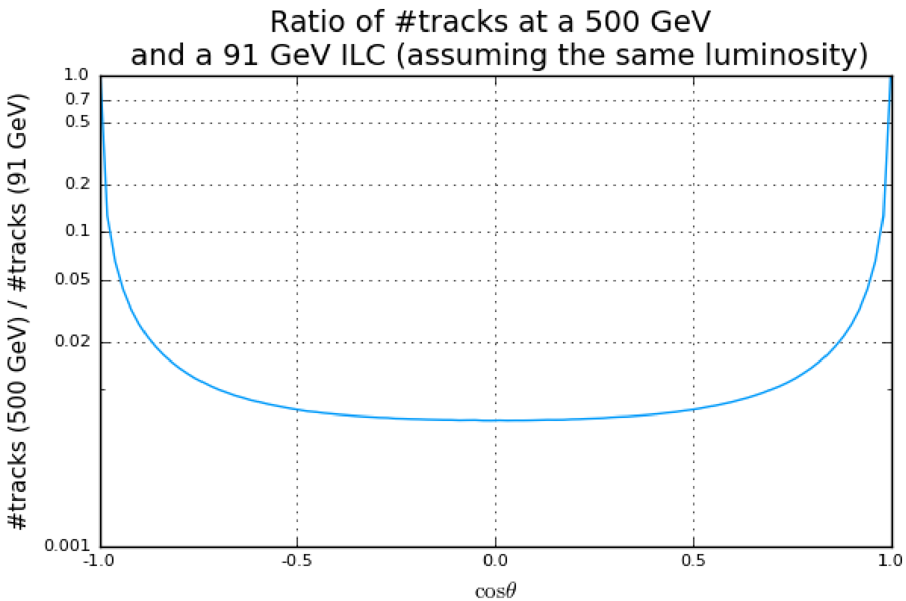
- Meeting at Pacific Northwest National Laboratory
  - Richland, WA
- Good attendance
- "Working" Workshop
  - Less talks
  - Lots of tutorials
- Big thanks to
  - Jan Strube & Aidan Robson for organizing



Why no Z calibrationrun

- With $Lumi_Z = 0.01\ Lumi_{500\ GeV}$
  - Just not competitive
- If there is more Luminosity ?
  - A Z run after every push-pull ?
  - After every MD?
- With the desired accuracy
  - need to have other means of alignment
- Moving the machine from 500 GeV to 91 GeV and back
  - Non trivial (several Days/few weeks)
- Current View
  - SiD does not request any running at the Z for calibration purposes, as we don't have a case. SiD however requests, that machine design will not be altered in way, which would prevent Z running at all





Summary

- SiD is moving ahead
  - Clear plan what “needs to be done” for a TDR
- Recent changes
  - HCAL change
  - Redesign of Iron Yoke
  - Adoption of DD4HEP-base framework
- Progress is made more difficult by the lack of funding
  - Global problem
- SiD is committed to deliver a detector that
  - Delivers the ILC physics
  - Is cost-effective

Waiting for that green light from Japan !!!