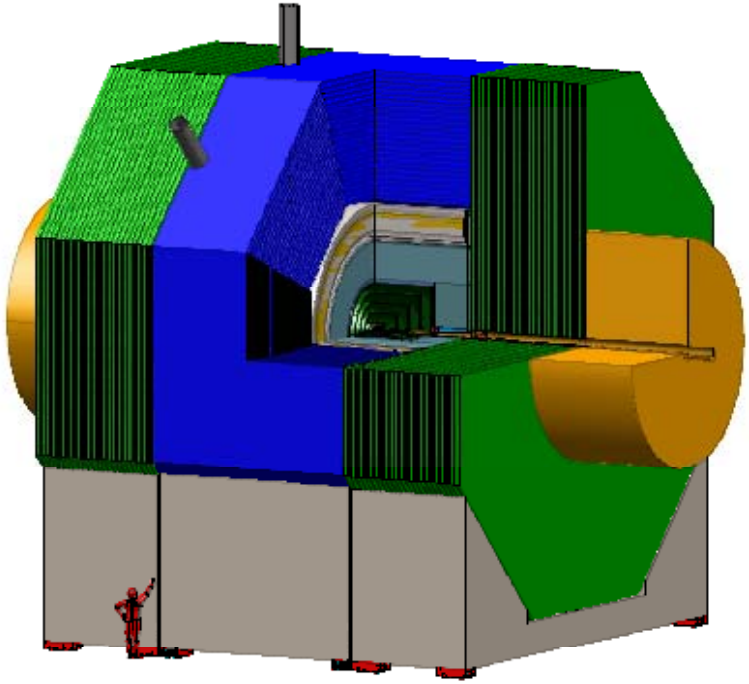
SiD Engineering Status Report

Kurt Krempetz



SiD Engineering Group

Engineers

- ANL
  - Victor Guarino→Hcal
- FNAL
  - Bob Wands→FEA
  - Joe Howell
  - Kurt Krempetz→Integration
  - Walter Jaskierny→Solenoid Electrical
- PSL
  - Farshid Feyzi→Muon Steel
- SLAC
  - Jim Krebs→EndDoors
  - Marco Oriunno→Ecal
  - Wes Craddock→Solenoid
- RAL
  - Andy Nichols→Tracking
- LAPP
  - Claude Girard
  - Franck Cadoux
  - Nicolas Geffroy→Hcal

Physicists

Bill Cooper

Marty Breidenbach
Tom Markiewicz

Phil Burrows

Yannis Karyotakis

Subsystem Liaisons to the Engineering Group

- Vertex→ Bill Cooper
- Silicon Tracker→ Tim Nelson
- Ecal→Marty Breidenbach
- Hcal→Andy White
- Muons→Henry Band
- Forward→Bill Morse
- MDI→Tom Markiewicz

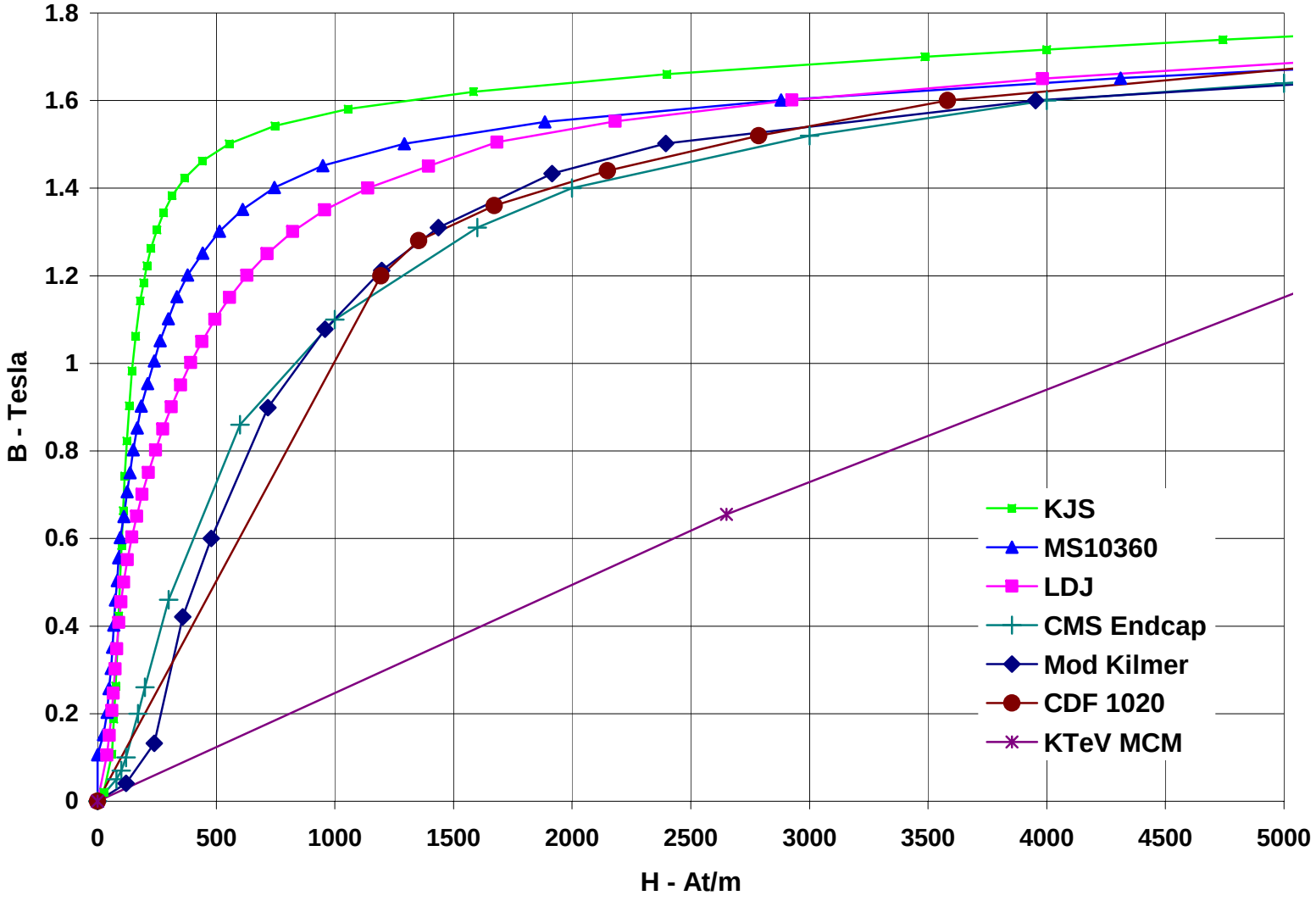
Recent Work

- Solenoid Conductor
- Vertex Detector Mechanics
- Forward Region
- Magnetic Field Calculations
- Hcal
- Ecal
- Beam Tube

BH Curve Effects on SiD Field Calculations (Bob Wands-Fermilab)

- **Seven BH curves were used:**
  - **Three of these curves (KJS, LDJ, and MS10360) are from the Minos steels**
  - **One curve (CMS) is from the CMS endwall steel**
  - **One curve (CDF1020) is from the CDF solenoid**
  - **One curve (Mod-Kilmer) is from early Minos R&D**
  - **One curve (MCM) is from the Michigan Cyclotron Magnet steel used in the KTeV dipole**

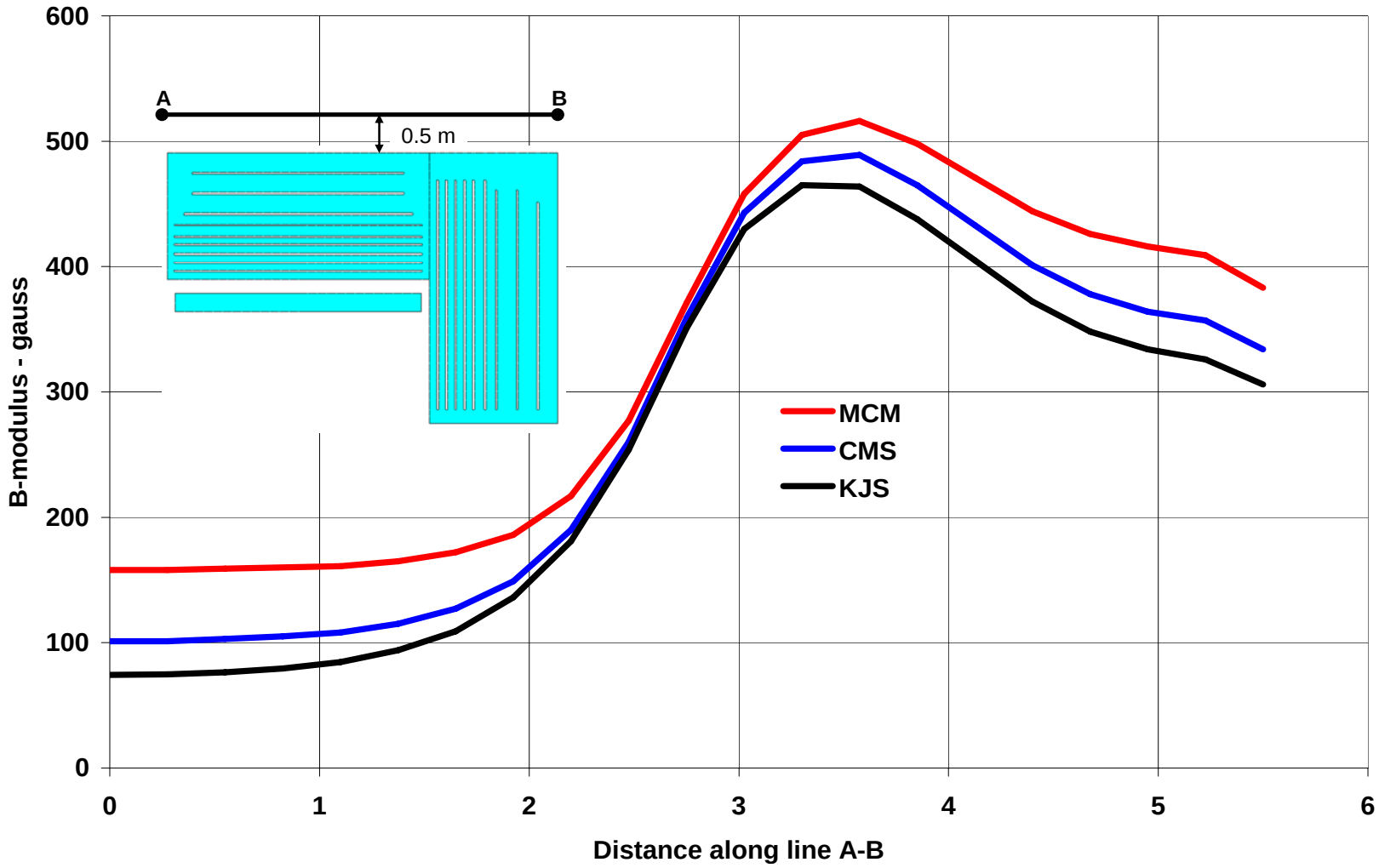
BH Curves for Various Magnet Steels



Axial decentering due to differences in BH between steel flux return components (positive toward endwall)

BH of Barrel and One Endwall	BH of Other Endwall	Axial Decentering (tonnes)
CMS	Endwall missing	14000
CMS	KJS	-177
CMS	MS10360	34
CMS	LDJ	-570
CMS	Mod_Kilmer	415
CMS	CDF1020	166
CMS	MCM	315

Fringe Fields - Comparison of Results for Three Curves

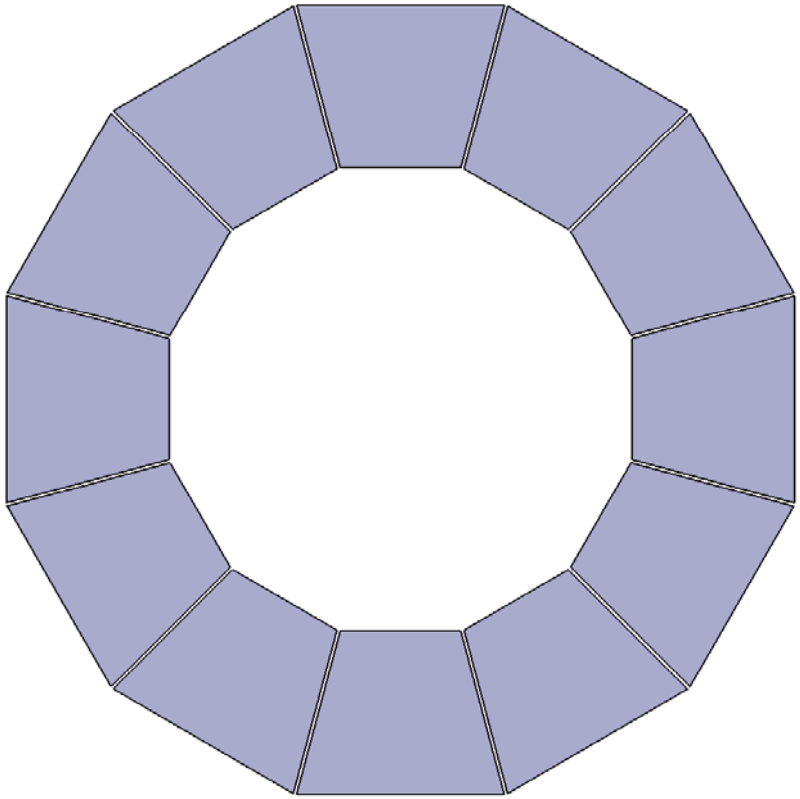


Conclusions

- **BH of steel has small effect on axial decentering due to misalignment (~10%)**
- **BH differences in endwalls could cause large decentering forces even if no misalignment is present, though calculation here is extremely conservative**
- **BH of steel has negligible effect on central field, and field uniformity in tracking volume**
- **Largest effect of BH is on fringe fields (~100% between best and worst curves at some locations)**
- **Characterization of BH at high fields are important for calculations because steel is heavily saturated**

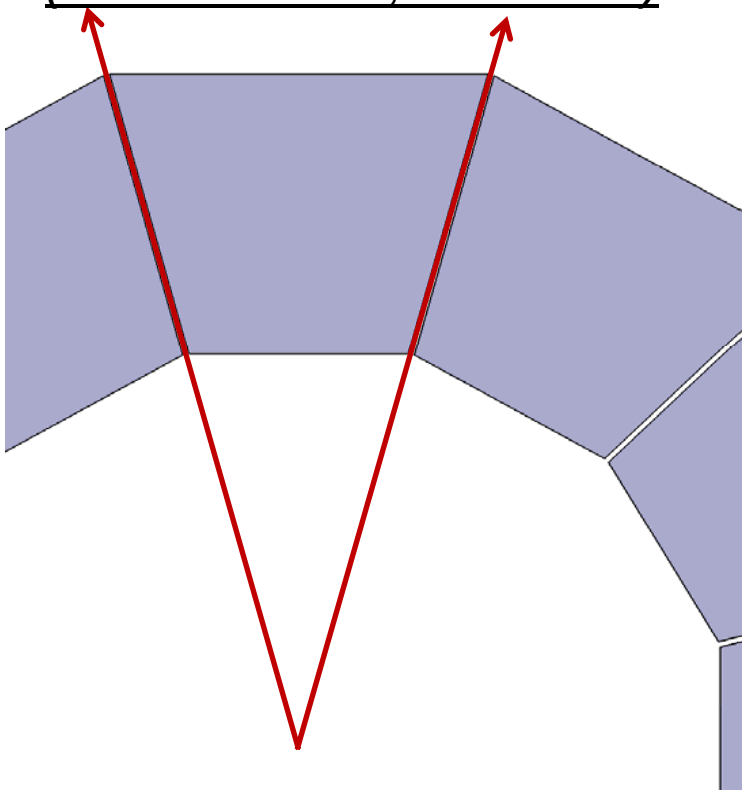
Study of a new Hcal geometry- (Nicolas Geffory-LAPP)

…motivation: « cracks » in the calorimeter



Classical geometry

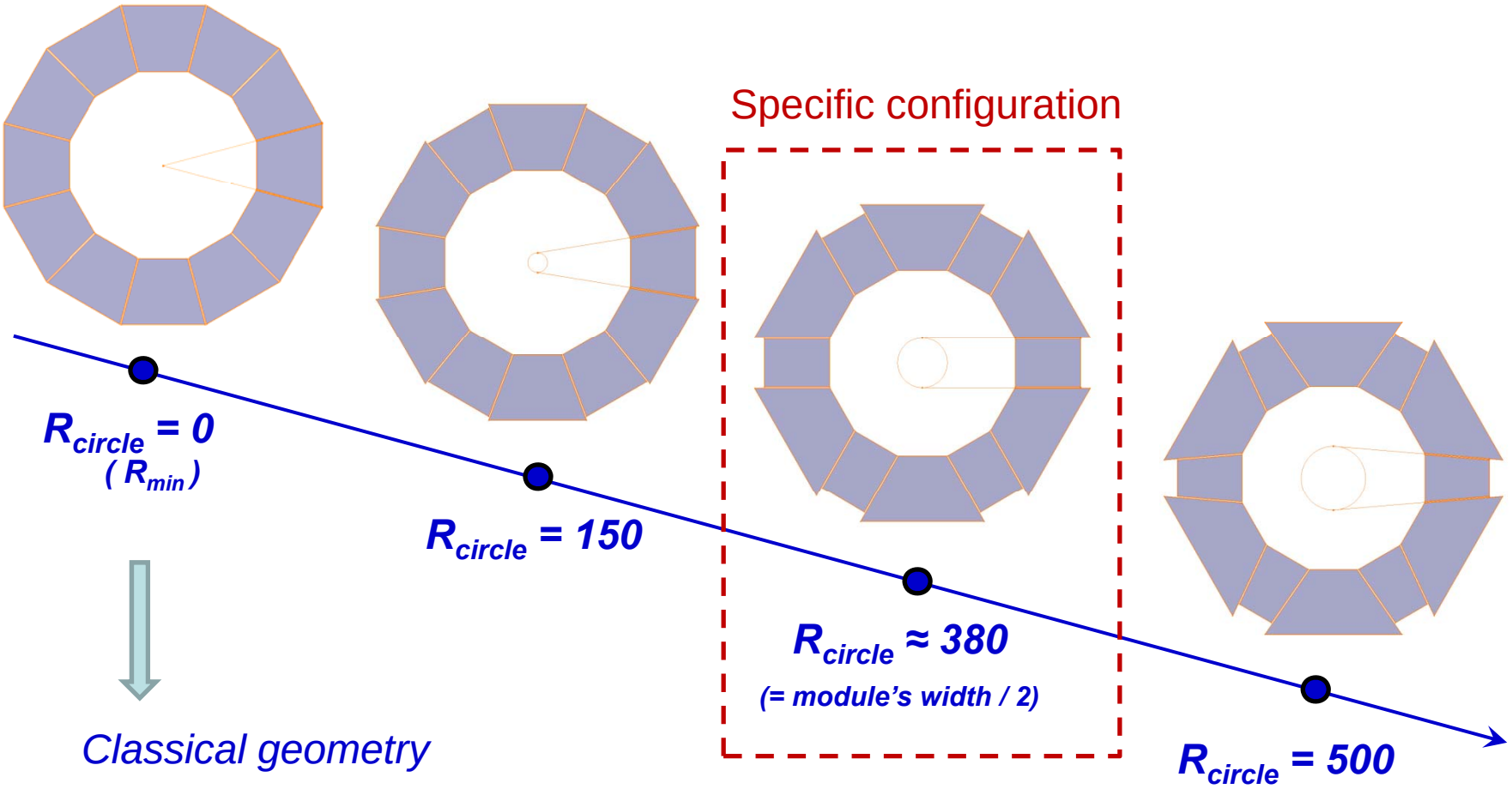
(muons are lost, hadrons ?)



Study of a new Hcal geometry…

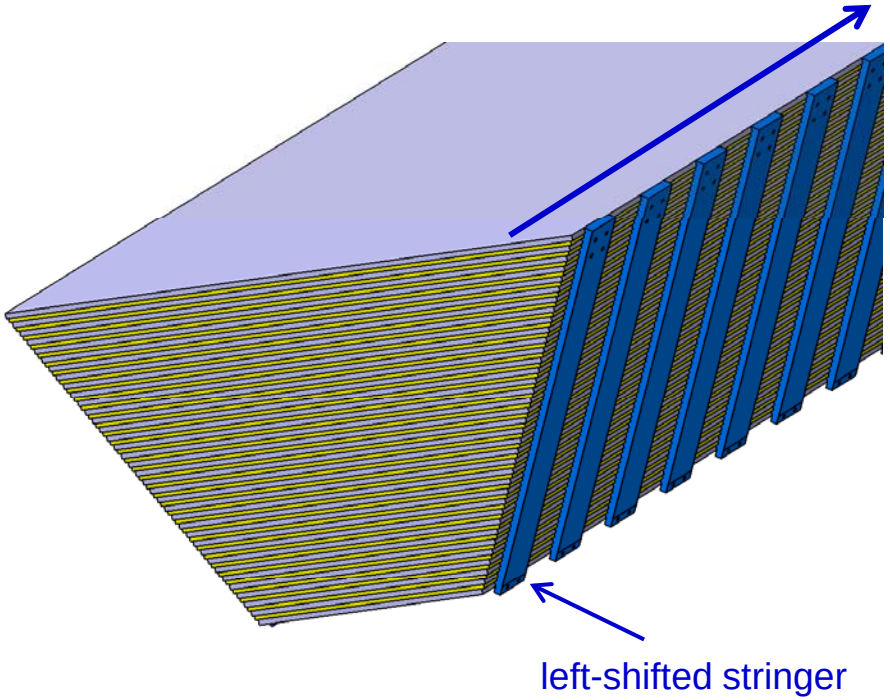
- 2nd version -

Examples of tilt level as a function of the tangent circle radius

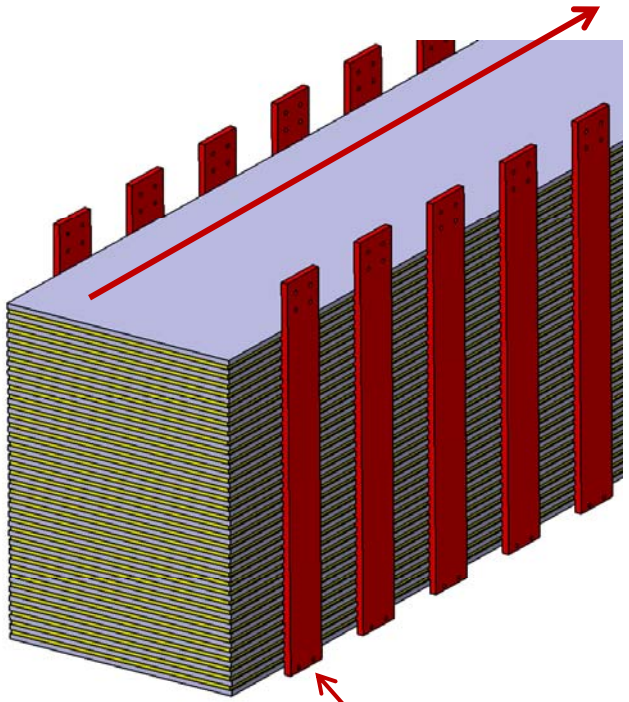


Proposal of Hcal assembly

Several stringers are welded along the module



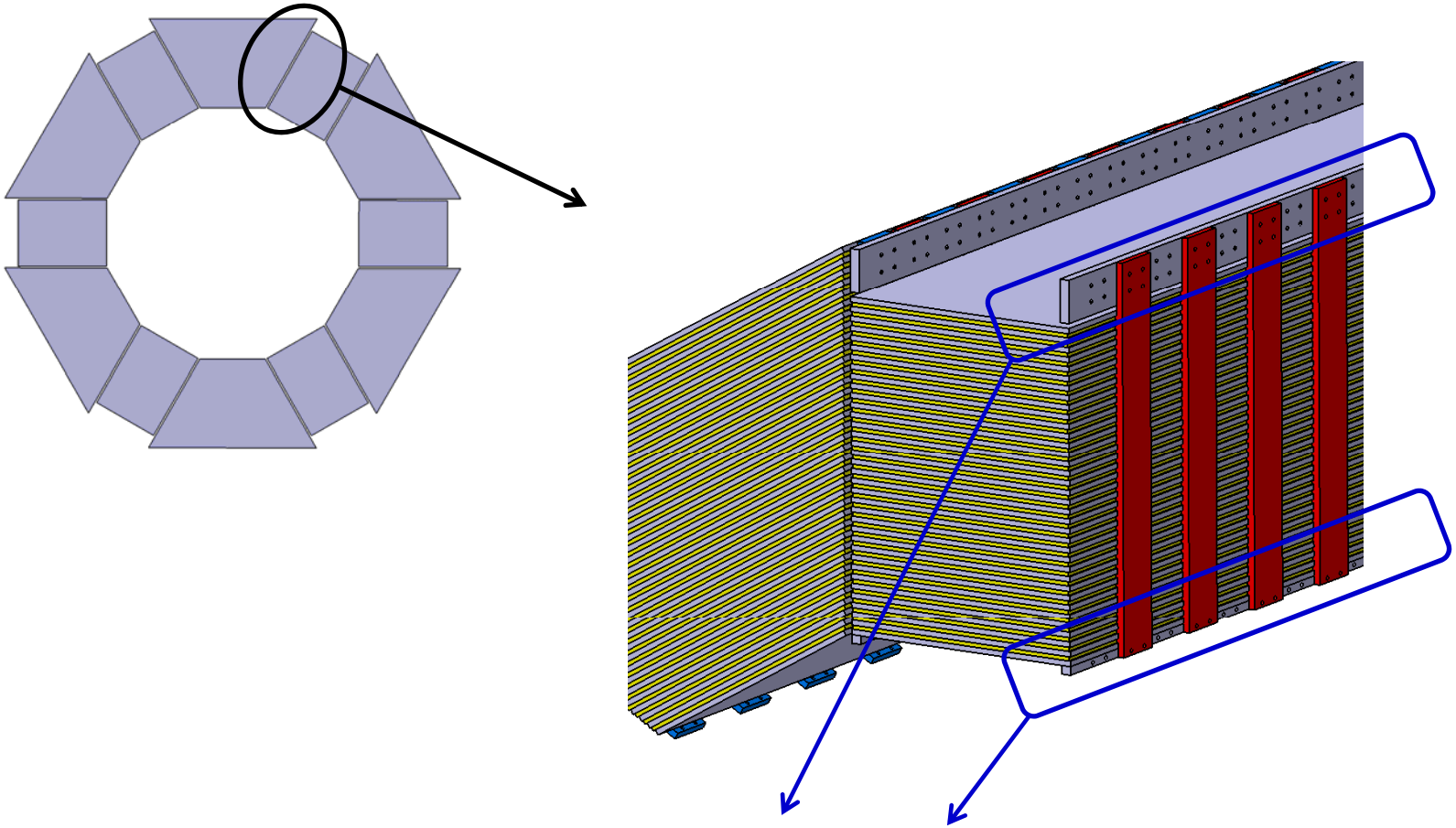
left-shifted stringer



right-shifted stringer

➡ Each module is thus a stiff structure in which chambers can be inserted

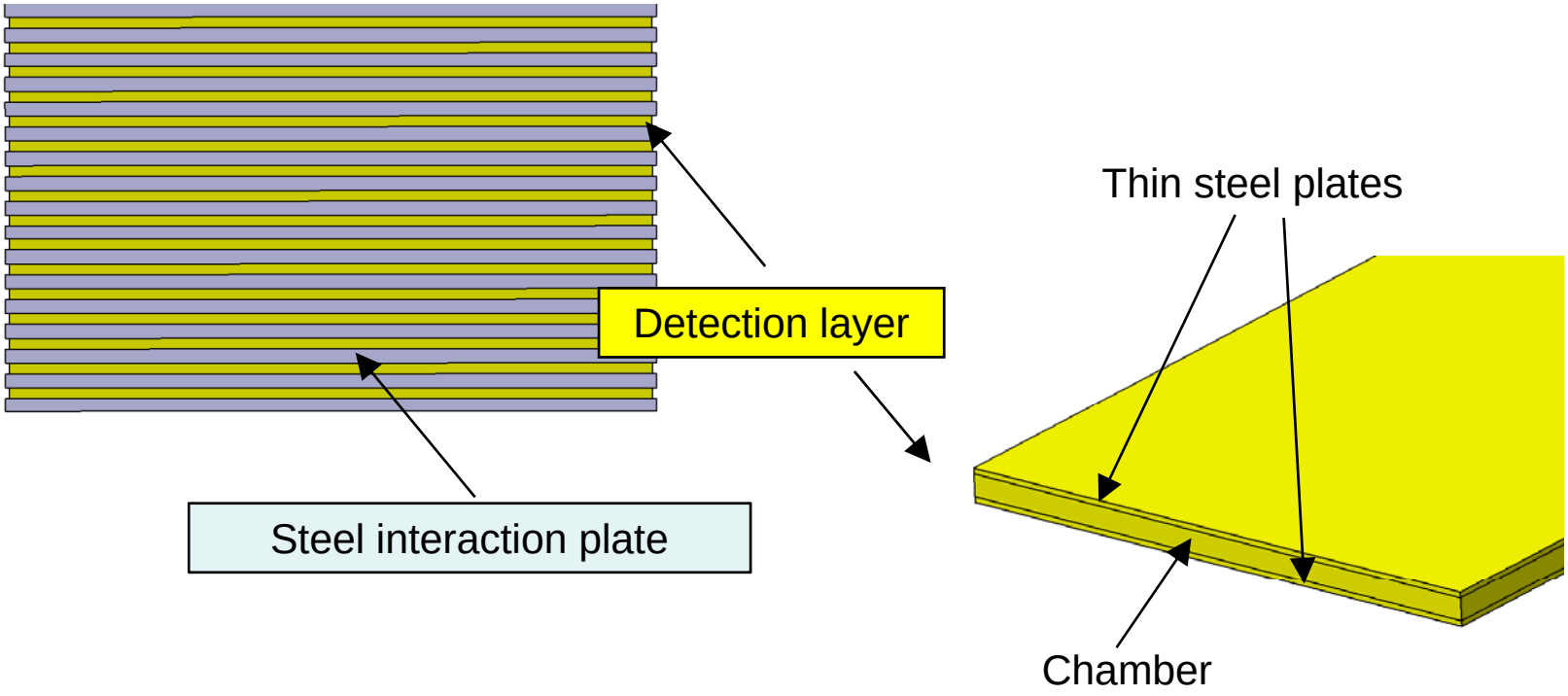
Proposal of Hcal assembly



Inter-modules fixation: 2 small plates are screwed on blue and red stringers.

Proposal of Hcal assembly

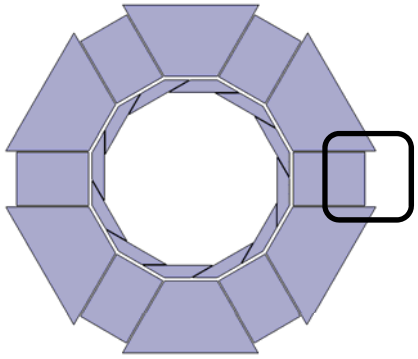
Detail of a detection layer



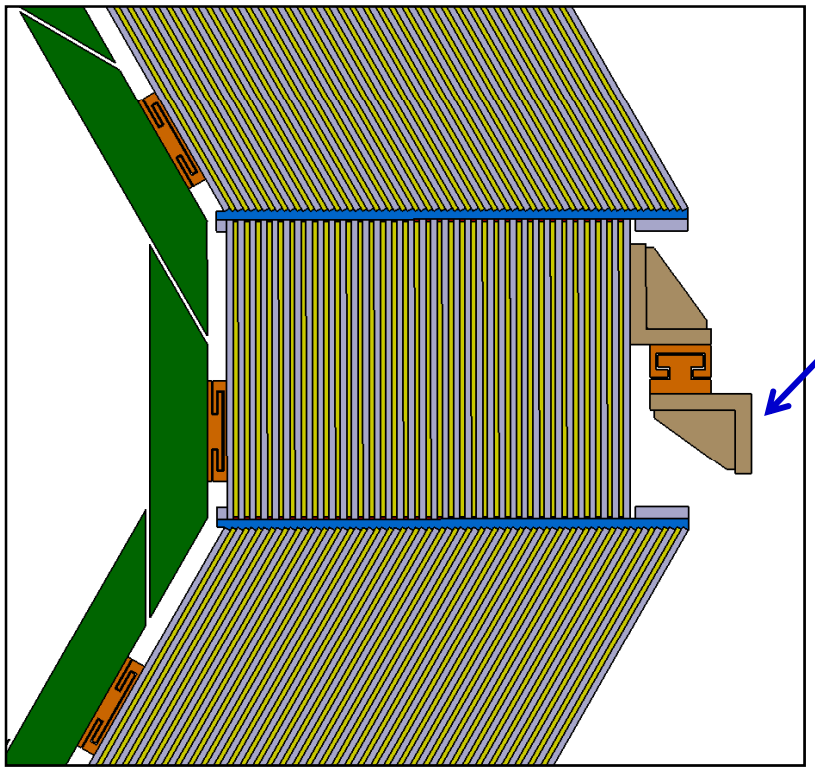
A detection layer (“sandwich part”) consists in a chamber rigidified with two thin steel plates.

→ **Protection and stiffness !**

Proposal of Hcal assembly



3h & 9h fixation

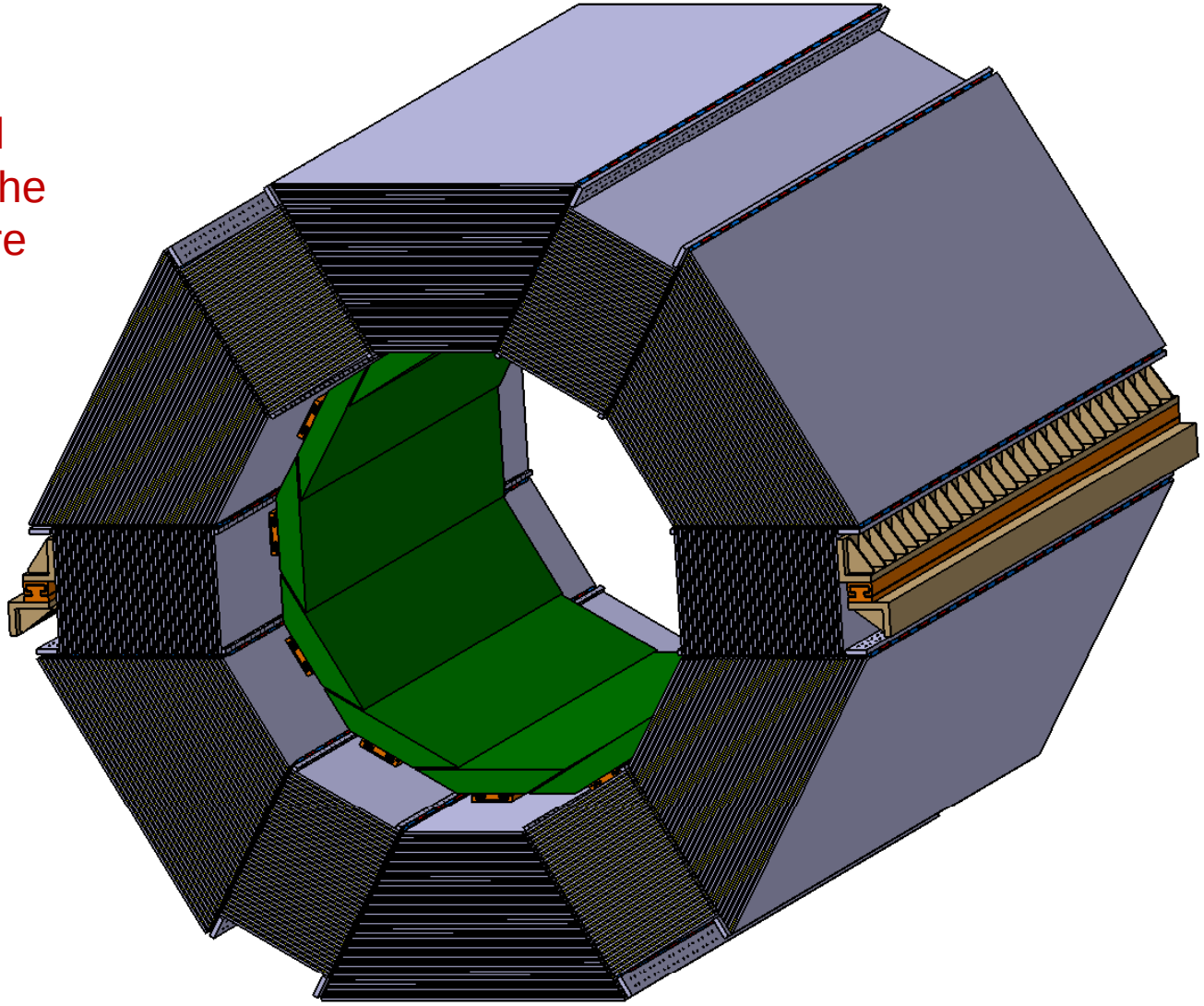


Part fixed on the cryogenic structure

The whole system (Hcal & Ecal) slides inside the magnet thanks to rails.

Proposal of Hcal assembly

Global view of the structure

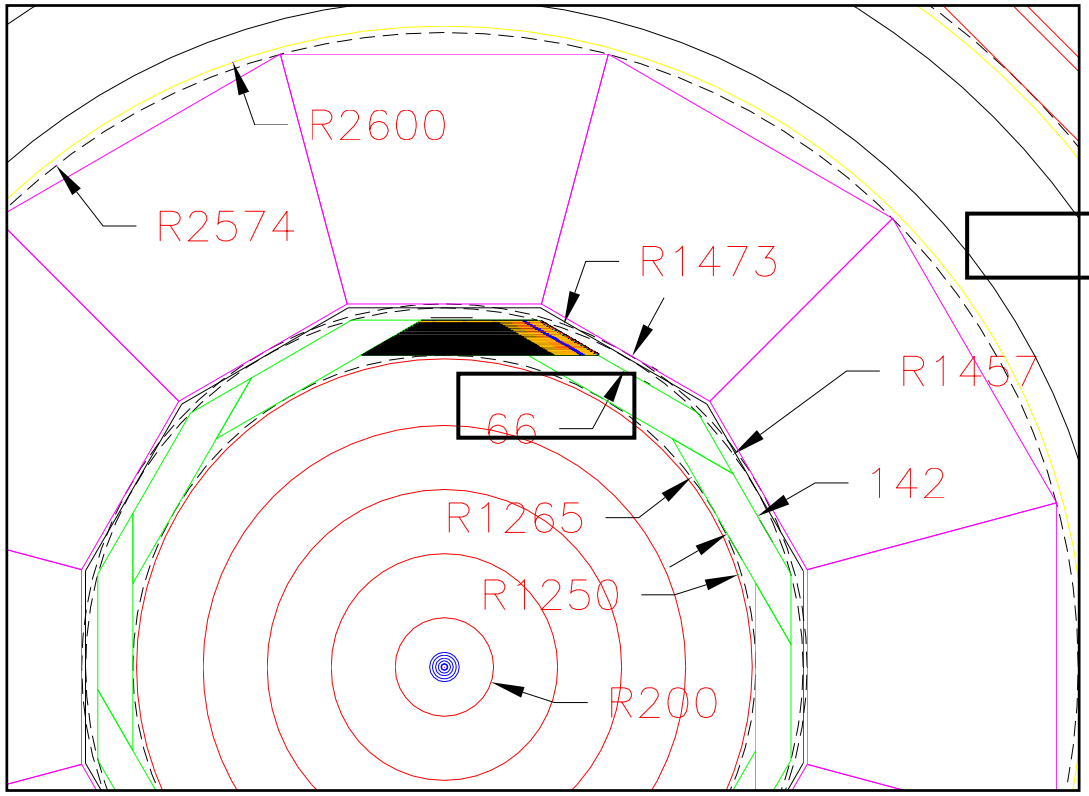


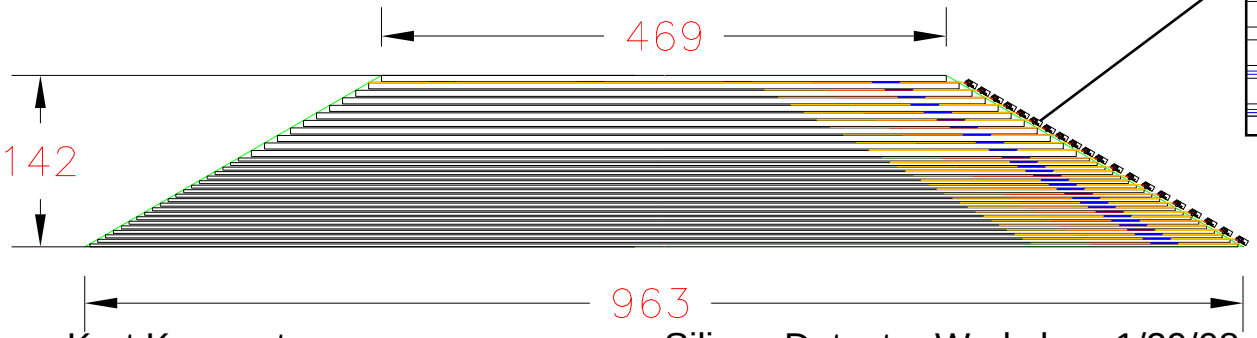
Conclusions

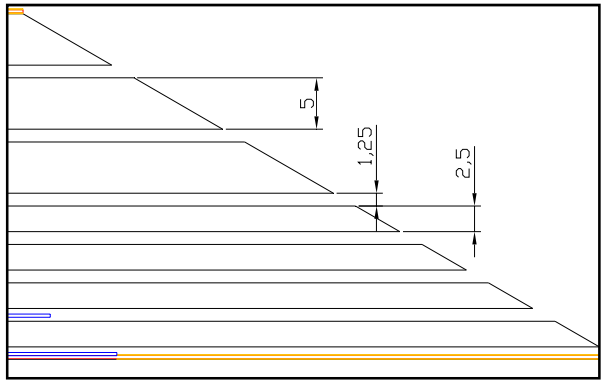
- Several designs of Hcal are possible to avoid cracks
- Finite Element Analyses will be performed to confirm the feasibility of such designs

Physic simulation is necessary to optimize the mechanics

Parameters Si/W ECAL Barrel
Marco Oriunno-SLAC







Physics requirement

Radial envelope: 1265 mm to 1473 mm

12 wedges over 2π

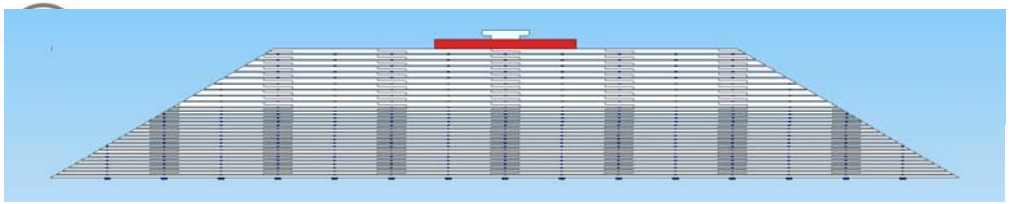
20 tungsten layers of 2.5 mm

10 tungsten layers of 5 mm

Instrumented gap 1.25 mm. i.e. shortest Moliere radius

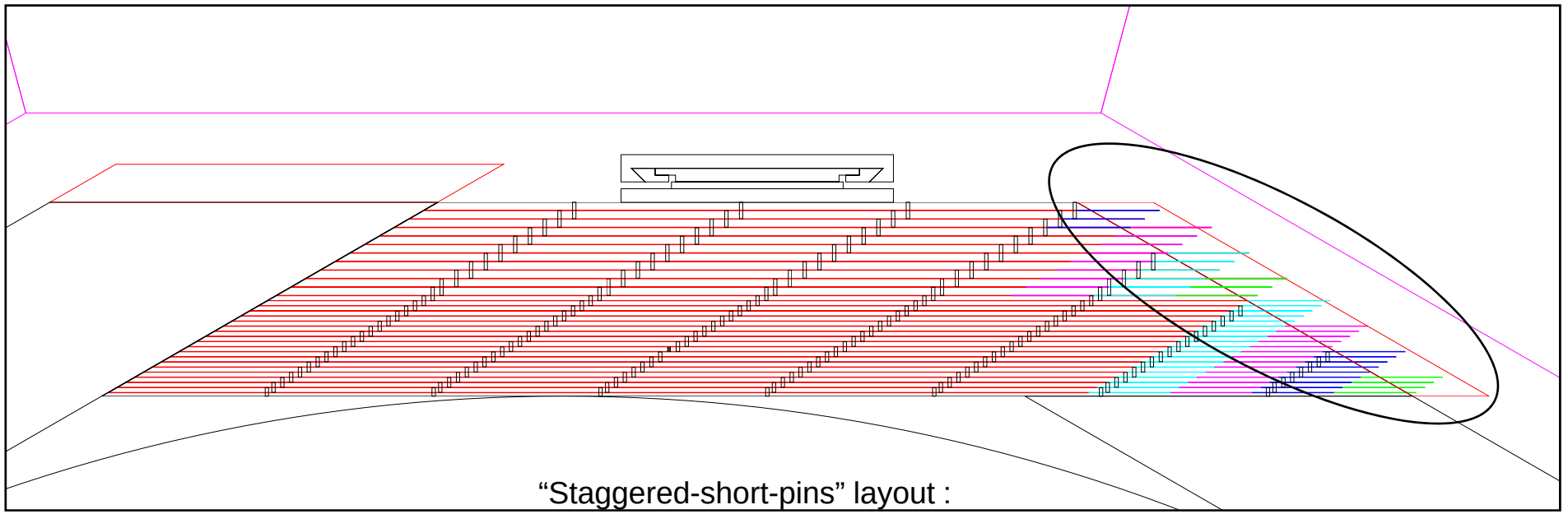
Z length: 3600 mm

Wedge mass 4900 Kg



"Through-all-pins" layout

Proposal under study

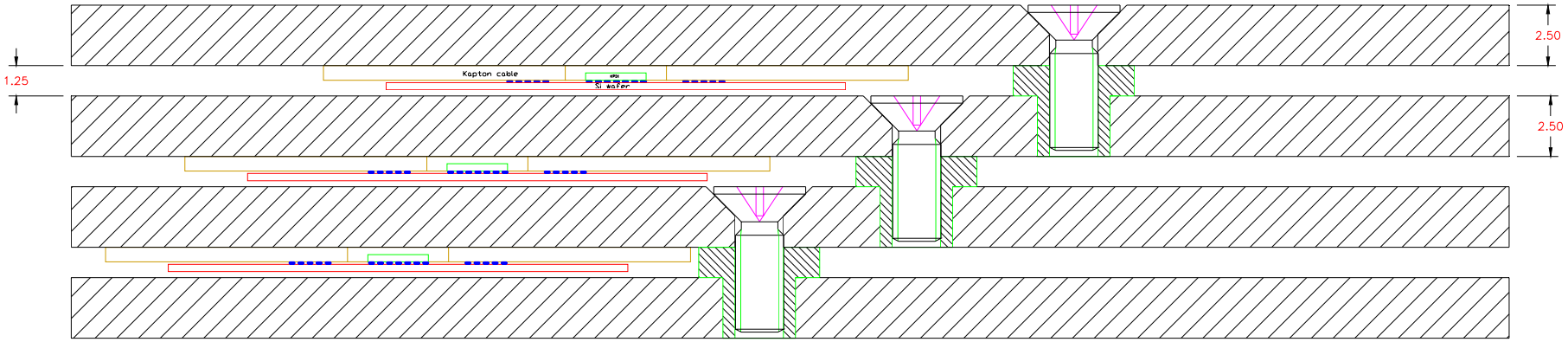


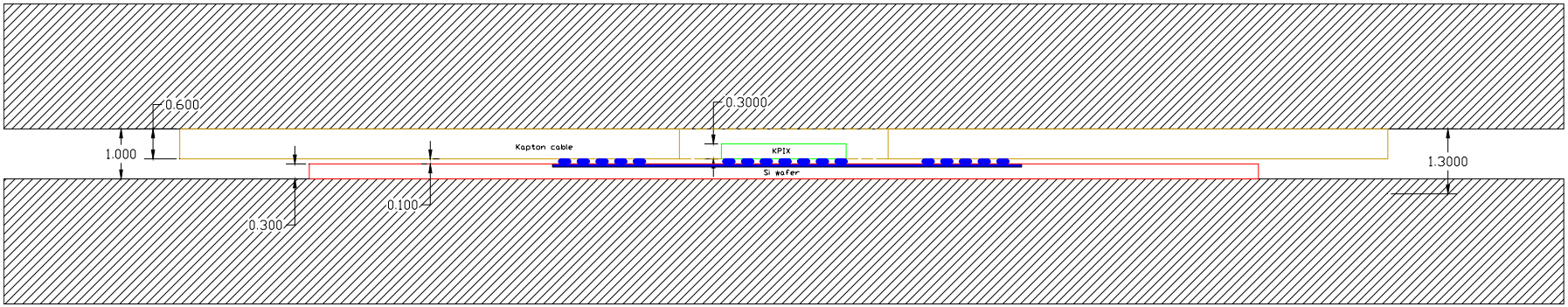
"Staggered-short-pins" layout :

requires only 2 masks for silicon and 8 masks for the kapton

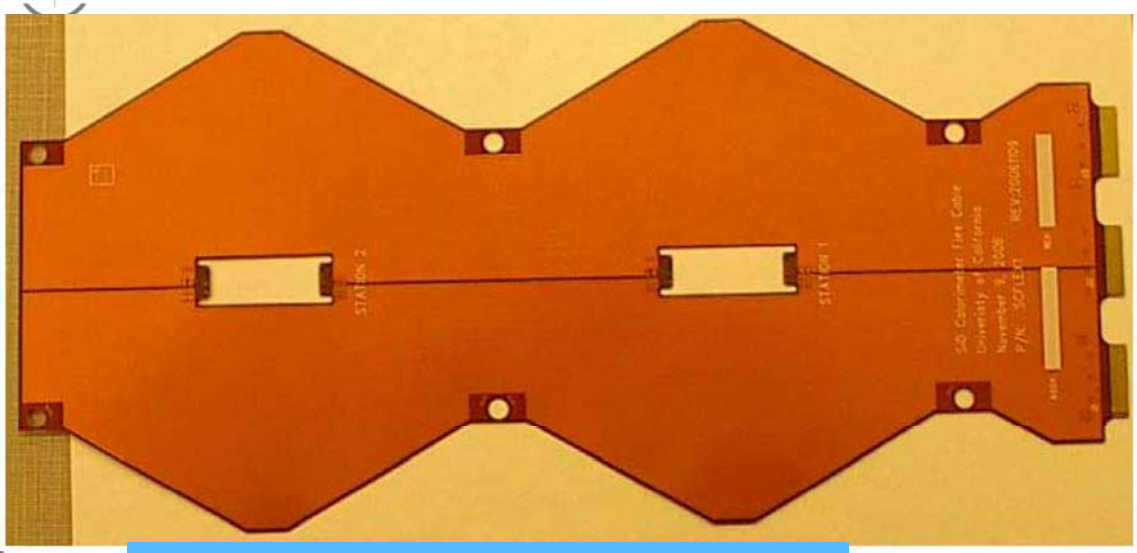
Irregular geometry on one edge

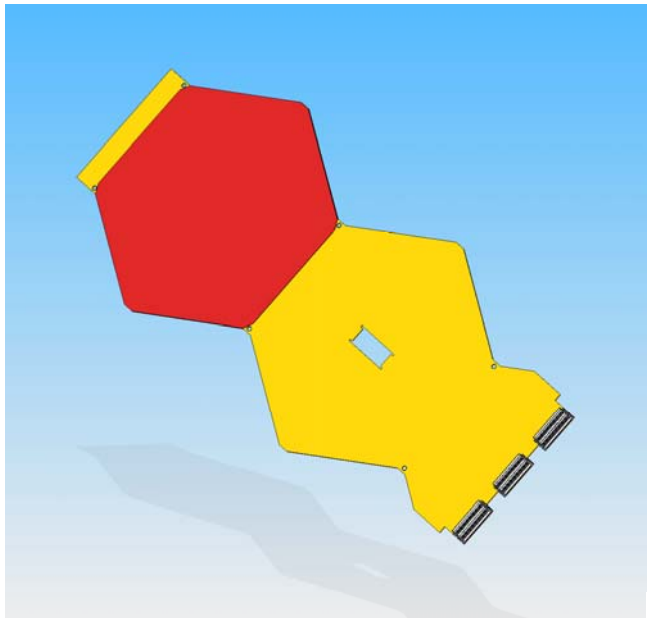
Countersunk Flat Head Screw
ISO 7046-1 - M2 x 6 - 4.8 - H

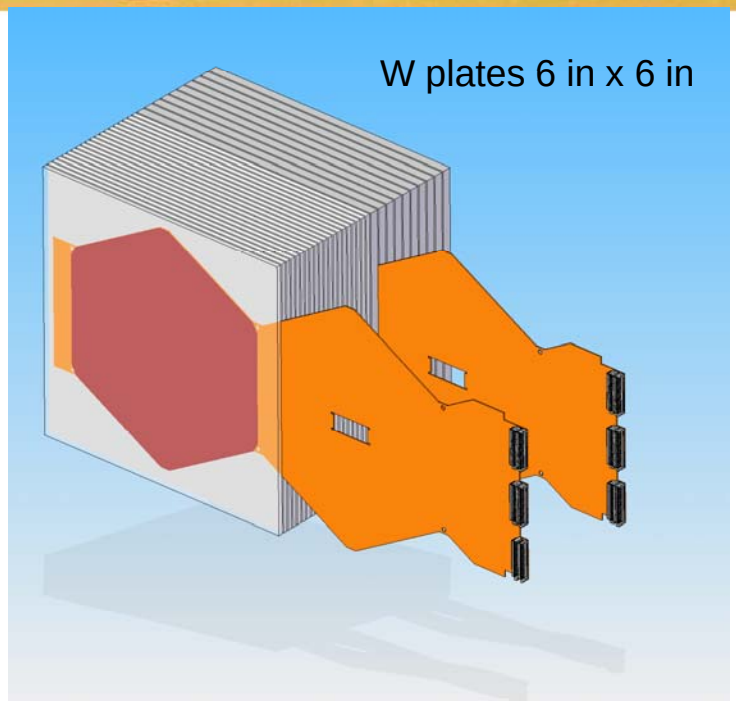


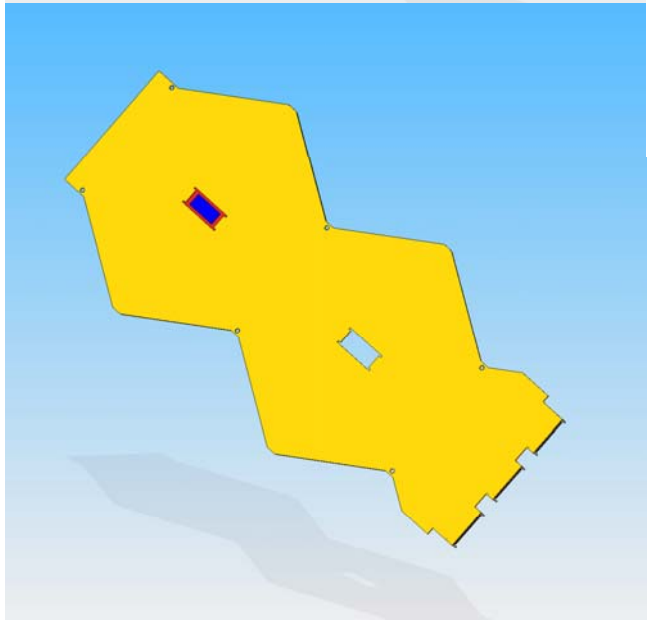


Test Beam components

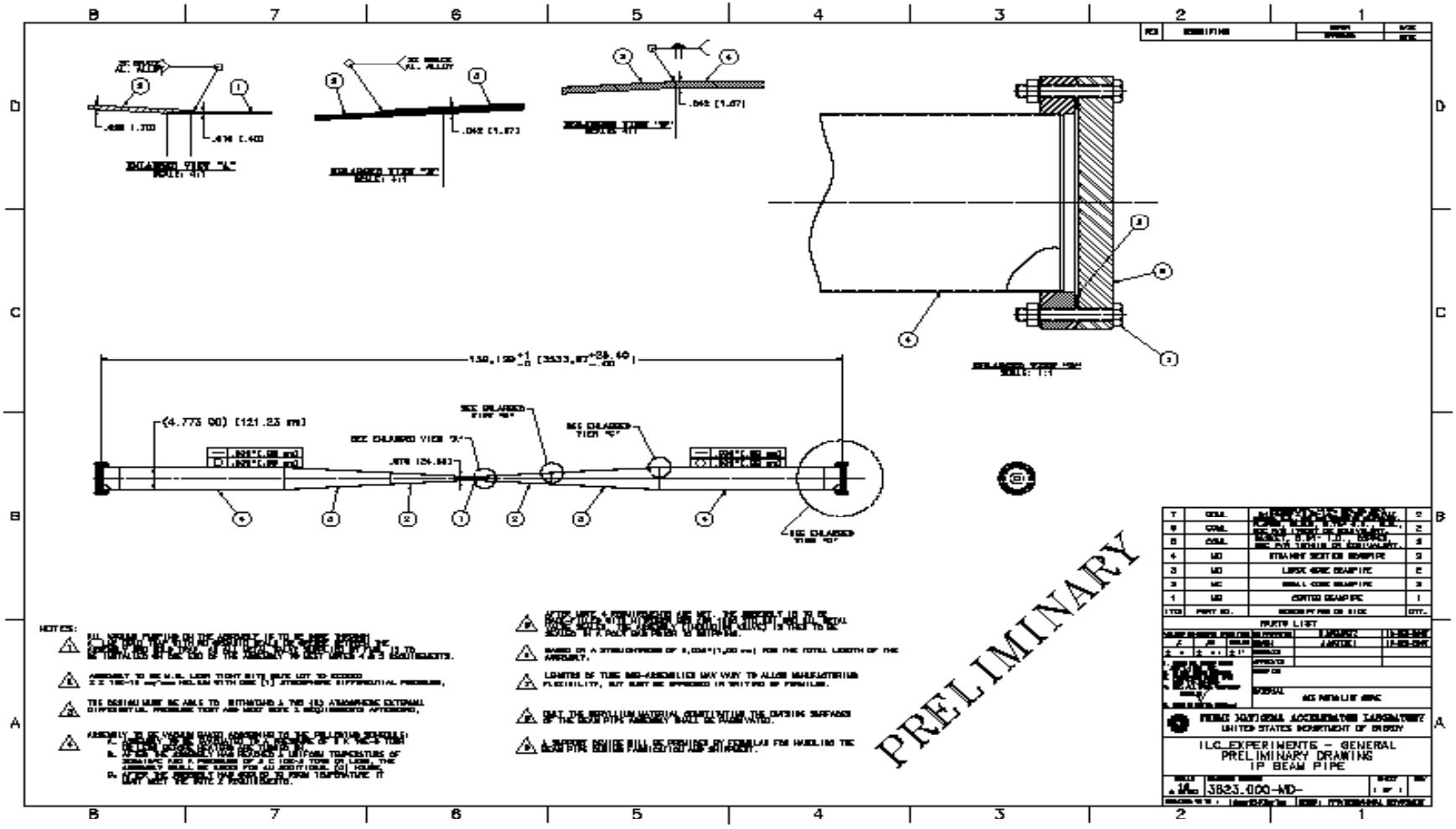




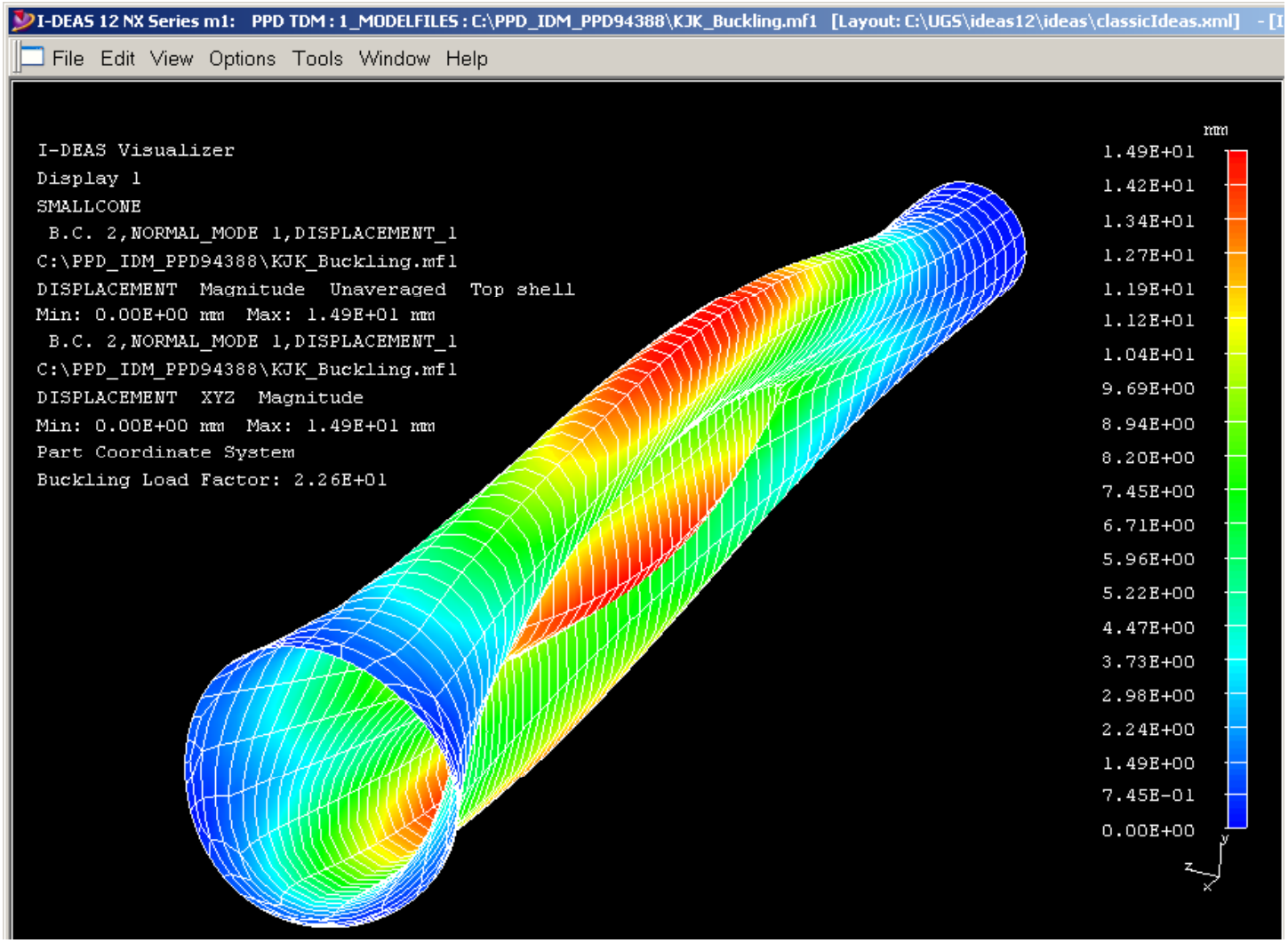




Beam Tube From LumiCal to LumiCal (Cooper/Krempetz-Fermilab)



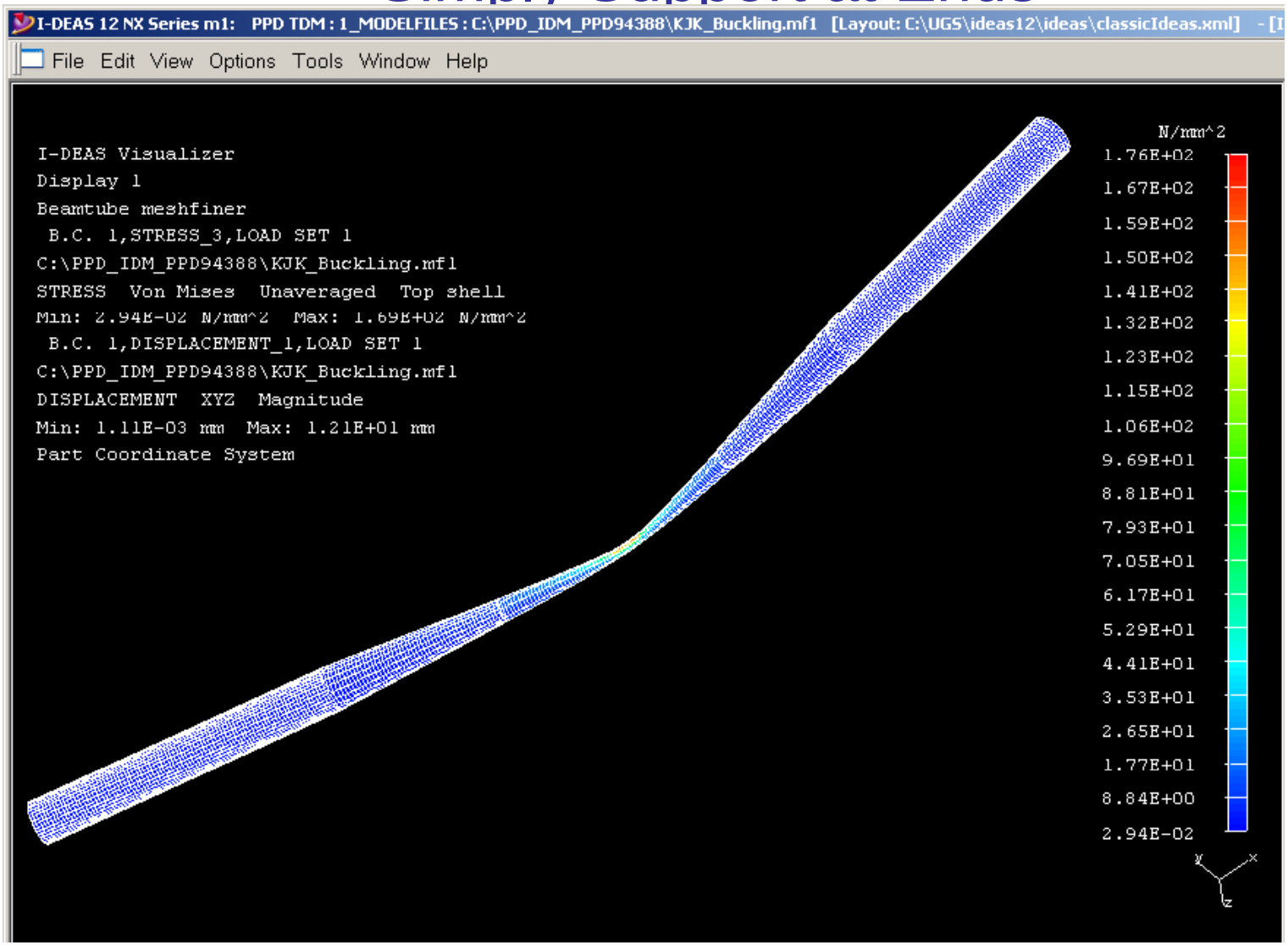
Beam Tube External Pressure Calculations
Small Cone



Beam Tube External Pressure Calculations

Collapse Pressure Comparisons										
ASME calclulates pressure which is allows by code (includes safety factor)										
Collapse Pressure is calculated by Formulas from "Formulas for Stress and Strain"by Roark and Young										
FEA is collapse pressure calculated by Linear Buckling Analysis in IDEAS										
	ASME	Collapse	FEA	Collapse /ASME	FEA/Collapse					
Vertex Section	9.64E+05	4.07E+06	4.20E+06	4.22E+00	1.03E+00					
Start of Small Cone	1.98E+06	6.54E+06	2.19E+07	3.30E+00	3.35E+00					
End of Small Cone	2.11E+05	1.75E+06	2.19E+07	8.30E+00	1.25E+01					
Start of Large Cone	8.60E+05	2.19E+06		2.55E+00						
End of Large Cone	2.92E+05	7.97E+05		2.73E+00						
Straight Section to LumiCal	1.62E+05	4.77E+05		2.94E+00						

Beam Tube Under its Own Weight Simply Support at Ends



Proposed Global Parameters

Detector	Radius (m)		Axial (z) (m)	
	Min	Max	Min	Max
Vertex Detector	0.01	0.06	0.00	0.18
Central Tracking	0.21	1.25	0.00	1.61
Endcap Tracker	0.00	0.49	0.85	1.37
Barrel Ecal	1.27	1.41	0.00	1.79
Endcap Ecal	0.21	1.27	1.65	1.79
Barrel Hcal	1.42	2.37	0.00	2.74
Endcap Hcal	0.21	1.41	1.79	2.74
Coil	2.46	3.27	0.00	2.74
Barrel Iron	3.28	5.92	0.00	2.75
Endcap Iron	0.21	5.92	2.75	5.39

SiD Engineering Group-Estimated Future Involvement

Engineers

- ANL
  - Victor Guarino→*Limited*
- FNAL
  - Bob Wands→*Slighty Reduced*
  - Joe Howell→Greatly Reduced
  - Kurt Krempetz→Slightly Reduced
  - Walter Jaskierny→Slightly Reduced
- PSL
  - Farshid Feyzi→Reduced
- SLAC
  - Jim Krebs→Greatly Reduced
  - Marco Oriunno→Remains Same
  - Wes Craddock→ Remains Same
- RAL
  - Andy Nichols→Limited
- LAPP
  - Claude Girard
  - Franck Cadoux
  - Nicolas Geffroy→Remains Same

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