ILC / ILD TPC

TPC Integration
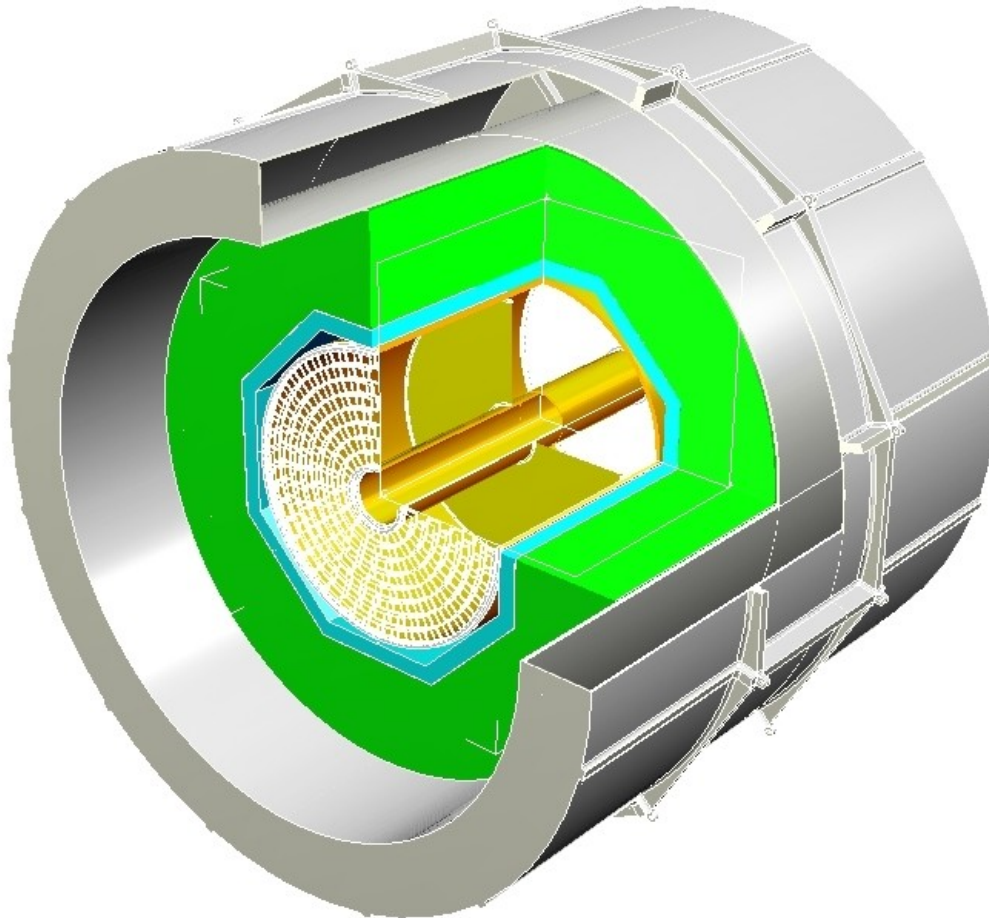
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Paris, 01-02.02.2012

HELMHOLTZ | GEMEINSCHAFT

DESY

TPC

- Dimensions Date Jan. 2012

- Fitted into Detector

- Request for the TPC-Support

- Gap for TPC-Support

- Various designs for an TPC support

- FEA calculation

- Open mechanical questions

- Conclusion

Dimensions

Main dimensions of the TPC (outside)
Ø Od   = 3616, r=1808
Ø Id   = 658,   r=329
Lenght   =4700 incl. endplate and cabling

Dimensions

The next slides shows an estimated weight calculation of the ILD TPC

Paul presented numbers for the Micro Megas on WP143

Backframe:	938g
Mounting Bracked:	120g
Incl. Radiator	294g
FEMI	170g
Air Cooling	140g
Total	1662 g / Module
240 Module:	399 Kg / Endplate
Total weight of the TPC:	1483 Kg

Estimated weight calculation of the ILD TPC

Technical Data: Field cage outer vessel

Component	Outer dia. [mm]	Inner dia. [mm]	Thikness [mm]	Length [mm]	Layer	Volume [m³] Shell [m²]	Unit weight
Outer vessel Core	3615	3495	60	4500	1	3.015 m³	144.72 kg Honeycomb Nomex 48kg/m³
Outer facing Glasfiber 200g/m² Matrix 1,3g/cm³ 40/60	3616	(3615)	0.16 per layer	4500	2	0.0164 m³ Shell 51.12 m² 60% Matrix 9815 cm³	20 kg S2-Glasmesh 195 g/m² (Silan) 12.75 kg
Inner facing Glasfiber 200g/m² Matrix 1,3 g/cm³ 40/60	3495	3496	0.16 per layer	4500	2	0.0158 m³ Shell 49.40 m² 60 % Matrix 9486 cm³	19.76 kg 12.33 kg

Estimated weight calculation of the ILD TPC

Technical Data: Field Cage inner vessel

Component	Outer dia. [mm]	Inner dia. [mm]	Thikness [mm]	Length [mm]	Layer	Volume [m³] Shell [m²]	Unit weight
Inner vessel Core	707	659	50	4500	1	0.241 m³	11.58 kg Honeycomb Nomex 48kg/m³
Outer facing Glasfiber 200g/m² Matrix 1.3g/cm³ 40/60	708	(707)	0.16 per layer	4500	2	0.0032 m³ Shell 9.99 m² 60% Matrix cm³	1.99 kg S2-Glasmesh 195 g/m² (Silan) 2.50 kg
Inner facing Glasfiber 200g/m² Matrix 1.3 g/cm³ 40/60	659	(658)	0.16 per layer	4500	2	0.0030 m³ Shell 9.30 m² 60 % Matrix cm³	1.86 kg 2.32 kg

Estimated weight calculation of the ILD TPC
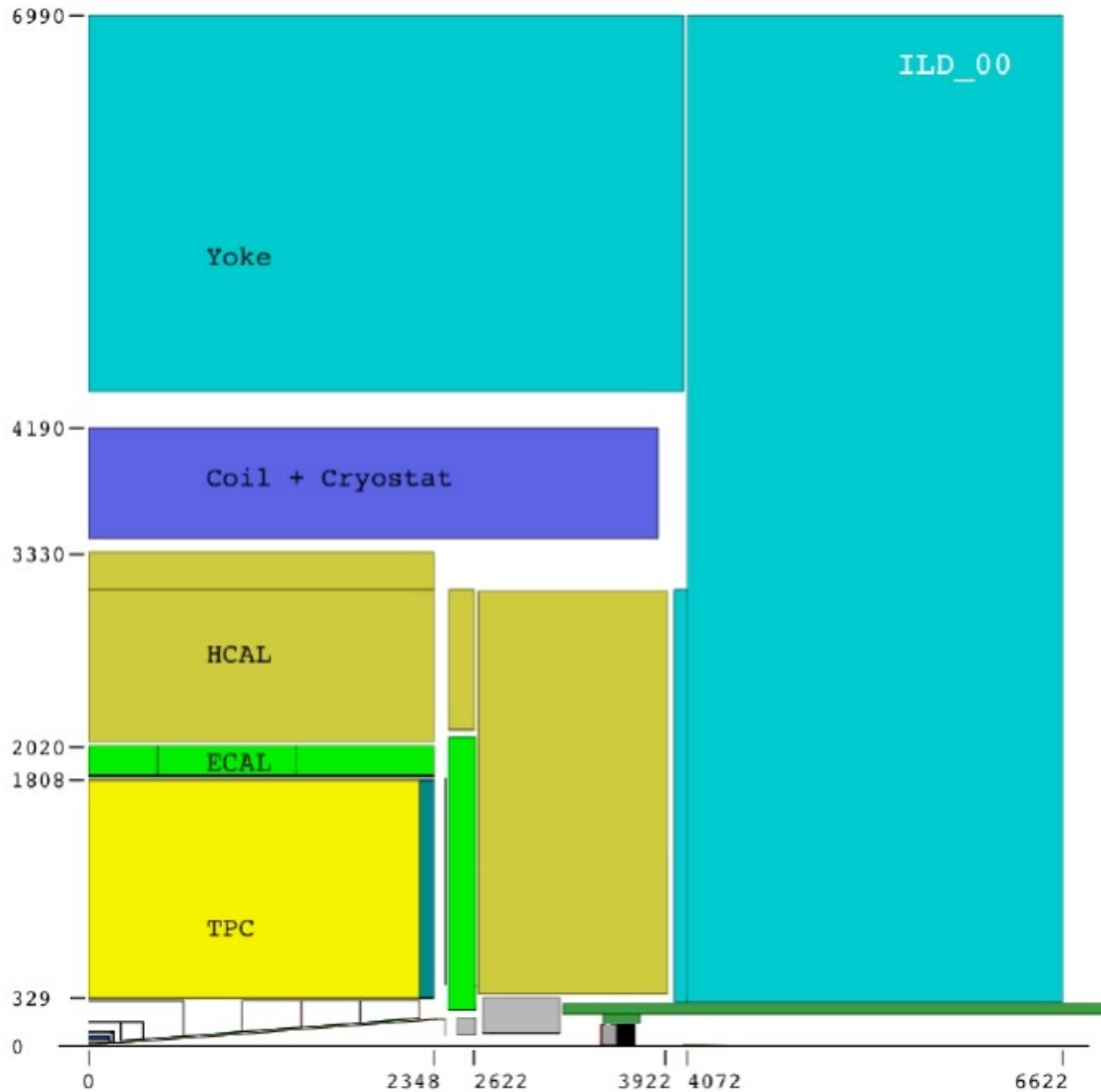
Technical Data: Field cage inner vessel

Component	Outer dia. [mm]	Inner dia. [mm]	Thikness [mm]	Length [mm]	Quatity	Volume [m³]	Density Kg/m³	Unit weight
Foam ring (outer)	3615	3495	60	50	2		150	7.03kg / 14,07kg
Foam ring (Inner)	708	658	50	50	2	Corecell S 800	150	0.56kg/1.13kg
Kapton foil	3615		0.025	4500	1	1277cm³	1.42g/cm³	1.8kg
Screws to fix the Endplate ! Outer vessel !					2 x 223 M8x70 1,612°		7.81kg/dm³	0.0314kg 14,0kg
Screws to fix the Endplate ! Inner vessel !					2 x 54 M8x70 6,667°			3.4kg
Inserts M8					2 x 223		7.81kg/dm³	0.0712kg 31.8kg

Estimated weight calculation of the ILD TPC

Technical Data: Endplate

Component	Outer dia.	Inner dia.	Material	Quantity	Weight
Endplate +Z	3616	718		1	136 kg
Endplate -Z	3616	718		1	136 kg
Module ! Raw data !				2 x 240	0.500 kg ? 240kg ?
Central Electrode Adjustment	Approval: Core, Honeycomb Facings: on both sides		Alu	1	Core: 2.6kg Facings: 3.57 kg Matrix: 5kg Epoxy 10kg
HV feed through					
! Attention !	Calculation for fieldstrips, shielding, isolation				100kg
Preliminary weight					925kg with Mico Megas 1483Kg

Fitted into Detector

Quarter of the cross section
Incl. Vertex, SIT, FTD

The sketch shows only an quarter of the cross section

endplate / cabling

100

45

25mm

amplification / gating / first active field strip region

outer field cage wall 60mm

service area 30mm

Ro 1808

Ri 1748

Rs 1718

cross section of sensitiv area

first active field strip

central membrane 60 um foil

Al grips for membrane height 30, width 15

service area 30mm

inner field cage wall 25mm

4450

end plate

Roi 354

Rii 329

4500

4700
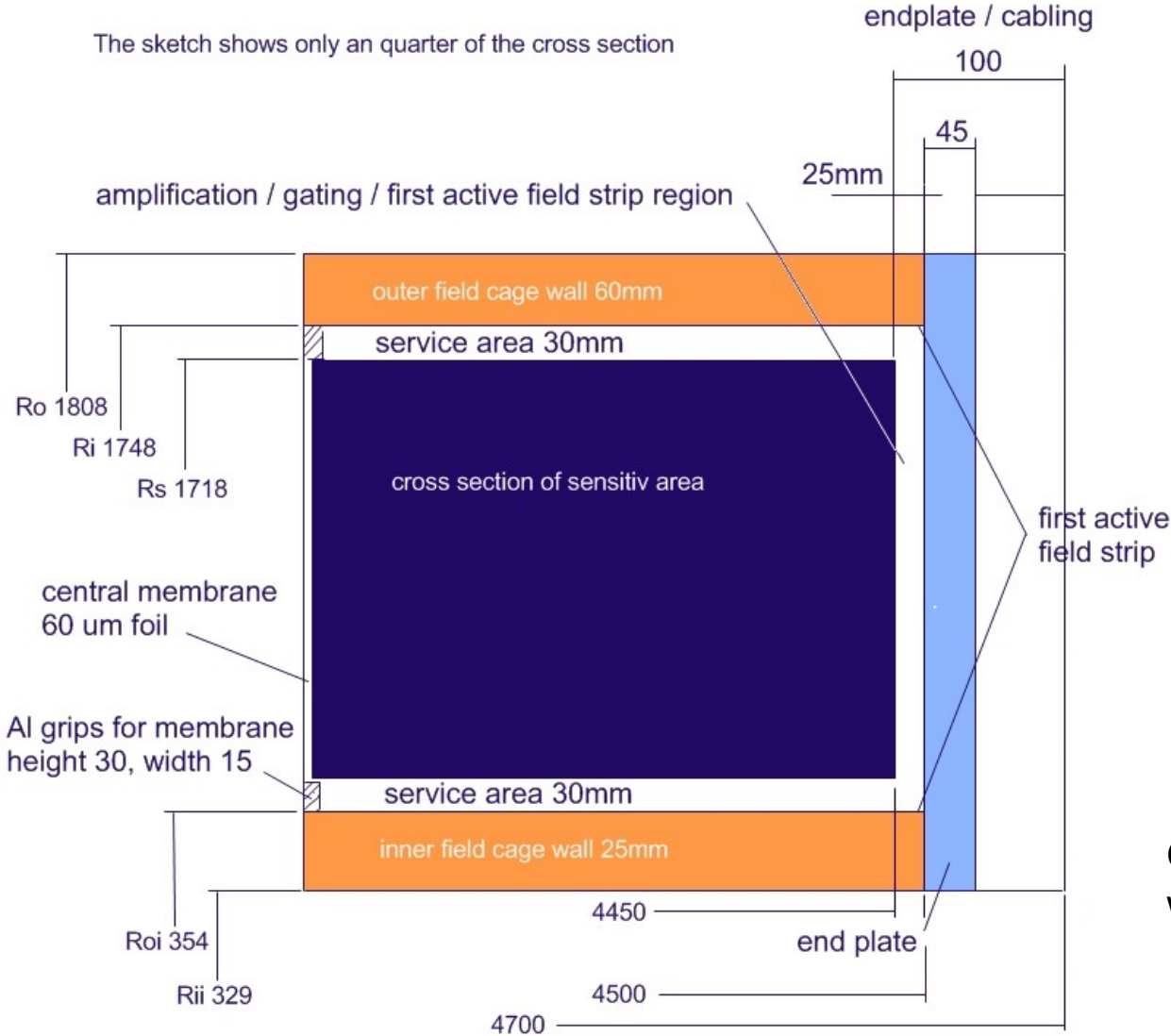
Quarter of the cross section with TPC details

Request for the TPC support structure

The support structure has to be fulfill the following tasks

> Non-magnetic material

> Low thermal expansion coefficient

> Robust system in x,y,z,

> Short support structure (more a wish than a realistic option)

> Radiation length is only important at the end of the ECAL

> Vibration absorption in Z direction

> Accuracy 100 µm or better for Vertex, SIT, FTD !

Gap (s) for TPC-Support

Support structure

15
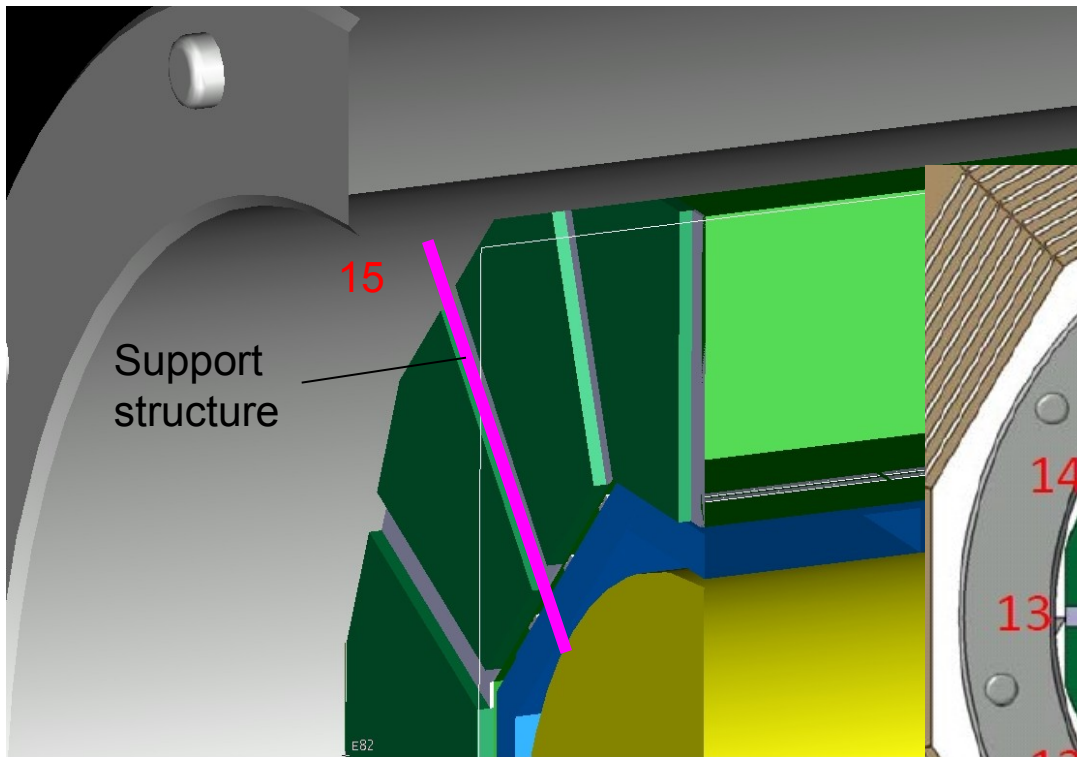
Prefered gaps for support structure
No. 3, 15, 9
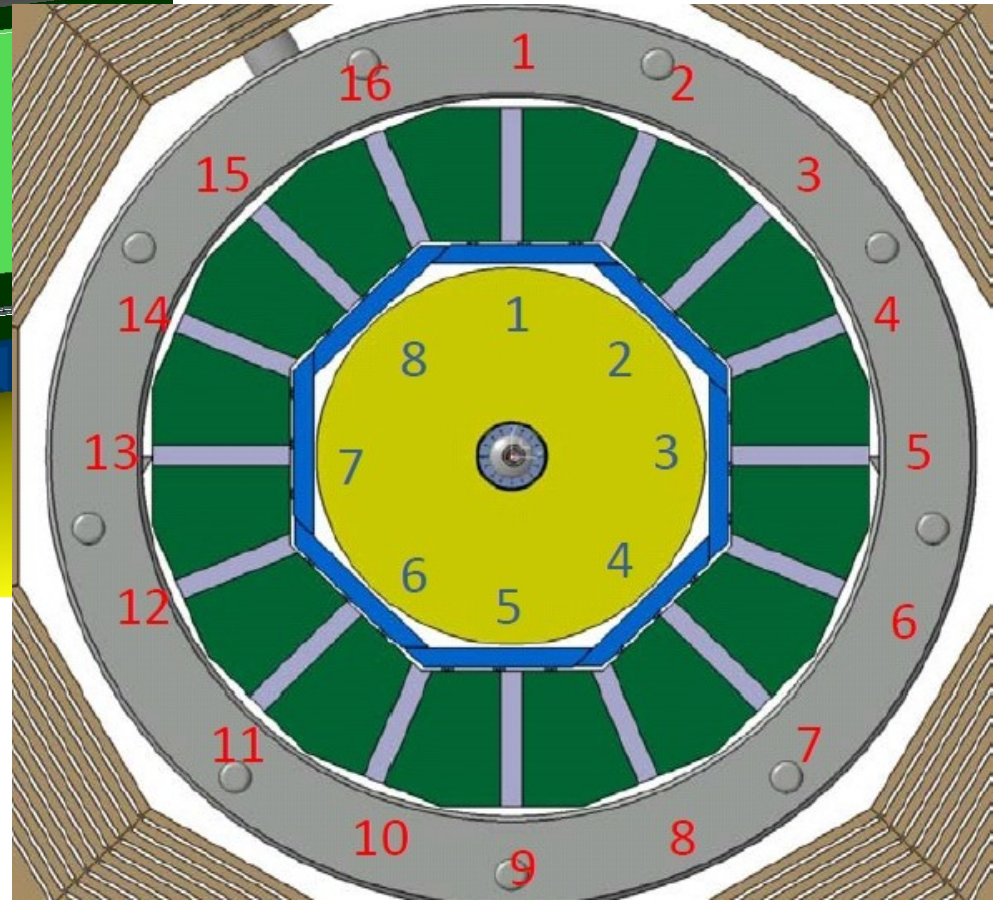
View -Z Catherine Clerc

Gap (s) for TPC-Support

FACE Z-

Way in	Hcal	TPC	Cables Ecal Barrel	Ecal Endcaps	Ecal cooling Water Barrel Water Endcaps	Endcaps	Total cm²
1	100	0					100
2	0	10	30	7		0	47
3	100	0					100
4	0	10	30	7		0	47
5	100	0					100
6	0	10	30	7	42	14	103
7	100	0					100
8	0	10	30	7	28	14	89
9	100	0					100
10	0	10	30	7	14	14	75
11	100	0					100
12	0	10	30	7	28	14	89
13	100	0					100
14	0	10	30	7		0	47
15	100	0					100
16	0	10	30	7		0	47

Table Catherine Clerc

List of Cables, Cooling…
- Update available ?

Various designs for an TPC support

- Post or feet ?
- Ropes or bars ?
- Hanging on the HCAL or Cryostat ?

If you collect pros and cons
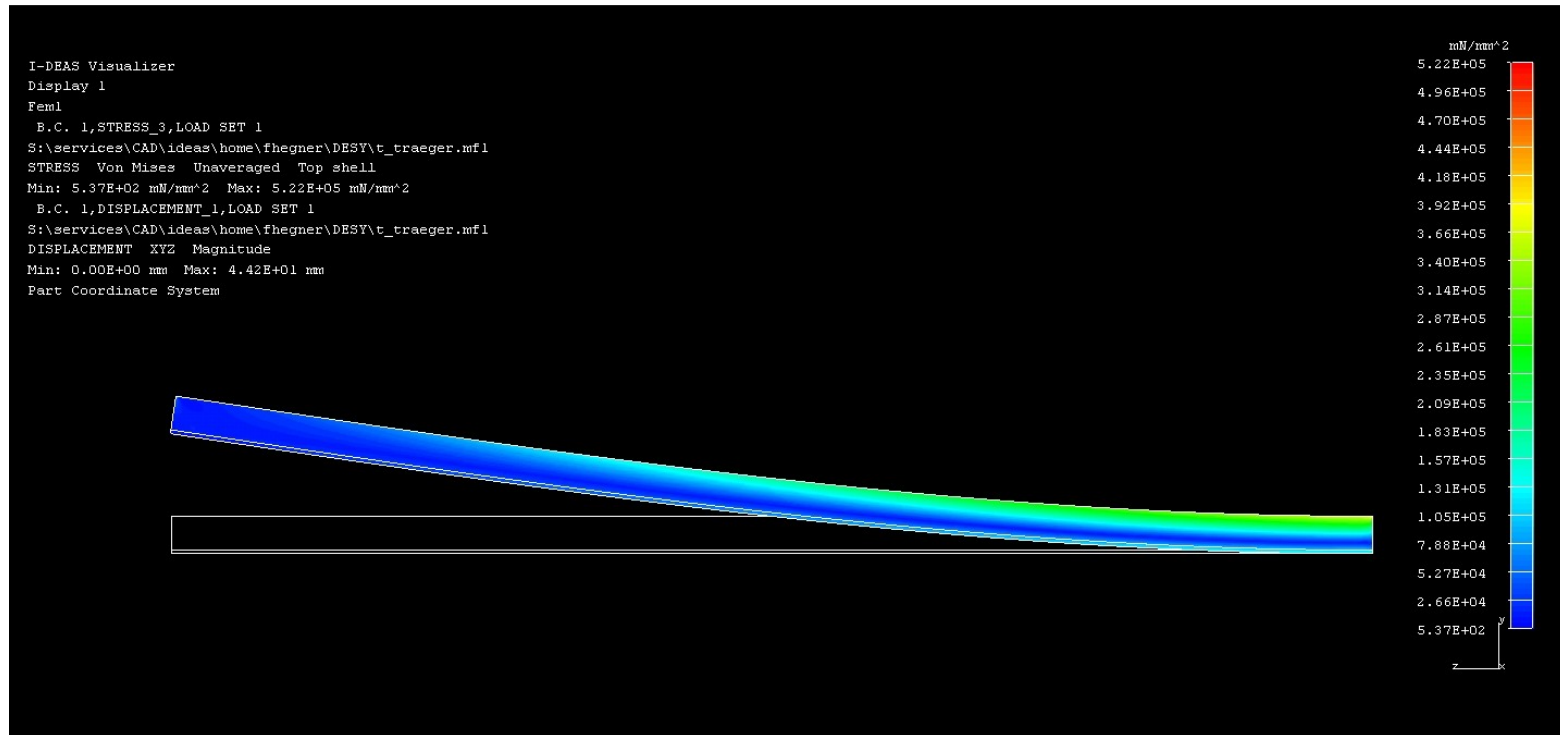the "best" solution locks like
- Supported by bars
- Fixed on the Cryostat
- Min. three bars
- Made out of CF

But:
- Is the Cryostat stable enough for the requested accuracy of 100 µm?

First FEA calculation of the TPC-Supportbeam

T-beam 50x50x5

Loadset: 1000N in Z, 10000N length direction

Bending: f= 44.2mm

Can we trust this calculation?

No elongation in length

New FEA simulation now in progress

Open mechanical questions

- ➢ HV feed through
- ➢ Central electrode design (tests for LP-TPC in progress)
- ➢ Mounting procedure of the TPC
- ➢ Mounting support for the TPC Vessel
- ➢ Fixation the TPC in Z (open issue)
- ➢ How to mount the CF-pipe for the Vertex, SIT, FTD
- ➢ Alignment of the TPC plus attached detectors
- ➢ Design and size of the support structure (in progress)

Only some of open questions

Conclusion

> Decoupling TPC from Silicon tracking?

> Dampening of vibrations understudy

> Cabling could be an issue due to Lorentz forces

> Bar made out of CF will be build for tests soon

- Bending and stretching tests

- Vibration studys

- Verifying FEA studys

Thank you !