# SVT & L0

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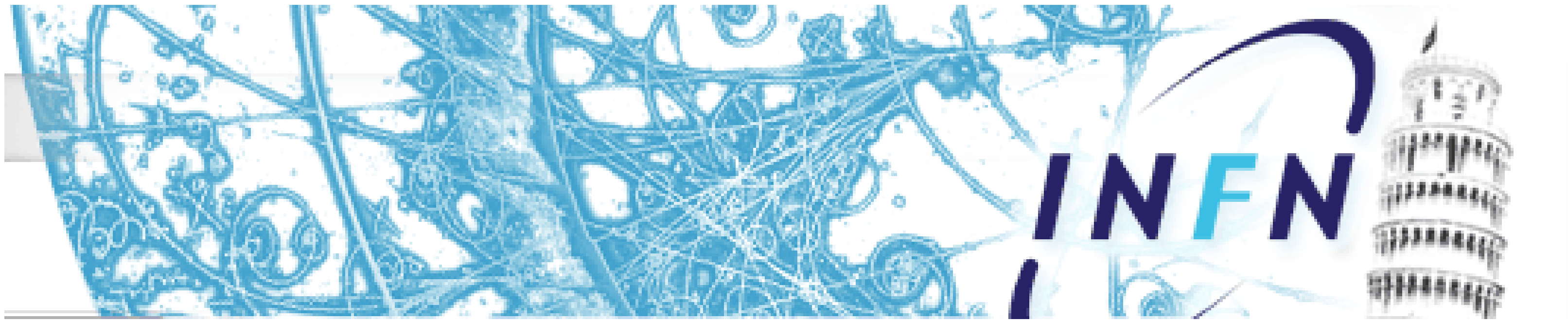
*on behalf of the SuperB SVT Group*

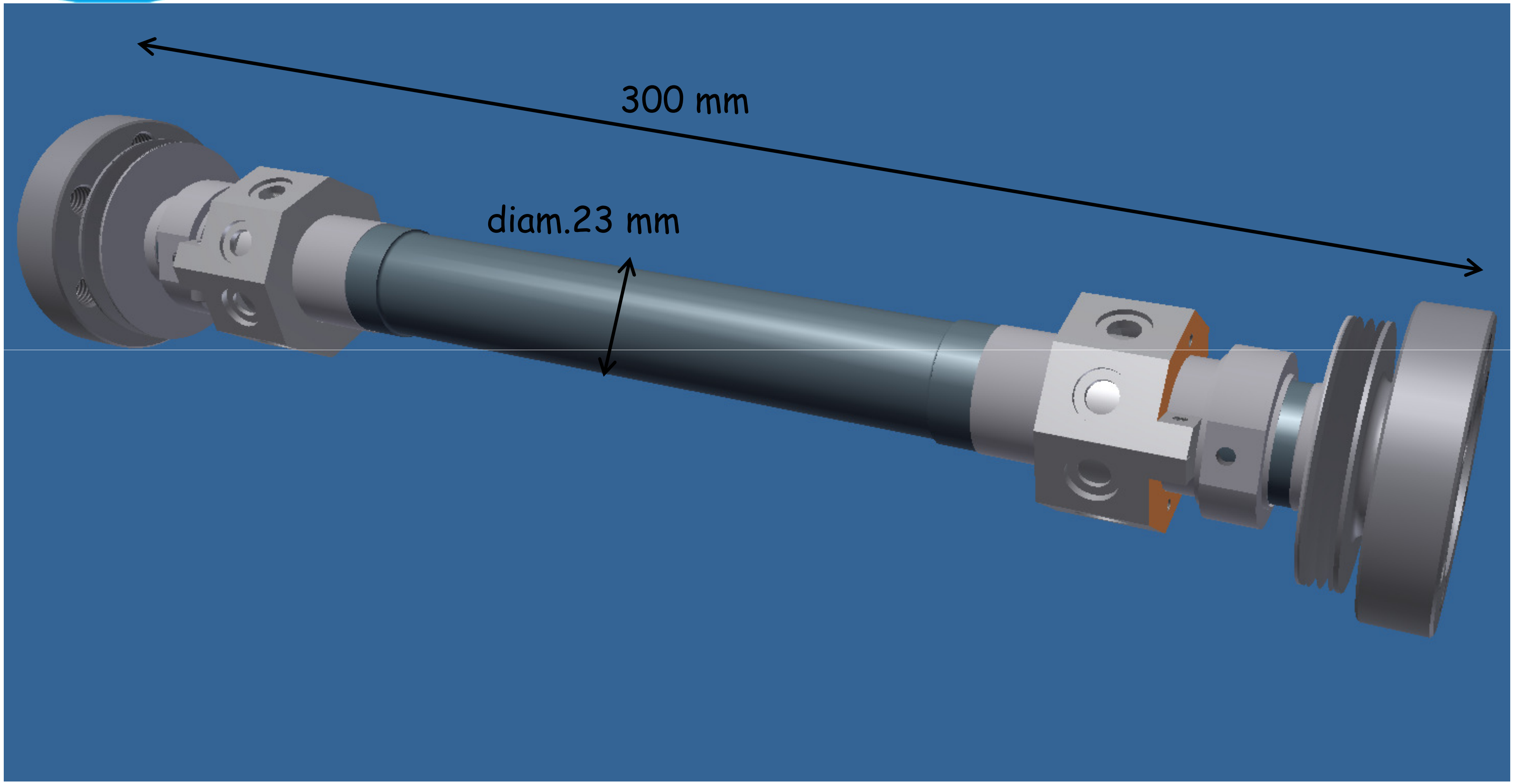
*SuperB Workshop 4-7 April 2011, INFN-LNF*



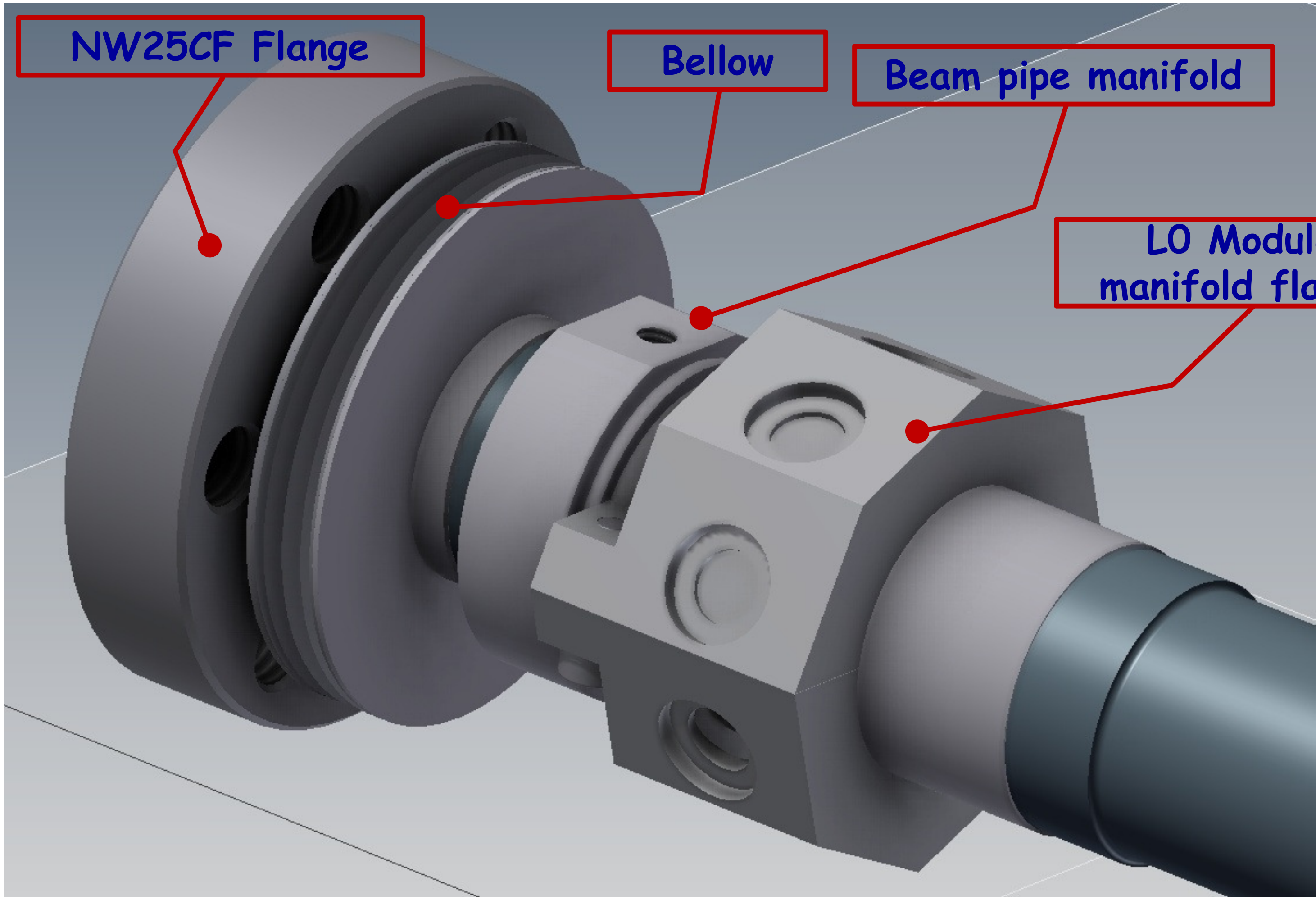
# Outline

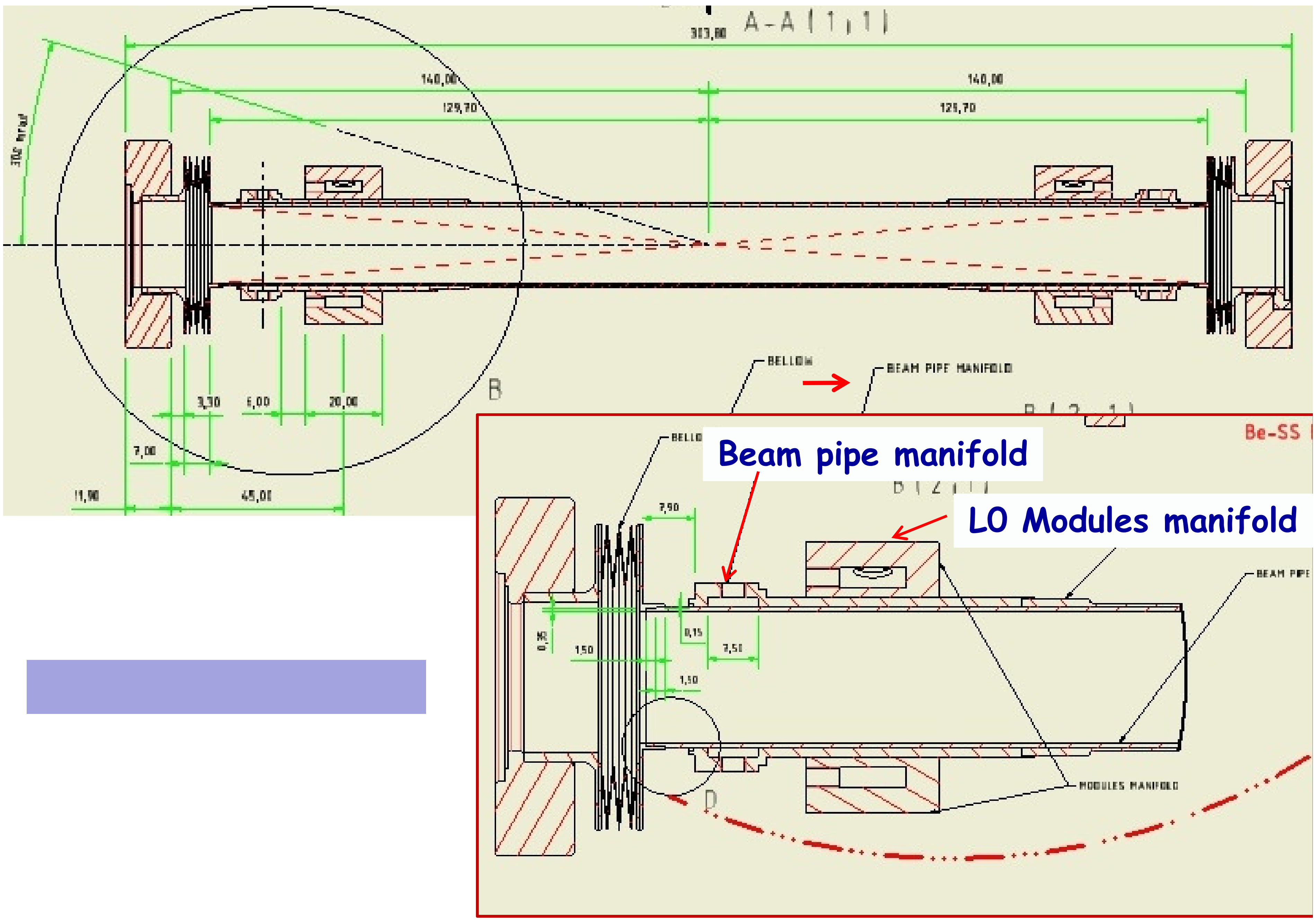
- Central Beam-pipe
- L0 Module (Pixel version)
- L0 Module (Striplets version)
- SVT
- L0/SVT Supports condition for demounting

# Central Beam Pipe



# Internal Bellows

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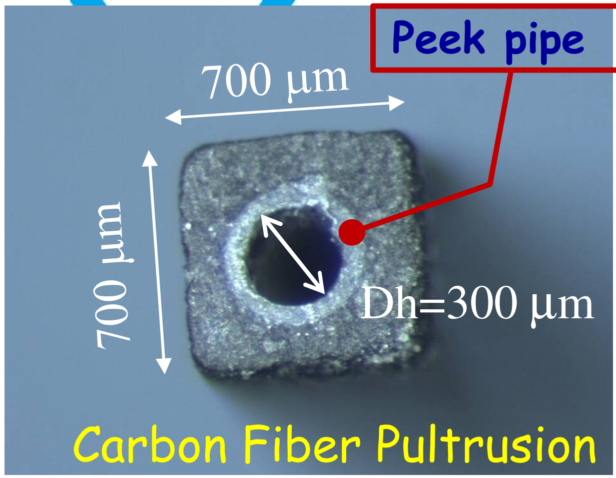
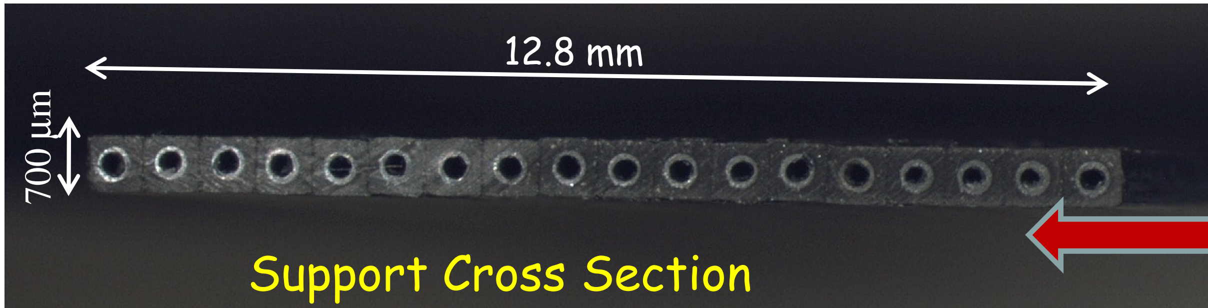
303,80
140,00
140,00
129,70
125,70
3,30
6,00
20,00
7,00
11,90
45,00
B
BELLOW
BEAM PIPE MANIFOLD
Be-SS
Beam pipe manifold
L0 Modules manifold
7,90
0,15
7,50
1,50
1,50
BEAM PIPE
MODULES MANIFOLD
D

# Module Pixel supports



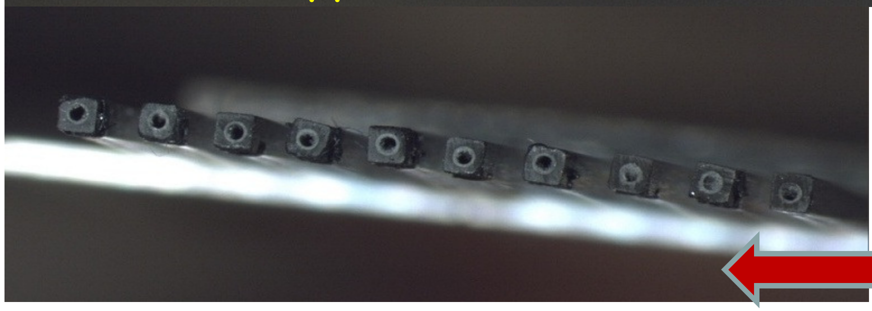

The single base microchannel unit

A square CF micro-tube with an internal peek tube 50 μm thick used to avoid moisture on carbon fiber




Full micro-channel module

The total radiation length (*) of this support is 0.28 $\%X_0$



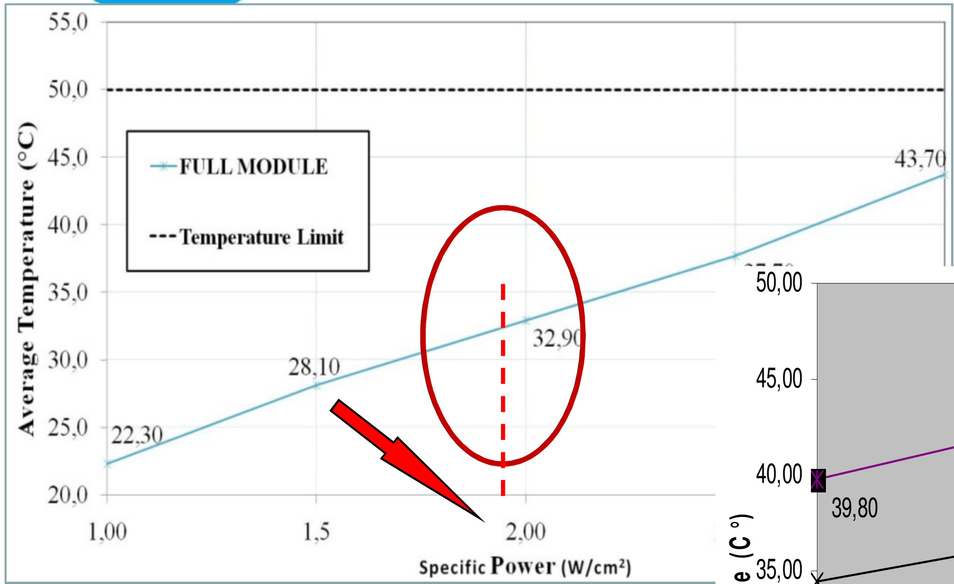
Net micro-channel module

Same dimensions of full micro-channel but vacancies of tubes in the structure.

The total radiation length (*) is 0.15 $\%X_0$

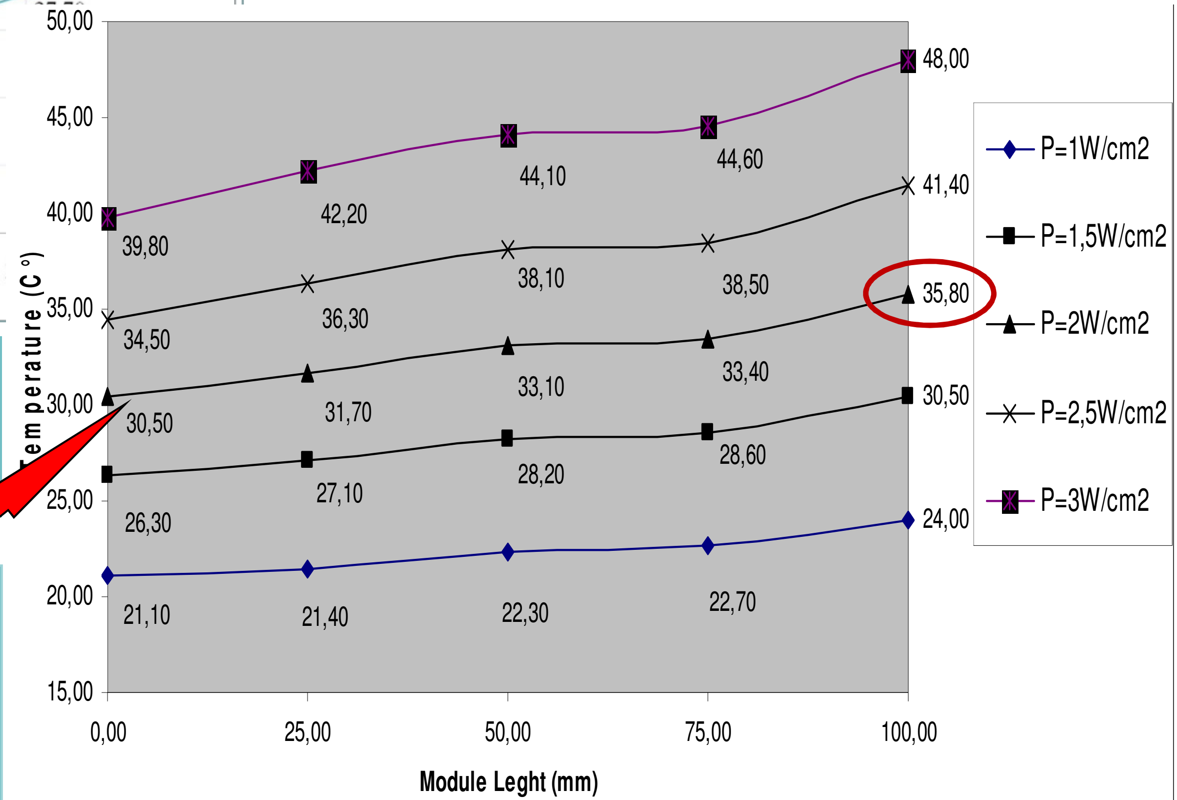
(*): Material of the support structure: ( All C.F. material + peek tube + Water)

# Full module test results




Tests performed on full module sample (length = 120 mm) at Δ p =3.6 atm.

Average module Temperature vs Specific Power




**Temperature along the module: $\Delta T$ = 5,3 °C at $2W/cm^2$ and $\Delta p$ =3,6 atm**

# Net Module test results

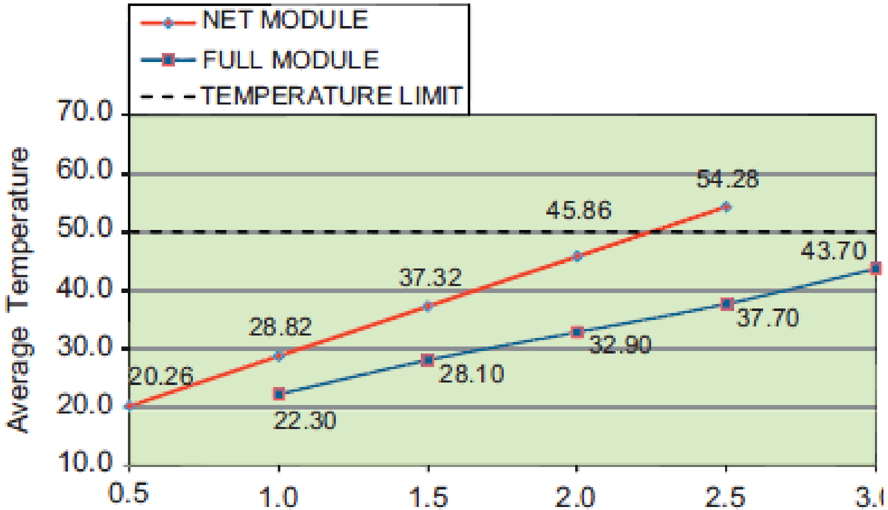
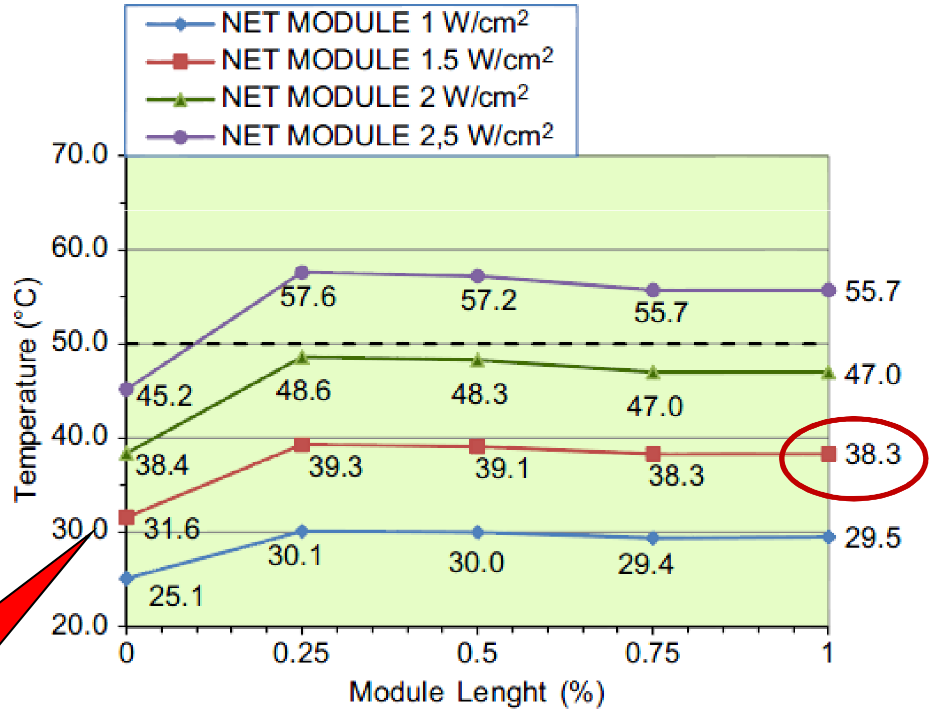


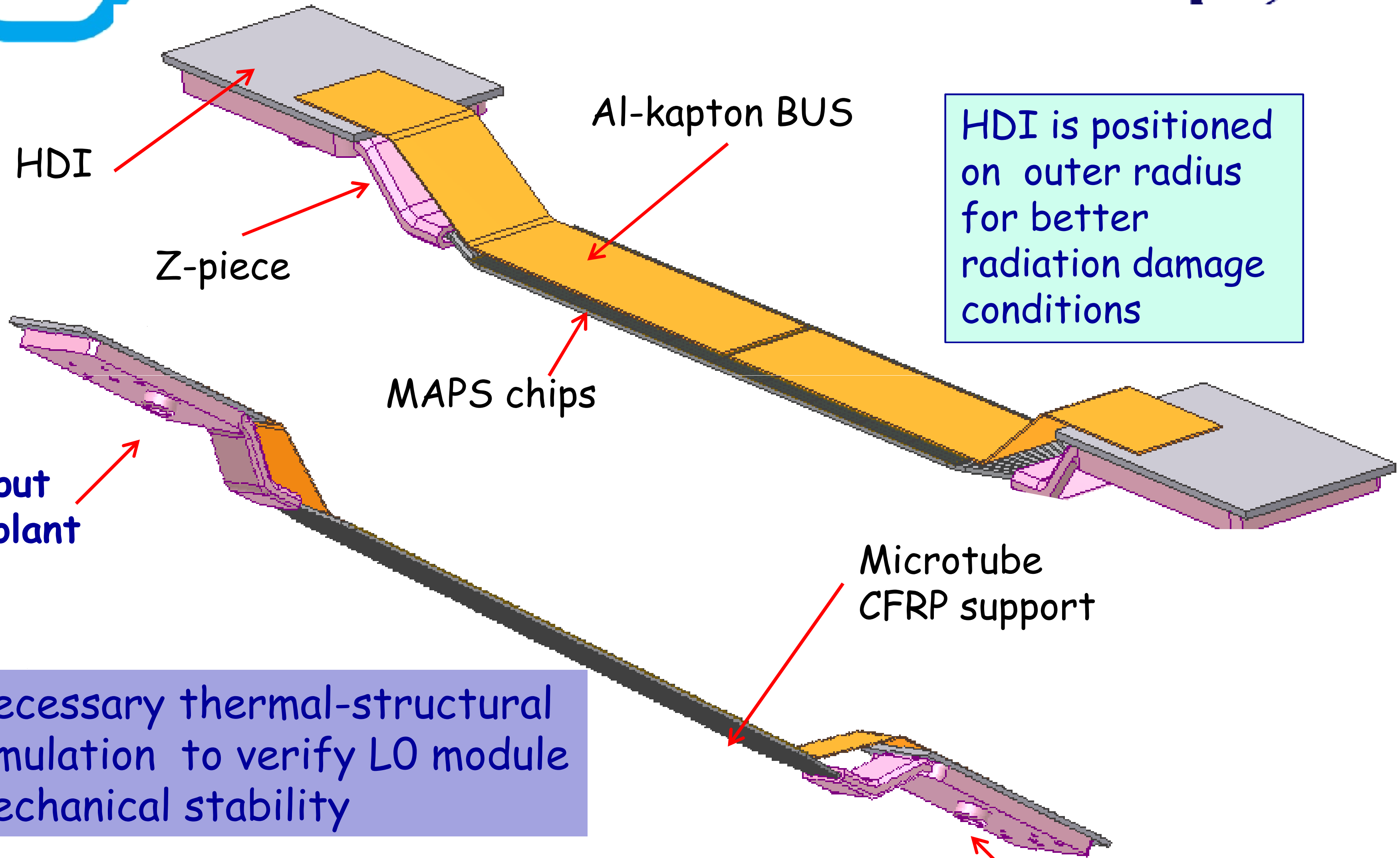

Fig. 5. Sensor average temperature vs. heating power for Net and Full Module

Tests performed on net module sample (length = 120 mm) with water-glycol @ 10 °C as coolant (Δp =3,5 atm).




**Data shown that Net Module is able to cool power up to about 1.5 W/cm² below the max required Temperature (50 °C).**
**This goal can also be achieved with a greater safety factor by reducing the inlet coolant temperature.**

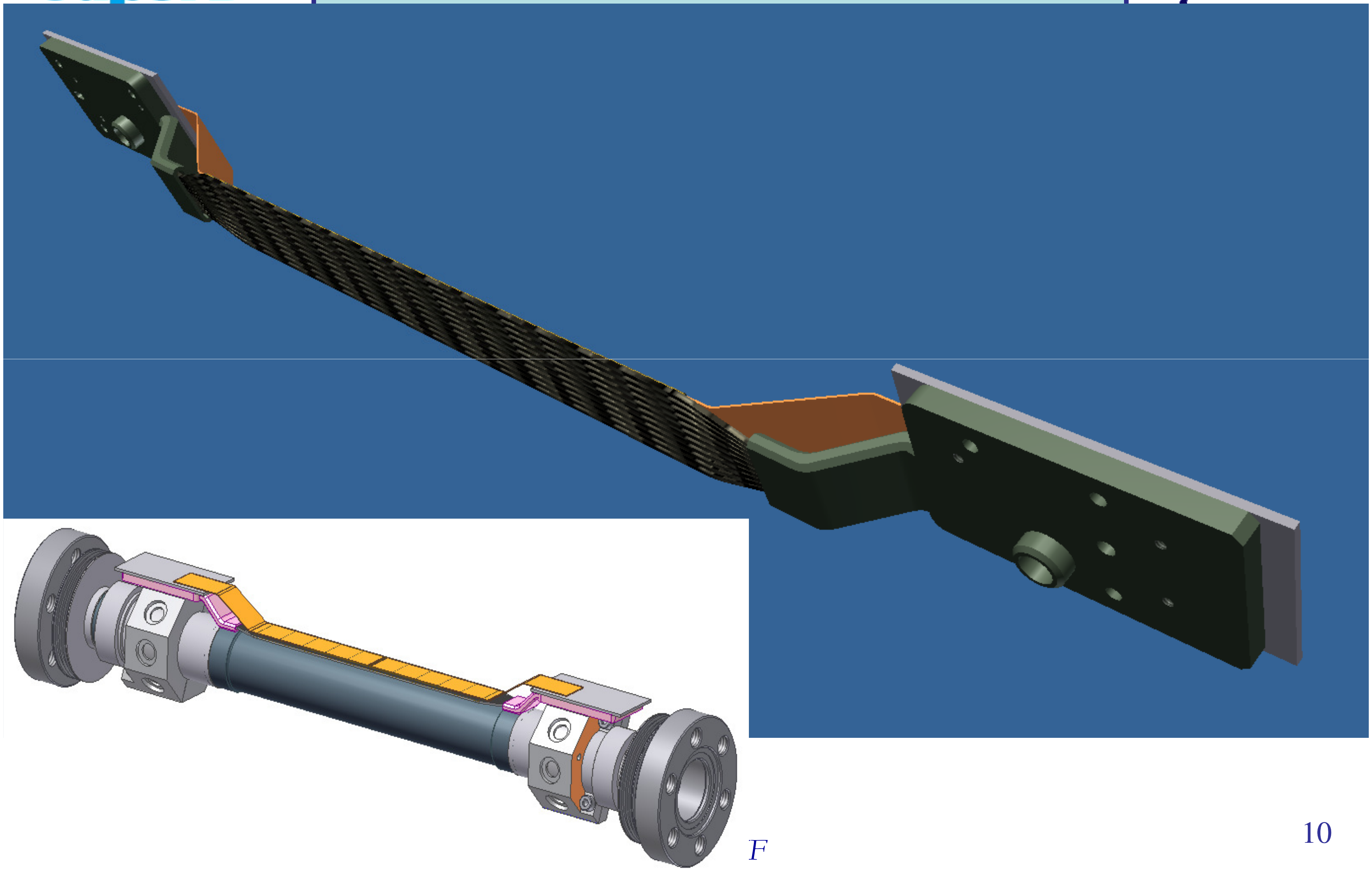
# MAPS L0 module Design




HDI is positioned on outer radius for better radiation damage conditions

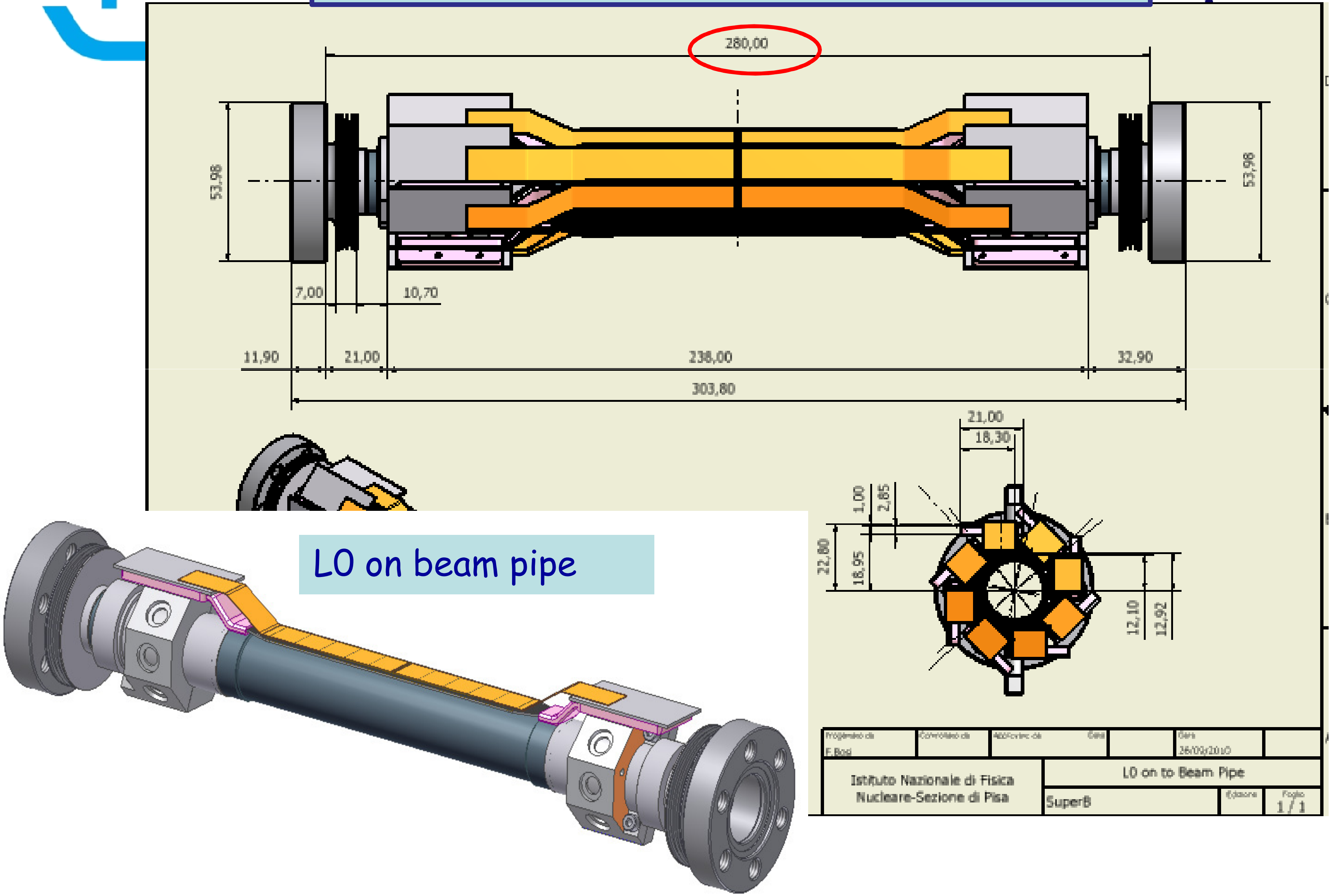
Necessary thermal-structural simulation to verify L0 module mechanical stability

# Beam Pipe with L0

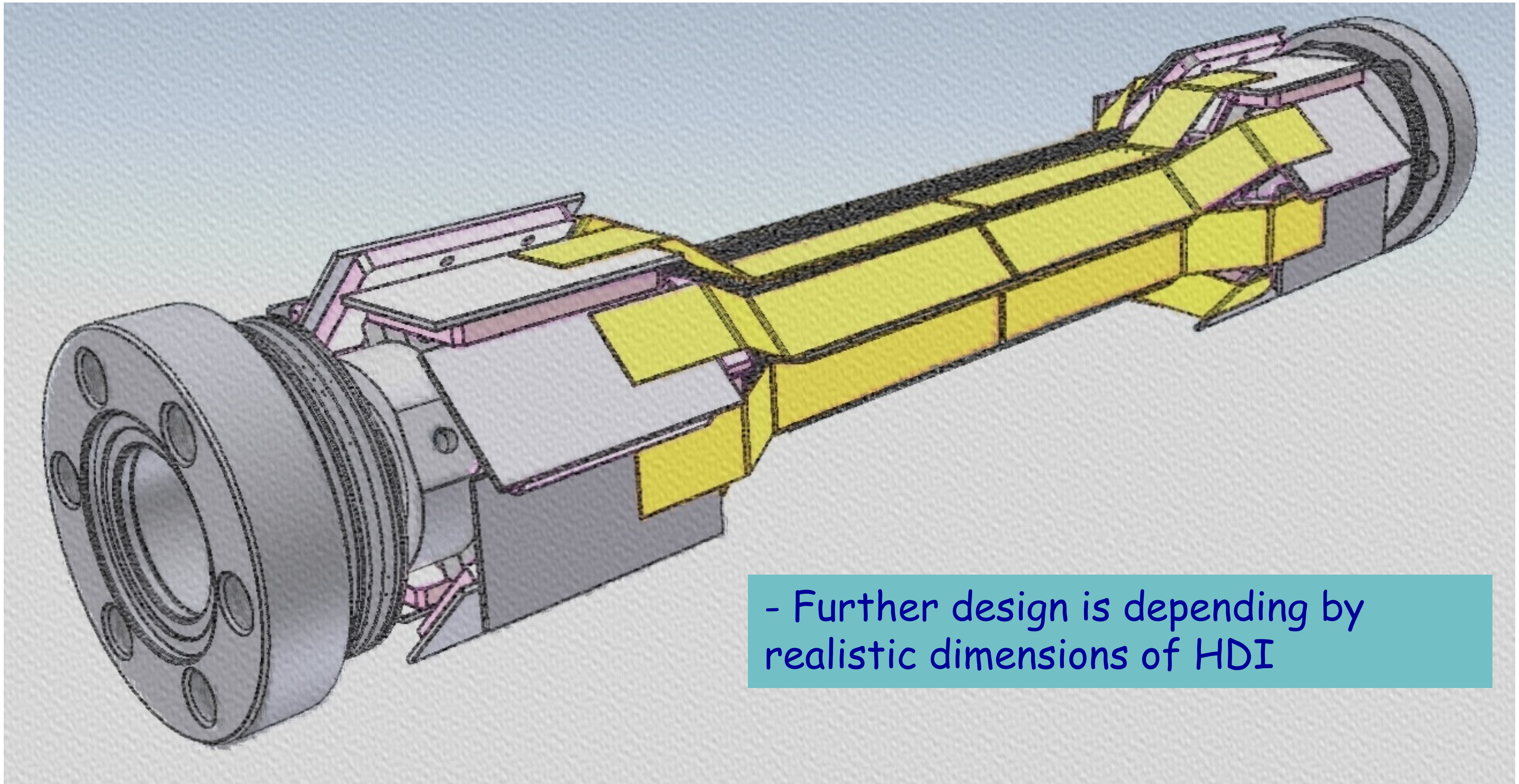


F

# Beam Pipe with L0



# L0 on Beam Pipe



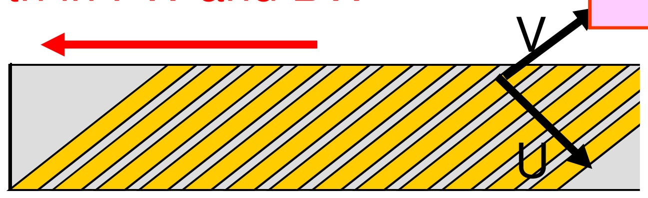
- Further design is depending by realistic dimensions of HDI

# Layer 0 striplets design

CDR design is being revised for TDR!

(Lab.) Geometrical acceptance: 300 mrad both in FW and BW

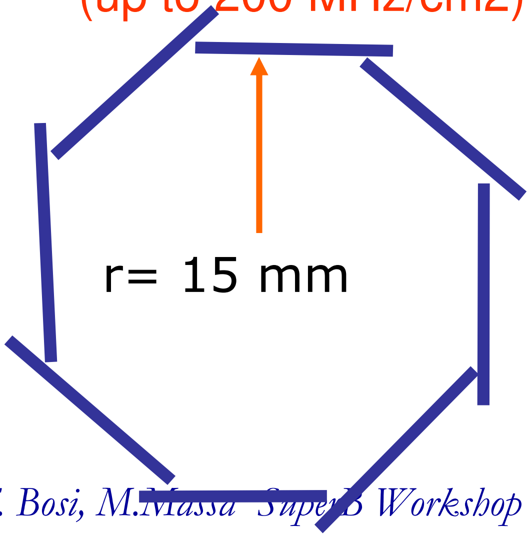
Distance from the i.p. : R=15 mm

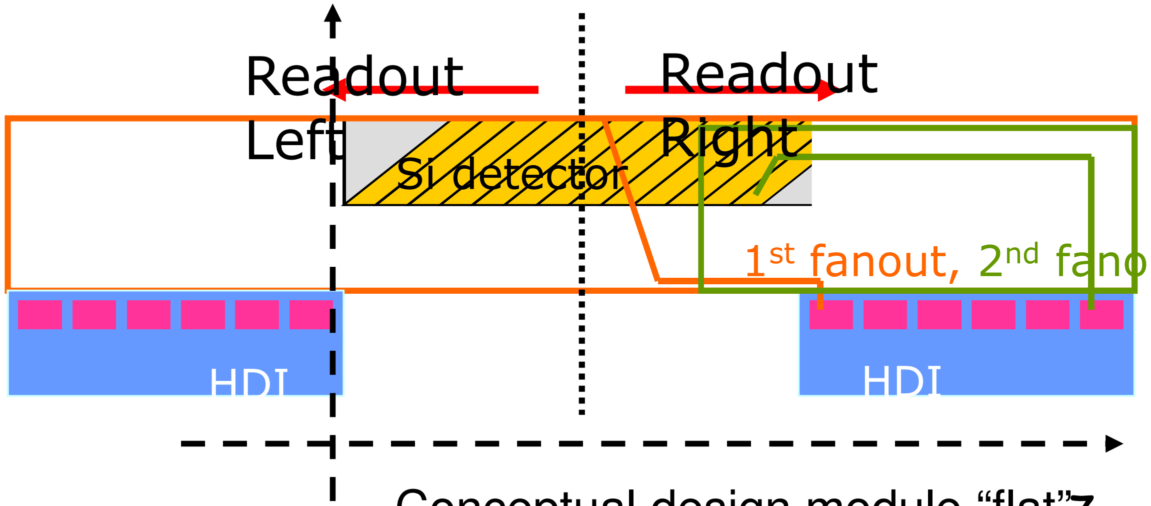



Choosing an Octagonal shape:

- Module active area = 12.9 x 97.0 mm2
  (includes 4% area overlap for alignment)
- double sided Si detector, 200 μm thick with striplets (45° w.r.t det. edges)
  readout pitch 50 μm
- multi-layer fanout circuits (similar to SVT modules, z side) are glued on each sensor,
  connecting Si strips to Front End Electronics
  (fanout extends twice wider than the detector, to allow a minimum of 50 μm between metal traces ~ 700 strip/readout side!).
- In a module needed ~2 fanouts/side !

- A new readout chip is needed to cope with the high background rate (up to 200 MHz/cm2)

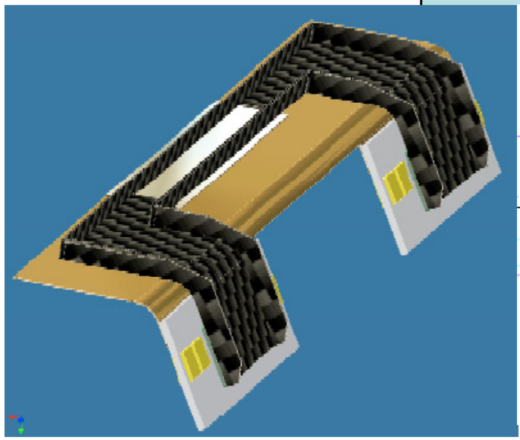


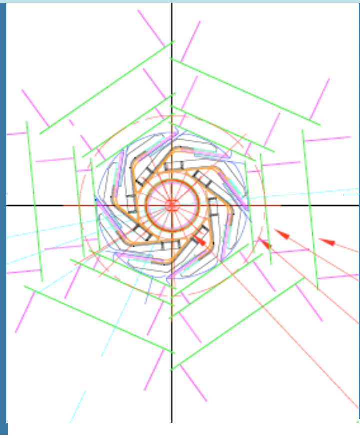



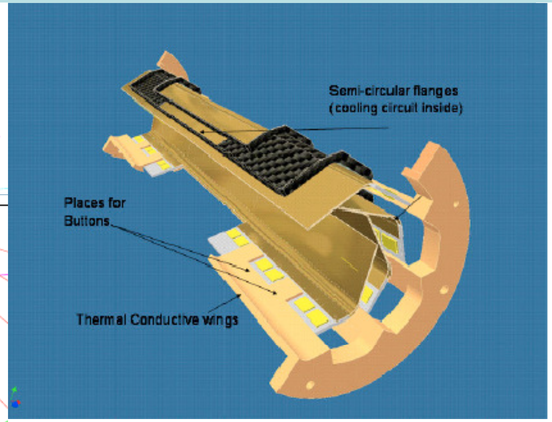

Conceptual design module “flat”

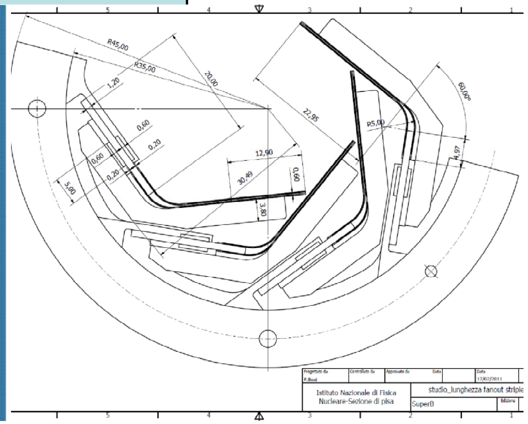
# Module Striplets

The Striplets module layout designed for CDR ( HDI in lateral position) was lately discarded because too much passive material in active region (below 300 mrad).

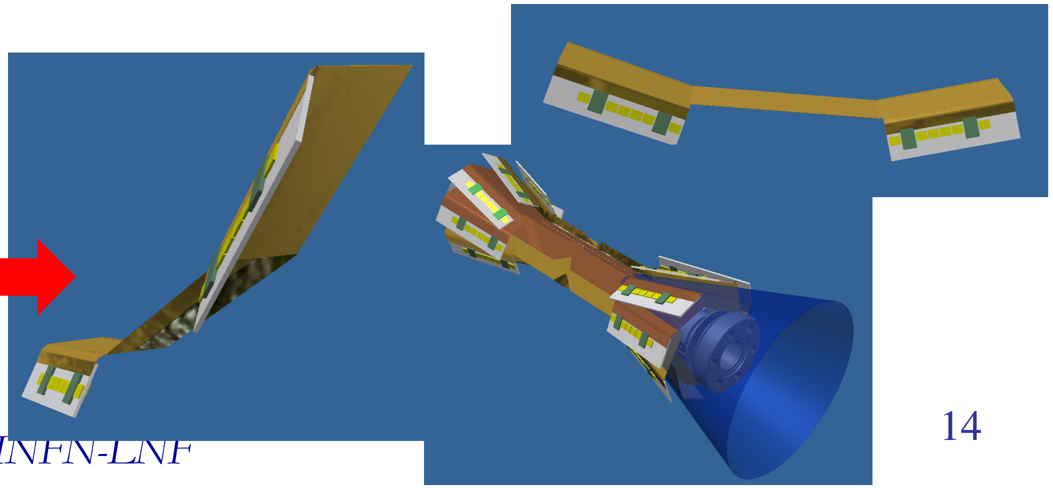




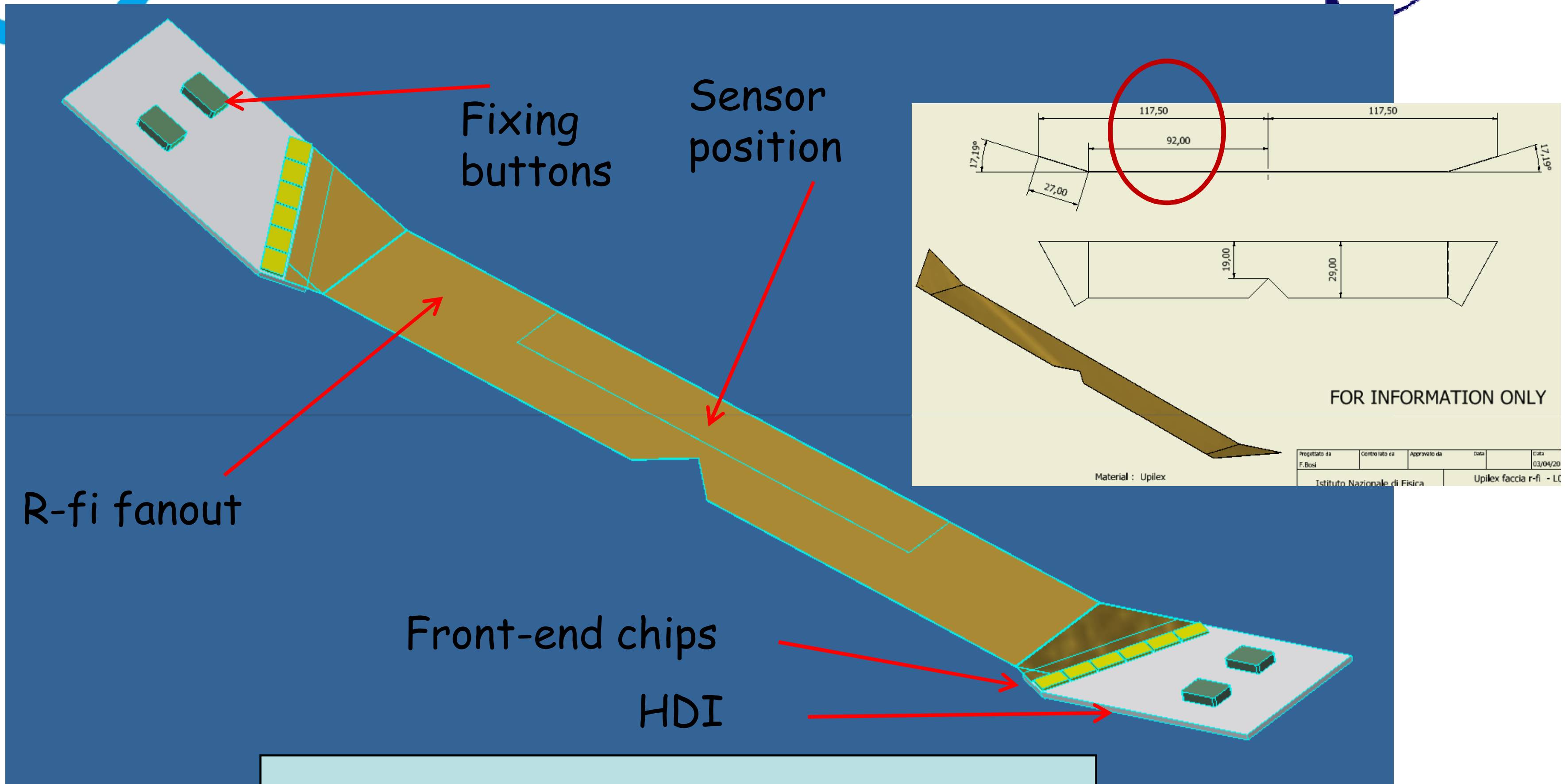


Several module layout has been studied to hold passive material below 300mrad, also with fantasy…… but not solution found with lateral HDI

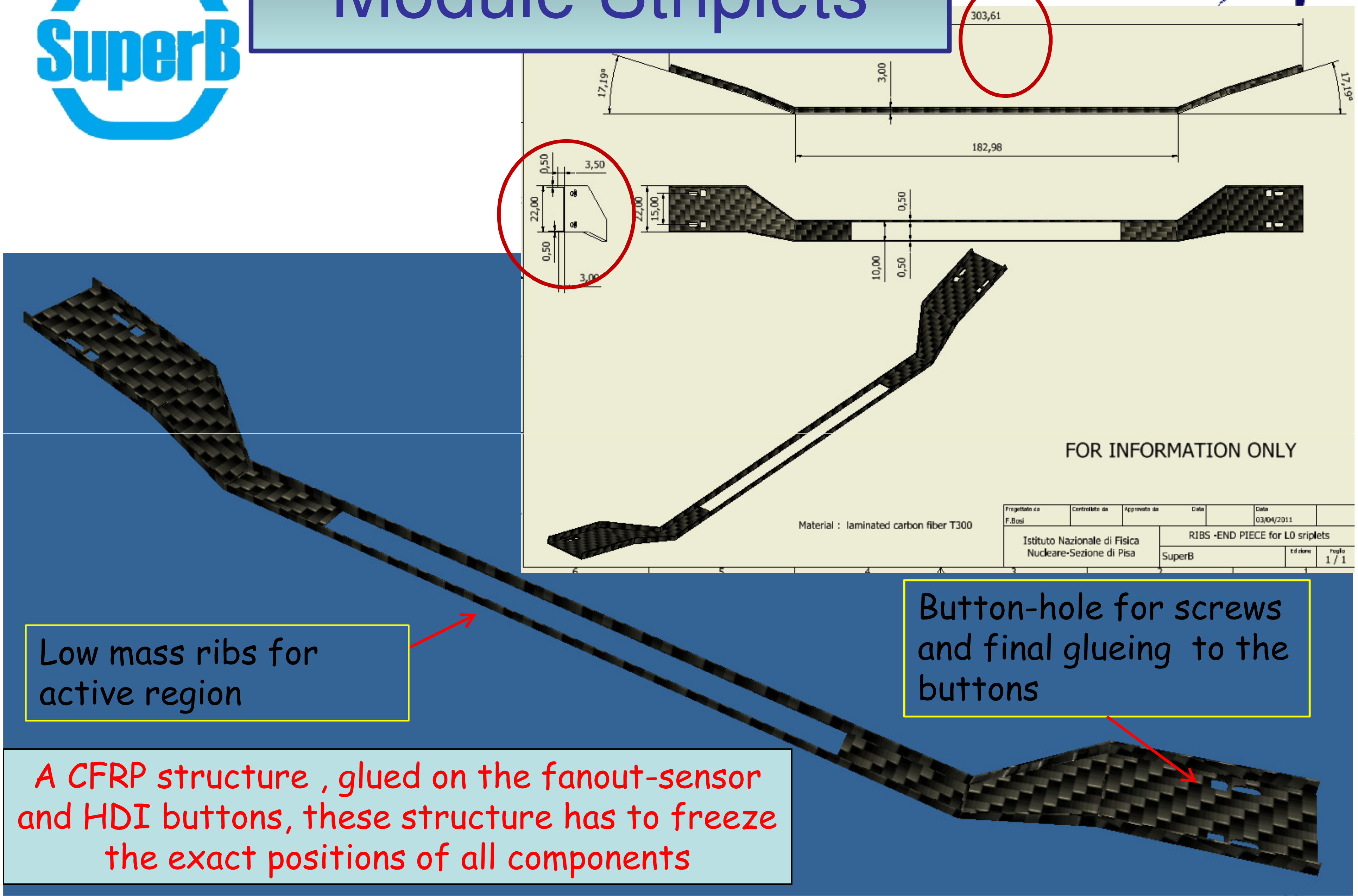


# Module Striplets




Final solution –HDI in axial direction inclinated at 300 mrad, with front-end chips 30° oriented

# Module Striplets

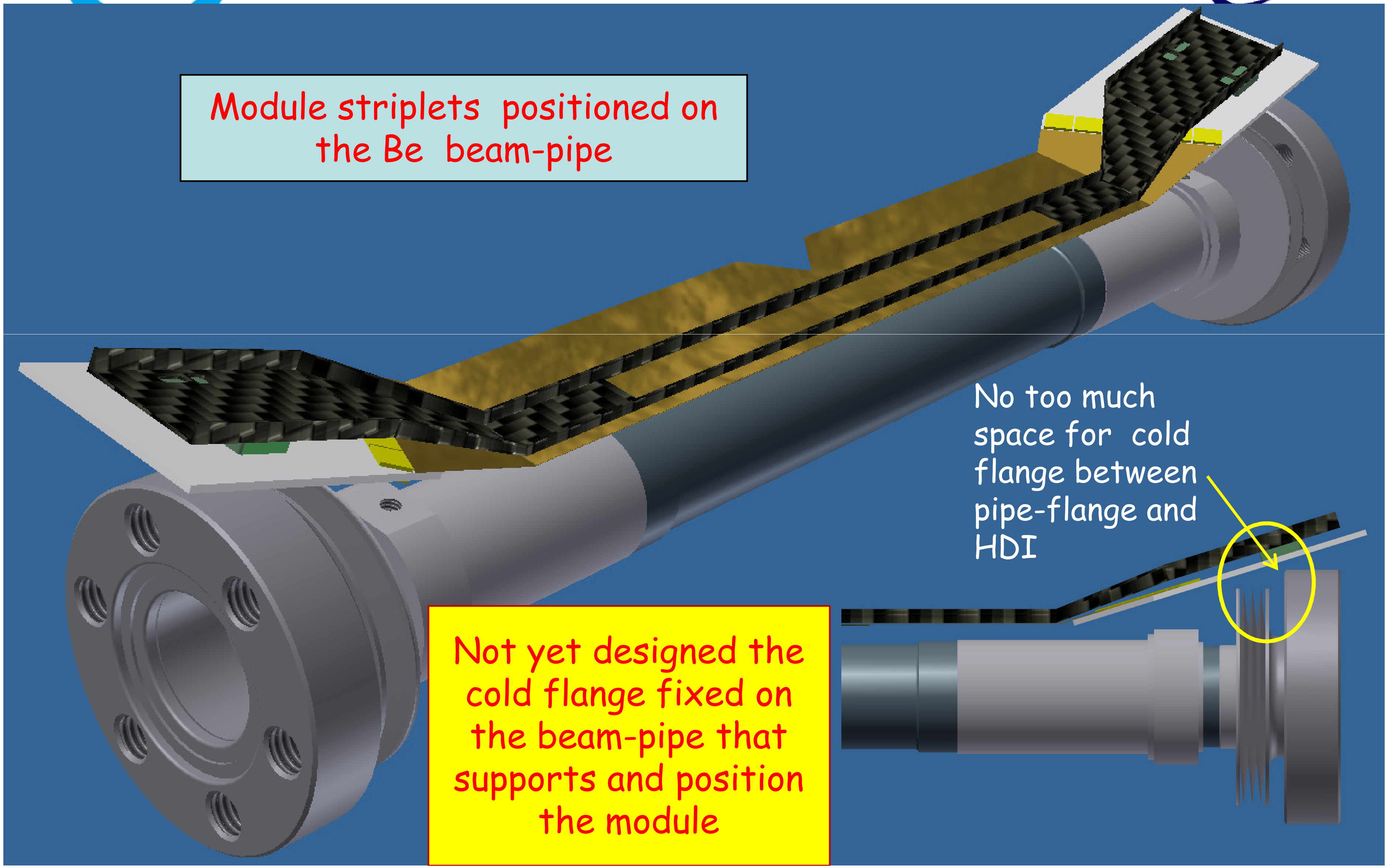



Low mass ribs for active region

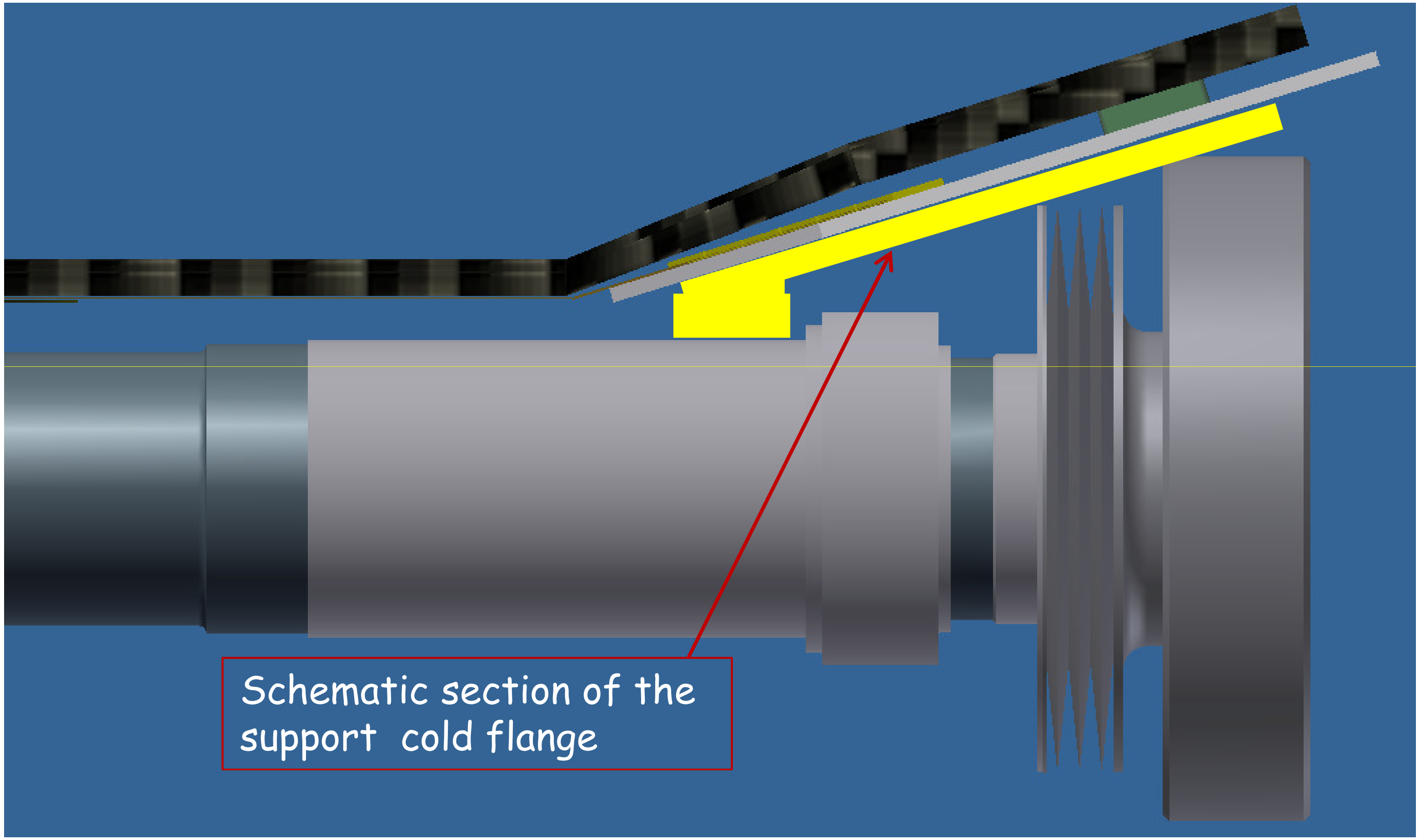
Button-hole for screws and final glueing to the buttons

A CFRP structure , glued on the fanout-sensor and HDI buttons, these structure has to freeze the exact positions of all components

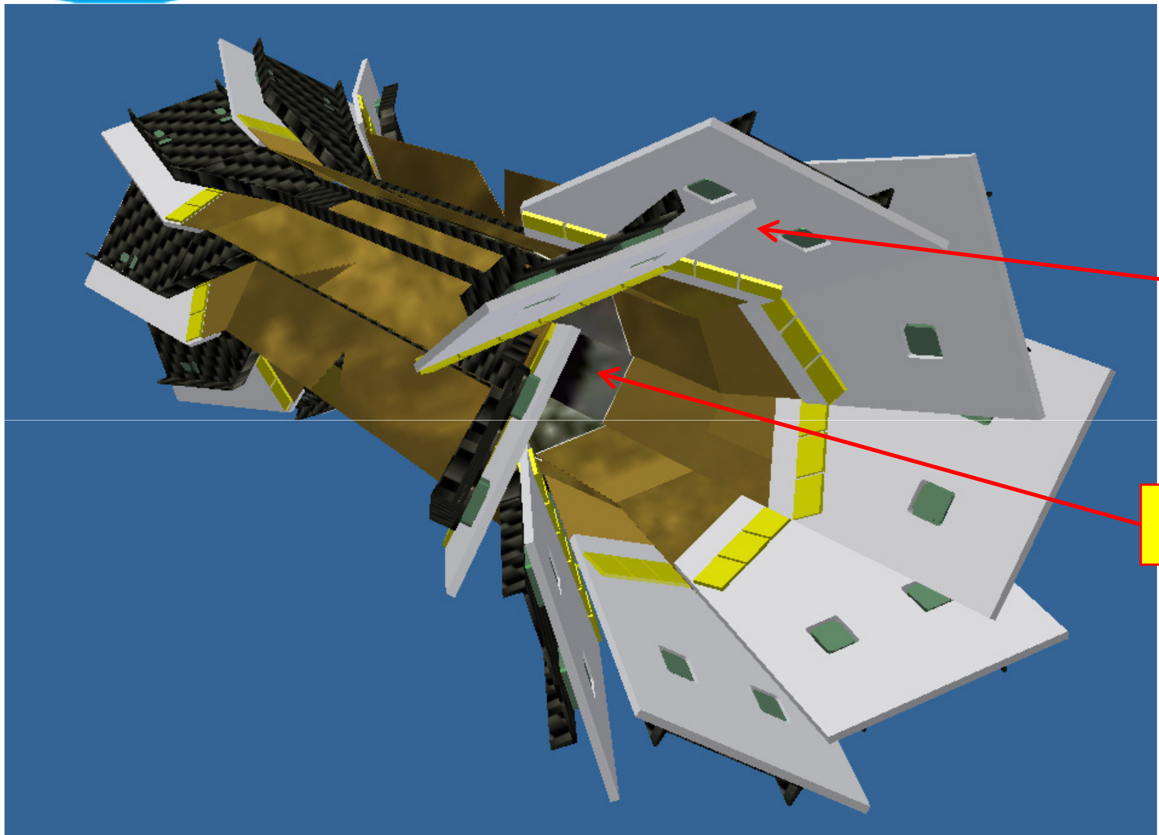
# Module Striplets



# Module Striplets



# Module Striplets

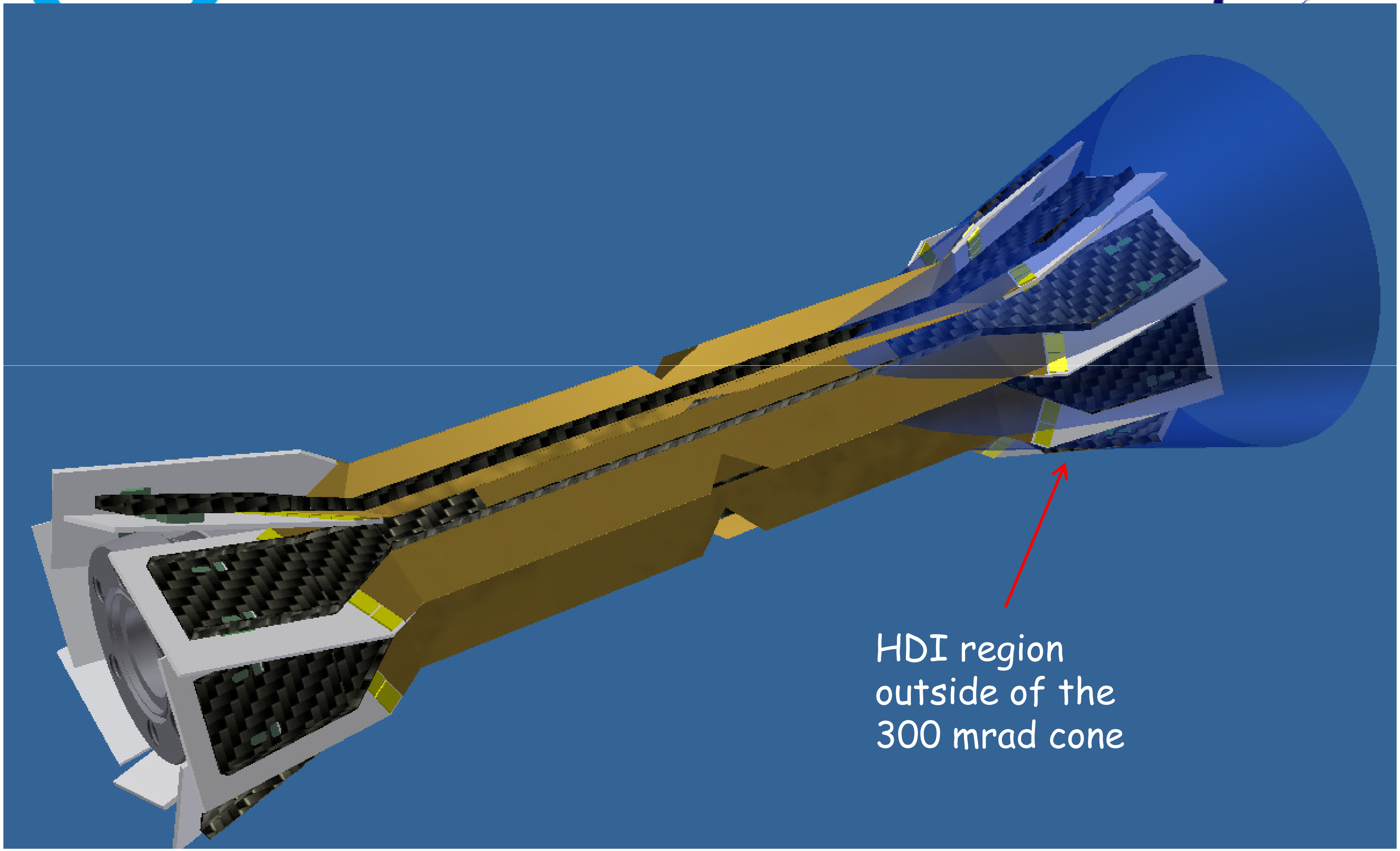


In this view are missing the z fanouts in order to be able to see sensors and back side HDI

Surfaces devoted to couple the support flange fixed on the beam-pipe with L0 module (through buttons of HDI)

Sensors

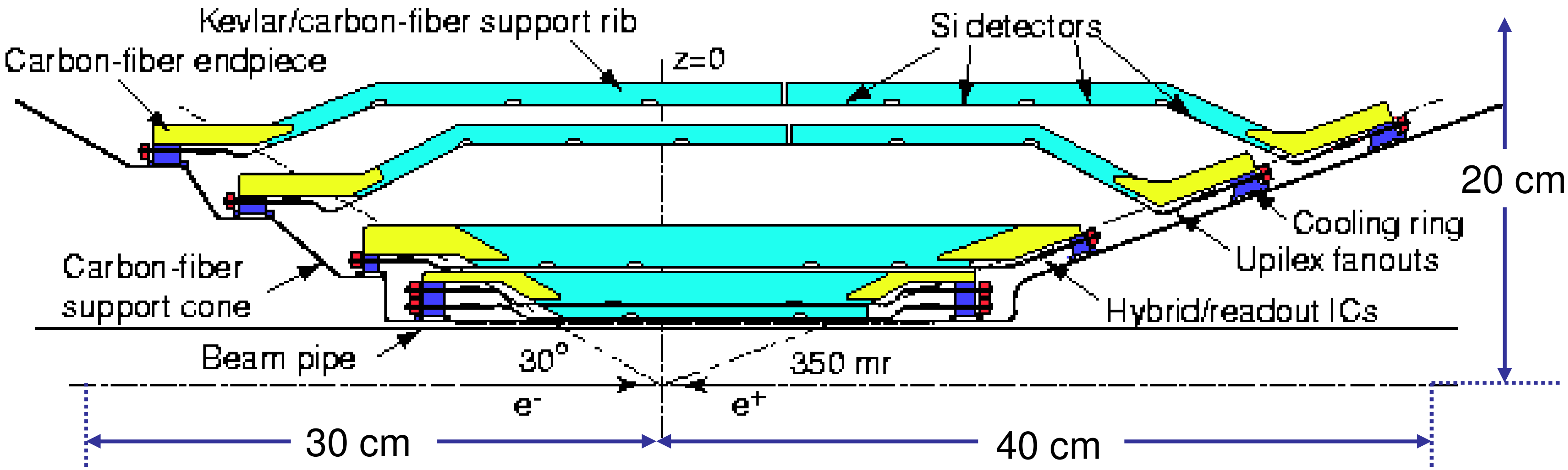
# Module Striplets



# The BaBar Silicon Vertex Tracker

5 Layers of double-sided, AC-coupled Silicon.
Custom rad-hard readout IC (the AToM chip).
Low-mass design. ( Pt < 2.7 GeV/$c^2$ for B daughters)
Stand-alone tracking for slow particles.

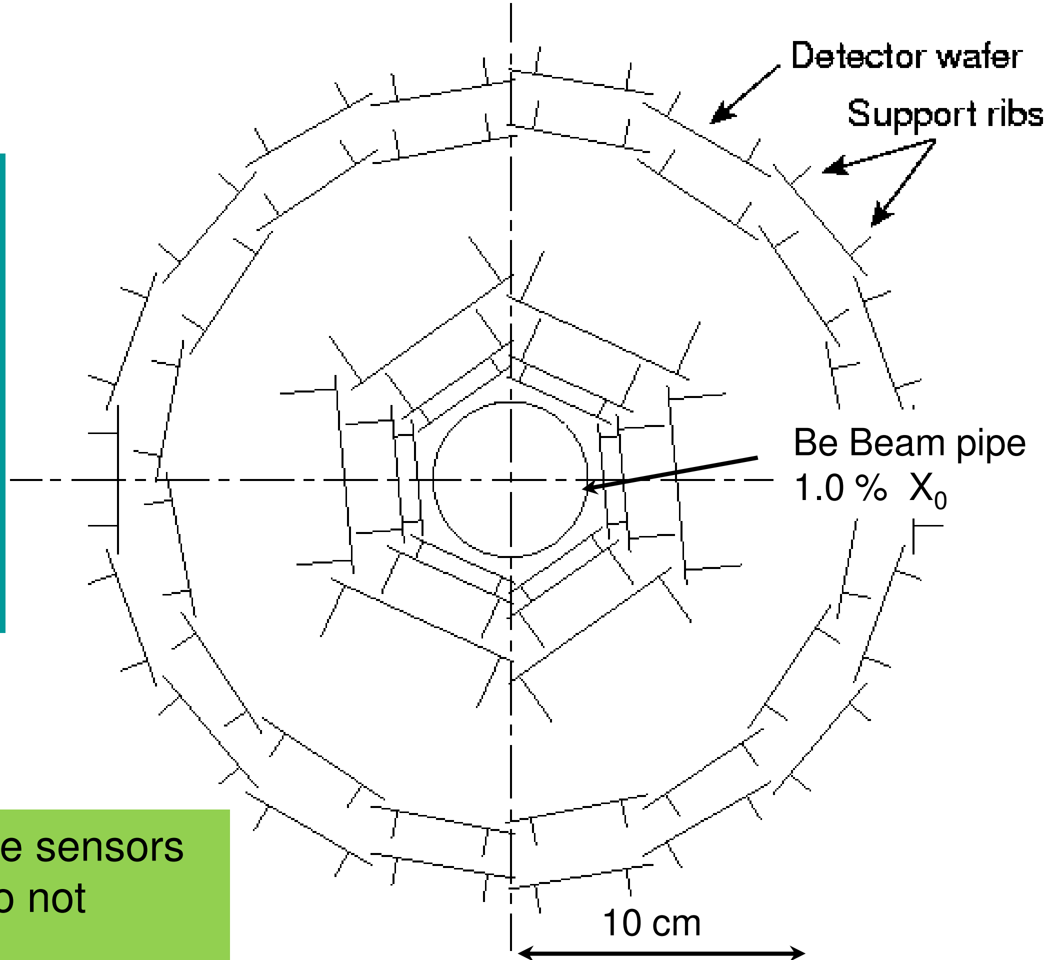
- Inner 3 layers for angle and impact parameter measurement.
- Outer 2 layers for pattern recognition and low Pt tracking.




For the SuperB SVT L1-L5 we start from the BaBar configuration

# SVT Geometry

| Layer | Radius |
|---|---|
| 1 | 3.3 cm |
| 2 | 4.0 cm |
| 3 | 5.9 cm |
| 4 | 9.1 to 12.7 cm |
| 5 | 11.4 to 14.6 cm |

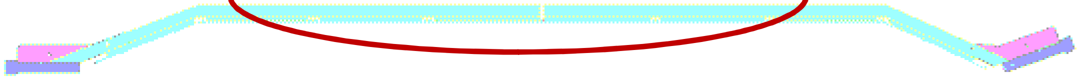
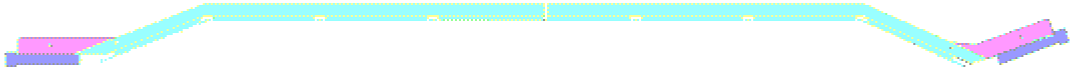
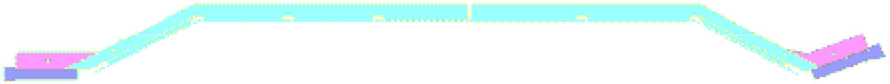
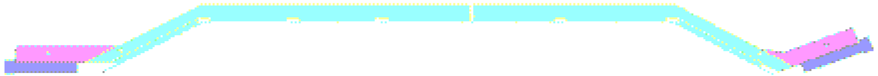



(Arched wedge wafers not shown)

The modules radius and the width of the sensors remain the same so this geometry do not change

# SVT BaBar Modules

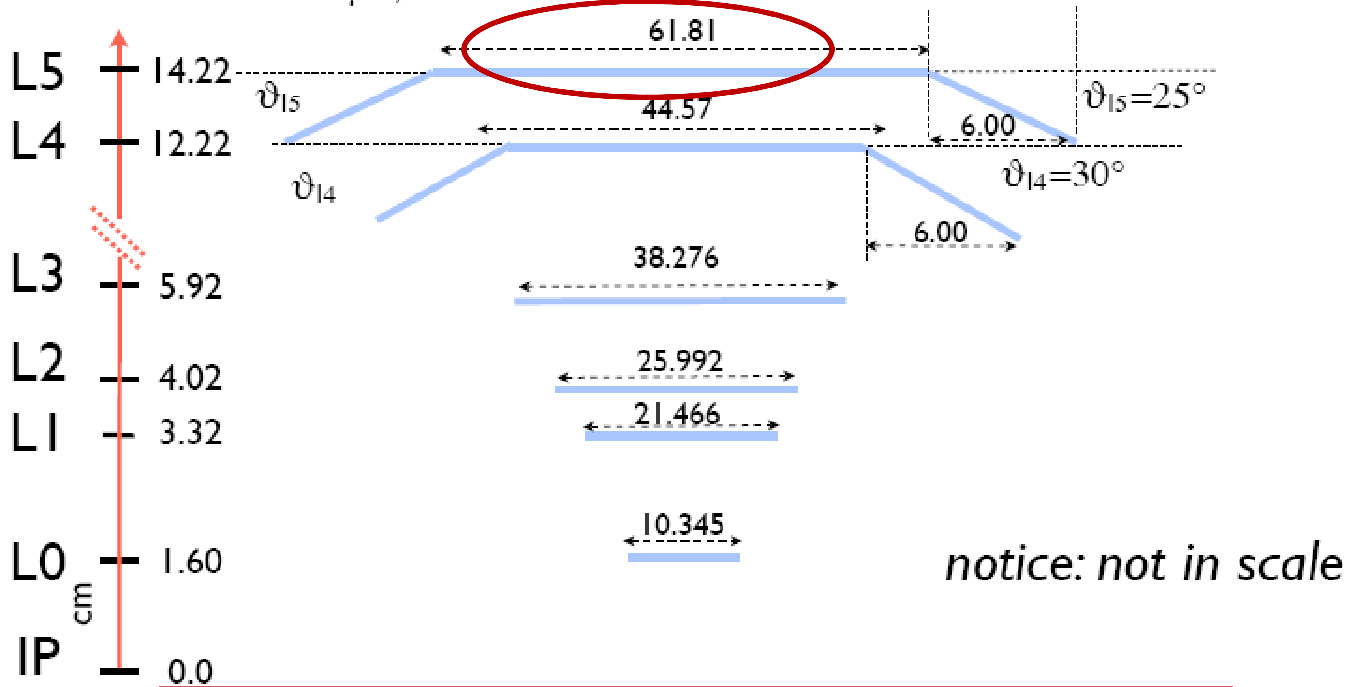
| Layer | Number of Wafers | Total Phi-Strip Length Backward | Total Phi-Strip Length Forward | Z-Strip Length |
|---|---|---|---|---|
| 5b | 8 | 26.5 cm | 26.5 cm | 4.1 to 5.1 cm |
| 5a | 8 | 26.5 cm | 25.1 cm | 4.2 to 5.1 cm |
| 4b | 7 | 22.4 cm | 19.9 cm | 4.2 to 5.1 cm |
| 4a | 7 | 22.4 cm | 18.5 cm | 4.2 to 5.1 cm |
| 3 | 6 | 12.8 cm | 12.8 cm | 7.0 cm |
| 2 | 4 | 8.8 cm | 8.8 cm | 4.8 cm |
| 1 | 4 | 8.2 cm | 8.2 cm | 4.0 cm |

# SVT SuperB Modules (first guess!)

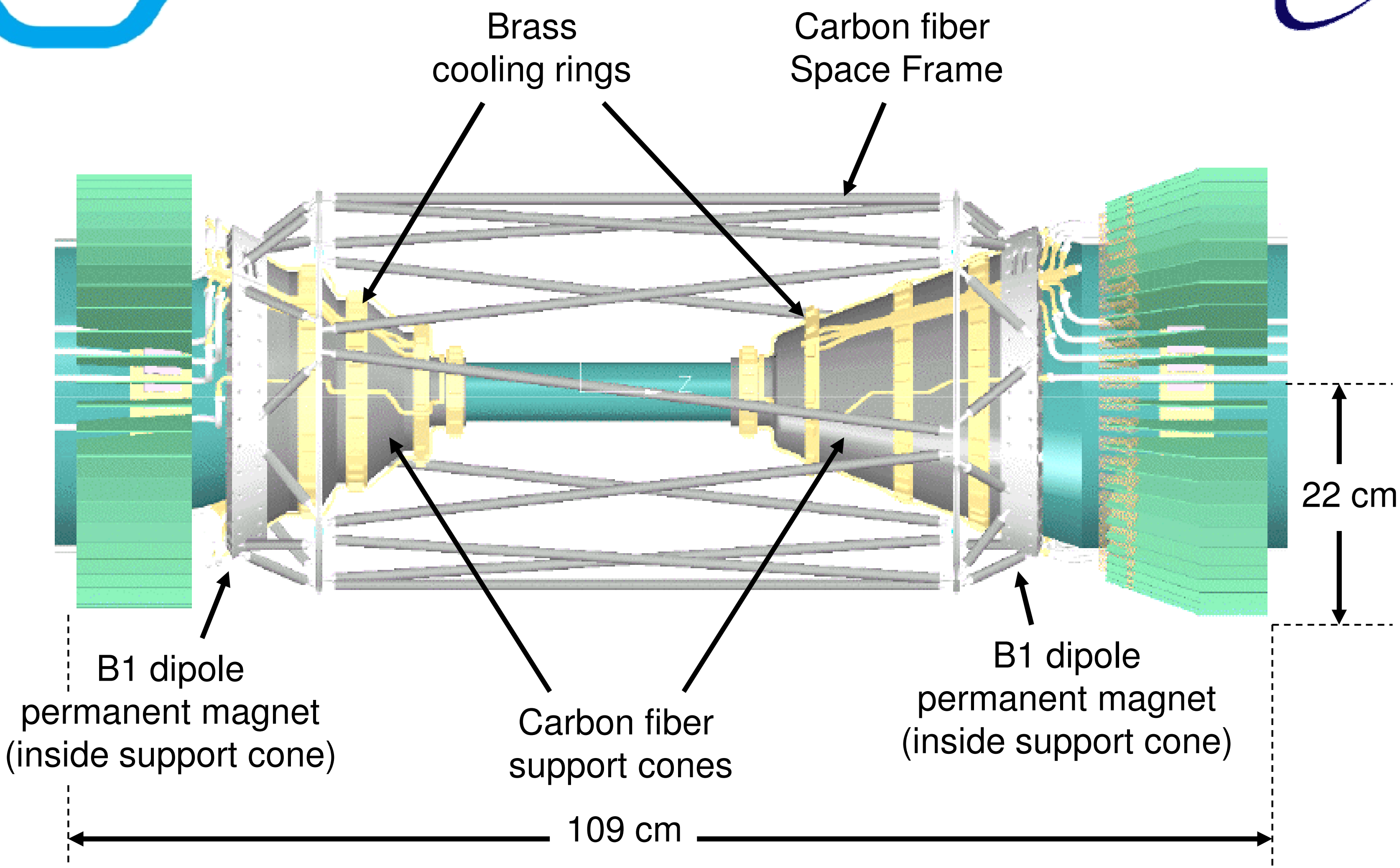
## 1. SuperB baseline:

- SVT baseline: L0 + L1-L5 strip detectors, ±300 rad angular coverage;
- DCH baseline: 10 SuperLayers (4 cell layers per SL); inner radius 23.6 cm, spatial resolution 125 µm;

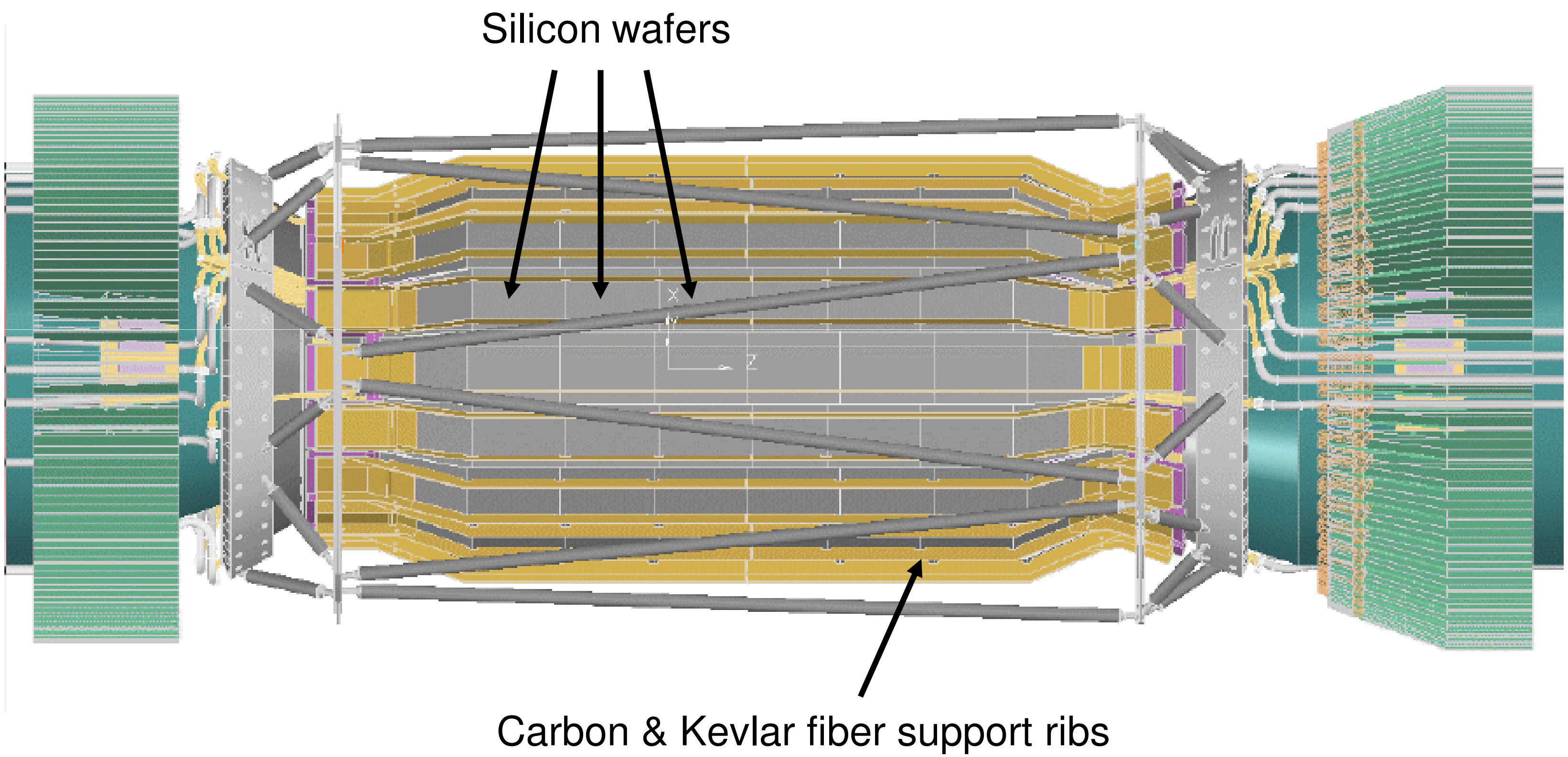



**Coverage down to 300 mrad FW and BW**

# SVT Mechanical Features



# SVT Mechanical Features



# L0/SVT architecture supports

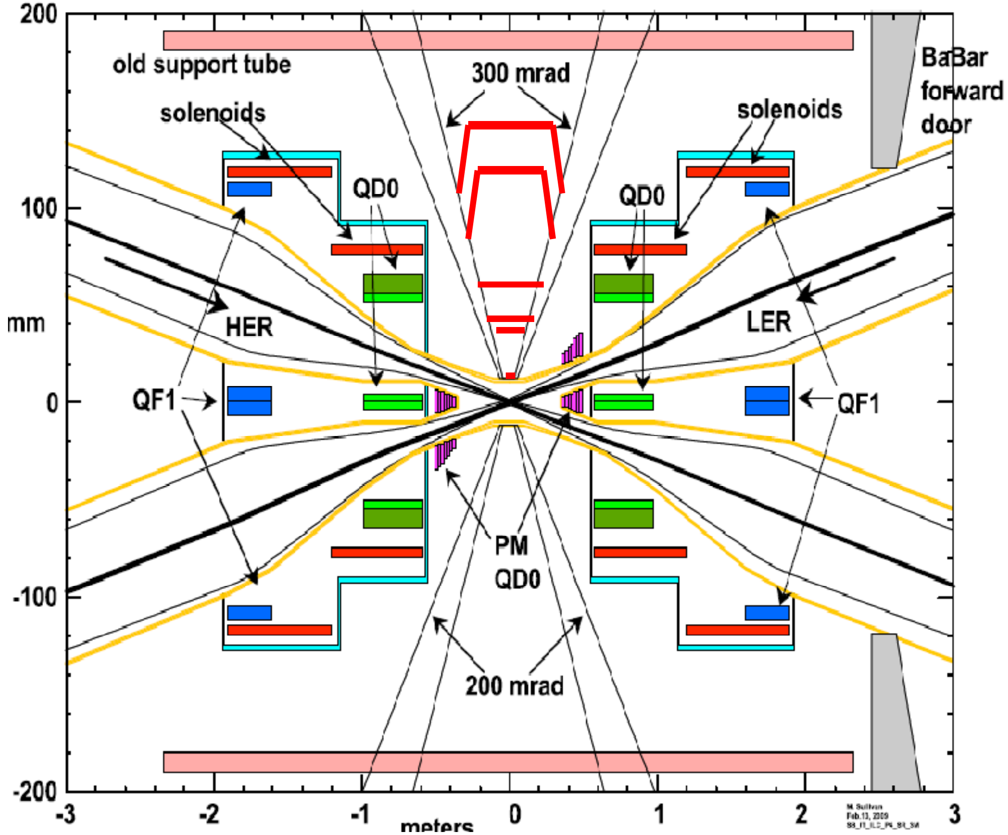
Difficult at this stage to have an IR design frozen to perform a realistic mechanical design of L0 and SVT :

Anyway, at the moment, there are some constraints that force the design :

B) L0 must be mounted on the Be beam pipe to avoid any possible relative movement (low clearance from beam pipe).

A) L0 and SVT design should allow a quick demounting from the IR.

C) SVT has to be independent from beam pipe and supported on the flange/QD0 criostat.

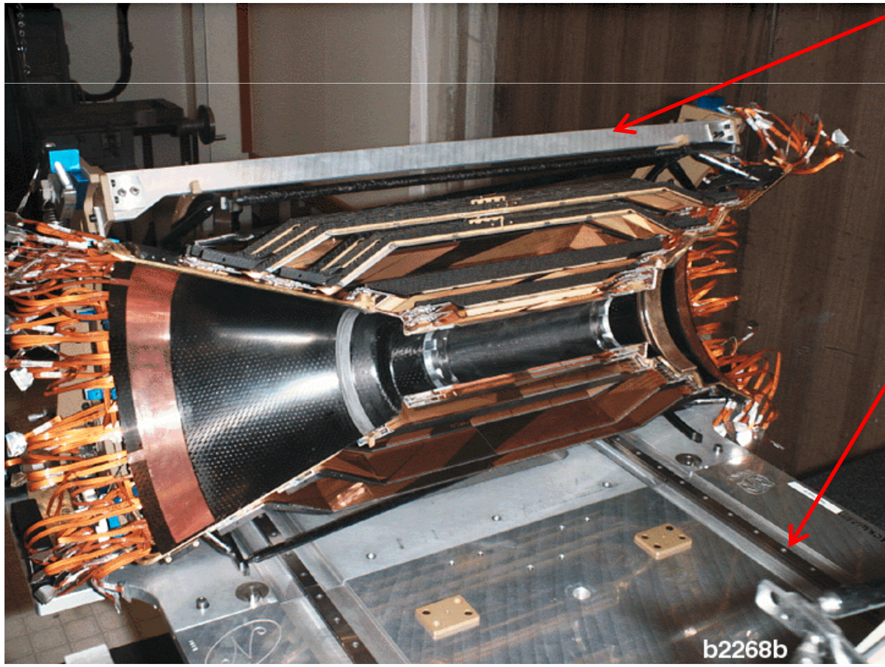


# L0/SVT demounting

A quick demounting means to spilt  SVT in two half around beam pipe :

SVT structure has to be very rigid to assure good stability (space frame structure needed), also it is necessary a mechanical equipments (HDMF) that is able to hold and support with high precision to decouple the two SVT halves just beside of central Be pipe.

If we  assume a support structure with two semicone support, (BaBar like), for SVT demounting, L0 cable routing is passing below  the semicone structure

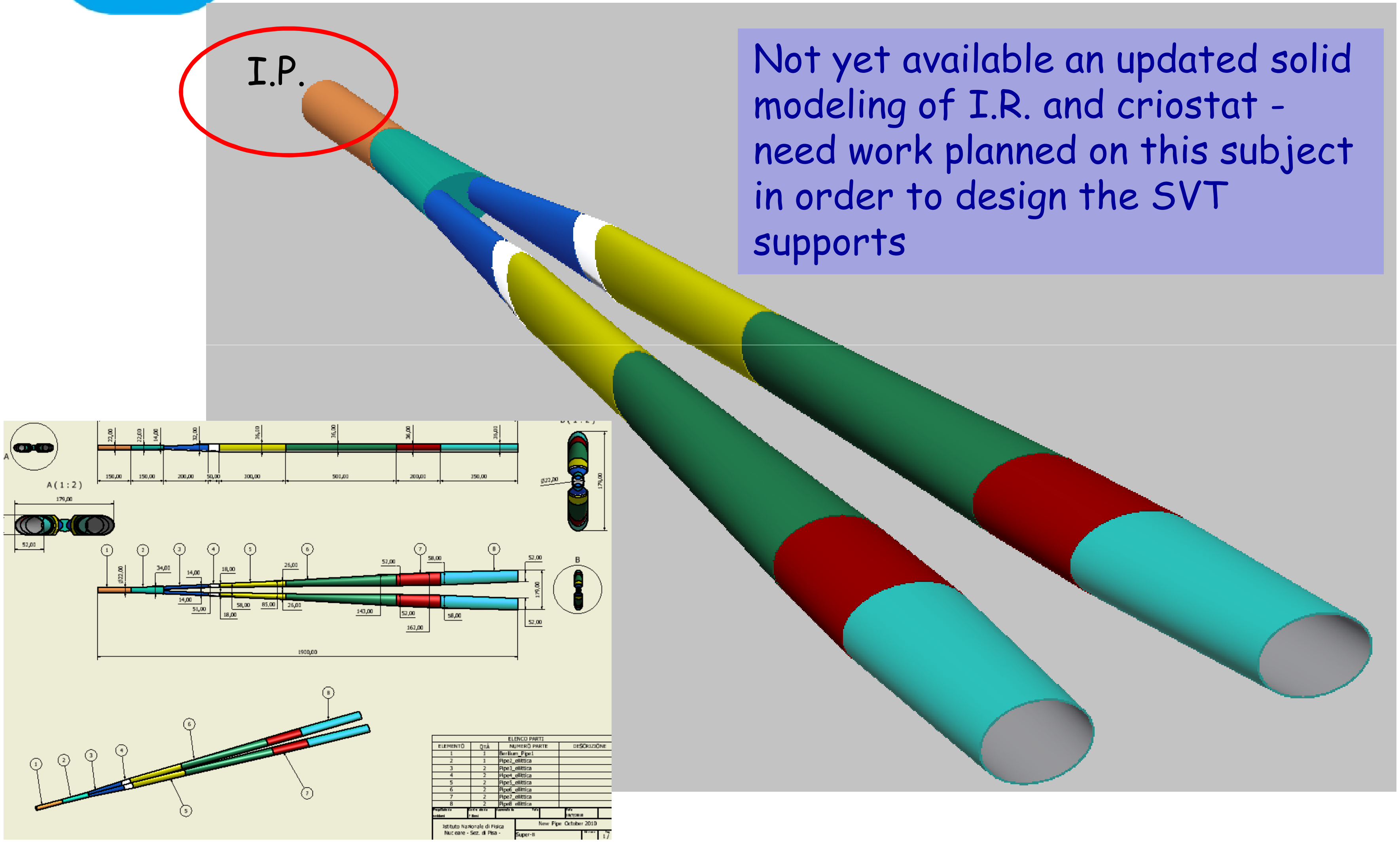



HDMF Support

HDMF Translation rails

For an independent demounting, cooling system, cables and any SVT service has to be independent from  L0 component .

# L0/SVT demounting

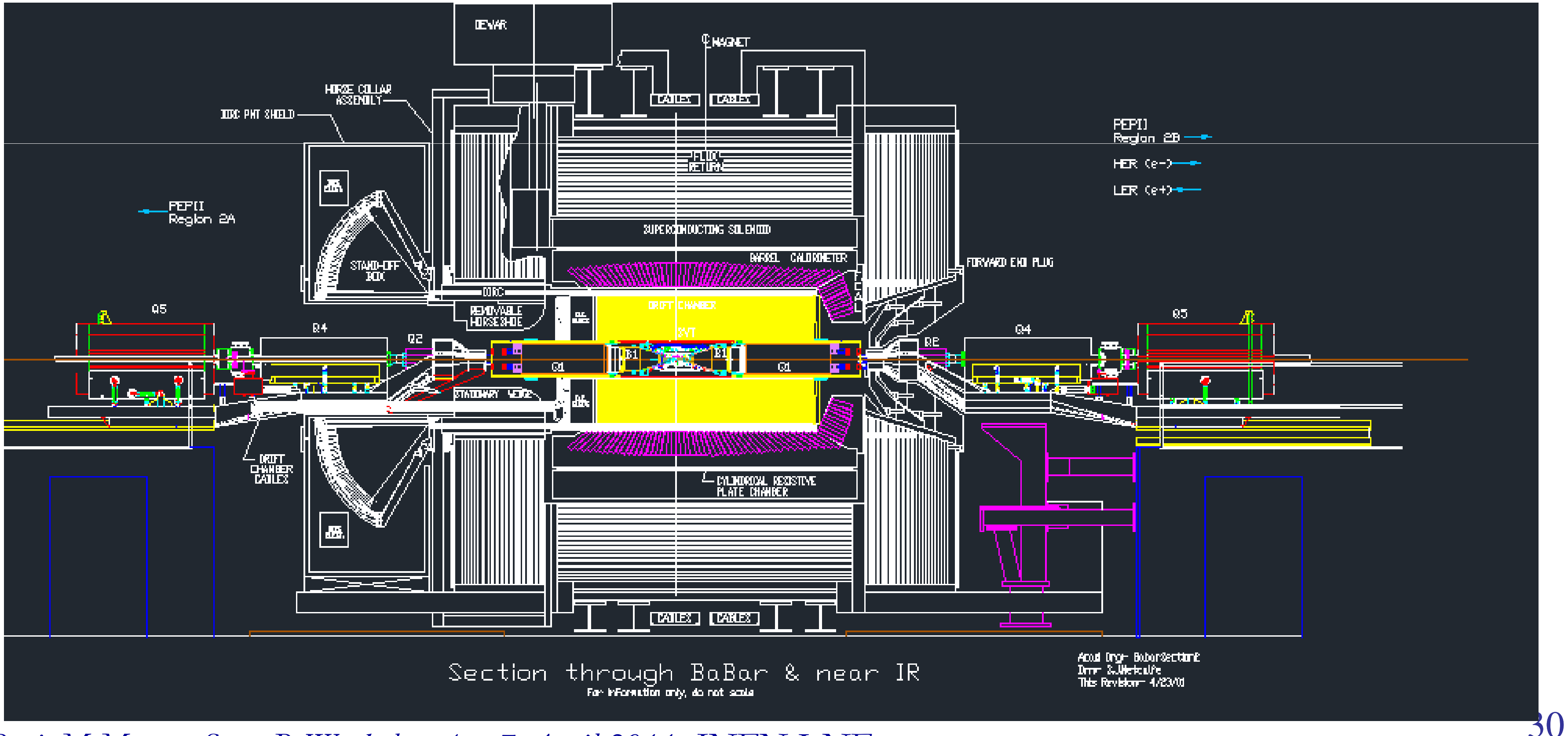



Not yet available an updated solid modeling of I.R. and criostat - need work planned on this subject in order to design the SVT supports

# Babar Layout

Because no available a new layout, need thinking how make SVT quick demounting on the old babar layout……

Need to know exactly the clearance between Drift Chamber and QD0 criostat..



# SVT/L0 demounting

Shorter travel to move the Moving System (M.S) (cryostats +B.P.+ SVT+L0) in forward direction

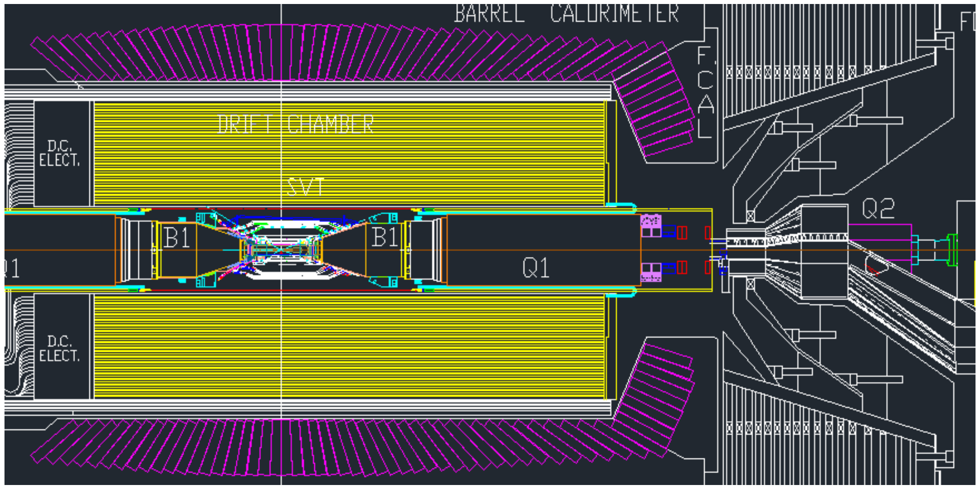
Insert a rigid structure to hold together the two opposite cryostat

Insert a rail system between D.C. and SVT (if clearance from Drift Chamber allows)

Insert from backward direction a rigid beam to hold the M.S. weight

Move in forward direction to arrive in fw end-plug region

Install an enviroment cleaning structure (contamination control space) ,where operate the demount of SVT and the sobstitutution of the L0



# Work …

1) Good progress of the design of L0 (pixel/striplets)

2) Need Design of the L0 support flanges for striplets module positioned on the beam-pipe and on the SVT .

3) Need to define the general architecture of the SVT and L0 supports . Need interaction between machinist and detector engineer, important contact with M.Sullivan in order to set general layout of I.R.

3) Need Start with engineering work to design the mechanics for quick demounting of the SVT + L0 from the I.R.

# BACKUP