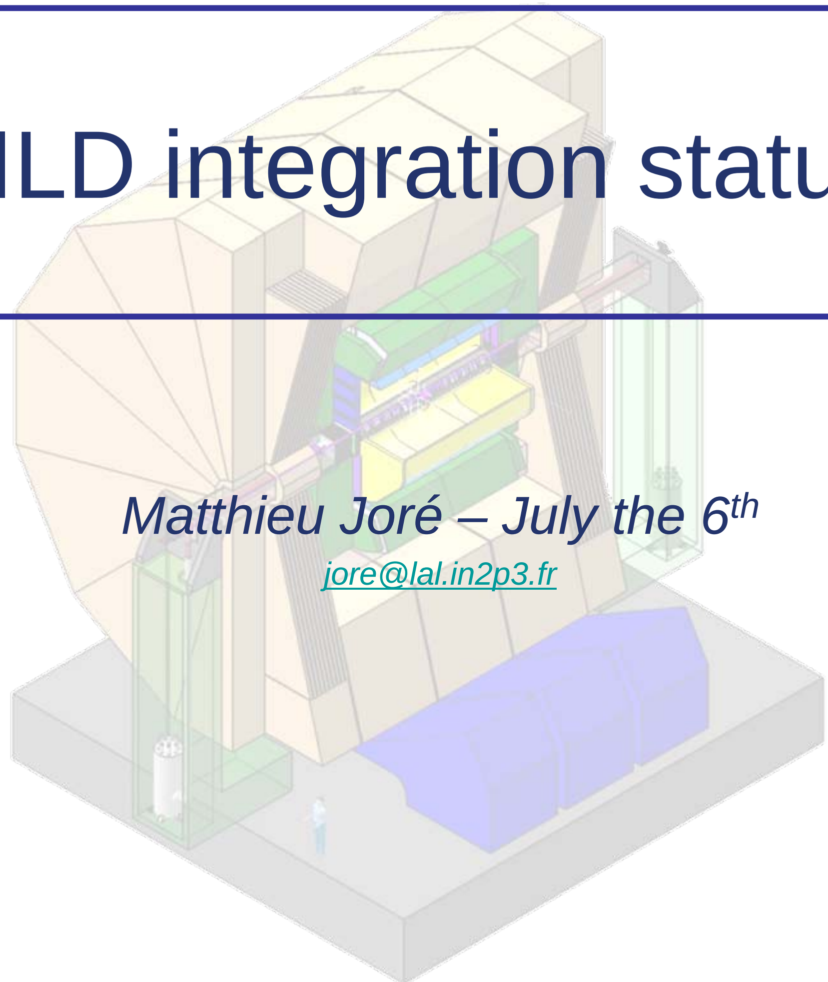
ILD integration status



Matthieu Joré – July the 6th

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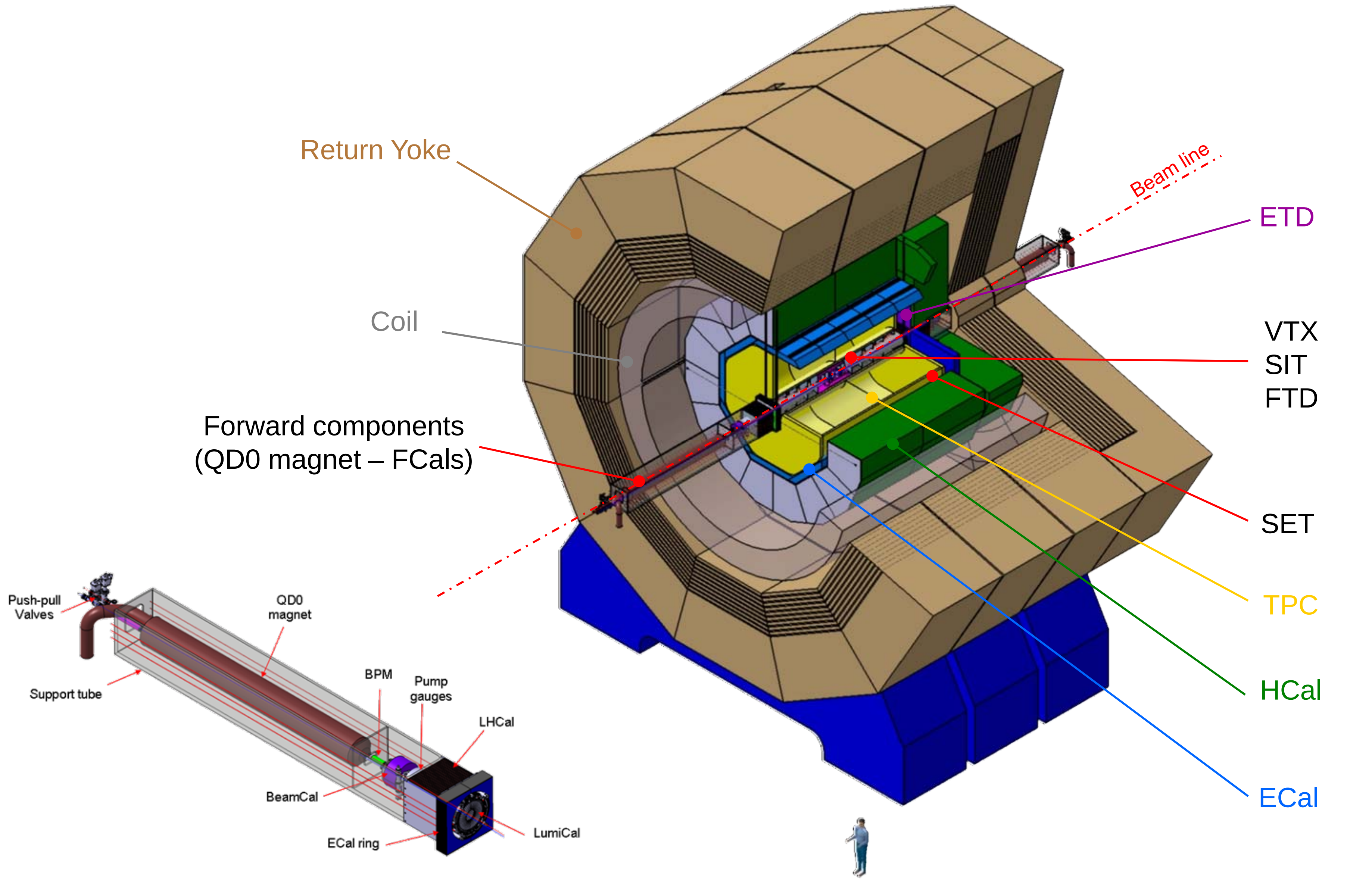
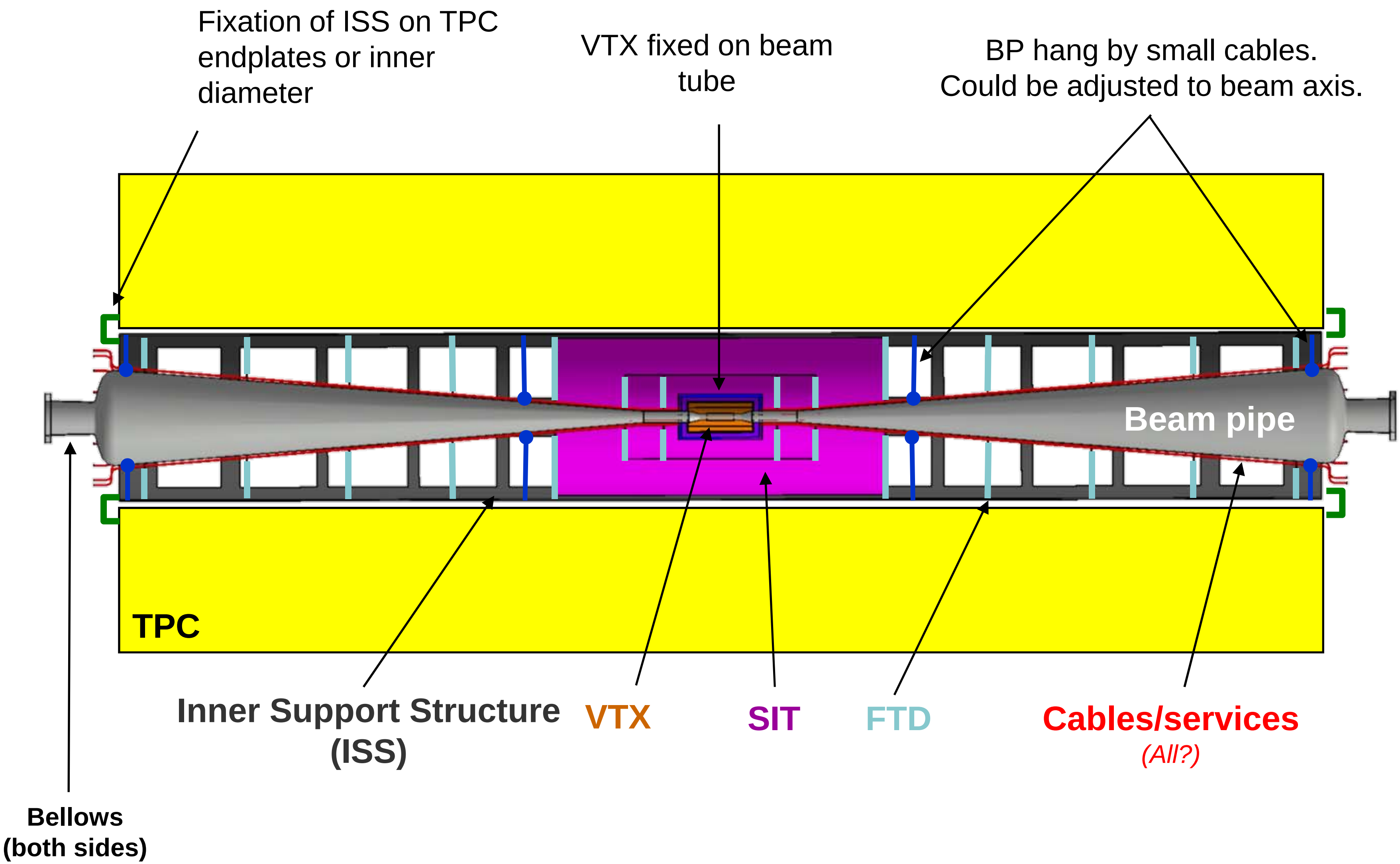
Outline

- Introduction
  - **Reminder of present design**
  - **Goals for DBD 2012**
- Report from the inner meeting
  - **Vertex detector construction**
  - **SIT mechanical design**
  - **FTD 3->7 design**
  - **Integration of inner detectors**
- Some remaining issues
  - **Calorimeters**
  - **TPC**
  - **Forward region**
  - **Etc….**
- Conclusions

ILD overview



Inner region



Goals for DBD 2012

- From ILD work plan:
  - ***Complete basic mechanical integration of the baseline design accounting for insensitive zones such as the beam holes, support structure, cables, gaps or inner detector material***
  - ***Develop a realistic simulation model of the baseline design, including the identified faults and limitations***

- We need to focus on 2 region of the ILD detector for end 2010 :
  - **Overlap region between barrel and endcaps calorimeter**
    - Estimation of cables, services and gaps (see Catherine's talk)
  - **Inner region :**
    - Identify supporting material which has a huge impact on the detector performance
    - Estimate cables and services

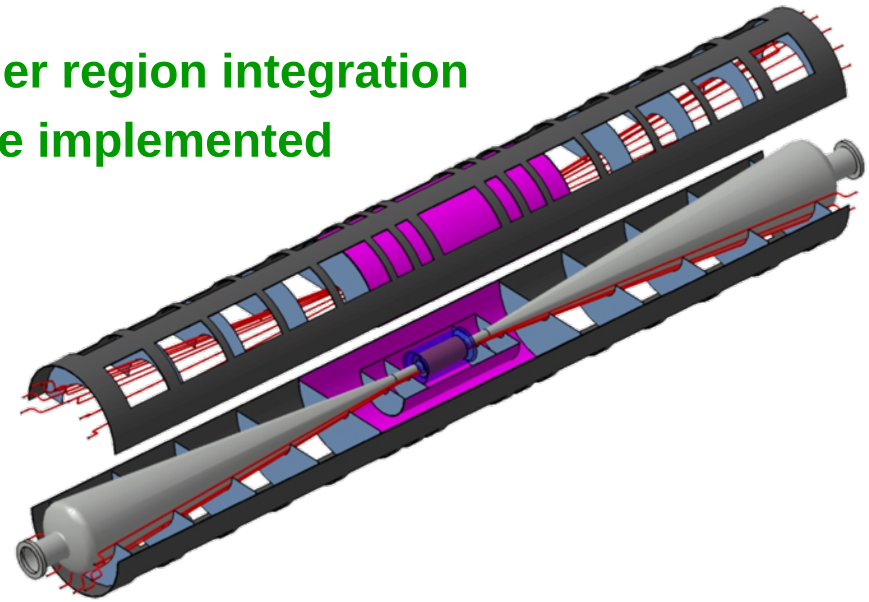
    - Report of first meeting after

Report of the inner region meeting

Aims of the meeting

- Focus on several aspects of these sub detectors :
  - **Mechanical design**
  - **Cooling**
  - **Cabling**
  - **Integration of all the components**

- The goals were to
  - **Sketch first solution for the inner region integration**
  - **Define the material budget to be implemented in the simulation model**



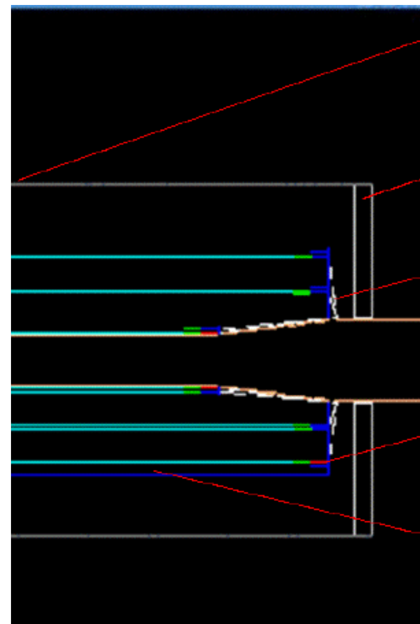
The vertex detector

Cooling

From J. Baudot

- Room temperature operation
  - ✗ CMOS-like sensors
  - ✗ Passive cooling
    - → Air flow ~ 1 m/s (for mech. Stability)
    - → Sensor Temp~10-30 °C
    - → Air Temp. Under study
  - ✗ No real cryostat, nevertheless
    - → Faraday cage needed
    - → May require air separation / SIT
    - → Some thickness of aluminium
  - ✗ Tubes required on beam pipe
    - → Diameter ? mm

- Negative temperature operation
  - ✗ FinePixel-CCD-like sensors
  - ✗ Active cooling required
    - → C02 evaporation in tubes
    - → Sensor Temp~ -(5-15) °C
  - ✗ Real cryostat needed
    - → Backbone 0.5 mm aluminium
    - → Isolation material = 10mm styropor
    - → 0.15(?) % X0
  - ✗ Tubes required on beam-pipe
    - → ?



Cabling

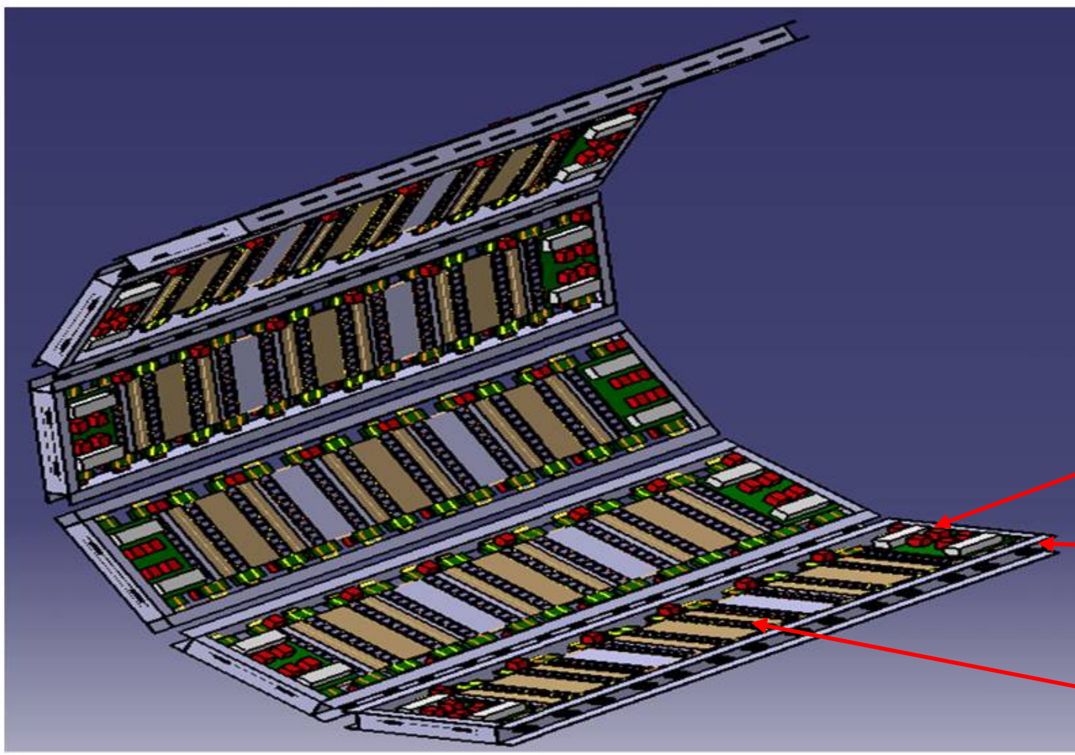
- Basic option
  - ✗ Flat kapton cables running from each ladder to the beam pipe
  - ✗ Small patch panel on the cryostat to interconnect to other flat kapton cables running to the next larger patch pannel some meters away
  - ✗ 2 such cables for each ladder
    - → ~200 cables divided on the 2 end-caps
  - ✗ Kapton cable ~ 50 μm thick, ~1cm wide
  - ✗ After some distance (meters) conversion to long distance cables
    - → How much ?
    - → What kind ?

- Layer support
  - ✗ 1st layer is mounted on the beam pipe
  - ✗ 2nd & 3rd layers mounted on the Beryllium support
  - ✗ Beryllium support clamped on beam pipe
  - ✗ No study on the impact of beam pipe deformation
  - ✗ No technical drawing available (manpower)

The SIT mechanical design

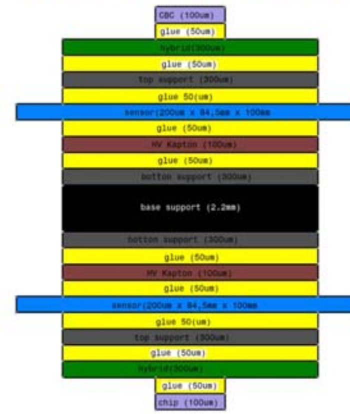
- One proposal from D. Moya and Al.

SIT EXTERNAL LAYER



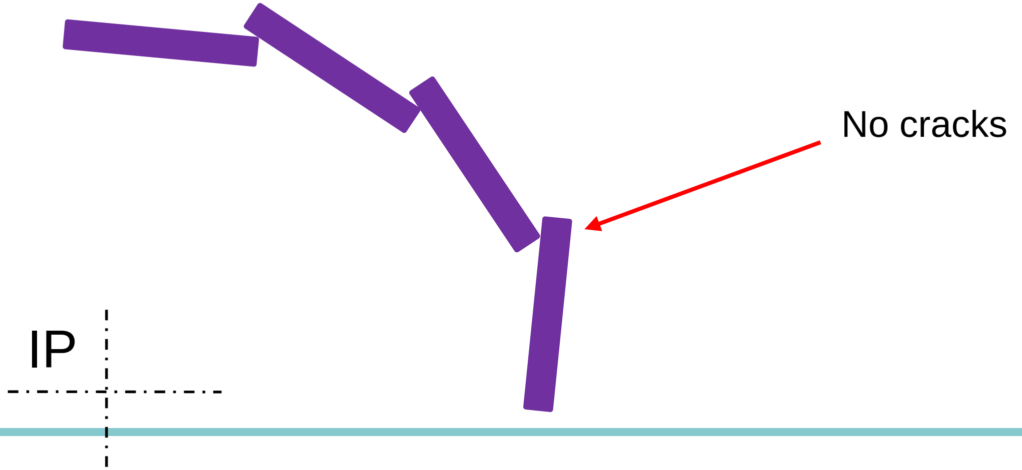
30 JUNE 2010 David Moya IFCA 9

MODULE LAYOUT



SIT (2)

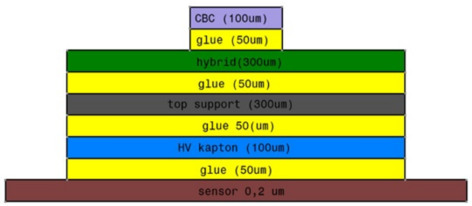
- Cabling :
  - **1 HV cable per sensor**
  - **2 twisted pairs for readout per 2 Chips' = 52 tp per module = 208 tp per inner rod /364 tp per outer rod**
  - **1 supply cable per DC-DC converter (12 V)**
  - **1 output (1-2 V) connector per DC-DC converter containing 2 cables for 2 hybrids**
- Cooling :
  - **Still open issue**
  - **Air flow solution to be checked**
    - If not sufficient, first layer maight be included in VTX Cryostat
- A new assembly must be studied avoiding cracks



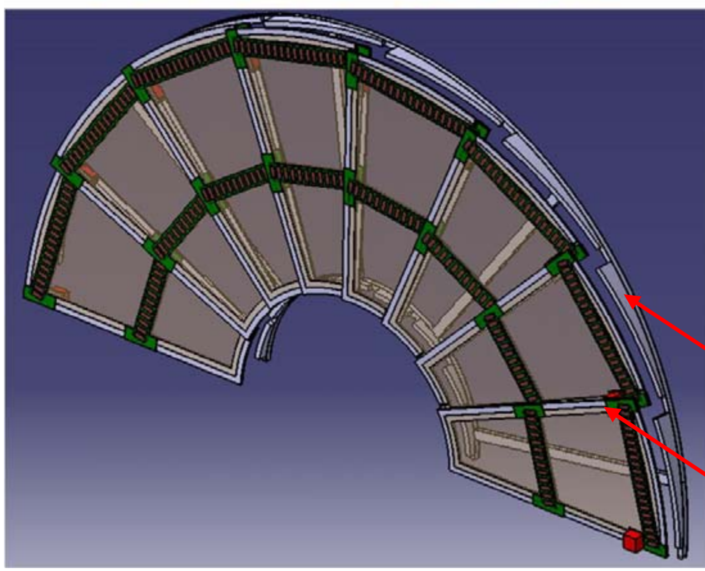
FTD D3 to D7

- Proposal from D. Moya and Al.

FTD MODULE LAYOUT



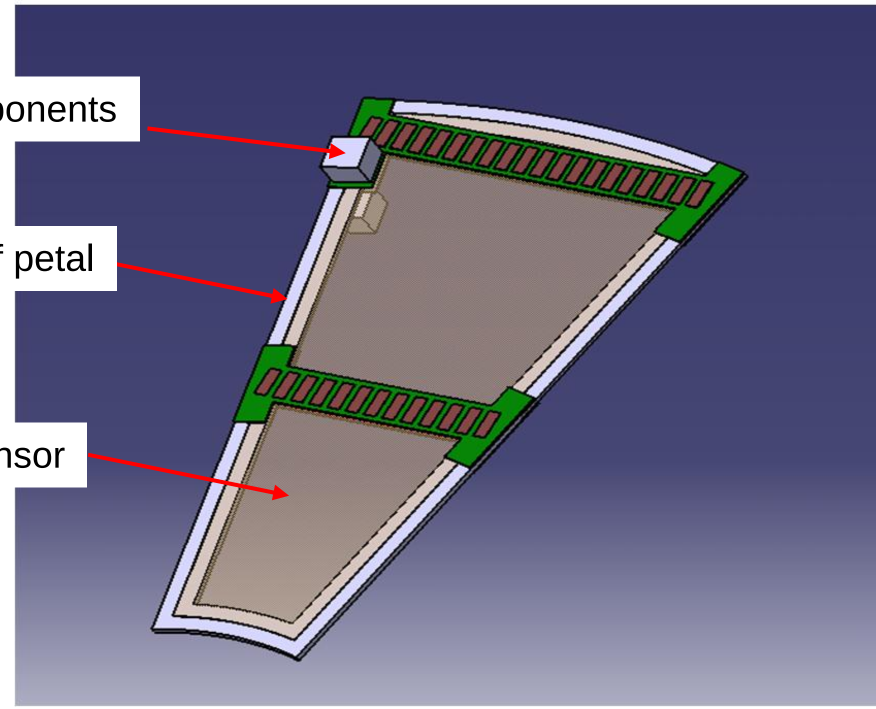
SUPPORT STRUCTURE



Support structure

Petal assembly

FTD PETAL DESIGN



Electronic components

Support of petal

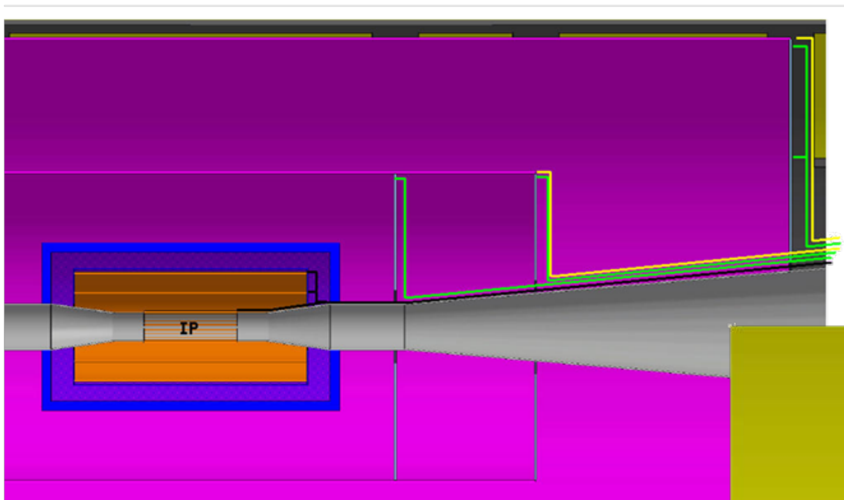
Silicon sensor

FTD (2)

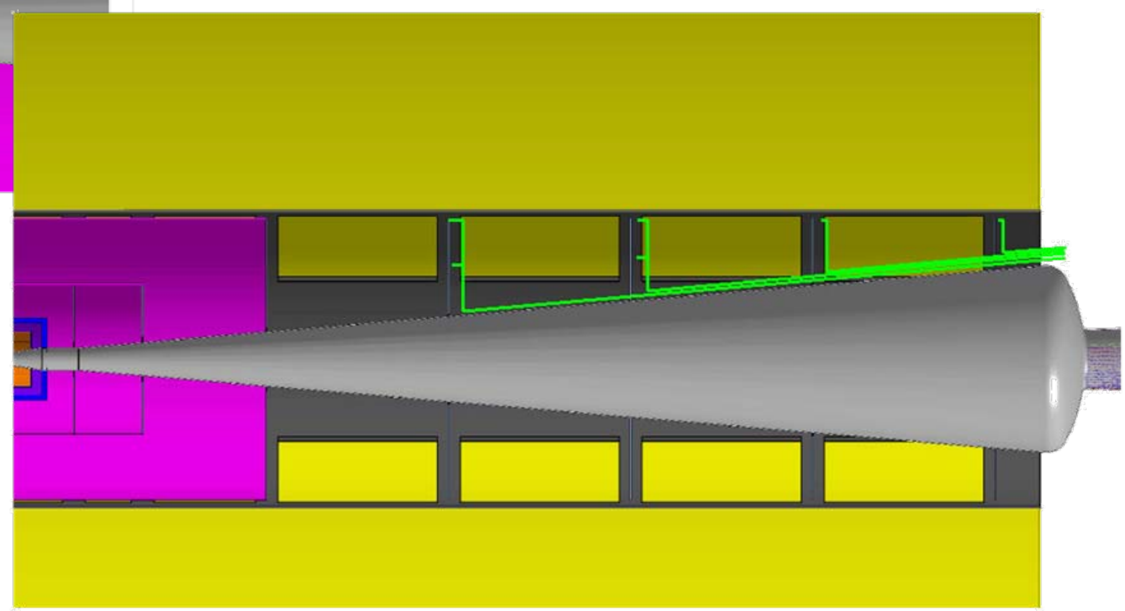
- Cabling
  - **1 HV cable per sensor**
  - **2 twisted pairs for readout per 2 Chips'**
  - **1 supply cable per DC-DC converter (12 V)**
  - **1 output (1-2 V) connector per DC-DC converter containing 2 cables for 2 hybrids**
- Cooling
  - **To be studied**
  - **Air flow cooling as the first solution**

The cabling paths in that region

- We agreed to keep the first concept along the beam tube
  - **Cable amount to be estimated to check needed gaps**



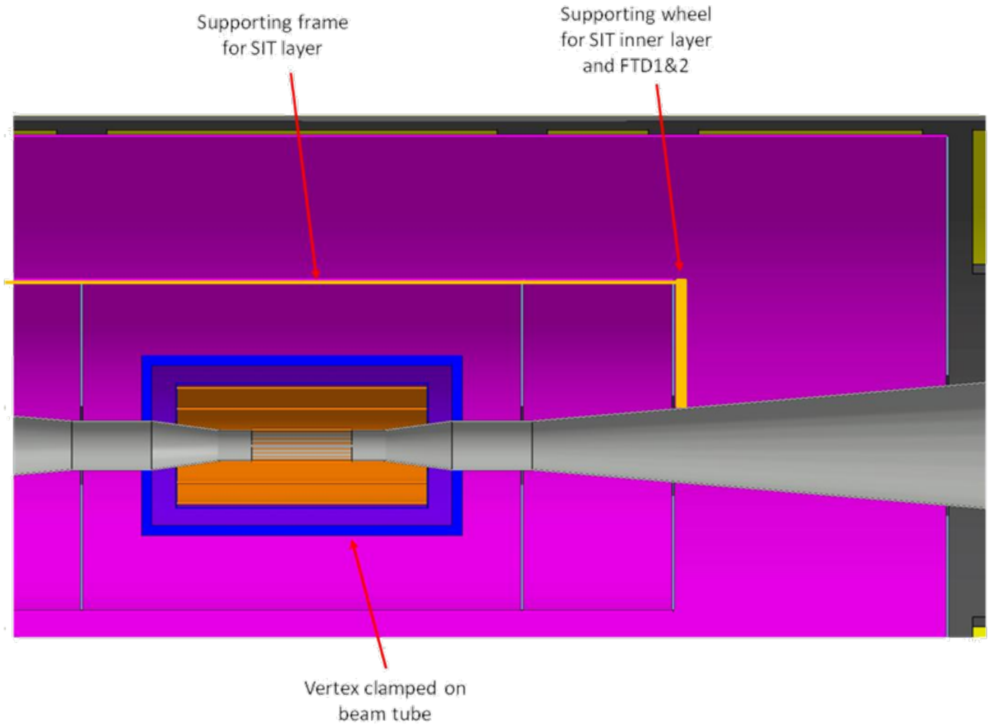
VTX/SIT/FTD1,2,3



FTD4->7

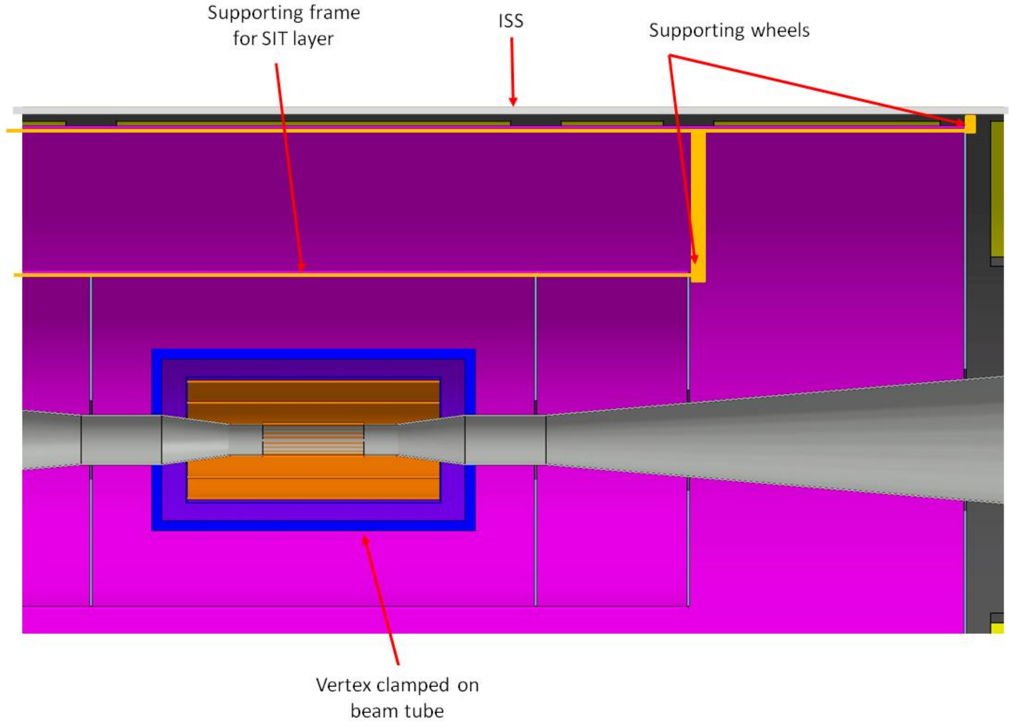
Mechanical integration

- First concept approved by sub detectors groups
  - **VTX clamped on beam pipe**
  - **FTD 3->7, beam pipe and SIT outer layer on Inner Support Structure**
  - **SIT layers are assembled on an end cap wheel**
- Different solution for SIT inner layer and FTD1&2
  - **1 : supporting on beam pipe**



Mechanical integration (2)

– **2 : supporting on SIT outer layer**



- The best compromise must be found between
  – **Less material budget (solution 1?)**
  – **Best mechanical behaviour (solution 2)**
    - Decoupled SIT and FTD1&2 from beam tube

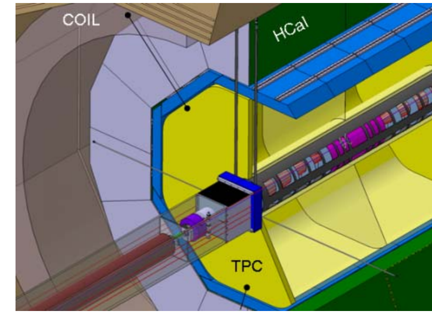
Next steps for inner region

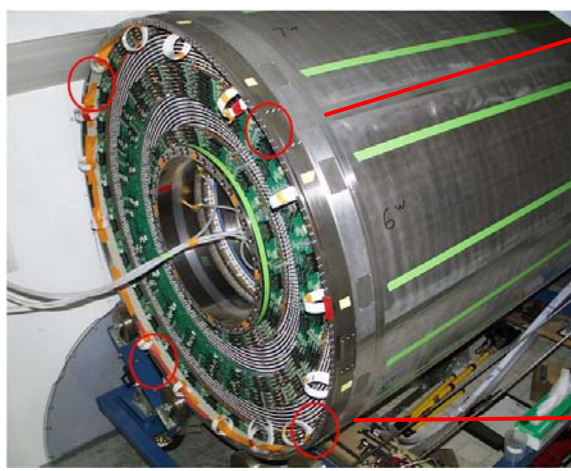
- Next meeting planned during CERN meeting in October

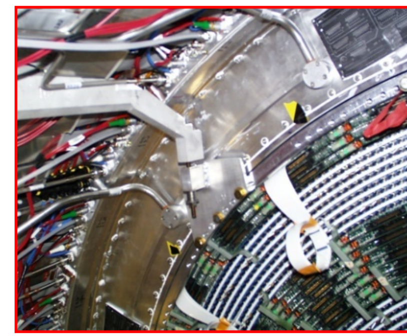
- Items to be studied :
  - **Heat power and cooling**
  - **More details on cables dimensions**
  - **Stability of each components**
  - **Mechanical design of the VTX detector (no one for the moment)**
  - **Design of FTD1&2**
  - **Other proposal for the SIT design (from Torino?LPHNE?)**
  - **Mechanical design of the supporting structure (MJ)**
  - **Interfaces with TPC (MJ)**
  - **….**

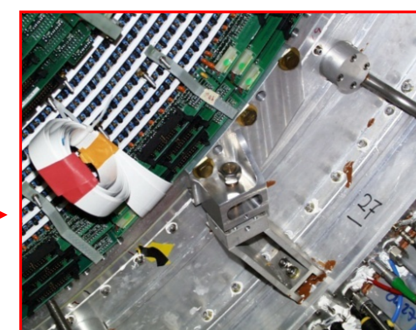
Other issues to be studied for the DBD 2012

- TPC support :
  - **First ideas with tie rods from Hcal or Cryostat**
    - Hcal solution will provide a better vibration behaviour
  - **Rough estimation of tie rods dimensions :**
    - TPC weight : 1000Kg
    - 3 tie rods both sides (minimum number to lock every degrees of freedom
    - Titanium
    - Safety coefficient of 6
    - Tie rods diameter : 6mm
  - **Detailed study to be performed**





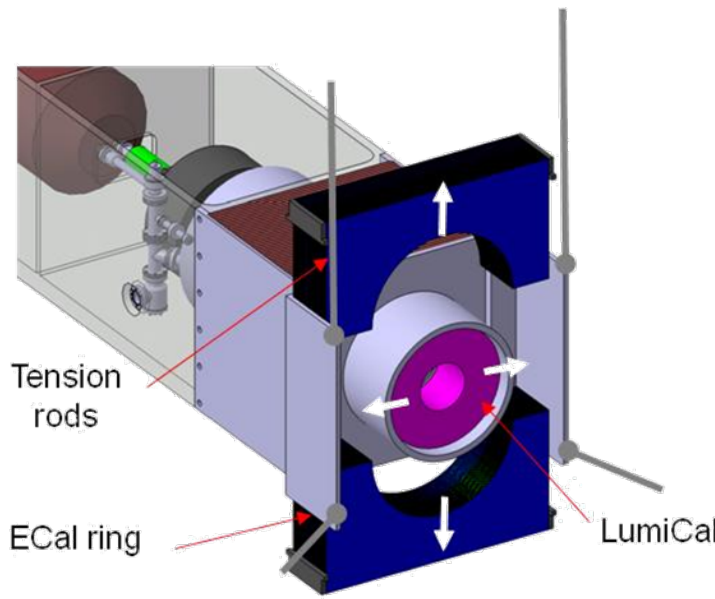




Comments on the CLEO-III drift chamber support, Dan Peterson, Cornell, 2010-07-01

Integration issues for DBD 2012

- Calorimeters integration and assembly :
  - **Hcal : Integration studies on going by both concepts (see Karsten's and Imad's talks)**
  - **Ecal : Important effort from LPSC on cooling (see Catherine's talk)**
- Forward region :
  - **Optimisation to be performed to reduce material budget**
- QD0 support
- Etc…



Conclusions

- Inner region integration meeting
  - **We had an interesting meeting last week**
    - Agreement on a first sketch
    - First cabling paths
    - Important to start face to face meetings
  - **But there are a lot studies to be performed to get a real estimation of the material budget**
    - Mechanical design of every elements including their supporting structures
    - Go into details concerning the cables/services amount (cooling studies mandatory)
  - **Very difficult due to the limited resources**

- Integration studies for DBD2012
  - **Some studies on going**
  - **We need to reinforce the synergy between integration and sub detector groups (TPC, calorimeters, etc..)**