ILD detector design

Matthieu Joré – December the 1st

Outline

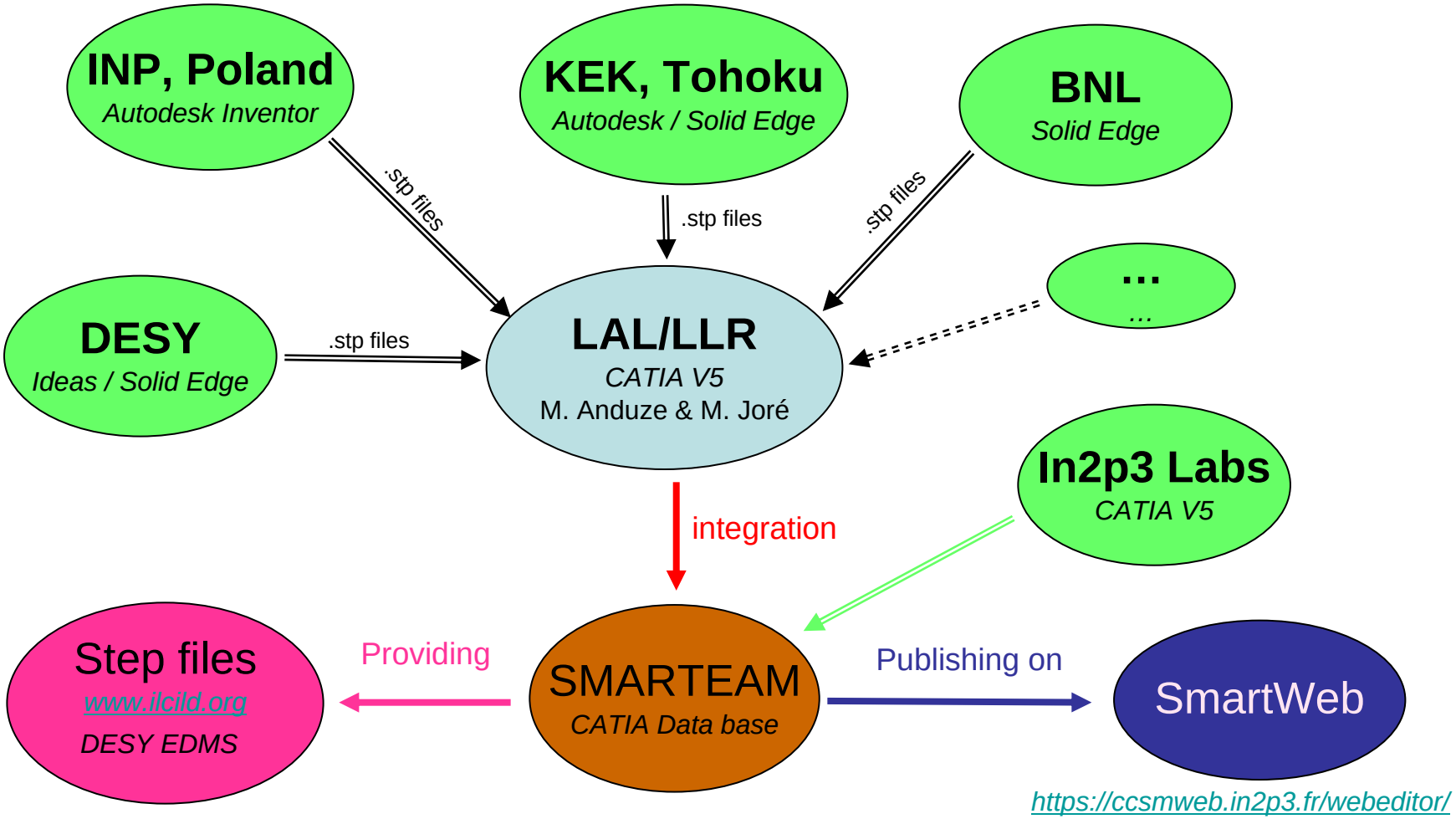
- Intro
  - **Motivation for a mechanical integration of ILD**
- Toward a complete CAD model
  - **Baseline CAD organisation**
  - **First feedbacks**
- ILD design status
- Some integration issues
  - **Square support tube solutions**
    - Layout
    - FEA Calculations
  - **Cabling scheme**
  - **Beam pipe shape**
- Conclusions

Integration of ILD

- Motivations
  - **Engineering model makes the simulations more realistics**
  - **Need studies on opening/supporting issues for the LoI**
    (submitted in March 09)
    - Push-Pull scenario
    - QD0 magnet stability
    - Assembly and maintenance of each subdetector
    - Etc…
  - **Integration process can influence subdetector design**
- To perform this, we need :
  - **Information from subdetector groups (cables, supporting method, weight, accuracy needed, alignment method, etc..)**
  - **Realistic CAD model for doing a complete ILD model**

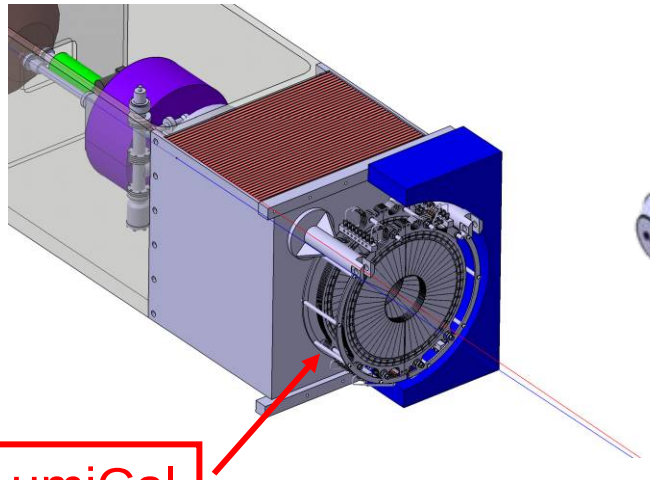
Toward an ILD CAD model

- Structure defined at TILC08



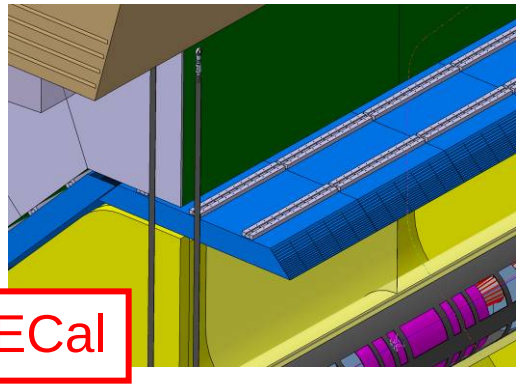
CAD system feedback

- It seems complicated, but it works !!!



LumiCal

QD0 Magnet

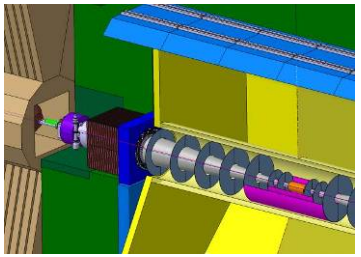


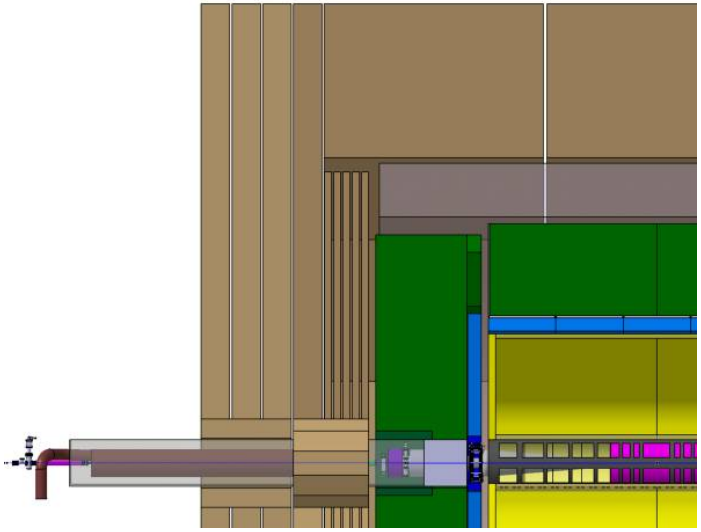
Si/W ECal

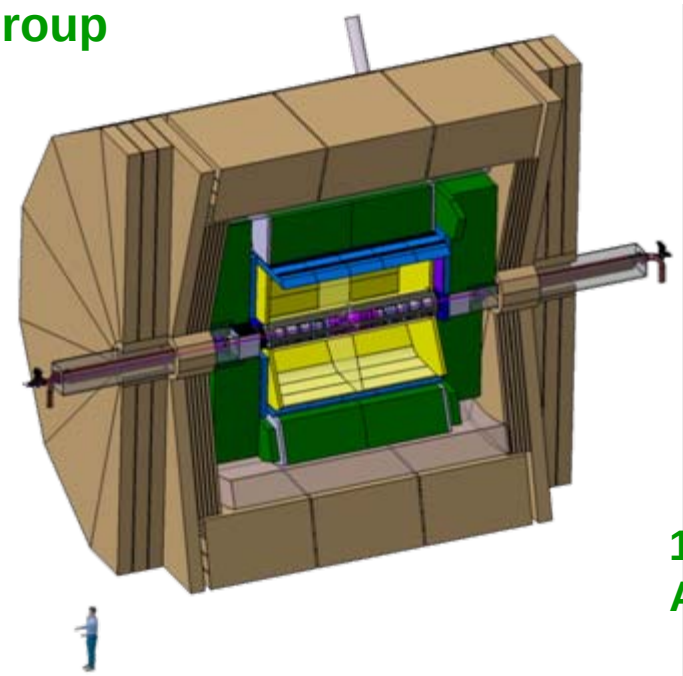
- But it's not sufficient. We need more detailed CAD model mainly for :
  - **HCal**
  - **Forward Tracker**
  - **TPC**
  - **etc…**

ILD design status

- LoI parameters defined in Cambridge meeting (=ILD0)
  - **ECAL : Si/W**
  - **HCAL : AHCal with Scintillator/SS**
  - **8 folds for Calorimeters, 12 folds for return yoke**
  - **Vertex : 3 twin layers**
  - **Field : 3,5T (but still possible to operate at 4T)**
  - **Big effort with simulations group**





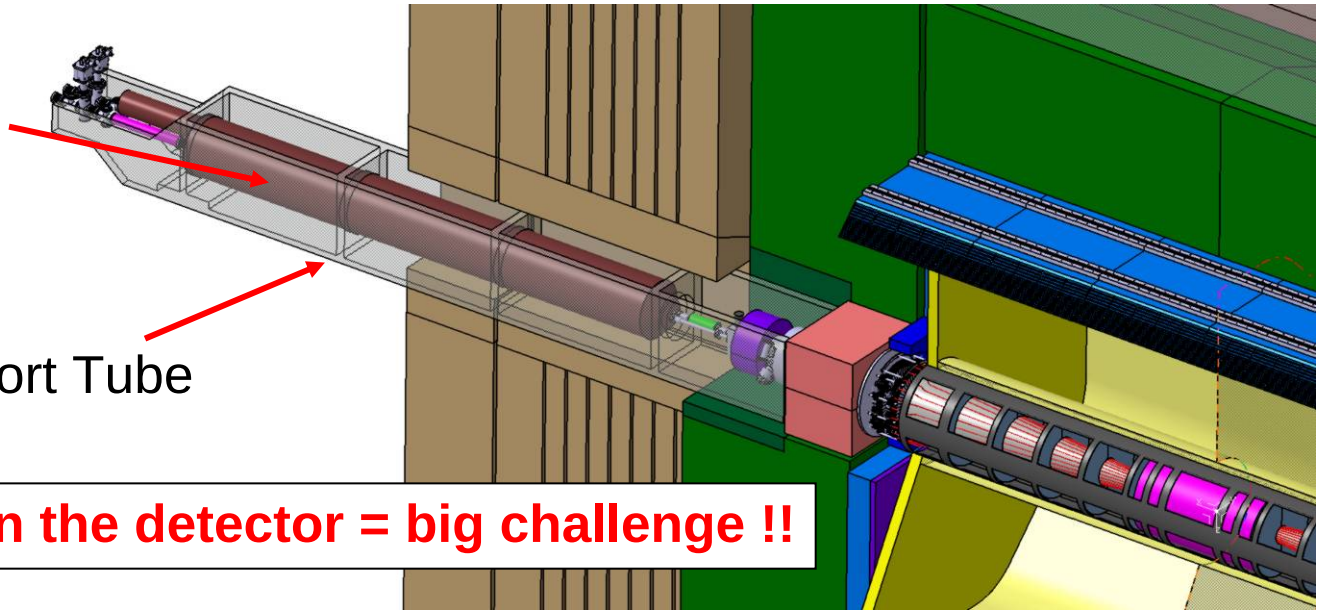


12 000tons
Ab. 12x12m

one integration issue : the forward region

- ILD forward region

QD0
(superconducting magnet)

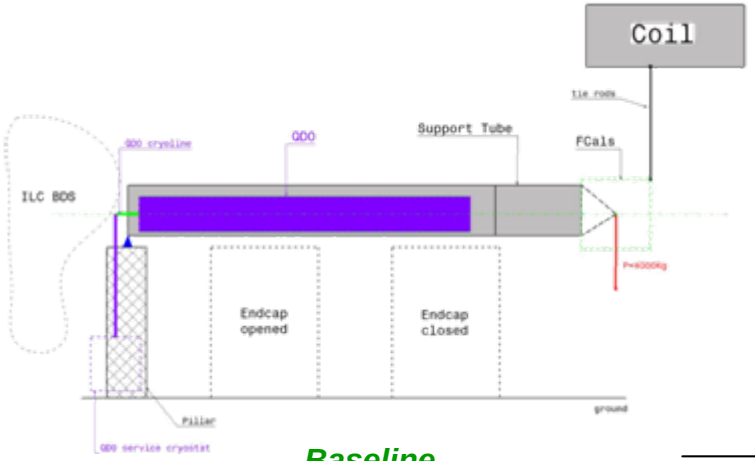


Integrating QD0 in the detector = big challenge !!

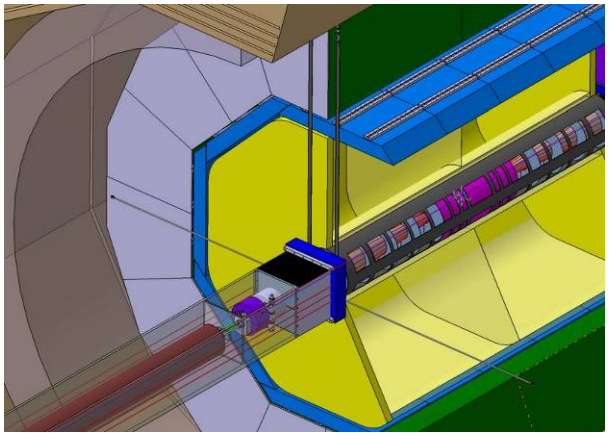
- Requirements on support tube
  - **Support all the forward components**
  - **Good vibration performance (QD0 stability)**
  - **Allowable amplitude**
    - Few mm in static load
    - About 50nm for ground motion (IR interface document)
  - **Alignment system is needed (in a mm range)**

Solution layout

- Square support tube fixed on a pillar and tension rods
  - **Square shape is stiffer (ab. 40% less deformation / round)**
  - **Better stability behavior than cantilever solution**
  - **Alignment performed with tension rods length (H/V + tilt)**
  - **Independent of EndCap**



Baseline

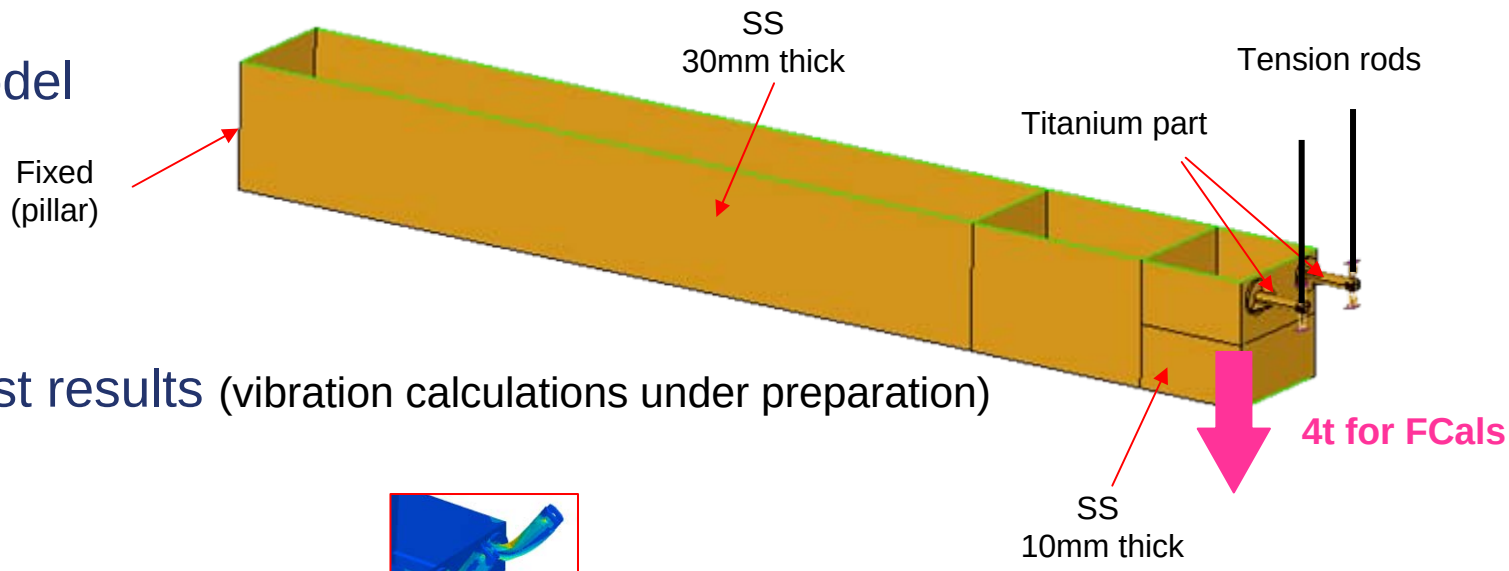


In ILD detector

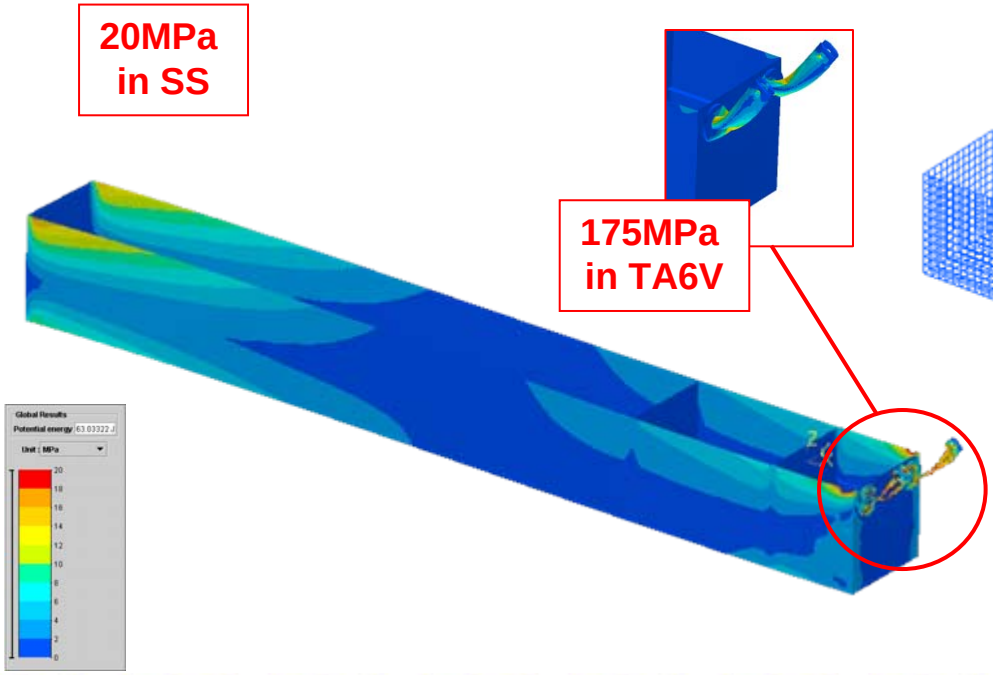
- 2 vertical tension rods in CFRP (best candidate) :
  - **50x2mm - 3m long**
  - **Less than 1%X0**

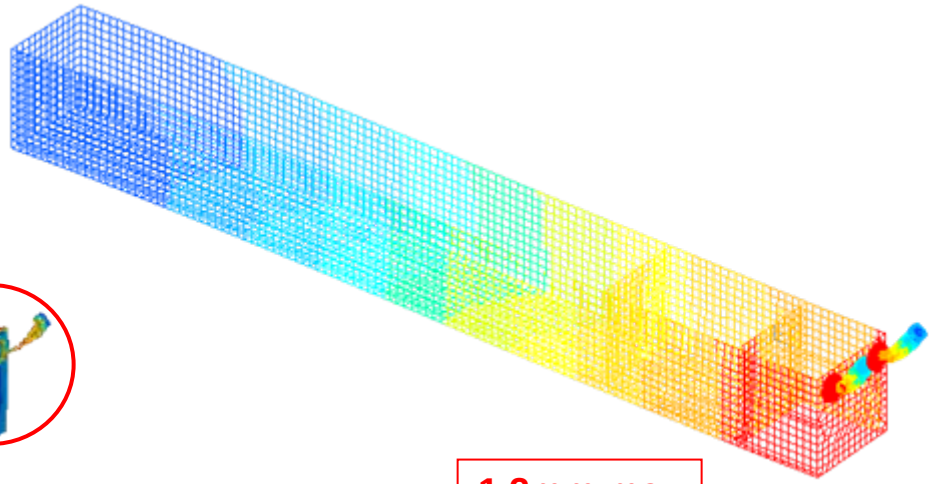
Design & FEA calculations

- Model

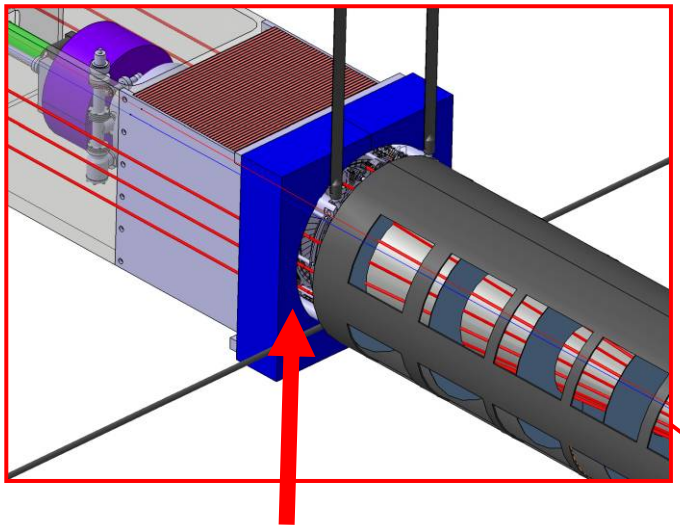


- First results (vibration calculations under preparation)

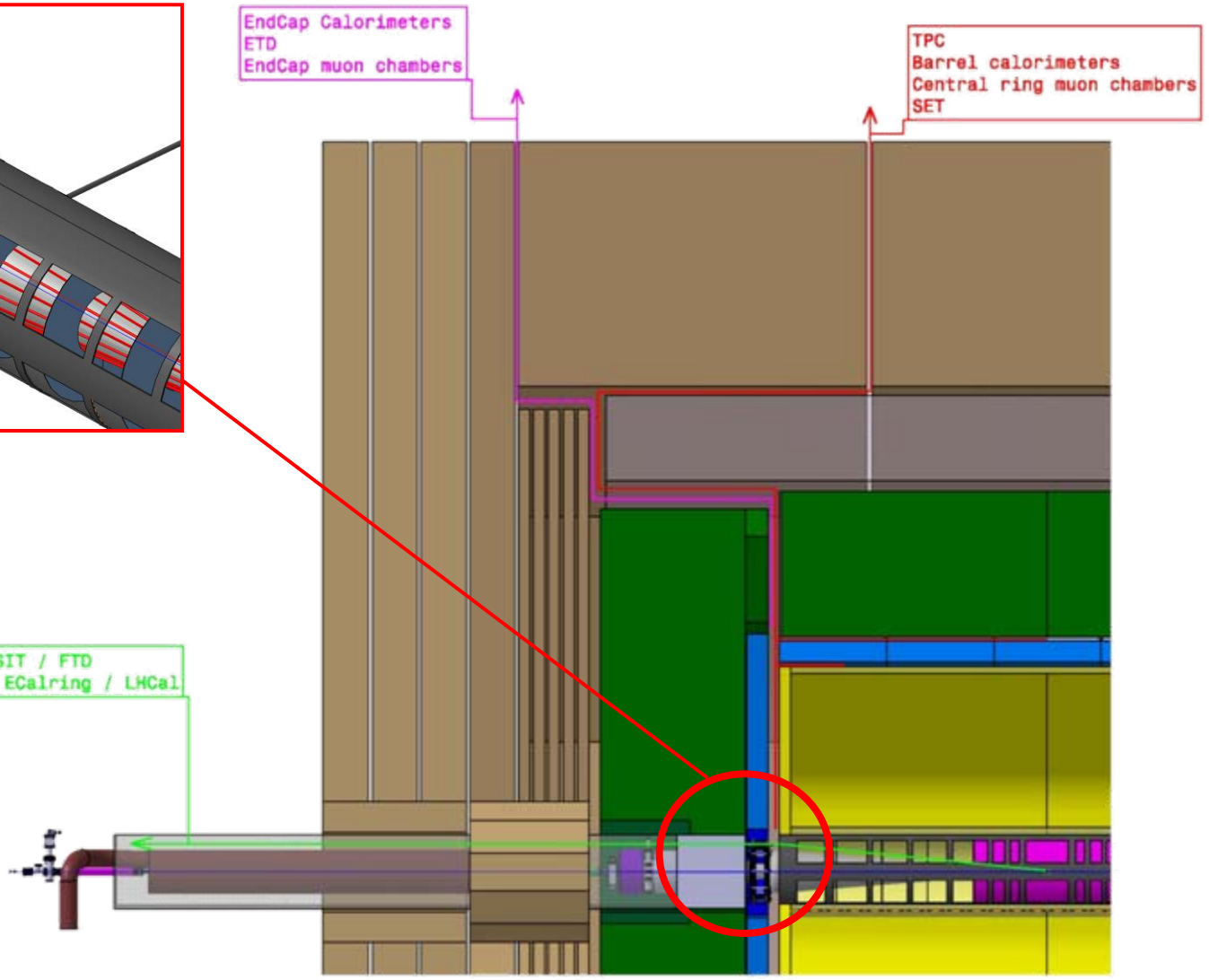




Cabling scheme

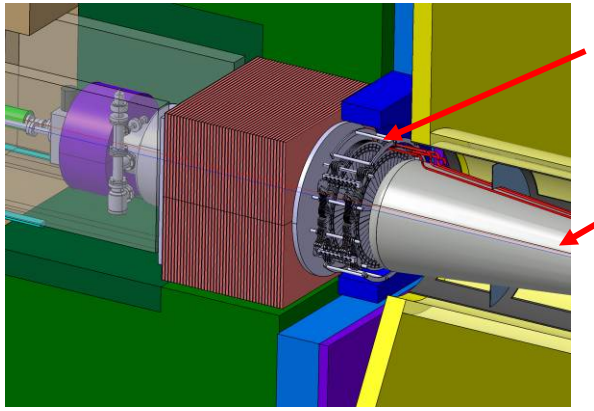


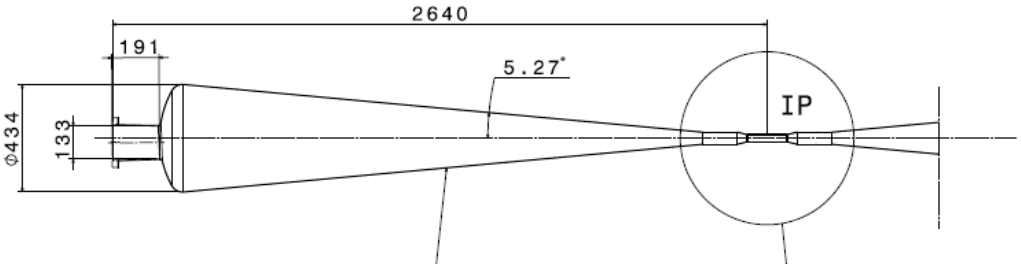
Inner cables/supplies
behind the ECal ring



Beam pipe shape & material

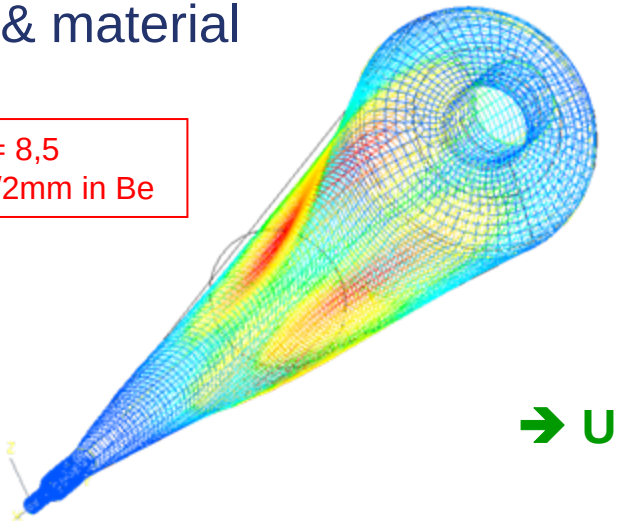
- Conical solution for minimizing material budget in front of LumiCal





- Reduce the material budget in a such area by playing with the shape & material

Buckling coef = 8,5
4mm in Al / 2,5 in SS/2mm in Be



➔ **Under optimisation by Marc Anduze**

Conclusions

- List of issues is bigger than shown
  - **Vacuum :** studied at KEK and under study at LAL
  - **Opening scenario :** partially known
  - **Assembly process :** partially known
  - **Design of the Return Yoke :** under design by DESY
  - **Push-Pull :**
    - platform solution studied A. Hervé from CMS
    - Need to provide a realistic push-pull schedule
  - **Cables/cooling :** under discussion but really need informations from subdetector groups

- We have a hard work before the LoI
- But I think we are on the right way for writing a realistic LoI

Thank you !

Spare pictures