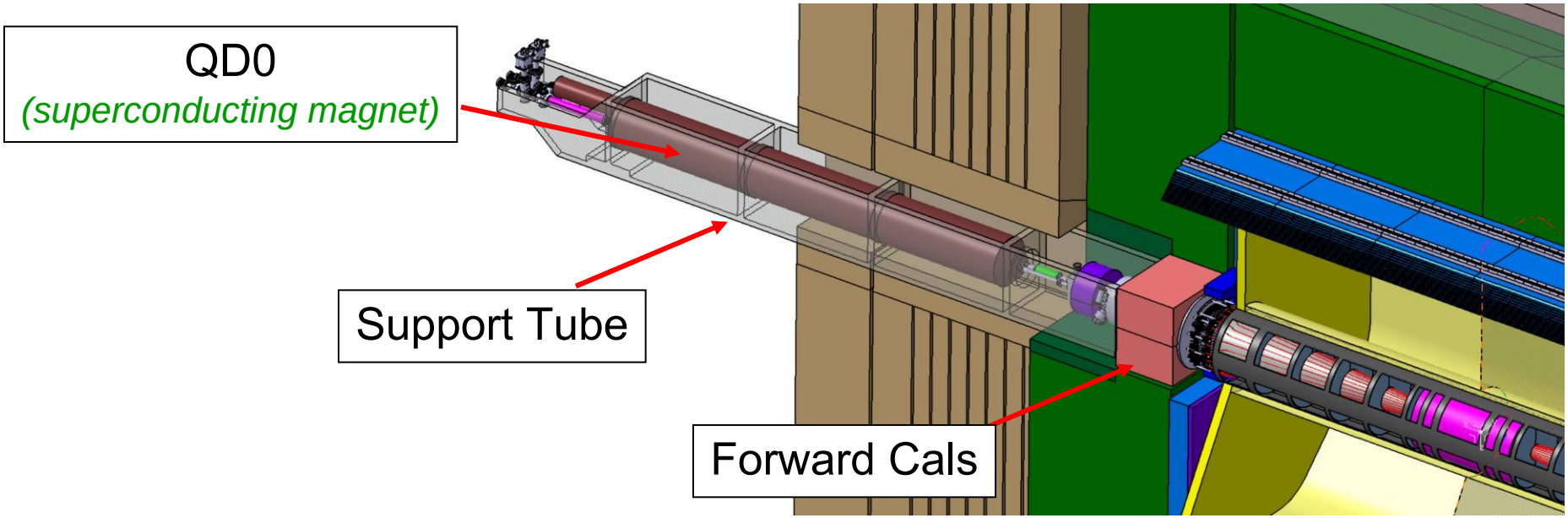
ILD Forward region

Matthieu Joré – December the 12th

- Forward support tube
- LHCal
- Forward region integration

Forward support tube requirements

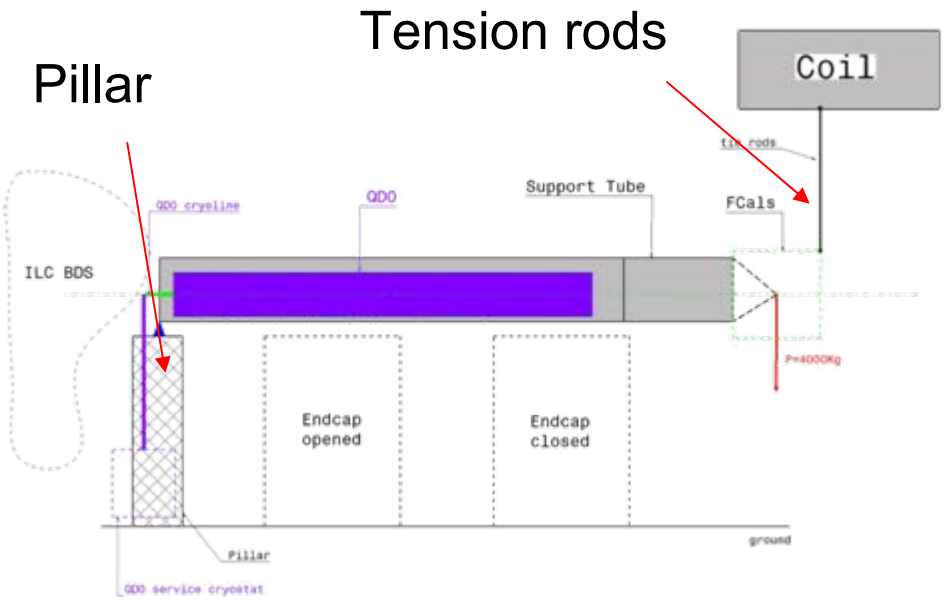
- ILD forward region



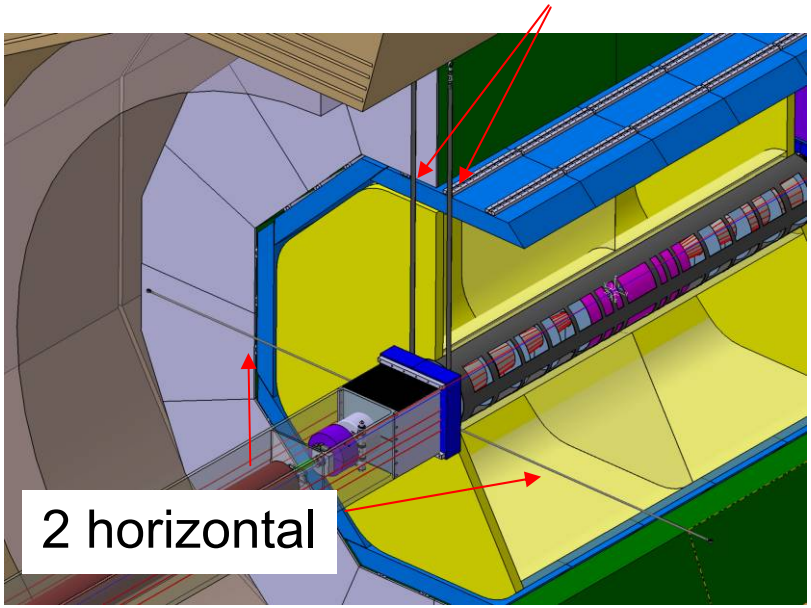
- Requirements on support tube
  - **Support all the forward components**
  - **Good vibration performance (QD0 stability)**
  - **Allowable amplitude**
    - Few mm in static load
    - About 50nm for ground motion (IR interface document)
  - **Alignment system is needed (in a mm range)**

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**
  - **Rods have a rectangular shape**



Baseline



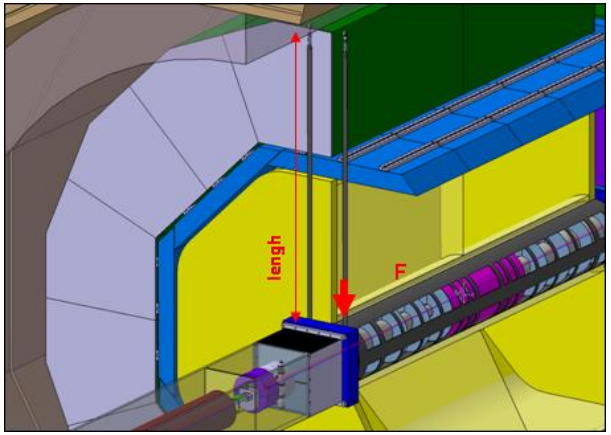
In ILD detector

Tension rods choice

- Calculation inputs :
  - **Effort on each vertical tension rods = 26000N**
  - **Safety coefficient = 6**
  - **Dimension of each rod = 3mx50mm width**

$$thickness \geq \frac{F \times s}{\mathrm{Re} \times width}$$

$$Def = \frac{F \times length}{thick \times width \times E}$$



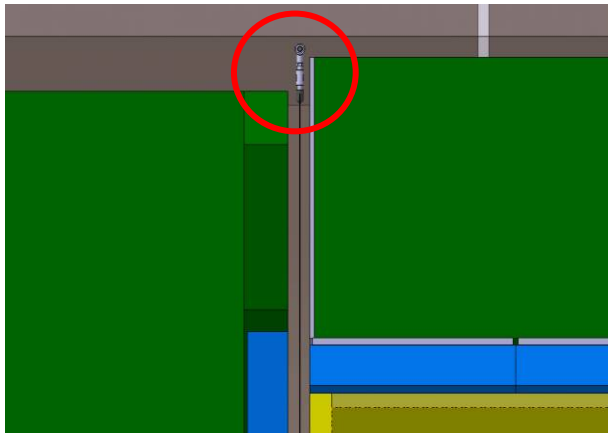
- Results :

	X0(mm)	Re(Mpa)	E(Mpa)	Thermal expansion coef.	Thickness needed (mm)	Deformation (mm)	Material budget (%X0)	Delta µm/°
316L	17,9	300	200000	1,50E-05	10,40	0,75	58,1%	45
Be	353	60	300000	1,23E-05	52,00	0,10	14,7%	36,9
TA6V	35,9	1000	105000	8,00E-06	3,12	4,76	8,7%	24
Carbo HR/epoxy	**302**	**1200**	**130000**	**3,60E-06**	**2,60**	**4,62**	**0,9%**	**10,8**
AU4G	89	240	75000	2,26E-05	13,00	1,60	14,6%	67,8

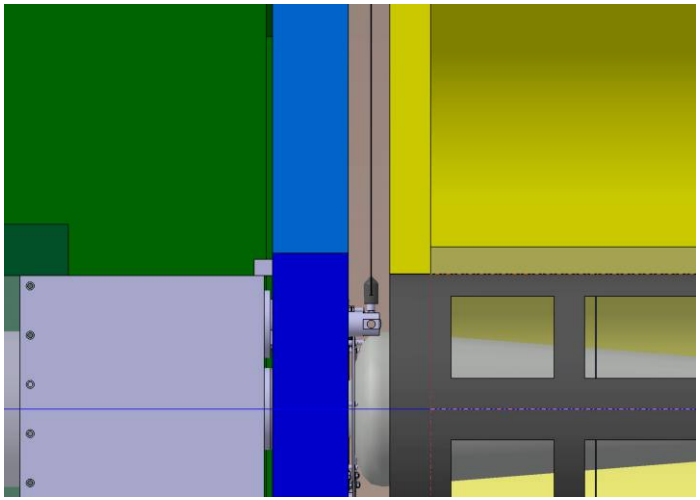
- Choice : Carbon fiber/epoxy
  - **Lowest material budget (<1%X0 in 2 small areas – 2,6 mm thick)**
  - **Better thermal stability : support tube position is stable**
  - **But big deformation ⇨ correction needed**

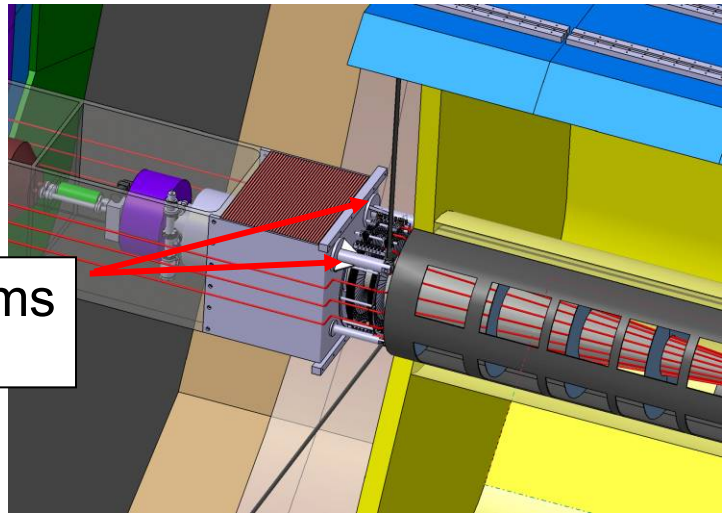
Integration of those rods

- Adjustment of the support tube position
  - **= Adjusting the tension rods length**
    - Put in a “dead” area
    - Simply realised



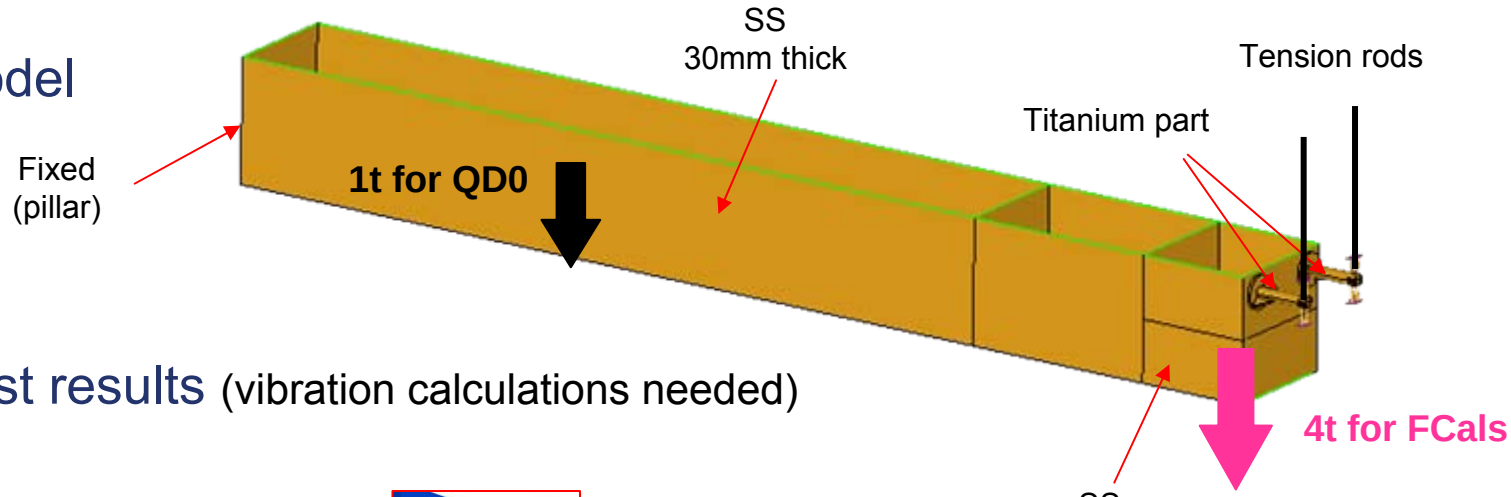
- Connection to the support tube
  - **= Titanium arms bolted to support tube**



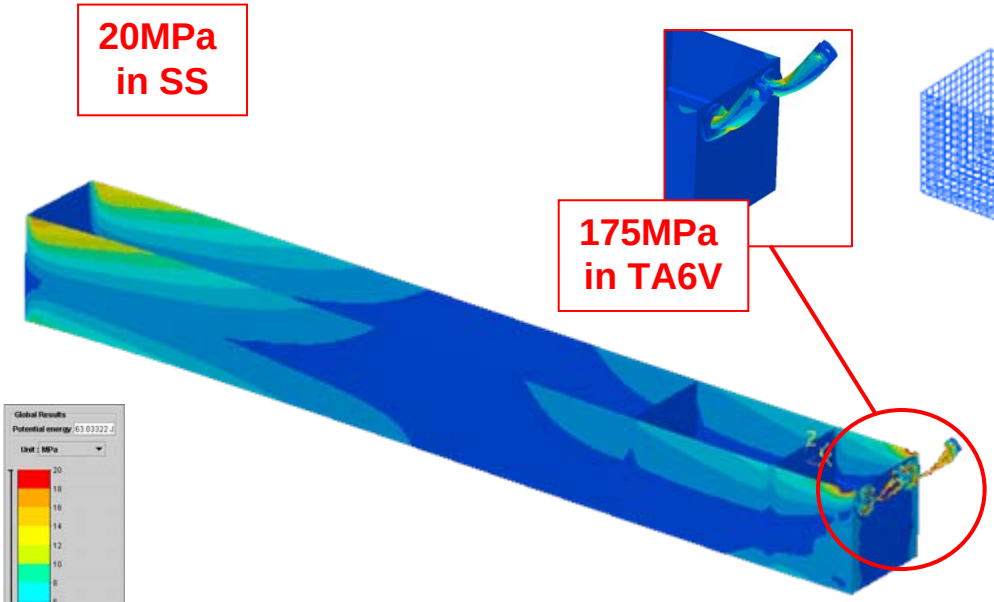


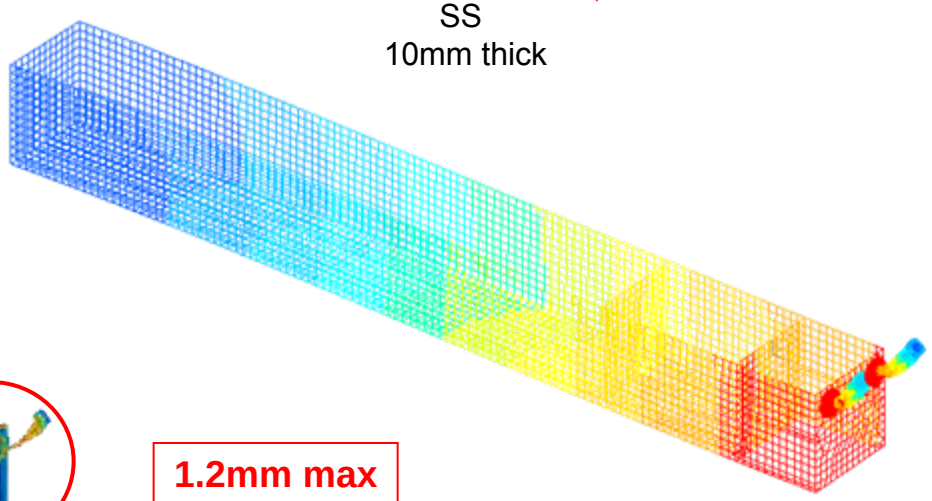
FEA calculations

- Model



- First results (vibration calculations needed)

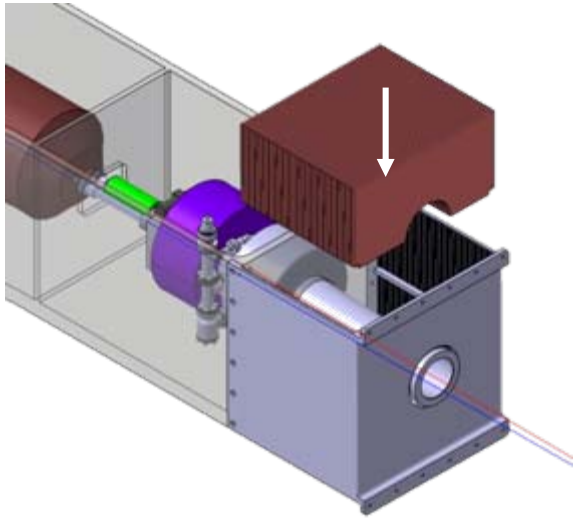


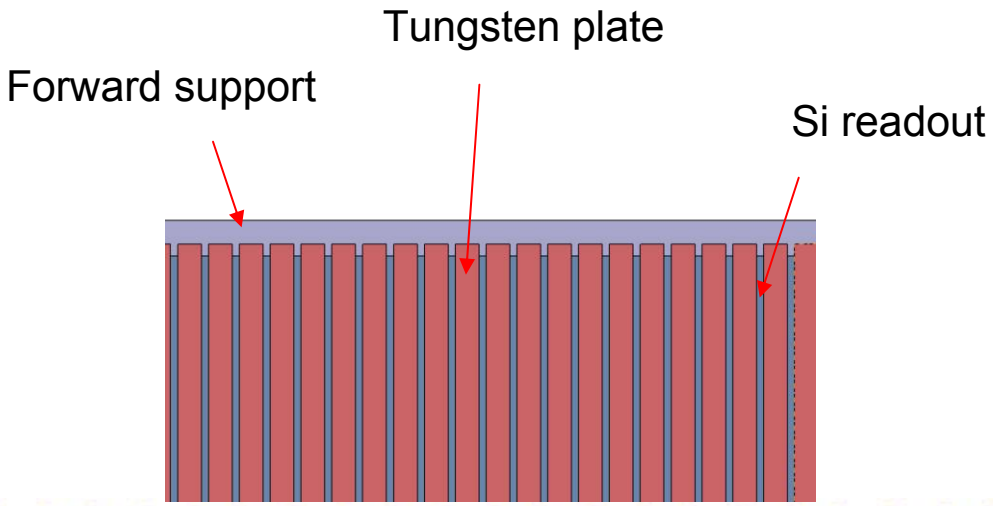


Corrected with tension rods length

LHCal mechanical design

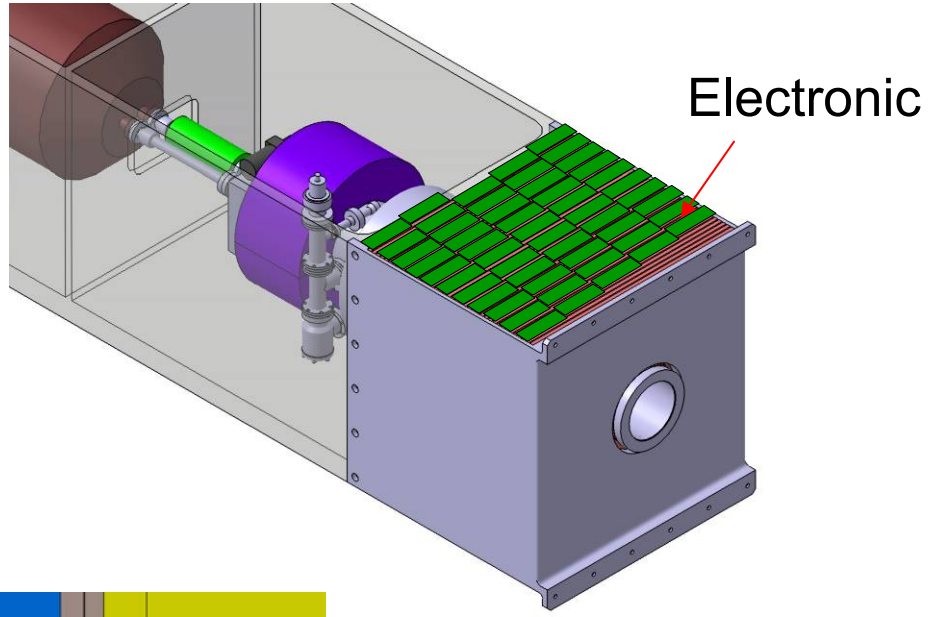
- LHCal main characteristics :
  - **40 layers of Tungsten (10mm thick – 4,17λ)**
  - **Silicon readout (3mm thick)**
- Construction :
  - **Split in 2 parts**
  - **Supported by 2 vertical plates (closer to BP & stiffer)**
  - **Tungsten plates guided by forward support**
  - **Silicon inserted between Tungsten plates**



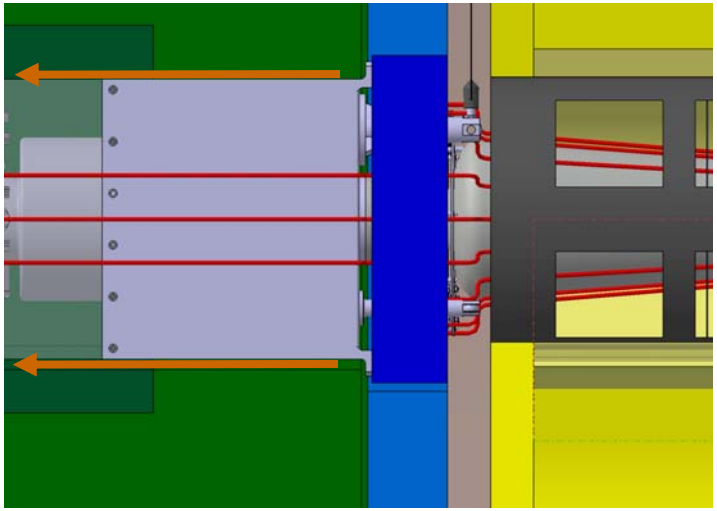


LHCal electronic & cabling

- Electronic boards integration
  - **Top & bottom**



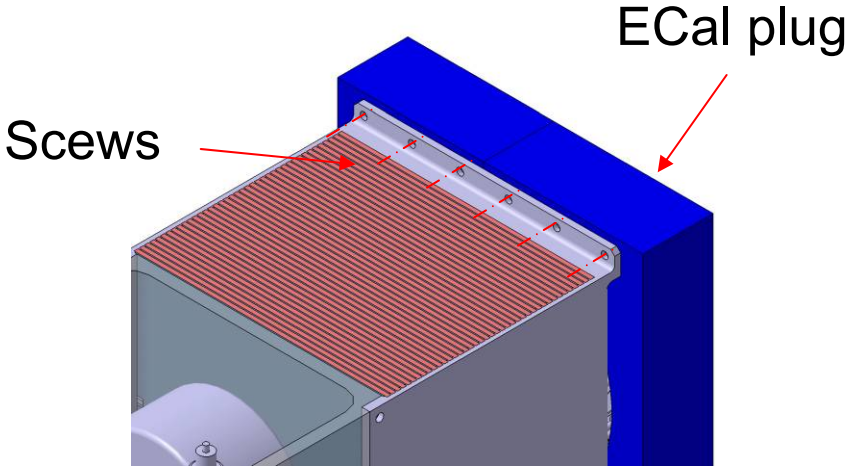
- Cabling
  - **Between LHCal & HCal EC**



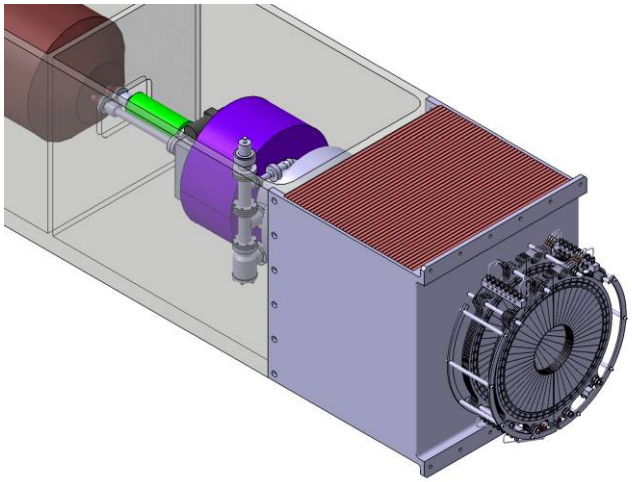
Forward region integration

- ECal plug (or ring) mounting :
  - **Bolted on forward support**
  - **Mechanical design**

    (see marc's slides)

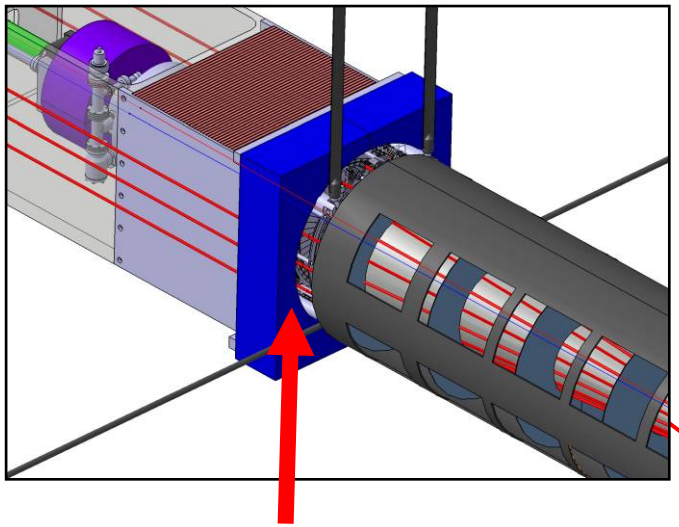


- LumiCal

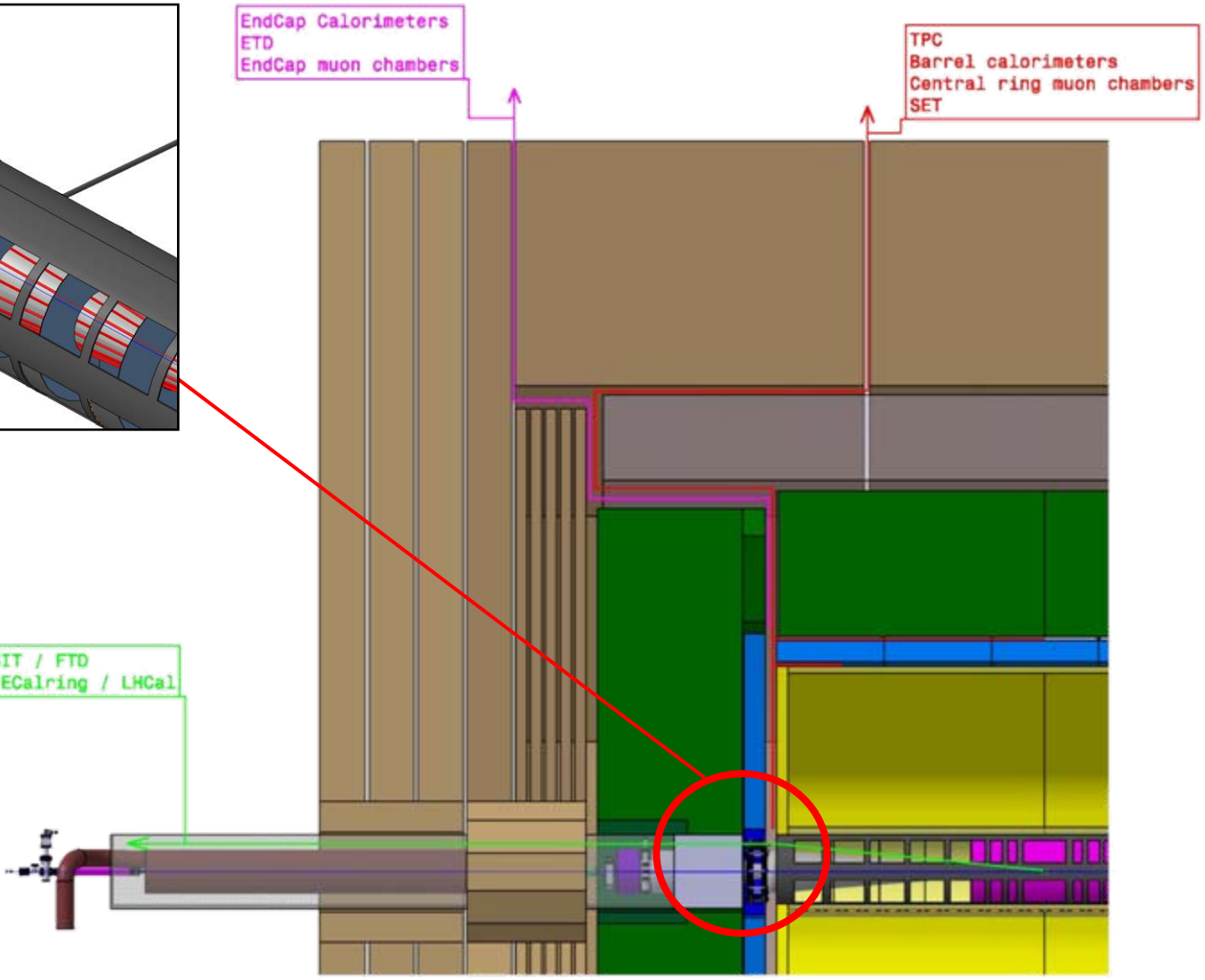


- **Intermediate support bolted on forward support**
- **Under designed by Lumi group**
- **Need closer discussion with them**

Cabling scheme

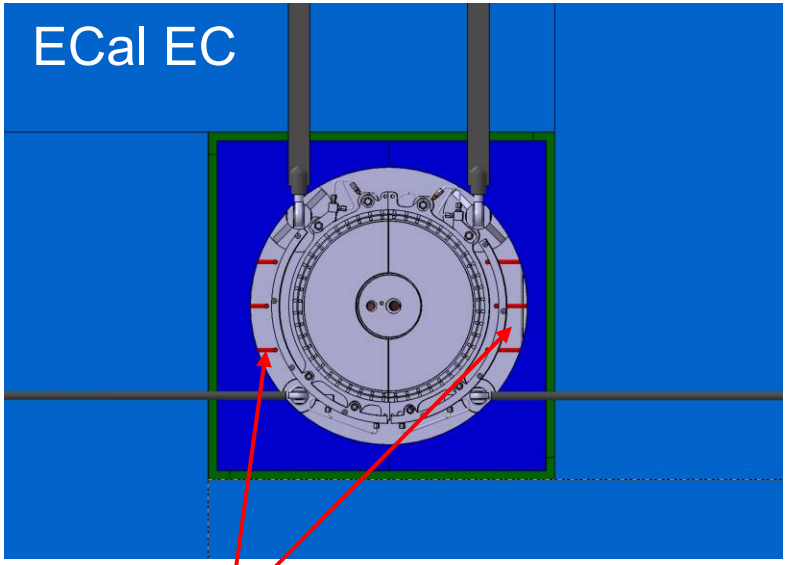


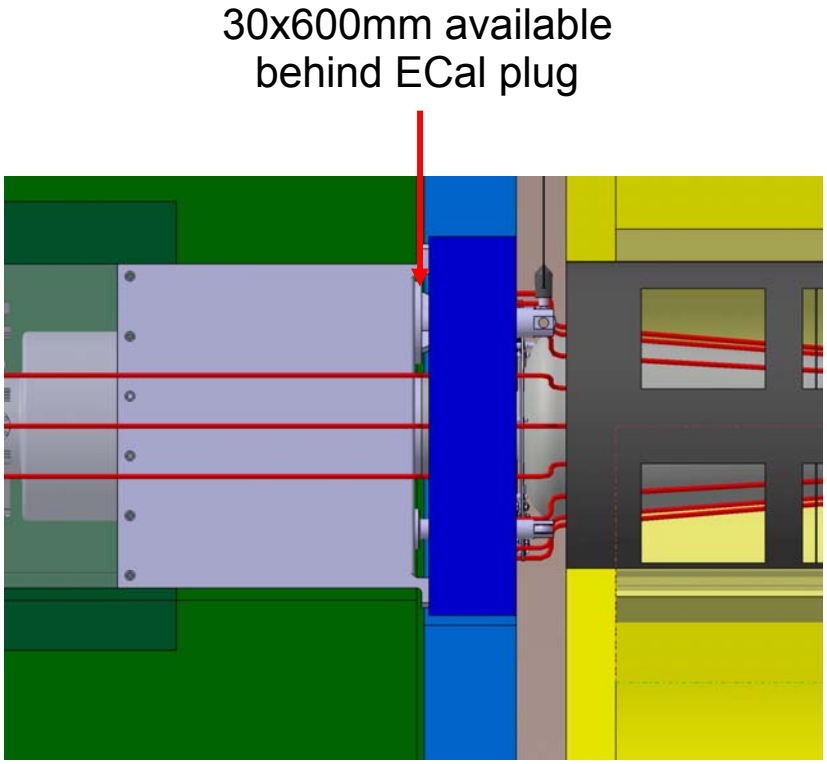
Inner cables/supplies
behind the ECal ring



Forward region cabling

- Inner cables/services between Lumi and ECal plug





➔ Need inputs from inner detector groups

Conclusions

- Forward support tube
  - **CFRP tension rods for a better mechanical behavior**
  - **Need to perform ground motion calculations**
    (Maybe need support from Yamaoka san)
  - **Need to evaluate compatibility with a round support tube**

- LHCal
  - **First mechanical concept**
  - **Need more detail on electronic boards**

- Forward region integration
  - **Some space is available for cables/services for inner detectors**
  - **Need more details from inner groups (number of cables,etc..)**
  - **Need discussion with LumiCal people on supporting system**

Thanks for your attention.