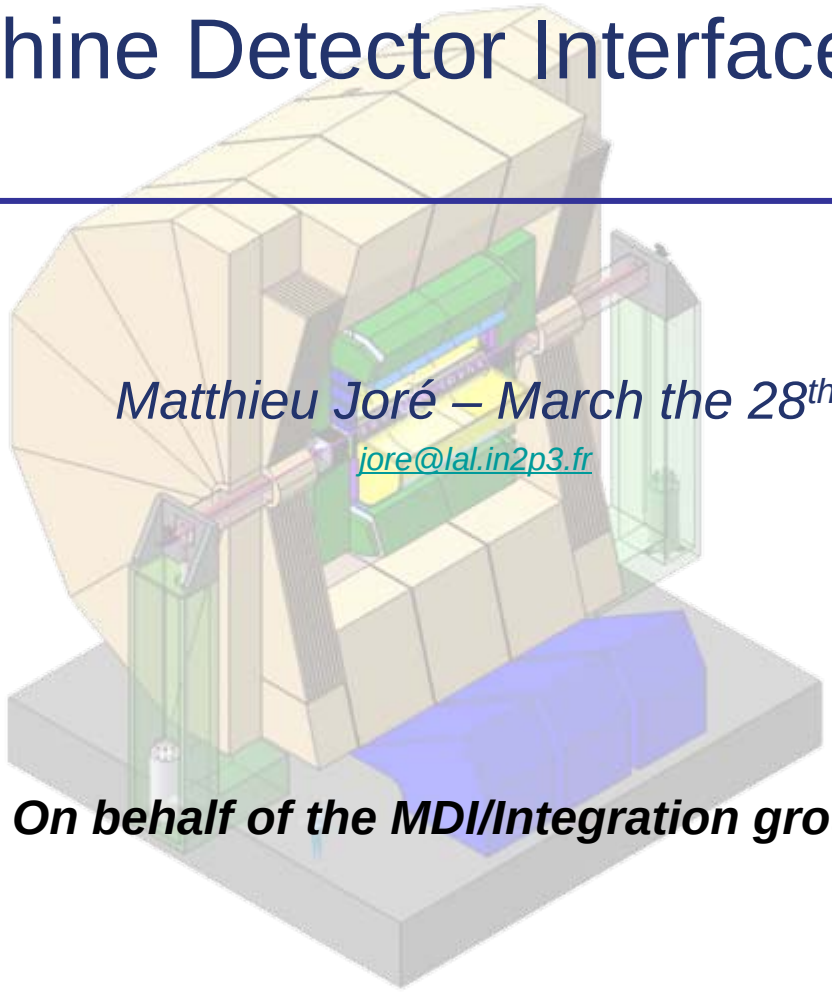
Machine Detector Interface at ILD



Matthieu Joré – March the 28th

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On behalf of the MDI/Integration group

Outline

- Introduction to the ILD detector

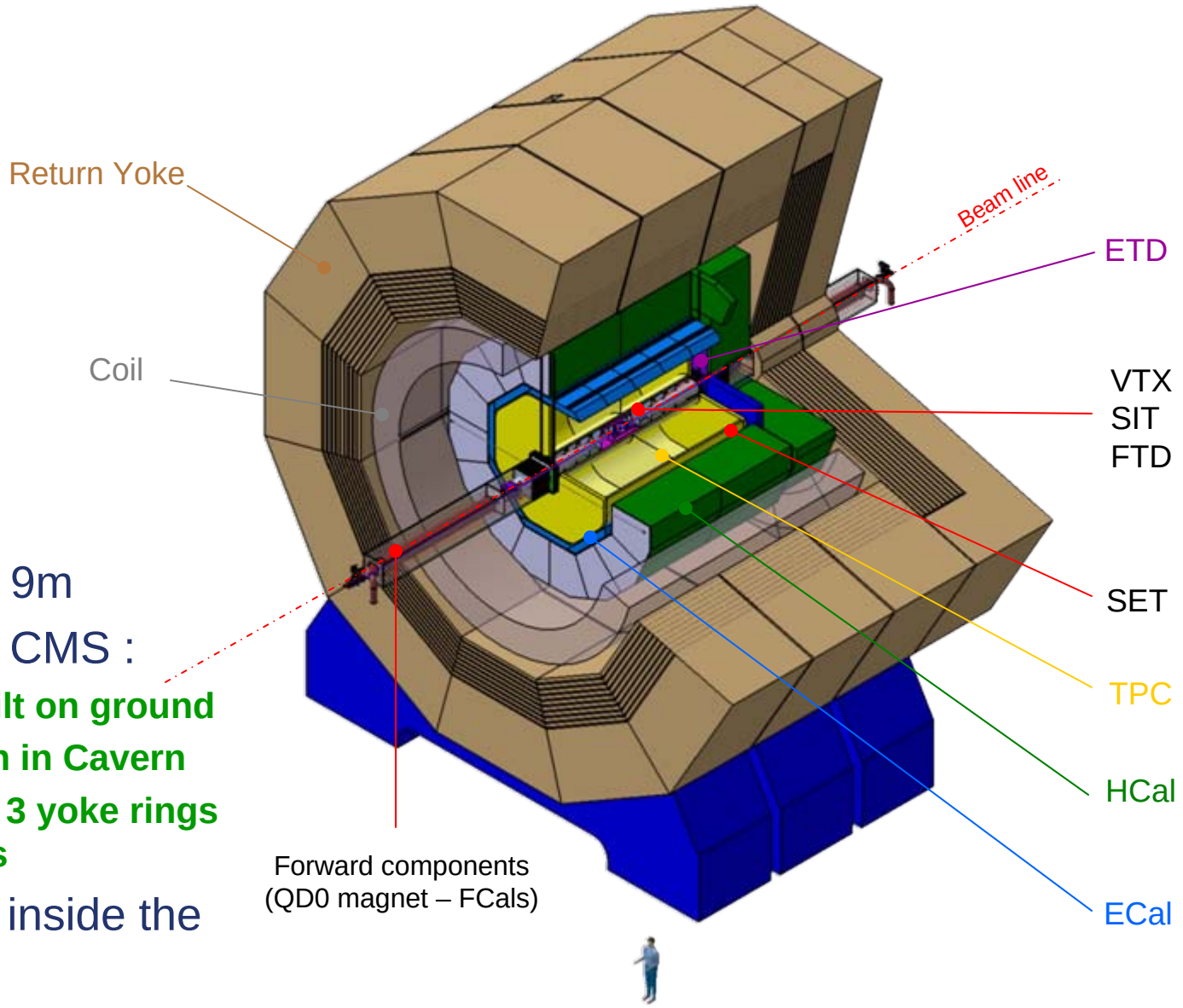
- Integration with the accelerator
  - **Beam line components**
  - **QD0 integration**
  - **Updates on vibration calculations**
  - **Updates on vacuum calculations**

- Integration in IR Hall
  - **Motivations toward a platform**
  - **Push Pull mechanism**
  - **Cabling in the cavern**
  - **Pacman shielding**

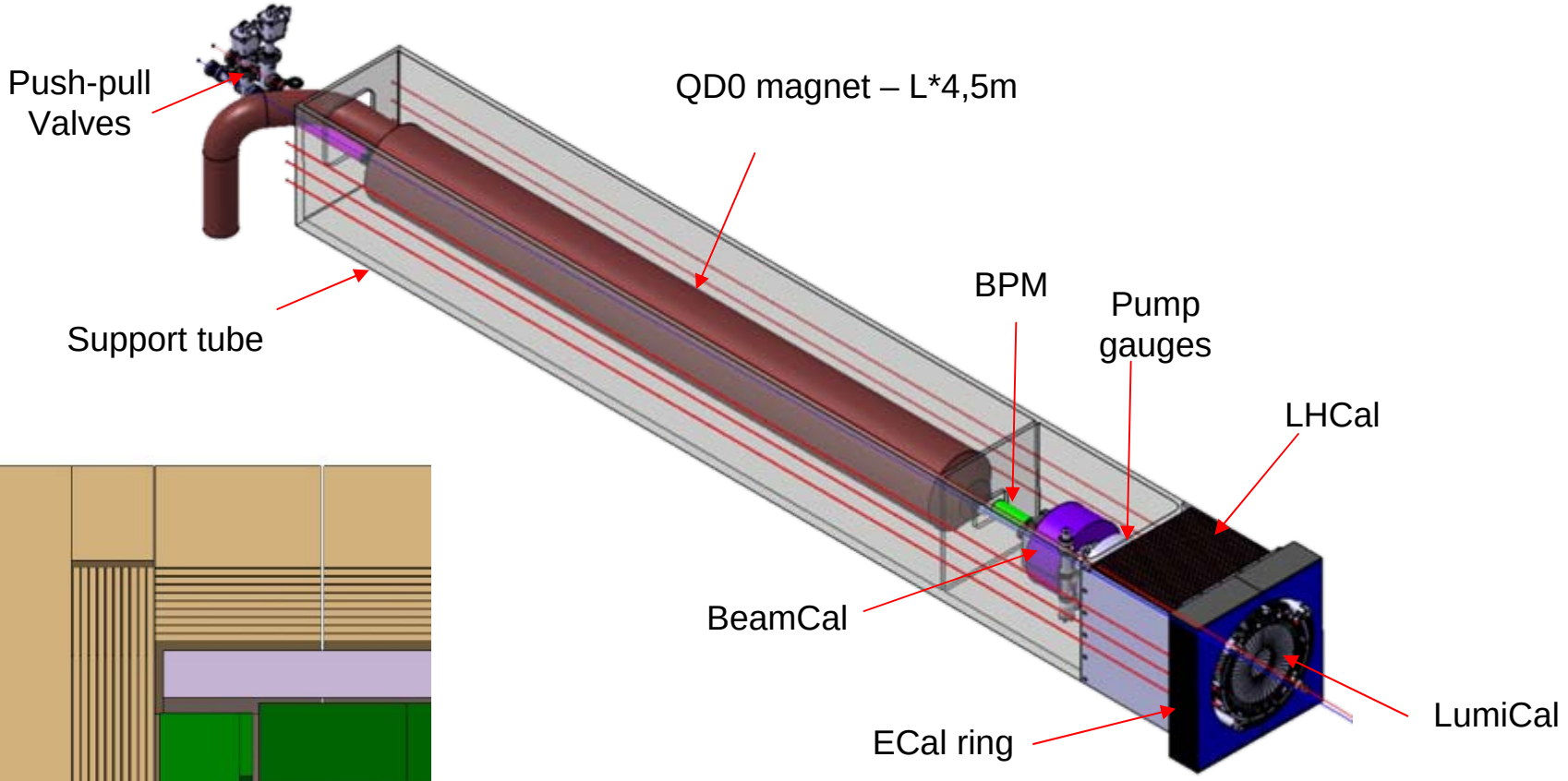
- Conclusions

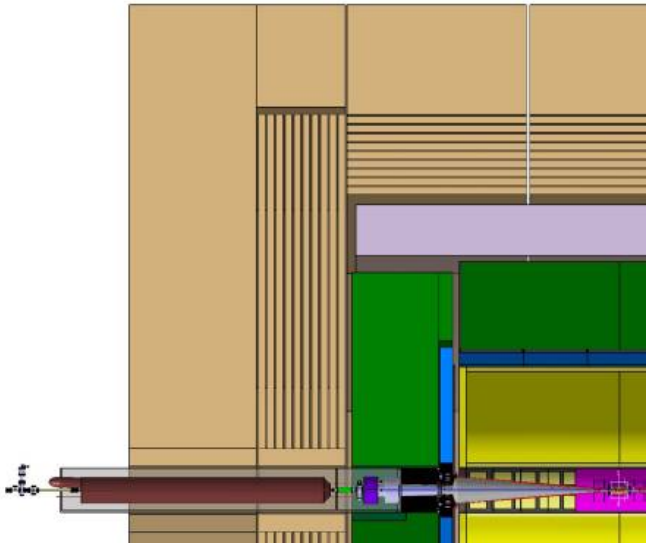
Key features of ILD

- ~Φ15x15m
- 15 000 tons
- Beam height @ 9m
- Assembly “à la” CMS :
  - **Main parts built on ground**
  - **Lowered down in Cavern**
  - **Composed by 3 yoke rings and 2 endcaps**
- QD0 final focus inside the detector



ILD Forward Region

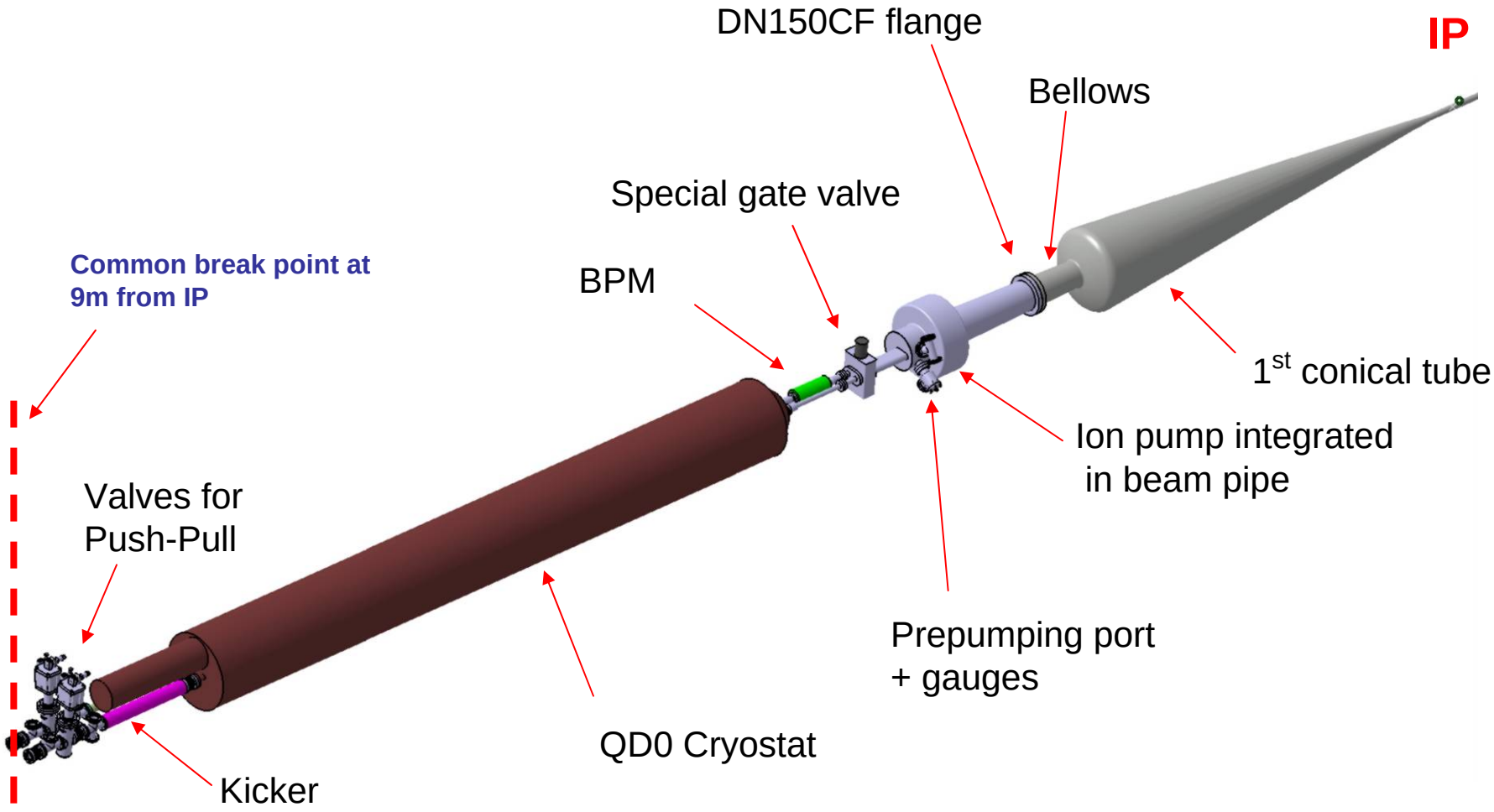




Section of ILD

Integration with the accelerator

ILD beam line components



QDO integration

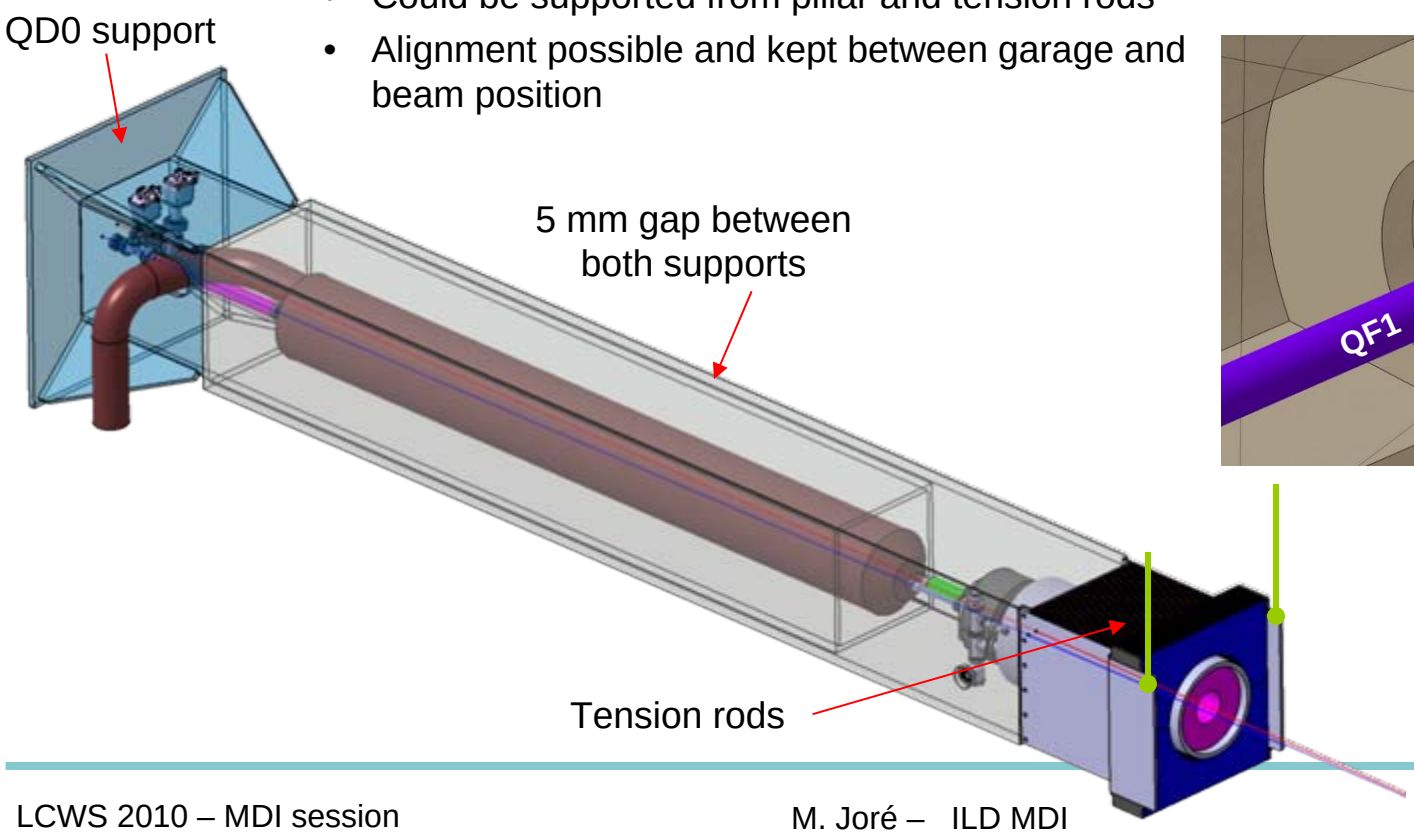
- A big issue :
  - **Superconducting magnet inside the detector**
  - **Allowable amplitude is 50nm@5Hz** *(a lower value is targeted)*
  - **Few millimeters allowed for adjustment to beam axis**

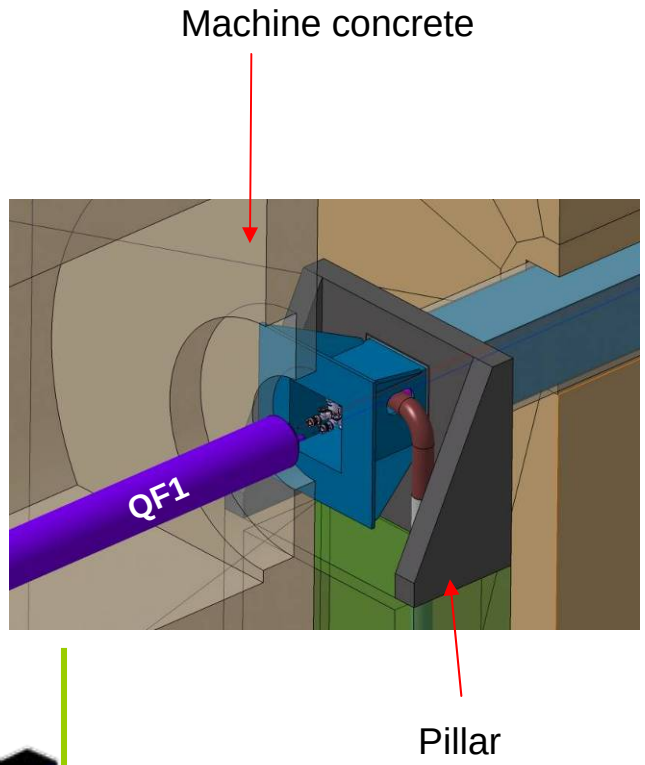
- Previous design with pillar and tension rods from the main solenoid has shown its limitation *(from Yamoaka san's recommendation)*
  - **We need to decouple the support of QDO from the FCal one**

- A better vibration behaviour could result from having :
  - **A lower weight** *(the 4 tons of FCals are removed)*
  - **No coupling with tension rods and coil**
  - **A less cantilever effect** *(shorter beam)*
  - **A better coherency with machine**

New QDO support

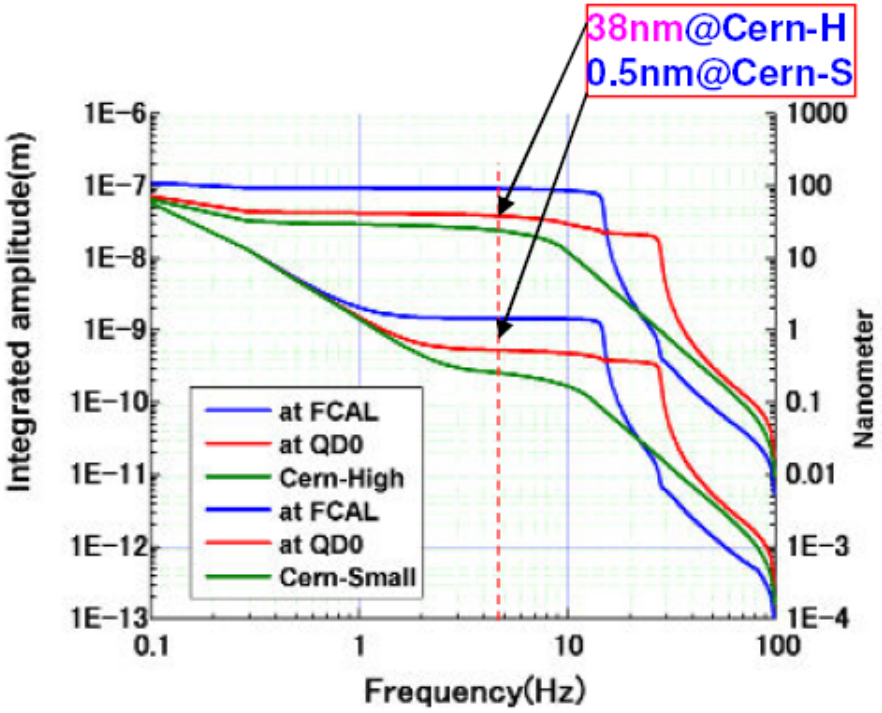
- Having 2 square tubes :
  - **QD0 one**
    - Fastened to machine tunnel
    - Better coherency with machine vibrations
    - Supports also Kicker and BPM (same reference)
  - **FCals one**
    - Could be supported from pillar and tension rods
    - Alignment possible and kept between garage and beam position

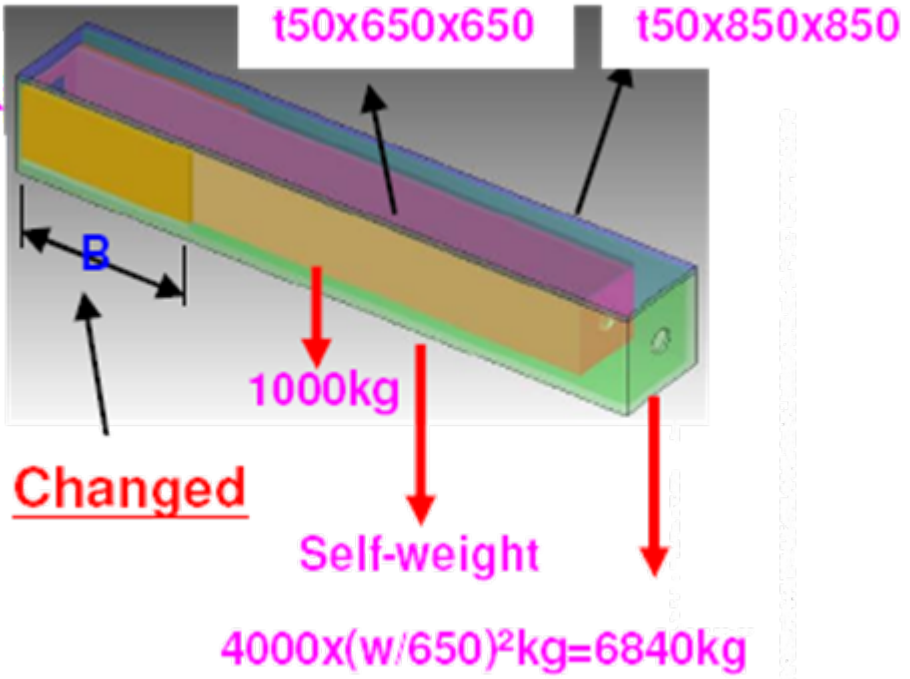




Vibration calculation results

B=500mm ~ real decoupled





- OK for QD0 support even in the case of the CERN high noise

From Yamaoka san, see also Tauchi san's talk

Updates on vacuum calculations

- The aim of these one was to simulate with details the present design and check compatibility with IR interface document
  - **Precise results will be shown in a next presentation**

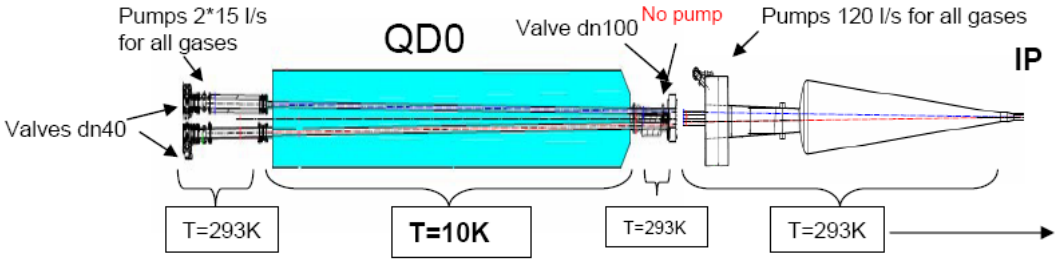
Optimized annular triode pump for experimental areas in the LHC M. Busso and all, LHC Project Report 670

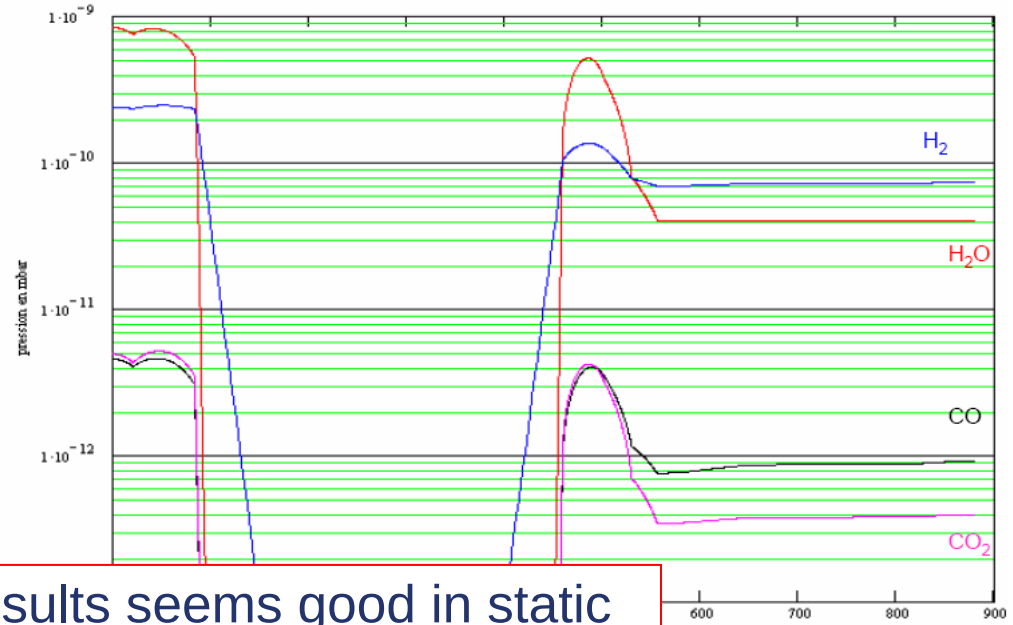
- Main parameters
  - **Integrated ion pump Atlas like close to the IP** *(pumping speed about 120l/s)*
  - **2 ion pumps (15l/s) between PP valves and QDO**
  - **Cryo pumping effect due to QD0**
  - **Small in situ baking or good preparation** *(heat treatment and assembly in dry air condition)*
  - **Targeted pressure is below 10^{-9}mbar in static condition**

Results on vacuum

UNDER STATIC CONDITION

QD0 + IP region





IP region with baking

Alu or Cu or SS after 100h pumping

τ (H_2) ≈ 2.10^{-13} mbar.l.s^{-1}.cm^{-2}
τ (H_2O) ≈ 0 mbar.l.s^{-1}.cm^{-2}
τ (CO) ≈ 2.10^{-15} mbar.l.s^{-1}.cm^{-2}
τ (CO_2) ≈ 5.10^{-16} mbar.l.s^{-1}.cm^{-2}

Between valves dn40 and dn100
Without baking

T=293K

τ (H_2) ≈ 5.10^{-12} mbar.l.s^{-1}.cm^{-2}
τ (H_2O) ≈ 2.10^{-11} mbar.l.s^{-1}.cm^{-2}
τ (CO) ≈ 1.10^{-13} mbar.l.s^{-1}.cm^{-2}
τ (CO_2) ≈ 1.10^{-13} mbar.l.s^{-1}.cm^{-2}

T=10K

τ (all gases) ≈ 0 mbar.l.s^{-1}.cm^{-2}
σ (all gases) = 1 few monolayers

For H_2 beam screen 2% surface

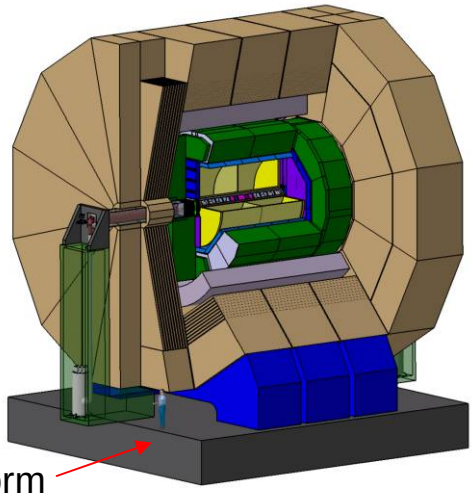
- Results seems good in static
- BUT what about in dynamic?
- Do the BDS people agree?

From B. Mercier (LAL)

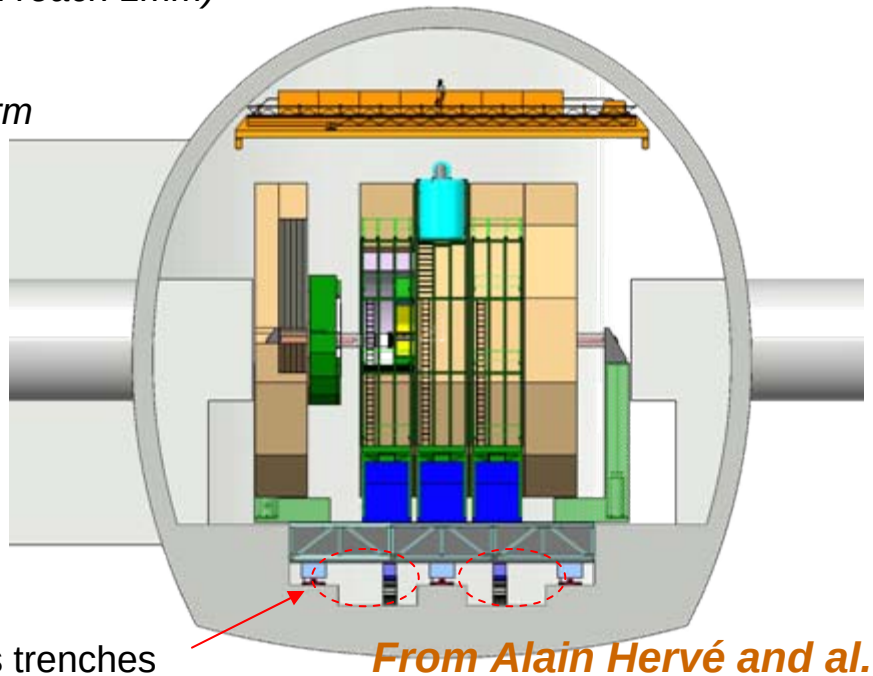
Integration in the IR Hall

Motivations toward a platform

- A platform could :
  - **Maintain all pieces of the detector during push pull :**
    - *Everything moves together*
    - *The movement is safer for the detector*
  - **Ease and speed up the alignment on beam :**
    - *Detector alignment could be performed on garage position (when we have time) and kept when moving on beam position*
    - *The platform could be aligned one first time and then replaced after each push-pull with hard references (repeatability could then reach 1mm)*
  - **Make a cleaner hall :**
    - *all cables/services are below the platform*



Platform



Cables/services trenches

From Alain Hervé and al.

Platform considerations

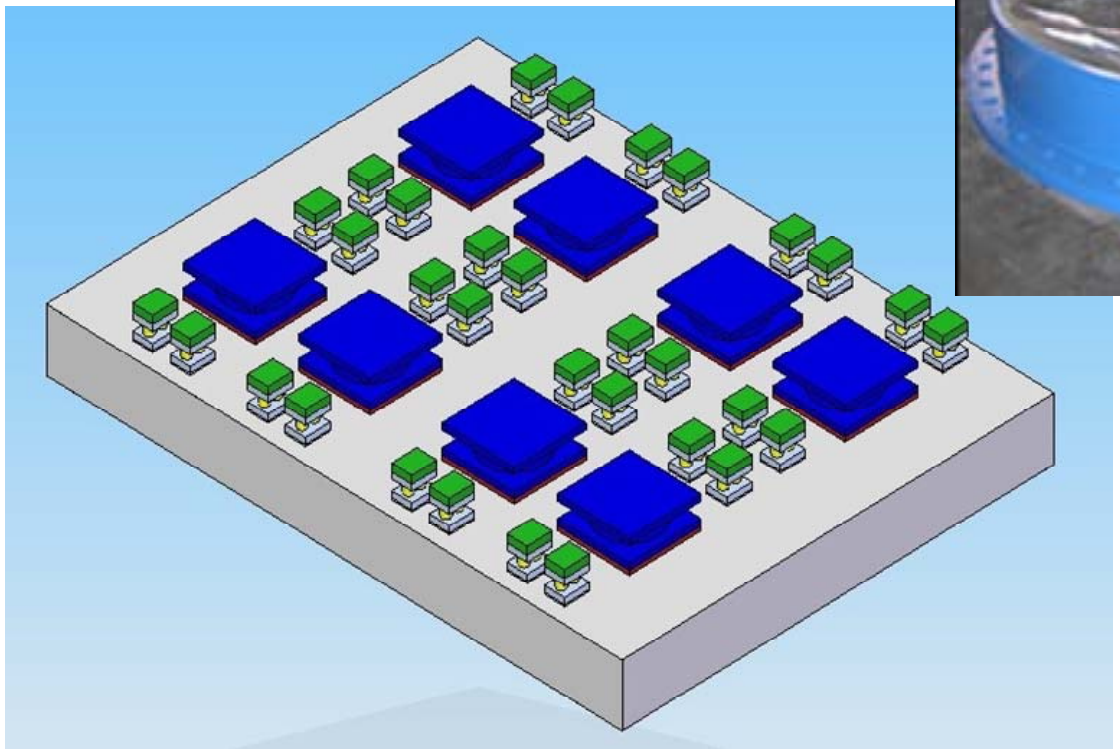
- Roller or airpads could be used for moving
  - **Airpads would ease the adjustment on beam**

Alain Hervé, CLIC08 Workshop, 16 October 2008

- Special earthquake protection supports could provide many things *(from Alain Hervé)* :
  - **Protection against earthquakes if necessary.**
  - **Active vertical positioning system to maintain experiment axis on beam axis independently of vertical ground setting**
  - **An isolation of the platform and experiment from ground noise and vibrations and isolate ground from vibrations coming from the experiment itself.**

Support of the platform

View from below (Rollers)



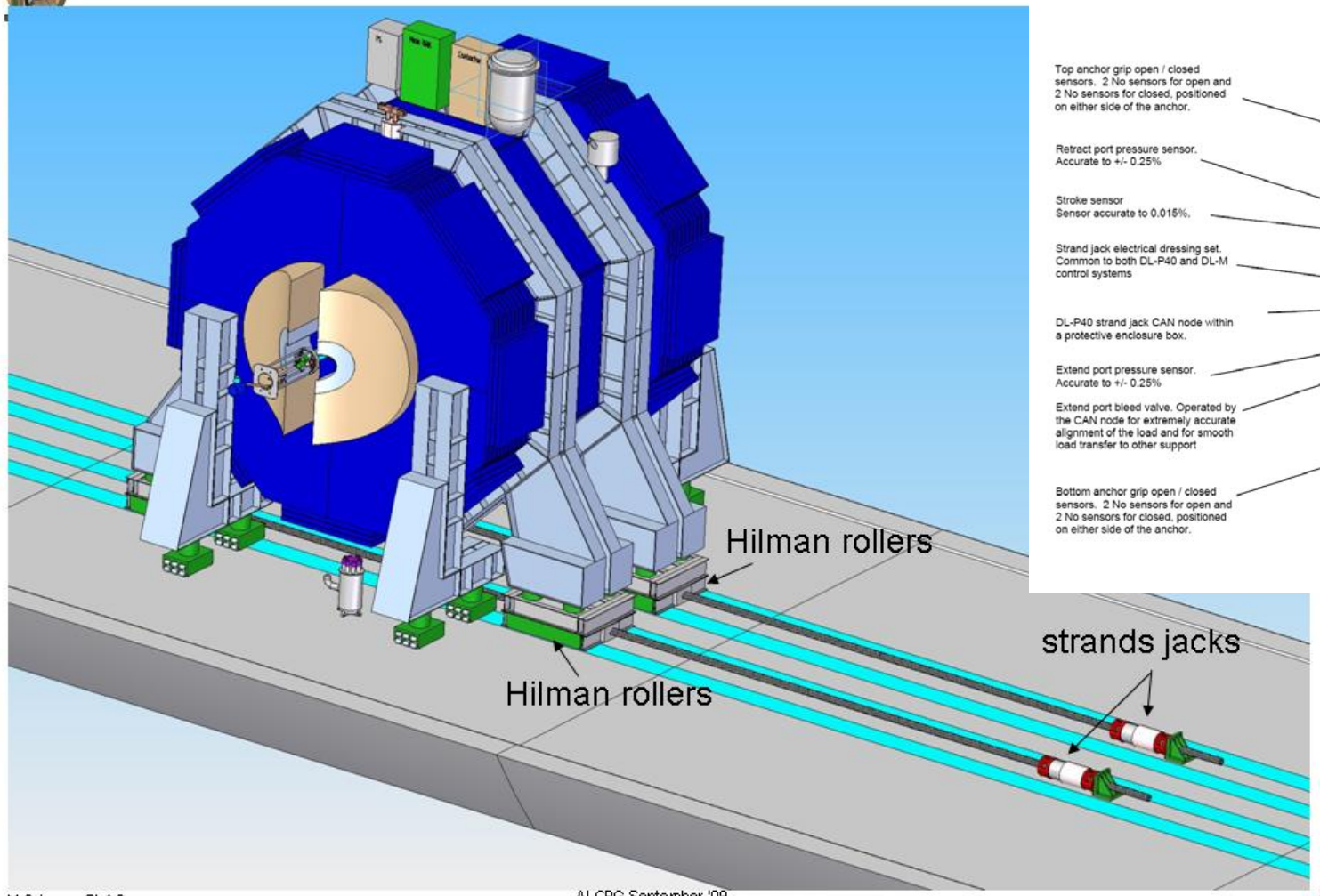
10kt unit
Anti-Seismic support

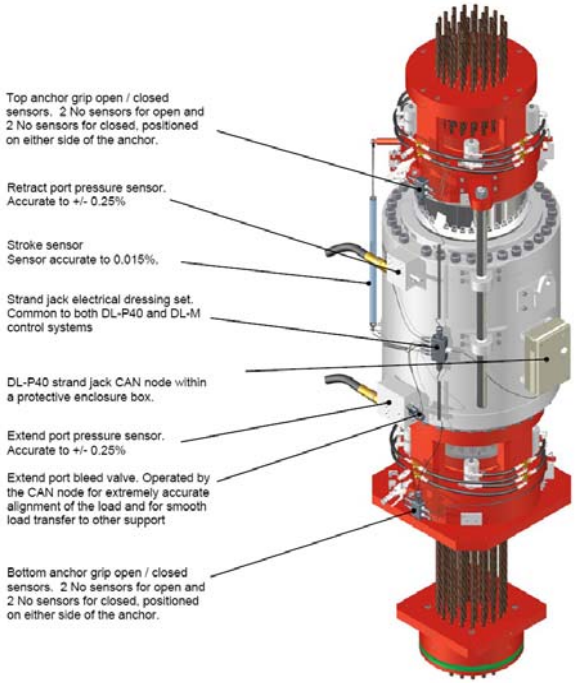
Four support lines for 4’000 tons each

From A. Hervé, K. Sinram, M. Oriunno

Push Pull mechanism as SiD proposal

Push/pull locomotion
Dedicated session in this workshop

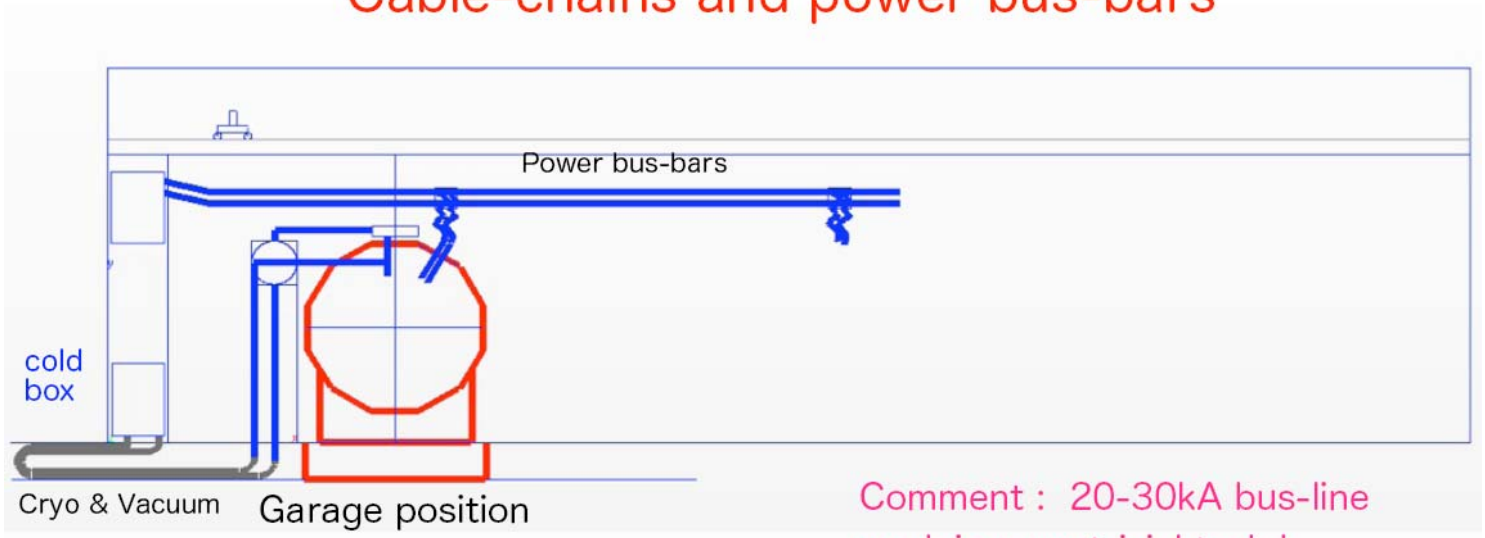




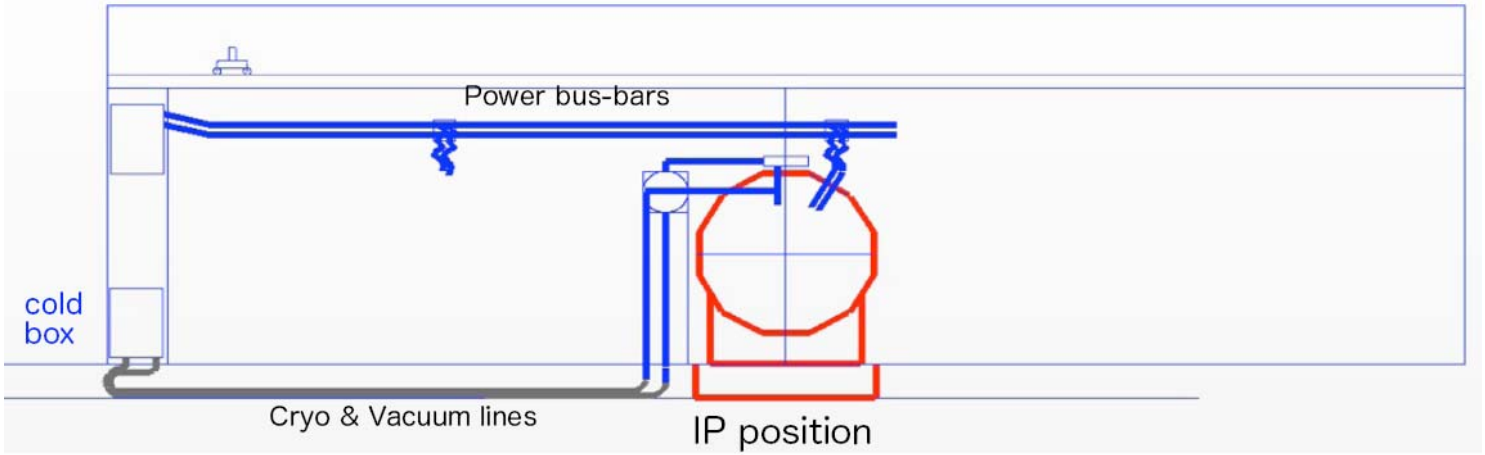
M.Oriunno, SLAC ALCPG September '09 17

Cabling/services

Cable-chains and power bus-bars

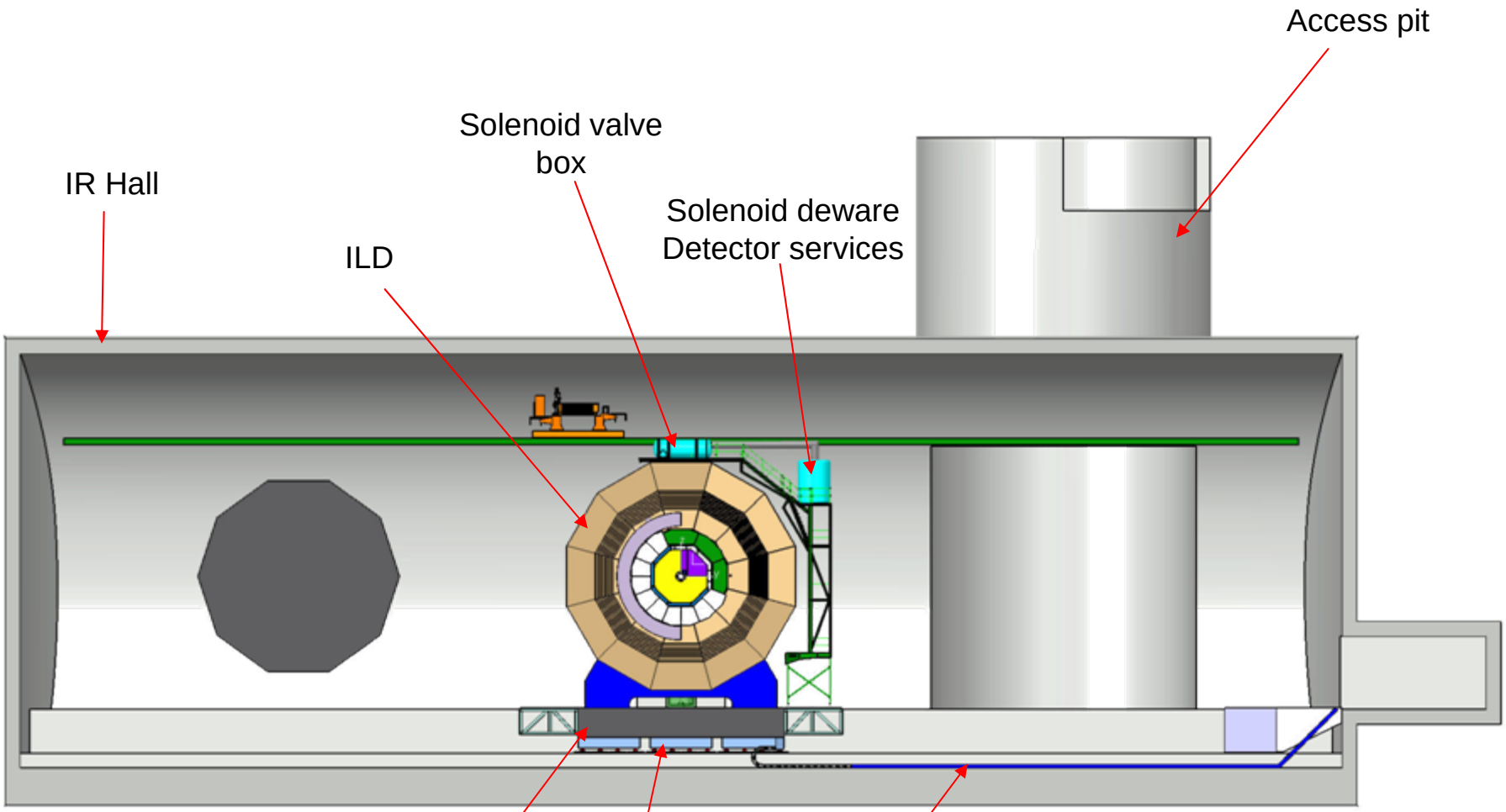


Comment : 20-30kA bus-line work is a nontrivial task !



From Andrea Gaddi

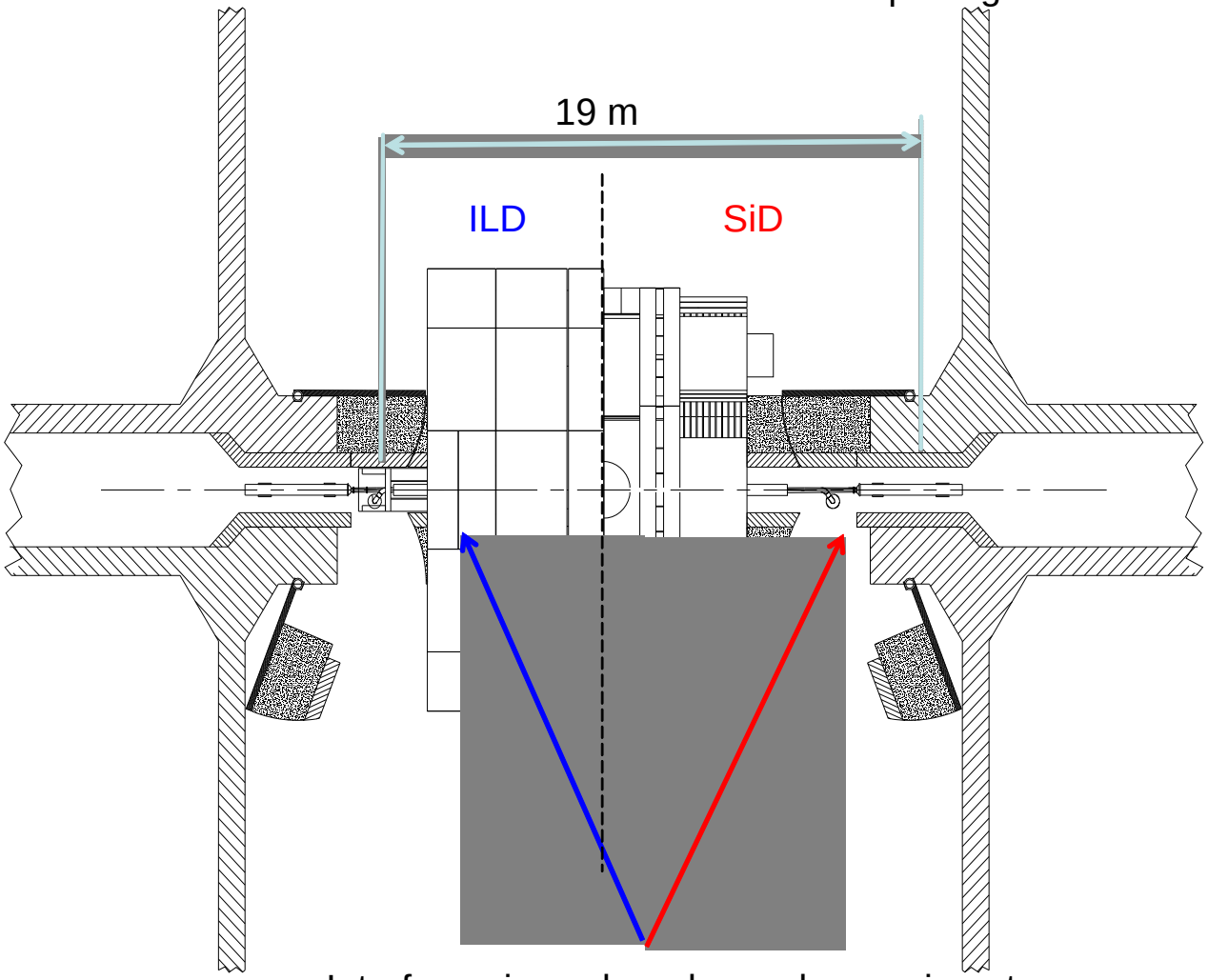
ILD in IR Hall



From Alain Hervé and al.

Pacman compatible with SiD

Pacmen closed: Modified to allow ILD opening



Interface pieces born by each experiment

From A. Hervé, K. Sinram, M. Oriunno

Conclusions

- Important steps have been made :
  - **Better understanding of the QD0 support and the vacuum**
  - **A first idea of a push pull scenario and mechanism**
  - **Integration of both detectors in the hall seems possible even if their philosophy is different**

- BUT the common effort between detectors concepts and BDS people have to be reinforced in the hottest topics :
  - **IR Hall design**
  - **Engineering studies on the push pull mechanism including the platform design**
  - **Supporting QD0** *(Do we need a common solution with SiD?)*
  - **Etc….**

Thank you very much for your attention