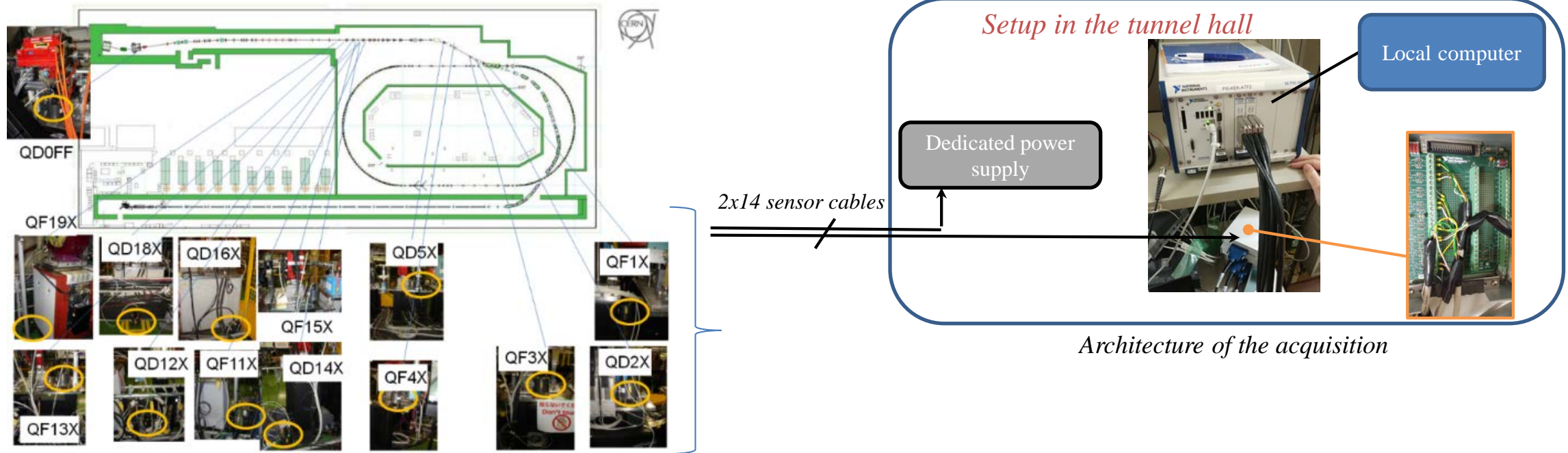


Vibrations monitoring and Final Focus upgrades

L. Brunetti for the LAPP team

ATF2 weekly meeting, 27th of November 2020

Current setup

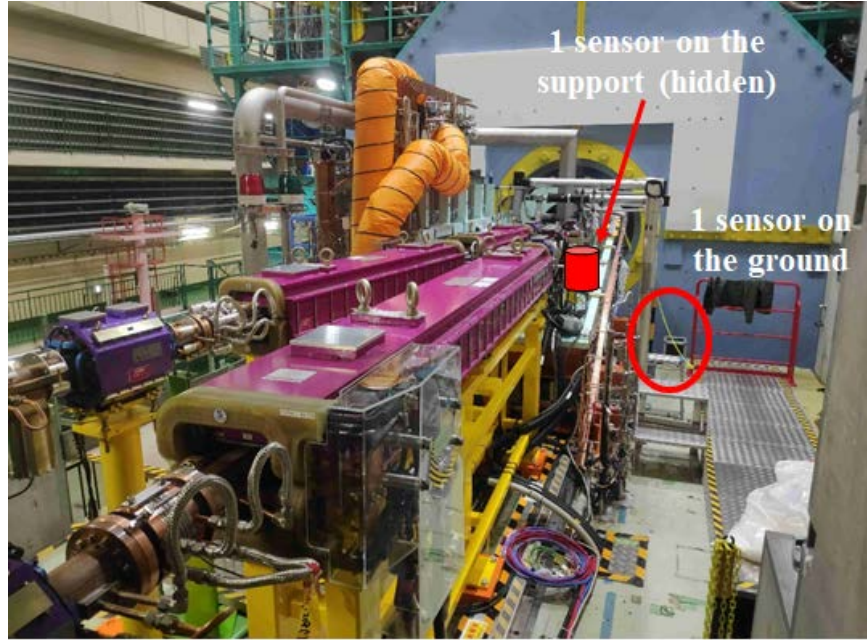


Even if this system has allowed a lot of analysis & developments, a few aspects could be improved:

- Application with a manual and deported start, which is not a continuous 24 for hours long-term measurements (-> not processing at each shift)
- No possibility to share the measurement signals in RT – ex: feedforward tests
- No remote system – the data are not easily available for the collaboration

➤ **The system could be more used for transverse applications, especially for the beam dynamics studies**

SuperKEKB – vibration measurements



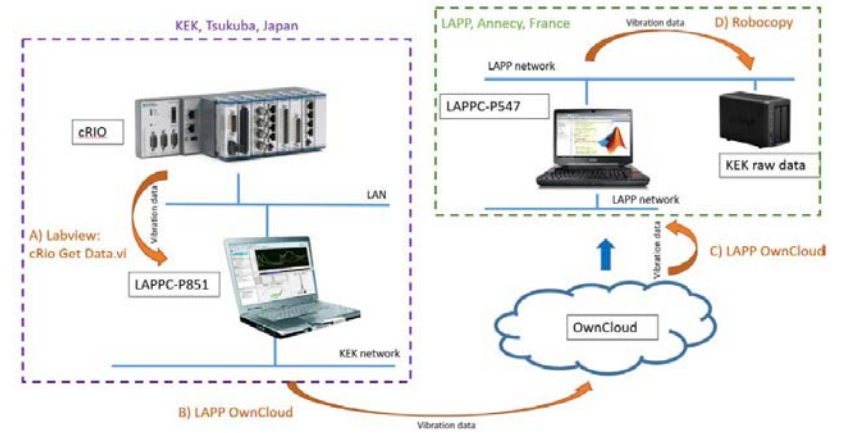
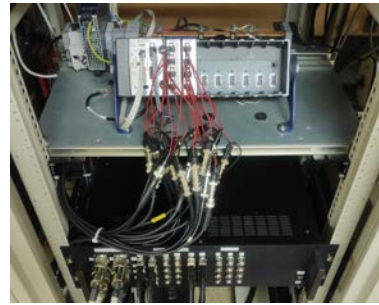
Global view of the final installation (back side)

4 seismic sensors - 2 at each side of the BELLE II detector

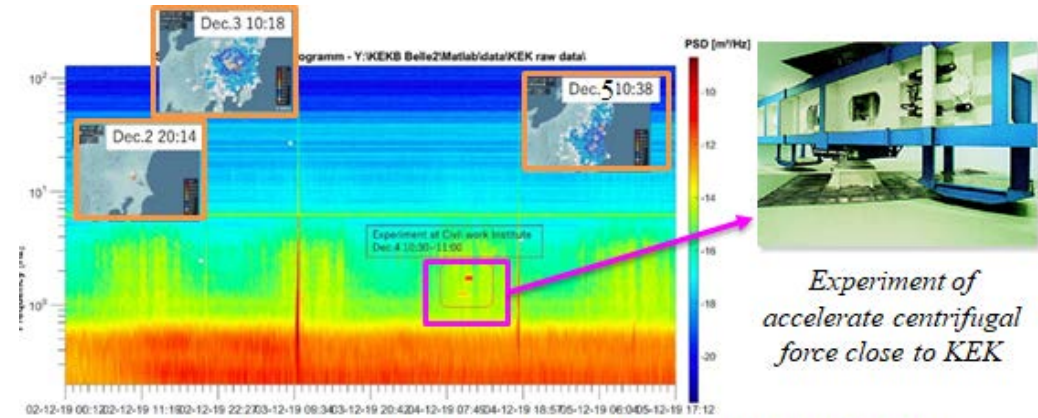
Long-term monitoring with continuous available data for the collaboration

- Monitoring of the seismic motion and the collider cultural noise
- Identification of disturbances or specific event (not the topic)
- Weekly reports are available at : <https://lappweb.in2p3.fr/SuperKEKB/>
- Comparison with the luminosity measurements

Monitoring 10'our to limit the data

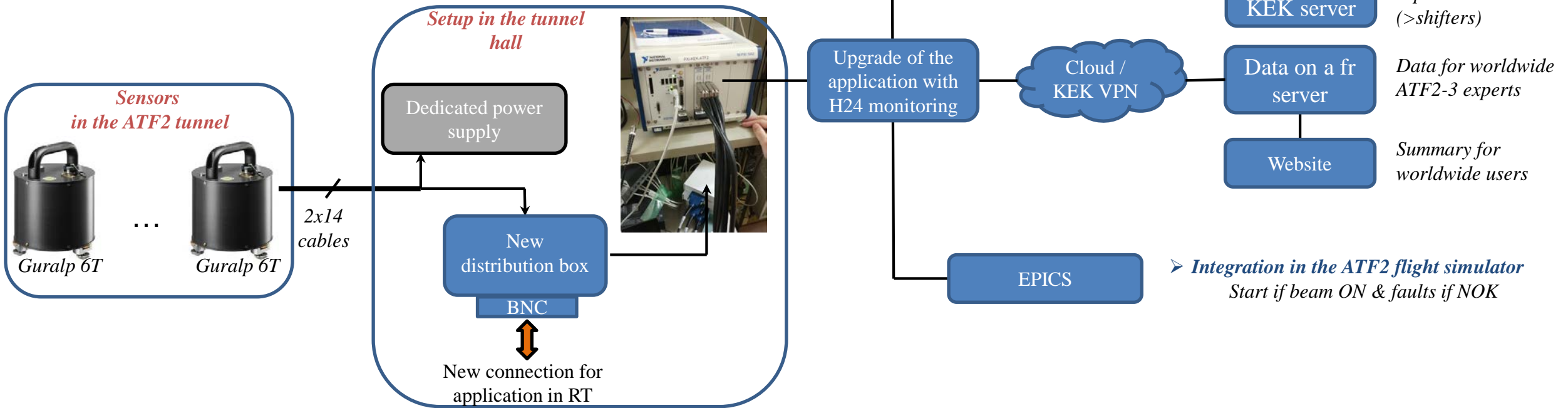


Architecture of the acquisition

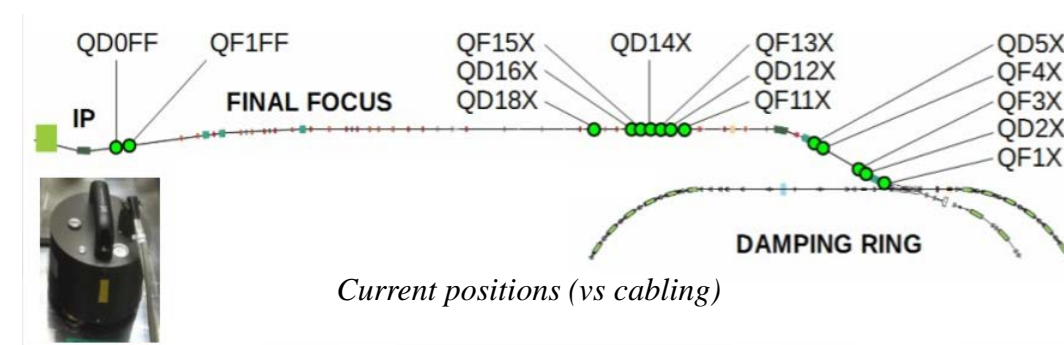


Vibration analysis: *earthquake* and *external perturbations*

▪ **Upgraded setup – has to be discussed :**

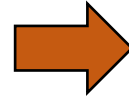
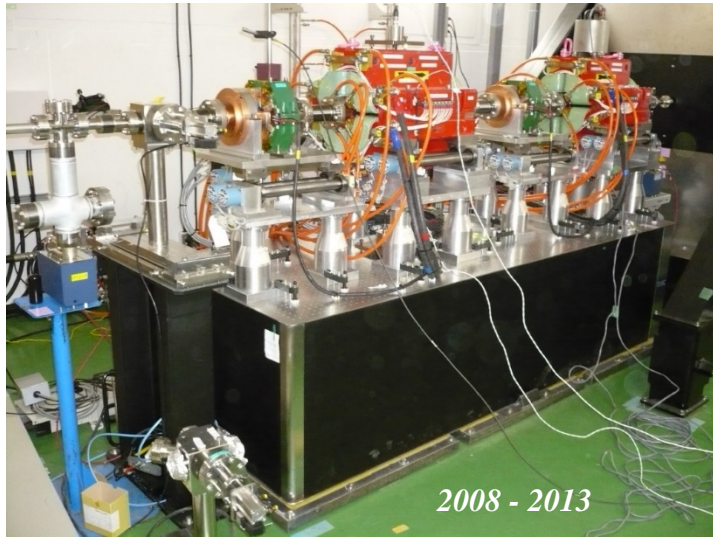


- Upgrade of the application has to be discussed with **CERN team** (availabilities, Labview compatibility (v2012)...)
- The new connection has to be confirmed in function of the impedance and the current setup properties
- Sensors are located at strategic locations in function of the research program (if an upgrade of the positions is needed, extended cables or adaptations of the cabling could be done)



- ❑ **For budget & resources reasons, has probably to be coupled with SuperKEKB missions at KEK during the next year**
- ❑ **Could we plan to organize a shipment of the NI real time module & the computer from KEK to Annecy / CERN?**

- Integration of a new QF1

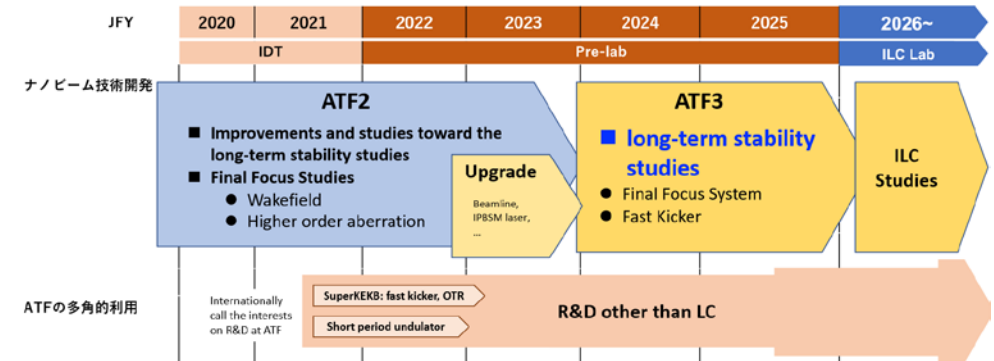


- Bigger mass of QF1 (x3 from 450kg to 1184kg)

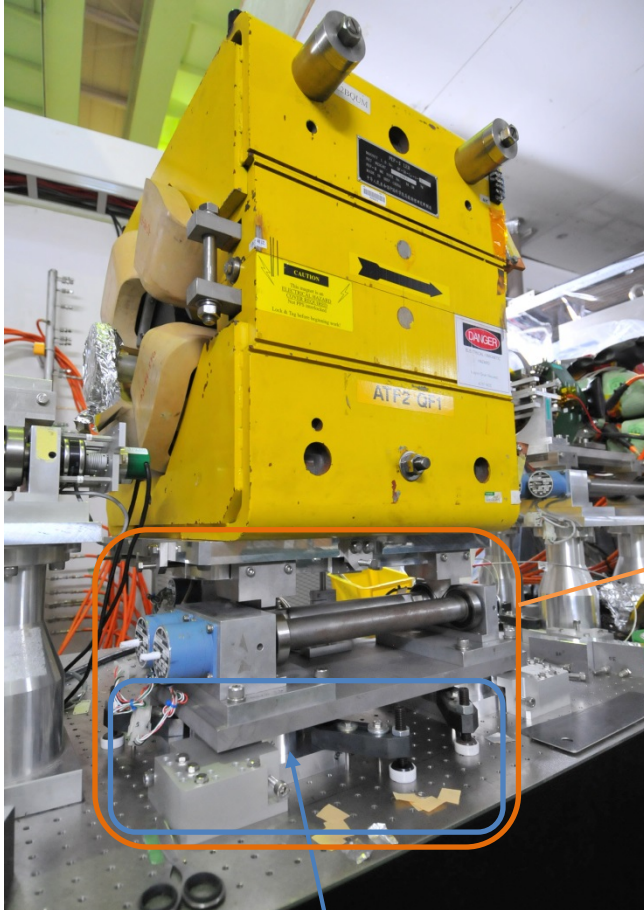
2008 (former magnets)	Tolerance	Measurement [SM-QD0]	Measurement [SM-QF1]
Vertical	7 nm (for QD0) 20 nm (for QF1)	4.8 nm	6.3 nm
Perpendicular to the beam	~ 500 nm	30.7 nm	30.6 nm
Parallel to the beam	~ 10,000 nm	36.5 nm	27.1 nm
2013 (new magnets)	Tolerance	Measurement [SM-QD0]	Measurement [SM-QF1]
Vertical	7 nm (for QD0) 20 nm (for QF1)	4.8 nm	30 nm
Parallel to the beam	~ 10,000 nm	25 nm	290 nm

➤ New QF1 : relative motion of Shintake monitor to new QF1 > Tolerance

Tentative Plan of ATF (should be updated by international discussions) 2020/10/30



- *Spring 2015: new support of QF1 & ATF2 improvement*



New support -
2015

- Improvement of the transfer function
- Differential displacement (magnet vs shintake monitor) was not reduced significantly. It is due to an external vibration (cooling?) whose the frequency is closed to the new first eigenfrequency
- It is very complex to improve the stiffness of the current setup, the resonance is probably due to QF1 on the positioning system

ATF2 (2022-23) :

Necessity of a new support which will probably include the positioning concept of QF1

- Collaboration with a new positioning system development (Japanese University) ?
 - QF1 will just put on the positioning system (with a better guiding / contact?) or maybe QF1 could be locked on?
- **For various reasons (FTE issue, very specific development, short term development...), it could not be a priority of the LAPP team even if we would be pleased to collaborate for the positioning system. However we could be in charge of the support and of the vibrations aspects**

- ATF3 (2024) : Integration of a girder and a positioning support of the girder



ATF3 IP specifications:

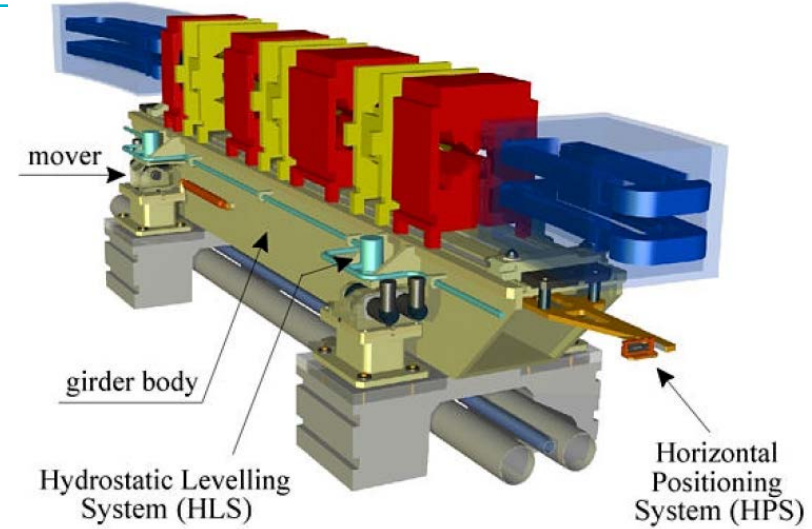
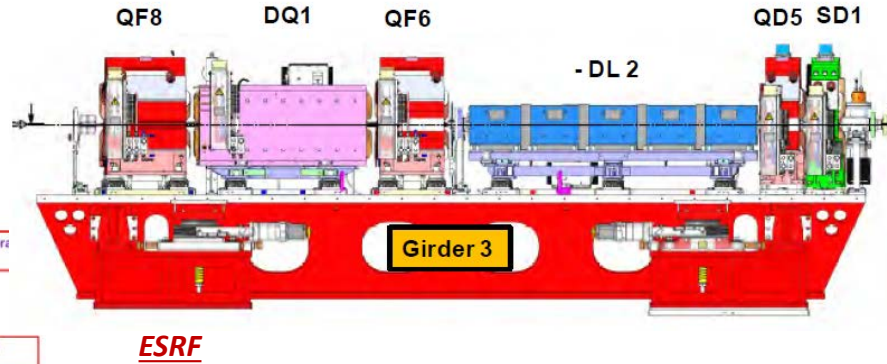
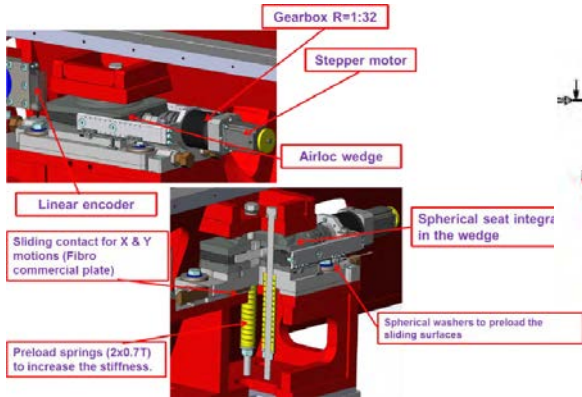
- 7nm IP beam size (vertical direction)
- IP stabilization <20% of IP beam size



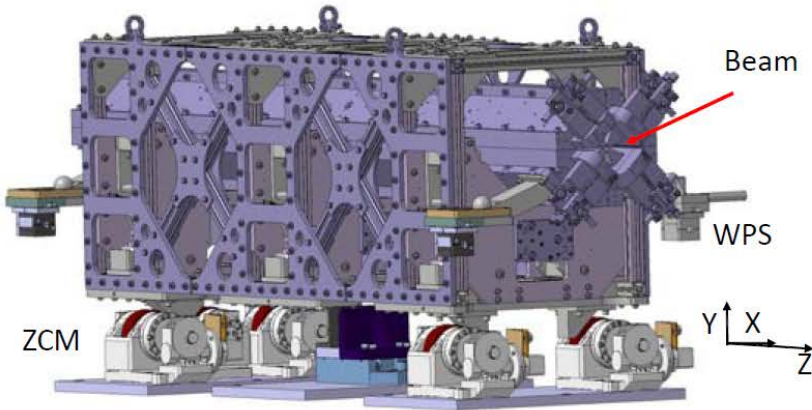
In term of RMS?

- Waiting the ILC magnets parameters (superconductive magnet?)
 - Girder placed on the optic table or instead of the optic table
 - Strategy of positioning system: all the elements which are now on the optic table will be on a girder (common support) and it is the position of the girder which will be controlled
 - A complex and challenging upgrade (interfaces, collaboration, innovations...)
 - Possibility to improve significantly the final focus vibrations mitigations which is one of the main critical aspects since QF1 is bigger
 - **Common development with FCCee -> strategic tests facilities**
-
- **Could be a priority of the LAPP team, but has to be confirmed vs the resources in the next years**
 - **If the collaboration validates this approach, this involvement could be confirmed before end of 2021.**

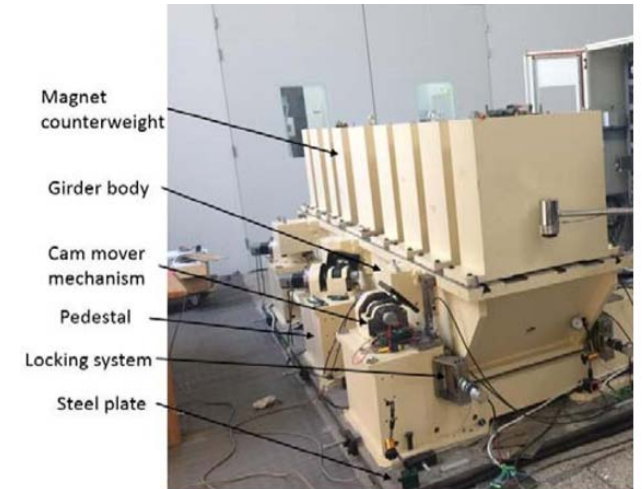
Investigated solutions



SLS storage ring girder assembly at PSI



CLIC : Type 4 MBQ and stabilization system mounted on cam movers (left) and test setup including ZCMs, follower girder and local coordinate system (right).



Magnet Girder Prototypes for HEPS-TF

- **Vibrations long-term monitoring system – ATF2 upgrade – 2021/22**
 - To have data of all shifts even if no vibrations studies are planned
 - To increase the possibility to use this monitoring with dynamics beam studies by all the collaborators
 - New setup has to be discussed
 - Installation before end of 2021 could be possible if various factors are going in the right way...

- **Final Doublets vibrations mitigation – ATF3 upgrade - 2024**
 - To design a girder for all the final elements coupled with a global positioning system
 - To attempt to develop a common solution with the FCCee strategy
 - Specifications and setup have to be discussed... and the strategy.

- **Post doc at LAPP for two years (Japanese candidates are welcome!):**
<https://emploi.cnrs.fr/Offres/CDD/UMR5814-CLABOM-046/Default.aspx>