Possible synergy with ongoing/starting tuner work at CERN

Testing of SPL cavity with CEA tuner, Mechanical measurement lab
Tuner of HIE ISOLDE
Tuner HL LHC Crab cavities

Kurt Artoos, 5th September 2014

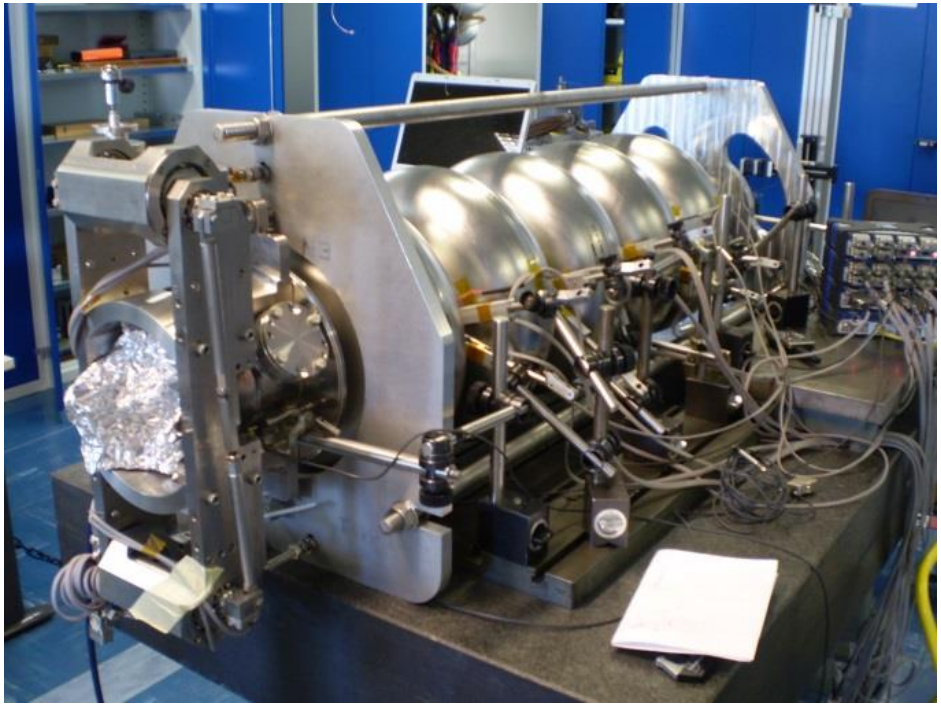
Touching points open for development :

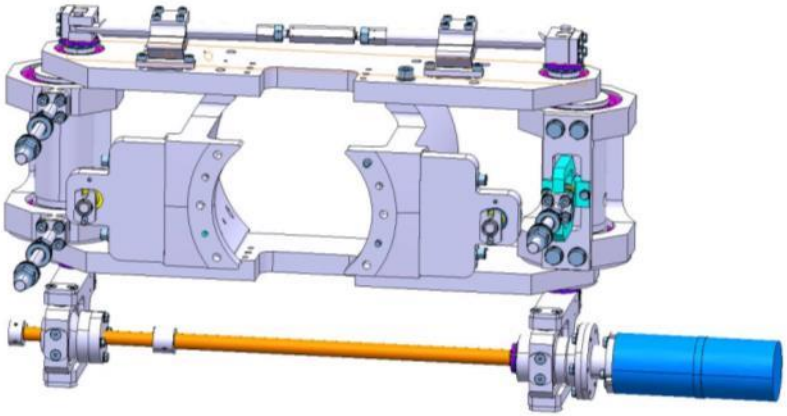
- Test set-ups
- Compact design
- Stiffness management
- Motor design, outside or inside
- cold motorisation and transmissions
- Tuning and alignment, floating tuners
- Cost optimisation
- High resolution, low hysteresis design
- reliability/ maintainability (give example of exchangeability + access motor flange Isolde

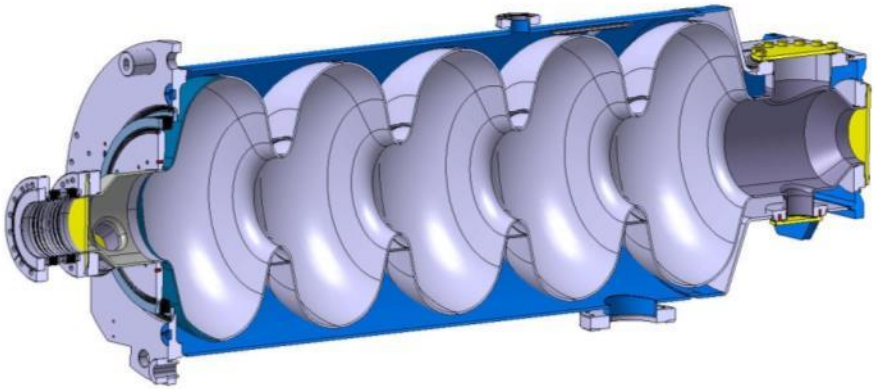
Testing of tuner SPL cavities

Cavity stiffness 4 kN/mm
Tank 130 kN/mm

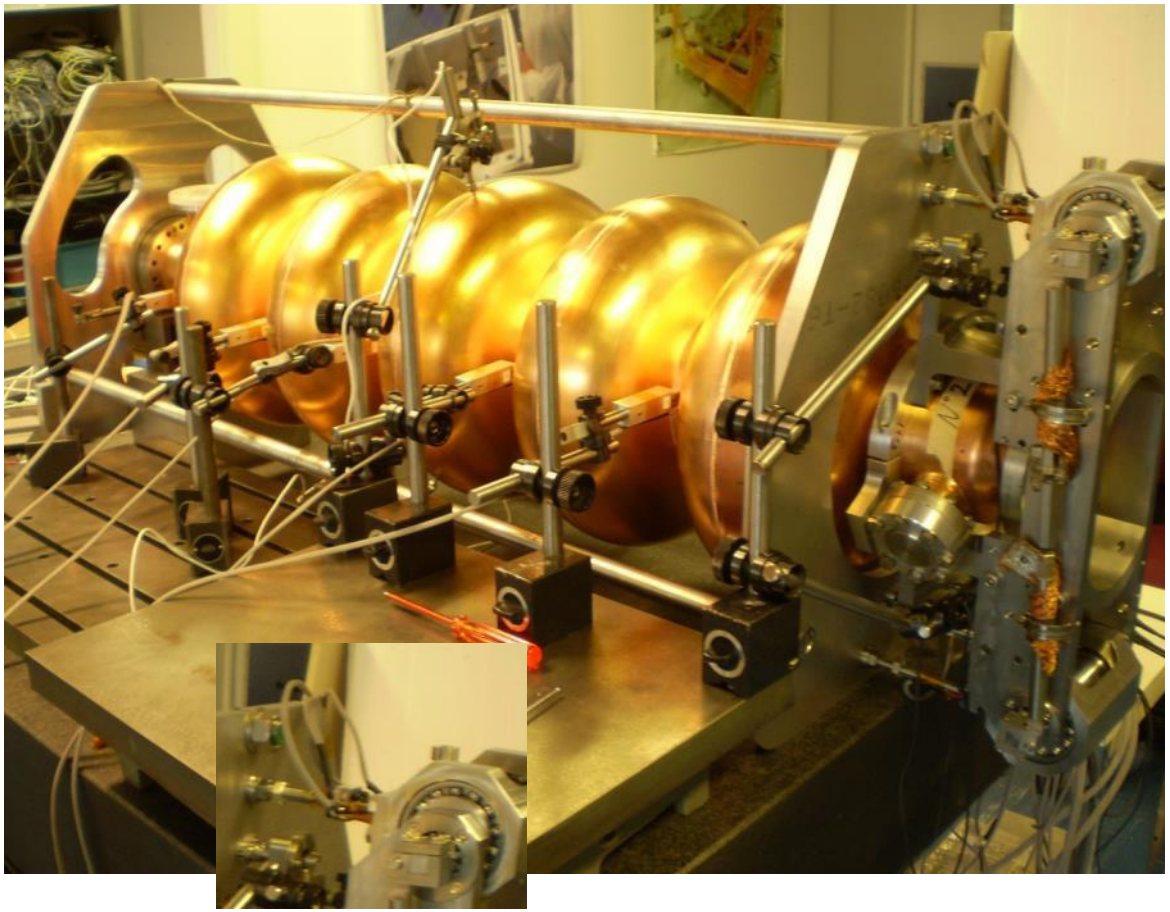
CEA tuner provided

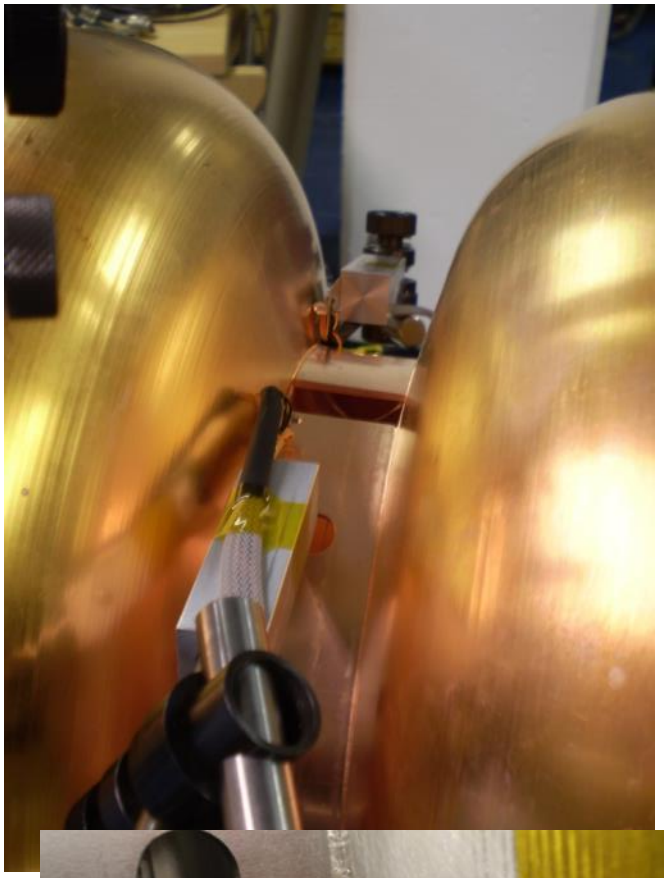


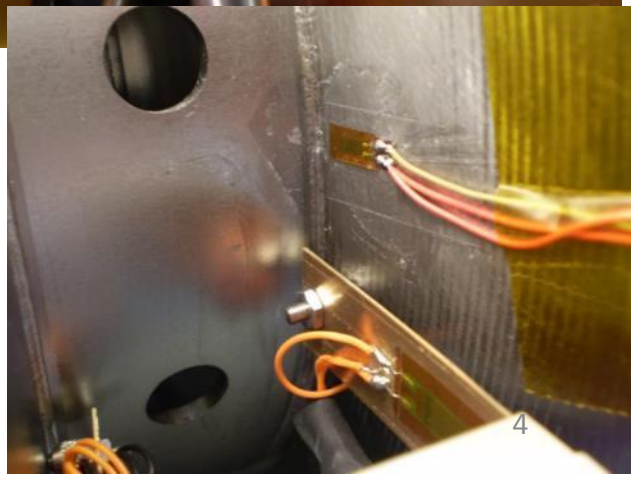




Courtesy M. Guinchard







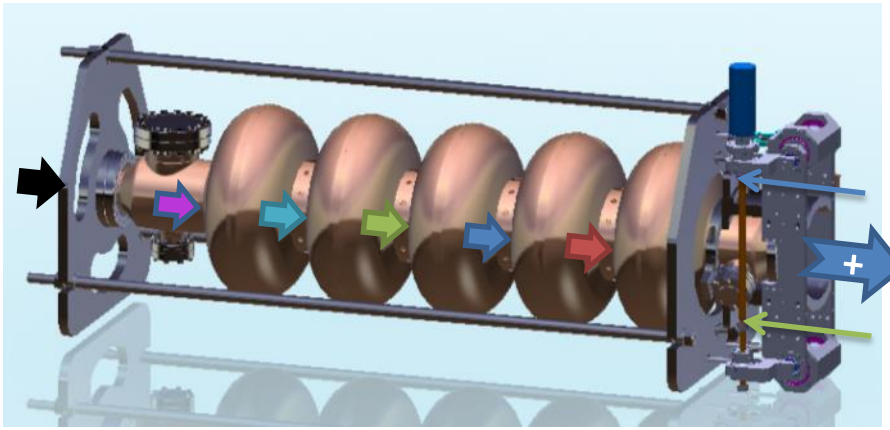
- 5 LVDT's HBM® – WI +/- 2.5mm
- 5 Displacement sensors based on bending stress measurements
- Custom force sensors on rods
- HBM® load cells
- DAQ QuantumX from HBM ® – Fs 50 Hz

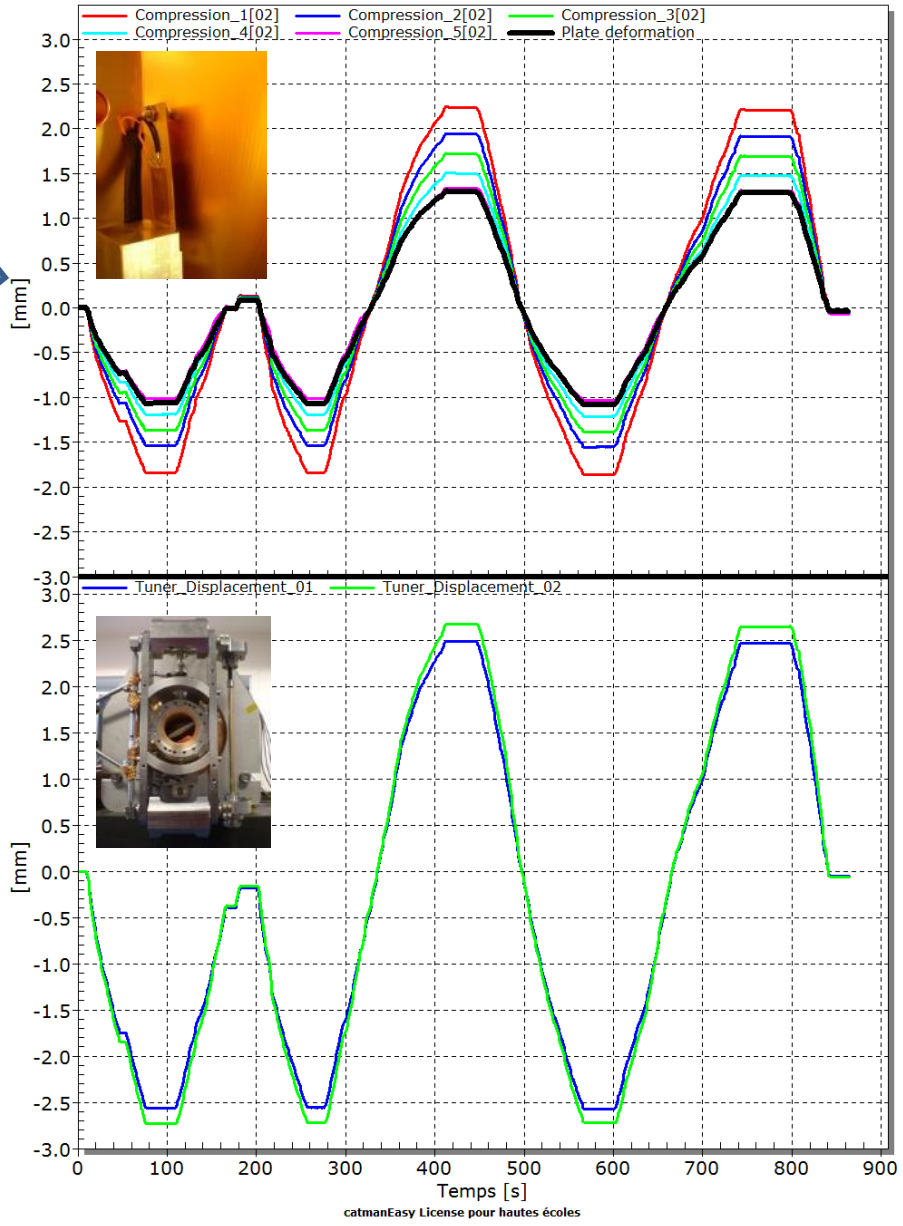
- http://en-dep.web.cern.ch/en-dep/Groups/MME/DEO/MECHANICAL-LAB/default.asp
- Vibrometers + interferometer
- nm and below experience CLIC stabilisation work, measurements + actuation
- In the frame of PACMAN project, work on long range

Periodic (piezo) actuators.

- EN/MME expertise : production techniques, material engineering

Test#01 : Cells deformation during cycles





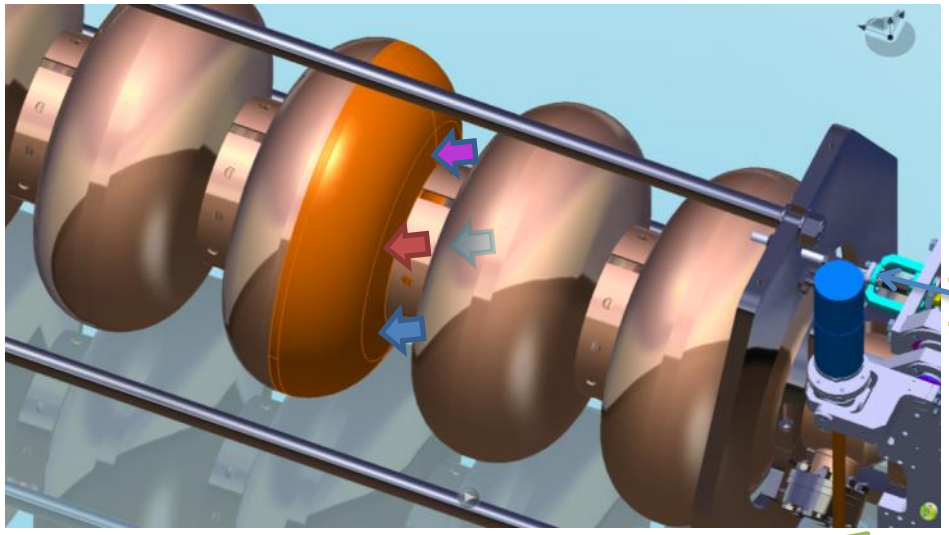
	Traction	Compression
Force@01	0.69 kN	No data
Force@02	1.27 kN	No data
Force@03	3.12 kN	No data
Tuner@01	2.46 mm	-2.56 mm
Tuner@02	2.65 mm	-2.72 mm
Cell@01	2.21 mm	-1.84 mm
Cell@02	1.91 mm	-1.54 mm
Cell@03	1.69 mm	-1.37 mm
Cell@04	1.47 mm	-1.19 mm
Cell@05	1.31 mm	-1.01 mm
Extremity	**1.28 mm**	**-1.07 mm**

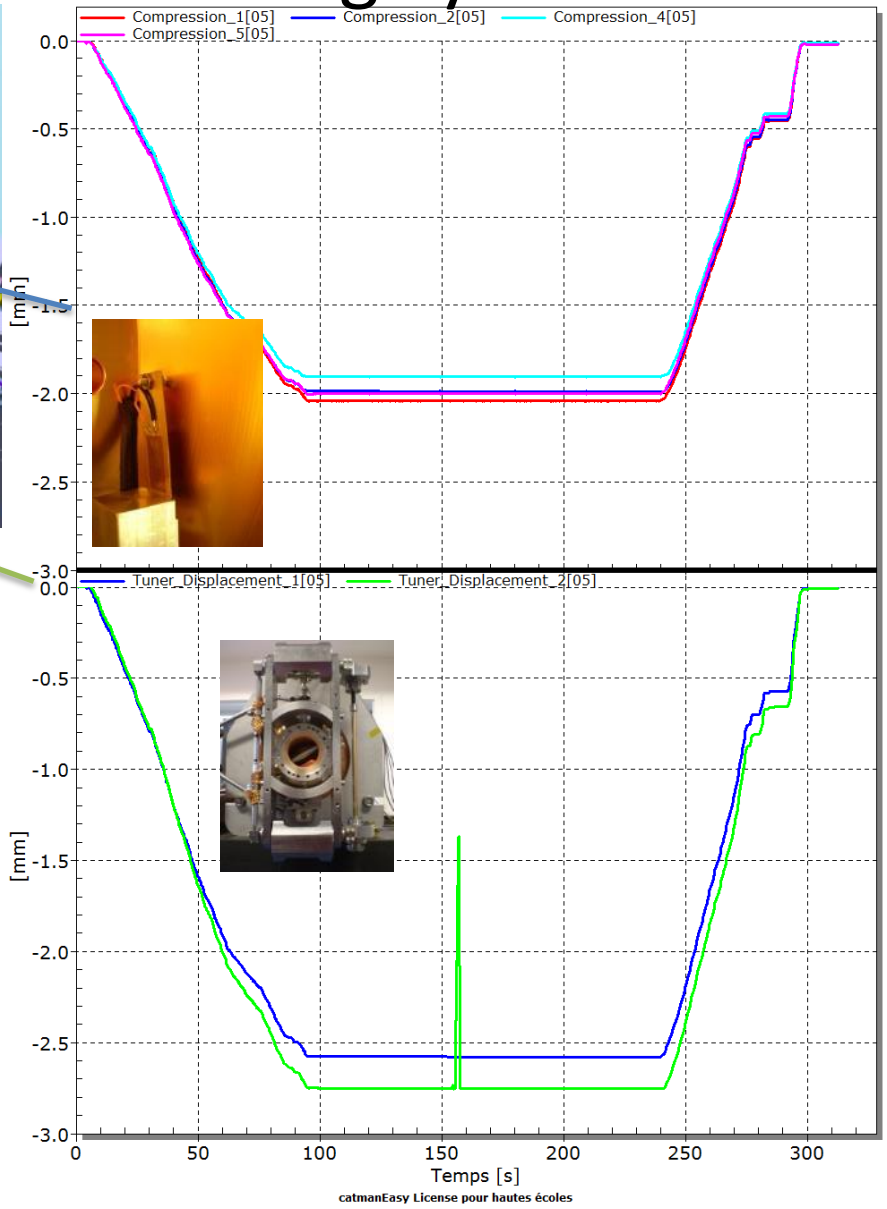
Next step : install motor + piezo

Test resolution + LD compensation

Courtesy M. Guinchard

Test#02 : Cell deformation during cycles

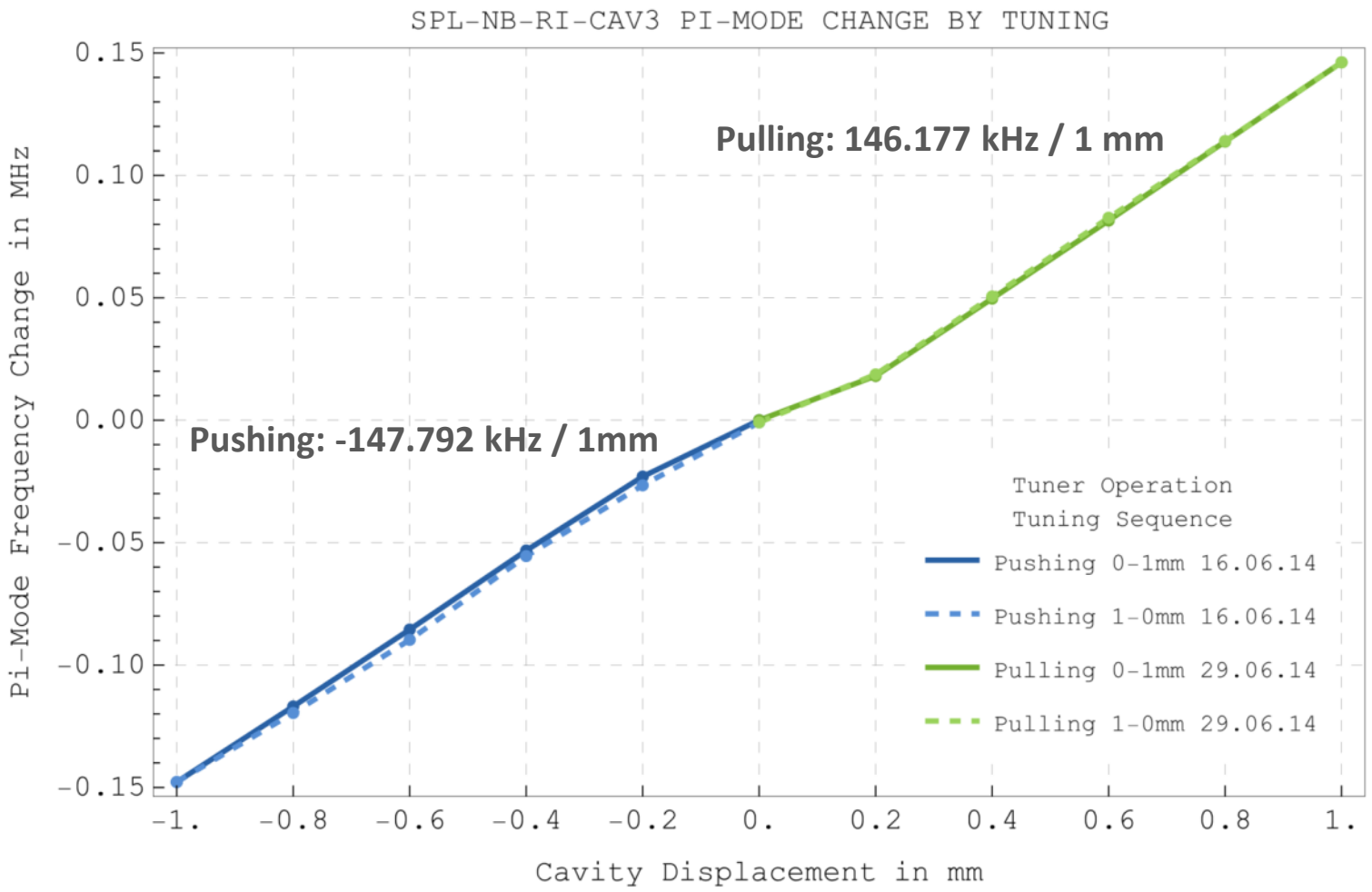




	Traction
Tuner@01	-2.58 mm
Tuner@02	-2.75 mm
Cell@01	-2.04 mm
Cell@02	-1.99 mm
Cell@03	-1.90 mm
Cell@04	-2.00 mm

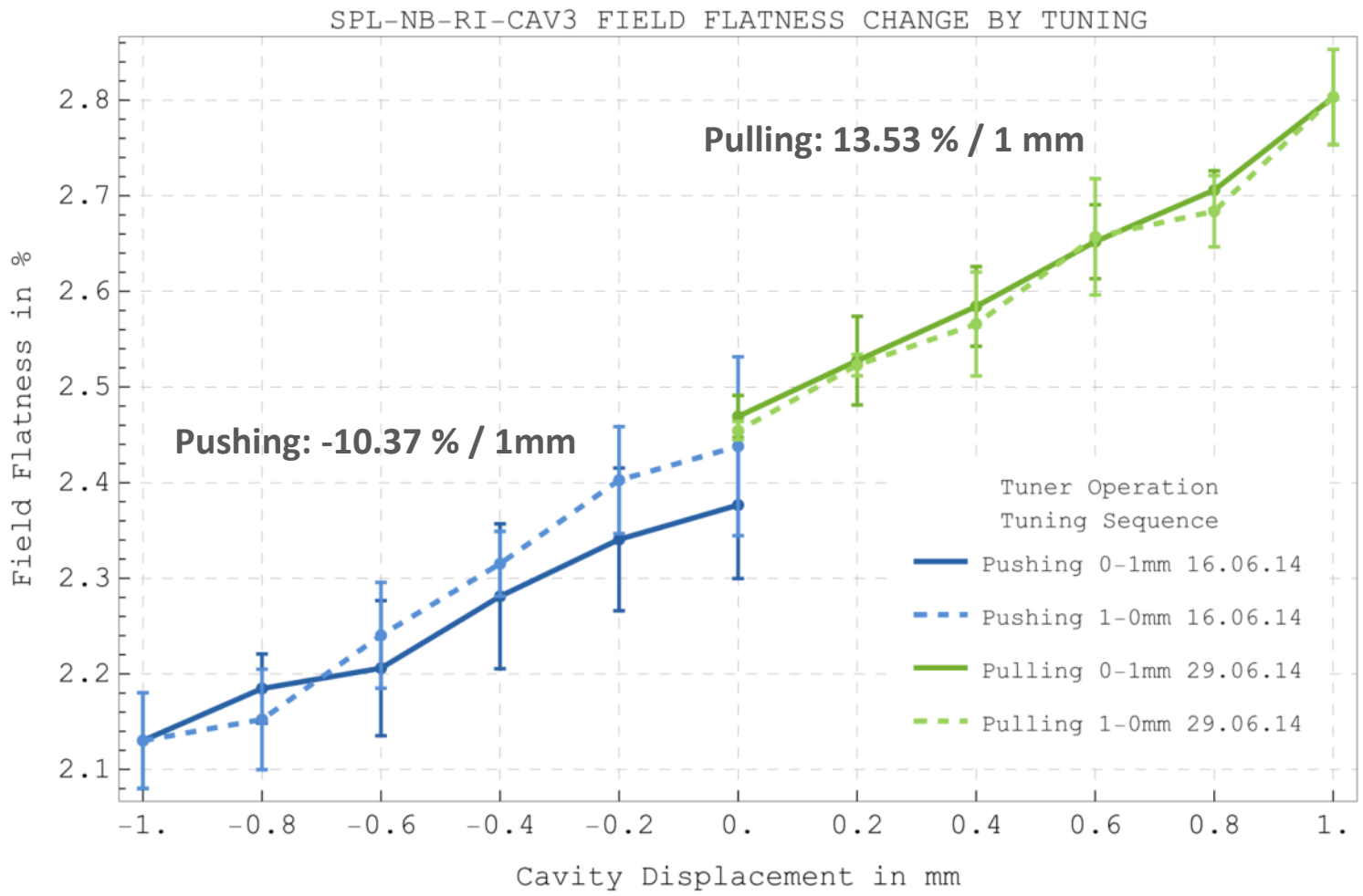
Courtesy M. Guinchard

Frequency Sensitivity



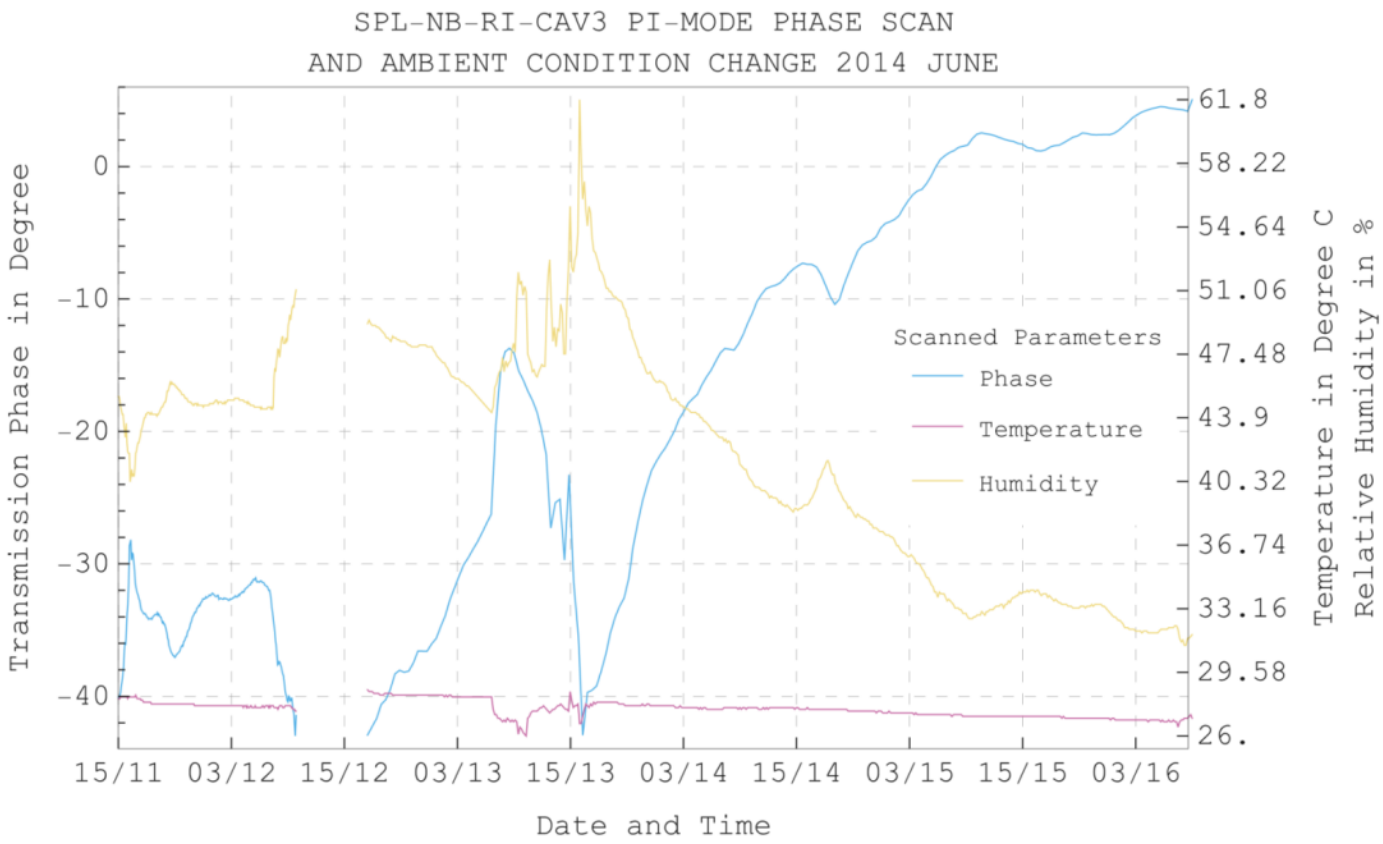
Courtesy S. Horvath-Mikulas

Field-Flatness Sensitivity



Courtesy S. Horvath-Mikulas

Evaluation Phase

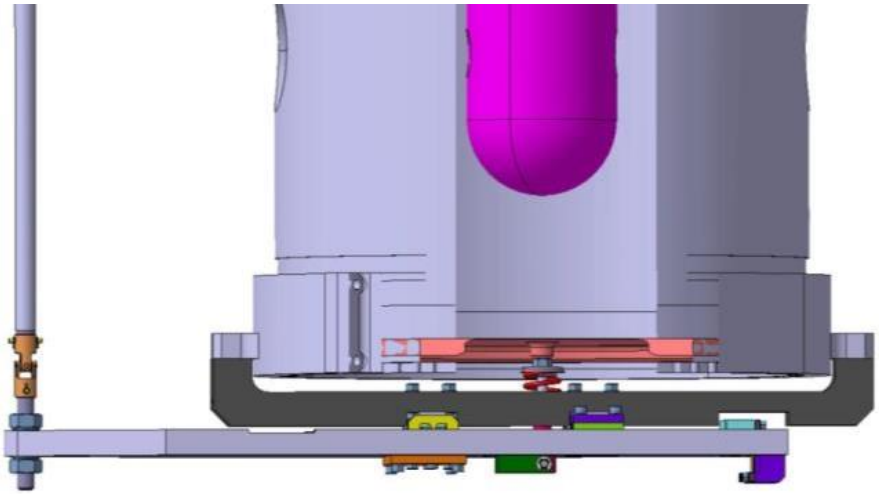


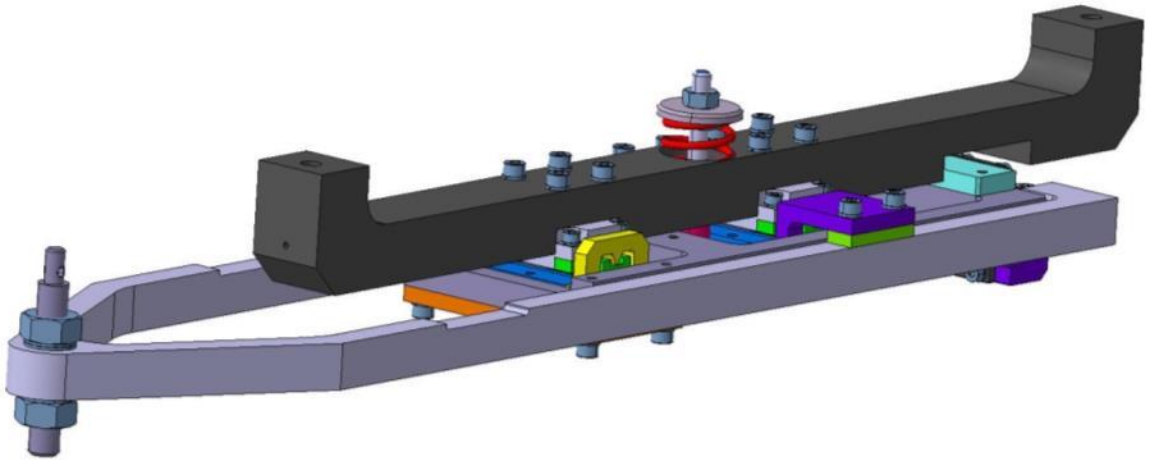
Next step: obtain a room with well controlled environment

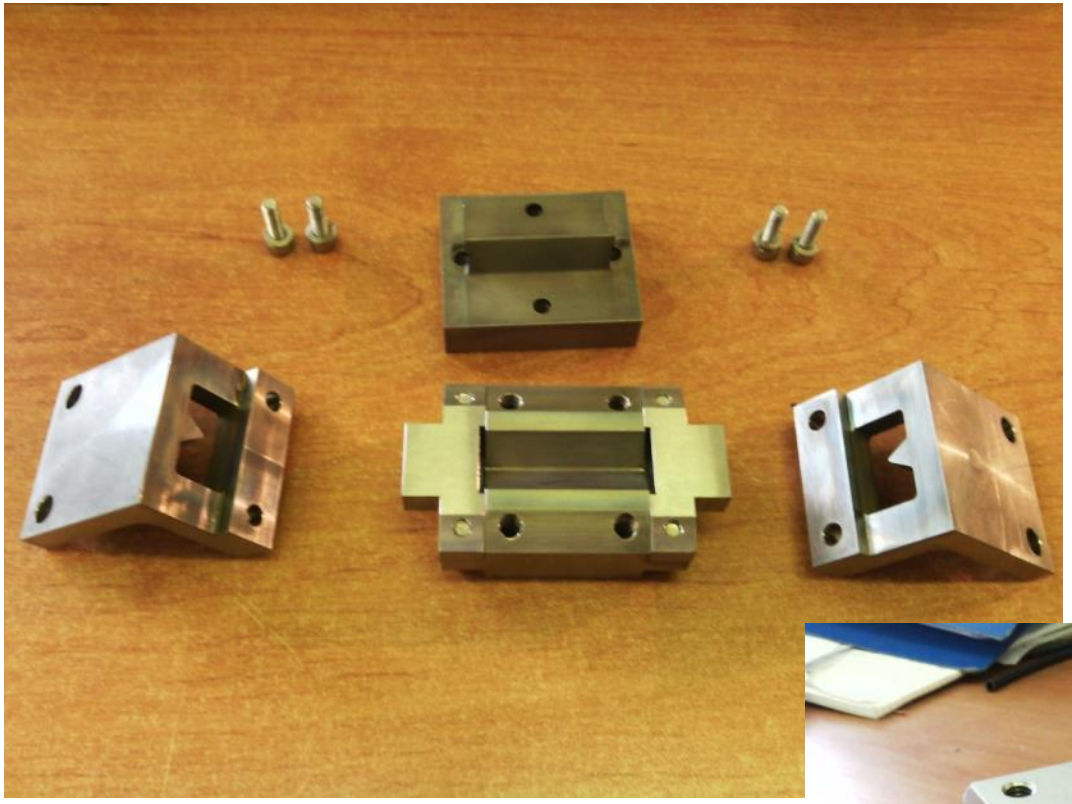
Courtesy S. Horvath-Mikulas

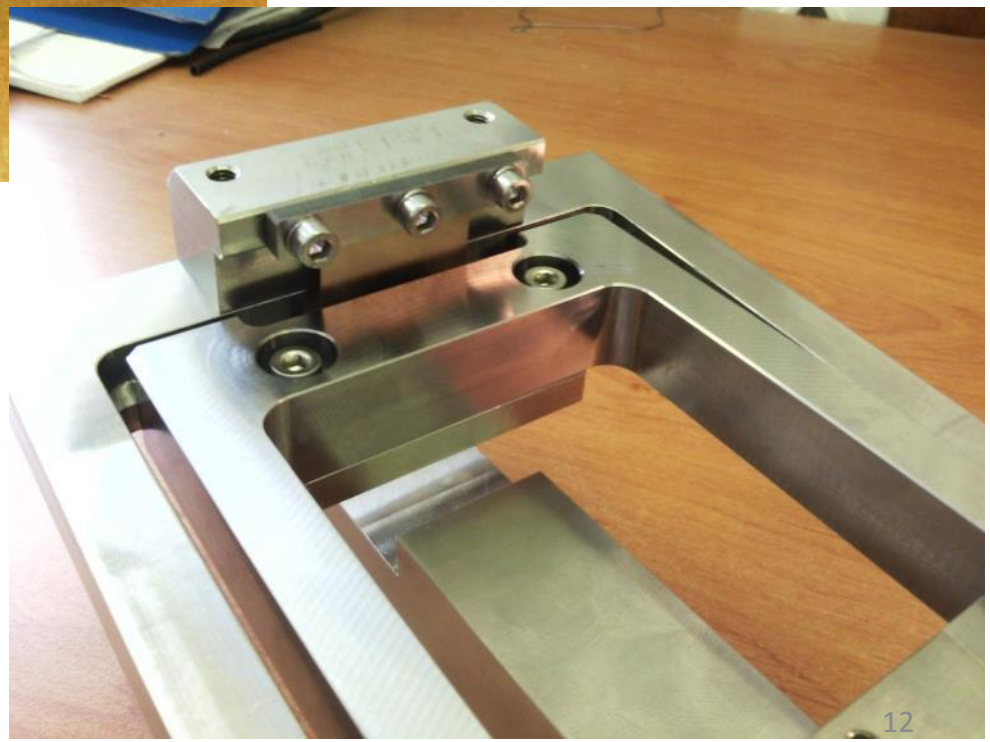
HIE Isolde QW cavity tuner

Requested range 32 kHz, resolution 0.5 Hz
Deformation 0.3 mm Cu OFE tuning plate 5 mm
Required high reliability + maintainability
Compact tuner
Low tuning forces to respect alignment





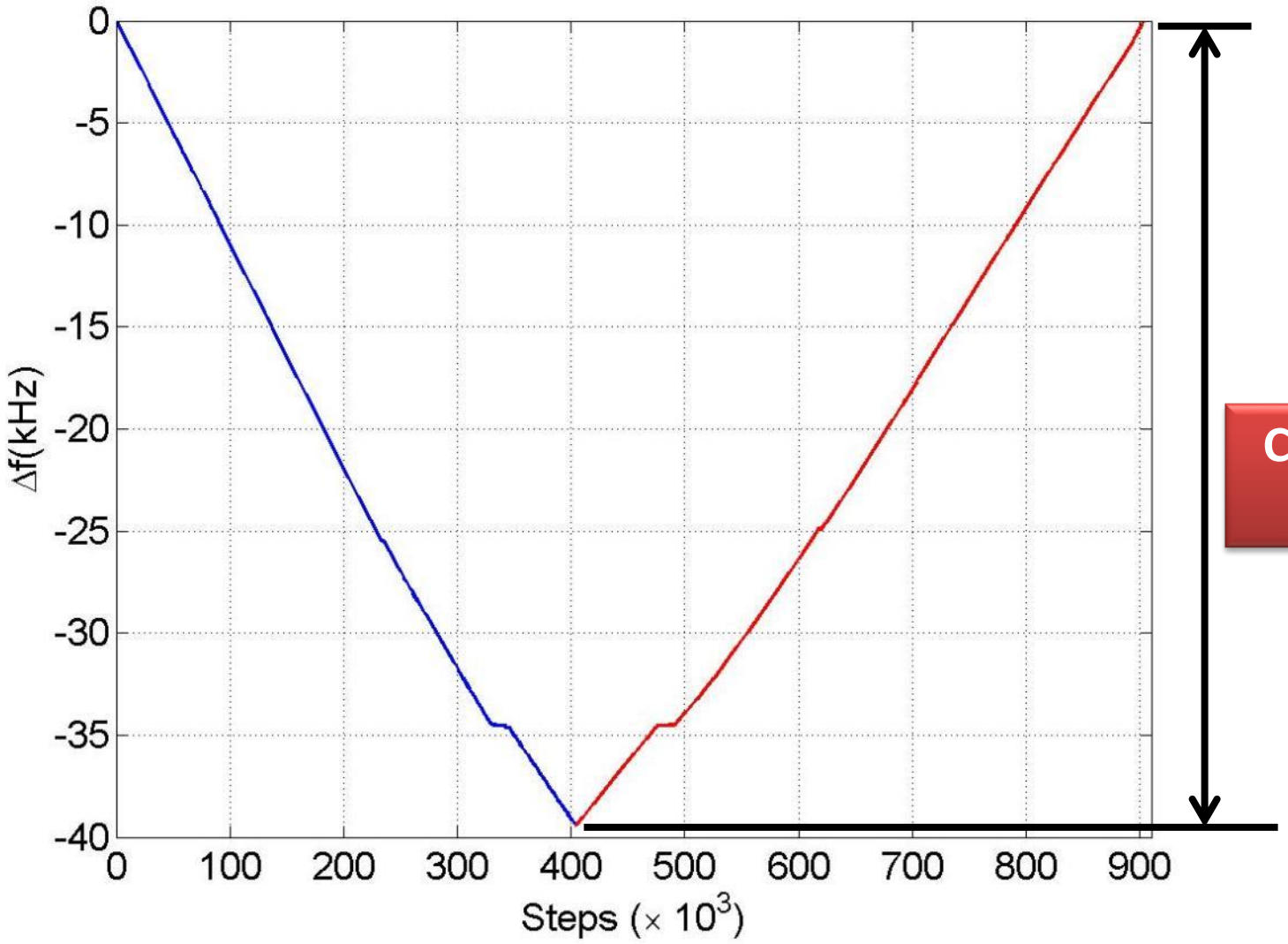




Double Knife edge pivots

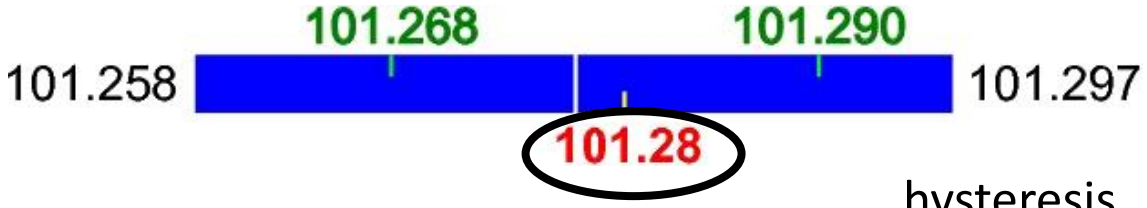
Flexural link

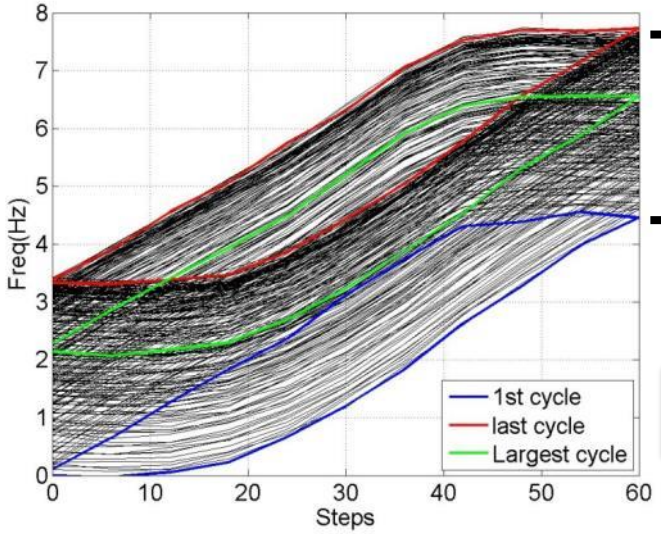
Full range



Coarse range 39 kHz

100 cycles

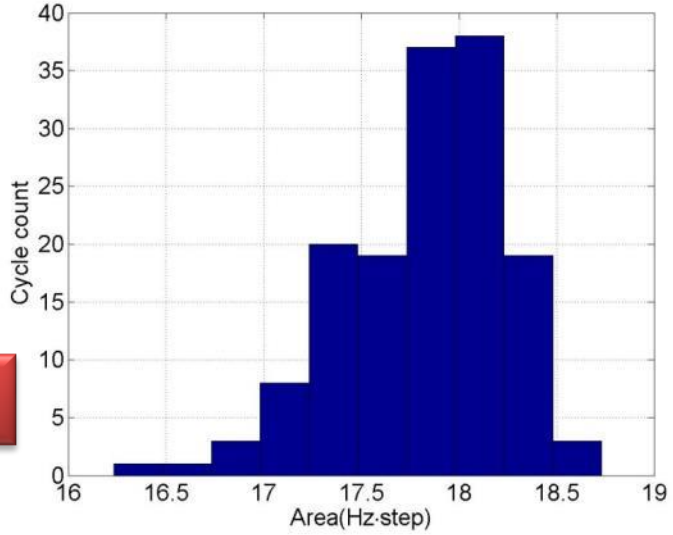


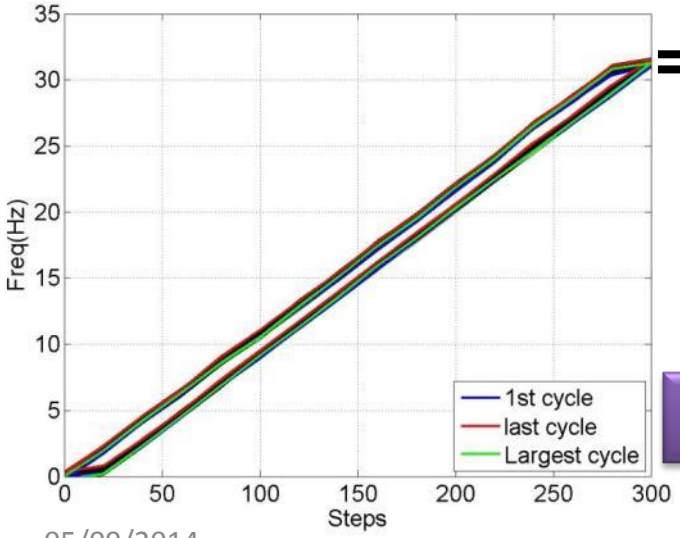


3Hz

0.08Hz/step

hysteresis

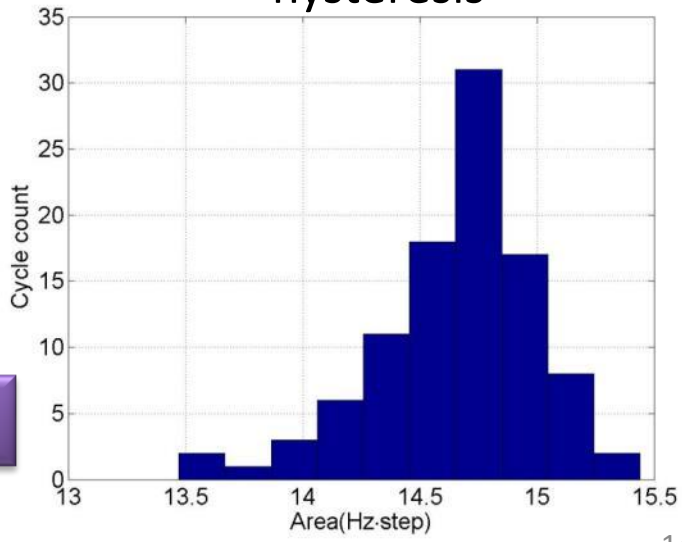




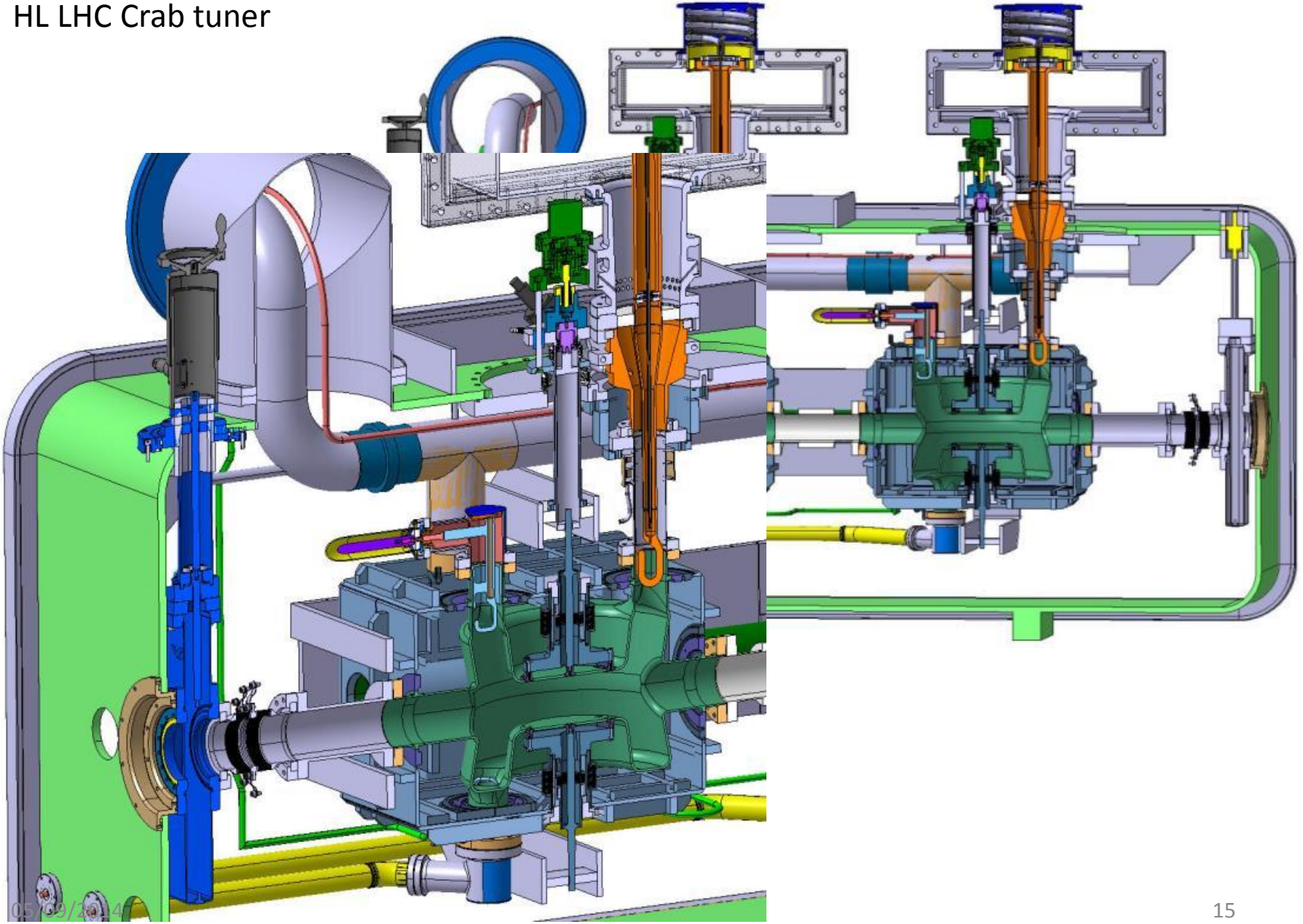
0.6Hz

0.11Hz/step

hysteresis



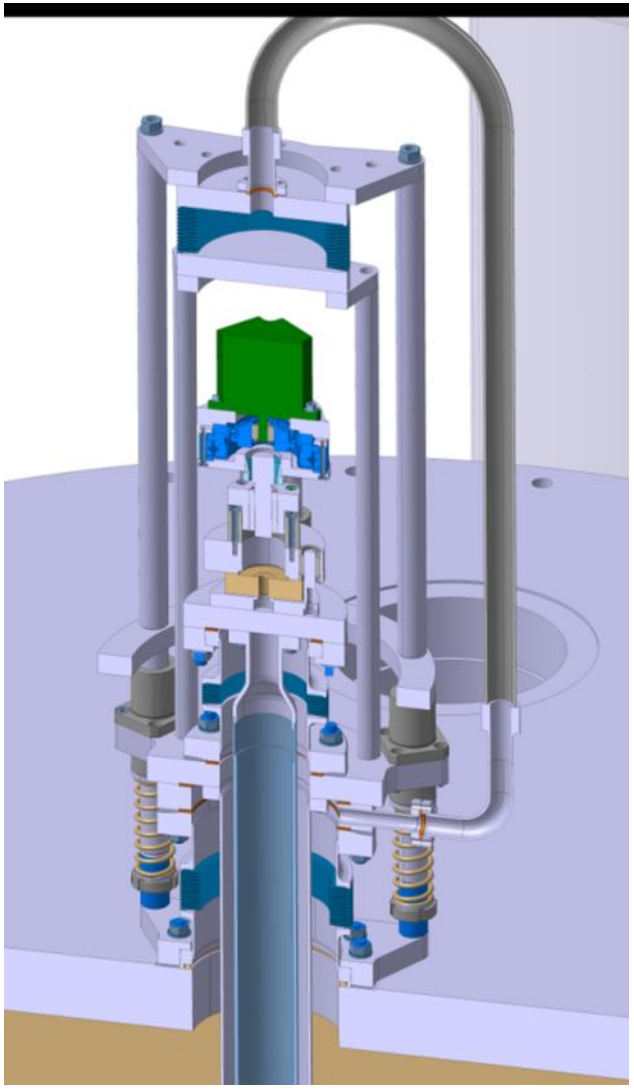
HL LHC Crab tuner



- External motorisation for reliability

(advised by collaborations, inspired by Jlab design)

- First motor designed for first testing in vertical cryostat
- For SPS height needs to be devided by 3
- Heat inleak will only work with proper thermalisation/heat intercepts
- Might need cold motor development later on
- Test benches will be build for motor testing



Summary

- Tuner design and implementation ongoing at CERN for HIE ISOLDE, SPL , CRAB
- For the moment little man power available to do much more but maybe with the similarities in the work some exchange can be made with the ILC
- In EN/MME we have measurement and analysis capabilities, as well as for design, production and material science.
- This meeting very useful to avoid double work

Test set-ups
Compact design
Stiffness management
Motor design, outside or inside
cold motorisation and transmissions
Tuning and alignment, floating tuners
Cost optimisation
High resolution, low hysteresis design
reliability/ maintainability