CRAB cavity tuning system update

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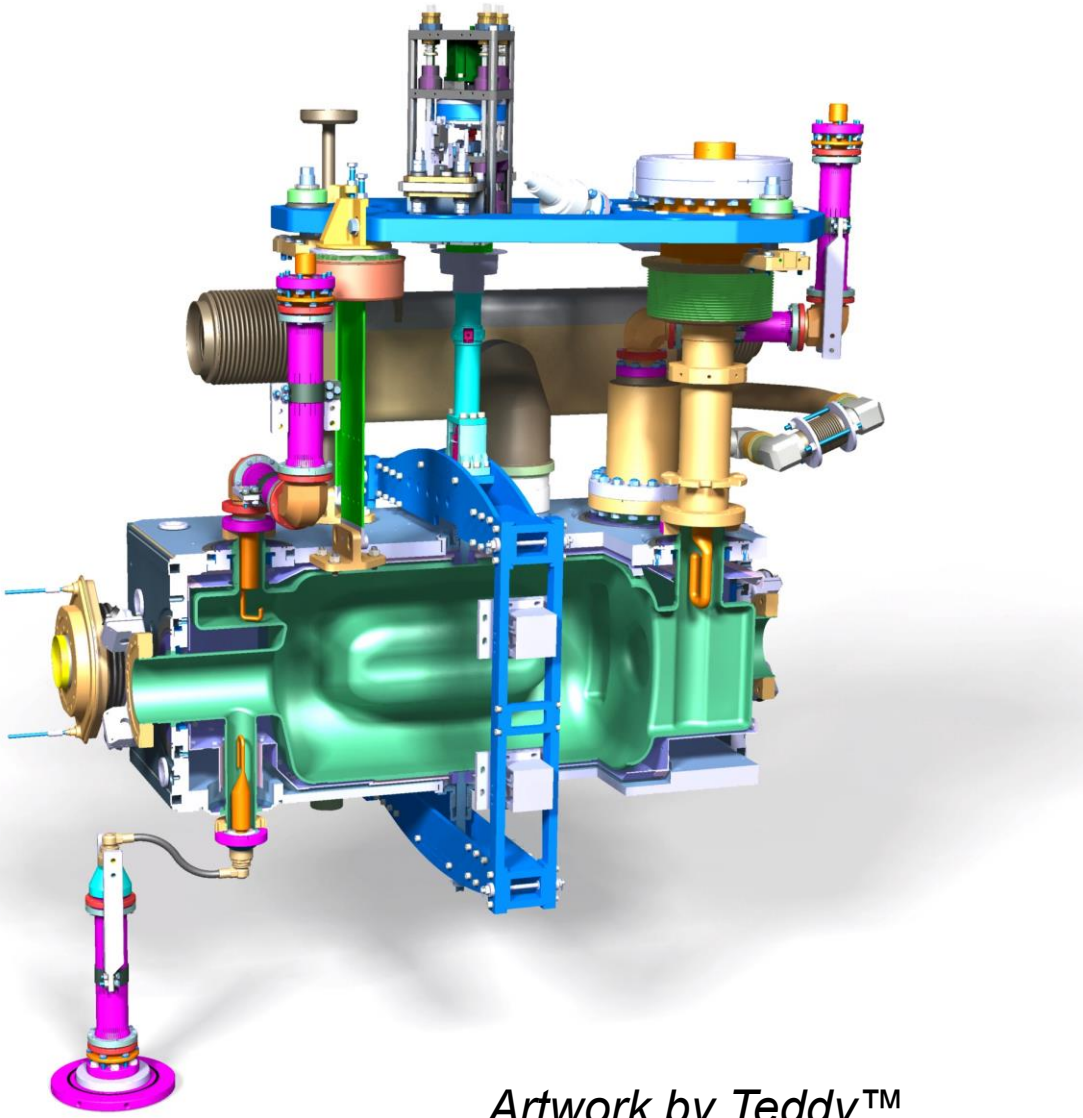
Thanks to WP4 team

Outline

- Reminder functioning tuner
- Lessons and upgrade from SPS DQW tuner
- Status SPS RFD parts
- Status LHC DQW

Reminder functioning tuner



Artwork by Teddy™

Tuning principle

FINE TUNING PRINCIPLE

Symmetric actuation through tuner frame and concentric tubes. Actuator outside cryostat and floating

DQW

318 kHz/mm*

S. Verdú Andrés

Tuning range

± 509 kHz

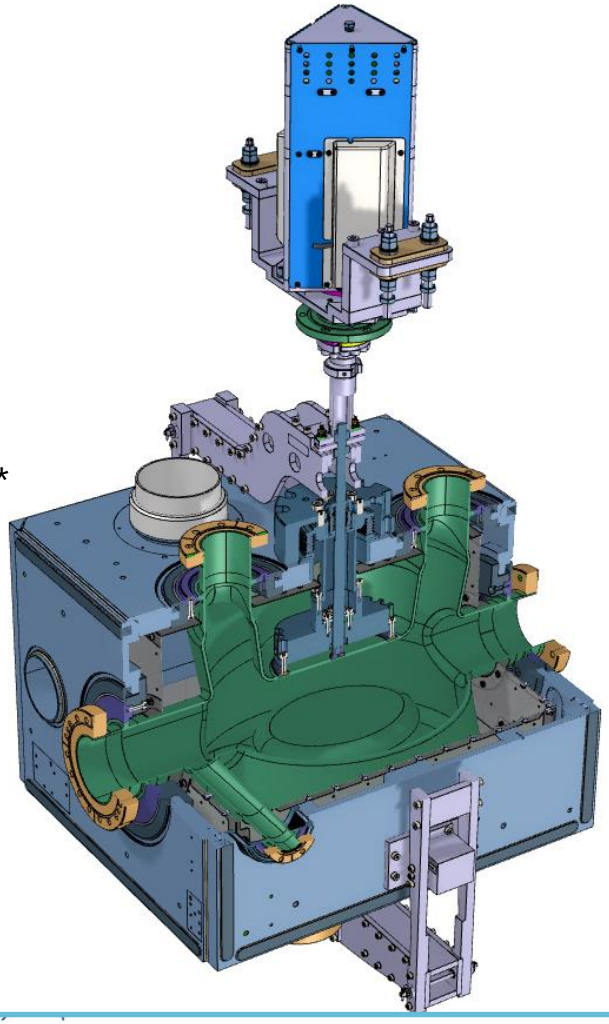
±1.6 mm*

elastic range at 2 K

Max. force:

± 3.8 kN

2.2-2.4 kN/mm*



RFD

512 kHz/mm*

E. Cano Pleite

Tuning range

± 1.22 MHz

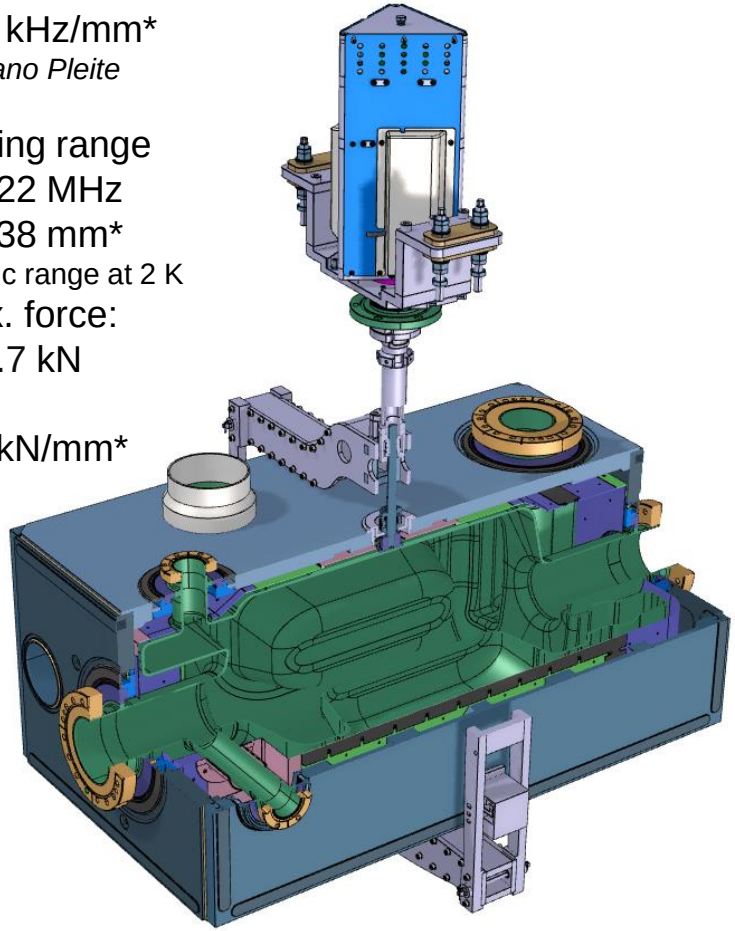
± 2.38 mm*

elastic range at 2 K

Max. force:

± 6.7 kN

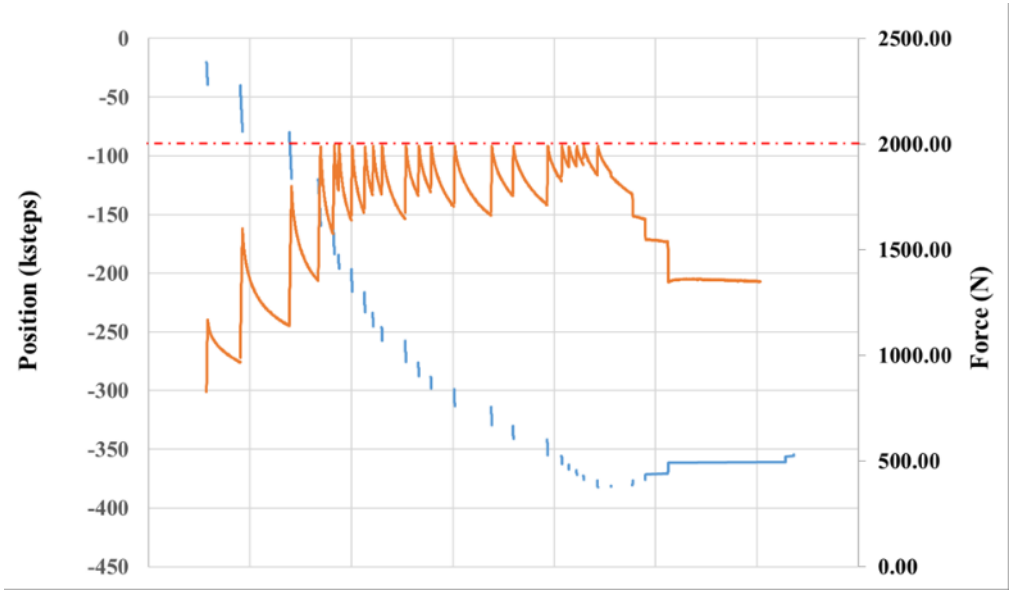
2.8 kN/mm*



*Measured as tuner stroke or Δ distance between 2 plates

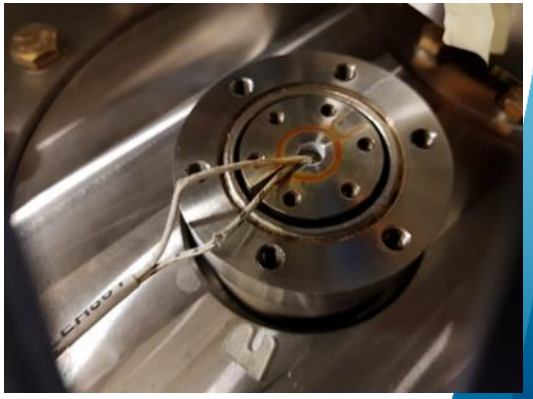
Reminder end of Run1 DQW SPS 2018

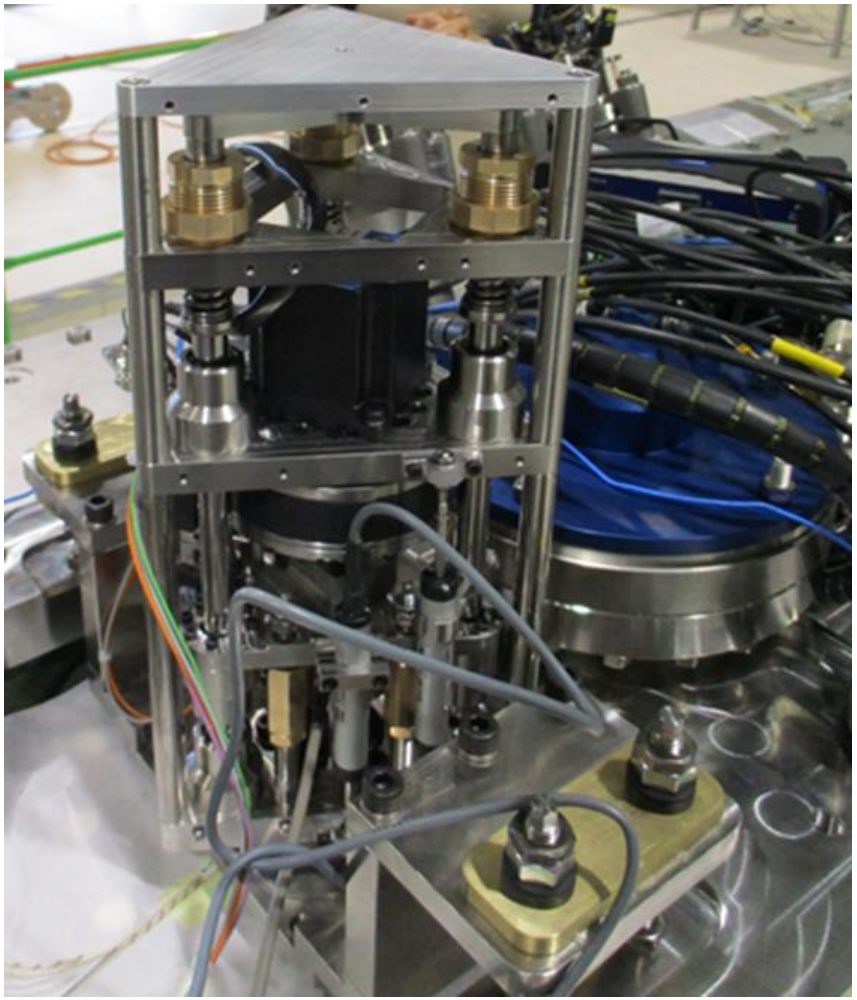
- Sudden increase of stiffness 2-3 October after thermal cycle
- no real blockage
- One motor-gear coupling started slipping 19/10
- Tuner heaters broken + wires damaged
- Possible ice formation



Important observations:

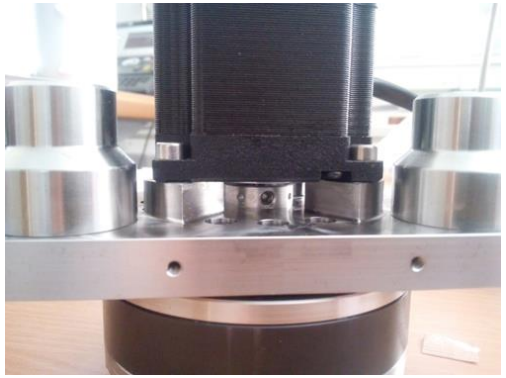
- Very hard to dismount motor in-situ or to replace the heater
- Impossible to retighten the coupling without full actuator disassembly
- No access to set limit switches and hard stop
- Potentiometer not needed

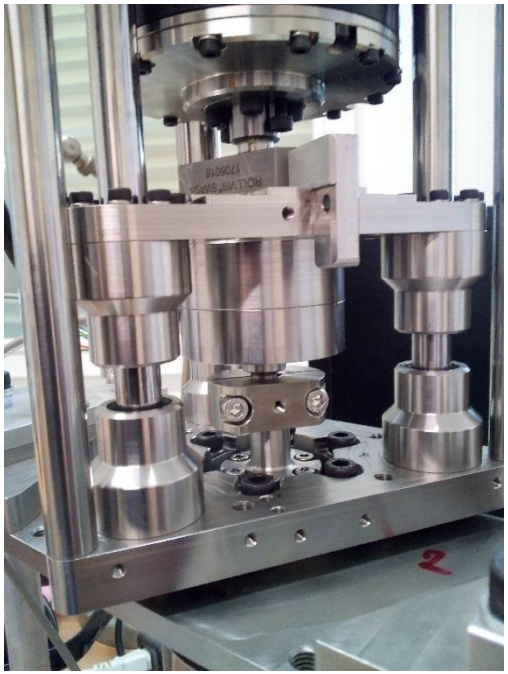


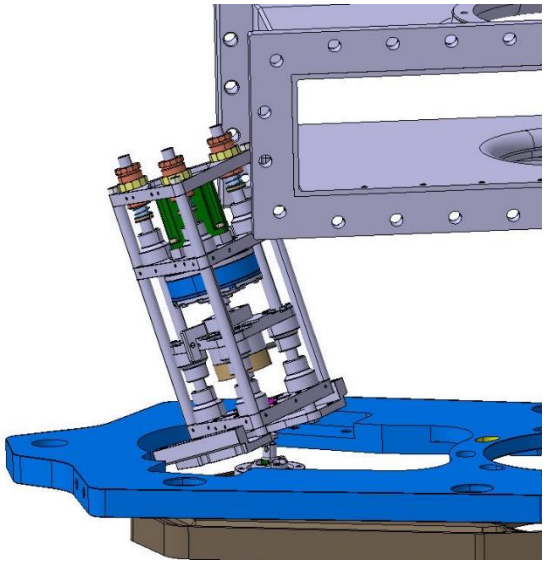


SPS DQW and RFD Upgrade

- D-type slip-free Oldham coupling with set screw
- Introduction connection clamp
- Creation more space
- Lowered actuator height

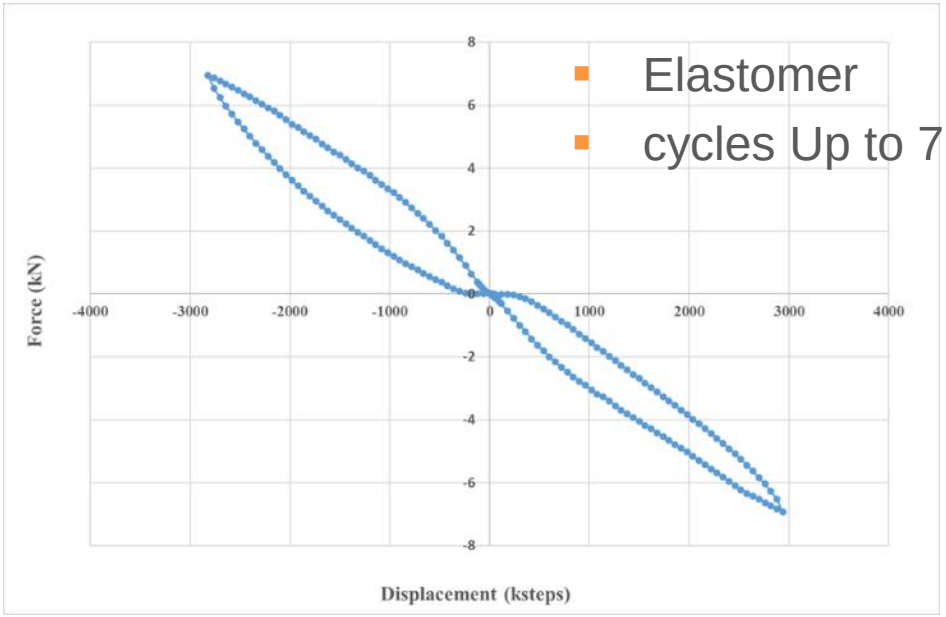


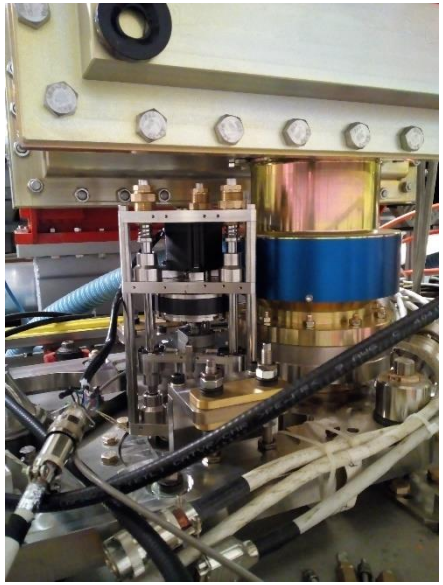


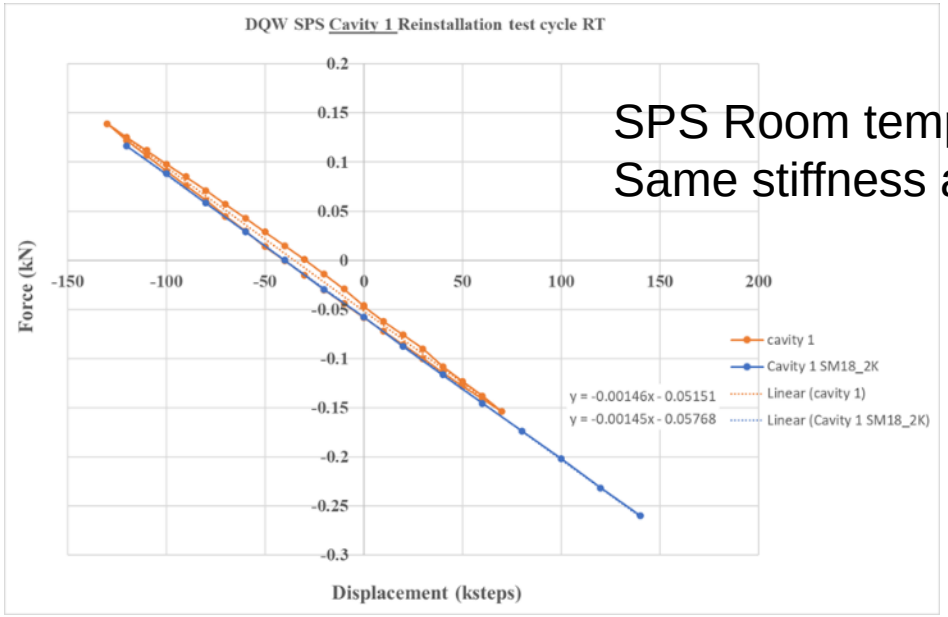


- Removed potentiometers
- Moved limit switches to front
- Only 1 hard stop in front

Testing



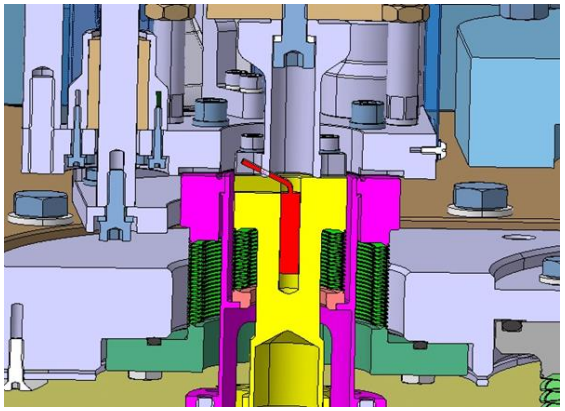


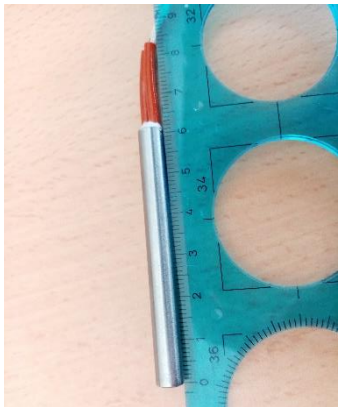


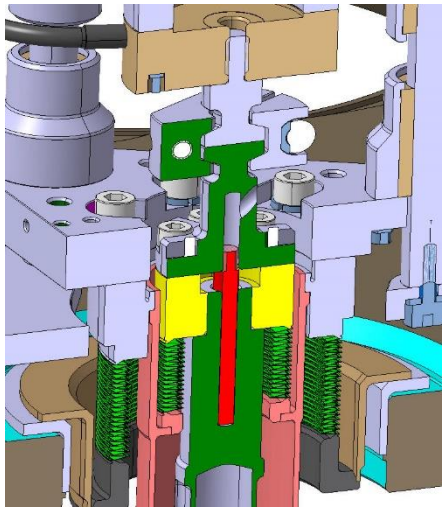
SPS Room temperature
Same stiffness as SM18

Heater and temperature gauge

- SPS DQW tuner heaters broke due to water inside heater
- Cables were found damaged
- Waterproof equivalent same provider is too long

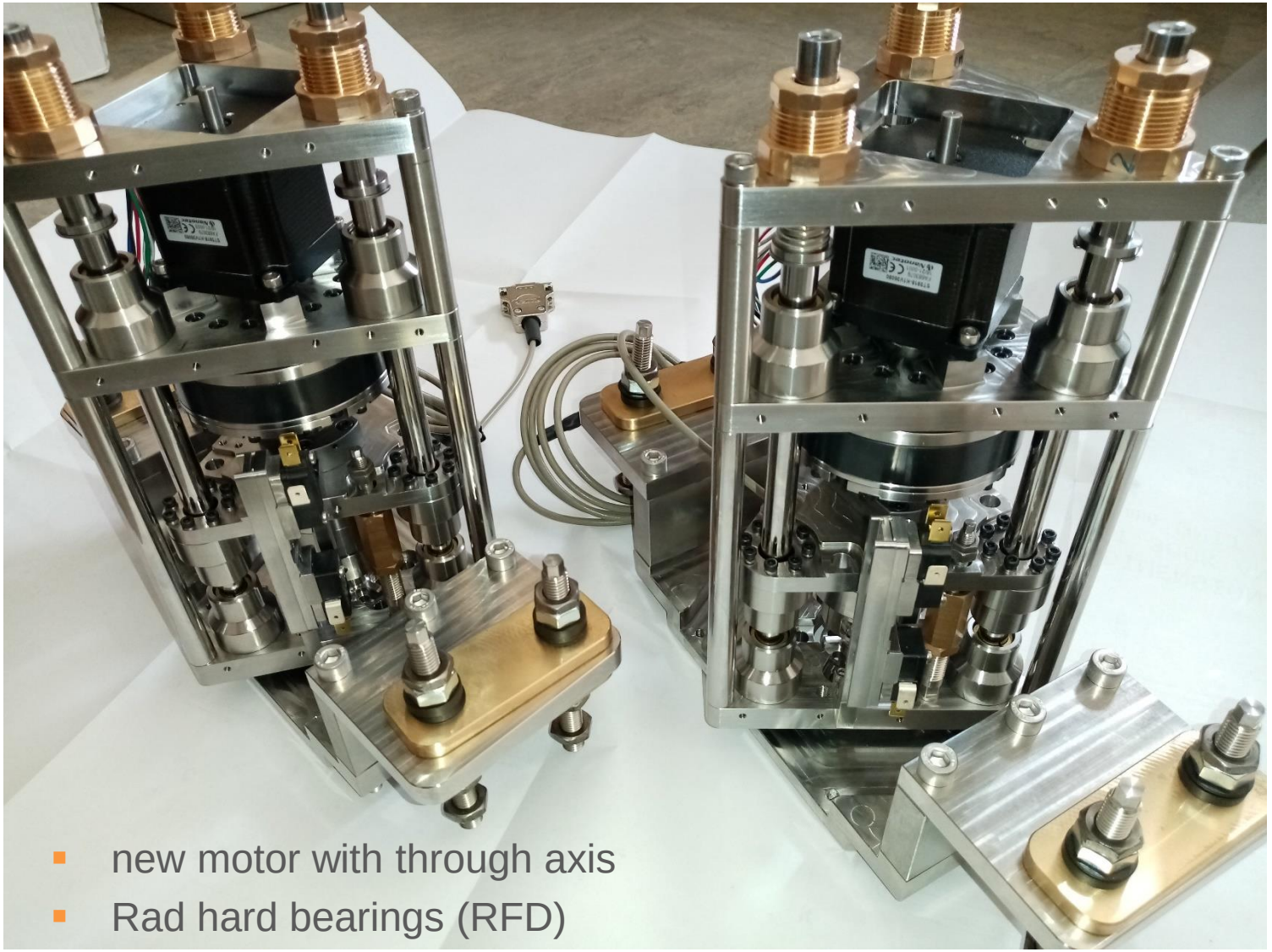






- Increased available space
- Possibility to inject protection grease or resin
- Exit wires better
- Temperature gauge on screw
- Replaceable unit

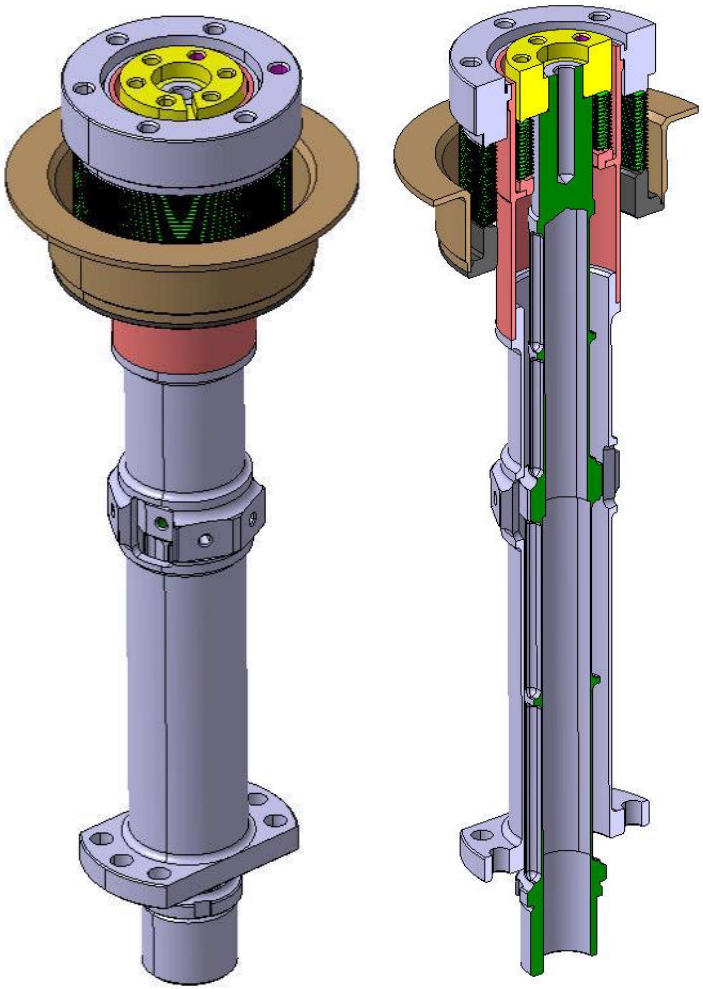
SPS RFD Status: actuators

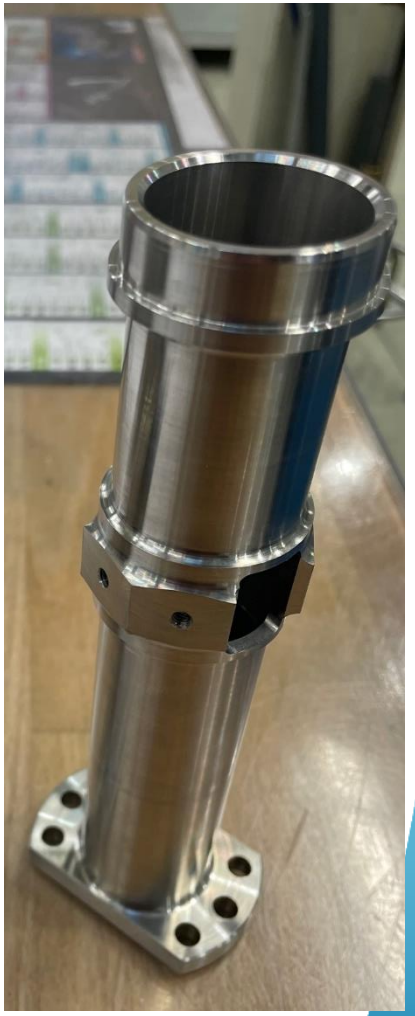


- new motor with through axis
- Rad hard bearings (RFD)

RFD Status: Double tuner tube bellows

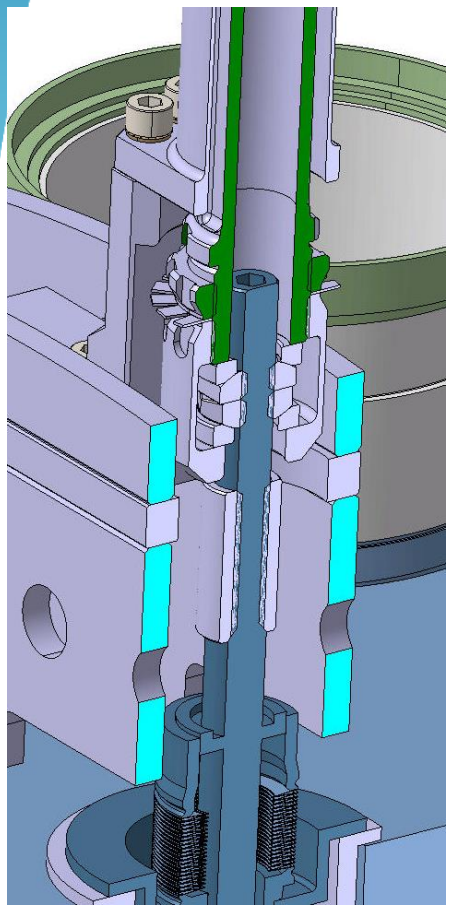
- Rearrangements following DQW assembly experience
- No more intermediate flanges
- Easier coupling
- Higher clearance

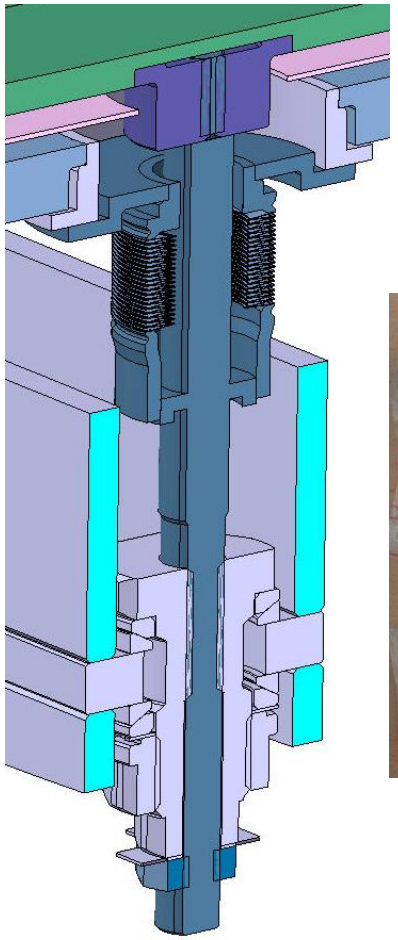




Assembly of the parts in preparation

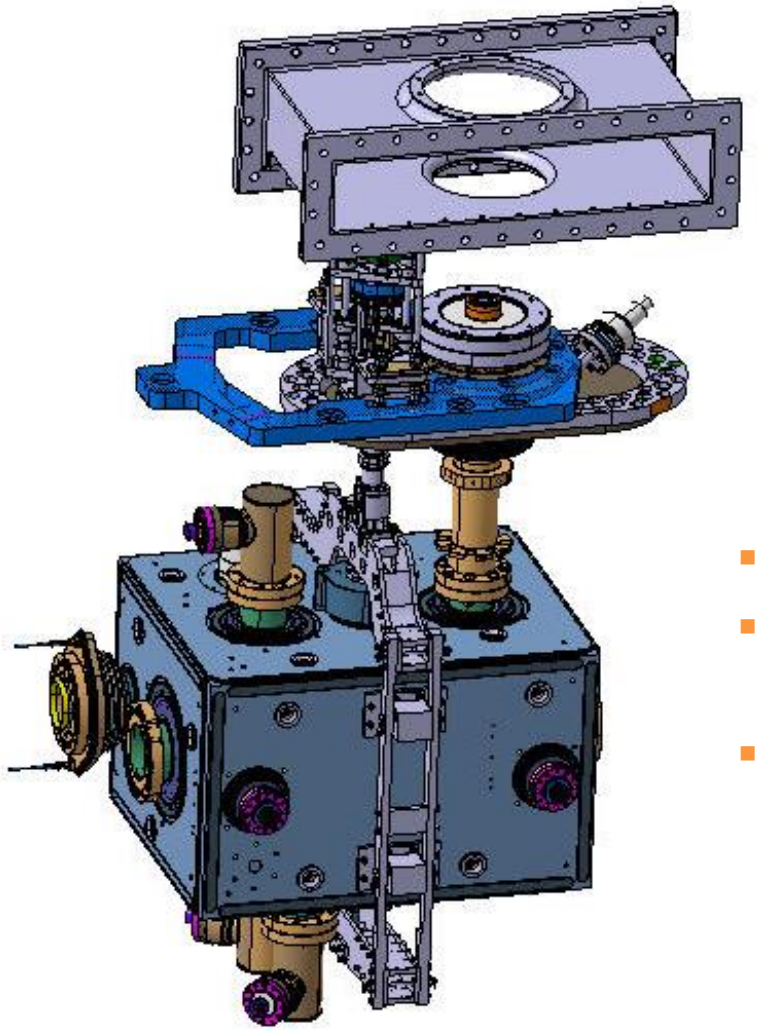
RFD Status: Top and bottom coupling





Tuner frame and guidance

LHC DQW Status



- Shared components
- Planning: Learning from SPS RFD assembly
- Work on radiation hardness, reliability and fatigue testing + optimisation

Conclusions

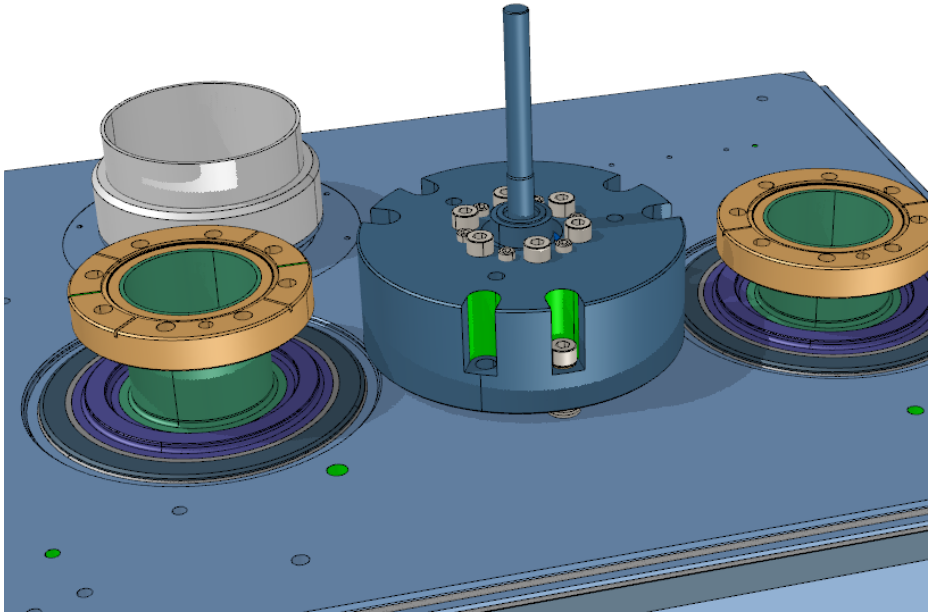
- SPS DQW tuner upgraded
- Well advanced for SPS RFD tuners
- Next step is the preparation for series LHC Crab tuners

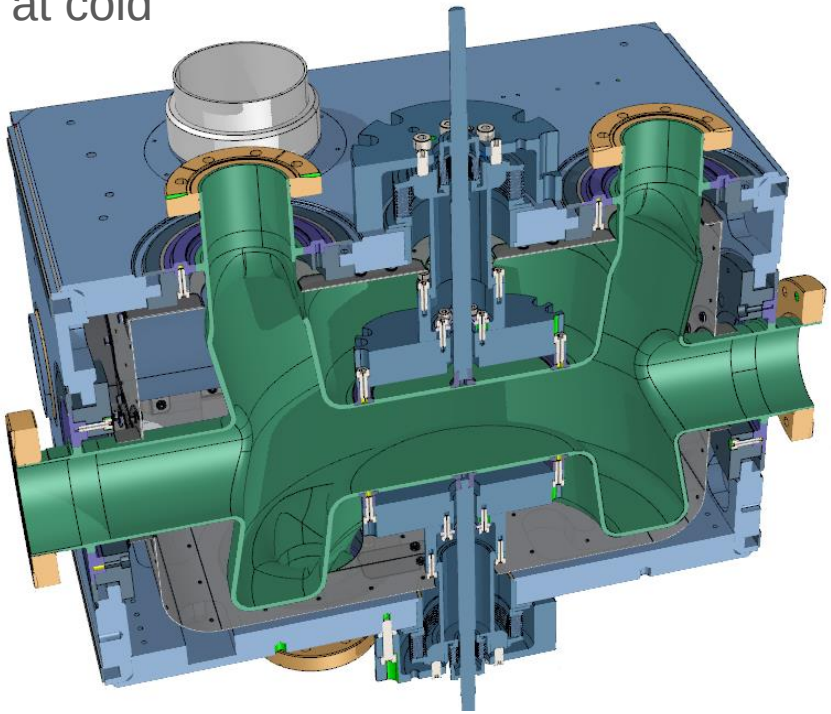
Thank you for your attention!

Tuning principle

- DQW:
  - **1. pre-tuning at warm**
  - 2. fine tuning at cold
- RFD:
  - **1. -**
  - 2. fine tuning at cold

PRE-TUNING PRINCIPLE





Pre-tuning sensitivity: 1046 kHz/mm*
Elastic Pre-tuning range: ± 400 kHz
Non-elastic range: ± 1 MHz

Silvia Verdu Andres