Cryomodule alignment

AUP-Canada-CERN-UK meeting 2020.03.13

Vivien RUDE, Mateusz SOSIN

Outline

- **Reminder – Cryomodule alignment activities**
- **CRAB alignment – coordination between CERN and Canada/UK teams**
- **Current schedule discussion**
- **Summary**

Alignment activities

CRAB cryomodule alignment (based on SPS DQW prototype)

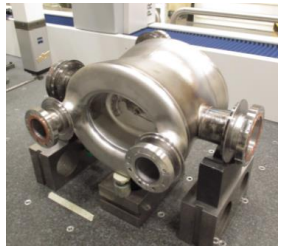
- Measurement on the associated infrastructures (string trolley, cryostat assembly gantry, test sites)
- Workflow (Assembly of the Crab-cavity string)
  - Determination of the mechanical axis → Capacitive plate of the cavities
  - Fiducialisation of the Dressed Cavities
  - String line assembly in clean room
  - (Installation of the others components on the string line)*
  - Final alignment of the string line
  - Installation of the top plate (supporting plate of the string line)*
  - Insertion of string line in the cryomodule
- Installation of FSI system
  - Calibration of FSI feedthrough
  - Installation of FSI feedthrough on the cryomodule
  - Installation of FSI targets
- Validation at warm and cold conditions
  - Validation at warm
  - (Impact of vacuum on the string line)*
  - (Impact of transport on the string line)*
  - Validation at cold condition

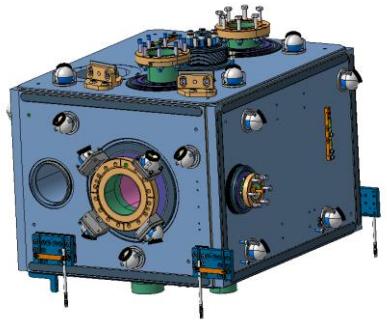
*To be discussed/agreed if required

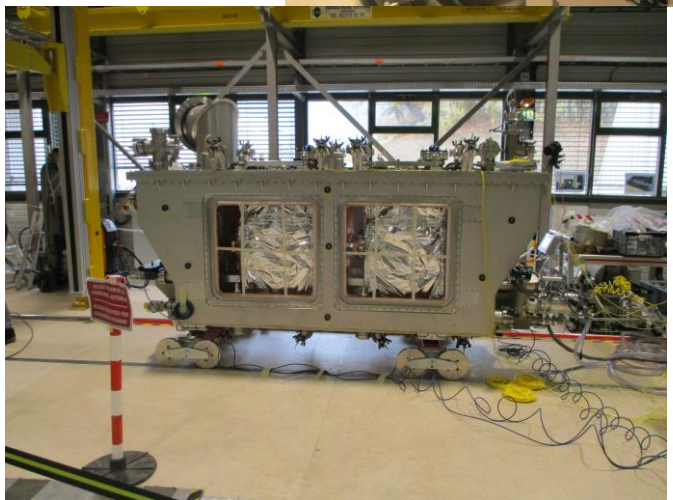
Reminder - Workflow (Assembly of the Crab-cavity string)

- Determination of the mechanical axis → Capacitive plate of the cavities
- Fiducialisation of the Dressed Cavities
- String line assembly in clean room
- Installation of the others components on the string line
- Final alignment of the string line
- Installation of the top plate (supporting plate of the string line)
- Insertion of string line in the cryomodule

Vivien RUDE, Review of HL-LHC Alignment and Internal Metrology
26-28 August 2019, CERN

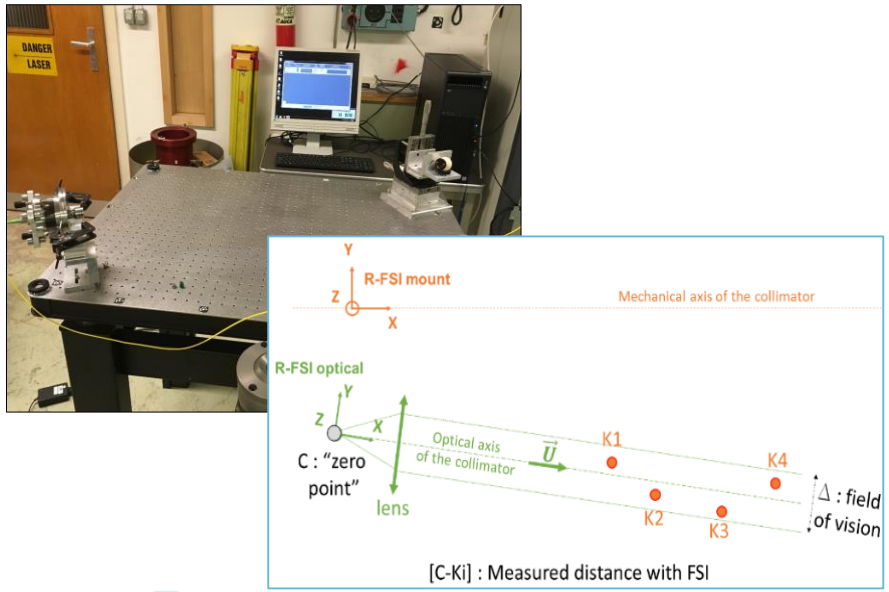






Reminder – Installation of FSI system

- **Assembly measurements of the DQW prototype**
  - Measurement on the associated infrastructures
  - Workflow (Assembly of the Crab-cavities)
  - **Installation of FSI system**
    - **Calibration of FSI feedthrough**
    - **Installation of FSI feedthrough on the cryomodule**
    - **Installation of FSI targets**
  - Validation at warm and cold conditions
  - Installation of the DQW prototype in SPS tunnel



3D measurement of :

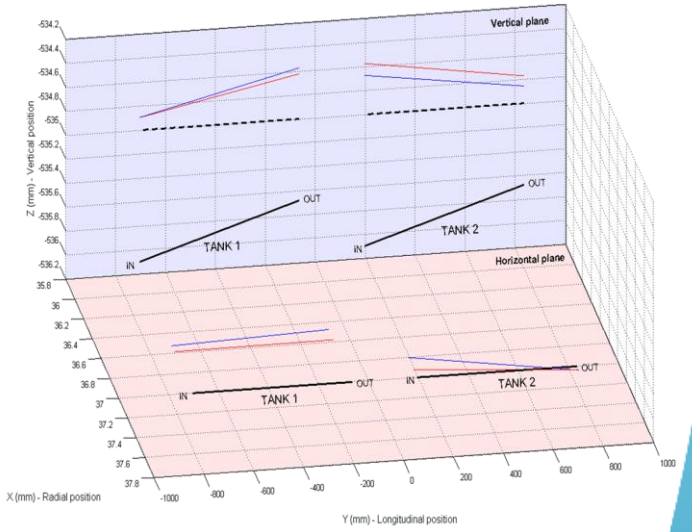
- Dressed cavities
- FSI targets

Reminder - Validation at warm and cold conditions

- **Validation at warm (1)**
- **Impact of vacuum on the string line (2)**
- **Impact of transport on the string line (3)**
- **Validation at cold condition (4)**

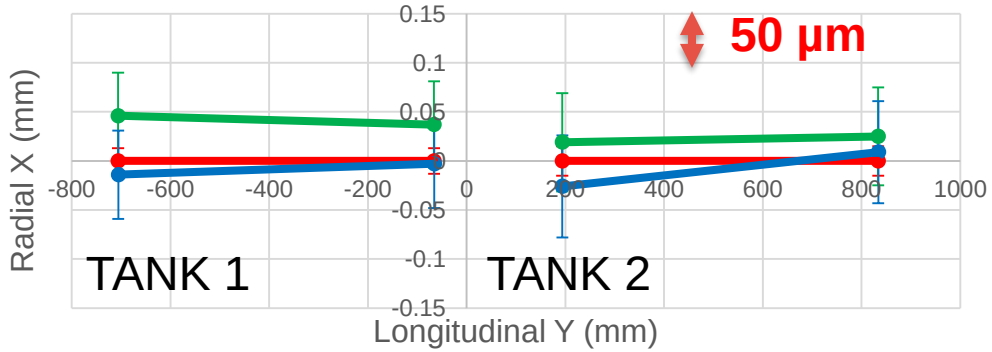
3

4



1

Radial position (relatif with respected to AT401 measurement)



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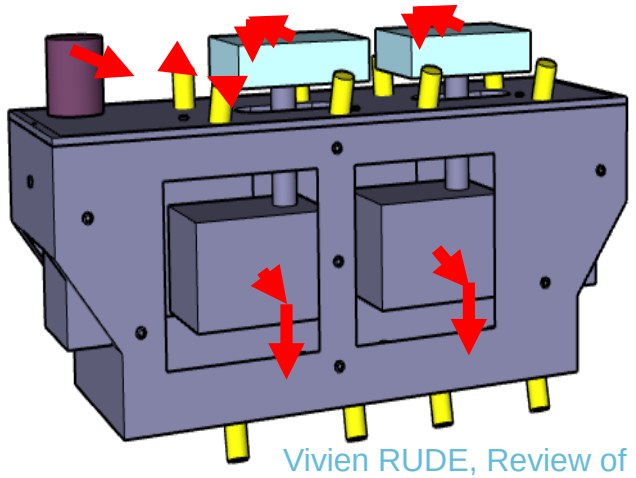
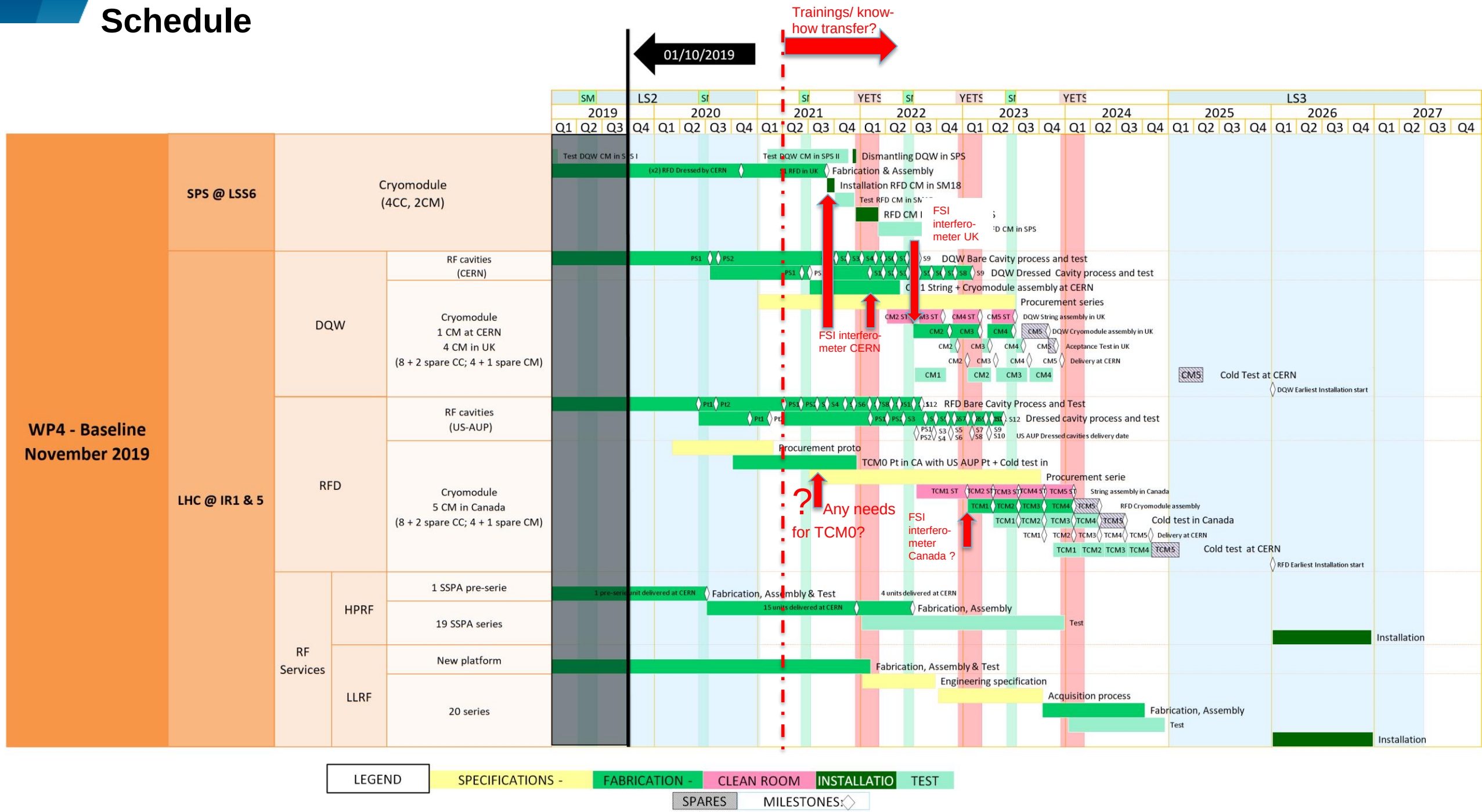


CRAB alignment – coordination between CERN and Canada/UK teams

- Needed contact with persons in charge, to agree the alignment know-how transfer / surveyors training
  - With help of CERN personnel in Canada/UK or Training in CERN?
- Dates of FSI interferometers reediness for Cryomodules FSI systems validation after assembly (1x for Canada; 1x for UK), including:
  - Interferometer operators training
  - FSI equipment handling Training
- Delivery of FSI equipment (Feedthroughs, Reflective targets, target supports) – according to current planning?
- 1x PJAS for CRAB alignment related activities: mid 2021 – mid 2024

Schedule


Trainings/ know-how transfer?
01/10/2019
SM
LS2
SI
YETS
LS3
2019
2020
2021
2022
2023
2024
2025
2026
2027
Q1 Q2 Q3 Q4
WP4 - Baseline November 2019
SPS @ LSS6
LHC @ IR1 & 5
Cryomodule (4CC, 2CM)
DQW
RF cavities (CERN)
Cryomodule 1 CM at CERN 4 CM in UK (8 + 2 spare CC; 4 + 1 spare CM)
RFD
RF cavities (US-AUP)
Cryomodule 5 CM in Canada (8 + 2 spare CC; 4 + 1 spare CM)
RF Services
HPRF
1 SSPA pre-serie
19 SSPA series
LLRF
New platform
20 series
Test DQW CM in SPS I
Test DQW CM in SPS II
Dismantling DQW in SPS
(x2) RFD Dressed by CERN
RFD in UK
Fabrication & Assembly
Installation RFD CM in SM18
Test RFD CM in SM
RFD CM I
FD CM in SPS
FSI interfero-meter UK
FSI interfero-meter CERN
DQW Bare Cavity process and test
DQW Dressed Cavity process and test
1 String + Cryomodule assembly at CERN
Procurement series
DQW String assembly in UK
DQW Cryomodule assembly in UK
Aceptance Test in UK
Delivery at CERN
Cold Test at CERN
DQW Earliest Installation start
RFD Bare Cavity Process and Test
Dressed cavity process and test
US AUP Dressed cavities delivery date
Procurement proto
TCM0 Pt in CA with US AUP Pt + Cold test in
Procurement serie
String assembly in Canada
RFD Cryomodule assembly
Cold test in Canada
Delivery at CERN
Cold test at CERN
RFD Earliest Installation start
? Any needs for TCM0?
FSI interfero-meter Canada ?
1 pre-serie unit delivered at CERN
Fabrication, Assembly & Test
4 units delivered at CERN
15 units delivered at CERN
Fabrication, Assembly
Test
Installation
Fabrication, Assembly & Test
Engineering specification
Acquisition process
Fabrication, Assembly
Test
Installation
LEGEND
SPECIFICATIONS -
FABRICATION -
CLEAN ROOM
INSTALLATIO
TEST
SPARES
MILESTONES:

Summary

- **Information on CERN, Canada and UK alignment team coordination needs to be agreed**
  - **Dates of trainings and know-how transfer**
- **FSI interferometers delivery to be confirmed (needed for in-CERN production coordination)**
- **Dates of FSI equipment production, testing, calibration and delivery**
  - **Is current planning up to date?**
  - **Impact on CERN personnel work planning (tests, calibration)**