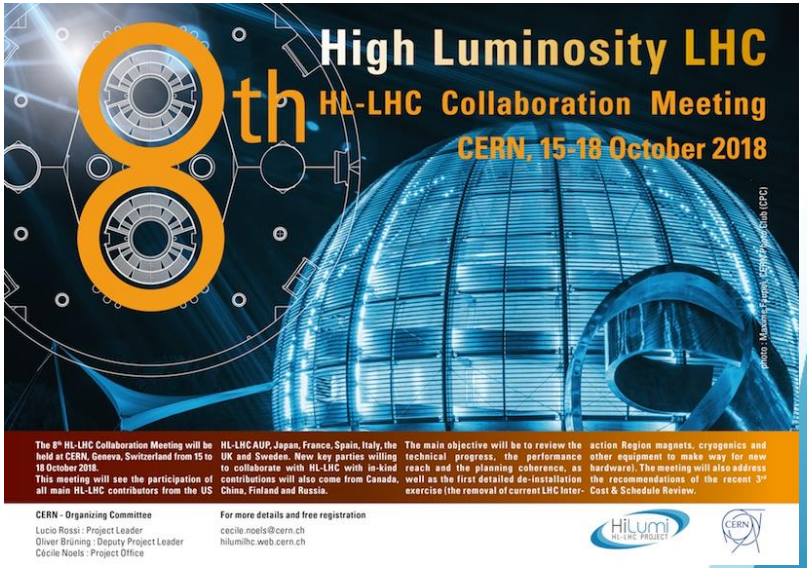
Summary of the Open Points from WP11



L. Bottura, S. Bustamante, P. Fessia, H. Prin, **F. Savary**, D. Schoerling, T. Sahner, J.-P. Tock

8th HL-LHC Collaboration Meeting – CERN Kjell Johnsen Auditorium – 2018.10.17

Outlook

- Introductory note
- Main stakeholders
- Technical Machine Interfaces WG
- WP11 Installation: installation and coordination meeting
- Detailed scheduling of installation activities
- Engineering Change Request
- N-Line integration
- Interconnects between main cryostats and by-pass
- Quench Heaters in 11T Dipole Coils

Introductory note

- Open points: those which still require decision, and work, potentially critical from both technical and schedule view points
- Generally, these points regard interfaces and installation matters, all the rest being pretty well under control
- The performance of the 11T dipole has been discussed earlier today, see talk by F. Savary et al. on "*The 11T Dipole – Test results, Prototyping, and Industrial Production*"

Main stakeholders

- The Technical Machine Interfaces are treated in a Working Group set up in April 2018. This WG is chaired by D. Schoerling
  - See Indico https://indico.cern.ch/category/10184/
- The Installation matters relating to WP11 are treated in a Preparation and Coordination Meeting set up in September 2018. This meeting is chaired by D. Schoerling
  - See Indico https://indico.cern.ch/category/10549/
- The Electrical Circuit matters are treated in the Magnet Circuit Forum. This forum is chaired by F. Rodriguez Mateos
  - See Indico https://indico.cern.ch/category/7175/
  - It covers the High Voltage Withstand Levels and the HL-LHC Magnet Circuit matters
- The Integration and (De)-Installation matters are treated by WP15, led by P. Fessia
  - See Indico https://indico.cern.ch/category/3856/

Mandate of the Technical Machine Interfaces WG

- The WP11 technical interfaces working group meeting is the meeting where all aspects related to interfaces of WP11's deliverables are discussed
- If an issue concerning the WP11 interfaces is identified it will be escalated to the proper project bodies (HL-TCC, HL-PSM, MCF, HL-LHC integration meeting), groups, WP leaders or the project management
- The aim of this meeting is to ensure the compatibility of technical interfaces of WP11 and their readiness for operation
- After first successful operation of the deliverables of WP11 the work is considered completed
- Subjects in the agenda are defined in close collaboration with the relevant WPs and the other meetings (HL-TCC, HL-PSM, MCF, MP3, HL-LHC integration meeting)
- Prepare two HL-LHC Interface Specifications (IS): WP11 Point 7 11 T Dipole and WP11 Point2 Connection Cryostat Full Assembly
- Establish two Engineering Change Requests (ECR): WP11 Point 7 11 T Dipole and WP11 Point2 Connection Cryostat Full Assembly
- The outline, content and progress of the ECRs is discussed in the meeting
- The meetings will take place bi-weekly (Tuesdays, *3:15-5:15 pm*, odd weeks)

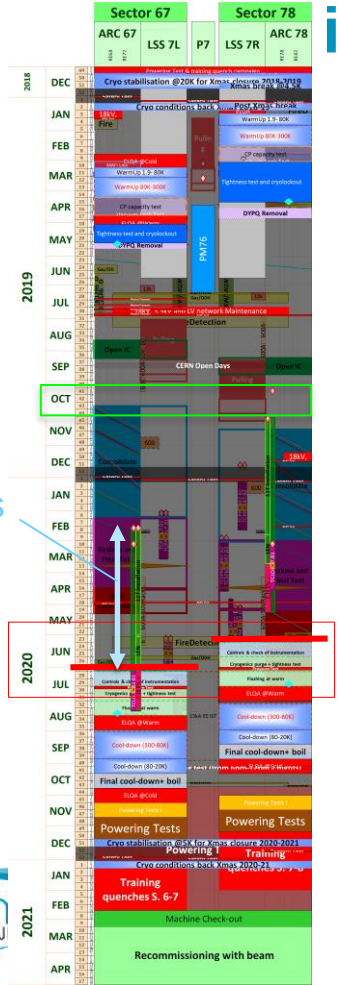
WP11 Installation: installation and coordination meeting

- A work package analysis (WPA) review is being conducted. The scope of this review covers:
  - The Identification/confirmation of 1 work supervisor for each of the groups involved
  - A thorough check that all the activities required for the installation of the deliverables of WP11 are well taken into account in the LS2 preparatory works, for all the groups involved
  - A compilation/review of all the necessary procedures, and the identification of any missing documentation (in order to trigger actions, as needed)
- See Indico https://indico.cern.ch/event/752372/

Detailed scheduling of installation activities

- A more detailed installation schedule is under development, taking into account the intervention during LS2 of all groups concerned
  - Need estimated durations for each of the activities declared
- Is followed up by the WP11 Installation: Preparation and Coordination Group

11T Installation @ P7: Planning constraints and integration LHC main planning *Courtesy S. Bustamante*



19 wks

- All the works (vacuum leak tests completed) shall be ended before LHC cryogenics unlockout

Sector #	Cryo unlockout underground
Sector 6-7	29-June-20
Sector 7-8	02-June-20

- Prior to these dates the following activities must be completed:
  - 11T installation & connection
  - Local leak tests
  - Vacuum SS global leak tests
- **<u>Removal of existing Main Dipole only after readiness of the 11T Dipole is confirmed</u>**
- 11T Full assembly actual readiness date

11T Ready to install date	
In LSS7L	17-Feb-20
In LSS7R	4-Nov-19

→ Maximum available time for installation of the full assembly and associated tests (including VSC) **<u>is 19 wks</u>**, followed by the TCLD installation

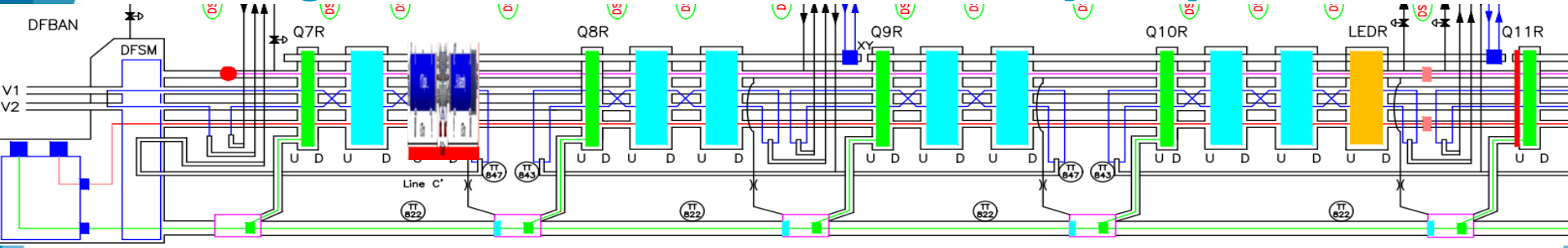
→ Deadline for Go/No Go decision by end of September 2019 in order to allow preparatory works between old dipole removal and 11T installation

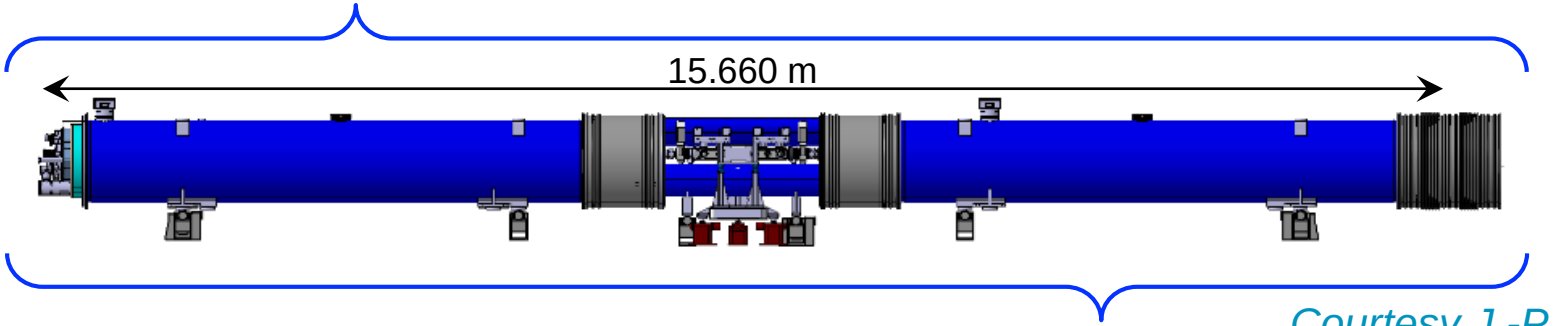
→ 11T installation is critical if installation +reconnection + tests in LSS7L are longer than 19 wks

Engineering Change Request

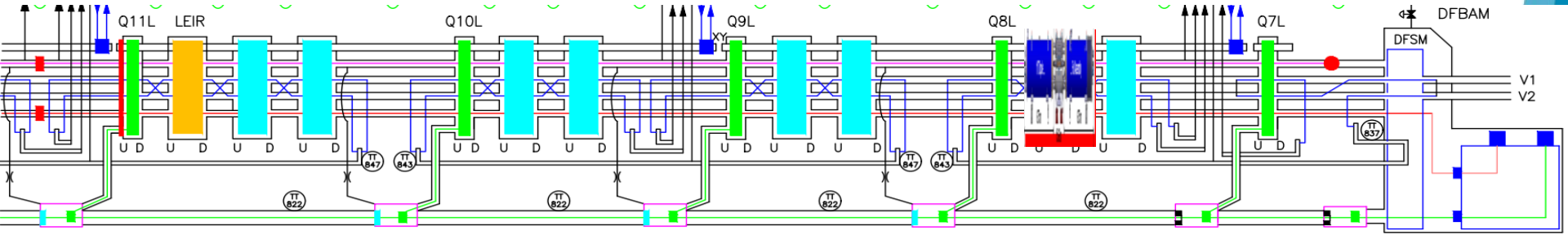
- ECR for P2: LHC-LE-EC-0005 v.0.1 “Installation of the Connection Cryostat Full Assembly in the LHC P2 (HL-LHC WP11)”, https://edms.cern.ch/document/1995583/0.1
- ECR for P7: LHC-LBH-EC-0001 v.0.1 “Installation of the 11 T Dipole Full Assembly in LHC P7 (HL-LHC WP11)”, https://edms.cern.ch/document/1995306/0.1
- These **two ECRs are now pending formal approval**
- The **operating margin** (in temperature, i.e. cooling performance) **of the 11T dipole magnet was perceived as a potential limiting factor for run 3 and after**. Discussions were held in different committees, and the point was clarified by L. Bottura both at the TE Technical Meeting of October 4th and at the 59th HL-LHC Technical Coordination Committee (TCC) meeting on the same day (11T Nb_3Sn coils vs MB Nb-Ti coils). **See presentation by L. Bottura in this session**

Integration of 11T full assembly at point 7





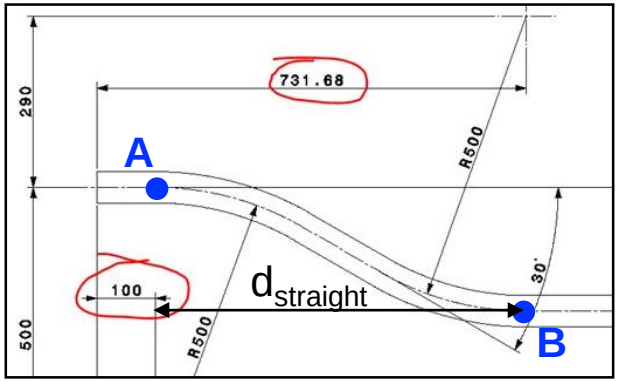
Courtesy J.-P. Tock



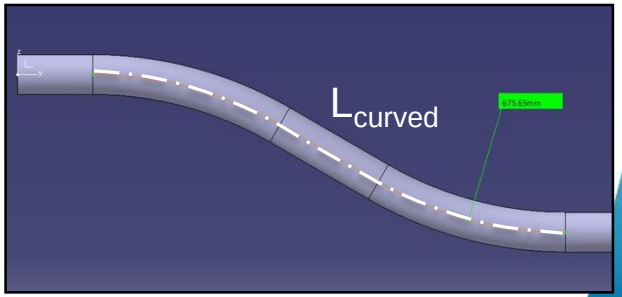
N-line integration

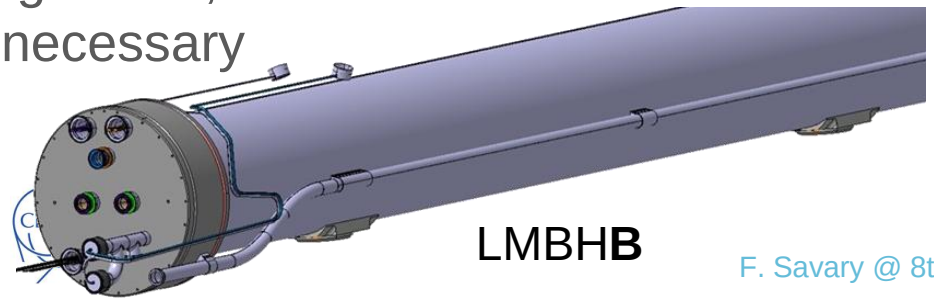
Courtesy J.-P. Tock

- The existing N-line is too short for both the 11T Dipole Full Assembly at P7, and the New Connection Cryostats for Collimators at P2. This is due to the routing of the N-line along the by-pass that requires pushing it radially outwards
- An extension of about 100 mm will allow the integration of the existing N-line
- Design work, and construction activities are necessary



- $d_{straight}$ = 631.68 mm
- L_{curved} = 675.65 mm
- Delta ≈ 44
- 2 x Delta = 88 ≈ 100 mm





LMBH**B**

Interconnects between main cryostats and by-pass

- Drawings need to be produced
  - Ongoing at the design office in EN-MME
- Procedures need to be developed
  - In MSC-LMF
  - Only minor adaptations of existing procedures are needed

Quench Heaters in 11T Dipole Coils – Impregnated or Not

- Decision to be taken by mid-November this year
- Within the framework of the 11T Dipole Task Force
- In relation to this, a review of the electrical QC plan will be conducted with both the 11T Dipole Task Force and the Magnet Circuit Forum
- See also talk by F. Savary et al. on "*The 11T Dipole – Test results, Prototyping, and Industrial Production*"

Summary

- No real show stopper amongst the open points
- The schedule is more than challenging, and it is closely followed

Thank you very much for your attention