



MQXF Status and Plans

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on behalf of the MQXF collaboration

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Acknowledgments

- **CERN**

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- **BNL**

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- **FNAL**

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- **SLAC**

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- **CEA Saclay**

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- **LASA**

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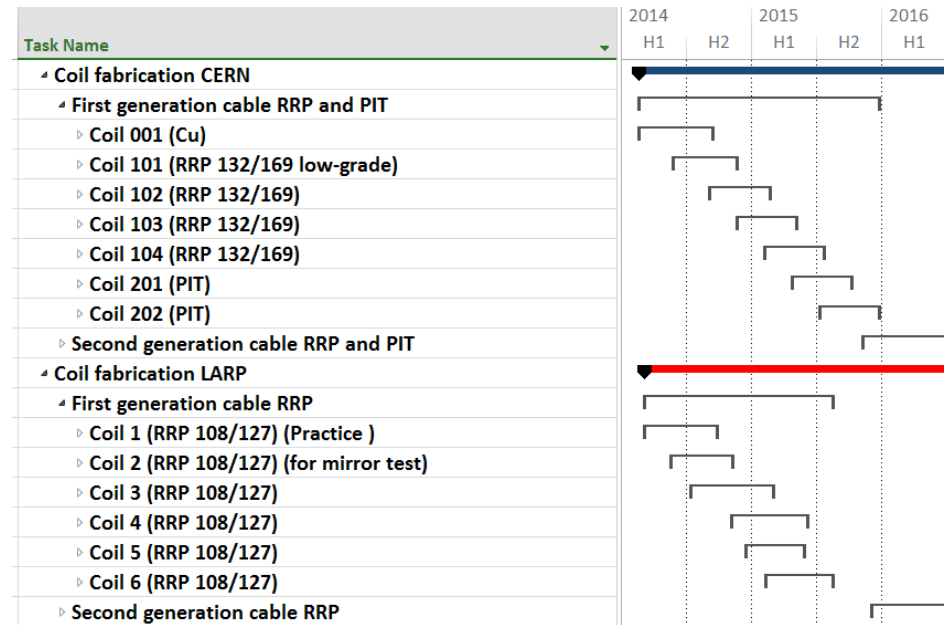
Outline

- Short models
- Prototypes
- Overview of series production

Short model program

Coil fabrication

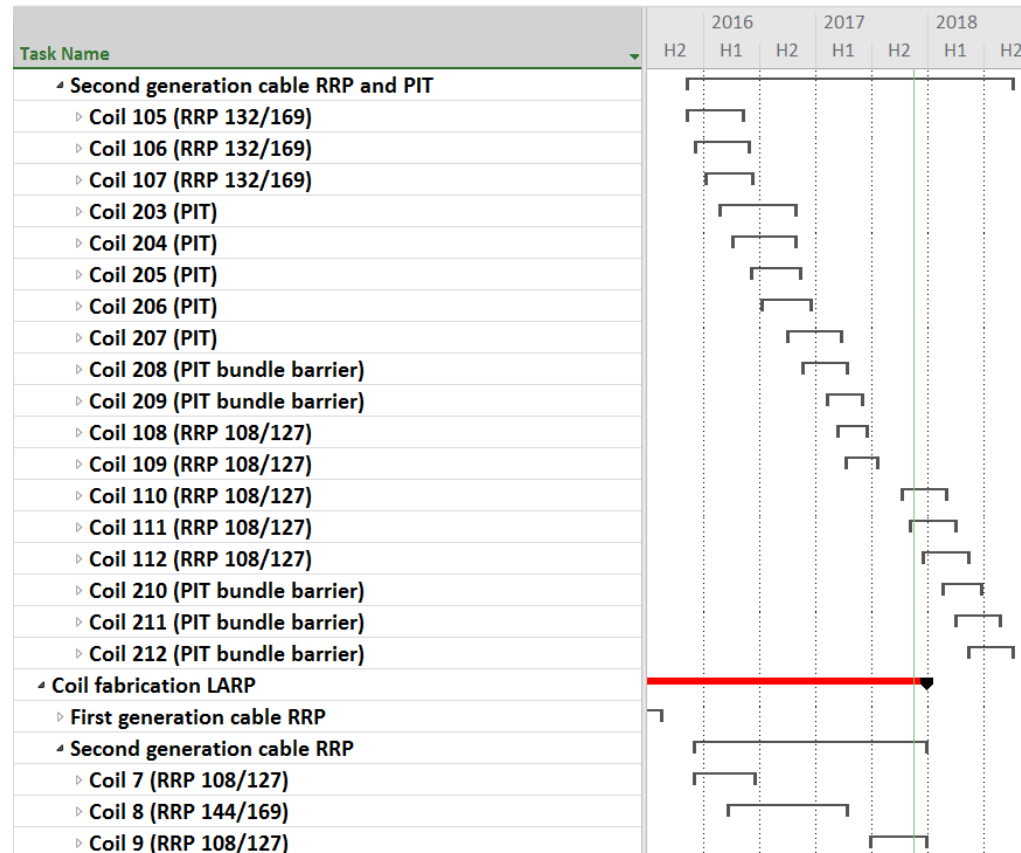
- 1st generation coils: **13**
 - CERN: **7**
 - 1 Cu and 1 low-grade
 - 3 RRP 132/169 and 2 PIT
 - LARP: **6**
 - All RRP 108/127
- Available for test: **8**
- **1** tested in MQXFSM1
 - Coil 2
- **4** tested in MQXFS1
 - 103,104,3,5
- **4** not tested (MQXFS2)
 - 102 (splice issue)
 - 201- 202 (low J_c and RRR)
 - Coil 6



Short model program

Coil fabrication

- 2st generation coils: **21** planned
 - CERN: **18**
 - RRP: 3 (132/169) and 5 (108/127)
 - PIT: 5 (no barrier) and 5 (barrier)
 - LARP: **3**
 - RRP 1 (144/169) and 2 (108/127)
- **5** to be tested in MQXFS3
 - 105,106,107,7 (8)
- **5** to be tested in MQXFS5
 - 203,204,205,206 (207)
- **5** to be tested in MQXFS4
 - 108,109,110,111 (112)
- **5** to be tested in MQXFS6
 - 208,209,210,211 (212)
- **1** to be tested in MQXFS1e
 - 9



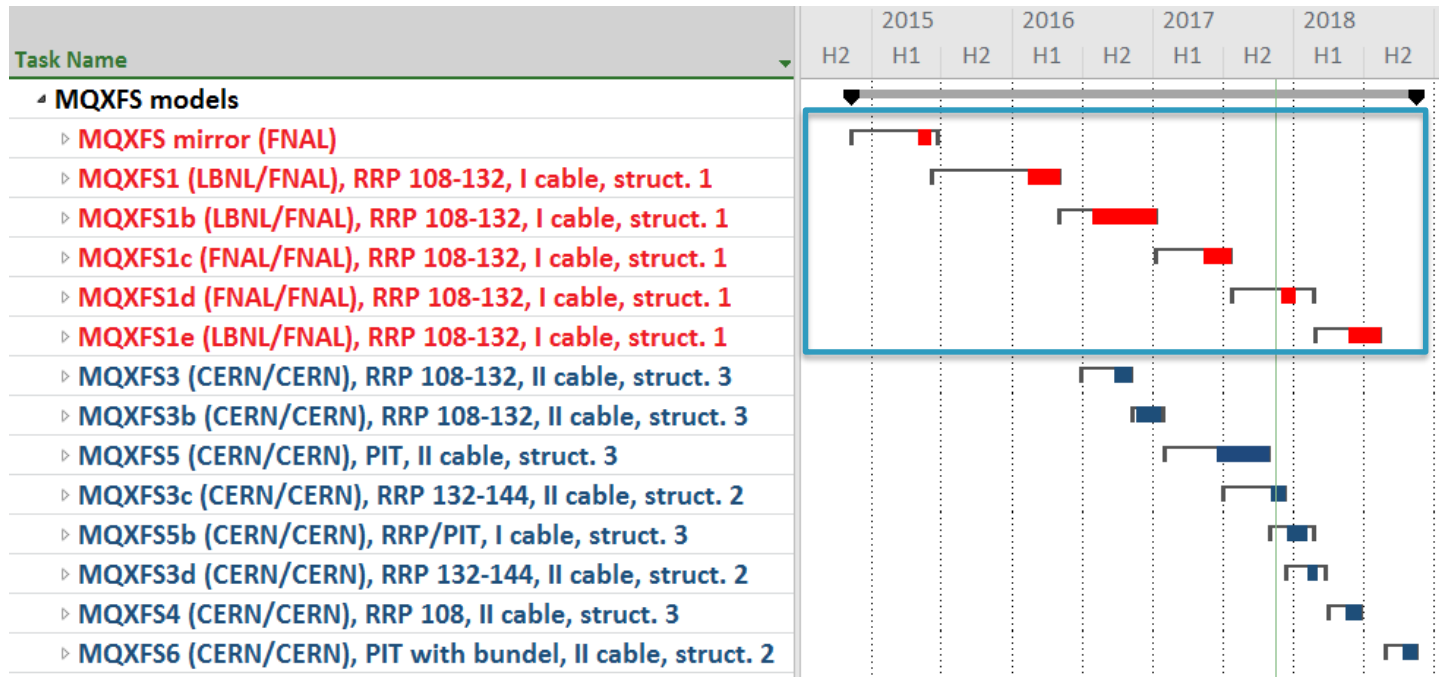
Short model program

Coil fabrication

- Summary
 - **27** coils fabricated from early 2014
 - **19** by CERN
 - **8** by LARP
 - **7** coils to be fabricated by mid 2018
 - **6** by CERN
 - **1** by LARP
 - Total: **34** coils
- Spare or not tested (without major NC)
 - 2nd generation: 207, 107, 212
 - 1st generation: 6

Short model program Magnets

- MQXFS mirror
- MQXFS1
 - RRP coils, first generation cable (a)
 - azimuthal and axial increase (b and c)
 - Stainless steel shell and coil with smaller wedge gap (d and e)



- Test FNAL
- Test CERN
- Test BNL
- Shipment

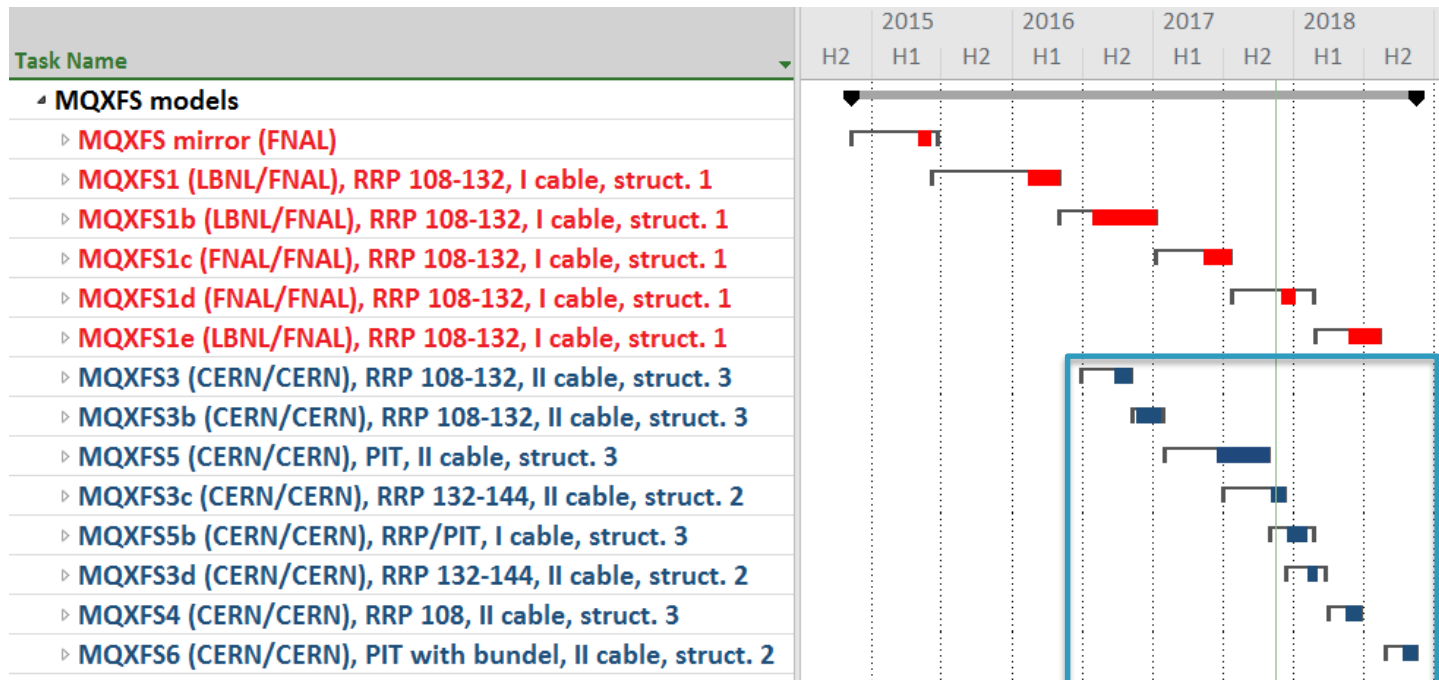
Short model program Magnets

• MQXFS3

- RRP coils, second generation cable (a)
 - Axial increase (b), change of coil with azimuthal increase (c), stainless steel shell + beam screen (d)

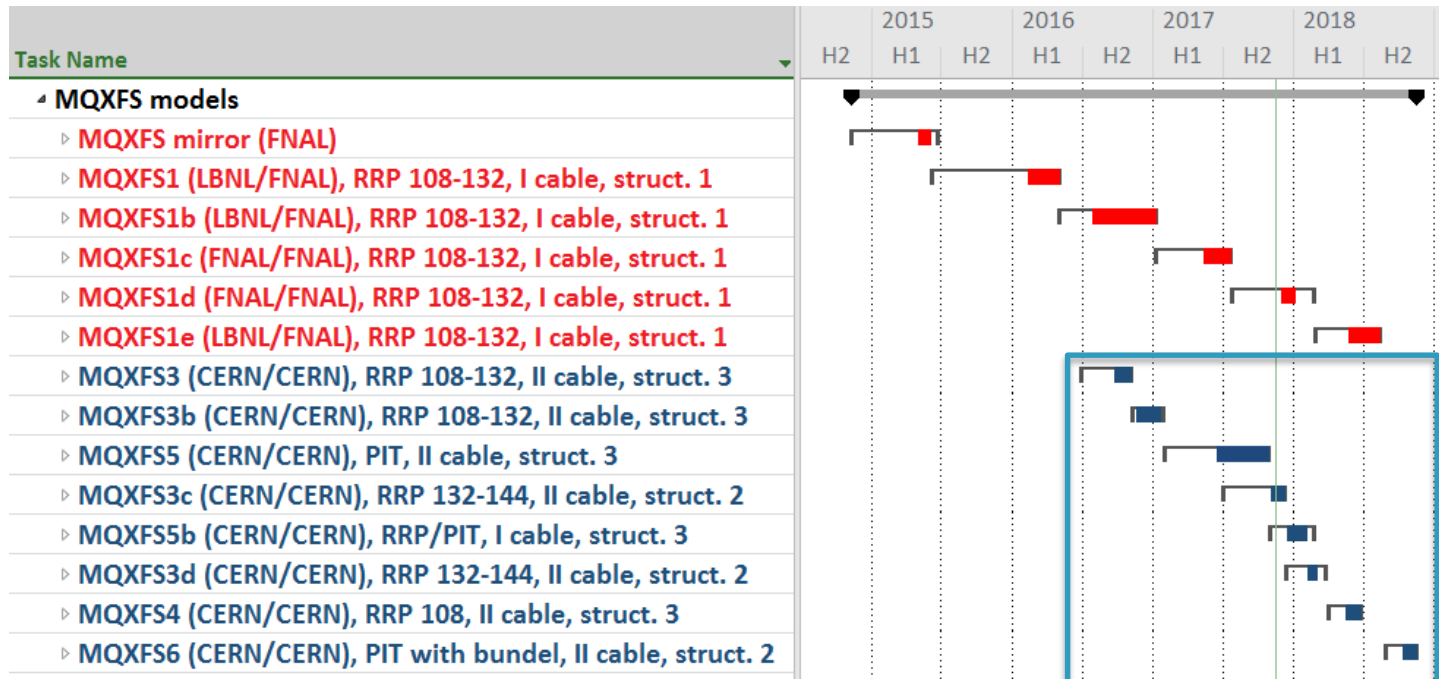
• MQXFS5 (PIT)

- RRP coils, second generation cable (a)
 - Beam screen (d)



Short model program Magnets

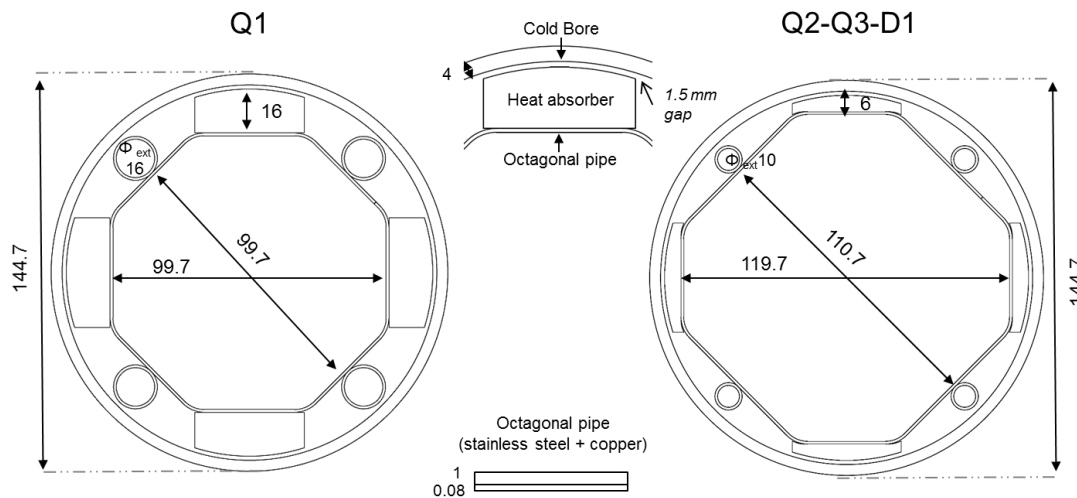
- **MQXFS4**
 - RRP (final) coils, second generation cable (a)
- **MQXFS6** (PIT)
 - PIT (with bundle) coils, second generation cable (a)
- Test to be added: 2000 powering cycles



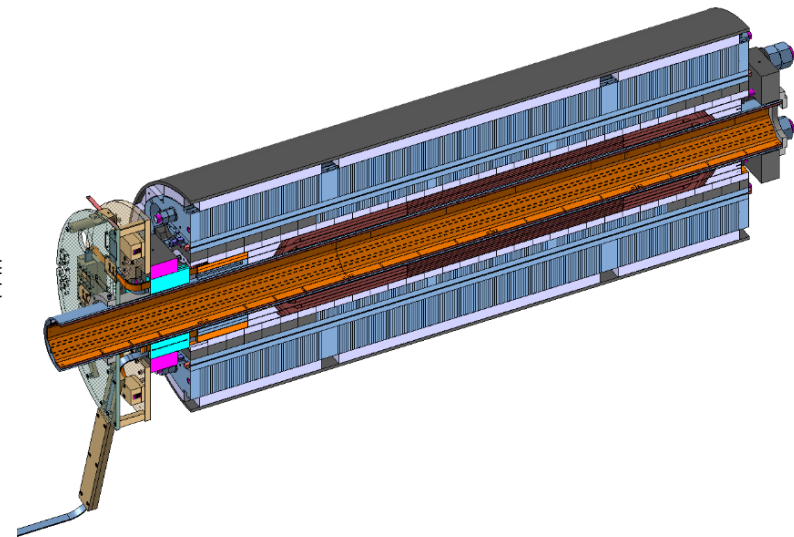
- Test FNAL
- Test CERN
- Test BNL
- Shipment

Test of cold bore tube and beam screen

- After test of MQXFS5
 - Insertion of cold bore and beam screen 1 in vertical position (no bumpers) → [MQXFS5b](#) in Jan-Feb/2018
- After test of MQXFS3c
 - Insertion of cold bore and beam screen 2 in horiz. position (bumpers) → [MQXFS3d](#) in Mar-Apr/2018

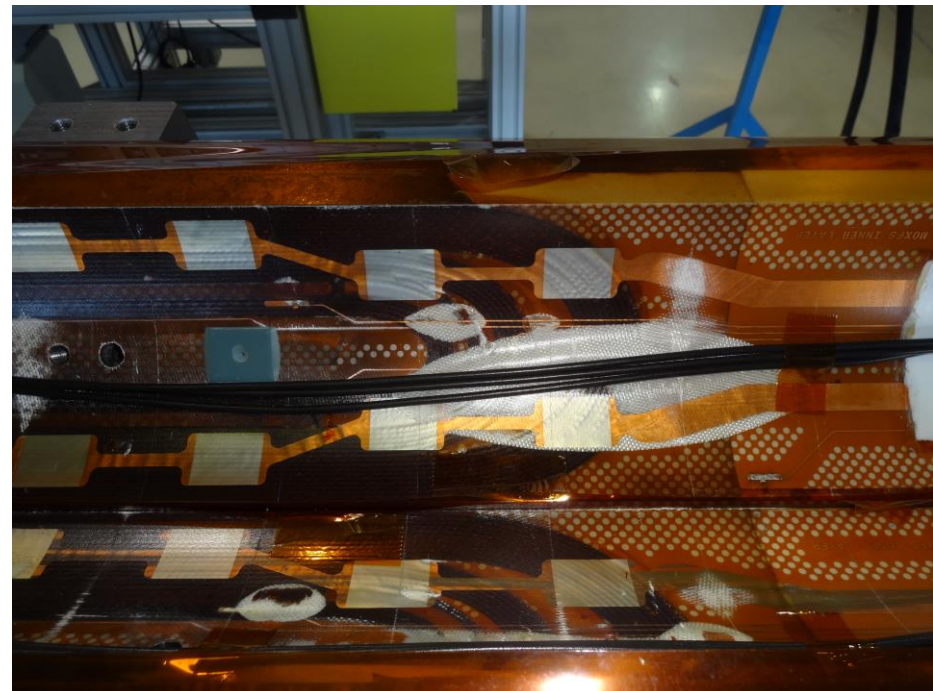
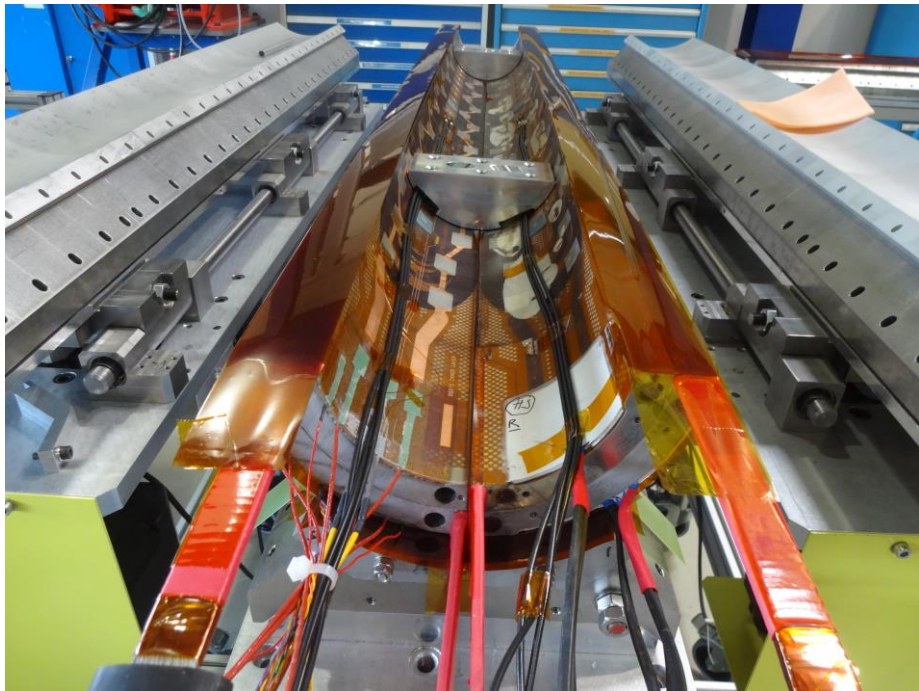


*The dimensions are given in mm



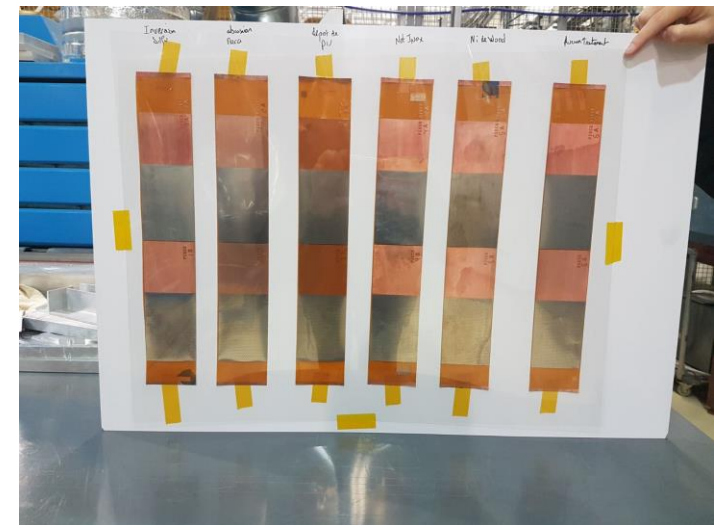
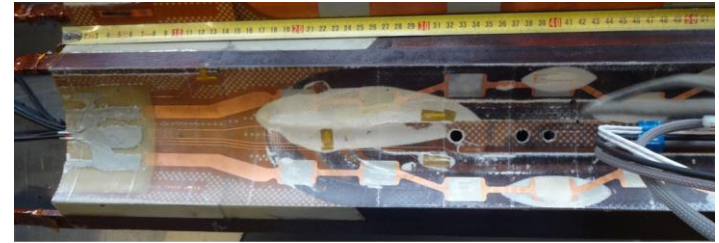
Test of cold bore tube and beam screen

- Radial displacement of the cold bore caused by the Q1 beam screen : **1.5 mm**
- A **33 % reduction** of forces is estimated by considering the “electro-magnetics dynamics” of the coil



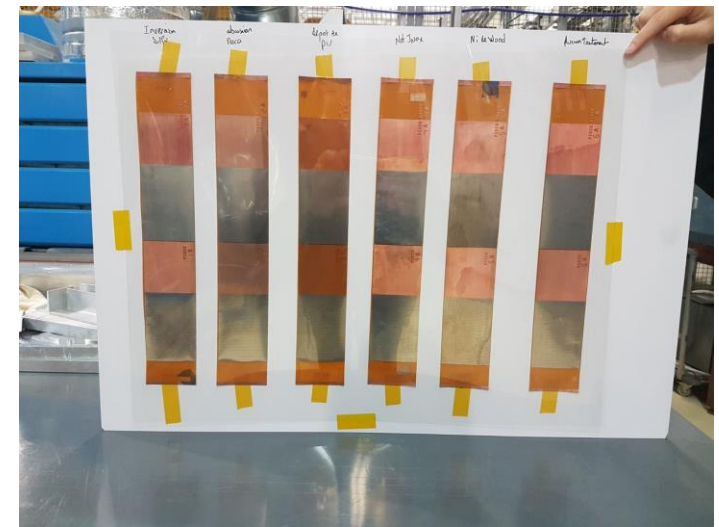
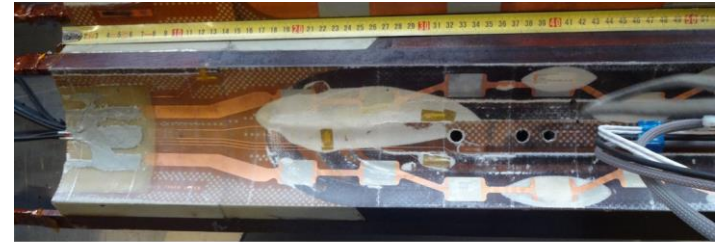
Test of new inner layer trace

- Outcome from MQXFS3 and MQXFS5
 - Bubbles associated to weak bonding epoxy-metal
 - Also if QH not fired
- On going R&D
 - Encapsulated trace (polyimide cover layer pressed)
 - Surface treatment of metal parts
 - sample 1: *inversion sulfurique*
 - sample 2: *abrasion mécanique*
 - sample 3: *deposit of thin layer of Polyuréthane on ss*
 - sample 4: *Cleaning of ss (with Acide Fluoridrique)*
 - sample 5: *Laisser le Ni de wood*
 - sample 6: *no treatment*



Test of new inner layer trace

- Test in MQXF4
 - Coil 108: standard trace,
 - Coil 109: No inner layer trace
 - Coil 110: encapsulated trace
 - Coil 111: surface treated trace
- Results in summer 2018
 - First set of series QH must be standard



Outline

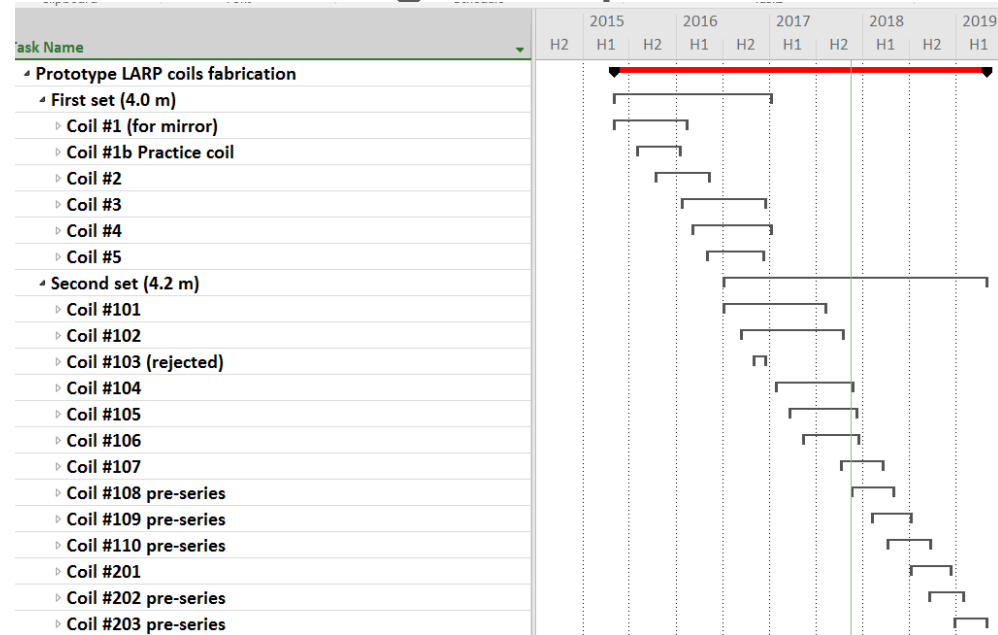
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LARP prototype program

Coil fabrication

- Coils for practice & mirror: **2** coil, 4-m long, completed
 - Coil 01 for mirror (1st generation cable)
 - Coil 01b practice (1st generation cable)
- Coils for MQXFAP1: **4** coils, 4-m long, completed

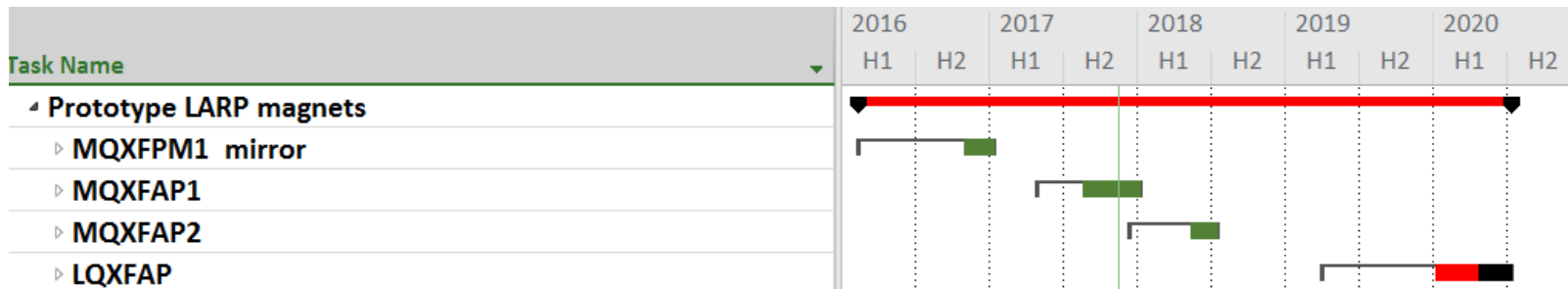
- Coils for MQXFAP2
 - 101 to 106 (FNAL and BNL)
- Coil for MQXFA3
 - From 107 (FNAL) and from 201 (BNL)



LARP prototype program

Prototype plans

- **MQXFAP1** (4 m long)
 - Test in summer 2017 with coils 02,03,04,05
- **MQXFAP2** (4.2 m long)
 - Test in by mid-2019 with 101,102,104,105
- **LQXFAP** (prototype cold mass)
 - Test in by early 2020 with MQXFAP1 and MQXFAP2
- MQXFA3 will be first series magnet



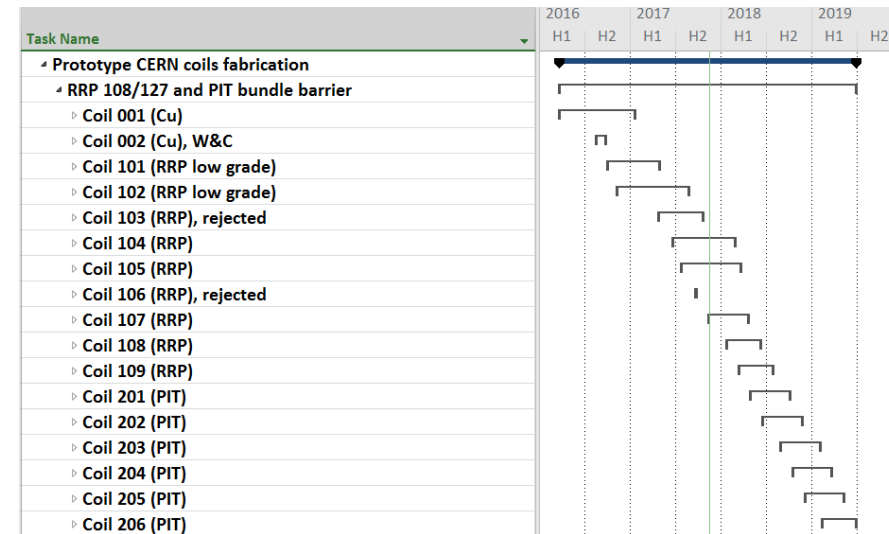
LARP prototype program (MQXFAP1)



CERN prototype program

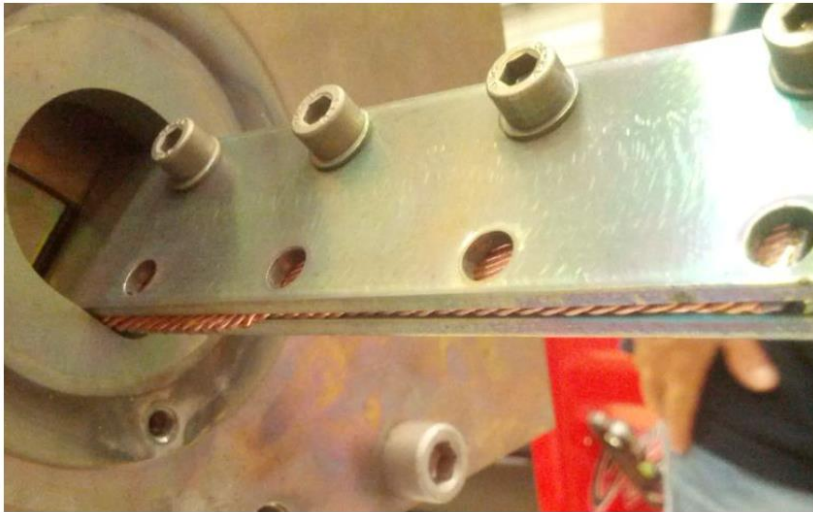
Coil fabrication

- 1 coil with Cu cable and 2 with low grade Nb₃Sn completed
- 1st and 4th prototype coils (103 and 106) rejected for major NC
- New 1st and 2nd prototype coils (104 and 105) ready for reaction
- The 3rd (107) ready for winding
- In total, 5 RRP and 6 PIT coils to be produced



Rejected coils (Non conformities)

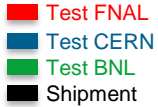
- Coil 103
 - Leads clamped during HT by a tool to prevent twisting



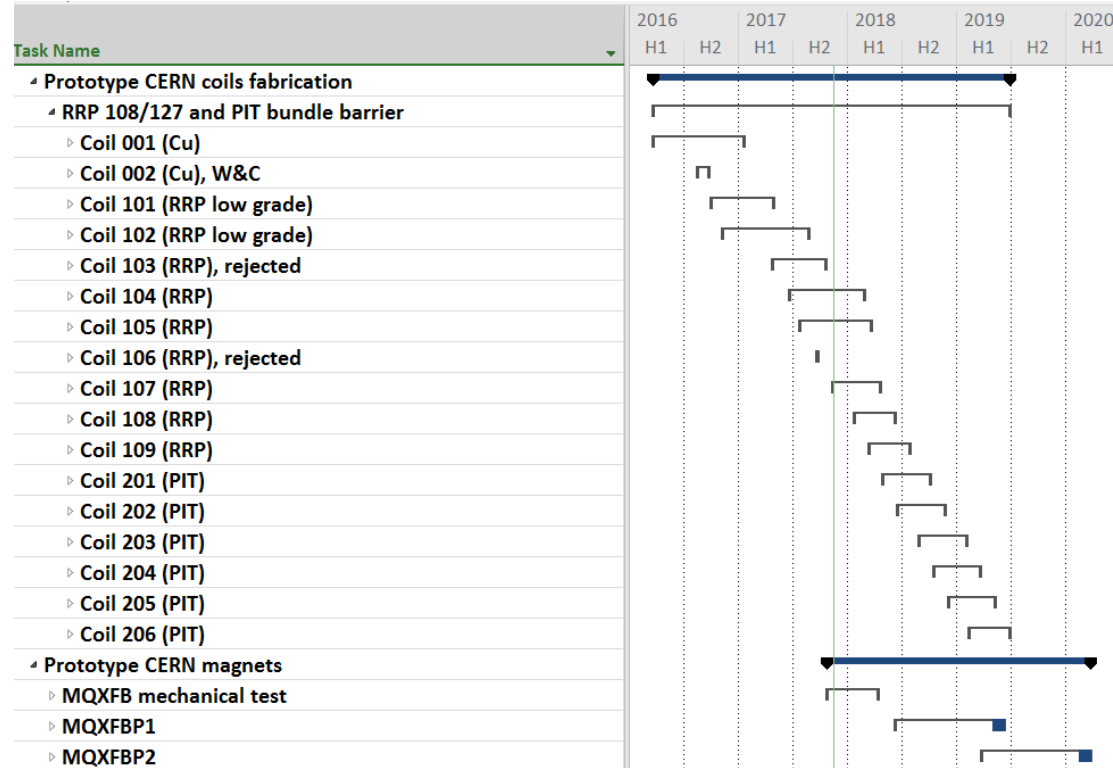
- Coil 106
 - Error in communication
 - 2nd layer cable length assigned to the spool for the 1st winding, and viceversa

CERN prototype program

Prototype plans



- Assembly structure started
- 4 practice coils available
 - 001,101,102,103
- MQXFB mech. test
 - Goal: full loading
- MQXFBP1
 - Test in May 2019
 - *Proposal: test of MQXFBP1b with beam screen*
- MQXFBP2
 - Test in Feb. 2020



- Under investigation
 - Vertical test at CEA ?

CERN prototype program



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Overview of MQXF series

