



WP4: High-Order Mode (HOM) dampers Fundamental Power couplers (FPC)

Steering Committee, October 20, 2026

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WP4 – HOM dampers and FPC

CERN, CNRS (IJCLab, LPSC), INFN

Convener: Y. GOMEZ MARTINEZ (CNRS/ LPSC)

Main contacts with other partners: V. PARMA (CERN), P. DUCHESNE (CNRS/IJCLab), D. GIOVE (deputy INFN)

Task 4.1: General coordination of WP4

March 24 → March 28 (M)

CNRS, INFN

M: Milestone
D: Deliverable

Task 4.2: HOM coupler design

March 24 → August 25 (M)

INFN, CNRS, CERN

At 800 MHz with the goal to minimize static and dynamic heat loads on the cryogenic circuits of the cryomodule

Task 4.3: Fabrication of HOM couplers

May 25 → December 2026 (M)

CERN, CNRS, CERN

4 HOMs at 800 MHz with the goal of employing cost and production-time reduction techniques

Task 4.4: Test of HOM couplers

Nov 25 → March 27 (M) & September 27 (D)

CNRS, INFN

On mono-cell and multi-cell 800 MHz at 300 K

Task 4.5: FP coupler design

March 24 → June 25 (M)

CERN, CNRS

At 800 MHz with the goal to improve sustainability

Task 4.6: Fabrication of FP couplers

July 25 → January 27 (M)

CERN, CNRS

4 new 800 MHz FPC with the goal of employing cost and production-time reduction techniques.

Task 4.7: Test of FP couplers

February 27 → June 2027 (M) & December 27 (D)

CERN, CNRS

Preparation & RF conditioning at 800 MHz and 50 kW CW

Task 4.8: BLA design

January 26 → May 26(M)

INFN, CNRS

At 1,3 GHz with the goal to cover a very significant gap in the sector

Task 4.9: Fabrication of BLA

May 26 → February 27 (M)

INFN, CNRS

Build 1 prototype of the 1,3 GHz BLA with the goal of employing cost and production-time reduction techniques

Task 4.10: Test of ceramics of BLA

Jan 26 → March 27 (M) & December 27 (D)

INFN, CNRS, CERN

At room and at cryogenic temperature



WP4 – HOM dampers et FPC: status/evolution of Task 4.1

General coordination of WP4

- 27 WP4 meetings and 2 technical review (800 MHz & FPC) held
- 3 milestones achieved: 800 MHz HOM design report (4.2), FPC design report (4.5), BLA design (4.8)
- Participation in the amendment AMD2
- WP4 work plan
- Post doc position transfer INFN to IJCLab: budget?



WP4 – HOM and FPC: status/evolution of Task 4.3

Fabrication of 800 MHz HOM couplers.

- **Past developments (at CERN)**

- All main subcomponents produced (**6 HOM** couplers including **2** fabrication **spares**)
- All tooling for final assembly steps designed and produced

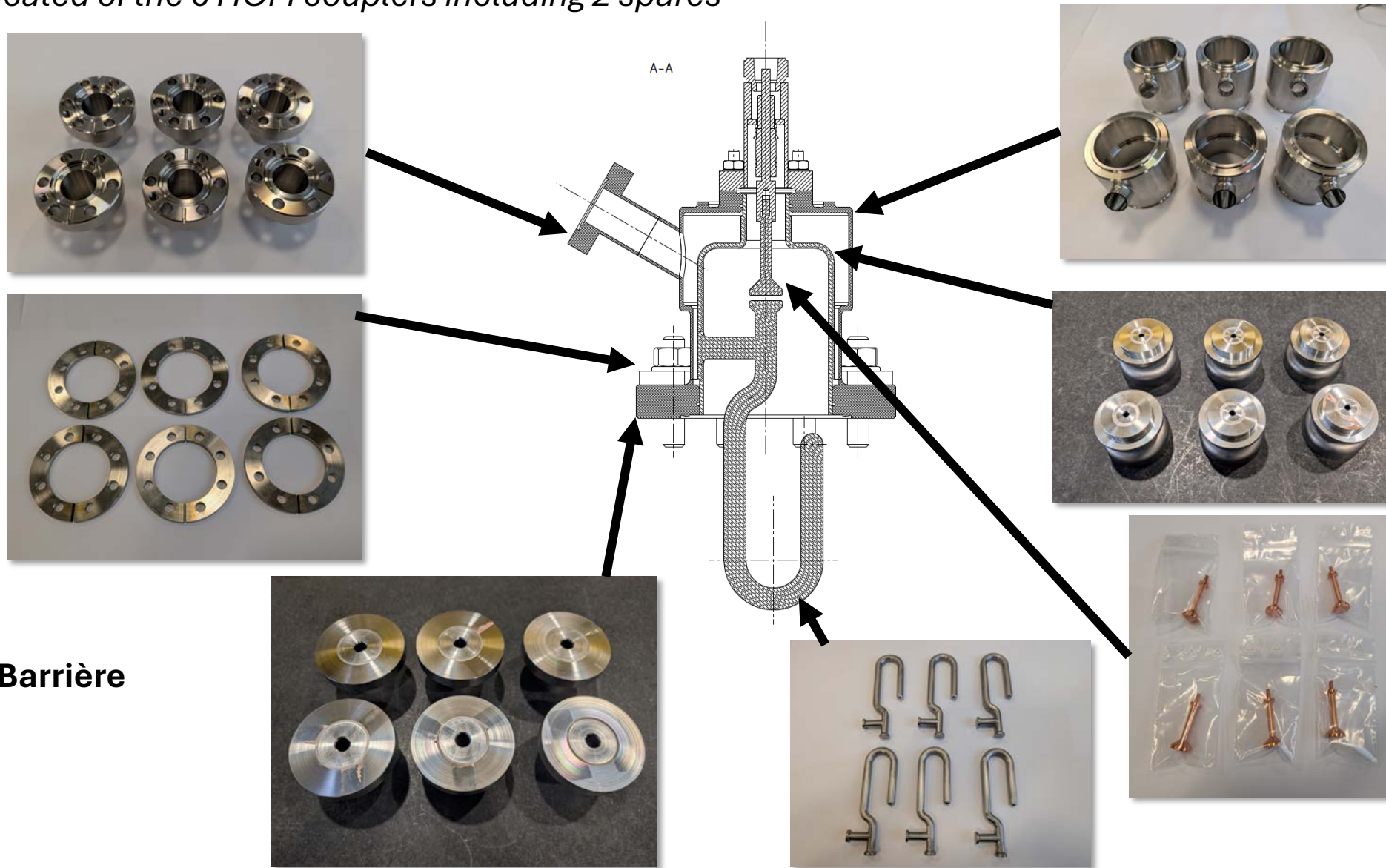
- **Current developments (at CERN)**

- Metrologies and NDT ongoing (visual and ultrasonic test of brazed joints)
- **EB weld of niobium parts**, most critical step, soon

WP4 – HOM and FPC: status/evolution of Task 4.3

Fabrication of 800 MHz HOM couplers.

Pieces fabricated of the 6 HOM couplers including 2 spares



c/o S.Barrière



WP4 – HOM dampers et FPC : status/evolution of Task 4.4

Test of 800 HOM couplers

- **Past developments**
 - Nothing to report
- **Current developments at IJC Lab**
 - Updating the copper 5-cell cavity to test HOM couplers on progress

WP4 – HOM dampers and FPC: status/evolution of Task 4.6

Fabrication of FP couplers

- **Past developments at CERN**

- Feasibility production study
- SPL antenna/window transport box prepared for extraction:

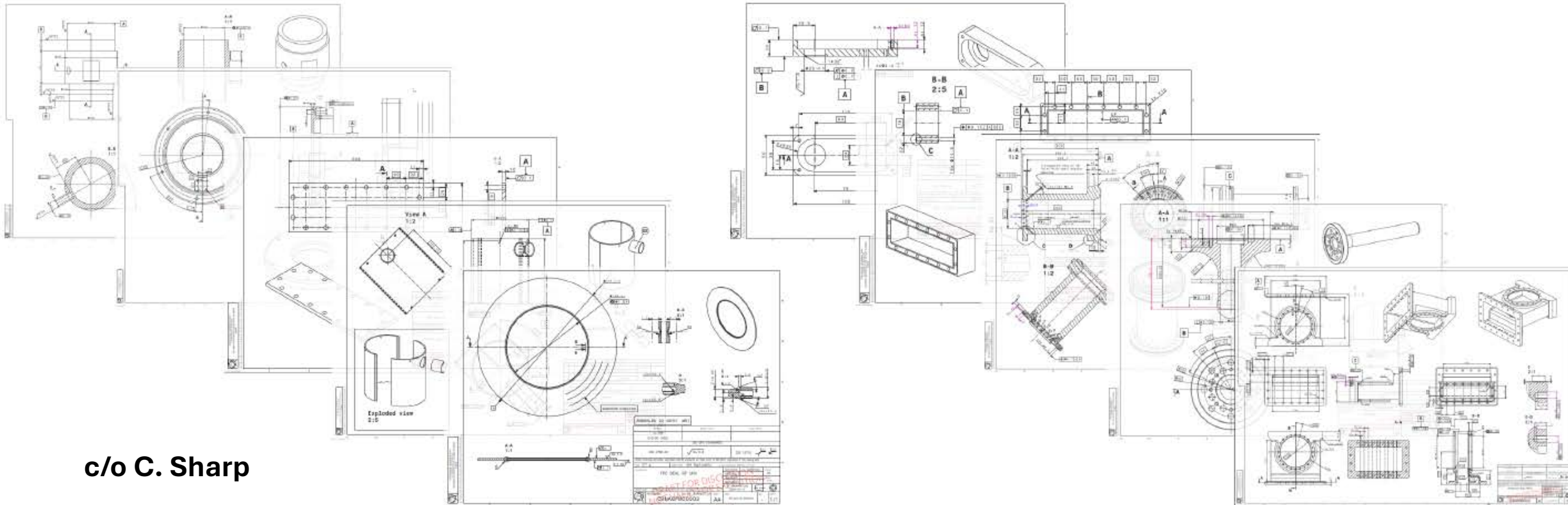


c/o C. Sharp

WP4 – HOM dampers and FPC: status/evolution of Task 4.6

Fabrication of FP couplers

- **Current developments at CERN**
 - **First antenna/window extraction**, critical step, soon
 - Manufacturing drawings ongoing



c/o C. Sharp



WP4 – HOM dampers and FPC: status/evolution of Task 4.7

Test 50 kW CW of FP couplers

- **Past developments at CERN**

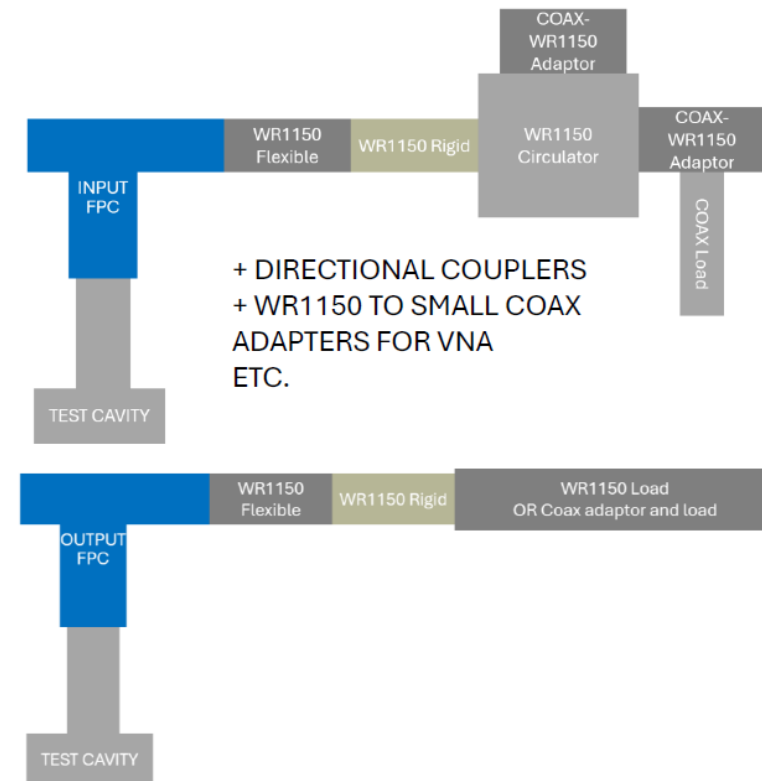
- CERN HL-LHC IOT transmitter and PERLE 800 MHz circulator (PERLE loan) defined
- Checked constraints on water and electricity supplies: some interruption to water network in 2027 but should not be too restrictive

WP4 – HOM dampers and FPC: status/evolution of Task 4.7

Test of FP couplers

- **Current developments at CERN**

- Test cavity conductors on progress
- Started to consider hardware needs and trying to track down existing WR1150 waveguide components





WP4 – HOM dampers and FPC: Task 4.9

Fabrication of 1.3 GHz BLA

- **Current developments at INFN**
 - **Two purchase processes initiated** in early September 2026:
 - Full BLA (excluding ceramic).
 - Ceramic only.
 - Expecting company responses
 - Total process: ~3 months (including company selection).

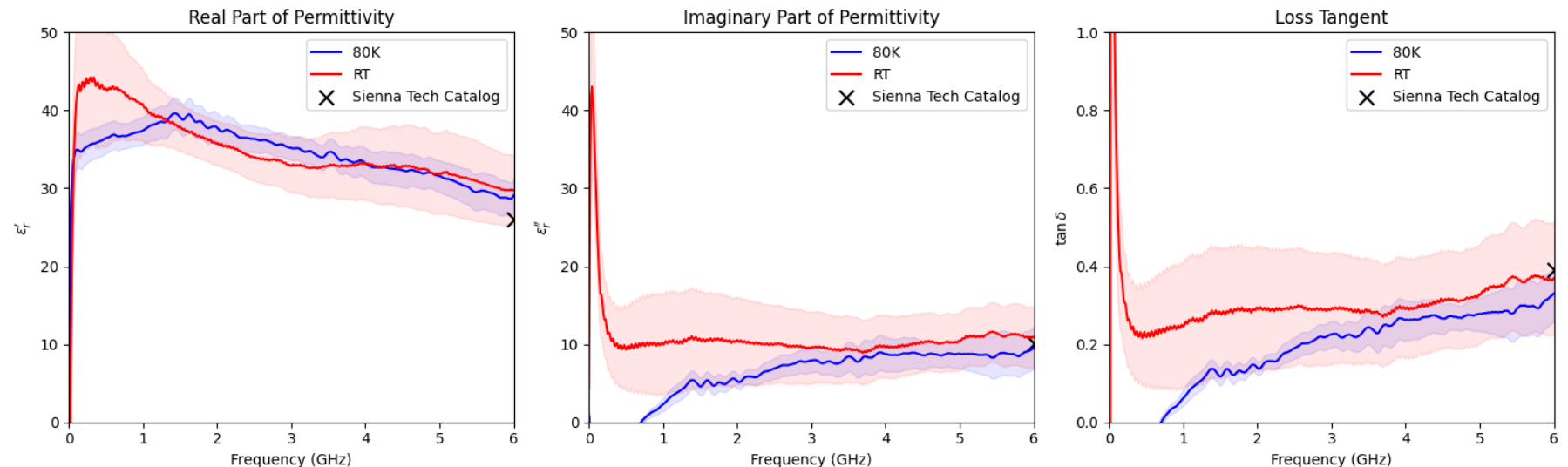
- **Past developments at IJC Lab**

- Ceramic characterization completed at room and cryogenic temperature
 - Silicon Carbide - KYOCERA - SC1000, candidate for FCC: **Lossy behavior at RT only**
 - Aluminum Nitride - Sienna Techn STL – 150D14KL: It broke during RT measurement
 - Aluminum Nitride - SiennaTech STL150D11: **Lossy behavior at RT and 80K**



Absorber samples

Comparison of Relative Permittivity for STL150D11 at 80K and RT



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- Technical drawing of the PERLE Cryomobile assembly, showing a side view (A-A) and a top view. The side view indicates a total length of 225.5 mm, with a central section of 125 mm and flanges of 125 mm. The top view shows a circular flange with 12 holes, a central hole of 125 mm, and an outer diameter of 125 mm. A 3D perspective view of the assembly is shown at the bottom right.
- | Fabrication des Réceptacles des 2 Lignes Néon - Model Code | | Fabrication des Réceptacles des 2 Lignes Néon - Model Code | |
|--|------------|--|------------|
| Fabrication des Réceptacles des 2 Lignes Néon - Model Code | | Fabrication des Réceptacles des 2 Lignes Néon - Model Code | |
| Part No. | 1000000000 | Part No. | 1000000000 |
| Rev. | 001 | Rev. | 001 |
| QTY | 1 | QTY | 1 |
| DATE | 0000-00-00 | DATE | 0000-00-00 |
| FILE | 0000000000 | FILE | 0000000000 |
| DRW | 0000000000 | DRW | 0000000000 |
- PERLE**
Cryomobile
- BELLOWASSEMBLY 0100-107 - ASSEMBLY**
- | Part No. | QTY | Rev. | DATE | FILE | DRW |
|----------|-----|------|------------|------------|------------|
| 0100-107 | 1 | 001 | 0000-00-00 | 0000000000 | 0000000000 |
- 1 of 1

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WP4 – HOM dampers and FPC : plans to achieve milestones & deliverables

- Milestones & deliverables **on track?**

Timeline in project months (M)				M/D	#	Related WP	Related task	Description	Status	Risk level	Comments
Y3	M27	May	2026	M	43	WP4	4.8 BLA design	Design of BLA	Done		Jan 2027: new milestone
Y3	M34	Dec	2026	M	17	WP4	4.3 Fabrication of HOM couplers	Fabrication of HOM couplers	In progress	On track	{{ Interconnexion }} w/ WP6 Task 6.5: impact WP4--> WP6 Jan 2027: Postponed date from M24 to M34
Y3	M35	January	2027	M	19	WP4	4.6 Fabrication of RF couplers	Fabrication of FPCs	In progress	In difficulty	{{ Interconnexion }} w/ WP6 Task 6.5: impact WP4 -> WP6 Jan 2027: postponed date from M27 to M35
Y4	M36	February	2027	M	44	WP4	4.9 Fabrication of BLA	Fabrication of BLA	In progress	On track	Jan 2027: new milestone July 2027: Milestone date postponed from M30 to M36
Y4	M37	March	2027	M	45	WP4	4.10 Test of ceramics for BLA	Test of ceramics for BLA	In progress	On track	Jan 2027: new milestone
Y4	M37	March	2027	M	18	WP4	4.4 Test of HOM couplers	Test of HOM couplers	In progress	On track	Test infra to be prepped & <u>available</u> Jan 2027: Milestone postponed date: from M27 to M37
Y4	M40	June	2027	M	20	WP4	4.7 Test of RF couplers	Test of FPC couplers	In progress	Risk to mitigate	Test infra to be prepped & <u>available</u> Jan 2027: Milestone postponed date from M33 to M40
Y4	M43	Sept	2027	D	14	WP4	4.4 Test of HOM couplers	Report qualification HOM couplers on cavities at 300 K	Not started	On track	Jan 2027: Deliverable postponed date from M33 to M43
Y4	M43	Sept	2027	D	36	WP4	4.10 Test of ceramics of BLA	Test of ceramics for BLA	Not started	On track	Jan 2027: new deliverable
Y4	M46	Dec	2027	D	15	WP4	4.7 Test of RF couplers	Report on RF test of 800-MHz FPC at 50 kW CW	Not started	On track	Jan 2027: Deliverable postponed date from M39 to M46



WP4 – HOM dampers and FPC : plans to achieve milestones & deliverables

- Plans to **achieve** milestones & deliverables
 - Cooperation with Task leaders or other WP(s) to be reactivated?
 - Delay risks to be anticipated?
 - Risk mitigation measures to be implemented? Any risks realized to share? Any new risks emerged to share?

Risk	Mitigation measures
Issue with SPL extraction antenna/window and no spares available	A CERN team of highly competent experts has been formed. The lack of spare parts will be taken into account and they will proceed with the utmost caution
Human ressources not allowed for WP4 at CERN	Discussion inside the CERN to reinforce project priority will be launched
Specific test bench materials unavailable	A census of required materials is underway to identify critical items. Strengthened collaboration between CERN and IJC Lab is being established for material lending



WP4 – HOM dampers and FPC : progress to take into account Advisory Board recommendations

- **Progress** to take into account Advisory Board recommendations
- The limited availability of key components, such as SPL antennas (only 4 windows and antennas from SPL are available), represents a significant vulnerability, as no spares are currently available .
 - **The CERN workshop has the experience and the level of competences to succeed the operations. A CERN team of highly competent experts has been formed. The lack of spare parts will be taken into account and they will proceed with the utmost caution**
- An interference from one of the HOMs that cannot be mounted on the cavity for the ESS test has been mentioned and should be clarified.
 - **Misunderstanding, all HOM C can be mounted on the ESS test bench**
- The Board considers that a more systematic approach to risk analysis is needed in this work package, including the identification of mitigation strategies.
 - **The risk analyses have been updated (see previous slide)**
- In parallel, a quantitative assessment of the expected energy savings associated with the design choices should be developed in order to better justify the proposed solutions.
 - **See D34 ‘Impact and potential barriers to optimal energy savings ‘**

Thank-you for your attention

Yolanda Gómez Martínez on behalf of the WP4 team:

- **CERN** : Simon Barriere, Sebastien Calvo, Karin Canderan, Marco Garlasche, Vittorio Parma, Calum Sharp
- **INFN** : Dario Giove (deputy)
- **CNRS / IJCLab** : Sebastien Blivet, Patricia Duchesne, Akira Miyazaki, Gilles Olivier, Guillaume Olry, Axel Perez Ruiz
- **CNRS / LPSC** : J. Angot, Yolanda Gómez Martínez (convener), Adrien Plaçais



WP4 – HOM dampers and FPC : conference talks, proceedings, publications

- Conference talks, proceedings, publications
 - Any news to communicate?
 - Any participation to a conference to share?
 - Any publications to share (w/ the EU logo as in slide 1 & available on ArXiv)?



WP4 – HOM dampers and FPC :

young researcher hires, changes in WP composition

- Young researcher hires, changes in WP composition
 - Post-doc



WP4 – HOM dampers and FPC : ideas for connections to industry

- Ideas for connections to industry
 - Any contacts with industry to share?
 - Any opportunities raised to share?