

Integration in SM18 & Horizontal Tests

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- RF zone under preparation full integration model
 - Horizontal Bunker: LSS6 cryomodule assembly can be installed into M7
 - Design ongoing (TE-CRG-ME for cryo distribution box)
 - Vertical Cryostats: V3 Operational, V4 coming online (assigned to Crabs)
 - Provide backup incase dressed cavities need re-testing



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SM18 Cryomodule assembly and test bunker



SM18: Bare Cavity Tests



- Vertical test program well established
 - Permits development of SRF techniques, RF surface preparation and RF performance analysis

PoP Crab bare cavity measurements

- Cavity Performance measurements
- Effect of ambient B-field and cool down on RF performance
- Cross-calibration tests of SM18 with other labs
- Development + qualification of cleanroom assembly steps
- Qualification of HPR and drying procedure
- Controls and LLRF prototype tests

Horizontal Bunker (M7)

• Test stand to be installed and equipped: Planned for 2016



SM18: Bare cavity Testing



Test Stands: Sowftare and Interfaces

Vertical Test stands:

uminosity

- LabView based measurement stand
- Horizontal Bunker: to be resurrected in 2016
 - Based on standard LHC controls platform







Status: Testing of Bare and Dressed Cavities

- V3 Cryostat: Operational and used for bare cavity testing
- V4 Cryostat: Dedicated to Crabs Not yet operational
- Insert upgrade: Launched in April 2015
 - Common insert design for V3 and V4
 - Needed for bare cavity + tuner test
 - Possibility of installing two cavities
 - New pumping line with RGA analysis
- Assembly expect Jan 2016
 - Cold test of DQW+ tuner before SM18 cryo stop (15/03/16)





SM18 RF Test stand: Infrastructure development

- Infrastructure upgrade: Ongoing in 2015; almost completed
 - Strong emphasis on diagnostics environmental conditions

https://wikis.web.cern.ch/wikis/display/EN/SRF+Collaboration

- Includes
 - Ambient B-field control
 - RGA analysis
 - HPR quality control
 - 2nd Sound OST readout
 - Quench localisation
 - Cavity Thermometry
 - Material properties





SM18 Cleanroom

- Clean room tooling design:
 - Handling of bare cavities: design compatible ongoing projects
 - String assembly: Designs ongoing, (See talk by P Minginette)
- Present schedule: Tooling should be in place by Q4 2016
 - Validation of assembly process and handling in Q4 of 2016



SM18 Cryo preparations

- Cryo Process Control
 - V3: operational. V4: installed and ready for testing
 - Operations to test instrumentation & update supervision panel
 - Includes new instrumentation for V4
 - M7: Process is to be defined by end of 2015 (O. Pirotte)
 - Planning is for delivery of validated system by end of 2016
 - Cryo module + service module to be tested in M7: no buffer tank
 - Test of SM18 infrastructure in terms of thermal shielding 50-80K
 - Requested for December 2015 (TBC)
 - M7 PID prepared assuming thermal shield is OK for operation



Schedule

| | | | | | Q1 2016 | | Q3 2016 | | Q1 2017 | , | Q3 2017 | Q1 2018 |
|---------|---|--------|---------------------|---------------------|------------------------------------|------------------------|-----------------------|----------------------|------------------------|--------------------|----------------------------|--------------------------------|
| # Info | Title | Q2 / | Q3 / 2015 | Q4 / 2015 | Q1 / 2016 | Q2 / 2016 | Q3 / 2016 | Q4 / 2016 | Q1 / 2017 | Q2 / 2017 | Q3 / 2017 | Q4 / 2017 Q1 / 2018 👻 |
| 0.00 | | June | July Augu Sept | Octo Nove De | ce Janu Febr Marc | April May June | July Augu Sept | Octo Nove Dec | e Janu Febr Marc | April May June | e July Augu Sept C | cto Nove Dece Janu Febr Marc 👻 |
| 1 | HL-WP4_Crab_SM18 | | Cavity Propagaion | | | | | | | | | |
| 1 | Cavity Preparation | Cavita | cavity rieparation | 1 15 10255 | | | | | D: D: D | | | |
| 2 | F Cavity construction - no 1 | cavity | construction - no 1 | 1.15 years | | | First sovity many | factured | , 0, 0, 0 | Sto | rt hond | dling onvition |
| 64 | First cavity manufactured | | | | | | First cavity manu | | A | Sia | n nano | Jung Cavilies |
| 65 | Second cavity manufactured | | | | | 6 | second ca | vity manufactured | ~ | | | • |
| 66 | Cavity RF measurements at warm | | | | | Ca | Carity RF measurement | s at warm | | In C | leanro | om |
| 67 | Cavity RF measurements at warm | | | | | U.S | Cavity RF mea | asurements at warr | רי־ " | | | •••• |
| 68 9 | ► Heavy BCP | | | | | Heavy BCP ST | nontris | | | | | |
| 73 9 | ▶ Tuning | | | | 6.11. · | Tuning 6 mor | itns | D; D | | | | |
| 78 🙂 | Cold test of bare cavity- preparation | | | | Cold test o | of bare cavity- prepar | ation <u>5 months</u> | (5 | 0,0 | | | |
| 83 🔮 | Cold test of dressed cavity - Preparation | | | | C | old test of dressed ca | vity - Preparation | 5 months ? | | D; D | | |
| 88 | ▶ RF Surface Preparation - Cavity 1 | | | | | ŀ | F Surface Preparation | n - Cavity 1 4 | S month: | | | EYEIS |
| 95 | First cavity ready for cold test | | | | | | First | cavity ready for col | d test | | | |
| 96 | Assembley & Test of dressed Cavity - Cavity 2 | | | | | | Assembley & Test o | f dressed Cavity - (| Cavity 2 2.88 mor | iths | C | DC Installation |
| 103 | Validated dressed cavity- Cavity 1 | | | | | | | Validated dress | ed cavity | • > | J | r S mstallation |
| 104 | RF Surface Preparation - Cavity 2 | | | | | | RF Surface I | Preparation - Cavit | y 2 1.75m | | | |
| 111 | Second cavity ready for cold test | | | | | | Se | econd cavity ready | for cold test | | | |
| 112 | Assembley & Test of dressed Cavity - Cavity 2 | | | | | | Assembley & | Test of dressed Ca | vity - Cavity 2 3.1 | 2 months | | |
| 119 | Validated dressed cavity – Cavity 2 | | | | | | | Val | lidated dressed cavity | - Cavity 2 | 1 | |
| 120 | Two cavities ready for assembly in cryomodule | | | | | | | Two cavities re | ady for assembly in c | ryomodule | | |
| 121 | Assembly of FPC and cavity string in clean room | | | | | | | Assembly of FF | C and cavity string in | clean room 41m | 7 | |
| 122 | Assembly of cryomodule outside clean room | | | | | | | Asse | mbly of cryomodule of | outside clean room | 4.5 months | |
| 123 | Cryomodule assembled (ready for cold test) | | | | | | | | | Cryomodule assen | nbled (ready for cold test | › • • • - |
| 124 | ► M7 Cryomodule Test | | | | | | | | | | M7 Cryomodule Te | st 2.15 months |
| 133 | ▶ Vertical cryostat upgrade | | Vertica | al cryostat upgrad | e 1.75m | | \cap | rvom | nodula | a tact | tin MT | 7 |
| 137 | Cold test: PoP DQW +Tuner | | | Cold test: PoP DQV | V +Tuner 🛛 | | U | i yon | louun | | L V <i>1</i> | |
| 138 | Cold test: PoP Crab to validate V4 | | Colo | i test: PoP Crab to | validate V4 🔽 | | | | | | | |
| 139 | SM18 Cryo stop | | | | 5M18 Cryo stop | 8m? | | | | | | |
| 140 | ▼RF Power preparations | | RF Power prep | arations 🦕 | | | | , | 2 | | | |
| 141 | M7 Tetrode installation | | | M7 1 | 'etrode installatio n → | 1m | | | | | | |
| 142 | FPC Test box fabrication | | FPC Test box fa | brication 6 m | onths | | | | | · Pow | ver an | d FPC Testina |
| 143 | FPC Tests | | | | | FPC Tests 7 m | onths |) | | | | |
| 144 | FPC Ready for installation | | | | | | FPC Ready fo | or installation 😽 | | | | |
| 145 | RF power ready for testing | | | RF | power ready for testing | , L | | | | | | |
| 146 | LLRF- Installation of test stand | | | LLRF- Installatio | n of test stand 🛏 🛯 🖛 | 1 | | | | | | |
| 147 | LLRF - First tests with PoP Cavity | | | LLRF - | First tests with PoP Ca | avity Im | | | | | | |
| 148 | ▼M7 Cryogenics | | | M7 Cryogenics | - | | | | | | | - |
| 149 | Definition of Cryo PID | | Definit | ion of Cryo PLD | ◇ ¬ | | | | | vo Di | stribut | ion & process |
| 150 | Specification and Manufacture | | Specificatio | n and Manufactur | e 10 months | | | | | ,00 | | |
| 151 | Installation and Validation | | | | | Instal | ation and Validation | 2 months | | | | |
| 152 | M7 Cryo line ready | | | | | | M7 Cryo | line ready | | | | |
| - Login | | | | | | | | | | | | |



Cryo Module Testing: breakdown of tests

- Planning based on experience from LHC module testing
 - Assumes that cavities can be conditioned in parallel
 - Potential issue with helium capacity of SM18

| Activity | Duration | | |
|---------------------------------|-----------------|--|--|
| Q_ext measurements at 300K | 1 day | | |
| Cooldown to 2K | 2 week | | |
| Low Power measurements | 1week | | |
| RF Conditioning (FPC + Cavity) | 2 weeks /cavity | | |
| Cavity Performance measurements | 3 days | | |
| LLRF Gymnastics | 1 week | | |
| HOM efficiency measurements | 1 week | | |
| Heat Run | 2 days | | |
| Warm up | 1 week | | |
| | 9 weeks | | |



Schedule Issues

- Cavity RF surface preparation: if to be done at CERN, requires optimisation of procedures. Close collaboration with TE_VSC
 - 2016 has to be used to validate surface preparation process
- M7 CM Tests: CM ready in Nov 2017 => Limited time for SM18 testing
 - 9 week program risks cutting into SPS installation window
 - Assumption: assumes both cavities can be tested in parallel

Crab test program

- Assumes only 1 cold test per cavity for bare & dressed cavities
- CM program: tight planning for a first-time set of tests

• 2016 test program in SM18 = Essential

- V3&V4: DQW+ tuner, LLRF + cavity, HPR procedure validation
- RF power + controls commissioning
- Must use SM18 shutdown in 2016 to install infrastructure