Test Program Summary

- **In-situ cryomodule testing** in out-of-beam position
- **RF commissioning** with low-intensity beam, 1-12 bunches
  - *Establish proper RF parameters (operating frequency, amplitude, and phase)*
  - *Verify that CCs are transparent (cavity counter-phasing and detuning)*

- **High intensity** single bunch up to 4x72 trains
  - *Impact on cavity performance (including transient behavior), impedance, stability & machine protection as a function of beam current; interlocks*
  - *Verify cavity stability over many hours (relevant for LHC physics fill)*
- **Long-term behavior** of coasting beams in the SPS with 1-bunch
  - *Study the effects of cavity drifts, emittance growth, non-linear effects such as RF multipoles*

High Luminosity LHC

Minimum Test Program

- Vacuum & Cryogenic aspects
  - We depend on NEG coating on either side to keep the pressure
  - The cryo limit will determine the operational field
  - Moving a 3 Ton object with 2K He
- Inject & capture 1-12 bunches – 10^{10} -10^{11} p/b
  - Beam properties well known, effect of strong impedance might be visible
  - Cavities always on (5-10% of nominal) to ensure RF feedback
- Amplitude and phase scan
  - Input/Output power to determine the electrical center + correct crabbing phase and counter-phasing for transparency & re-phasing during collisions
  - Have to test a minimum set of RF controls for LHC operational cycle
- Measurements with other instruments (HT monitor, BPMS …)

We are planning ½ day SPS test program meeting to go through the detailed commissioning and testing in SPS at the end of Nov.

High Luminosity LHC

SPS-LSS6

Machine Parameters

Energy = $55, 120, 270\ \mathrm{GeV}$

$\beta_{x,y} = 40, 80\ \mathrm{m}$

Dispersion = $-50\ \mathrm{cm}$

Available length $\sim 9.5\ \mathrm{m}$

Instrumentation

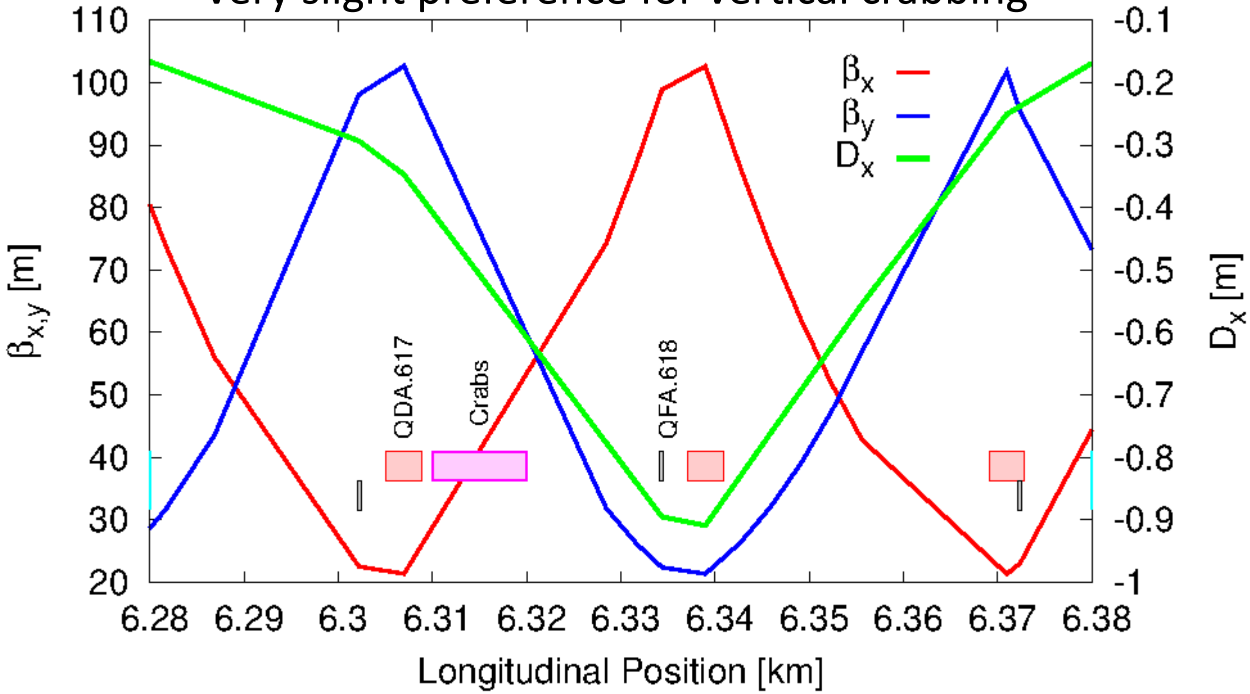
Longitudinal: BCT, Fast BCT, BSRT

Transverse: Wire scanners, BGI

Trajectory: 216 BPMs, 4 LHC BPMs, Damper PUs

Intra-bunch: Head-tail monitors, Optical PU

Very slight preference for vertical crabbing



Overall Activity Planning

SPS

2015 YETS	1st – 2nd Quarter	3rd -4th Quarter	2016 EYETS	1st – 2nd Quarter	3rd -4th Quarter	2017 YETS
False floor & reinforcement inspection	BA6 Surface clean up & Preparation for RF		Install: RF & Cryo Lines, Movable table, Cabling & Y-chamber+valves	RF, Cryo, Vacuum Tests Movable Table(?)		Install CM1 Vacuum commissioning
Uninstall 2K pumps from LSS4	Design of y-chamber and vacuum Cryo equipment procurement		Other services: Cooling, ventilation, water, electricity & Ethernet			DQW Cryomodule Cooldown + RF Commissioning + Movement

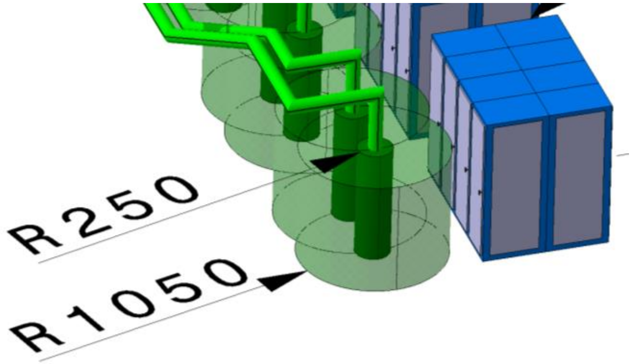
SM18

2015 YETS	1st – 2nd Quarter	3rd -4th Quarter	2016 EYETS	1st – 2nd Quarter	3rd -4th Quarter	2017 YETS+After
Cryo M7 Bunker Preparation		DQW CM1 Integration, 2-cavity cryomodule		DQW Dressed Cavities Preparation	DQW CM1 assembly & Horizontal testing	
	High Power & Low level RF Prep SM18 Cryogenic validation		LLRF & Controls Preparation for Hor testing			RFD Dressed Cavity Preparation

High Luminosity LHC

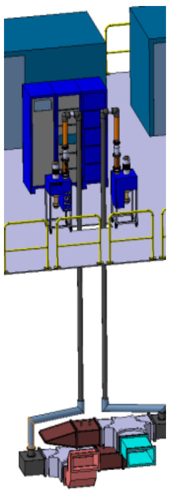
RF Distribution

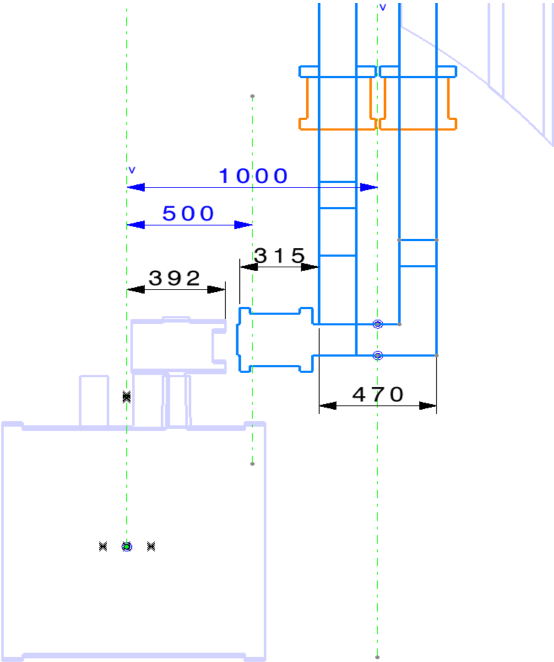
Pics shown as in LHC, for illustration
Courtesy (S. Maridor et al.)



Surface/Cavern (Tetrode + HVPS)
3 LLRF (faraday cage), 1 SSA, 1 PLC, 1 spare racks

Circulator/load placement
TBD (**surface** or tunnel)





Cryomodule interface, transpose the LHC concept with additional 0.5m movement capability

Beamline Vacuum

* Preliminary for illustration only

- 16°Y-chamber with multiple vacuum sectorization & NEG – ready for EYETS
  - *NEG coating on either side of the module with differential pumping*
  - *Operating pressure* $\sim 10^{-10} mbar$

- Movable table – 510 mm transversely in ~20 min (EYETS ?)