High power RF tests places at CERN

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Scope of the presentation

- High power and SCRF activities @ CERN
- Existing infrastructures
- SPL cryomodule tests
- Conclusions

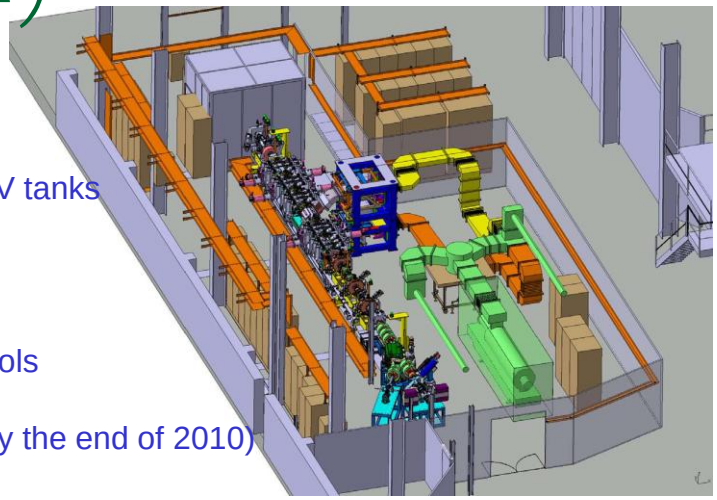
High power and SC RF activities (1)

- High power RF
  - LHC
    - 400MHz, 330kW CW, 16 power stations in LHC + 2 test stations
  - Linac4
    - 352MHz, 1.3/2.8 MW, 19 future power stations + 2 (3) test stations
  - CLIC&CTF3
    - 3GHz, 45 MW, 1.5GHz, 25 MW, 13 power stations + 1 place
    - 12GHz, 50MW, 1 test station
  - LEP RF equipment tests for external requests
    - 352MHz, almost finished
  - SPL test stand
    - 704 MHz, ≈1MW, 50 Hz, 1 future test stand
  - Crab cavities
    - Under study..

High power and SC RF activities (2)

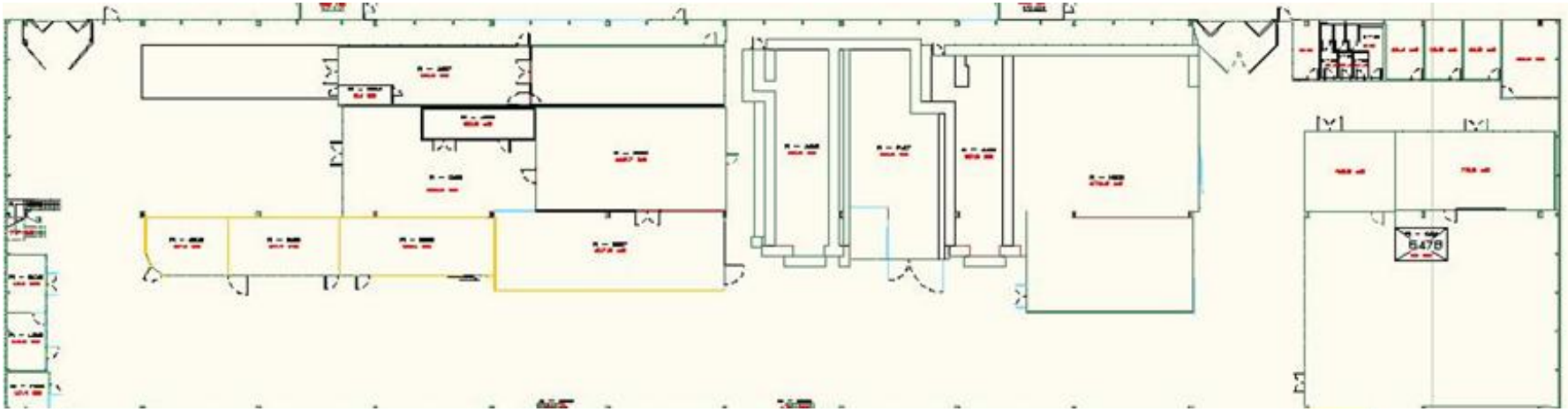
- SC cavities & Cryomodules
  - LHC
    - 4 cryomodules in LHC, 1 spare + 1 spare cavity (to be tested)
    - 3 spare cavities to be built & tested (2011-2012)
  - HIE Isolde
    - 32 cavities to be built & tested
    - 5 cryomodules to be assembled & tested
  - SPL
    - 4 cavities to be built & tested
    - 1 cryomodules to be assembled & tested
  - CLIC & CTF3 structures
    - RF structure assembly in clean rooms

Available infrastructure (1)



- Building A5:
  - LHC & Linac4 High Voltage
    - Klystron modulators, fast protection systems, klystron HV tanks
    - 100kV, 15mA power supply
- Building 112:
  - LHC & Linac4 High Power RF
    - Tests of klystrons, circulators, WG, HV equipment, controls
    - LHC power coupler tests
    - 100kV, 20A power supply, Linac 2Hz modulator (ready by the end of 2010)
- Building 152:
  - Linac4 3MeV test station
    - Tests of Linac4 3MeV section (in 2011) + some L4 RF structures (2010 ->?)
    - Complete Linac4 2Hz power station (modulator, klystron,..)
- Building 252:
  - SC cavities coating & clean rooms
    - LHC, HIE Isolde, SPL
    - Nb deposition system for HIE Isolde cavities (system for LHC cavities to be re-installed)
    - Low pressure ultra pure water rinsing (max 10 bars)
    - Two clean room (class 100, 10)
- Building 118 (vacuum group):
  - Chemical treatments
    - LHC, HIE Isolde, SPL + many other activities
    - EP station
    - High pressure ultra pure water rinsing (100 bars) – refurbishment in progress

Available infrastructure (2)



- Building SM18:
  - Cavity/cryomodule assembly
  - Two 15m clean rooms (class1000/10) + access zone
  - One 4 meter high clean room (class100)
  - Four vertical cryostats
  - Two bunkers
  - High RF power zone
  - Main control room
  - Cryogenic system
    - Limited availability (LHe to be shared with other SM18 activities -> LHC magnets)
    - LHe distribution line will be replaced in 2011

SPL cryomodule – Cavities, Assembly

- Will profit from all existing infrastructure (W.W 's talk)
  - Clean rooms
  - UP water rinsing stations
  - EP station

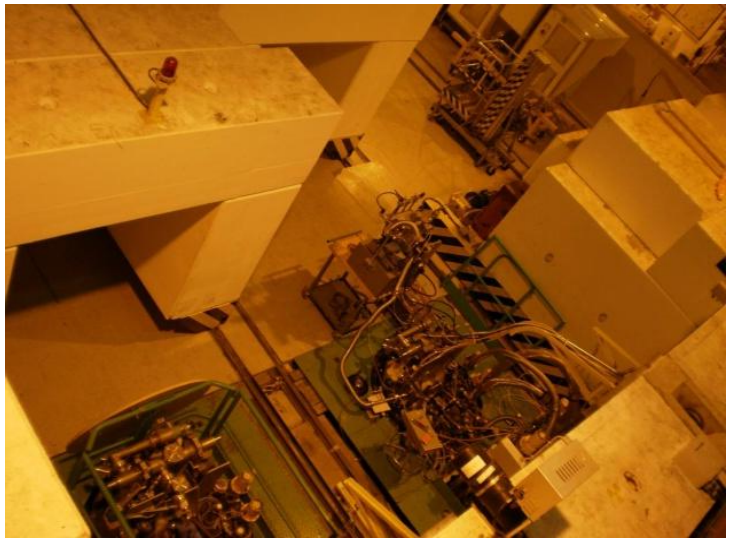
- SM18 clean rooms not fully compliant with SPL cryomodule assembly requirements
  - Must be equipped with:
    - Dressing zone (class100)
    - UP water rinsing zone(class 100) – main couplers, hom couplers,..
    - Existing 15 m class 10 room shall be equipped with vacuum leak detection equipment

➔ feasibility study to be made!!

SPL cryomodule – Cavity tests

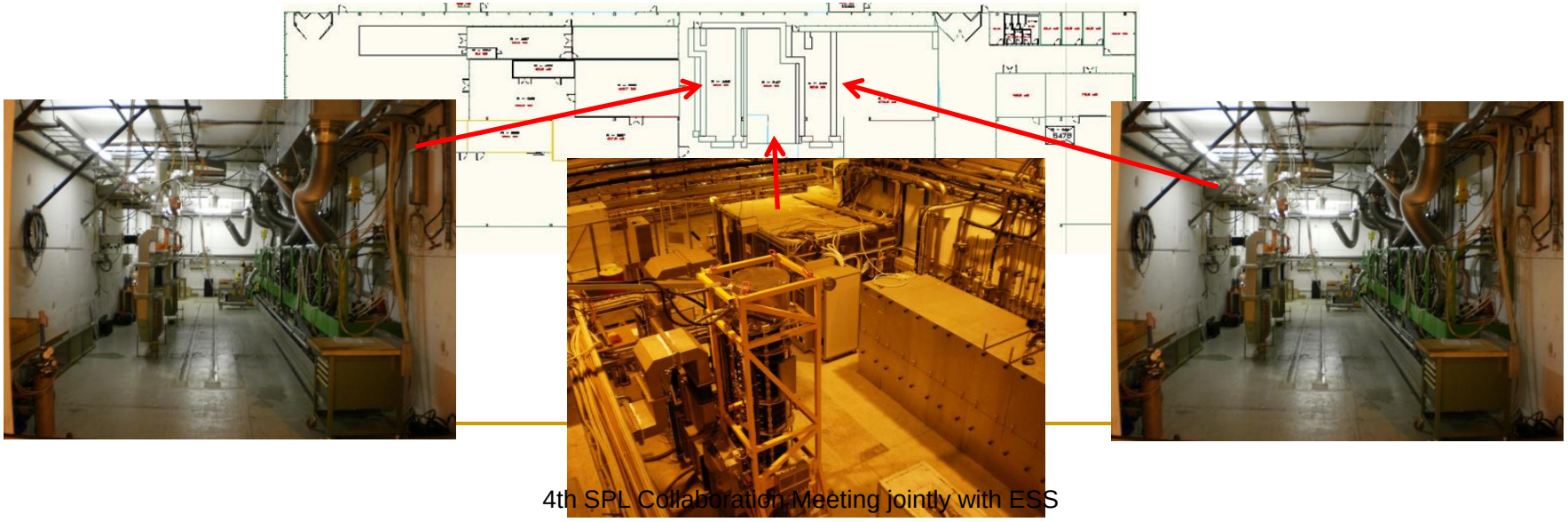
- SM 18 is equipped with four vertical cryostats
  - LHC cavities (4.2K) – operational
  - HIE Isolde cavities (4.2K) – availability: Summer 2010
  - Nb surface studies / diagnostic tools developments (2K) – operational
  - SPL cavities (2K) – availability: end 2010

- One fellow will be working on SC cavities diagnostic tools
  - Temperature mapping
  - LHe second sound



SPL – high power tests (1)

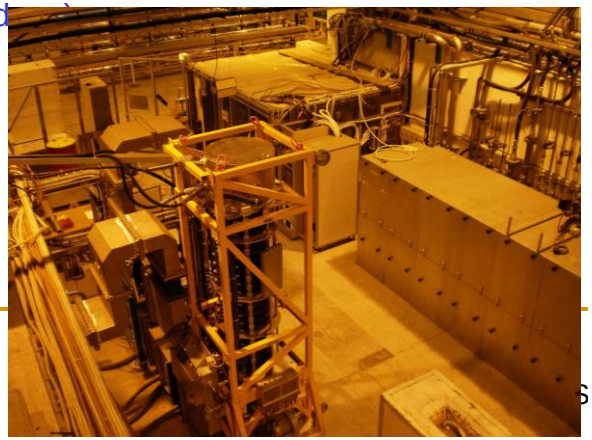
- Two bunkers in SM18:
  - Bunker A :
    - will be modified for 2K operation (2011) /control system to be completely renewed
    - will be modified for the Linac4 RF structure tests (2011 -> end 2012)
    - ready for SPL cryomodule tests in 2013
  - Bunker B:
    - operational
    - priority: LHC cryomodules
    - HIE Isolde cryomodule tests (2012/14)

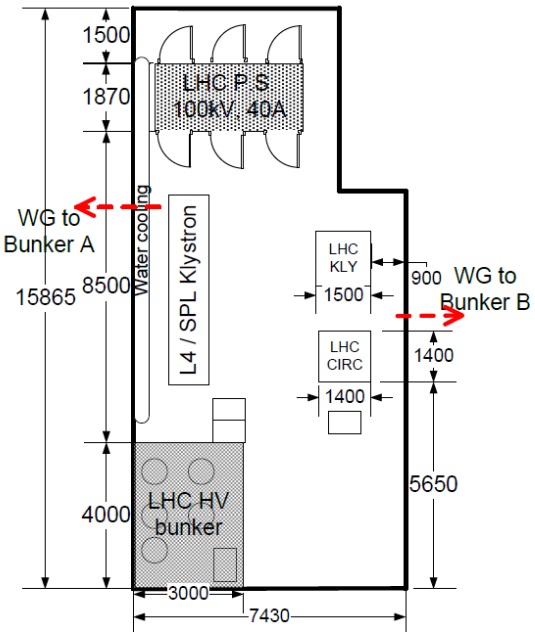


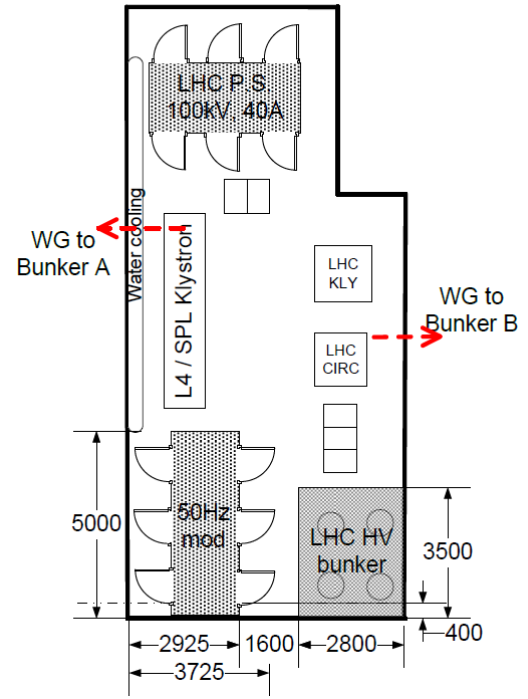
SPL – high power tests (2)

- Bottleneck is the High RF power zone:
  - Very crowded area:
    - 100kV, 40A PC
    - LHC high RF power
    - LHC HV bunker
    - 352MHz 1.3MW klystron (Linac4 tests)
  - No real extension possible

- Upgrade towards L4 / SPL tests:
  - Move LHC HV bunker to free space for pulsed modulator
    - 2011: installation of a 2Hz Linac 4 type modulator
    - Asap: integration of 50Hz modulator – **footprint??**
      -> being studied…
  - Specify & order high power components
    - 704MHz, 1MW klystron (specs 90% completed)
      - Interface with modulator not defined!
    - Circulator & RF load (specs to be done)
    - WG components (specs to be d…)
  - Specify & built control system
    - ready early 2011 for L4 tests







SPL – high power planning

	2010			2011				2012				2013
	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1
SM18 - 2K Vertical Cryostat		operational			new LHe line							
SM18 - 2K Bunker						new control system		New LHe line				
704MHz RF power		specs ready			orders					installation		
50Hz modulator			Footprint/dim							installation		
High power test place (352-704)		Integration/prep for L4									SPL modif	
Clean rooms upgrade			study?			upgrade?						

LHC OPERATION	LHC SHUTDOWN / STARTUP
LINAC 4 EQUIPMENT TESTS	
	LINAC4 INSTALLATION
HIE ISOLDE CAVITIES & CRYOMODULES	

Conclusions

- Several projects going on in parallel
  - Existing infrastructure: good starting point
  - Objective is to get the best share of the existing infrastructures between activities/projects
- Upgrade of infrastructures is ongoing, in particular for the SPL cryomodule
  - High pressure UP water rinsing
  - Electro-polishing station (new)
  - Cavity vertical test stations, diagnostic tools
  - SM18 LHe distribution line
  - Clean room upgrade necessary – possible???
- SPL cryomodule high power tests
  - Bunker A in SM18 requires hardware modification to host SPL high power tests
    - 50Hz modulator size?
  - Will profit from preparation work done for L4
  - Specification documents for 704MHz high power equipment in preparation