HIE-ISOLDE Project Status Report

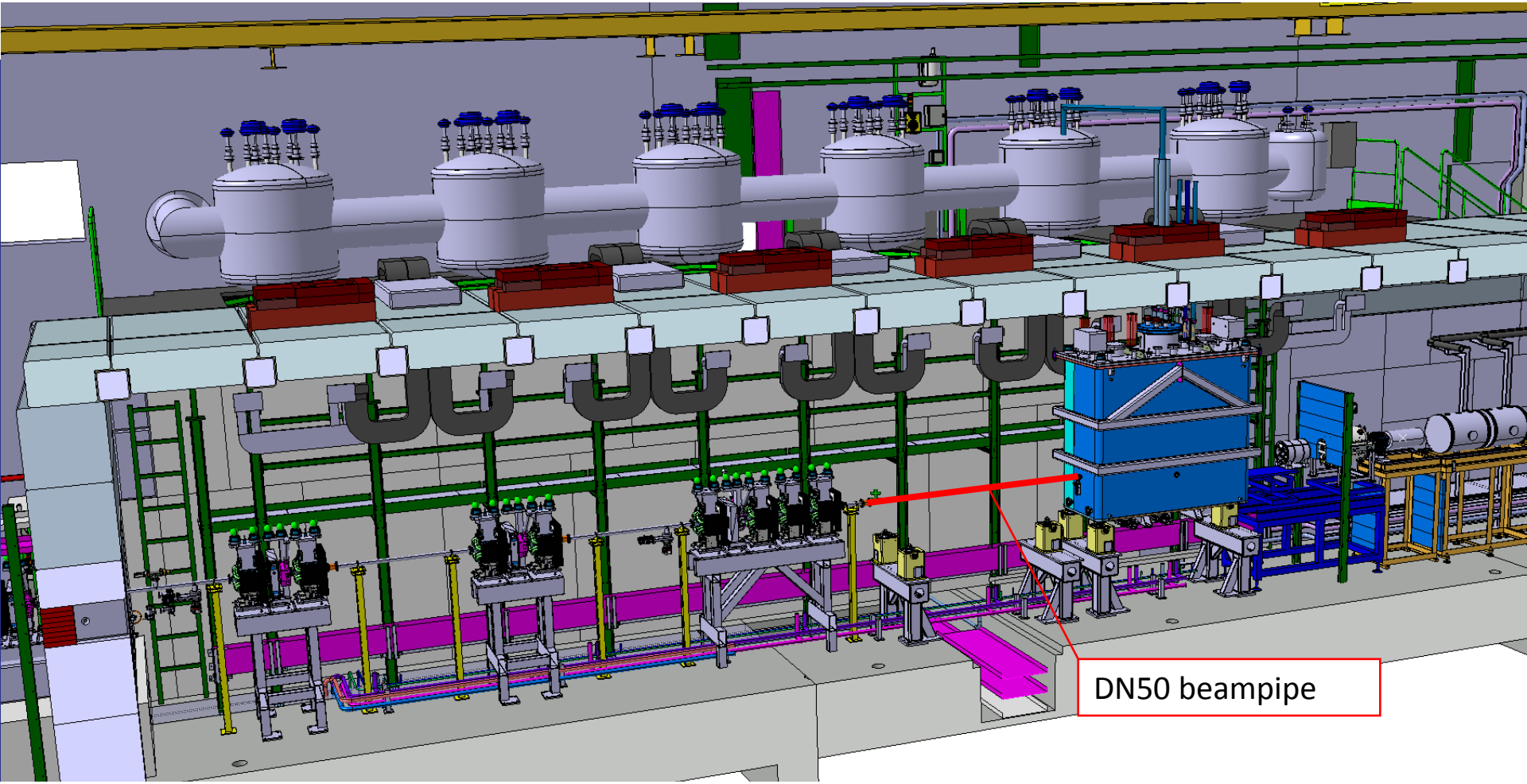
Y. Kadi for the HIE-ISOLDE Project Team

70th ISOLDE Collaboration Committee Meeting
CERN, 24 June 2014

OUTLINE

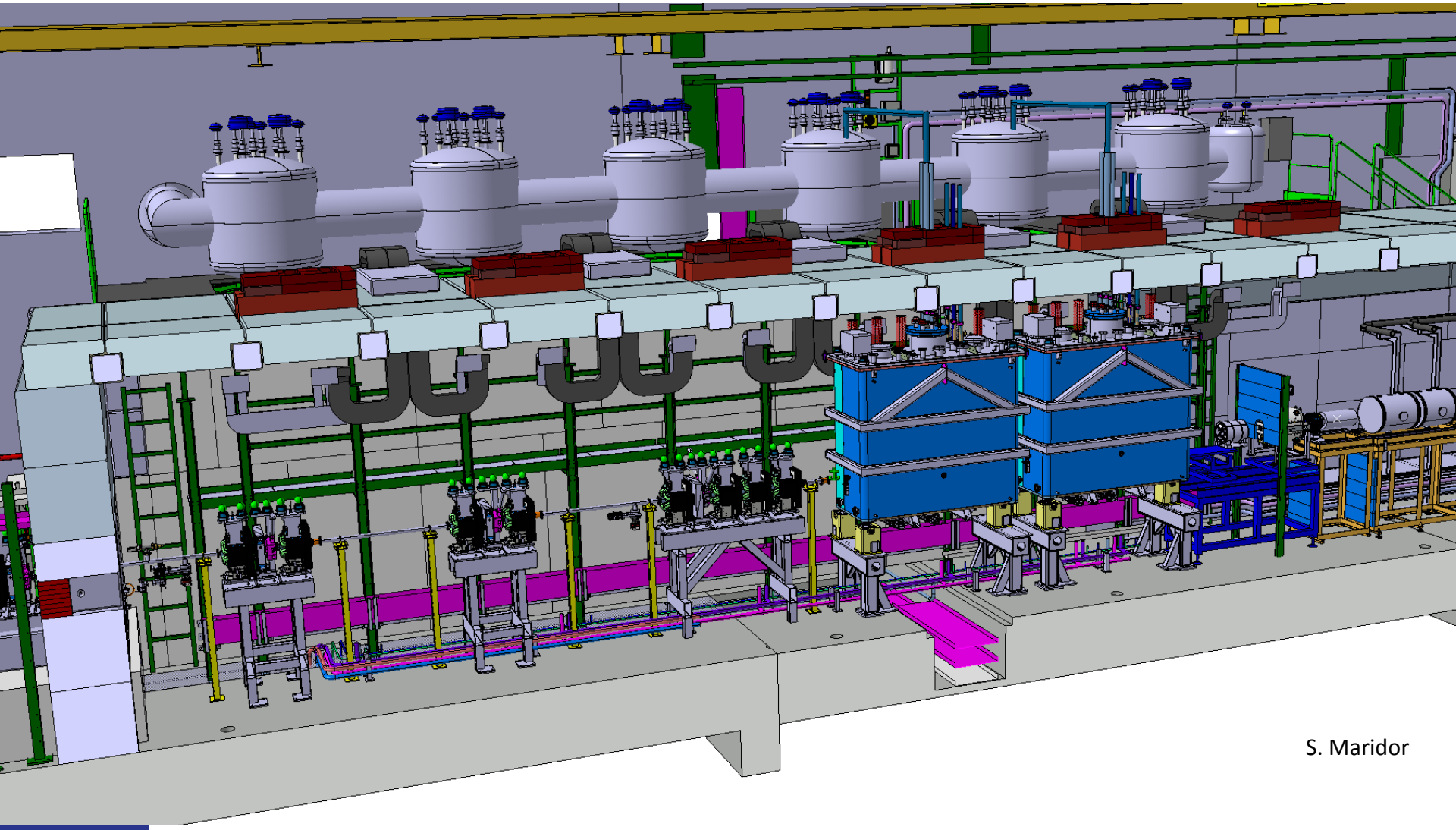
- **Project Schedule: New Baseline**
- Main Technical Points:
  - ✓ Accelerating Structures
  - ✓ RF Systems
  - ✓ SC Solenoid Production
  - ✓ Cryomodule Production
  - ✓ Magnet Production
- Progress Monitoring
- EVM
- Resources
- Update of the Risk Register
- Summary

HIE LINAC elements



Cryo Cold Line & Jumper Boxes installation: Sept 2014 – Jan 2015
(construction Line, Jumper Boxes & Dewar (2000L) ongoing at CRIOTEC)
Cryo Module 1 installation: April – June 2015
Scenario: Physics at 4.3MeV/u with 1 CM as of October 2015

HIE LINAC elements



S. Maridor

Cryo Module 2 installation: Shutdown 2015/16: Jan – March 2016

Scenario: 2nd commissioning at 5.5Mev/u with 2 CM‘s as of May 2016

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  - ✓ **Magnet Production**
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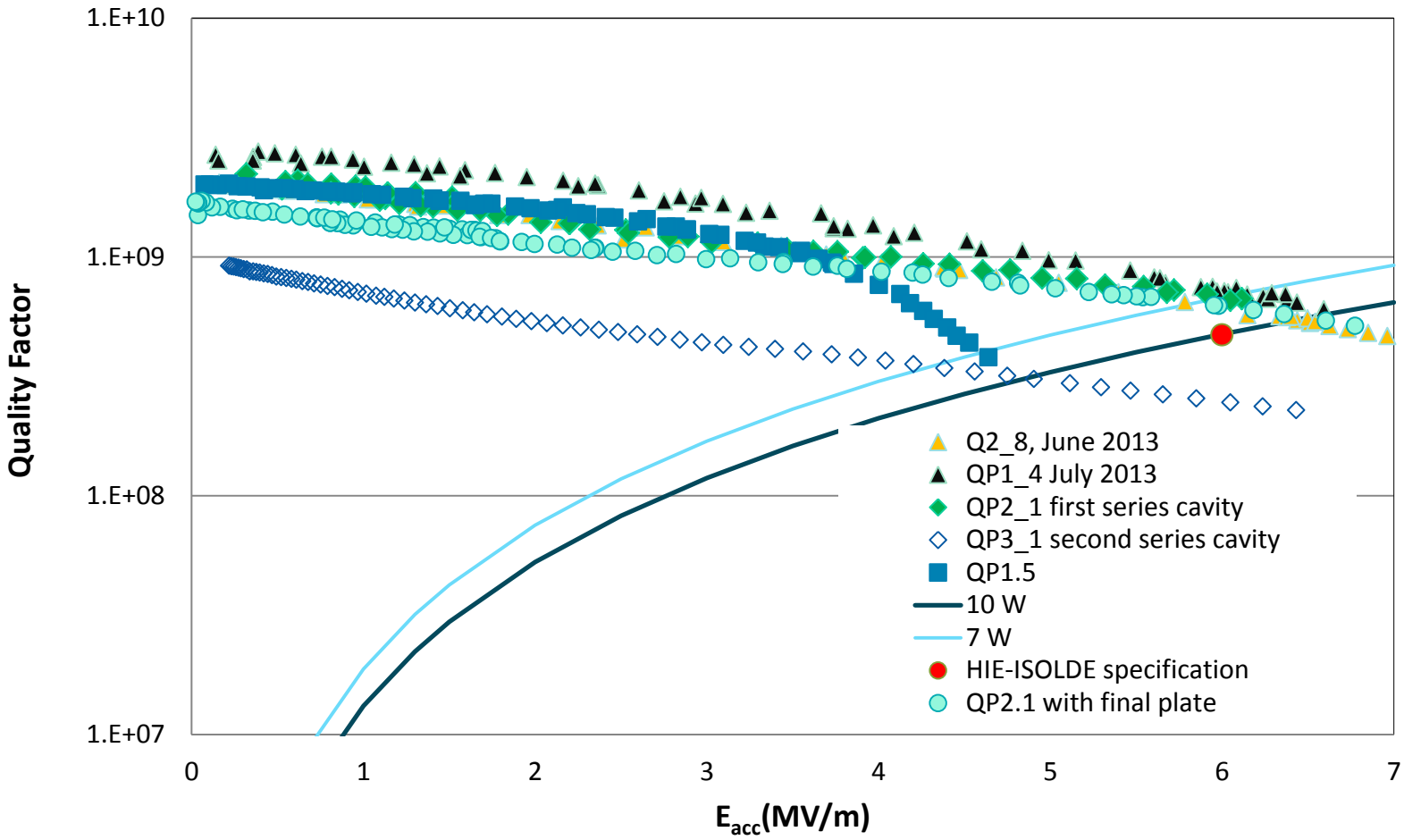
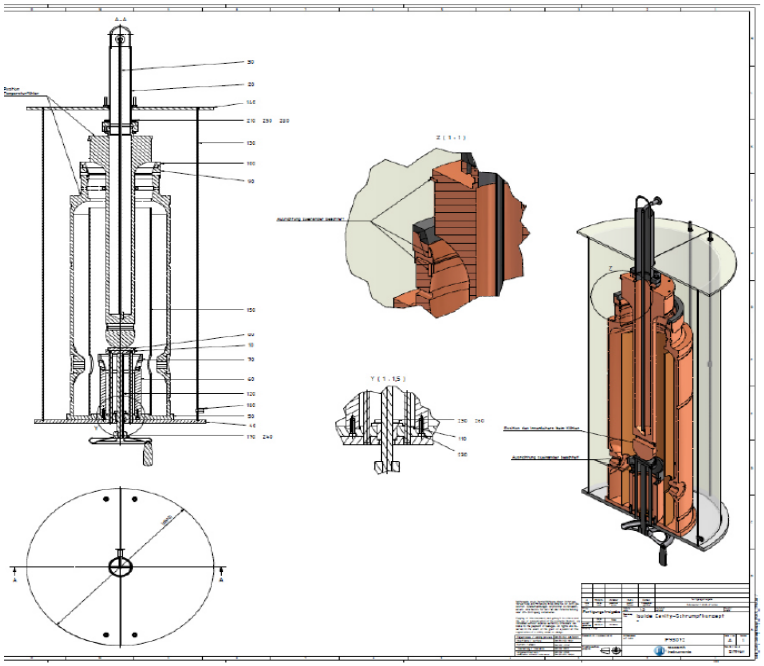
First three series cavities: QP2, QP3 & QS1

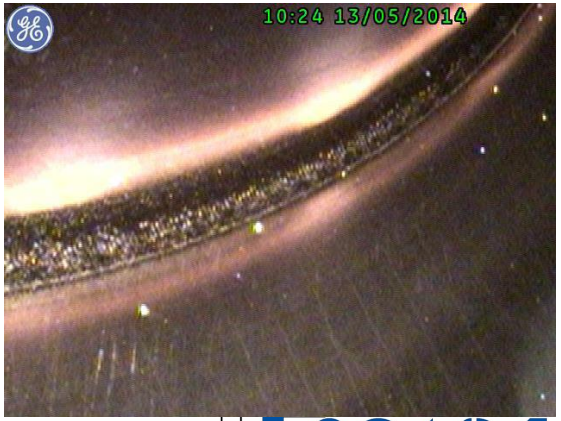
- QP2 and QP3 Substrates manufactured at CERN, treated with production protocol
- **QP2 went to 6 MV/m at 7 W (30% margin)**
- **QP3 did not reach nominal performance**, precise cause not clear
  - Copper from a different manufacturer than the one chosen for the industry production, different machinability was noticed
  - Strong field emission on first cool-down, was rinsed
  - Field emission suppressed on second cool down, but lower Q
  - Probably some part of the RF surface was contaminated
  - **Decision to strip and coat it again => now under going RF tests**
- **QS1 manufactured at RI (Germany)**
  - 3 non-conformities (outer diameter; beam hole alignment, EB weld)
  - Cavity trimmed to corresponding frequency
  - Ready for coating
- **QS2 to be delivered by June 26th**
- So far success rate of 75% for sputtering

Cavity Performance (last two prototypes and first two series)



Copper Cavity production in Industry:QS1





Copper Cavity production in Industry

Company delay on pre-series (5 months)

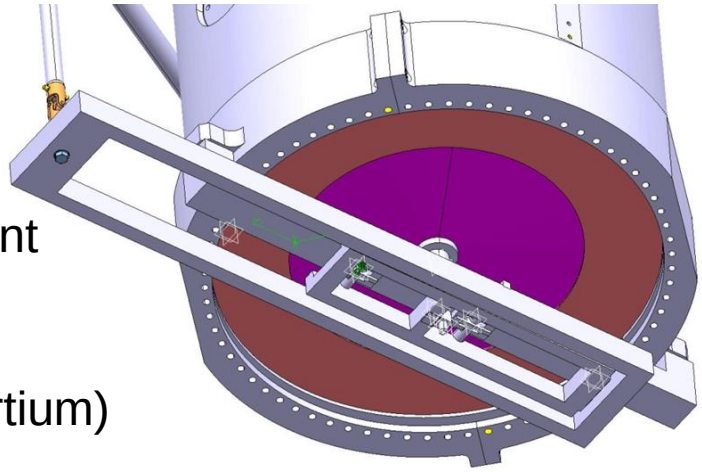
Pre-machining of series advancing

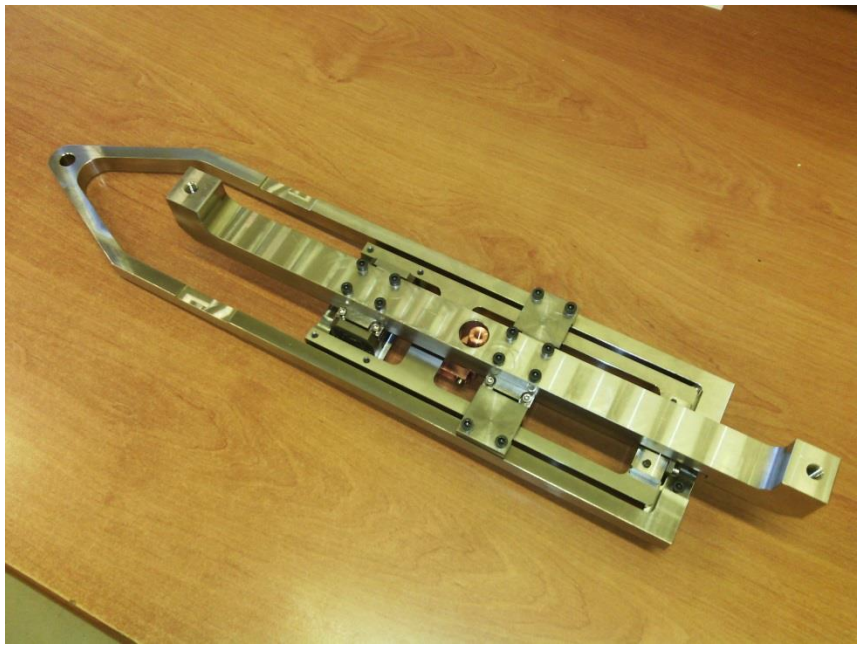
Expected delivery of QS2 June 26th

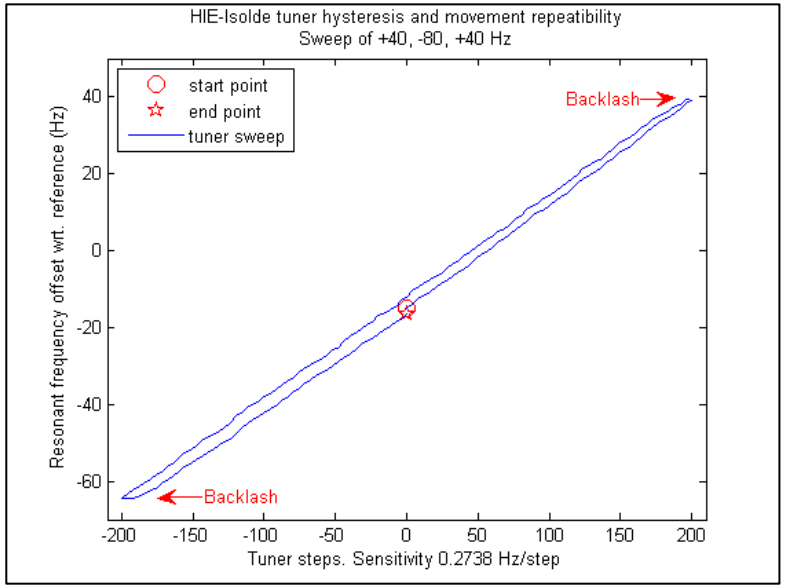
Tuning system

- 6 Cu plates available, 5 sputtered
- Actuating system fully redesigned

  to reduce torques and preserve alignment
- Two pre series systems fully tested
- 15 units under production (CATE consortium)







Coupling system

- Couplers:
  - 2 pre series available (tested)
  - 10 series assembled and cleaned
- Transmission system
  - Prototype tested in SM18
  - Design change done to allow easy replacement in the CM

Low Level RF status

First prototype LLRF controller commissioned in SM18

Monitoring of RF signals, locking in Self Excited Loop mode, control of Coupling and Tuning

FESA class operational, high level software to be developed

3 LLRF controllers for SM18 cryomodule test manufactured

7 more controllers being assembled

Installation of the shielded racks for the machine (Bldg 199) already finished

RF Power status

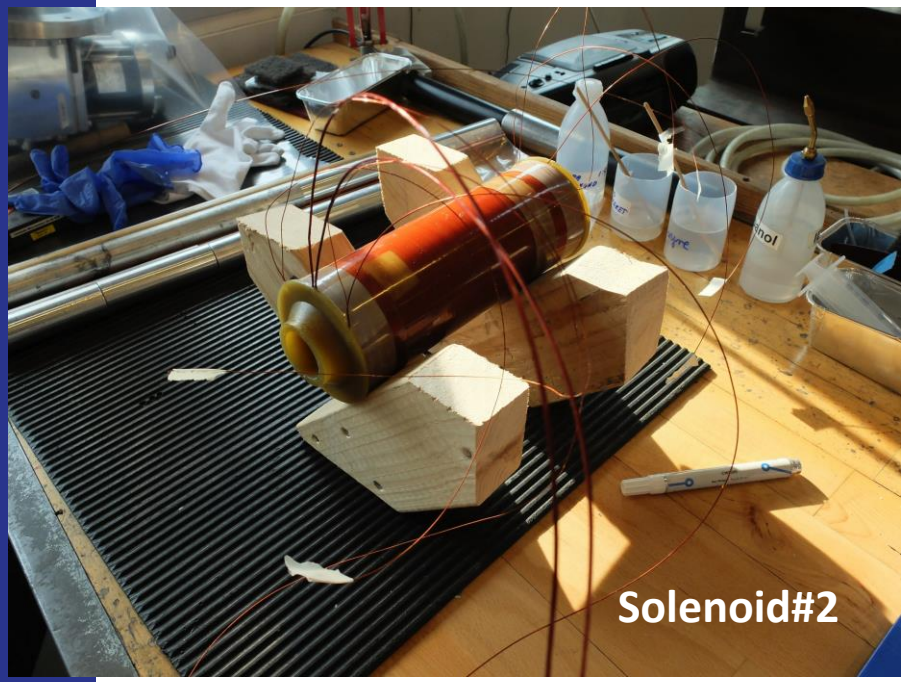
All 6 Air cooled Amplifiers
(for SM18 horizontal tests)
delivered at CERN and accepted

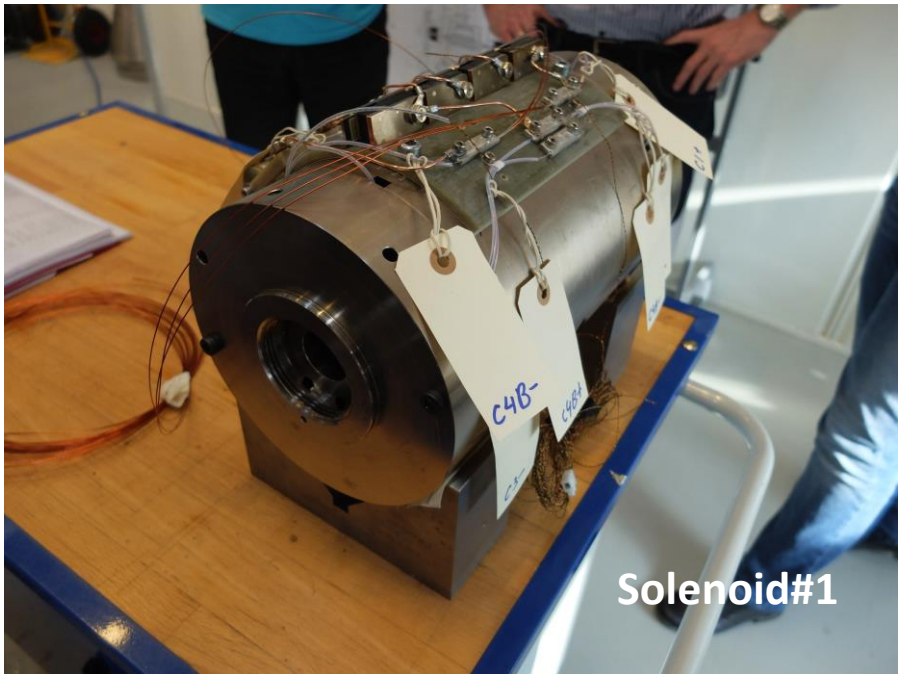
Water cooled Amplifiers
(for SC linac)

- First pre series being qualified at CERN
- Delivery of the remaining 11 by August 2014

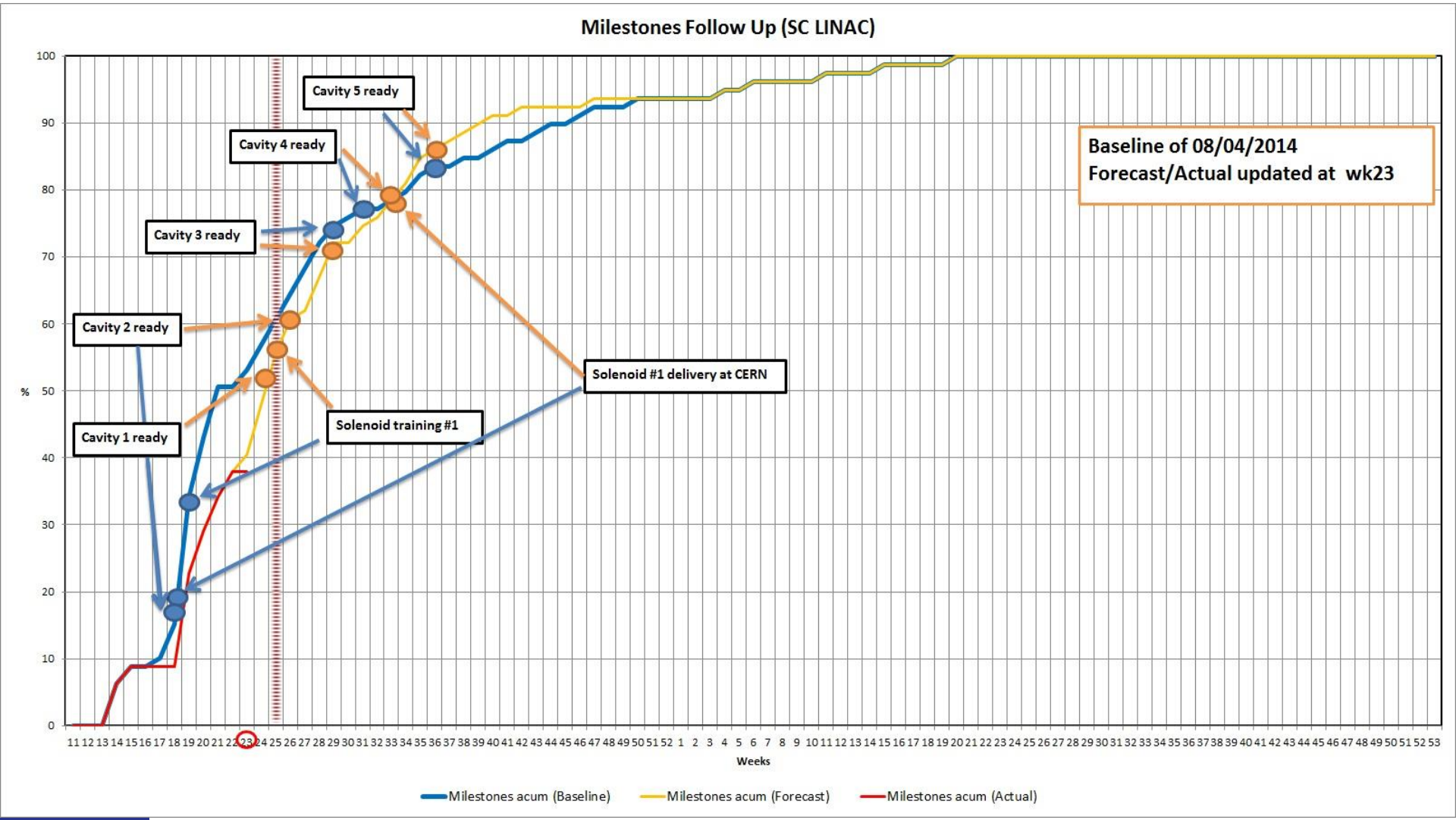
Superconducting solenoid

- Status
  - **Solenoid 1:** rejected => quench @ 50% Inom
  - **Solenoid 2:** undergoing training => quench 90% Inom
  - Expected delivery date: wk 34 (16 weeks delay)
  - Mitigation plan under preparation with TE/MSC



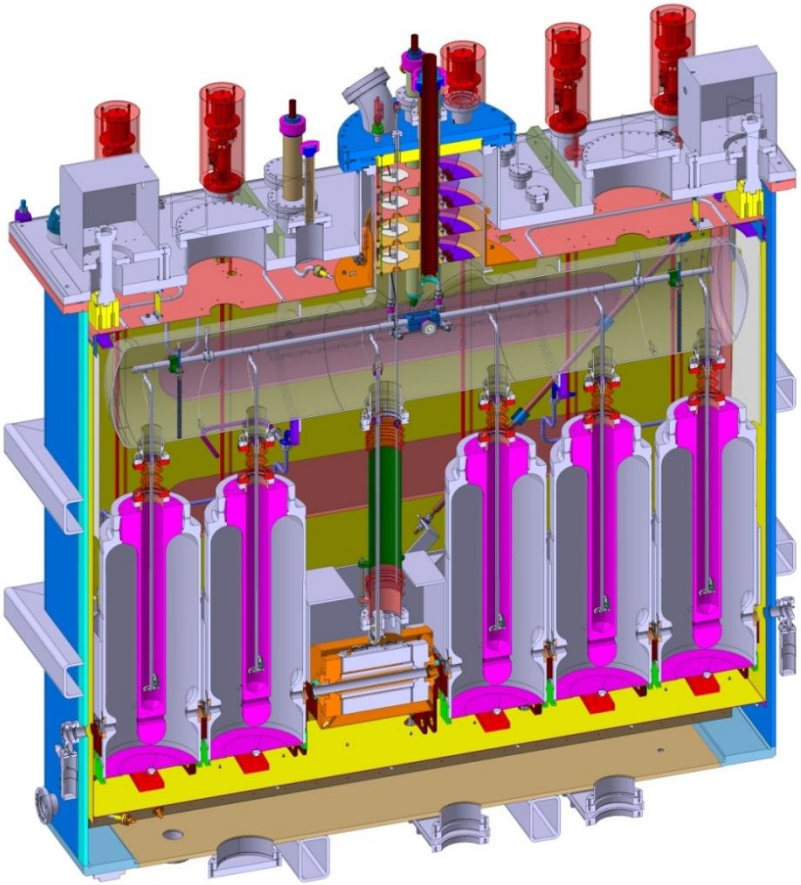


Progress Monitoring: Linac



Cryomodule sub elements procurement

- Vacuum Vessel and Helium Vessel: contracts running
- Suspension frame: contract adjudicated
- Thermal Shield: in production through CERN (EN-MME) => **large delays**
- Other components/items, including Assembly Tooling: in production through CERN (EN-MME) **=> Critical Item**
- Few more items to be designed/launched in production



Cryomodule sub elements procurement

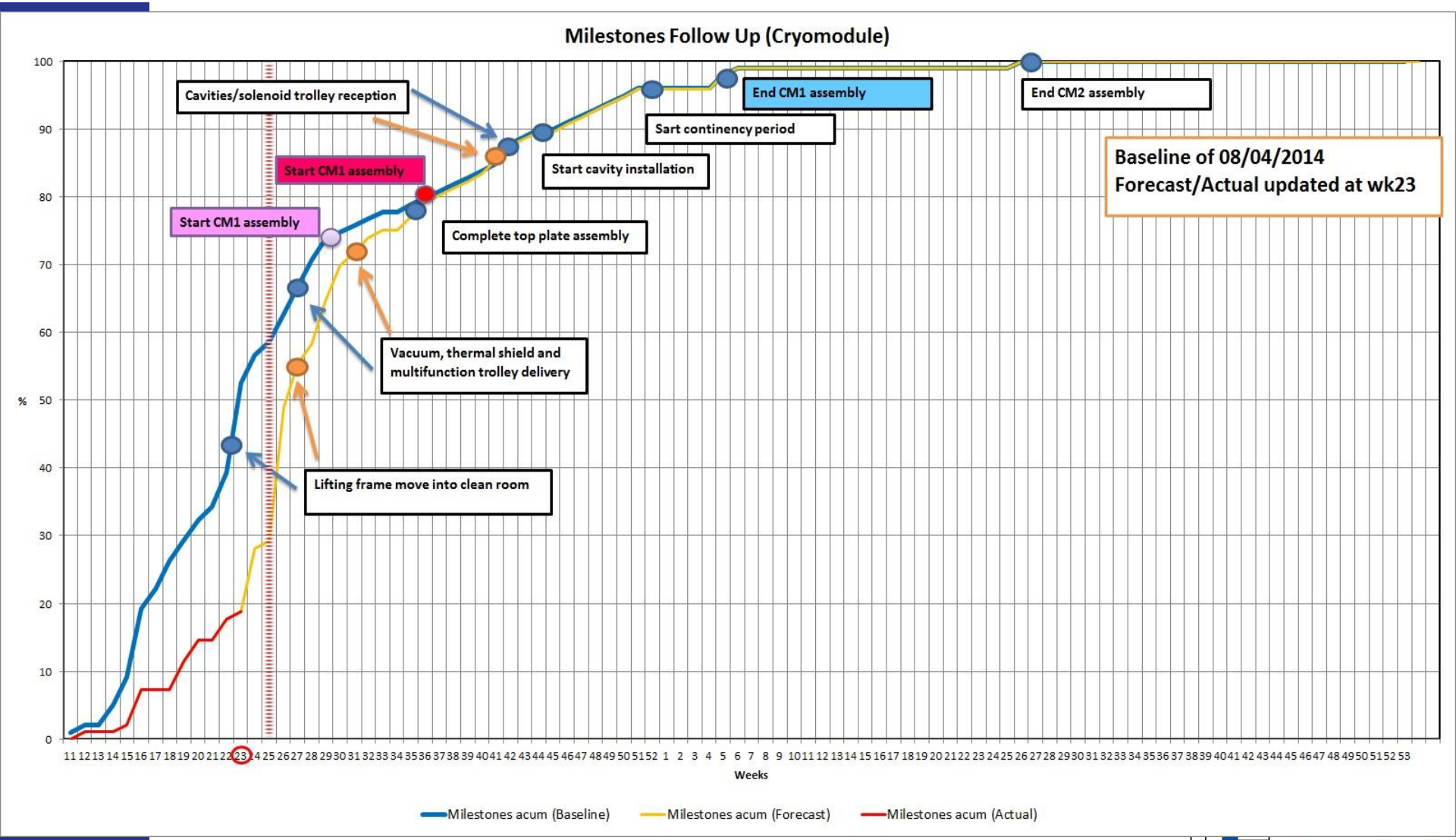
SM18 infrastructure: clean room

- Status of clean room: qualified empty (no tooling inside), better than specs

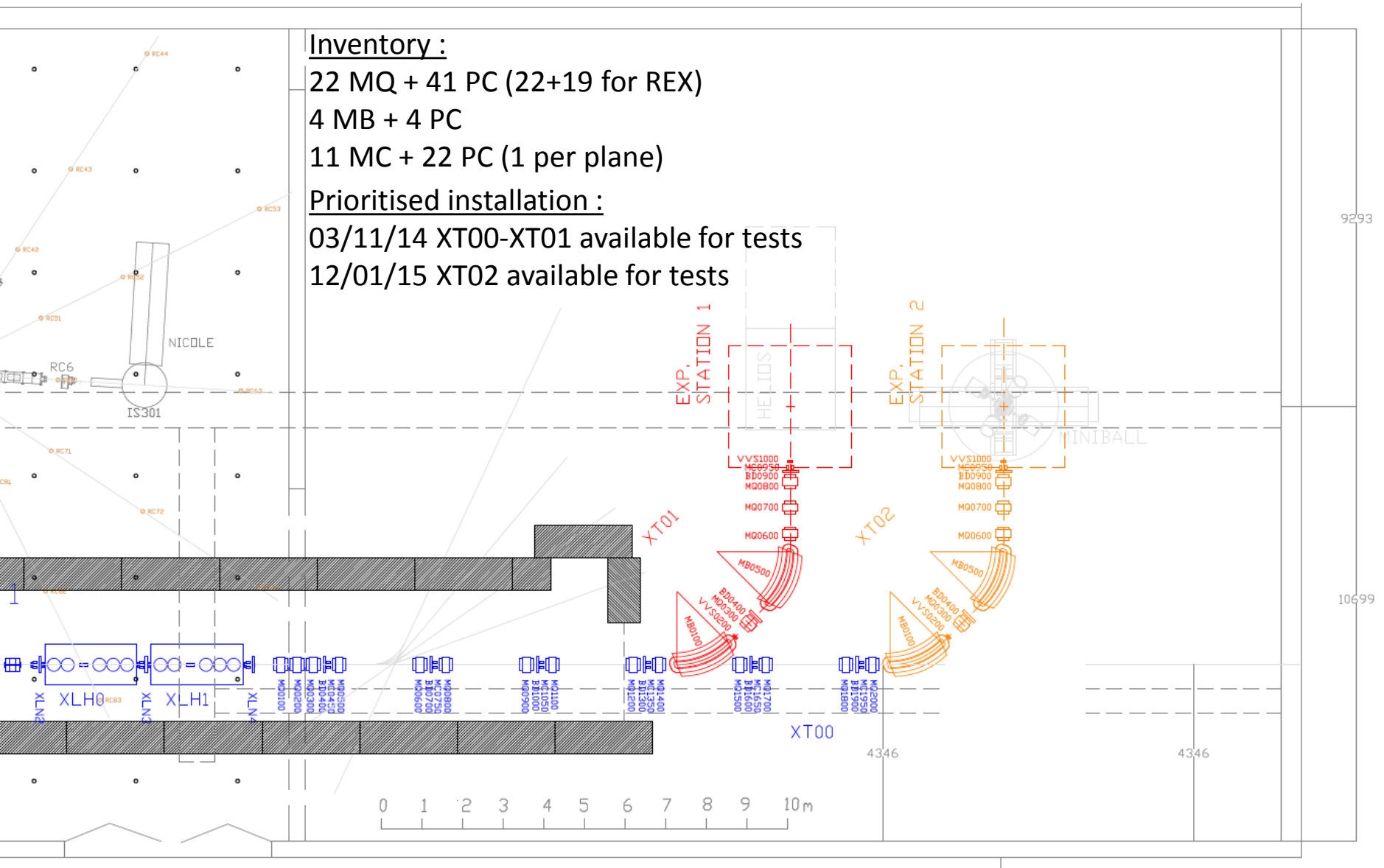
remaining issues being addressed

- Procurement of the Cavity/Solenoid Trolley:
- Thermal Shield fabrication
  - late design modifications
  - => delay for Ni plating => under discussion (EN/MME)
- Cryomodule Assembly:
  - Procedures and assembly tooling to be further elaborated
  - Manpower for assembly in clean room, training
  - Logistics and support from other groups/services

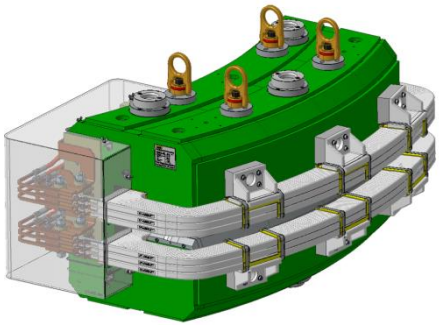
Progress Monitoring: Cryomodule



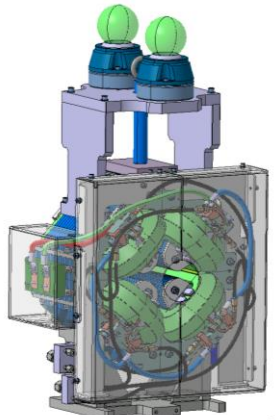
HEBT layout


Inventory :
22 MQ + 41 PC (22+19 for REX)
4 MB + 4 PC
11 MC + 22 PC (1 per plane)
Prioritised installation :
03/11/14 XT00-XT01 available for tests
12/01/15 XT02 available for tests
NICOLE
RC6
IS301
EXP. STATION 1
HELIOS
EXP. STATION 2
MINIBALL
XT01
XT02
XT00
XLH0
XLH1
9293
10699
4346
4346
0 1 2 3 4 5 6 7 8 9 10 m

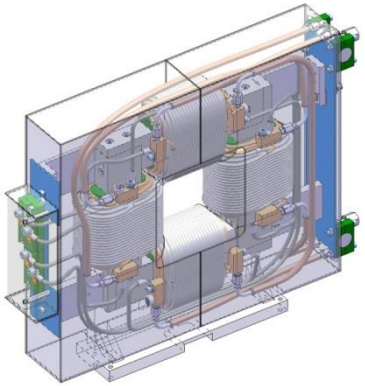
Magnets



- All contracts placed; magnet manufacturing budget within estimates
- Magnets production
  - Dipoles
    - ✓ 1 pre-series dipole ~~30/5/14~~ 15/08/14
    - ✓ 4 units ~~10/10/14~~ 10/11/14
  - Quadrupoles
    - ✓ 2 pre-series quadrupoles ~~14/4/14~~ 13/06/14 => only 1 pre-series magnet delivered => ELYTT not putting appropriate means
    - ✓ 22 units (2 lines) ~~13/10/14~~ 15/12/14
  - Steerers
    - ✓ 1 pre-series steerer20/6/14
    - ✓ 15 units (2 lines) 19/9/14

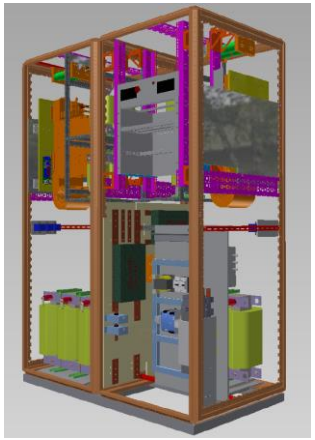


- Magnetic measurements
  - Acceptance tests to confirm manufacturing up to specifications
  - More in depth characterization of the field on pre-series magnet for beam optics



- Installation ~~September 14 to January 15~~
  November 14 to March15

Power converters

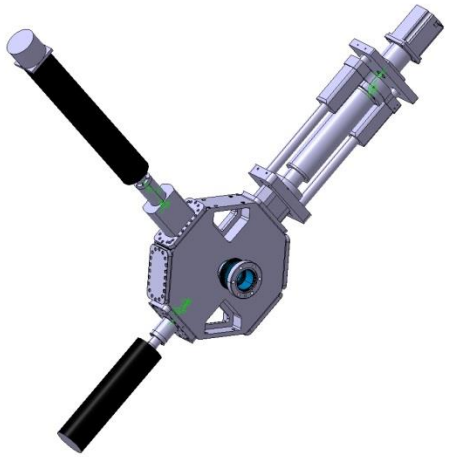


- COMET (S500) – Dipoles
  - CERN design and manufacturing
  - 4 units by 12/11/14
  - Installation finished 15/11/14
- COBALT – Quadrupoles
  - 6 units available for test: 15/10/14
  - 21 series in 7/1/15 and 20 series 15/3/15 (production rescheduled)
  - Final installation (18 racks) mid-April 15

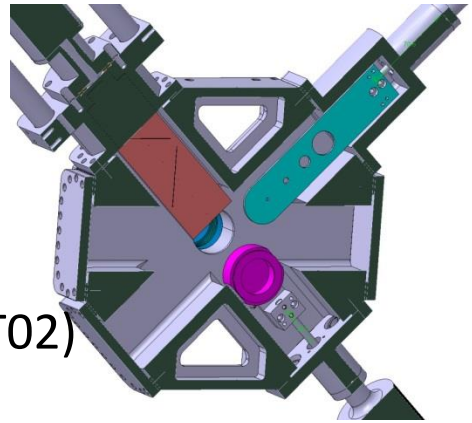
  Only the power part is missing. Tests can be performed with the 6 available units.
- CANCUN50 – Correctors
  - 4 pre-series at CERN
  - 34 units by 31/8/14 (need only 22 units)
  - Installation finished (6 racks) 30/6/14, Tested 21/9/14

Beam instrumentation

- Two types of diag. boxes: Short (SC linac) and Long (HEBT)
  - Short box
    - ✓ Contract signed (AVS, Spain)
    - ✓ First unit ~~early May~~ end June 14
    - ✓ 5 units by end of ~~July 14~~ August 14 (last unit in September)
  - Long box
    - ✓ contract Awarded beginning June
    - ✓ Requested delivery time for the 9 long DB's: ~~21 weeks~~ 18 weeks (~~mid-October~~ mid-November)

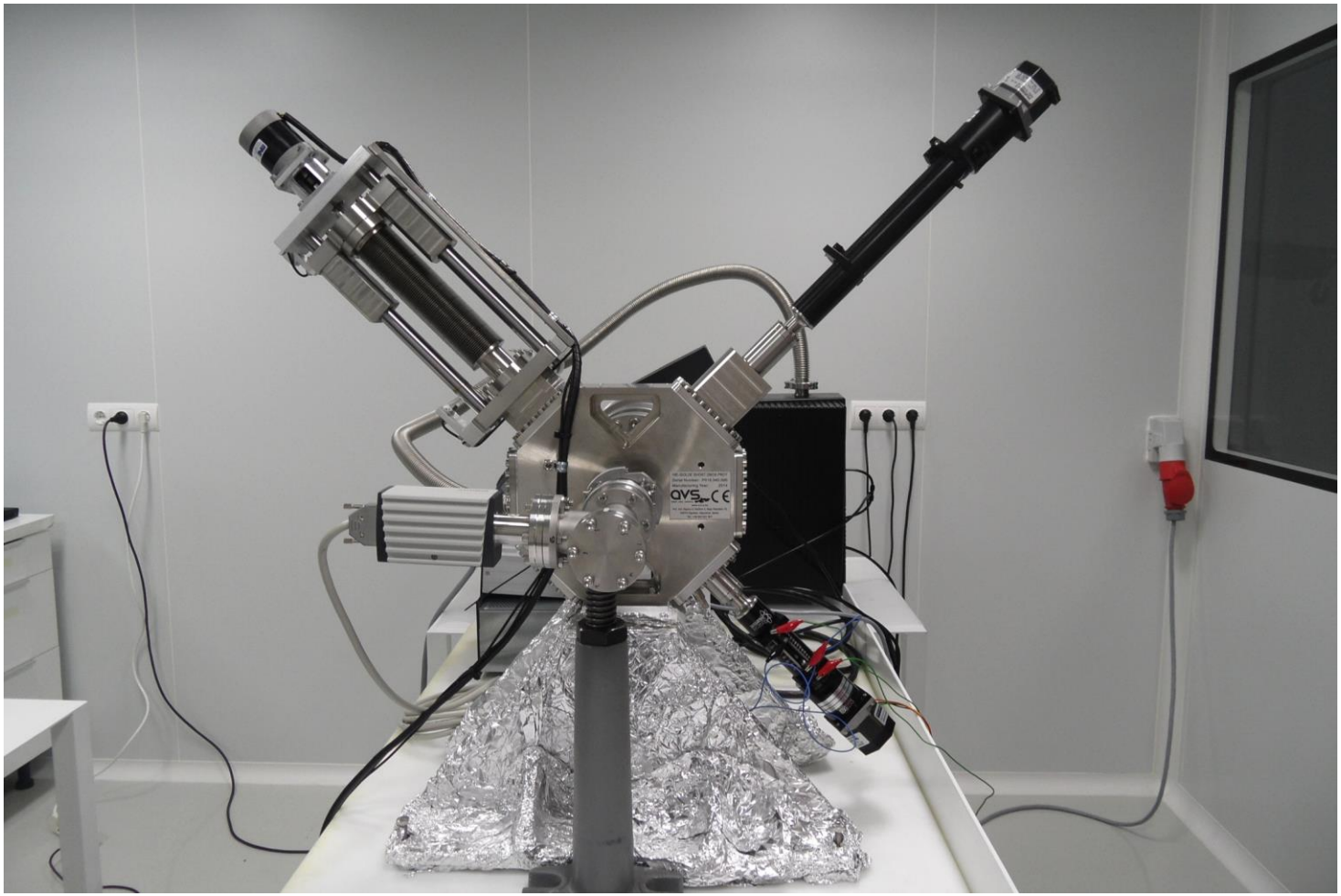


- Electronics
  - Diag. box control
    - ✓ Single VME card for current measurement and motor control
    - ✓ Received and tested (20 units) by October 14
  - Energy and bunch length (PIPS detectors)
    - ✓ Two options considered for the electronics
    - ✓ Not mandatory for operation



- Control software October 14
- Installation Nov – Dec 14 (XT01) Dec 14 – Feb 15 (XT02)

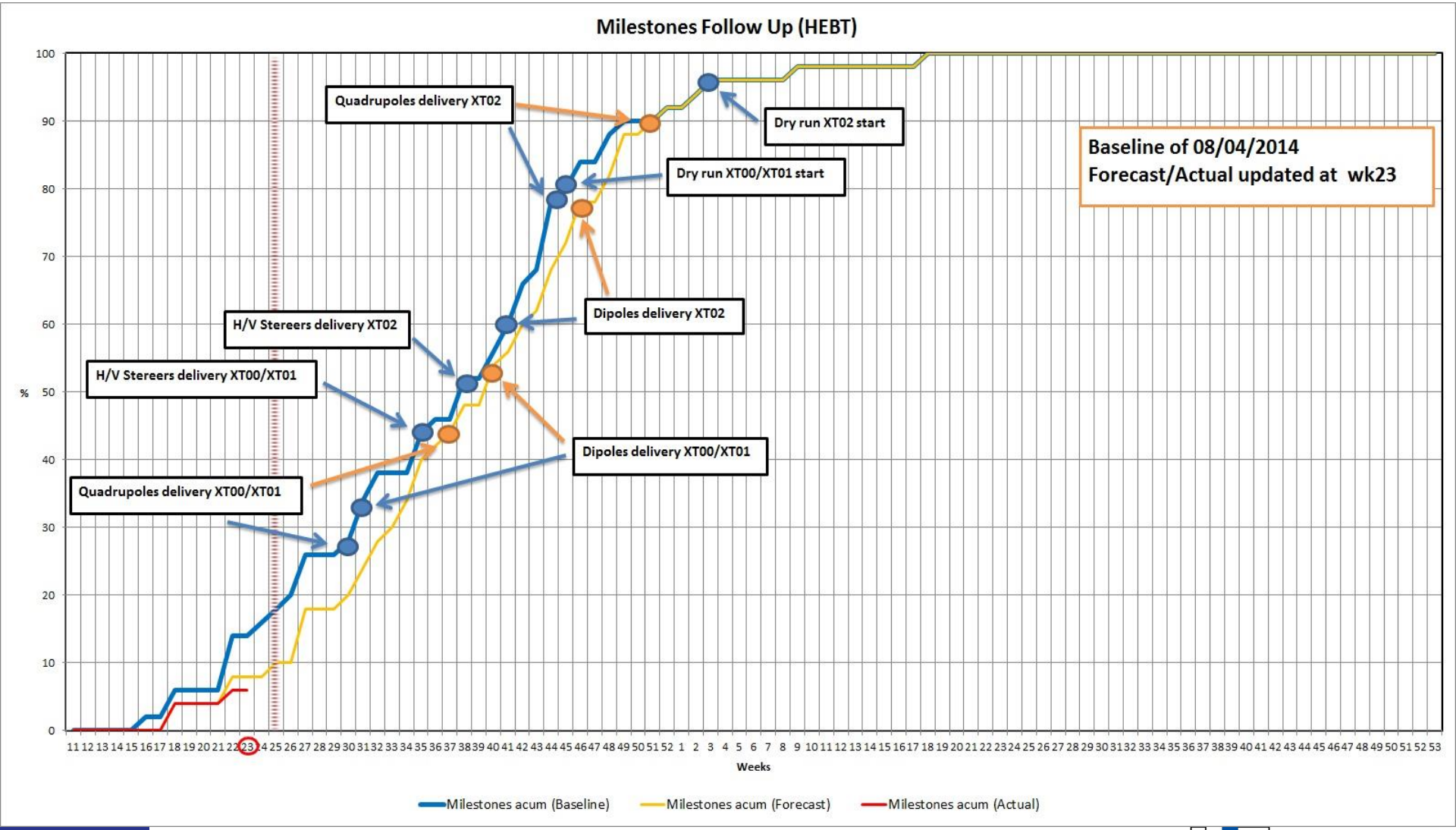
Beam Instrumentation: SDB



Beam Instrumentation: SDB

P016.010.001

Progress Monitoring: HEBT



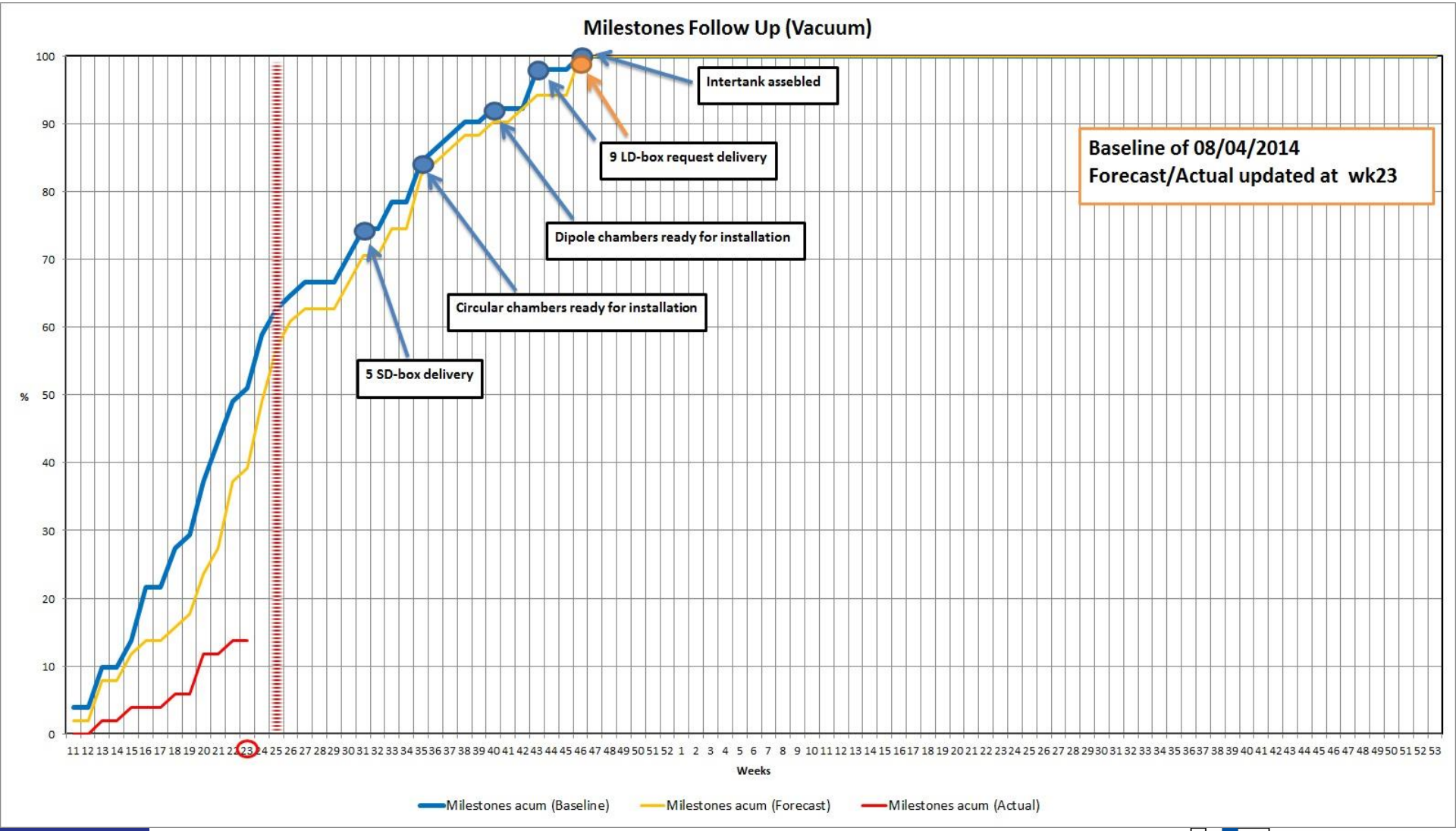
Vacuum

- Vacuum chambers

  Dipoles and circular chambers

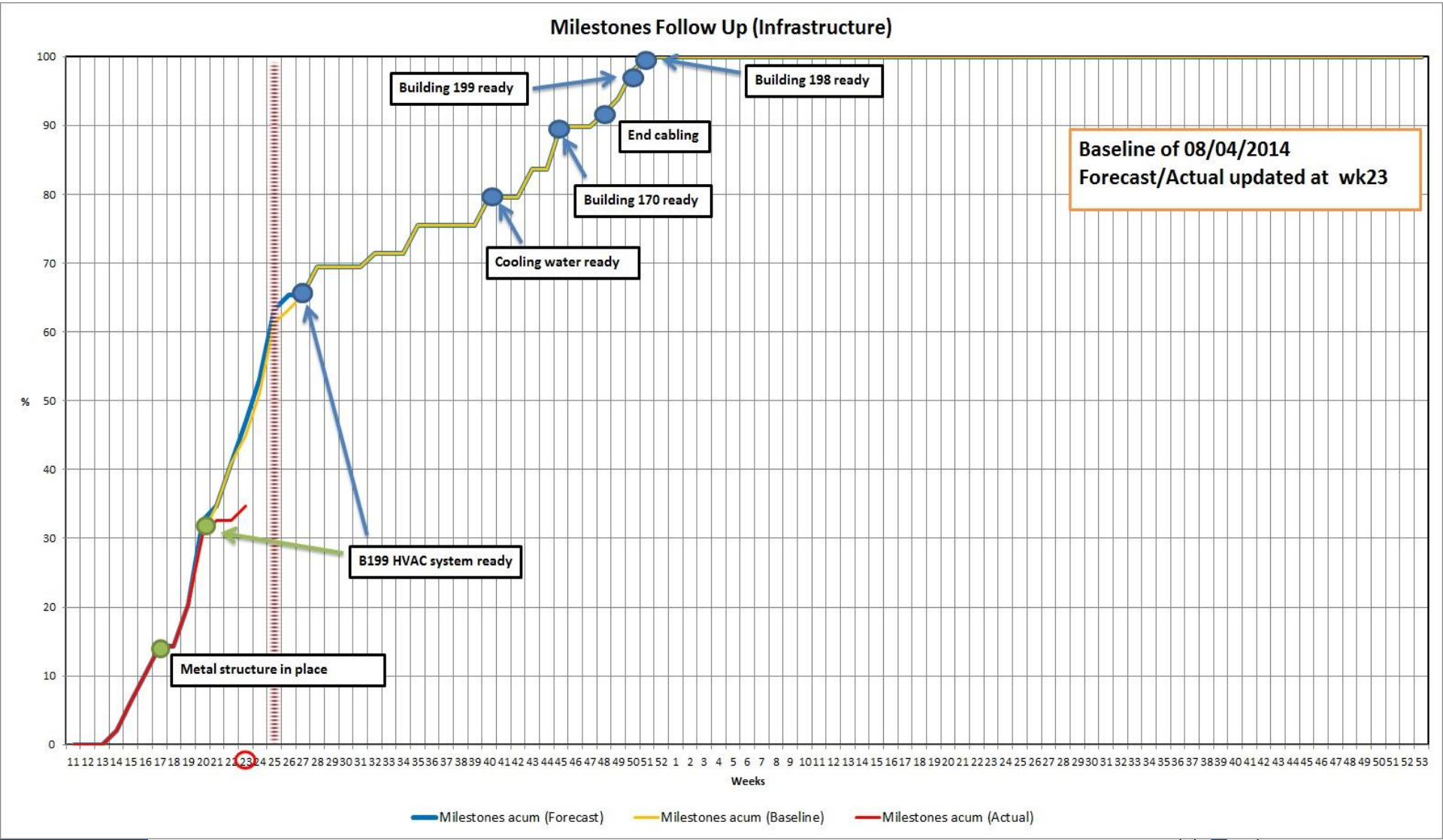
  - Design on-going
  - Production to start in May ?
  - Delivery beginning of September (October for the dipoles)
- Vacuum component
  - Standard CERN components (CERN contracts)
  - Delivery May (end of June for seals and collars)
- Ancillary lines (compressed air, N2, backing and roughing lines)
  - End of July
- Installation Sep 14 - Jan 15

Progress Monitoring: Vacuum

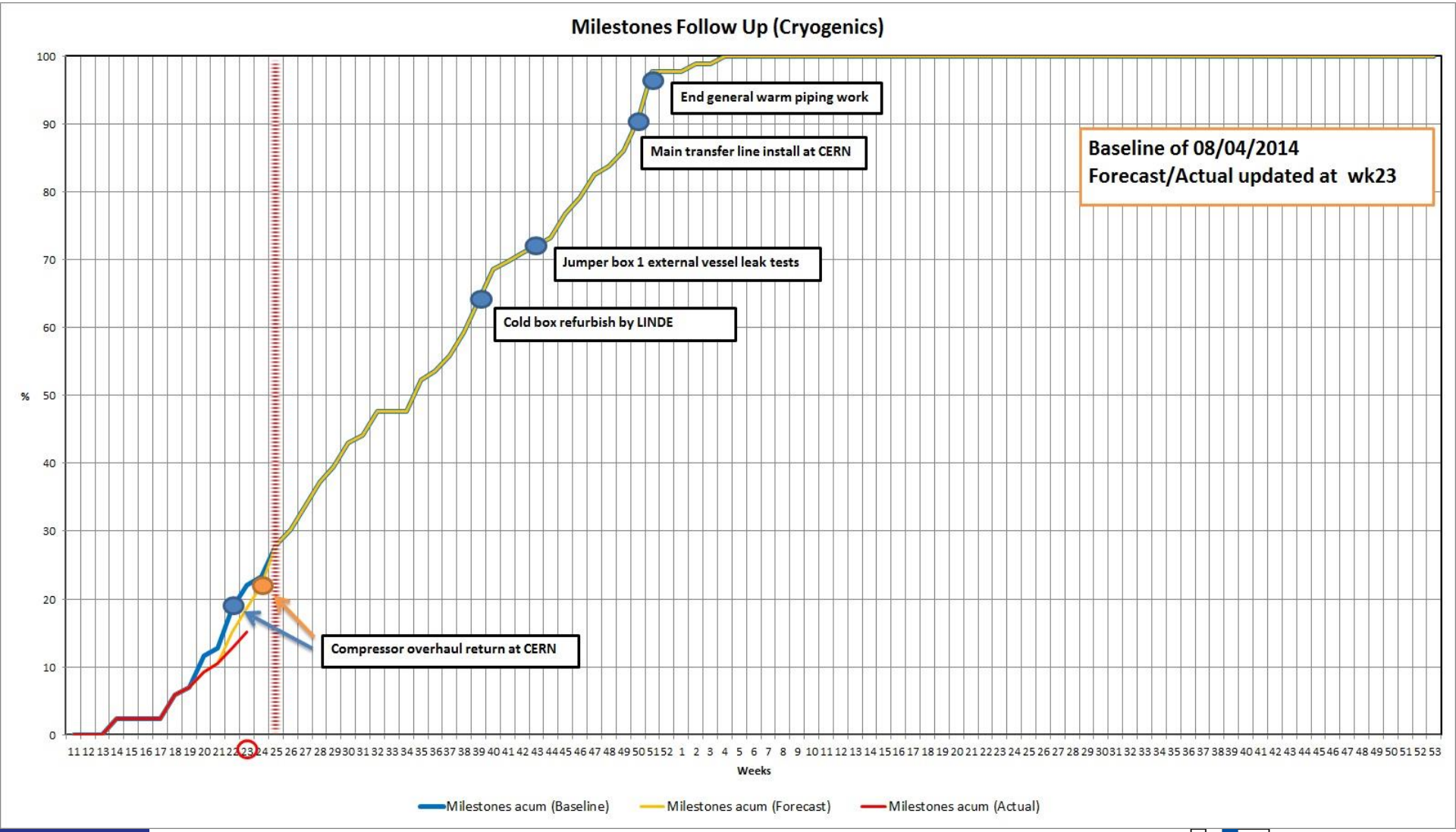


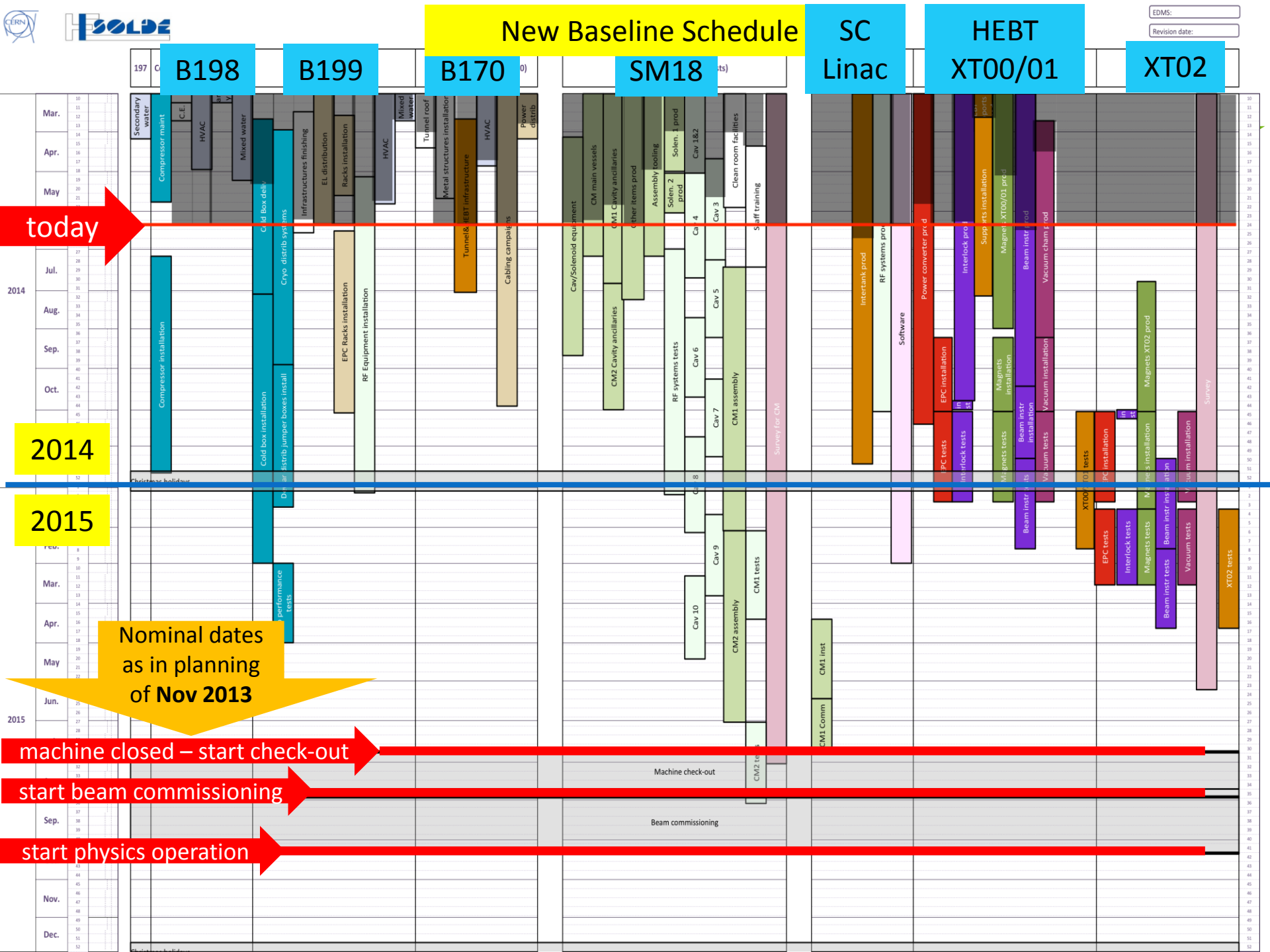
HIE ISOLDE installation

Progress Monitoring: Infrastructure



Progress Monitoring: Cryogenics




New Baseline Schedule
B198
B199
B170
SM18
SC Linac
HEBT XT00/01
XT02
today
2014
2015
Nominal dates as in planning of Nov 2013
machine closed – start check-out
start beam commissioning
start physics operation
Machine check-out
Beam commissioning
Compressor installation
Cold box installation
Cryo distrib systems
EPC Racks installation
RF Equipment installation
Tunnel& EBT infrastructure
Cabling campaigns
Cav/Solenoid equipment
CM main vessels
CM1 Cavity ancillaries
CM2 Cavity ancillaries
RF systems tests
Cav 5
Cav 6
Cav 7
CM1 assembly
CM2 assembly
CM1 tests
Cav 10
Cav 9
Staff training
Survey for CM
intertank prod
RF systems prod
Software
Power converter prod
EPC installation
Interlock tests
Magnets installation
Beam instr installation
Vacuum installation
Magnets XT02 prod
EPC tests
Interlock tests
Magnets tests
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Vacuum tests
XT02 tests
Survey
CM1 inst
CM1 Comm

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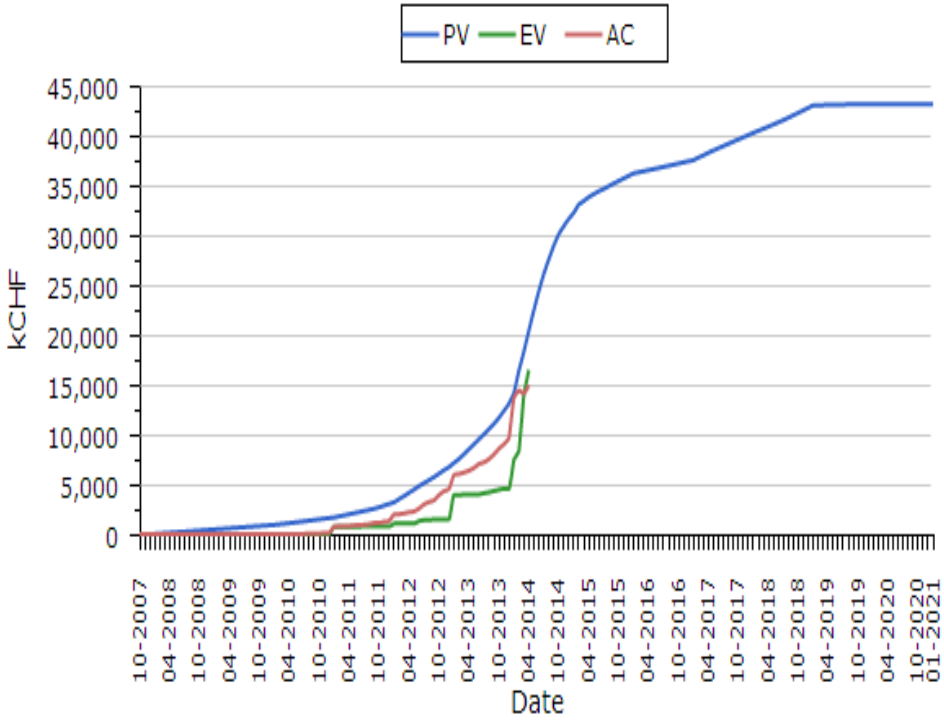
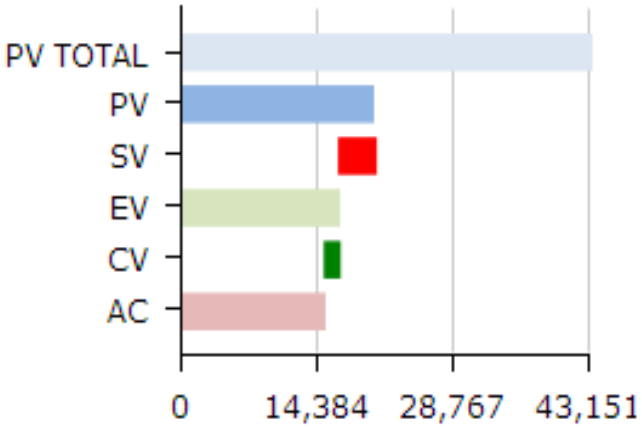
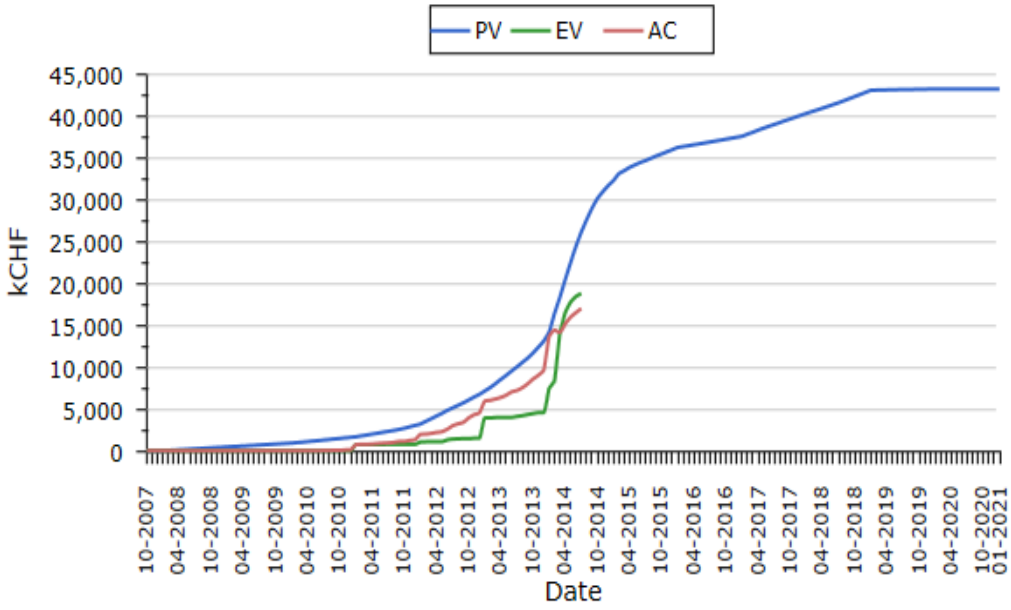
EVM Analysis

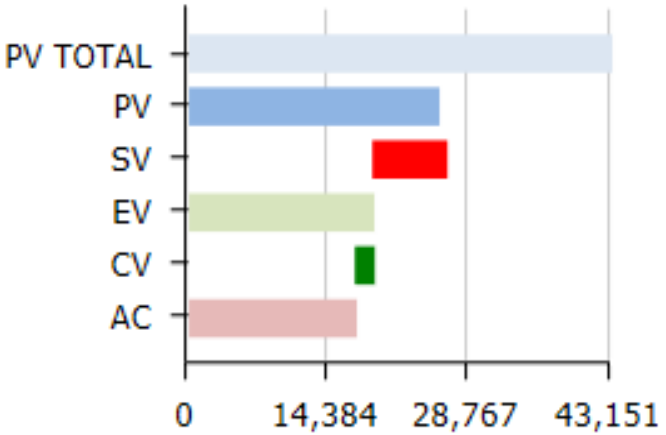


28 March 2014





17 June2014



EVM Analysis

March 2014

	From Project Start To Date					Total	
	Cost Variance	Schedule Variance	Planned Value	Earned Value	Actual Cost	Planned Value	% Progress
Total	1'538'801	-3'446'916	19'918'900	**16'471'983**	14'932'745	**43'150'641**	**39%**

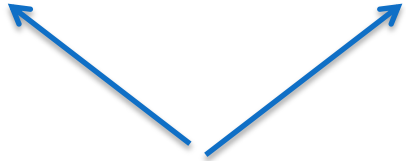
June 2014

	From Project Start To Date					Total	
	Cost Variance	Schedule Variance	Planned Value	Earned Value	Actual Cost	Planned Value	% Progress
Total	1'790'952	-6'587'110	25'350'755	**18'763'645**	16'972'694	**43'150'641**	**44%**

- Schedule Variance is worsening
  - Real delays in the project, namely:
    - Cavity production, Cryomodule Tooling and assembly, Cryogenic plant, Vacuum, warm magnets

Expenditures on Machine Budget (31 May 2014)

Budget Code Description	Department	Group	PPA Sub-Unit	Project	Charged to Budget Code (CHF)	Annual Commitment (CHF)	Annual Open Commitment (CHF)	Payment Budget (CHF)
HIE ISOLDE Linac SC Cavity Manufacturing	EN	HDO	ISO-PRJ	HIE-MAC1	48,252	54,339	6,087	43,000
HIE ISOLDE Linac Cryomodules (design office)	EN	HDO	ISO-PRJ	HIE-MAC1	106,230	113,702	7,472	254,000
HIE ISOLDE Linac Integration	EN	MEF	ISO-PRJ	HIE-MAC1	0	0	0	15,000
HIE ISOLDE SC Linac Installation WP4.4	EN	MEF	ISO-PRJ	HIE-MAC1	26,564	36,764	10,200	20,000
Initial R&D	EN	HDO	ISO-PRJ	HIE-MAC1	0	0	0	87,000
HIE-ISOLDE SC Linac Monitoring	EN	MEF	ISO-PRJ	HIE-MAC1	30,278	806	-29,472	93,000
HIE-ISOLDE Beam Instrumentation	BE	BI	ISO-PRJ	HIE-MAC1	97,140	175,886	78,746	1,273,000
HIE-ISOLDE Low level RF	BE	RF	ISO-PRJ	HIE-MAC1	301,208	341,806	40,598	732,000
HIE-ISOLDE Linac Commissioning	BE	OP	ISO-PRJ	HIE-MAC1	0	0	0	22,000
HIE-ISOLDE SC Cavity Manufacturing	BE	RF	ISO-PRJ	HIE-MAC1	73,531	732,166	658,635	1,152,000
HIE-ISOLDE Power RF	BE	RF	ISO-PRJ	HIE-MAC1	26,479	51,454	24,975	105,000
HIE-ISOLDE RF slow controls	BE	RF	ISO-PRJ	HIE-MAC1	30,890	36,311	5,421	80,000
HIE-ISOLDE Linac SC Solenoids Series Production	TE	MSC	ISO-PRJ	HIE-MAC1	12,606	14,949	2,343	272,000
HIE-ISOLDE Linac SC Cryomodule Series Production	TE	MSC	ISO-PRJ	HIE-MAC1	202,248	384,143	181,895	1,205,000
HIE ISOLDE Linac Beam Transfer Line (Magnet & Supports)	TE	MSC	ISO-PRJ	HIE-MAC1	104,478	1,102,514	998,036	1,406,000
HIE-ISOLDE Linac SC Cavity Sputtering Series Production	TE	VSC	ISO-PRJ	HIE-MAC1	10,309	42,145	31,836	113,000
HIE-ISOLDE Linac Machine Vacuum	TE	VSC	ISO-PRJ	HIE-MAC1	98,503	131,183	32,680	577,000
					1,168,714	**3,218,167**	**2,049,453**	**7,449,000**



Funding

Cash Balance of the Machine Part of the HIE-ISOLDE Project (in kCHF)

	Phase 1	**Phase 2**	**Phase 3**	**Total**
Cost	13'048	3'578	5'327	21'953
Funding (including CERN loan and increase of contribution)	12'984	640		13'624
Cash balance	**-64**	**-2'938**	**-5'327**	**-8'329**

- **Phase 1 is secured** provided special CERN contribution is approved in June
- Advanced procurement of agreed Phase 2 components also covered
- **Phase 2 and Phase 3 are presently unfunded**

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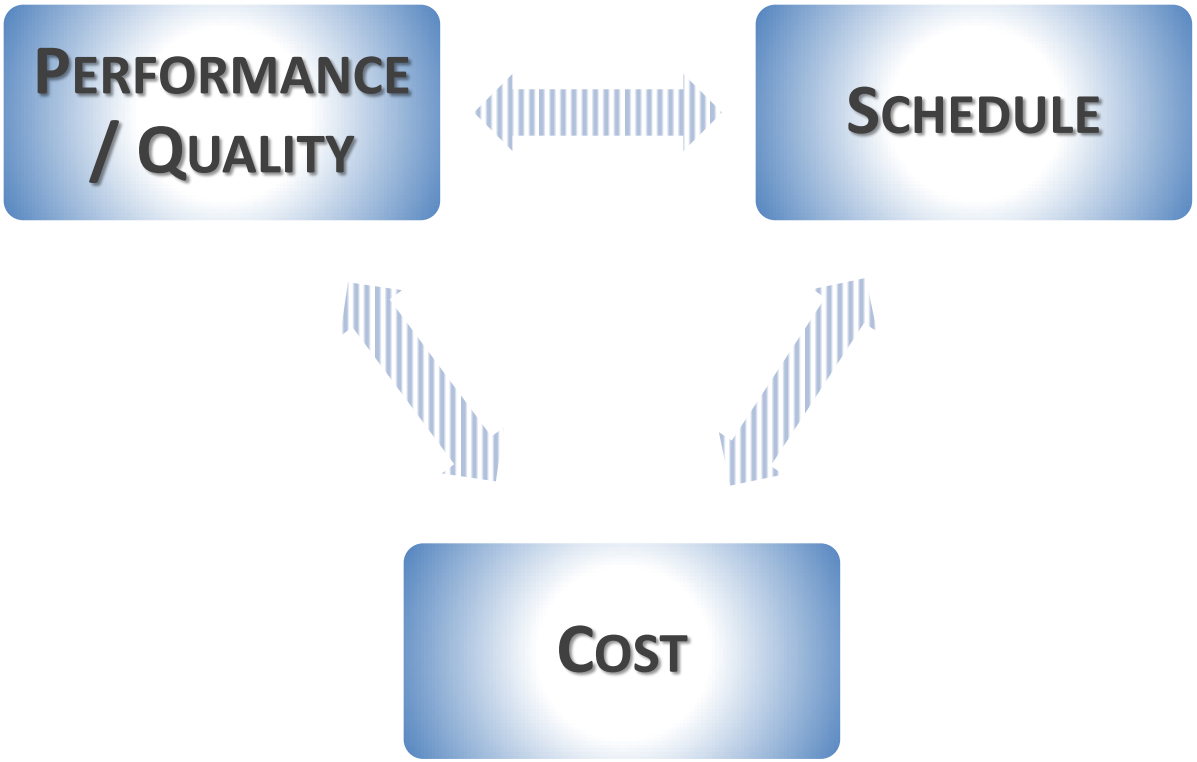
- **Update of the Risk Register**
- Summary

1 risk management

For this project the main categories of risk are sub-divided regarding their impact to:



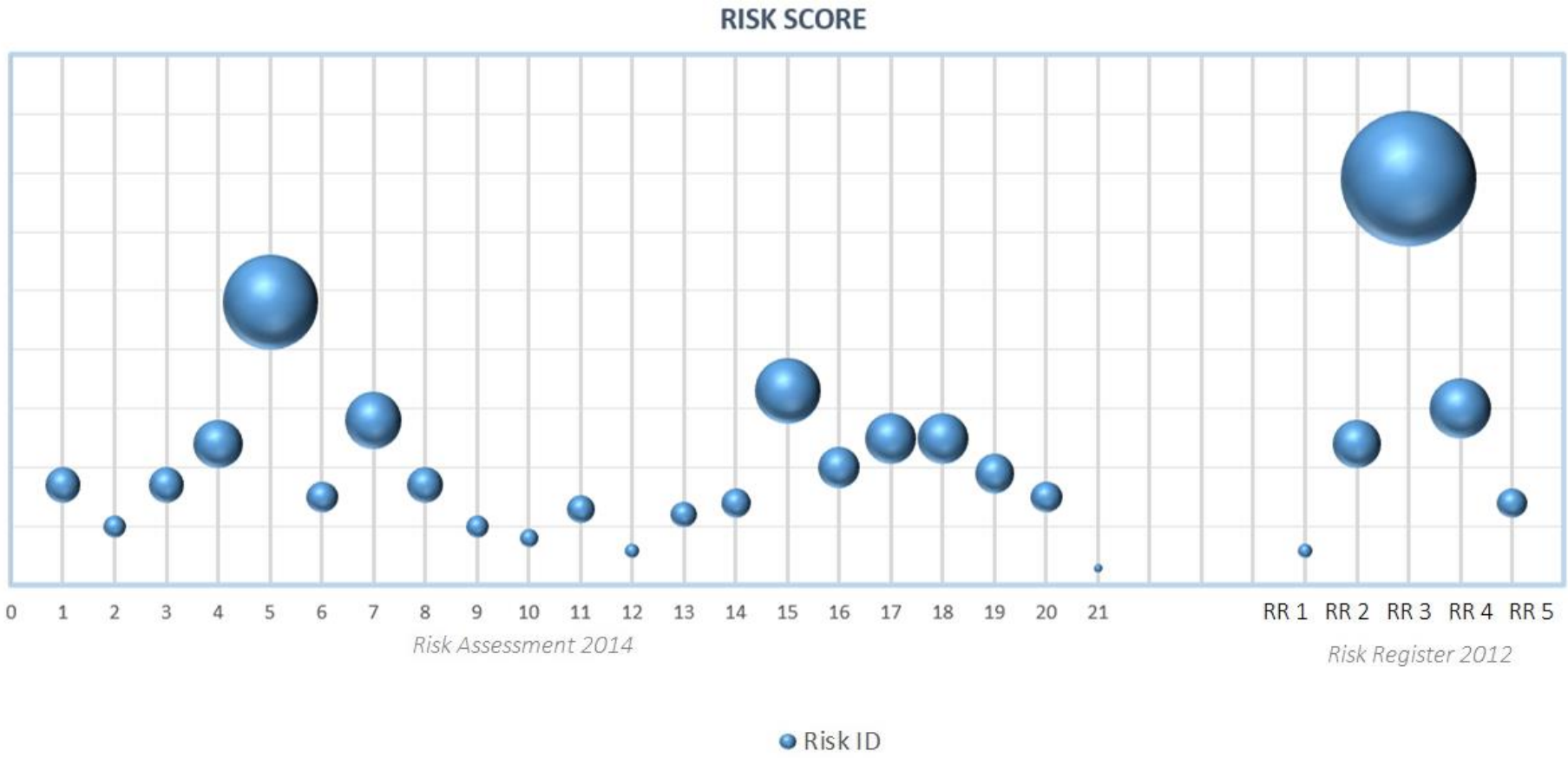
6 risk assessment 2014

I successfully met will ALL WP Owners (17), and discussed the RA methodology and the objectives of this exercise.
(However I have yet received the results for 1 WP).

During this exercise *(so far)* 446 Project Risks have been assessed.

68 risks have been taken into account in the Risk Register
(many combined with several WPs).

8 risk score



The bigger the result, the higher perception WP Owners have of the severity (or likelihood) of that risk impacting the project.

8 risk score

Based on the Risk Score, we can derive that out of the 68 registered risks, these are the main risks perceived by the WP owners:

Risk ID	Description	Risk Score
RR3	Inadequate availability of CERN and/or contractor's manpower	77
RR4	Need to (late) design / adaptation of items	35
1.5	Conflicting projects and sharing man-power	56
1.7	Inexperienced staff assigned to project items	36
1.15	Learning curve on 1st unit	34
1.18	Non conformity of outsourced equipment	27

**** For more details please consult the Risk Register: EDMS 1368552***

Summary…

- **Key issues in next six months will be:**
  - Maintaining the 75% success rate for the cavity sputtering/processing protocol with sufficient margin in peak gradient while meeting CM schedule
  - Maintaining tight cryomodule assembly
  - Maintaining tight cryogenic installation schedule
- **Planning and Activity Monitoring reviewed weekly**
- **Resources issues (highlighted by Risk Analysis) are being addressed**
- **Budget under control**

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