HIE-ISOLDE Project Status Report

ISOLDE & nTOF Technical Committee Meeting
CERN, 31 October 2012
Yacine.Kadi@cern.ch

- Main Highlights & R&D Activities
- Project Schedule
- Outlook

HIGHLIGHTS (1/3)

- Civil Engineering contract adjudicated and signed (IT+FR for 1185 kCHF) => construction works finalized (1.5 month delay)
- HAVC System contract adjudicated and signed (IT for 1320 kCHF) => start of installation November 2012
- Cooling System contract adjudicated and signed (IT for 1255 kCHF) => start of installation November 2012
- Copper forgings for cavity fabrication (8 + 2 options) => 4 companies => first 2 blocks delivered
- Cavity Alignment system design and fabrication => CATE
- SC Solenoids contract adjudicated and signed (DK for 390 kCHF: 4 + 2 options) => expect first 2 solenoids in 12 months
- Invitation for Tenders
  - Cryogenic Plant => + reply from Air Liquide and Linde => under review
  - Clean room at SM18 => sent out
  - Cavity substrate manufacturing => in preparation
  - CM1 and CM2 vacuum + He vessels manufacturing via CATE => in preparation
- Market surveys
  - HEBT lines magnets (dipoles, quadrupoles and steerers) => launched

HIGHLIGHTS (2/3)

- HEBT line Review (April 25 & July 6 2012)
- Cryomodule Technical Review (April 26-27 2012)
- Risk Assessment (Aug-Sep 2012)
- Design Study for the Intensity Upgrade well underway
  - Target + Front-end
  - Offline separator test bench
  - HVAC + Cooling => nuclearization
  - Charge Breeder => EBIS workshop Oct. 16-17 2012
- SRF activities
  - Cavity tests (more substrate, improved sputtering, procurement, etc…)
  - Cavity ancillaries (RF coupler and tuner)
  - LLRF (prototype, integration, etc…)
  - RF controls and interlocks

HIGHLIGHTS (3/3)

- Design of prototype Diagnostic Box
  - AVS delivered Faraday Cup which was tested at REX-ISOLDE
  - Body of the DB is next
  - Additional Resources needed to develop the electronics for acquisition and motor control
  - MS in preparation

- Integration issues (building 170):
  - Advance on tunnel/shielding design and integration
  - Integration of power converter racks on mezzanine in building 170
  - Integration of beam transfer lines

FINAL LIST OF RISKS ASSESSED « HIGH »

Highest: 4

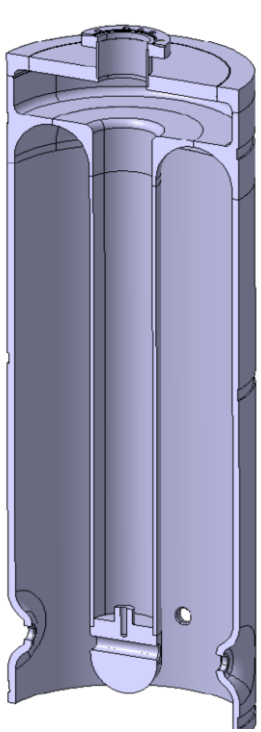
- 1A: Learning curve on 1st *cryo-module* out of schedule
- 1C: Learning curve on 1st *RF cavities* out of schedule
- 2B: *cryogenics* procurement and industrialization strategy lead to delays / cost overruns
- 3: inadequate availability of CERN and/or contractors' manpower

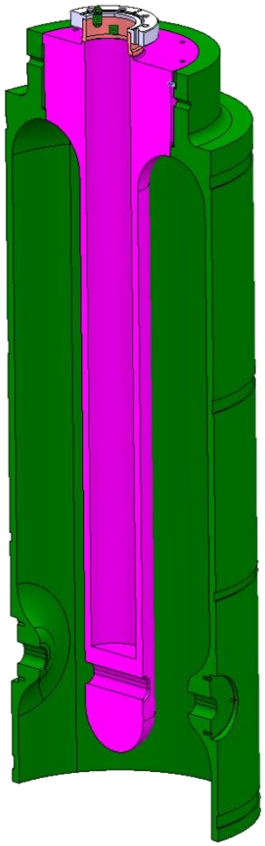
Should be considered: 6

- 2D : *RF cavities* procurement strategy
- 4B: need to redesign *cryo-module*
- 5: technical management of interfaces
- 6: HIE-LINAC not delivering to spec
- 7: Performance of series *RF cavities*
- 8A: *Cryogenics* late delivery

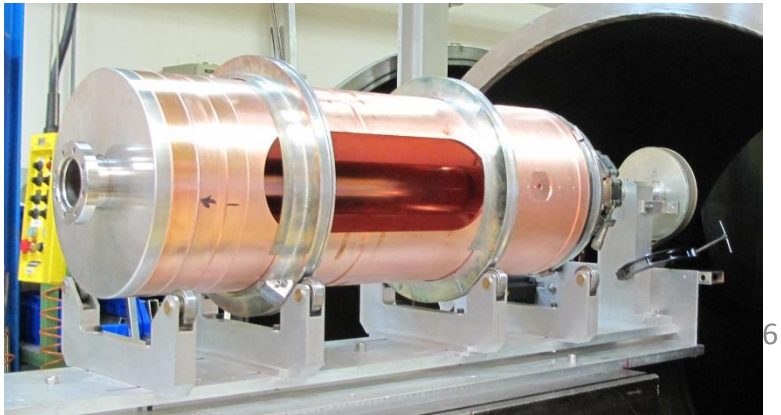
Cavity prototypes designed and built at CERN (W. Venturini)

- 4 units “old design”: Q1-Q2-Q3-Q5
  (rolling, EB welding, deep-drawing)
- 1 new design: QP1
  (3D machining in bulk copper, EB welding)





- 1 cavity (Q4) manufactured for sputtering tests on samples

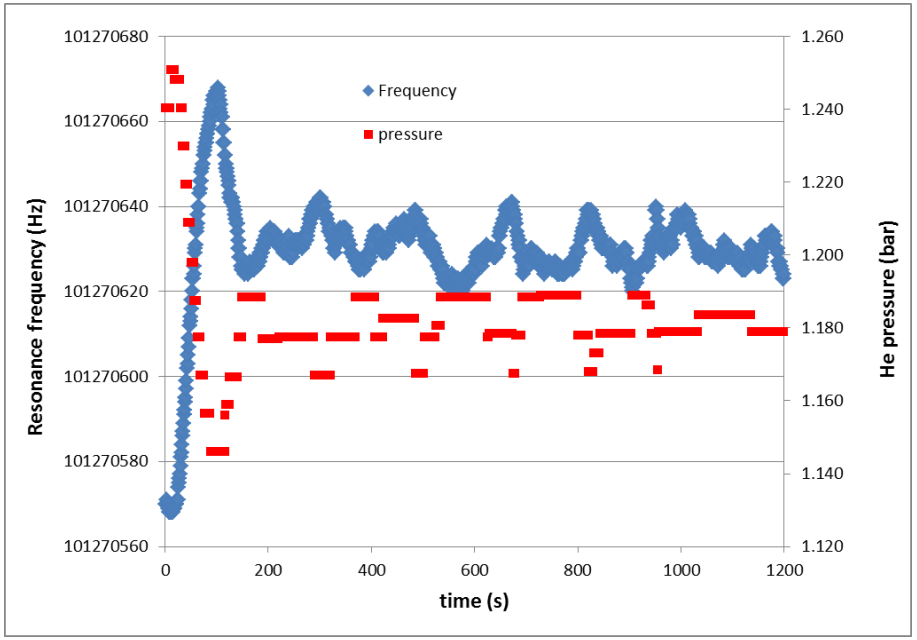


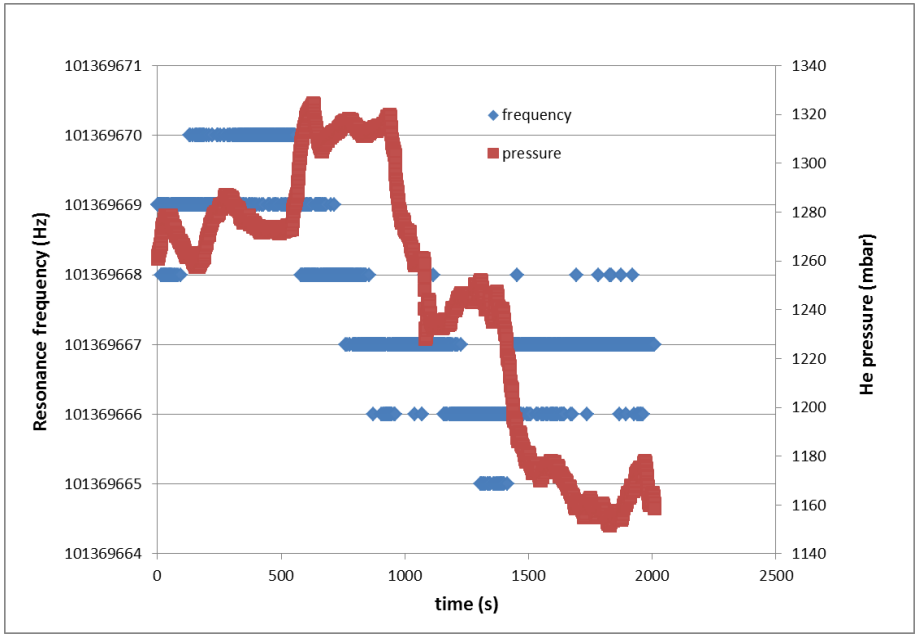
Note: Q3 and QP1 were left longer to reduce B on RF contact with tuning plate

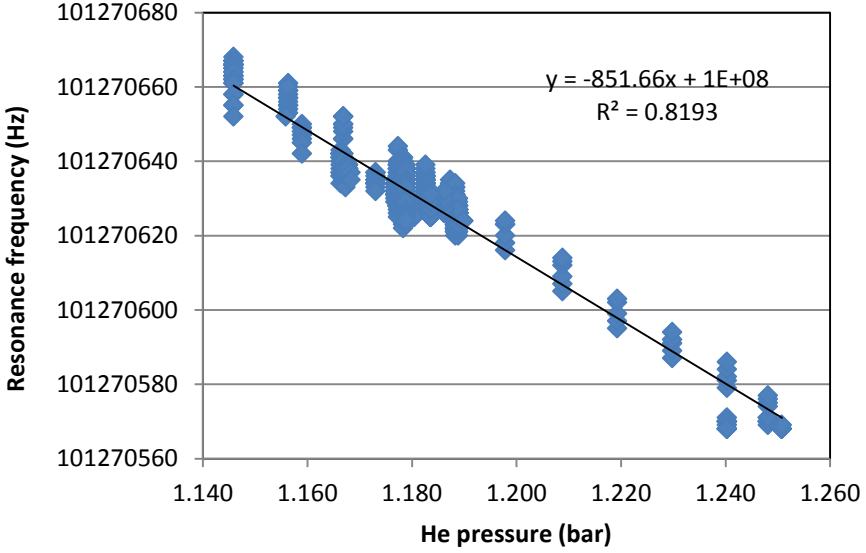
QP1: sensitivity to He pressure (W. Venturini)

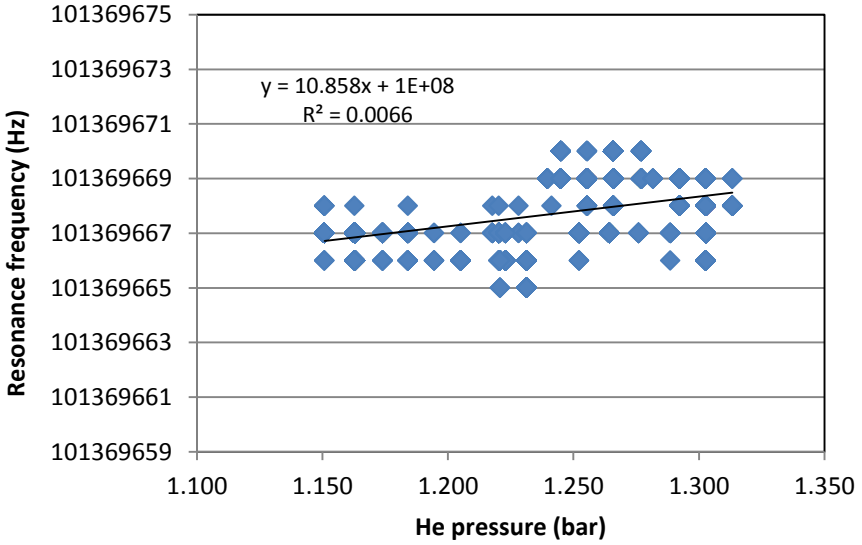
Q2 (old design) ~ 1 Hz/mbar

QP1 (new design) ~ 0.01 Hz/mbar

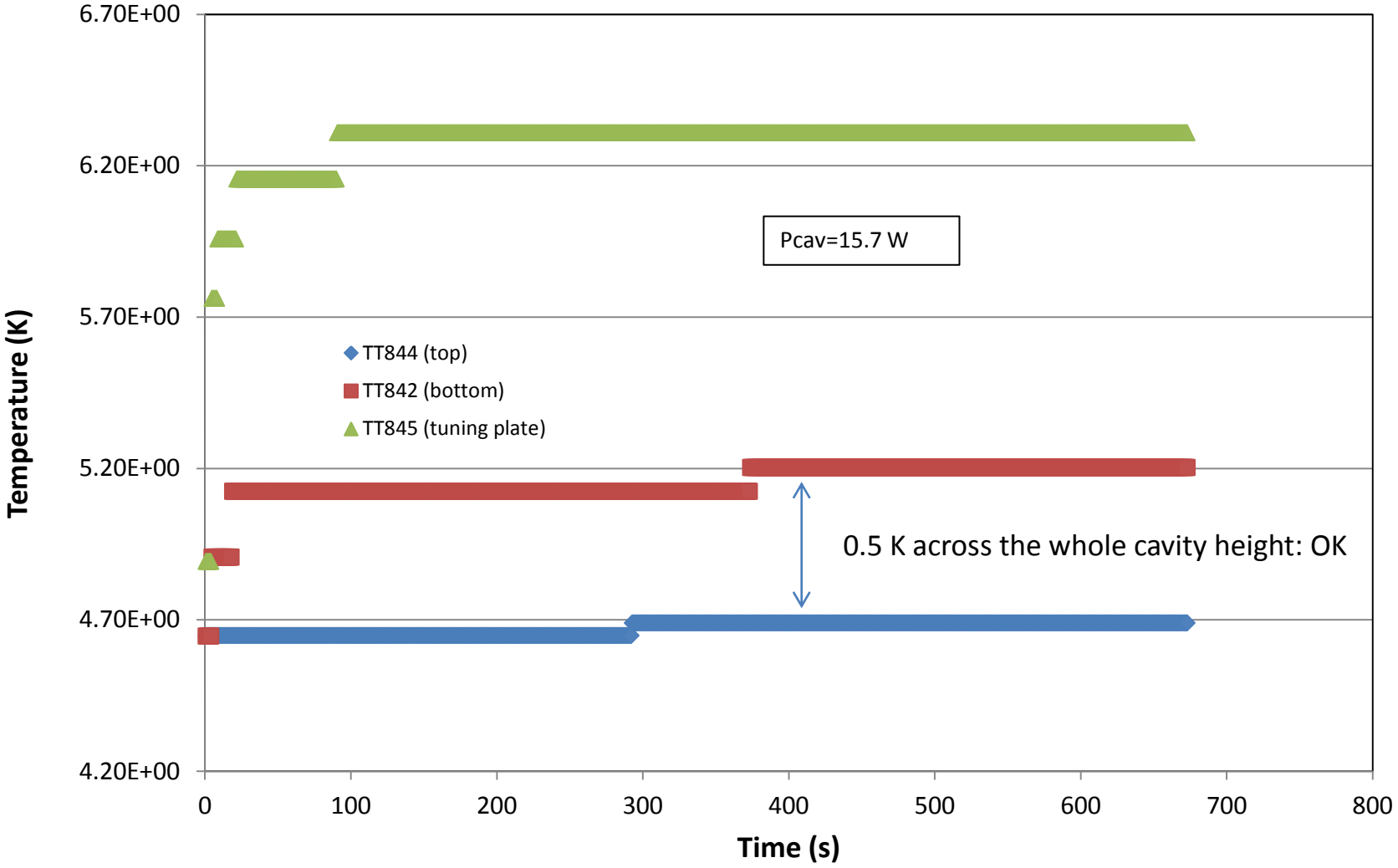




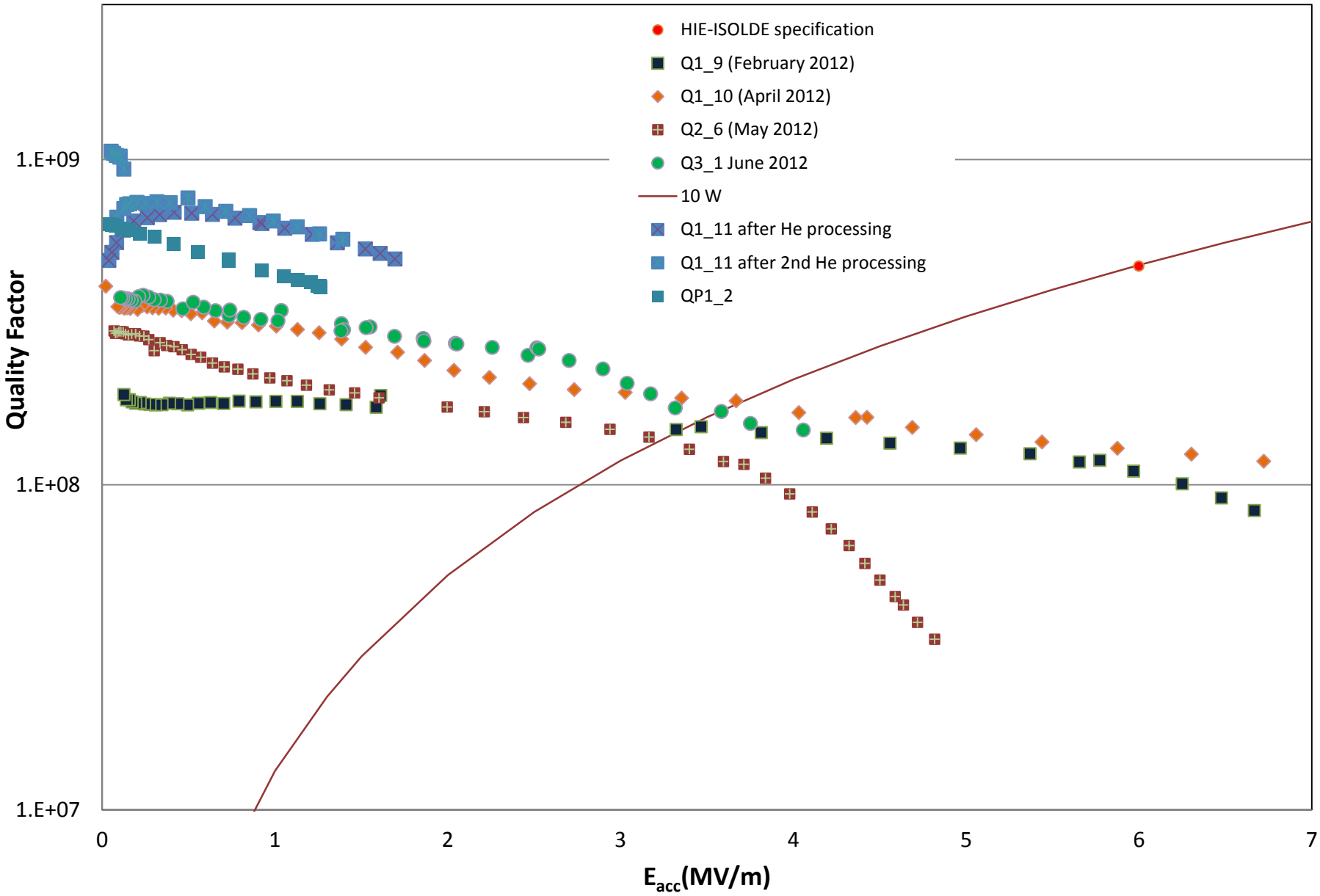




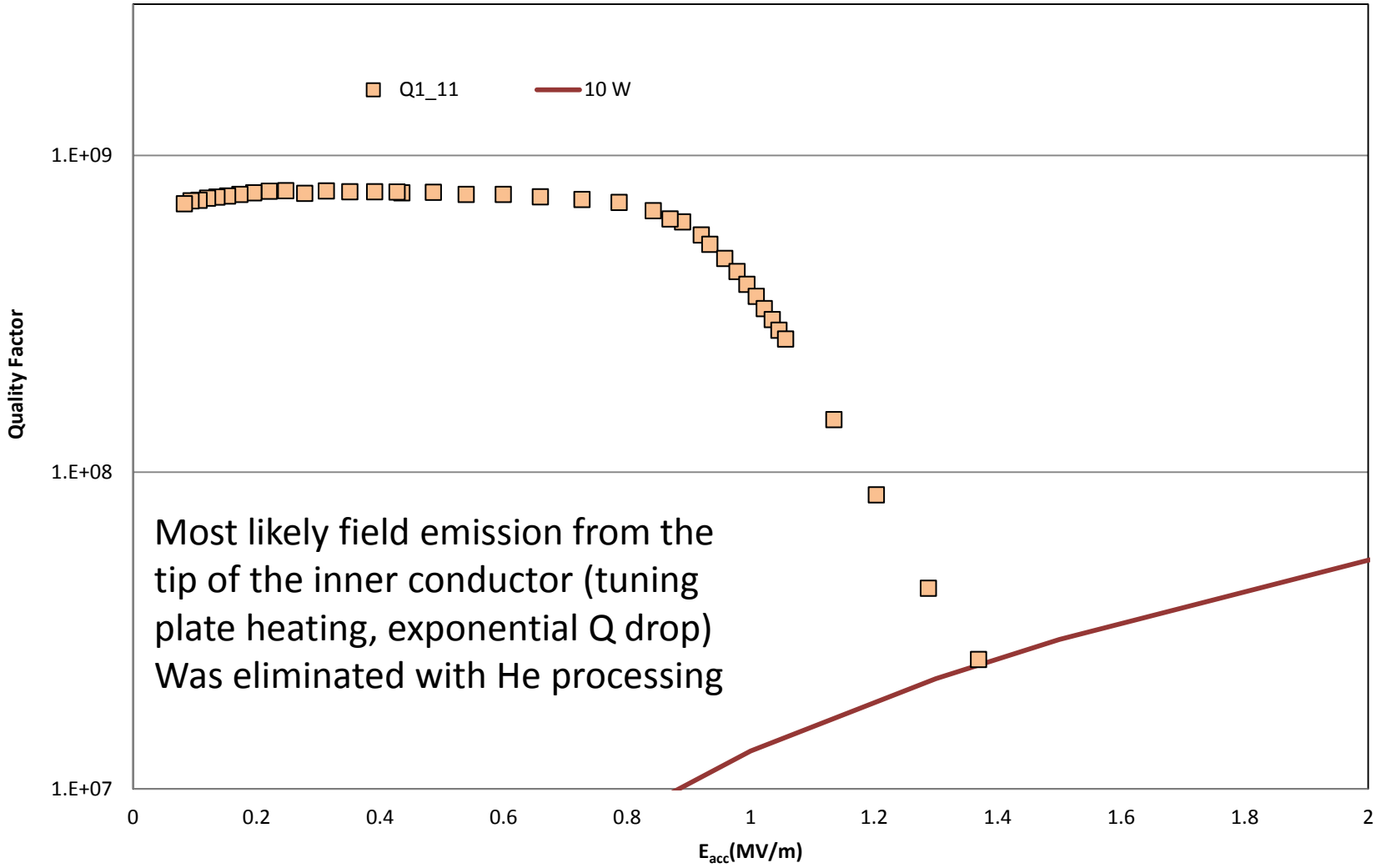
QP1 thermal performance
(with high dissipation in the cavity bottom after Q-switch)
(W. Venturini)



Test cavity performances in 2012 (W. Venturini)



Q1_11 first test results at 4.5 K



Last two cavities (Q1_11 and QP1_2)

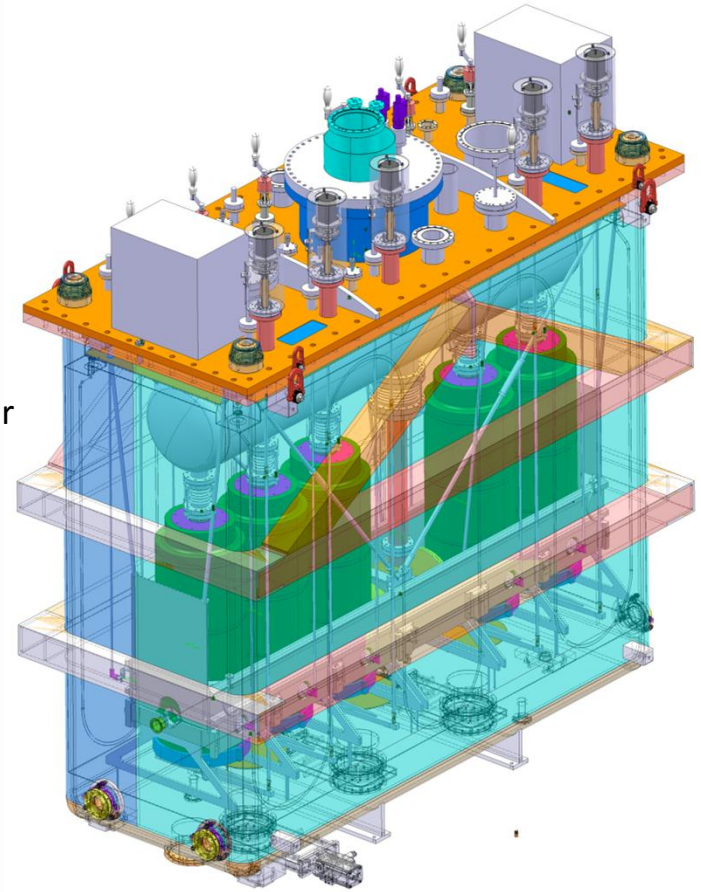
- Desired sputtering parameters almost reached (discharge power increased to 8 kW)

- Q1_11: inner electrode at ground potential
  - Corrugated film surface on the tip of the inner conductor
  - Nb peel off at cavity lower edge
  - Tested with flat Nb/Cu tuning plate

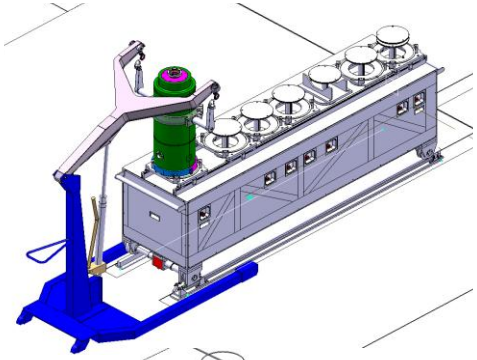
- QP1_2: inner electrode at cavity (bias) potential
  - Corrugated area on the tip was much reduced
  - Better adhesion on lower cavity edge
  - Tested with Cu/Be tuning plate

What's going on now and next steps

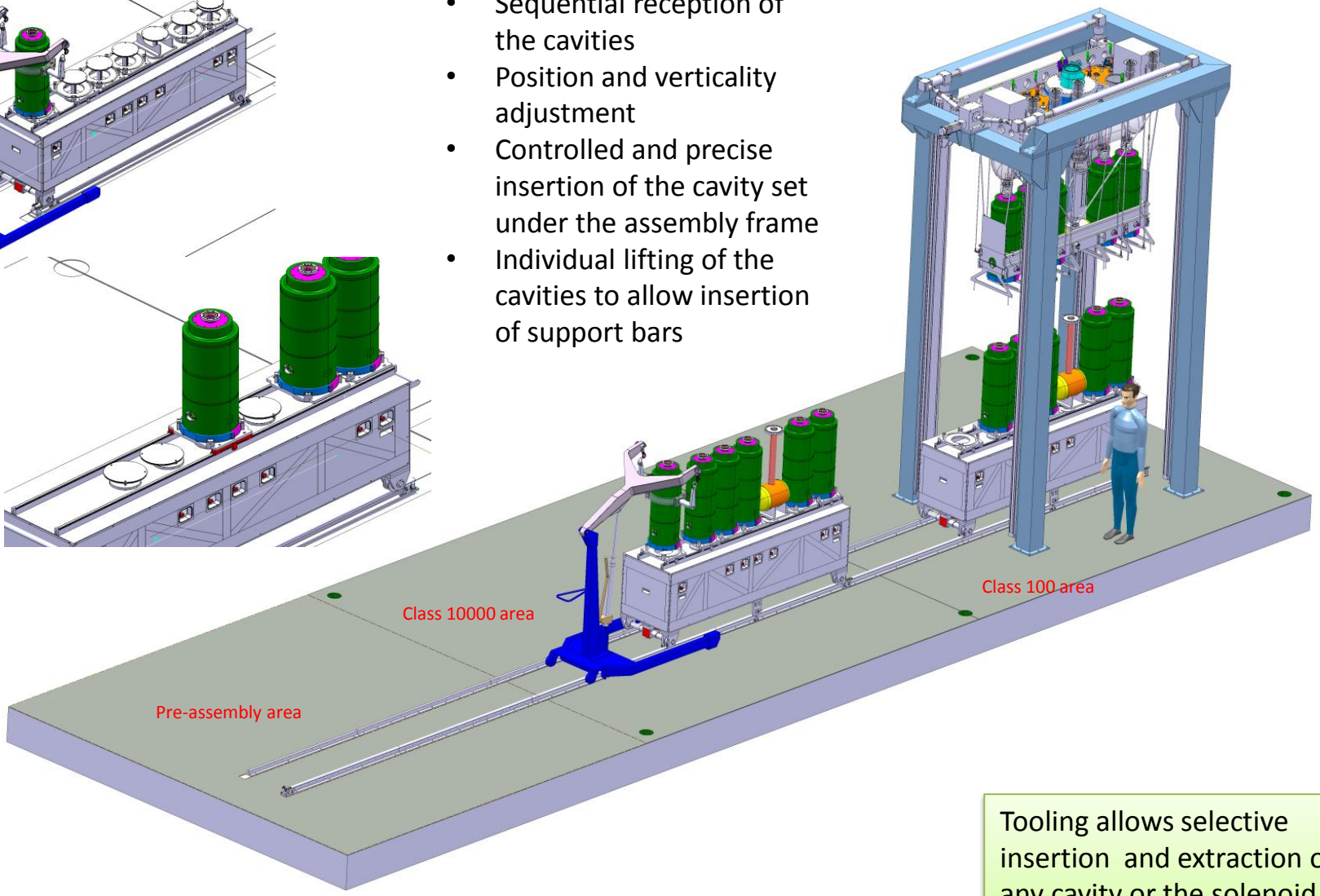
- **Design**
  - Support frame detail design
  - Specific tooling conceptual and detail design
- **Specification Drawings**
  - Thermal Shield
  - Support frame
- **Procurement**
  - Frame position Adjusters - industrial production underway
  - Clean room – Out to industry next week
  - (Vacuum and helium vessels) – Out to industry by mid October
  - Thermal Shield – Out to industry by end November
  - Support Frame – Out to industry by mid December
  - External jacks - Out to industry by mid December
  - Specific Tooling Out to industry in January 2013
- **Documentation**
  - Assembly procedures
  - Technical specifications
  - Product Breakdown Structure (PBS)
  - Work-package description
- **New studies**
  - Integration of the Cryo-module into the shielding tunnel



Specific Assembly Tooling

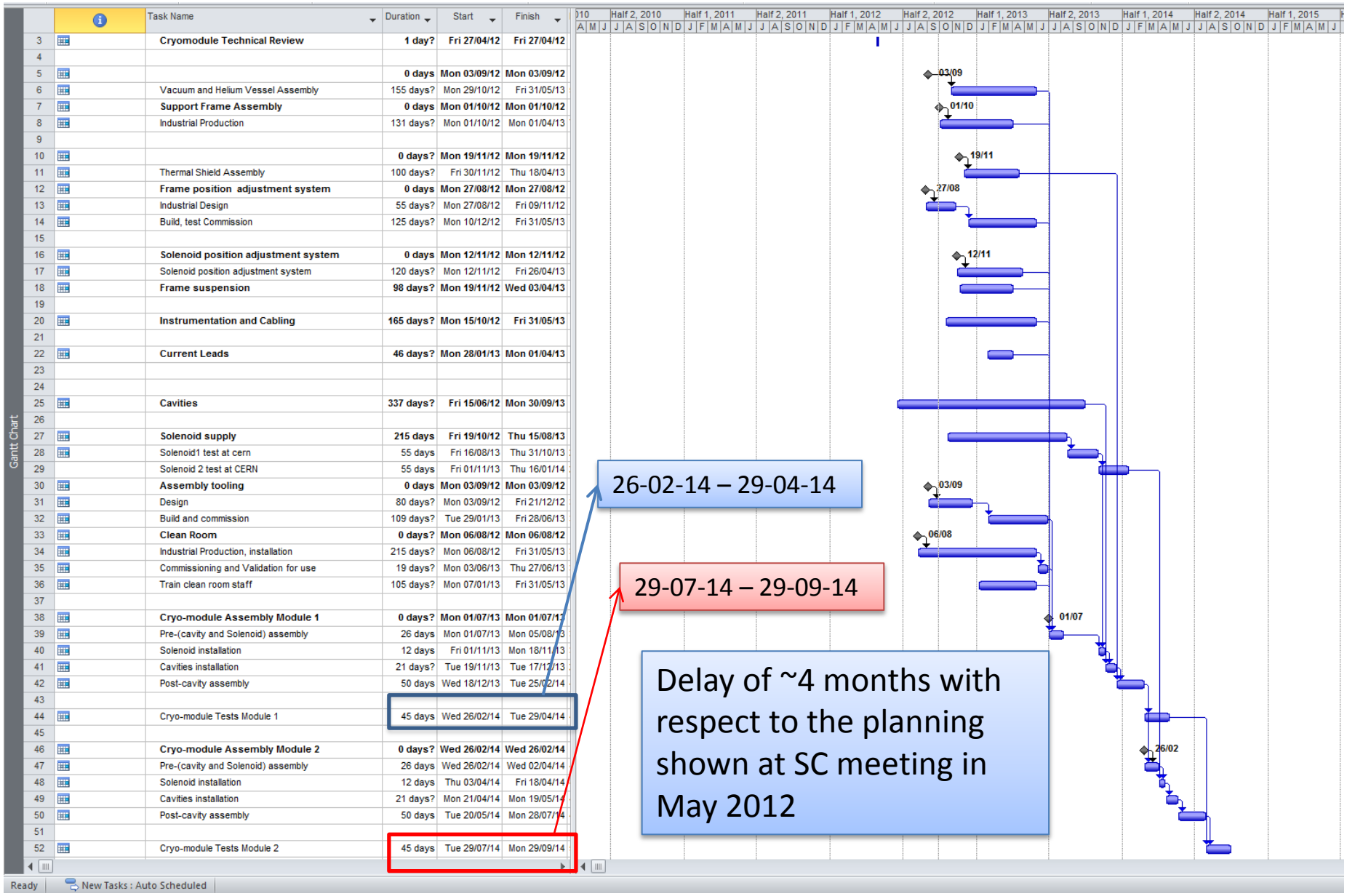


- Sequential reception of the cavities
- Position and verticality adjustment
- Controlled and precise insertion of the cavity set under the assembly frame
- Individual lifting of the cavities to allow insertion of support bars



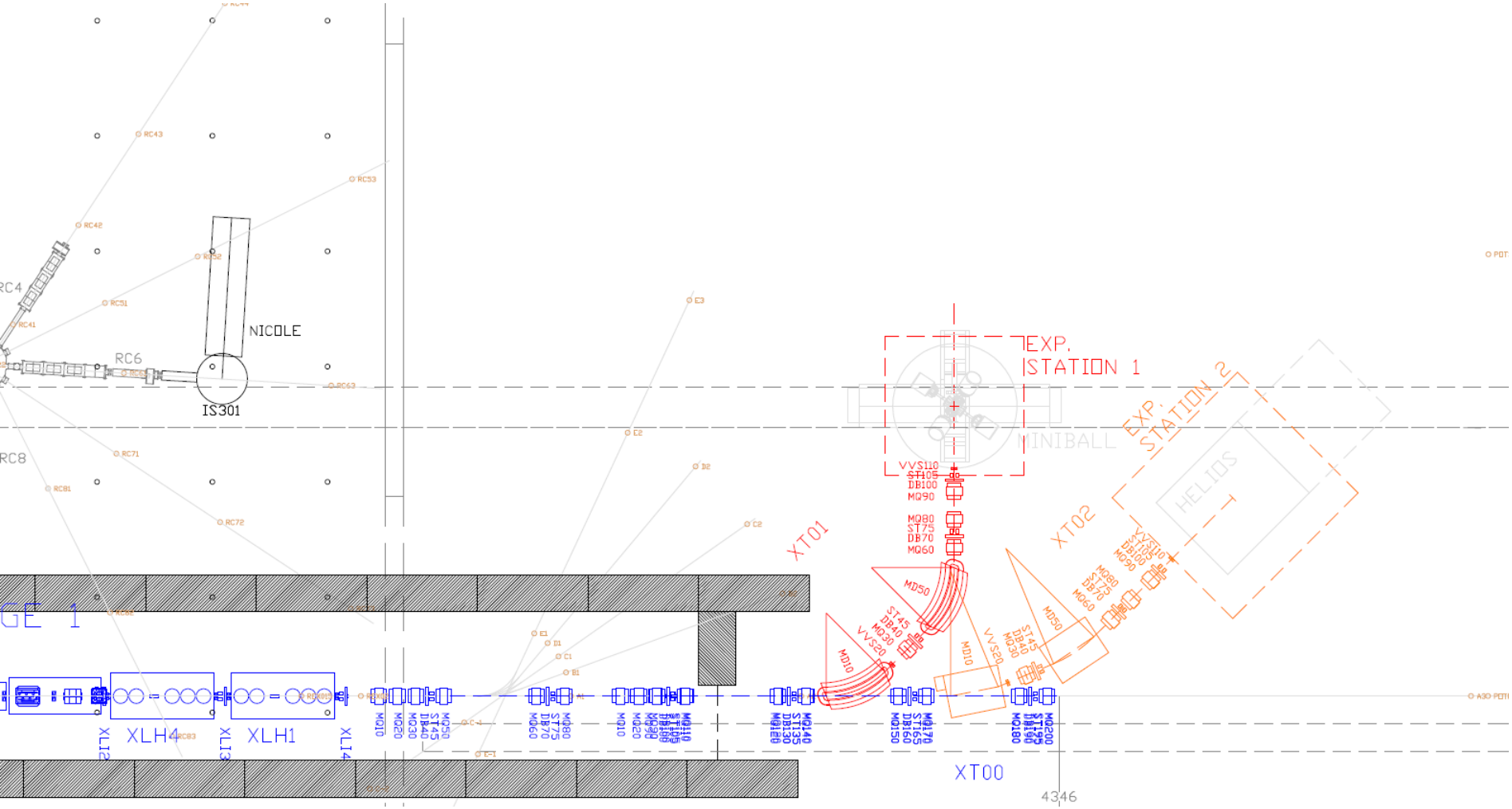
Tooling allows selective insertion and extraction of any cavity or the solenoid

Planning


Gantt Chart
Task Name
Duration
Start
Finish
Cryomodule Technical Review 1 day? Fri 27/04/12 Fri 27/04/12
0 days Mon 03/09/12 Mon 03/09/12
Vacuum and Helium Vessel Assembly 155 days? Mon 29/10/12 Fri 31/05/13
Support Frame Assembly 0 days Mon 01/10/12 Mon 01/10/12
Industrial Production 131 days? Mon 01/10/12 Mon 01/04/13
0 days? Mon 19/11/12 Mon 19/11/12
Thermal Shield Assembly 100 days? Fri 30/11/12 Thu 18/04/13
Frame position adjustment system 0 days Mon 27/08/12 Mon 27/08/12
Industrial Design 55 days? Mon 27/08/12 Fri 09/11/12
Build, test Commission 125 days? Mon 10/12/12 Fri 31/05/13
Solenoid position adjustment system 0 days Mon 12/11/12 Mon 12/11/12
Solenoid position adjustment system 120 days? Mon 12/11/12 Fri 26/04/13
Frame suspension 98 days? Mon 19/11/12 Wed 03/04/13
Instrumentation and Cabling 165 days? Mon 15/10/12 Fri 31/05/13
Current Leads 46 days? Mon 28/01/13 Mon 01/04/13
Cavities 337 days? Fri 15/06/12 Mon 30/09/13
Solenoid supply 215 days Fri 19/10/12 Thu 15/08/13
Solenoid1 test at cern 55 days Fri 16/08/13 Thu 31/10/13
Solenoid 2 test at CERN 55 days Fri 01/11/13 Thu 16/01/14
Assembly tooling 0 days Mon 03/09/12 Mon 03/09/12
Design 80 days? Mon 03/09/12 Fri 21/12/12
Build and commission 109 days? Tue 29/01/13 Fri 28/06/13
Clean Room 0 days? Mon 06/08/12 Mon 06/08/12
Industrial Production, installation 215 days? Mon 06/08/12 Fri 31/05/13
Commissioning and Validation for use 19 days? Mon 03/06/13 Thu 27/06/13
Train clean room staff 105 days? Mon 07/01/13 Fri 31/05/13
Cryo-module Assembly Module 1 0 days? Mon 01/07/13 Mon 01/07/13
Pre-(cavity and Solenoid) assembly 26 days Mon 01/07/13 Mon 05/08/13
Solenoid installation 12 days Fri 01/11/13 Mon 18/11/13
Cavities installation 21 days? Tue 19/11/13 Tue 17/12/13
Post-cavity assembly 50 days Wed 18/12/13 Tue 25/02/14
Cryo-module Tests Module 1 45 days Wed 26/02/14 Tue 29/04/14
Cryo-module Assembly Module 2 0 days? Wed 26/02/14 Wed 26/02/14
Pre-(cavity and Solenoid) assembly 26 days Wed 26/02/14 Wed 02/04/14
Solenoid installation 12 days Thu 03/04/14 Fri 18/04/14
Cavities installation 21 days? Mon 21/04/14 Mon 19/05/14
Post-cavity assembly 50 days Tue 20/05/14 Mon 28/07/14
Cryo-module Tests Module 2 45 days Tue 29/07/14 Mon 29/09/14
Half 2, 2010
Half 1, 2011
Half 2, 2011
Half 1, 2012
Half 2, 2012
Half 1, 2013
Half 2, 2013
Half 1, 2014
Half 2, 2014
Half 1, 2015
03/09
01/10
19/11
27/08
12/11
03/09
06/08
01/07
26/02
26-02-14 – 29-04-14
29-07-14 – 29-09-14
Delay of ~4 months with respect to the planning shown at SC meeting in May 2012
Ready
New Tasks : Auto Scheduled

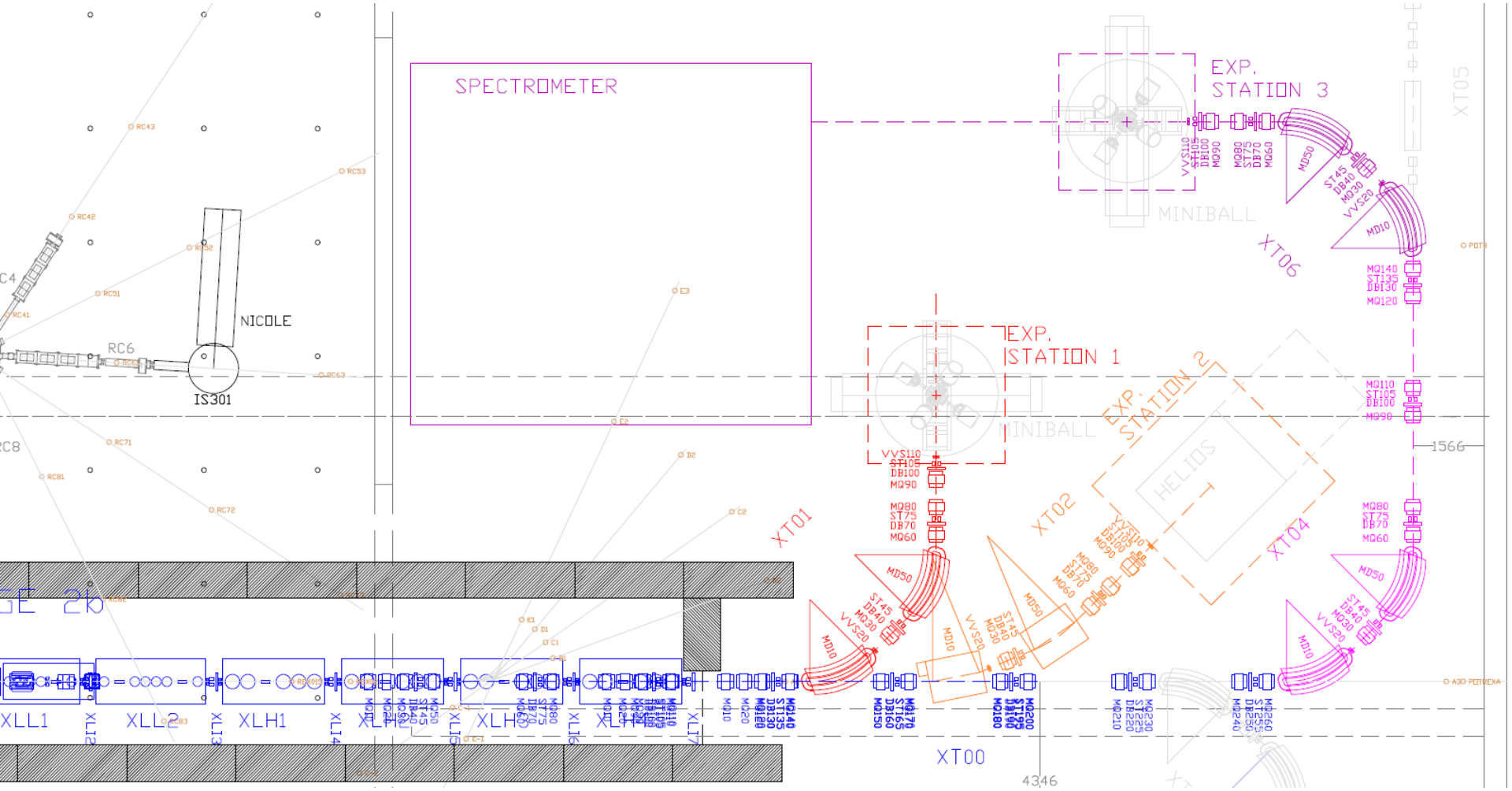
Latest HEBT design – stage 1

- All details on EDMS (HIE-ISOLDE/HEBT LINES OPTICS AND LAYOUT)
  - Drawings, layout tables and (new) madx reference optics files



Latest HEBT design – stage 2b

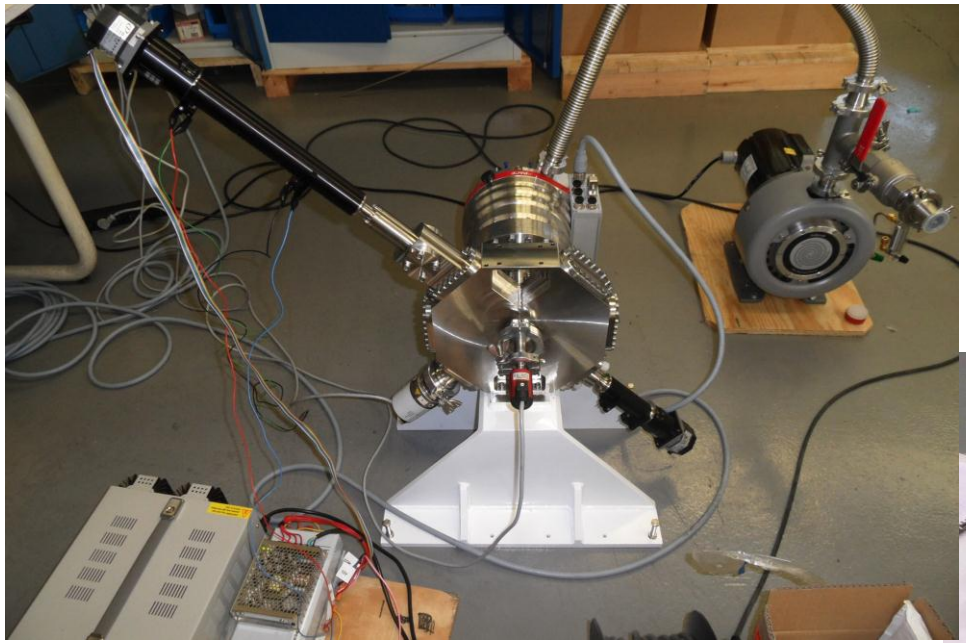
- All details on EDMS (HIE-ISOLDE/HEBT LINES OPTICS AND LAYOUT)
  - Drawings, layout tables and (new) madx reference optics files

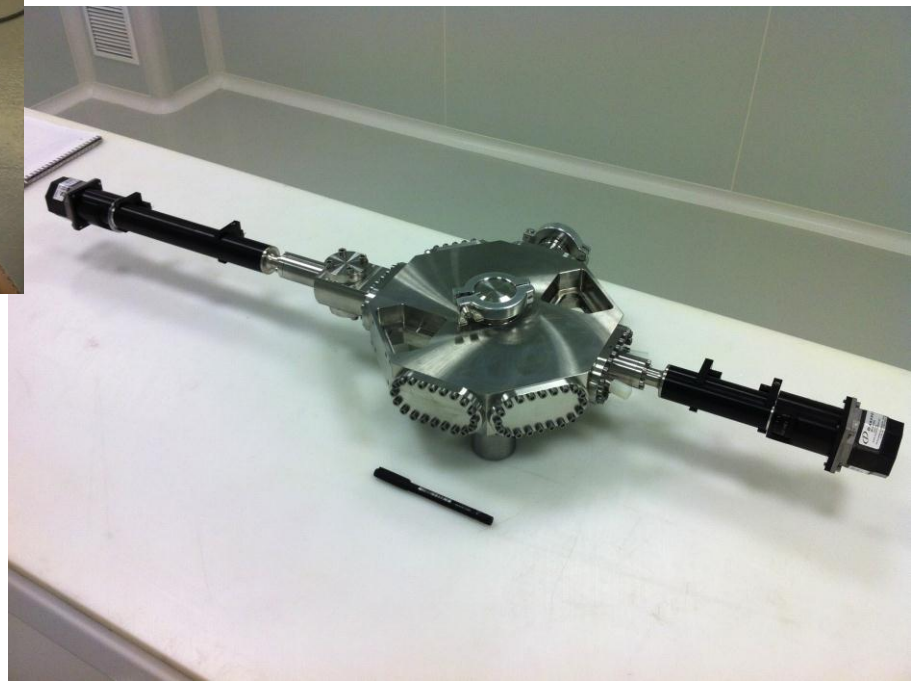


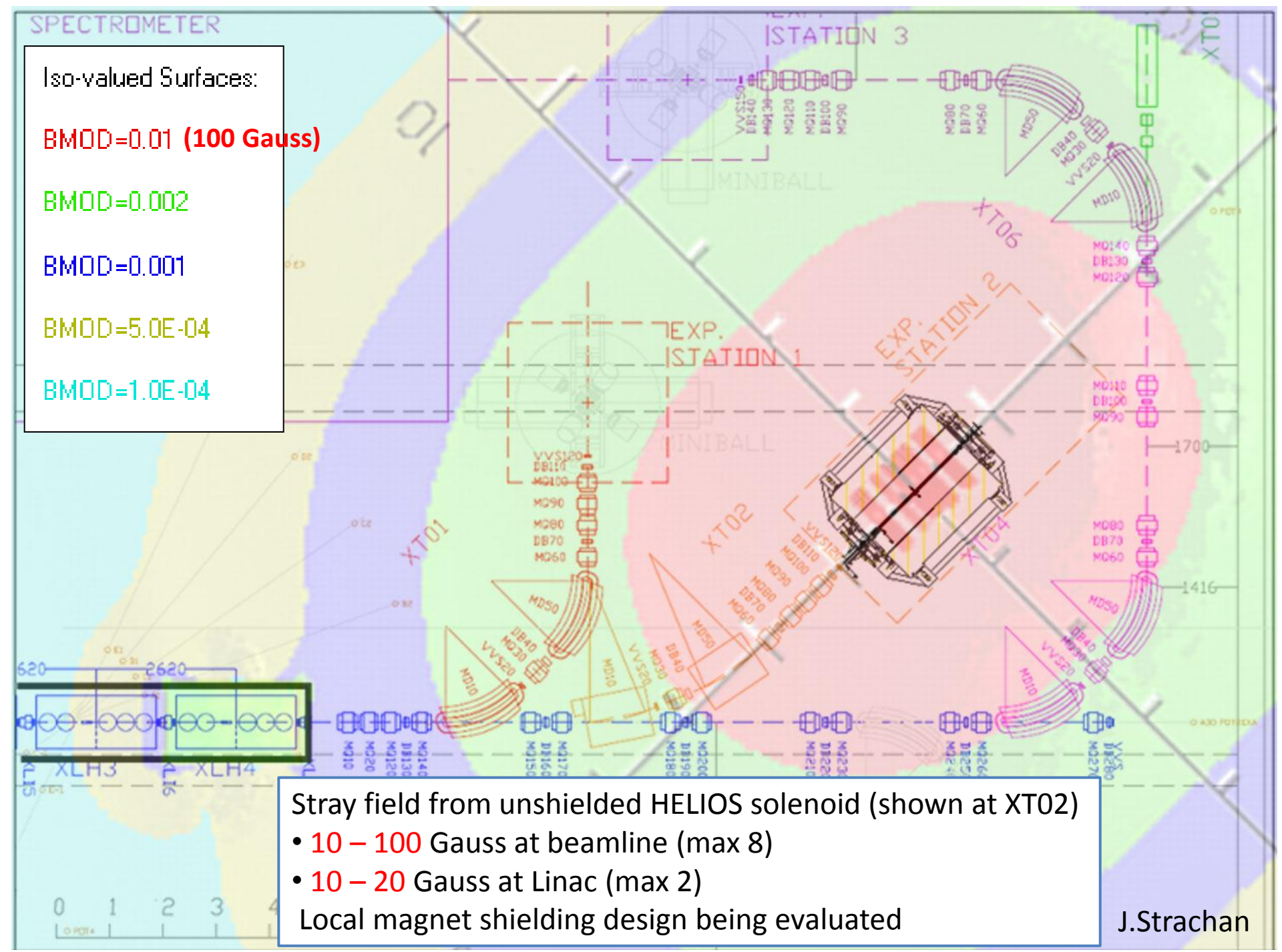
Remaining issues/concerns

- Performance of the Faraday cup in the DB
- Electronics for diagnostic boxes (acquisition and positioning). Resources requirement defined – need to obtain the people.
- Fast-valve effectiveness for protection of SC cavities
- Shielding of HELIOS magnetic field

Diagnostic box







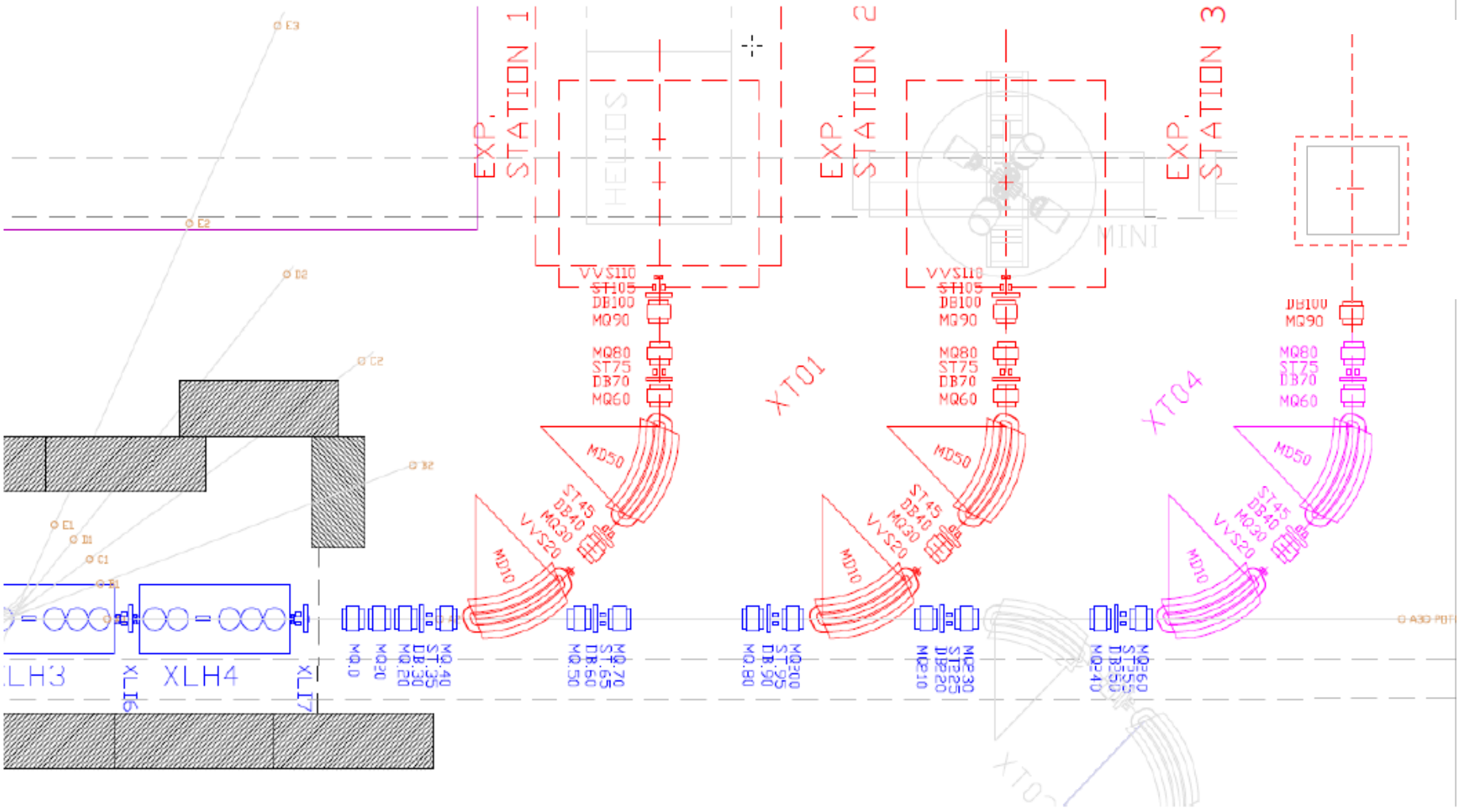
Stray field from unshielded HELIOS solenoid (shown at XT02)

- 10 – 100 Gauss at beamline (max 8)
- 10 – 20 Gauss at Linac (max 2)

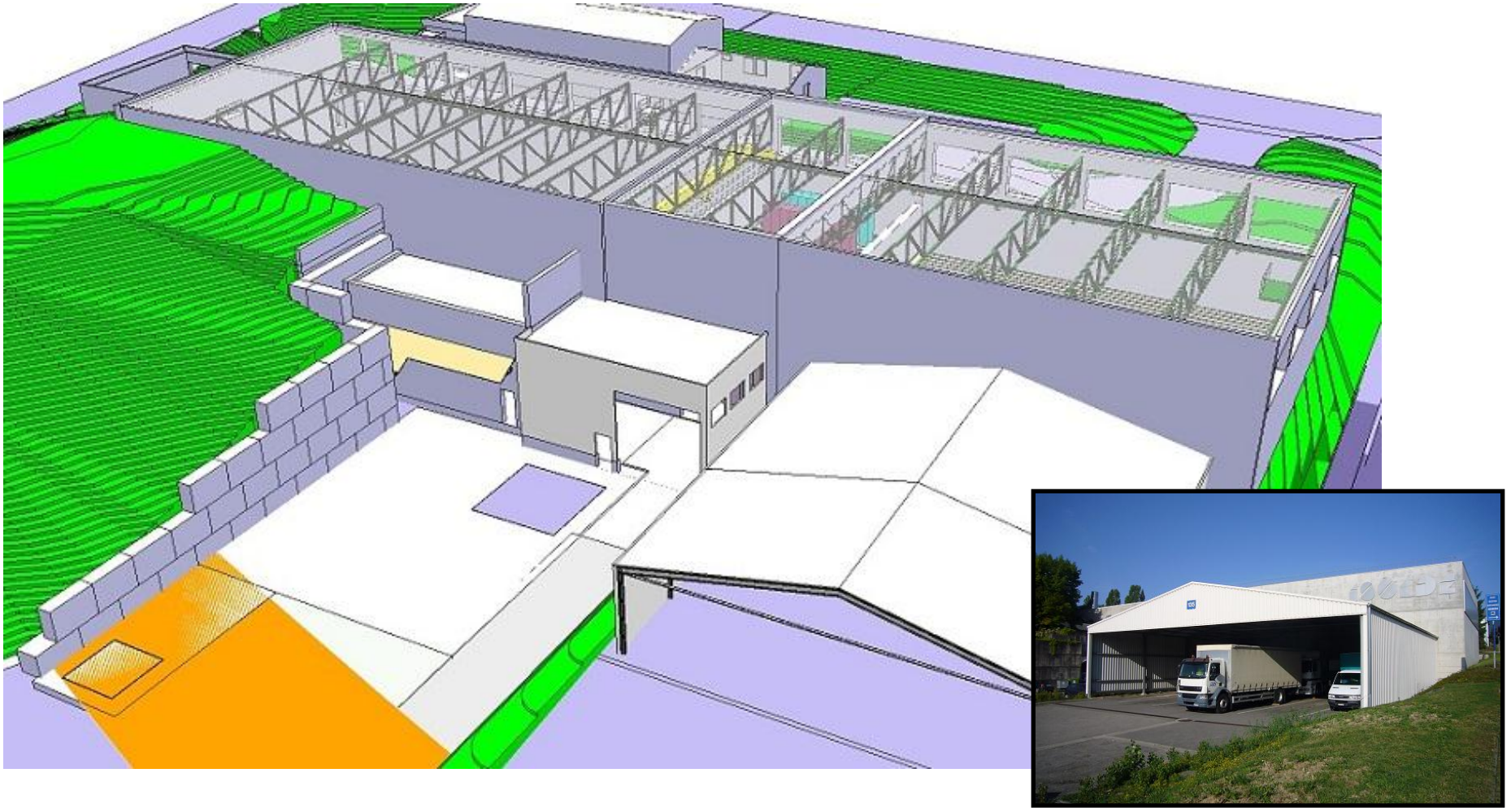
Local magnet shielding design being evaluated

J.Strachan

Proposed stage 1 HEBT layout



Civil Engineering



Construction starting date: Aug 2011

Civil Engineering

9th Steering Committee May 2012

Civil Engineering

Top-view construction side: 10 July

Construction site

July 2012

B199 (Cold Box) and B198 (Compressors)

Civil Engineering

B198 (Compressors), roof closed: 19 Sept

Compressor building 198

Installation of the crane and roof September 2012

Civil Engineering

B199 (Cold Box) finishing the walls: 16 Aug & 29 Aug

B199 (Cold Box) installation of the roof: 5 Sept & 19 Sept

Cold Box building installation of the roof Sept 2012

Civil Engineering

Top-view construction side: 20 September

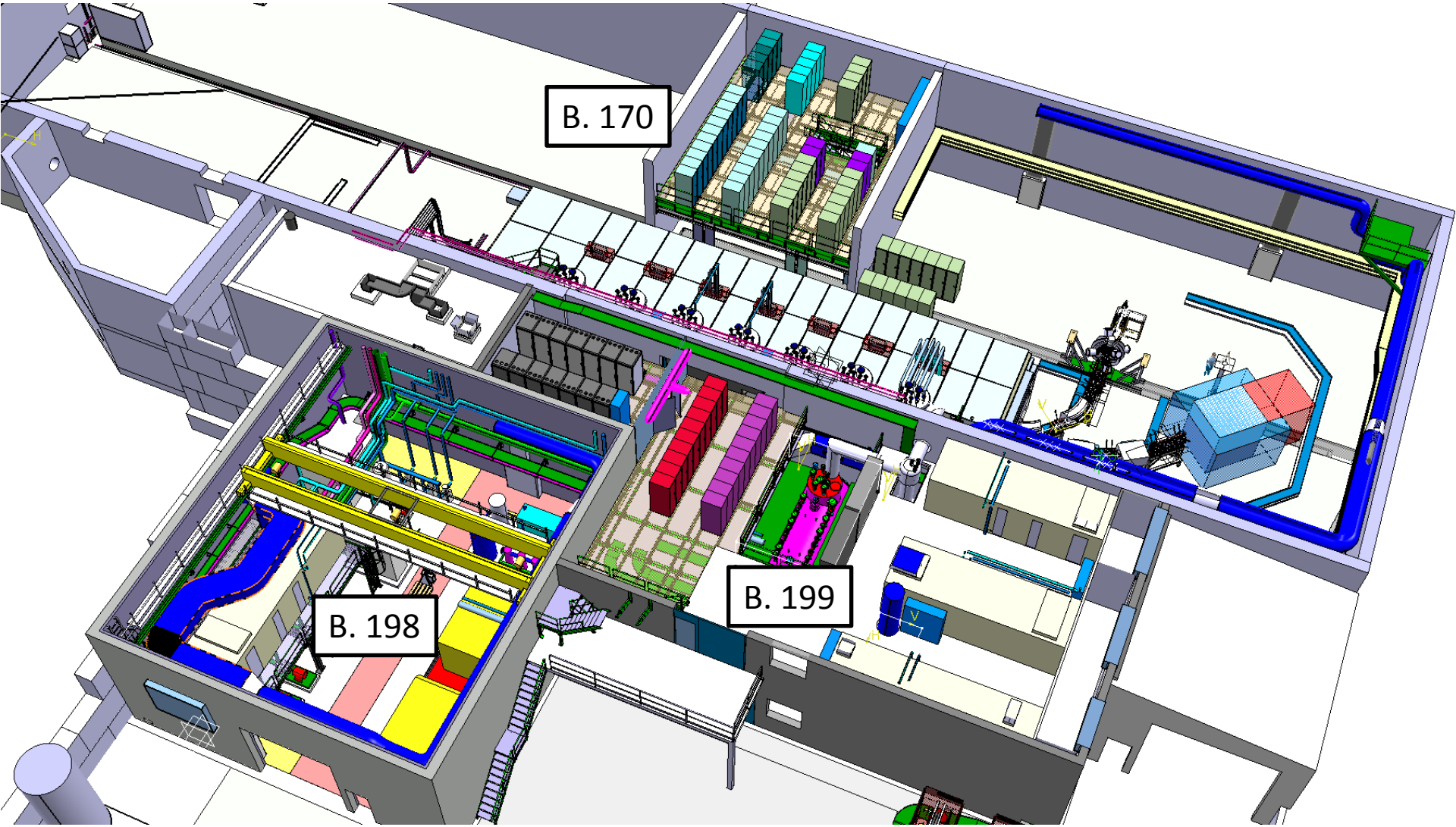
Construction site

September 2012

Civil Engineering

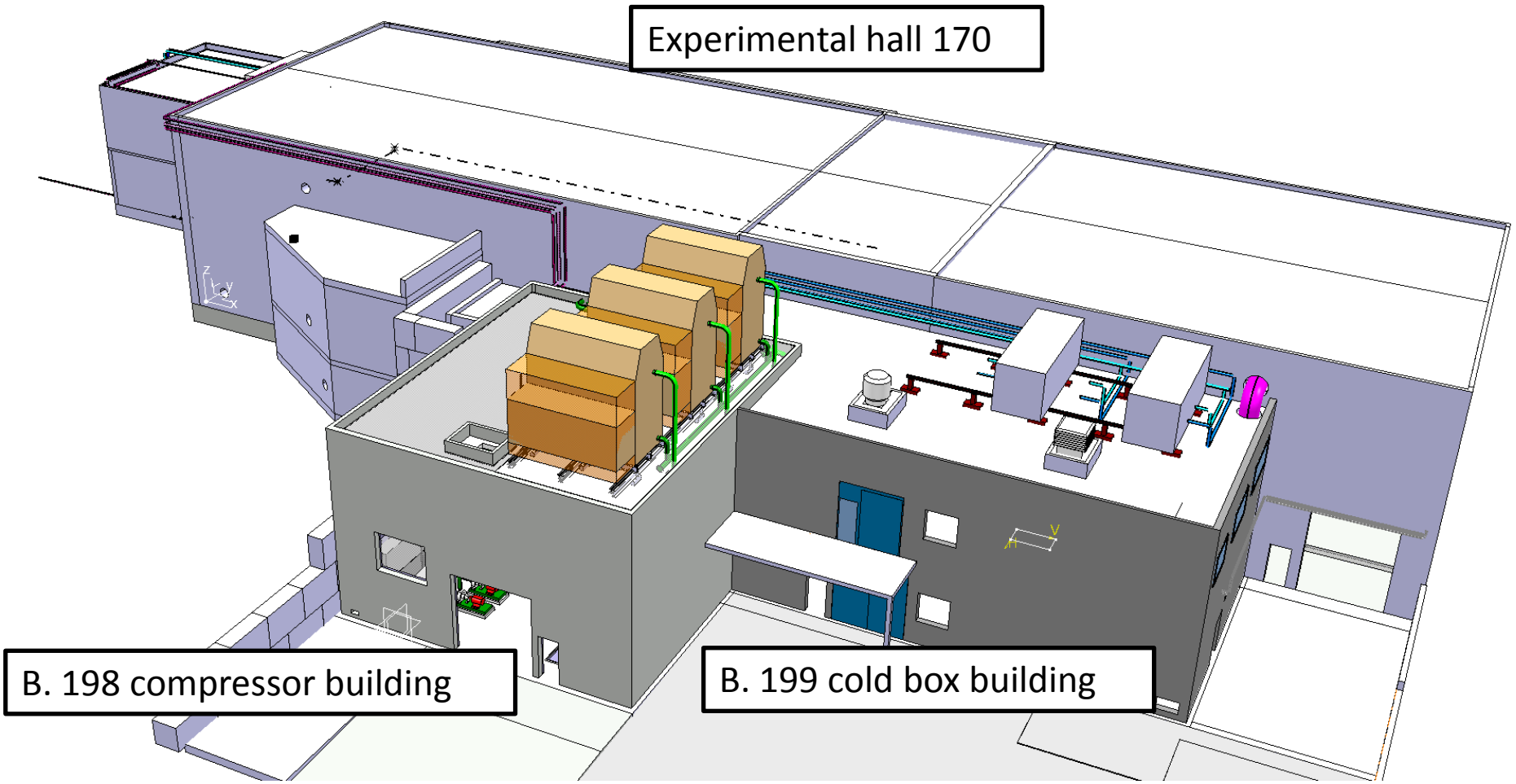
Civil Engineering finished summer 2012

Racks sub systems



Electrical systems: Oct 2012 – June 2013

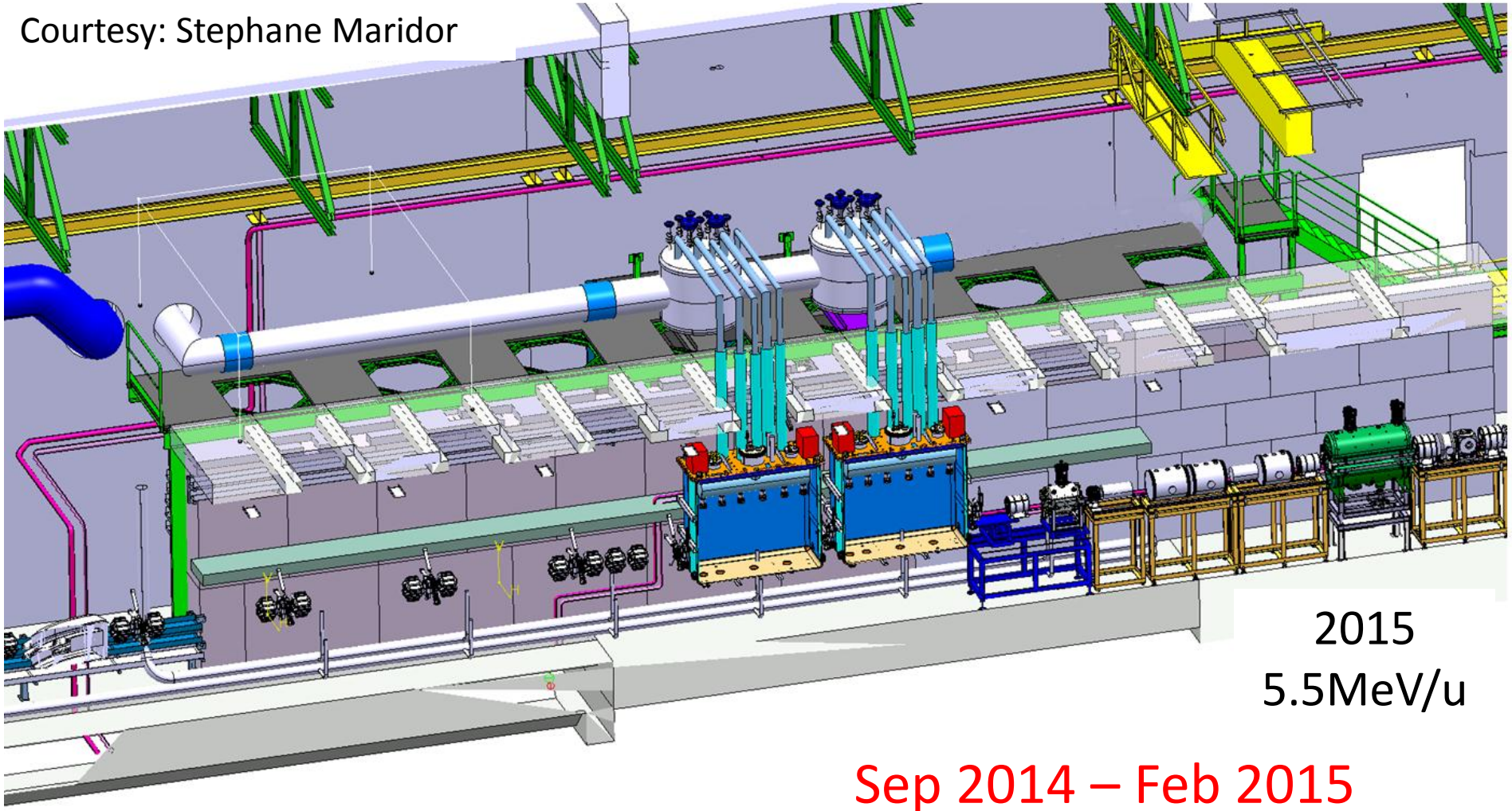
Cooling & Ventilation



Cooling & Ventilation: Oct 2012 – June 2013

Modular Linac & Cryo Line

Courtesy: Stephane Maridor



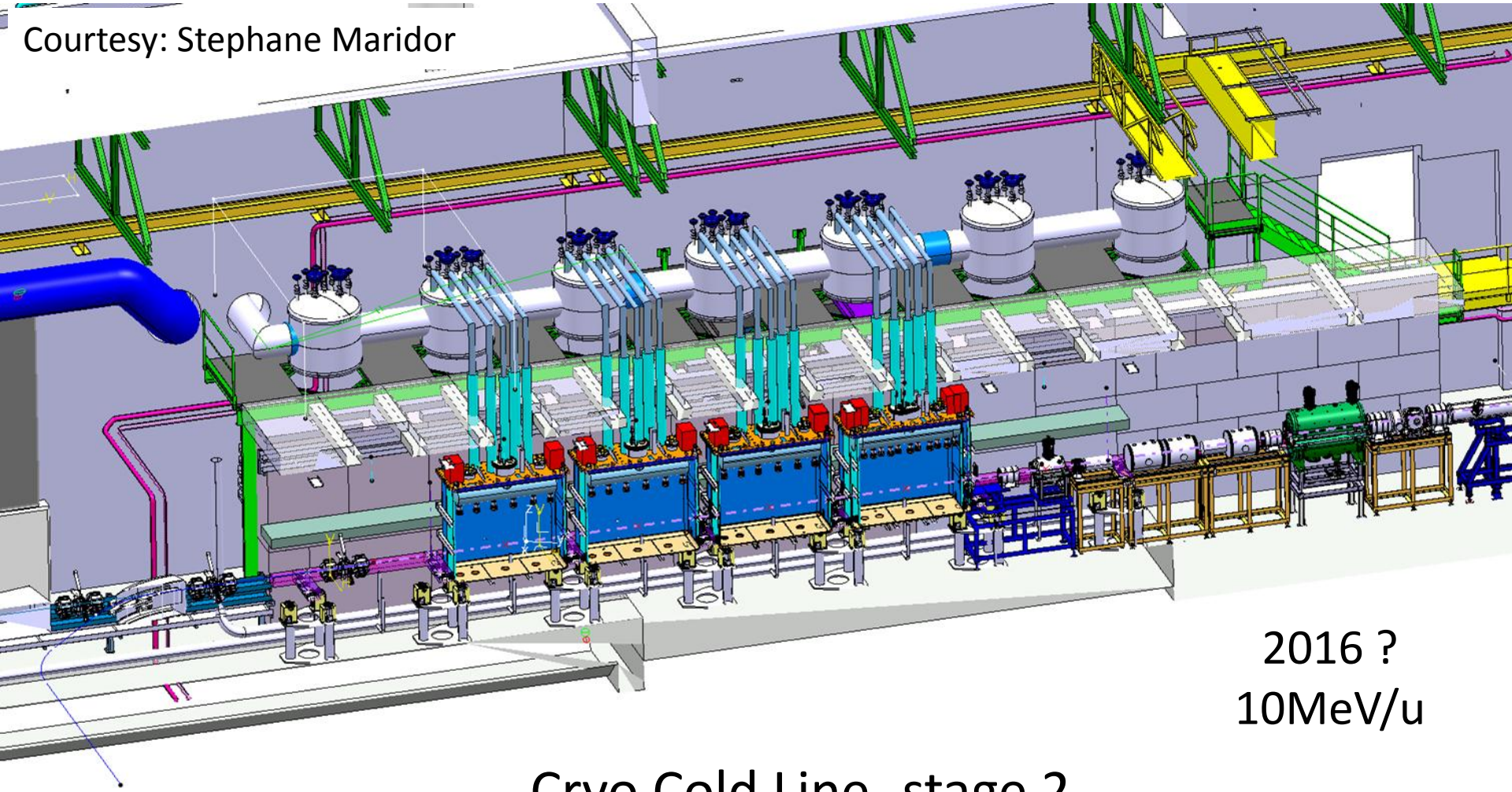
2015
5.5MeV/u

Sep 2014 – Feb 2015

Cryo Cold Line- stage 1: ~~January 2014 – June 2014~~

Linac CM 1&2 - stage 1: August 2014 – October 2014

Modular Cryo Line



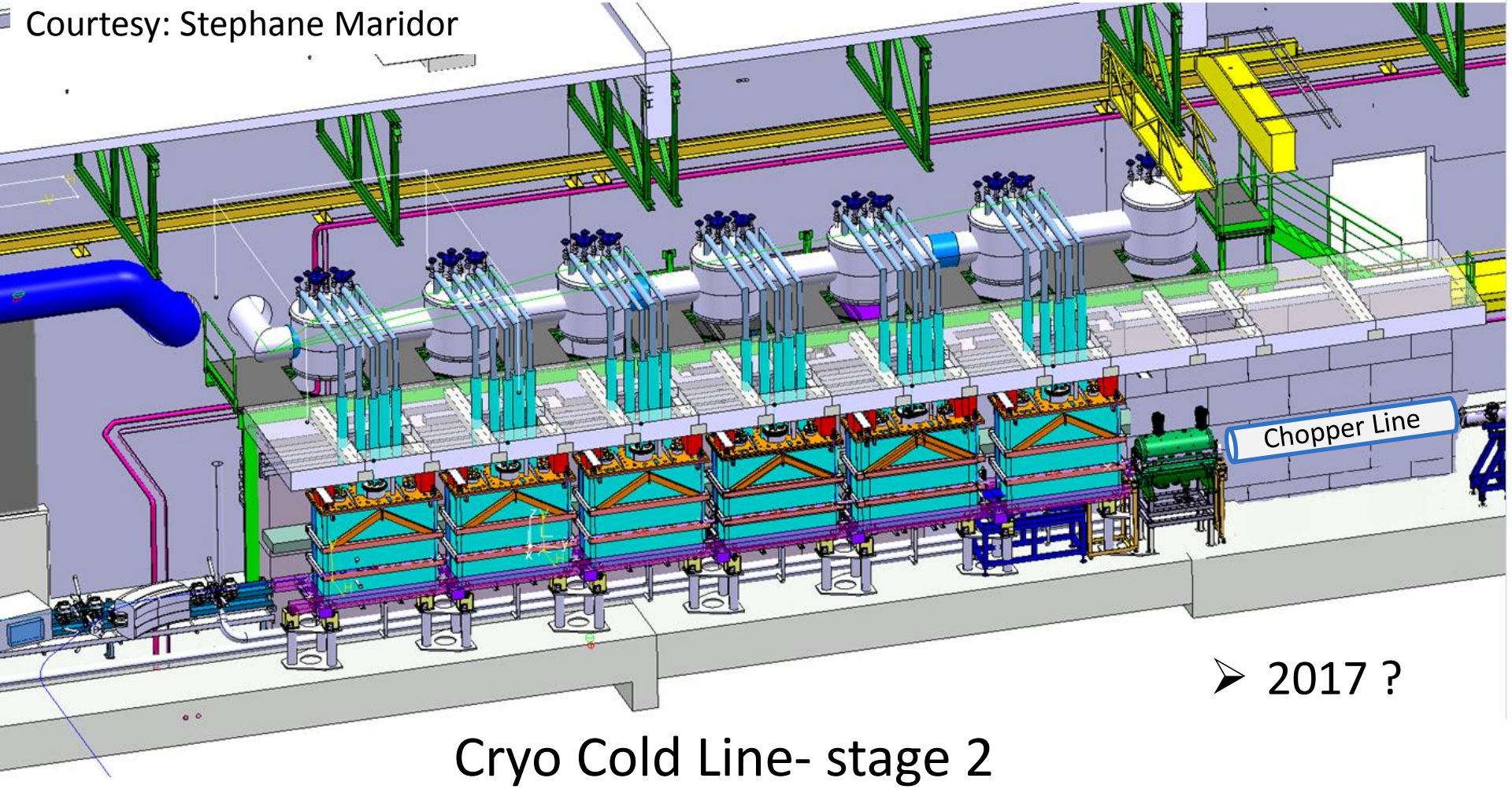
2016 ?
10MeV/u

Cryo Cold Line- stage 2

Linac CM High-β 1,2,3&4 - stage 2a

Modular Cryo Line

Courtesy: Stephane Maridor

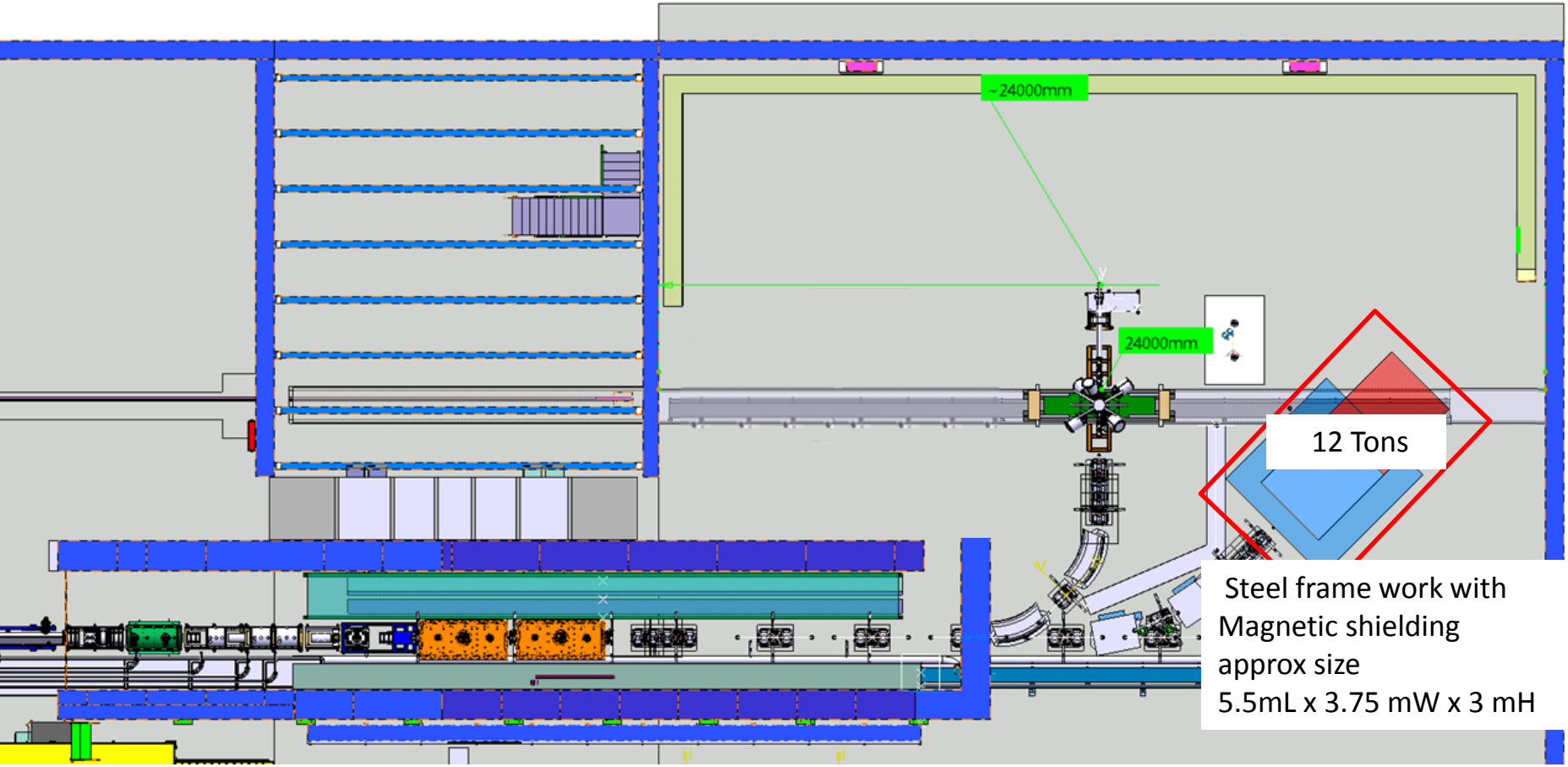


- 2017 ?

Cryo Cold Line- stage 2

Linac CM High-β 1,2,3 & 4, Low-β 1&2 - stage 2b and Chopper Line

HEBT Stage 1

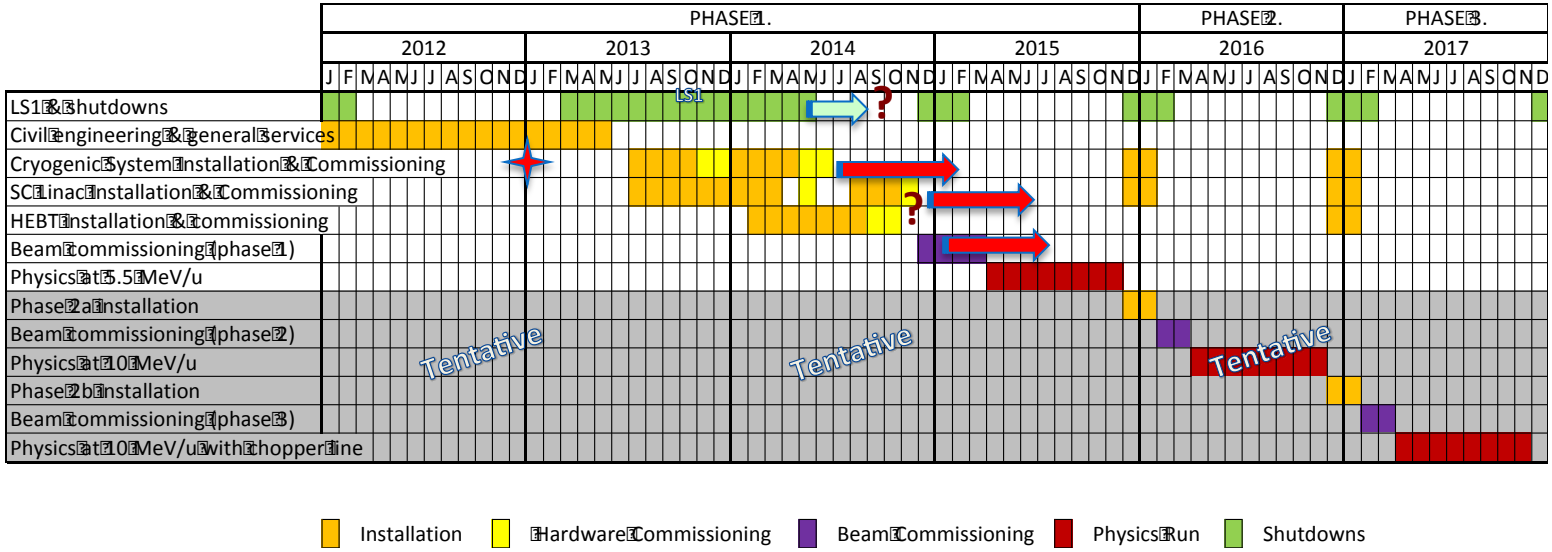


Straight line with 2 experiment stations – Oct 2013 - Sept 2014

Miniball move: Oct 2013 – April 2014

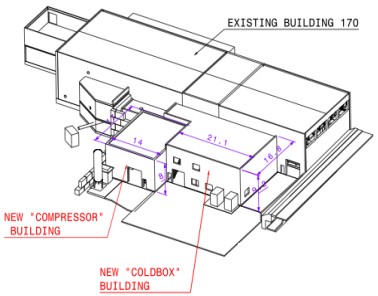
Main Issue

- Procurement of Cryogenic System
  - Analysing response of the 2 bidders (Air Liquide and Linde)
  - Compressor system delivery November 2013
  - Compressor commissioning March 2014
  - Cold box + transfer line delivery July 2014
  - Cold box + transfer line commissioning Jan/Feb 2015 =>

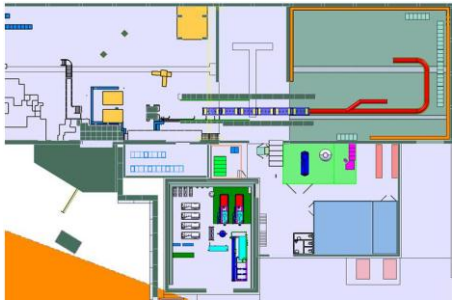


OUTLOOK

- Civil Engineering Works completed
- Installation of Main Services (EL, CV, others)
- Decision on the procurement of Cryogenic Plant (FC Dec. 2012)
- Ready to launch procurement of first batch of high-beta cavities => via CATE + others
- Ready to launch procurement of CM1 and CM2 => via CATE
- Ready to launch procurement of HEBT phase-1
- Cost and Schedule Review (22-23 Nov. 2012)



Thank you



HIE-ISOLDE web site -> http://hie-isolde.web.cern.ch/hie-isolde/

CATHI-ITN web site -> https://espace.cern.ch/Marie-Curie-CATHI/default.aspx