ISOLDE Technical Report

61th INTC meeting 2 July 2019, CERN

Richard Catherall EN-STI-RBS, ISOLDE Technical Coordinator

Erwin Siesling BE-OP-ISO, Deputy ISOLDE Technical Coordinator

ISOLDE Target zone & Low E

Richard Catherall EN-STI-RBS
ISOLDE Technical Coordinator

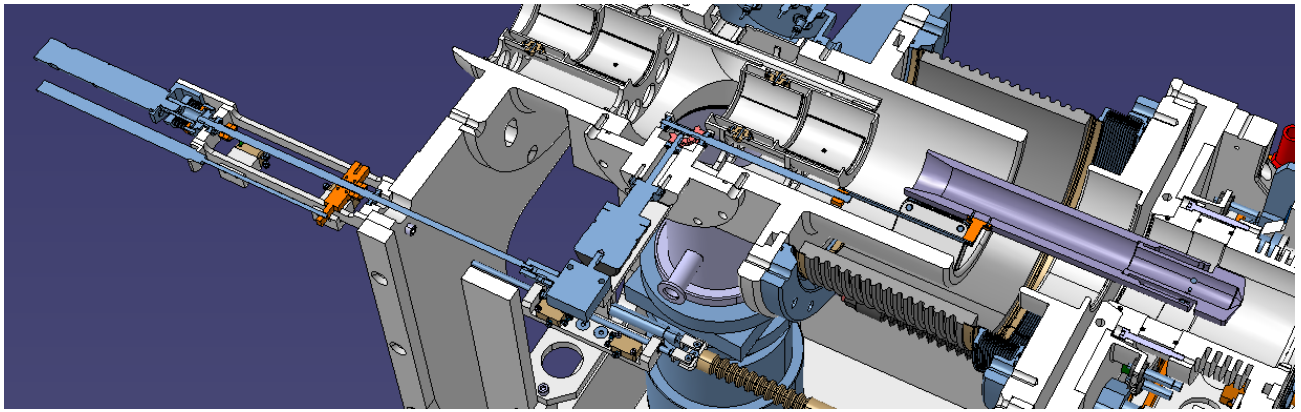
Outline

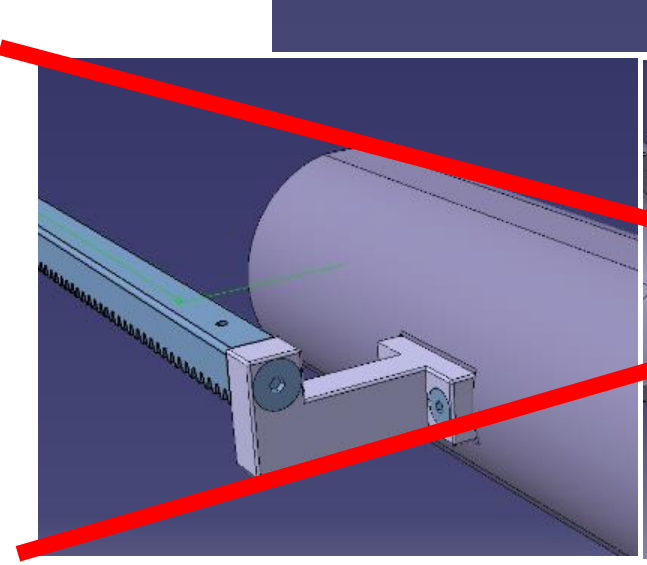
- Frontend Status
- Tape station
- HT renovation
- Nanolab project

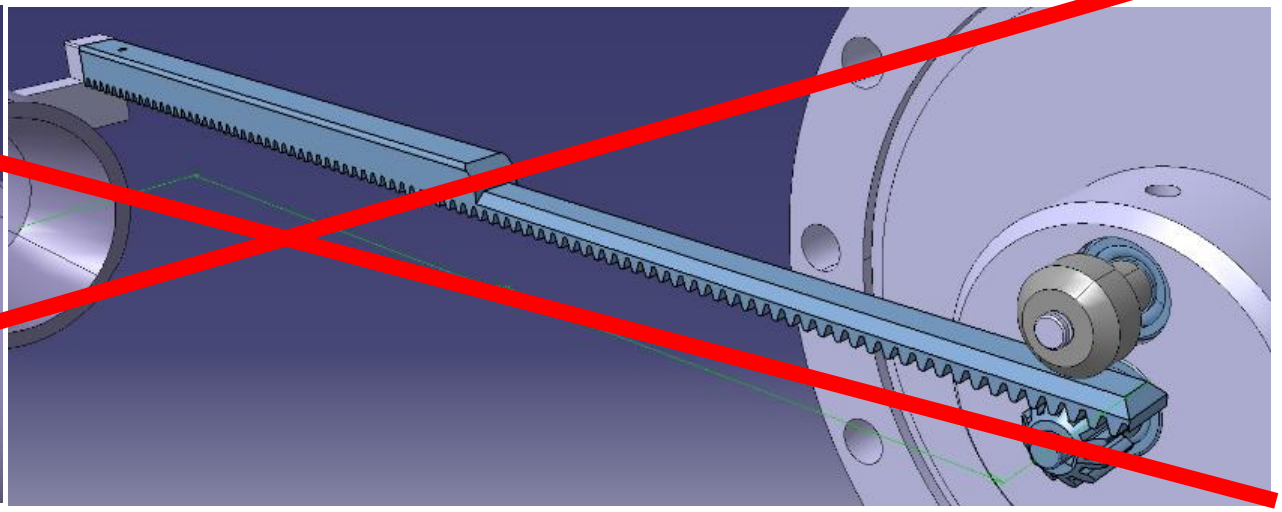
Extraction Electrode Design

- The feedback from testing the new design on the MEDICIS FE is a concern for the ISOLDE FEs
  - Bending of the rail, gripping of the bearings, separation of rack from pinion.
- Even though operational parameters are not identical
  - Greater heating power, HT run at a higher vacuum pressure at MEDICIS
- Decided to go back to tried and tested version
  - But this has cost us a lot of time
  - Overlap of resources for the repair of MEDICIS and FE production

Extraction Electrode Design



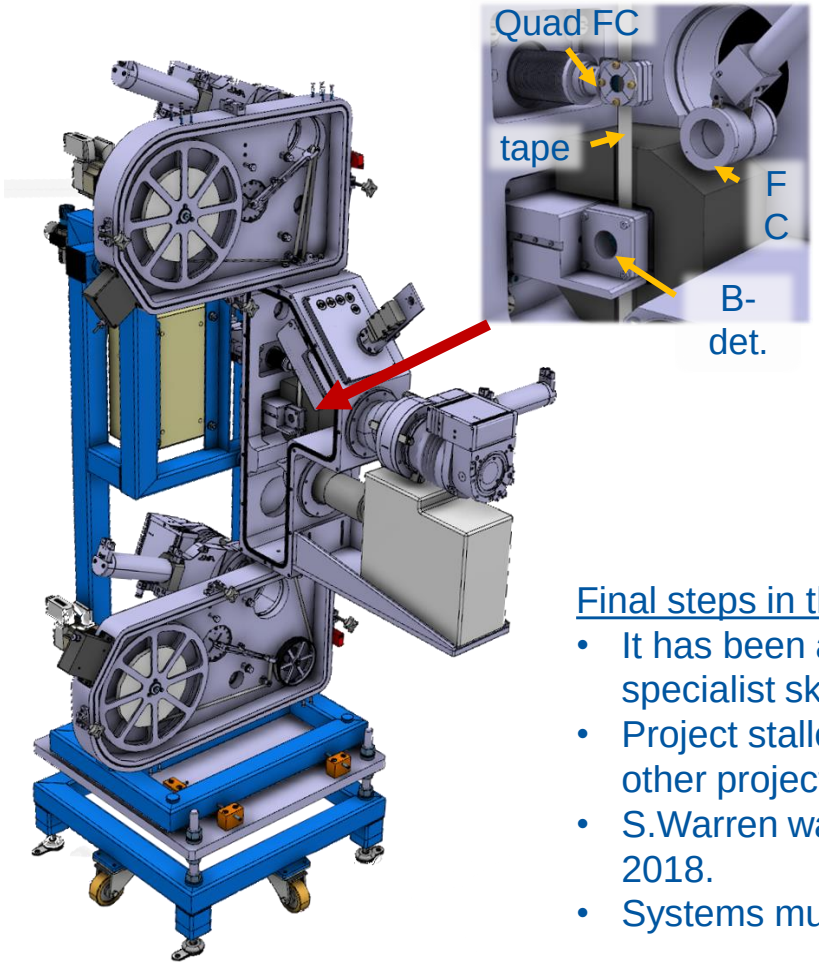


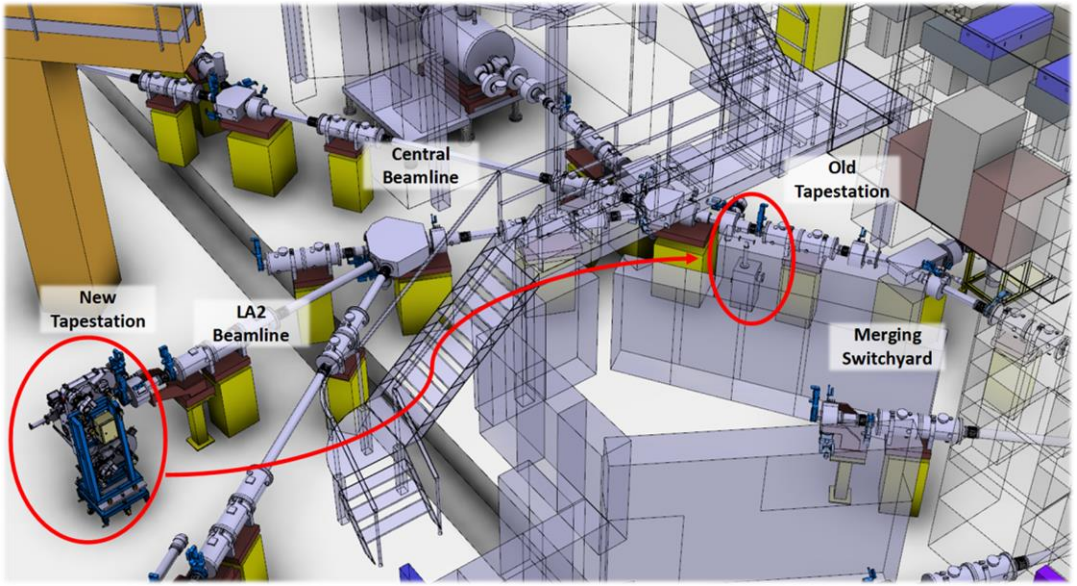


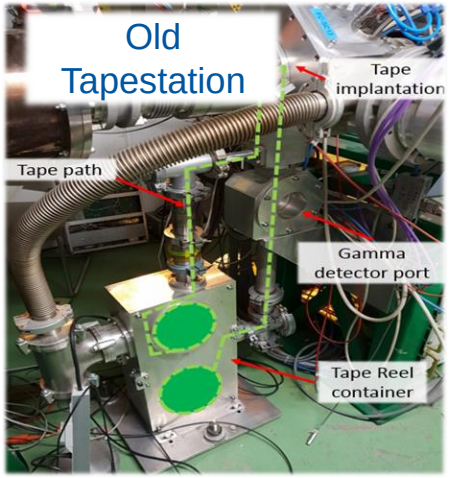
Current status

- All components and modifications are currently being reviewed.
  - The objective is to “fix” the design with no more modifications possible.
- There is already a 10 month delay in the production of the Frontends.
  - Every effort will be made to reduce this delay
  - All pieces for FE#11 are ready so production should be quicker.
  - No more modifications

New Tapestation







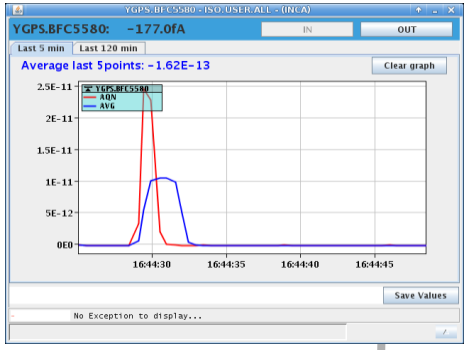
Final steps in the new fast tapestation project.

- It has been a lengthy project, lots of different specialist skills required.
- Project stalled due to lack of manpower and other projects of greater importance in 2016-18.
- S.Warren was asked to take over project in July 2018.
- Systems must be fully operational start-up 2020

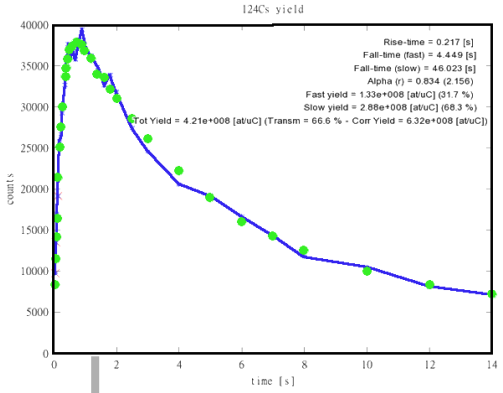
Richard Catherall, Tim Giles, Stuart Warren

Detector commissioning with source

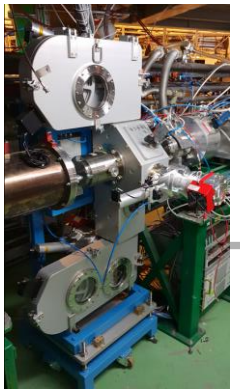
First radioactive beam tests



124Cs release-curve measured.



Moved to new location at CA0



Ready for handover to start up and user/ operators.

July 2018

Aug 2018

Sep 2018

Oct 2018

Nov 2018

Waiting for beam time

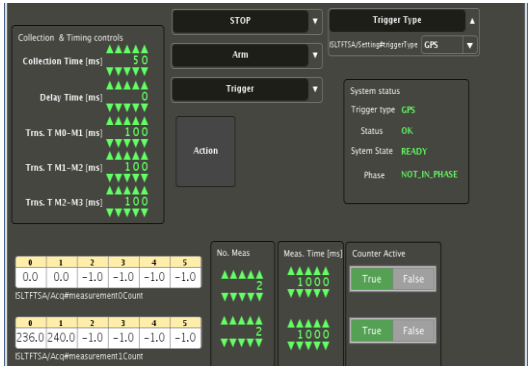
April 2019

2020

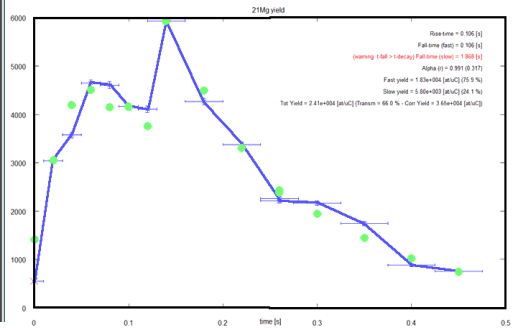
S. Warren take over

Modifications to the detector hardware controls systems with K.Szczurek

Temporary controls software complete and commissioned



First release measurements of 21Mg ever at ISOLDE
$t_{1/2}$=122ms !!!!



To be completed:

- **SMB controls crate installation**
- Vacuum pipes for CA0 coupling (J.Cruickshank)
- SCADA controls for vacuum
- Detector optimization in new location.
- Final cabling of systems
- **Tapestation controls software**

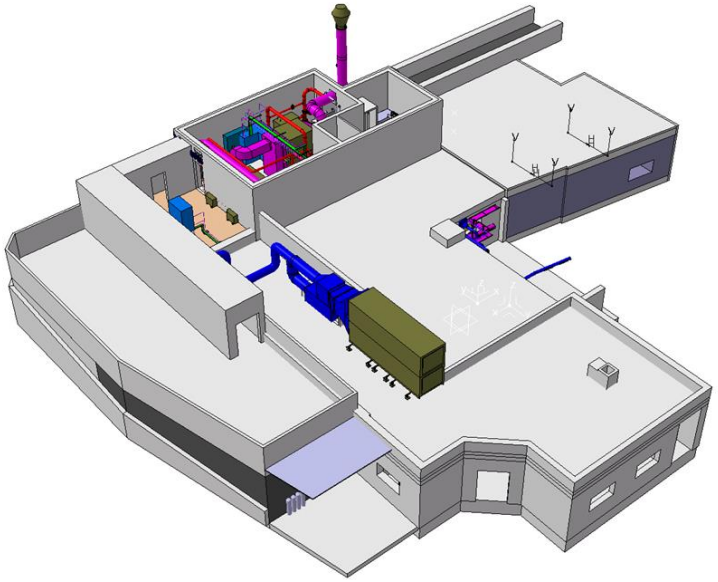
Richard Catherall, Tim Giles, Stuart Warren EN-STI-RBS

Installation of the HT modulators

Thierry Gharsa, Jan Schipper TE-ABT

- **High precision 60kV D.C. HV Power Supply**
  - 2 operational HVPS units installed on HT1 & HT2 and 2 spares available.
- **Target Modulators**
  - 2 operational HT fast recovery systems installed on HT1 & HT2, 1 spare in b867.
  - Improved HT ripple on HT1. Measured to < 1 Vpp @30kV (to be done on HT2).
  - Capable of recovery time to 1 Vpp in 1 ms (load dependent but not only…).
  - HV dividers need fine compensation adjustment of the frequency response to truly get precise recovery time < ~ 5 ms. Tested but not yet performed.
- **FESA3 compliant control systems deployed**
  - PXIe controllers and acquisition boards replace the FEC LynxOS + GM (discarded).
  - Power Control Units with HT safety interlocks, 1 spare available in b867.
  - No more water cooling. Only oil circulation pumps integrated in the control.
  - HT1/HT2 start modulator triggers auto managed based on the HRS/GPS HT switch position.
- **On site test load and HT calibration tools for troubleshooting**
  - Dynamic test load for testing HT1/HT2 only when disconnected from targets.
  - External commercial HT divider for DC calibration.
  - Ripple measurement to 10^{-5}.
- **To be done**
  - HT2 maintenance, fine compensation adjustment of the dividers, cleaning (LS2).
  - Old control decabling (YETS21-22).
  - Negative polarity (2021).

General Layout of the Nanolab

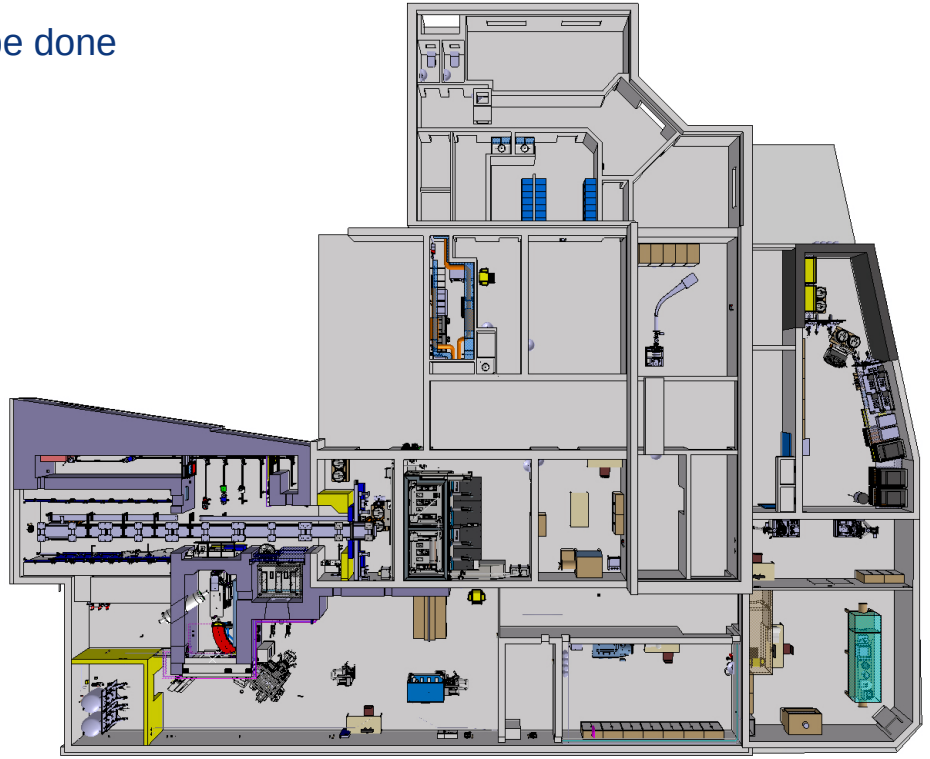


Phase 1: Jan 2020 – Oct 2020
Overseen by SMB /civil engineering:

- Technical corridor to be approved by CV
- Final finishing of walls and ceiling including first coat of paint
- Passages in walls for services will be done

Phase 2: Nov 2020 – May 2021
Installation of services:

- CV
- EL
- Finalising civil engineering work by SMB
- IT / DI/ CA/ Gaz



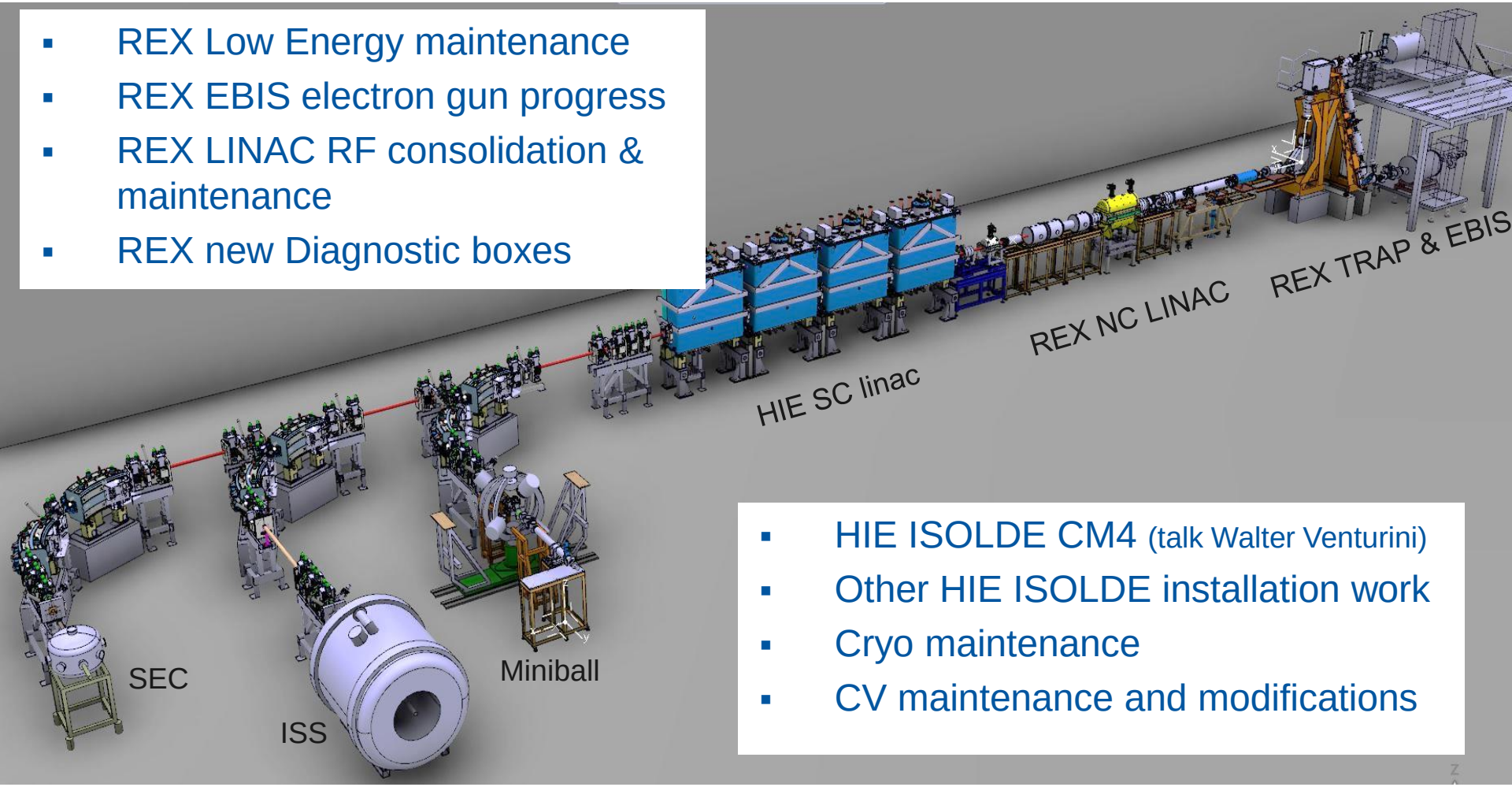
REX/HIE ISOLDE Post-Accelerator

Erwin Siesling BE-OP-ISO

Deputy ISOLDE Technical Coordinator

Outline:

- REX Low Energy maintenance
- REX EBIS electron gun progress
- REX LINAC RF consolidation & maintenance
- REX new Diagnostic boxes



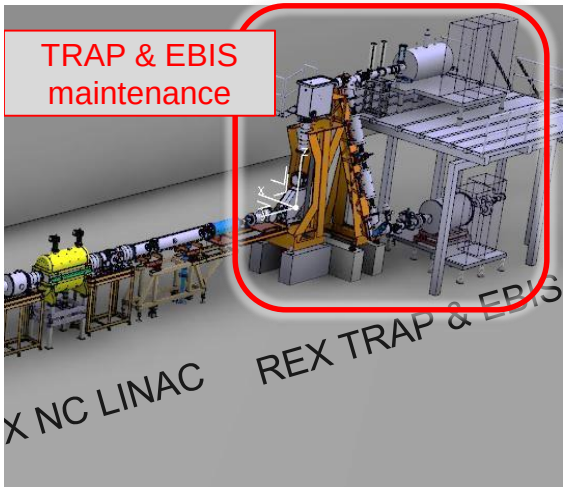
- HIE ISOLDE CM4 (talk Walter Venturini)
- Other HIE ISOLDE installation work
- Cryo maintenance
- CV maintenance and modifications

REX Low Energy maintenance

courtesy Fredrik Wenander BE-ABP:

REXTRAP:

1 Verify insulation of all internal electrodes, use HV tester - Done, suspicious cables replaced
2. Instability of XTRAP.ST_EJC (and INJ) – to be tested when controls available
3. Measure RF amplitudes on the 8 central electrodes for different frequencies – on hold as we plan NOT to open the trap
4. Exchange hardware for the generation of the RF signal (from CVORG for an 8-ch DDS card) – with A. Butterworth (BE RF) – to identify implications for timing & software – maybe first restart TRAP and then implement (end of the year)
5. Revise power supplies for REXTRAP solenoid – ongoing (ramping up TRAP could be a problem if we loose the field. Last ramp-up was oct '97)
6. Exchange zeolithe powder for the local ion source – Miguel Lozano – done. Tests foreseen when RAO vacuum is back.
7. Make sure all three Scope-in-the-box for the RF electrodes work correctly – Miguel Lozano - ongoing
8. Mark timing cables for REXTRAP – Miguel & Fredrik – to do
9. Clean REXTRAP HV platform and cage – will be done before startup



BE-ABP F. Wenander,
C. Mastrostefano, J. Thiboud
BE-OP-ISO M. Lozano Benito, N. Bidault
BE-RF (M. Paoluzzi)
TE-EPC N. David
TE-VSC J. Ferreira Somoza

REXEBIS:

10. Revision of motor-generator, complete over-haul – evaluating options
11. Rebuild electron gun (electron current losses, stability, vacuum, ion injection)
    See separate comments next slide
12. Exchange water cooling tubes EBIS – to be done just before startup
13. Clean water flow meters EBIS – to be done just before startup
14. Perform necessary bakeouts at each electron gun test – before startup
15. Clean HV platform and cage – to be done just before startup
16. Controls: 'standardize' application for slow extraction – Emiliano Piselli
    correct readback of EBIS HV, Lens1 and Lens2 voltages – Emiliano Piselli
    Atten. RF generator changes at TRAP might have effect on the EBIS controls

Common tasks

17. Vacuum work – starting this month.
    Service all turbo pumps
    Verify status of tubes for compressed air

REX EBIS electron gun alternatives:

courtesy Fredrik Wenander BE-ABP:

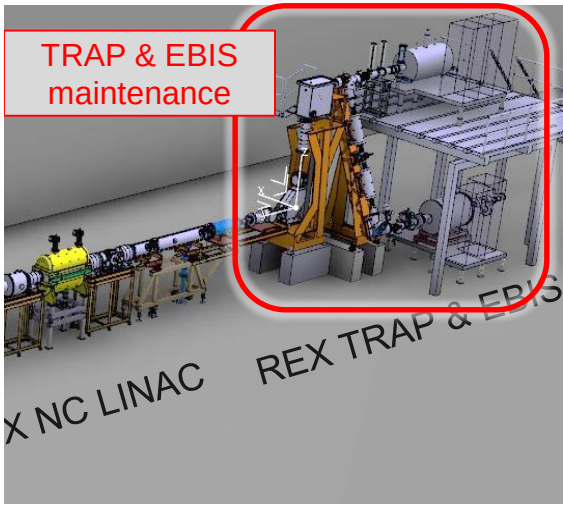
Objective: To replace the existing cathode and configuration that has been unstable and causing issues during the last years

Alt 1. New Immersed gun solution
- Two possible cathode providers: Russian IrCe and Chinese BaO scandate doped in W grid. Will need two different holders. Worries Fredrik: Evaporation of the cathode might give contaminants at critical masses?
- Simulations Immersed E gun ongoing and values being confirmed
- Design ongoing. Autocad 2 D to finish end June(with help from BE-OP: M. Lozano)
- Identify companies for production. To launch asap. Expect first parts Sept. Assembly Nov, tests Feb 2020 for validation and run

Alt 2. New MEDeGUN Brillouin gun solution
- Presently being tested at the Twin EBIS – good results
- Complicated design
- In development phase: NOT an option for the operational EBIS

Alt 3. Stay with present cathode
- Alternative backup solution in case the new design does not work

Main message from Fredrik:
Apart from the EBIS electron gun upgrade, where time for the development and production is an issue, there is not much of a problem to have the REX Low Energy part up and running for next year's 2020 commissioning, test and development run.



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REX LINAC RF consolidation & maintenance

courtesy Cristiano Gagliardi, Luca Timeo BE-RF:

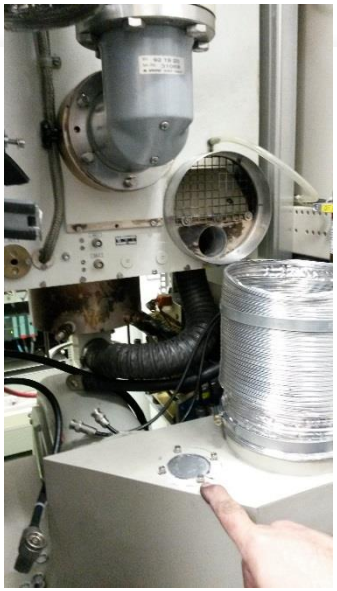
- Maintenance of the 90 kW 101 MHz amplifier resonators (full disassembly) – all validation tests in April finished with good result
- Installation 5kW 101MHz solid-state Buncher amplifier (plus one purchased as spare) – in progress – tender launched. Tests probably early next year.
- Replace the optical links in the power amplifiers
- Consolidate the “Measurements Units” – done, feedback modules now allowing calibration for precise feedback referred to the workingset value
- Replace Grid1 and Grid2 variacs with solid state modules – in progress
- Consolidate the 202MHz Dressler solid-state amplifier used as tube amplifier pre-driver (obsolescence of some strategical components) – done
- Develop new FESA 3 classes for remote control of power amplifiers:
  -Implement an automatic ramp-up of the equipment after “reset” – not this shutdown. It is not foreseen to provide the commands/status: on/off/standby in the working-set. Being cautious with introducing new systems that could lead to new issues, instead of the implementation of an automatic restart, only an automatic reset will be available. Together with the lower expected failure rate the RF team considers this feature to be sufficient for a reliable operation of the systems.
  -Improve the monitoring/logging (e.g. critical interlocks, tube gain) - in progress

- REX RF validation tests will be carried out during LS2 (CV-OP: the 20 degree cooling water will be made available during Q2/3 2019) – well ahead of schedule ongoing since 6th June thanks to the RF and CV teams. RFQ RF conditioning OK. RF to all structures.

REX RF amplifiers in the REX RF room

REX LINAC RF: full disassembly of the 90kW 101MHz amplifiers (Cristiano Gagliardi BE-RF)

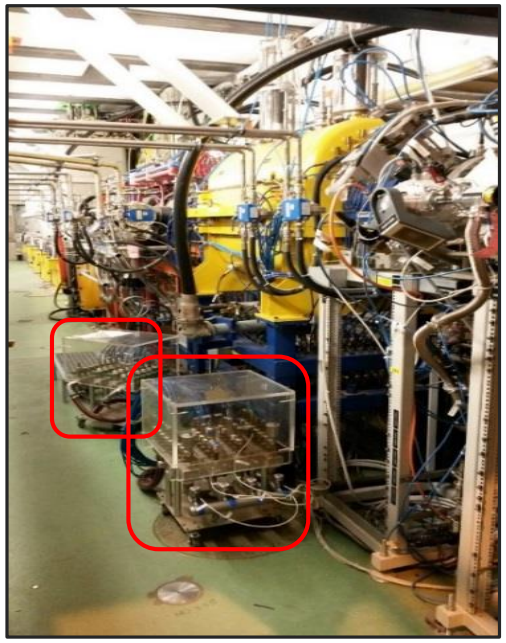




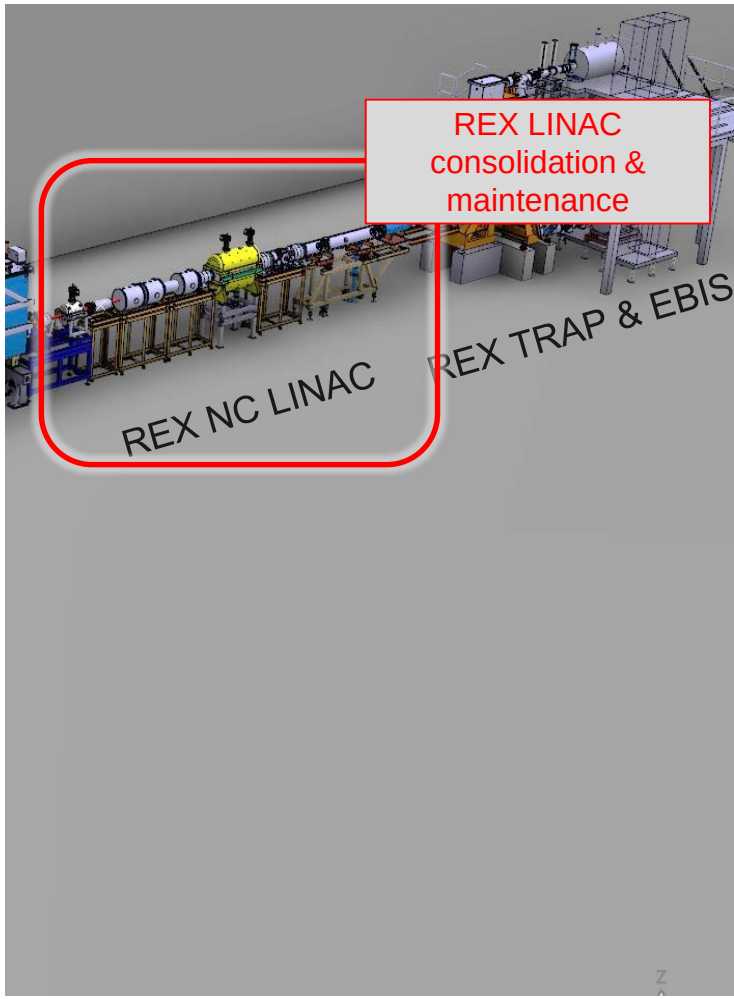

REX RF amplifiers in the REX RF room

other REX LINAC consolidation & maintenance

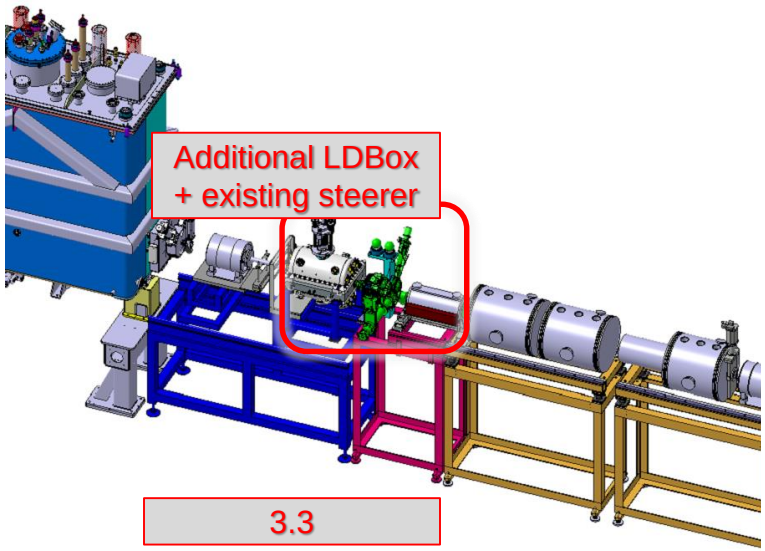
- Full vacuum system maintenance (Jose Ferreira Somoza & Vacuum team) – starting this month: TRAP, EBIS and REX
- new cooling system for IH structure (contractor) – design ongoing (via Richard) – moving slowly..
- Water cooling hoses of some cavities might need an overhaul – magnet group to check
- Check of all flow and thermal interlock switches (magnets & NC cavities) – cavities done, magnets to check



IH structure cooling water distribution



REX 3 new diagnostic boxes + additional steerer



Presently 20% of beam is lost between the REX separator and the HIE-ISOLDE LINAC

To understand and improve the quality of the beam, and reduce losses 3 new standard Long type HIE-ISOLDE diagnostic boxes with modified vacuum chambers + one additional steerer will be installed.

Project initiated by Jose Alberto Rodriguez BE-OP.

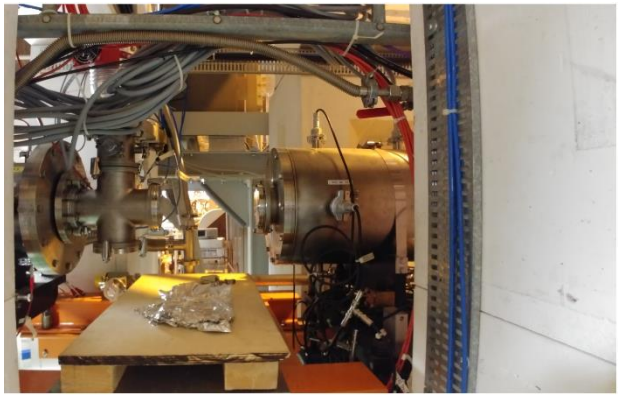
In charge of the project Simon Mataguez BE-OP.

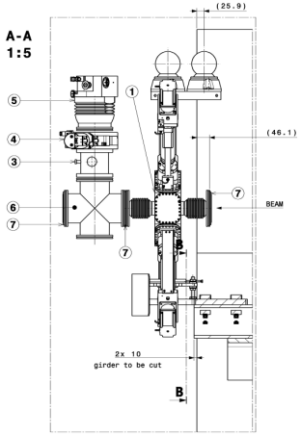
Status:

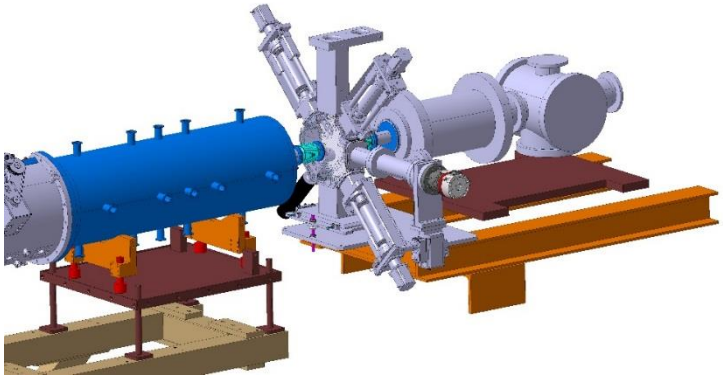
- The different sectors were opened for verification of the flanges – occasion used to check the aperture of the REX LINAC by the Survey team – no obstacles in the beam
- Integration and drawings of all components are ready – final drawings going around for comments and approval. Some small final adaptations done.
- Fabrication of the 3DBs has started: EN-MME and CERN main workshop will provide all the necessary mechanical pieces
- BE-BI (W. Andreazza) has sent the order end of March for the motors, joints, bellows, connectors, etc. – orders are out
- EN-MME will deliver the tables and support plates and direct the modifications to the existing supports (Q4 ‘19)
- Mid-June a follow-up meeting was held – small adaptations to the drawings now being approved
- As of September assembly of all the mechanical components
- Mid-November the 3 DBs should be complete and ready for vacuum tests and survey fiducialisation
- Installation of the Dboxes in the machine foreseen early 2020 / already end 2019
- (Affordable) Attenuator solution found by Niels Bidault BE-OP

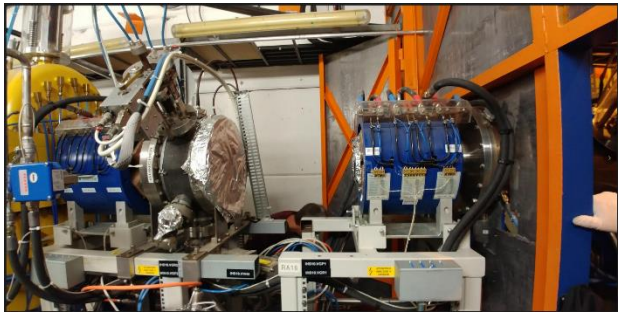
REX 3 new diagnostic boxes + additional steerer

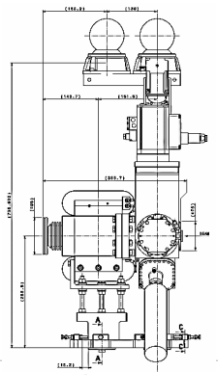
Verification, drawings and integration done. Final drawings being commented and approved

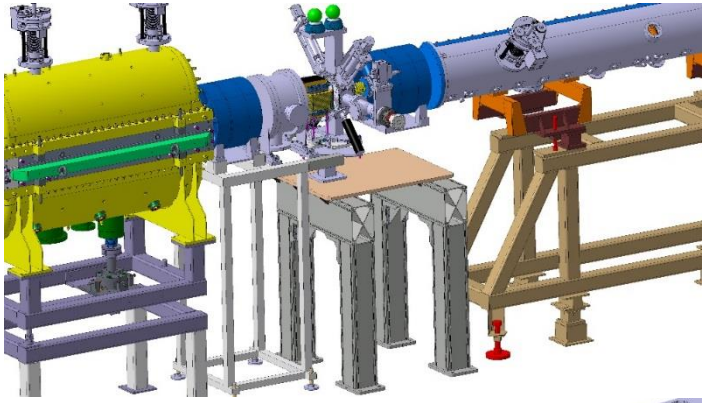


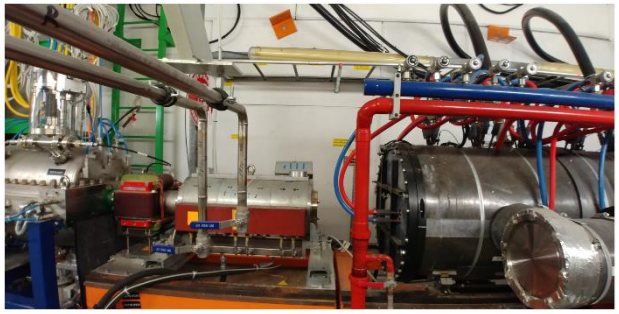


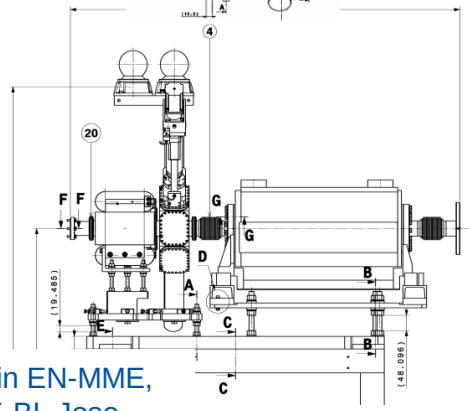


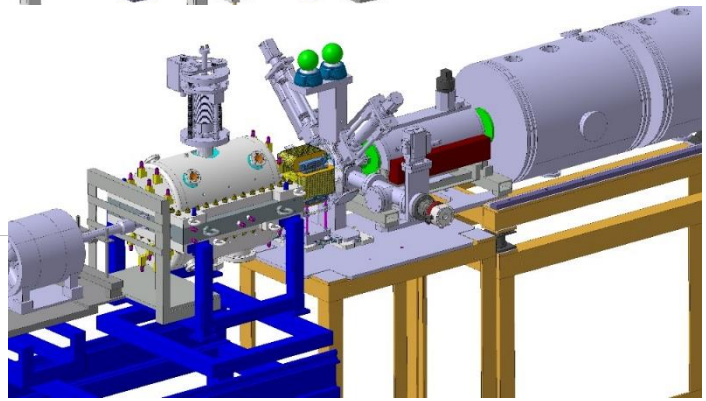






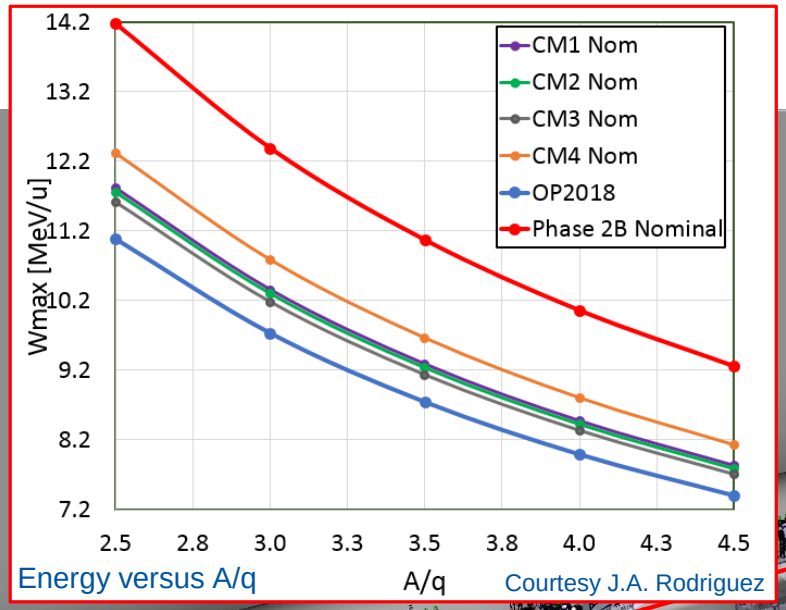






Courtesy Candy Capelli EN-MME, Nicolas Chritin EN-MME, Simon Mataguez BE-OP, William Andreazza BE-BI, Jose Ferreira Somoza TE-VSC

HIE ISOLDE CM4 repair (CAV 3 RF coupler issue)



CM4:
- Non-conformity for CAV 3 (SRF18) – RF coupler issue
- Two other cavities with low Q
- All cavities r… lower …
- W… …CM …S

CM4 Repair scheduled for LS2

CM3:
- Close to specs at 5.5MV/m
- Very stable
- Best operational CM

CM2:
- Most problematic CM
- Running at low gradients
- Mild Field emission in CAV 3 (SRF8)
- Instabilities CAV 2 & 4 (SRF7 & SRF9)
- High vacuum at start of run which disappeared
- Anomalous static heat load and microphonics. Not understood.

CM1:
- Field emission mostly in CAV5 (SRF5)
- non-conformity of solenoid#1 – short to ground (but able to run)

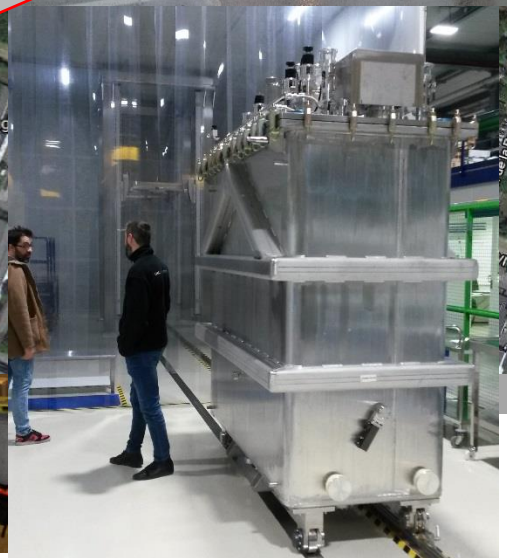
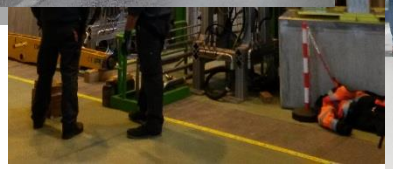
HIE ISOLDE CM4 repair

Dis-mounting CM4:

- Warm-up of the HIE SC LINAC as of 7th December until max 18th December (cooling water stop)
- Gave enough time to finish all planned ‘Winter-Physics’ + TRAP, EBIS & REX tests (Niels Bidault)
- Preparations CM4 dismount as of January. It involved dismounting of all services connected to the Cryo Module:
- Taken the heavy LS2 workload of all support groups in account the planning was adapted when necessary. The transport of CM4 took place as scheduled Thursday, March 14th to SM18 (cleanroom)

- CM4 expected to come back to the ISOLDE hall January 2020
- Aiming to finish installation and start re-commissioning by April 2020. Cooling water will be available and the Cryo plant will be able to start up. Tests with stable beam in parallel with ISOLDE Low Energy start-up.



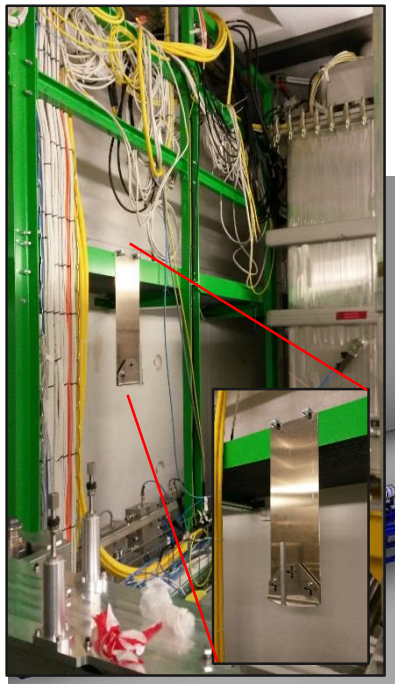




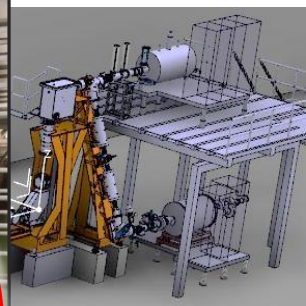
Talk Walter Venturini: ‘HIE ISOLDE repair status’

Other HIE ISOLDE installation work

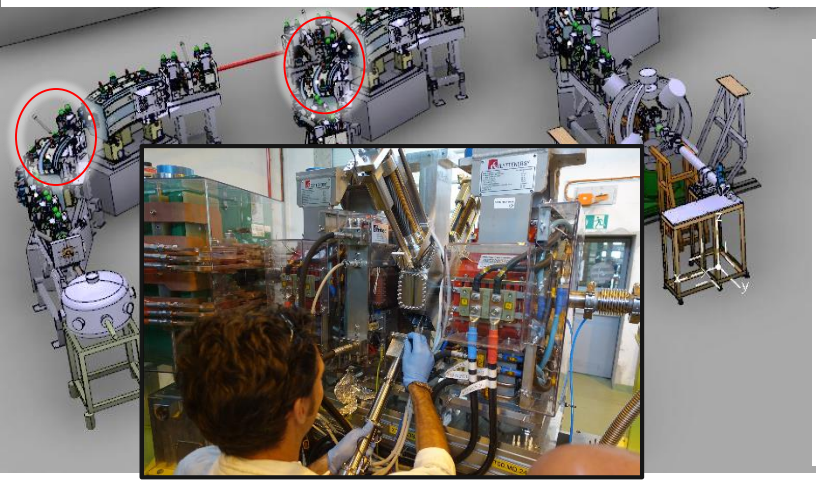
- Installation of 4 RAMSES radiation monitors type IAM (Induced Activity Monitor), one for each CM (Alexandre Dorsival, Guillaume Michet, RP team, Pawel Burdelski, Cabling team)
  - This will significantly improve the analysis of SRF cavities' field emission issues during RF conditioning and during the run

Installation May - done, cables, commissioning & acceptance Q3 '19





Presently: Mobile radiation monitor



- Survey scan of the complete SC LINAC and REX (Antje Behrens, Survey team) -done
- Installation of Silicon detectors in the XT02 & XT03 Dboxes (between the dipoles) for energy measurements (William Andreazza, Sergey Sadovich, BI team) – Q3 '19
- Maintenance and filling at ISS at XT02 - done

Cryo maintenance

Cryogenics

- Preventive maintenance of the cryogenic system including major overhauling of rotating machinery - ongoing
- Cryo operation: Setup of the automatic controls for transient modes – ongoing
- Due to the adequate repair this year (YETS 2018) by CRIOTEC of the Cryo Distribution System, no CDS intervention will be needed
- All maintenance work will be carried out through 2019. The cryo plant will be operational and ready for re-start before April 2020 for cooldown and re-commissioning of the HIE LINAC

HIE / ISOLDE CV maintenance & modif

HIE CV

- Installation of a new, smaller Daikin chiller on B199 (HIE ISOLDE) + move of the existing McQuay chiller (over-capacity) from B199 to B197 - done
- Replaces the aging ISOLDE Trane chiller (end of lifetime) on B197
- Gives 25% more cooling power (for 508)
- Crane work done, chillers installed and connected, pipe work done, electrical connections and isolation being finished (EN-CV Sebastien Acera) – all done

508

- Ventilation and airco in 508 will be upgraded in order to meet the user-labs' requirements and have circulation of fresh air on the first floor – all done. Some issues with condensation water in one of the labs is being dealt with

Conclusions REX/HIE ISOLDE LS2 work:

- All REX / HIE ISOLDE LS2 tasks are on track
- Design and construction of a new REX EBIS electron gun is on its way and things might be ready by the end of this year for testing next year during the test and development run. In worst case EBIS can run with existing configuration (for 2020 commissioning, test & development run)
- Hard work carried out by the REX LINAC RF team. RF tests running ahead of schedule thanks to RF and CV teams. REX RF will (again) be in a good shape
- REX new Diagnostic boxes integration and drawings ready. Fabrication starting. Installation foreseen ~~early next year~~, end of this year
- HIE ISOLDE Cryo Module 4 is in SM18. Repair of the coupler issue done (on all CM4 cavities). Test phase in the bunker starting (Walter Venturini & BE-RF team). Expected back at ISOLDE Januari 2020
- HIE ISOLDE CV modification finished and beneficial for the upgrade of the 508 CV/airco system (user labs). 508 CV/airco system finished and labs up to user specs.
- Aiming as planned for an early 2020 start-up:
  Commissioning, Test and Development run (HW tests as of April, cooldown May 2020)

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