ISOLDE Technical Report

J. Vollaire EN-STI-RBS
ISOLDE Technical Coordinator

63rd INTC Meeting, 5th of February 2020

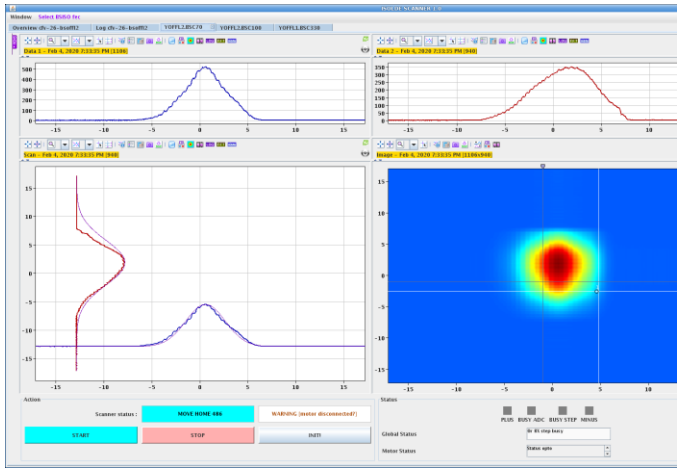
CERN | EN ENGINEERING DEPARTMENT

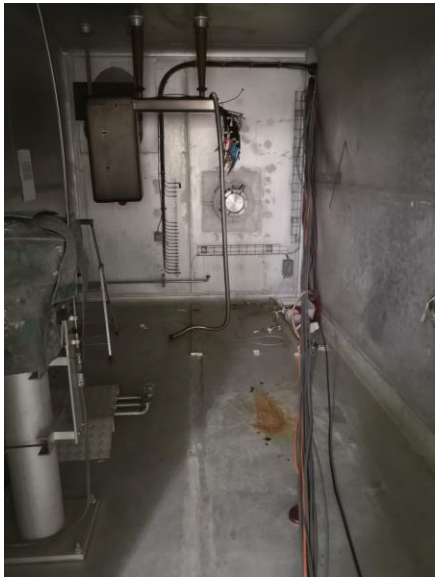
Outline

- Front Ends replacement status
- RILIS activities update
- Low-Energy beam lines
- REX and HIE ISOLDE
  - Status of LS2 activities
  - Beam Instrumentation
  - Commissioning and machine studies in 2020
- MEDICIS report

Front End 10 status

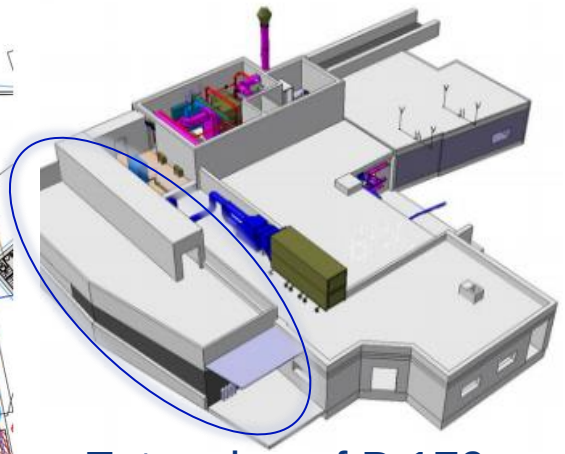
- FE10 performances tested during the last weeks in offline2
- FE10 will be transported to Build. 179 this month (before startup of civil engineering work for the nano-laboratory)
- Preparatory activities the Faraday Cage for the FE installation
- HW tests followed by commissioning (starting in April)





Front End 11 status

- FE11 mechanical assembly progressing smoothly (benefit from FE10 experience)
- FE11 tests on offline2 expected as of April
- FE11 to be installed in the target area in June (no possibility for access before due to civil engineering work for nano-lab)
- HW tests followed by commissioning during the summer

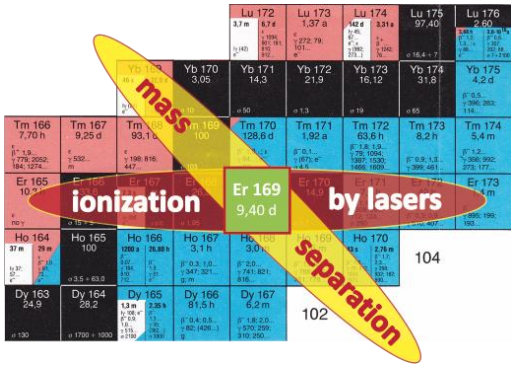


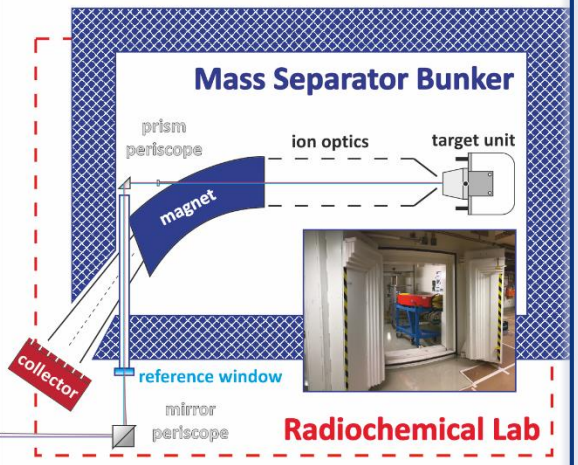
Extension of B.179

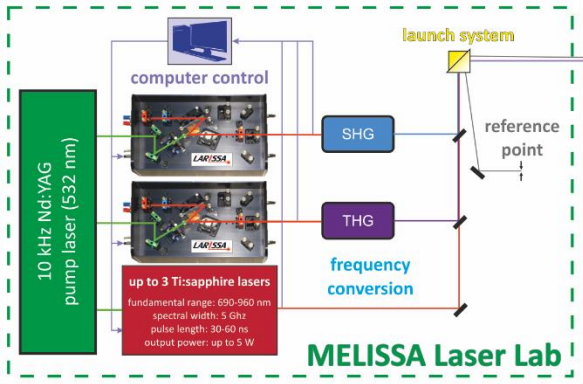
RILIS update

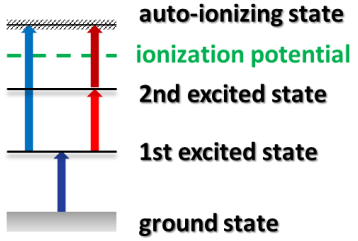
MELISSA: Laser ion source for MEDICIS

- Laser Lab became operational in 2019
- Laser-ionized beams of Tb, Er, and Yb produced
- First radioisotope collections performed









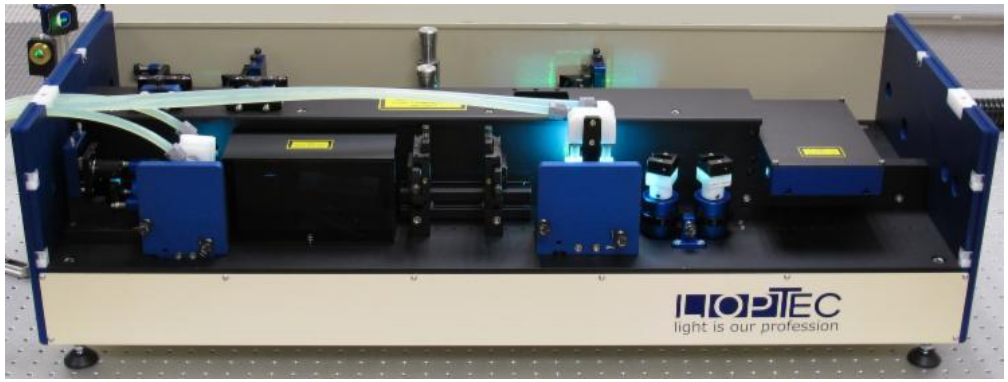
Enhancement of beam purity due to the laser resonance ionization

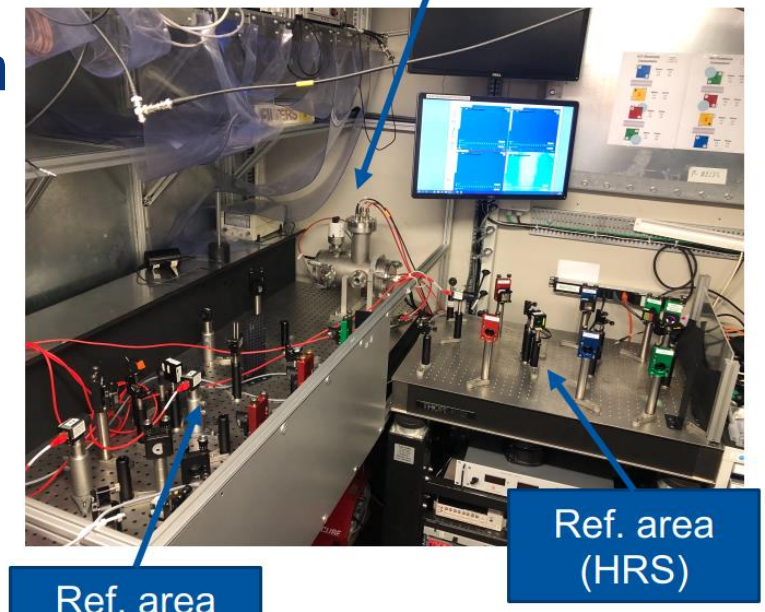
Offline Laser Ion Source R&D at **ISOLDE Offline 2 separator**

- Laser Lab is ready and will make use of spare laser equipment from ISOLDE-RILIS
- Aim to be operational from winter 2019-2020

Works at RILIS before restart

- Extension of the reference area for independent setup and stabilization of laser beams to both GPS and HRS ✓ Done
- Optimization of the optical layout ✓ In process
- Upgrade of dye lasers system
- Upgrade of the RILIS control system
- Exchange of magnet windows





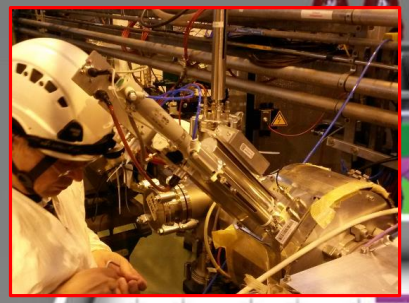
S. Tsangari

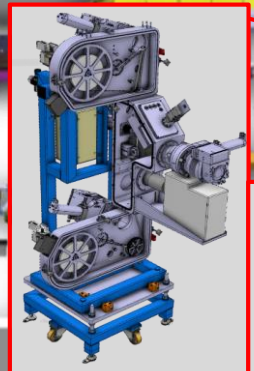
Status ISOLDE Low Energy

All Low E LS2 tasks are on track
Early start-up approved for a ISOLDE re-commissioning, test & development run in 2020

Beam Instrumentation Low E beamlines
- operational at start-up in 2020

GLM & GHM area:
- Refurbishment to comply to modern legislation for the manipulation of open sources
- Ready for start-up in 2020





HRS

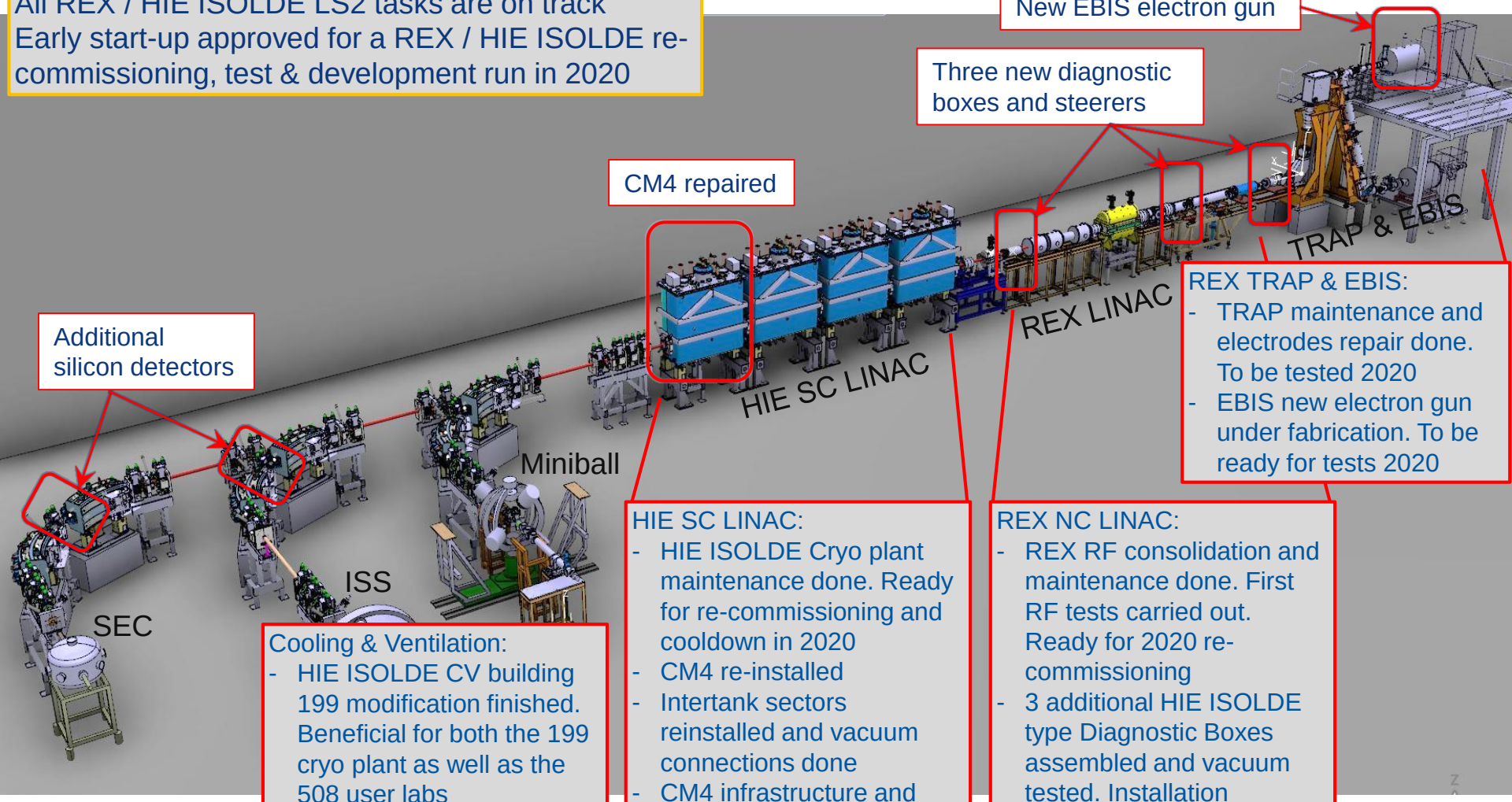
GPS

Cooling & Ventilation:
- Maintenance on the different cooling water and ventilation systems finishing: All cooling water back end February 2020

New fast Tape-Station:
- Installed in the CAO beamline
- Operational at start-up in 2020

Status REX & HIE ISOLDE

All REX / HIE ISOLDE LS2 tasks are on track
Early start-up approved for a REX / HIE ISOLDE re-commissioning, test & development run in 2020



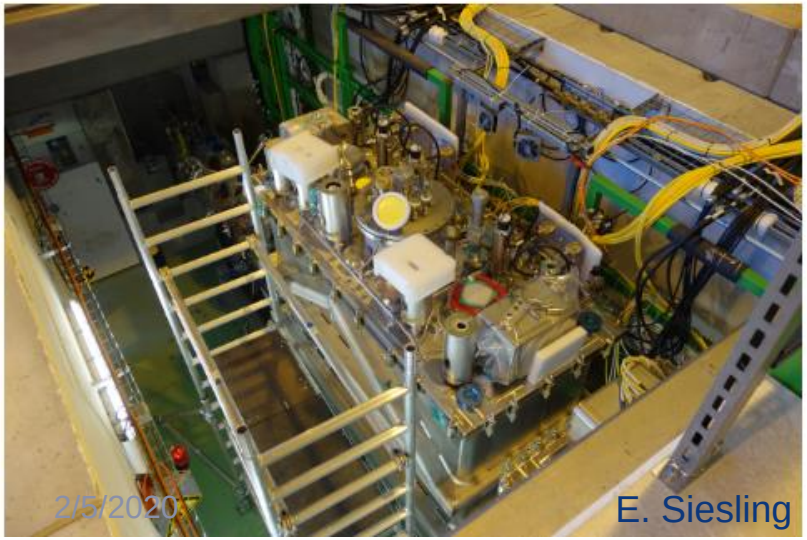
REX TRAP & EBIS:
- TRAP maintenance and electrodes repair done. To be tested 2020
- EBIS new electron gun under fabrication. To be ready for tests 2020

Cooling & Ventilation:
- HIE ISOLDE CV building 199 modification finished. Beneficial for both the 199 cryo plant as well as the 508 user labs
- 508 CV/airco upgrade finished and labs are up to user specs
- All cooling water back end February 2020

HIE SC LINAC:
- HIE ISOLDE Cryo plant maintenance done. Ready for re-commissioning and cooldown in 2020
- CM4 re-installed
- Intertank sectors reinstalled and vacuum connections done
- CM4 infrastructure and cryo connections ongoing
- Re-commissioning CM1-4 with stable beam from EBIS foreseen as of July 2020

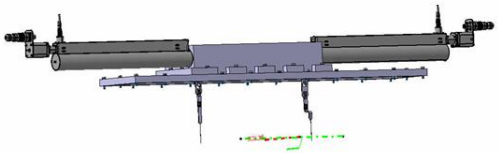
REX NC LINAC:
- REX RF consolidation and maintenance done. First RF tests carried out. Ready for 2020 re-commissioning
- 3 additional HIE ISOLDE type Diagnostic Boxes assembled and vacuum tested. Installation February 2020, operational for 2020
- REX vacuum maintenance finished. Ready for 2020 re-commissioning

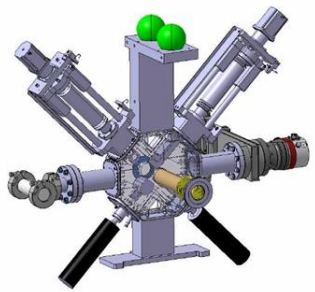
Transport Cryo Module 4 from SM18 back to ISOLDE:

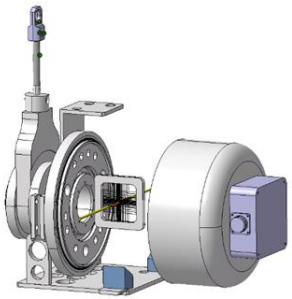


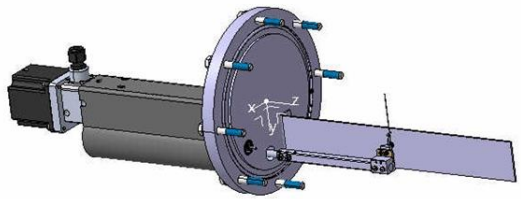
Beam Instrumentation consolidation and upgrades

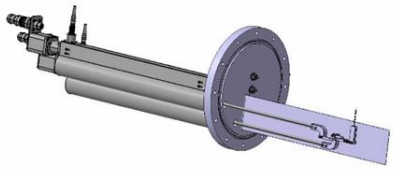
16 new FC+scanner
1 new GPS scanner
2 new HRS scanner
2 new Frontend FC
2 new Frontend SEMGRID
3 new REX DB
New design of Frontend SEMGRID casserole





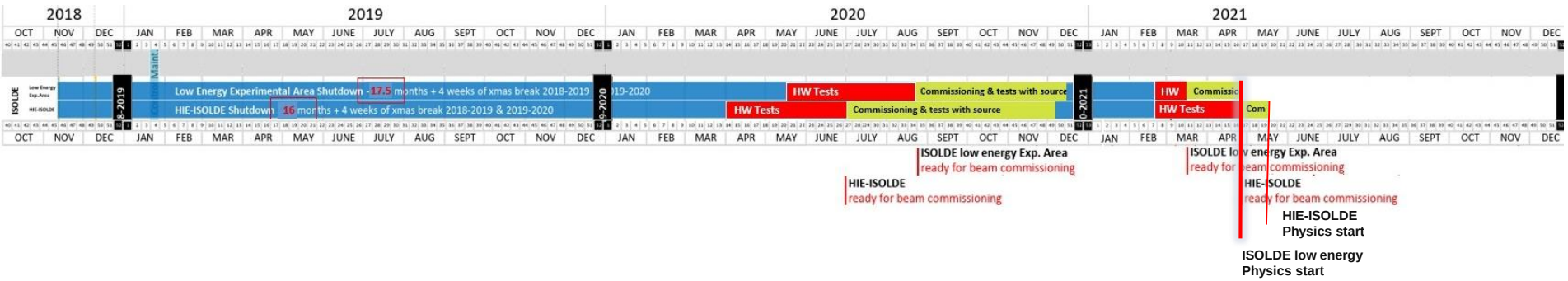






William Andreazza

As requested LS2 Schedule 2.4: Early start-up in 2020:



Early start-up 2020:

- Approved by the CERN Research Board, LS2 Committee and IEFC
- Low E Beam commissioning and development tests with stable beam as of end-Aug 2020
- Low E Physics start end April 2021
- HIE-ISOLDE Beam commissioning and development tests with stable beam as of July 2020
- HIE-ISOLDE Physics start mid-May 2021

Gain:

- ~ 4 months HIE ISOLDE Physics, ~1 month Low Energy Physics
- Better performing machine, better understanding of the machine parameters resulting in higher quality beams and shorter set-up times

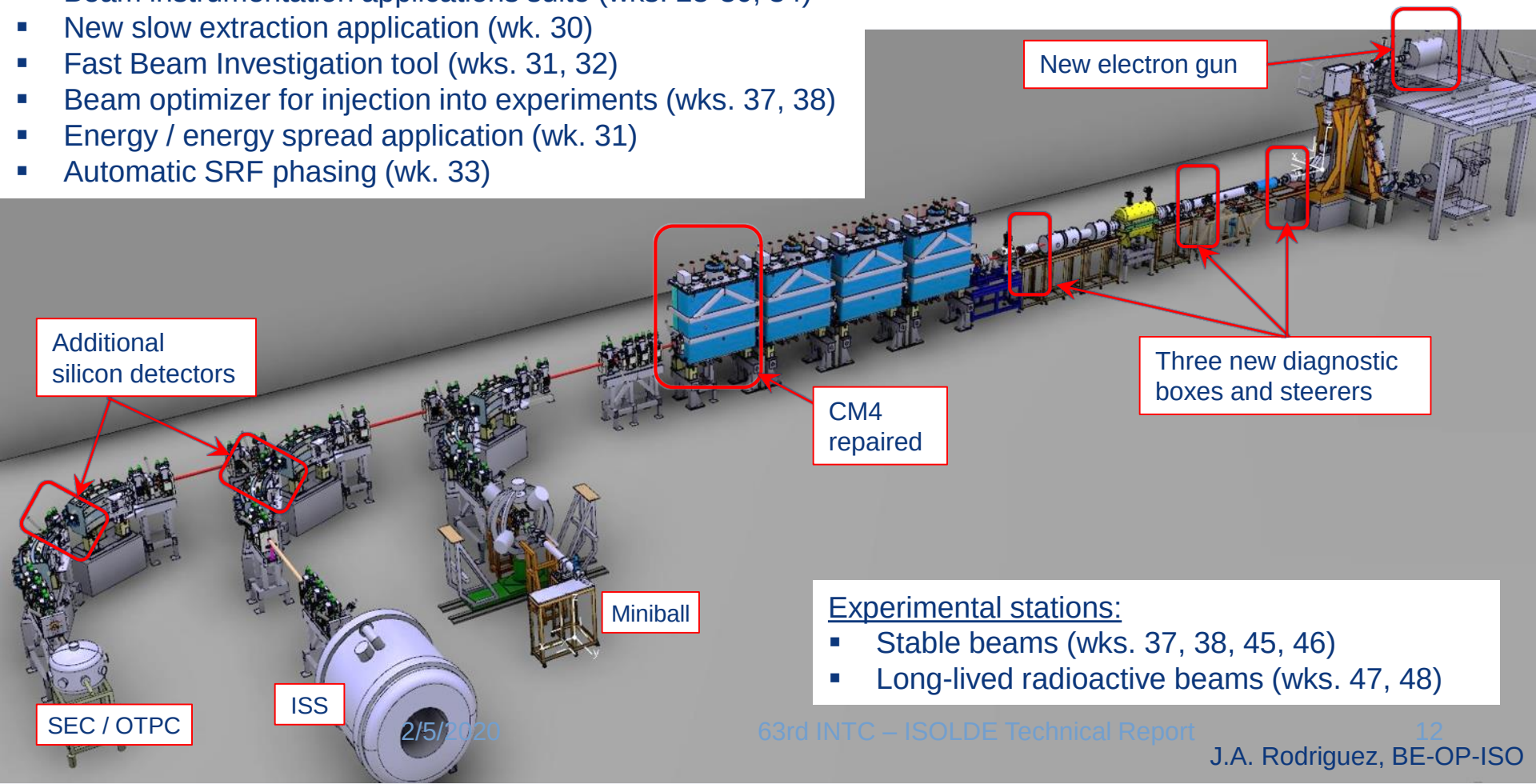
Beam Commissioning 2020:

New or heavily refurbished hardware:

- New steerers and diagnostic boxes: FCs, slits, attenuators, collimators and silicon detectors (wks. 28, 29, 30)
- New electron gun in the REX-EBIS charge breeder (contaminant characterization: wks. 29, 31)
- REX RF amplifiers (wks. 30-32)
- Phasing of refurbished cryomodule 4 (CM4) (wk. 33)
- Two additional silicon detectors (wk. 34)

New software or major upgrades:

- Beam instrumentation applications suite (wks. 28-30, 34)
- New slow extraction application (wk. 30)
- Fast Beam Investigation tool (wks. 31, 32)
- Beam optimizer for injection into experiments (wks. 37, 38)
- Energy / energy spread application (wk. 31)
- Automatic SRF phasing (wk. 33)



Experimental stations:

- Stable beams (wks. 37, 38, 45, 46)
- Long-lived radioactive beams (wks. 47, 48)

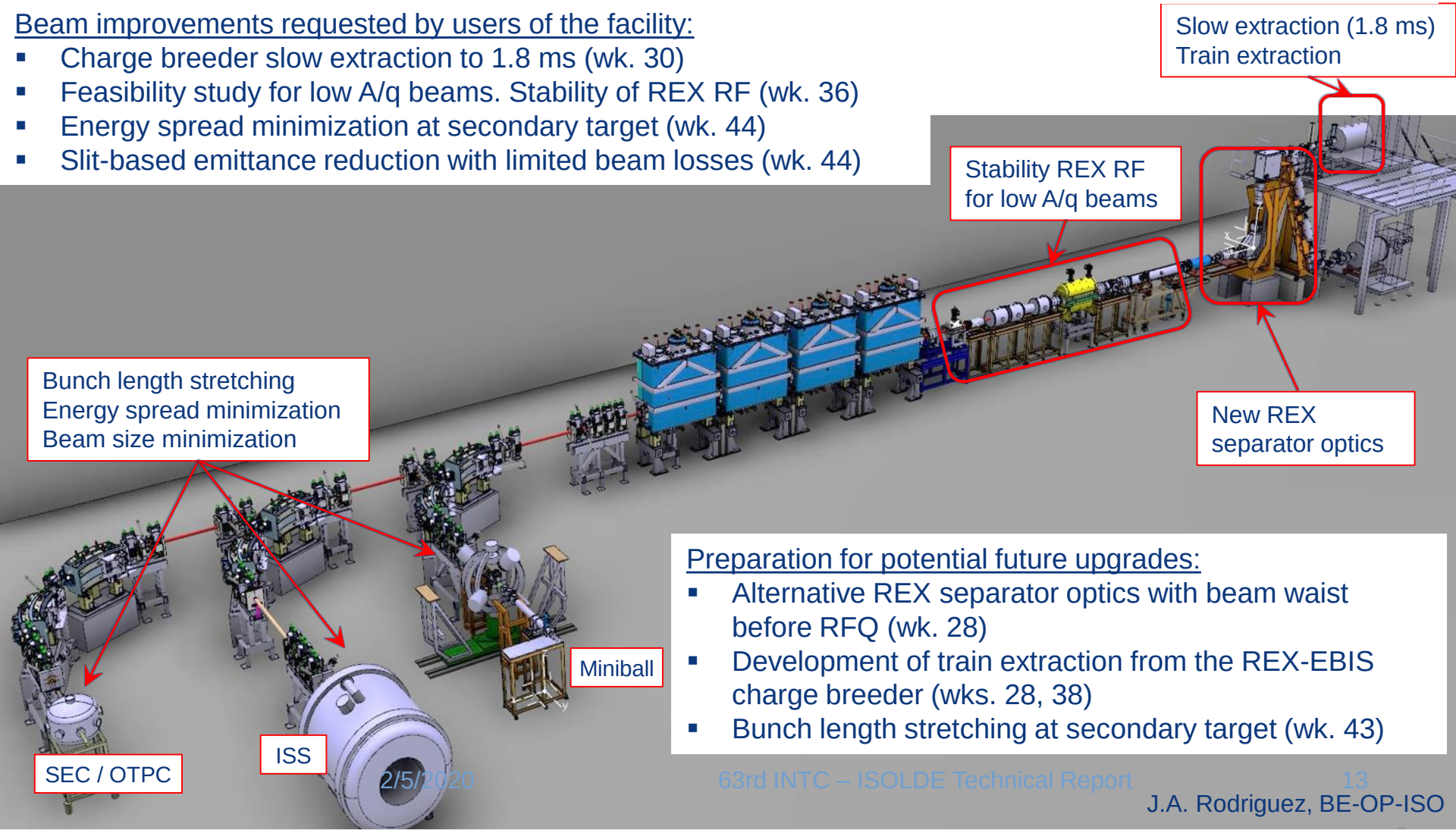
Machine Studies 2020:

Machine development:

- Energy and energy spread measurement in three HEBT lines (wk. 34)
- Transverse and longitudinal phase space characterization and validation of optics models (wks. 35, 43)
- Machine A/q scalability studies (wk. 41)
- Development of beam-based energy gain measurement (wk. 42)

Beam improvements requested by users of the facility:

- Charge breeder slow extraction to 1.8 ms (wk. 30)
- Feasibility study for low A/q beams. Stability of REX RF (wk. 36)
- Energy spread minimization at secondary target (wk. 44)
- Slit-based emittance reduction with limited beam losses (wk. 44)

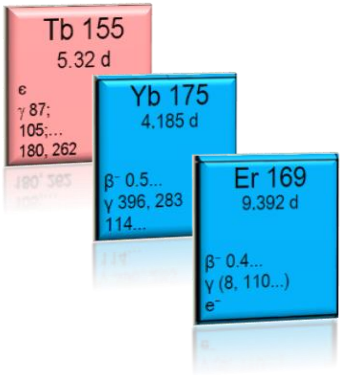


Preparation for potential future upgrades:

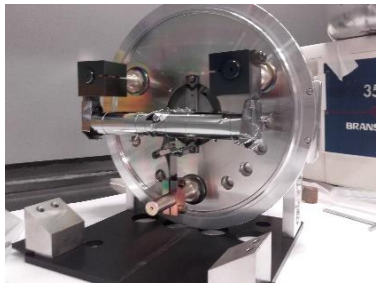
- Alternative REX separator optics with beam waist before RFQ (wk. 28)
- Development of train extraction from the REX-EBIS charge breeder (wks. 28, 38)
- Bunch length stretching at secondary target (wk. 43)

MEDICIS 2019 summary

- **Summary of 2019 achievements in term of collections from external sources at MEDICIS**
  - ✓ **15 sources** from two external suppliers (ILL (Grenoble) & Arronax (Nantes));
  - ✓ **3 radionuclides** of medical interest Tb-155, Yb-175 & Er-169;
  - ✓ **870 MBq** in total collected in 2019;
  - ✓ **4 institutes** part of the MEDICIS collaboration received activity;

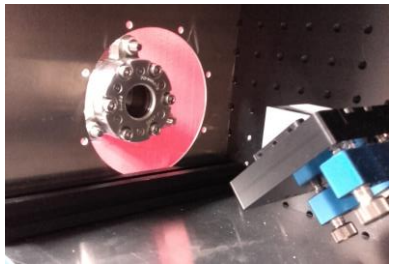


  - ✓ **8 targets** produced & re-used up to 3 times.



MEDICIS in 2020

- **From January to beginning of March 2020, MEDICIS is in technical stop for maintenance**
  - ✓ Maintenance of the ventilation, access and safety system
  - ✓ Replacement of the extraction electrode
  - ✓ Robot trajectories checks – **ONGOING**
  - ✓ Installation of a switch inside the collection chamber
  - ✓ Cleaning/replacement of the laser windows
  - ✓ Installation of the new gas system
  - ✓ Radiation monitor tests



One laser window

New electrode installed, aligned and calibrated

- **5th MEDICIS Collaboration Board Meeting**
  - ✓ Will be held at CERN on the 20th of February
- **Operation 2020**
  - ✓ Will re-start from middle of March 2020 with already 3 foreseen Tb-155 collections