ISOLDE Technical Report

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ISOLDE Technical Coordinator
62nd INTC meeting 6th November 2019

CERN | EN ENGINEERING DEPARTMENT

Outline

- Target Development and Disposal
- Medicis
- Nanolab
- Status of work in experimental hall
- Frontends
- HIE and FE Commissioning

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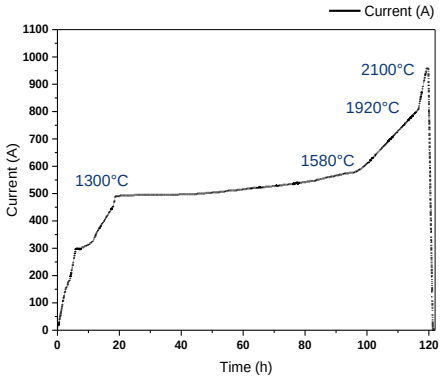
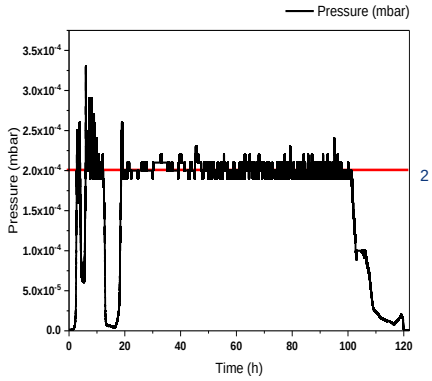
Optimisation of UC_x production

Annual production: 10-12 batch
Production rate: 1 batch / week

Current method







Mixing → Pressing → **Carburization**

1.5 hours | 2.5 hours | **120 hours**

Heating speed is limited by vacuum level (max. 2 x 10^{-4} mba

Increase of pressure limit
→ 2 mbar

New method

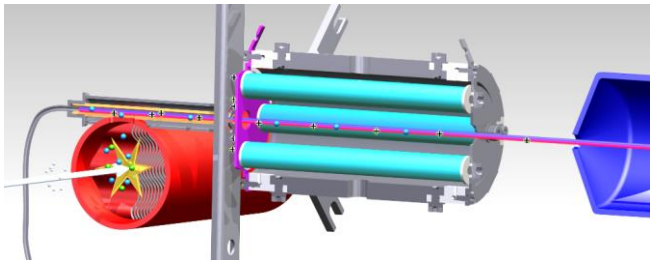
Mixing → Pressing → **Carburization**

1.5 hours | 2.5 hours | **15 hours**

NEXT STEP:
Control and Validation of new method
- ✓ Microstructural characterisation of UC_x
- ✓ Isotope release tests online

(N.-T. Vuong, M. Owen, S. Rothe)

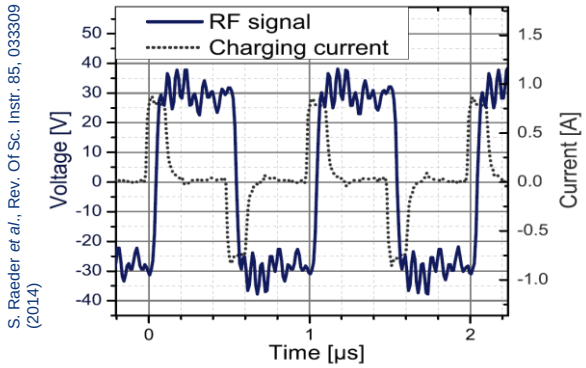
LIST @ Frontend 10,11

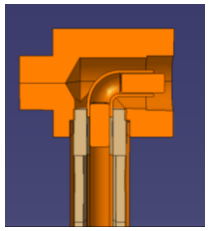


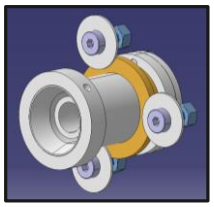
- LIST delivers very pure beams at ISOLDE: More and more requests
- LS2: More reliable rad. hard RF connector designed, integrated to FE
- Square wave driven RFQ needs to be verified, respective hardware purchased and installed

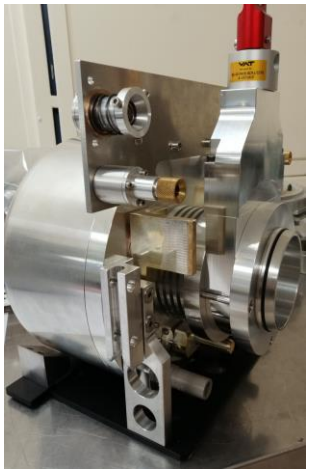
Objectives for after LS2:

- **both Frontends** will be compatible to LIST
- 2 RF lines **reduce complexity** of the target
- **LIST** offered **as standard ion source** to users









LIST RF connectors: frontend and target side
(J.Cruikshank, R.Heinke, S.Rothe)

Restart of non-actinide nano materials

- Requirement for development towards actinide nano materials. Equipment purchase ongoing.

- Old **Glovebox to be refurbished** in Chemical lab Bat.26
- New extraction system for hydraulic press: design phase
- Dry **tests and documentation** with HSE planned for Q4 2019

- After LS2: Ensure safe production of MWCNT and other non-actinide nano targets in-house

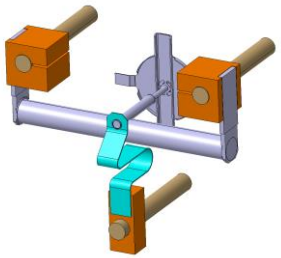
Glovebox underpressure test

(B.Crepieux, R.Martins, S.Rothe)

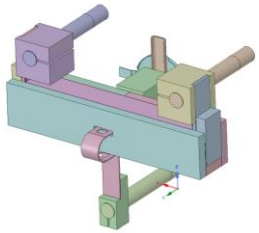
Improved target and ion source heating

- Main goal is to **remove cold spots in the target**, which reduce yield
- CAD design and ANSYS ready, **waiting for prototype**

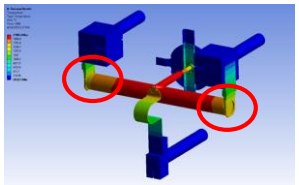
1) Transfer line heating from the back



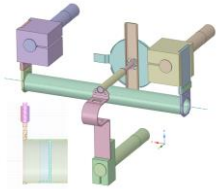
2) SIGRATHERM® MFA as a new thermal insulation



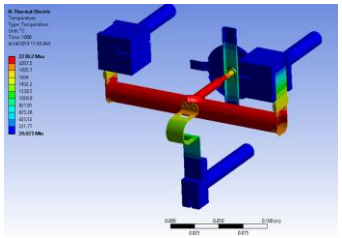
3) New optimized cap design



New caps design + 50% less material in the container extremities

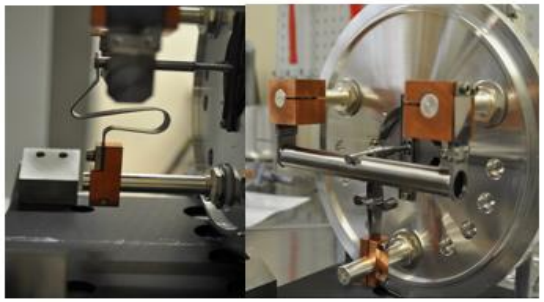


Simulated concept

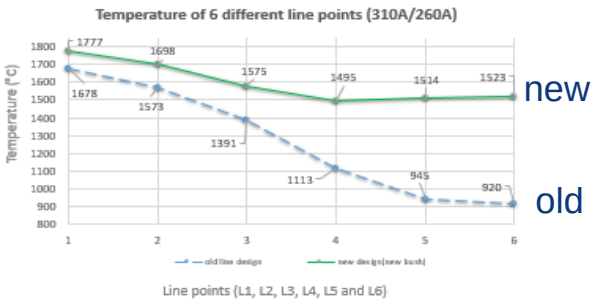


DT<150°C

First exp. results: New line heating reduces ΔT



new old



(V.Samothrakis, S.Marzari, S.Roth

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MEDICIS Status Report

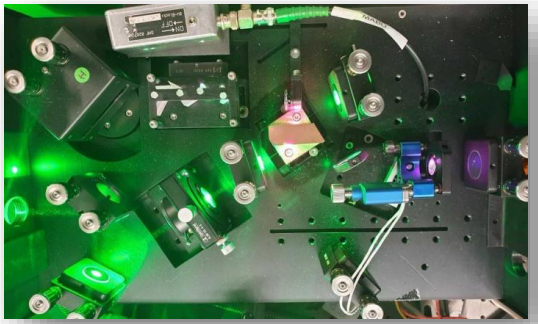
- **Successful first collections using external sources and first ever laser ionized beam used during collection**
  - ✓ 7x Er-169 → 288MBq Total
    - ➢ Ampoules imported from ILL, delivered to PSI and NPL
  - ✓ 4x Yb-175 → 519MBq Total
    - ➢ Ampoules imported from ILL, delivered to PSI : **1st results for medical experiment MED-18 already achieved.**
  - ✓ 2x Tb-155 → 0.2MBq Total
    - ➢ Target imported from Arronax, delivered to NPL and SCK/KULeuven
  - ✓ 3x Pt-195m → 450 MBq total
    - ➢ Ampoules imported from ILL, 1 delivered to HUG without mass separation

- **New set-up for decontamination and opening of ampoules (courtesy B. Crepieux)**
  - ✓ Successful reduction of dose received during procedure by factor 3
    - ➢ Factor 10 reduction achievable with planned development
  - ✓ Well in compliance with ALARA

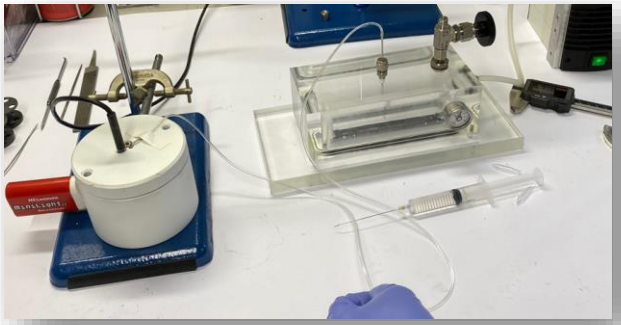
- **4th MEDICIS Collaboration Board Meeting**
  - ✓ Reports from collaborations and experimental status updates
  - ✓ New proposals and future upgrades discussed

- **Latvia minister visited CERN**
  - ✓ Waiting for the official notification of Latvia joining up

Laser beam in MELISSA laboratory



New set-up for decontamination and opening of vials



Open Days at MEDICIS (~1400 visitors)

LP + RBS team

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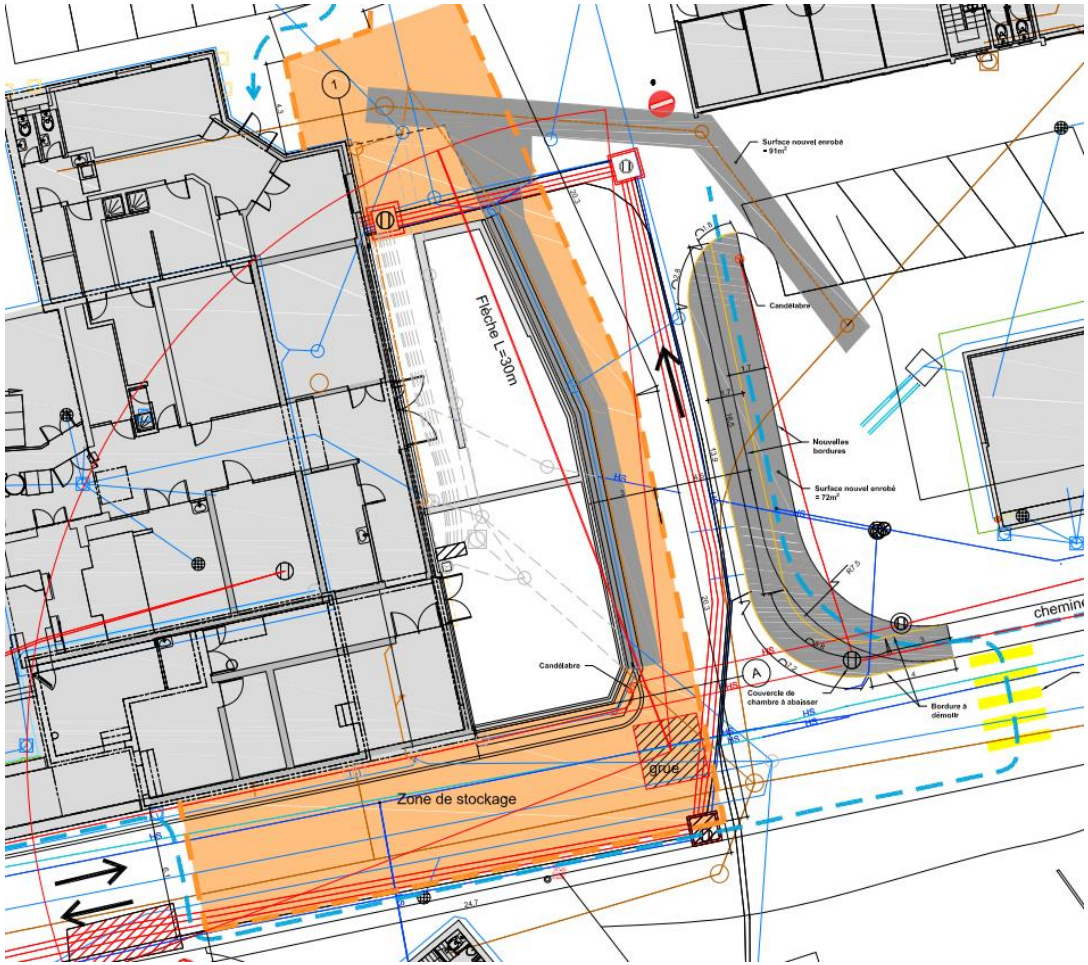
Nano-lab



- As from January 2020, the worksite will be closed off as shown.
- Access to B. 179 for “big” material will be difficult between Feb and May.
- Ventilation of the labs (not target area) will be stopped for ~5 months starting Jan 2021
  - Impact on actinide target production

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Readiness ISOLDE Low Energy

Status:

Delay on the production of the new Front-End: a lot of time has been recovered

FE10 and FE11 installation in resp. January and June 2020 followed by commissioning

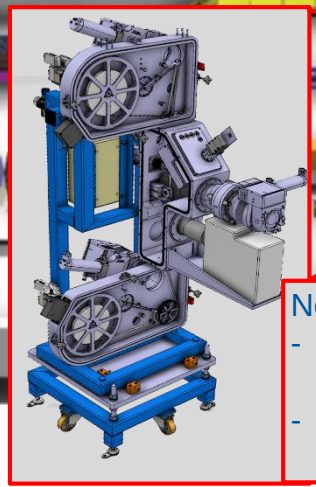
New Front-Ends:
- Catching up delay caused by mechanical issues (extraction electrode)
- FE10 (HRS) assembly finalized. Ready for installation Jan 2020
- FE11 ready for installation June 2020

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

HRS

HT modulators:
- High Precision 60kV DC HV power supplies installed on HT 1 & 2
- Target Modulators, HT fast recovery systems, installed on HT1 & 2
- FESA3 compliant control system deployed
- On site test load and HT calibration tools installed
- Ready for commissioning at start-up in 2020

REX / HIE ISOLDE:
- See next slide



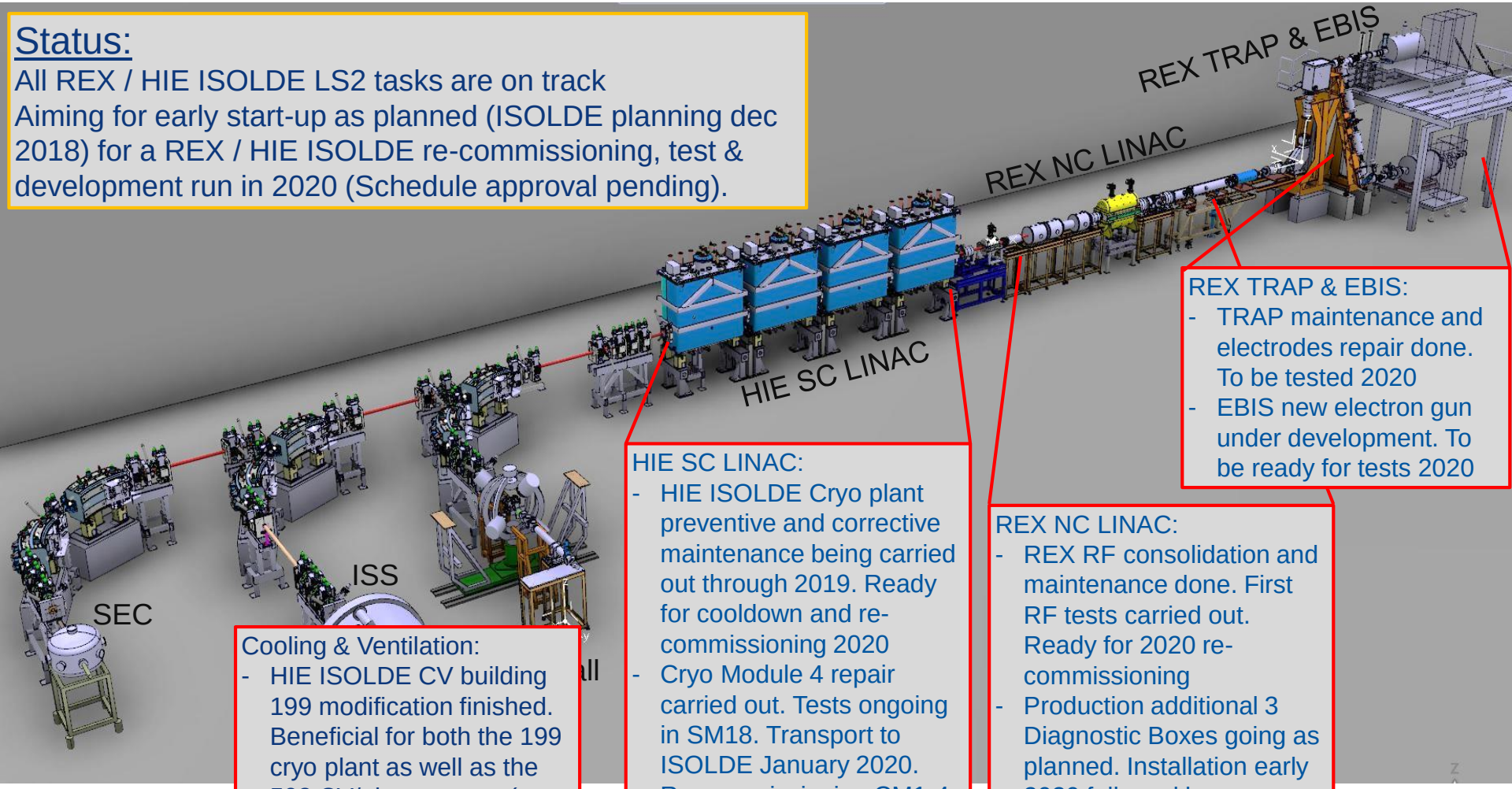
New fast Tape-Station:
- Installed in the CAO beamline
- Operational at start-up in 2020

Readiness REX & HIE ISOLDE

Status:

All REX / HIE ISOLDE LS2 tasks are on track

Aiming for early start-up as planned (ISOLDE planning dec 2018) for a REX / HIE ISOLDE re-commissioning, test & development run in 2020 (Schedule approval pending).



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

REX NC LINAC:
- REX RF consolidation and maintenance done. First RF tests carried out. Ready for 2020 re-commissioning
- Production additional 3 Diagnostic Boxes going as planned. Installation early 2020 followed by commissioning and test
- REX vacuum maintenance ongoing. To be ready for 2020 re-commissioning

HIE SC LINAC:
- HIE ISOLDE Cryo plant preventive and corrective maintenance being carried out through 2019. Ready for cooldown and re-commissioning 2020
- Cryo Module 4 repair carried out. Tests ongoing in SM18. Transport to ISOLDE January 2020.
- Re-commissioning CM1-4 with stable beam from EBIS foreseen as of May 2020 as per ISOLDE planning

Cooling & Ventilation:
- HIE ISOLDE CV building 199 modification finished. Beneficial for both the 199 cryo plant as well as the 508 CV/airco system (user labs).
- 508 CV/airco upgrade finished and labs are up to user specs.

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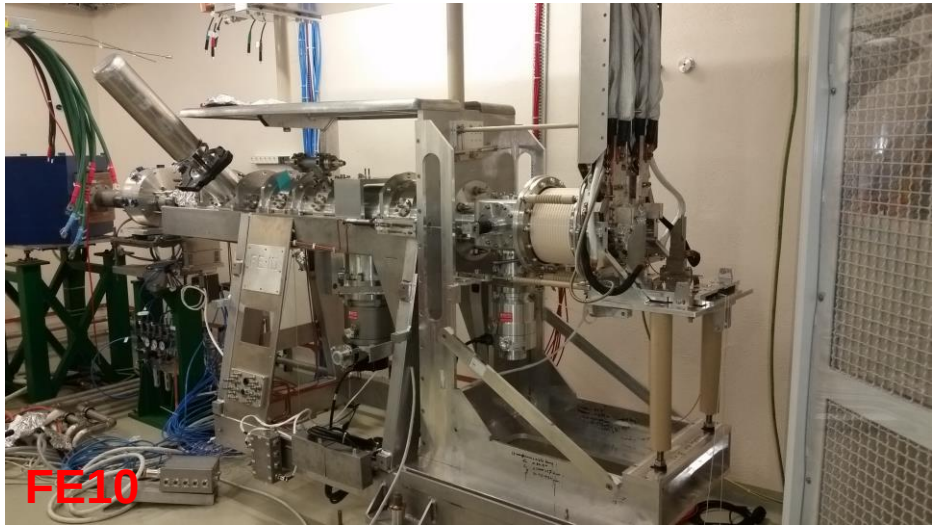
FE10 and FE 11 Production

- **Status of Front End 10:**
  - FE10 has been moved to the offline 2 for testing.
  - Fudicialization and alignment done
  - Objective is to have FE10 transported to the target area in January 2020

- **Status of Front End 11:**
  - All pieces are ready and assembling activities have started.
  - Based on experience and duplicity of pieces, assembly should be faster
  - Transfer to ISOLDE in Spring of 2020



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Start Up 2020?

- The decision to start the ISOLDE facility as early as summer 2020 in preparation for the physic's run in 2021 is still under discussion.
- A justification/planning will be presented to the IEFC on the 22nd November for information prior to the Research Board in December 2019.
- Constraints for FE's
  - Finishing and testing
  - Access due to nano lab construction
- Constraints for HIE-ISOLDE
  - Operation costs – estimated at 130kCHF
  - Both installations and the facility have an intense commissioning program…

Phases for hardware testing of FEs

Action	Group	~Time (days)
Connection	EN-STI-RBS EN-HE	5
Alignment	EN-SMM	2
Movement	RBS/SMM	2
Robot	EN-HE/SMM	3
Vacuum	TE-VSC	3
Water	EN-CV	1
Low tension	RBS/ TE-EPC	2
Target connections	RBS BE-OP	2
HT transfer tube	RBS	1
Controls	BE-OP BE-CO	10
Interlocks	BE-OP	1
High tension (1/2)	TE-ABT	2

Commissioning of FE with stable beam

Action	Group	~Time (days)
Beam production	BE-OP EN-STI	5
Beam transport	BE-OP	5
Scanners and FCs	BE-OP BE-BI	10
Electrostatic equipment	TE-EPC BE-OP	5
Fast tape station	BE-OP/CO EN-STI/SMM	5
RFQ Cooler	EN-STI BE-OP	5
Transport to REX/HIE	BE-OP/ABP	20
Transport to experiments	BE-OP EP-SME	20
Laser tests	EN-LP	20

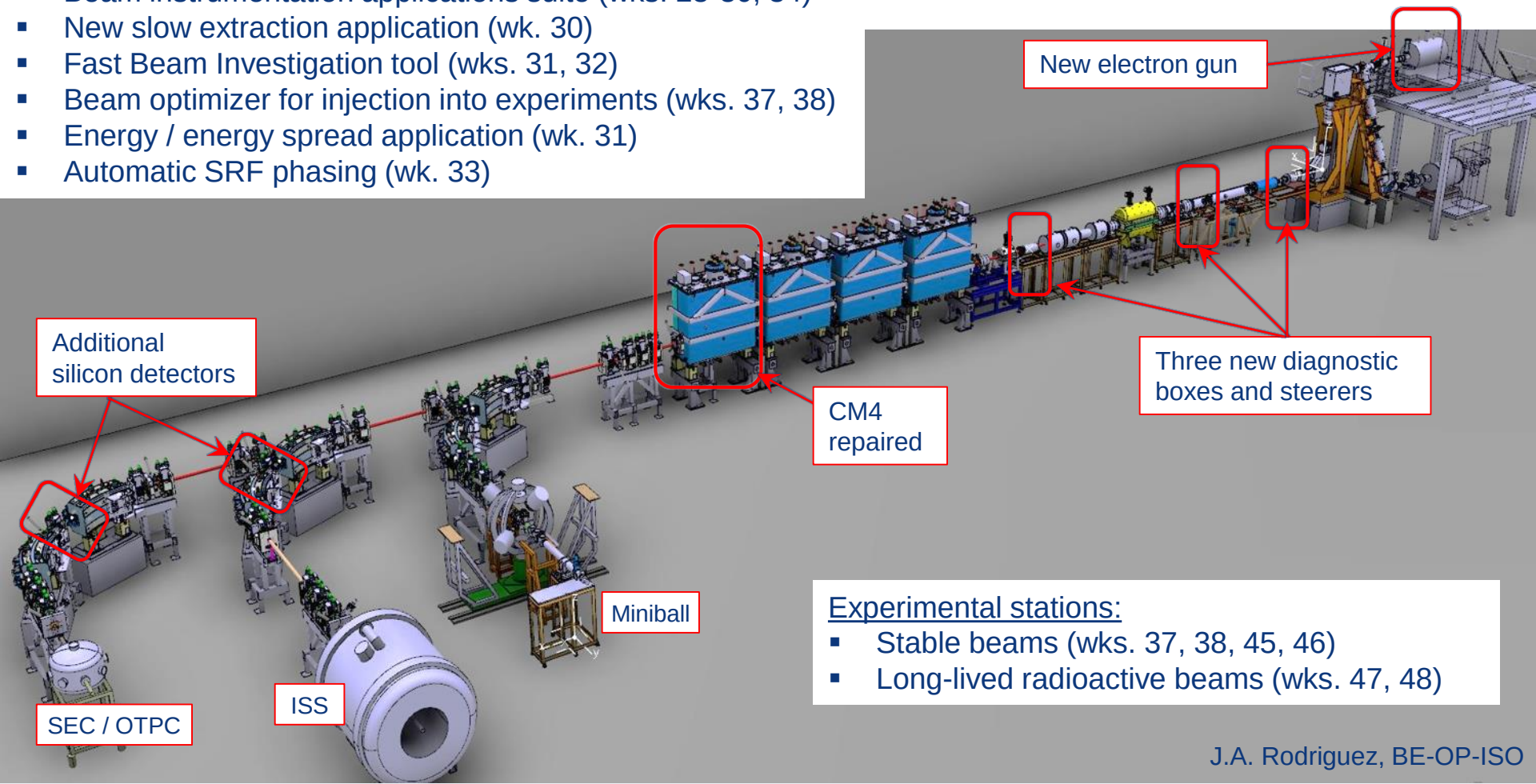
Beam Commissioning 2020:

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)

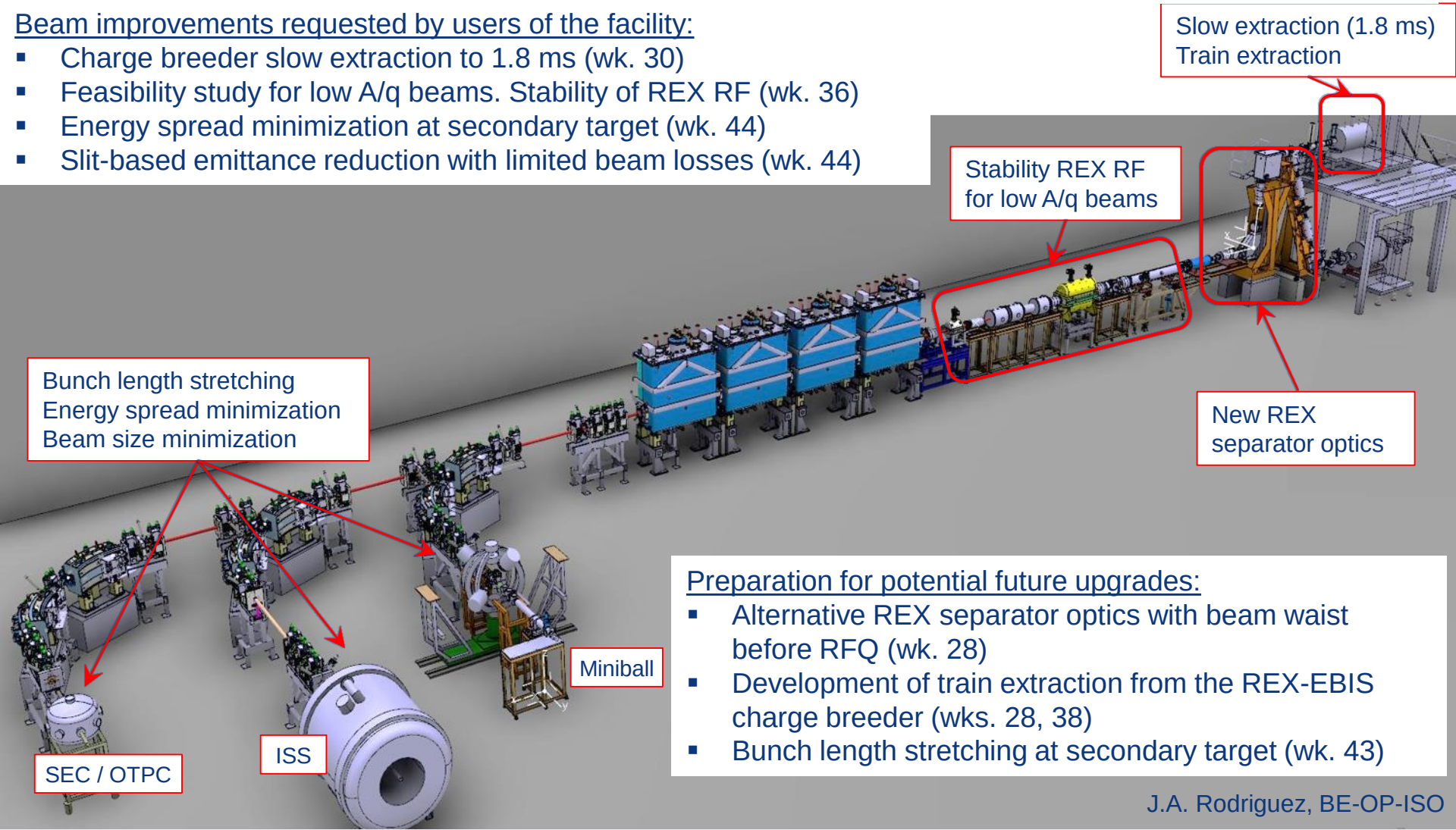
Machine Studies 2020:

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)

J.A. Rodriguez, BE-OP-ISO

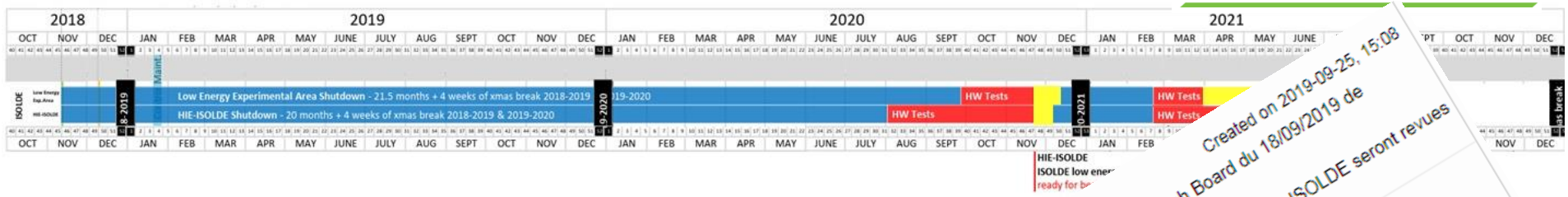
HIE-ISOLDE commissioning

Action	Groups	~Time (days)
Cryo commissioning	TE-CRG	55
CM commissioning	TE-CRG	35 (+20)
Survey	EN-SMM	12
Beam commissioning	BE-OP	42
Machine development	BE-OP	40
Total		184

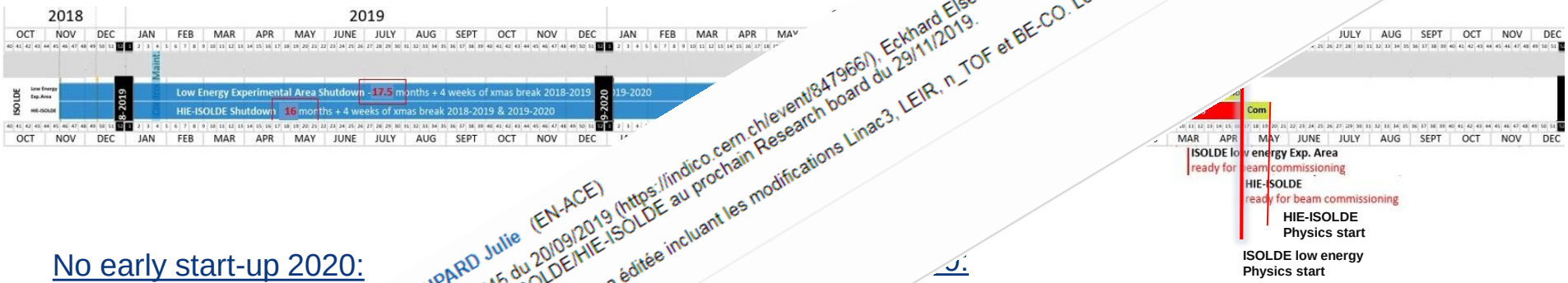
2021 start – up if fully commissioned in 2020

Action	Groups	~Time (days)
Cryo commissioning	TE-CRG	55
CM commissioning	TE-CRG	35 (+20)
Survey	EN-SMM	12
Beam commissioning	BE-OP	15
Machine development	BE-OP	0
Total		117

LS2 Schedule V 2.3: No early start-up in 2020 (since Oct.



As requested: Early start-up in 2020:



Created on 2019-09-25, 15:08

Accepted with Warning by COUPARD Julie (EN-ACE)
Comme indiqué par Miguel lors du LS2C #45 du 20/09/2019 (https://indico.cern.ch/event/847966/), Eckhard Elsen a demandé lors du Research Board du 18/09/2019 de repousser la décision pour les changements ISOLDE/HIE-ISOLDE au prochain Research board du 29/11/2019.
Une version Released 2.3 du Master Schedule LS2 sera éditée incluant les modifications Linac3, LEIR, n_TOF et BE-CO. Les modifications ISOLDE/HIE-ISOLDE seront revues en fin d'année.
Approval Closed status - PERROT Anne-Laure - 2019-10-02, 15:15
Approval Accepted status - PERROT Anne-Laure - 2019-10-02, 15:16

No early start-up 2020:

- Low E Physics sta… …ysics start end April 2021
- HIE-ISOLDE P… …SOLDE Physics start mid-May 2021

Gain:

- … month Low Energy Physics
- L… …er understanding of the machine pa… …er quality beams and shorter set-up times

Courtesy of E. Siesling and J.Vollaire for BE-OP-ISO

Possible Planning Scenarios