



ISOLDE Technical Report

71st Meeting of the INTC – 8th November 2022

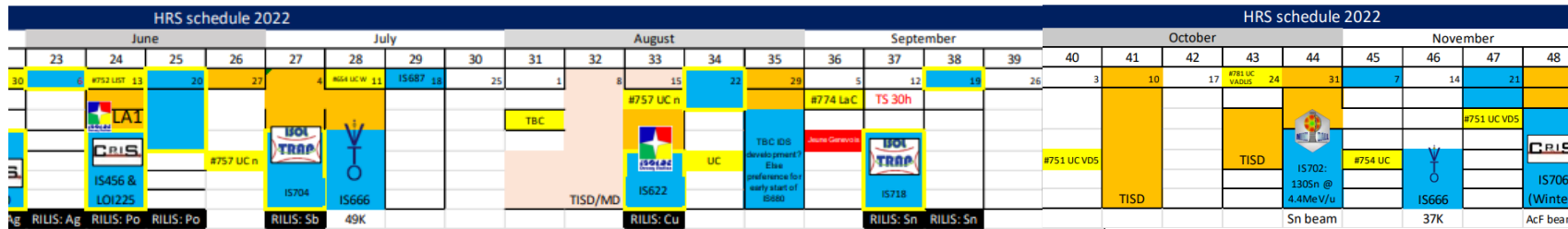
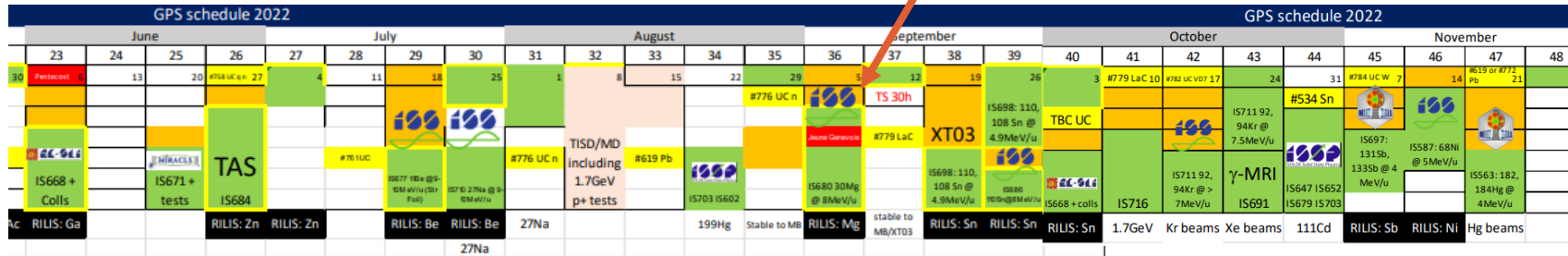
Joachim Voltaire (Technical Coordinator) on behalf of ISOLDE Technical Teams

Outline

- **Restart of REX/HIE Linac / Status of the facility(update since June)**
- **Machine Development: 1.7 GeV proton beam to GPS**
- **Update on target lifecycle**
- **Conclusions and Perspectives**

ISOLDE 2022 Schedule

Last INTC Meeting



protons for physics: 28 March
ions for physics: 28 November



KJ: 29.07.22

- Physics with protons not impacted by CERN decision to anticipate the start of the YETS (energy saving measure)
- One week of winter physics being discussed

REX-HIE ISOLDE Linac restart

- Recommissioning of the REX-HIE Linac was on the critical path end of June (7Gap1 cavity)
- Beginning July (04/07), increase of the RF amplifiers temperature for REX
- Investigations by EN-CV: RF amplifiers clogged by dirt (suspended matter found in water)
- Follow-up (mitigation of the pollution) and cleaning led to another 2 weeks “delay”



S. Deval IEFB report



Reminder end of June report

Status of REX-HIE ISOLDE

Difficult recommissioning of REX-HIE ISOLDE Linac:
 - 3 compressor station cuts (reconditioning required)
 - End of May: 7GP1 (NC accelerating structure) can't hold the required accelerating gradient

The 7GP1 spiral resonator:

- Accelerating structure of the REX linac
- In operation for ~ 20 yrs
- Beam energy: from 1.2 to 1.55 MeV/u
- RF power: ~ 80 kW for A/q = 4.5

Foreseen commissioning plan

Wk. number	Task
21	Beam through cryomodules (ahead of time thanks to D. Valuch who completed the hardware commissioning of the SRF cavities)
21, 22	Beam commissioning of REX linac (phasing, reference set-ups...)
23, 24	Beam commissioning of HIE-ISOLDE linac
25	Beam commissioning of the HEBT lines
26	First stable beam to users
28, 29	Setup and first Radioactive Ion Beam (RiB) to users

Input: J.-A. Rodriguez Rodriguez, E. Siesling, S. Ramberger, C. Gagliardi

REX-ISOLDE 7gap1 investigations

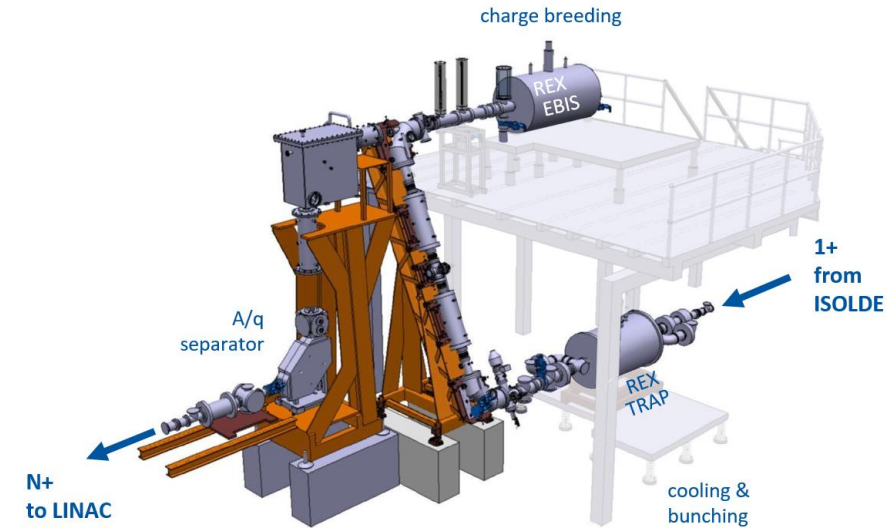
- Extensive RF measurements to validate proper functioning of the amplifier and status of RF cables
- Cavity opened twice (endoscopy inspection). No defect found.
- Several external vibration measurements. Permanent measurement setup (data logging)
- Strong vibrations felt end of May in the tunnel have disappeared (most likely caused by cryogenic compressor in nearby building)

**With low external vibration (for the moment) operation possible as is (not further investigations)
 Focus on beam commissioning**

70th Meeting of the INTC – 22nd of June 2022

REX-HIE ISOLDE Linac restart and operation

- Despite all technical problems encountered and with a reduced program (OP measurements, stable beams to experiment) HE physics could restart as per schedule (week 29)
- Problems REX-EBIS solenoid magnet (1997):
 - Two unexplained rapid LHe boil-off since July
 - Quenches at higher field, so operating at 1.5 T (2 T nominal)
 - LHe level probe has stopped working



Action Plan for the EBIS solenoid magnet:

- Repair of TwinEBIS ongoing (LHe consumption x3)
- Investigation of REXEBIS solenoid in Dec/Jan
- Decision (repair in situ/exchange)
- Technical support from TE-MSD for activities (repair of the TwinEBIS and future work on the EBIS solenoid)

+ Long term consolidation plan for REX-EBIS and REX-TRAP initiated (BE-ABP-HSL)

From F. Wenander presentation (Mini-consolidation and improvement workshop)

REX-HIE ISOLDE Linac restart and operation

- Frequent SRF cavities trips (high sensitivity to vibrations, LHe pressure variations...) and loss of available accelerating gradient after the winter thermal cycle
- Issue being closely followed by RF expert in collaboration with TE-CRG (change in operating parameters of the cryo-plant)
- RF optimized the cavity sequencer to restart the cavity faster after a trip to reduce downtime.

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01.Aug.22 07:17 - 13:17
1 ends > 10:56:28
10:17:28
Trips of the SRF cavities during the last 88 hours.

CM1: no trips

CM2: SRF07 36 trips
      SRF09 17 trips
      SRF10 1 trip

CM3:
      SRF15: 1 trip

CM4:
      SRF18: 57 trips
      SRF19: 82 trips
      SRF20: 4 trips
  
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D. Valuch | REX HIE issues: SRF cavities trips report

Machine Development: 1.7 GeV beam test (GPS)

EUROPEAN ORGANIZATION FOR NUCLEAR RESEARCH

Proposal to the ISOLDE and Neutron Time-of-Flight Committee

Determination of radioactive ion beam production yields using 1.4- and 1.7-GeV protons

May 13, 2022

Simon Stegemann¹, Jose-Luis Sanchez Alvarez¹, Mia Au^{1,2}, Elodie Aubert¹, Ana-Paula Bernardes¹, Cyril Bernerd¹, Edouard Grenier-Boley¹, Marco Calviani¹, Francesco Cerutti¹, Katerina Chrysalidis¹, Thomas Elias Cocolios³, Gian Piero Di Giovanni¹, Alexandre Dorsival¹, Charlotte Duchemin, Sean Freeman^{1,4}, Matthew Fraser¹, Simone Gilardoni¹, Reinhard Heinke¹, Karl Johnston¹, Ulli Köster⁵, Giuseppe Lerner¹, Bruce Marsh¹, Fabio Pozzi¹, Francesc Salvat Pujol¹, João Pedro Ramos⁶, Edgar Reis¹, Jose Alberto Rodriguez Rodriguez¹, Ralf Erik Rossel¹, Sebastian Rothe¹, Jose Maria Martin Ruiz¹, Maximilian Schütt¹, Erwin Siesling¹, Piotr Krzysztof Skowronski¹, Thierry Stora¹, Joachim Vollaire¹

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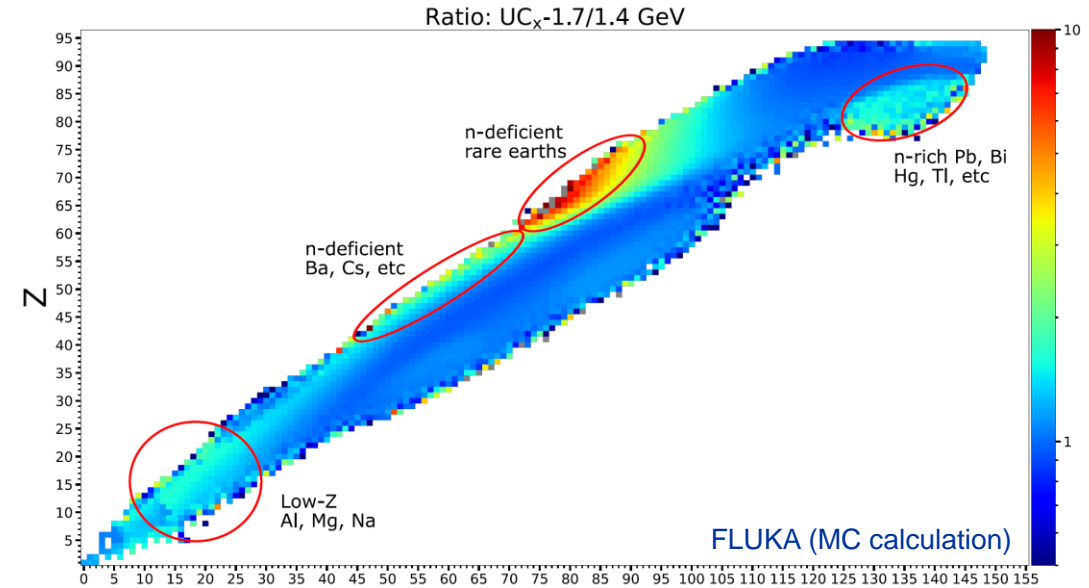
⁴The University of Manchester, Manchester, UK

⁵Institut Laue-Langevin, Grenoble, France

⁶Belgian Nuclear Research Centre, SCK CEN, Mol, Belgium

ISOLDE could receive 2.0 GeV from the PS Booster with infrastructure (dumps) and proton beam line upgrades

S. Stegemann & al



FLUKA (MC calculation)

Proton beam tuning PSB-GPS			
Stray radiation measurements			
Beam scattering measurements			
	Isotopes	Target	Ion source
(a)	^{6,8} He	UC _X /Ta	VD7
	^{8,9} Li	UC _X /Ta	MK1
	¹¹ Be	UC _X /Ta	RILIS
(b)	^X Ne	UC _X	VD7
	^X Na	UC _X	MK1
	^X Mg	UC _X	RILIS
(c)	^X Al	UC _X	RILIS
	²³⁰ Fr, ²³¹ Ra	ThC _X	MK1
	^X Fr, ^X Ra	UC _X + ThC _X	MK1
(d)/(e)	^X Rn	UC _X + ThC _X	VD7
	^X Xe	UC _X + CeO _X or LaC _X	VD7
	^X Cs, ^X Ba	UC _X + CeO _X or LaC _X	MK1
	^X Ag, ^X Cd, ^X In, ^X Sn	UC _X + CeO _X or LaC _X	RILIS

Machine Development: 1.7 GeV beam test (GPS)

- Measurements in August: UCx target + Ta-surface (MK1) ion source. Many surface ionized species of interest (large mass range). Four different laser ionization schemes
- Measurements in October: LaCx target + Ta-surface (MK1) ion source + Sn laser ionization)
- Analysis ongoing (lot of data collected) but preliminary results confirm the gains using 1.7 GeV for several isotopes of interest
- Results agree well with MC calculations (extrapolations for 2.0 GeV)
- **Future:**
 - Data analysis from present beamtime
 - Explore other regions of the nuclear chart
 - Further study proton beam transport to ISOLDE

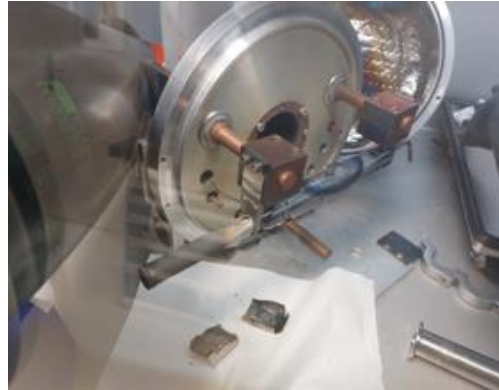
Presentation in the ISOLDE Users Workshop end of the year

Update on target production

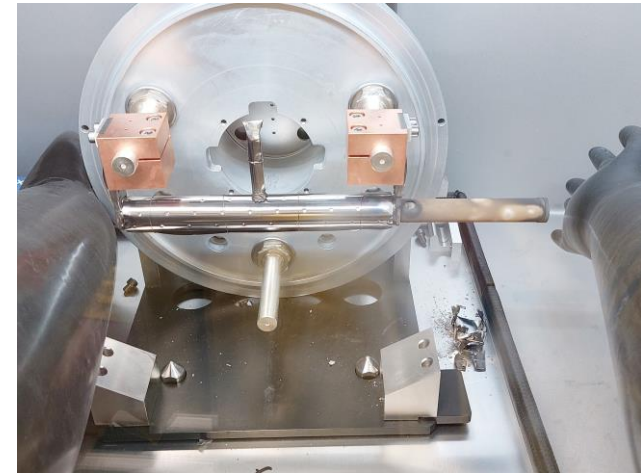
LaC_x production and charge transfer (very reactive target material)



- Storage of pressed un-carburized La(OH)₃+C pills
- Storage of carburized LaC_x



- Inerted GB5: Transfer of carburized charge into storage capsule
 - PPM levels of O₂
 - Batch production



- Inerted GB5: Transfer of carburized charge from storage capsule into ISOLDE target.
 - Fast transfer to ISOLDE front-end
 - Minimized risk of material re-oxidation



One of the new nano-laboratory glove box

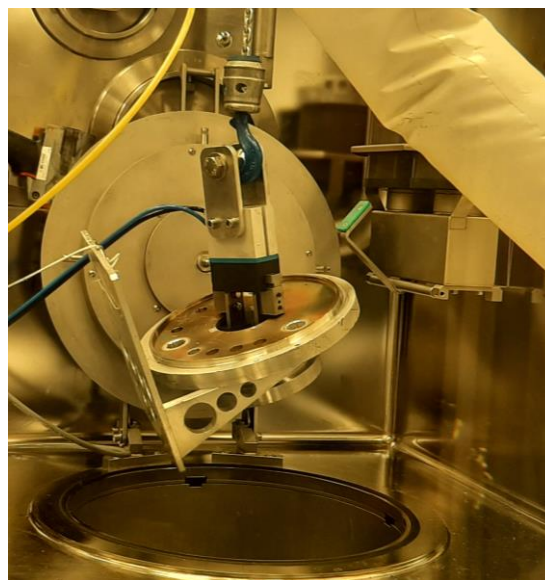
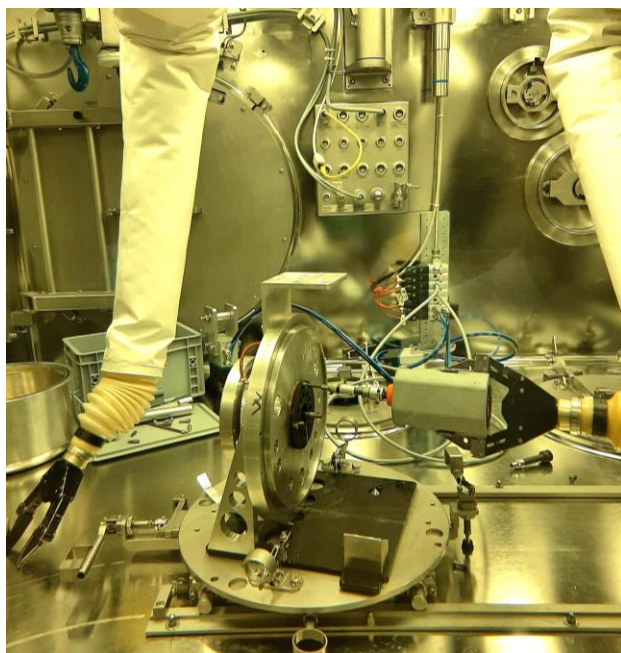
S. Stegemann, E. Reis & Target team courtesy

Closing the target lifecycle (disposal)

Two tantalum targets dismantled inside the ISOLDE Hot Cell (very important milestone)



Storage of used targets



S. De Man & B. Fost courtesy

Conclusions and Perspectives

- Challenging run but very successful overall run: several problems encountered but solved thanks to the effort and commitment of all teams supporting the facility
- First run above 1.4 GeV ! Very important milestone to pave the way to an energy increase (excellent synergy between different teams)
- Dismantling of 2 radioactive targets (ISOLDE Hot Cell Commissioning)
- For the coming YETS:
 - Finalization of control and electrical supply of the primary areas ventilation system (started during LS2)
 - Standard YETS intervention in the target and separator areas will start after the ventilation is operational again (end of February). Normal maintenance and investigations of technical problems (target clamping on HRS)
 - EBIS solenoid magnet repair



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