ISOLDE Technical and physics update: INTC 58

Richard Catherall/Sebastian Rothe/Karl Johnston
Power supply consolidation

• GPS + REX Power converter replacement
  • Consolidation of the following GPS and REX converters: RPSEV.197.YGPS.SEP70, XSEP.RB.1000, XL9GP.RCV.0400 and XL9GP.RCH.0400.

• 60kV HT power supply and modulator
  • To be used mainly for the HRS
  • Includes new controls so will have 2 separate control applications for the different HT power supplies.
  • Depending on operational experience, 2nd new PS and modulator to be installed in 2021/2022 shutdown
Install the fast recovery system only on HT2 during YETS 2017/2018
- Easy reversal to present configuration system in case of major problems
- **As a negative solution is not yet available**, better to keep HT1 unchanged
- Full consolidation of both modulator during LS2 with positive and negative HT
A telescopic camera for the target area

- To provide an overall view of the target area (in the absence of protons)
- Visualize target changes over internet
- Screens to be placed in target entrance
- Partially eliminates the need to call upon the Telemax robot in the event of a failure – quicker diagnostics

As presented in 2017
Telescopic camera in images

Existing camera images

Telescopic camera in position

Zoom
Nano lab

V. Barozier
Nano Lab

• Finalisation of IPP document for end of February
  • Cost analysis, functional specs, risk analysis
  • Combines nano, pyrophoric, radiological and chemical risks

• Start construction ~ September 2018
  • Conflict with access to Class A labs and MEDICIS

• Civil engineering ends June 2019

• 3 months required for ventilation coupling and minor civil engineering work during the last quarter of 2020
RILIS YETS equipment / upgrades

RILIS Pump lasers

2\textsuperscript{nd} Ionization laser
Coherent Blaze
March 2018

Ti:Sapphire pump laser failure
To be repaired/ replaced ASAP

RILIS tunable lasers

Ready before on-line period
Injection-seeded
NB Ring Tisa

Pulsed dye amplifier

RILIS Air quality issue:
Proposal by CV to improve fresh air exchange and reduce dust
Important for laser performance reliability
Estimated cost 20 kCHF - save for LS2?

- annual window changes on separators, plus HRS alignment and power transmission checks with power-meter target.

Bruce Marsh
Radiation survey on 14/09/17, proton beam intensity: 2 μA
Ambient dose rates $H^*(10) \sim$ at 40cm from the beam lines

A. Dorsival, E. Aubert, M. Deschamps

IS572: 94Rb @ 6.5 MeV/u
Operations -94Rb Issue

• After an initial working group meeting to explore the possibilities, the following action plan has been outlined

• Proposition
  • Identify and flag high intensity RIB during TAC and schedule
  • Inform ISOLDE community that hall will become a Limited Stay Controlled Area for the duration of the experiment
  • Change panels and monitoring thresholds the day before the experiment starts
  • Put in place mobile alarms (balise) at entrances to hall
  • Do a visual inspection to:
    • Inform occupants that the lab has changed classification
    • Identify “hot spots” along the beam line

• Proposition to be refined and presented to the PS-CSAP
RILIS Developments before 2018 physics:

1) 2-photon spectroscopy of stable Si and Rb.

2) Samarium Efficiency measurement with alternative Blue-Blue scheme.

PhD project: Katerina Chrysalidis

Injection-seeded NB Ring Ti:Sa

Tests planned in March

Bruce Marsh
RI LIS @ Offline 1

- 1 laser, blue-blue TiSa scheme for Sm will be prepared.
  - Pump laser will be a demo unit from INNOLAS – arrival March 2018
  - This doubles as a trial for RILIS@MEDICIS and possible RILIS Ti:Sa pump laser replacement

- CERN LIST tests will be carried out with Reinhard Heinke
- Further tests of VADLIS and laser-induced molecular break-up are foreseen (a loan of a high-energy ps laser from Edgewave has been agreed).
- Ongoing work on high-resistance LIS cavities (SIGRADUR)

RILIS Fellow: Shane Wilkins will perform these tests

Bruce Marsh
Ongoing VADLIS development

Tested at ISOLDE for Hg, Mo, Mg
Factor of >2 improvement in RILIS-mode efficiency for all cases

Proposal For 2018:
More VADIS sources equipped with adjustable extractor?
Ongoing investigation at offline (inverted polarity cathode, further optimization of construction of anode holder)
Use VSIM to optimize geometry for RILIS-mode operation (VSIM workshop in Leuven next week)

PhD work: Yisel Martinez
Standard VADIS
= FEBIAD MK5 (but with Mo anode)

Prototype tested for Ga at OFFLINE 1
At least 2 X efficiency improvement

Continued work of PhD student
David Leimbach

Bruce Marsh
Yets 2017-2018 main works in MEDICIS

- Collection box movement control alignment and completion
- Ventilation process dismount and upgrade
- First transfer port and shielded trolley delivery, alignment and installation. Slits motorization and control completion
- Second transfer port delivery and installation
- Outgazing vacuum and collection sample design optimization
- RCS Montrac upgrades and tests completion
Start up planning

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**Operation**
- Water on
- Deconsignation power supplies
- Cold check out
- RILIS tests GPS
- RILIS tests HRS PM target
- Access maintenance
- Access tests
- Patrols
- DSO tests
- Beam permit signature
- Protons for ISOLDE
- SEM grid tests
- HT tests with p-beam
- Physics start
LIST v 2.0

Upgraded 2018 LIST laser ion source for

*INTC-P-459: Measurement of the super-allowed branching ratio of $^{22}\text{Mg}$*

- Laser ionization of Mg - suppression of surface ionized Na contamination

Compact isolator design: Narrow spacing to atomizer

Dual repeller: Ion and electron suppression

Adapted length: Reduced deposition and compatibility to additional purification techniques

- Operation analog to 2012
- 1 unit available, 2 more machined at JGU workshop right now
- Robot handling tests with mock up unit in shutdown

Ideal opportunity for Al yield checks
Neutron deficient SeCO beams

Principle: \( \text{Se} + \text{CO} \rightarrow \text{SeCO} \)

Shifting the mass to get pure beams
Beam available since many years.
but….

- SeCO gone after a few days
- Atomic Se still released after days

Why does SeCO disappear, even if we inject \( \text{CO}_2 \)?

Injecting \( \text{^{13}CO}_2 \)…
…extracting \( \text{^{12}CO} \)

Injected \( \text{CO}_2 \) gas does not promote SeCO formation!

What's the source of carbon?
Carbon from the ion source?
- \( \rightarrow \) Placed graphite grid, but still depleting

Carbon from the target material?
- \( \rightarrow \) EDS (preliminary) shows no carbon in ZrO fibers

Indications, that CF\(_4\) gas might serve as carbon source. Work in progress.
Studying molecular beam formation
Concept for a dedicated development unit for molecular beams

**Study chemical reactions**

- Injection of gases and vapor of solid samples into reaction volume
- Suppression by quartz and other materials

**Parameters**

- 2 gases, controllable flow rates
- 2 mass markers
- Controllable temperatures in reaction volume and chromatography column
- Materials for chromatography and
- Materials in reaction volume (target matrix)

- better understanding of molecule formation
- improve reliability of existing beams, tailor new beams
Collaboration started to design two p2n-converters:
- Improve the one of ISOLDE
- Design one for TRIUMF ISAC

Brings high purity neutron-induced fission fragments

L. Egoriti, et al. (TRIUMF)
p2n-converter 2.0

- Normal shielding – several metal foils stacked
- New shielding: Sigratherm material – 1 cm thick

Converter will act as internal heat source

- 57.8 cc of lower density UCx (normally 30 cc – mass is the same to standard)
- 2.1 x more n-ind fissions
- 2.4x less %p-ind fissions
### ISOLDE Schedule 2017: weeks 16 - 48

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**ISOLTRAP:** Cd/Kr/Ar/Cs/development

**IDS:** In/Bi/B

**VITO:** Ar/Na

**COLLAPS:** Al/W/Sn

**CRIS:** In/K/Sc

**Biophysics:** Tb/Cd/Hg

**SSP:** Mn/In/Cd/Hg/Cu

**Medical:** Tb

**Scattering Chamber:**
- 15C beams to XT03
- IS619
- 9Li
- IS661
- 59Cu for Edinburgh chamber
- IS607
Experiments scheduled (and mostly possible) from 7th July till 4th Dec

Overview of HIE ISOLDE runs 2017

Liberally borrowed from Liam Gaffney’s talk to the ISOLDE workshop

Reactions:
- $^{94}$Rb($^{208}$Pb) MNT (Legnaro/Zagreb)
- $^{15}$C($^{208}$Pb) Elastic (Huelva)
- $^9$Li($t,p$) (Aarhus)
- $^{59}$Cu($p,\alpha$) (Edinburgh)

Commissioning:
- $^{14}$N to ISS

Coulomb excitation:
- $^{72}$Se (Surrey)
- $^{70}$Se/$^{66}$Ge (Western Cape)
- $^{142,144}$Ba (Paisley/Liverpool)
- $^{140}$Sm (Oslo)
- $^{140}$Nd (Darmstadt/Sofia)
- $^{108}$Sn (Lund)
- $^{206}$Hg (Surrey)

Moments:
- $^{28}$Mg g-factor (Orsay)
Nuclear astrophysics – IS607

- \(^{59}\text{Cu}(p, \alpha)\) – Implications for nucleosynthesis in core collapse supernovae

Experimental Setup

Thanks to Claudia Lederer-Woods and Ruchi Garg

Rutherford scattering of beam on \(^{12}\text{C}\) in the \(\text{CH}_2\) target
IS628: plunger measurements on $^{28}$Mg

- $^{22}$Ne stable beam from EBIS @ 5.5 MeV/u:
  - TDRIV $\rightarrow$ Zero-point calibration of target-degrader (plunger)
  - $(d,n) \rightarrow$ Angles of Ge detectors from Doppler shift (target wheel).
  - Required a week of stable beam....
IS628 TDRIV on $^{28}$Mg – on-line results

- First Miniball plunger experiment

- Calibration run with $^{22}$Ne beam
  - known $g$ factor
  - observed expected frequency

- (Very) High intensity $^{28}$Mg beam – $5 \times 10^6$ pps/$\mu$Cu

- Some difficulties with RIB scattered in the chamber

- Very promising results for $^{28}$Mg TDRIV – presently under analysis

Thanks to Georgi Georgiev
ISOLDE Solenoidal Spectrometer

- Tight schedule over last 2 months.
  - Shielding
  - Energising to 2.5 T (x2)
  - Field mapping
  - Vacuum
  - Beam tests
- Ready for RIB in 2018!!
  - $^{206}\text{Hg}(d,p)$
  - $^{28}\text{Mg}(d,p)$

Helical orbit spectrometer principle
In total 427 RIB shifts delivered in 2017

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Protons available for physics to ISOLDE from 9th April – 12th November 2018.

217 days for physics (compared to 224 in 2017)

HIE ISOLDE expected to start similarly to 2017 i.e. ~ July 9. this leads to ~ 126 days available for HIE ISOLDE, compared to 150 in 2017.

Dedicated low energy block from 9th April: ~ 90 days for LE.

Interleave HIE and LE runs as in 2017.

LIEBE postponed in 2017; end of 2018?

Strategy for HIE: 4CMS so optimized for reactions. Starting with CE then switch to T-Rex; XT03 and ISS to be accommodated.
Beam requests received yesterday. Currently being compiled. In addition to usual suspects, LIST beams and negative ion requests....

- Draft of low energy runs till ~ mid-June by late Feb- early March.
- Mid-June – end of September released around early May
- Rest of year in mid-July

Schedule will be discussed at a technical advisory panel (similar to what’s done for INTC proposals) to avoid any surprises in terms of targets, ion sources, machine parameters and recent developments. In addition, safety aspects can be addressed. Also involving user input....

Hostel reserves 10 over the Summer period rooms 1 month in advance of experiments running.

ENSAR2 funding forms sent around upon release of schedule.
Safety and training etc

Required training for ISOHALL

Online:

• Safety at CERN
• RP supervised
• Basic electrical awareness
• Radiation Protection - Controlled area (refresh the...new)

Hands-on:

• Electrical awareness
• RP handling

Every Tuesday @ 1300 – 1700), training centre Prevessin.

*External trainer: Recent cancellations have been a problem. Discussions underway to mitigate this.*

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<td>10860</td>
<td>ISOLDE - Experimental Hall - Electrical Safety - Handling</td>
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ISOLDE webpage a little unclear: to be re-freshed soon