Group for the Upgrade of Isolde - GUI Meeting - 06th November 2017

Present : Bertram Blank, Richard Catherall, Valentin Fedosseev, , Kieran Flanagan, Tim Giles, Karl Johnston, Betina Mikulec, Gerda Neyens, Sebastian Rothe, Jose Alberto Sanchez, Thierry Stora, Joachim Vollaire; by video or phone bridge : Alex Gottberg, Thomas Cocolios, Pierre Delahaye

Excused : Karsten Risager, Klaus Blaum

Absent : -

Link to the meeting : https://indico.cern.ch/event/678161/

DRAFT

1.- New members, agenda, minutes of previous meeting – G. Neyens, T. Stora, All

Minutes of the previous meeting were approved, with a request to get the drafted minutes well before the meeting. M. Borge offers herself as a possible GUI group member. It was agreed that she would join a reserve list, should a need arises. It was also mentioned that the membership be extended by one external member with expertise in HIE-ISOLDE physics.

2.- Implementation of a short LIST at ISOLDE - S. Rothe on behalf of R. Heinke, JGU, Mainz

The LIST trap with repeller has been used online with a suppression factor of >1000 and an efficiency loss of x50 for Po beams for IS456. The LIST is now operated with an equivalent circuit.

The development of a short LIST (45mm) took place in Mainz, and is now a standard version for its operation. During the development, it was seen that the overlap of the atomic beam from the ionizer and the laser beam path, as well as the distance of the repeller with the cavity were all important parameters for selectivity and efficiency.

During tests with radioisotopes at Isolde and Mainz, the suppression was seen to be isotope dependent due to adsorption on the rods.

Different evolutions/options are proposed for improvement of the performance:

A double repeller design has been proposed and shown to suppress better electron impact impurities, but mat be at the expense of efficiency; ion source distance vs repeller should be investigated.

Line polarity inversion and fast switching are alternative options for impurity suppression. Also the LIST can be operated in a mass selective mode using quadrupole as filter. Here again it would suppress neighboring masses but could loose an additional 10x efficiency.

The RF circuit matching may not be required anymore if High Voltage Switches are used to generate the RF signal, but cooling would need to be implemented.

LIST can be connected to a Sigradur cavity and beam gating can be used.

The doppler broadening could be reduced using a perpendicular laser path, which would lead to isomer selectivity with about 0.1% efficiency, 400x losses.

Tim Giles proposes that since no confinement of neutrals is demonstrated, the use of an electrostatic optimised extraction optics with a field-free region could be proposed instead. Prof. Mishin might have already implemented this in his TOF-LIS (Time-Of-Flight Laser Ion Source) proposal. Finally, instead of polarity, different extraction regions leading to different beam energies delta E might be exploited to extract the appropriate isotope and clean out the impurities in the mass separator.

Pierre Delahaye finally commented that the proposed fast polarity switching and the RF quadrupole operation are not obvious modes of operation.

3.- Review of delivered beams in 2017 – K. Johnston

K. Johnston showed an overview of the delivered beams in 2017: (Johnston_GUI_2017.pdf).

COLLAPS : IS573 108-134Sn; IS617 Al ; IS568 Ni

CRIS : IS571 : Ga ; IS639 In ; IS620 K

IDS : IS633 : 8B; IS632 : n-rich In; IS608: Bi

ISOLTRAP : IS574 : Cd; IS592: Cs tests; IS490

SSP: IS640: Cd, Hg; IS647 : Cd; IS585: Cd, Hg ; IS515: Hg ; IS611/612: In/Cd/Mn; IS634; Mg; IS543: Mg; IS492: Mn; IS580: Mn;IS630: Mn/In; IS576/578: Mn, In; IS602: Hg; IS645, I168: Na; IS638: lanthanide, Cd

VITO : IS601; I168: Na

Biophysics : IS638, Hg

Medical : IS528, Tb

HIE-ISOLDE : Coulex: IS546 Nd, Sm; IS547 Hg; IS553 BaF; IS558 140Sm; IS563 108Sn; IS569 Ge; IS572 Rb; IS597 Se;

Scattering: IS561 Li; IS619:15C;

As General feedback:

Se beams as SeCO+ seems not to be delivered anymore; Molecular beams are more in demand but need longer set-up time, eg SnS+ for 136Sn; n-rich Ni beams had low yields; Is GeB6 cavity required to deliver 140Nd? Is the delivery of newly available GeS+ beams (A=64, 66) reliable ? What are the options if 8B fails ? What is the status of the gas supply and gas leaks for Isolde targets. Finally, what is the status of the Sigradur (glassy carbon) development for the delivery, eg of Ni beams.

At the next INTC, proposals with new beams of n-rich Sc and SbS will be discussed.

AG commented that some of the issues could be addressed by a proper quality control done on the targets/beams if time would be allocated ahead of the physics run. There is a strong asymmetry in the use of HRS and GPS separators in 2017.

SR mentions that some studies could be initiated to understand the issues with Se beams. Eventual extra time could be allocated for so-called difficult beams.

JAR commented that the schedule may be too ambitious, eg as for the delivery of Hg beams. The TAC may be useful to propose extra MD time related to beam requests.

4. Mode of operation of ISOLDE in 2017 + HIE Isolde beam intensities – J. A. Rodriguez

J.A. Rodriguez gave a presentation on the 12 series of beams delivered to HIE-ISOLDE experiments. From the proposal in alternating low energy and high energy beams, and target cou[pling on Friday's to deliver beam on Thursday the week after, 4 targets were installed on Fridays and 3 on Mondays. Beams were indeed delivered on Thursdays (9/10 scheduled up to now) and characterized further on Fridays. In principle this would allow to deliver stable high energy beams over the week end while Low Energy physics is delivered on the other (HRS) separator.

IS597 72Se19+ from SeCO+, 4.4MeV/u, ½ rate every 12h hours.

IS659 66Ge16+ from GeS+(instead of 70Se17+) 4.4MeV/u,

IS553 142,144Ba33+ from BaF+ 3.4 4.2 MeV/u 1 energy not done because target lost at 8e18poT; some contaminants seen in the beam.

IS558 140Sm34+, 4.65MeV/u, 2e6pps

IS619 15C5+ from CO+, 4.35 MeV/u, RIB ready before start, 2 days delay because of diagnosis mistuning in set-up

IS572 94Rb23+ 6.21 MeV/u radiation alarm in Bld 170 limited p beam current to 0.2-0.5 uA

IS546 142Sm33+ (instead of 140Nd) 4.62 MeV/u 1e6 pps; 140Nd could be delivered with higher target/line temperature at the end with proper rate. P beam limited to 0.5 and 0.2 muA not to saturate Miniball

IS562 108Sn26+ 4.5 MeV/u 108In present at beginning 3e6pps limited by acceptable rate at MiniBall

IS561 9Li3+ 8.05 MeV/u 1e5pps delivered (1e6pps in the proposal)

IS547 206Hg46+ 4.19MeV/u 206Pb (75%) gone when using VADIS 0.6e6pps (instead of 1e6pps in proposal); STAGISO 8e12ppp was delivered, but 1.5e13ppp could have been requested.

IS607 to be delivered : 59Cu20+ 6 energies in 3.6-5.3 MeV/u

IS628 to be delivered : 28Mg9+ 5.5MeV/u

Plans for a proper documentation, in a database, of the beam intensities at HIE-ISOLDE should be followed up. This is to be discussed with F. Wenander, JARodriguez, KJohnston, S. Rothe and T. Stora. This beam intensity report is also often only one point report, and suffers sometimes from a wrong

5. Target and Ion Source Developments – S. Rothe

S. Rothe reported on TISD activities. He first introduces the TISD and the RILIS teams. From the list of possible developments discussed at the GUI meeting in February, n-rich Sc beams were produced (from a reused thick Ta target and RILIS ionization) and n-rich Te beams from UCx targets and RILIS. Tests on isotope release properties with STAGISO beams were also done.

Different ionization schemes were tested by the RILIS team (Se, Ti, Dy, Sc, Sm, Ni). Other ongoing projects are MCO+ carbonyl beam formation, offline tests of negative beams with ThO, LIEBE, the development of a new neutron converter in collaboration with SCK and TRIUMF, a large diameter and new graphite heat screen, carbon nanotube target production and simulations/tests of VADLIS (laser in VADIS cavity). New findings on SeCO+ beam formation has been done were the injection of gaseous carbon molecule is seen not to have any impact. A new nanolab is under construction, as well as a new process for uranium carburization which now only takes 4 days.

The potential developments for 2017/2018 are tests of LIEBE, LIST 2.0, tests of MCO at MEDICSI irradiation stands, the development of a new neutron converter, the negative ion sources, SI beams and a tests of a VADLIS prototype online.

Thomas Cocolios asks what is foreseen for the LIST tests in 2018, eg regarding the RF transmission.

He also mentions that affiliated members to the TISD team (Reinhard Heinke, Yisel Martinez) received 2 awards at the ICIS international conference on ion sources.

At the next GUI, resources and matching developments should be addressed.

6. Follow-up on previous meeting – T. Stora

A project to construct laboratories for actinide nanomaterials has started. For the moment, no glovebox is foreseen for non-actinide materials.

The LIEBE target operation could be delivering beams to the windmill collaboration, however this would become a challenging beam time.

RILIS resources have been reinforced with 2 new fellows hired and being trained. A further support from PNPI is still required.

Increase of the proton limit:

Some of the radiation monitors are already close to trigger an alarm in normal operation (ca 2uA proton intensity), there is no project to change these limits for the time being.

STAGISO beam delivery with the 4 rings of the PSB: no project has been started yet in the accelerator sector. The activated air release won't be a limiting factor. It is proposed that the increased proton beam intensity be requested for upcoming Mg beams. One week in advance notification should be given to HSE-RP, BE-OP and the Isolde Technical Coordination.

7. AOB and next meeting

A. Gottberg mentions that other facilities, such as TRIUMF, share 50% of the development goals as discussed in this meeting, and could offer beam time for testing. Both facilities would benefit from this overlap, with a TRIUMF/CERN MoU in place.

Minutes by T. Stora