

Technical news, shutdown and TISD

Thierry Stora on behalf of Richard Catherall

MENU

Issues in Summer:

HRS coupling table piston 14th July

BTY Line water leak 28th July

HRS valve shutter 5th August

GPS Extraction Electrode (and coupling piston) 11th August

Shutdown (not yet finalized):

Final modification of the target area/ventilation

Completion of target storage in class A building

Machine

TISD:

Negative ion source tests

LIEBE high power target

New uranium oxide batch/ 6mu/25mu Ta foil targets

NEWS Isolde and EN dept

HRS Coupling Issue

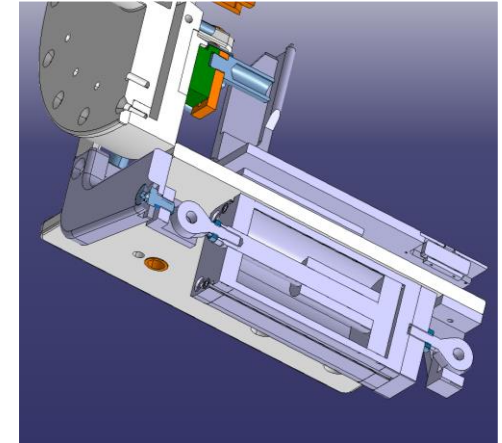
14th July 2015

History

- The HRS coupling piston was modified and replaced in Oct 2014 (IEFC).
- All metal leaking piston replaced with standard piston with polyurethane seals.
(Expected lifetime ~ 1-2 years) :GPS piston exchanged March 2015

Observations...Monday 13th July

- Unable to pump target #541, then target #519.
- Potentiometer value OK but large uncertainty.
- Human intervention for observation:
 - Target clearly not connected to Front end + A lack of coupling force
- Compressed air electrovalves in HRS separator confirms that Frontend piston has internal leaking



Replacement and outlook

- Piston replaced with spare identical : ~ 1 min (Collective dose observ 66 μ Sv & repair 51 μ Sv)
- With piston lifetime ~ 6 months, exchange GPS piston in Sept 2015 after 2 weeks w/o protons.
all metal replacement... if finished and tested, or with identical standard piston with PU seals.

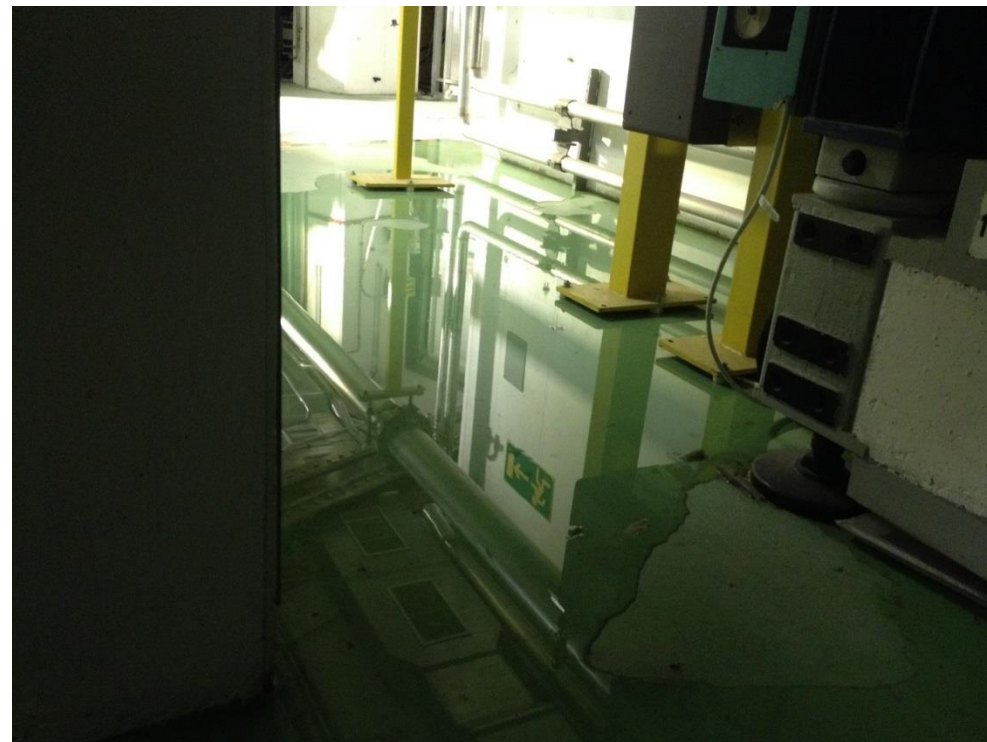
All metal pistons should be available for replacement during the next shutdown

Water Leak Near BTY Line

28th July 2015

Water leak – Tuesday 28th July 2015

- Alarm on water detectors in both GPS and HRS trenches
 - Repeated filling of water reservoir not detected due to slow rate (6lh^{-1}). This will be modified this shutdown
 - <1cm of water in GPS trench
 - Water puddle underneath BTY line between GPS and HRS Frontends
- A disconnected tube and faulty valve used for the purge of the magnet cooling system.
- A permanent repair will be done during the YETS



HRS Target Valve/Shutter Issue

11th August 2015

HRS Valve/Shutter Checks

- The valve on target #543 could not be moved to its fully closed (sealed) position
- No sign of movement could be observed on the cameras (all interlocks ok)
- A compressed air tube in the HRS separator zone was reconnected but still no movement
- An electro-valve on the same compressed air line was found to have a fault.
- These were (all replaced in January 2015 as a preventive measure) still no piston movement
- The compressed air pressure was checked in the line No sign of any CA leaks in the accessible areas

Possible causes

A compressed air leak in the line situated in the less accessible areas

- This has happened 1x / only checked by measuring P at the entrance to the target valve piston

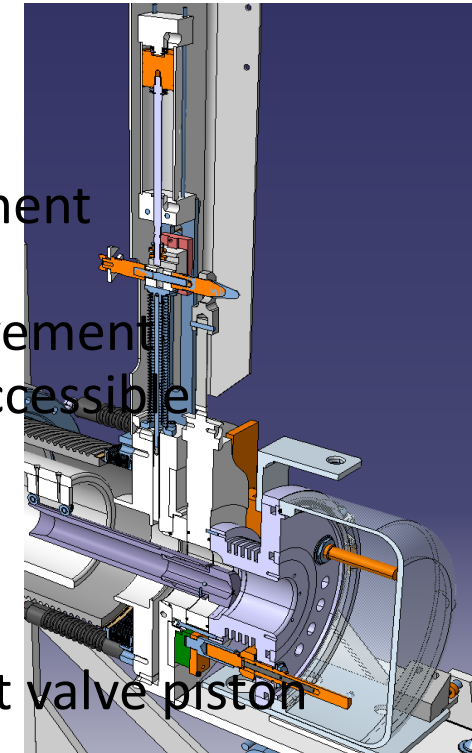
A compressed air leak at the CA connection with the piston

- Possible due to orings in connectors: Would be heard/seen upon intervention

The extraction electrode is still inserted : since interlocks are OK : only if mechanics are broken internally

The target valve is gripped

The piston is gripped

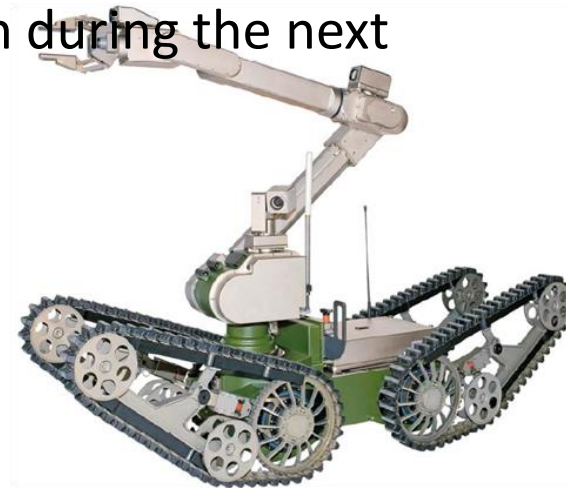


Control

- All possible causes were checked and everything was working fine with the exception that the valve closed but did not seal: Acceptable for target removal; Was probably the case all the time but...
- Poor visibility from existing cameras
- A certain stress accumulates under these circumstances
 - An accidental high dose received by one person
 - CERN hierarchy (On one occasion Richard was asked to present the issue to the IEFC before the actual repair)
 - CERN safety
 - Physics program etc

Long term action

- **Improve on cameras** : Telescopic camera design on-going. Ready for installation during the next shutdown
- **Improve on redundancy of feedback from Frontend movements**
 - During long shutdown period due to inaccessibility
- **Precede any human intervention with a Telex intervention**
 - Better diagnostics through visualization
 - Possible to do minor interventions if prepared beforehand

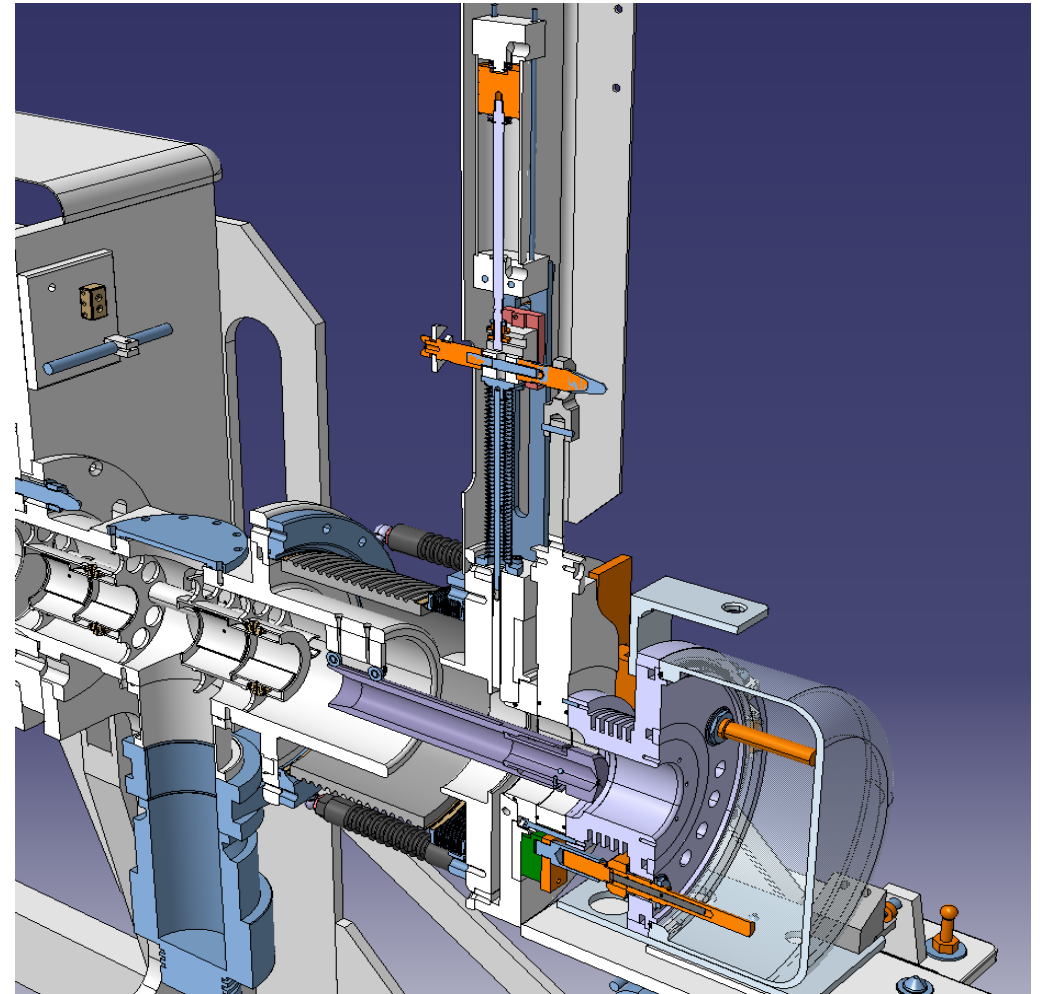


GPS Extraction Electrode Issue

11th August 2015

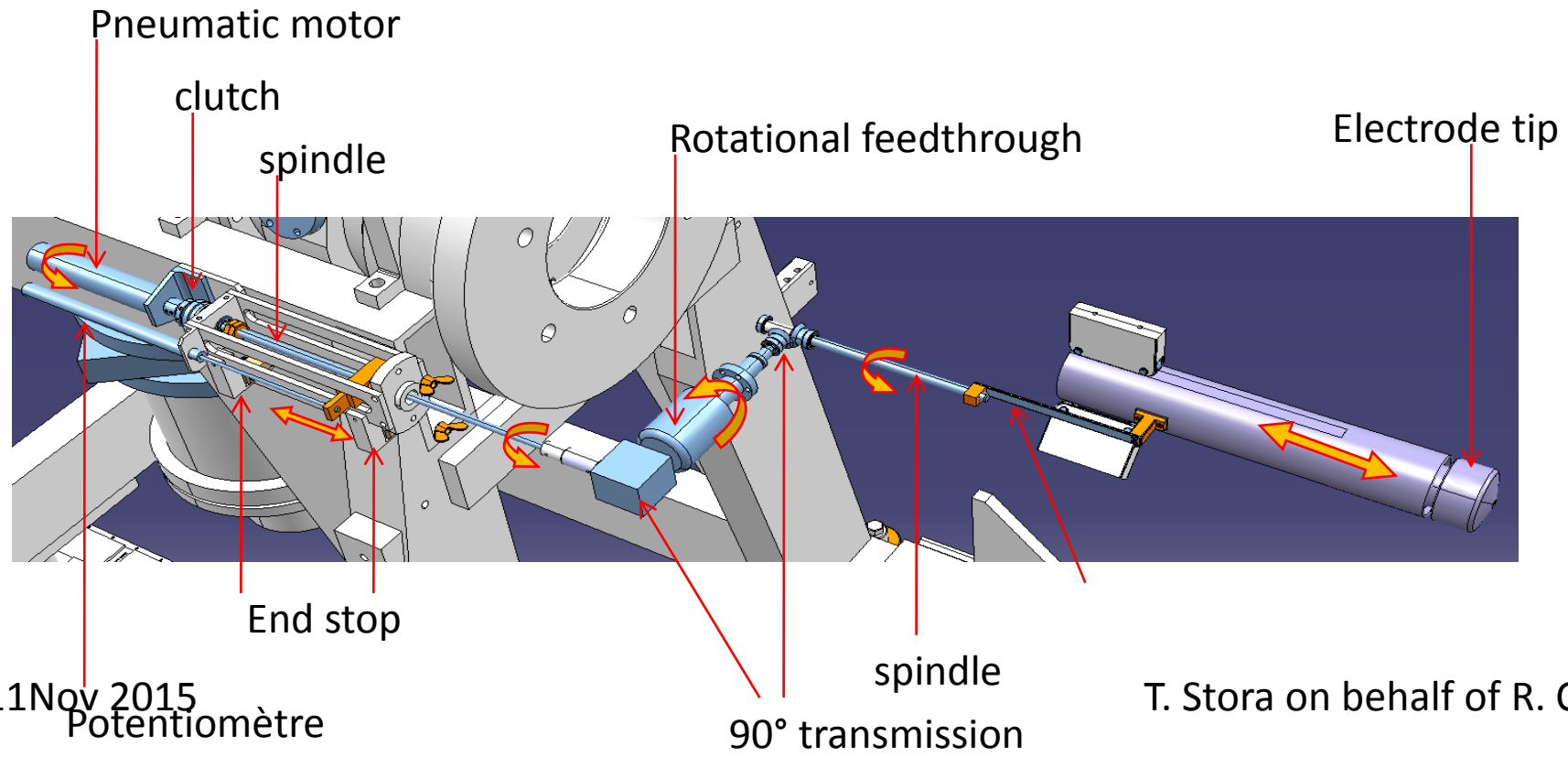
Situation

- Tuesday 11th August
 - The extraction electrode on the GPS Frontend could not be moved back to its home position
 - Stopped at position 153 instead of 178.
 - This is required to close the shutter and target valve prior to a target change.
 - All external infrastructure checked
 - Compressed air, controls etc



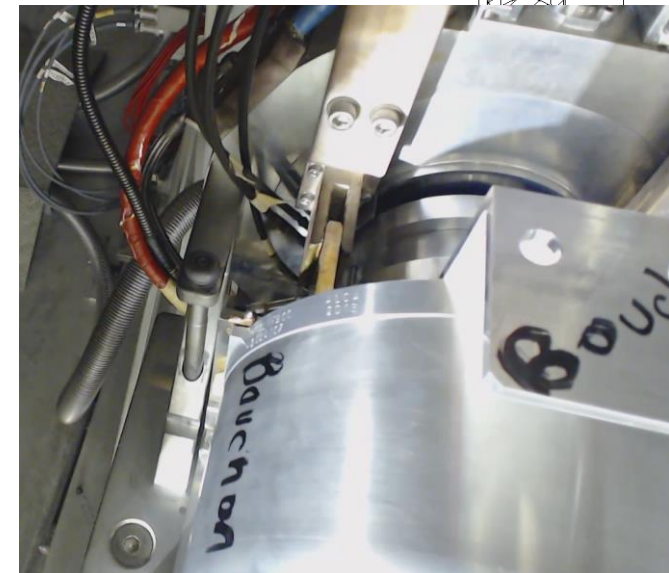
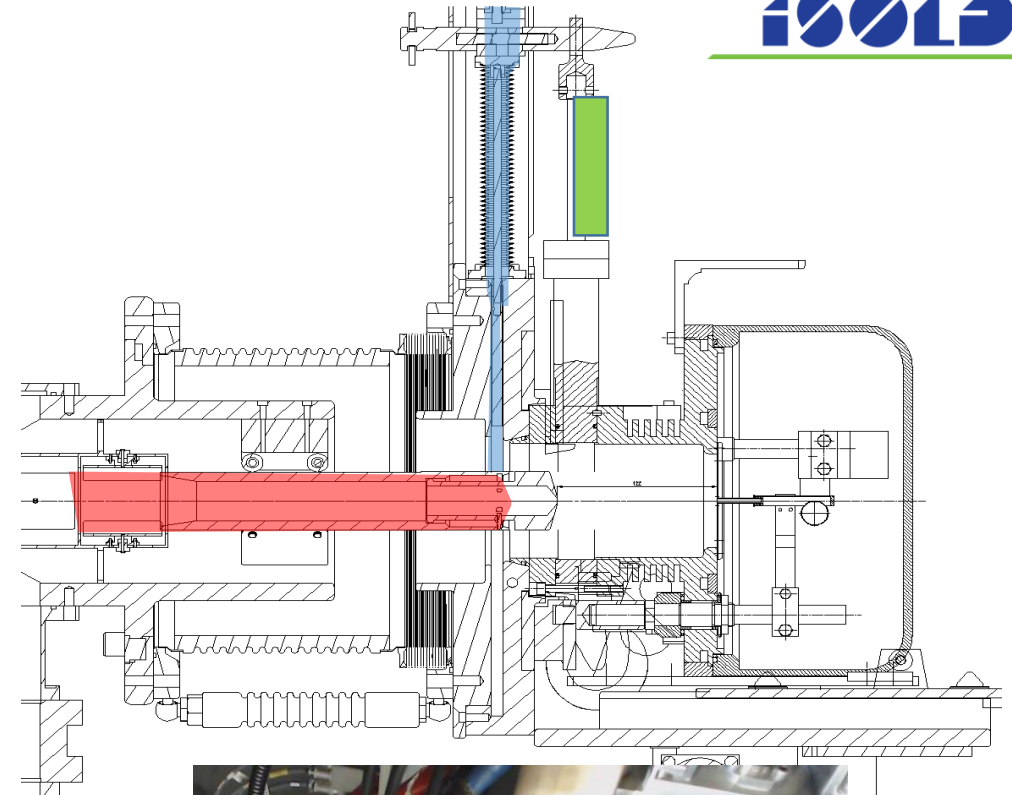
Remote Interventions

- Wednesday 12th August
- Sent in Telemax robot to visualise and to identify cause of problem



Remote Interventions

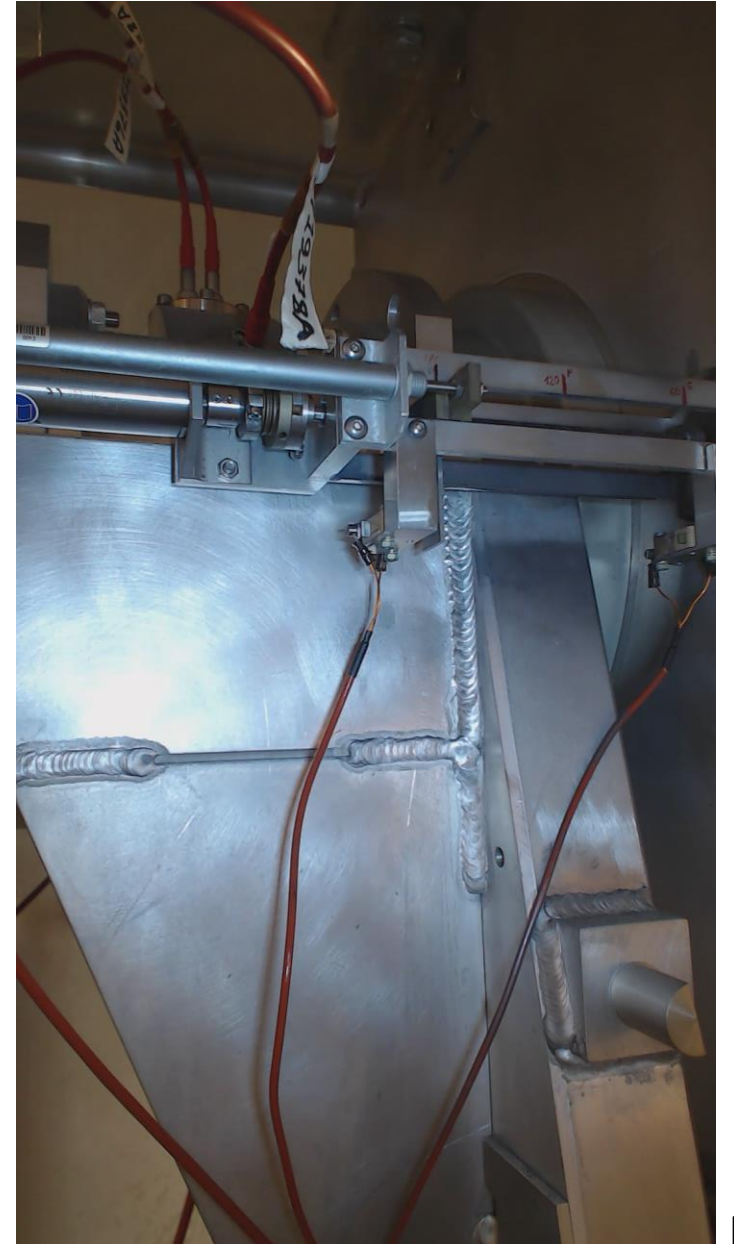
- Removal of highly radioactive target with Kuka robot to facilitate possible future interventions.
 - Repair or failure of Telemax
- Delicate operation due to unknown position of EE
- Used Telemax to place a support to maintain valve in open position
- Target uncoupled and after inspection, support removed with Telemax and target removed by Kuka robot
 - Valve closed (but not sealed) by gravity
- **But plug target didn't couple correctly?**
 - **Neither did the second plug target**
- After further observations, the problem was located at the connection between the clutch and the spindle.



The Repair

- 25th August
- Replace clutch screws with bigger and easily accessible pointed screws
- But...
- 2 screws on the 90 deg. transmission were also loose!
- Loss of synchronisation between real EE position and potentiometer measurements
 - Slippage
 - During tests, shutter hit the EE tip even though at home position
- **Replacement of target coupling piston**
 - Same as recent HRS coupling failure
 - Planned to be done as a preventive measure

ISCC/INTC 10-11Nov 2015



EN/STI

Finally...

- Extraction electrode couldn't be moved more than ~40mm (instead of up to 120mm)
 - During tests, a mix up in the EE/shutter/clamping process ended in the finger not being engaged in the target valve.
 - EE collided with valve and the tip had become dislodged in its support.
- Plate for micro-switch triggering had to be re-adjusted
- 26th August..12:00
 - Extraction electrode repaired and GPS FE deemed operational again.

Conclusions

- Vibration seems to be the cause of the screw loosening and we will have to revise the EE mechanism during the next shutdown
 - Very difficult for internal pieces
- The Telemax robot has been instrumental in diagnosis and consequently reducing the collective dose
- Hidden consequences of trying to improve on reliability
 - New robots > new coupling table > new piston design/configuration
 - Stepping motors with encoders > compressed air motors > new EE mechanism
 - All tested but not tried...

Other Issues

- A repeat of the coupling piston issue on HRS 30th October
 - Replaced with all metal piston 4th November
- Concerns with opening the GPS faraday cage door
 - Decided not to intervene due to dose rate. Telemax will be used to assist door if necessary.

Some news on the shutdown

Temporay Magnetite shielding removed next week

Ventilation SAS creation

Used target storage with shielded doors for Isolde and Medicis

Final shielding in primary target area

Rail Conveyor System Installation for Isolde and Medicis

Start up Kuka Robot for storage/Medicis

New ISOLDE Control room



New users and operations building 508:

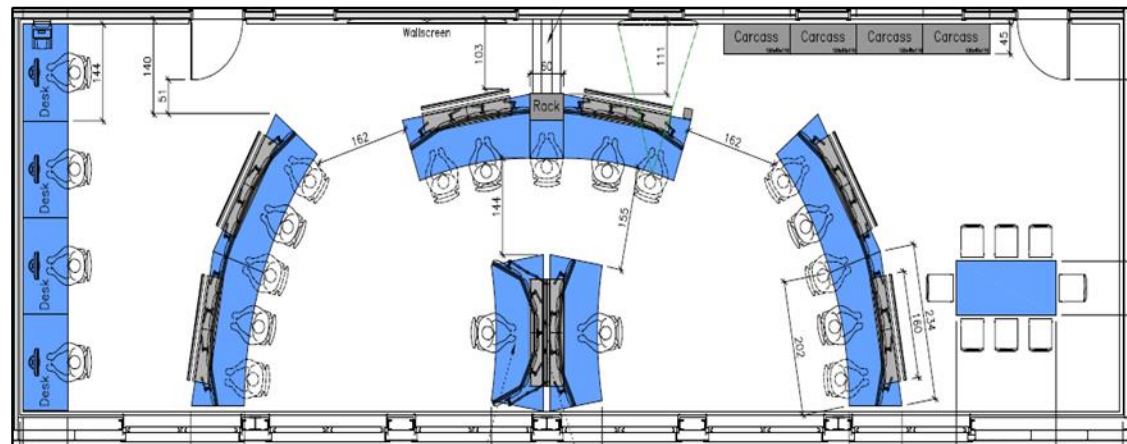
- ✓ ISOLDE Control room
outside the Class C experimental hall
- ✓ Kitchen
- ✓ Visitors/meeting room
- ✓ All furniture arriving as of 16th Nov.



New ISOLDE Control room in B508



Visitors/meeting room in B508



New 508 ISOLDE Control room layout

Courtesy E. Siesling

T. Stora on behalf of R. Catherall EN/STI

Target and Ion Source Development

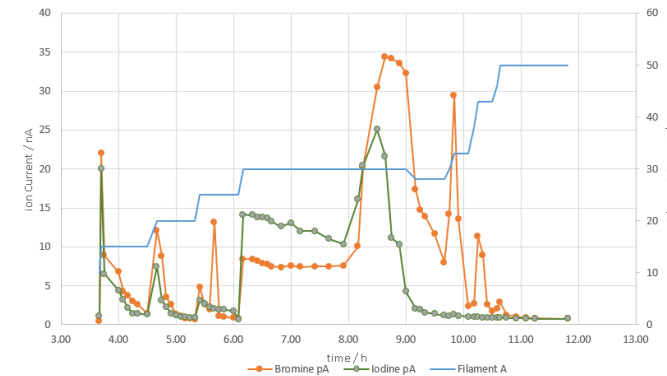
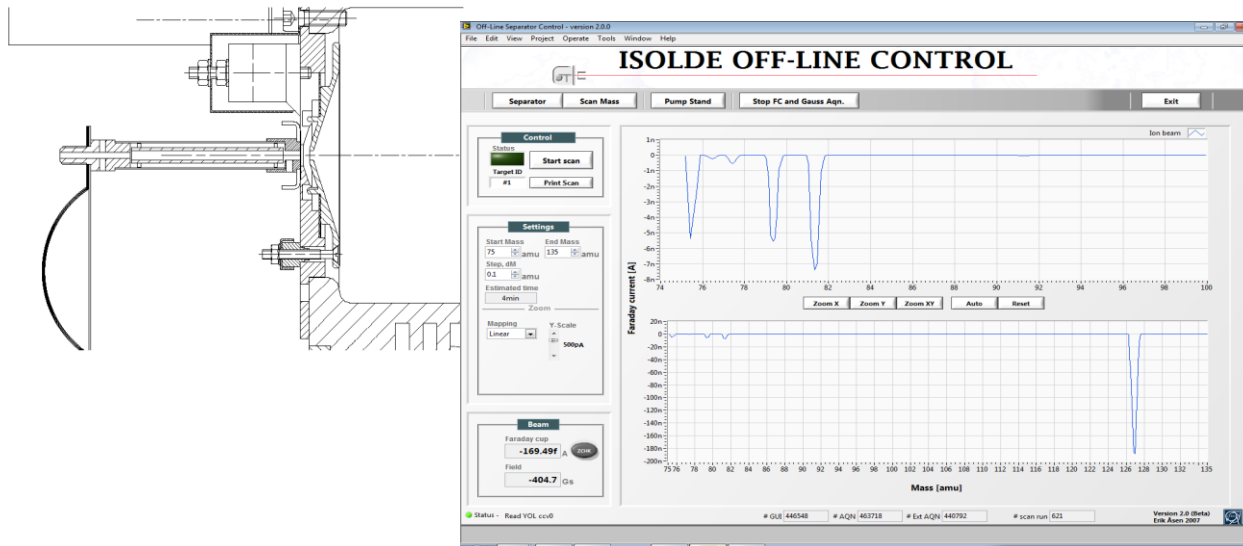
Negative ion source tests

LIEBE high power target

New uranium oxide batch/ 6mu/25mu Ta foil targets

Niobium and Thorium - negative ion source Nb535 & ThO540 units

- Negative beams :
 - Negative ion source prototype (GdB6 tub ion, Menna et al. NIMB, 266(2008) 4391)



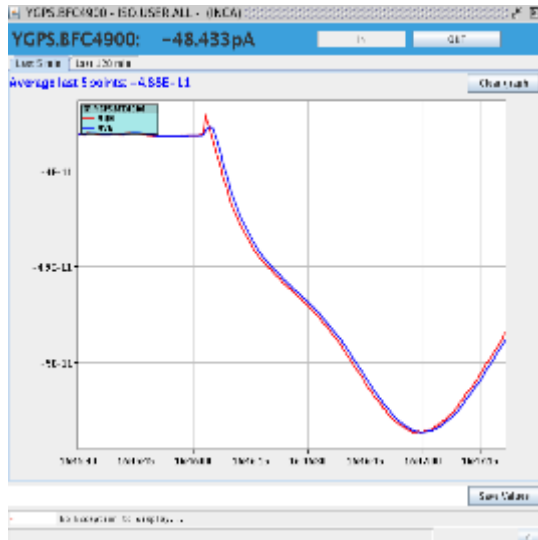
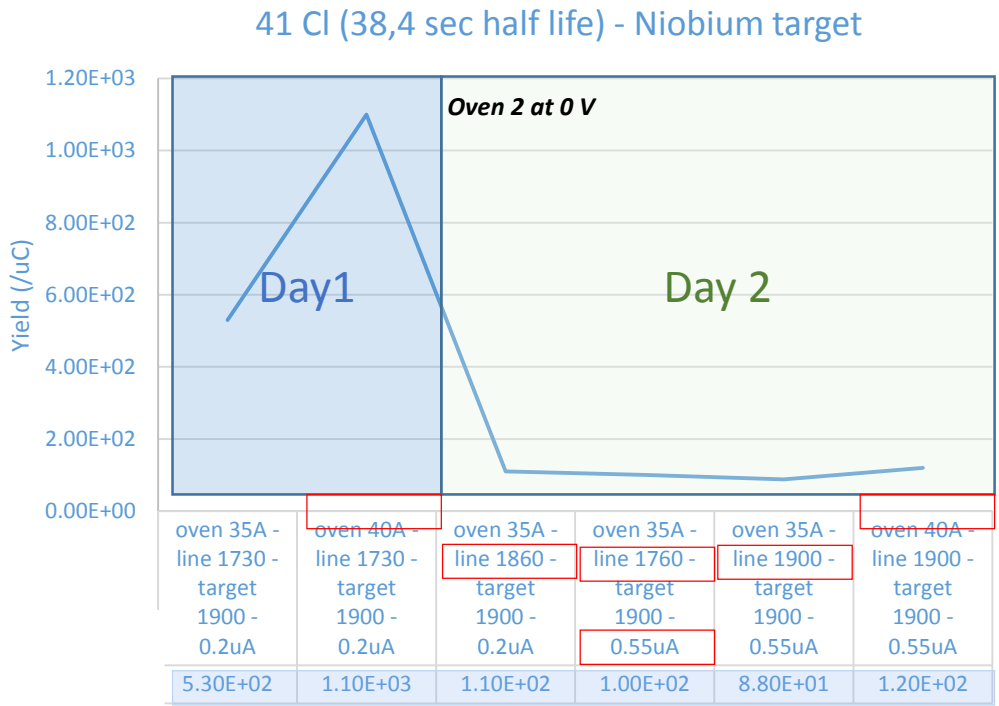
Offline efficiencies 2015:
 $\epsilon (\text{Br}^-, \text{I}^-) = 17\% @ 1700\text{C}$
with some questions remaining

Online TISD with Nb535
and ThO540 targets, starting this week

Y. Martinez, J. Ballof, T. Mendonca

Nb535-GdB6 unit

- Beam was not constant over time,
- Change in the line temperature have low impact on yield (below 20% variation – positive and negative),
- Not possible to recover the yields after a change in the Cs dispenser voltage,
- Highest gain in yield comes from increase of Cs dispenser voltage (up to 1 order of magnitude)



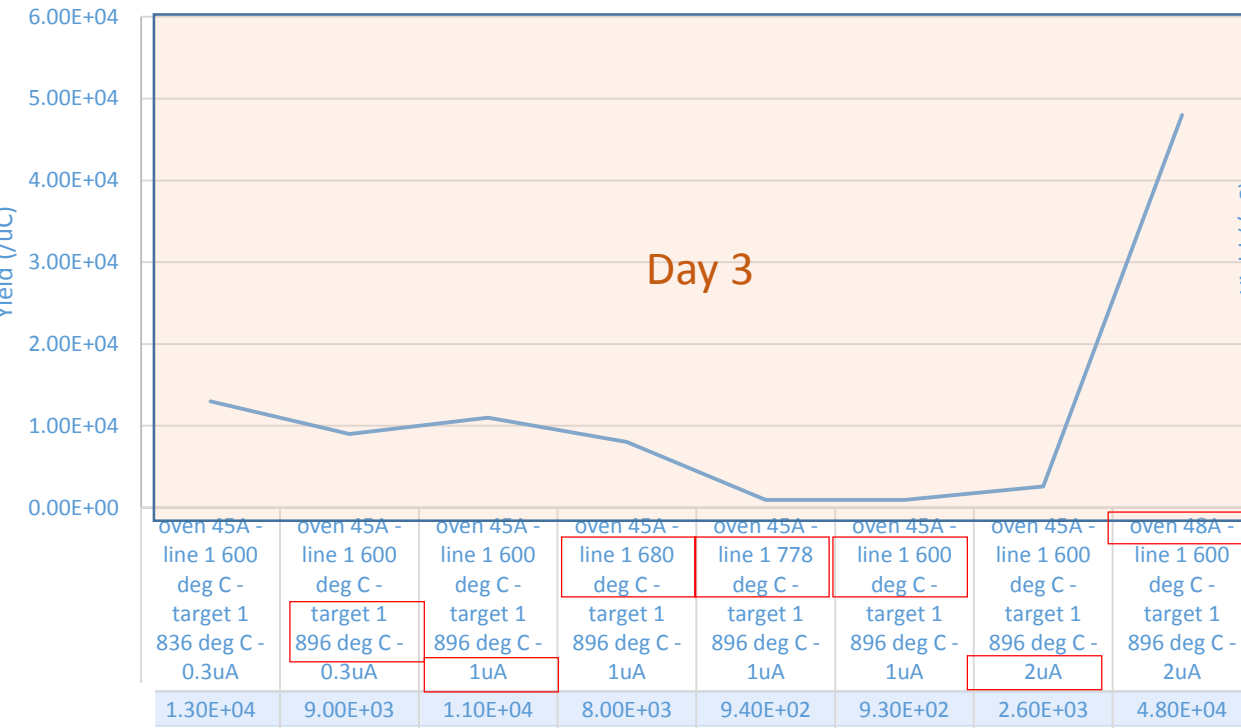
Variation of 127I beam over time

Courtesy T. Mendonca, Y. Martinez, J. Ballof, B. Gonsalves, JP Ramos on behalf of « negative beams group(s) » T. Stora on behalf of R. Catherall EN/STI

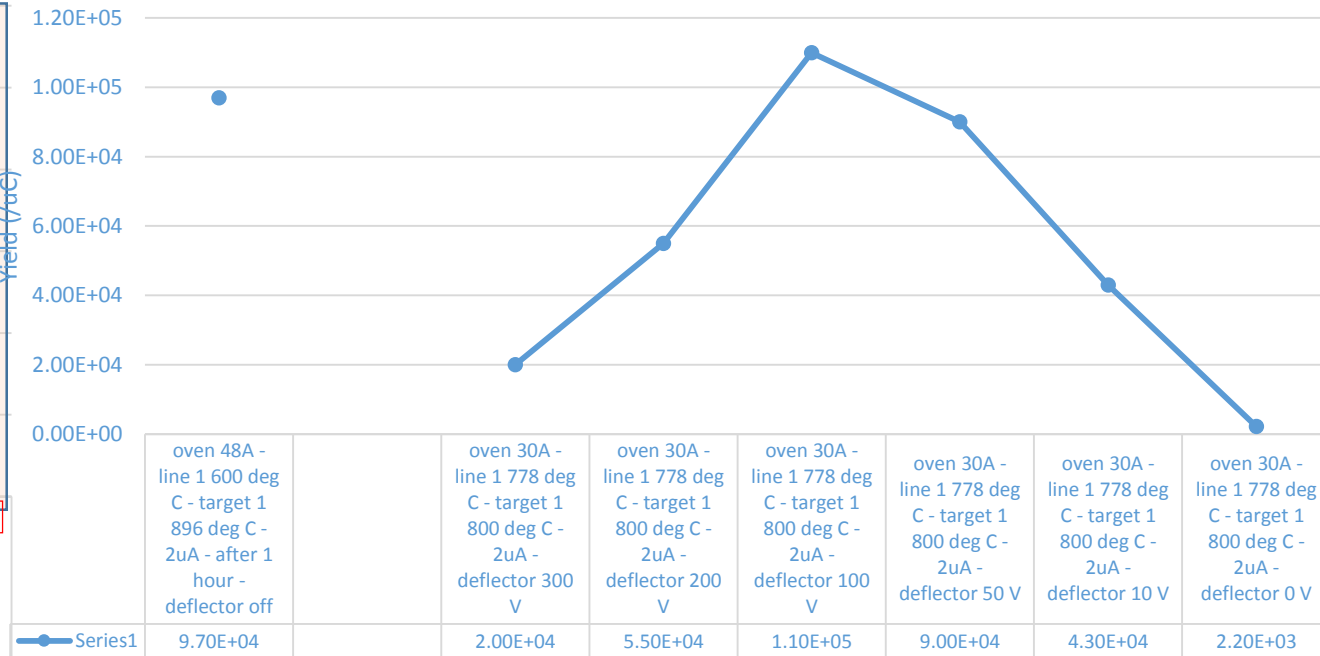
ThO540-GdB6 unit

- Identical behavior than previous unit.

87 Br (55,7 sec half life) - Thorium target



85 Br (2,86 min half life) - impact of the electron deflector plate on the yield

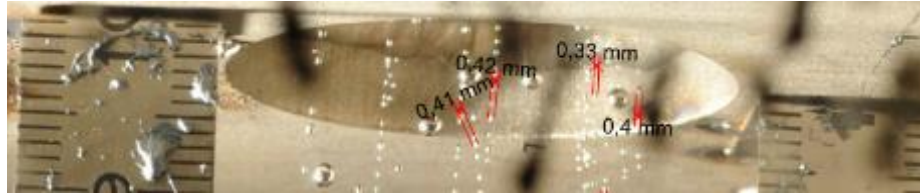


Despite a lot of efforts to obtain these online data, some more « offline work required »

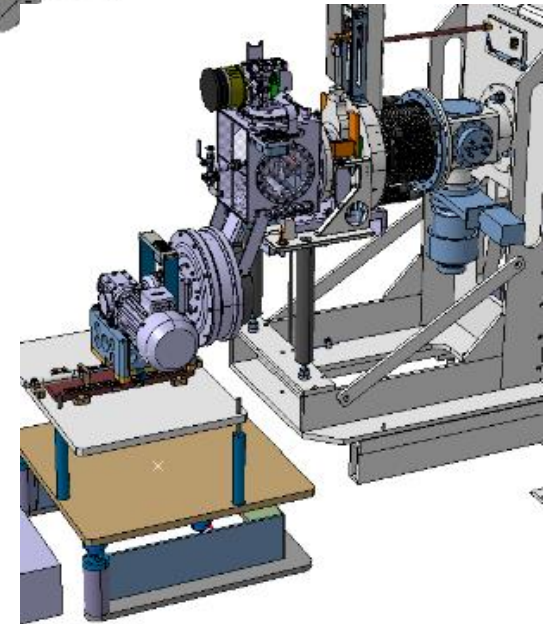
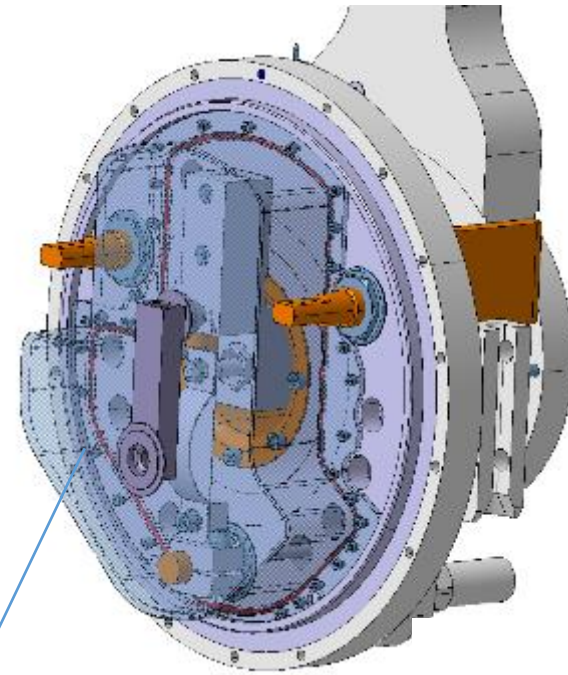
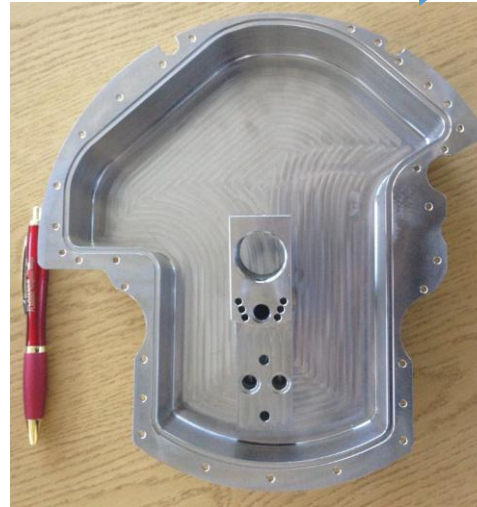
Courtesy T. Mendonca, Y. Martinez, J. Ballof, B. Gonsalves, JP Ramos on behalf of « negative beams group(s) »

LIEBE project – follow up

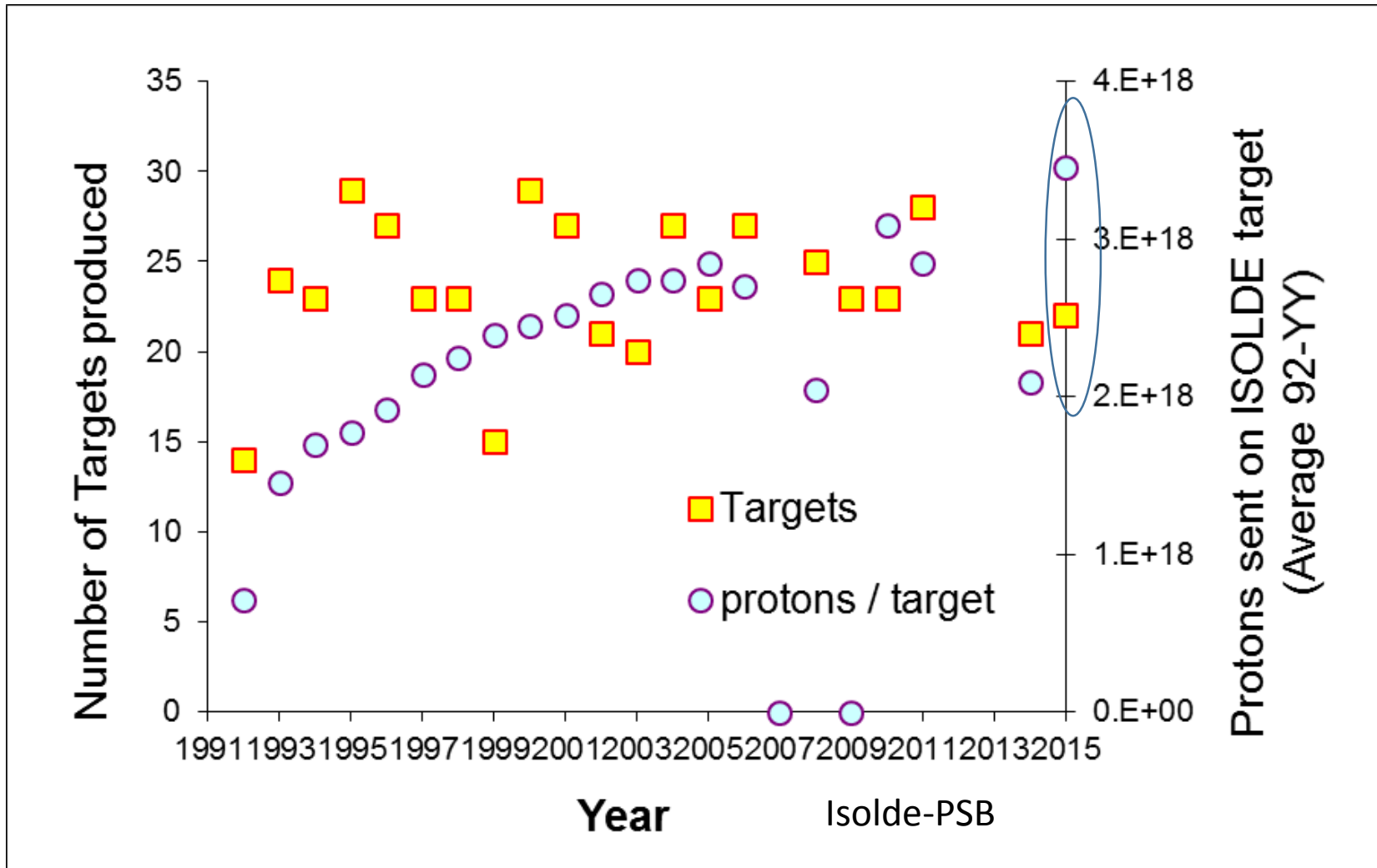
- Tests for shower feasibility done
 - *Minimum droplets size is 0,4 mm diameter*



- Design finalized,
- Manufacturing started (see pictures),
- Full target manufacturing and assembly planned for April 2016.



Target and Ion sources units in 2015




This year, UC-Ta n 539 unit
 Received the ISOLDE PSB record
 PoT (proton on target): **13.3 10¹⁸**;

It's good for operation optimization

But it's much detrimental for waste
 Management (**max PoT of max
 10 10¹⁸**)

A new UO2 batch

(total 6.1e19 81% of Isolde protons on UCx targets in 2015)



Westinghouse Electric Sweden AB

CERN
CH-1211 GENEVE 23

Invoice 90000150
SD-No. : 90298424
Reference no./Date : DM 14-598 / 24.02.2015
Order number/Date : 112767 / 05.03.2015
Customer number P : 31226/S: 607295
Your VAT-ID-No.:

Page 1/ 1 Date: 15.05.2015

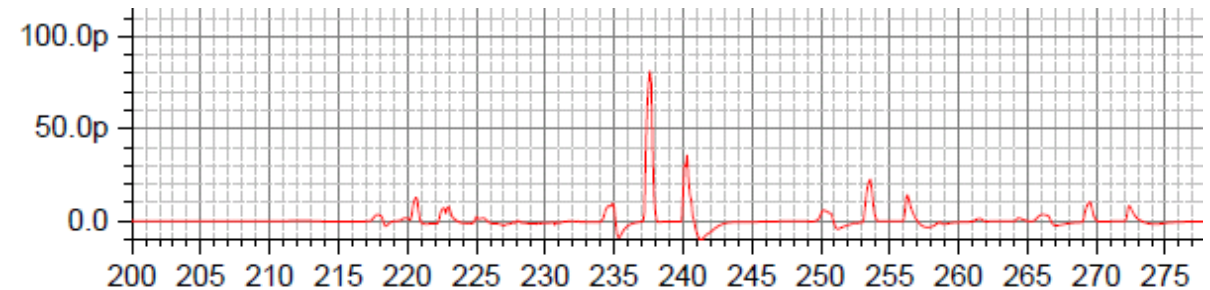
Project manager: Magnus Gylén Phone: +46 21 347685 Fax: +46(0)21-189471 E-mail: gylenmn@westinghouse.com
Referee: Hakan Yayintas +46 21 347028 yayinth@westinghouse.com

Item	Q'ty	Unit	Deliveries/Services	Unit Price	Price
000010	1,000	LO	Westinghouse Sweden Project FV-14-1293, DM 14-598, Delivery of 20 kg depleted UO2 Powder to CERN Your ref: Thiery Stora Invoice consists of fixed price 65.000 SEK and delivery confirmation enclosed. CERN - UO2 Powder 2015 (20 kg) Closing Invoice	SEK	65.000,00

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Mn yields from IDS (all yields
63Mn - 6000 ions/uC
64Mn - 1000 ions/uC
65Mn - 500 ions/uC
66Mn - 13 ions/uC
68Mn - 7 ions/uC

Target #550 - 580A, line 269A
    
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Mass scan #545 - UC-Ta
Target - 2050°C, Line - 2000°C

Total beam 920 pA
Slits IN

Ta544-W unit for medical Tb collections

- Mixed 6/25 mu Ta foils
- learning from EURISOL DS TARPIPE project: E, Noah et al.
<http://cds.cern.ch/record/1355076/files/document.pdf>
- S. Fernandes, et al *Journal of Nuclear Materials* 416.1 (2011): 99-110.



“Hi Thierry,

It was the first year that we came close to the shipping limits, between 150MBq and 170MBq or so of ¹⁴⁹Tb...(max is 200MBq).

Not every day but was like this for the first few days anyway. “

Courtesy Karl Johnston

Next step : reduce oxyde « sidebands »

News related to ISOLDE

- 2GeV...From the minutes of the ATSMB meeting
- Freddy concludes that this project will cost around 7 to 10 MCHF. Based on the positive reactions from Council in June, no changes will be done on the MTP that will be presented for approval in September, i.e. if this upgrade has to be done, it can only be during LS3.
- A request has been made for consolidation money (~4MCHF) for the beam dumps
- ...but after discussions and a clear lack of finance, this has not been further pursued.
- Consequently, ISOLDE will not benefit from more intensity due to Linac 4 commissioning
 - But this also depends on air activation to be further analysed next year once the ventilation systems are stable.
- 660kCHF has been granted from the consolidation budget for the replacement of both Frontends during LS2
- A work request **to re-align the hall beam lines in LS2** (yes already!) has been submitted to the PLAN office.
- **But the green light should be given by the ISCC**

News from EN dept

- Roberto Losito will become the EN department head
- He will be replaced by Simone Gilardoni
 - Who knows ISOLDE quite well due to work done on convertor target simulations and liquid mercury targets.
- Ana-Paula Bernardes will diversify her role by taking on PS complex shutdown safety coordination, especially LS2 but starting this year. She will be “replaced” by a Fellow paid for by TE department.

Thank you !