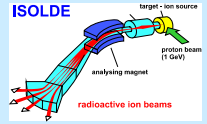


ISOLDE Technical report October 2005

Mats Lindroos on behalf of
CERN ISOLDE team



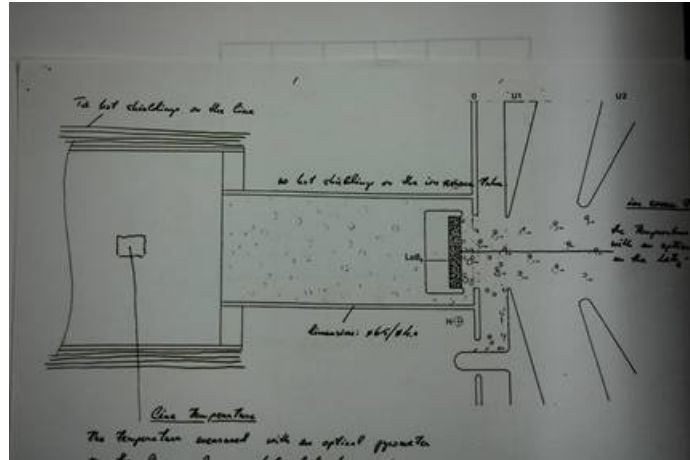
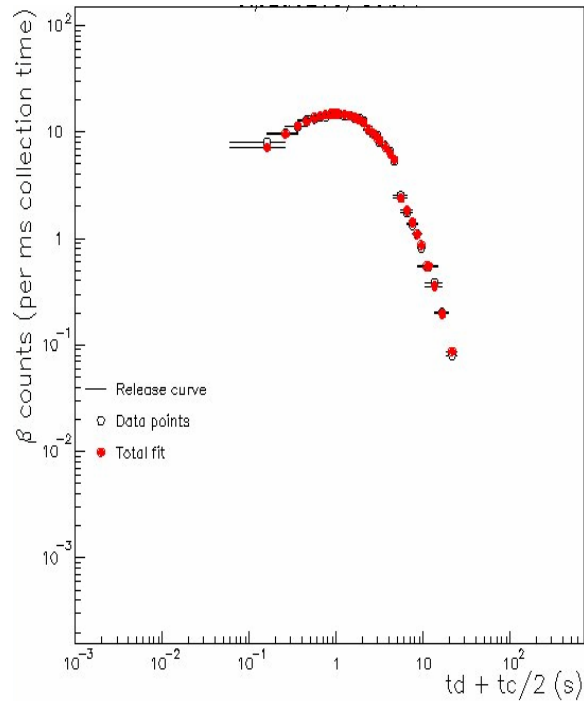
Outline



- Technical R&D at ISOLDE
- RILIS
- REX
- ISOLDE experimental area
- Safety
- Shutdown

Negative surface ion source

Release of ^{89}Br

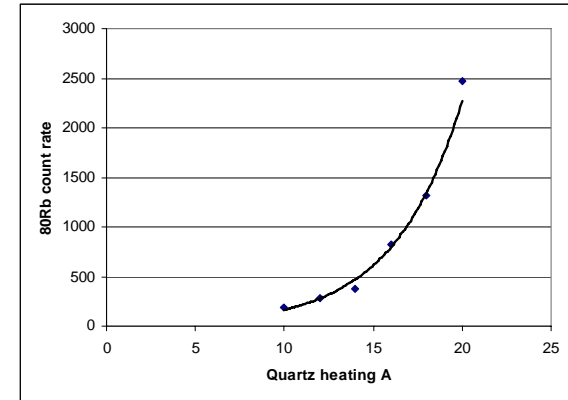
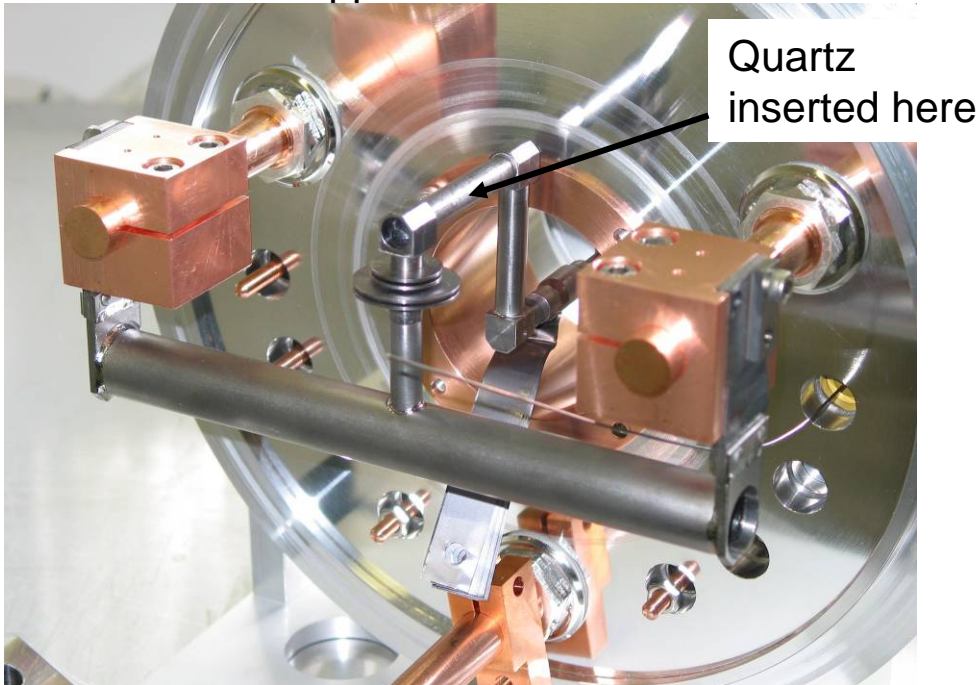


Inversion
of ALL polarities
for operation !!

T. Stora, M. Menna, D. Carminati, R. Catherall,
B. Crepieux, M. Eller, J. Lettry, R. Wilfinger

Target prototype for laser ionised Zn with alkaline suppression (Isothermal vacuum chromatography)

- Independently temperature controlled transfer line with quartz insert for alkaline suppression.



80Rb count rate as f[quartz heating]

On-line test results:

Temp. from 600° to 1000°

Cs and Rb reduced by 4 orders of magnitude

Zn minimally delayed (RILIS)

T. Stora, E. Bouquerel, R. Catherall,
D. Carminati, B. Crepieux, E. Barbero,
J. Lettry, U. Koester, M. Turrion

Task 3 100 kW Direct Targetry within ATB-IF

E. Bouquerel, E. Barbero, D. Carminati,
R. Catherall, B. Crepieux, M. Eller,
S. Fernandes, J. Lettry, S. Marzari,
E. Noah, L. Penescu, M. Santana,
T. Stora, R. Wilfinger

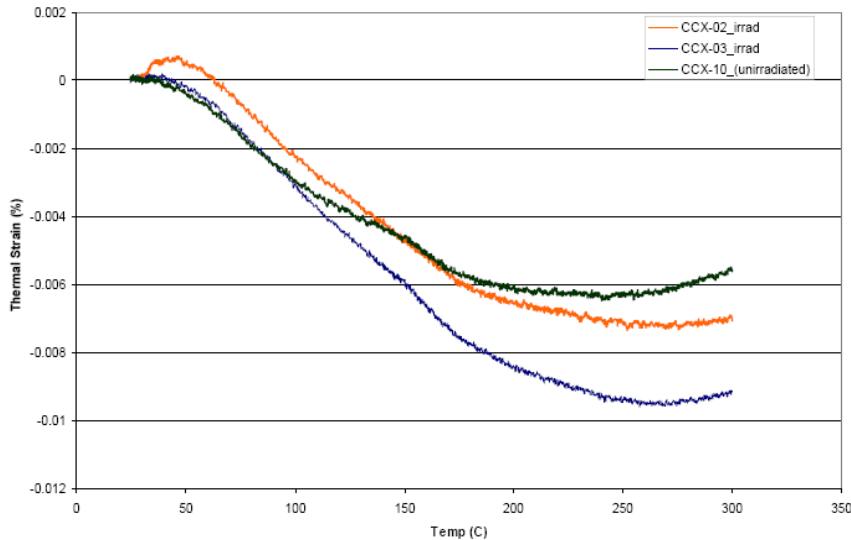
F. Groeschel, I. Guenter, A. Kalt
J. Neuhausen, L. Zanini

M. Loiselet
CERN, PSI, UCL

C-composite

Th-expansion

Ref: N.Simos et.at BNL



Th-conductivity

Ref: J.P. Bonal et C.H. Wu
Nucl. Mat. 277 (2000)

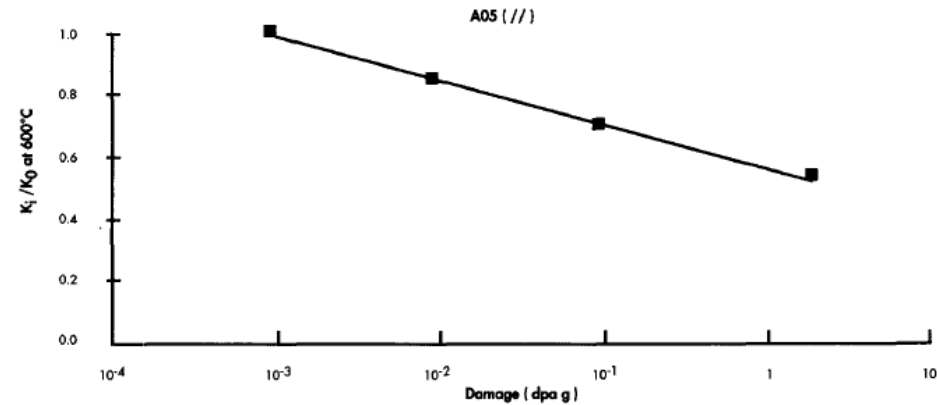
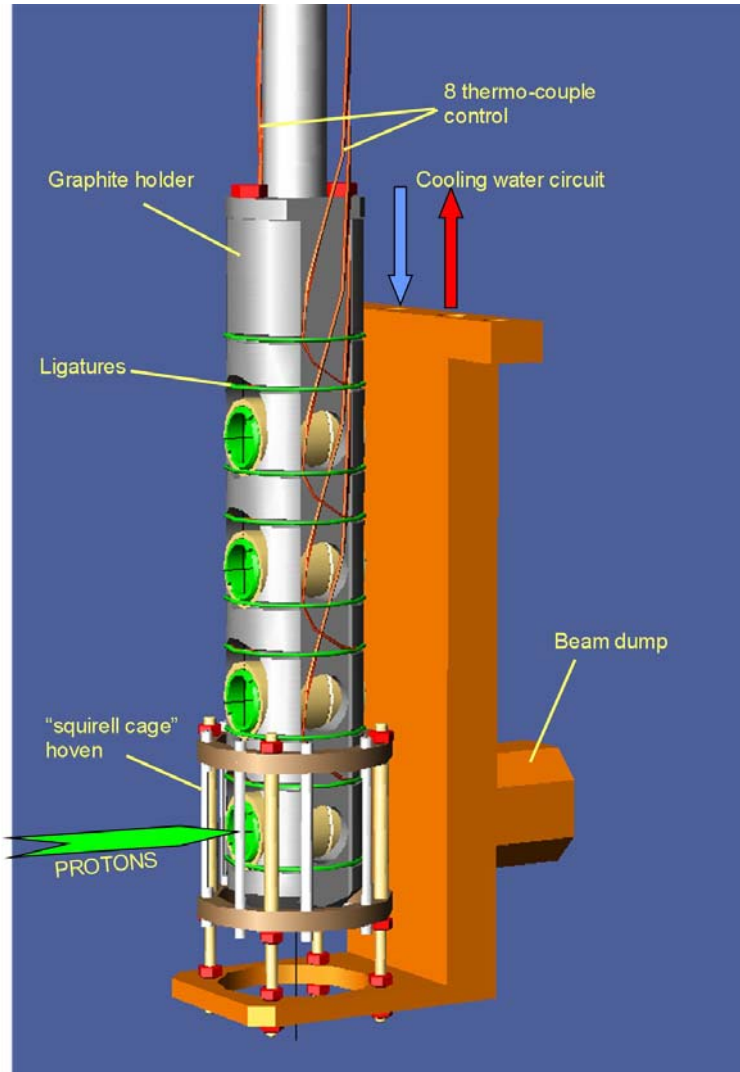


Fig. 4. Thermal conductivity A 05(//) normalized at 600°C as a function of neutron damage.

Do we need to measure these properties during irradiation at high temperature under realistic conditions ?

EURISOL-DS irradiation studies at PSI

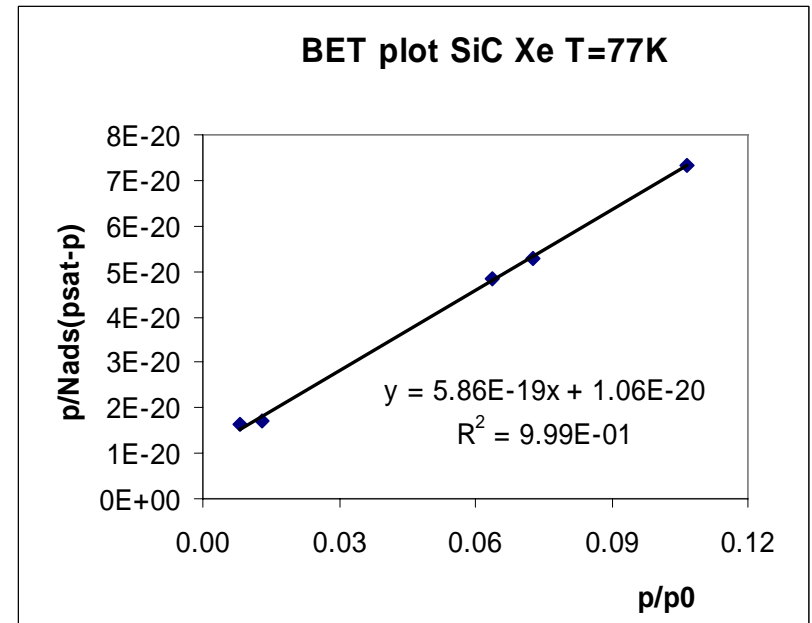
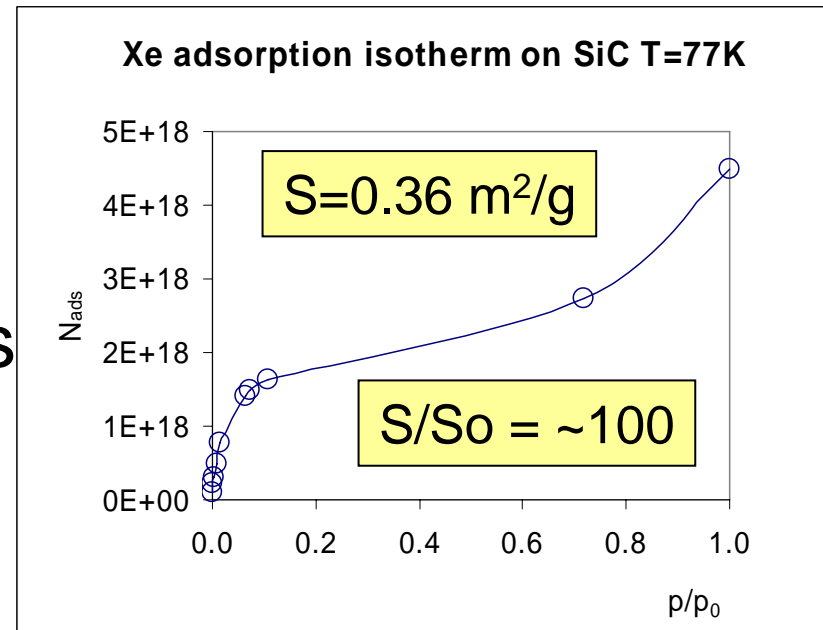
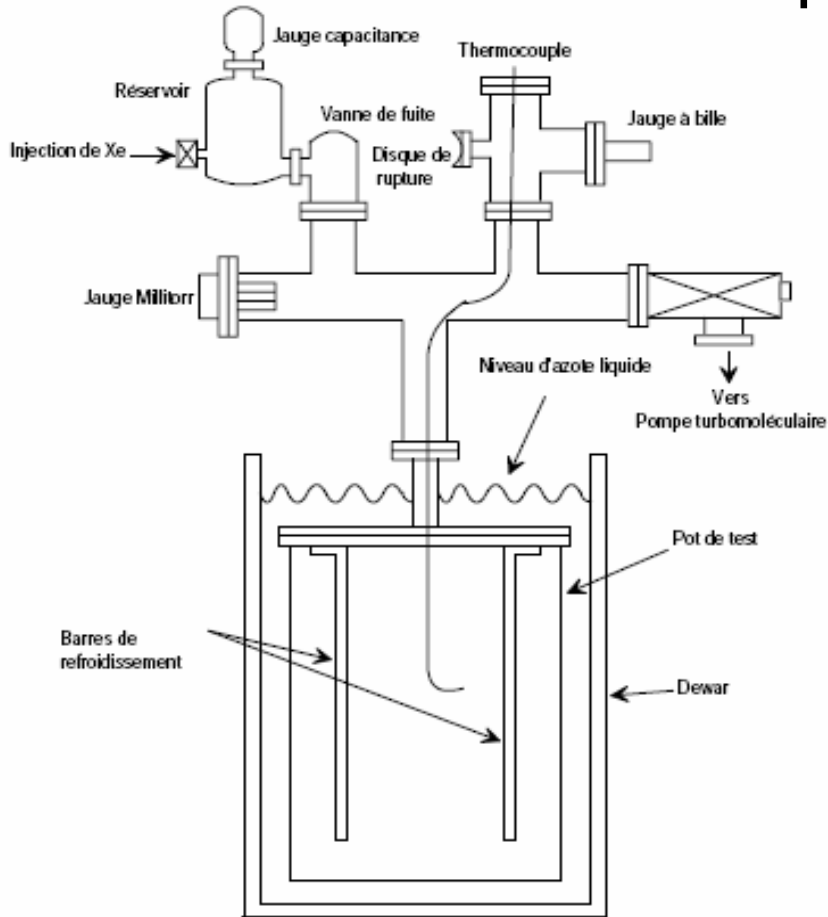


- Development of multi-sample holder for the irradiation of prospective target materials for the EURISOL at the PSI-LISOR facility
- Testing mechanical and diffusion properties of various samples

S. Marzari, T. Stora, E. Bouquerel

BET isotherm for specific surface ratio determination

i.e. SiC pills



TEST cases 100 kW

direct

- *Targets*

- Actinide target (**carbide**) (L. Penescu)
 - UC₂+C, ThC₂+C
 - W-converter, **Moderator & Reflector**
- Metal foil target (**solid**) (R. Wilfinger)
 - Ta, Nb
- **Oxide** powder of fiber (T. Stora)
 - BeO + converter
 - Insulating materials low dE/dx
- Molten metal (**Liquid**) (E. Noah)
 - Vapor condensation

- *Ion-sources, effusion (E. Bouquerel, M. Santana)*

- Mono ECR
- RILIS, Surface
- FEBIAD

- *Elements*

- He, Li, Be, Hg ...

4 Targets

4 Ion-sources

1 Front-end

Synergy with β -beam

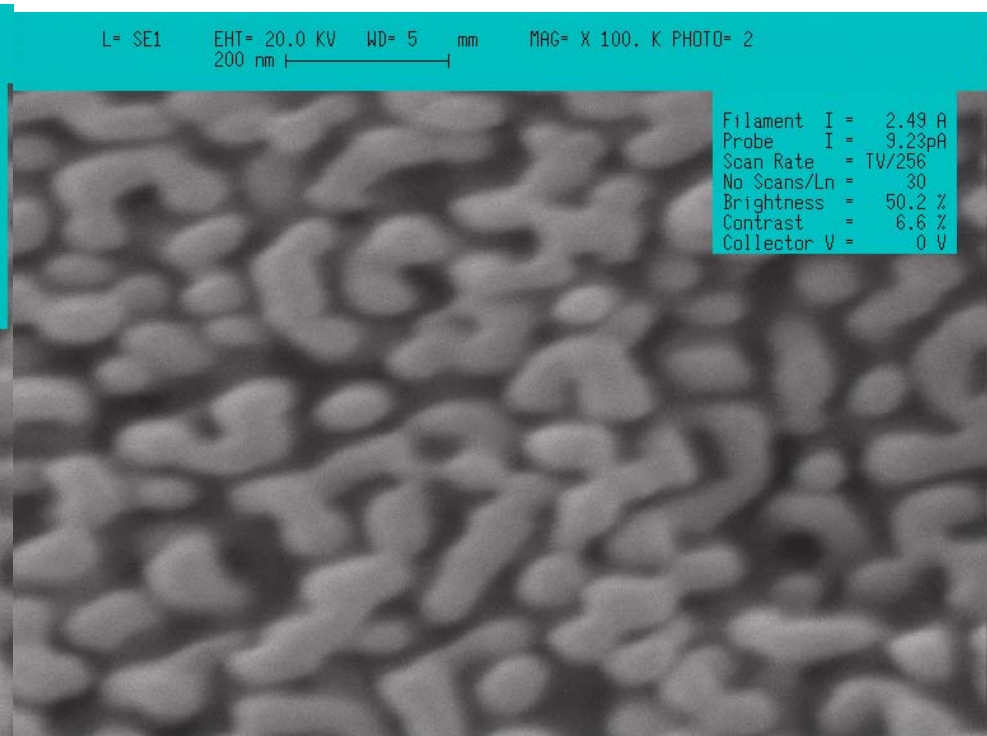
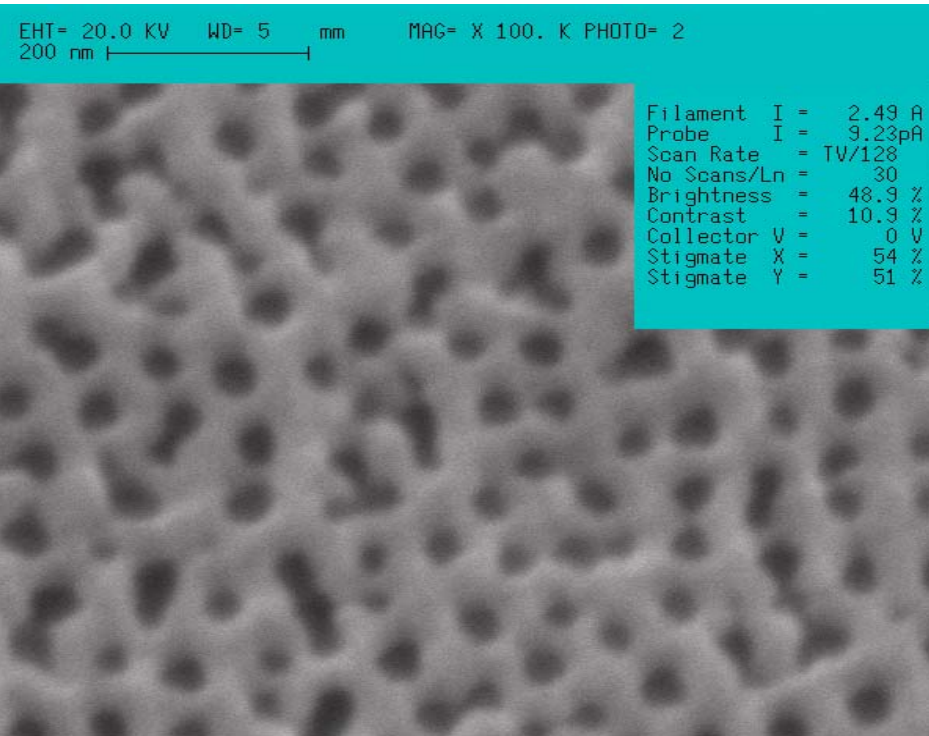
Spin off is expected on:
- Similar target materials
- Elements from the same chemical group

Super material design vs target life time

14h, 970 °C

Nanostructured Al_2O_3

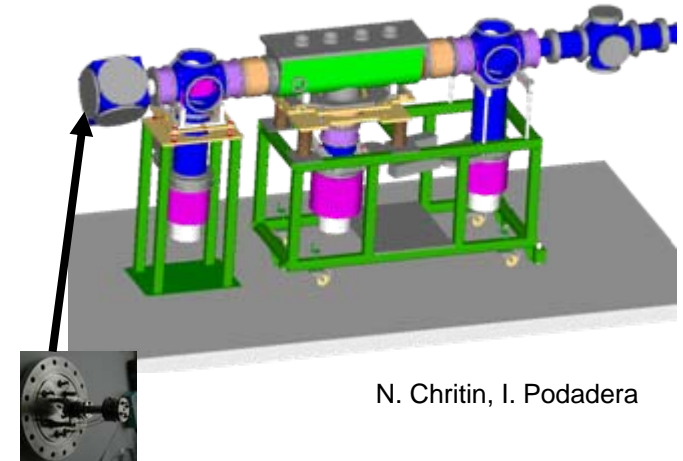
17h, 1250 °C



T. Stora

ISCOOL (ISOLDE COOLer)

- Mechanical assembly finished at ISOLDE workshop (E. Barbero, D. Carminati, I. Podadera, C. Bachelet) and last support pieces done in Mainz and CSNSM.
- Ready for assembly of all the ISCOOL components in building 275. (C. Bachelet, University of Manchester support). I. Podadera leaving tomorrow. Tests expected from beginning 2006 (P. Delahaye, Manchester group and others...).
- Control system for the test bench (DC power supplies and gas feeding) developed and tested successfully (T. Tallinen, I. Podadera, C. Bachelet, J. Parra-Lopez, D. Porret).
- RF supply expected for end of November (K. Rudolph). Prototype could be used meanwhile.
- Quadrupoles triplets under design (N. Chritin, I. Podadera).
- LPC ion source for first tests, but possibility to develop a new ion source used after at the on-line beam line to be investigated (difficult installation).
- Investigation of installation of a new HV platform aside EBIS platform for the electronics.
- Technical reports to all the groups involved in the on-line installation to be sent asap for 2006-2007 shutdown installation.



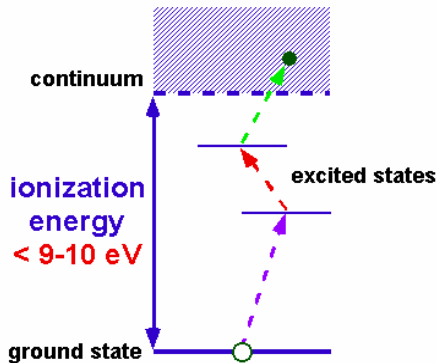
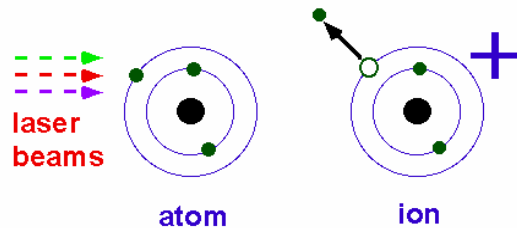
Ion source LPC

N. Chritin, I. Podadera

Test bench

RILIS : principle and general set-up

Laser Ionization



Main features of RILIS:

- Isobar and isomer selectivity
- Ionization efficiency: 2 - 27 %
- Feasibility for 80% of chemical elements

RILIS ion beams:

Be, Mg, Al, Ca, Sc, Mn,
Co, Ni, Cu, Zn, Ga, Y,
Ag, Cd, In, Sn, Sb, Tb,
Dy, Tm, Yb, Hg, Tl, Pb,
Bi

Ion beam lines

RILIS IN 2004 :

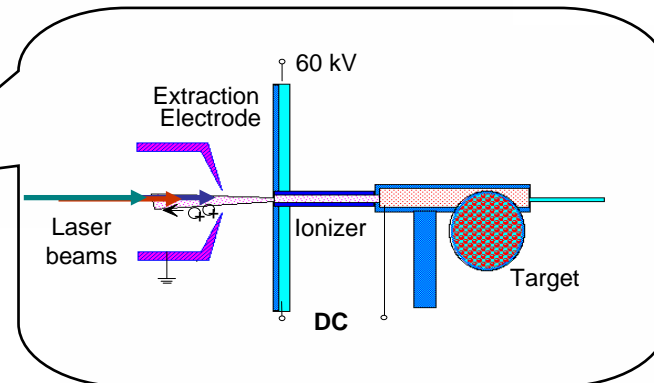
2055 working hours
10 ionized elements
21 experiments

Mass separator

Laser system

Proton beam

Target



Target - Ion Source Unit



On-line period 2005: RILIS Operation

- Radioactive ion beams scheduled: Mg, Pb, Ni, Cu, Sn, Sb, Be, Mg, Zn, Cd
- Radioactive ion beams produced: Mg, Pb, Ni, Cu, Sn, Sb, Be, Mg, Zn, Cd
- Number of experiments with RILIS - 21
- Number of RILIS operation hours - 1500 (by 27.09.2009)

Experimental achievements

- ☞ **For the first time radioactive isotopes of antimony have been produced :**
IS434: $^{136-138}\text{Sb}$ was investigated and good results on half-life and Pn-values were obtained.
- ☞ **For the first time isomerically separated beam has been accelerated :**
IS435: Coulomb excitation study of $^{68-70}\text{Cu}$ was performed at REX.
- ☞ IS436: MISTRAL performed successful mass measurement on $^{10-12}\text{Be}$.



On-line period 2005: RILIS Operation

- The extraordinary result of this year has only been possible due the use of more resources than foreseen:

		Staff plan for RILIS	Real work on RILIS in 2005
Applied physicist	V. Fedosseev	45%	80%
Doctoral student	B. Marsh	60%	100%
Technical Engineer	N. Champault	30%	60%
Technical engineer	E. Chevally	0%	20%

- **In 2006 this will not be possible anymore due to:**
- 1) Work on RILIS Laser Upgrade (hopefully in collaboration with the Royal Institute of Technology in Stockholm (KTH))
- 2) Set-up and first studies in the new Spectroscopy Lab
- 3) Installation of photoinjector for CTF3.

SPECTROSCOPY LAB



- ↙ **Two low pulse repetition rate solid state laser OPO systems**
- ↙ **190 KCHF already invested by CERN on top of standard exploitation budget**
- ↙ **1 Doctoral student in 2006 financed through EURONS**

- ↙ **Necessary to investigate new ionization schemes to be used with the new Solid State Lasers without jeopardizing the operation of RILIS.**
- ↙ **Part of the time dedicated to RILIS will have to be spent in this lab.**



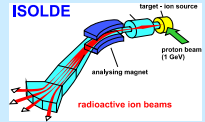
Rilis Operation in 2006/2007

- ↪ **Tubes and thyratrons for Copper Vapor Lasers are becoming less and less reliable (2 out of 4 had to be replaced after ~100h)**
- ↪ **It will be difficult to ensure the availability of CERN staff for shifts, without compromising the advancement of the new laser and of the research in the Spectroscopy lab**

- ↪ **An additional effort from the ISOLDE collaboration will be necessary in 2006 and 2007 to ensure the foreseen 1500h of shifts.**



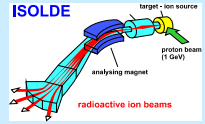
General REX



- Faster setting up time this year
- More conservative operation regime
=> safer runs
 - Higher average efficiencies
 - 8 successful runs in a row!
 - Less down time due faults
- High efficiency with SeCO this year
- Find run summaries at REX-ISOLDE homepage



New REX isotopes in 2005



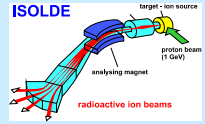
- $^{108}\text{In}^{30+}$
- $^{68}\text{Ni}^{19+}$
- $^{68,69,70}\text{Cu}^{19+,20+,19+}$
- $^{92}\text{Kr}^{22+}$
- $^{108}\text{Sn}^{27+,30+}$

Status of REX linac

- RF amplifiers: the 200MHz amplifier has been running for the first time at full power i.e. 100kW duty cycle 1/10. (Beams of 138,140Xe34+ were delivered at 2.85MeV/u.)
- The RF amplifiers both 100 and 200MHz remain unreliable (lots of maintenance and spares required).
- The rest of the machine is performing well (easy tuning, good transmissions, beam stable).
- Vacuum: the remaining “hand” valves after the bender will be included in the vacuum control system.
- Control: FEC beam optics applications are ready and FEC beam diagnostics applications are in progress. Consol control applications still missing.



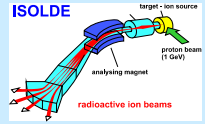
ISOLDE experimental area



- Re-organization as general CERN experimental area for 2006
 - Support
 - Routines for new installation
 - Staff for shutdown work
 - Alignment



Class A Laboratory



Access limitations:

Code A6 “Two man working rule”

Access granted only by an RP technician

Complete change of clothing

Distance etc...

Installations:

No off line separator installed in 2006

Calibration pump stand to be installed in March 2006



Consequences:

No off-line testing of actinide targets in 2006.

Maximum production of 10 (+2) actinide targets in 2006.

Request:

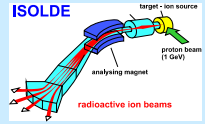
2 week interval between scheduled actinide target changes

November 2005

ISOLDE team



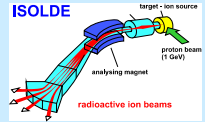
Class A lab



- In operation
 - Manufacturing and testing of UC targets
 - Target handling (used targets)
 - Target autopsies
- Equipment to be added for
 - Off-line testing of UC targets
 - Test of front-ends
 - Waste conditioning



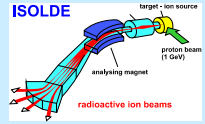
Extension



- Beam transport calculations for move of mini-ball and REX upgrades in progress
- Plans for infrastructure and alignment under discussion
- User input for experiments to Joakim Cederkäll
- User input for infrastructure requirements to Mats Lindroos



Shutdown 2005-2006



- The cooling water will be available at ISOLDE until 12 December (and back 20 February)
- Requests (and information) for shutdown work to Erwin Siesling ASAP