Radioactive Ion Beams (RIB) at ISOLDE

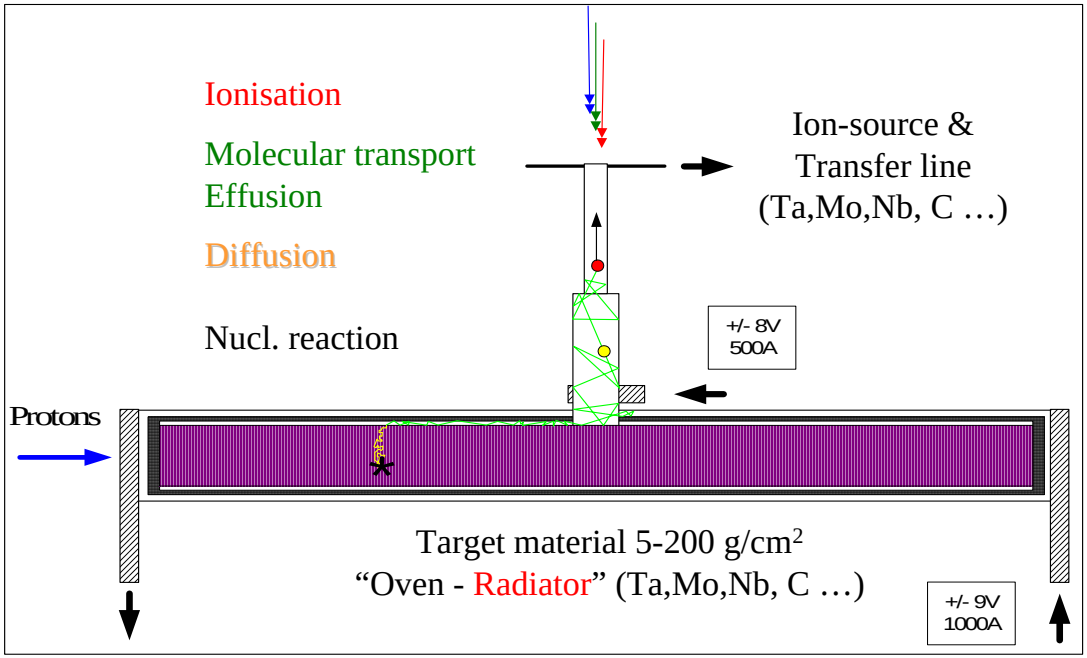
Target and Ion Sources

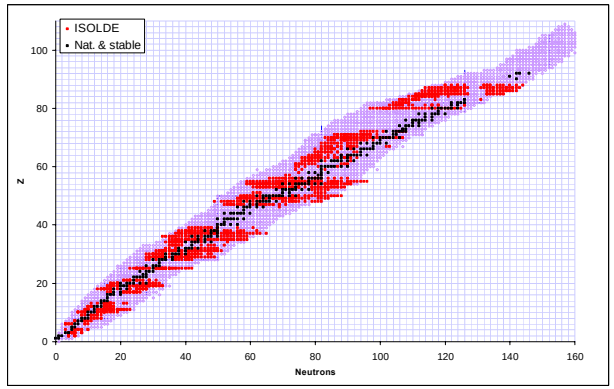
Thierry Stora – AB-ATB-IF

Activity overview in 2006

- Target & Ion Source Units Production
- Units Qualification - Quality Insurance
- Radioactive Ion Beam (RIB) – Target tests
- Prototype Development
- R&D – High power targetry

Target and Ion Source Units Production



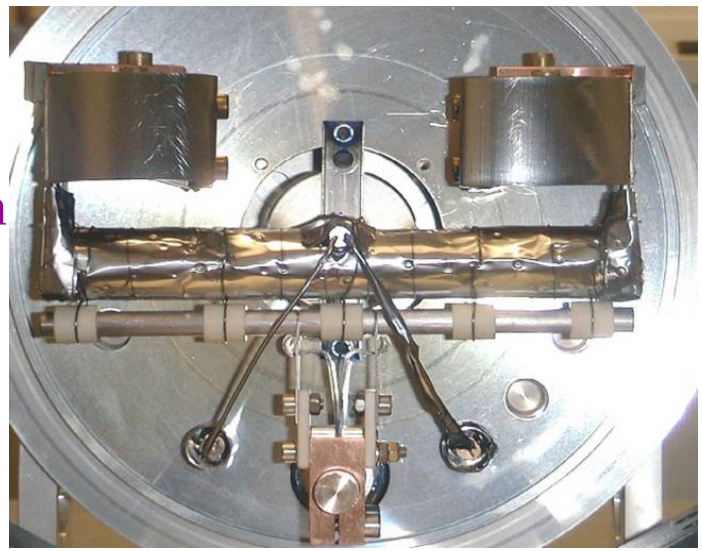


Upon physics request

More than 100 different "standard" combinations !! (25 target materials, 6 compounds, 5 ion sources)

Constitutes the corner stone of ISOLDE

ISOLDE Neutron spallation source



Production in 2006

GPS Separator

Target number	target	ion source	date online
320	UC2	MK8 W	21-04
321	ZrO	MK8 W	08-05.
254	*Sn*	*MK8 W*	17-05
324	SiC-SG	MK8 W	29-05
320	UC2	MK8 W	06-06.
329	UC2-n-q1	MK8 W	07-07.
326	ThC	MK8 W	24-07
333	UC2	MK8 Ta	09-08.
256	*Pb*	*MK3*	21-08.
333	UC2	MK8 Ta	30-08.
286	*LaC2*	*MK8 W*	14-09.
338	UC2-q2	MK8 W	02-10.
331	UC2	MK8 W	17-10.
343	Nb	MK4 Ir5Ce	10-11.

HRS Separator

Target number	target	ion source	date online
319	CeO	MK5	27-04
322	UC2-n	MK8 W	10-05.
323	Ti	MK8 W	19-05.
325	UC2	MK5	30-05.
326	ThC-n	MK8 W	13-06.
328	Nb	MK8 W	26-06.
330	UC2-qv1	MK8 W	19-07.
303	*UC2*	*MK8 W*	04-08.
334	SiC-SG	MK5	14-08.
335	Ta	MK8 W	23-08.
336	UC2-n	MK7	05-09.
337	CeO	MK5	22-09.
339	MgO	MK7	04-10.
340	UC2	MK7	17-10.
327	Ta	MK8 W	02-11.

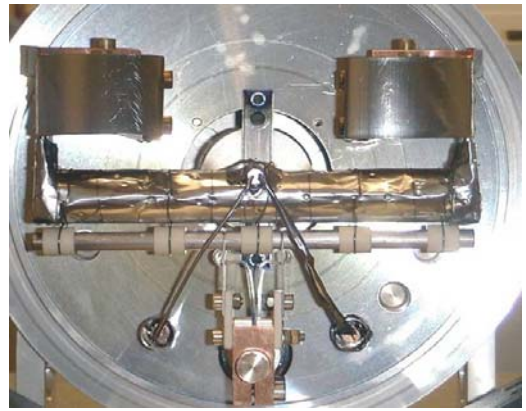
23 new units:

11 actinide targets

5 prototypes

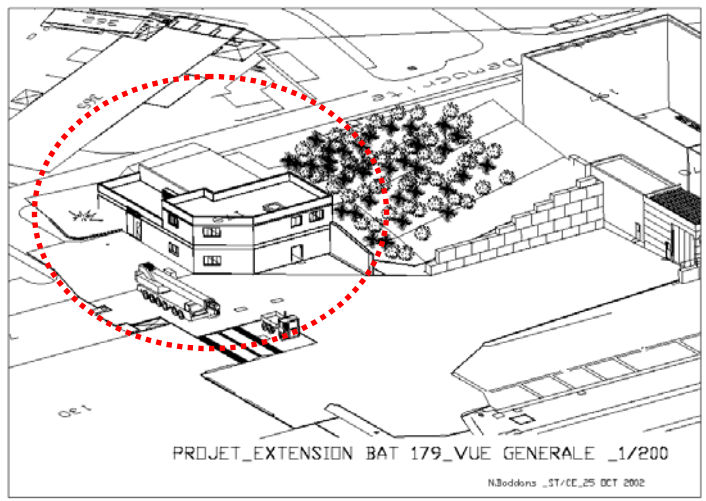
Production in 2006

B. Crepieux, D. Carminati



- Assembly (cleaning), marker
- Target
- Actinide production transferred to New Class A lab (bld 179) – RP technician mandatory
  Weighing, mixing, pressing, carburation
- Leak detection
- Calibration

Σ = 5-10 days (/UCx unit)

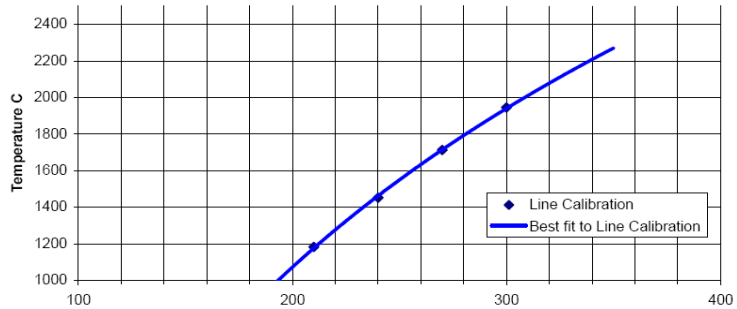


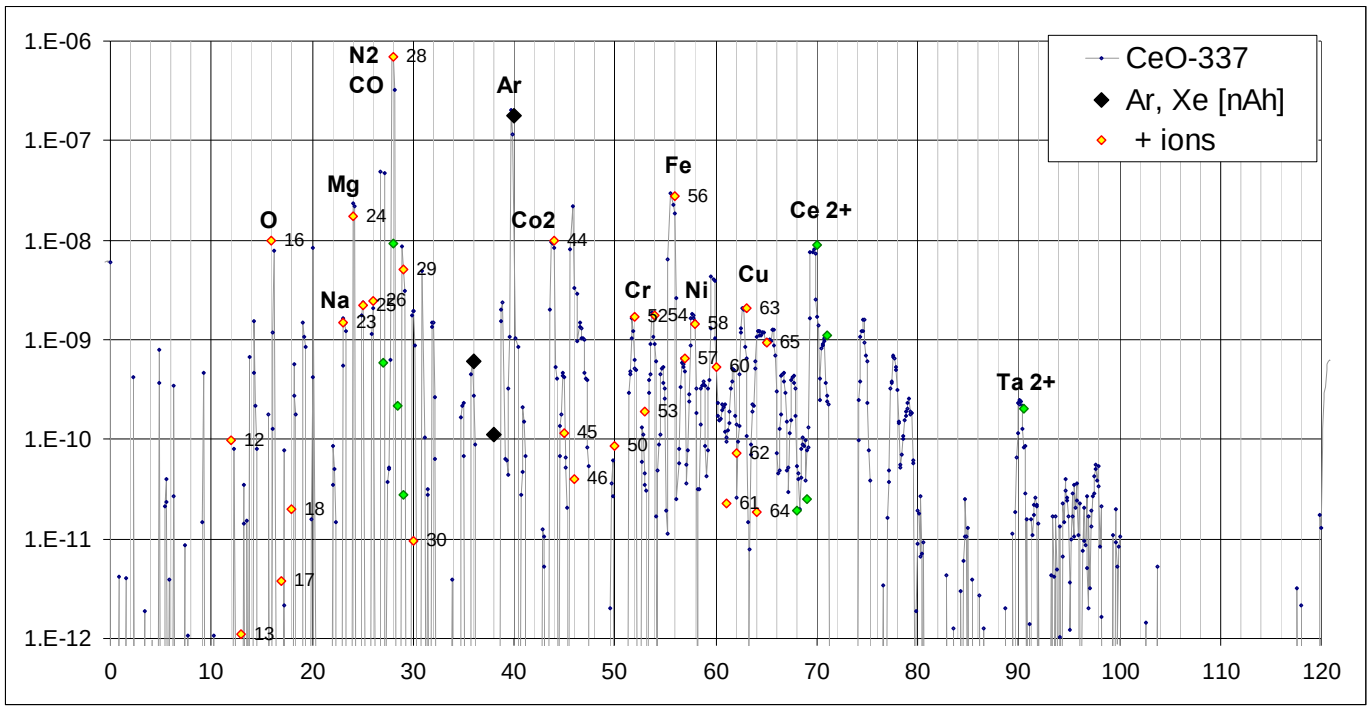
Quality Insurance

- Calibration
- Outgasing, vacuum
- Off-line mass scan
- Ion source efficiency
- total current

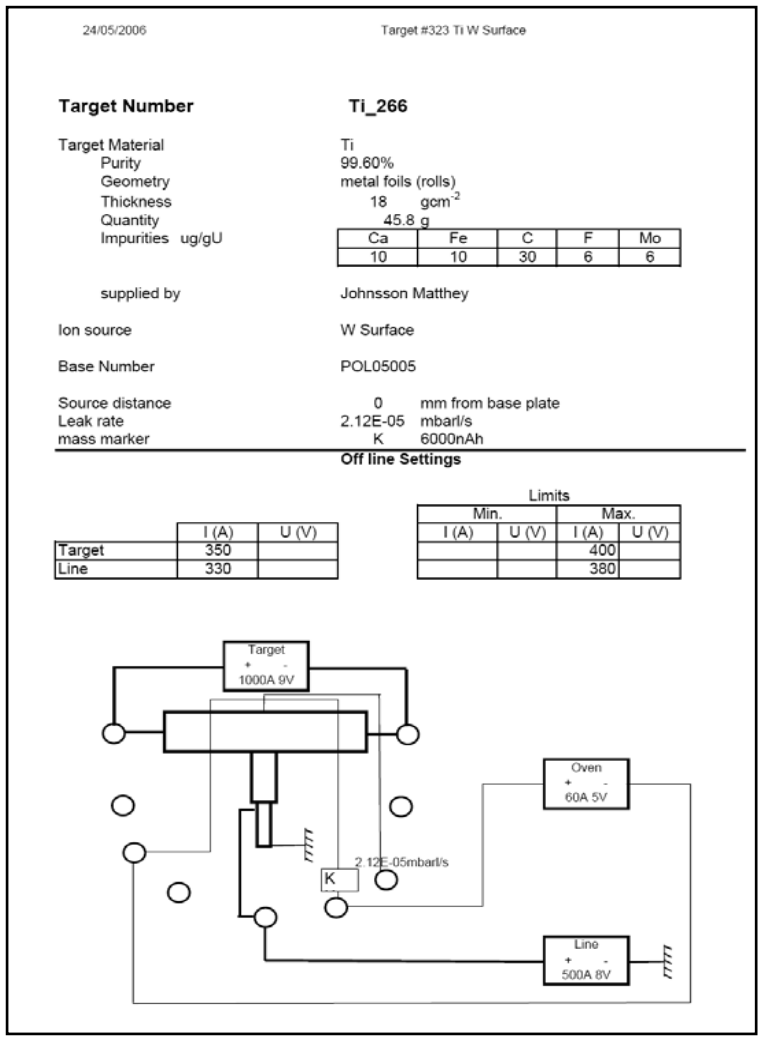
I (A)	U (V)	OT (C)	TT (C)
210	1.20	1110	**1183**
240	1.49	1350	**1452**
270	1.80	1580	**1713**
300	2.14	1780	**1945**

Line Calibration
Target at 400A





Quality Insurance



24/05/2006 Target #323 Ti W Surface

Target Number **Ti_266**

Target Material	Ti
Purity	99.60%
Geometry	metal foils (rolls)
Thickness	18 gcm^{-2}
Quantity	45.8 g
Impurities ug/gU	Ca 10, Fe 10, C 30, F 6, Mo 6
supplied by	Johnsson Matthey
Ion source	W Surface
Base Number	POL05005
Source distance	0 mm from base plate
Leak rate	2.12E-05 mbarl/s
mass marker	K 6000nAh

Off line Settings

	I (A)	U (V)	Limits Min. I (A)	Limits Min. U (V)	Limits Max. I (A)	Limits Max. U (V)
Target	350				400	
Line	330				380	

Final documentation

Conformity check
(R. Catherall/T. Stora)

Handed to OP-ISO

Paper copy (*or draft*)
in ISOLDE Control Room

Electronic version on
ATB-IF web site

Target Tests

- To assess the intensity and the purity of the Radioactive Ion Beam (RIB)
- Several goals:

  Quality insurance

  Tuning, optimisation

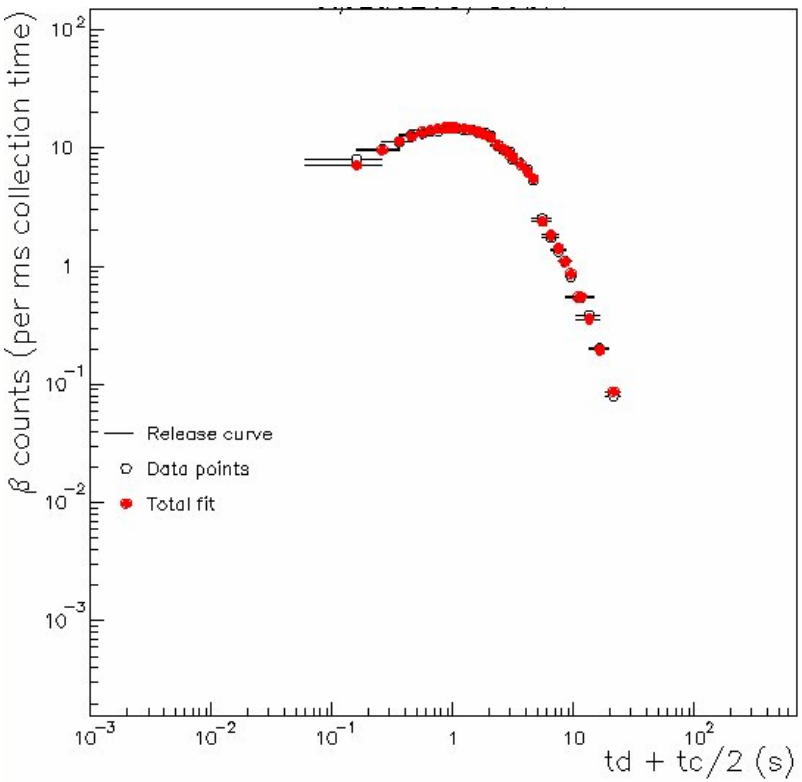
  Develop RIBs, test prototype

  Predict future RIBs

  Detect malfunctions

E. Bouquerel
M. Eller
S. Fernandes
E. Noah
L. Penescu
T. Stora (R. Catherall)
R. Wilfinger

Target Tests



- More than 150 Radioactive Ion Beams (RIB) measured and analyzed in 2006
- 200 (x2) hours
  > 50% out of office hours
- Preparation, analysis and report
- Σ=0.5-1 FTE

ISOLDE, the only facility in the world where this can be done

Examples for 2006

- Ti323:
  Optimization after reported yield drop

  39Ca: 2.7 10^4/μC (in database*: 2 10^4)
  38Ca: 0.5→3.5 10^3/μC (in database: 3-10 10^3)
- But fast sintering due to focused proton beam

- UCx320 (UCx331) (New batch of UO_2):
  75Ga: 5.0(8.6) 10^6/μC (in database: 3.1 10^7)

- UCx331:

  29Mg: 1.7 10^6/μC (in database: 1.6 10^6)

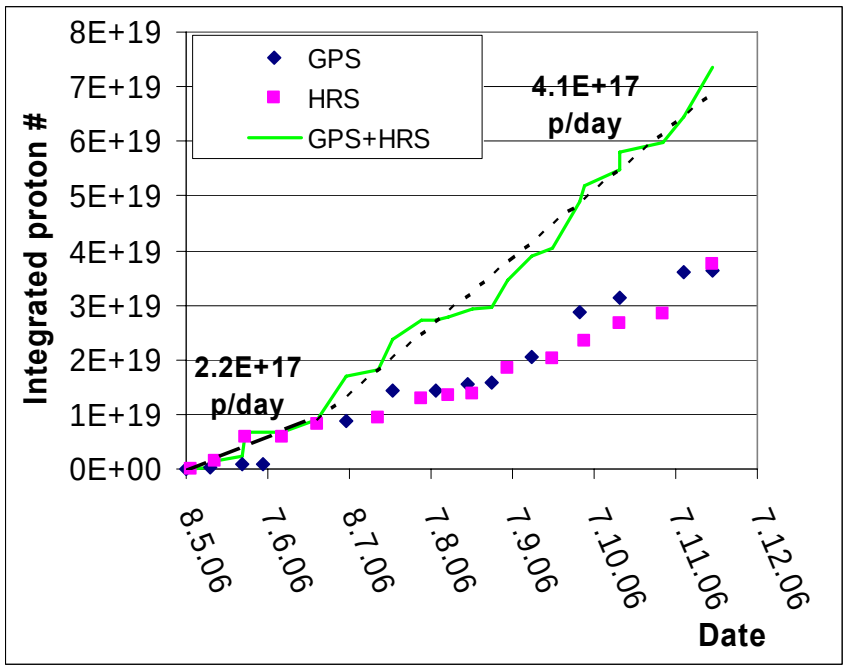
  30Mg: 2.0 10^6/μC (in database: 6.0 10^5)

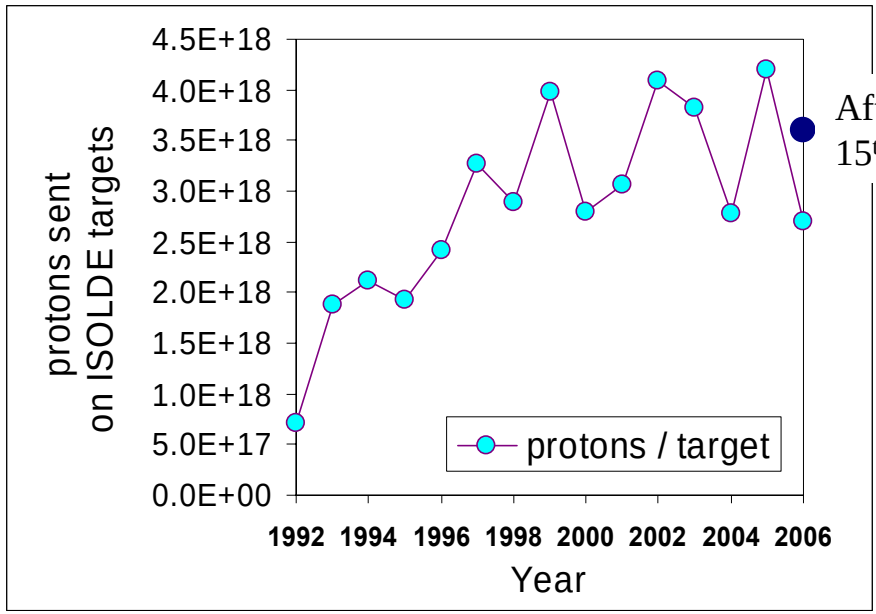
  31Mg: 1.8 10^5/μC (in database for 32Mg: 3.0 10^4)

* ISOLDE web site, M. Turrion

Target Unit Operation in 2006

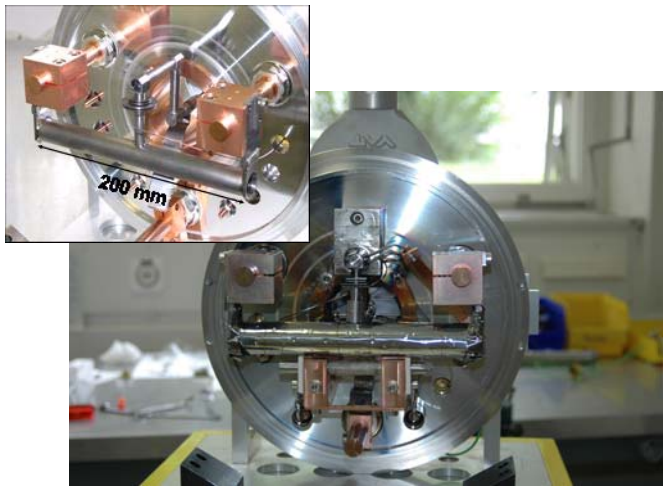
- A difficult start-up until 15th June



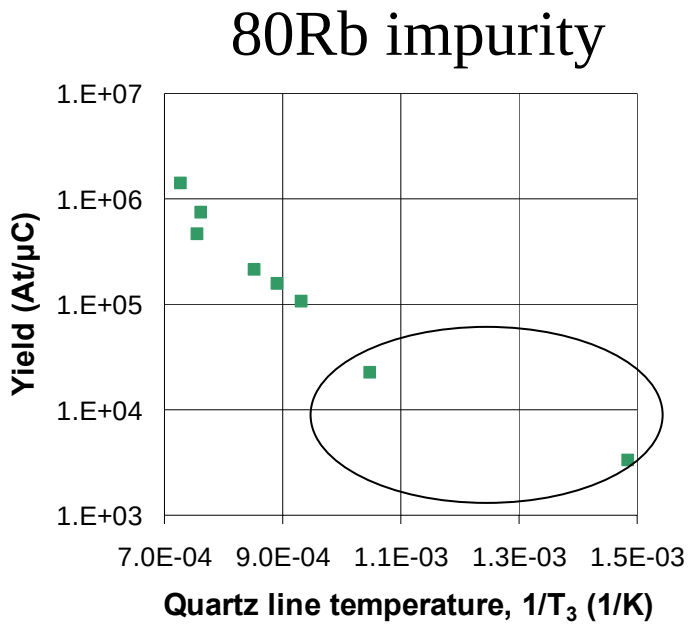


Prototype/beam development

- Priorities set by the Standing Group for the Upgrade of ISOLDE (SGUI)



Impurity trapping
by selective adsorption on quartz
in the temperature controlled
transfer line



Storage, Waste, Disposal

Intermediate storage in ISR

24 Units of low activity dismantled in 2006

In Class A lab
(bld 179)
RP technician

By material type

To be shipped to PSI

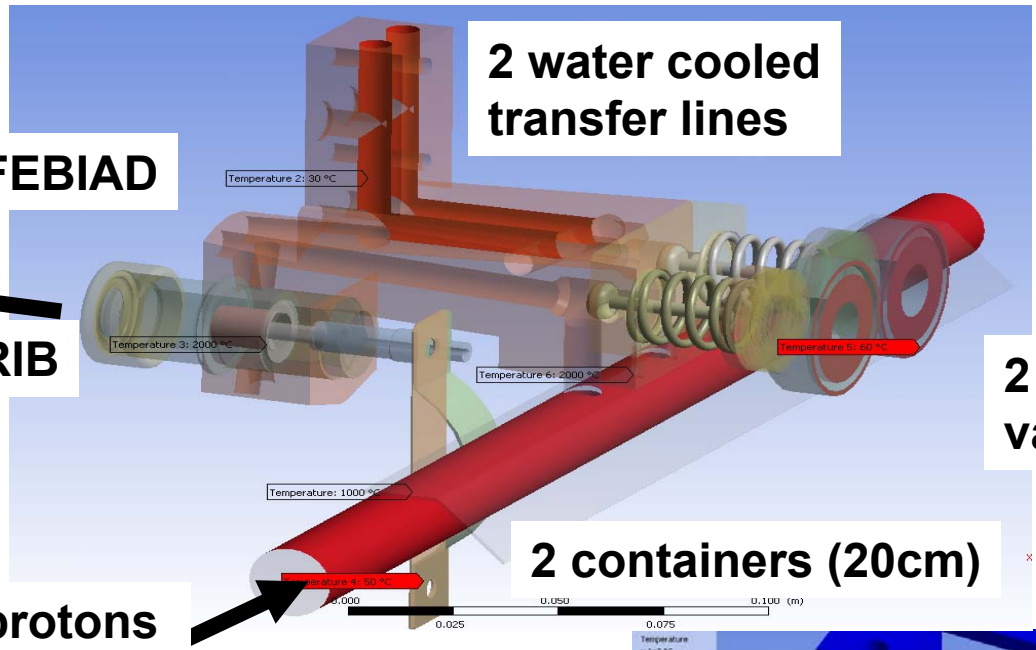
High Power Targetry

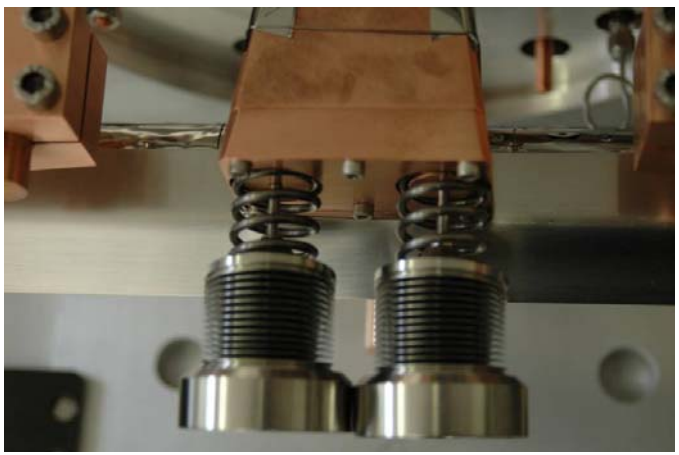
- Task 3 – 100kW direct target

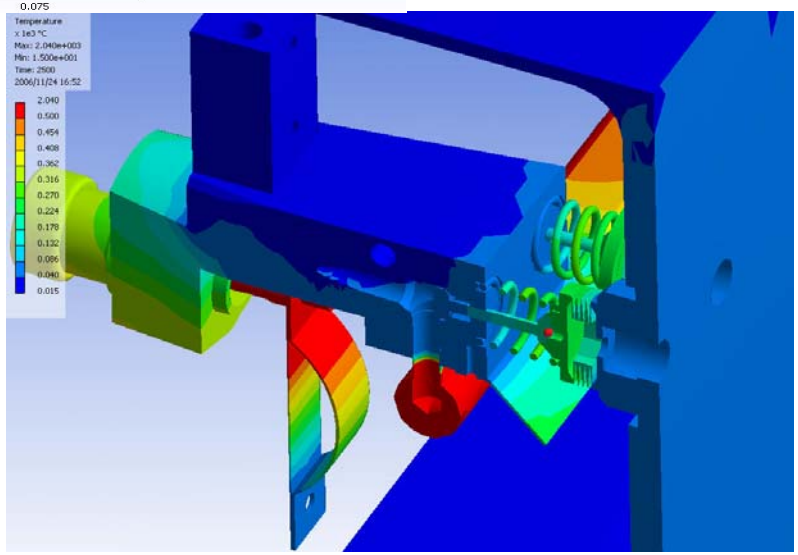
EURISOL Design Study

- Marie-Curie Fellowship: HIGH INT

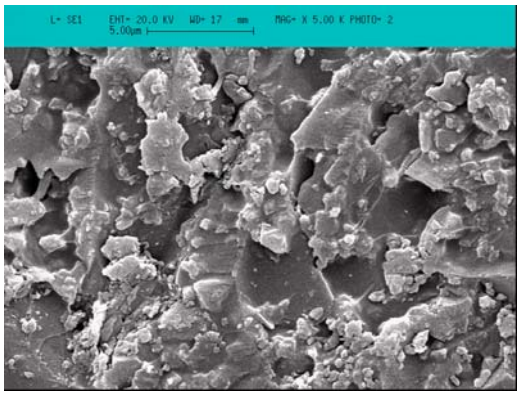
Prototype Development





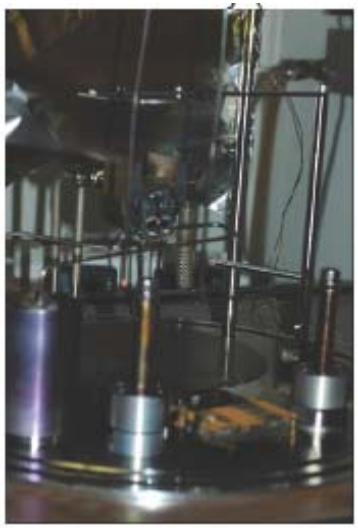


R&D in 2006

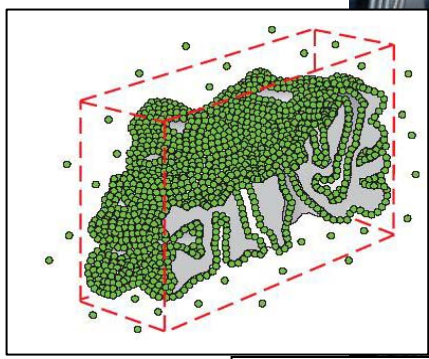


New SiC for F beams

e- gun to measure thermal conductivity



Diffusion studies (RaBIT, bld 179)
RP Technician



Specific surface (BET)

Collaborations

Bricault
High power targetry

Groeschel, Zanini
Ageing, Corrosion

Roux
New materials

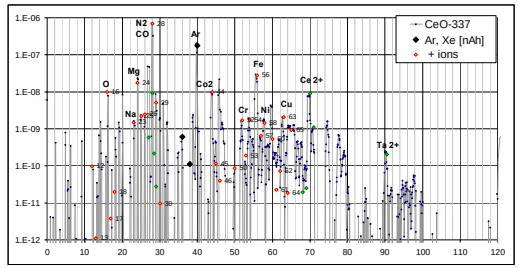
Andrighetto
Emissivity

Hofmann, Hollenstein
Inorganic Powders, Plasmas

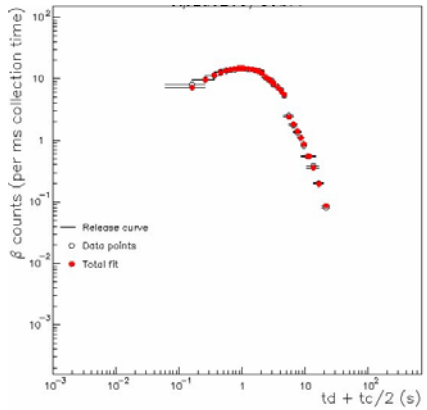
Carter
Trapping materials

Some improvements for 2007

Design of an off-line mass separator for actinide targets in the Class A lab. (Bld 179)



Design and production of a new tape-station for target tests
Major revision of the beta-gamma detector set-up



Beam time for more proactive investigations

Recover release properties of UCx targets

Need to dispose of 50 old units of increasing activity