

Target and Ion Source - *Development*

RIB Development

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ISOLDE TISD

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L. Penescu (USAS)



HighInt

E. Noah

S. Fernandes (fellow doct)

EURISOL
Design Study

100kW
target station

ISOLDE PH, AB

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A. Herlert

K. Johnston

F. Wenander

York Univ.

B. S. Nara Singh

J. E. Butterworth

Beams at ISOLDE

Access to the Yield information

Find the produced isotopes from a given target --

Nuclear Chart for ISOLDE

Find the produced isotope from an element independent on target

Group	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	
	1A	2A	3B	4B	5B	6B	7B	8B			1B	2B	3A	4A	5A	6A	7A	8A	
Period																			
1	1 H																		
2	3 Li	4 Be																	
3	11 Na	12 Mg																	
4	19 K	20 Ca	21 Sc	22 Ti	23 V	24 Cr	25 Mn	26 Fe	27 Co	28 Ni	29 Cu	30 Zn	31 Ga	32 Ge	33 As	34 Se	35 Br	36 Kr	
5	37 Rb	38 Sr	39 Y	40 Zr	41 Nb	42 Mo	43 Tc	44 Ru	45 Rh	46 Pd	47 Ag	48 Cd	49 In	50 Sn	51 Sb	52 Te	53 I	54 Xe	
6	55 Cs	56 Ba	*	71 Lu	72 Hf	73 Ta	74 W	75 Re	76 Os	77 Ir	78 Pt	79 Au	80 Hg	81 Tl	82 Pb	83 Bi	84 Po	85 At	86 Rn
7	87 Fr	88 Ra	**	103 Lr	104 Rf	105 Db	106 Sg	107 Bh	108 Hs	109 Mt	110 Ds	111 Rg							
* Lanthanides		*	57 La	58 Ce	59 Pr	60 Nd	61 Pm	62 Sm	63 Eu	64 Gd	65 Tb	66 Dy	67 Ho	68 Er	69 Tm	70 Yb			
** Actinides		**	89 Ac	90 Th	91 Pa	92 U	93 Np	94 Pu	95 Am	96 Cm	97 Bk	98 Cf	99 Es	100 Fm	101 Md	102 No			

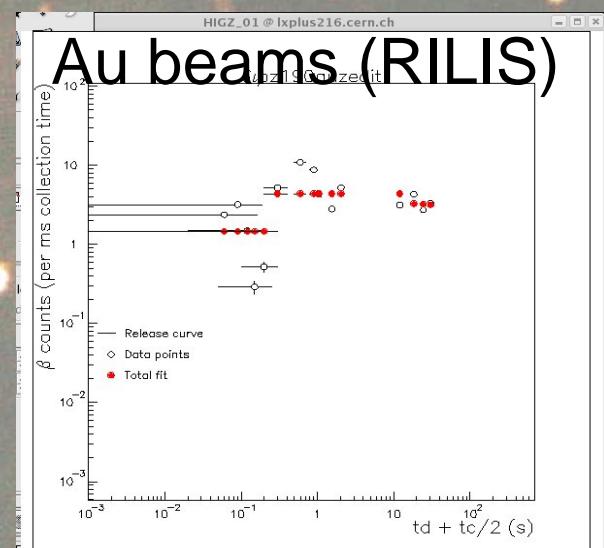
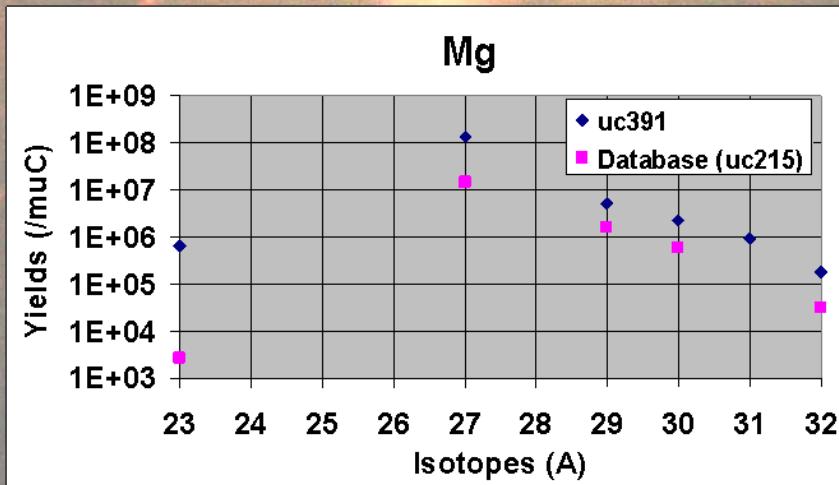
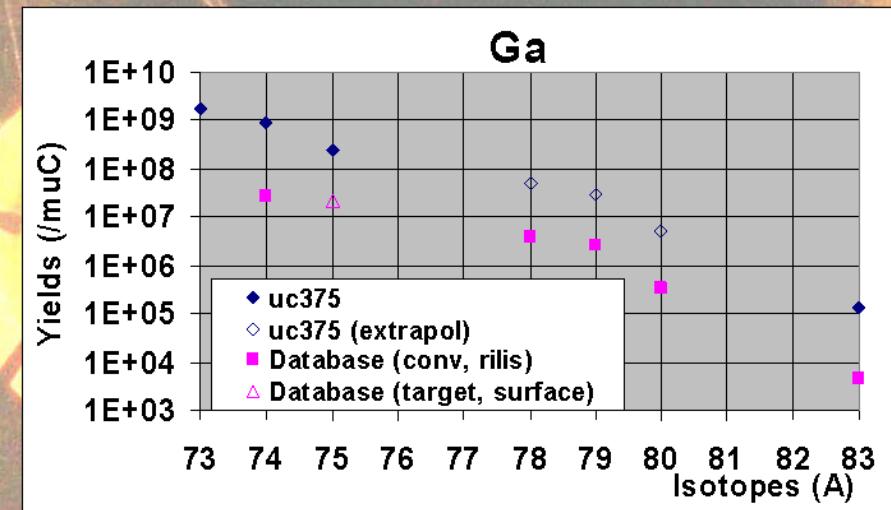
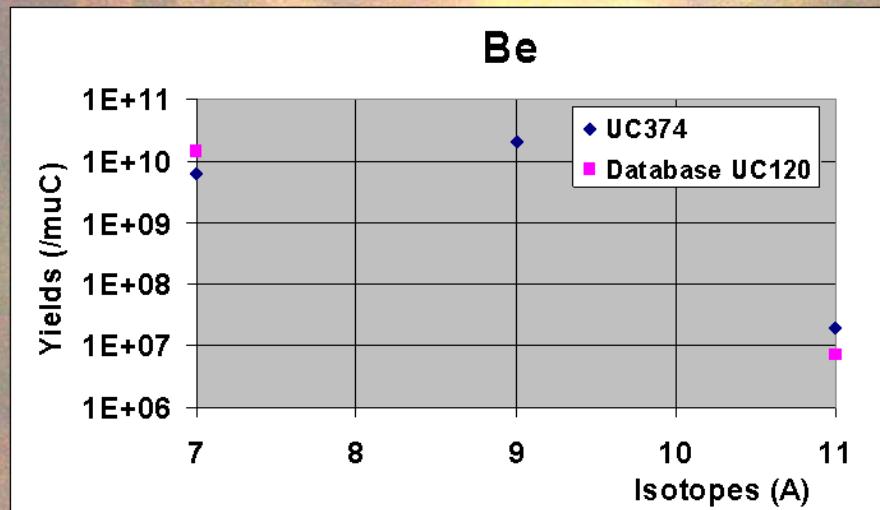
RILIS

Molecules

Ion source

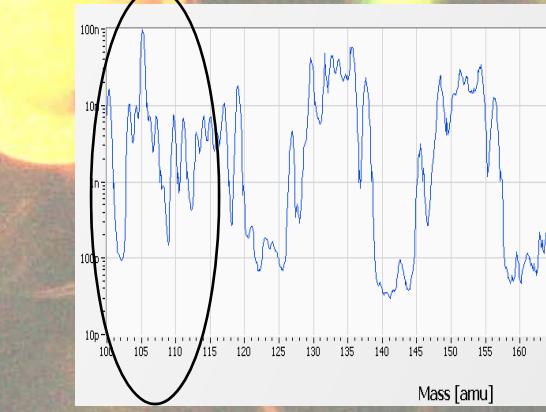
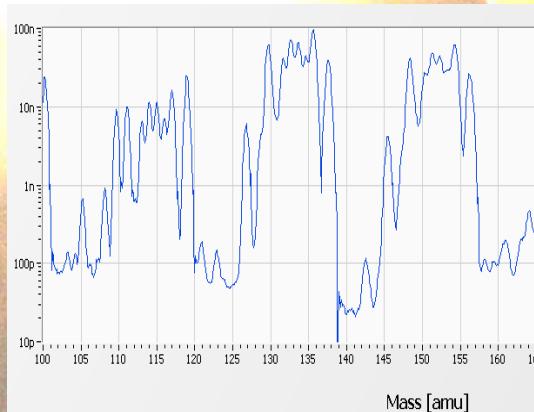
Contaminants

Some Yields in 2008

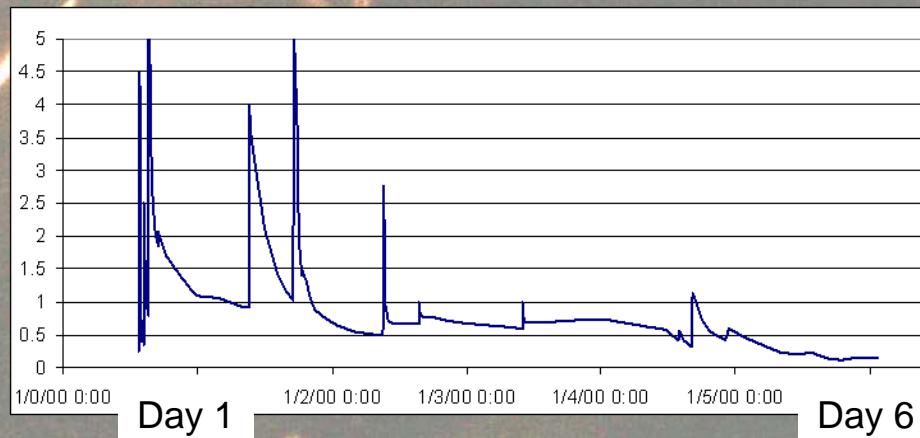


TiF_3^+ ionization

- For post-accelerated ^{44}Ti ($t_{1/2}=60\text{yrs}$) beams :
 - MK3+ CF_4 : Target #366 : did not work out
 - MK5+ CF_4 : Target #369 : $\varepsilon=3.5\%$ as TiF_3^+

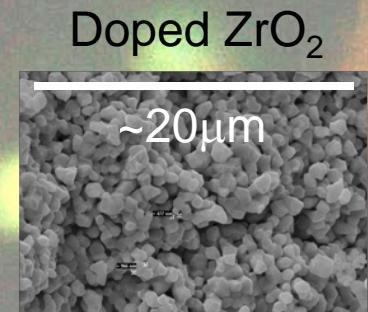
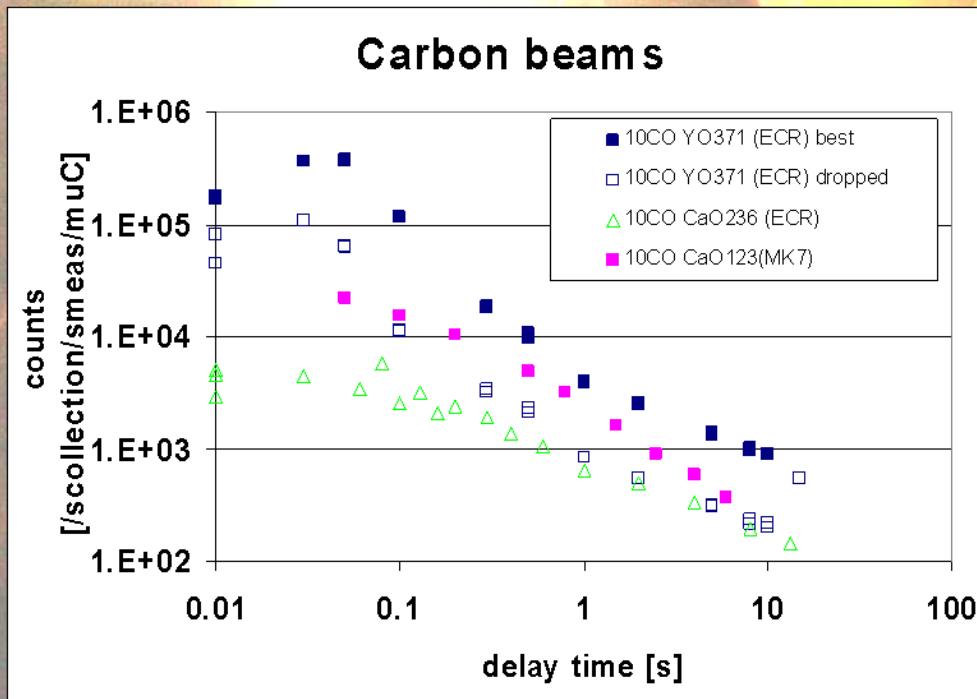


	Ti (mass 48) (nA)	TiF (mass 67) (nA)	TiF_2 (mass 86) (nA)	TiF_3 (mass 105) (nA)
Oven=0A	Hidden	8	0.8	0.7
Oven=70A	No change	20	20	100
Net increase:	0	12	19	99
Percentual Distribution:	0	9.2%	14.6%	76%



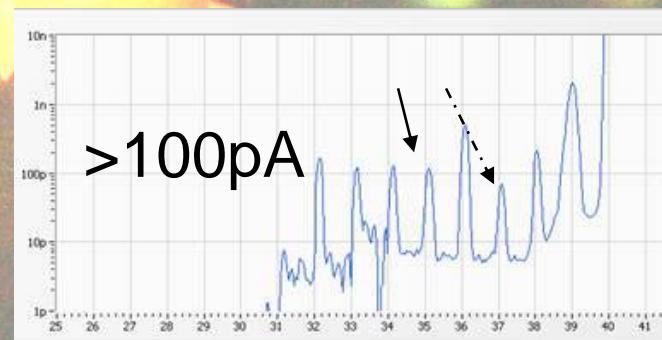
Carbon beams

- ^{10}C : $2\text{e}6/\mu\text{C}$ (^9C ~ $1\text{e}4/\mu\text{C}$)
- New Y_2O_3 target combined with Minimono 1+ ECR:



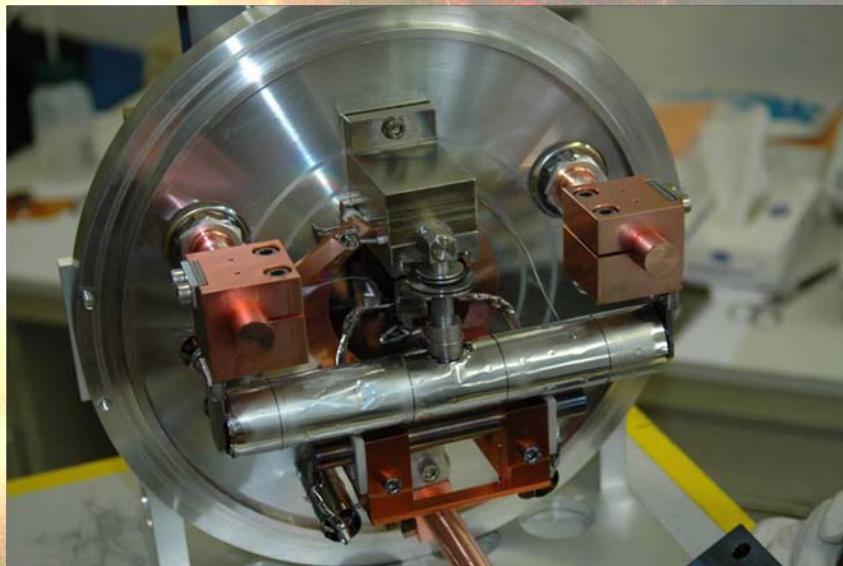
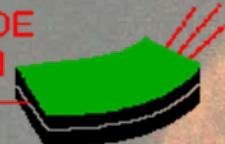
^{35}Cl impurity in ^{35}Ar

- Cl impurity has always been present in CaO-MK7 units



- $< 6\text{e}7$ ^{35}Cl pps by cleaning with HNO_3 and thermal outgassing of the transfer line
- Expected increased ^{35}Ar yield with new FEBIAD

^{128}Cd beam for REX



UC362 : v3.0 quartz line unit equipped with n-conv

^{128}Cd : $1.3\text{e}4/\mu\text{C}$ (x10 reduction with n-conv)

^{128}In : $1.6\text{e}2/\mu\text{C}$ (ca x1000(0) suppression factor)

But UC390Mk5 v4 quartz did not deliver Hg, Cd, Tl

New FEBIAD Ion Sources

- Modeling concept introduced last year by L. Penescu et al.
- Prototypes tested both offline and online
- Nb380: x5 on $^{72-73}\text{Kr}$ yields
- UC392: ^{229}Rn 180/ μC

Element	He	Ne	Ar	Kr	Xe	Rn
Standard ISOLDE MK7 ionization efficiency (%)	0.14	0.36	2.0	4.3	11	-
New Ion source ionization efficiency (%)	1.4	6.7	26	38	47	62

What else in the pipeline ?

Access to the Yield information

Find the produced isotopes from a given target

Nuclear Chart for ISOLDE

Find the produced isotope from an element independent on target

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Actinide targets (ThO, UCx)

$^9\text{Be}(\text{n},\alpha)^6\text{He}$

pure

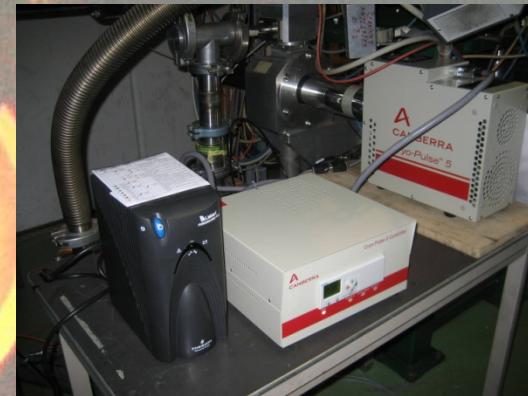
n-rich

Pure Lanthanide beams

And actual and future priority-1 RIB developments
(Group for Upgrade of ISOLDE)

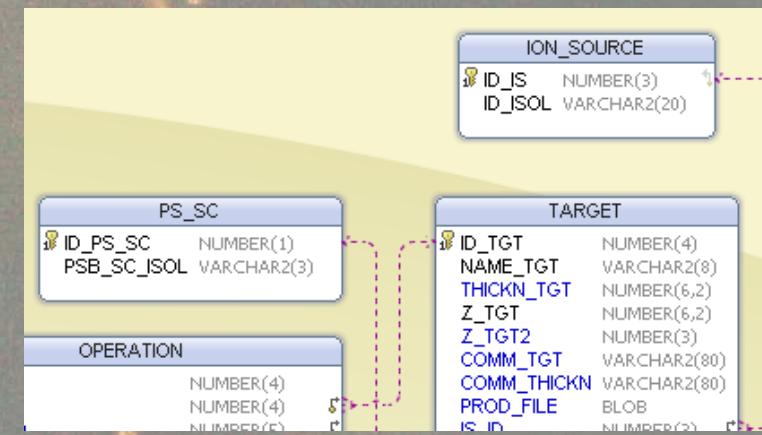
Target tests

Non liquid-N₂ cooled Ge detector



Fast (reliable) tape station from Strasbourg (Richard Catherall)

Technical Database (mtf, tests, etc)



Open positions



THE ISOLDE FACILITY

ISOLDE yields
 (test)
 REX-ISOLDE
 RILIS
 IMS
 Experiments
 Schedule
 ISOLDE Operatio



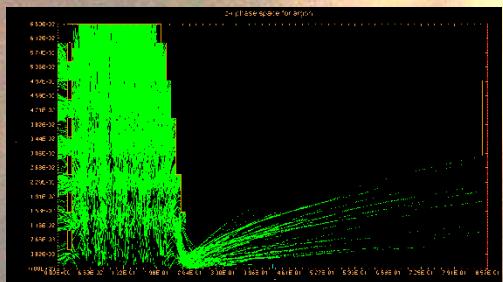
Technisches
 Doktorandenprogramm
 am CERN (Wolfgang-
 Gentner-Stipendien)

Informationen
zur Bewerbung

**Technisches Doktorandenprogramm für
 deutsche Doktoranden am CERN (Wolfgang-
 Gentner-Stipendien)**



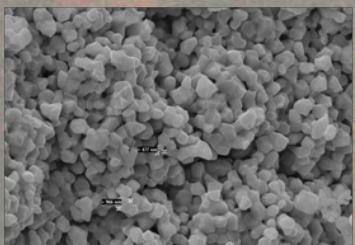
German Doctoral Student Programme at CERN



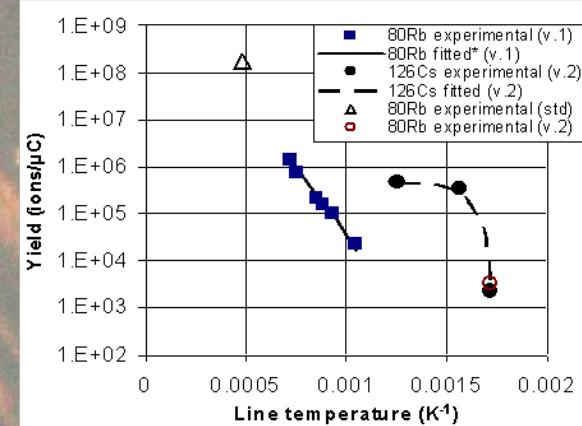
(plasma)-**physics**
(Modeling, experimental)

chemistry

(adsorption, phases)



(nano)-**materials**
(Synthesis, ageing,
diffusion)

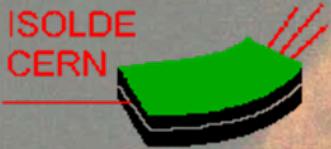


$$f_{th}(\lambda, T) = e^{\lambda \cdot t_0 \cdot \int \frac{dn_{coll}}{dl} e^{(-\Delta H_{ad} / kT(l))} dl}$$

Outlook

- The yield figures of the ISOLDE database (and planned at HIE-ISOLDE) have to be revised (increased!)
- The ISOLDE facility has a great variety of options to improve and develop the required beams (intensity, purity, quality):

RILIS, fast beam gate, HRS with slits, ISCOOL, REX, neutron converter, etc



Thank you !