

# Beam developments in 2011

Target and Ion Source Development (TISD)

Thierry Stora, EN-STI-RBS

With input from different colleagues

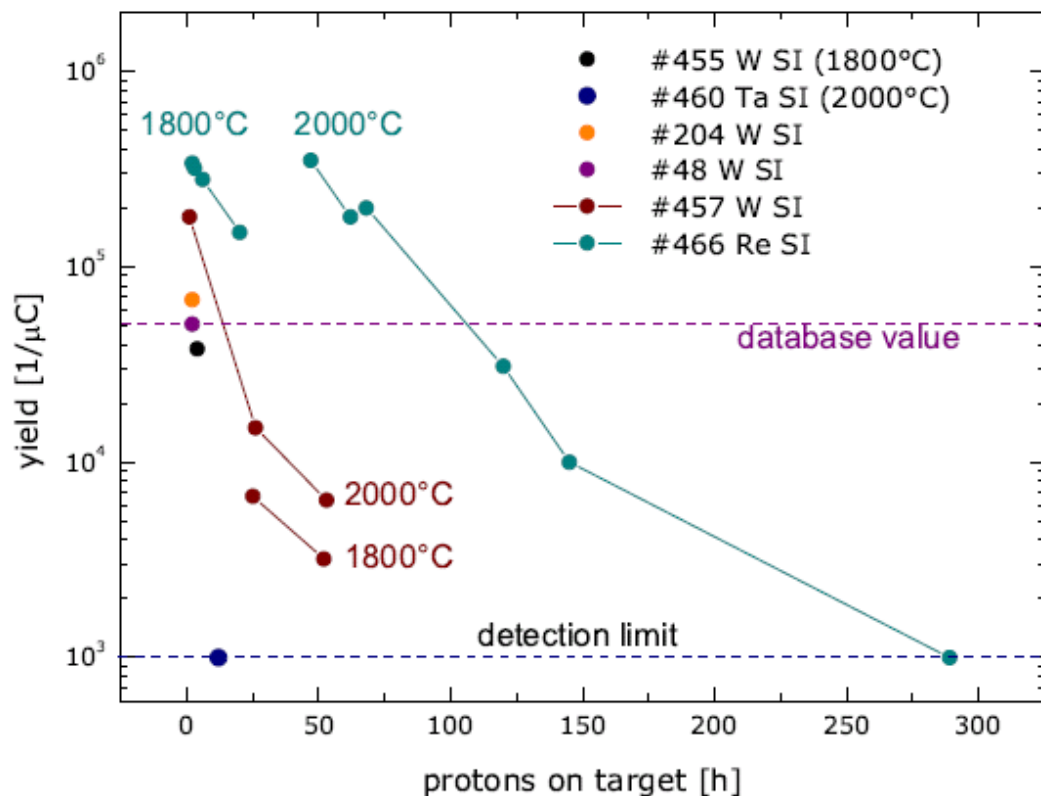
## From (since) last meeting

- $^{30}\text{Na}$  beam (recover historical yields)
- $^{72}\text{Kr}$  successful production
- Production of  $^8\text{B}$
- Completion of  $^{142}\text{Sm}$  beam development

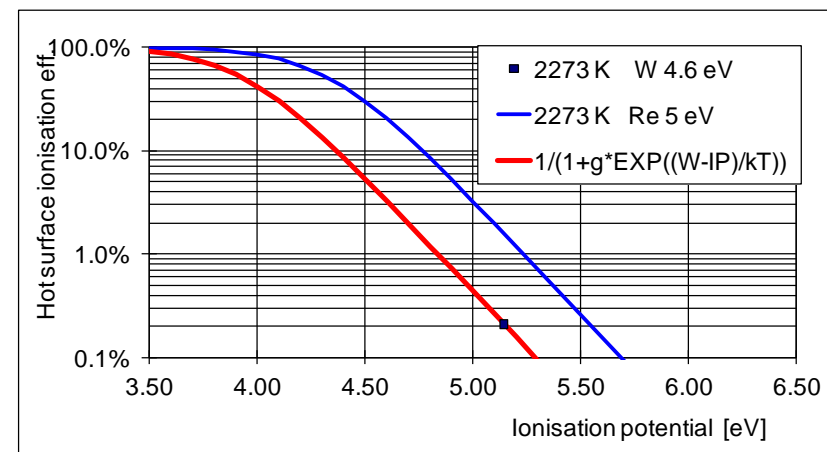
In addition

- $^9\text{C}$  ongoing development
- *Potential of VADIS/target*

# Recover of historical $^{30}\text{Na}$ yields



Manufacturing of a bulk Rhenium Cavity as hot surface ionizer



Evolution of yields of  $^{30}\text{Na}$  from UCx targets over time under irradiation at ISOLDE

# 72Kr beams

2  $10^4/\mu\text{C}$   $^{72}\text{Kr}$  from YO456-VD7 (VADIS ion source) (x10 improv. vs historical yields)  
 14  $^{71}\text{Kr}/\mu\text{C}$  (x7 improv.) (courtesy S. Kreim, ISOLTRAP)

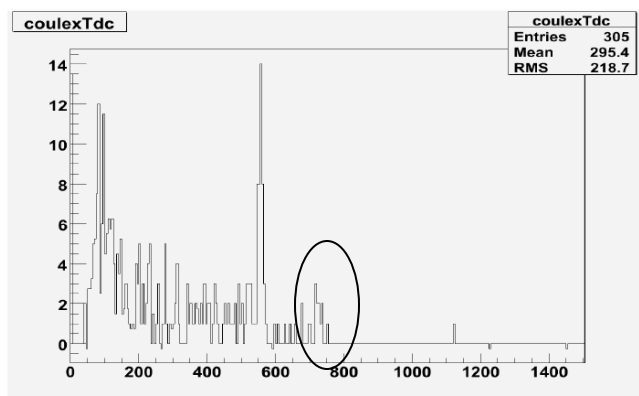
**IS478 16<sup>th</sup> to 22<sup>nd</sup> August 2011**

Report from IS478

*B.S. Nara Singh*

On 12<sup>th</sup> August, the yield checks from Thierry's group at the tape station on the central line showed that about **1500 pps** per 1.5  $\mu\text{C}$  proton beam at MINIBALL target position can be expected.

validate nuclear models. **We consider the outcome of this (although failed) experiment to be a big step forward and the feasibility of the measurement was shown beyond any doubt.**





# 8B beams (Carbon beams)

***1<sup>st</sup> online operation of a Helicon source for molecular Radioactive Ion Beams***

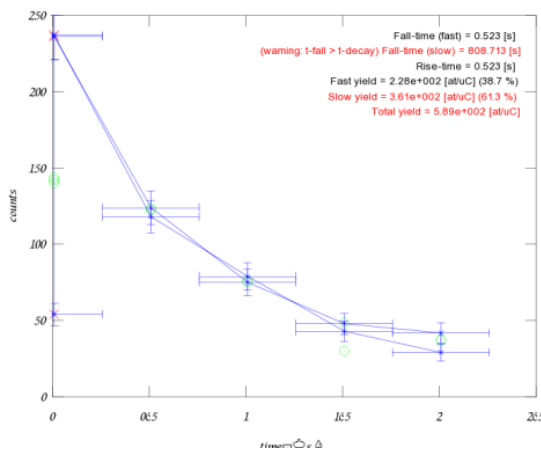
Production of  $^{17}\text{C}$  as  $^{17}\text{CO}^+$  to IS445

Successful use of double-stage extraction electrode

Stable operation and fast release of  $\text{CO}^+$  up to  $7 \cdot 10^{17}$  protons



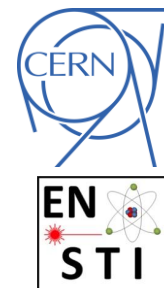
ISCCyield



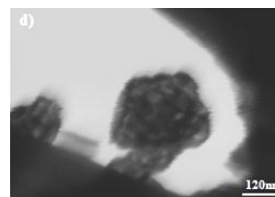
*P. Suominen, C. Seiffert, A. Gottberg, T. Mendonca, M. Czapski, IS445 H. Fynbo et al.*

# 9C beams + “Ar as Bonus”

A third target nanomaterial (SiC, Y<sub>2</sub>O<sub>3</sub>, **CaO**) for ISOLDE

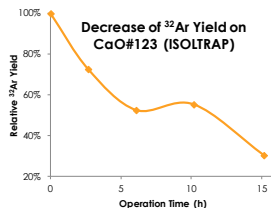


<sup>35</sup>Ar from CaO469-VD7 for 

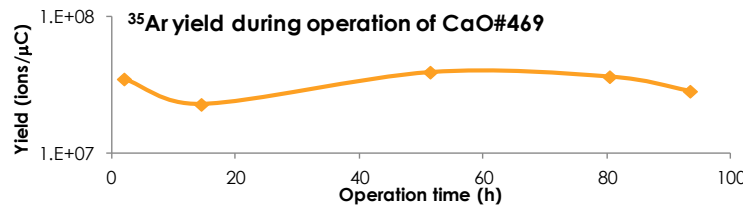


Proprietary CERN technology  
J. Nucl. Mat. 416, 99 (2011)

Before



Now



Protons per second	<sup>31</sup> Ar (15.1ms)	<sup>32</sup> Ar (98ms)	<sup>33</sup> Ar (174.1ms)	<sup>34</sup> Ar (844ms)	<sup>35</sup> Ar (1.78s)
ISOLDE	6.3E+01	3.6E+03	2.0E+05	2.6E+06	3.0E+08
TRIUMF	-	-	7.0E+02	2.9E+04	6.5E+06

Yields on <sup>31,32</sup>Ar measured by ISOLDE experiment IS476 – H. Fynbo and B. Blank.

Turrión, M.; Urszula, H.-I. ISOLDE Yield Database. [https://oraweb.cern.ch/pls/isolde/query\\_tgt](https://oraweb.cern.ch/pls/isolde/query_tgt) (accessed December 1st, 2011)

TRIUMF. ISAC Yield Measurement. [http://www.triumf.info/facility/research\\_fac/yield.php](http://www.triumf.info/facility/research_fac/yield.php) (accessed December 5th, 2011)

GANIL. SPIRAL Beams. <http://pro.ganil-spiral2.eu/users-guide/accelerators/spiral-beams> (accessed December 5th, 2011)

# $^{142}\text{Sm}$

## First RILIS Sm beam at ISOLDE

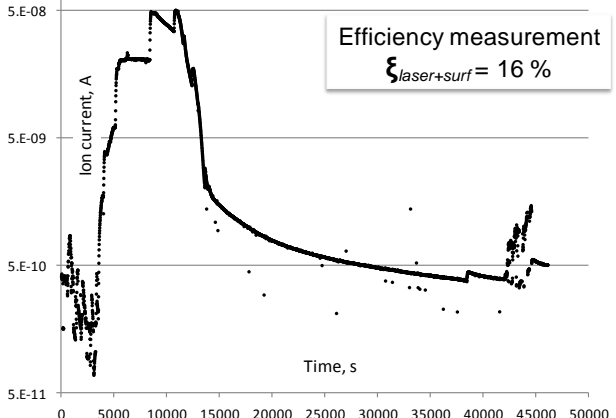


Attempted in 2010 with a  $\text{GdB}_6$  low work function cavity

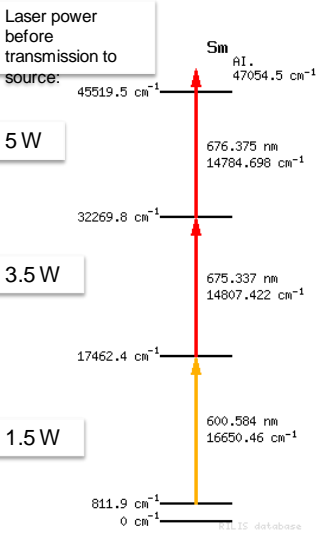
Re-tested in April 2011 with a standard Ta ionizer

No Sm was seen using the 2010 scheme but we discovered a discrepancy between two published values for the 1<sup>st</sup> step wavenumber. An alternative value was tested and determined to be the correct one.

1<sup>st</sup> step wavenumber: **2010 test:**  $16654.21\text{ cm}^{-1}$     **2011 correct value:**  $16650.46\text{ cm}^{-1}$



First RILIS run of 2011 with the refurbished RILIS room and new laser layout.



All 3 transitions were saturated

From: Amy Chiu  
 To: Thierry Stora  
 Subject: RE: order of GdB6 hollow tubes  
 Date: 19 January 2012 19:15:43

1. Material: **GdB6** Tube
2. Specification: Internal diameter: 3mm x External diameter: 5mm x length 4cm.  
 \*Open on both ends. Purity: 99.5%, Tolerance: +/- 0.2mm
3. Quantity: 10 pieces, USD\$320/pc CIF your there

delivery time: after payment 3-4 weeks

Amy Chiu 邱春

Huizhou Tian Yi Rare Material Co.,Ltd  
 惠州市天 有材料有 公  
 : 惠州市演 道世 天世 12K

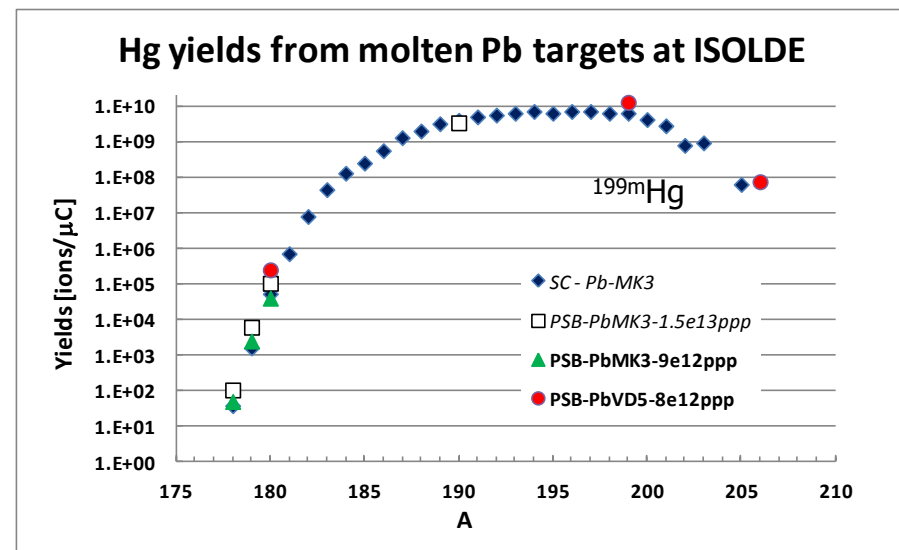
# « Bonus »

## Improved yields of Hg beams with VADIS ion source :

$^{199m}\text{Hg}$ ,  $^{193}\text{Hg}$  from Pb463-VD5 unit.

x5 improvement vs historical Molten Lead Target Units equipped with MK3 ion sources

*A. Gottberg, B. Crepieux,  
M. Owen, TISD team*

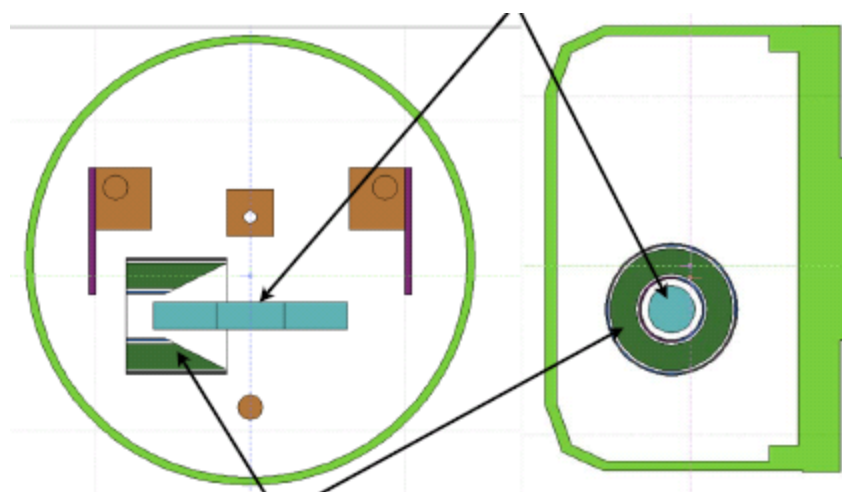
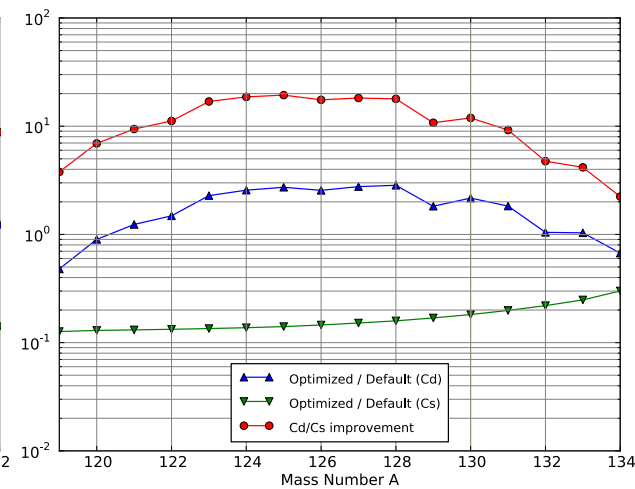
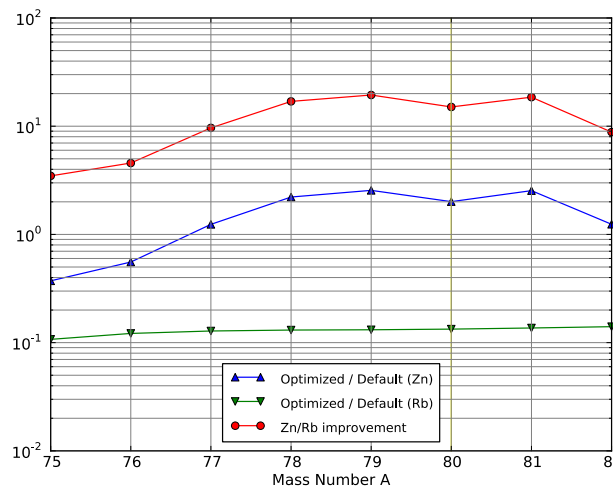


***178Lu produced from Ta/W/Ir mixed foil target unit***



# Ongoing

# N-converter optimization



R. Luis et al.  
ITN-Lisboa

# Molten salt target (72Kr, 18Ne for beta-beams)

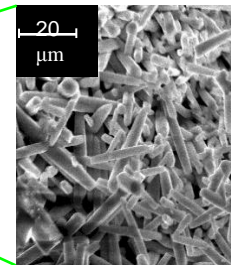
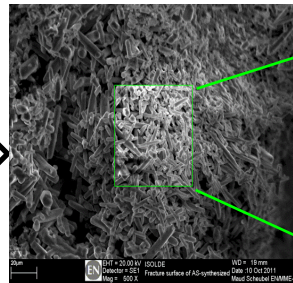
T.M. Mendonça, R. Hodak, M. Allibert, V. Ghetta, D. Heuer, T. Stora  
E. Noah, M. Taborelli, S. Sgobba, O. Benes

## Molten fluoride salts as targets in the production of $^{18}\text{Ne}$

- Target material preparation and quality control
- Preparation of the static target unit



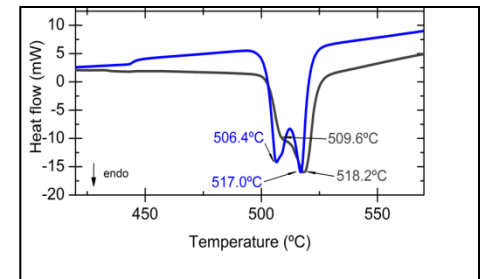
**$\text{NaF}:\text{ZrF}_4$**   
(60:40 %mol.)



Collab. S. Sgobba, EN-MME-MM

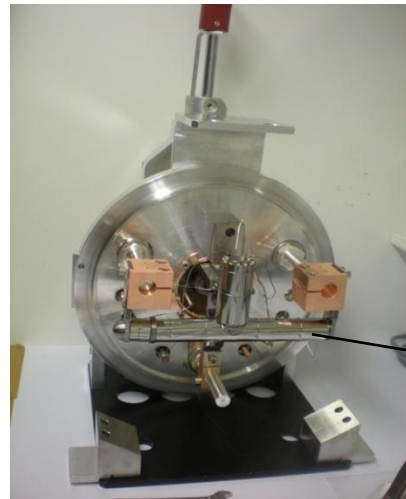
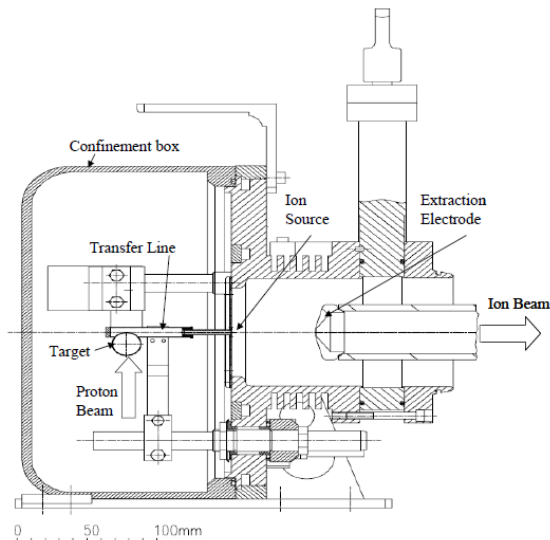
Collab. LPSC Grenoble

## Eutectic with melting points at $\sim 506^\circ\text{C}$ and $\sim 517^\circ\text{C}$

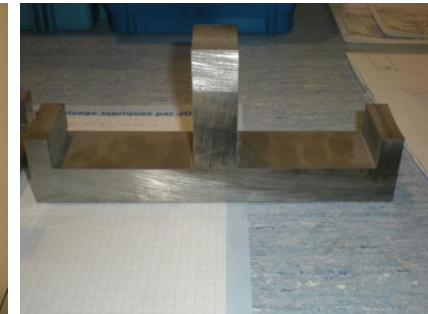
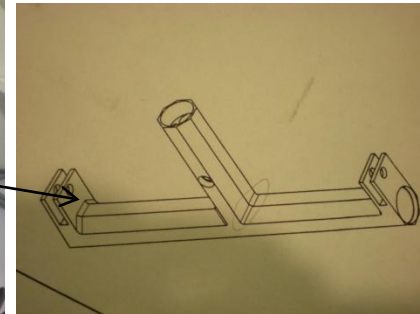


Collab. M. Taborelli, TE-VSC-SCC

## Validation of the target material using a static unit at ISOLDE (2012)



## Container in fluoride resistant alloy (Haynes 242) In production (Cern Main Workshop, EN-MME-MS)



Information	Discussion	Files
<b>Experiments at CERN</b>		
Title	Production and Release of Gas and Volatile Elements from Sodium-based Targets	
Author(s)	Stora, T. ; Plewinski, E. ; Noah, messomo, E. A. ; Wildner, E. ; Catherall, R.	
Experiment	IS509	
Institutes	See all IS509 institutes	
Approved	01 December 2010	
Status	Preparation	
Collaboration	ISOLDE	
Accelerator	ISOLDE	
Abstract	Several large scale facilities being studied for Europe use sodium or a sodium-based alloy either	

# Pb/Bi loop for EURISOL



# Next items

Input:

Should be compatible with LS1, ie ready to go online in 2012 or offline studies to prepare for 2014.

Human resources for this activity