Target and **I**on **S**ource - ***D****evelopment*

Applications for high power targetry

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ISOLDE TISD

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HighInt

100kW target station

Beam intensity (purity) and target temperature

RIB intensity [s^{-1} μA^{-1}]

Prim. Part. beam Intensity [s^{-1} μA^{-1}]

Avogadro #

Diffus.+Effus. Efficiency

Beam transport Efficiency

$$I = \int \sigma(E)\Phi(E,x)\rho(x)\,N/A\,dx\,\varepsilon_{diff+eff}\,\varepsilon_{ion}\,\varepsilon_{optics}$$

Cross section [cm^2]

Target density [$g\ cm^{-3}$]

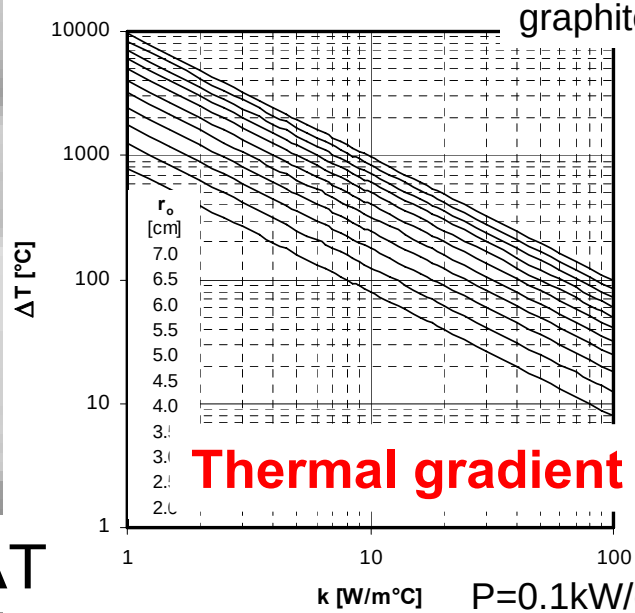
Target Atomic Mass [g]

Ionization Efficiency

Energy deposition [MeV $g^{-1}cm^2$]

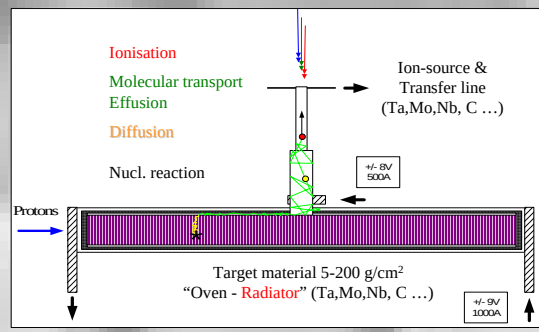
$$-\frac{dE}{\rho dx} \propto Z/A$$

Oxide | Carbide | Metal graphite



T=(1200-2200°C) + ΔT

P=0.1kW/cm2

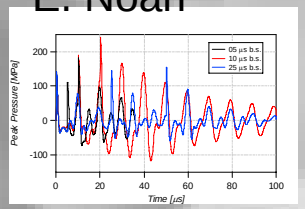


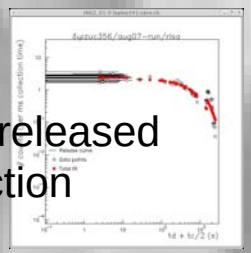
Release time [s]

$\tau_0 \sim V^y \exp(1/T)$

Approach used in TISD

E. Noah





Po released fraction

L. Penescu
Ar/Cl in FEBIAD

$$\sigma_{q\to q+1} \approx 4{,}5\cdot 10^{-14}\sum_{nl}\frac{\ln\left(E_e / E_{q+1,nl}\right)}{E_e \cdot E_{q+1,nl}} cm^2$$

Baseline parameters

FLUKA ANSYS
Thermal conductivity
Target material ageing

HEAT:
Deposition, transfer

FLUKA
Nuclear cross sections:
SigmasWin2000 ABRABLA

ISOTOPE PRODUCTION

RIBO RaBIT
Specific surface
Online tests

ISOTOPE RELEASE:
Diffusion, effusion

E. Bouquerel
Quartz v3.0

CPO VORPAL
Online tests
Emittance meter

ION SOURCE:
Efficiency, emittance

On-paper Target Unit Design

Tests of specific components

Validation

Prototype test

Final Target Unit Design
Target station specifications

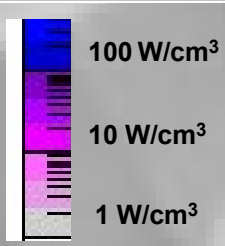
From EURISOL DS, Task#3

T. Stora

100kW oxide target benchmark

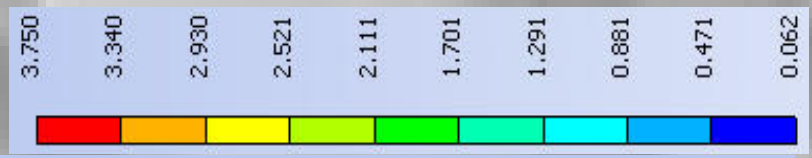
Al_2O_3

Heat deposition, FLUKA,
σ=7mm, R=3σ, 1GeV p, 100kW, X=200g/cm^2

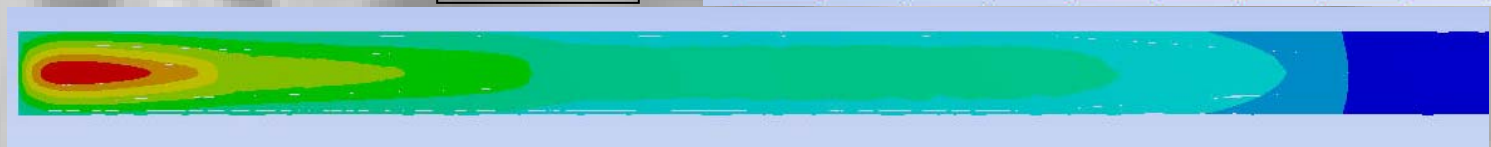


3750°C >> Melting Point !!

1700 °C



100 kW



Heat transfer, ANSYS wb 10.0

Radiative cooling towards T=25ºC

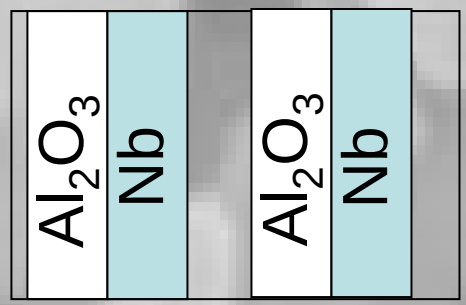
λ=1-4 W/mK

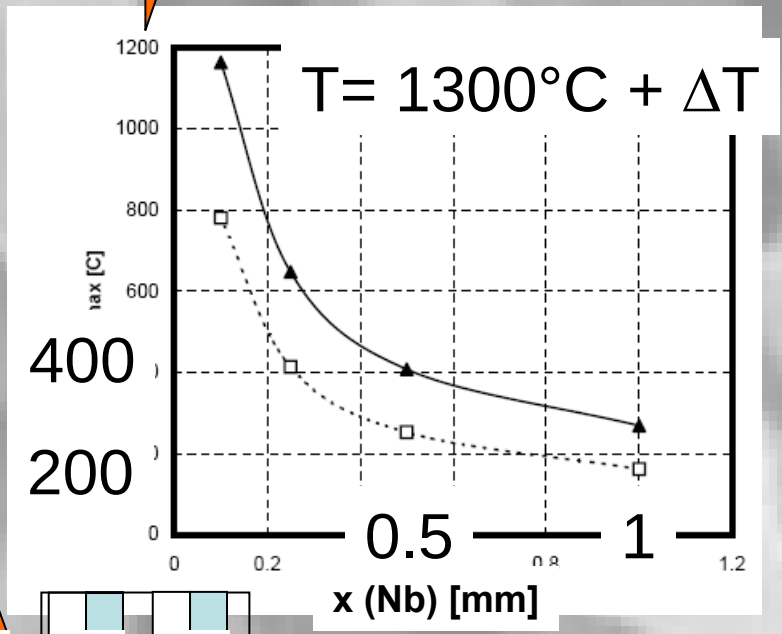
Oxides are thermal insulators

Oxide target material

T=30°C

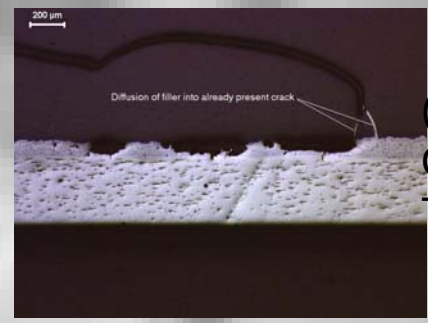
p 1GeV
25kW





Niobium / Al_2O_3 composite under development

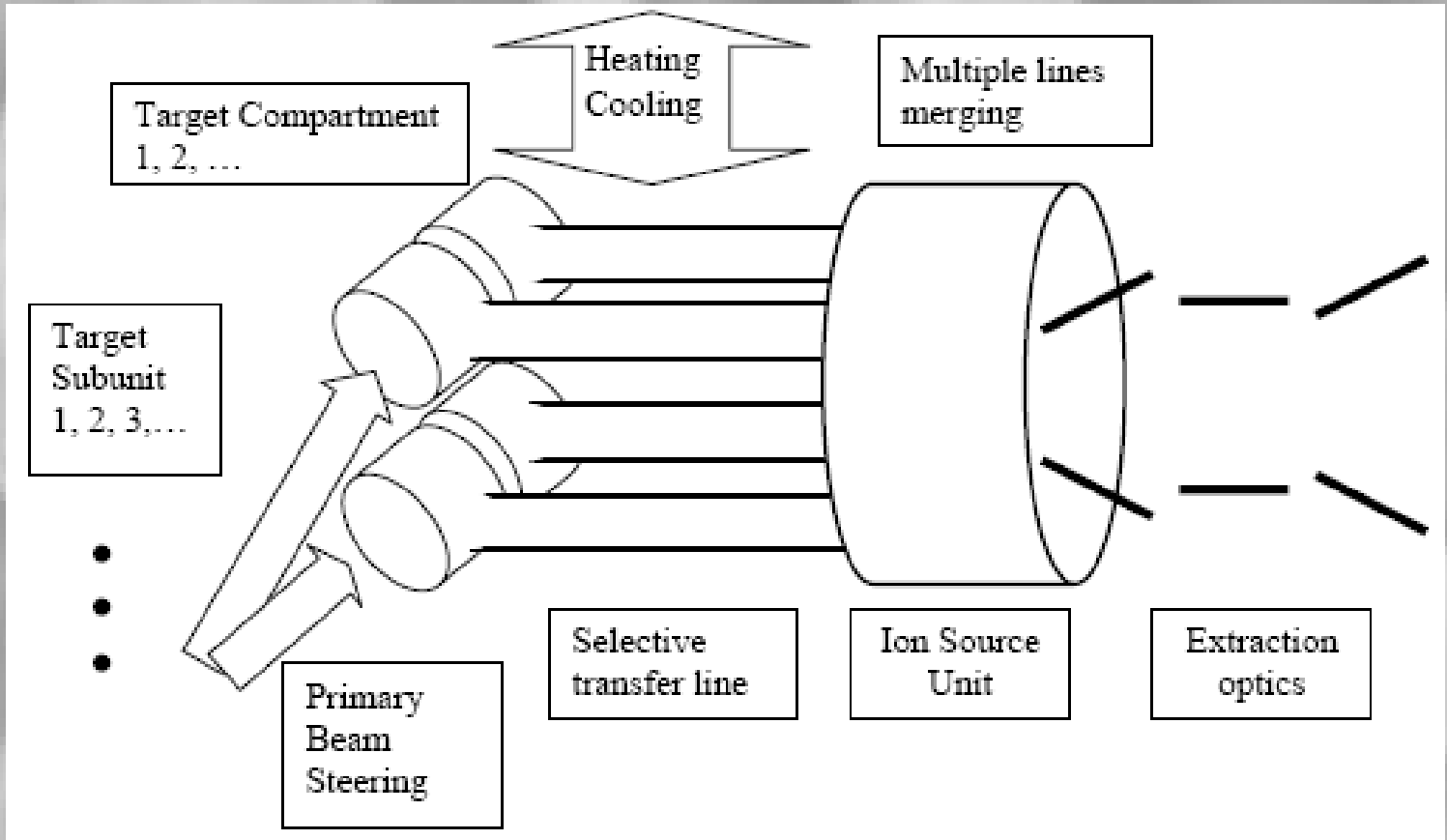
(S. Fernandes, S. Mathot)



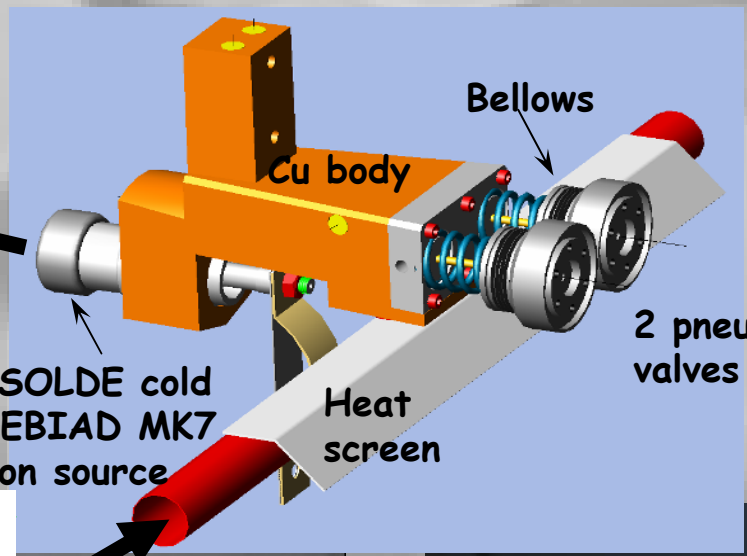
(Courtesy Of TS-MME)

Material Parameters	Al2O3 const.	Nb @ ~1700C
emissivity [-]	0.38	0.22
th. cond. [$Wm^{-1}C^{-1}$]	2	79

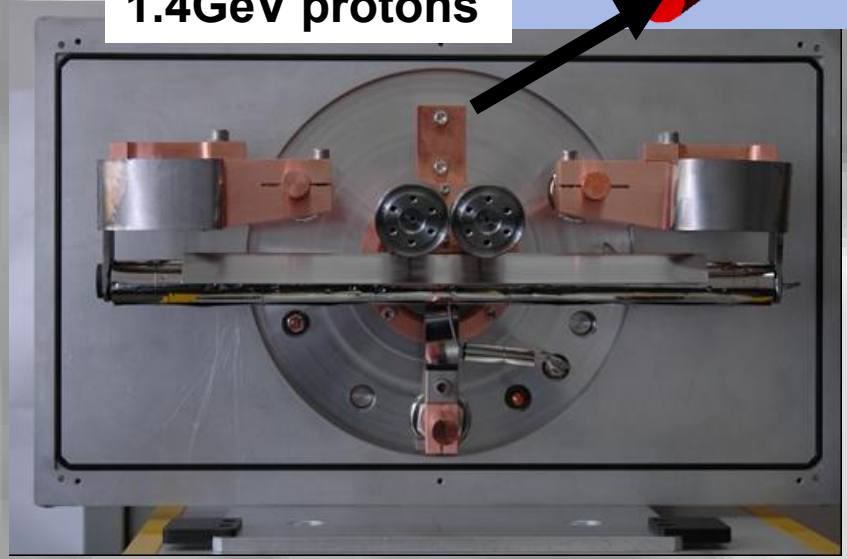
100kW Solid target benchmarks

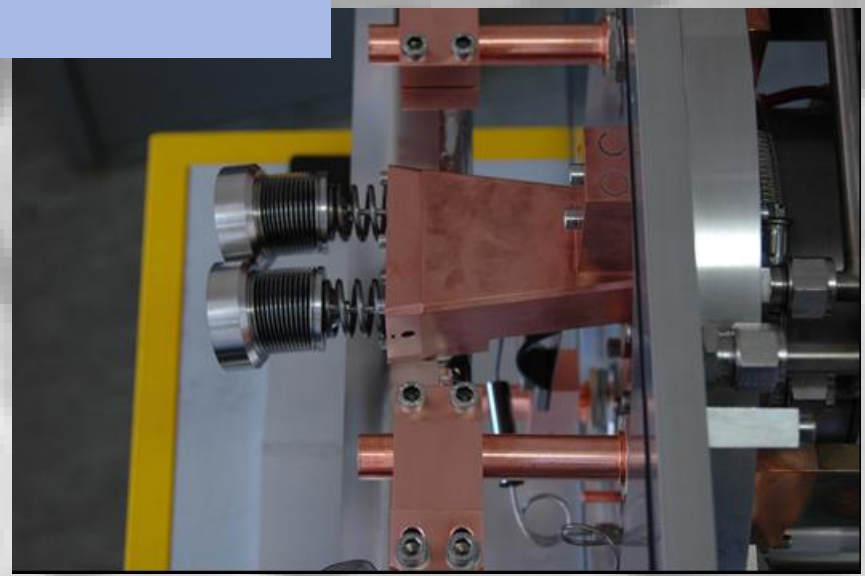


Double effusion line prototype (E. Bouquerel, L. Penescu)



2xwater cooled transfer lines
2x20cm containers

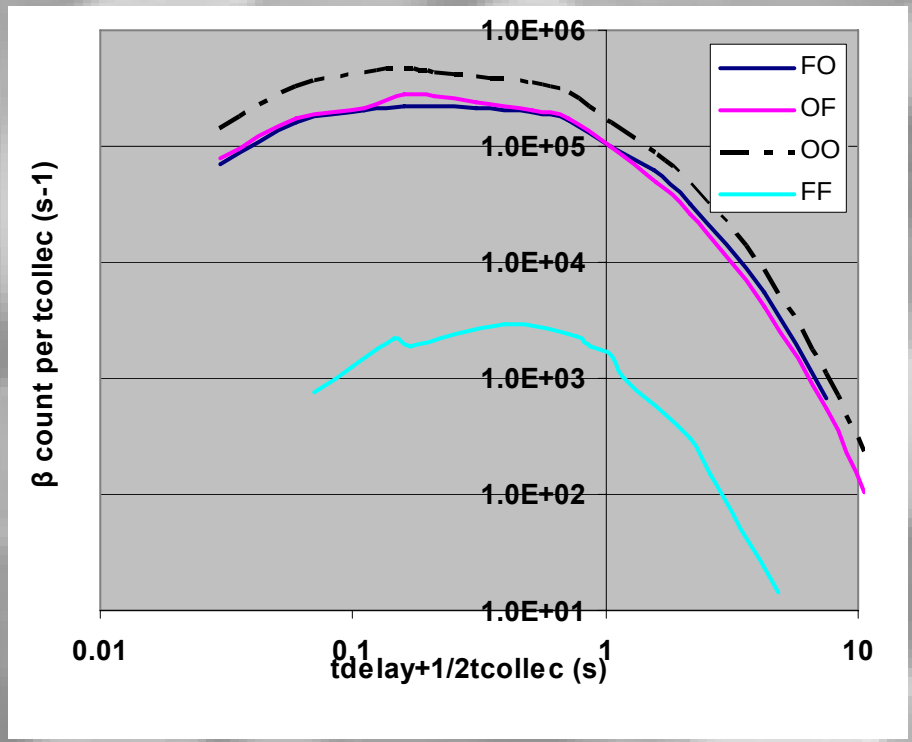




CaO344 online Apr 2007 Experimental data

35Ar

O: Open
F: Closed



Closed valve leak rate : 0.3%

Ratio (OO)/(OF+FO)
^{34}Ar : 95%
^{35}Ar : 83%

Symmetry : (FO)/(OF)
^{34}Ar : 94%
^{35}Ar : 92%

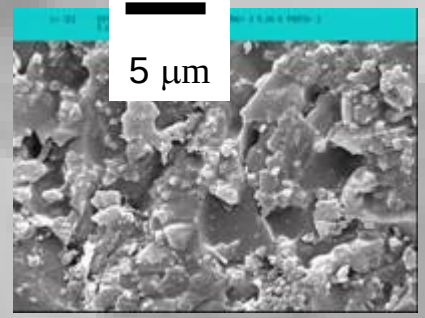
Ion source efficiency :
(FO or OF) Ar : 5.1%
(OO) Ar : 4.9%

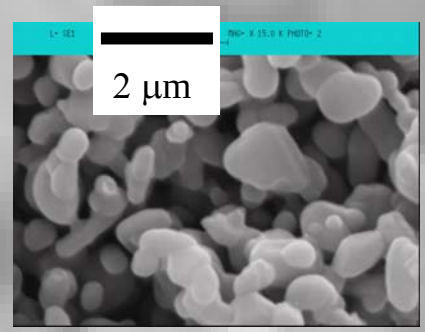
E. Bouquerel, L. Penescu, E. Barbero, D. Carminati, R. Catherall, B. Crepieux, J. Lettry, S. Marzari, E. Noah, T. Stora, R. Wilfinger

SiC353-364 (May-Sept07) online

(S. Fernandes)

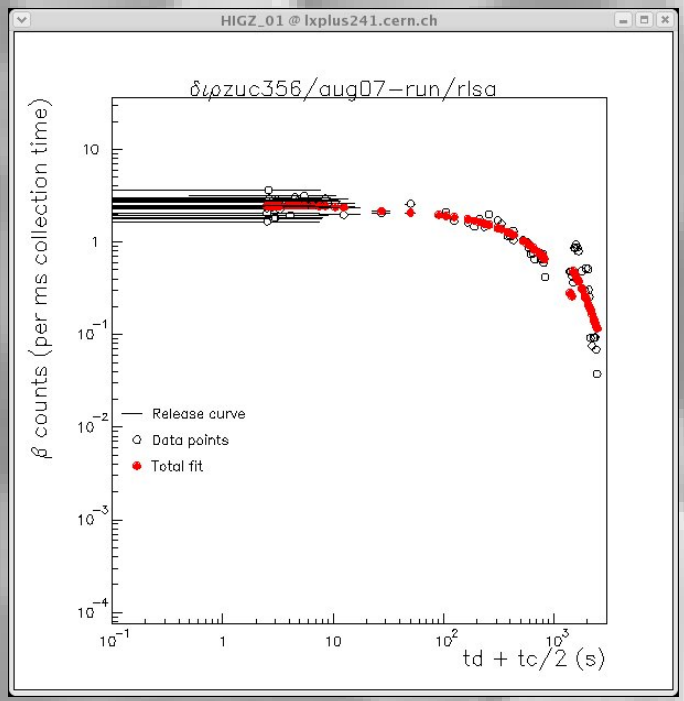
Sample description	Bulk density (g/cm^3)	Average total porosity (%)	Average grain size (μm)
SiC Starfire (CIP + Infiltration)	2.4	20	0.3
			0.7
SiC SG Saint –Gobain (CIP)	1.2	62	0.6

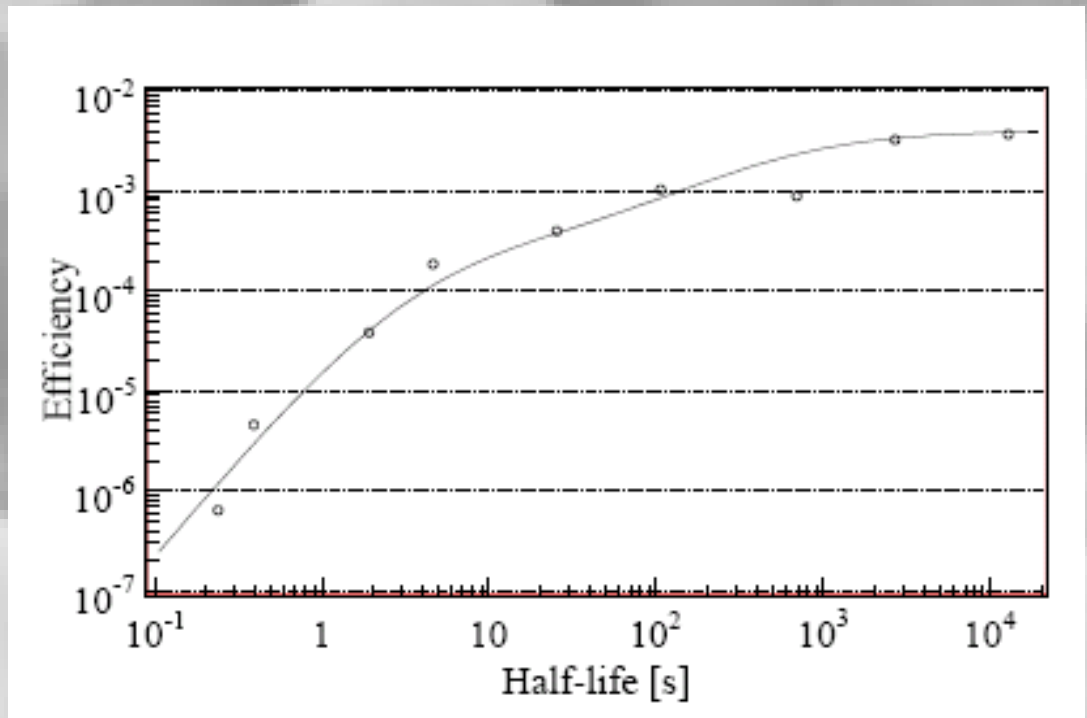




- Record ^{21}Mg and ^{22}Mg yields at ISOLDE, maintained for 2e18 protons (6e18p for ^{17}F)
- Post irradiation analysis of SiC334 started

In-target production
Released fraction





Po isotopes, UCx+RILIS,
T. Cocolios et al.

TISD

- 2008 will experience a strong reduction in resources for target tests and TISD
- A large number of projects for beam development are in the pipeline
- Only one new development is foreseen for 2008 (Priority list, Standing Group for Upgrade of ISOLDE)