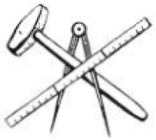
Task #3 :
100kW direct target stations



^{6}He & ^{18}Ne beams generation for β-beams

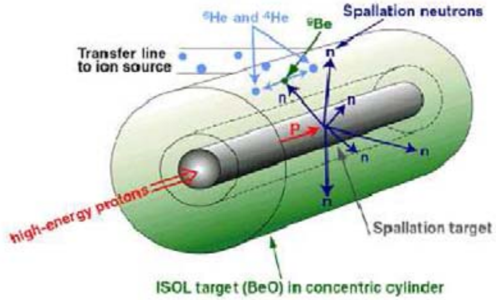
T. Stora on behalf of the Task

We acknowledge the financial support of the European Community under the FP6 “Research Infrastructure Action - Structuring the European Research Area” EURISOL DS Project Contract no. 515768 RIDS .

^{6}He production

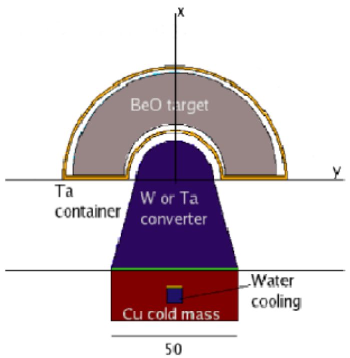
TN 03-25-2006-0003
TN 03-25-2006-0004

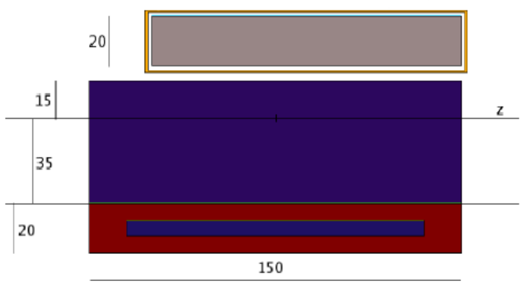
PhD thesis, M. Santana Leitner



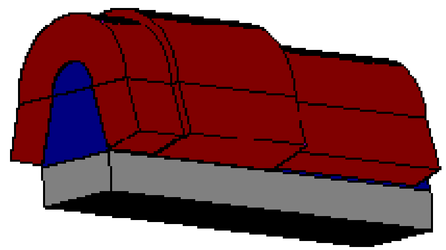
^{9}Be (n,α) ^{6}He

- In-target production :
  2 10^{13} ^{6}He/s 100kW, 1 GeV proton beam





Ø3cm , 15cm

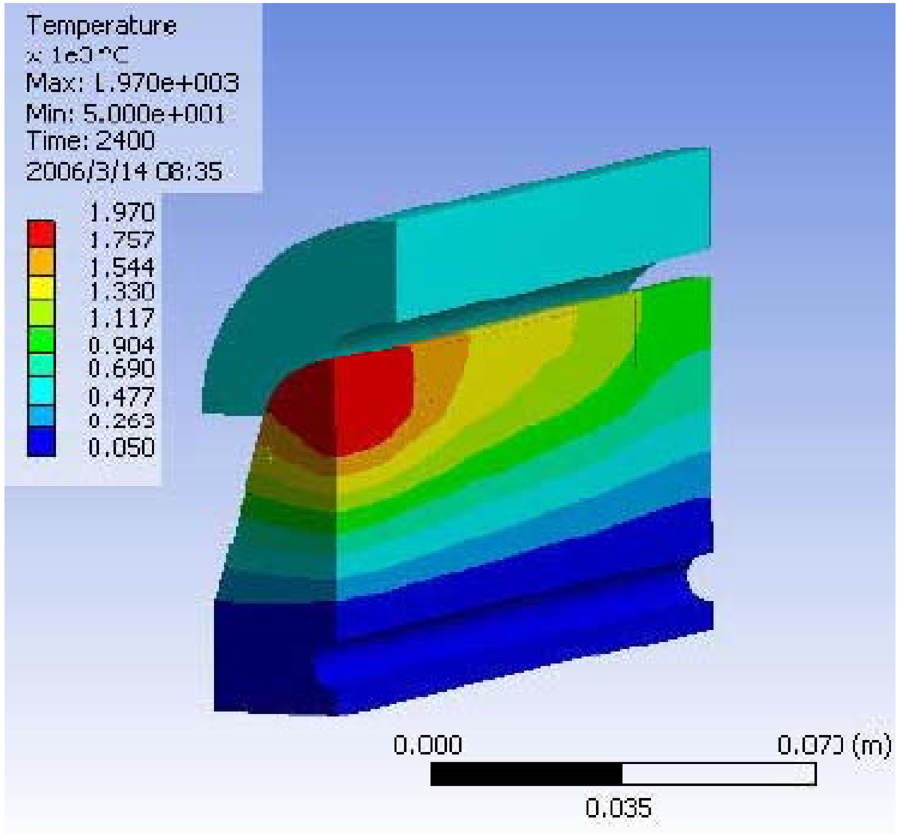


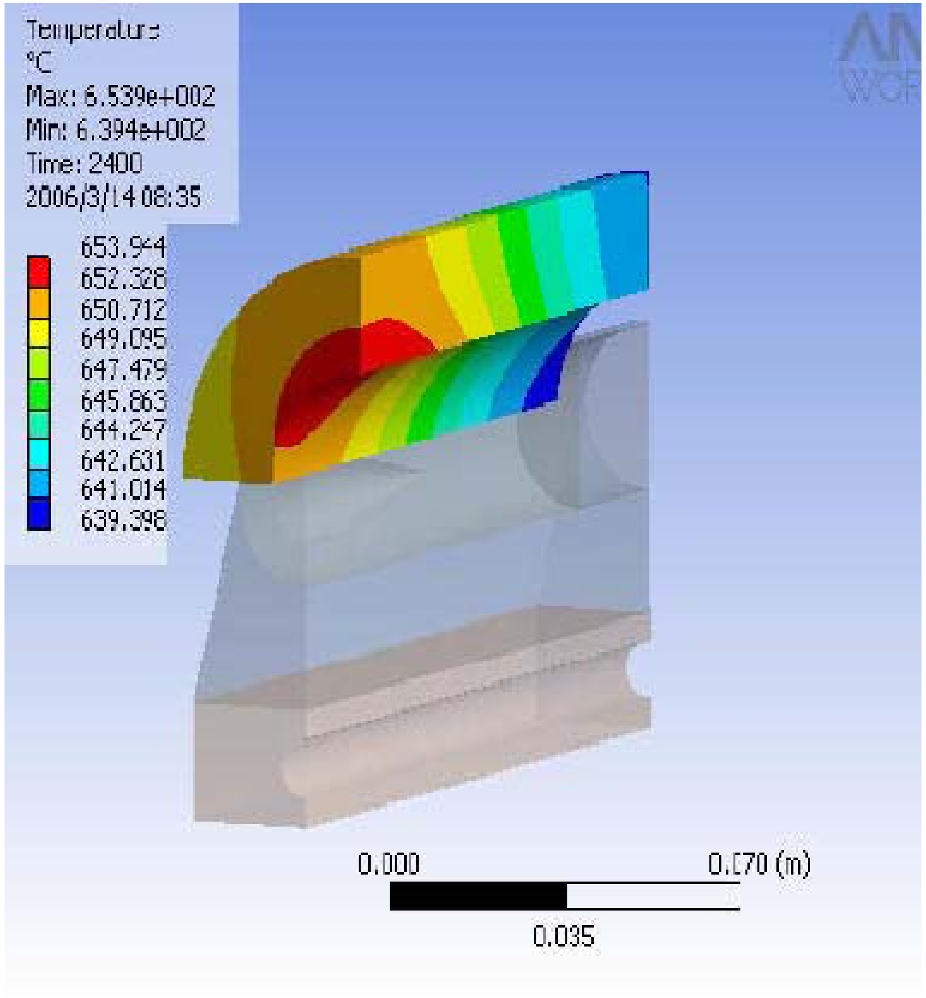
Ø3cm , 24cm

"Engineered oriented conceptual design"

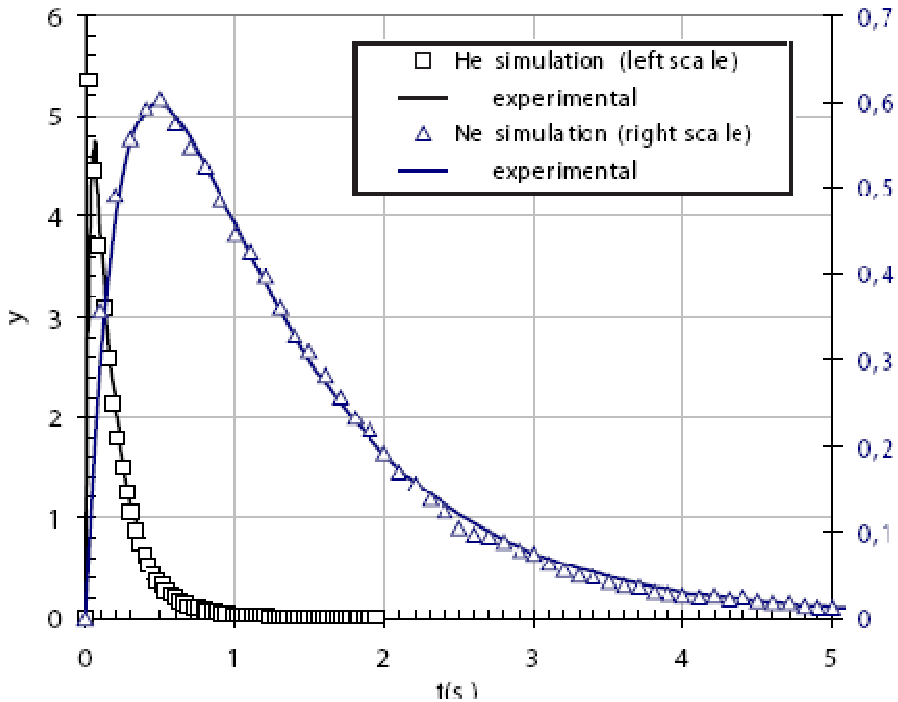
In-target production:
10^{14} ^{6}He/s 200kW, 2 GeV proton beam

Converter (3 cm diameter), σ_{beam} = 6mm

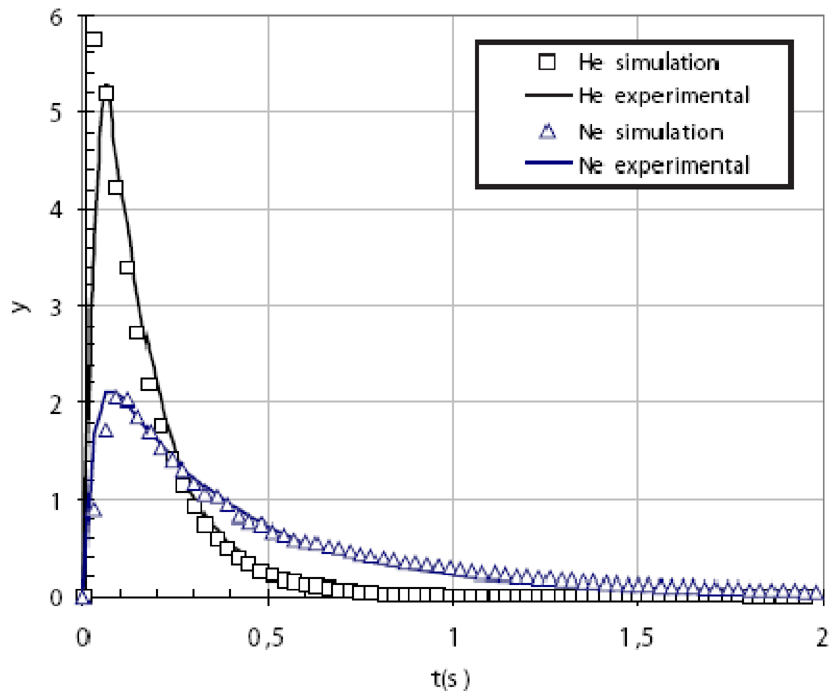




Existing experimental release curves at CERN-ISOLDE



ZrO_2



CaO

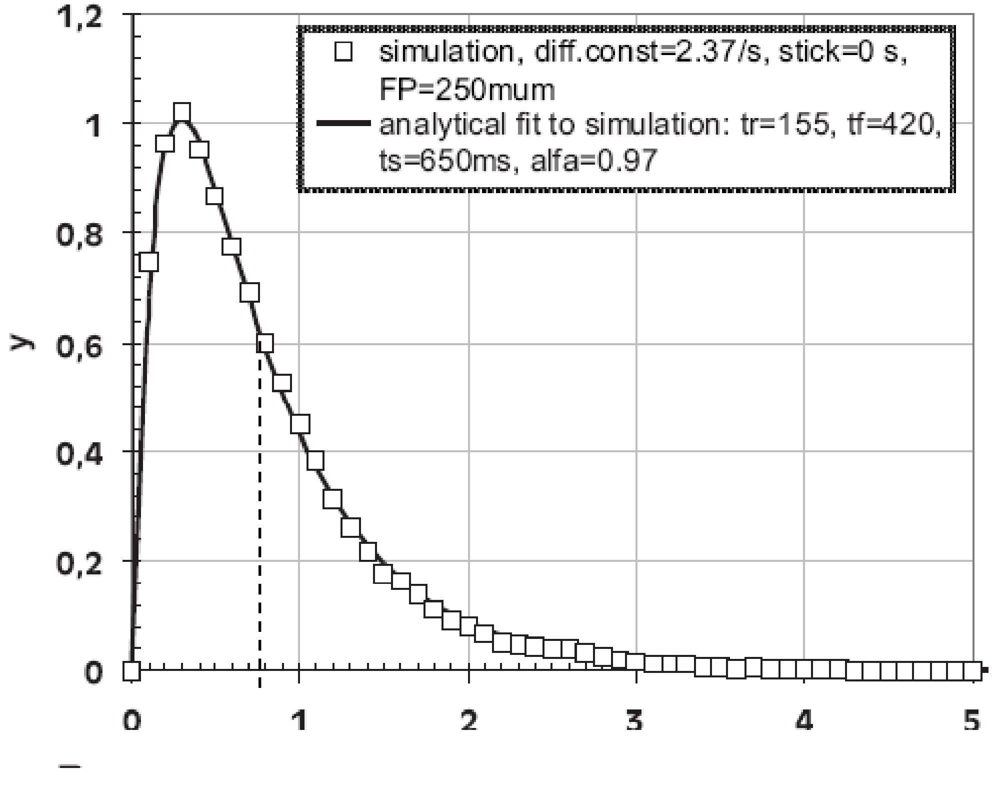
From M . Santana-Leitner

6th β-beam meeting
CERN – 22nd Oct 2008

Task #3

RIBO simulation

30cm long, 4-24 cm diameter thick BeO target



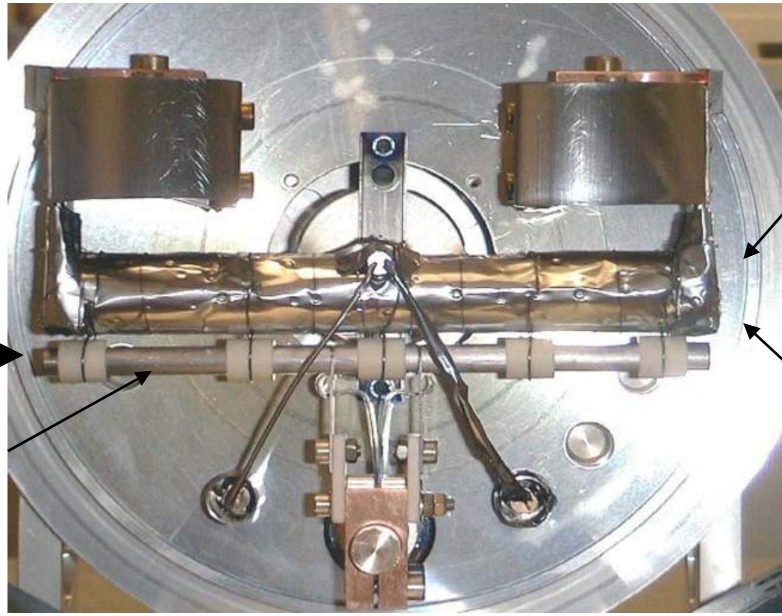
t [s]

M. Santana-Leitner, PhD thesis

Planned tests at CERN-ISOLDE (2009)

1 – 1.4 GeV from PSB

p-n W converter



VADIS ion source for Noble Gases
(1+ FEBIAD, cold line)

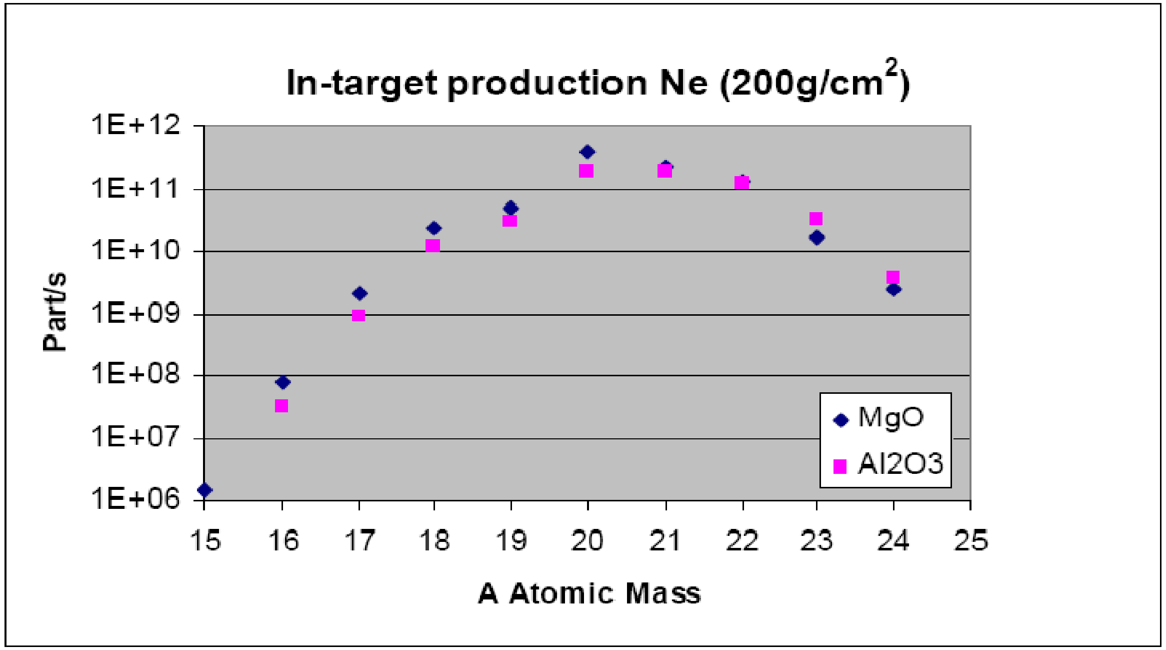
100 porous
BeO pellets

Release efficiency, operation temperature, outgasing, materials compatibility, ageing, etc..

We should obtain ~ 10^{10} x $\varepsilon_{released}$ $^{6}He^{+}$/s (~ $\varepsilon_{released}$ nA) for 3 kW beam.

^{18}Ne production

- Direct spallation of 1 GeV protons onto thick oxide targets Al (p,X) ^{18}Ne

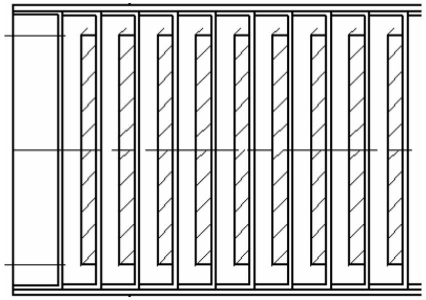


Silberberg-Tsao,
Thin target approx.

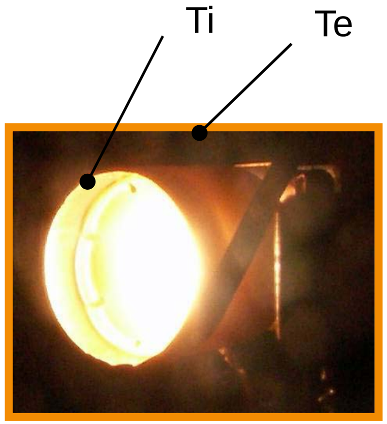
Nominal parameters:

3 10^{10} part/s (Fluka)

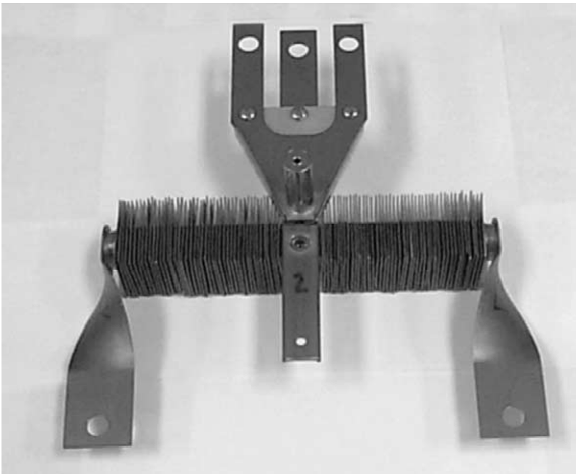
Preparation of EURISOL Oxide prototype tests - s1149

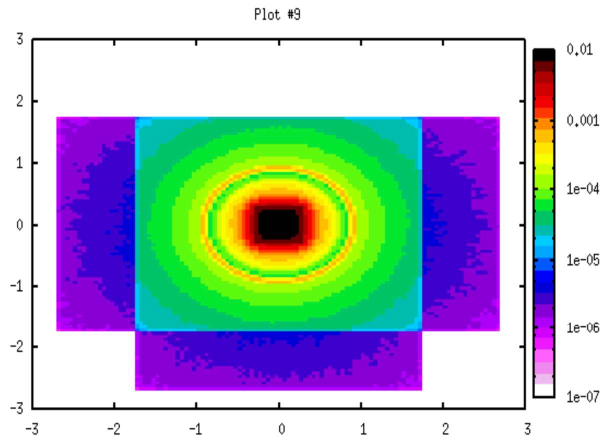


Nb-Al_2O_3 brazing

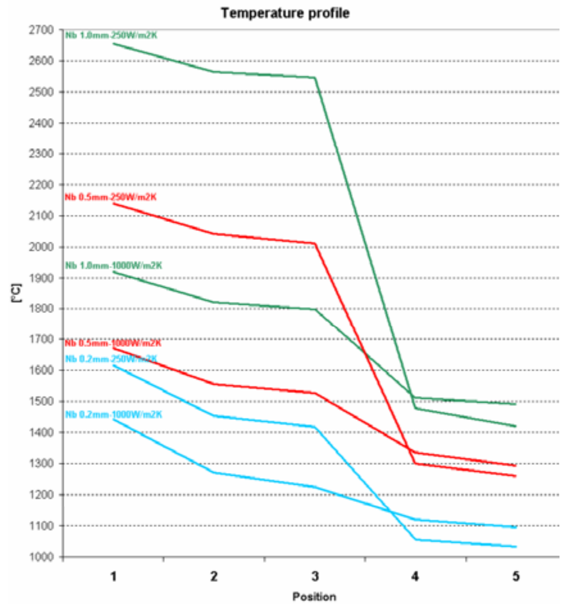


Thermal contact conductance





May 2009



EURISOL
Design Study

6th β-beam meeting
CERN – 22nd Oct 2008

Nominal parameters

Parameter	Symbol	Units	EURISOL Nominal	TRIUMF
Beam particles	Z_{beam}	-	Proton	Proton
Beam particle energy	E_{beam}	GeV	1	0.5
Beam current	I_{beam}	μA	100	100
Beam time structure	-	-	50Hz	cw
Gaussian beam geometry	σ_{beam}	mm	7	2.6
Beam wobbling parameters				
Beam power	P_{beam}	kW	100	50
Target material	Z_{targ}	-	$Nb\text{-}Al_2O_3$ composite foil	$Nb\text{-}Al_2O_3$ composite foil
Target thickness	X	g/cm^2	50	10 – 100
Target radius (cylinder)	r_{targ}	mm	$3\sigma_{beam}$	$3\sigma_{beam}$ – $5\sigma_{beam}$
Target temperature	T_{targ}	°C	1600	1200-1600
Number of target containers	j_{targ}	-	4	1
Ion-source type	IS	-	ECR – (MK7 FEBIAD)	MK7 FEBIAD type
Ion-current	I_{RIB}	μA	5	
Efficiencies	ε_{IS}	%	20 (1)	
Plasma ionization outlet diameter	$Ø_{out}$	mm	3	
Number of ion sources	j_{IS}	-	1	1
Emittance	E_{IS}	mm.mrad	20π	

10-20Hz?

10 (20 wob)

16

1450

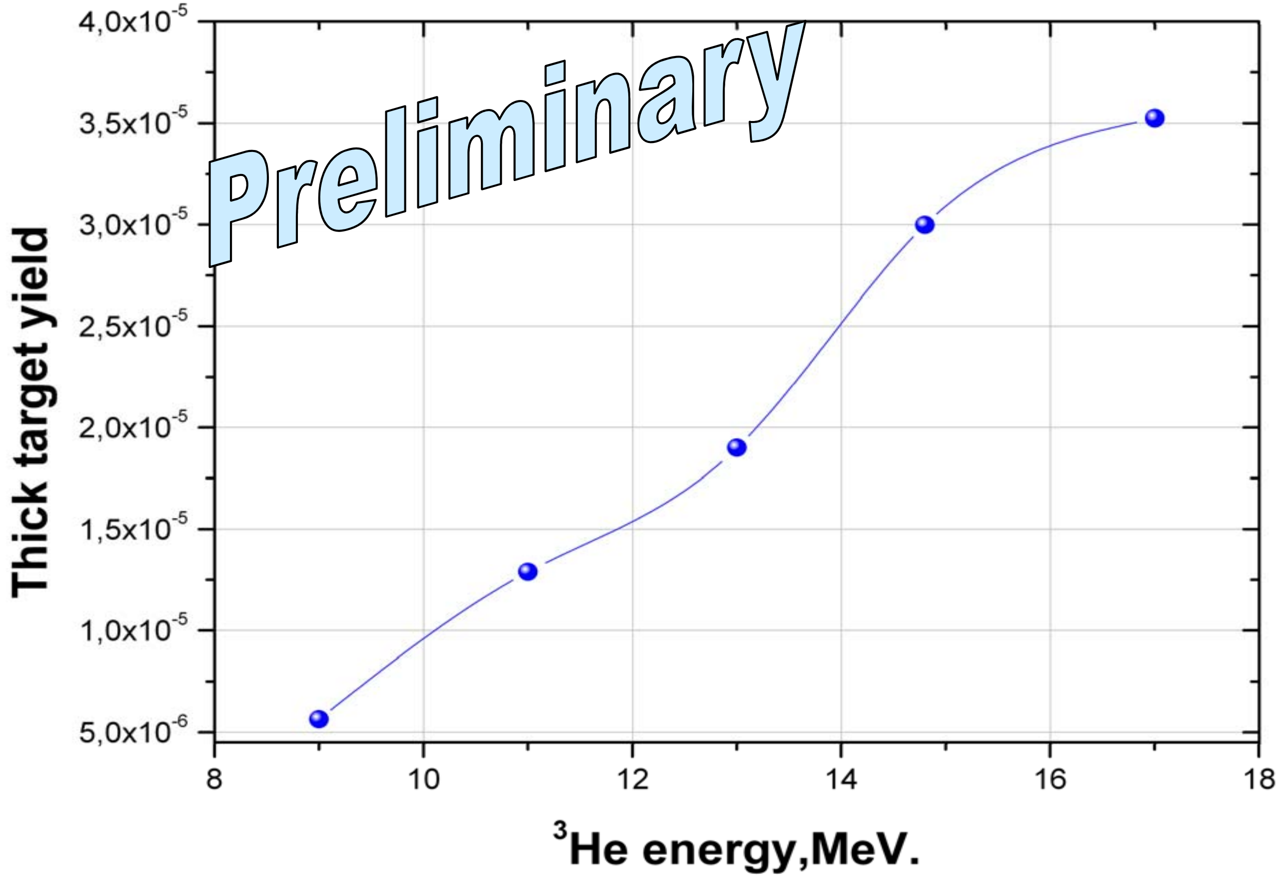
In-target prod (ABRABLA)

$5.3\ 10^8/\mu C$ ($2\ 10^{11}$/200kW)

1+ ion production (/10kW) :

$5\ 10^8\ \varepsilon_{rel}\ ^{18}Ne^+$ ions/s

Alternative scenario for ^{18}Ne prod (M. Loiselet, S. Mitrofanov)



^{16}O(^{3}He,n)^{18}Ne thick *(O_2)* target yield

Alternative scenario for ^{18}Ne prod (M. Loiselet, S. Mitrofanov)

- Production yield with ^{3}He at 17 MeV in an oxide target (Al_2O_3):

  $9\ 10^{7}$ 18Ne/μC

- Rough estimation: to produce

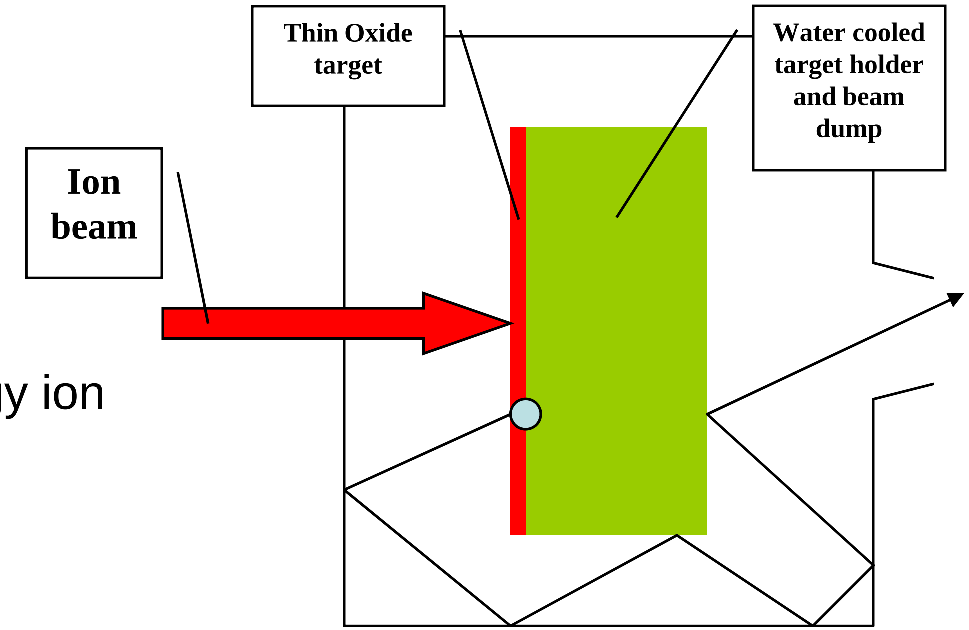
10^{12} ^{18}Ne/s : 12 mAp of ^{3}He at 17 MeV (~200 kW)

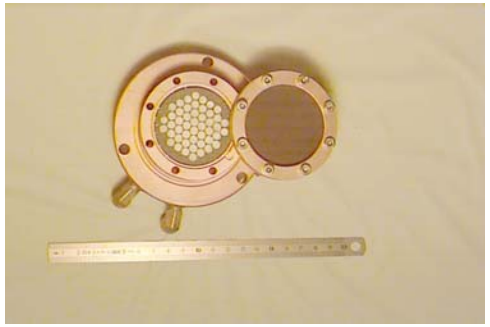
(Eurisol: ~10^{12} ^{18}Ne/s)

..10^{13} ^{18}Ne/s: 120 mAp of ^{3}He at 17 MeV (~2 MW)

Issues yet to be addressed

- To be studied:
  - Extraction efficiency
  - Optimum energy
  - Cooling of target unit
  - High intensity and low energy ion linac
  - High intensity ion source





LNL targettry
range of 20 MeV ^{3}He : ~0.3 mm
9kW is spread onto 4cm diameter disk
2MW would need 60cm diameter disk shape

Report in preparation

Conclusion and Outlook

- Two production scenarios can be put forward for ^{6}He and ^{18}Ne ion beam delivery
- Engineered-oriented validation needs to be performed, with for instance appropriate prototypes and in-beam tests
- We plan to include a distinct β-beam part in the final EURISOL-DS report

Hey, Elouan, have you got an idea to deliver 10^{14} ions/s ??

Hey, dad, don't you think it's the right time to step back a bit ??!!

Thank you !