UCx Fission Target and Geometry for High Yields of Exotic Ions

Luigi B. Tecchio
On behalf of T4

Laboratori Nazionali di Legnaro, LNL
Viale dell'Università 2 – 35020 Legnaro (PD) – Italy
tecchio@lnl.infn.it

Task#4 – Fission Target

EURISOL Design Study

Content

Fission Target assembly

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Task#4 – Fission Target

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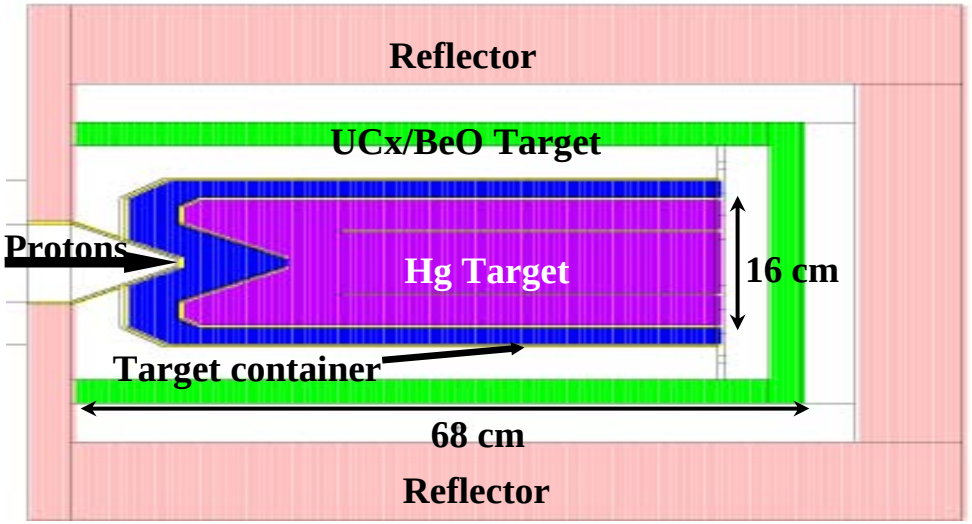
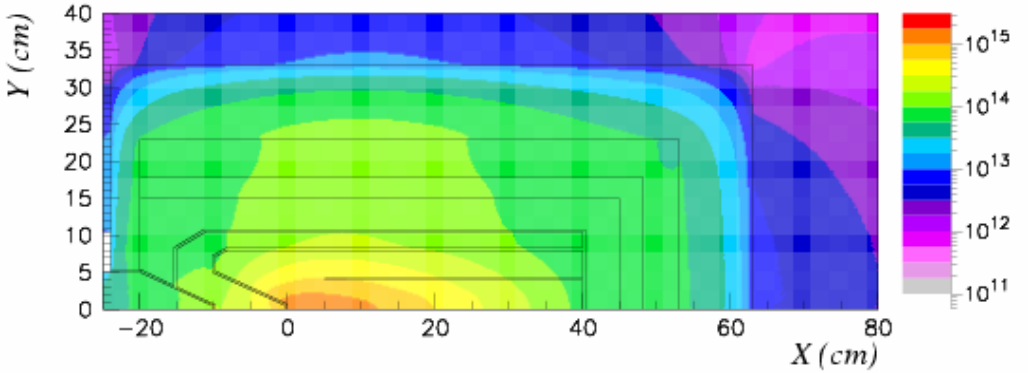
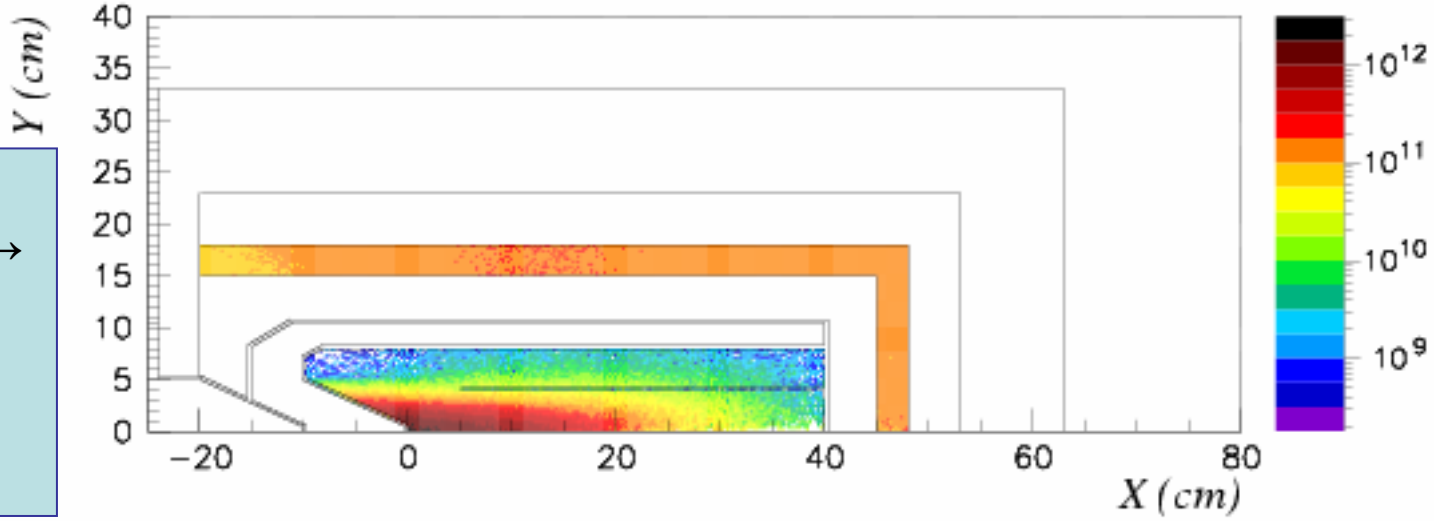
Neutron flux in the fission target >10^{14} n/cm^2/s/MW of beam





2×10^{12} fiss/cm^2/s/MW, homogenously distributed → >10^{15} fissions/s each target for 4 MW of beam with $UnatC_3$ (3 g/cm^3) fission target



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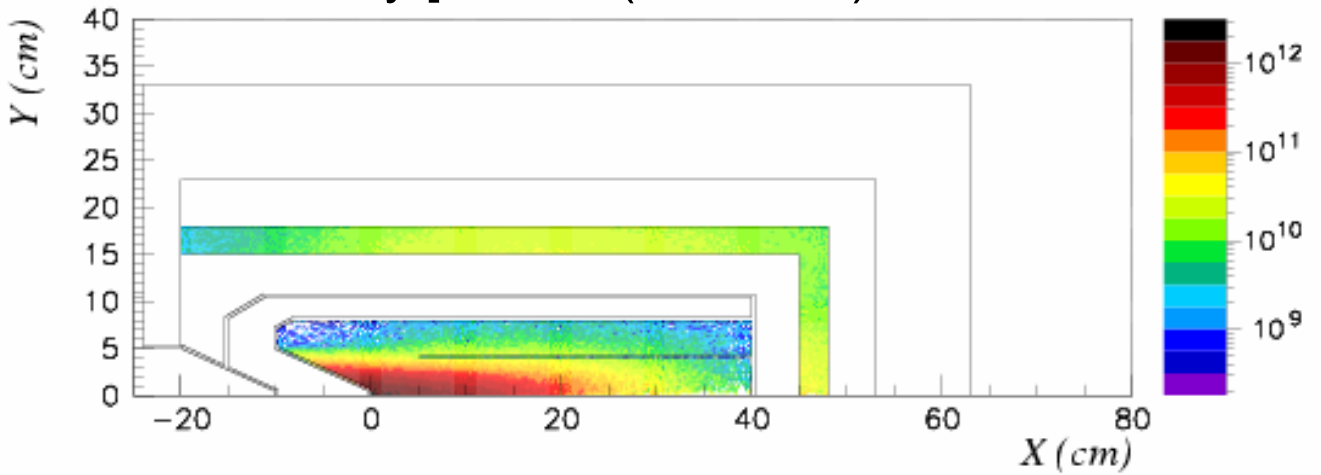
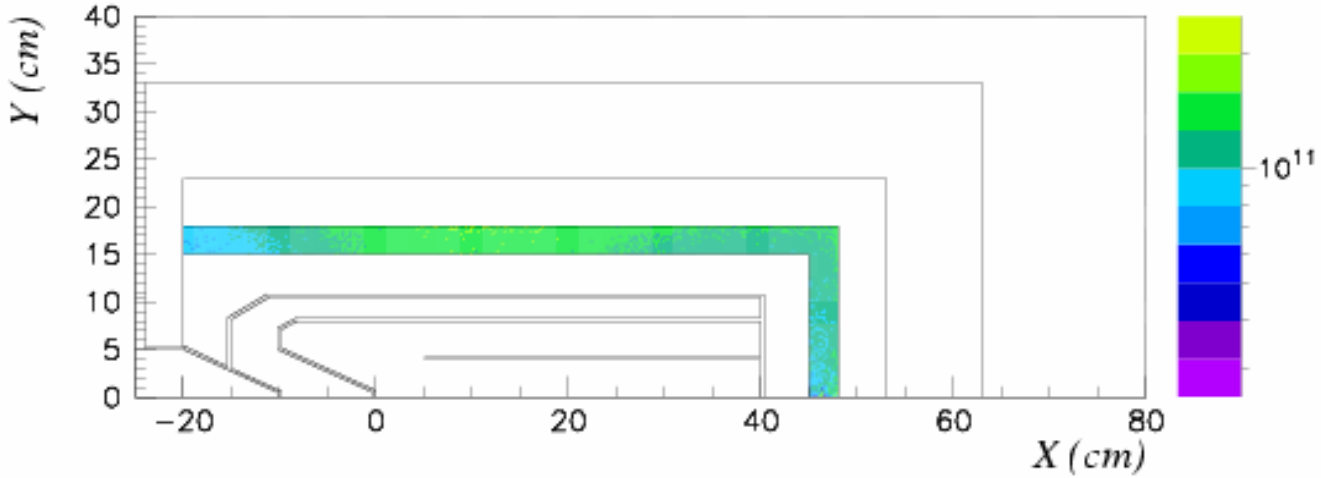
- Non-homogenous HE fissions in all cases
- IS: ~20% of the fissions are HE (>20 MeV)
- Important effect of the reflector

HE fission density [fissions(>20 MeV)/cm^3/s/MW of beam]



LE fission density [fissions(<20 MeV)/cm^3/s/MW of beam]



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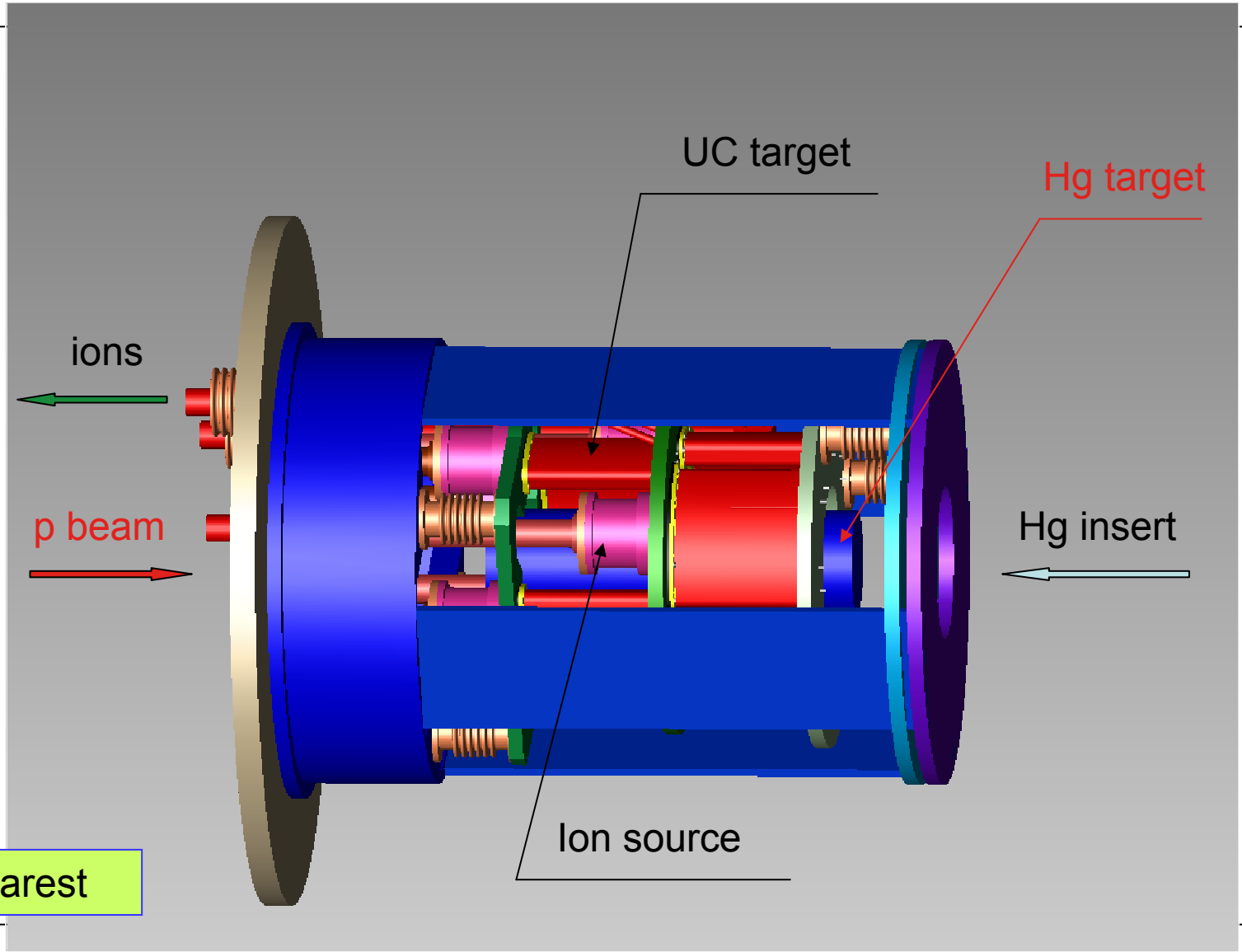

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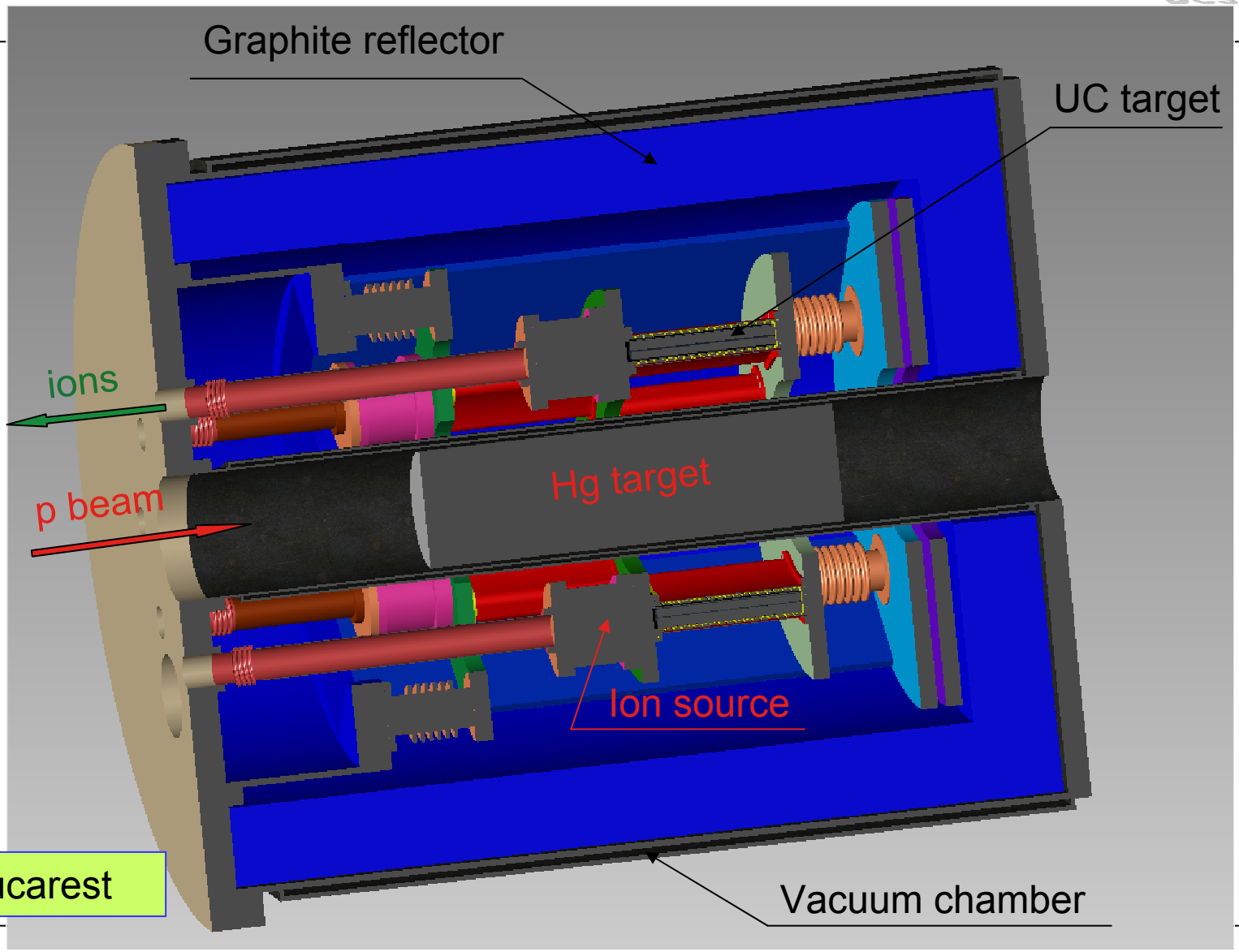

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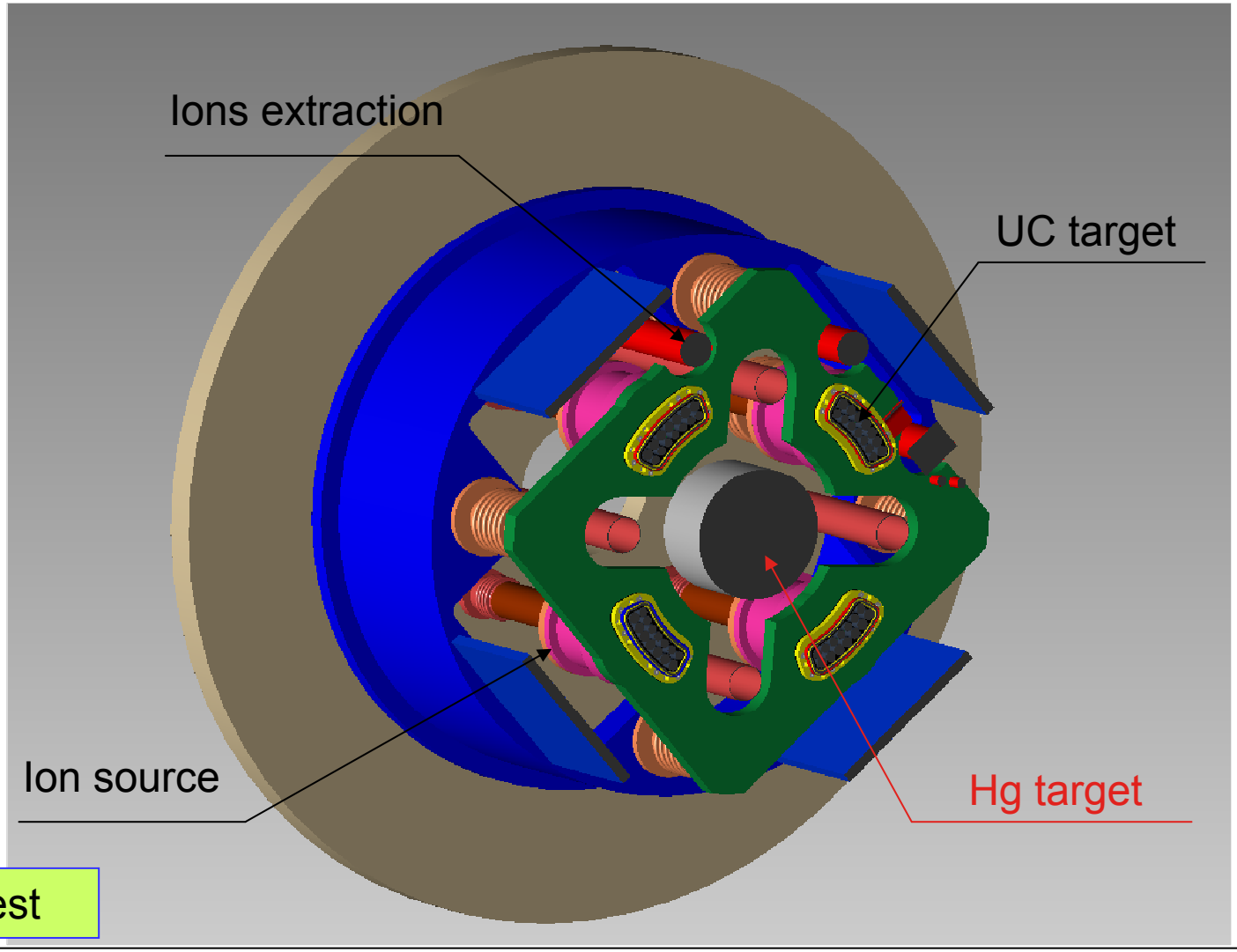

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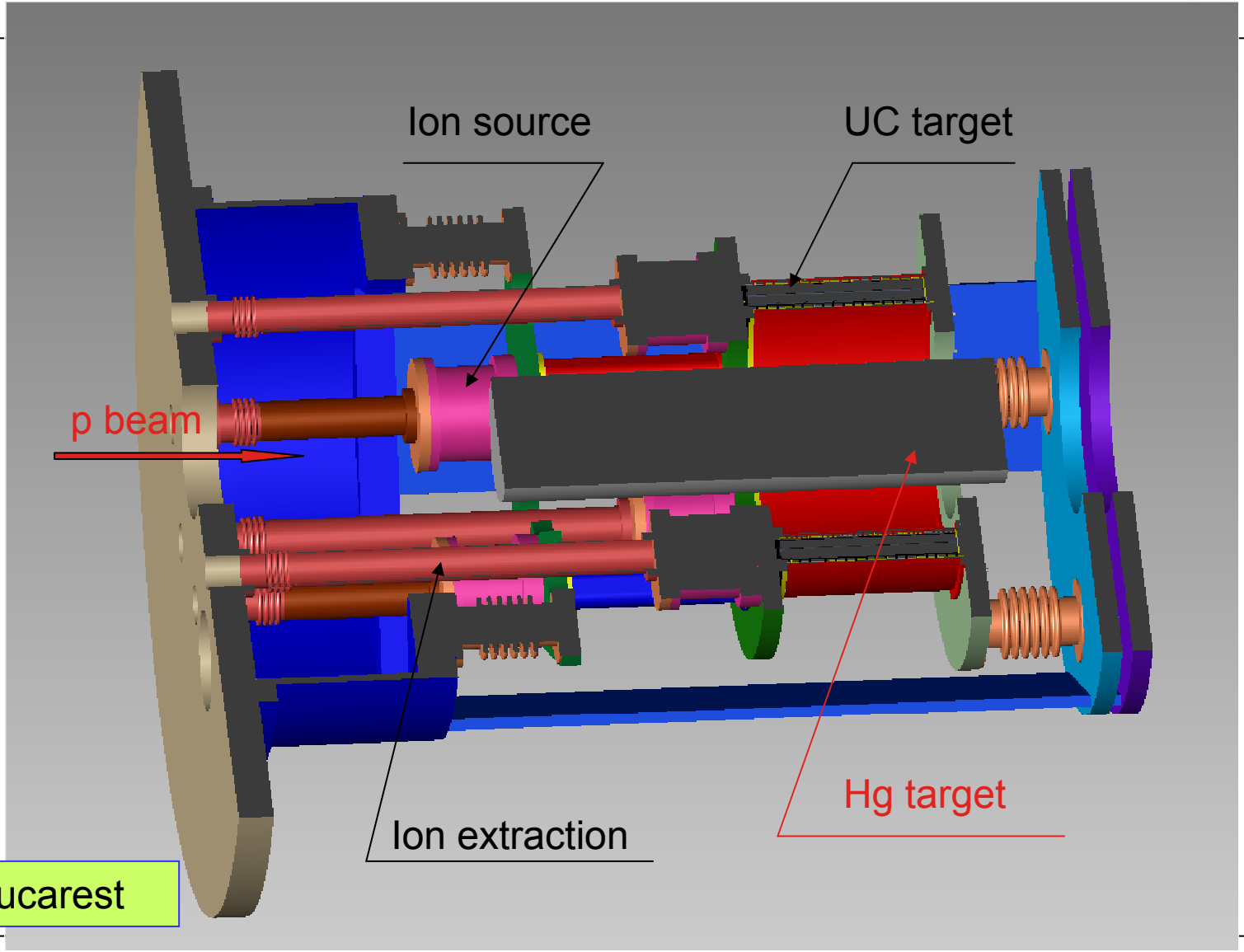

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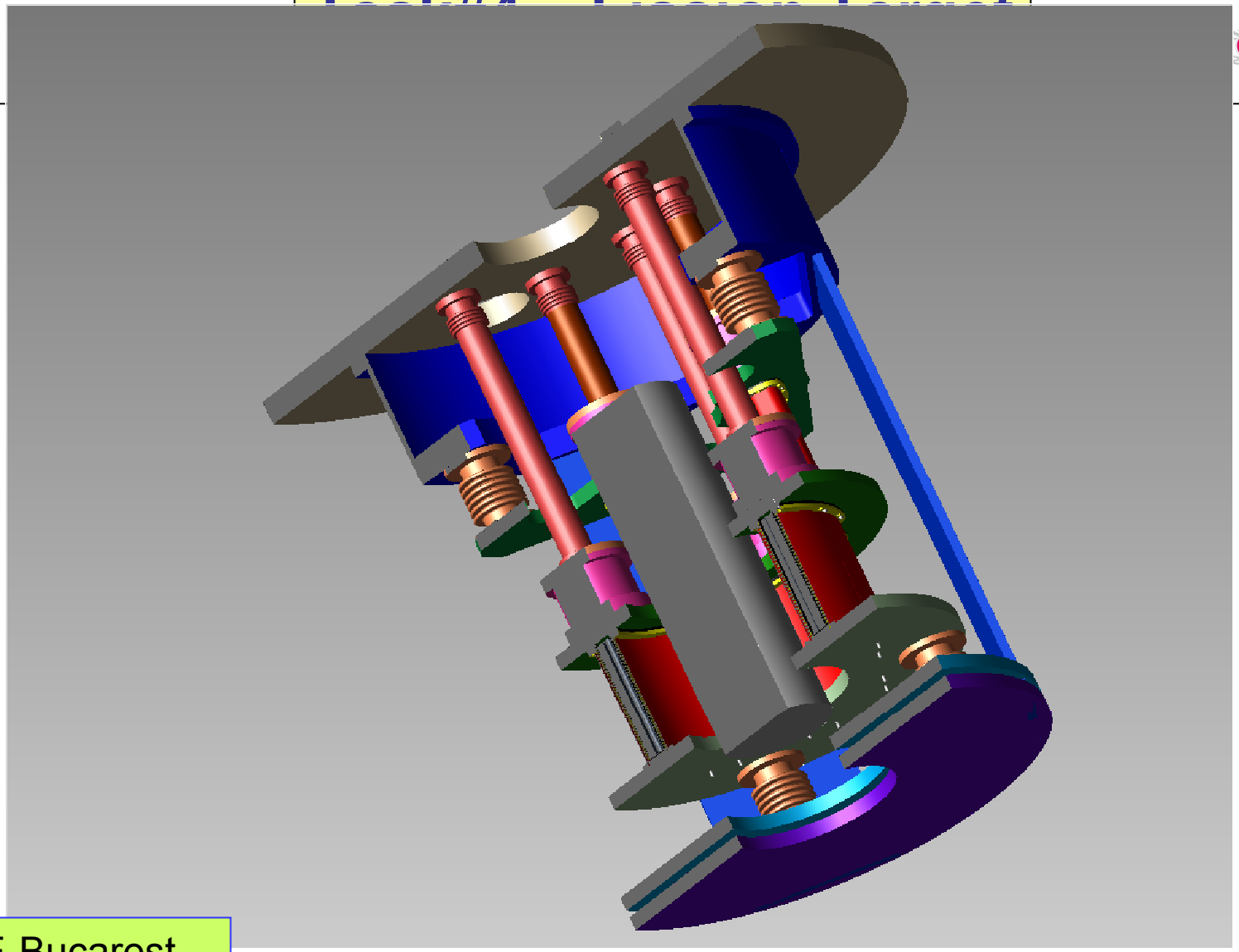

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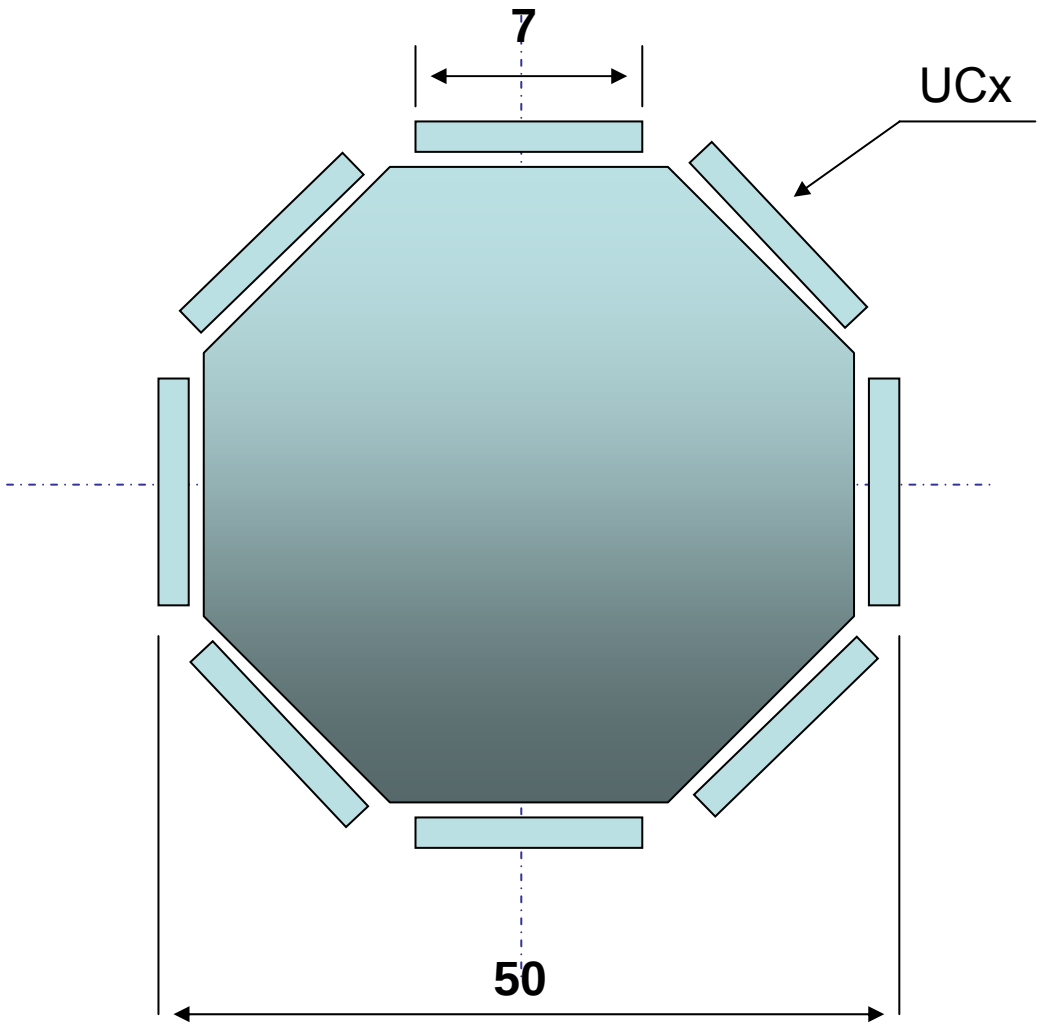

8 UCx targets

40x7x3 cm^3

0,7 Litre effective UCx volume

> 10^{15} Fiss/s each target

A smaller target for short lived nuclei a few cm^3

Each target

30 KW power **42 W/cm^3**

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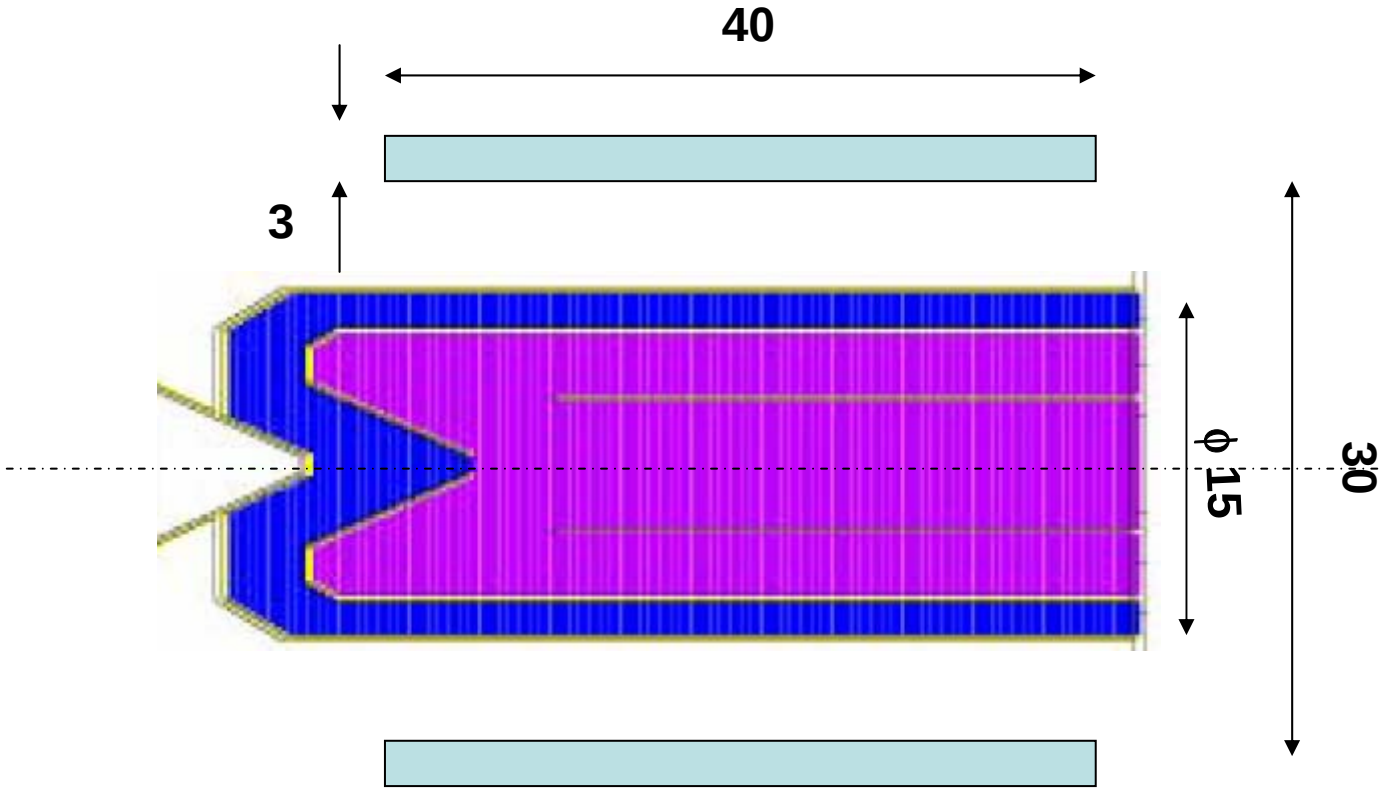

UCx 3 g/cm^3

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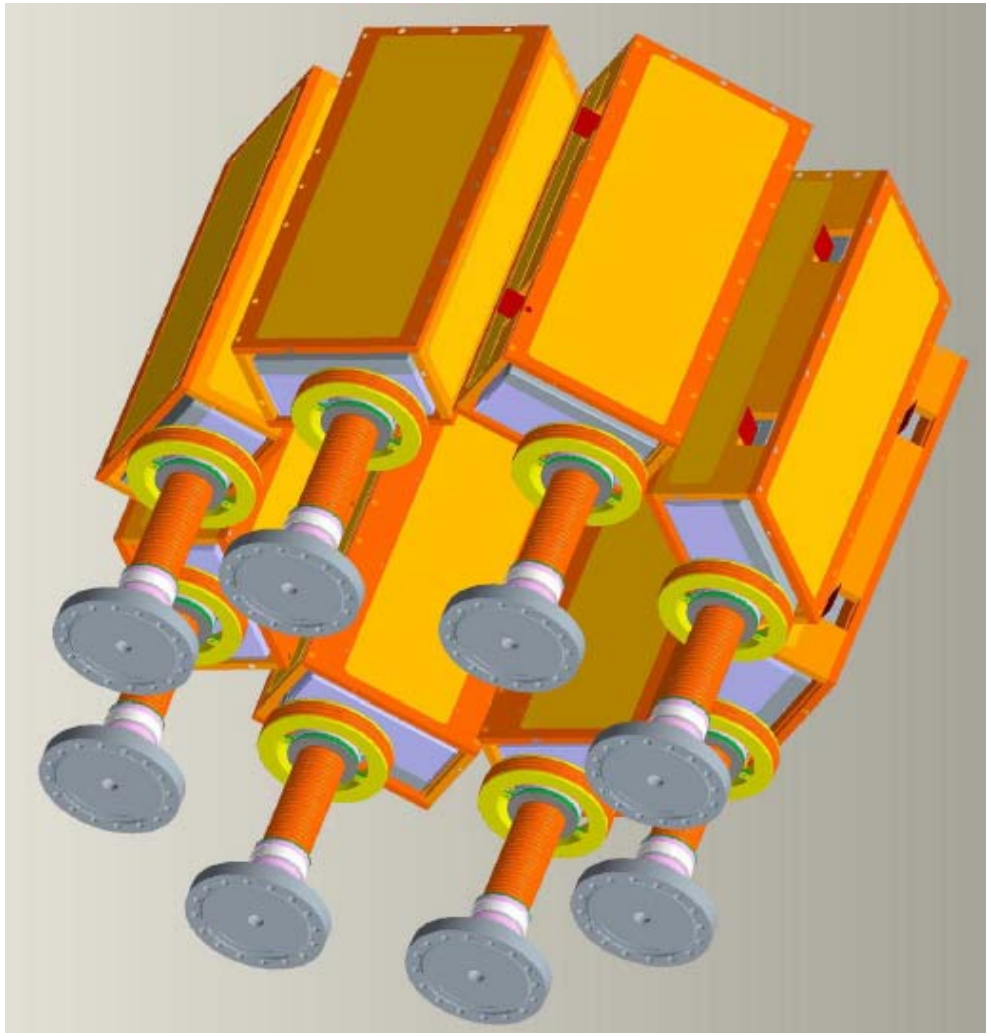

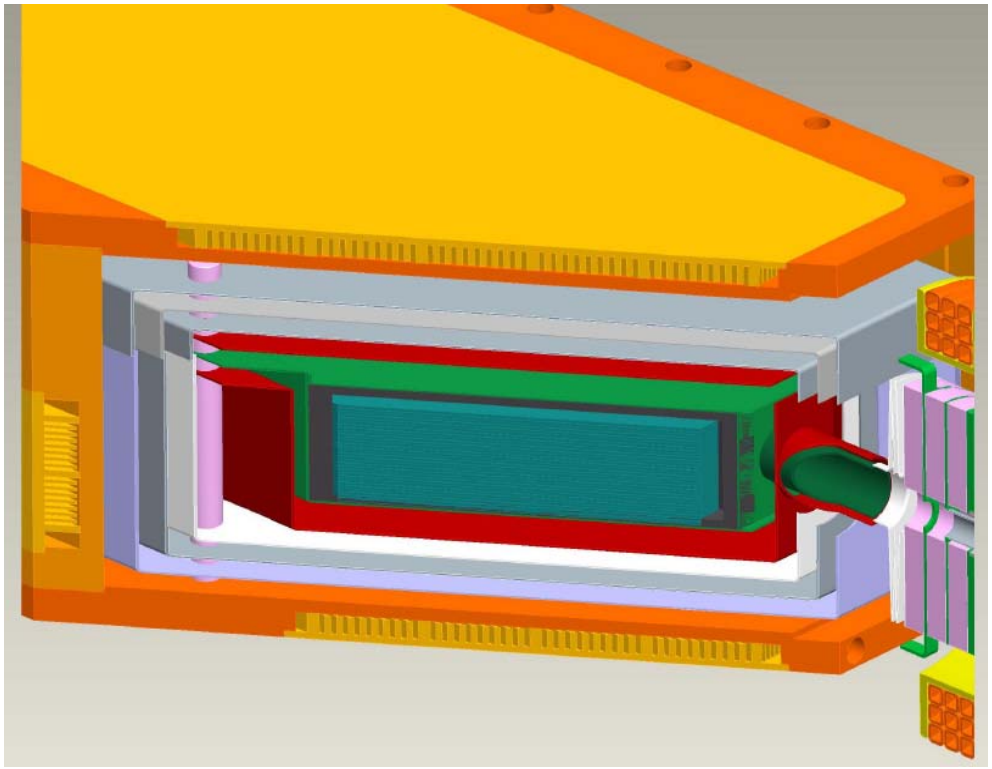

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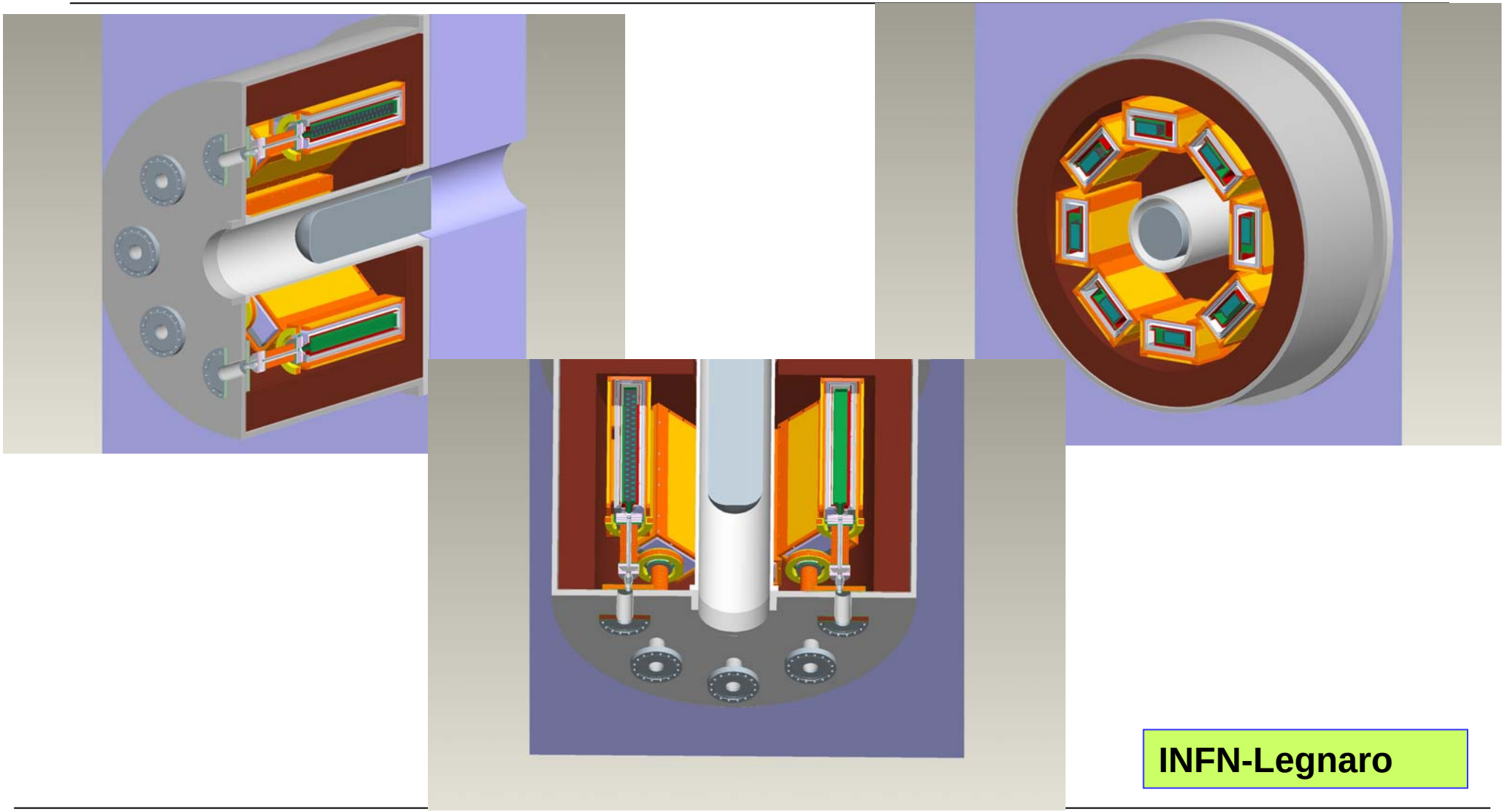

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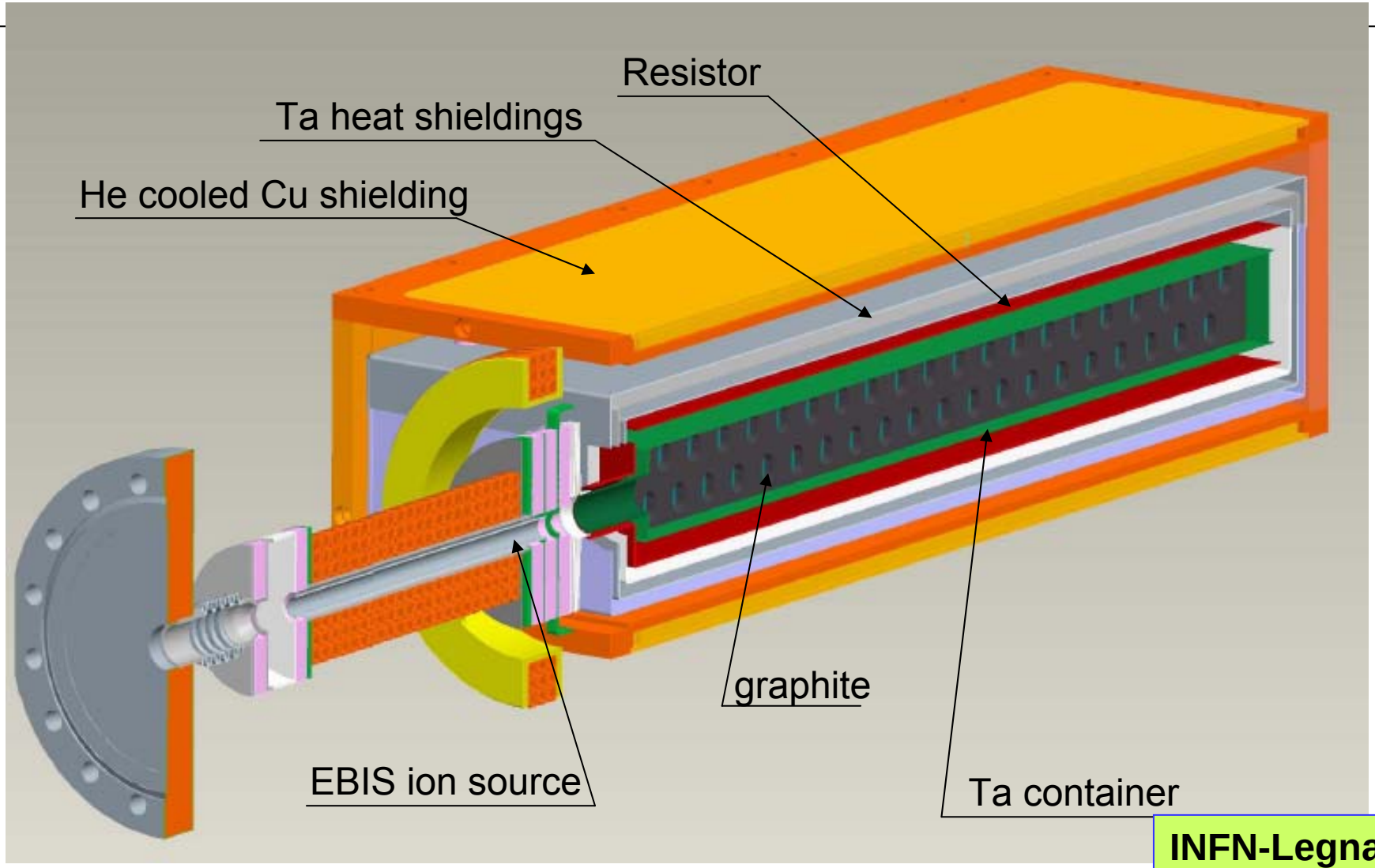

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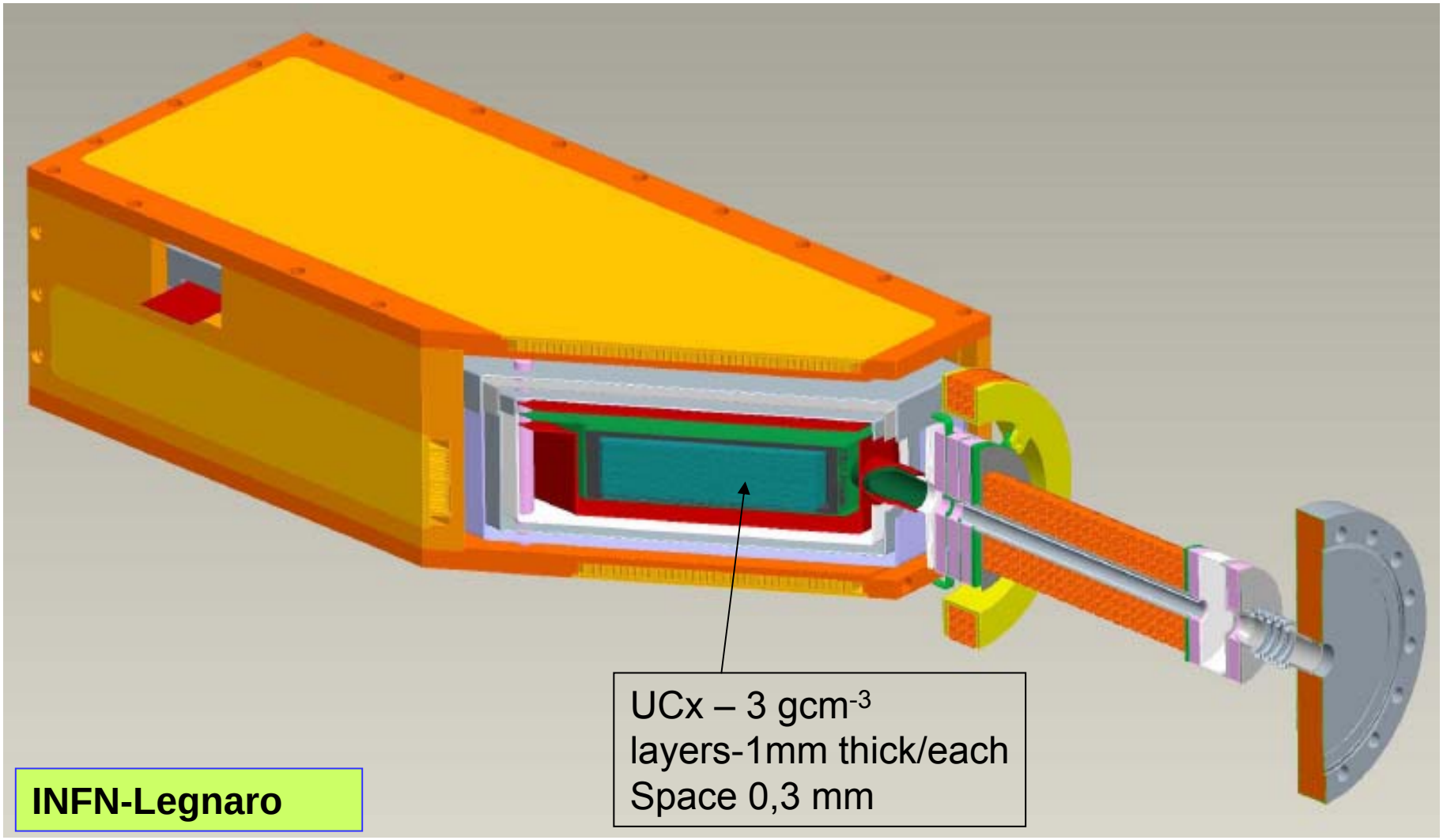

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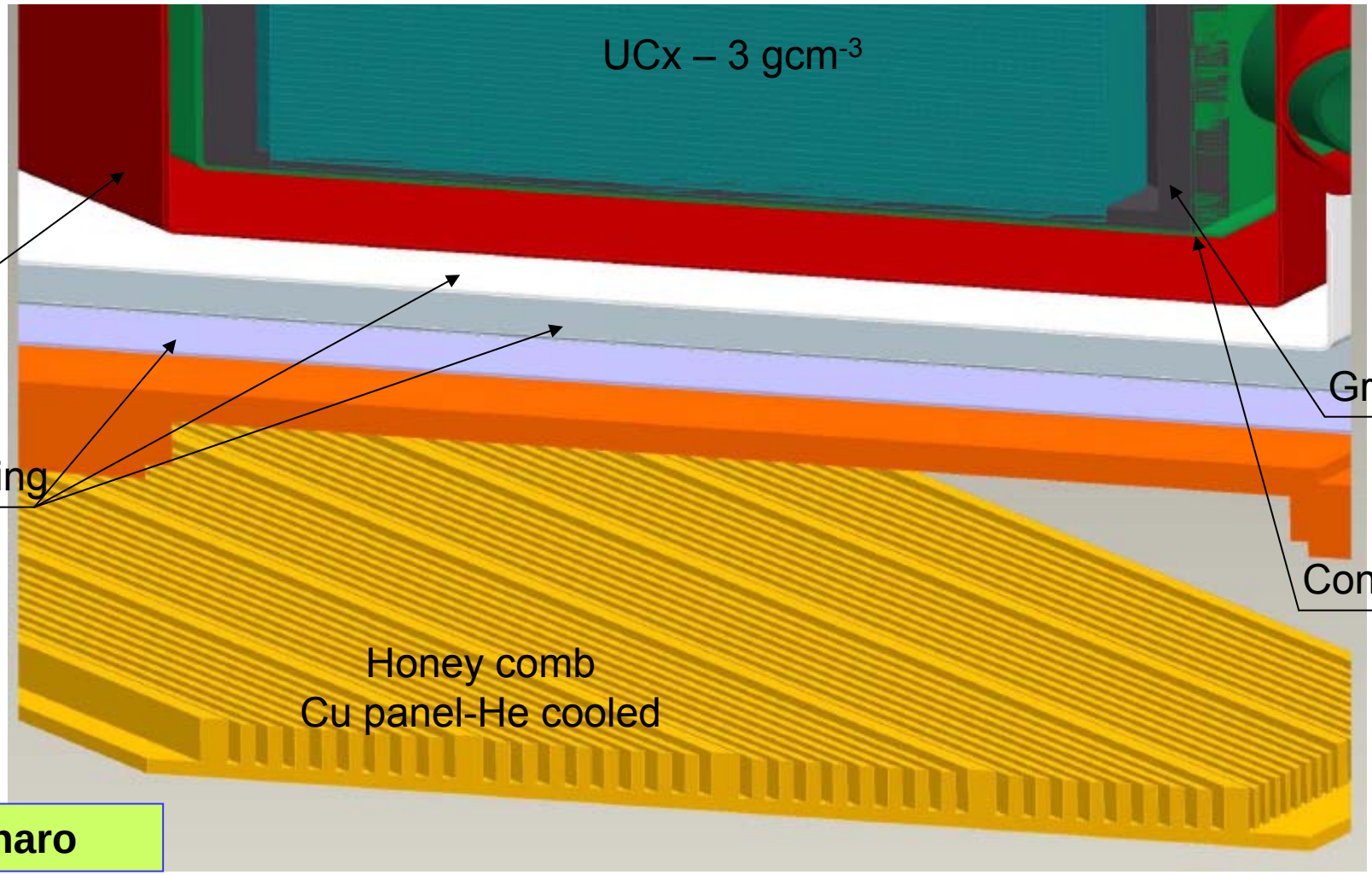

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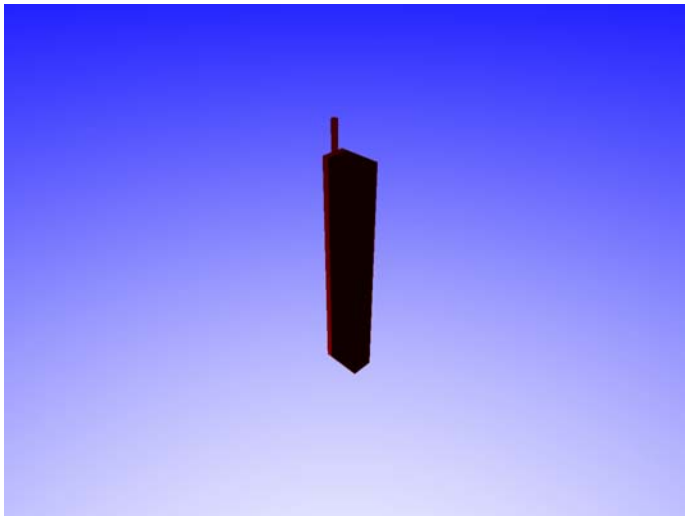

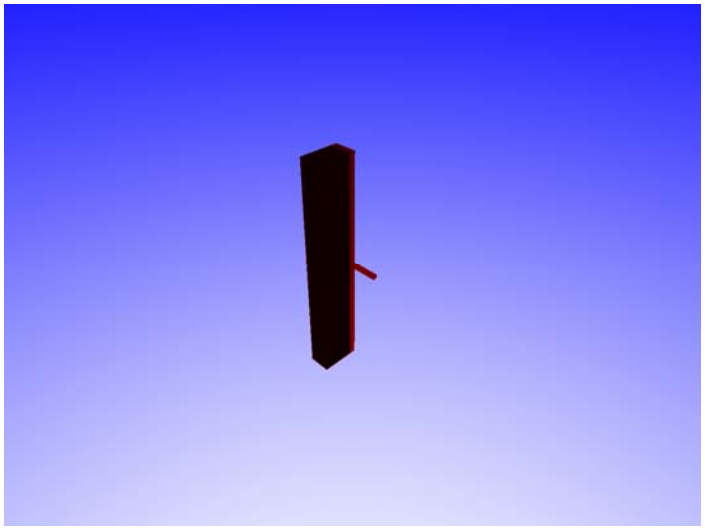

RIBO

d = 0.3 mm

Φ = 10 mm

Flight Time	147 ms
Collisions in powder	$1.6*10^6$
Collisions with walls	$4.2*10^3$

Flight Time	170 ms
Collisions in grains	$1.9*10^6$
Collisions with walls	$4.8*10^3$

see poster M. Barbui

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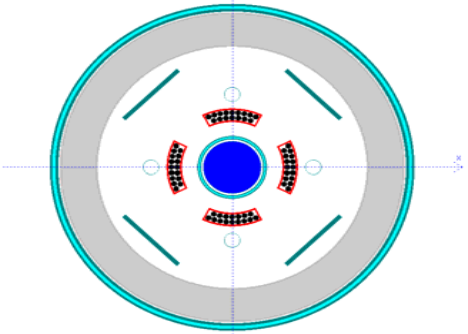
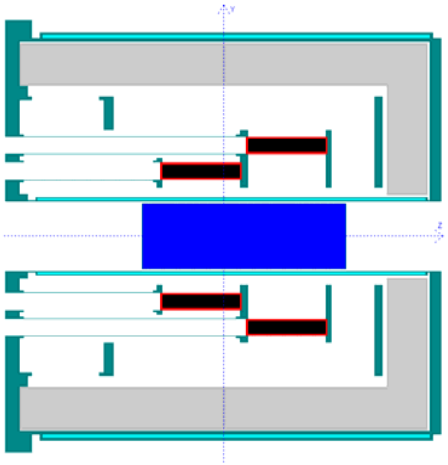
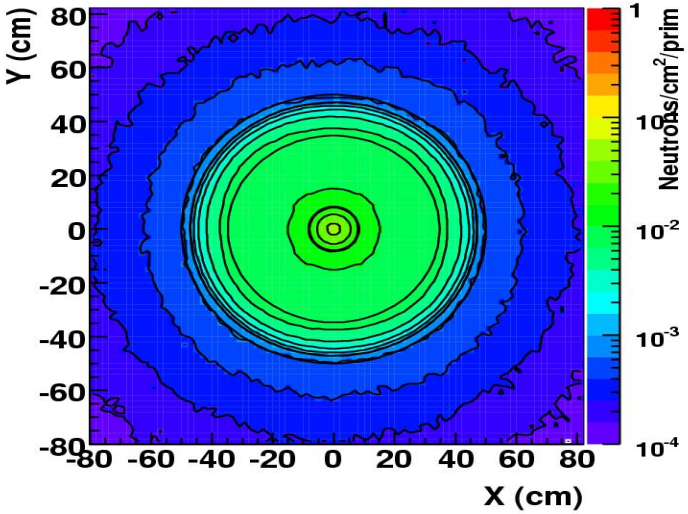
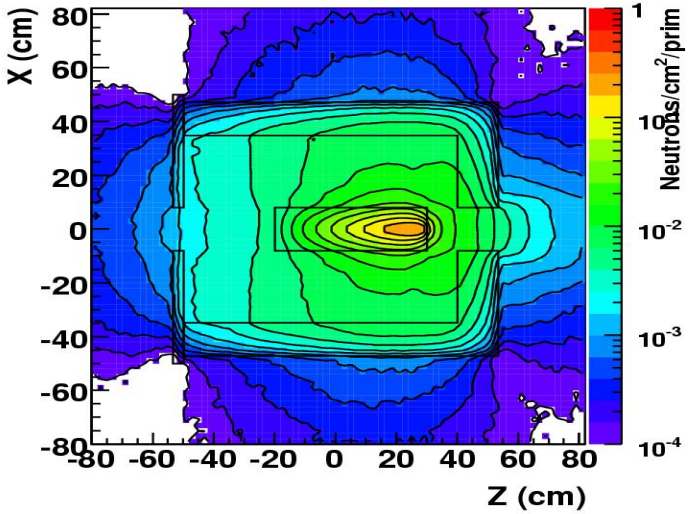
Neutron calculation – CEA Saclay









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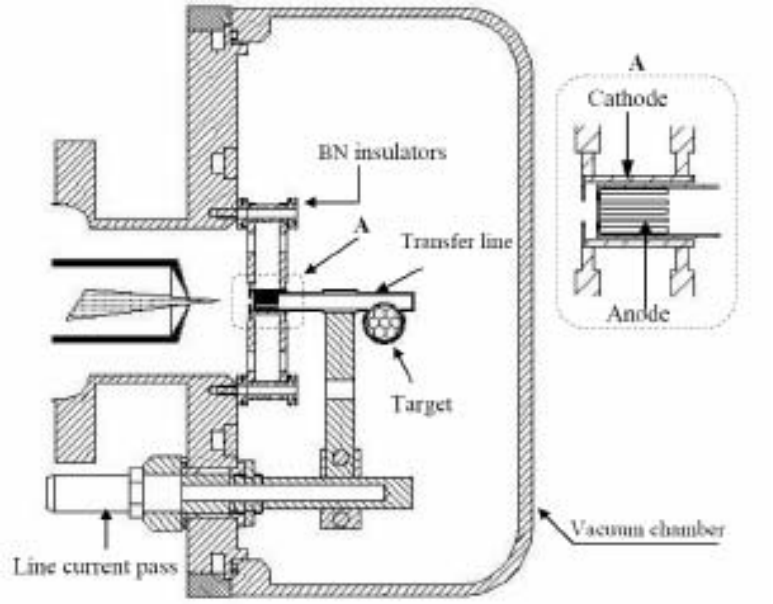
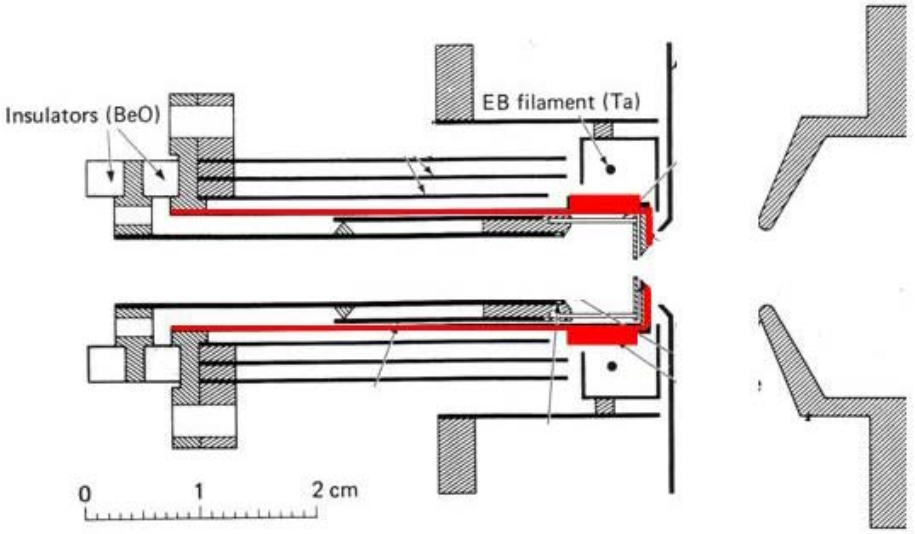
IRENA – IPN Orsay

Under test in ALTO facility





invited talk C. Lau

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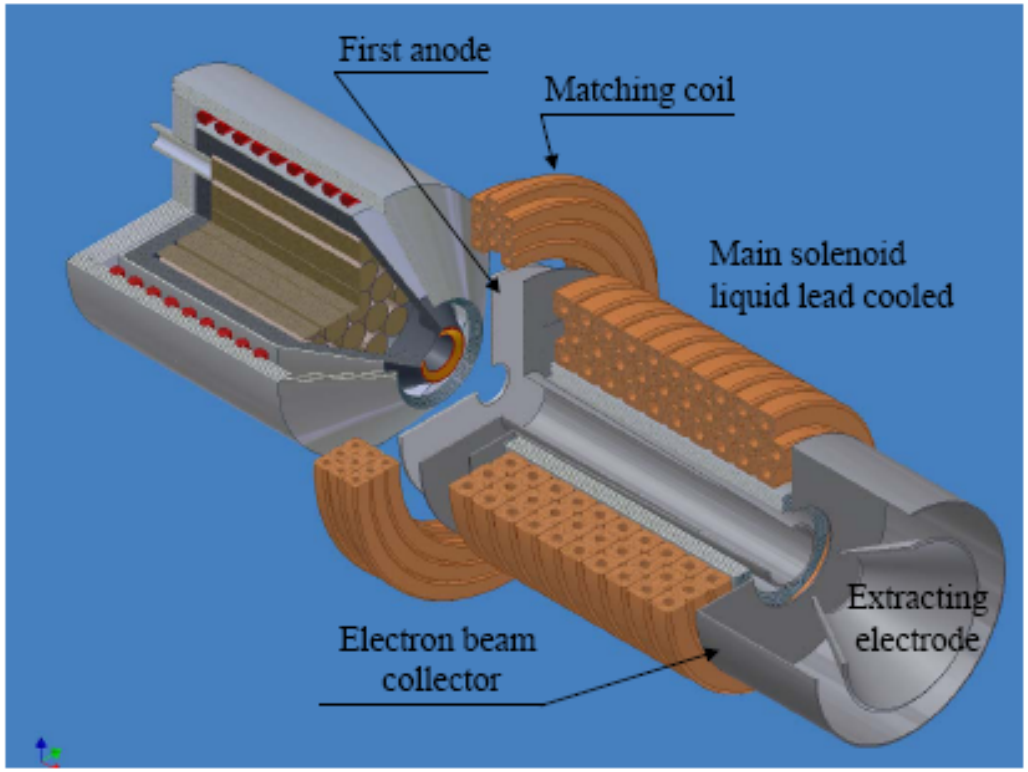

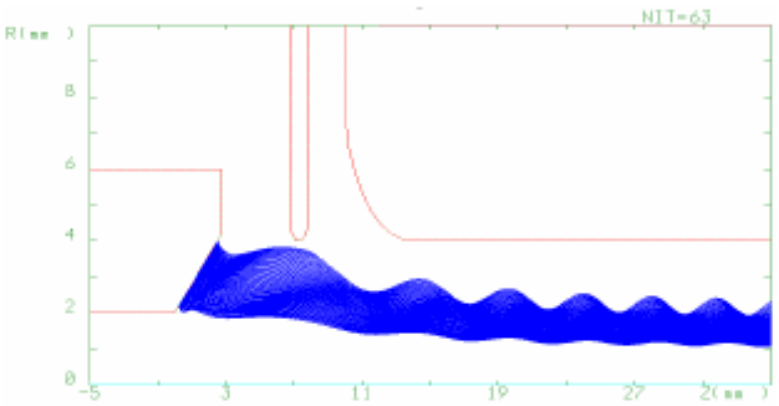

Electron beam energy / current	1-3 keV / 0.5-1 A
Ionization pipe sizes	Ø 8 mm x 10-20 cm
Ionizing factor $j \cdot \tau$	10^{-3} (A/cm^2)·s
Magnetic field	0.5 – 1.5 kGs
Ion extracting voltage	0.15 – 0.2 V/cm
Beam emittance	30·π mm·mrad

see poster O. Alyakrinskiy

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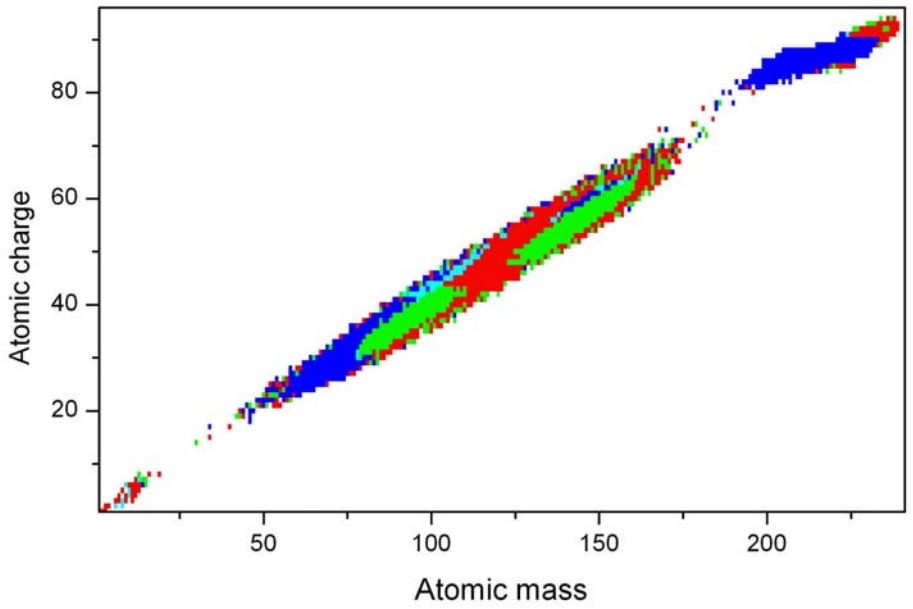

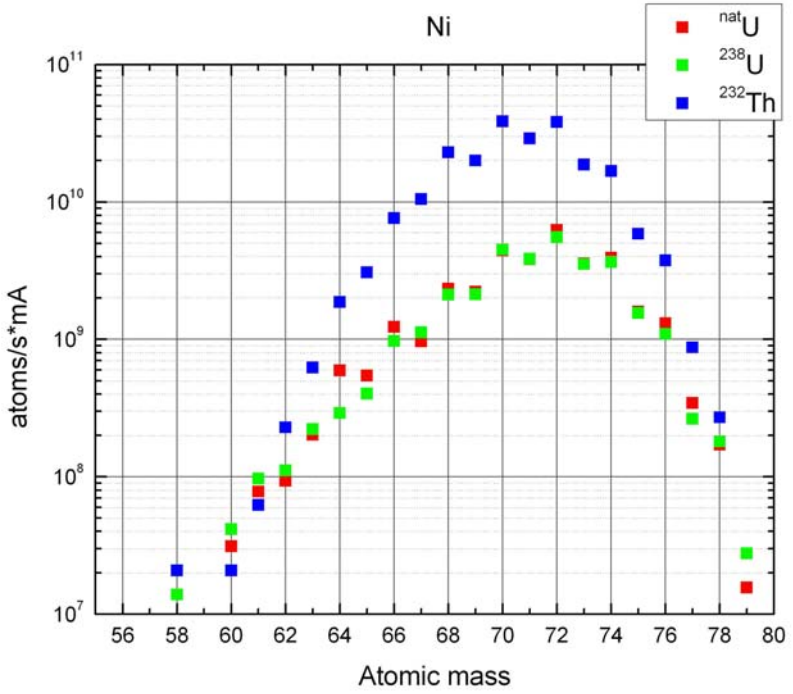

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^{238}U or ^{nat}U

see poster O. Alyakrinskiy

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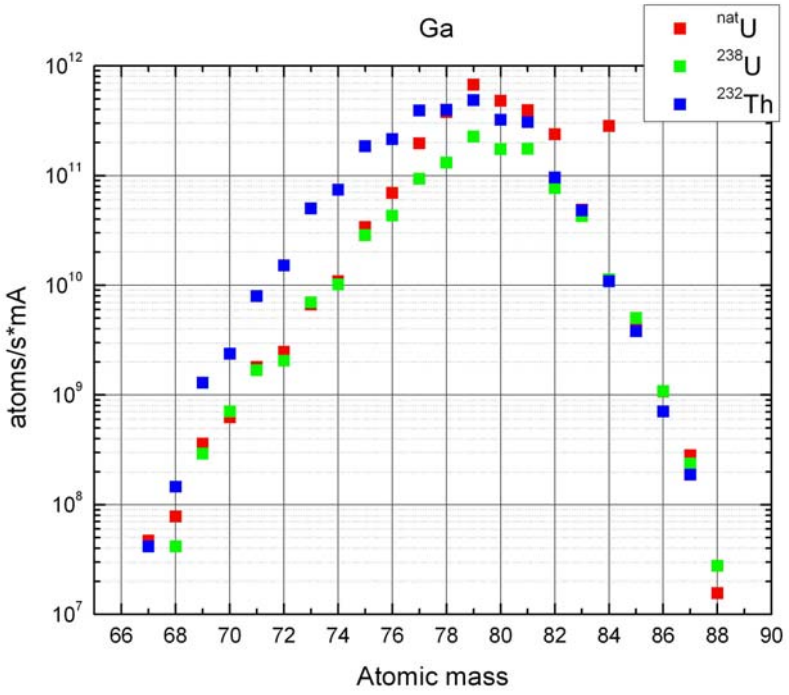

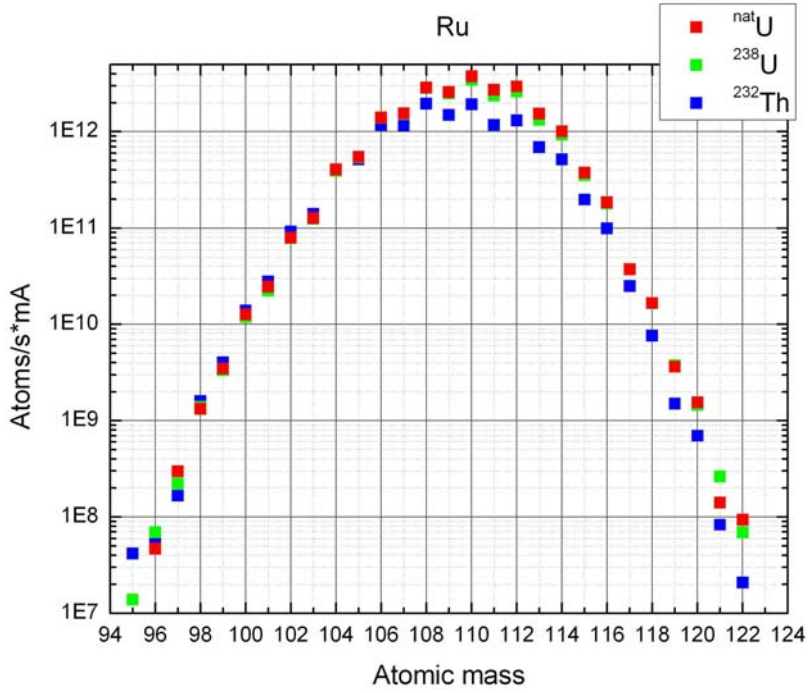

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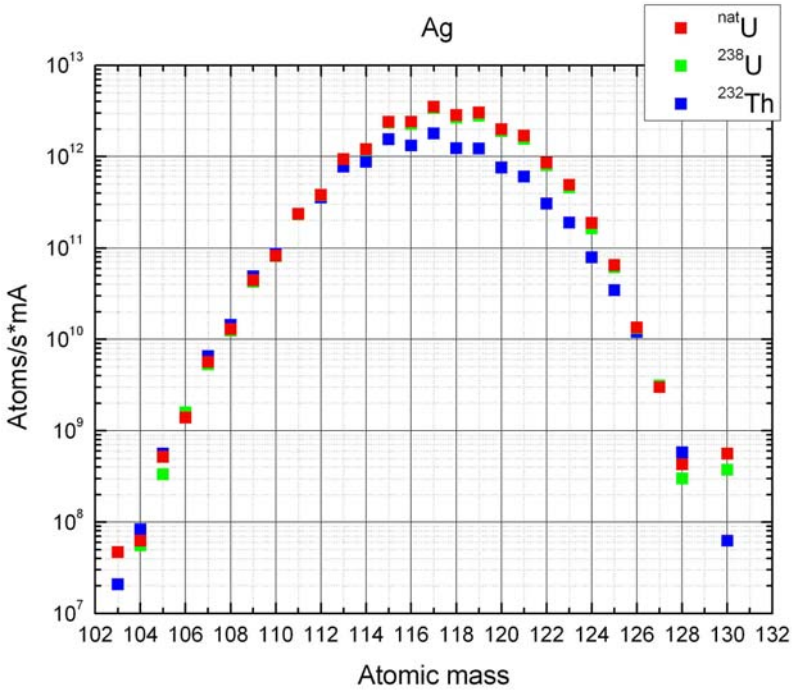

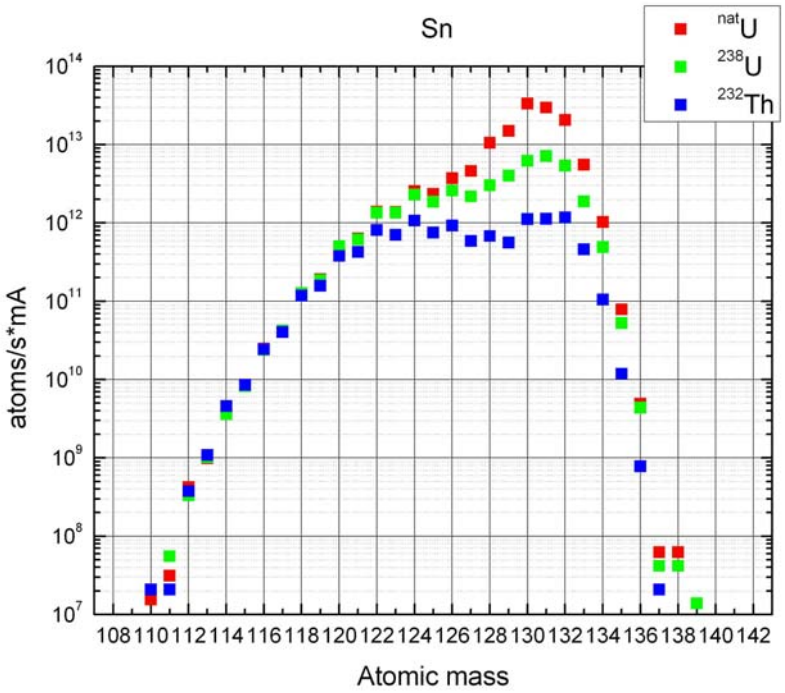

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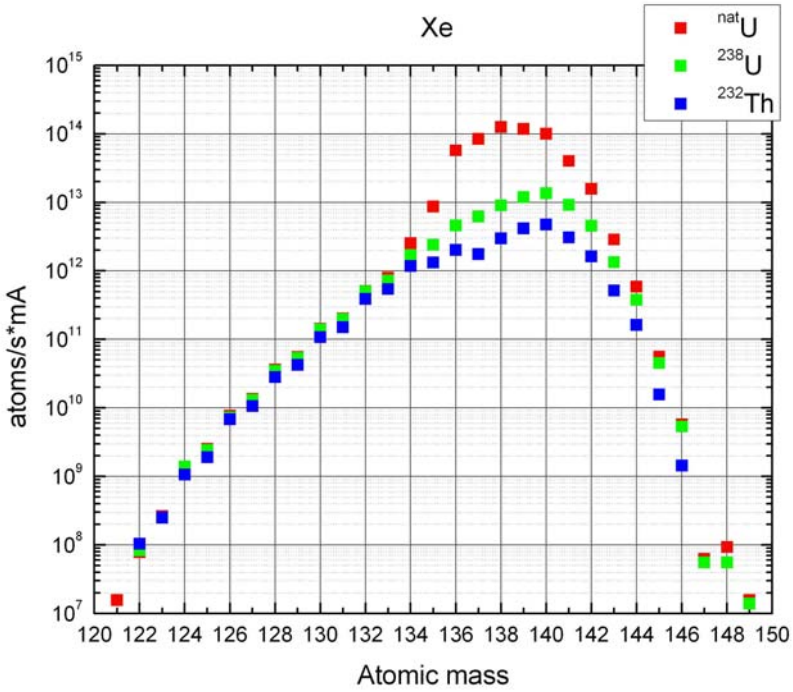

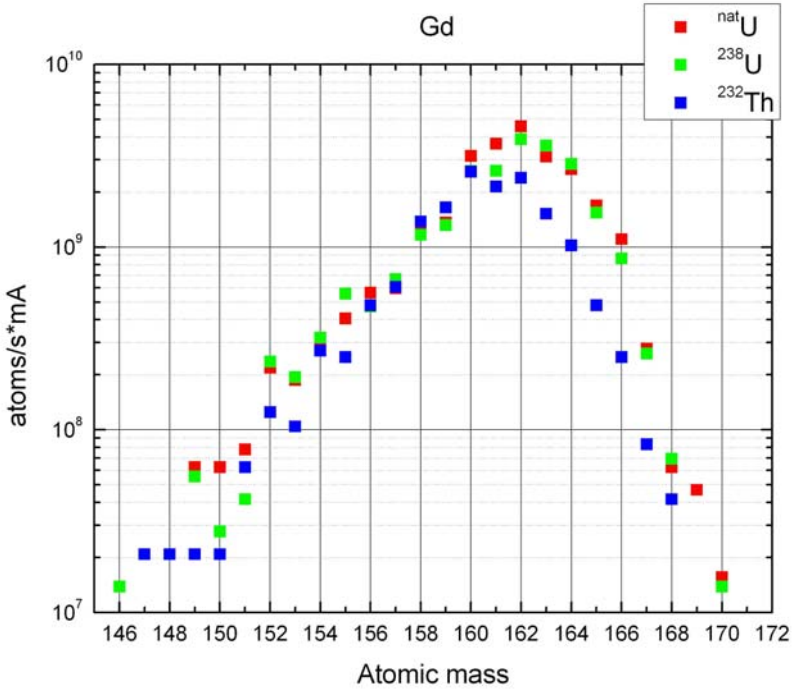

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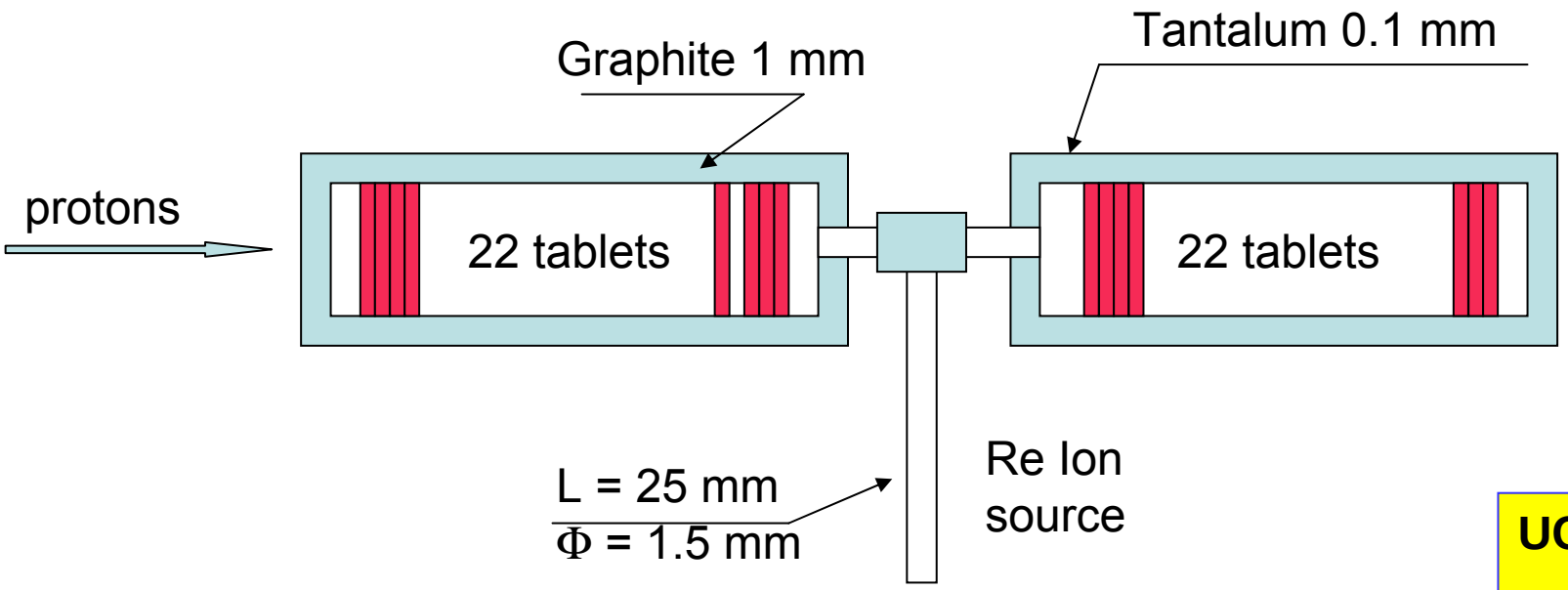
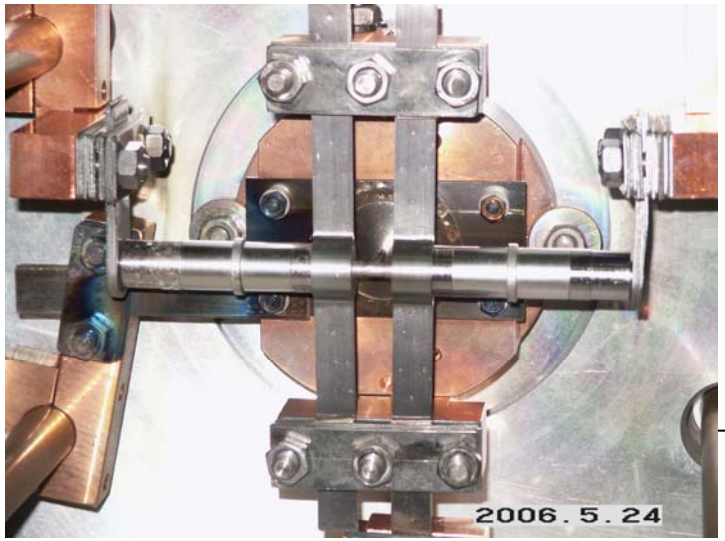
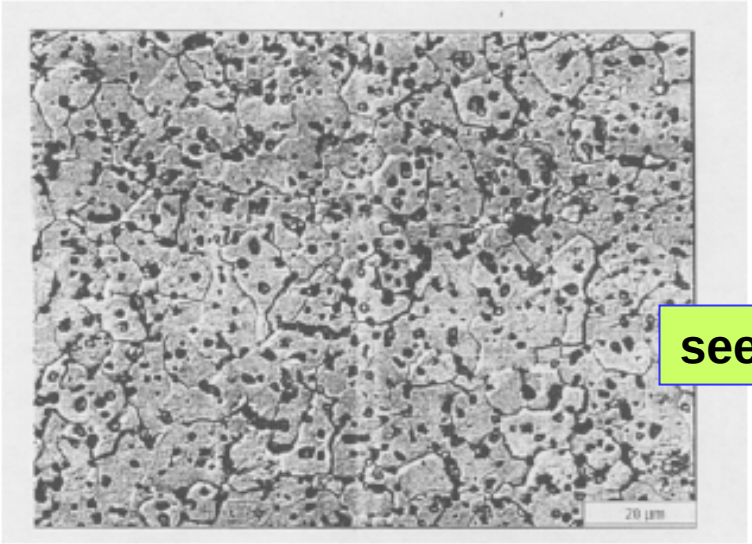
PNPI – LNL – IPN Orsay – GANIL – NIPNE collaboration







UC 91 gcm^{-2}

Grain size = 20 μm

δ = 13 gcm^{-3}

44 tablets

see poster V. Panteleev

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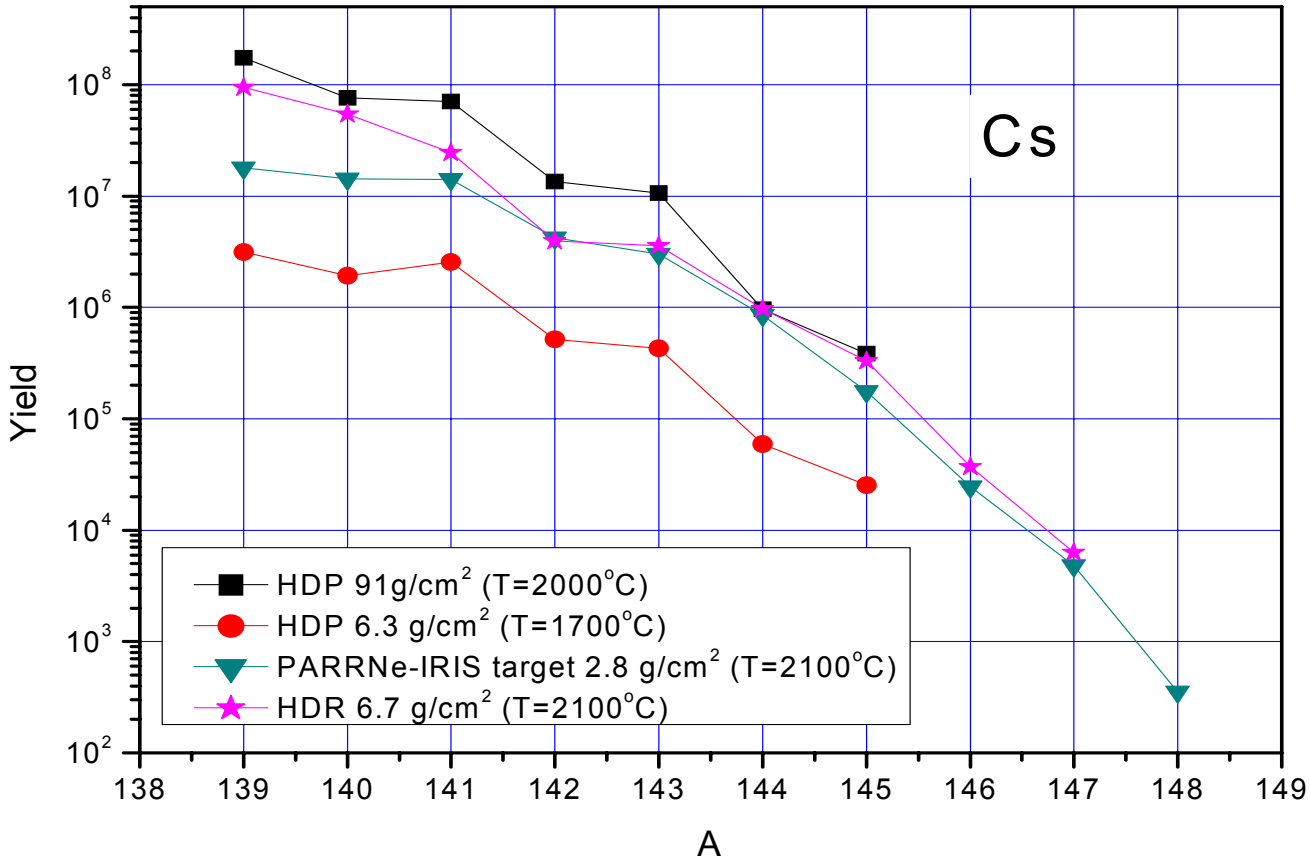

Absolute yields for different IRIS targets with the proton beam intensity 0.1 μA

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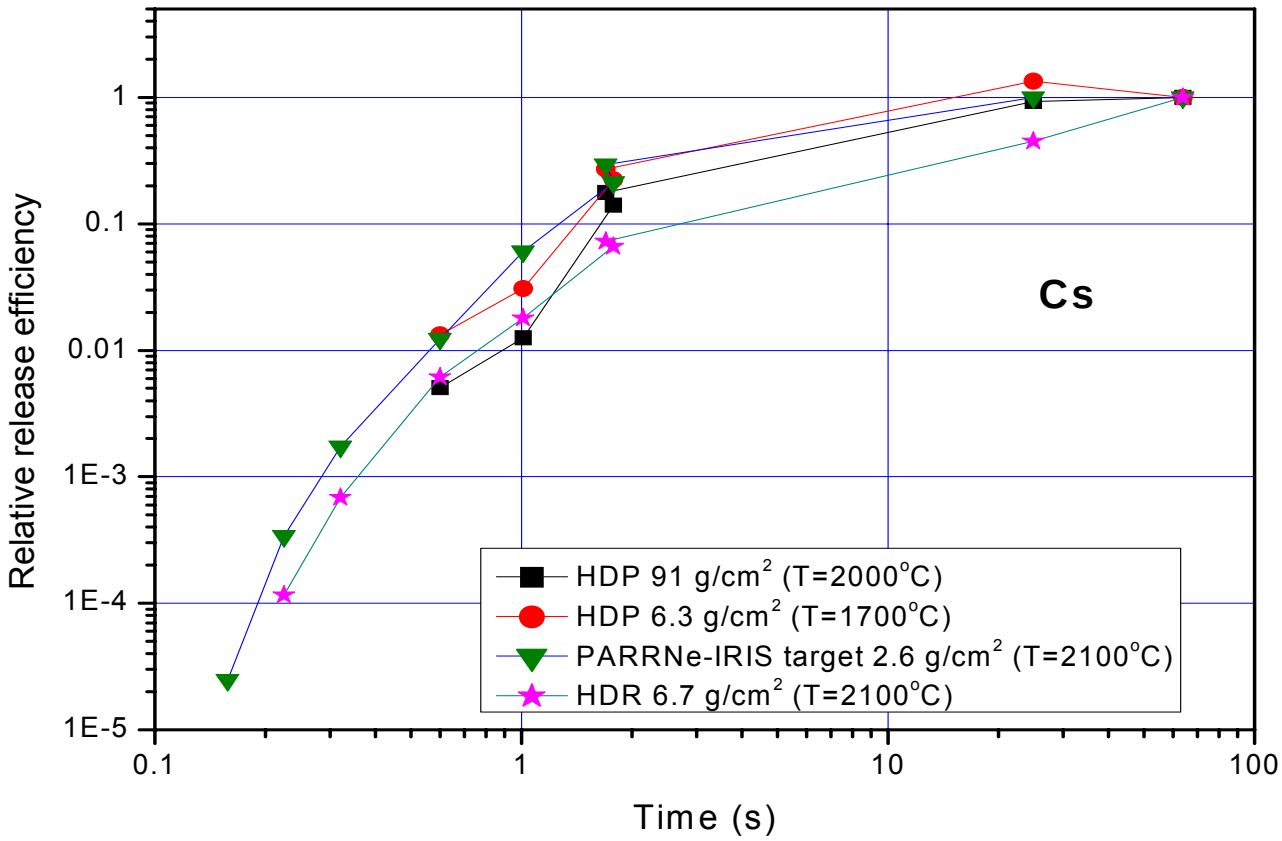

Relative release efficiences for different targets tested at IRIS

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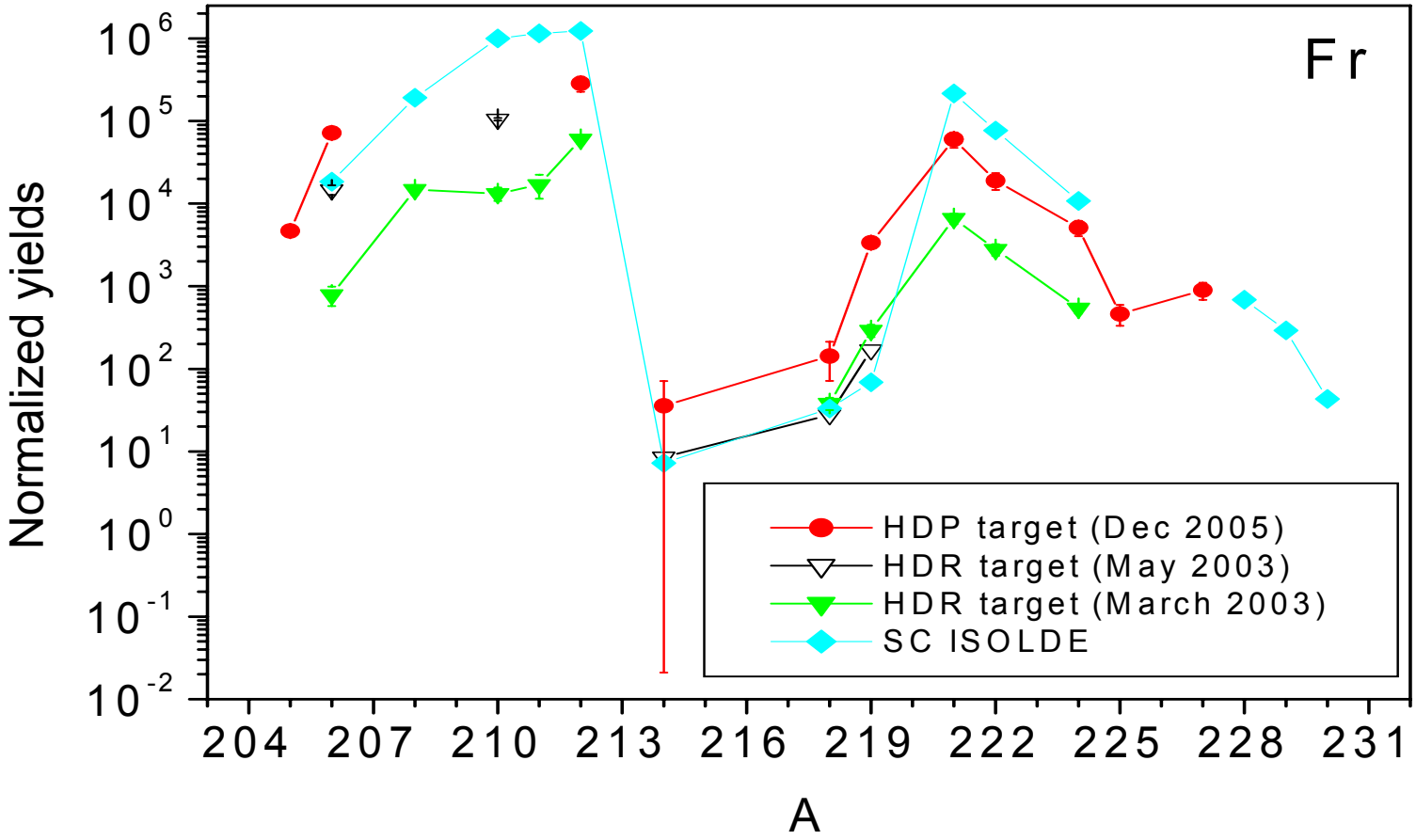

The yields of Fr isotopes from the HDR, HDP and ISOLDE graphite cloth targets.

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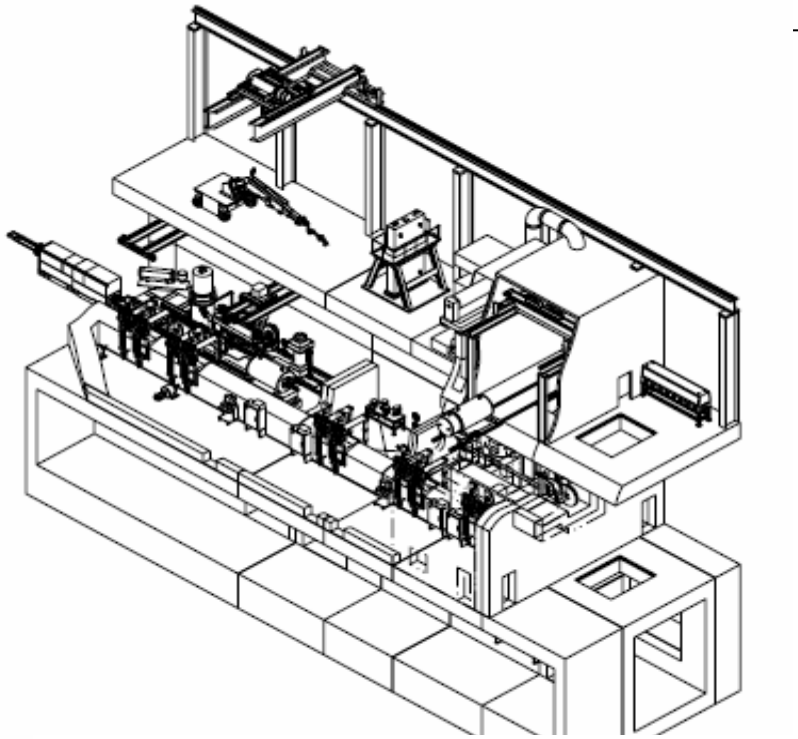

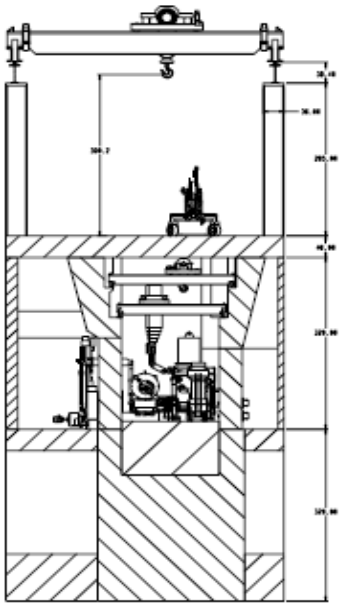

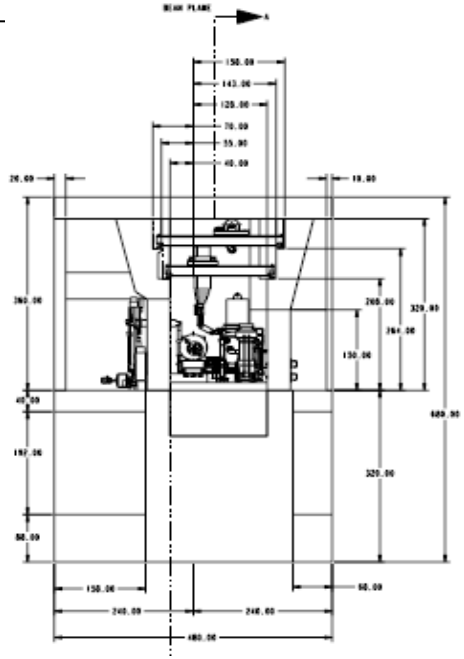

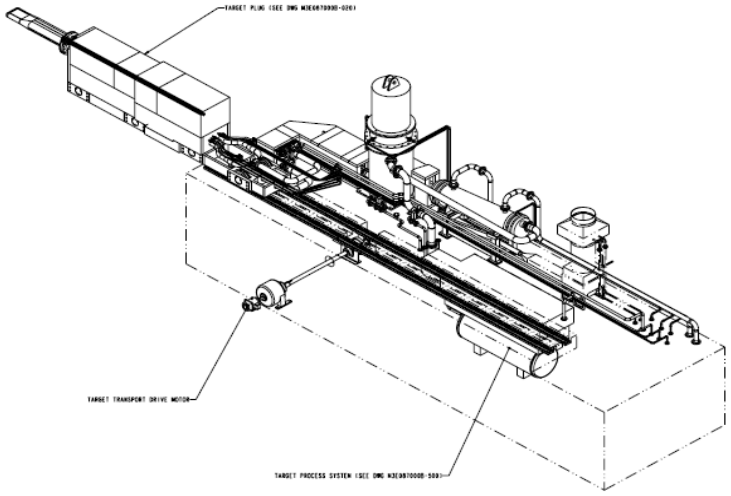

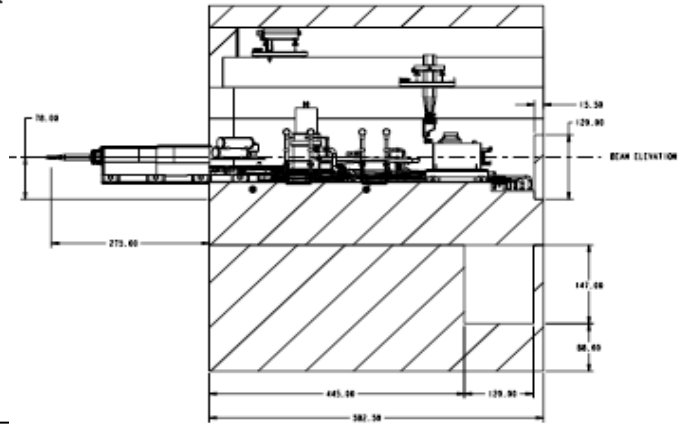

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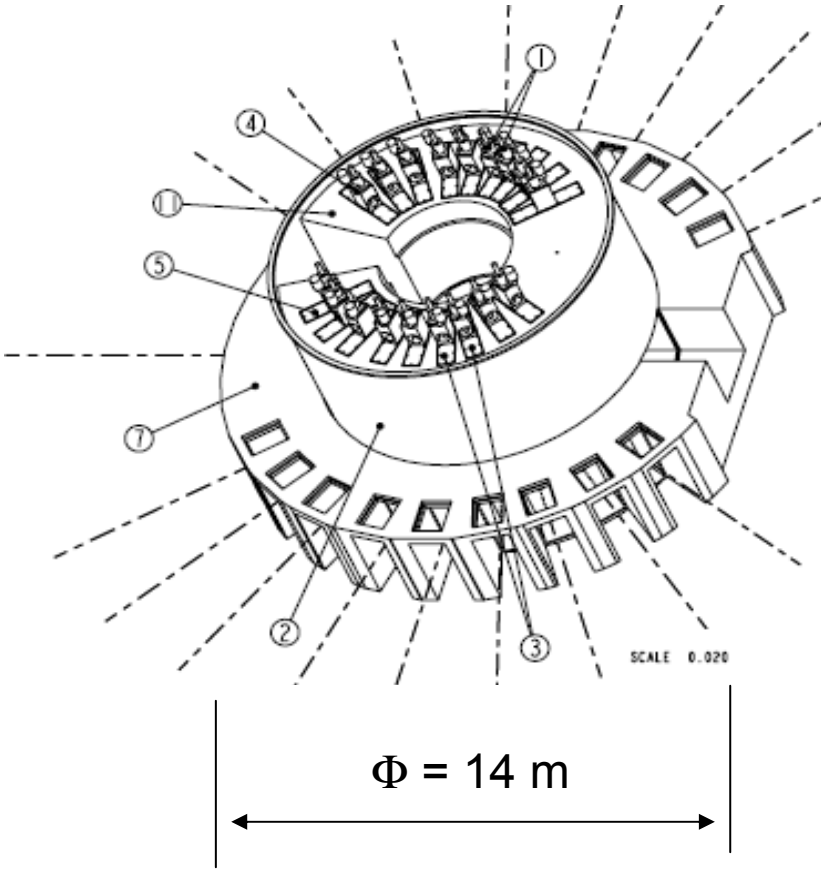

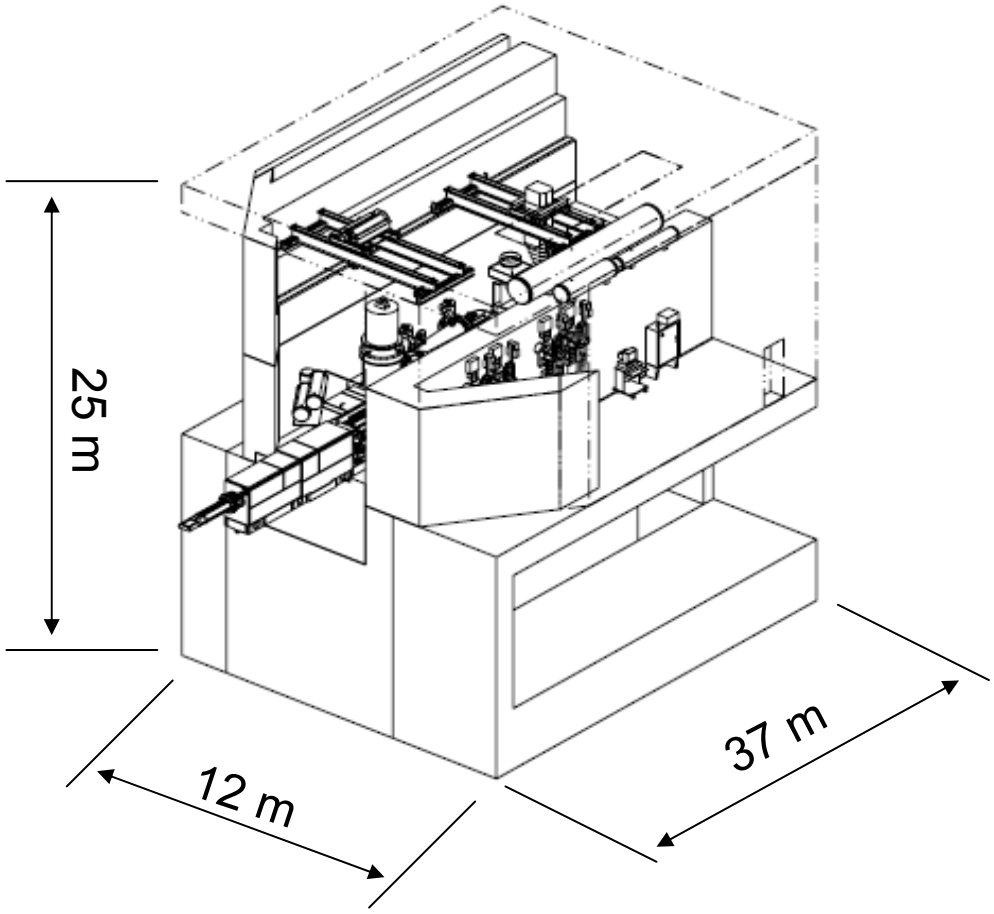

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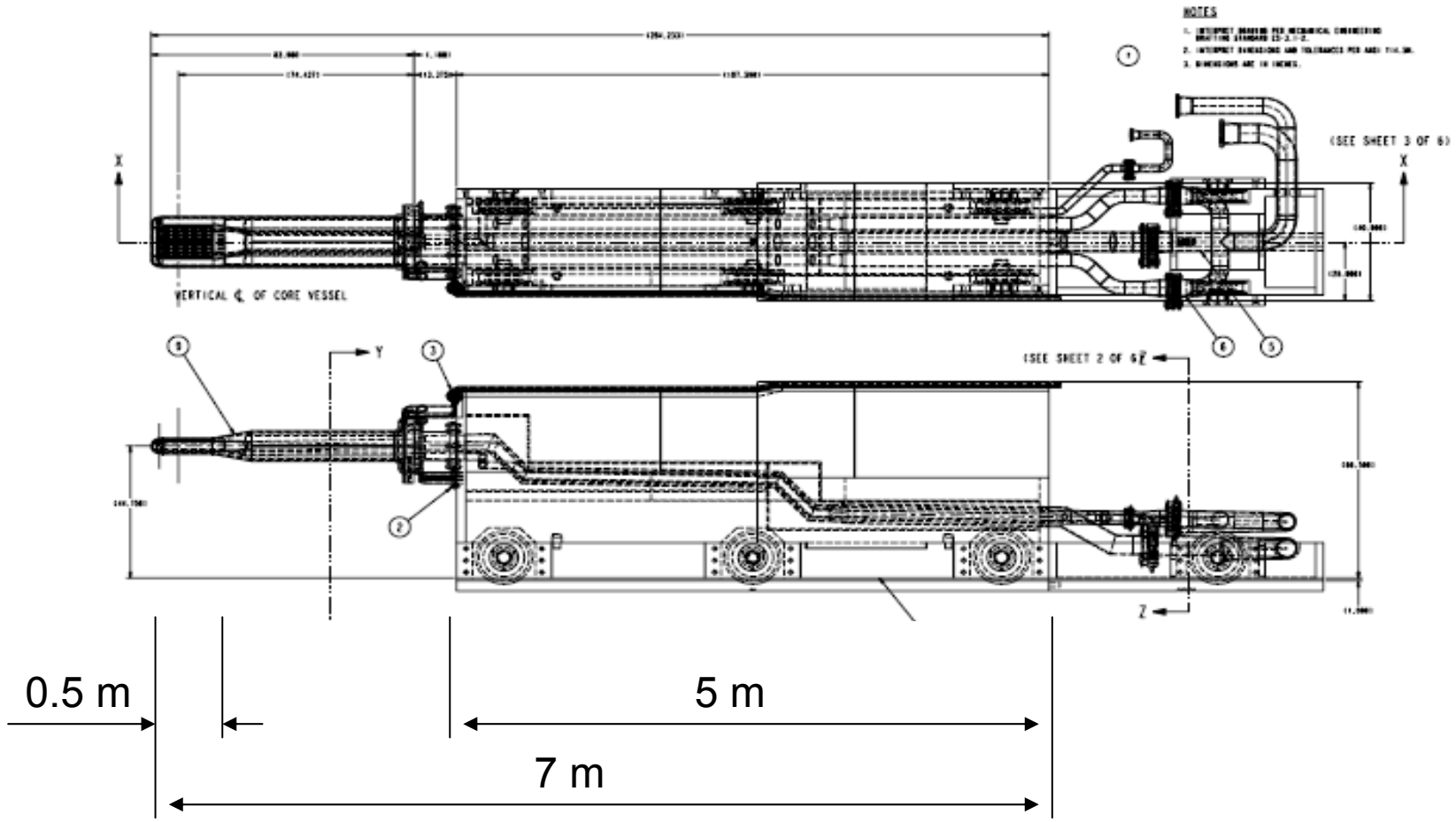

Conclusions

Preliminary design of Fission Target assembly is done

Fission Target design is in progress

R&D on UC target is in progress – first test with relatively big amount of UC

Some ideas for ion sources operating with high gas load are under investigation

Fission Target environment to be defined – SNS as a starting point

Task#4 – Fission Target

EURISOL Design Study

No.	Milestones and expected results of this task:	Months due	
M1	**Neutronic calculations**	18	OK
M2	**Fission target design**		
M2.1	Vacuum system design	17	NO
M2.2	Preliminary target design parameters	18	OK
M2.3	Target cooling & outgassing study	21	In progress
M3	**Ion sources**		
M3.1	Investigation on ion-source parameters	24	In progress

December 2006