

CATHI

Marie Curie Initial Training Network  
Cryogenics, Accelerators and Targets at HIE-ISOLDE

# Target Unit Design Study

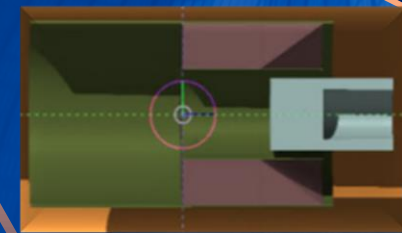
SERENA CIMMINO(EN-STI/RBS)\*

\* The research project has been supported by a Marie Curie Early Initial Training Network Fellowship of the European Community's Seventh Programme under contract number (PITN-GA-2010-264330-CATHI)

# Outline



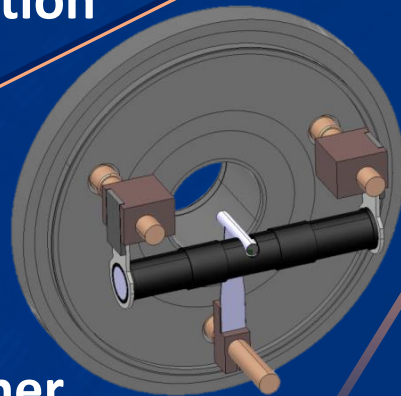
**Outlook**



**Neutron  
Converter  
Design Study**



**Cold Line – Alternative  
Cooling Solution Study**



**Standard  
Temperature  
Calibration**

**Target  
Container  
Optimization**

# \*ISOLDE Target Unit

## Systems

Ohmic Heat (2000 °C)

Vacuum (10<sup>-7</sup> mbar)

Active Cooling

- Flow rate: 180 L/h
- Inlet Temperature: 15°C
- Outlet Temperature: 24-25°C
- Pressure: Approx. 5 bars

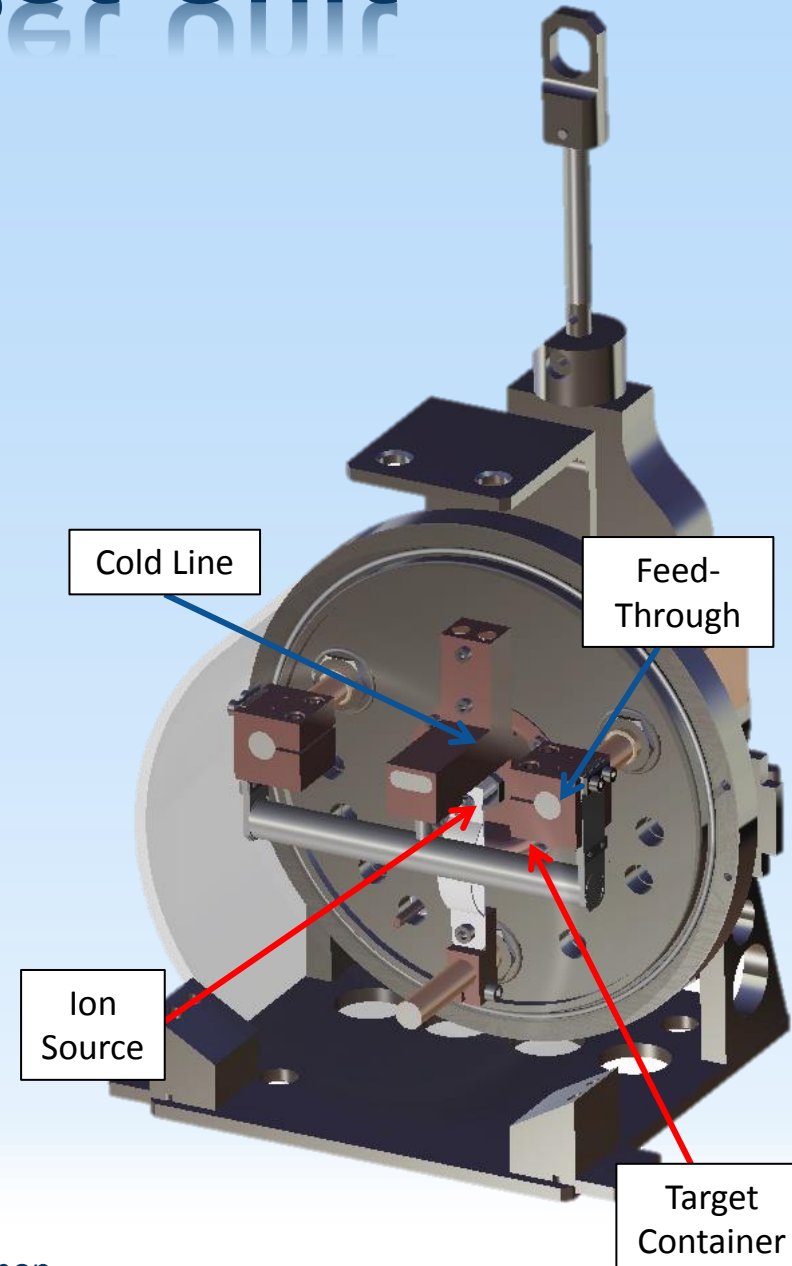
Target Life

Safety

Optimization

Production

Radioactive Waste





Cryogenics, Accelerators and Targets at HIE-ISOLDE

**CATHI Technical Report**

Target Conceptual Design: Mechanics: Target Calibration

S. Cammino, S. Mazzari

This work is part of CATHI Work Package 6: ISOL Target and Front-End Upgrade Studies

The research leading to these results has received funding from the European Commission under the FP7/PEOPLE/2010-ETN project CATHI-Master Course Actions - ITN.  
Grant agreement no. ITN-GA-2010-246410

# Standard Temperature Calibration



# \* Calibration Chart



Calibration Chart

$I_{\text{cont}}$ [A]	$V_{\text{cont}}$ [A]	$I_{\text{source}}$ [A]	$T_{\text{cont}}$ [°C]	$T_{\text{source}}$ [°C]
450	3.01	270	1717	1294
500	3.38	270	1740	1294
550	3.68	270	1850	1294



# \*Thermal Measures Optimization



Precision



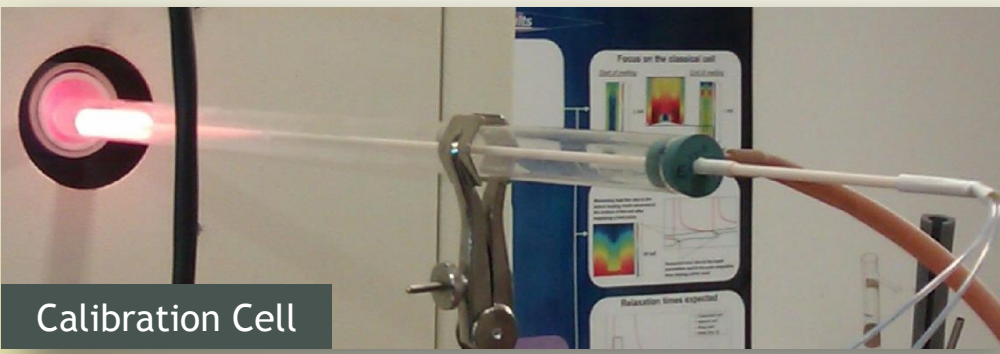
Reproducibility



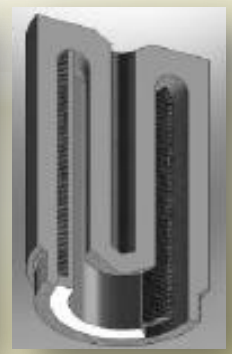
Intensive Test Campaign

Diagnostic Instrumentation Study

Laboratoire national de métrologie et d'essais



Calibration Cell



# \*Standard Thermal Calibration



Cryogenics, Accelerators and Targets at HIE-ISOLDE

## CATHI Technical Report

**Target Conceptual Design- Mechanics: Target Calibration**

S. Cimmino, S. Marzari

This work is part of CATHI Work Package 6: ISOL Target and Front-End Upgrade Studies

The research leading to these results has received funding from the European Commission under the FP7-PEOPLE-2010-ITN project CATHI (Marie Curie Actions - ITN).  
Grant agreement no PITN-GA-2010-264330.

Measurement Conditions

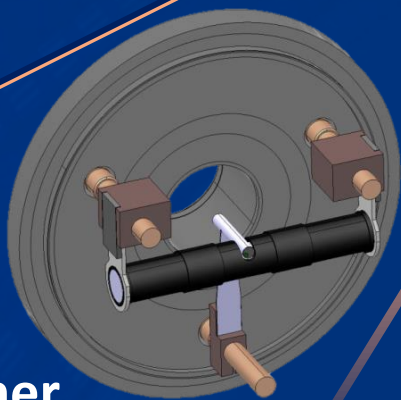
Pyrometer to use

Thermocouple Installation



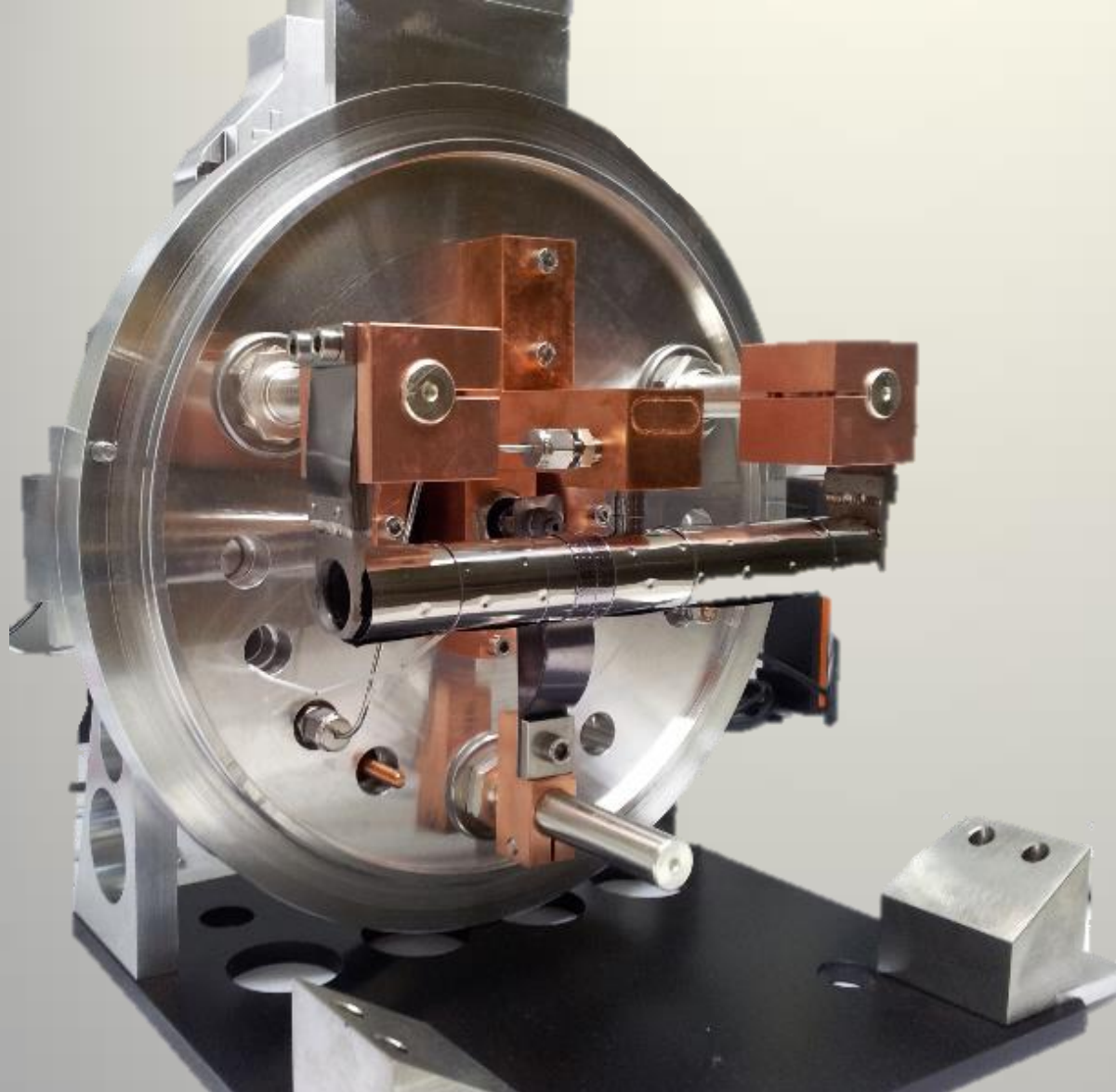


**Target  
Container  
Optimization**

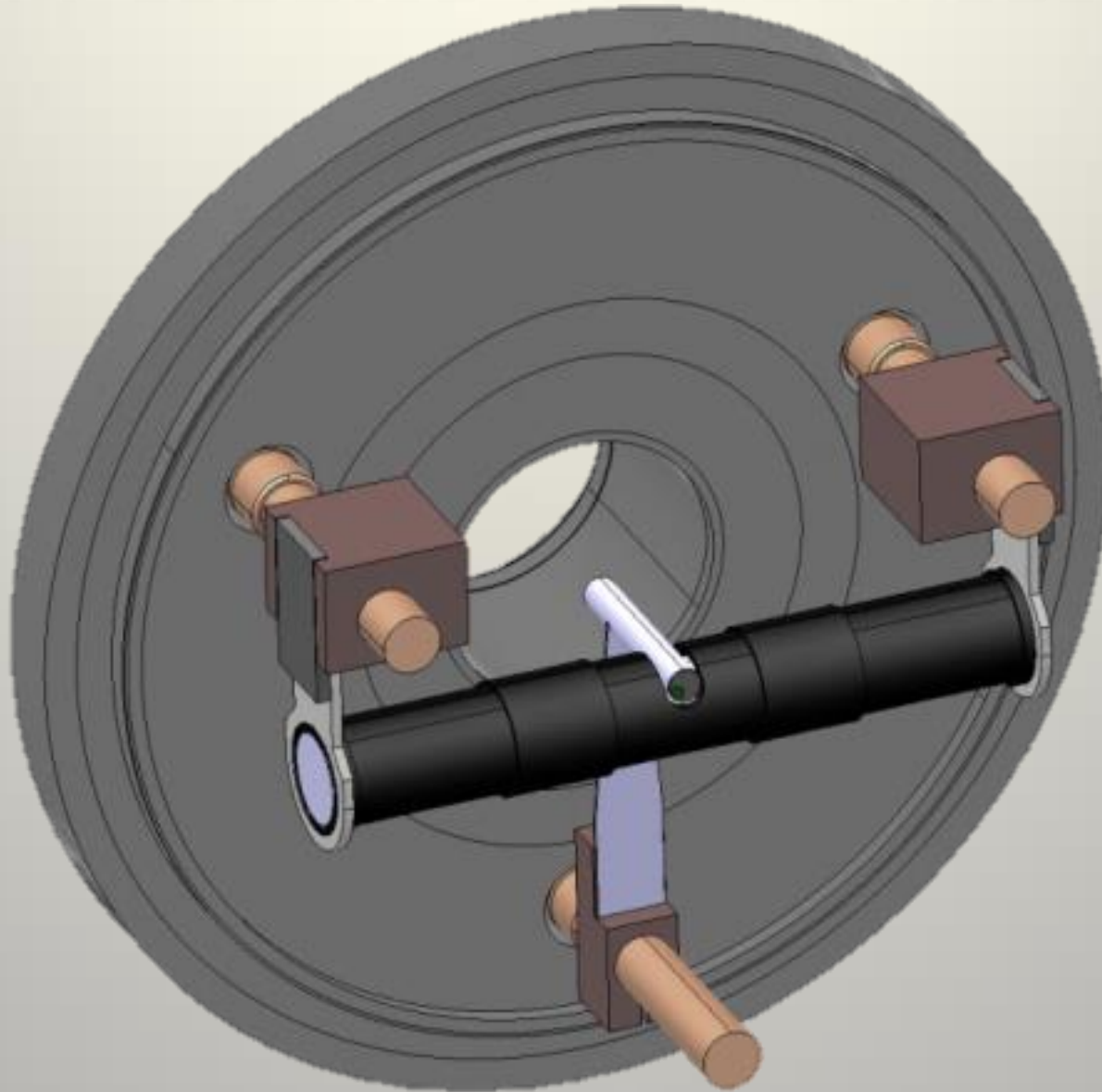




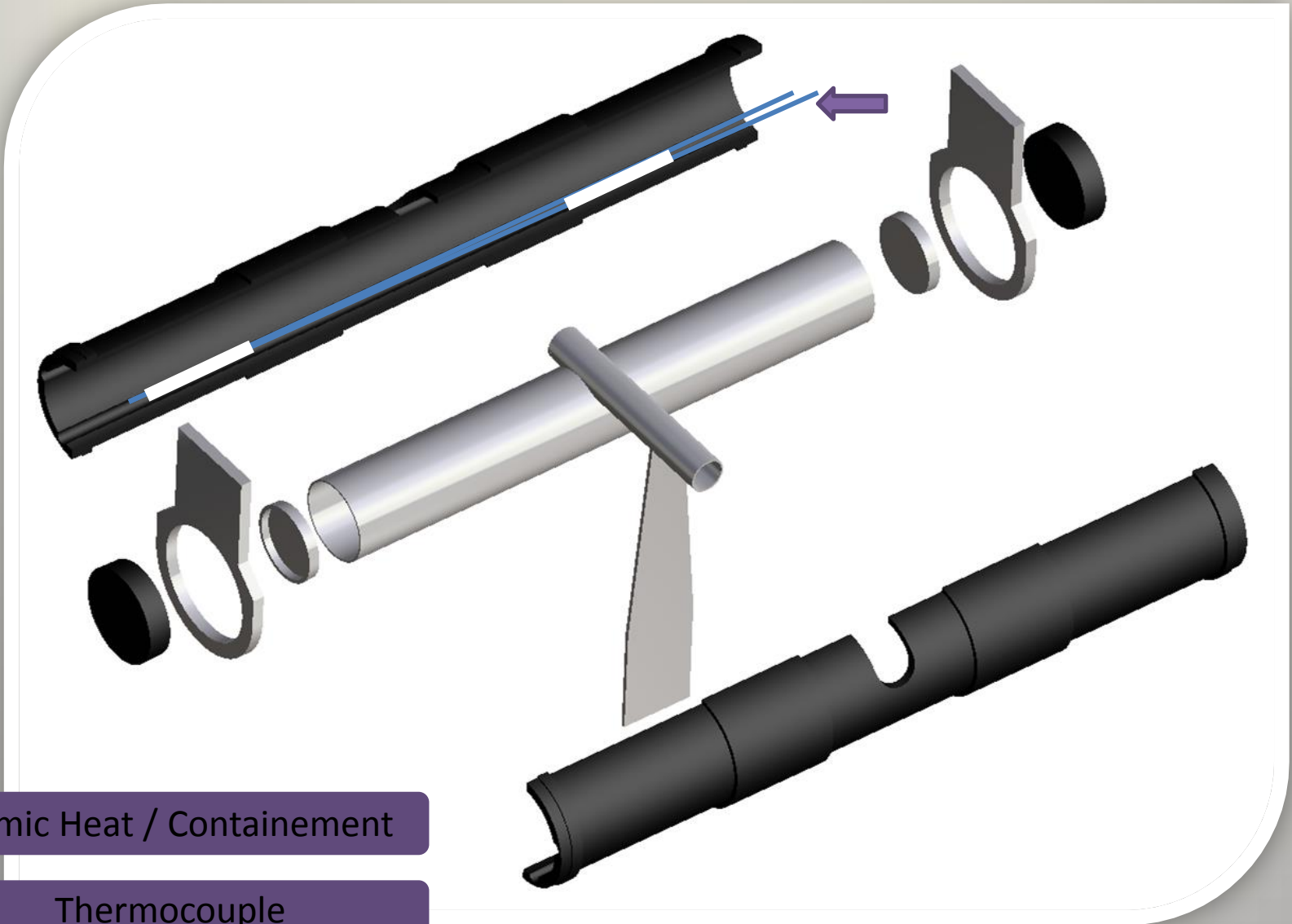
# \* Conventional ISOLDE Container



# \* New Graphite Heater Prototype



# \* New Graphite Heater Prototype



Ohmic Heat / Containment

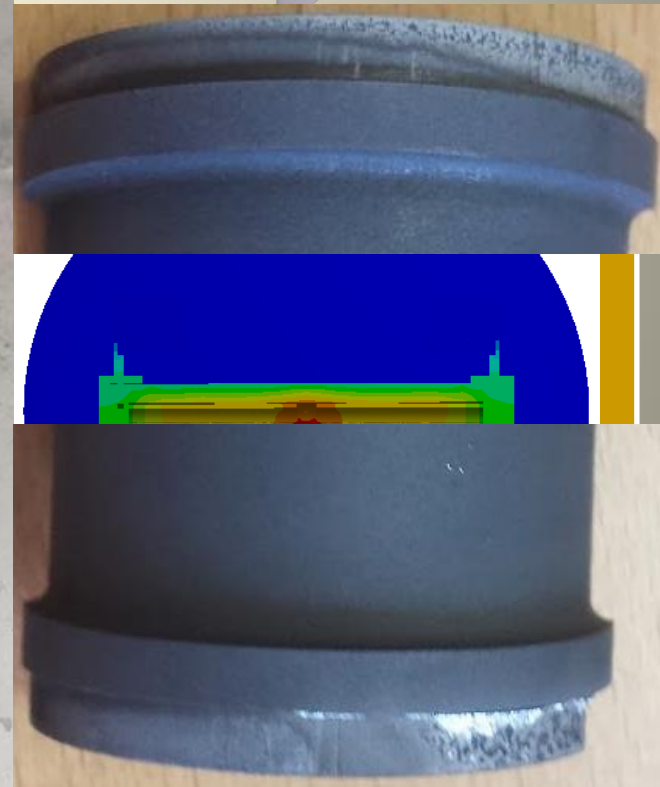
Thermocouple

# \*Graphite Prototype Study

Graphite Heater Tests and Simulations

Graphite Heater – Sigratherm Shielding : Tests and Simulations

Total Graphite

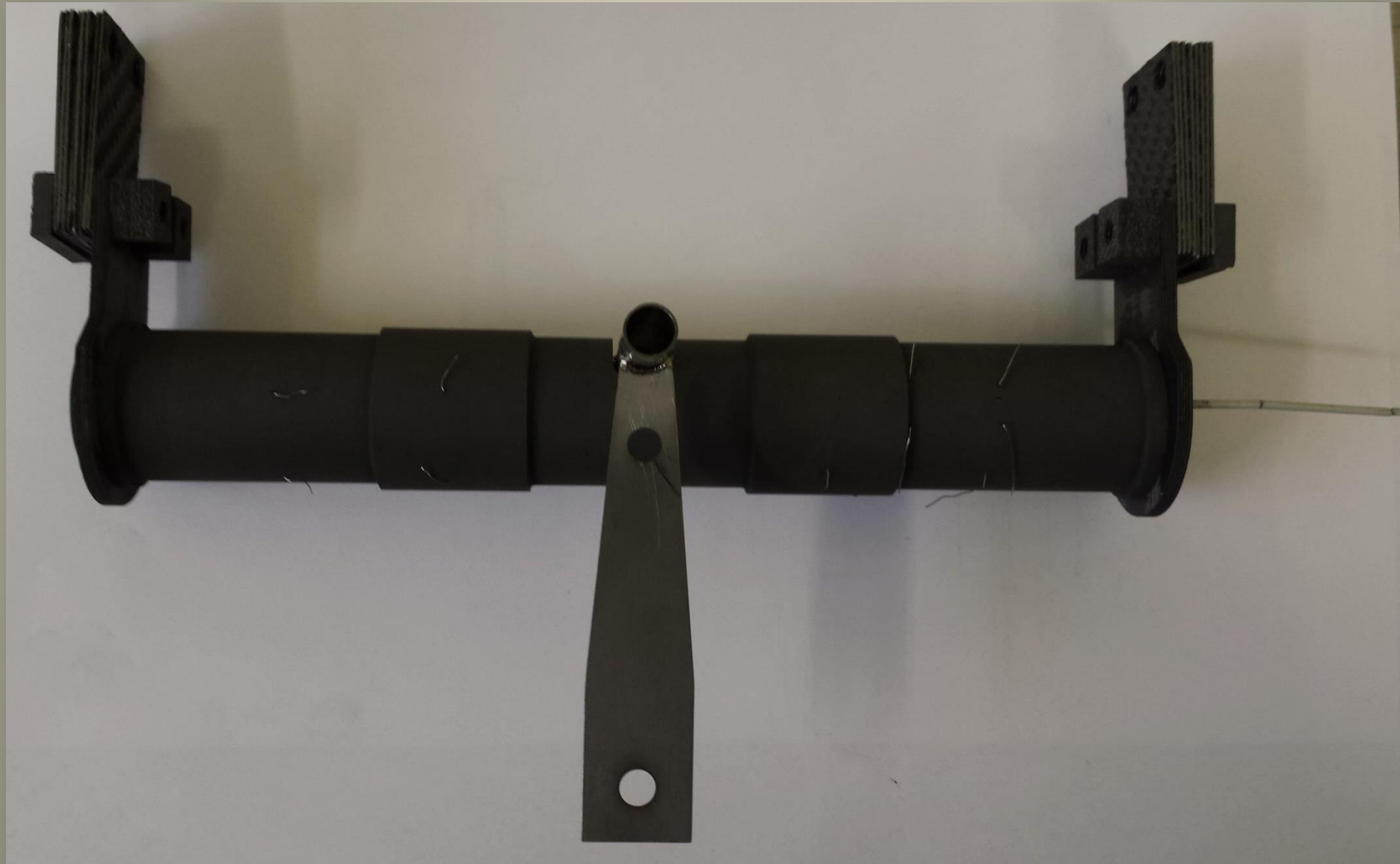




# \*Parts Collection



# \* Prototype

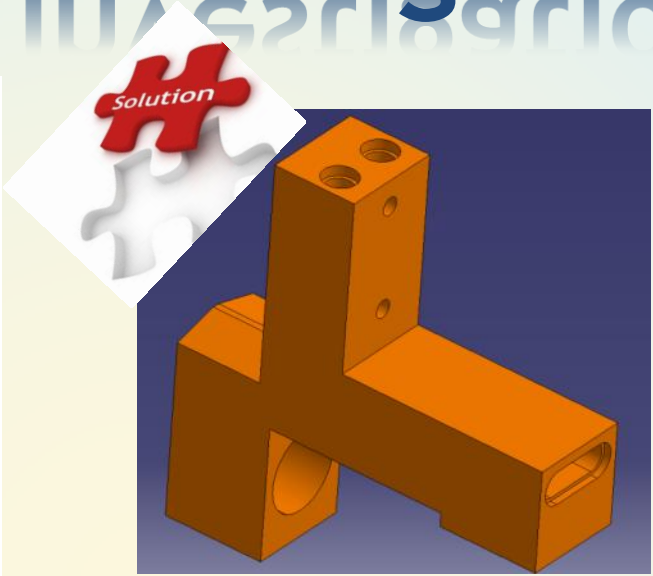
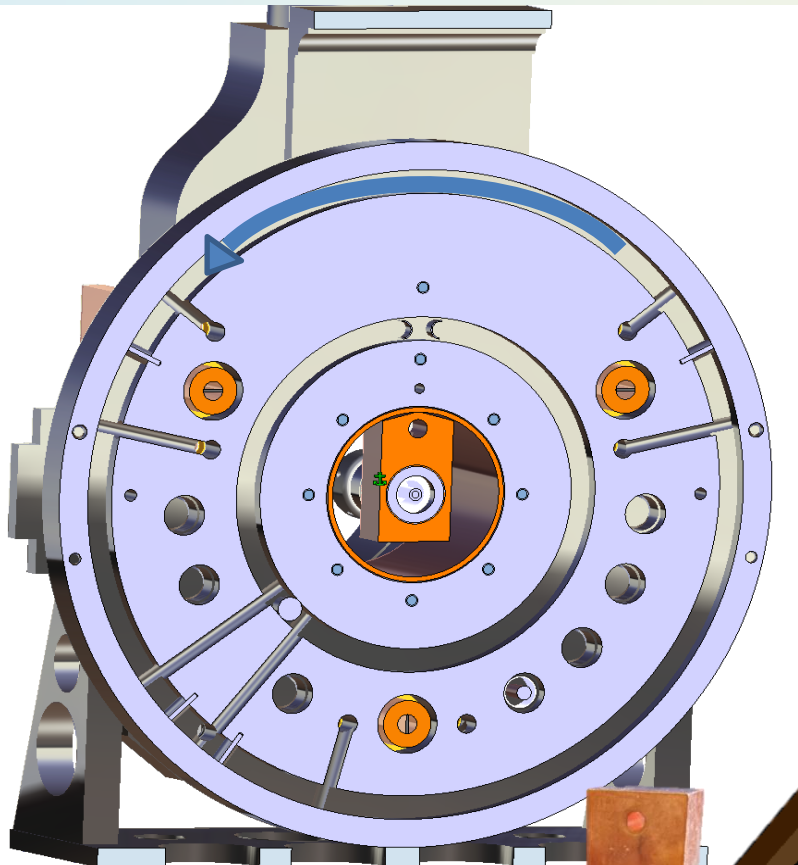




**Cold Line – Alternative  
Cooling Solution Study**



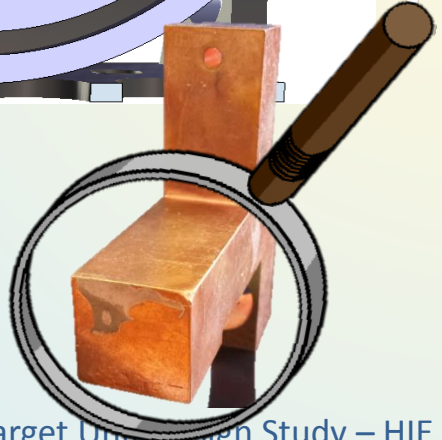
# \* Water Leaks Investigation



Electron Bombardment welding



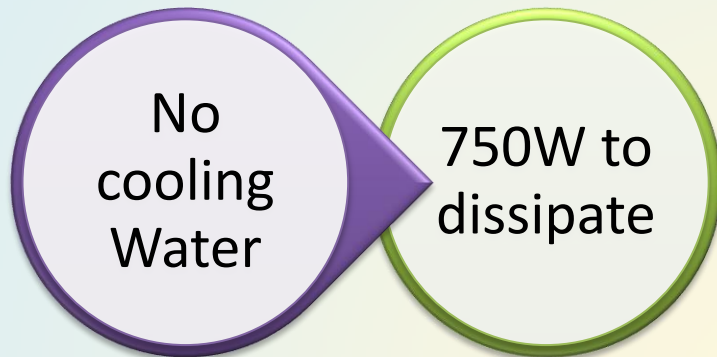
Brazing



It resists up to 500 bar



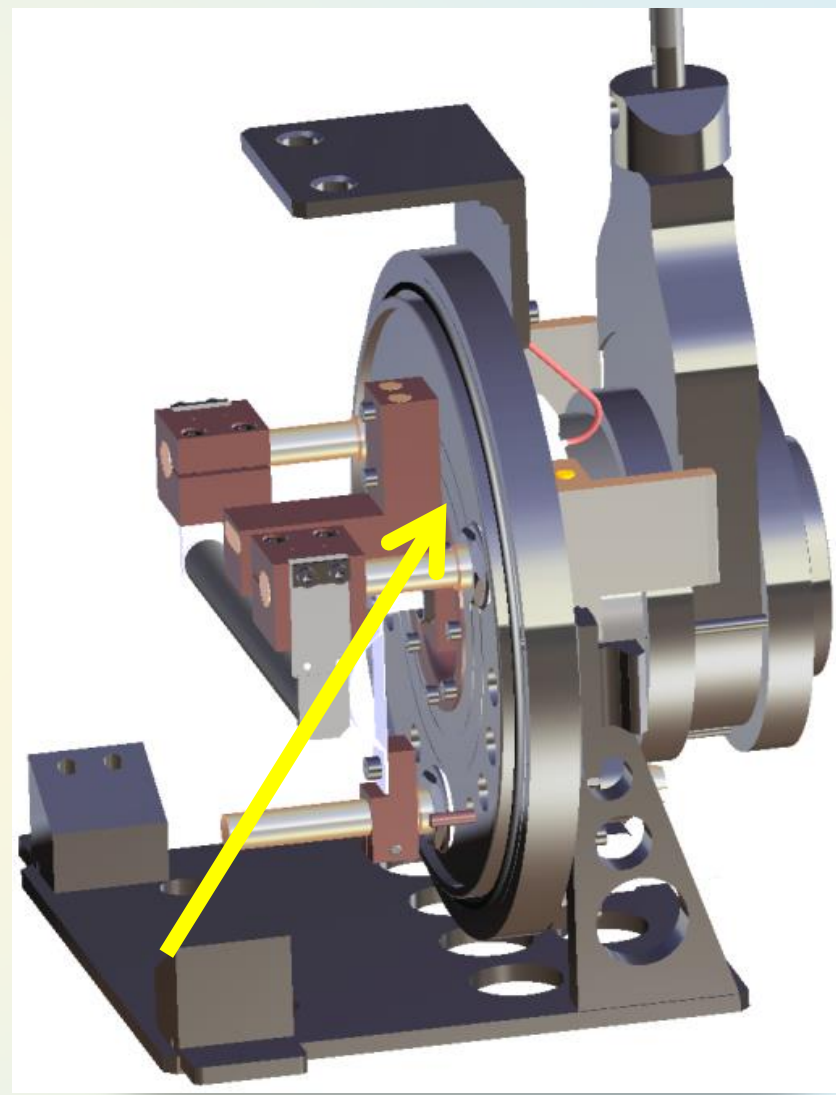
# \* Alternative Cooling Solutions



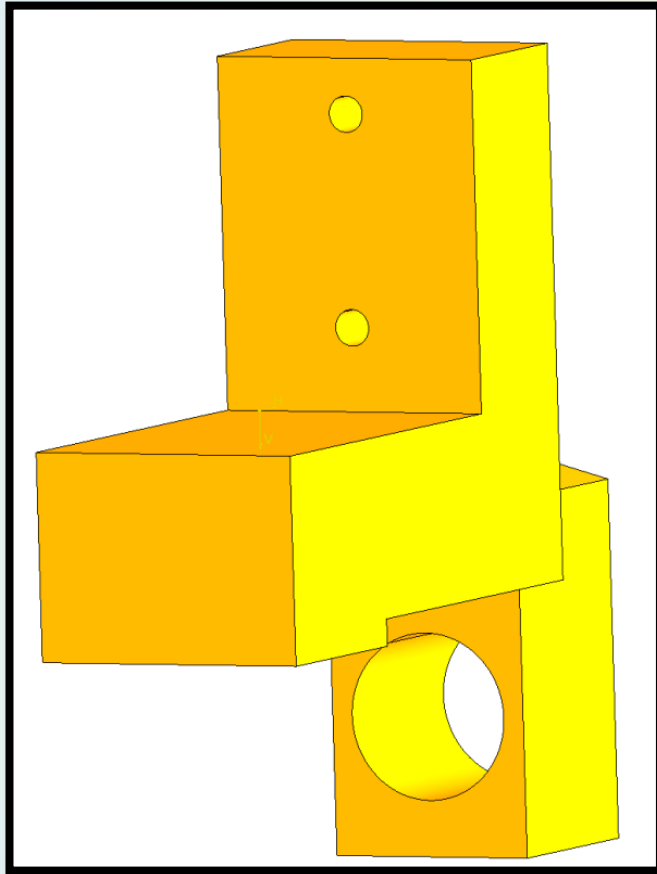
Thermal Contact Flange

Heat Flux Optimization

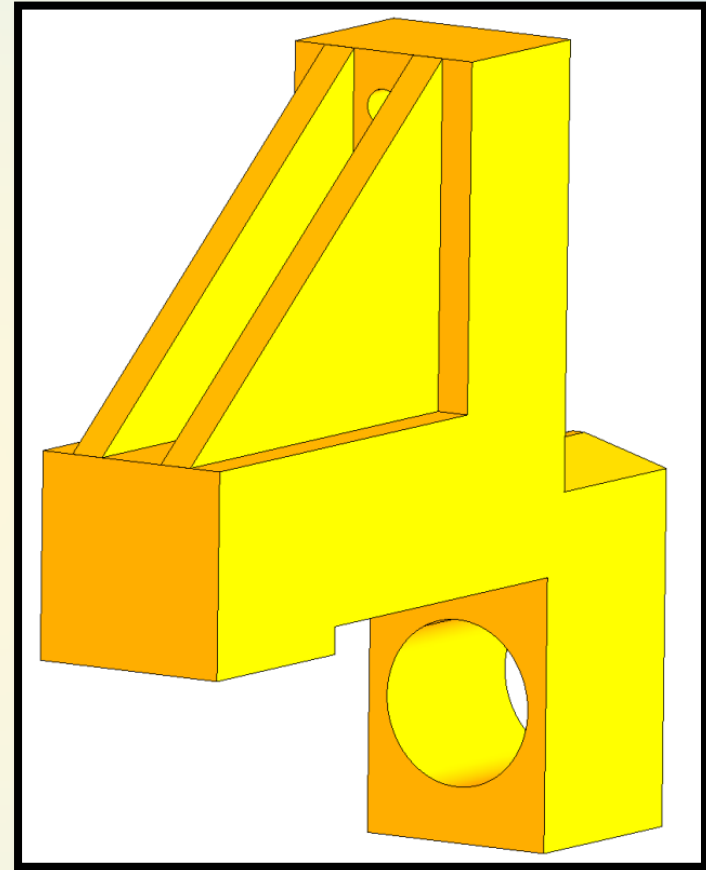
Heat Pipes Integration



# \* Heat Flux Optimization

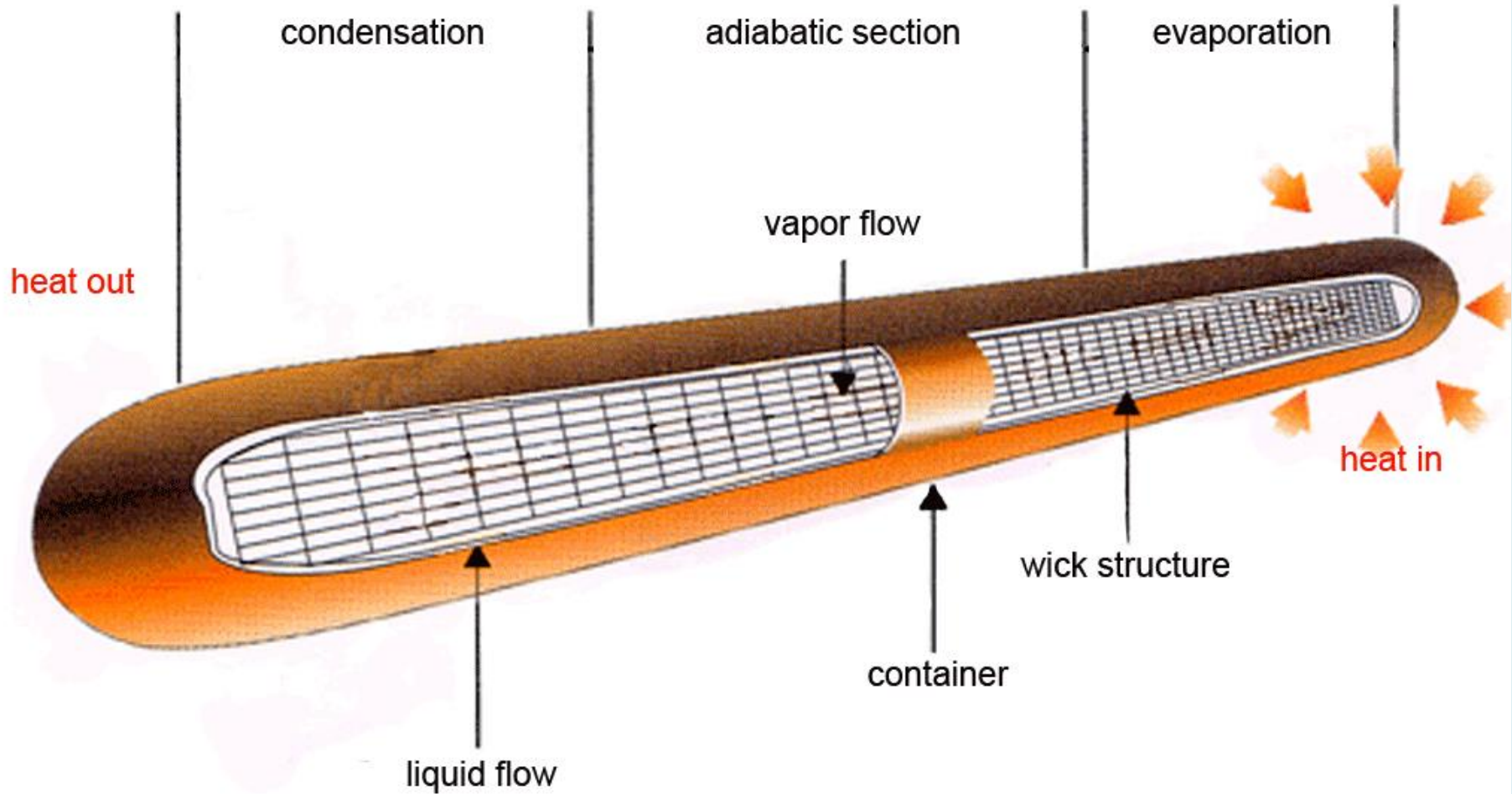


Thickness Increase



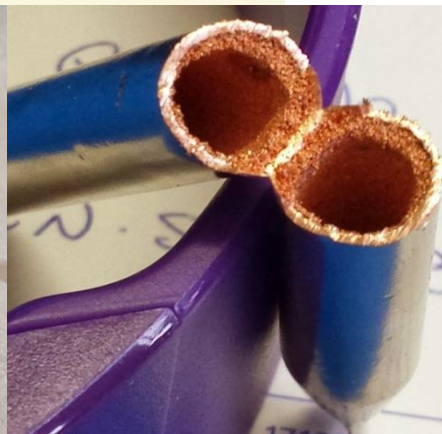
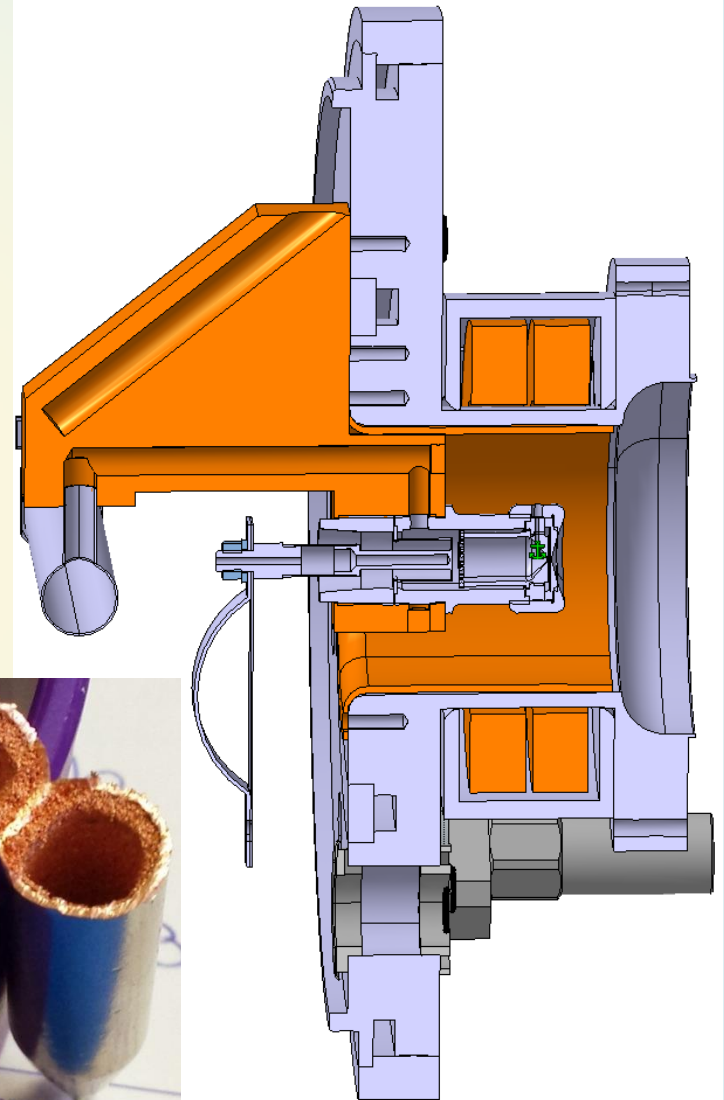
Connection Hot-Cold

# \* Heat Pipes



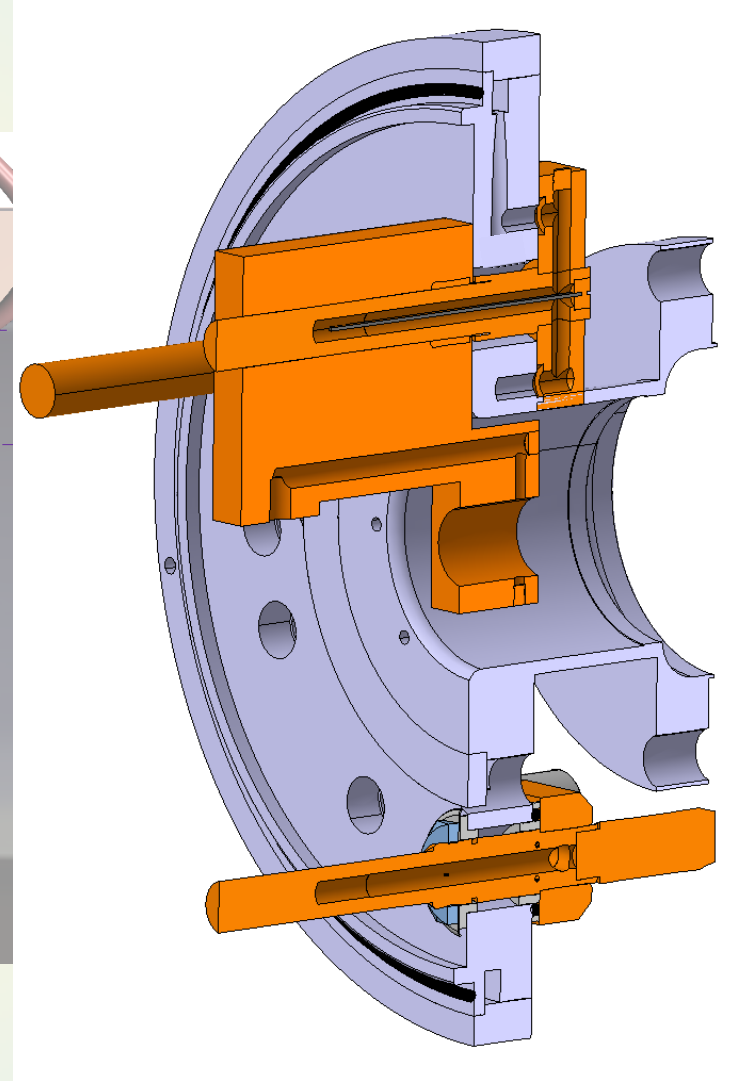
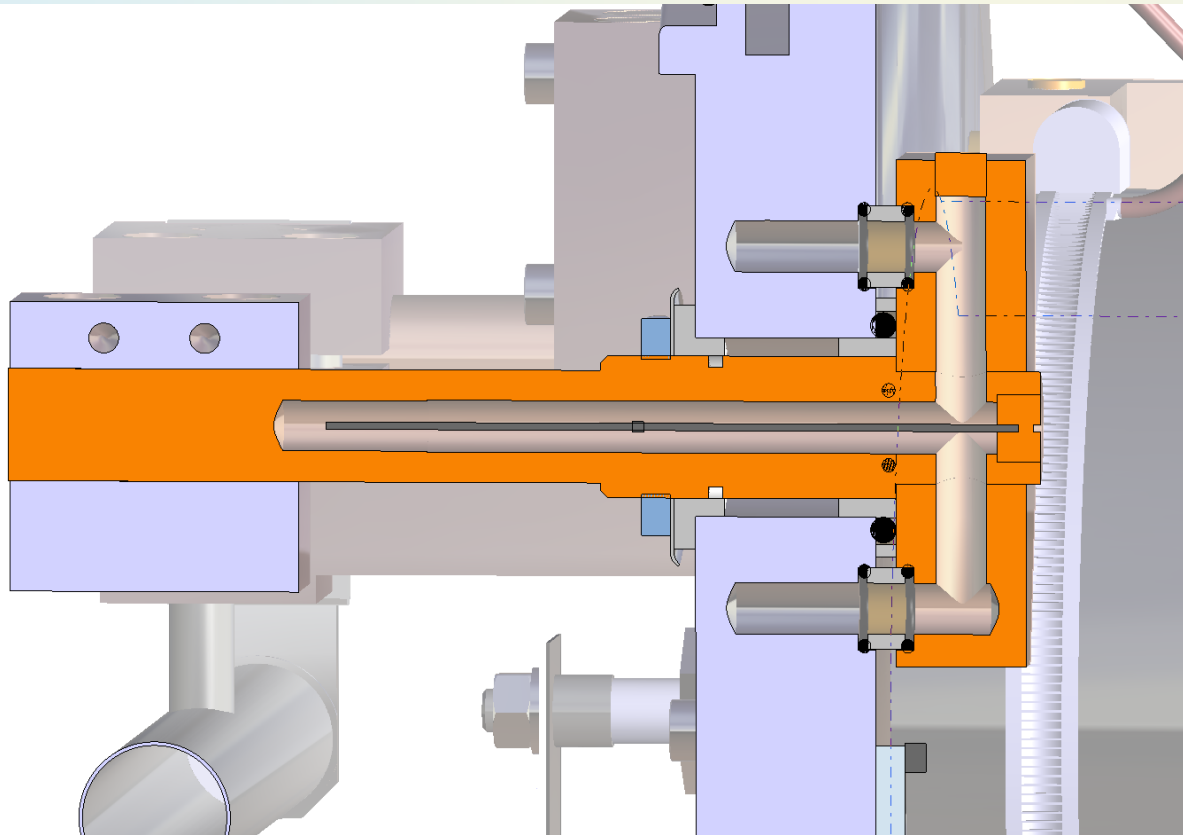
# \* Heat Pipes Integration

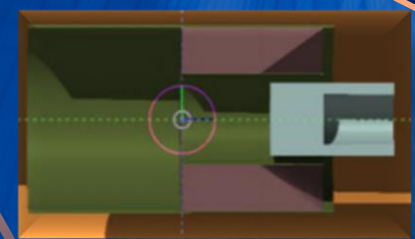
Material: Copper nickel plated;  
Wick Type: Sintered;  
Fluid: water;  
Active Length: 100mm;  
Total Length: 130mm;  
Diameter: 10mm;  
Heat Transport 65 W;  
Thermal Resistance: 0.015 ~ 0.0769.





# \* Feed Through Solution





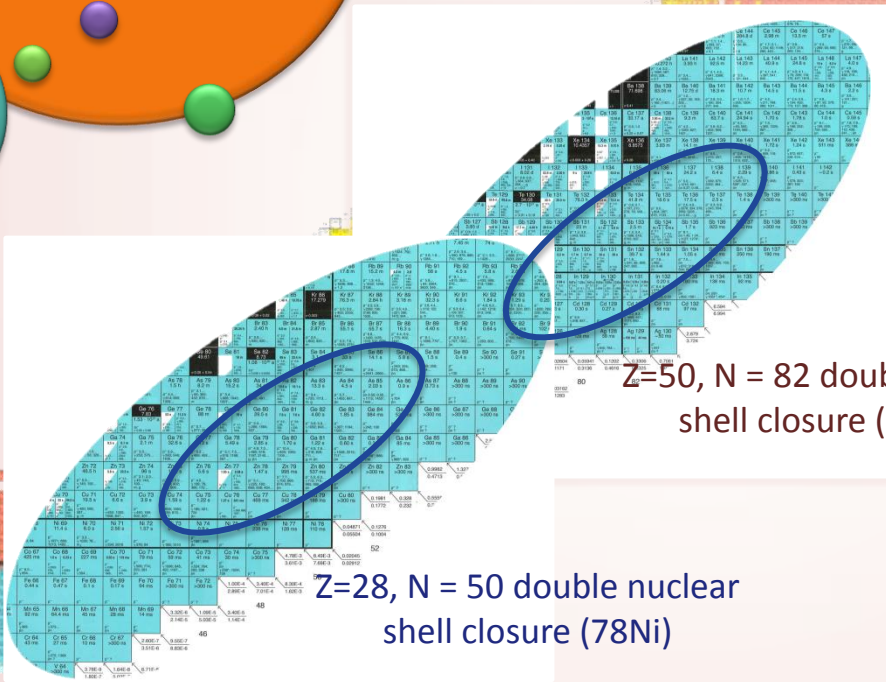
# Neutron Converter Design Study

# \* Neutron Spallation Source

Neutron Converter

Energy Deposition

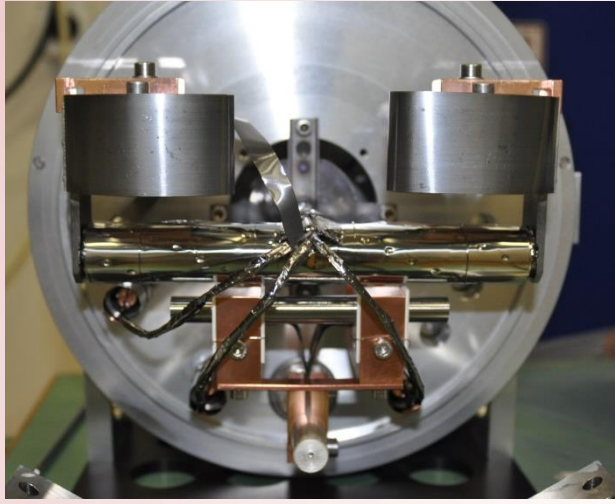
Isobaric Contaminant



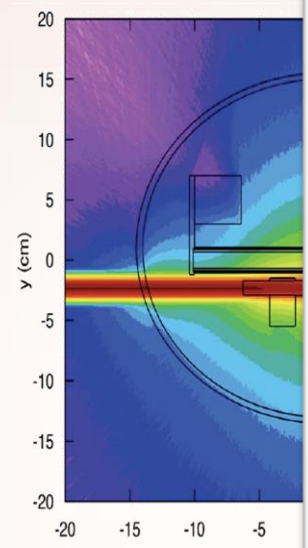
$Z=50, N=82$  double nuclear shell closure ( $^{132}\text{Sn}$ )

$Z=28, N=50$  double nuclear shell closure ( $^{78}\text{Ni}$ )

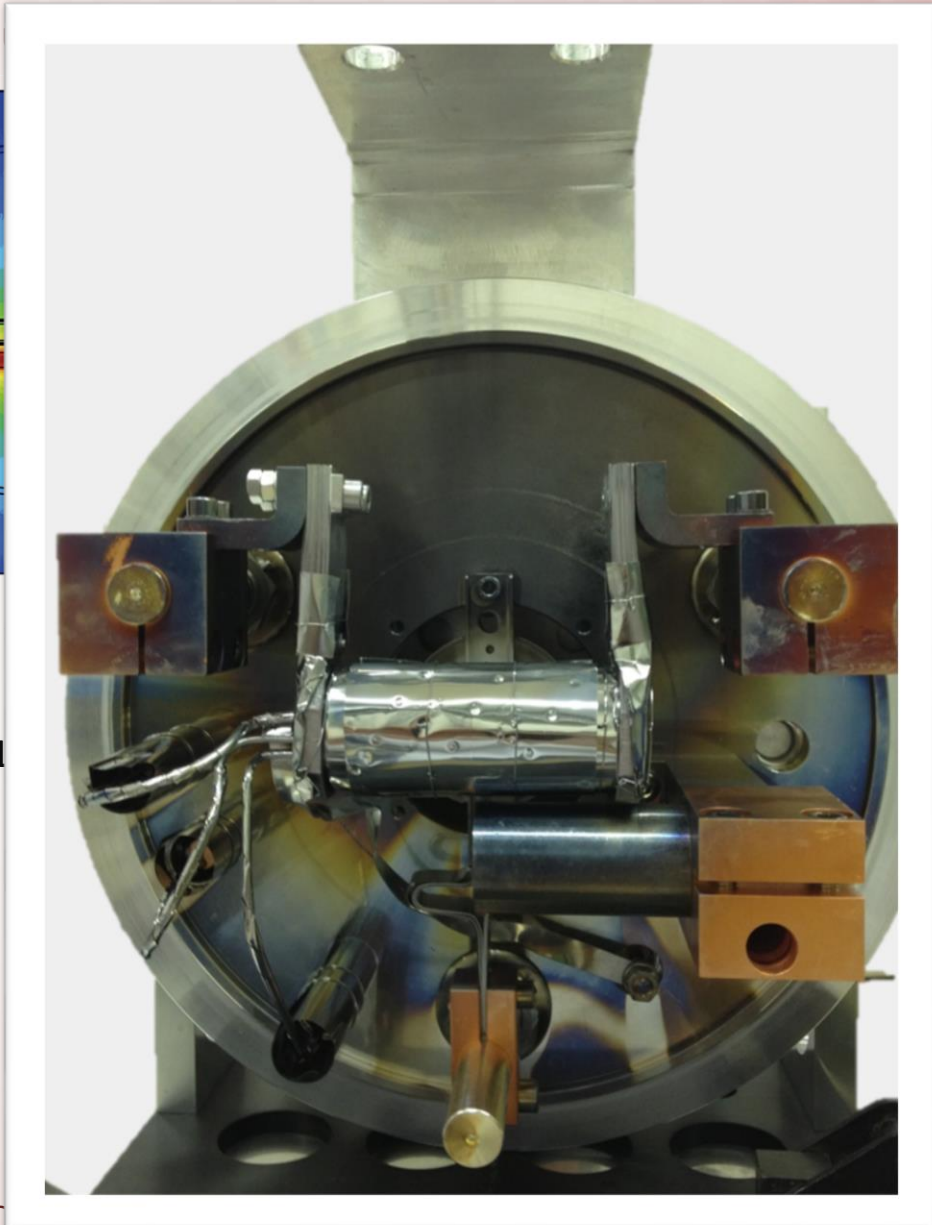
# \* ISOLDE Conventional Converter



Proton Distrib

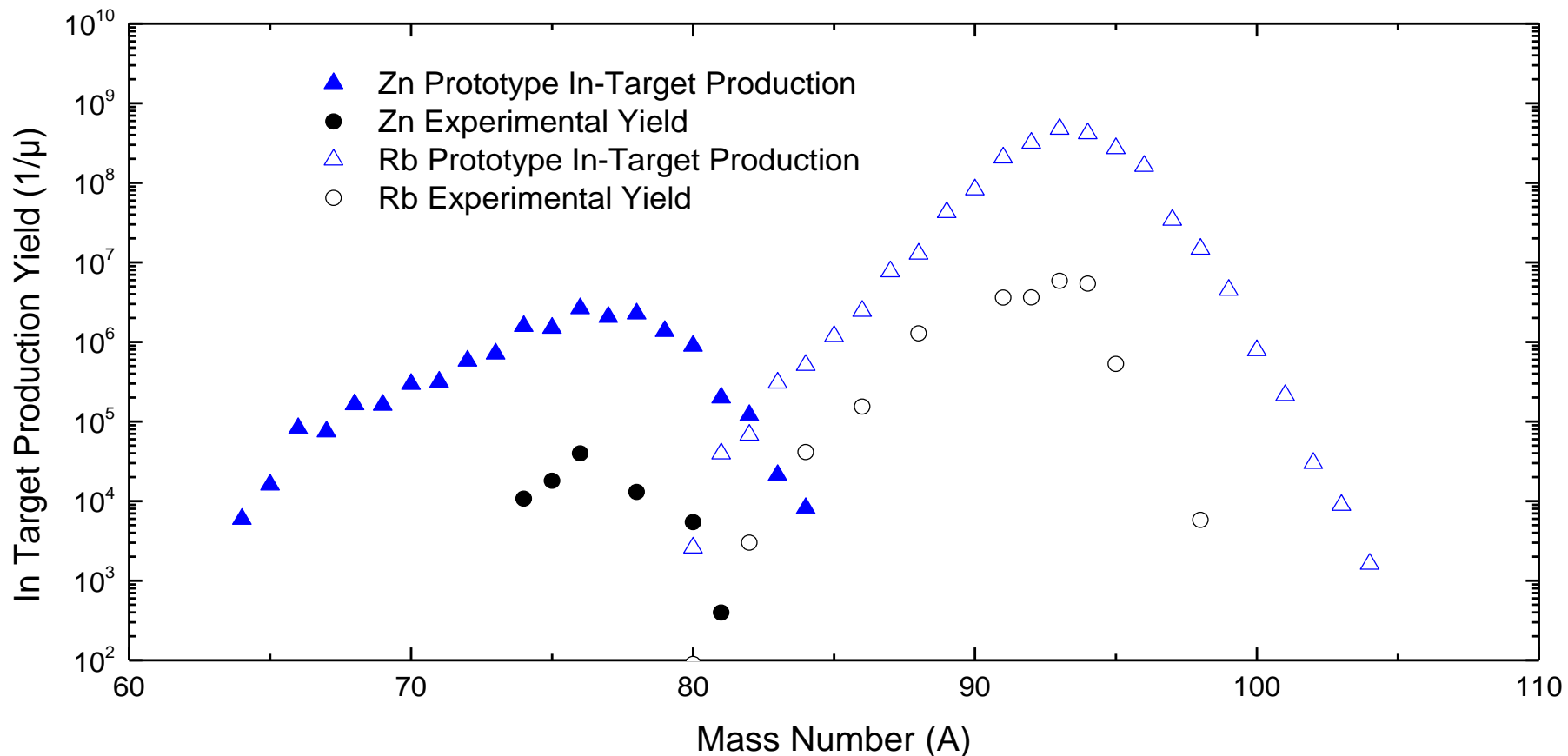


R. I



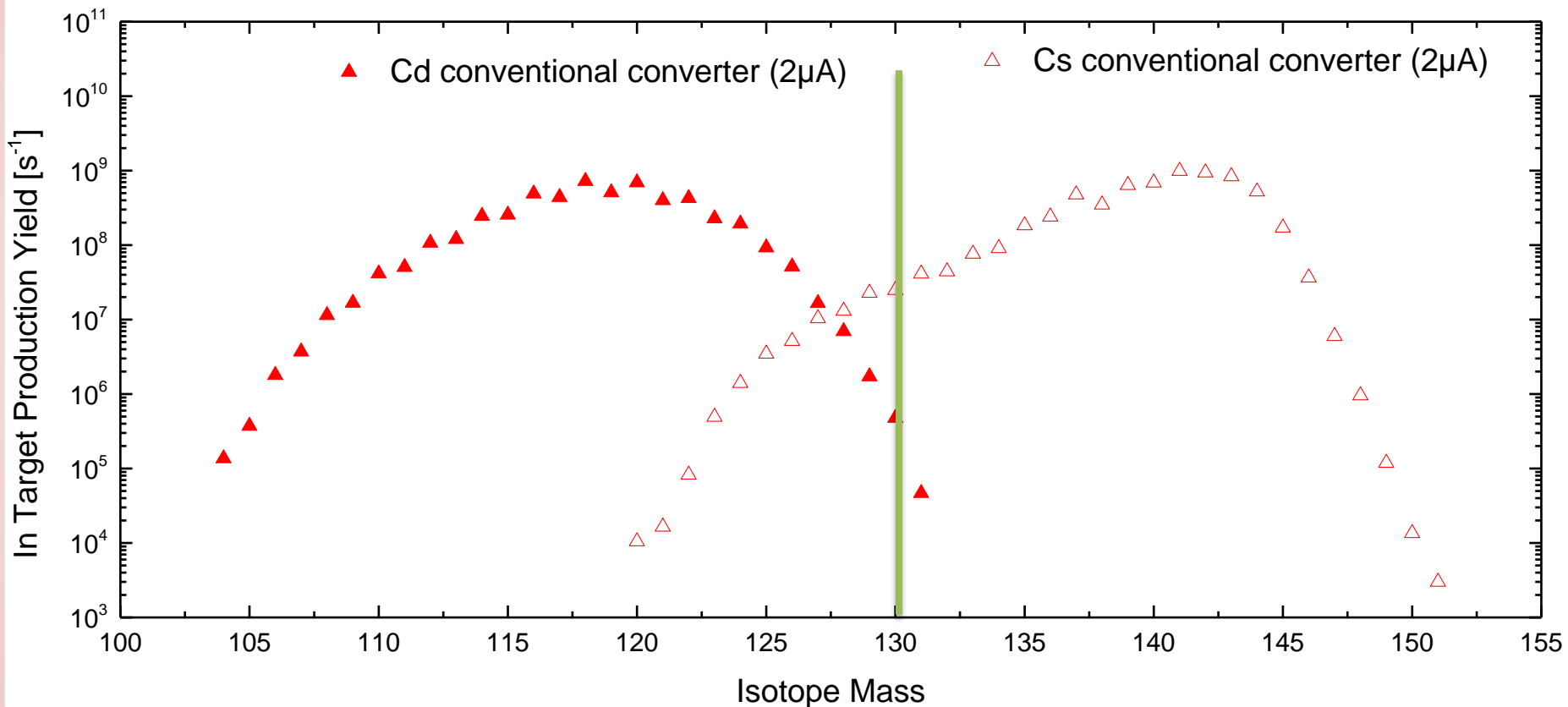


# \*Simulation Validation

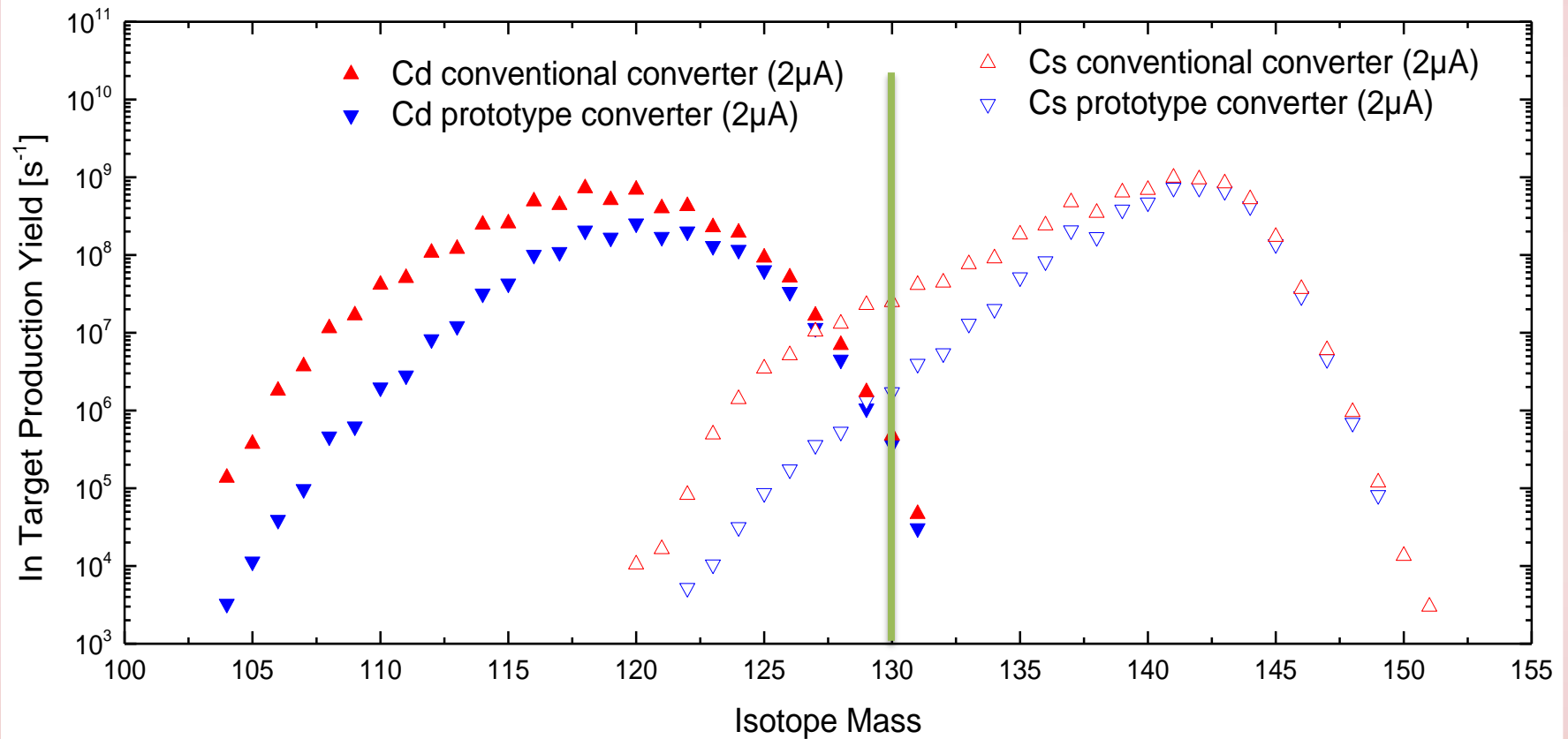


A. Gottberg et al., to be submitted to NIM B

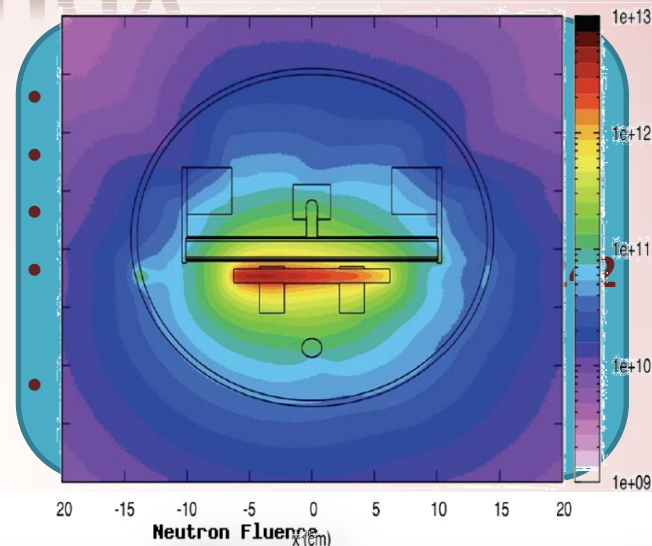
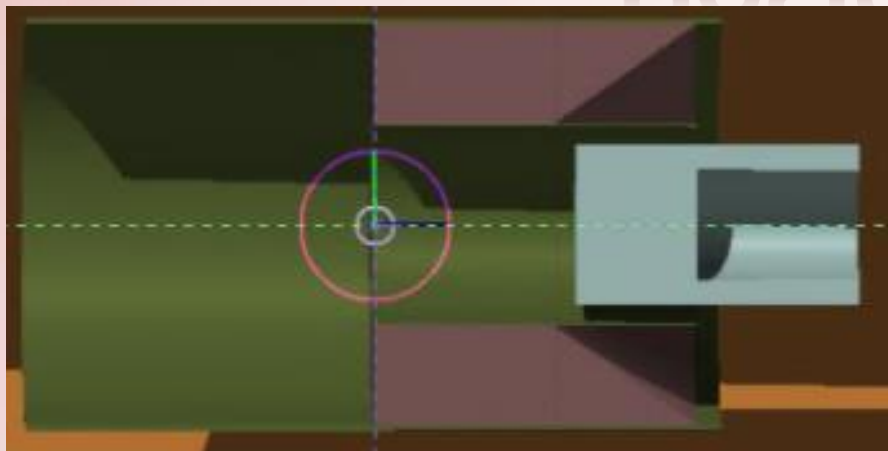
# \* Production Comparison



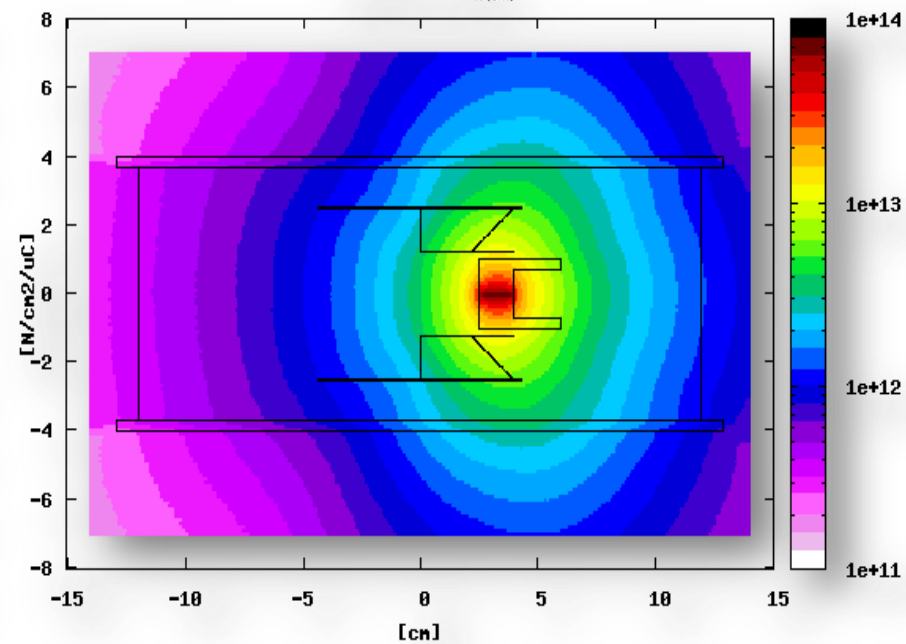
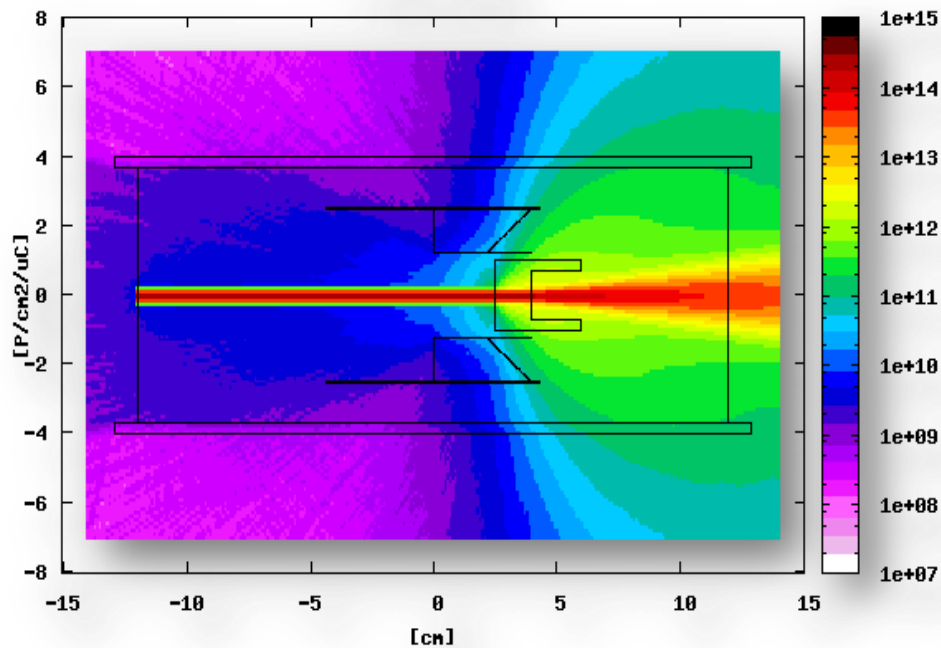
# \* Production Comparison



# \* Design Study

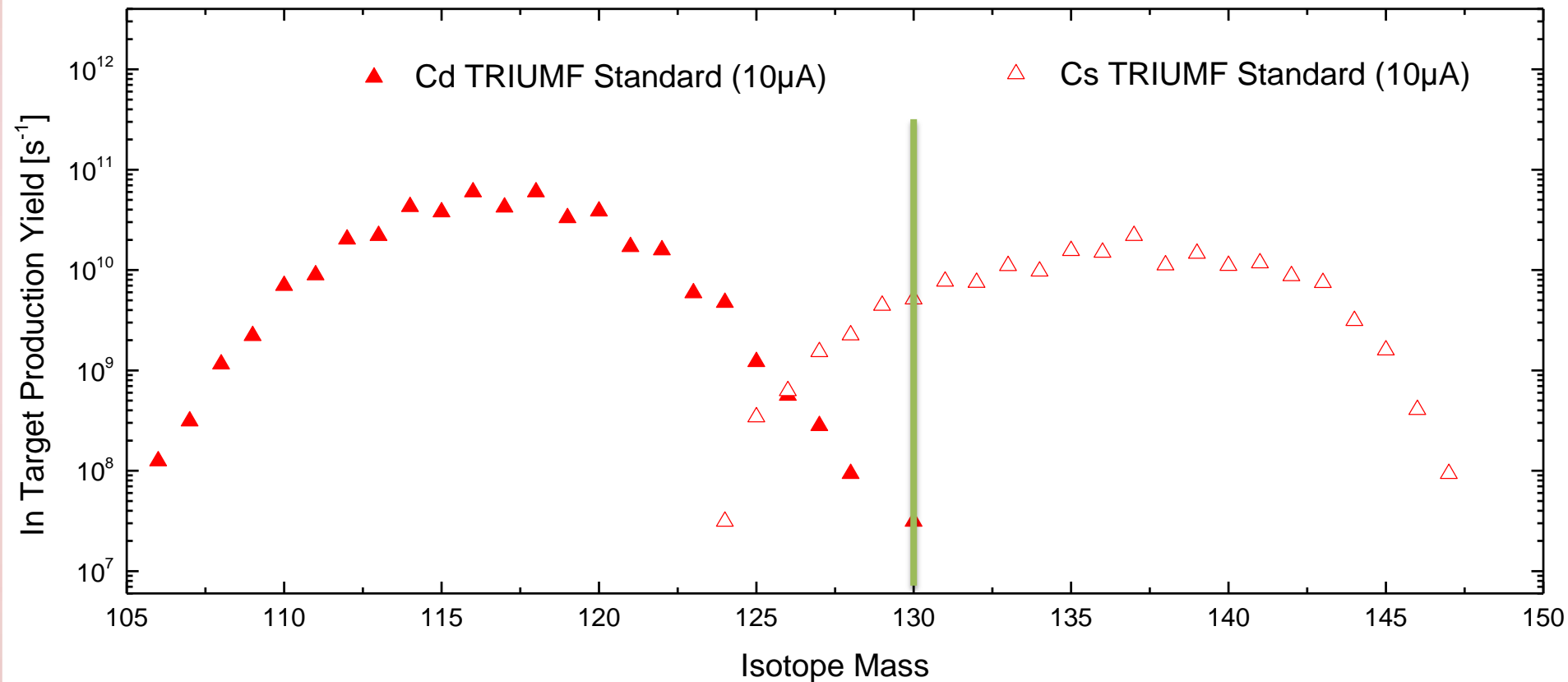


Proton Fluence

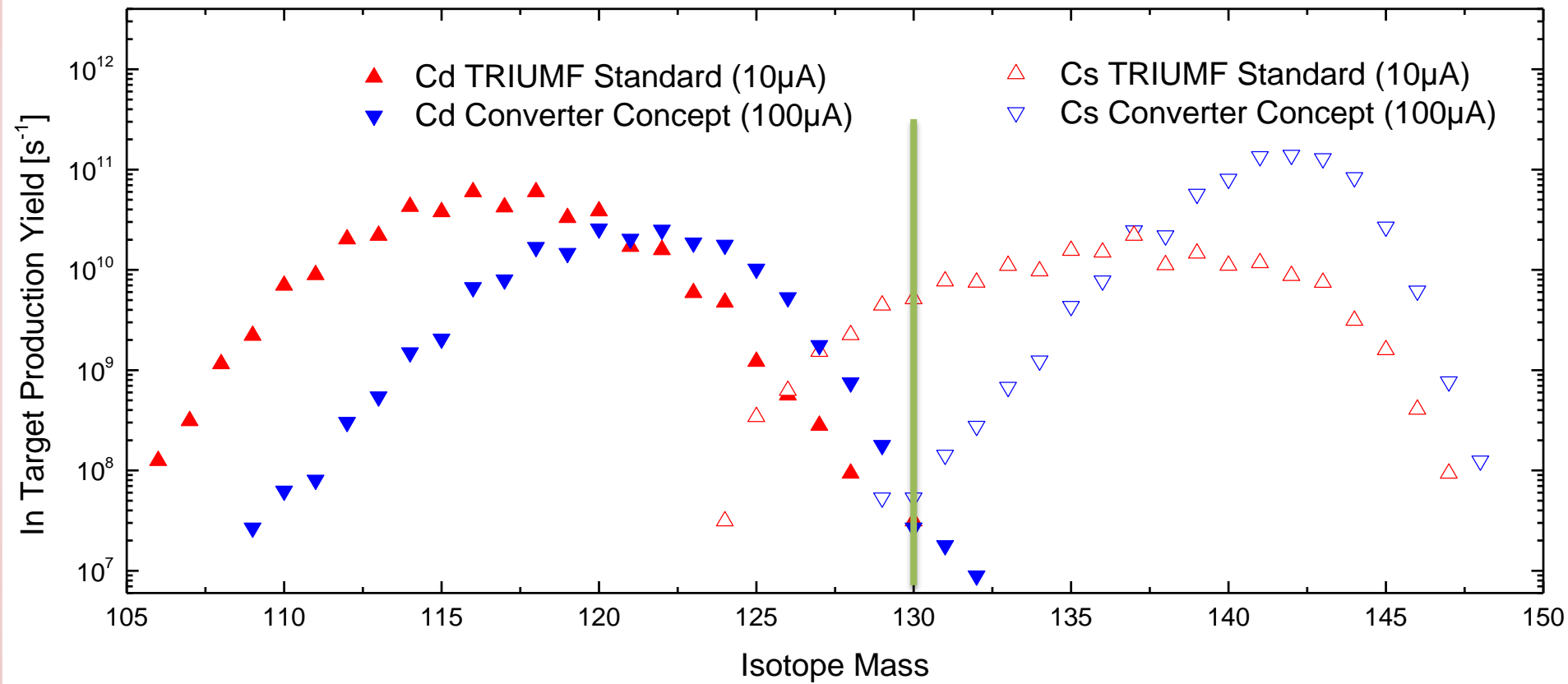




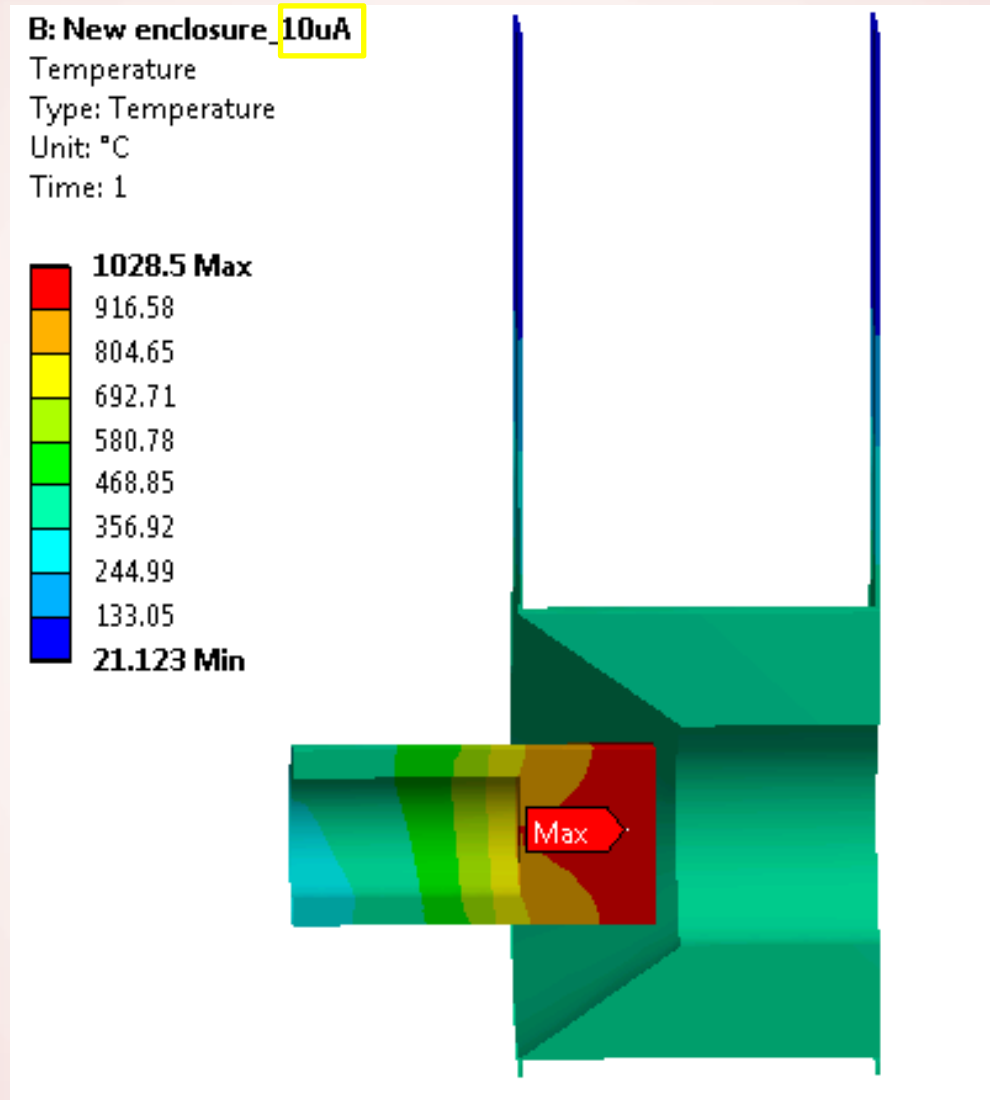
# \* Production Comparison



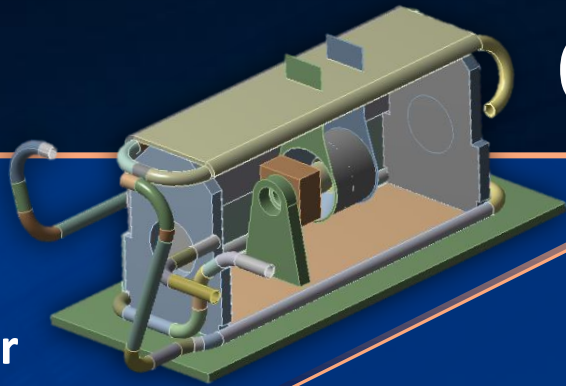
# \* Production Comparison



# \* Preliminary Thermal Analysis

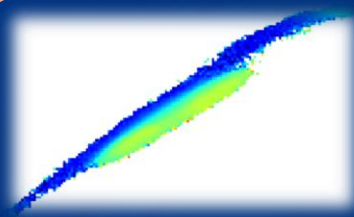


# Outlook



Calibration  
Cellule  
Development

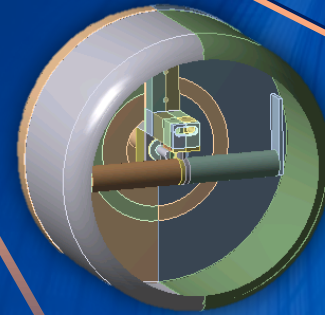
Neutron  
Converter  
Design  
Finalization



Converter  
Online Tests



Graphyte Prooptype  
Experimental Tests



Design Optimization  
Test and Simulations



**THANK YOU FOR  
THE ATTENTION**

