MEDICIS Board:
Tb155Productions @ Arronax in 2019

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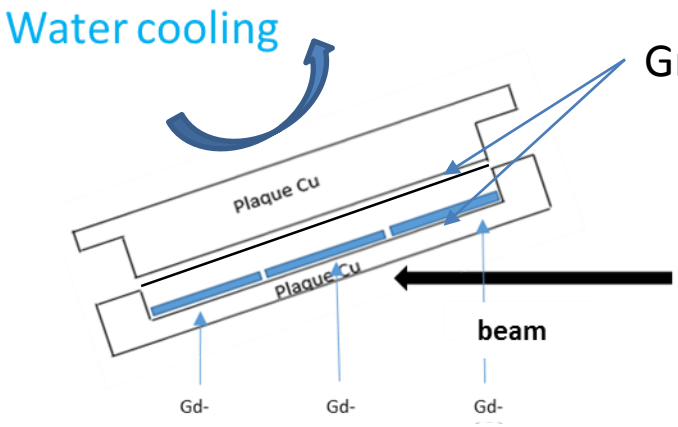
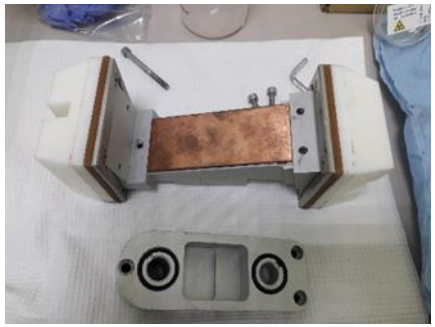
Group accelerator, radiosafety group

Tilted target with graphite foils

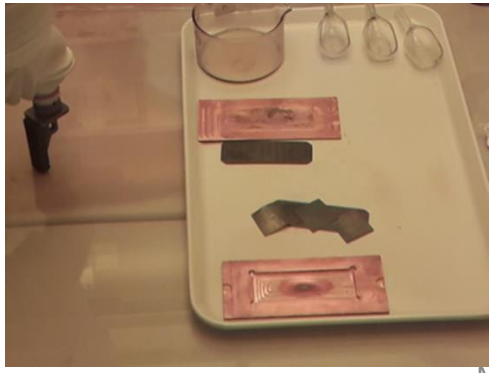
3 Gd foils 25µm thickness between 2 graphite foils 500µm thickness in copper body





Irradiation: JUL 02 2019

Proton beam 2h30– E=55MeV – 20µA– 50 µA*h integrated



No change in gadolinium foil aspect
No change in graphite foil aspect

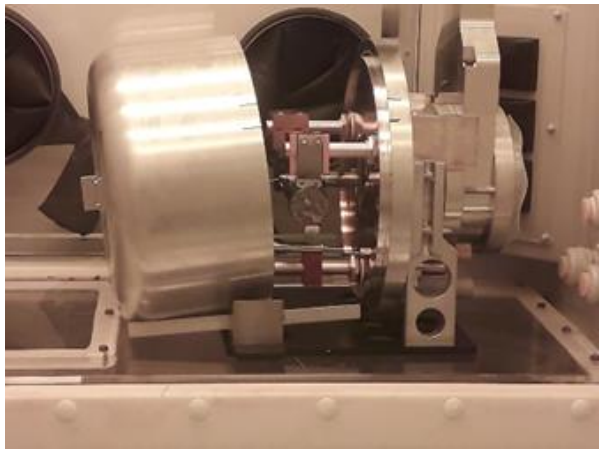
Target used for Tb 155 production

Two irradiations and shipping to CERN

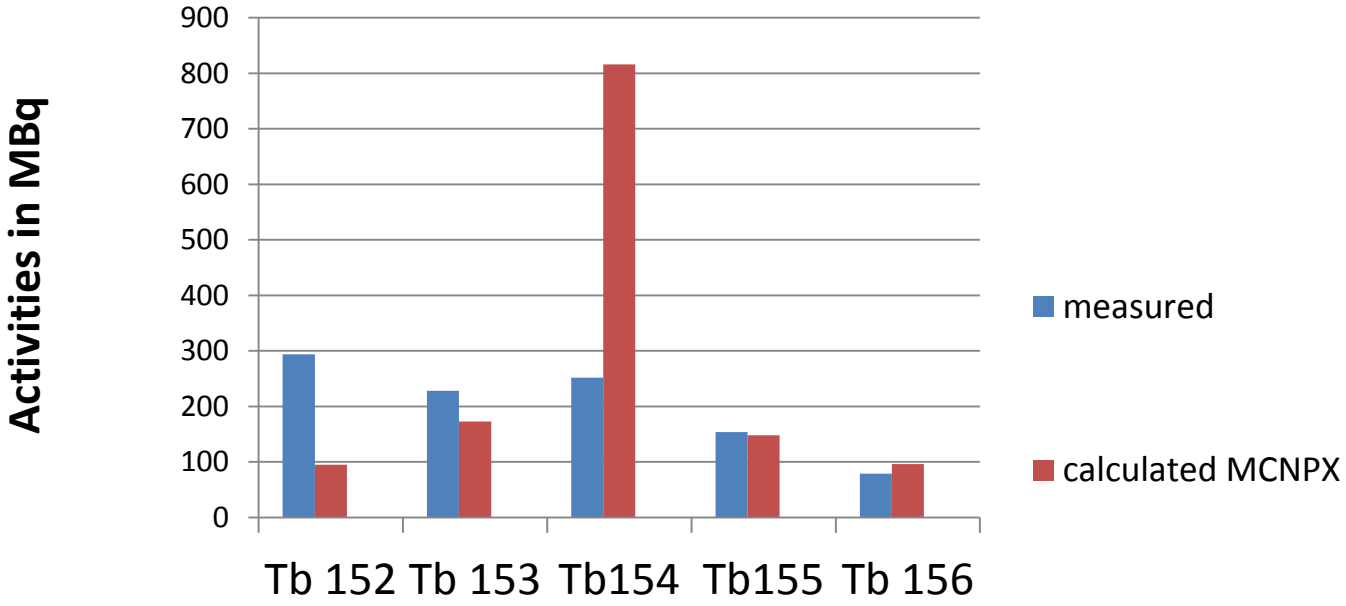
JUL 30 2019 and AUG 27 2019

Gd in MEDICIS #671 M Re target and shipping to CERN

Gd in MEDICIS #645 M W target and shipping to CERN



Produced Activities

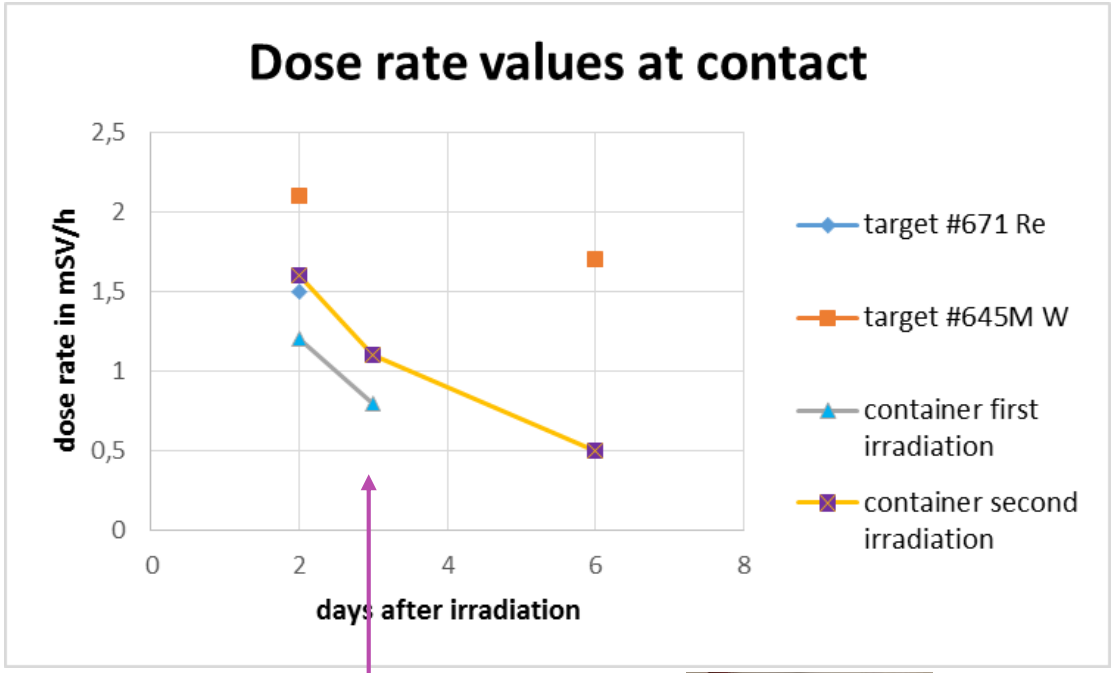


radionuclide	Half-life
Tb151	17.6 h
Tb152	17,5 h
Tb153	2,34 j
Tb154	21 h
Tb155	5,32 j
Tb156	5,35j

Good estimations of Tb 153, Tb 155, Tb 156 production with MCNPX in our conditions

Radionuclides	Tb153	Tb155	Tb156
Produced activities in MBq	228	154	79

Dose rate values



EOB + 3 days:
package shipping

Mean dose rate value at contact ~1 mSV/h

maximum authorized value for shipping 2 mSV/h

Conclusion

- Production of 150 MBq of Tb 155 at ARRONAX and shipping to CERN
- Dose rate value at contact of the package around 1mSV/h

➡ The activity can be multiply by two in the current setup

- Separation Gd/Tb in progress

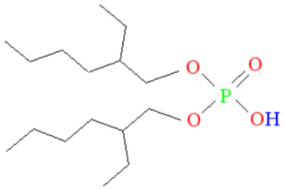
Gd/Tb separation

Separation done after dissolution of the irradiated target, solution S0 with aim :

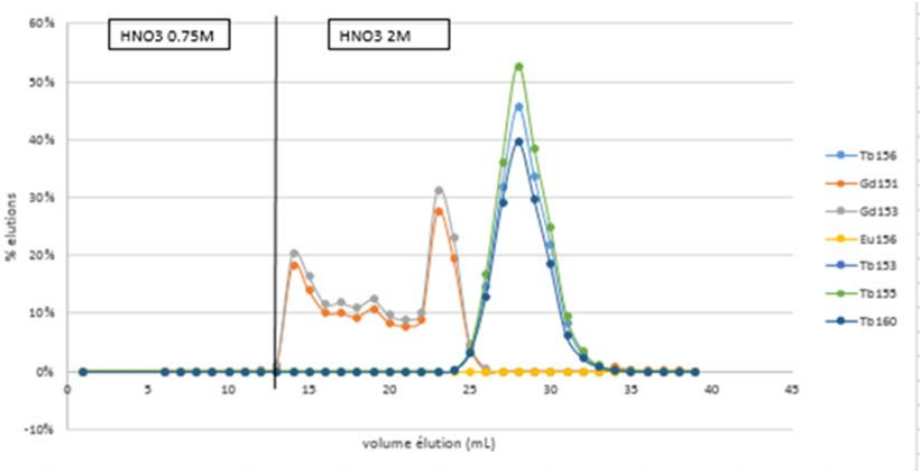
1 

: 100 

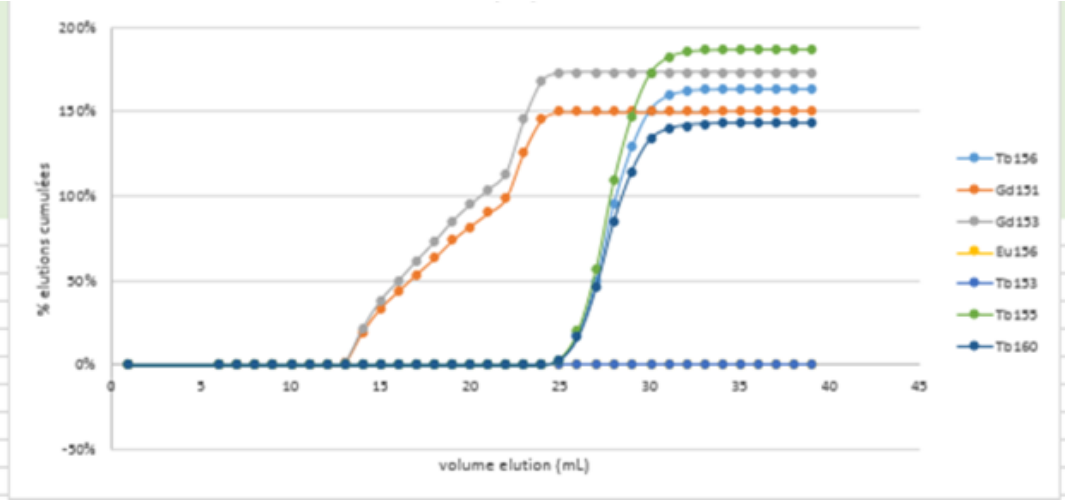
?



- LN (TRISKEM) resin washed with UP water + HNO_3 8M
- conditioning with HNO_3 0.75M at 1mL/min
- S0 in head column
- Rinsing of beaker : 2*1mL HNO_3 0.75M
- Rinsing of the column: 8*1mL HNO_3 0.75M
- Rinsing of the column : 30*1mL HNO_3 2M



Gd/Tb separation



Possibility to separate 90 % of the Gd from the solution

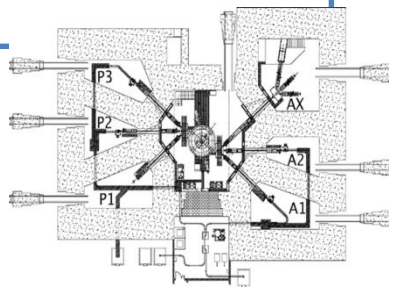
Repeating the elution 4 fold to reach 1: 100 (Tb: Gd)

Optimization of the protocol ongoing

Conclusion

- Possibility to really increase activity by shipping solution after radiochemistry in a vial inside a lead container and type A package.

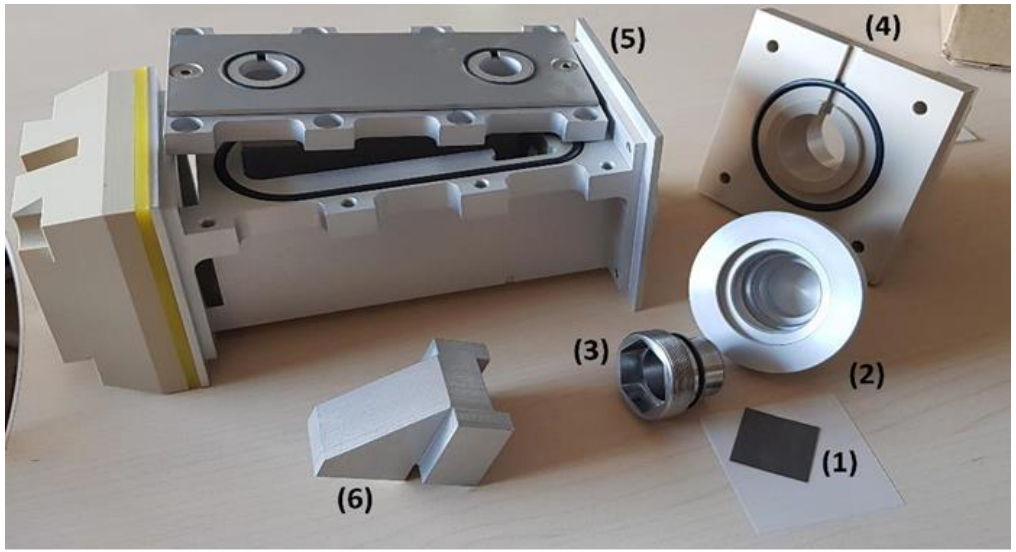
Five irradiations @ ARRONAX

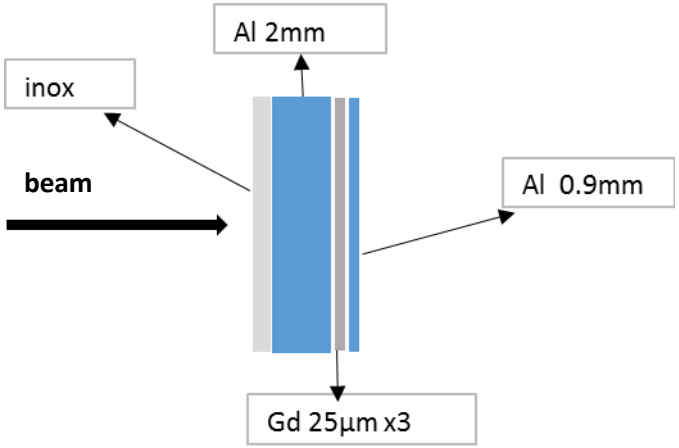


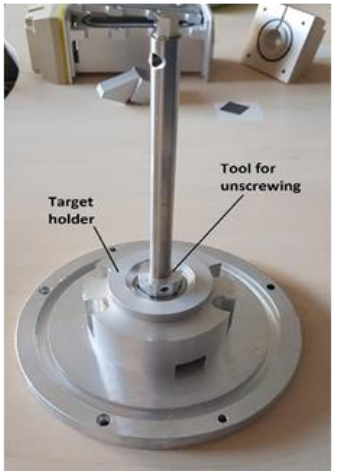
- Irradiation n°1 : 06 MAI 2019 EOB 15h15
  - Proton beam - 4h47– E=35MeV – 50µA – 250.52µA*h integrated
  - Target : 3 Gd foils of 25µm thickness+ aluminium 2mm + in stainless steel cap
- Irradiation n°2 : 28 MAI 2019 EOB 10h13
  - Proton beam – 15 mn– E=60MeV – 20µA– 5µA*h integrated
  - Target : 3 Gd foils of 25µm thickness between two copper plates in 15 ° tilted rabbit IBA12
- Irradiation n°3 : 02 JUL 2019 EOB 15h55
  - Proton beam – 2h30– E=55MeV – 20µA– 43.03µA*h integrated
  - Target : 3 Gd foils 25µm thickness between two graphite foils of 500 µm thickness in copper plates into 15 ° tilted rabbit IBA12
- Irradiation n°4 : 30 JUL 2019 EOB 16h58 - IBA12 en P3
  - Proton beam 7h – E=55MeV – 10µA– 70.20µA*h integrated
  - Target : 3 Gd foils 25µm thickness between two graphite foils of 500 µm thickness in copper plates into 15 ° tilted rabbit IBA12
- Irradiation n°5 : 27 AOU 2019 EOB 15h47 – IBA12 en P3
  - Proton beam 7h – E=55MeV – 10µA– 70.20µA*h integrated
  - Target : 3 Gd foils 25µm thickness between two graphite foils of 500 µm thickness in copper plates into 15 ° tilted rabbit IBA12

Target improvement

1st irradiation has been done with encapsulated Gd foils







Cooling issue with this system

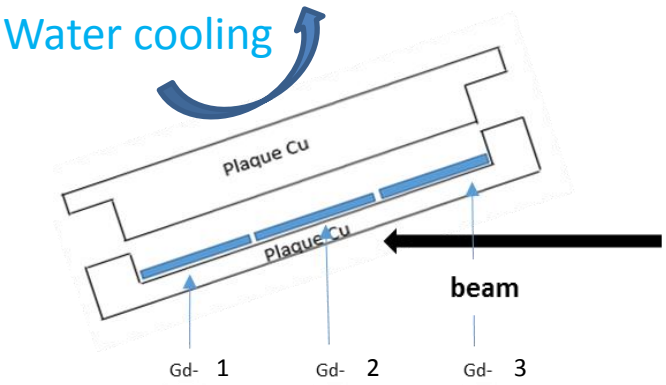
Irradiation: MAY 06 2019

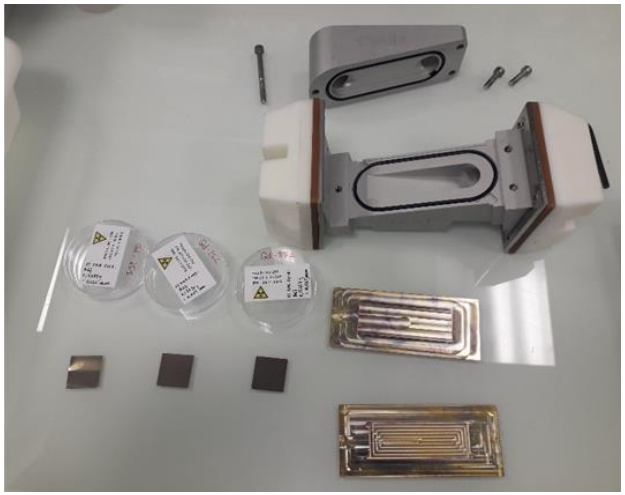
Proton beam 5h– E=35MeV – 50µA on target – 250 µA*h integrated

Window deformation
Bad thermal contact
Melting of the target

New design with tilted target

Second irradiation with Gd foils in copper body





Irradiation: MAY 28 2019 proton beam 15mn – E=60MeV – 20µA sur cible – 5µA*h integrated

- White traces on Gd: redox reactions under beam beetween Cu and Gd ?

→ Addition of a graphite sheet between Gd and Cu to avoid interaction.