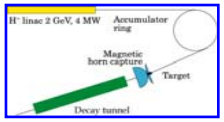
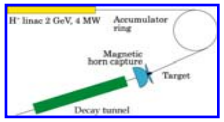


Radiations Studies (Update)

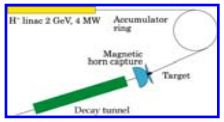
E. Baussan, N. Vassilopoulos

Radiations Studies



Outlines:

- The Two Step Method
- Radiation simulation
- Next steps



- Radiation simulations in Fluka:
  - **One-step method** : the radionucleide map, and the residual dose equivalent rate for different cooling times are estimated in one simulation for the whole layout.
  - **Two-step method** : Two separated simulations are needed to simulate the production of the radionucleides and the decay radiation transport

    => Evaluation of the contribution of **each element** of the layout to the dose.

Discussions with Stefan Roesler

Radiation Layout

Simulation Parameters :

Beam Power : 4MW
Irradiation Times : 200 days
One Horn : Geometry Updated
Cooling times : 1d,1w,1m, 6m,1y, 10y

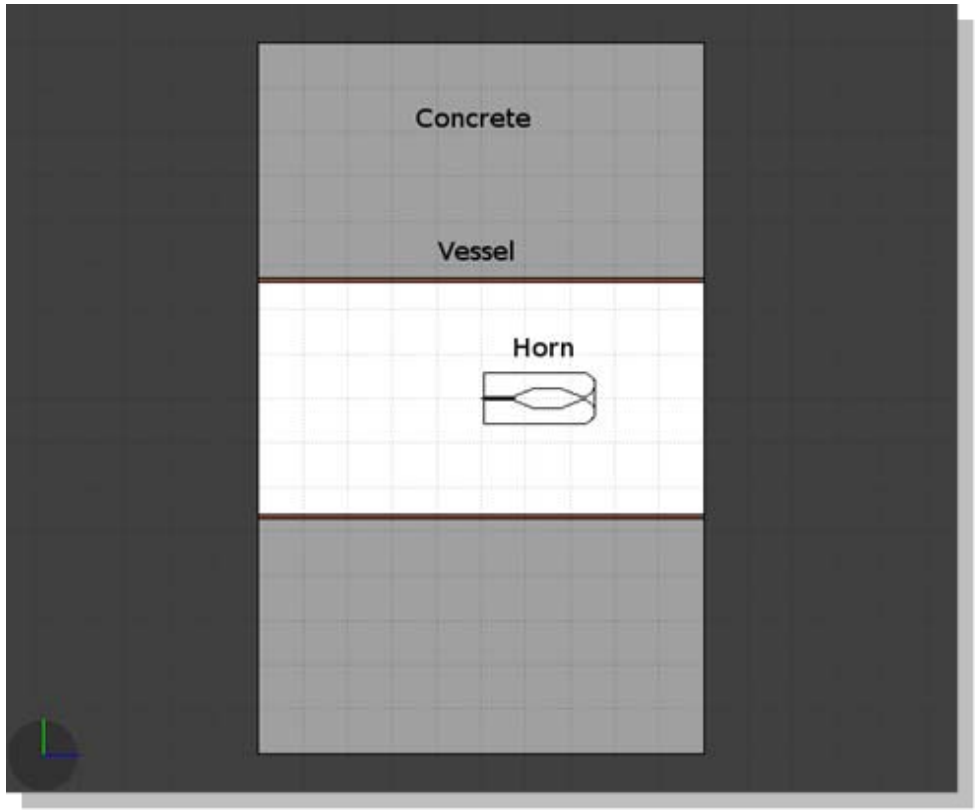
Chemical composition of Material:

Target => Titanium

Horn => Anticorodal 110 alloy
Al (95.5%), Si(1,3%), Mg(1,2%), Cr(0.2%), Mn(1%), Fe (0.5%), Zn(0.2%), Cu(0.1%)

Decay Pipe => Steel P355NH
Fe(96.8%), Mn(1.65%), Si(0.5%), Cr(0.3%), Ni(0.3%), C(0.2%)

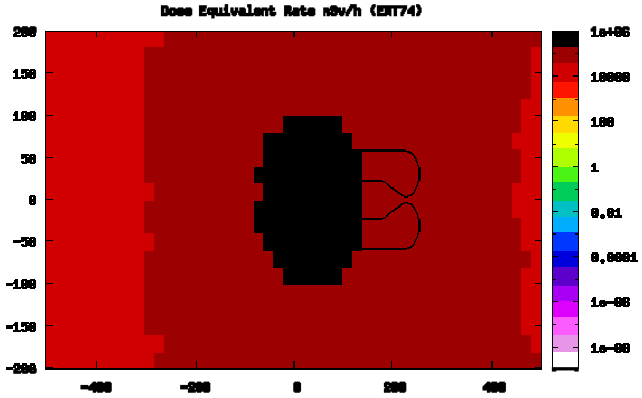
Tunnel => Concrete
O(52.9%), Si(33.7%), Ca(4.4%), Al(3,49%), Na(1,6%), Fe(1.4%), K(1,3%), H(1%), Mn(0.2%), C(0.01%)



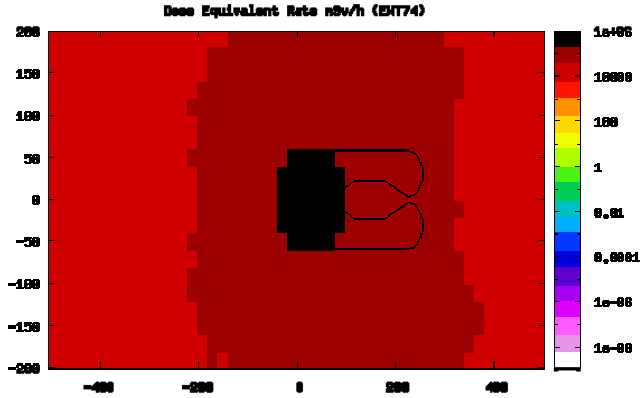
Radiation layout

Scoring Region : [-200,200]x[-200,200] [-500,500], cell dimension 20cm*20cm*20cm

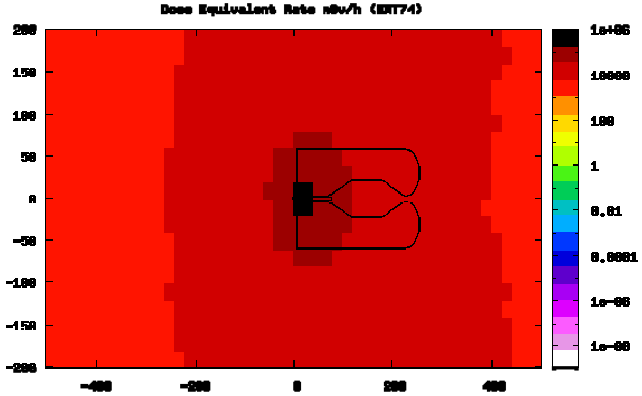
Dose Equivalent Rate (All Layout)



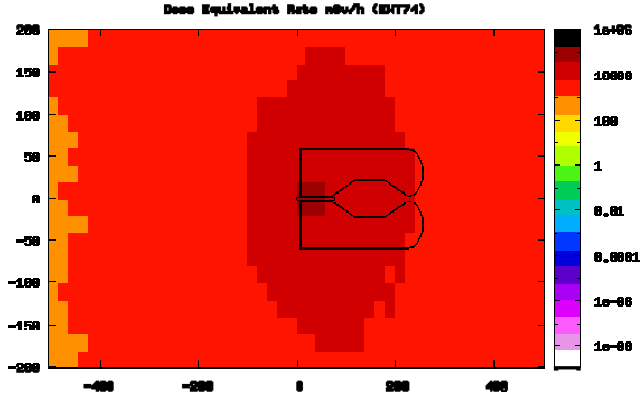
After 1day



After 1 week

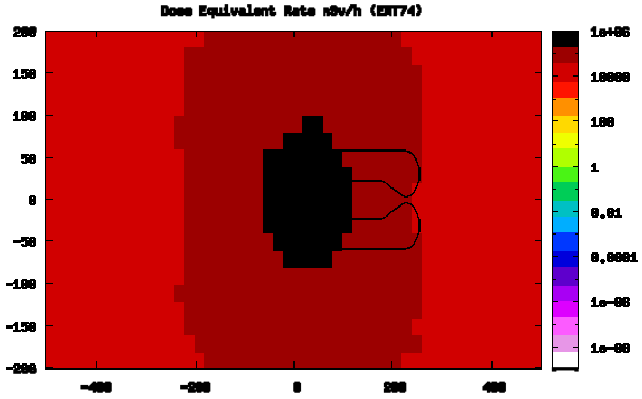


After 6m

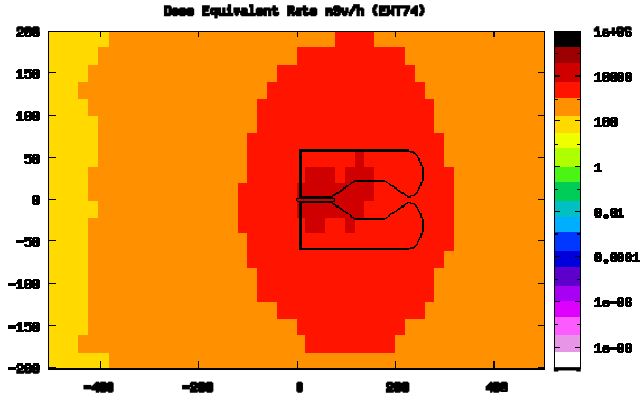


After 1y

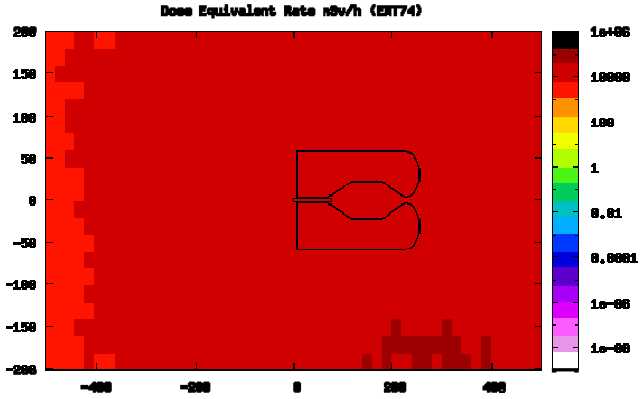
Dose Equivalent Rate contribution (cooling time 1d)



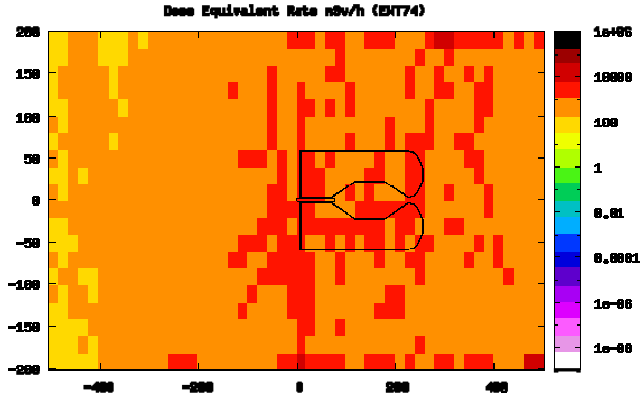
Target Contribution



Horn Contribution

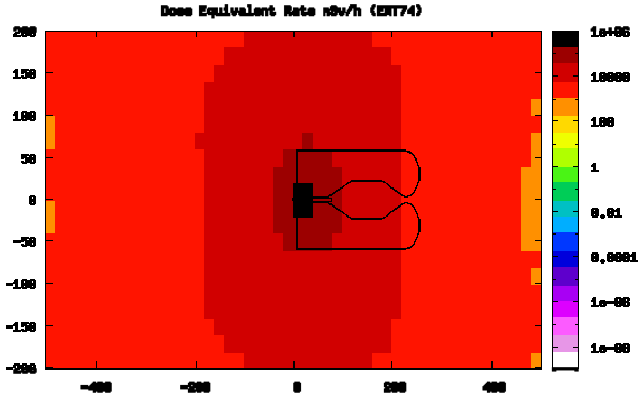


Vessel Contribution

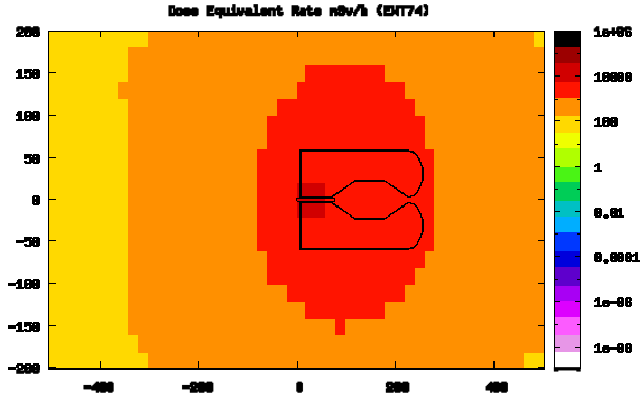


Tunnel Contribution

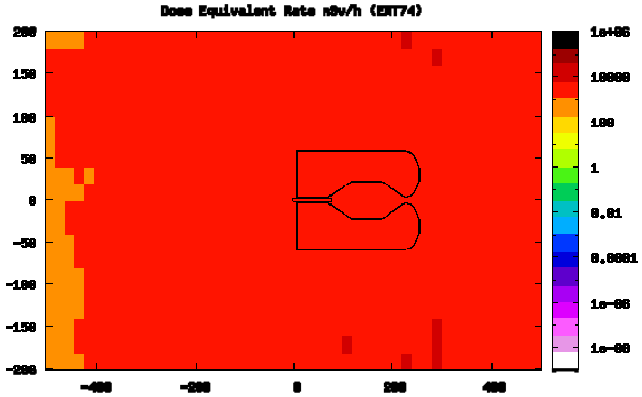
Dose Equivalent Rate contribution (cooling time 6m)



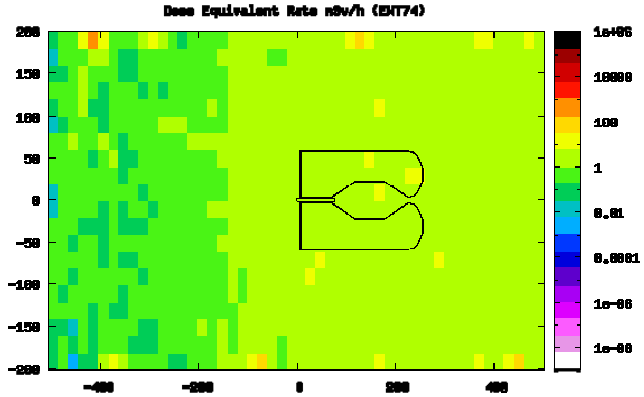
Target Contribution



Horn Contribution

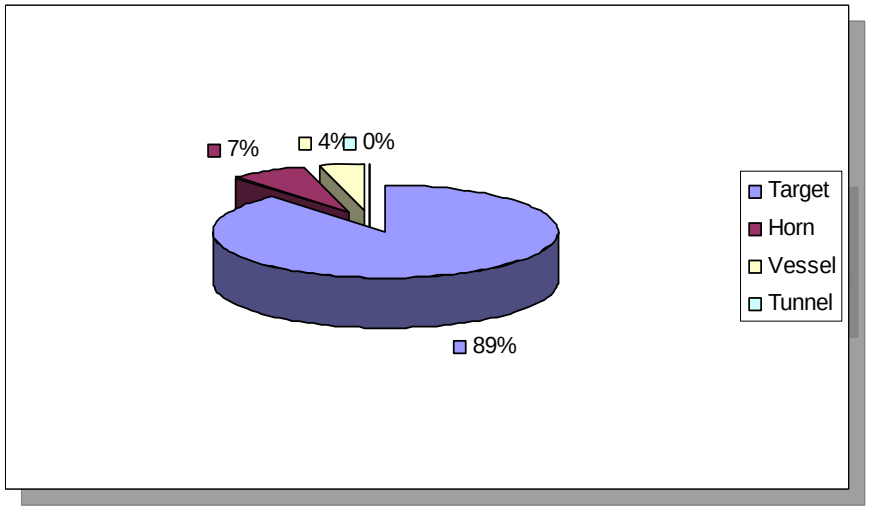


Vessel Contribution

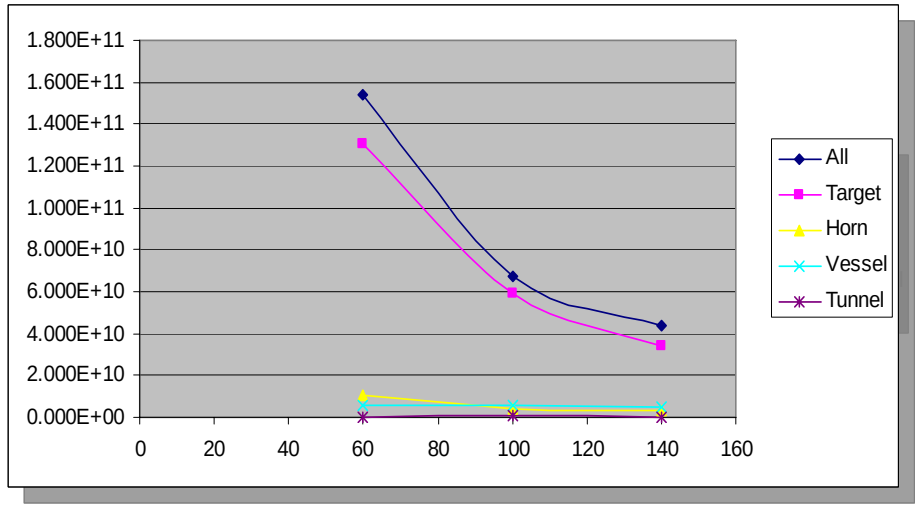


Tunnel Contribution

Dose Equivalent Rate contribution (cooling time 1d)



DER Contribution to the dose at 60cm



DER Evolution with distance

Fluka parameter Inputs :

Proton Energy : 4.5 Gev
Beam Intensity : 5.56*10^{15} protons
Irradiation times : 200 days

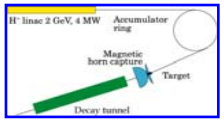
First Step : 10000 Histories
Second Step : 2000000 Histories

=> Increase statistics

Distance (cm)	All	Target	Horn	Vessel	Tunnel*
60	554400	469800	38304	21722.4	82.152
100	240948	213660	15933.6	20746.8	3664.8
140	157716	123372	11300.4	18478.8	418.32

*Vessel act as a shield

DER Estimation mSv/h



Next Steps :

- Implementation of the four horn layout,
- Hot cell structure investigation (need biasing techniques…),
- Individual and collective dose rate calculation with cooling times
- Energy deposition note to be submitted
- Radiation Studies note in preparation