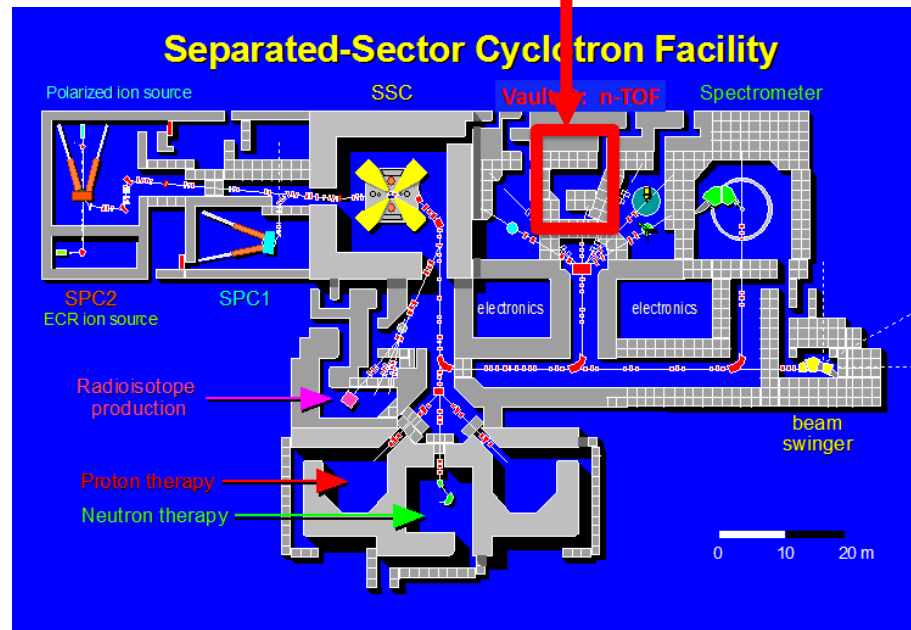


# Neutron background measurements and Monte Carlo simulations of the present vault

Quentin Ducasse  
05-02-19



# Introduction

## The Problem

- High neutron background in the vault hinders accurate measurements

## *The Study*

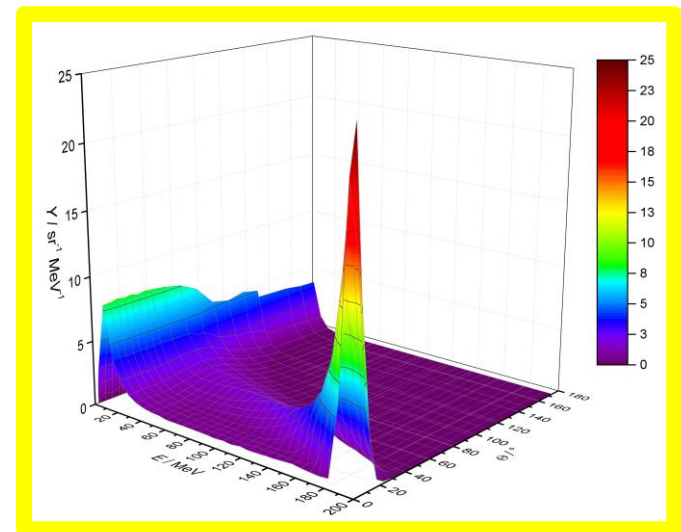
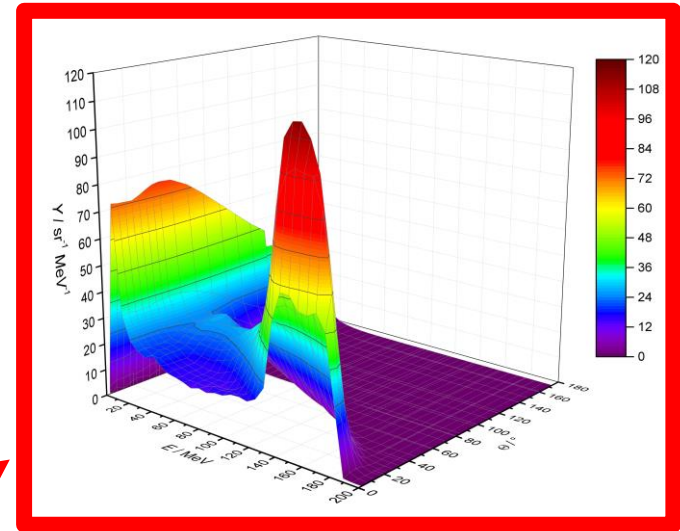
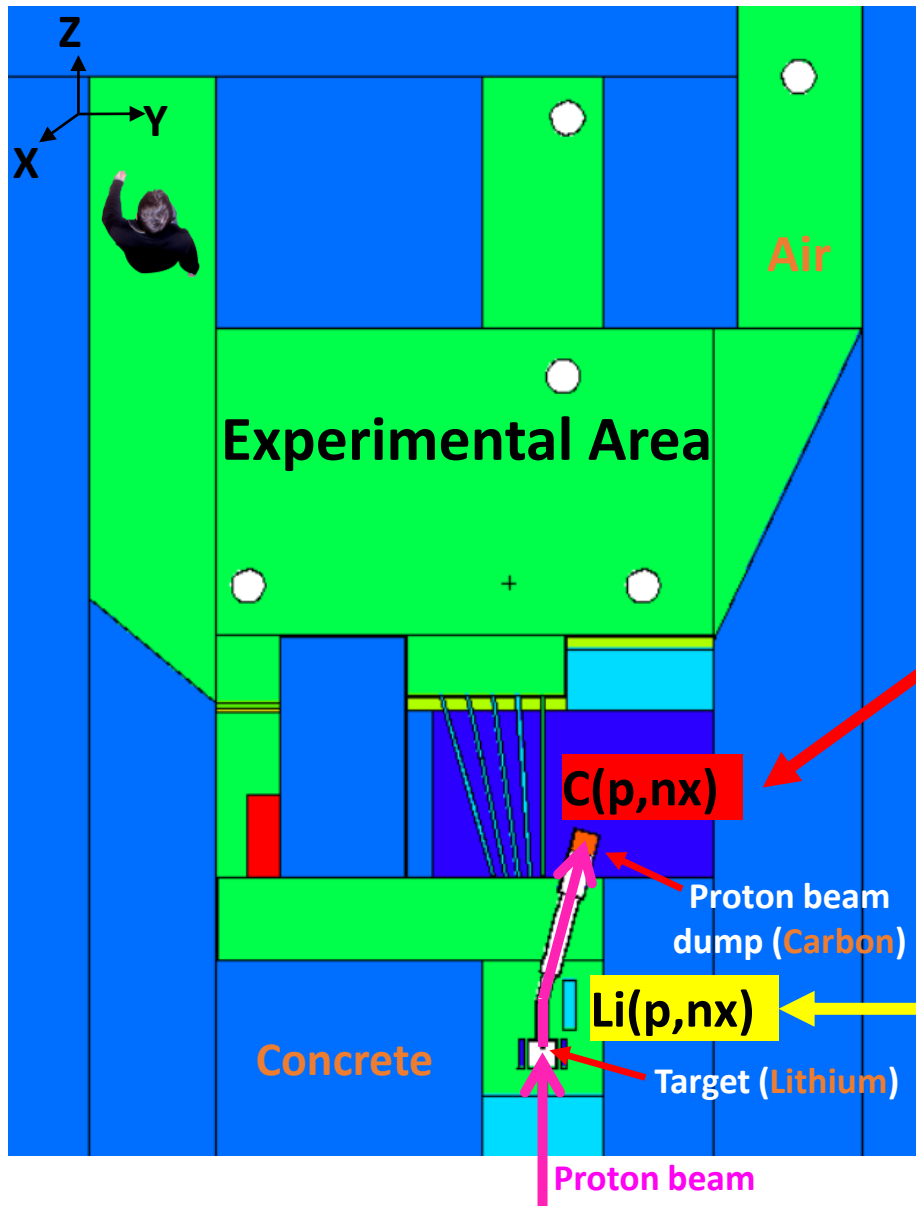
- Simulate the geometry of the vault
- Quantify the neutron background with MCNPX in the experimental area
- Compare simulated VS experimental results

## *The Objectives*

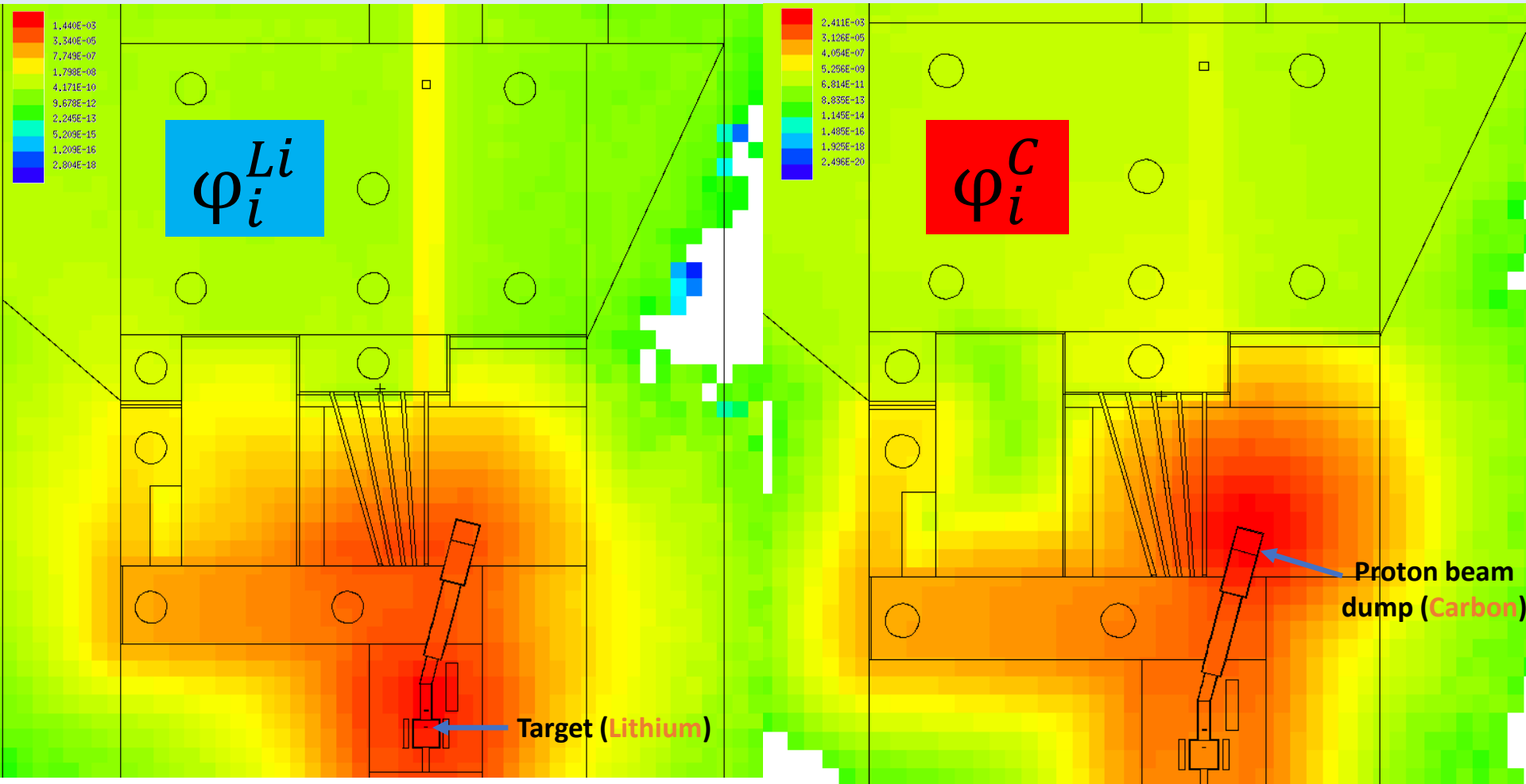
- Benchmark of the simulations
- Provide shielding recommendations/ideas to reduce the total background in the experimental area

# Present vault – MCNPX simulations

*Neutron source terms definition  
(200 MeV)*



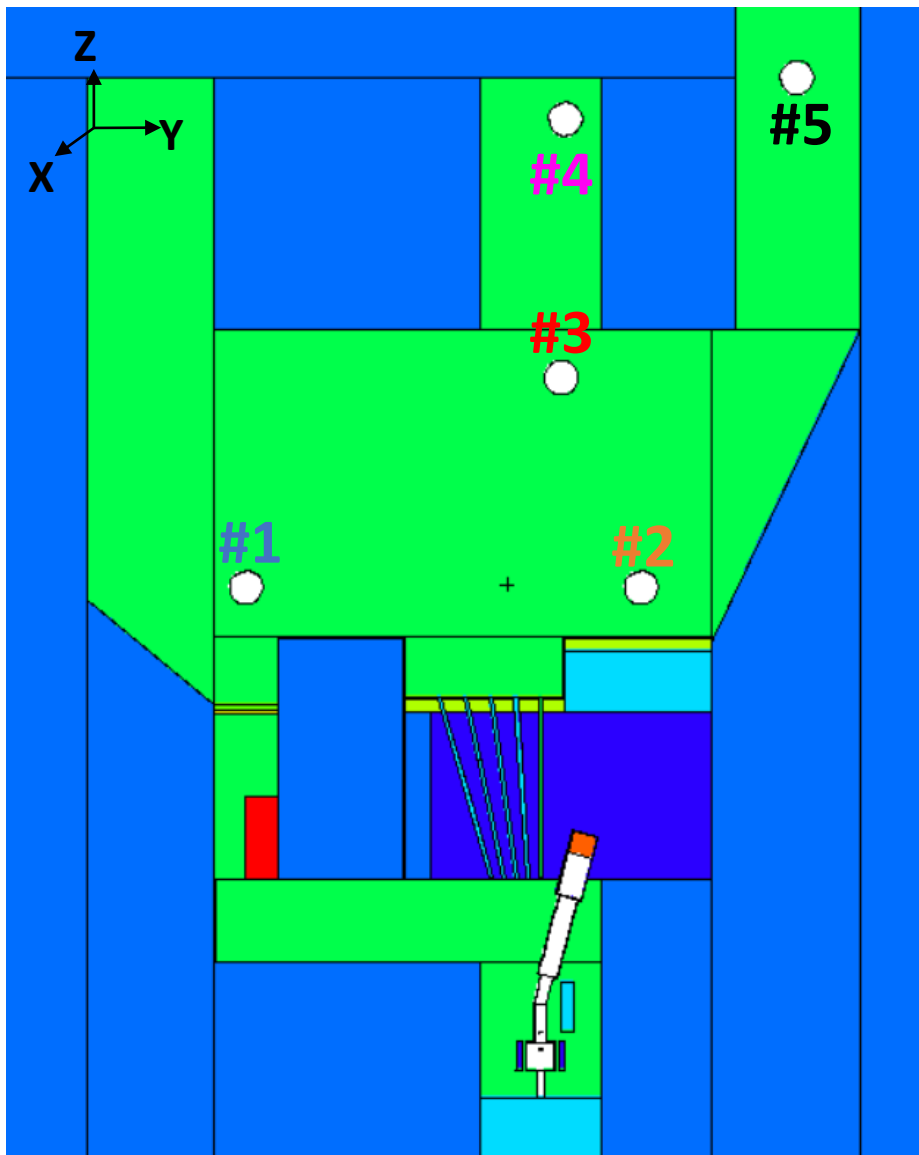
# Present vault – MCNPX simulations



$$\varphi_i^{tot} = \varphi_i^{Li} \cdot N^{Li} + \varphi_i^C \cdot N^C$$

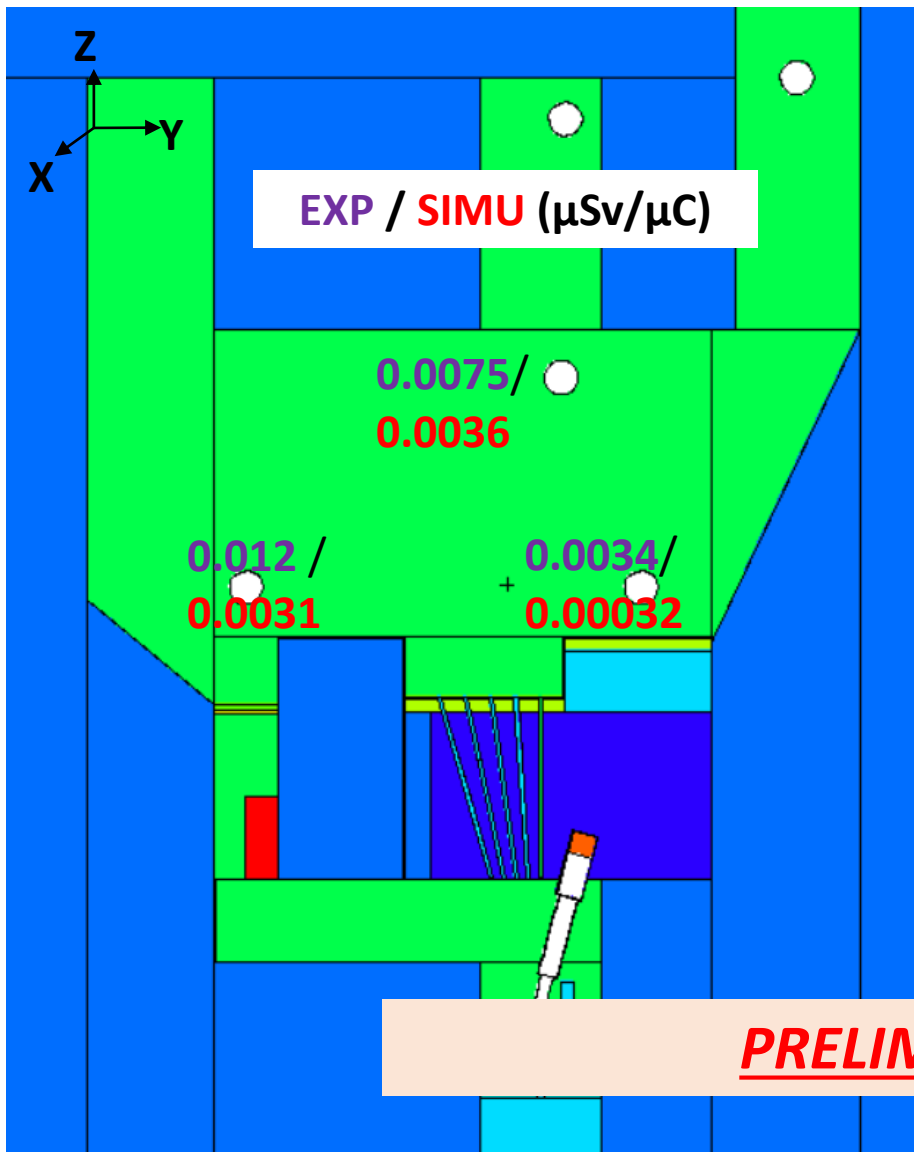
# Present vault – MCNPX VS Experiment

Measurement positions

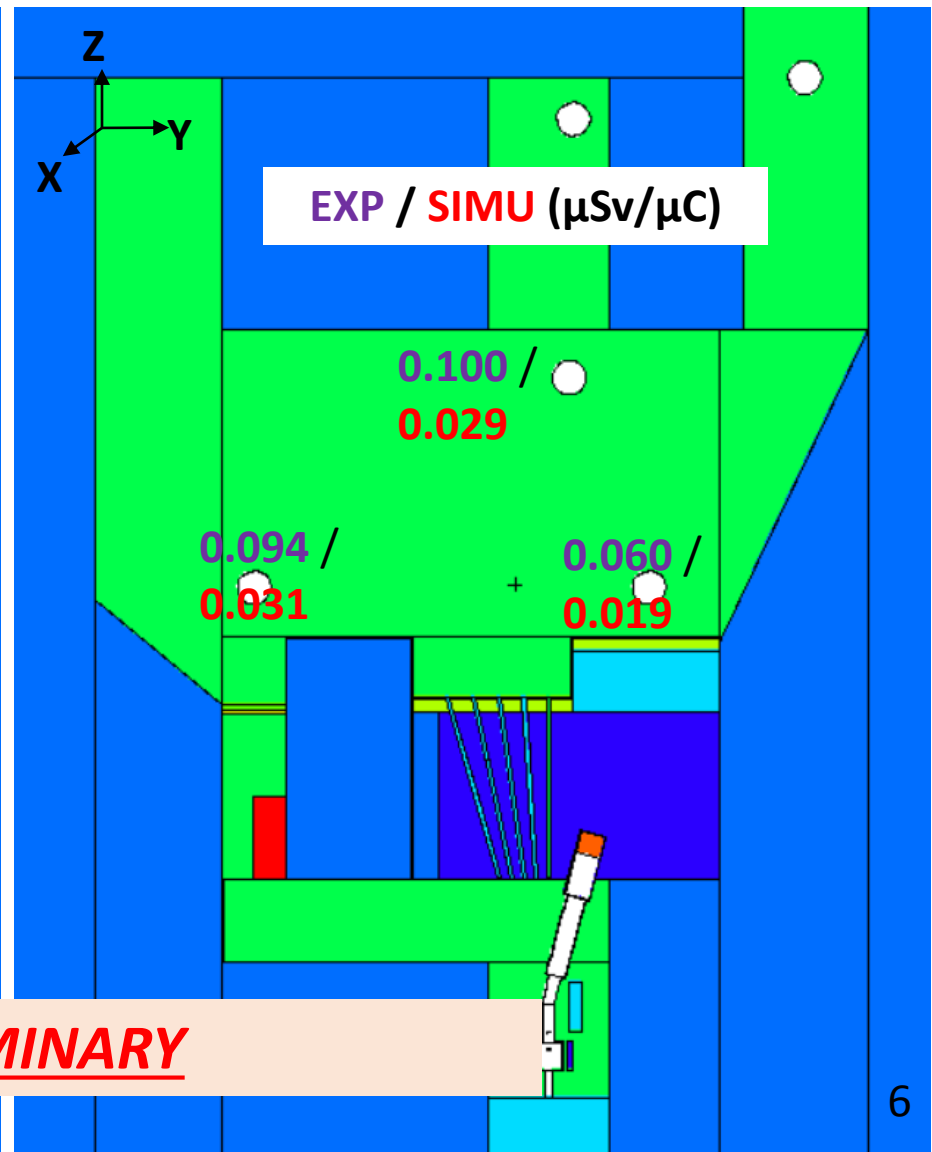


# Present vault – MCNPX VS Experiment

Dose rate comparison – 66 MeV



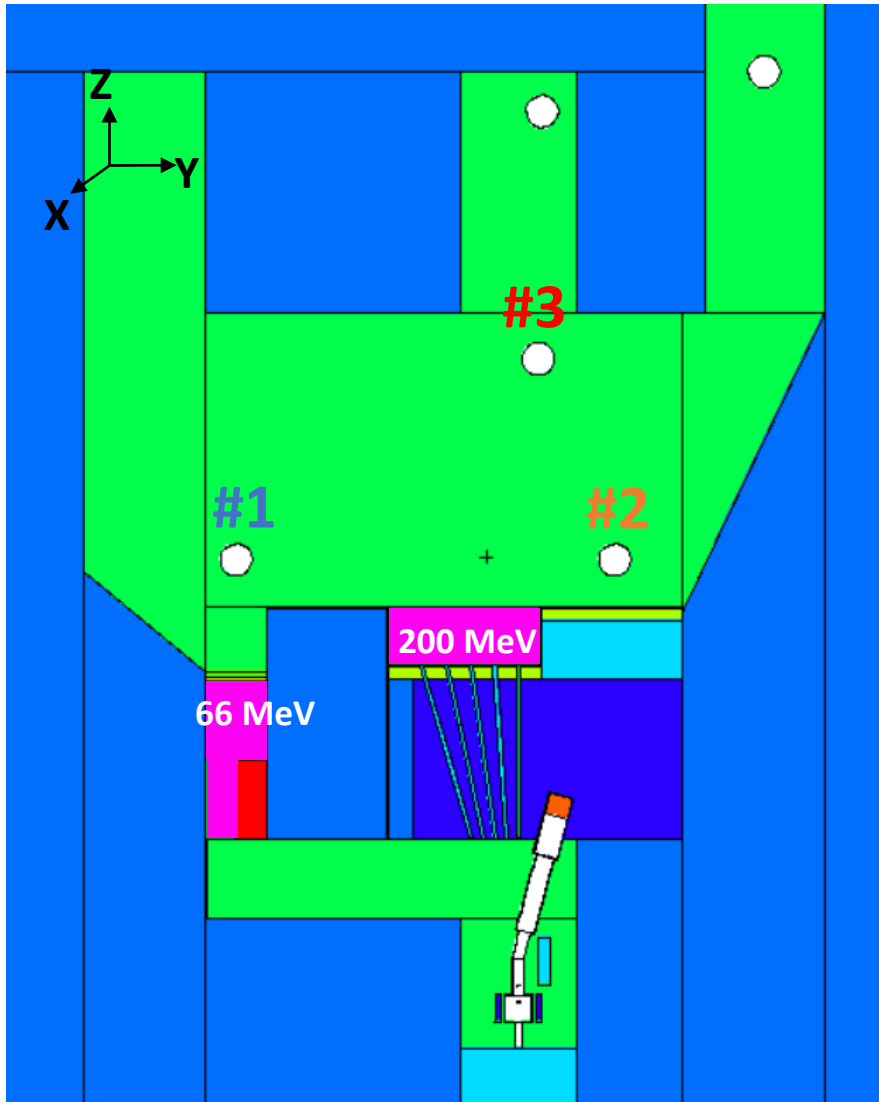
Dose rate comparison – 200 MeV



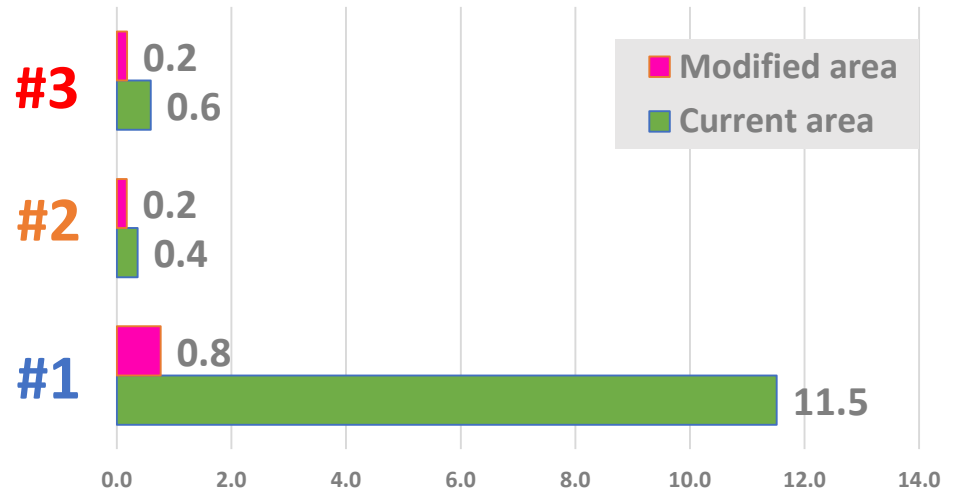
**PRELIMINARY**

# Future vault – some possibilities

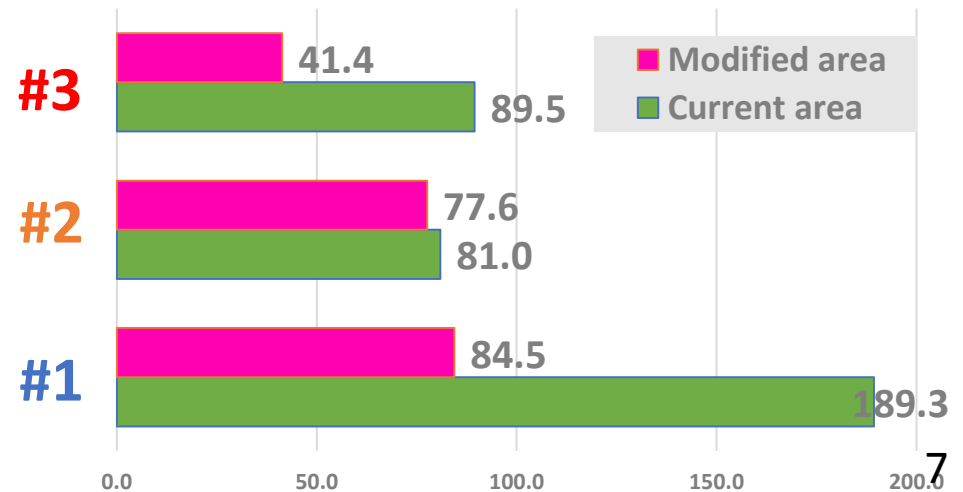
- Reduce neutron background: **shielding** -



$\Phi_{(.cm-2.\mu C-1)}$  - 66 MeV proton beam

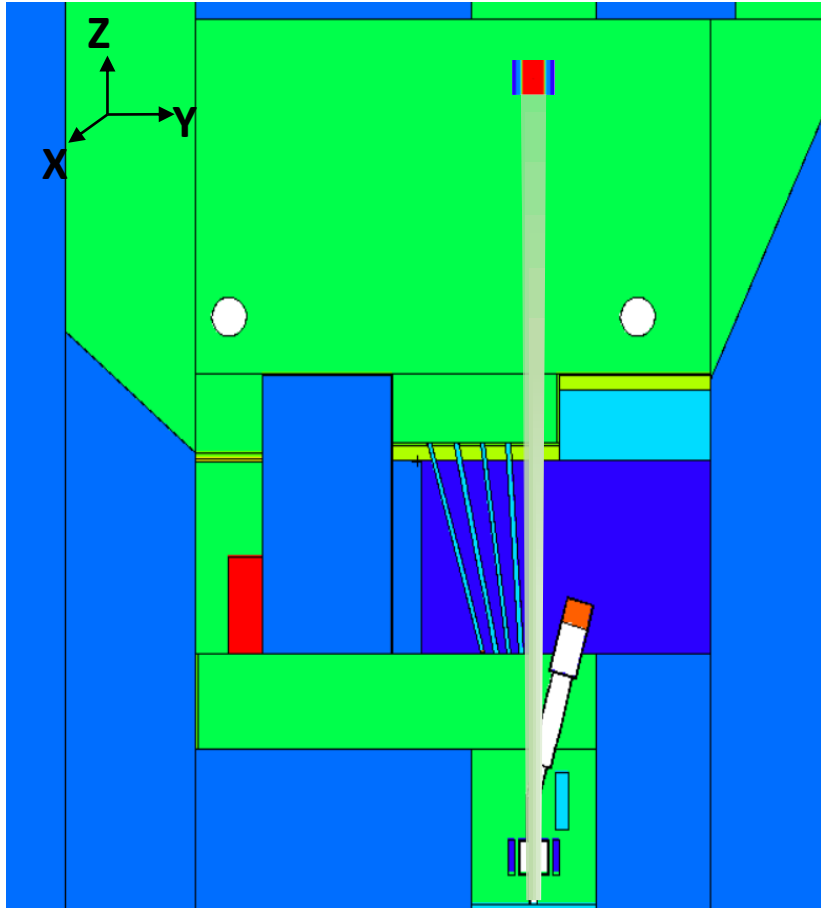


$\Phi_{(.cm-2.\mu C-1)}$  - 200 MeV proton beam

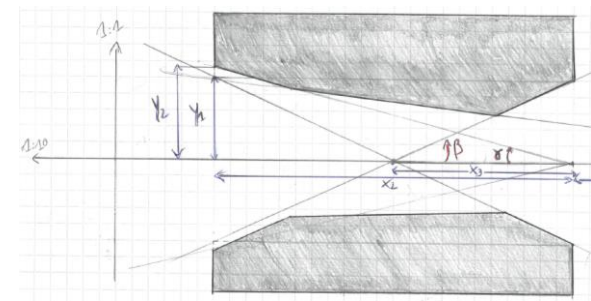


# Future vault – some possibilities

- Improve beam profile: **collimator design** -

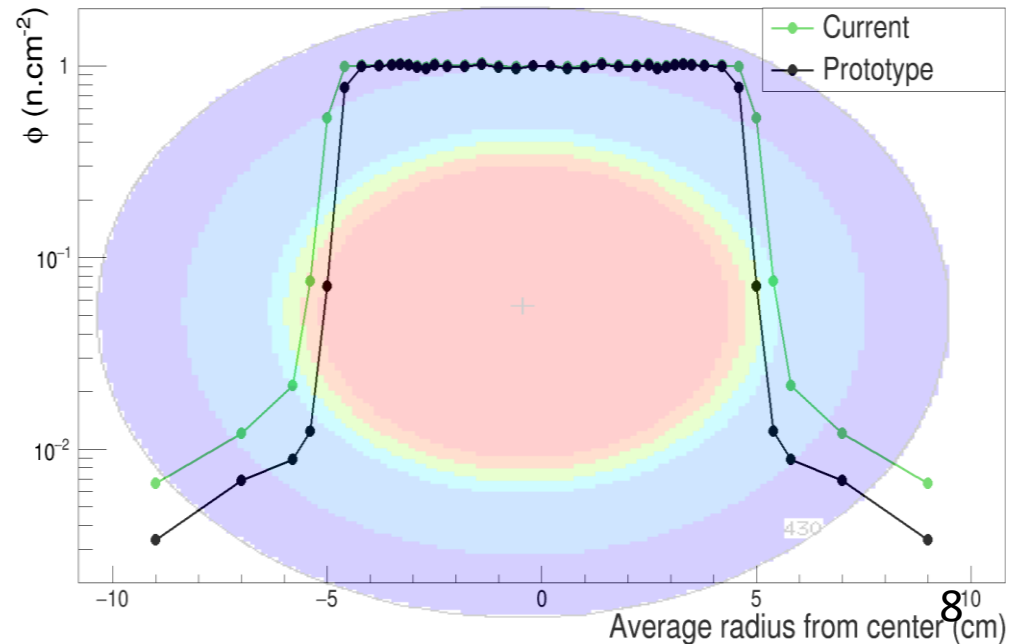


Current  
collimator



Prototype  
collimator

Beam profile at 8m from the target





# Conclusion - Outlooks

## - Present conclusions -

### - Reduce neutron background -

- ❖ Additional shielding elements could reduce the total neutron background fluence to:
  - X 2-10 at 66 MeV
  - X 2 at 200 MeV

### - Improve beam profile -

- ❖ A new collimator design would improve the sharpness of the neutron beam profile

## - Outlooks -

- ❖ Analysis of the experiment – compare exp/simu fluence spectra and dose rates
- ❖ Other type of shielding-material combinations could be considered
- ❖ Efficiency of shielding needs to be better estimated with additional calculations