# Study of the neutron induced radiation background at the MAGNEX facility via FLUKA simulations

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# Introduction-Motivation

- The upgrade of the Superconducting Cyclotron and MAGNEX spectrometer at INFN-LNS is currently in progress.
- The need for high intensity beams is a necessary prerequisite for the experimental campaigns foreseen within the IV phase of the NUMEN project.

**Talk of Manuela Cavallaro**

The interaction of the high intensity beams with the target, may give raise to large radiation background especially in the vicinity of the target.

The beam particles should be properly guided into an area where they will stop. This will trigger the production of a large amount of neutrons.

The knowledge of the radiation level expected inside the MAGNEX experimental hall is imperative, since high rates of neutron and gamma-rays could deteriorate the performance of the electronic devices and/or the detectors of the MAGNEX Focal Plane Detector (FPD).

# Beam-induced radiation background simulations

Dedicated Monte Carlo simulations for the radiation background at the MAGNEX experimental hall were performed using the FLUKA code.

## Simulation Inputs

Beam: $^{20}Ne^{10+}$ ions @ 60 AMeV.

Beam intensity: **2 kW (1.06 $10^{13}$ pps)**

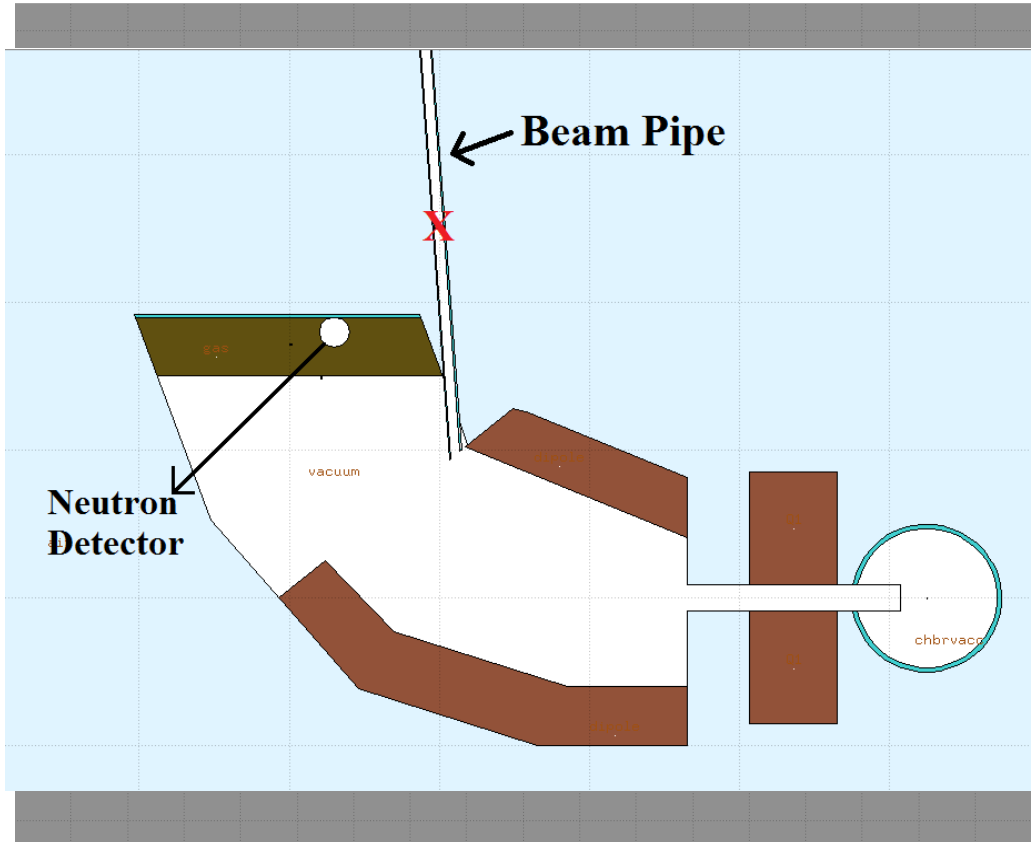
Target: $^{76}Ge$ 214 μg/cm$^2$.

Target substrate: $^{12}C$ layer 2 μm (450 μg/cm$^2$).

Beam dump stopper: Ag target 2 cm

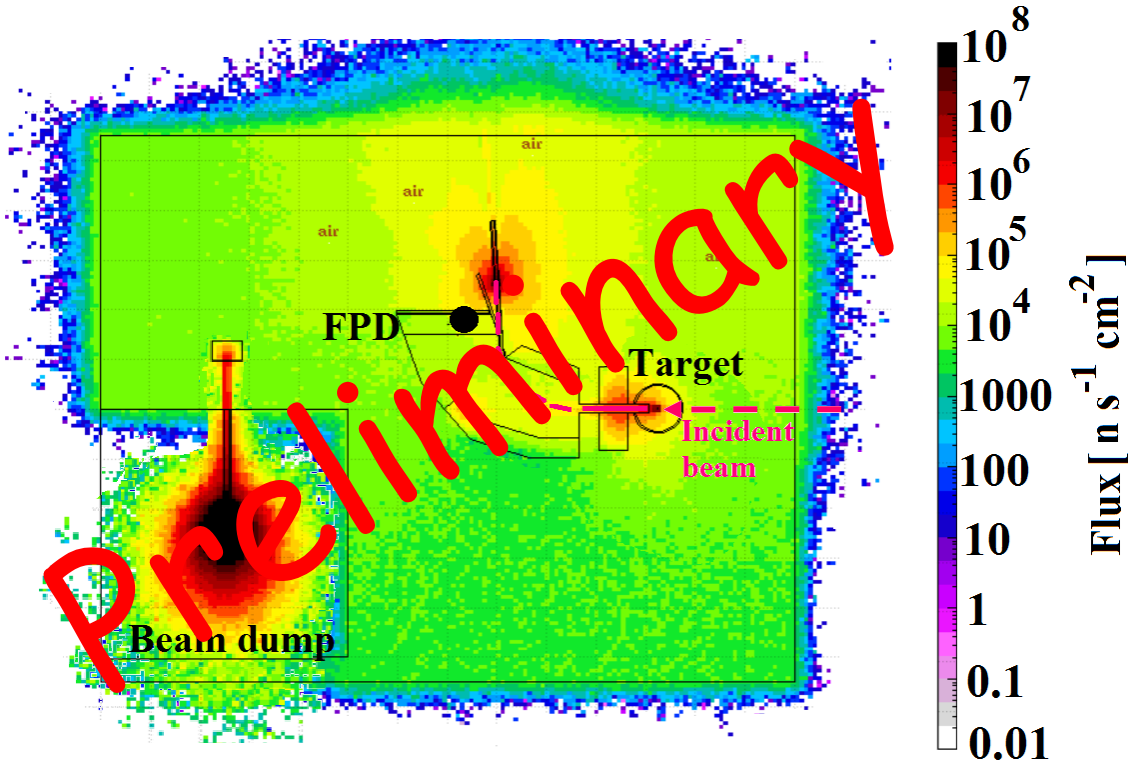
## Radiation Sources

- Beam-Target interaction
- Interaction of beam particles with the beam stopper.
- A hypothetical 10W power loss in the beam intensity along the beam line.




A schematic geometry of the MAGNEX experimental room adopted in the FLUKA simulations

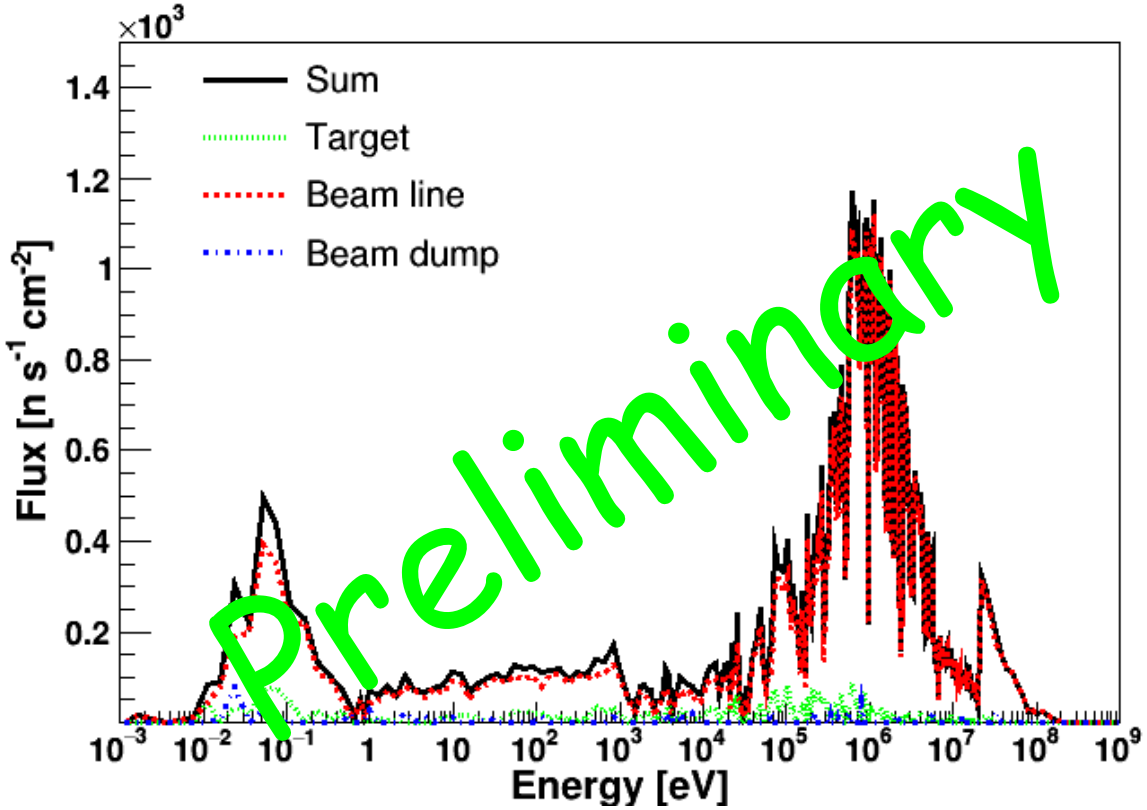
# Simulation Results







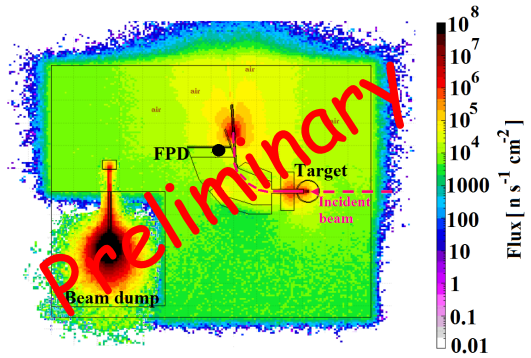
Bi-dimensional distribution of the neutron induced radiation background considering 3 radiation sources:
The Beam-(target + substrate) interaction, the beam dump and a 10 W power loss at the beam pipe close at FPD.

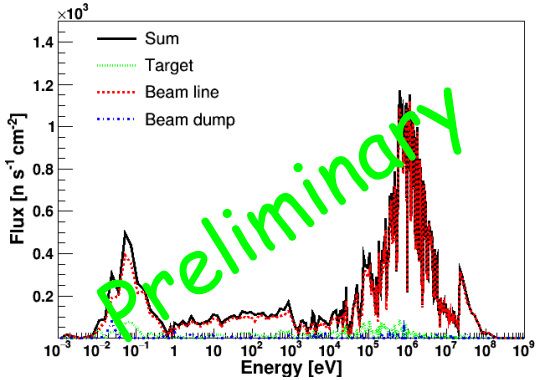



The simulated neutron energy spectra at the MAGNEX FPD region. The colored lines indicate the neutron spectrum originating from the three neutron sources considered in the simulations. The sum of the three contributions is illustrated with the solid black line.

# Summary-Conclusions

- Monte Carlo simulations for the beam-induced radiation background at the MAGNEX facility were performed using the FLUKA simulation toolkit.
- It was found  the main contribution to the neutron flux in the FPD region comes from the possible scattering of the beam into the beam pipe close to the FPD.
- The effect of shielding materials on the neutron spectra is under investigation.




**Thank you for your attention**