ANDES radiological shielding design

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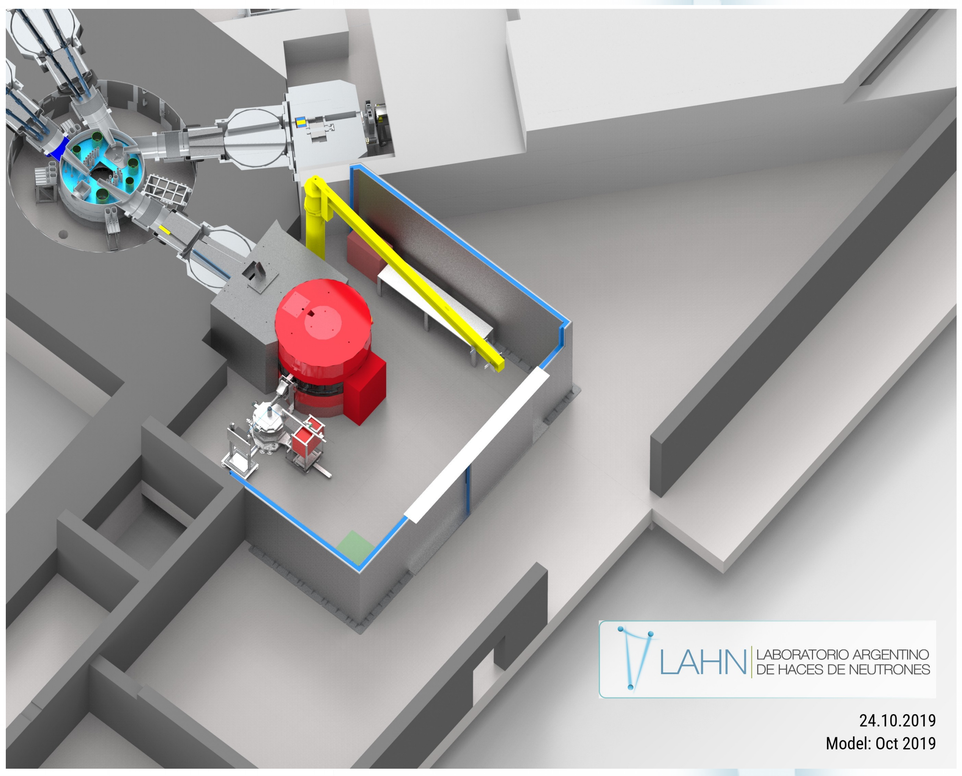
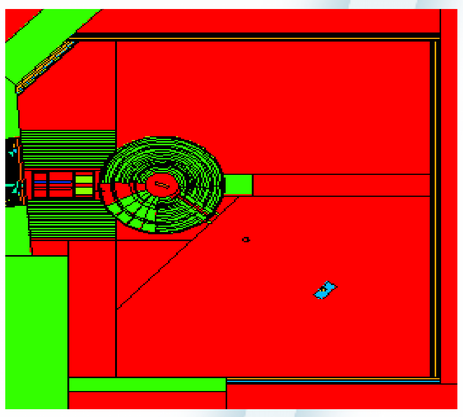
ANDES (Advanced Neutron Diffractometer for Engineering and Science) is a multipurpose diffractometer whose function will be to provide the service of nondestructive analysis of objects and samples by the neutron diffraction method. ANDES instrument is being designed and constructed in house. At this stage of development shielding design and calculation are being carried out. ANDES's shielding must comply with the radiological requirements of the ARN (National Regulatory Authority) considering also other aspects like minimization of costs and complexity of the shielding components. In this work, dose rate map calculation for a preliminary shielding design is presented. This calculation was carried out using MCNP and shows the hot regions of the instrument, for which the shielding design requires more attention.

ANDES IN REACTOR HALL

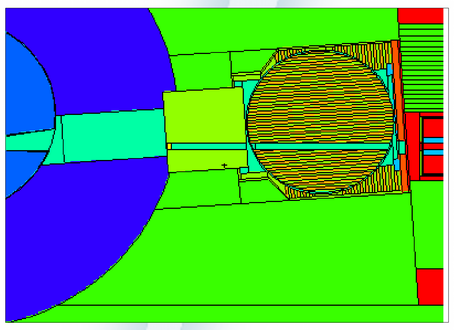


MCNP MODEL



- Preliminary radiological shielding design.
- Concrete walls of 80 cm thickness. Delimitation fence of 20 cm thickness.
- The current model contains the most relevant materials and components.

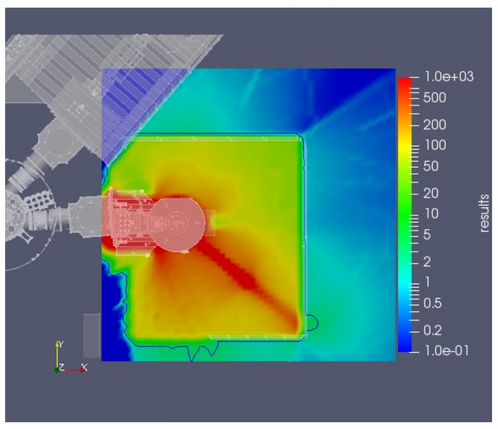
RADIATION TRANSPORT



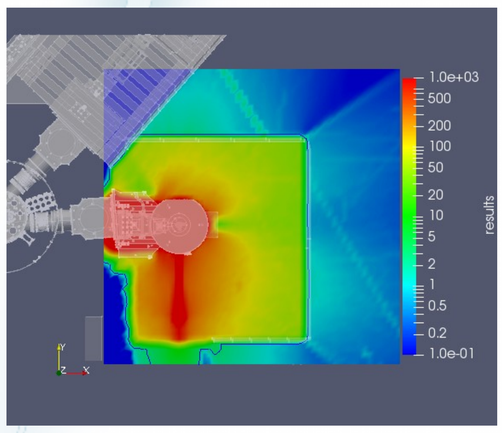
To speed up the convergence of the results, the neutron source is moved to the middle of the primary shutter.

DOSE RATE MAPS

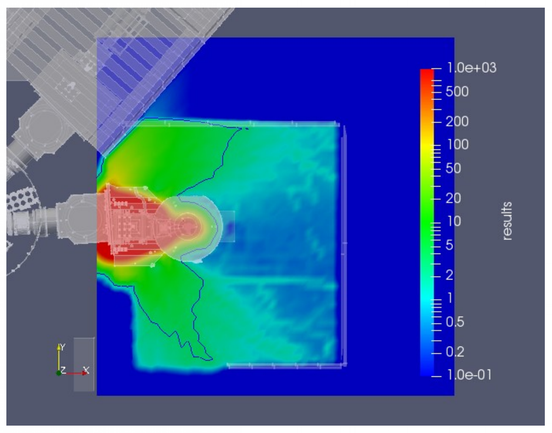
The model in MCNP is used to calculate a dose rate map throughout ANDES and its surroundings, using sapphire filter of 8cm thickness



Dose rate map with $2\theta M = 40º$. Secondary and tertiary shutter open. A 3μSv/h isodose line is shown in the map.



Dose rate map with $2\theta M = 90º$. Secondary and tertiary shutter open. A 3μSv/h isodose line is shown in the map.



Dose rate map with $2\theta M = 40º$. Secondary and tertiary shutter closed. A 3μSv/h isodose line is shown in the map.

CONCLUSIONS

ANDES preliminary shielding design is completed. Dose rate map calculation is very important to show the areas where the shielding requires more attention, in order to study different strategies in its design. Through the analysis of different shielding materials and geometries of the shields, the required dose rate will achieved.