The model is run in two steps to simulate the transition from the normal state to the superconductor state of the Nb. Since the shielding is designed so that at each end: Length of the cylinder = 3 * Diameter of the hole. The niobium shield surrounds the TES focal plane. It is cooled down to 50 mK. At this temperature, the Nb is superconducting (below 9 K) which gives the best compromise between the thickness of the Nb shield but can also trap flux. This temperature, the Nb is superconducting (below 9 K) which gives the best compromise between the thickness of the Nb shield but can also trap flux.

Niobium Shield – Study of the shape

The Niobium shield surrounds the TES focal plane. It is cooled down to 50 mK. At this temperature, the Nb is superconducting (below 9 K) which gives the best compromise between the thickness of the Nb shield but can also trap flux.

Cosmo Shielding – Study of the material thickness

The design is constrained by the value of $\alpha$ in the component of the Nb-field applied along the z-axis. Here we show a comparison of the different Nb shield shapes for an applied field of 1E-3 T.

Modeling of the three shields

The modeling of multiples shapes for the A4K shield have lead to a specific design: a wave shield design with smooth angle (no right angle) to allow the magnetic field to flow on the surface. See left figure. We studied the impact of the thickness of the A4K on the magnetic field.

The stack of Nb, A4K and Nb shield lead to a shielding factor on both normal (1) and parallel (2) components theoretically allowing the requirement (respectively 1E-10 and 1E-11).

Conclusions

We have modeled the magnetic shielding of the Mumat, A4K and Nb shields as well as the coil using Comsol. The modeling result will be used to test the FPA of Athena/RIU. The theoretical results meet the requirements and we can be confident to build this setup.

The CAD designs of the Nb, A4K and 300 K shields as well as the coil and SQUID shield sub-assembly are done. The fixation system of the Nb and A4K shields to the 50 mK and 3 steps, respectively, is still under construction.

A shielding/coil prototype will be machined within the next few months.