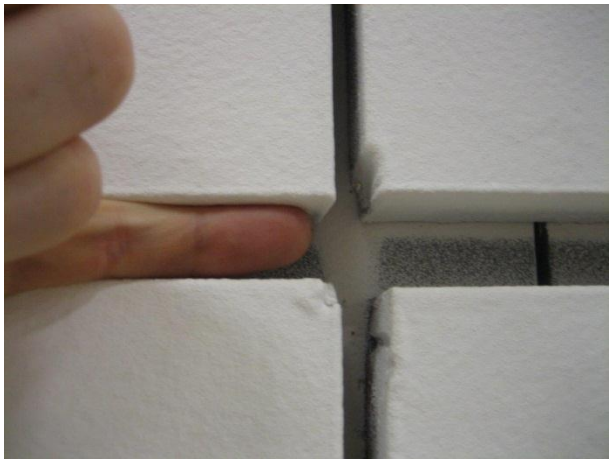
Magnetic Modelling
02/07/2013

Today I'm going to say a few words about the shield wall and a more refined model of the shield wall that I'm building.

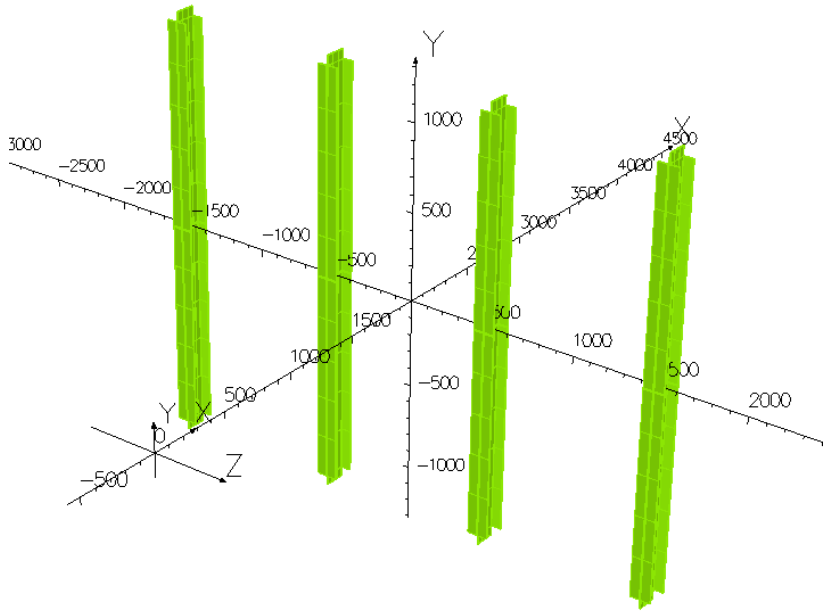


The current model of the Mice Hall assumes that the shield wall is homogenous, but as you can see this is not the case. There are regular breaks in the wall and the returned flux passes from magnetic quality steel (35mm thick) into mild steel (~8mm thick?), before passing back into the magnet steel again.

Whilst this is probably ok, this is a big assumption to make given that the shield walls form a core part of the shielding plan if a PRY is not used. It's an known unknown. The received wisdom has been that this needs modelling if we are to be sure that our assumption is ok.

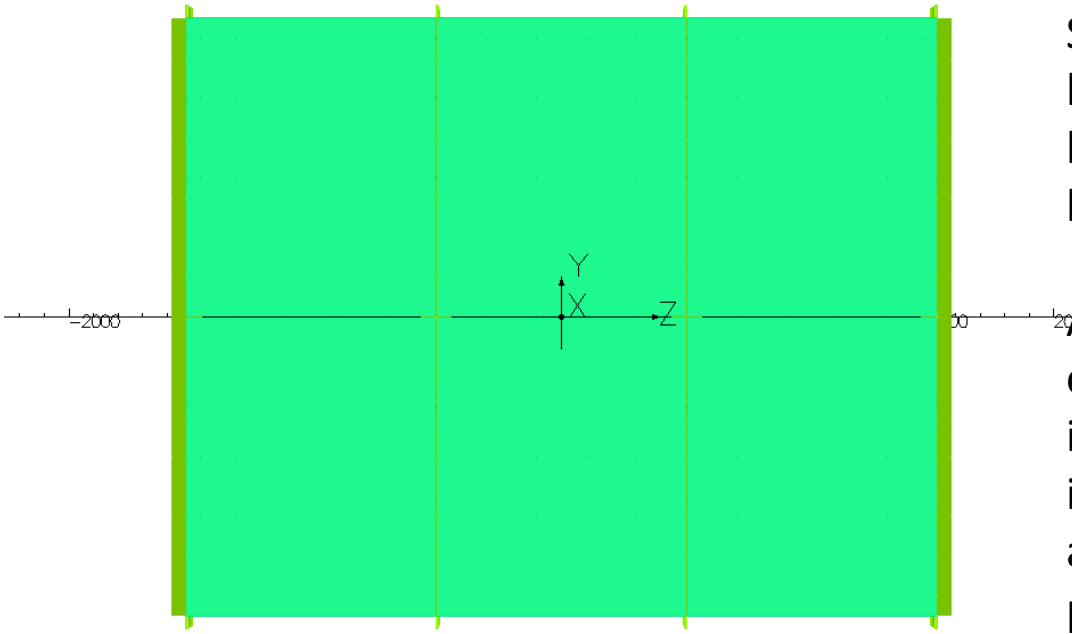
To try and understand whether this is an issue I have been putting together a partial model of a more realistic shield wall. The gaps and the steel beams require quite fine detail on quite large scales and so make the meshing more challenging.

Even then I have had to make some approximations…



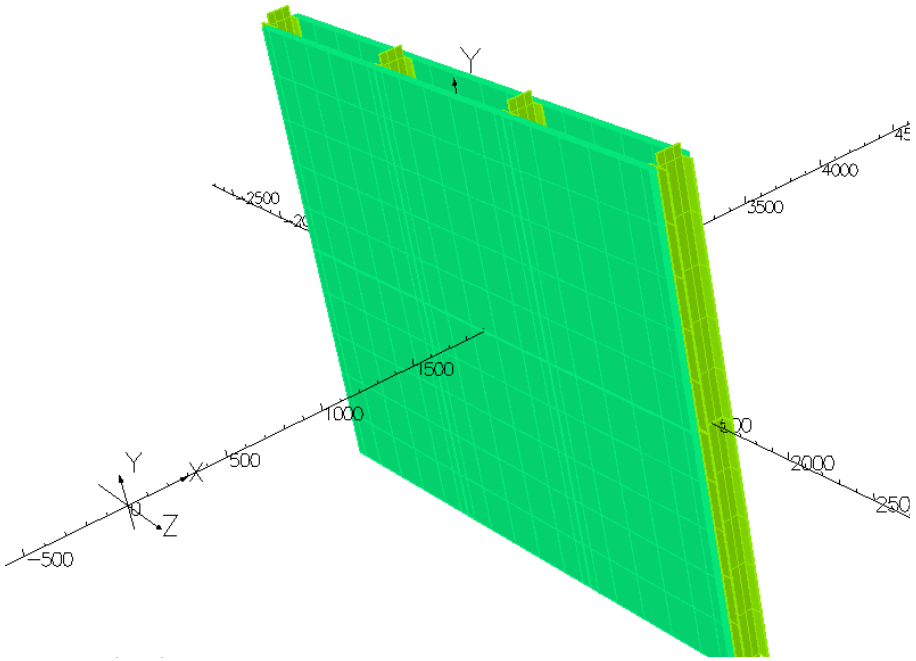
Underlying Structure:
Only the vertical I beams are modelled. The number of beams is set in the .comi (calculated from the required matrix of panels)

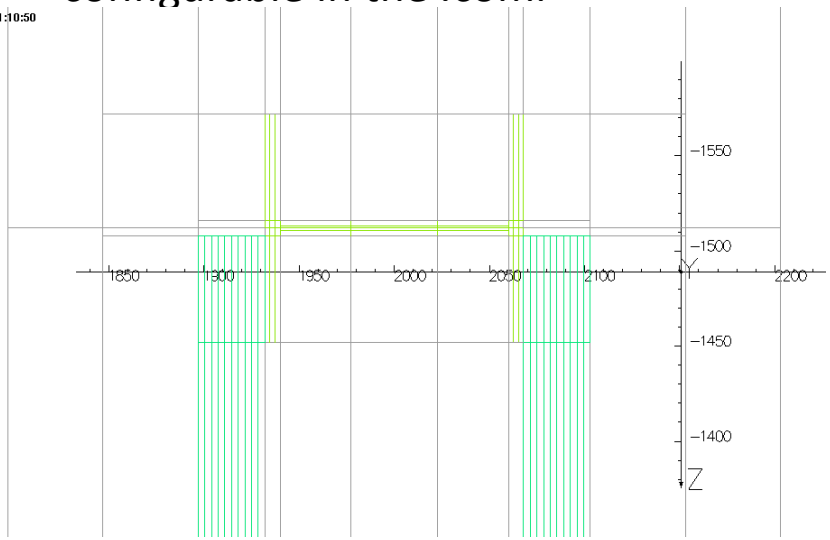
Potentially the Horizontal beams could be added later but would complicate the model significantly. Leaving them out means that the model is worse than reality as it removes a flux return path within the shield wall.

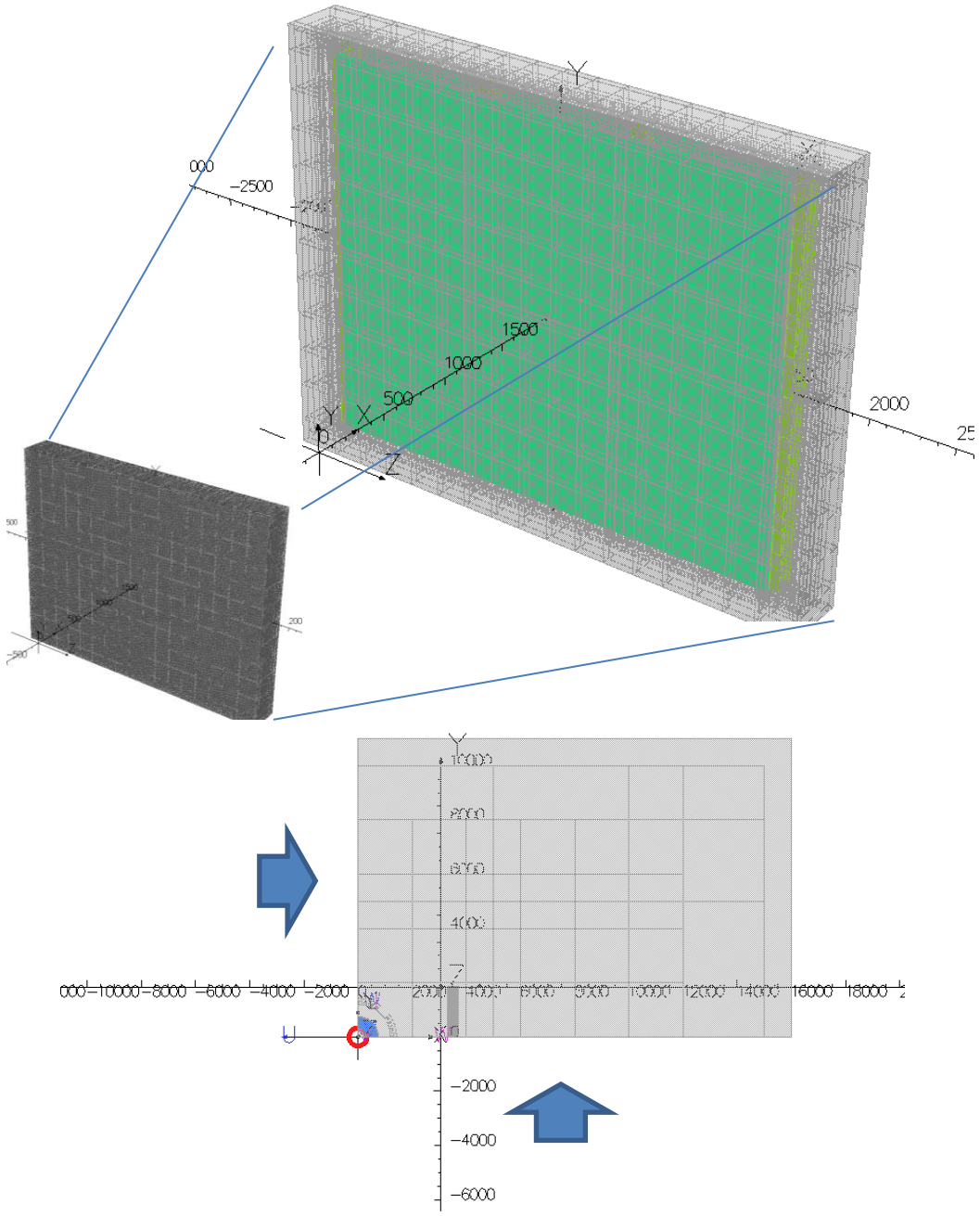


Steel panels are then added to the beams including a settable gap between the panels. This shows 2 x 3 but it can be N x M.

At the moment the panels sit flush onto the beams. There is some code in place to allow a small gap to be introduced to permit the modelling of an imperfect connection between plates and beam but this hasn't yet been completed. Everything is configurable in the .comi







It meshes ok but there are a large number of elements. For 2 x 3 panels there are more elements than are in the whole of the Hall model!

To try and help reduce the solve time I have created a symmetric model so that I can run ¼ of the model in a symmetry mode.

This uses Step IV solenoid with Virostek Plates and upstream TOF cover

Whilst this isn't quite what we have in the Hall still believe that I can do some valid comparisons. (next slide)

However I have yet to figure out the correct boundary conditions.

I think that I need at a minimum sets of three models:

1) The model as described.

2) A model with the gaps between the plates filled in (set as magnetic steel) and the vertical I beams set as air. This should give a homogenous shield akin to what is in the Hall model and will serve as a comparison for 1) and a first degree comparison to the hall model result.

3) To add a 1mm gap between the plates and the I beams to imitate a poor magnetic connection between plates and beams. This requires some more work on the comi, but in principle it should be straightforward to implement. This would in my opinion give a worse case scenario.

At the moment the model meshes and should solve, I'm currently running a first test through the solver, but:

1) I don't believe the boundary conditions are correct.
2) Some of the model dimensions need checking. I'm working on some first guesses.
3) The number of elements means that this is going to take a long time to solve. I might see if I can reduce the mesh resolution a little.