Hall D Fringe Field

Gary Adams and Ji Li, 24 May 1999

Model

The simulation code FLUX2D has been used to estimate the fringe field outside the spectrometer solenoid. The purpose of these calculations is to provide estimates of the ambient field in the regions where detector elements will be assembled. An axially symmetric detector was used to approximate the true geometry. The dimensions used are from the sketch in the Preliminary Design Report. The current elements were adjusted to reproduce the proper central field, again from the PDR.
Additional calculations on smaller models will be made to design the magnetic shields for individual detector elements. For the present calculation the LGD shields have been included with the equivalent mass density of 2mm thick high-mu tubes around each pmt, each 15 cm long. Magnetic Shield Corporation co-netic alloy was assumed for the LGD and magnet steel was used for the magnet yoke. Calculations were performed with and without the steel plate in the front of the LGD. LGD shield performance was greatly enhanced without this plate in place so those results are quoted below.

Results

The attached figure shows the H field lines for this model. Some general conclusions can be drawn from this plot. First, the LGD pmt shields have sufficient mass to significantly alter the fringe field in the detector region between the yoke and the front of the LGD. Also, the gaps in the magnet yoke have a noticeable effect on the fringe field. The field strength beside the yoke could be reduced a great deal by filling the gaps with magnet steel. This would reduce the field somewhat in the detector region as well. The attached table shows a field map in this region (Theta = 90 degrees is along the beam direction). In this table the field is given at 30 cm intervals in Z, starting with Z=0 at the downstream edge of the yoke. The cerenkov detector pmts will probably be placed near Z=30 cm, and the tof scintillators near Z=120 cm. As one can see from the table, the ambient field for both of these detector elements will be about a kg.