Magnetic field studies for CLAS12 RICH detector.

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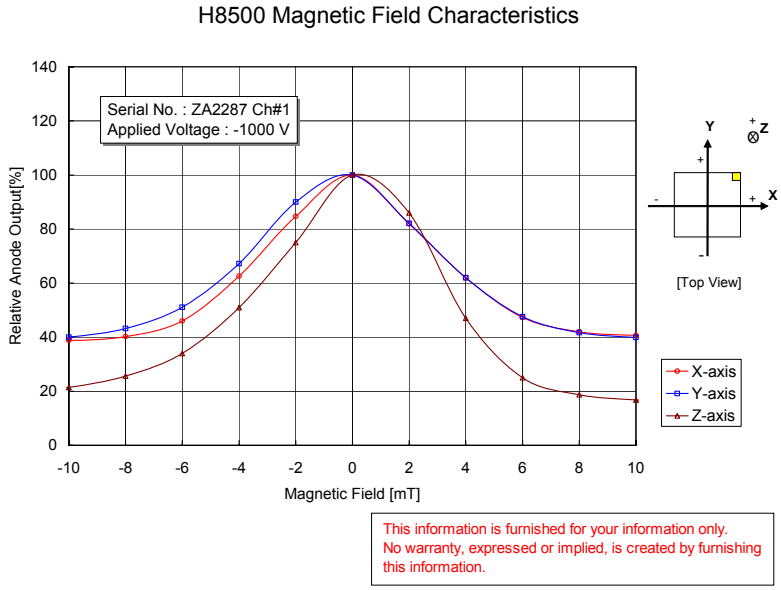
The addition of Ring Imaging Cherenkov counter (RICH) to CLAS12 detectors will help to make separation between protons, pions and kaons more effective in large momentum range (2-8 GeV).

The Hamamatsu H8500 64 channels multi-anode PMTs are chosen as photon detectors because of their excellent packing factor, position sensitivity and high quantum efficiency in the visible wavelength range (300-650 nm). However these PMTs are very sensitive to magnetic field. Pictures obtained from Hamamatsu show that loss of efficiency is about 1%/gauss (Fig. 1), so H8500 PMTs need magnetic shield if placed in magnetic field higher than 10 gauss. It is almost impossible to design such magnetic shield that will protect the PMTs and will not block the Cherenkov light. By this reason it is extremely important to know the magnetic field in the region of the RICH photomatrix.

The preliminary layout of one RICH sector is shown on Fig. 2. The sector consist of about 400 PMTs located on the plane between Drift Chambers and Forward Time-of-Flight counter. The z coordinates of the PMTs vary from 645 to 680 cm.

The torus magnetic field map was calculated by Jlab staff engineer Probir Ghoshal using Vector fields (Opera 3D) software by Gobham. For these calculations the updated coils configuration of the Torus Magnet was used.

The result of these calculations is shown on Fig. 3. The magnetic field absolute value varies from zero to five gauss depending on PMT position. It means that Hamamatsu H8500 multi-anode PMTs can be used as photon detectors for CLAS12 RICH counter without any magnetic shield.



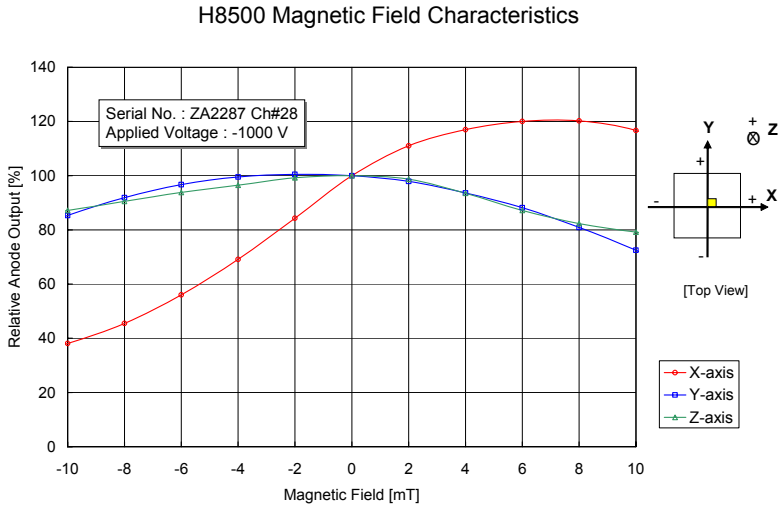


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FIG. 1: Hamamatsu H8500 PMT Field Characteristics.

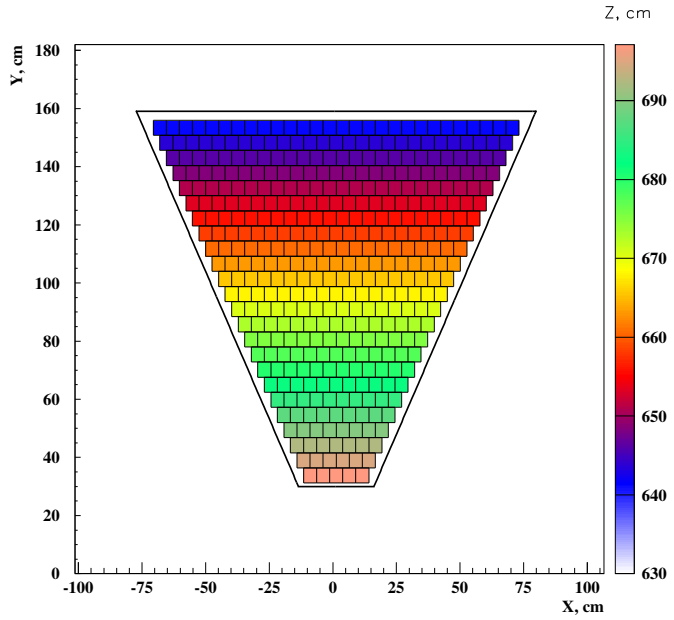

FIG. 2: Preliminary layout of one RICH sector.

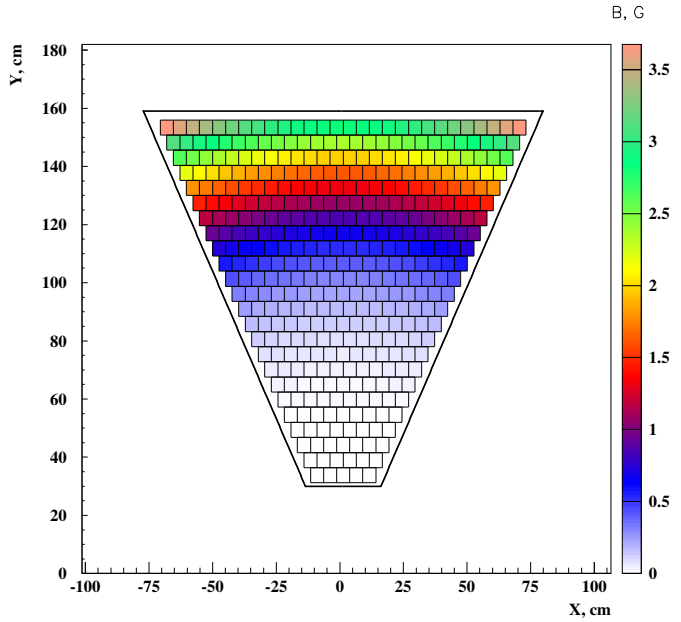

FIG. 3: Calculated magnetic field for each H8500 PMTs.