

Helmoltz coils to study the magnetic field effects on MAPMTs

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(with the support of the technical personnel)

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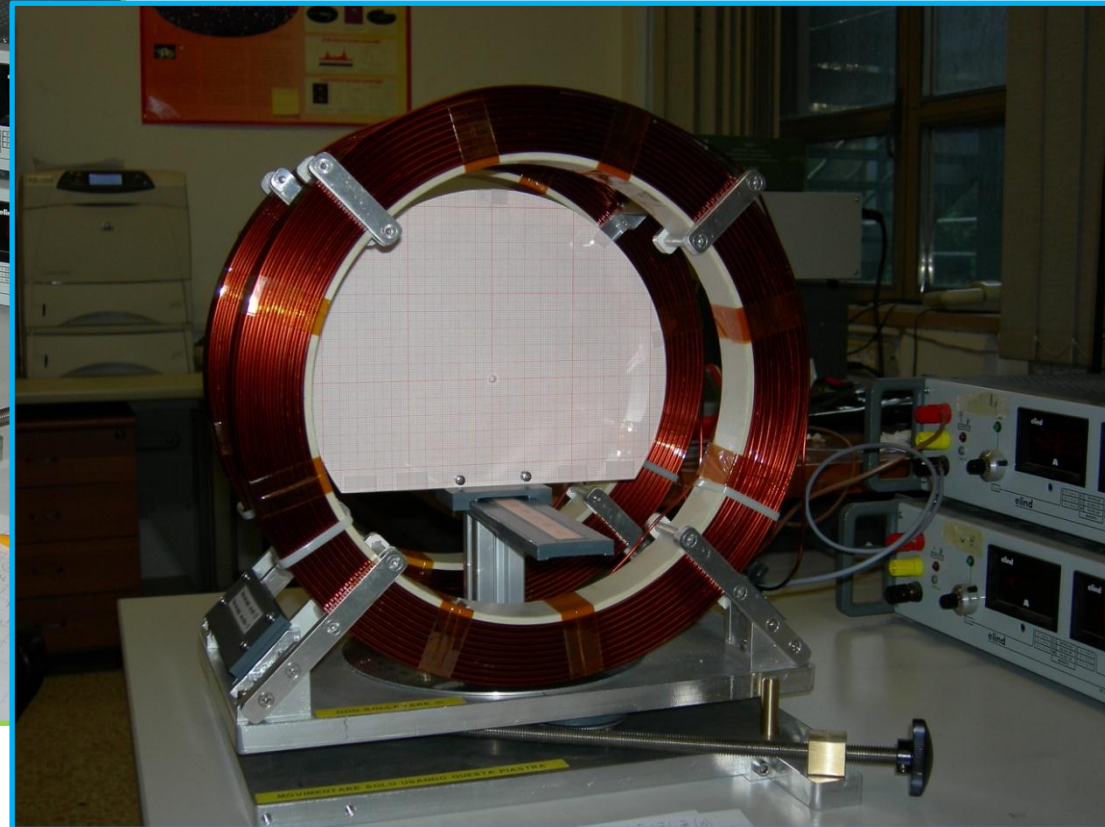
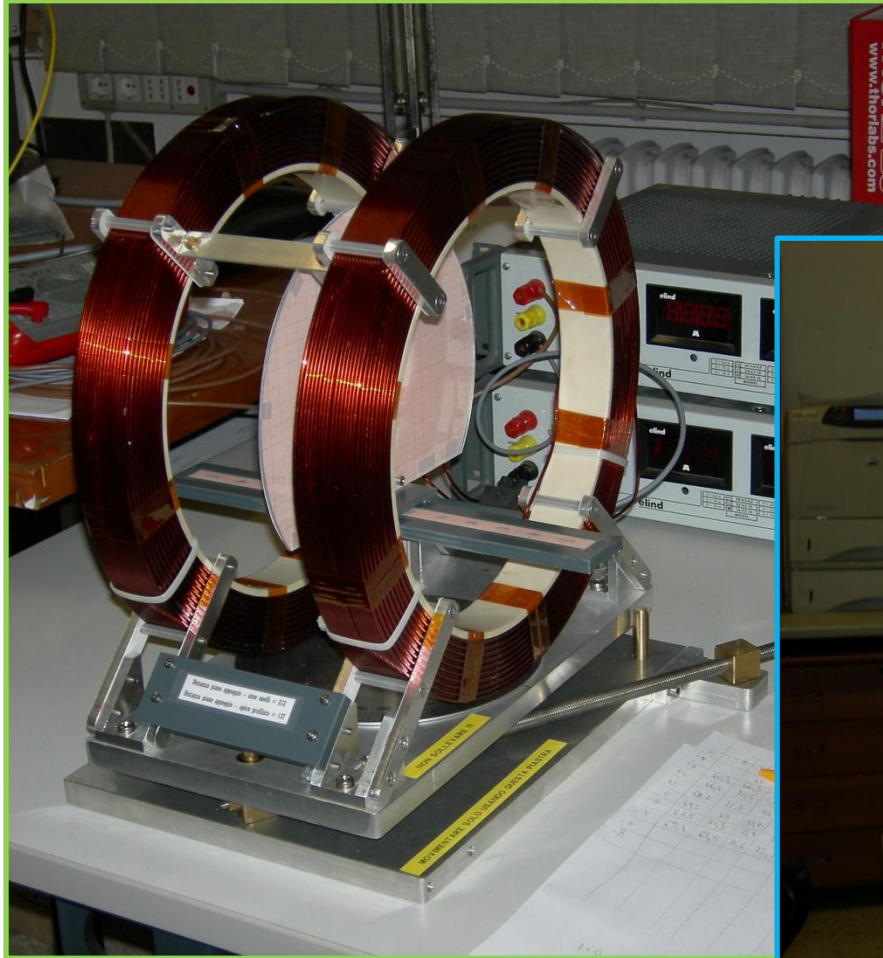
A device to study the magnetic field effects on MAPMTs

- Requirements:
 - magnetic field strength up to 100 gauss on the MAPMT
 - uniform magnetic field across the volume of the MAPMT
 - possibility of exploring different orientations of the magnetic field with respect to the MAPMT
 - the device will be operated within the dark box
 - it must be easy to install and to handle
- Solution:
 - we built a pair of Helmholtz coils equipped with a support for the MAPMTs
 - Helmholtz coils provide a uniform magnetic field in the region within the coils
 - the Helmholtz coils can be rotated with respect to the MAPMT

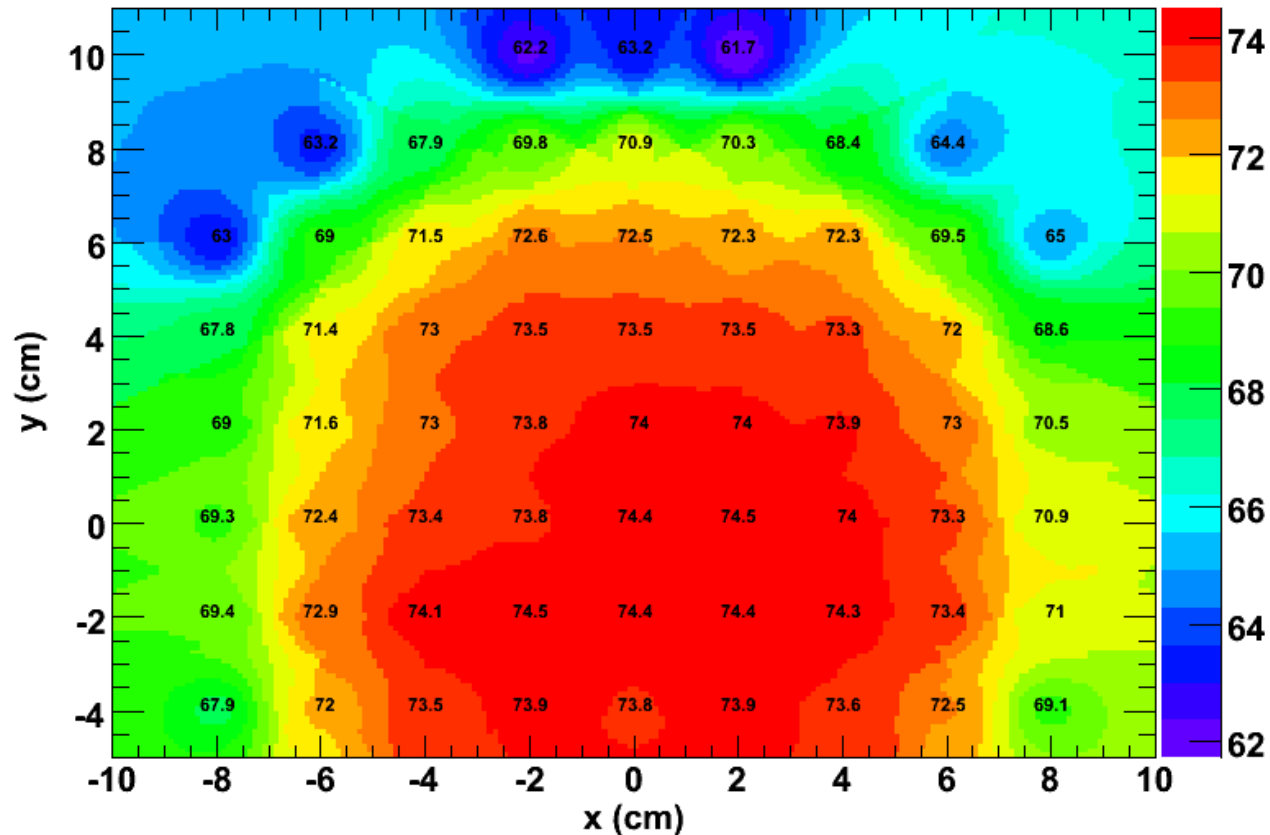
Design details

- The coils were built with enameled copper wire
 - average radius of each coil = 14.242cm
 - inner radius = 12.5cm; outer radius = 15.984cm
 - distance between the centers of the coils = 14.242cm
 - number of turns per coil = 295
 - wire outer diameter = 2.1mm
 - wire inner diameter = 2mm
 - if $J_{\max}=2.5\text{A/mm}^2 \rightarrow i_{\max}=7.85\text{A}$
 - total length of a coil = 264m
 - mass of a coil = 8.2kg
 - total electrical resistance = 3Ω
- Magnetic field in the center of the coils:
 - $B = \left(\frac{4}{5}\right)^{3/2} \frac{\mu_0 N i}{R} \rightarrow B=74.5 \text{ gauss with } i=4\text{A}$

The device

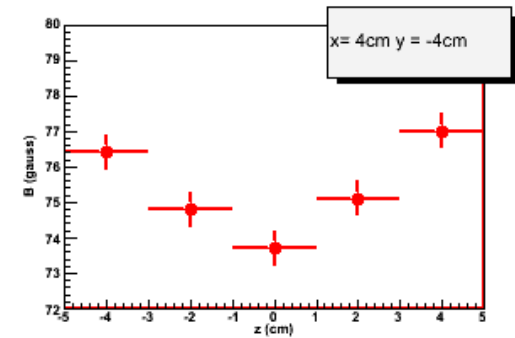
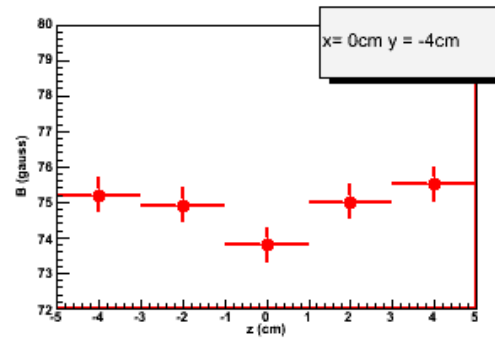
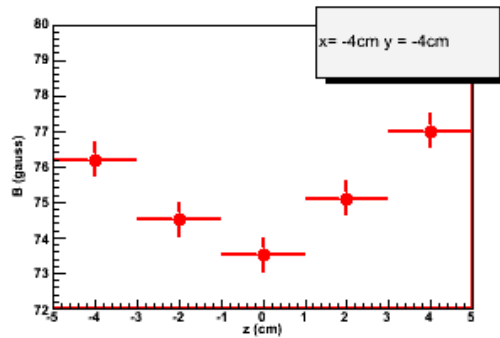
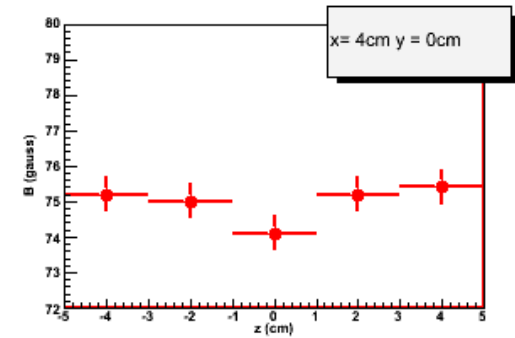
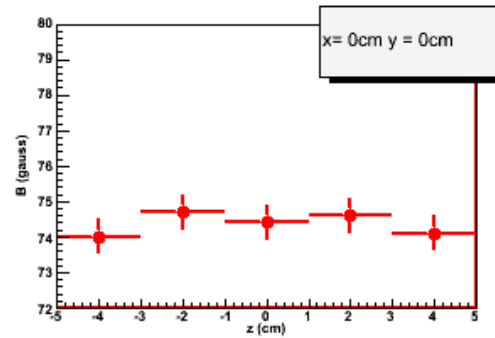
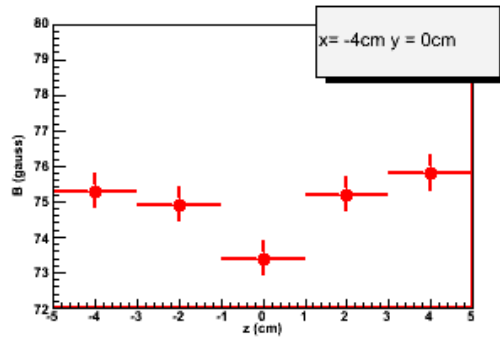
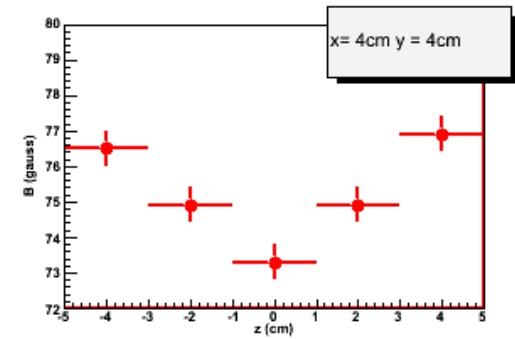
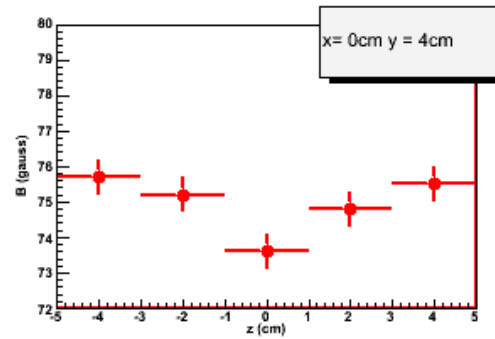
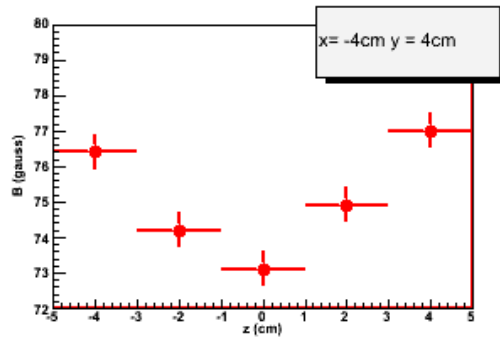


Measurement of the B field



- The magnetic field was measured setting $i=4\text{A}$ and using a Hall probe
- This map refers to the center of the coils ($z=0$)
- The measurement is in agreement with the theoretical expectations
- The magnetic field is almost uniform in the region where the MAPMT will be placed

Uniformity along the z-axis



Conclusions

- We designed and built a device to test the MAPMTs inside the magnetic field generated by a pair of Helmholtz coils
- The coils can rotate with respect to the MAPMT in order to study the effects of the different orientations of the magnetic field
- The magnetic field was measured using a Hall probe
 - the Helmholtz coils generate an approximately uniform magnetic field within the volume of the MAPMT