MaPMT H8500C magnetic field tests at Temple U.

a short (incomplete) summary

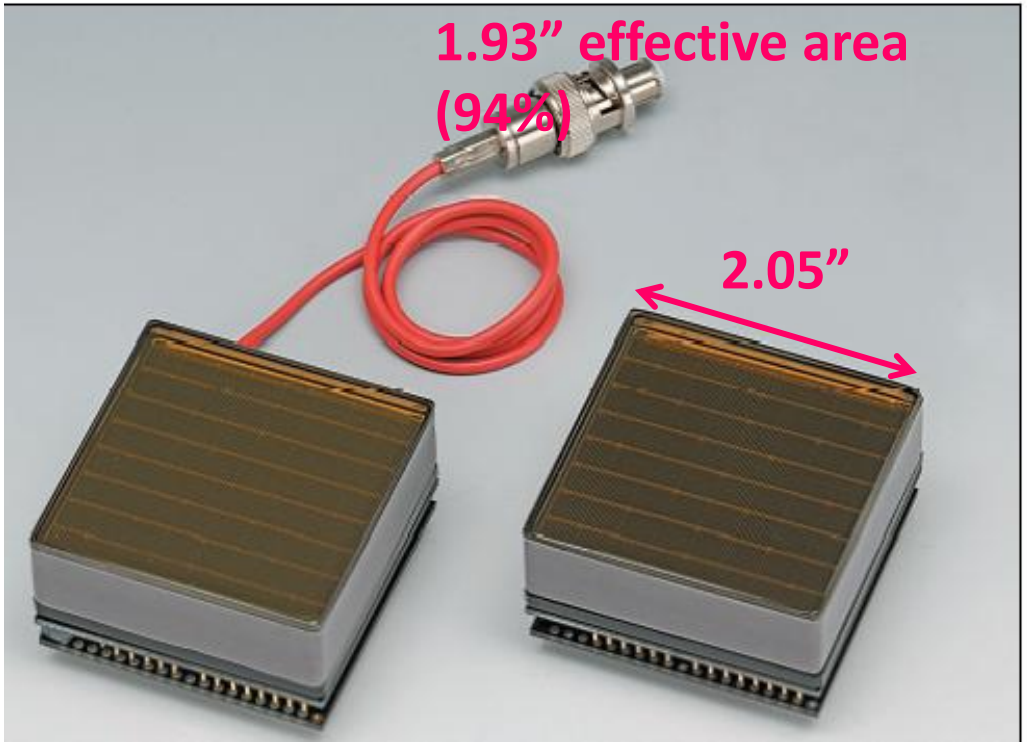
SIDIS L./H.-G. CHERENKOV: PHOTON DETECTOR

- (Some) Requirements: 1) resistant in magnetic field possibly good enough
  3) decent size yes if tiled
  2) "quiet"

At the last coll. meeting

Photomultiplier Tubes

- Multi-anode 2" PMT: fairly resistant in magnetic field; it can be tiled (data from Hamamatsu)



Square shaped and 94% effective area: ideal for tiling

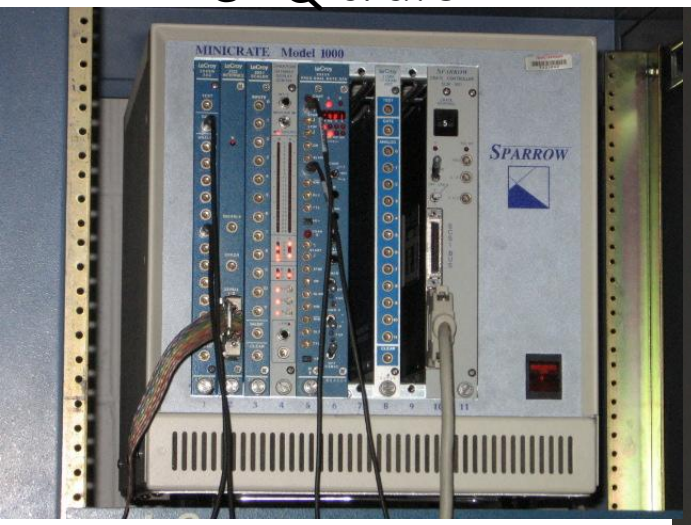
Drew Weisenberger (JLab) lent us one such PMT for tests

PMT now at Temple for initial magnetic field tests

Experimental Setup

- Source: green LED
- PMT for testing in a dark box
- Get the ADC response
- We read the sum of all pixels

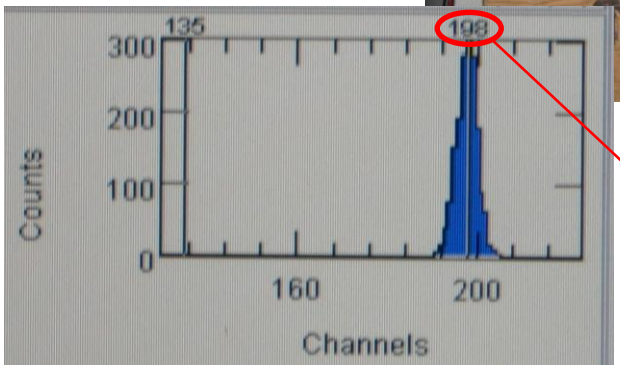
DAQ crate



Pulser which controls the green LED

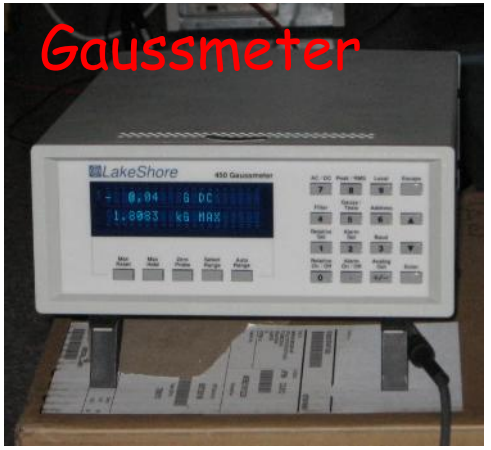
PMT and LED inside

HV crate



ADC spectrum of PMT response

TESTS: field, no shield



- Purpose: measure the degradation of the PMT signal with increasing magnetic field

Helmholtz coils

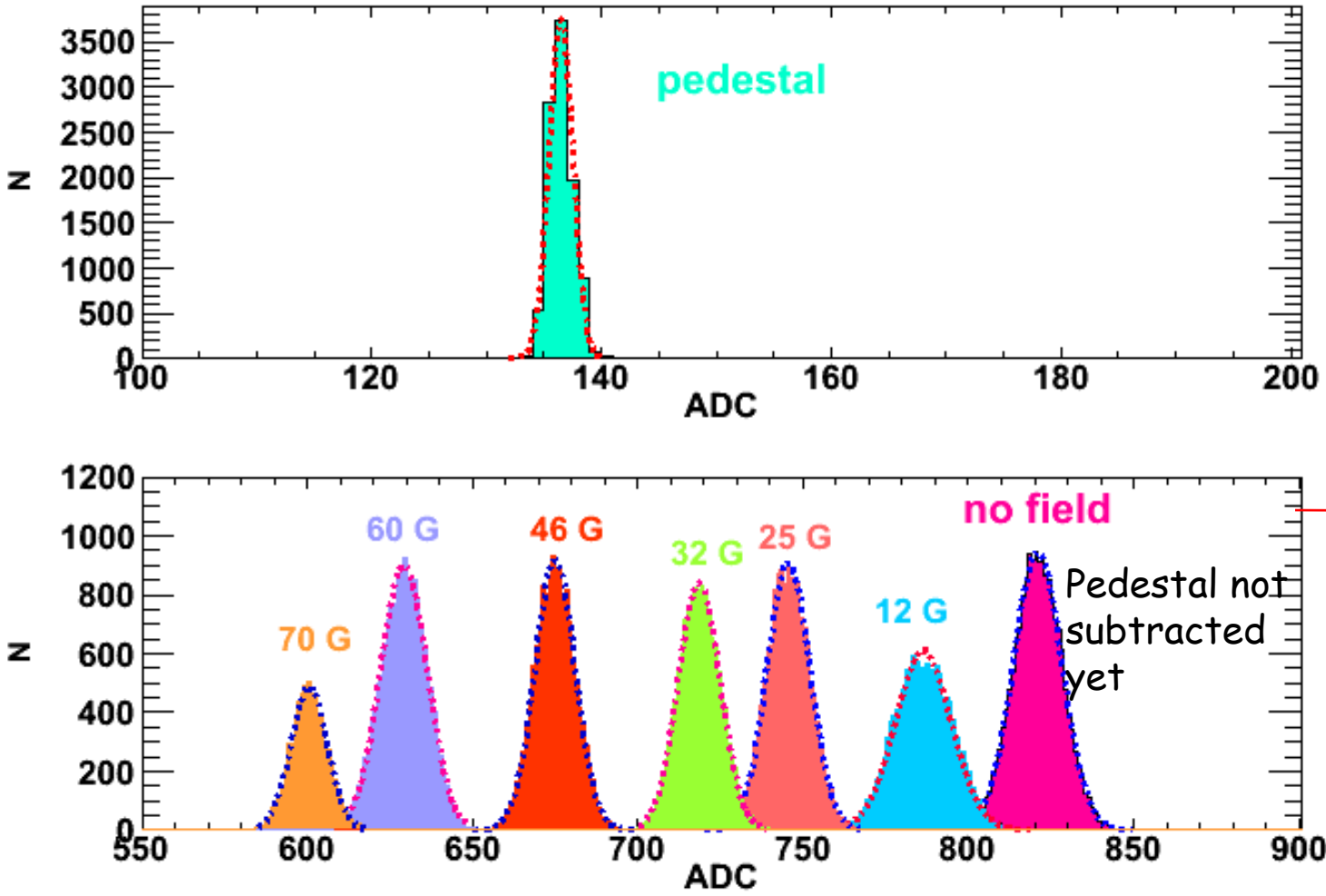
How we "map" the field:

We vary the current on the power supply in few steps and at each step:

1) PMT out, box opened: measure magnetic field inside the box at the PMT face and outside the box on the same axis (the latter is used as reference once the box is closed); 2 measurements ~=
2) we close the box with PMT in and go back to the same power supply settings for each step checking the field outside the box; the field measurement is reproducible

TESTS: field, no shield

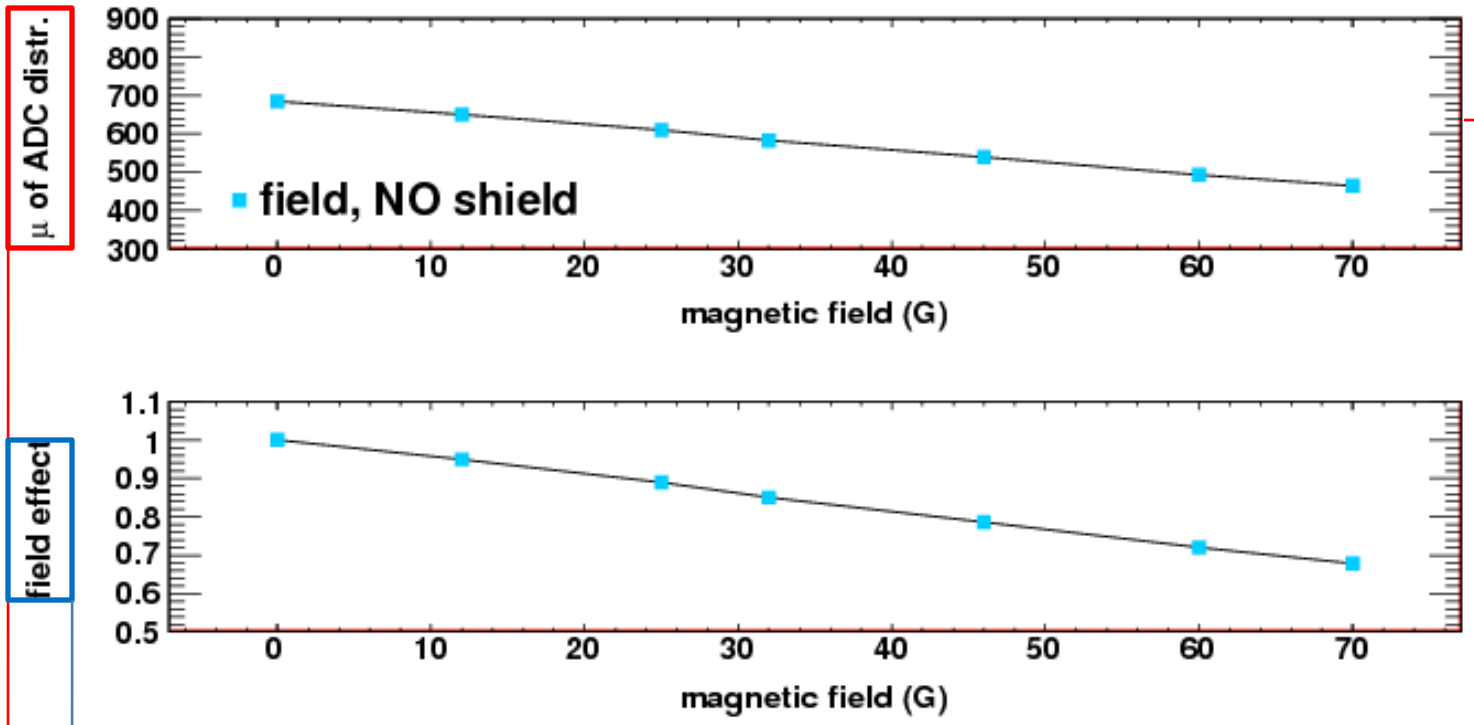
- Results: ADC spectra for few field settings



→ Field as measured at the face of PMT

TESTS: field, no shield

- Results: field effect



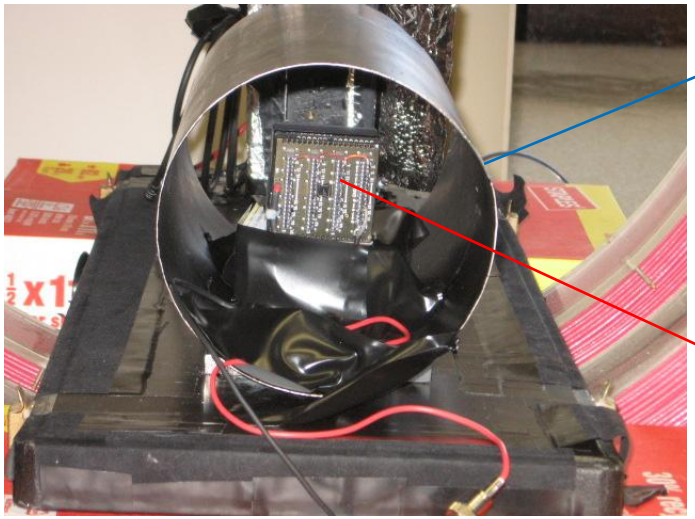
→ Field as measured at the face of PMT

(Mean from the gaussian fit of each ADC distribution)- pedestal

(mean from each setting)/(mean from the no field run); pedestal is subtracted

- PMT performance: not bad; ~30% signal reduction at 70 G

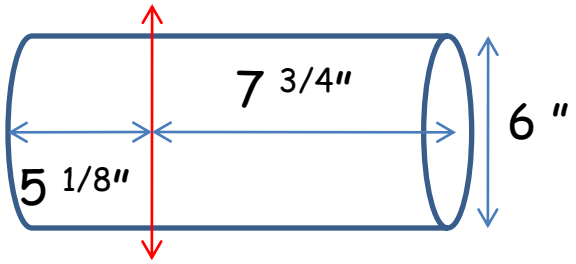
TESTS: field, with shield



shield

PMT inside the shield; back view

PMT inside the shield

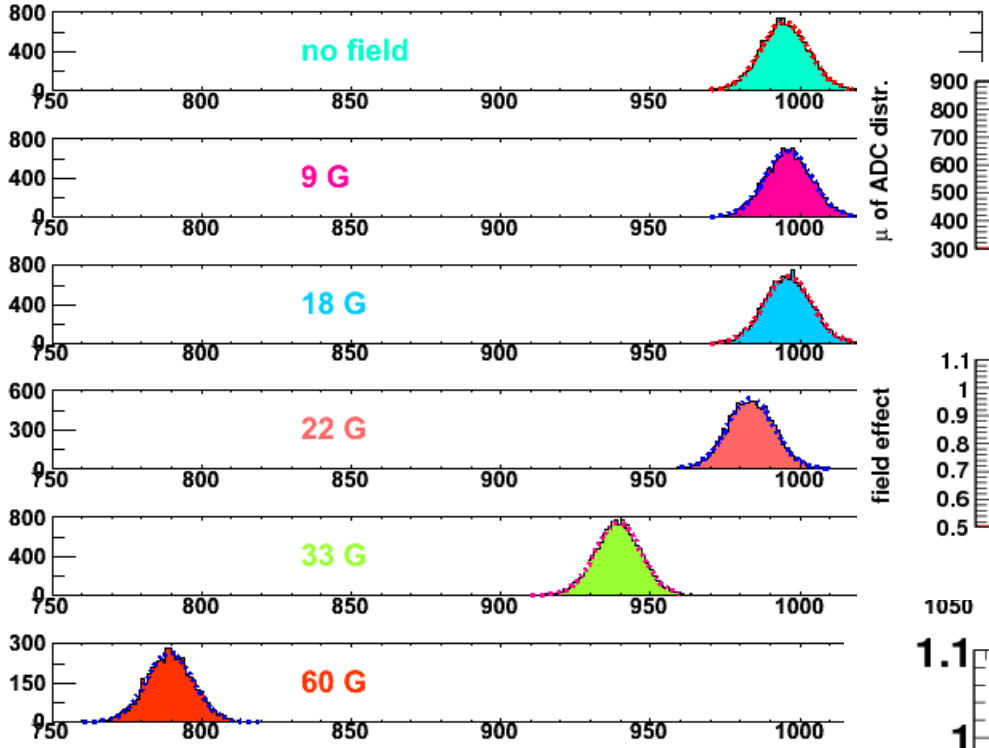


Face of PMT here

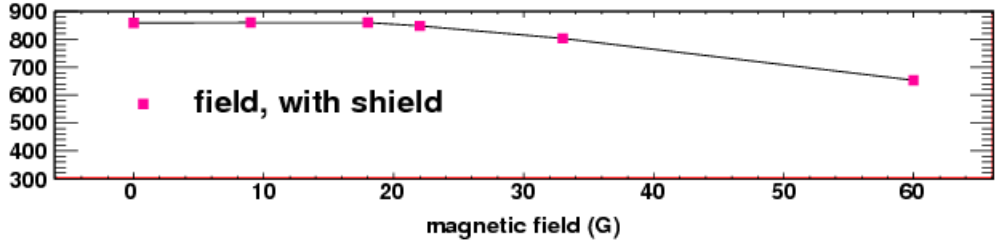
PMT placed at ~same location w.r.t. the LED as for the no shield runs

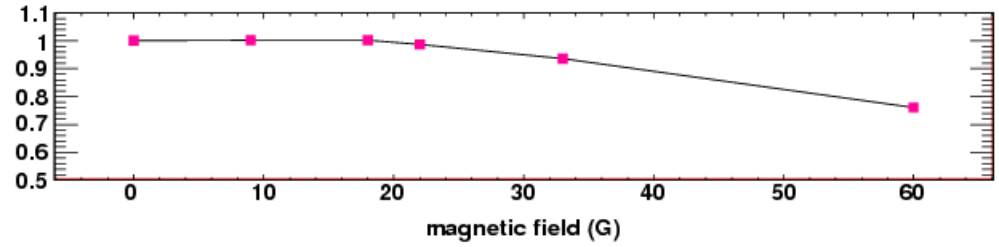
Measure field just outside the box at same location as for no field runs: cannot really measure longitudinal component of the field at the face of PMT inside the shield (sticking the probe in would mean to tilt it)

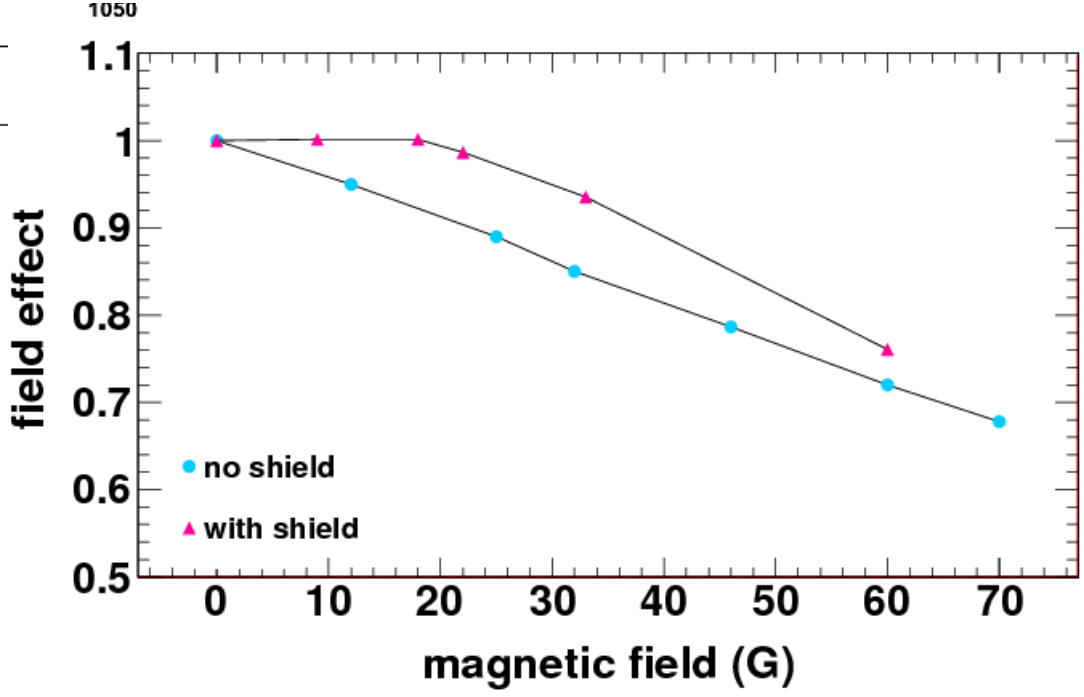
TESTS: field, with shield



Field as measured outside the box







- We can easily shield up to 20 G; even at ~33 G the signal degradation < 10 %

To Do:

- Took absolute measurements (not shown here) but the time was short (5 days) and we focused on the field effect on the PMT performance + not trivial to find the one photoelectron peak with such device: we will follow up with more absolute measurements at JLab

- We could safely run at 70 G or below (limitation of power supply + coils were heating up): if possible, we will try to do measurements at JLab at higher fields (+ play more with shielding)