Status of the COBRA Magnet

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MEG review meeting
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Status of the Construction

- Main superconducting magnet
  - ➢ An excitation test of the central part of the magnet was successfully done.

    The mechanical strength and superconducting performance were measured.

    → good performance!
  - ➢ A serious problem was found in one of the end coils.

    →We decided to wind another end coil.
  - ➢ Power supply is complete.
  - ➢ Cryostat is being assembled.
- Compensation coil

  Complete.
- Field measurement

  Design work of the mapping machine is in progress.

Construction Schedule

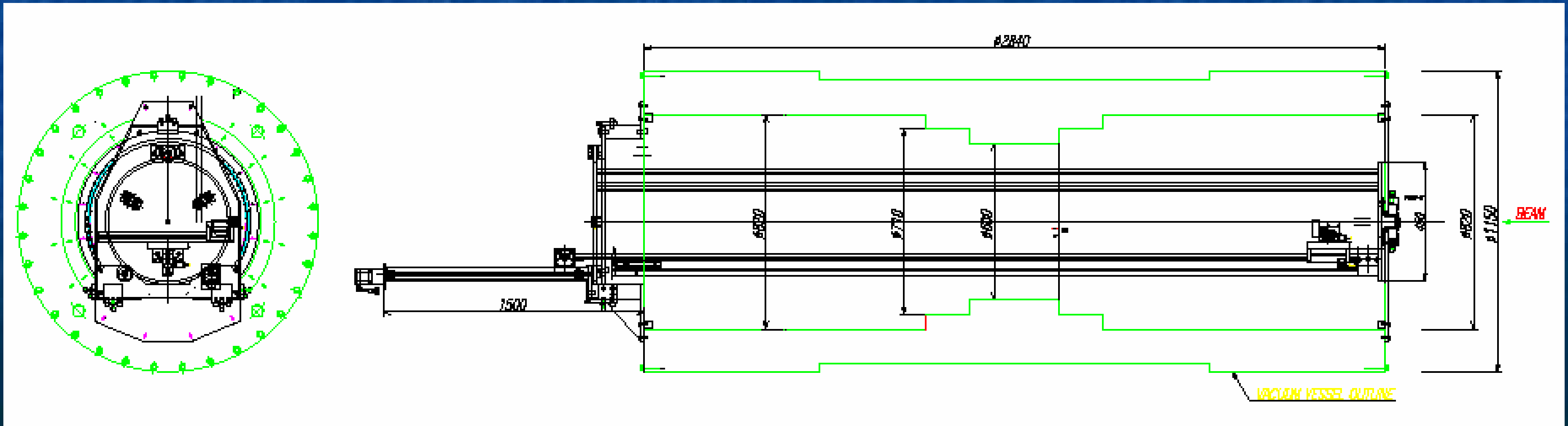
The schedule is delayed by a few months due to the problem in the end coil.

- early Feb. '03 Conductor for re-winding of the end coil will be delivered.
- mid-Feb. Winding completed.
- mid-Mar. Installation of the coils into the cryostat.
- late Mar. SCM completed.
- early Apr. Assembly of SCM and NCM completed
- early May Total test of the magnet
- early June Shipped to PSI

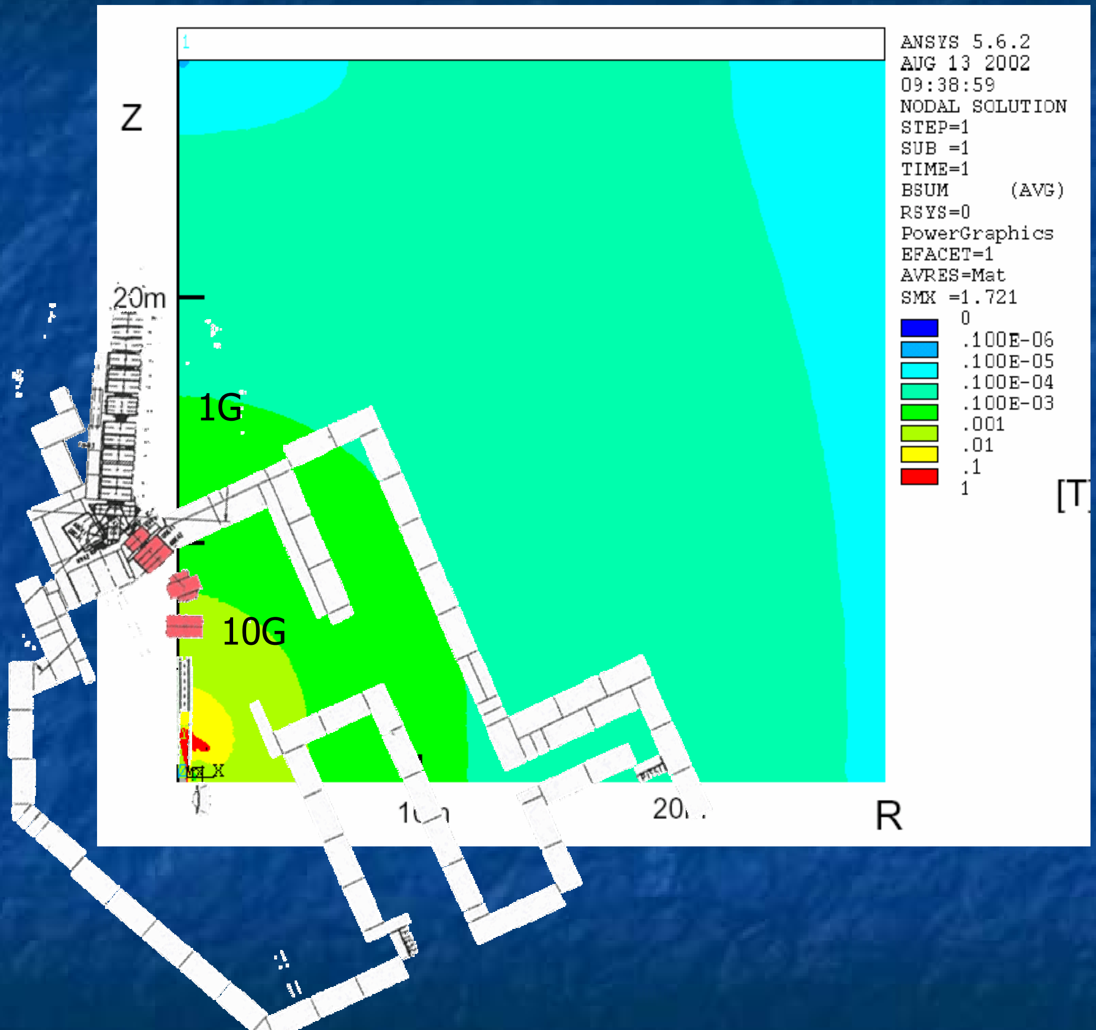
Field Mapping

Design work of the mapping machine is in progress.

- It can scan throughout inside the magnet.
- Point-by-point precision of the field map ~ 10Gauss
- Position accuracy ~ a few hundred μm
- Ultrasonic motor with a rotary encoder (4000pulses/rotation) for R- and Z-motion and high-torque AC servo-motor for θ-motion
- Timing belt will be used for the motion in all directions
- Absolute calibration of the probe position by an optical scale sensor
  → already tested in 1Tesla magnetic field.

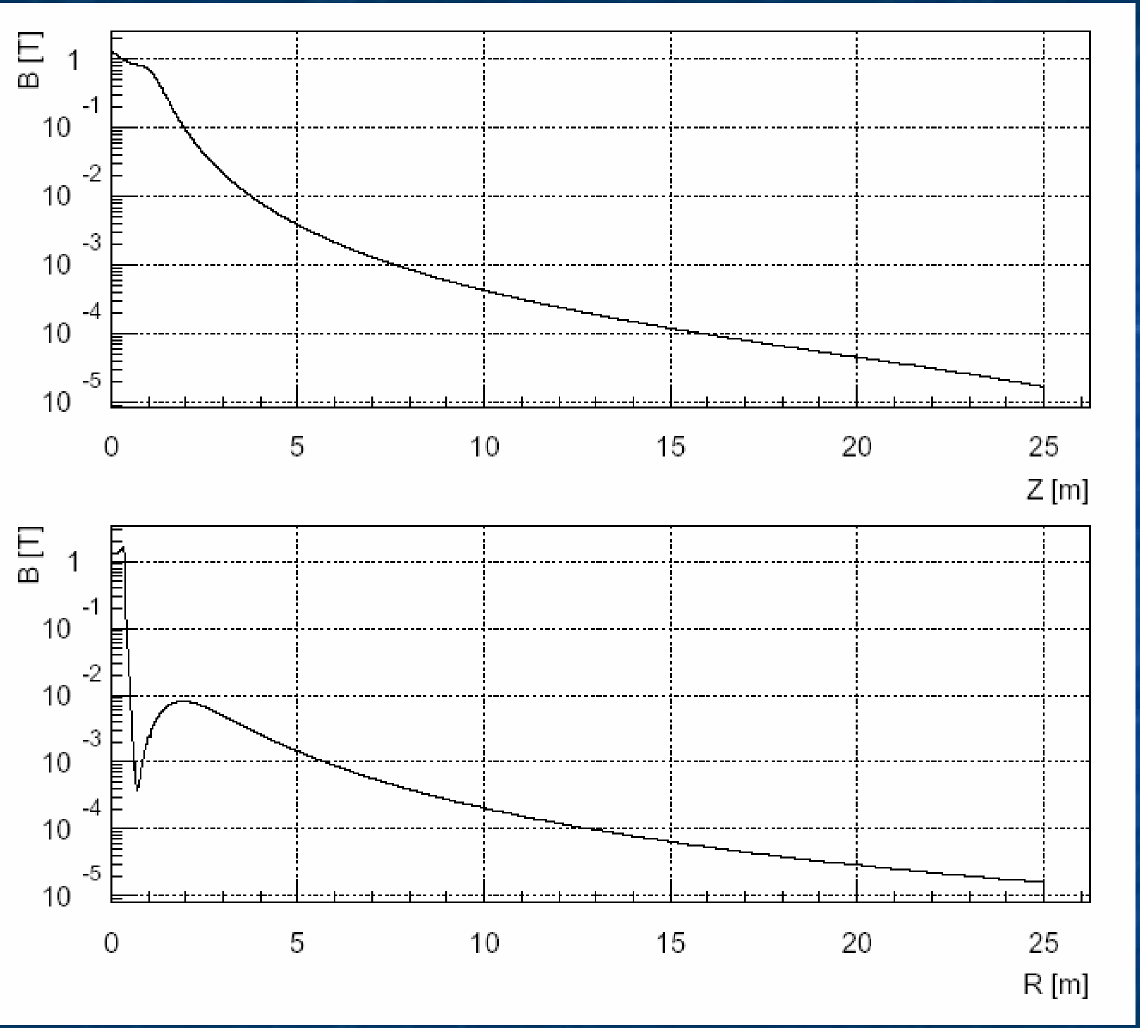


Fringe Field of the COBRA Magnet



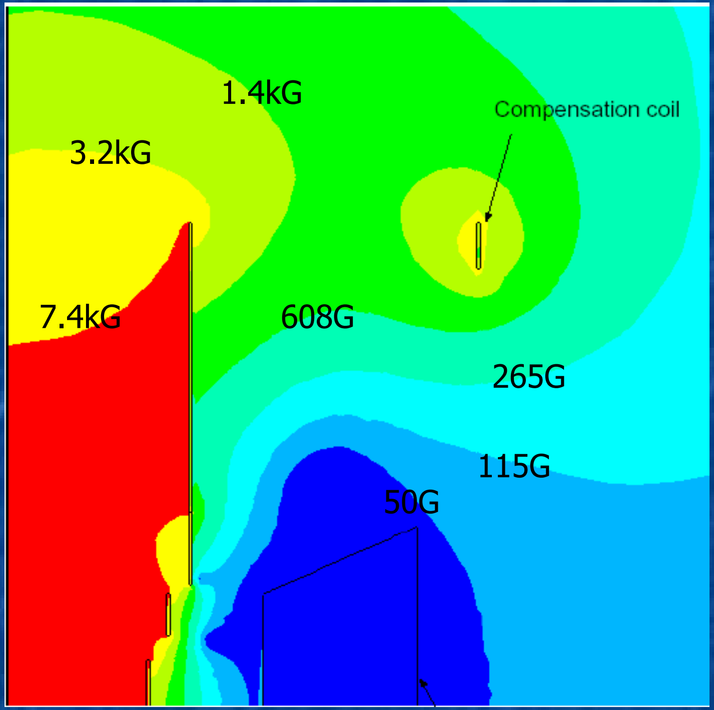
Fringe field <10Gauss outside πE5 area

Fringe Field of the COBRA Magnet, cont'd



~10Gauss at 5-7m ~1 Gauss at 12-15m

Effect of the Fringe Field on Other Detector Components



- Magnetic field olerance of the items to be used in the detector is being investigated.
  - Refrigerators(magnet & calorimeter) OK
  - Temperature sensor(PT100) OK
  - Pressure sensor
  - Pump
- Locations of the items should be determined according to their tolerance to the magnetic field.
- The region with low flux density
  - near the calorimeter (R=65-100cm, |Z|<50cm)
  - >5m apart from the magnet.

Ambient Magnetic Field in the Experimental Hall

- The ambient magnetic field in the PSI West area was already measured by UCN group.
- The measurements were made at several locations in the experimental hall.
  (not measured at πE5 area)
- They identified different kinds of magnetic noise sources.
  ALC magnet at πE3, GPS magnet, SULTAN,
  moving vehicles(cars, PSI trucks, lorries), …
- At all of the locations
  - average < 100μT
  - rms < 100nT
- The effect of the ambient magnetic noise seems to be negligible.

Effect of Magnetic Materials

- Magnetic materials inside the solenoid
  - ➢ We have to avoid using ferromagnetic materials in the inner detectors.
  - ➢ We are starting to list possible magnetic materials inevitably used inside the solenoid.

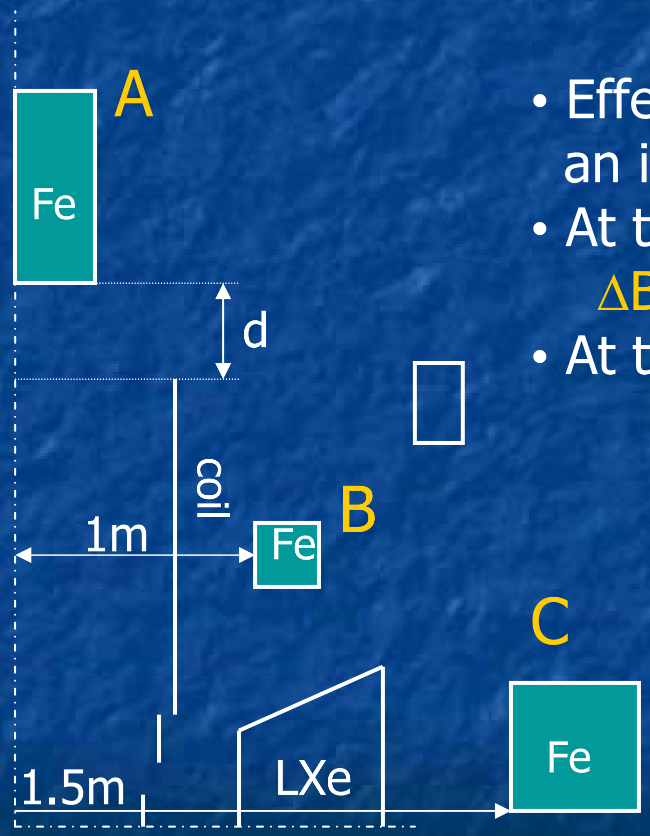
    Nickel coating on the connectors, Kovar alloy used in the PMT, etc.

- Magnetic materials outside the solenoid
  - ➢ We have to care about…
    - effect on the magnetic field around the photon detector

      Requirement: $B_{//} < 50G$ $B_{perpendicular} < 150G$ for a proper operation of the PMTs.
    - effect on the magnetic field inside the solenoid

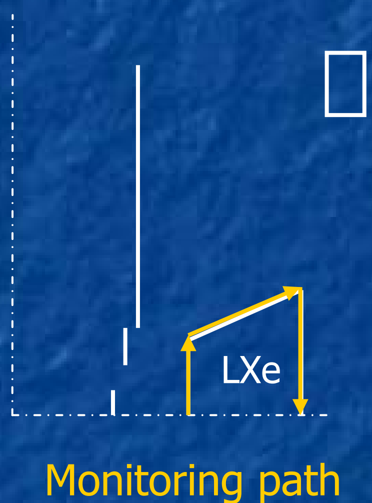
      Requirement: fluctuation < 0.1%

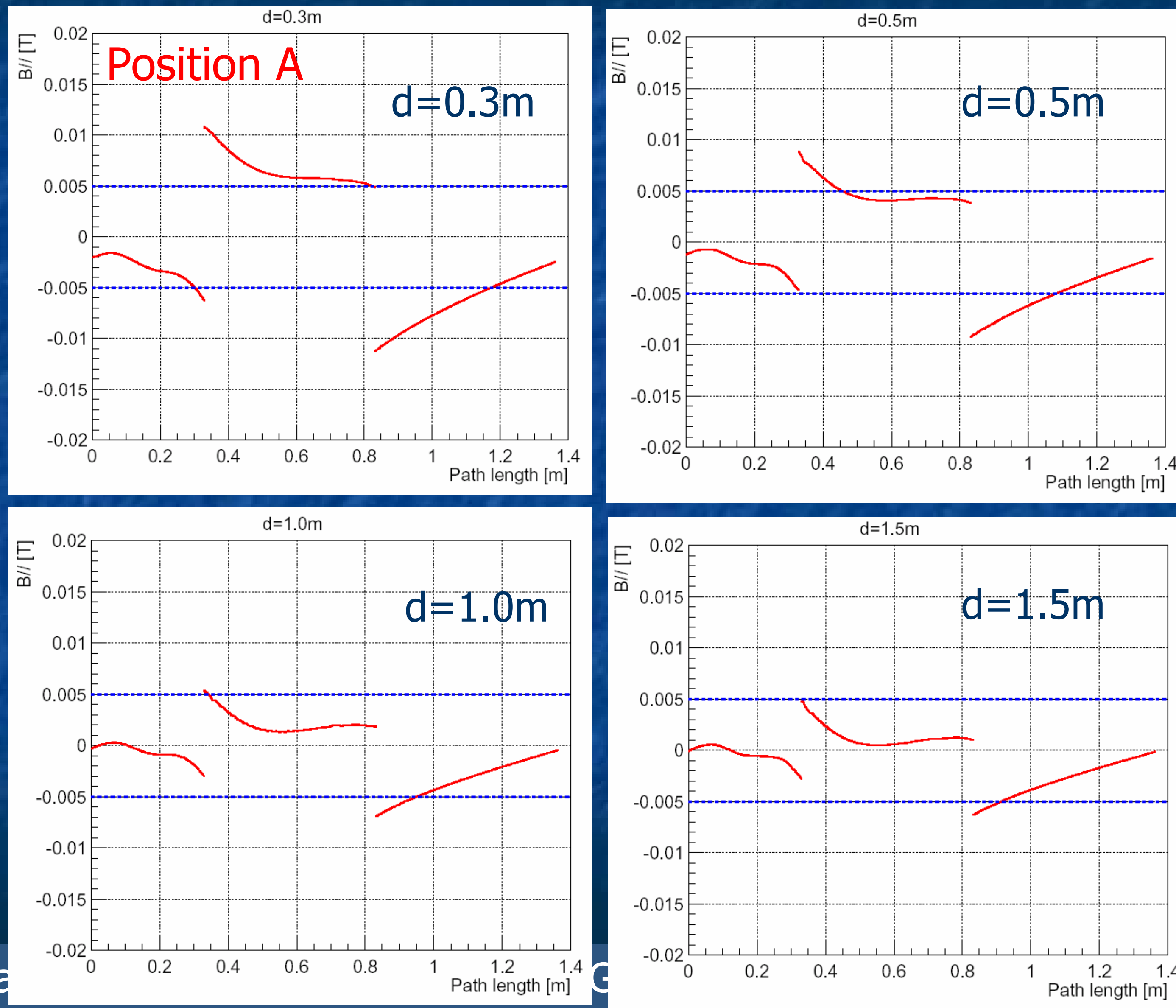
Effect on the Residual Field around the Photon Detector



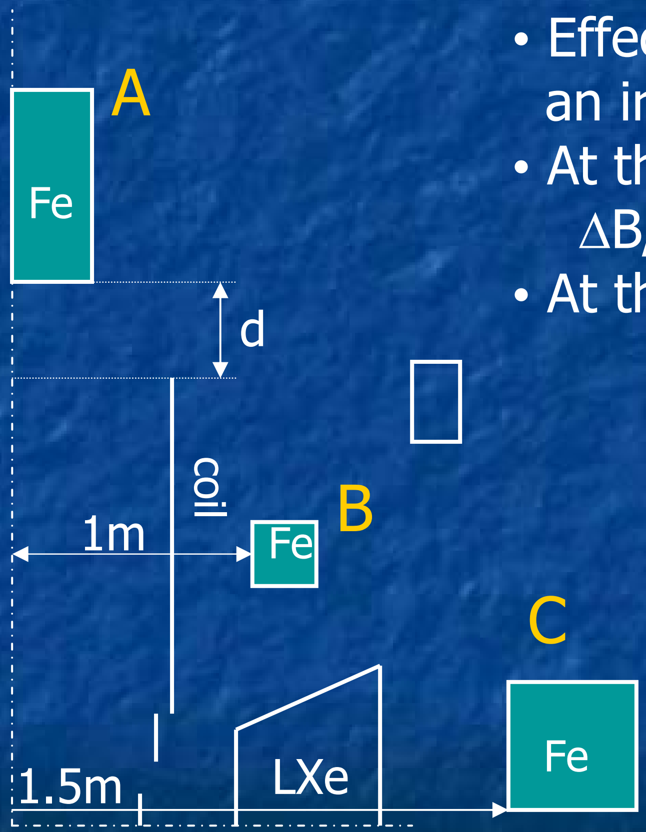
- Effect of the magnetic material was calculated placing an iron block at position A, B or C.
- At the position B and C, the effect is not so serious.
  $\Delta B \sim 10$ Gauss around the photon detector
- At the position A, the effect is serious if $d<1$m.

Effect on the Field around the Photon Detector, cont'd



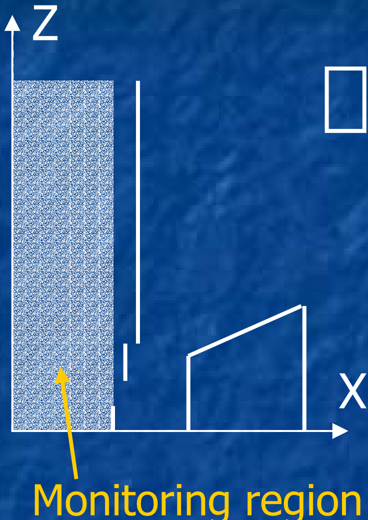


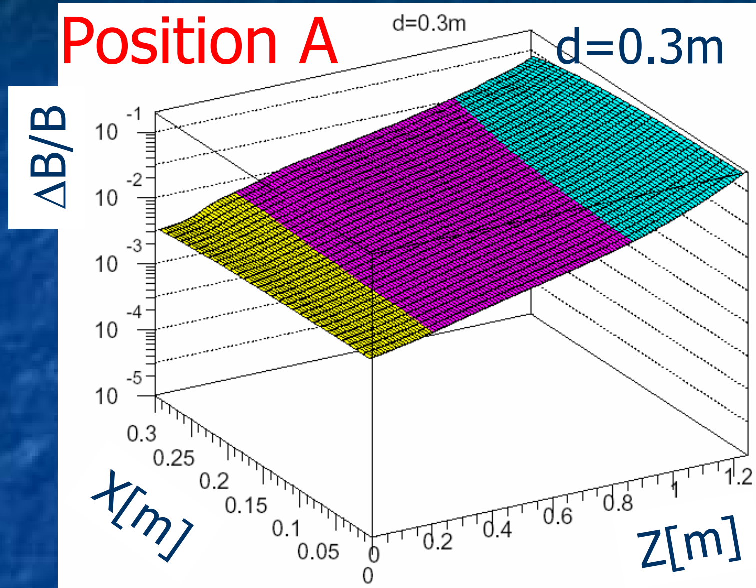
Effect on the Field inside the Solenoid

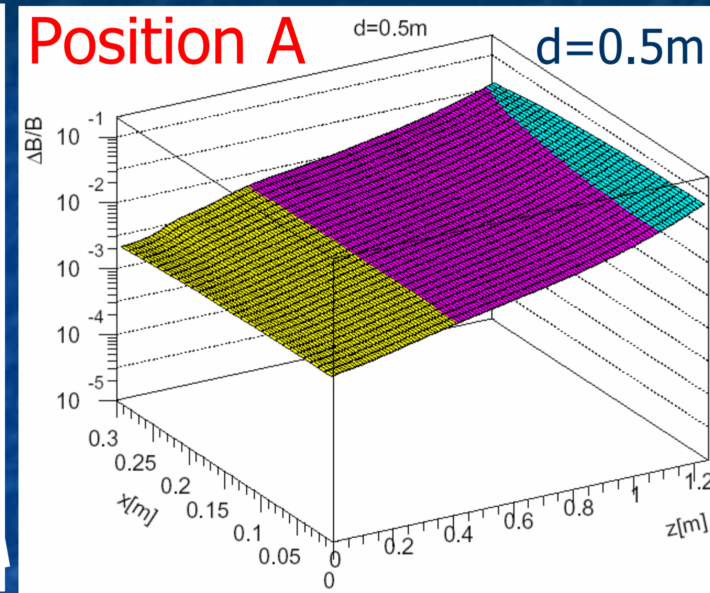


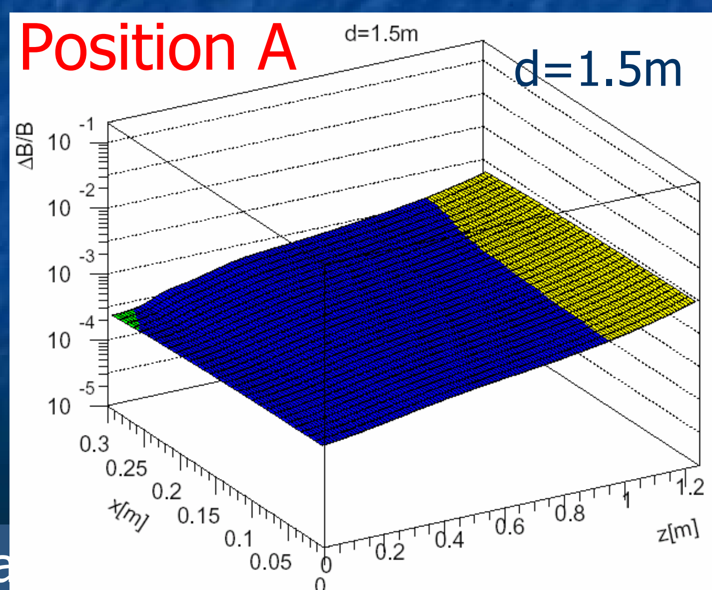
- Effect of the magnetic material was calculated placing an iron block at position A, B, or C.
- At the position B and C, the effect is negligible.
  $\Delta B/B < 0.01\%$ in the central tracking region.
- At the position A, the effect is negligible if d>1.5m.

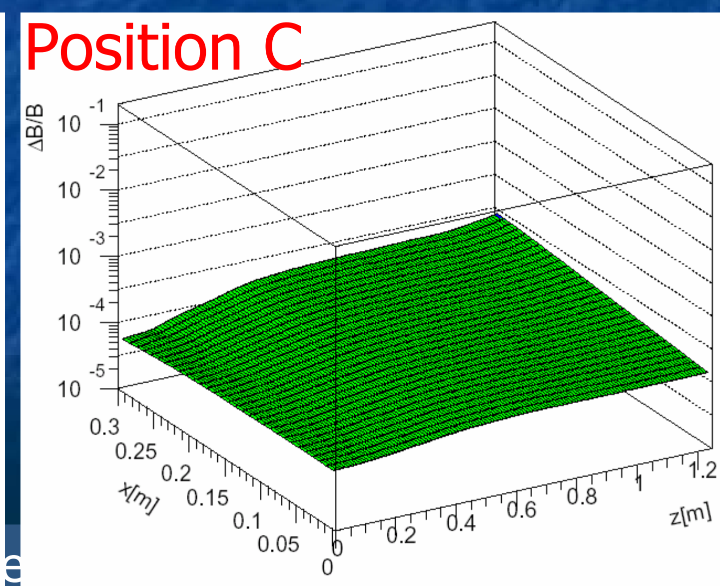
Effect on the Field inside the Solenoid, cont'd



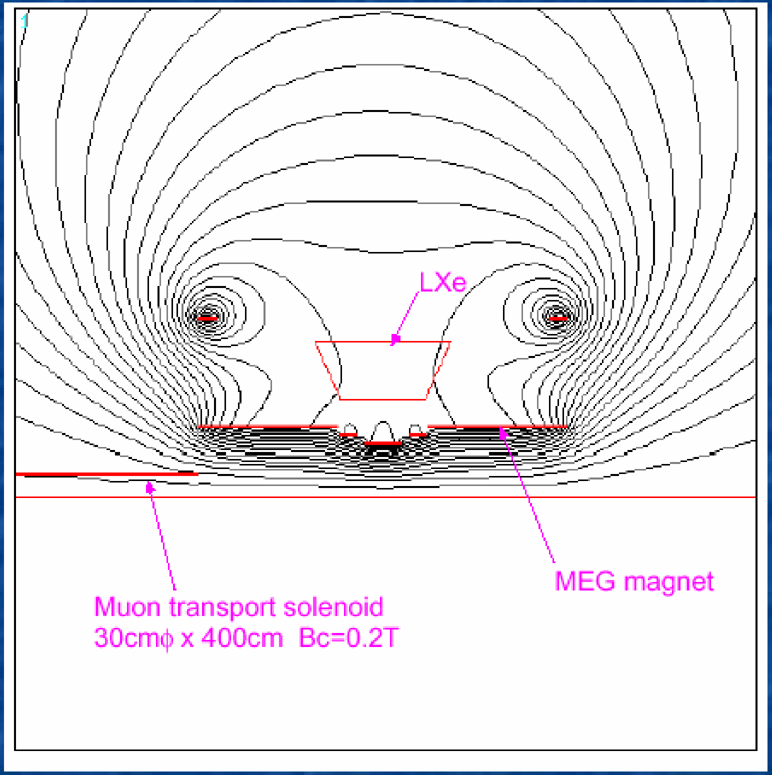








Effect of the Transport Solenoid



Influence of the muon transport magnet
(30cmφ x 400cm Bc=0.2T)

- Fringe field from the transport magnet
  < 10 Gauss in the calorimeter region
- Positron tracking
  Negligible effect
- EM interaction between MEG magnet and muon transport magnet
  OK

Summary

- Construction of the magnet is in progress.
- Construction is behind the schedule by a few months due to a serious problem found in the end coil.
- Fringe field of the magnet
  <10G outside the πE5 area
- Ambient magnetic noise in the area is negligible.
- Effect of the magnetic material was studied.
  - Avoid using massive iron within 1.5m along the magnet axis.
  - The effect of the magnetic material near the calorimeter is not so serious although the effect should be carefully evaluated in advance.