SHMS Studies

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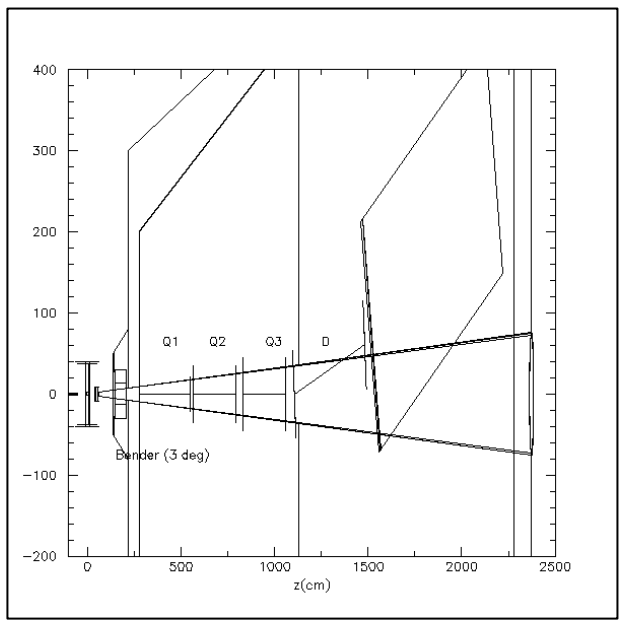
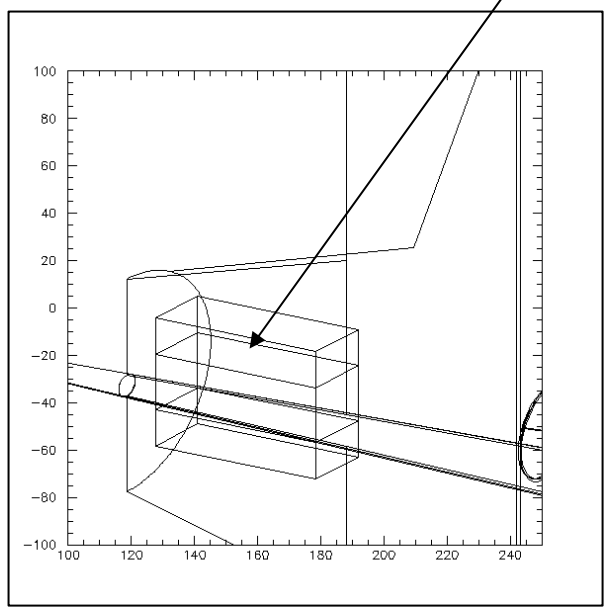
- Motivation
- SHMS background check
- Bender studies
- Outlook

SHMS GEANT Simulation

- Physics: interaction in the target (GEANT)
- Geometry: Target, vacuum chamber, SHMS
- SHMS: 4 magnets (bender, Q1, Q2, Q3, D) and apertures, detector at 18 deg
- Magnetic field: dipole tuned for 5 GeV
- Detector: for the moment full absorber to study rates
- Beam path: Target: LH2 15cm
- Out: ntuple with momenta, vertices and hits in detectors

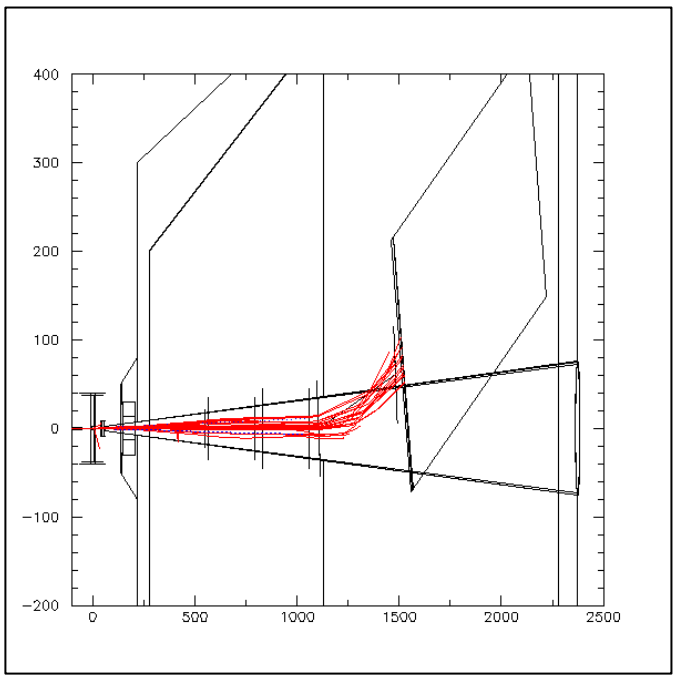
Bender, very simplified – no coils

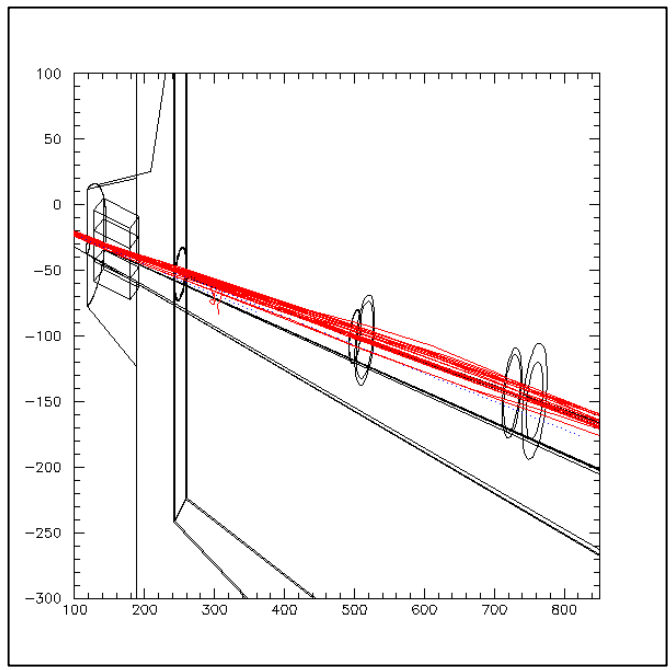




SHMS Acceptance

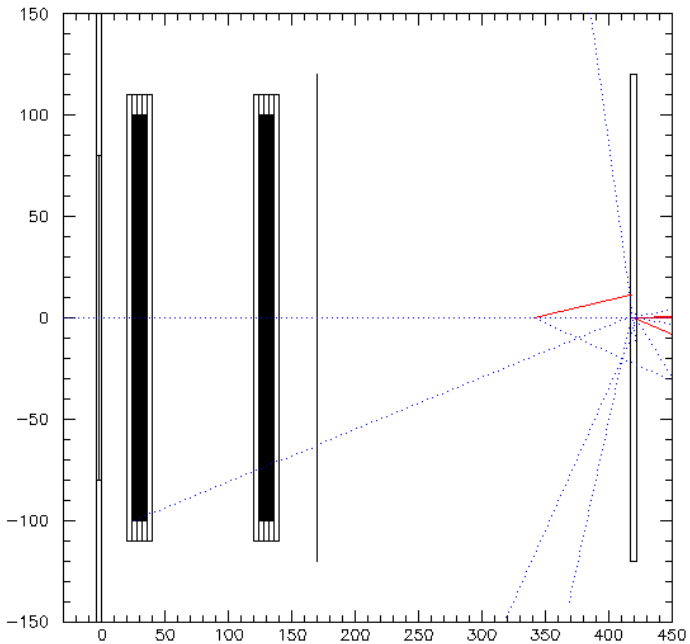
- Tune dipole for momentum 5 GeV, beam, 11GeV
- Background rates: ~100 MHz – low energy photons, but this is not the detector rate!



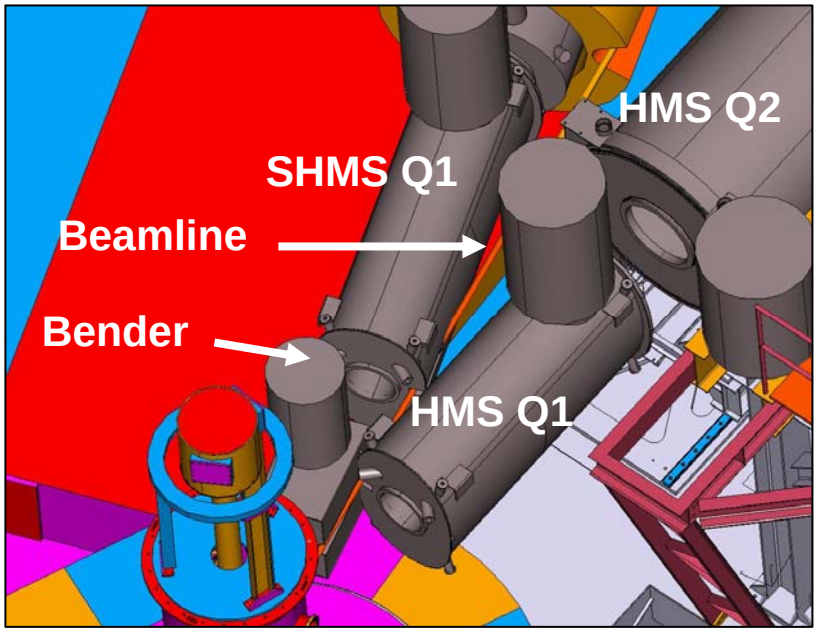


SHMS Detector rates

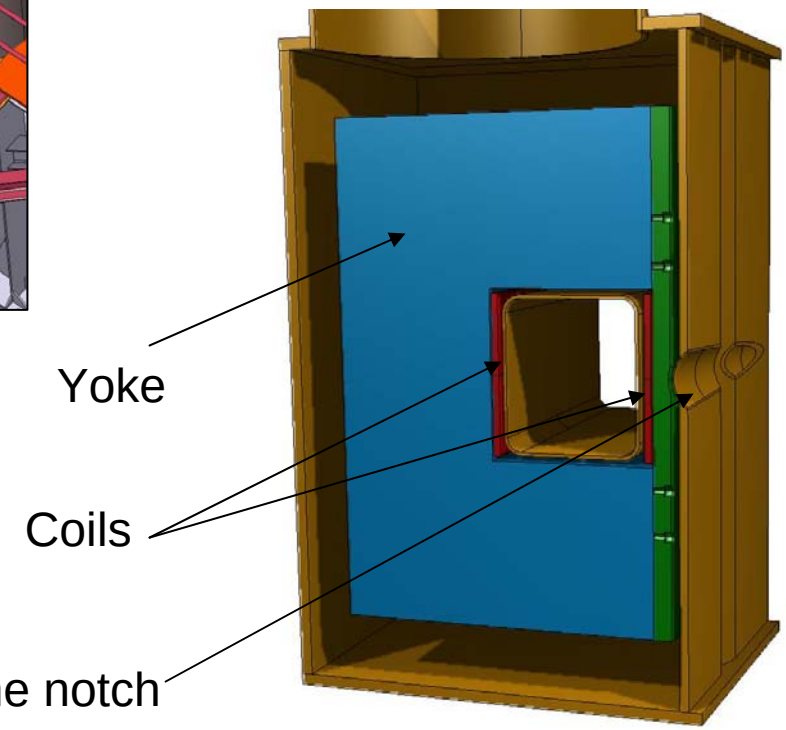
- Rough estimate with cell size from Hall A detectors – to refine use e.g. SOS DCs
- Generate photon spectrum (0.2-20 MeV) – real photon spectrum weighted by exponential
  - DC: rate ~1/6 hits/tracks ~ 0.1% probability
  - Scintillators: rate depends on threshold, 1-2 MHz, not unreasonable



SHMS Bender



- SHMS pre-bender magnet bends the central ray by 3° - allows for very small angle configuration

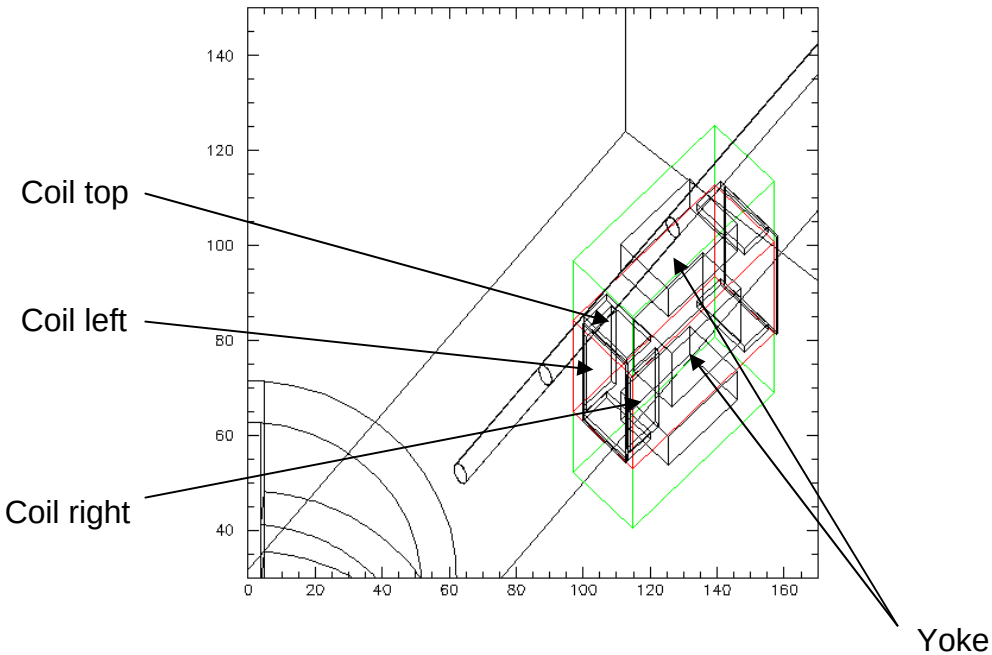


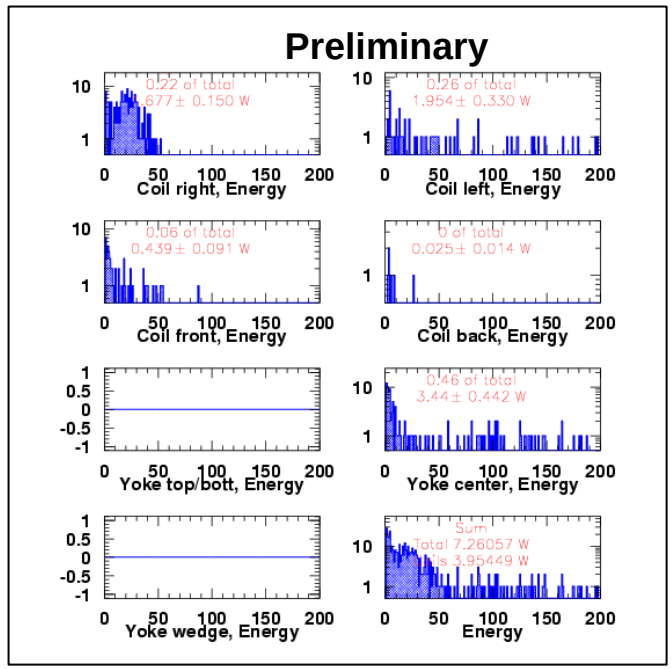
- Design question: How much energy is deposited in the coils at high beam energies and small angles?

SHMS bender heating simulation

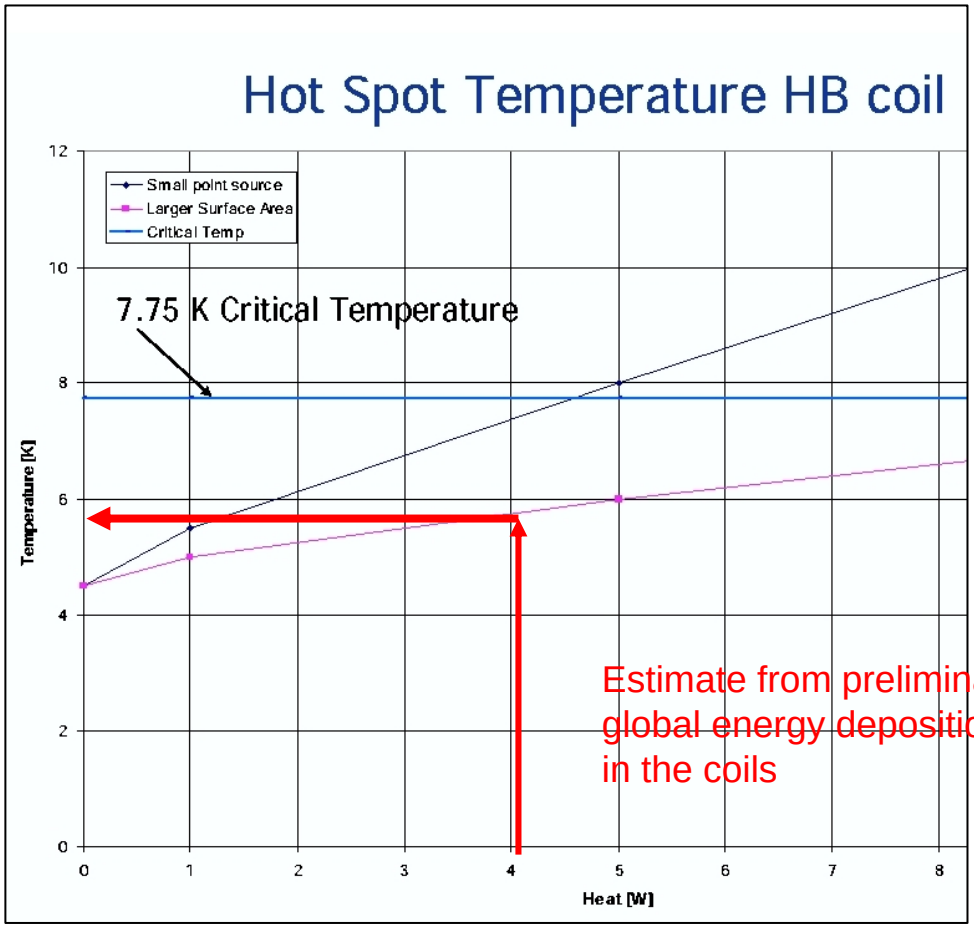
- Geant simulation of a perfect dipole with coils located at ~3.8cm from the beam line at 5.5 deg at the front of the magnet – closest approach
  - For final estimate need to do these studies with a realistic field map

- Preliminary heating estimate in coils: 1-4 W global



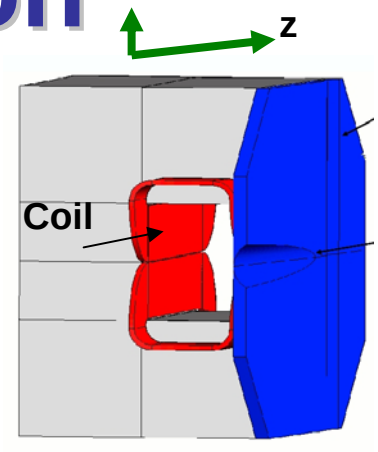


Bender coil temperature

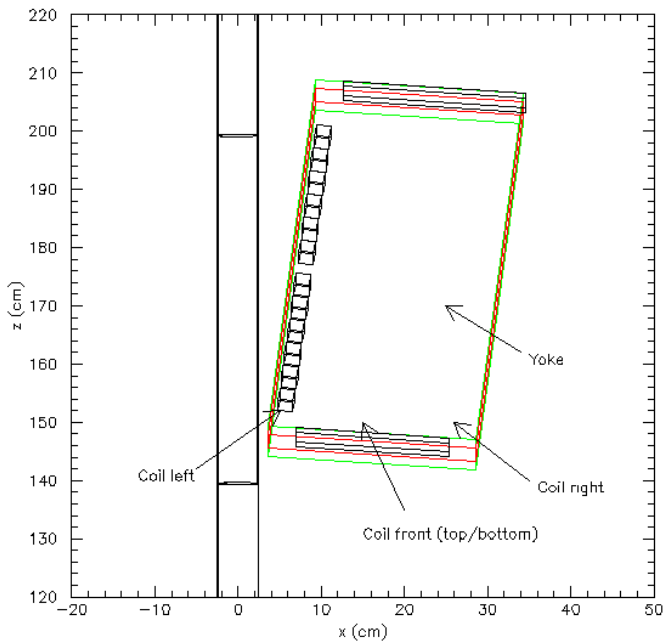


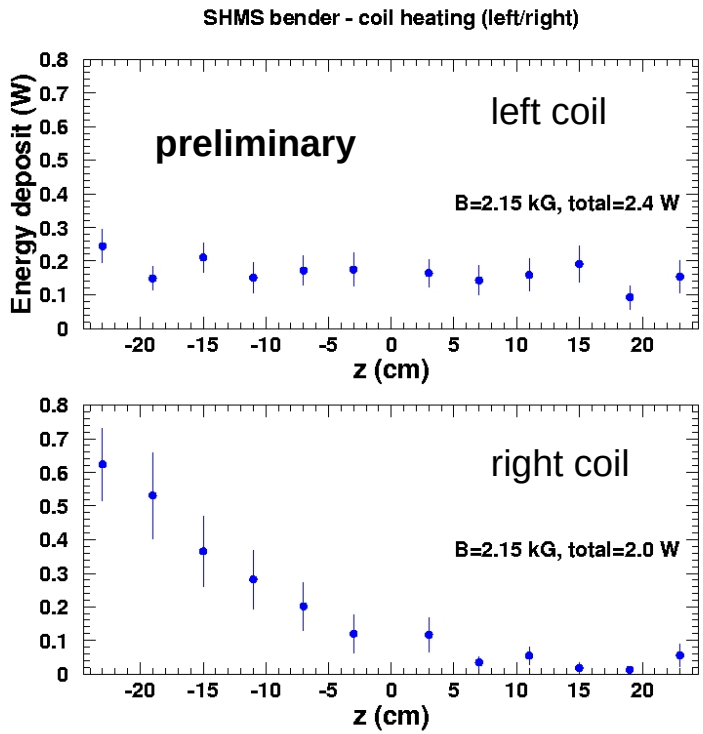
- Estimation of the coil temperature increase due to heating
- Preliminary studies suggest a global temperature increase below the critical temperature
  - This estimate is for a large surface area: 2-3 cm

Bender heating position dependence



- To estimate the energy deposition parallel to the beam line simulate a segmented coil
- Energy deposition in the right coil mostly due to low energy Moller electrons and photons





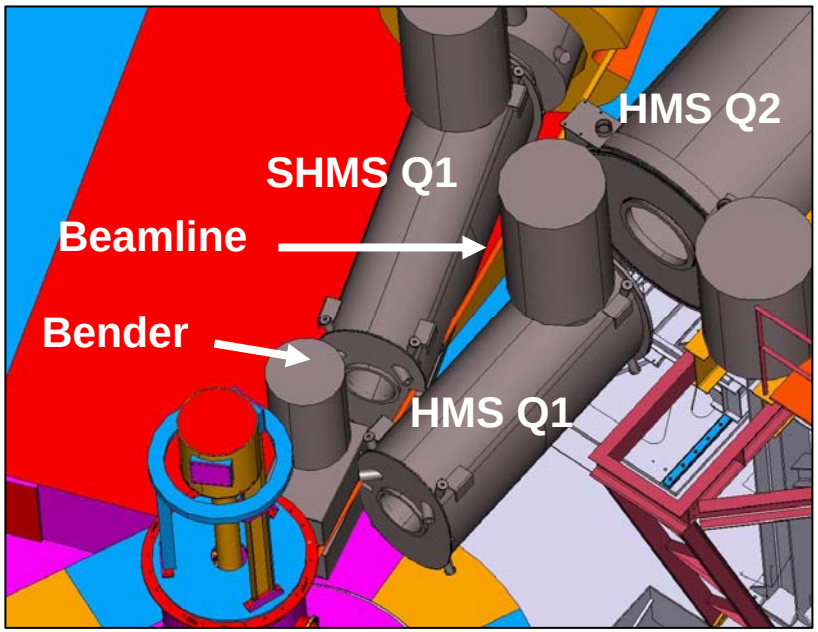
Bender heating: next steps

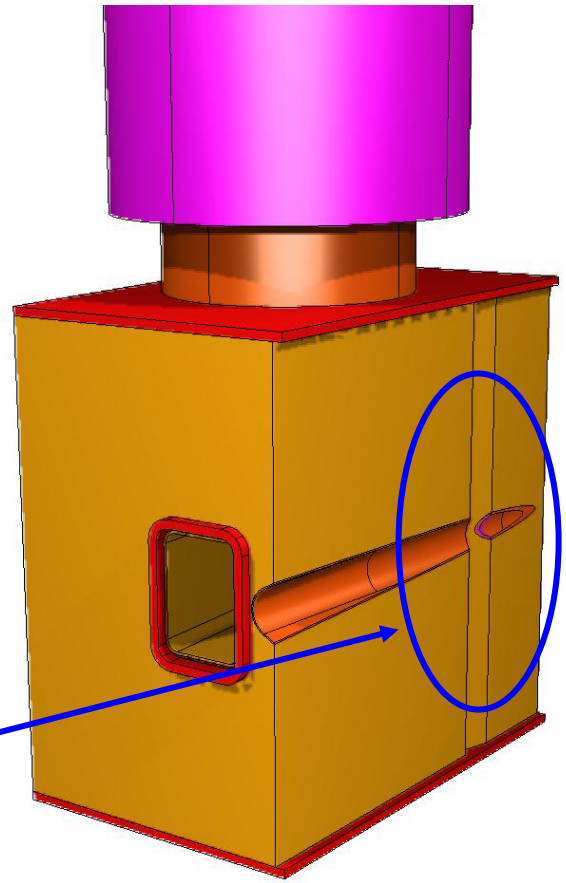
- More refinement in position dependence of the heating in the magnet
- Determine the dominant source of the energy deposition – low energy Moller electrons? Photons?
- Examine the worst case – e.g. beam steered into coils
- Simulation of low energy neutrons
- Build test device and test with beam (Antje's talk)

SHMS Monte Carlo and Bender Acceptance Studies

- Since the MC was released the design of Q2 has changed (Steve's talk)
  - An updated MC is available, but we are still using ideal magnets
- The updated MC was used in recent horizontal and vertical acceptance studies for the pre-bender magnet
- Purpose of the acceptance studies: Optimization of the pre-bender dimensions both horizontally and vertically

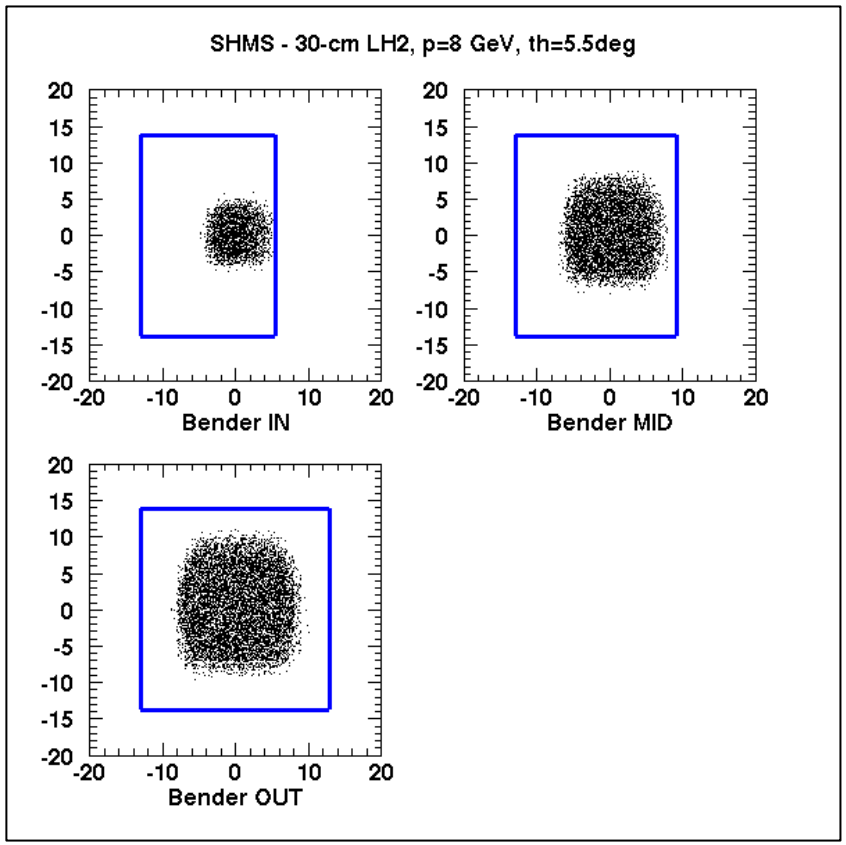
SHMS Optics - another design question

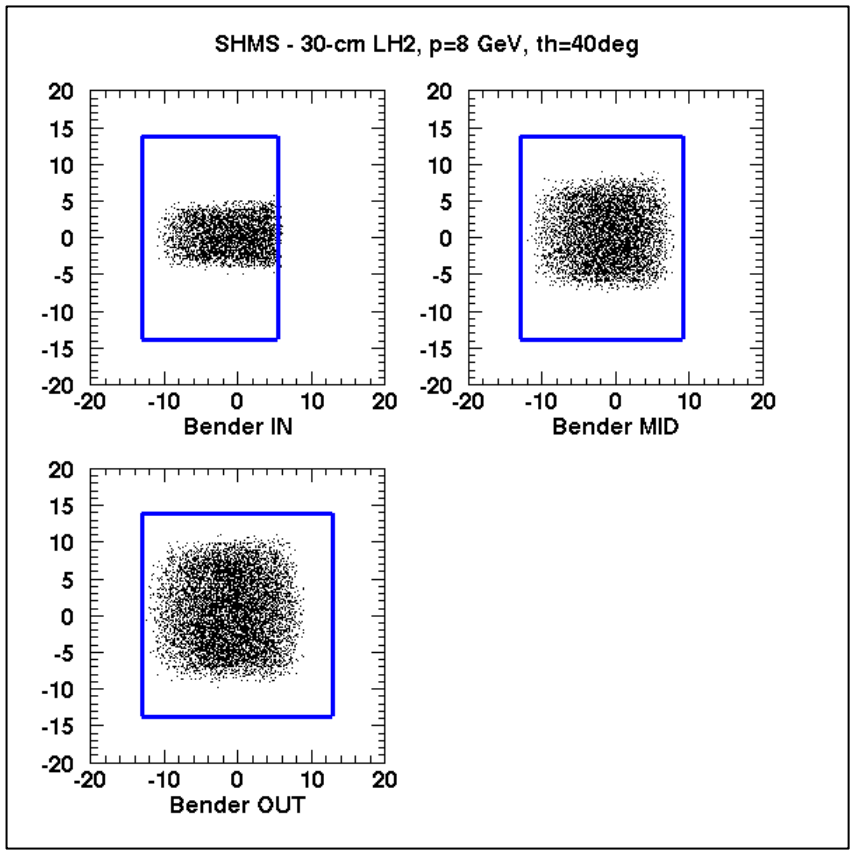




- Close fit between bender, beam line and HMS Q1 requires cutting into bender material
- This may be reduced by reducing magnet material in middle and exit region

Additional space at middle and exit of bender





At bender middle and exit reduction of 1.0 and 3.0 cm results in NO additional loss of events at any angle

Summary SHMS Optics and Status of the MC

- COSY (D. Potterveld)
  - A global fit for the field of the entire magnet – this gives e.g. a global multipole component
  - Relatively easy to add higher order terms (globally)

- J. Leroses field studies
  - Allows for studies of local features/imperfections of the field.

- SHMS MC status
  - Updated with updated Q2 design, but still using ideal magnets
  - Once results from COSY and John's studies are available we will include in the MC and distribute new version