

Magnetic Field Simulations

D. J. Hamilton and J. R. M. Annand
University of Glasgow

B. Wojtsekhowski
Jefferson Lab

A. Glamazdin
Kharkov Physics Institute

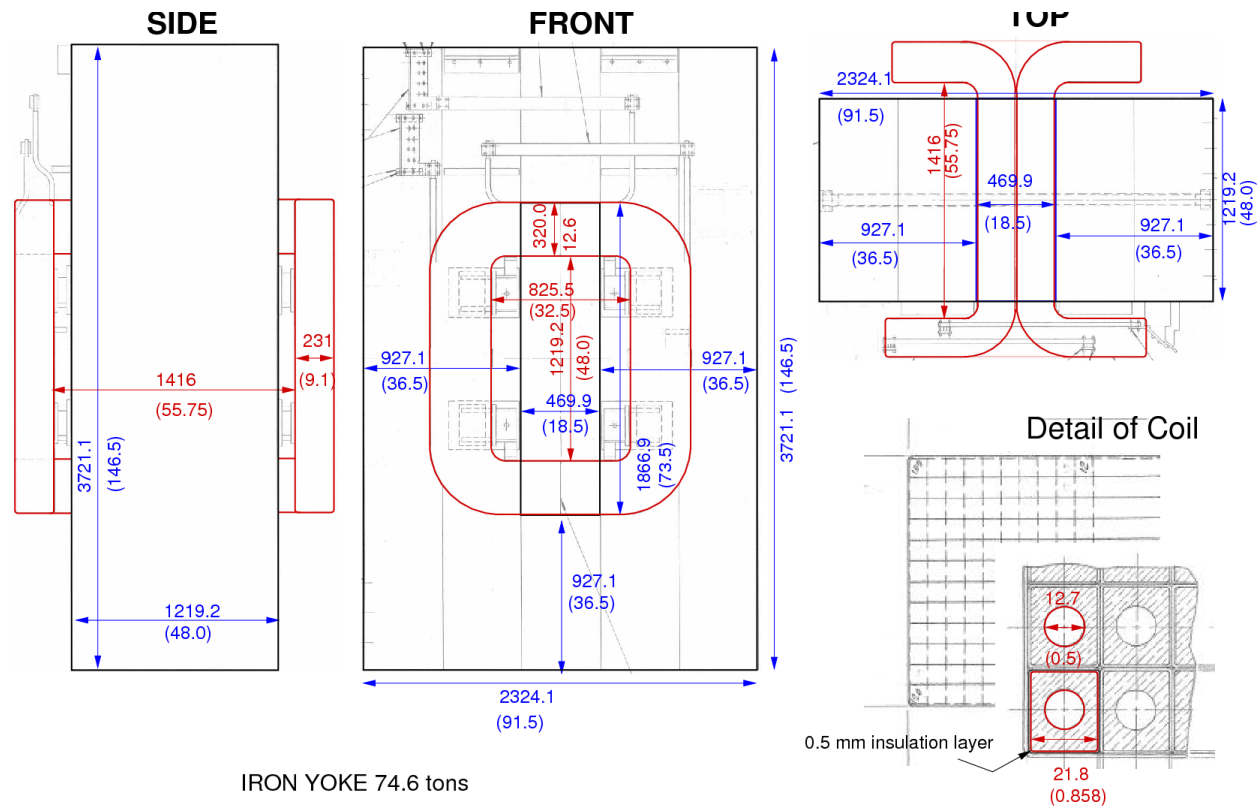
(Email: d.hamilton@physics.gla.ac.uk)

SBS Technical Review
JLab, 17th November 2008

Outline of this Work

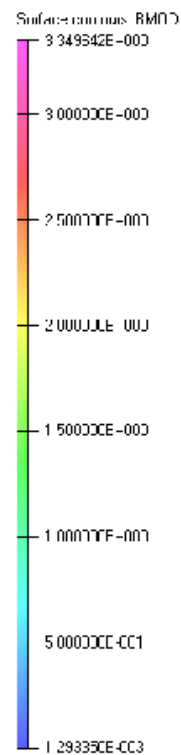
- The purpose of this work is to gain a better understanding of the field properties of the magnetic components which comprise the [SuperBigbite Spectrometer \(SBS\)](#).
- The main component of SBS is the 48D48 dipole, which was previously used at Brookhaven's AGS accelerator.
- This work has proceeded through many iterations, from modelling the magnetic field for the existing (AGS) yoke and coil geometry to a modified design based upon experimental requirements and constraints at Jlab.
- The most significant constraint for the new design is related to [shielding both the target and the outgoing beamline from the SBS fields](#), which has required the addition of new components.
- This is a work in progress, informed by Monte Carlo studies of background rates and other factors.
- 3D field calculations have been preformed within the [Opera \(Vector Fields\)](#) framework.

48D48 Basic Geometry

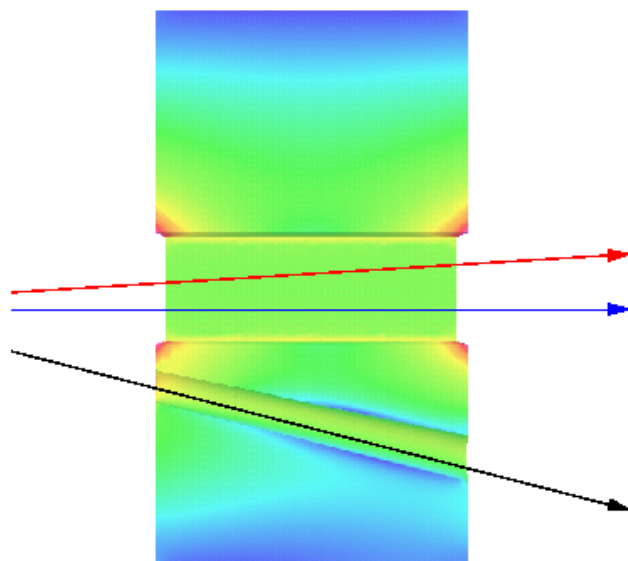


- Original 48D48 yoke and coil geometry taken from engineering drawings and encoded in [TOSCA 3D Modeller](#).
- Initial modifications to allow [beamline clearance](#) include extension of the right-hand coil legs and addition of gap in the yoke.

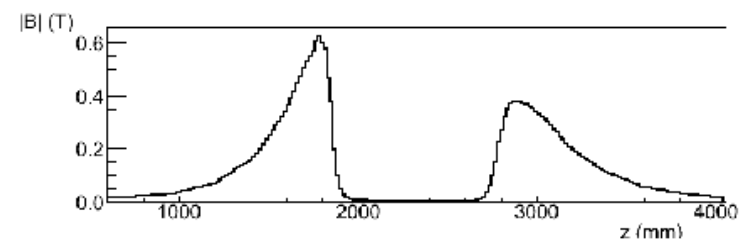
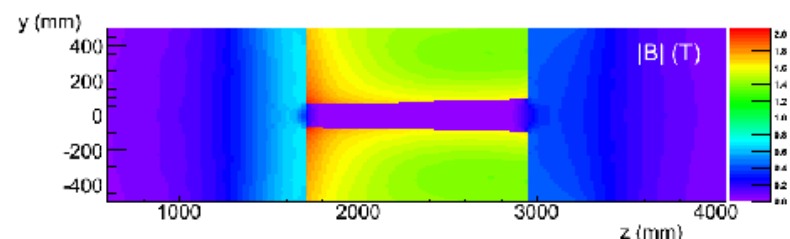
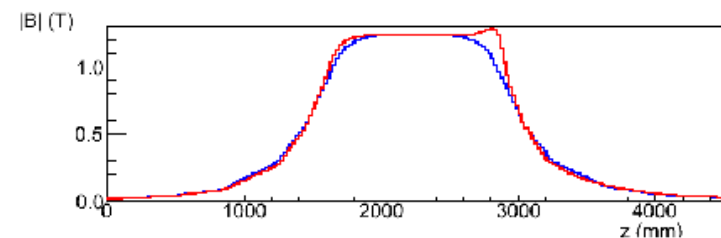
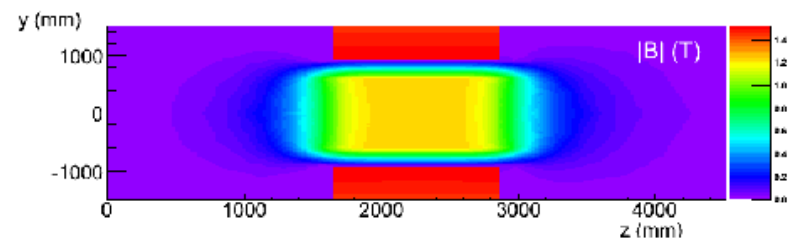
Basic Geometry Calculations



Excitation Current:
2000 A



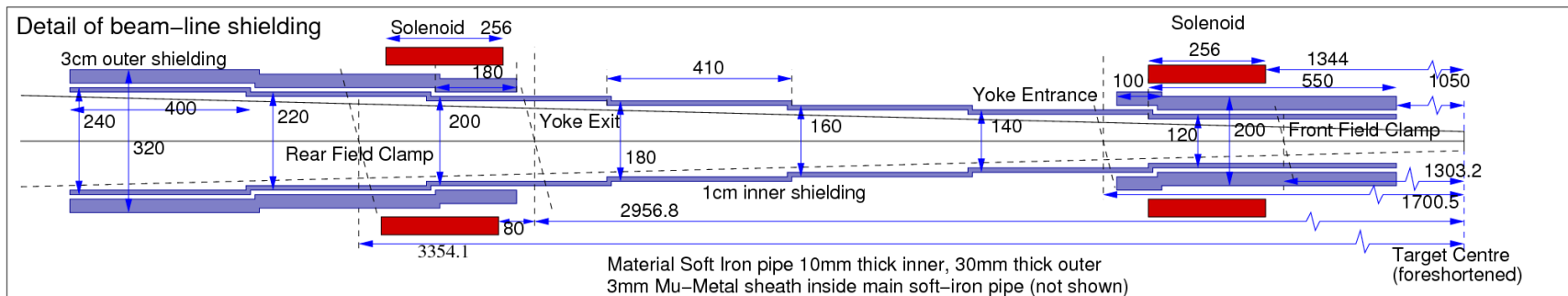
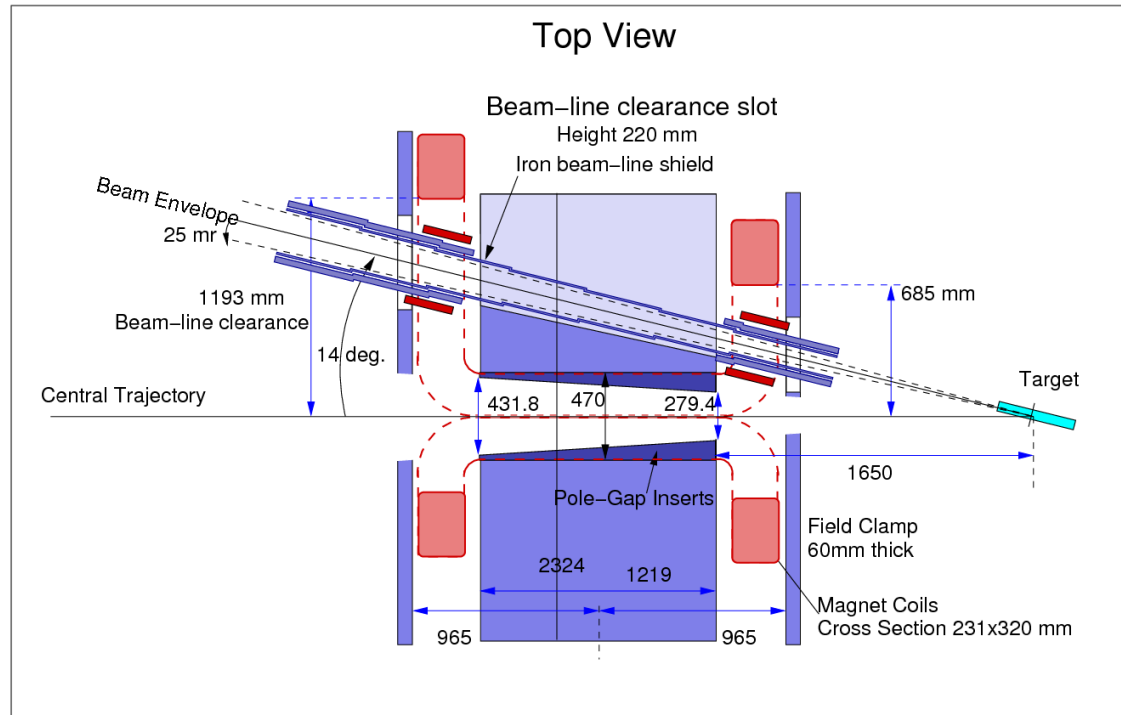
Field Integrals:
2.14 T.m
2.20 T.m
0.58 T.m



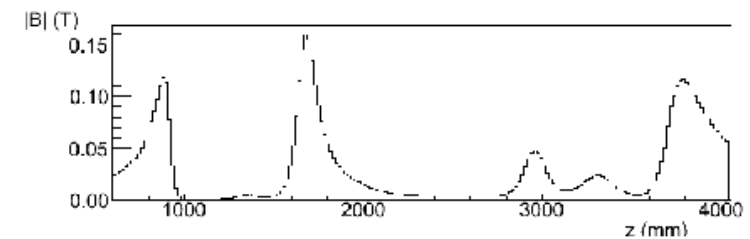
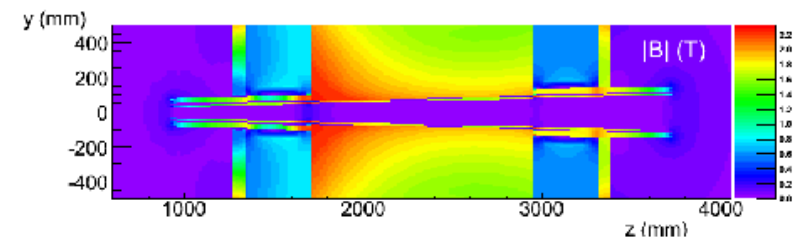
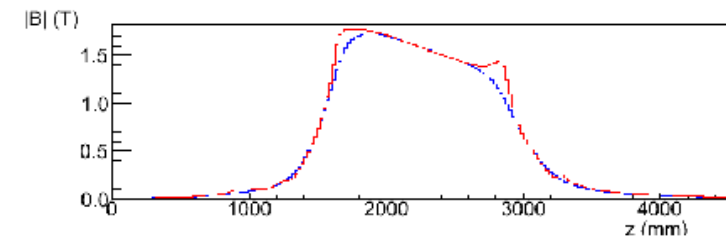
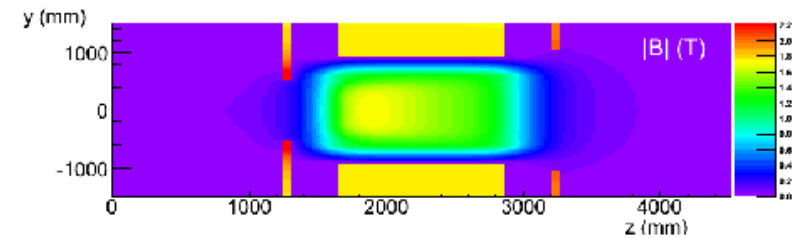
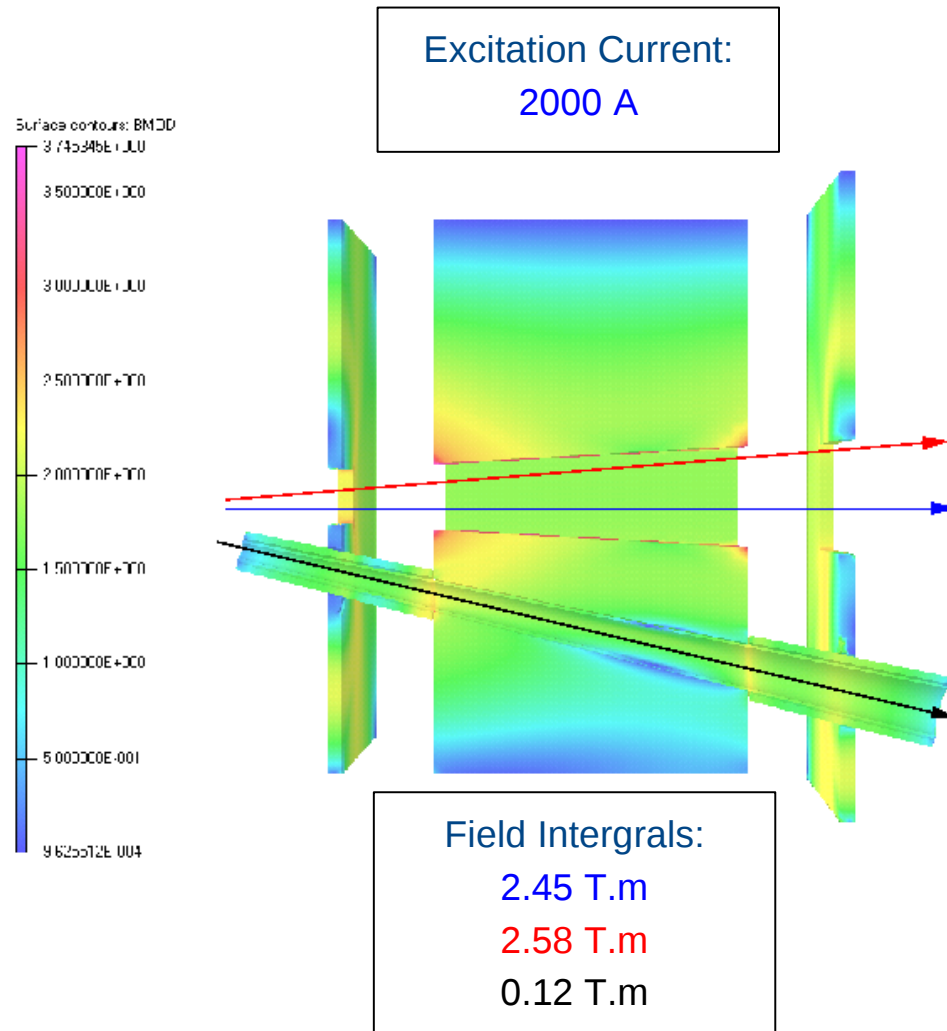
Modification Scheme

- For experiments at forward angles it is an unavoidable fact that significant modifications of the magnet yoke are required to accommodate and shield the outgoing beamline.
- For this reason a preliminary mixed passive/active shielding scheme has been devised, comprising:
 - Two **iron tubes (inner and outer shielding) around the beamline** to reduce field to the level of 0.1 T;
 - A **mu-metal tube around the beamline** to further reduce field;
 - Two **solenoid compensation coils** to de-gauss the iron along the beam direction.
- Further shielding for the target and detector regions has been introduced by the addition of **field clamps**.
- Finally, as the acceptance offered by the full pole gap will not be required in most of the planned experiments (including GEP5) **demountable pole shims (inserts)** have been added to enhance the field integral through the gap.

Modification Scheme II



Modified Geometry Calculations



Summary and Outlook

- Design parameters and 3D magnetic field calculations have been considered for a family of magnetic modification scenarios for the SuperBigbite Spectrometer.
- Sufficient field integrals can be obtained with modest coil excitation currents of 2000 – 2500 A for forward-angle experiments with an 11 GeV beam.
- Effective shielding of the target and focal plane detector regions is possible through the utilisation of appropriately designed field clamps.
- The biggest challenge remains shielding the outgoing beamline. Results from several preliminary schemes involving a mixture of passive and active components look promising.
- A preliminary concept for the magnetic components of SBS has been devised.
- It is clear that, as this work moves forward, a more optimal and simplified modification scheme at the technical design level will be achieved.

Extra Slide: Field Components Along Beamline

