



DUNE Near Detector Superconducting Magnet

Vladimir Kashikhin

DUNE Meeting

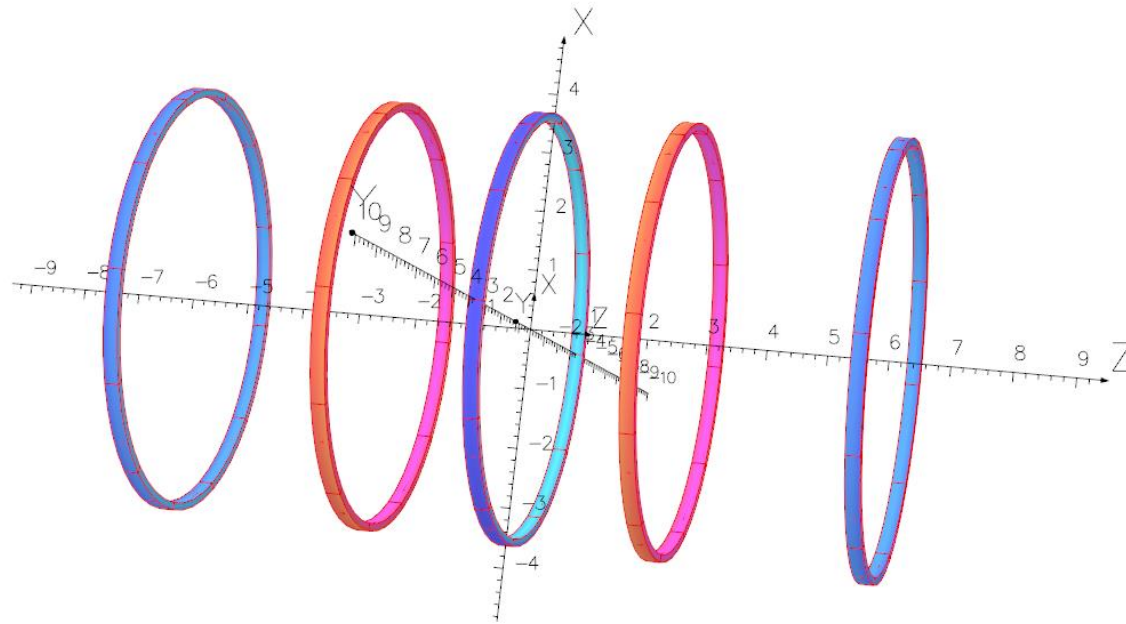
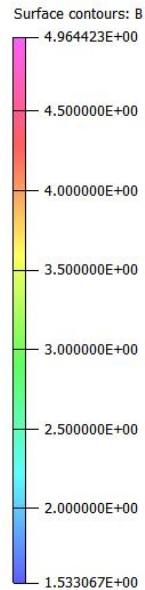
February 22, 2019

Magnet Design Update

- Recently when started underground hall conceptual design were raised several issues:
 - The proposed 5-coil magnet system has too large shielding coils dimensions (above 10 m diameter);
 - The equipment loading shaft has the limit driven by the cost;
 - There is no strong limitation along the magnet Z-axis.
- Was investigated the magnet variant with shielding coils having the same diameter as other 3 coils.
- It will simplify fabrication, transportation, and the final assembly.

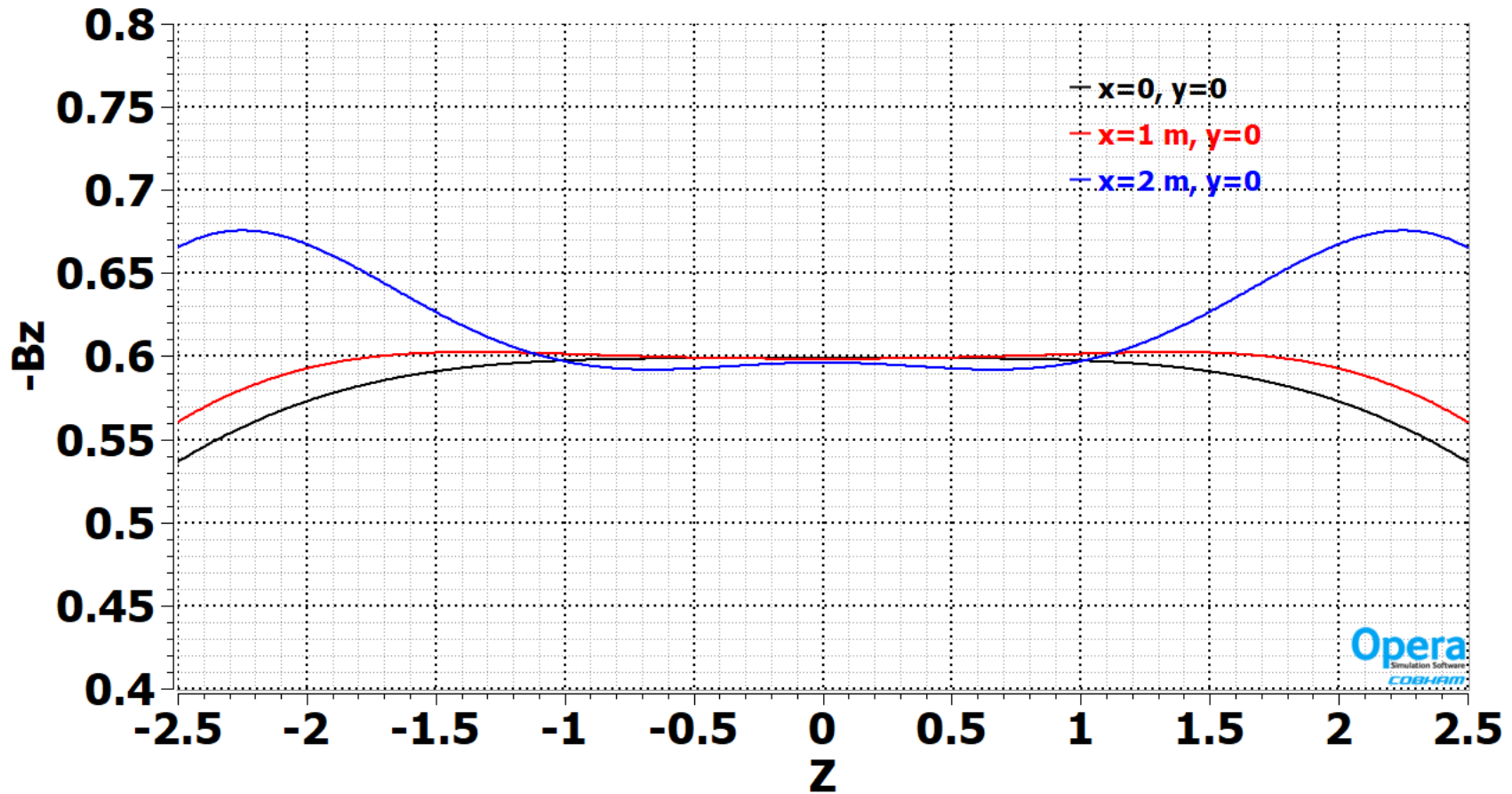
5 Coils Magnet System

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- Peak coil fields: 2.14 T (center), 5 T (side) 2.03 T (shield).
- Forces F_z : 0.0 (center), - 6.81 MN (side), 2.2 MN (shield).
- Side coils at 2.5 m, shielding coils placed at 6 m from the magnet center in Z.
- All coils have the same inner radius 3.5 m.
- Center and shielding coils are identical and have the same number of ampere-turns.

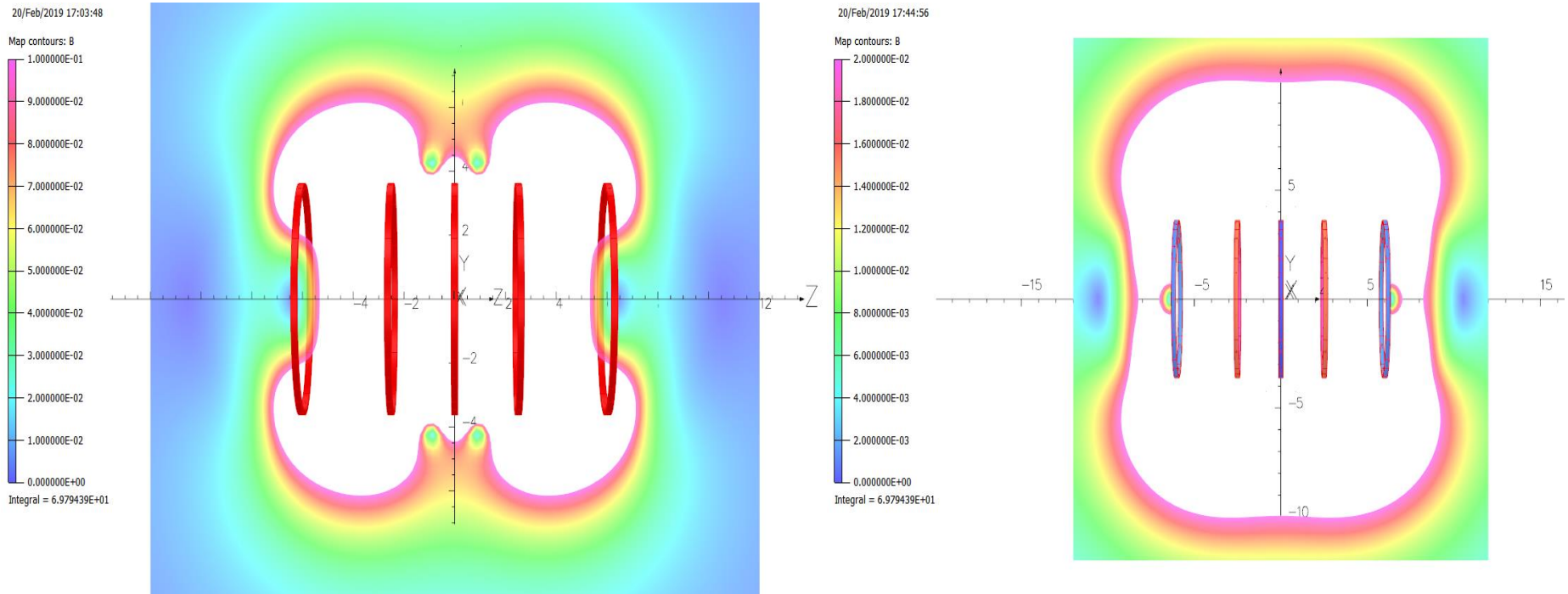
Bz Field in the Magnet Bore



- The center field is 0.6 T at coil total currents: 0.98 MA (center and shield), 2.44 MA (side).

Opera
Simulation Software
COBHAM

5 Coils Magnet Fringe Field



- Fringe fields less than 0.1 T (left) 0.02 T (right) shown as zone maps.

SUMMARY

- Preliminary magnet system conceptual design showed that it is possible to design system with the same coils outer diameter.
- Three from five coils could be identical.
- The fringe field from 7 m diameter coils are rather high, and if needed local field shielding could be added.
- For this design will be only F_z Lorentz force components.
- The small transverse centering force components possible caused by coils decentering because of mechanical errors.