Magnet design and field calculations

Alexey Bragin, Sergey Pivovarov
Budker Institute of Nuclear Physics, Novosibirsk, Russia

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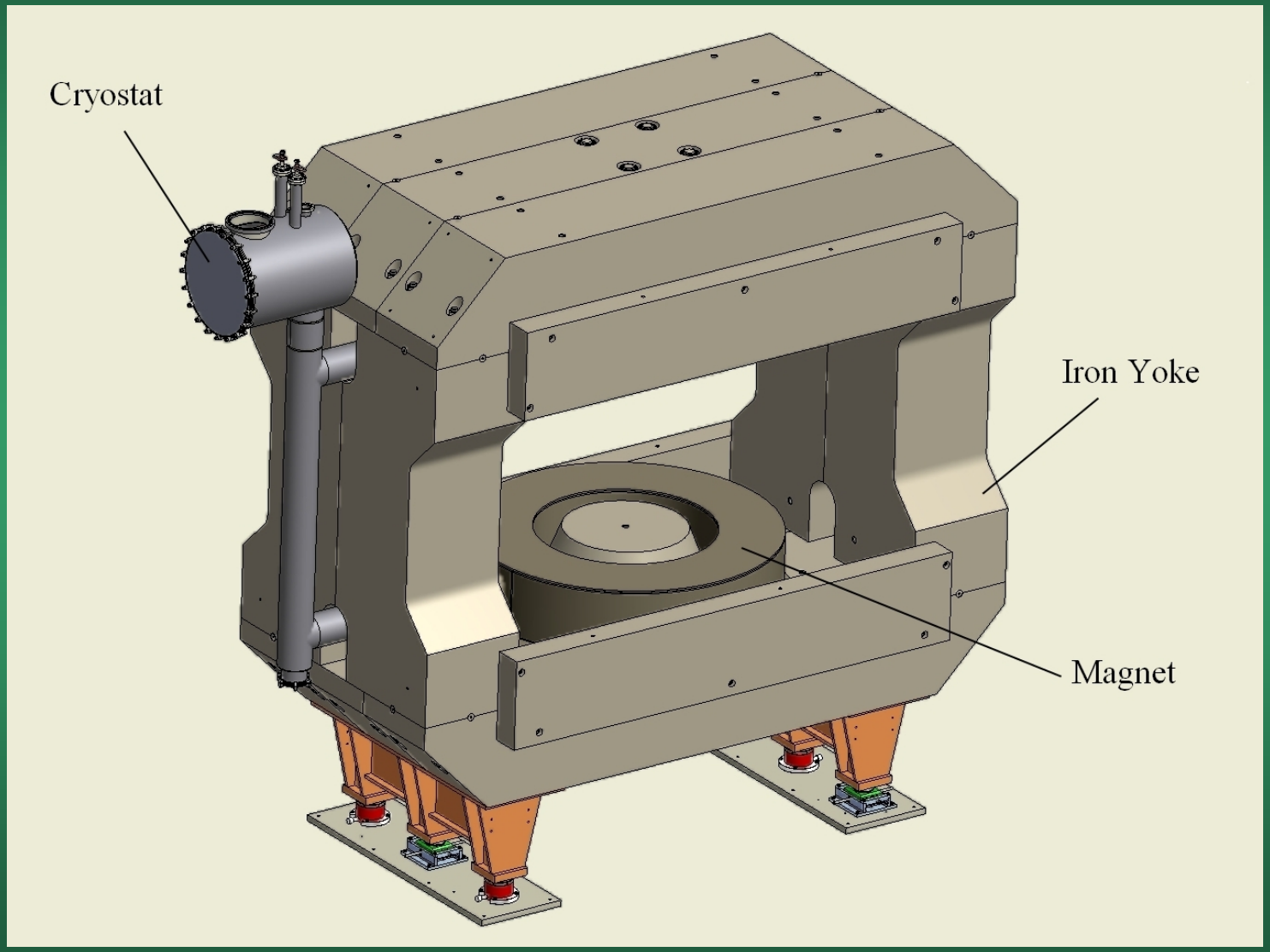
Total view of the magnet



Magnet design: iron yoke

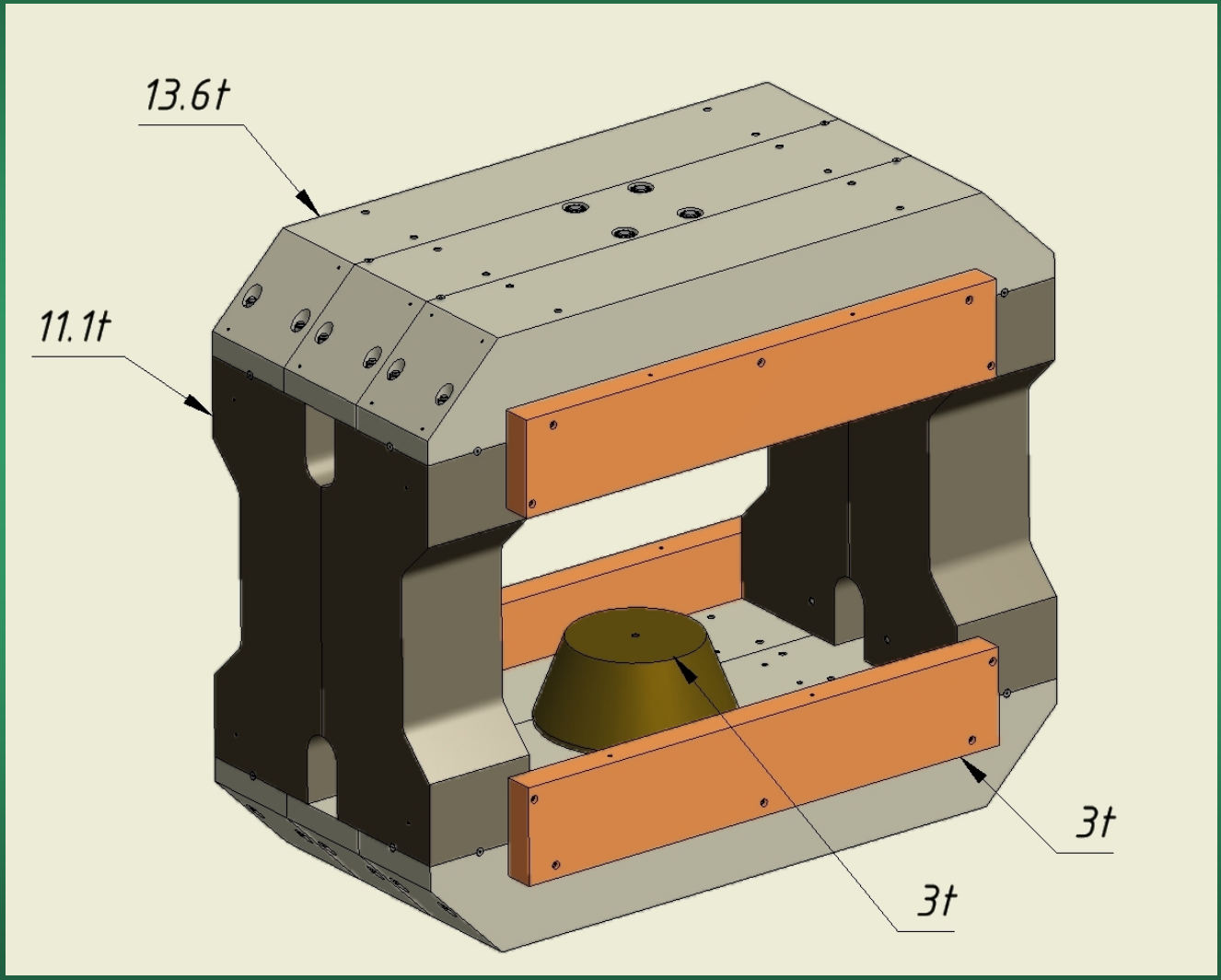
The yoke is of

Steel 1010,

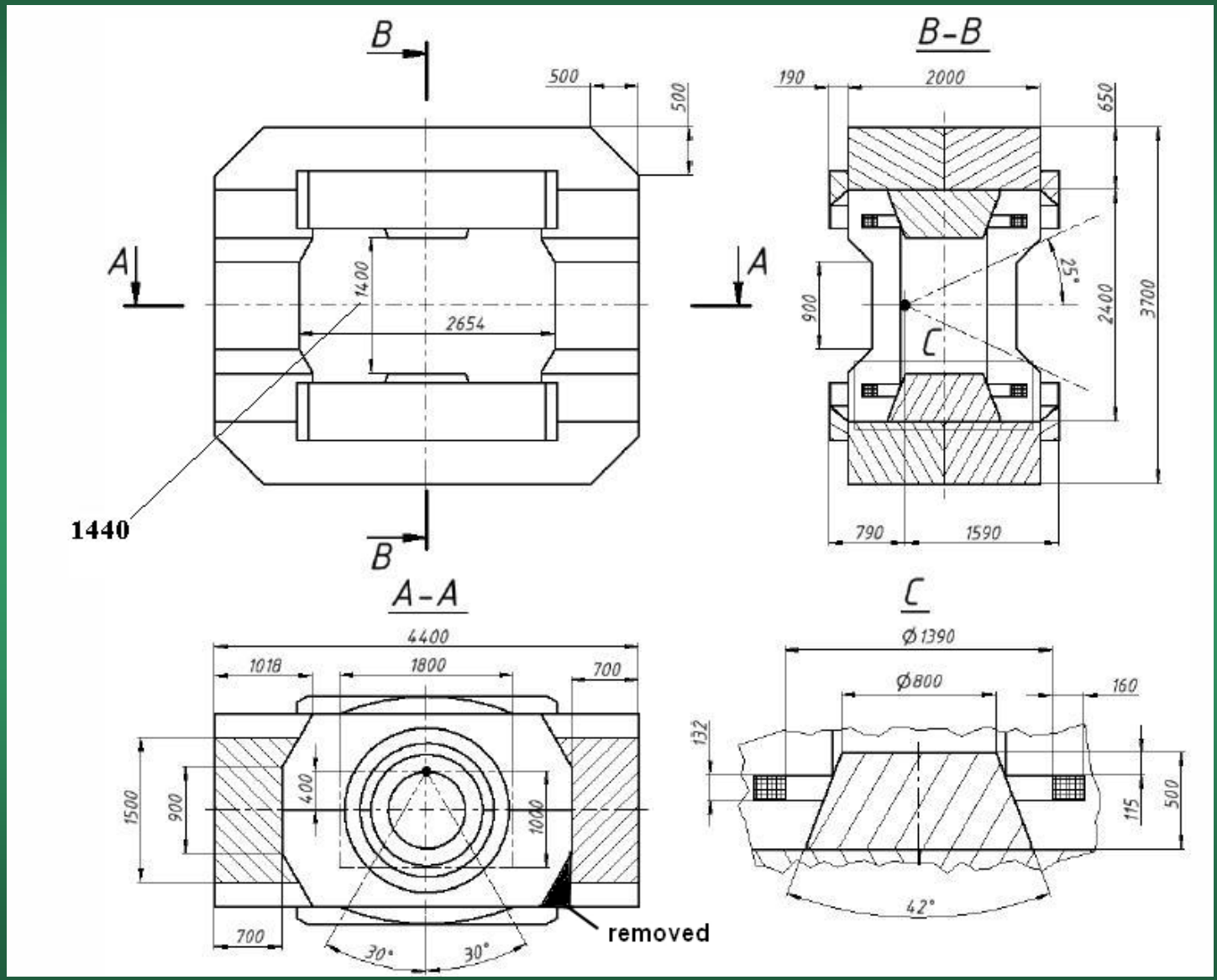
the taper part of the yoke is a kind of ARMCO

The clamps here don’t have inner round cuts.

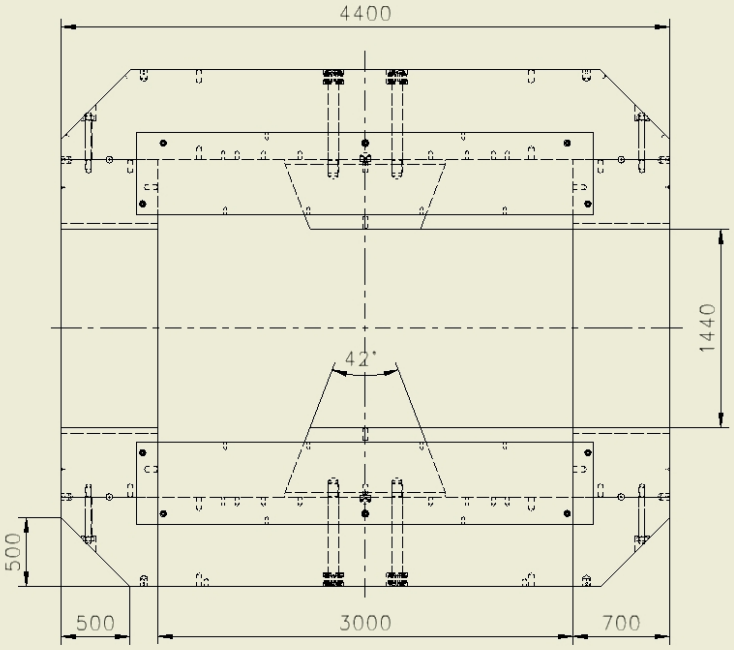
In calculations they exists.

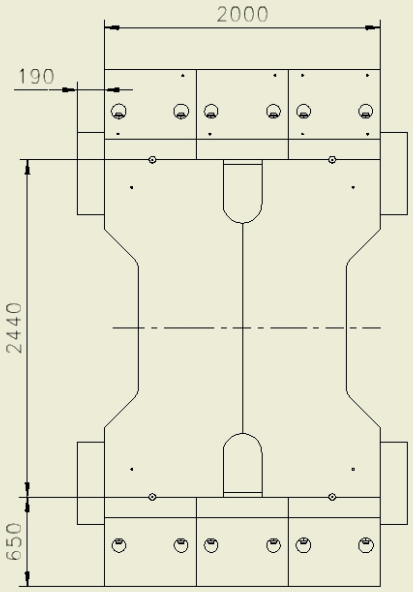


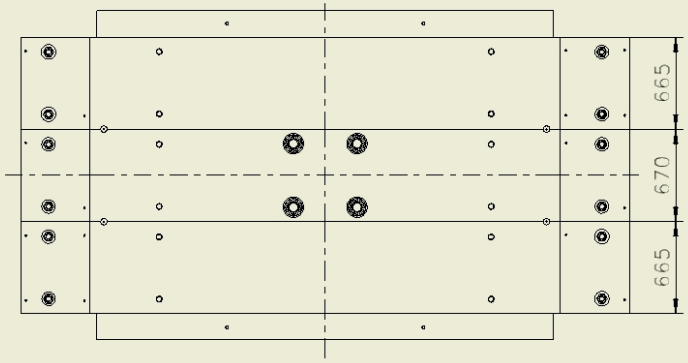
TDR dimensions



Dimensions now

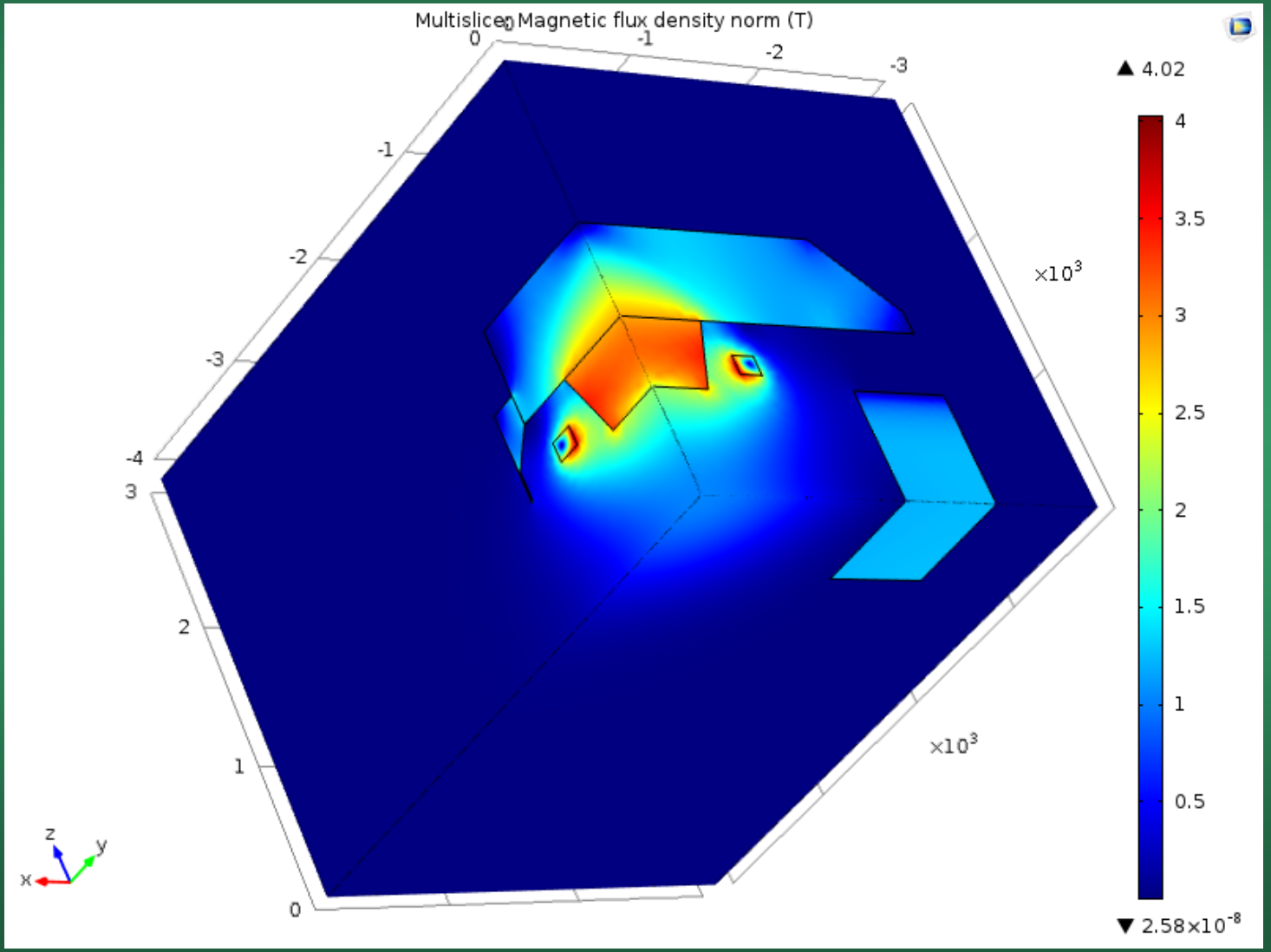




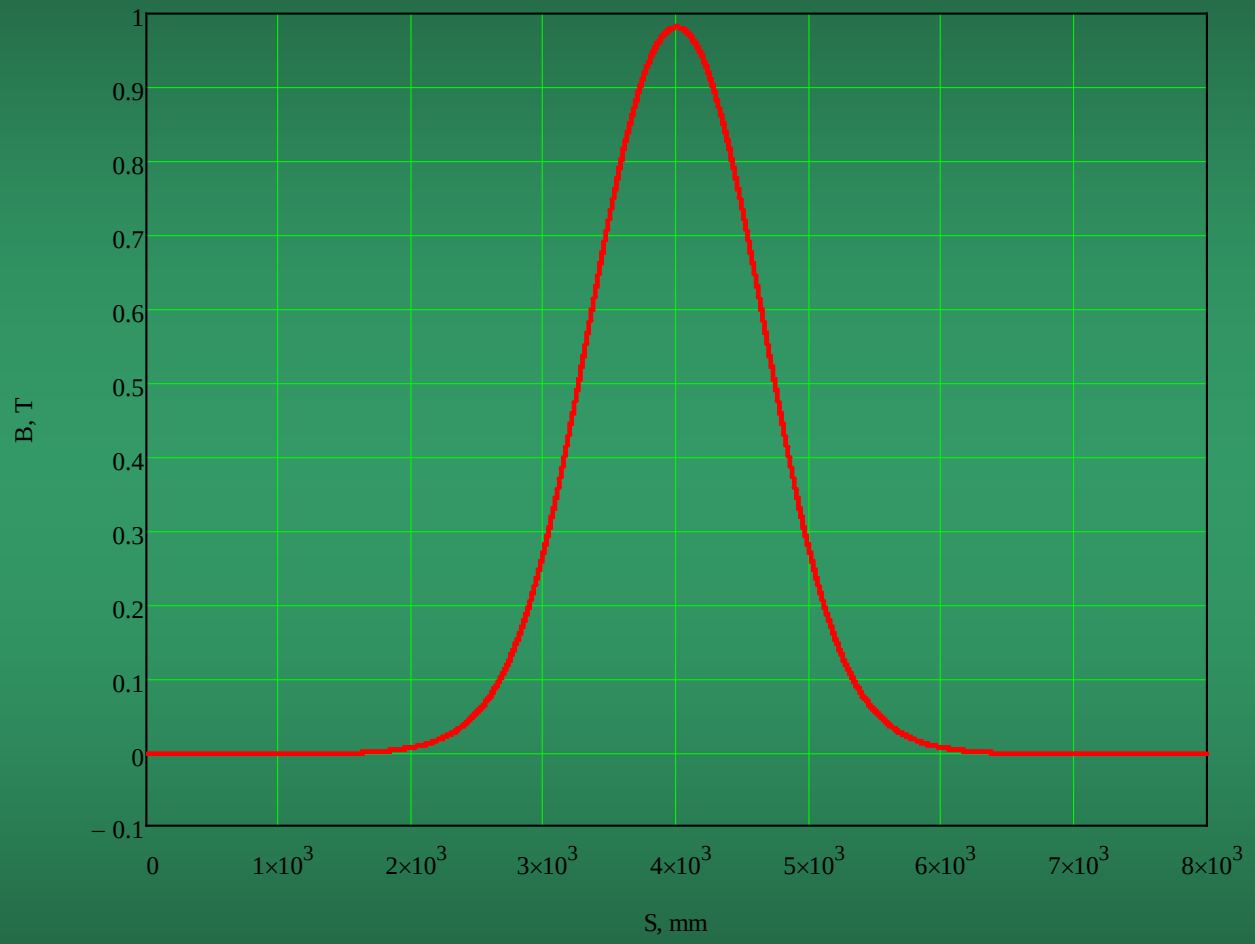


Dimensions of the coils are the same

3D model in COMSOL calculations

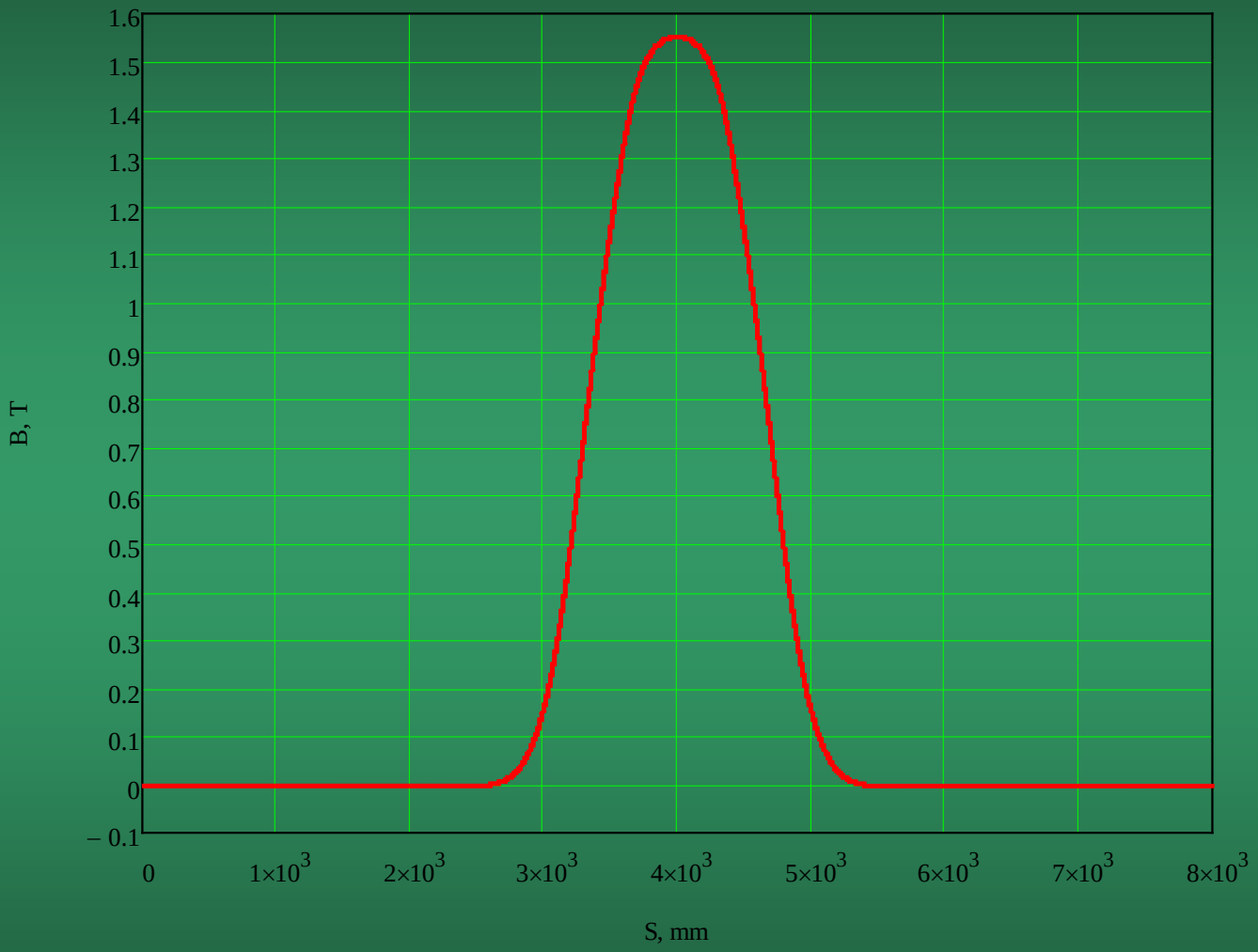


Magnetic field distribution



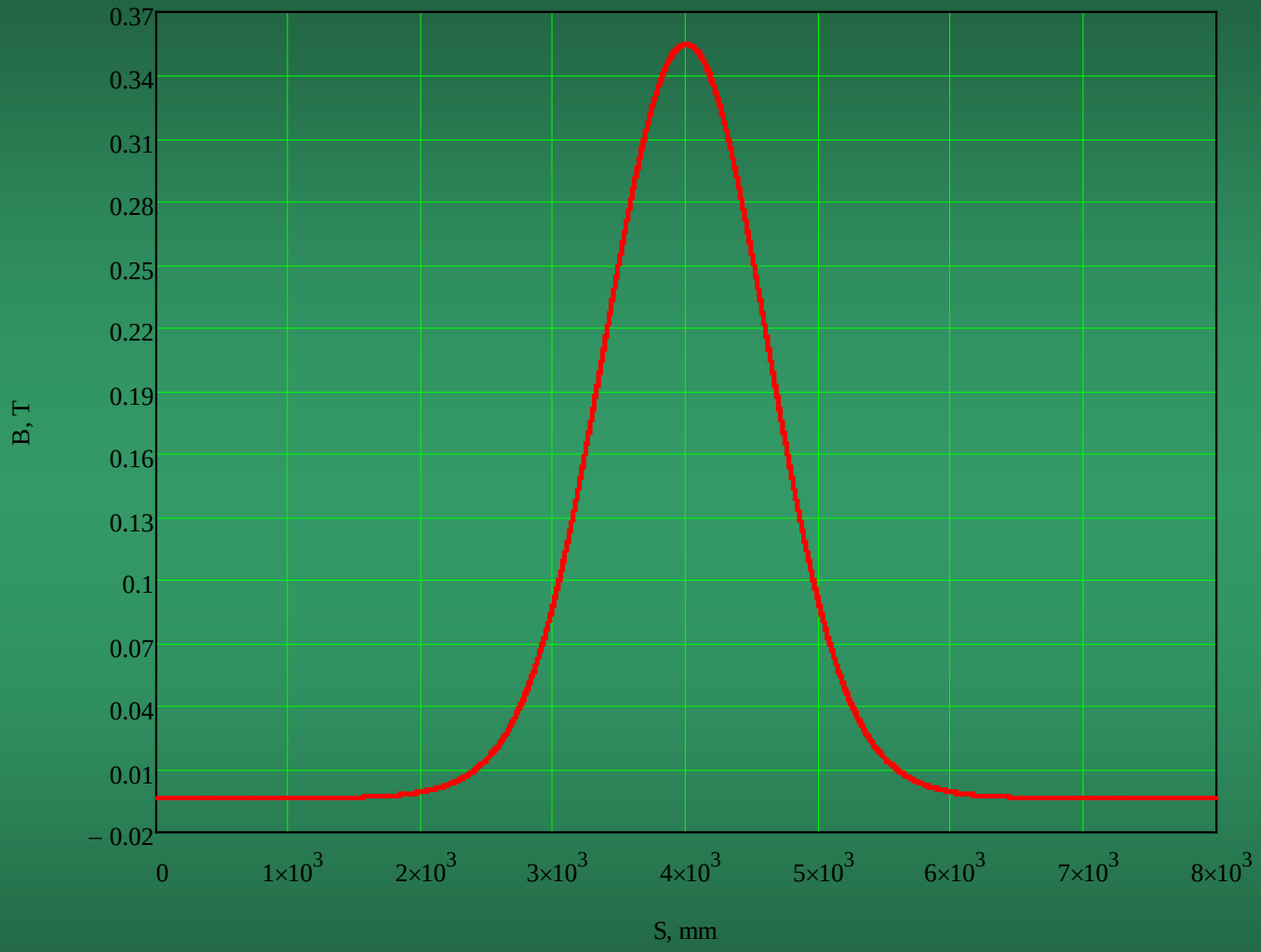
The integral from the target along the central line is 0.886 T*m in the length of 1 m.

Magnetic field distribution



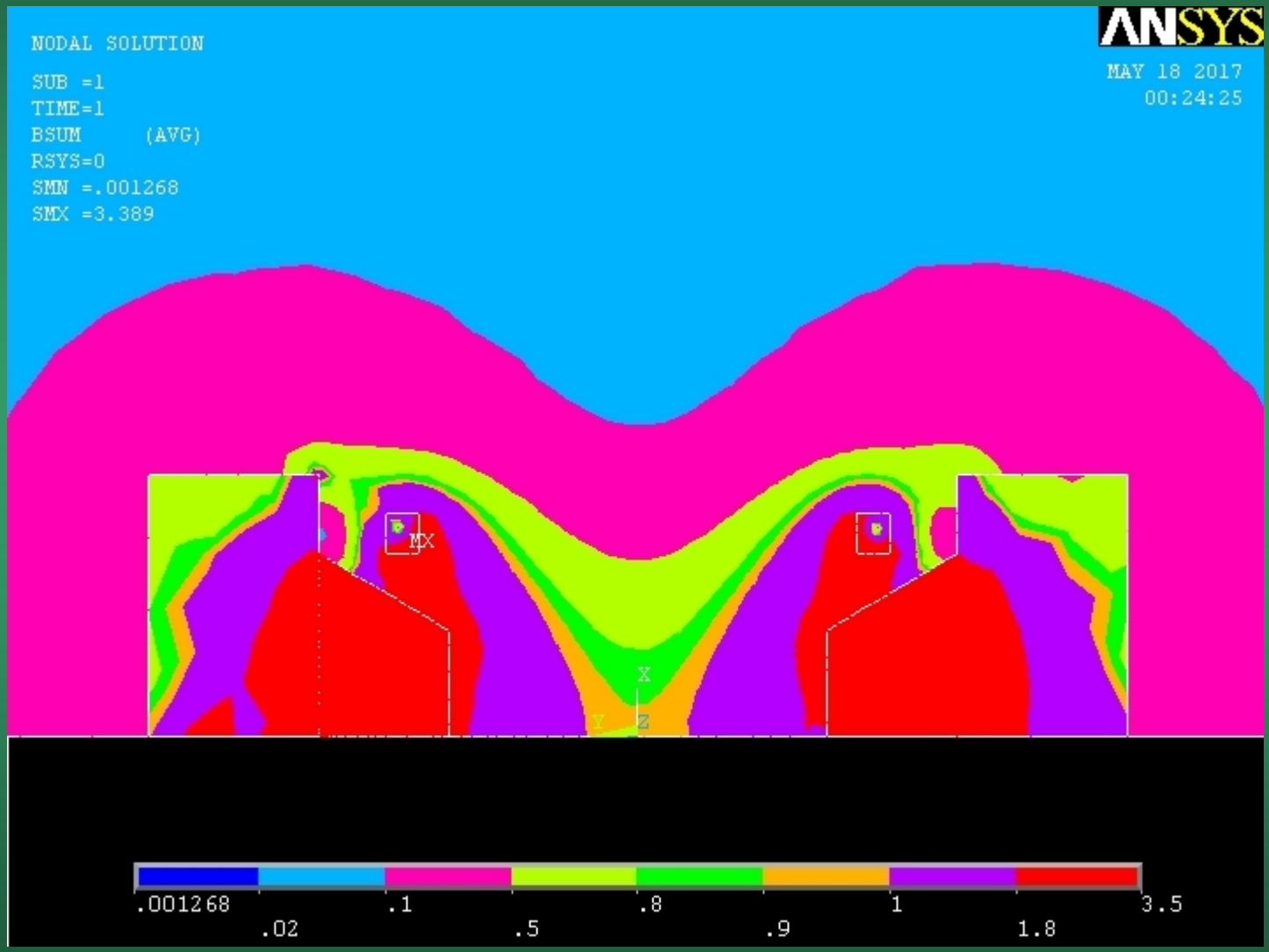
Magnetic field distribution at vertical shift on 450 mm, horizontal position is 0 mm.

Magnetic field distribution



Magnetic field distribution at horizontal shift on 900 mm, vertical position is 0 mm from the center

2D calculations



Forces, inductances

- Vertical forces on the coils are:
  - 2.6 MN (2.8 if only one coil charged as in TDR)
  - 3.3 (3.5 if only one coil charged as in TDR)
- Force on the pole iron is about 3 MN
- Mutual inductance between the coils is 0.21 H – very low. Calculated from stored energies of separately charged coils.

Results

- In the current design the magnetic field slightly decreased with respect to the TDR design
- Magnetic field on the winding is unchanged, the maximal value is 3.25 T
- Forces at test current are high. The test current is 20% higher than nominal current. Is there any sense to have such high test current? As a proposal – 5% only instead 20%.