# Simulation of magnetic shielding for PMTs next to the SP-41 magnet (SRC experiment)

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# **Proton-pion calorimeter for SRC**



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The PMTs XP2262 sensitive to the field ~1G The detailed magnetic field measurement of SP-41 is planned for August 21 Field simulation is essential for developing a suitable shielding for PMTs

### Field inside the SP-41 magnet. Input parameters.

![](_page_3_Figure_1.jpeg)

## Field inside the SP-41 magnet. Comparing to the field map

![](_page_4_Figure_1.jpeg)

### Field at the PMTs. Input parameters.

![](_page_5_Picture_1.jpeg)

Program: Ansoft Maxwell Solution type: Magnetostatic Materials:

Calorimeter sheets: iron (mu=10000) Yoke & poles: steel 1010 (BH curve) Coils: copper Current: assumed 200 turns x 1800 A

Bottomless hollow box covers PMTs of the calorimeter.

# Field at the PMTs.

Field is measured along the line crossing the axis of each PMT near the top, middle and bottom of each PMT

![](_page_6_Figure_2.jpeg)

### Field at the PMTs. The field in the PMTs region (no iron box)

![](_page_7_Figure_1.jpeg)

![](_page_7_Picture_2.jpeg)

#### Without LAND modules

![](_page_7_Figure_4.jpeg)

#### With LAND modules

Iron reduced the distance dependence of the magnetic field **8** 

### Field at the PMTs. The field in the box Bottomless hollow box covers PMTs of the calorimeter

![](_page_8_Figure_1.jpeg)

![](_page_8_Figure_2.jpeg)

With box

The field inside the box < 5 Gauss 9

### Field at the PMTs. The box thickness

![](_page_9_Figure_1.jpeg)

### Field at the PMTs. The box material

![](_page_10_Figure_1.jpeg)

Relative permeability does not have a strong influence on the magnetic field inside the box. Steel 10, steel 3, steel 7 or its analogs could be used.

# Field at the PMTs. Box and mu metal shielding

LAND modules include mu-metal shielding around PMTs. So that mu-metal tube have been added to the simulation.

![](_page_11_Figure_2.jpeg)

Inside box + mu-metal the field is less than 1 Gauss

### Field at the PMTs. Box for TOF layer

![](_page_12_Figure_1.jpeg)

### Conclusion

Simulation reproduce the magnetic field between the magnet poles.

The simulation was used to extrapolate the field to the area of PMTs.

Optimized shielding parameters:

- iron box with 10mm walls

-> less than 1 Gauss field

- individual mu-metal for each PMT

![](_page_14_Figure_0.jpeg)

Only mu