Magnetic Fields Near the Welds of the MiniBooNE PMT Frames

Kirk McDonald and Hirohisa Tanaka

Princeton University

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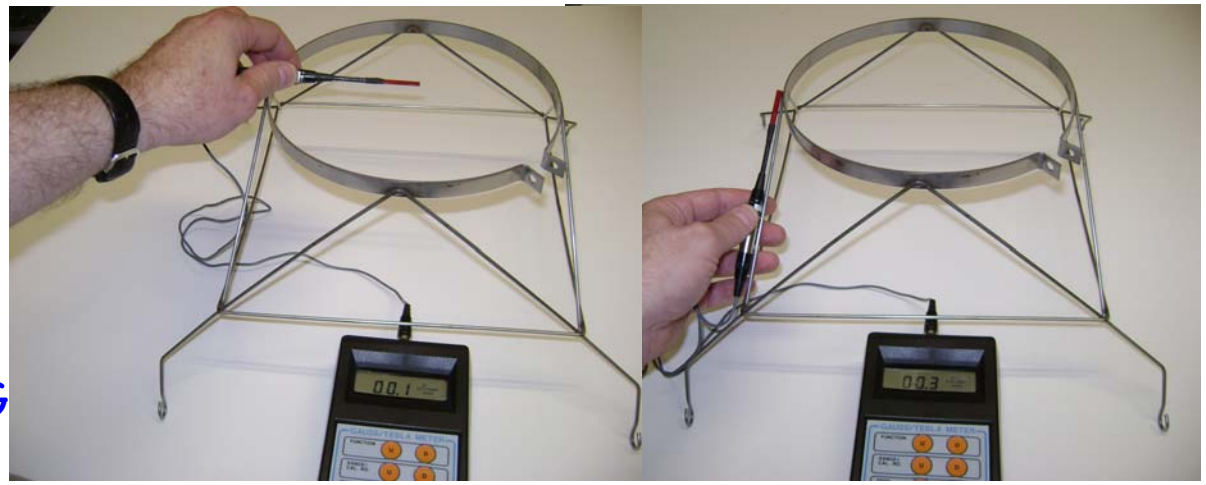
Measurements of PMT Frame #1

Earth's field = 0-0.3 *G*, depending on orientation of probe.

Field next to "belt" of the frame everywhere ≤ 0.3 *G*.

Field at welds near base of frame ≈ 1-2 *G*, but drop to 0.3 *G* in 2 mm.



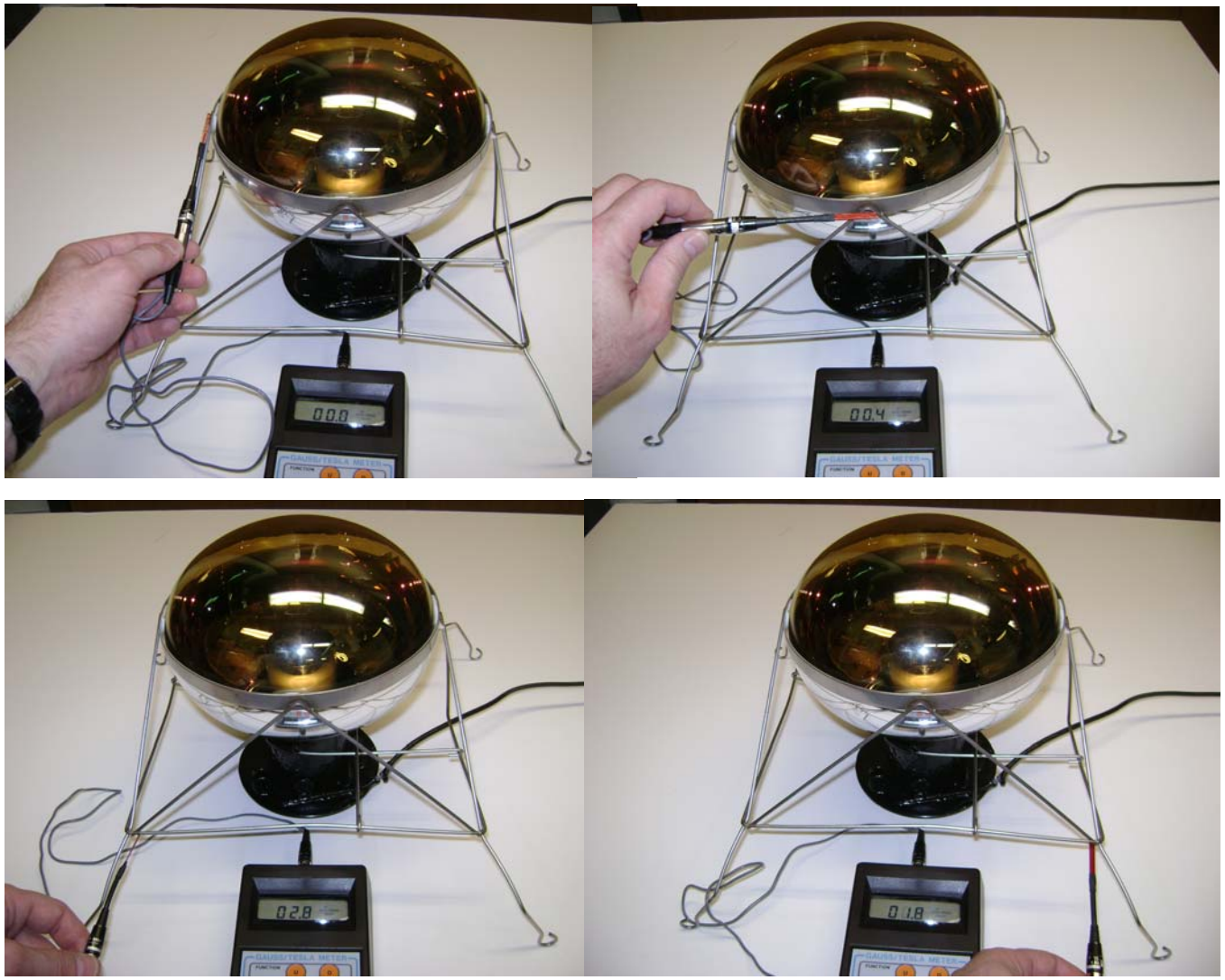
Measurements of PMT Frame #2

Again, field ≤ 0.3 G next to "belt" of frame.

Field near welds at base of frame ≈ 2-3 G.

⇒ The welds around the "belt" of the frame are no problem.

⇒ Should interact with the frame vendor to insure that all welds have low magnetic field.



Summary

The effect of residual magnetism of the welds of the stainless-steel PMT frames on PMT performance is negligible.

No magnetic field in excess of the Earth's field was measured near the 4 tack welds around the "belt" of the PMT frame,

$\Rightarrow$ Residual field on contact with (*i.e.*, within 1 mm of) the welds is less than 0.1 *G*;

$\Rightarrow$ Residual field at closest point of a PMT, some 5 mm away, is $< 0.1\ (1/5)^3 < 0.001$ *G*, assuming the weld constitutes a magnetic dipole of volume 1 mm^3.

A residual field of 1-3 *G* was observed at the cruder welds near the base of the PMT frame, some 10 cm from the closest point of the PMT,

$\Rightarrow$ Residual field at the PMT is $< 3\ (1/100)^3 = 0.000003$ *G*.

While the MiniBooNE PMT frames were manufactured without explicit regard to the magnetic quality of the welds, we should interact with the vendor to insure continued good magnetic quality of the welds of any future order for PMT frames.