# Effect of Copper Magnet: Comparison between Data and Simulation

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January 15, 2003

## Objective

A short study was undertaken to check if the kinks in the hit distribution of the hodoscope detector observed in the December 2002 data are reproduced by the Monte Carlo simulation.

Comparing the two December 2002 data sets with the magnet rotated by 90 degrees already unambiguously showed, that the kinks are due to the scattering in the $\mu$SR magnet.

## Simulation

The simulation was different with respect to the December 2002 setup, as the muon stopping was simulated in the hydrogen TPC and not in a scintillator target as used, which, of course, largely reduces the width of the stopping distribution in beam direction. A change in the muon momentum from 30 to 36 MeV/c was calculated to look for an effect of the muon stopping distribution. This showed that its influence on the scattering is negligible for the observation of the effect.

## Results

Figure 1 shows the results of the simulation of the setup without a magnet, the left side of the picture displays the inner hodoscope counters, the right side the outer counters. Some variations of the absolute count rate can be observed by varying the muon momentum between 30 and 36 MeV/c, however, no clear signature can be seen. A study with larger statistics could show effects of the TPC mounting frames, which seems to influence on the bottom side the same detectors (6,11) as the magnet.

Figure 2 shows the the results of the simulation with the magnet in the setup. There are four bins displaying a smaller count rate independent of the muon momentum (6,11-bottom;3,14-top detectors). They are consistent for the inner (left side) and outer (right side) counters.

Comparison with the actual data fom December 2002 shows a match of the hodoscope detectors with lower count rates. Figure 3 shows the single count-rates of the individual photo tubes for the following data sets (from top to bottom): a) inner hodoscope PMs - run 617; b) inner hodoscope PMs - run 766; c) outer hodoscope PMs - run 617; d) outer hodoscope PMs - run 766.

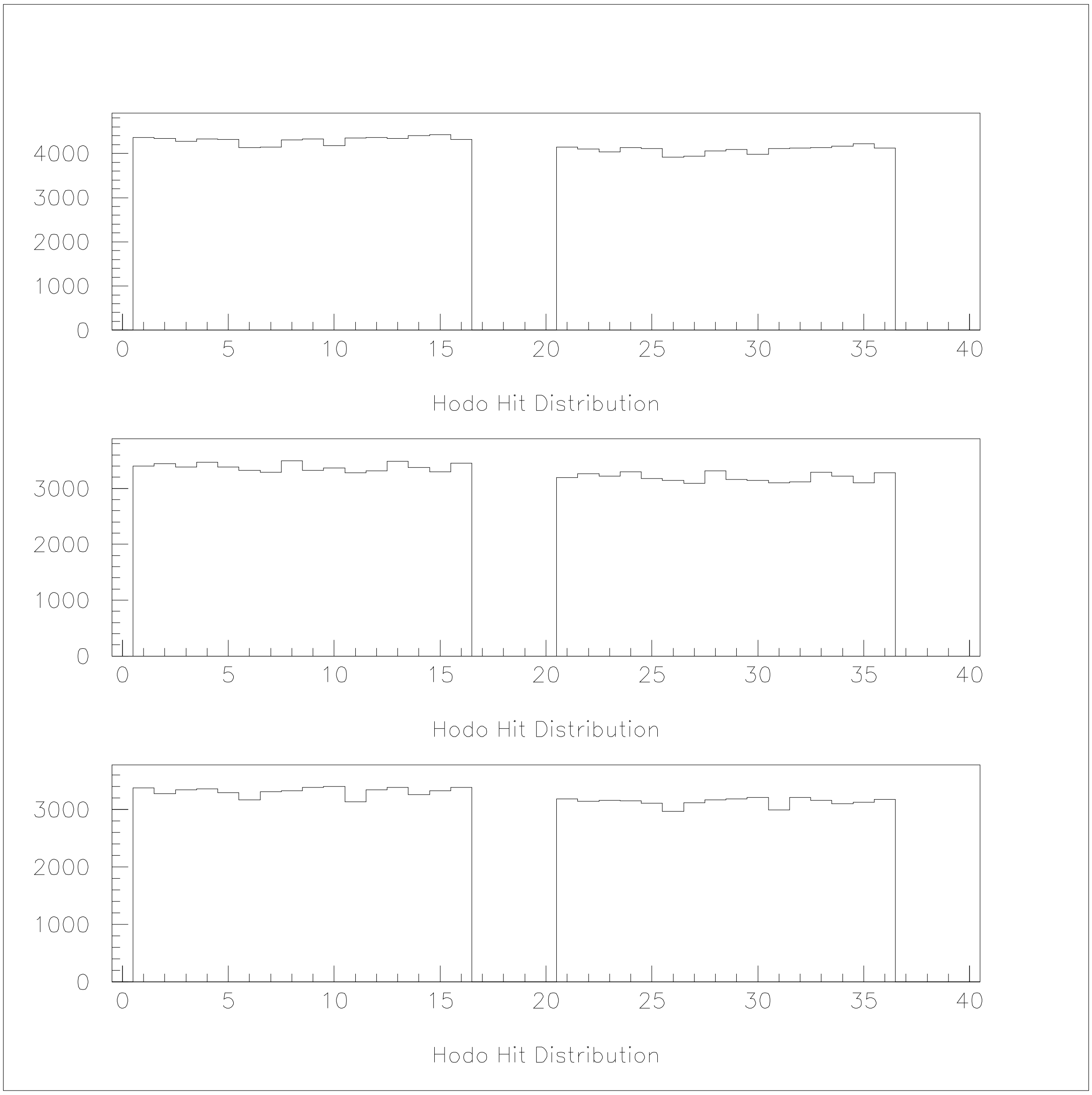


Figure 1: Setup without magnet

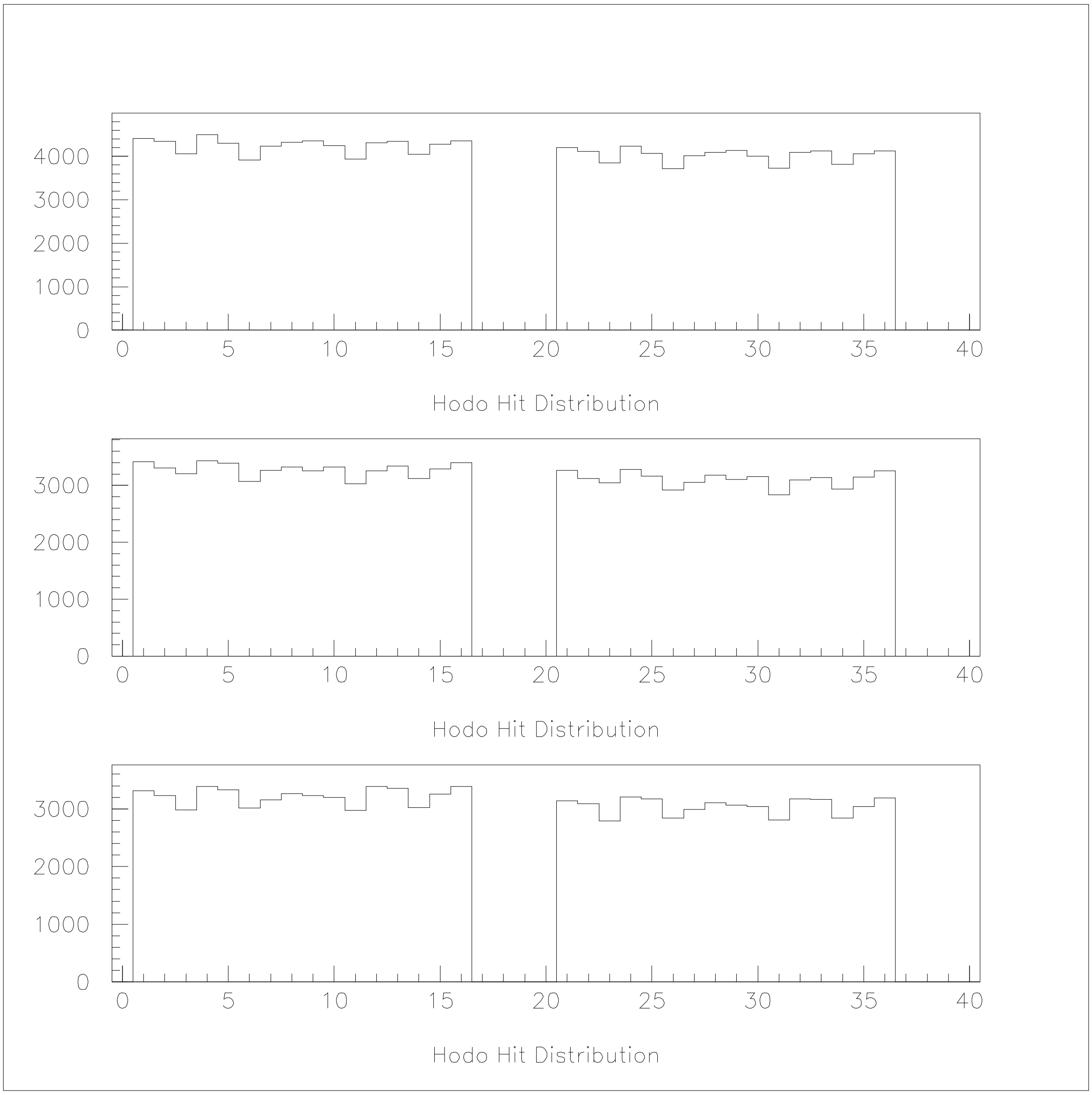


Figure 2: Setup with magnet

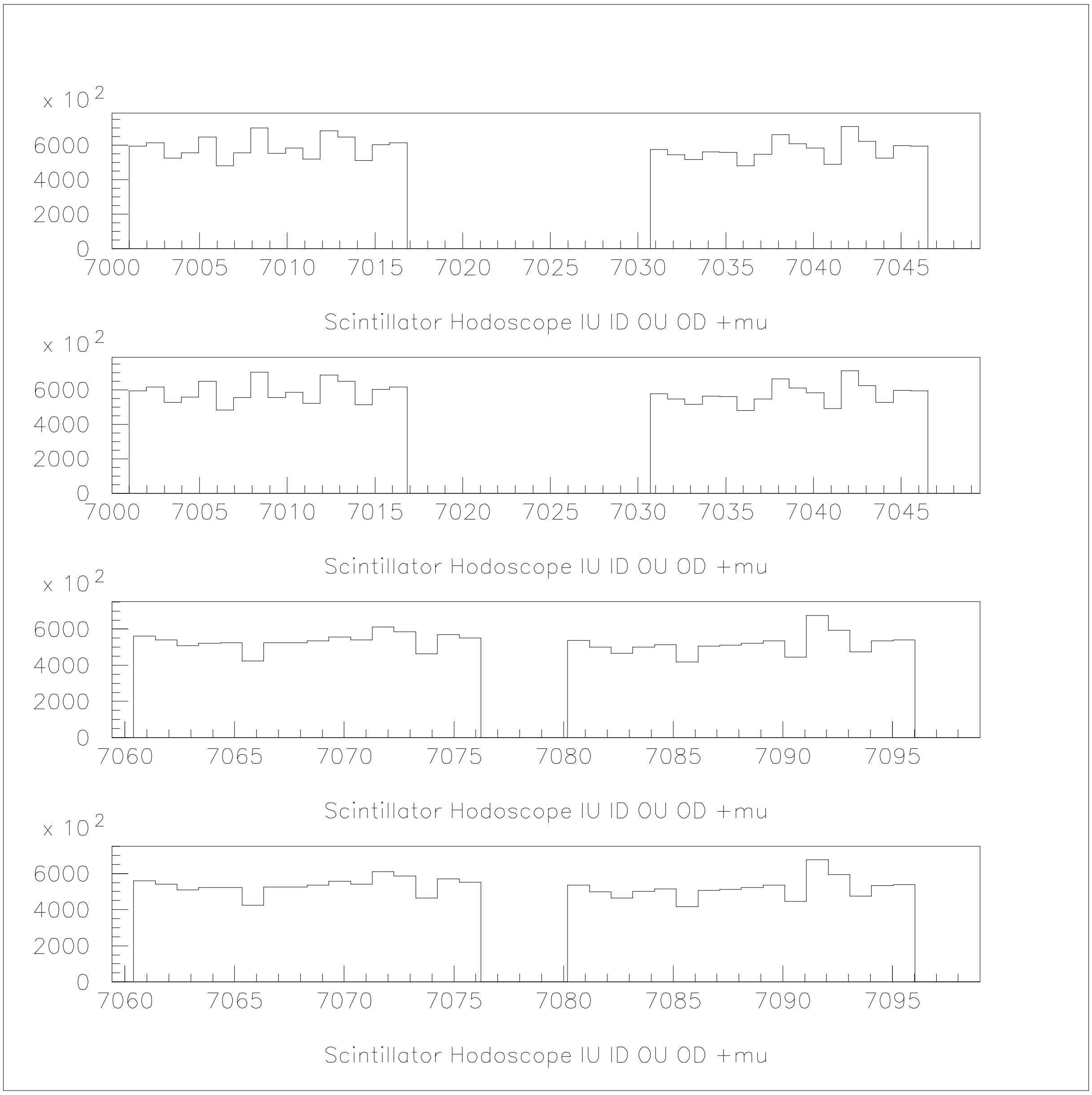


Figure 3: Data from Dec. 2002