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Status Report of Spectrometer-Simulation -Background Issues-

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Abstract

This memo concentrates on the reduction of the amount of background photons hitting the CsI Calorimeter. With proper shielding reducing the backgound to nearly 0 seems to be possible.

Status of Spectrometer Simulation

1 Preface

This memo is the successor of studies on the spectrometer design presented earlier [1, 2, 3, 4, 5].

It was found that a large amount of photon background could reach the CsI-Calorimeter directly because the vertical shielding was insufficient. This major defeciency has now been corrected.

2 Introduction of Setups

The following setups are investigated:

- Old Default Setup: This setup is shown in Fig. 1. The solenoid is directly attached to the vacuum chamber. The space between spectrometer and analyzer magnet as well as between gamma beamline and analyzer magnet/CsI is filled with a leadwall which covers the height, length and width of the analyzer magnet/CsI system.
- Kirk Setup: This setup shown in Fig. 2 corresponds to the most recent layout from Kirk [6]. In addition to that proposal the space between the solenoid and the vacuum chamber is filled with a 'shielding disc. Different materials of this shielding disk are studied. The length of the exit beampipe is set to 80 mm.

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For the studies in this memo the same input spectrum has been used as in the previous studies [1,2,3]. The target material of the conversion target is *Ti* with a thickness of 0.5 X_0. For all studies presented here 10^8 photons have been simulated which start at the conversion target.

2.1 Results

Fig. 3 shows for the three different layouts the energy spectrum of background photons for different layouts.

In all scenarios the background can be reduced close to 0. In addition the figure shows the resulting background for a setup where the shielding on the downstream side is (on top and bottom side) only 20 mm higher than the vacuum chamber (Height of vacuum chamber = 55 mm). In that case the background increases by roughly a factor of 6 w.r.t. a well shielded scenario. This demonstrates that it is necessary to shield the CsI-Calorimeter over its total height and width.

3 Conclusion and Outlook

In order to suppress photon background mainly coming directly from the conversion target it is necessary to cover the whole front face of the analyzer magnet with (at least) lead shielding. By doing so the backgound from photons coming from the conversion target or the gamma line can be reduced to practically 0. The background can be suppressed without modfying the most recent layour of Kirk. The actuators of the collimator slit in the vacuum chamber should be placed at the upstream end of the vacuum chamber, as indicated in Kirk's layout.

For the amount of photons in the real experiment ($4 \cdot 10^9$/pulse), the current results must be extrapolated by a factor of 40. In future studies we plan to simulate the full statistics.

References

[1] R. Pöschl, *Status Report of Spectrometer Simulation* Memo of 21/4/04 `http://www.slac.stanford.edu/exp/e166/internal/doc/2004/2004-04-21-rp-spectr_rp_210404.ps`.

[2] R. Pöschl, *Status Report of Spectrometer Simulation* Memo of 6/5/04 `http://www.slac.stanford.edu/exp/e166/internal/doc/2004/2004-05-06-rp-spectr_rp_070504.ps`.

[3] R. Pöschl, *Status Report of Spectrometer Simulation* Memo of 2/6/04 `http://www.slac.stanford.edu/exp/e166/internal/doc/2004/2004-06-02-rp-spectr_rp_060204.ps`.

[4] R. Pöschl, *Status Report of Spectrometer Simulation* Memo of 9/6/04 `http://www.slac.stanford.edu/exp/e166/internal/doc/2004/2004-06-09-rp-spectr_rp_060904.ps`.

[5] R. Pöschl, *Status Report of Spectrometer Simulation* Memo of 22/6/04 `http://www.slac.stanford.edu/exp/e166/internal/doc/2004/2004-06-22-rp-spectr_rp_062204.ps`.

[6] K. McDonald, *Proposal for Spectrometer Layout* 24/6/04 `http://www.slac.stanford.edu/exp/e166/`.

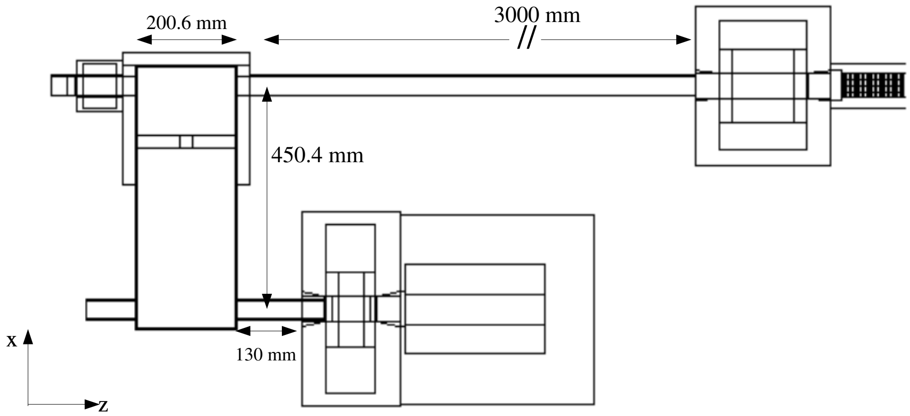

Figure 1: Spectrometer as implemented into the simulation (xz-view, called Old Default Setup in this memo).

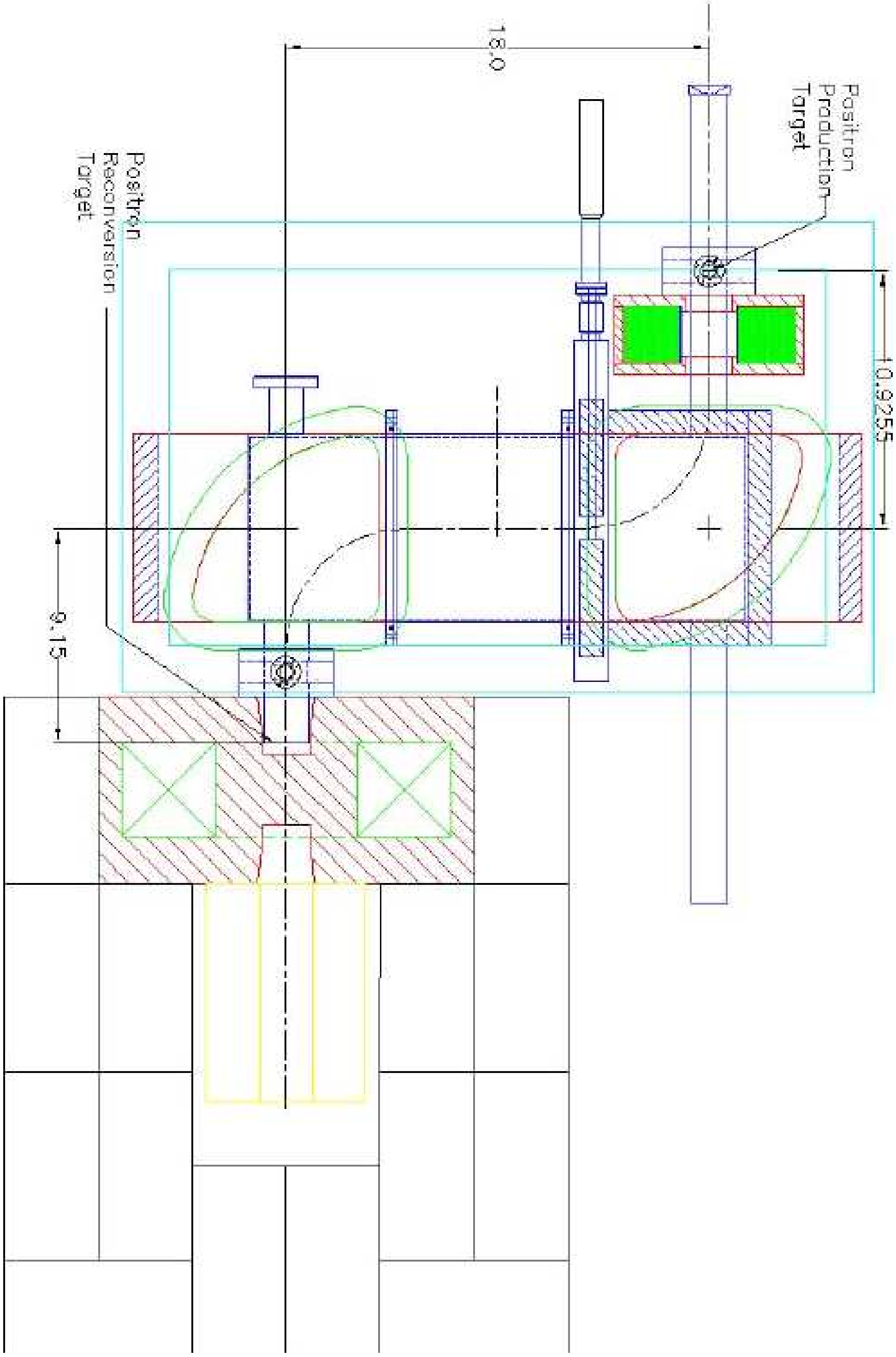

Figure 2: Setup as proposed by Kirk in [6] (called Kirk Setup in this memo).

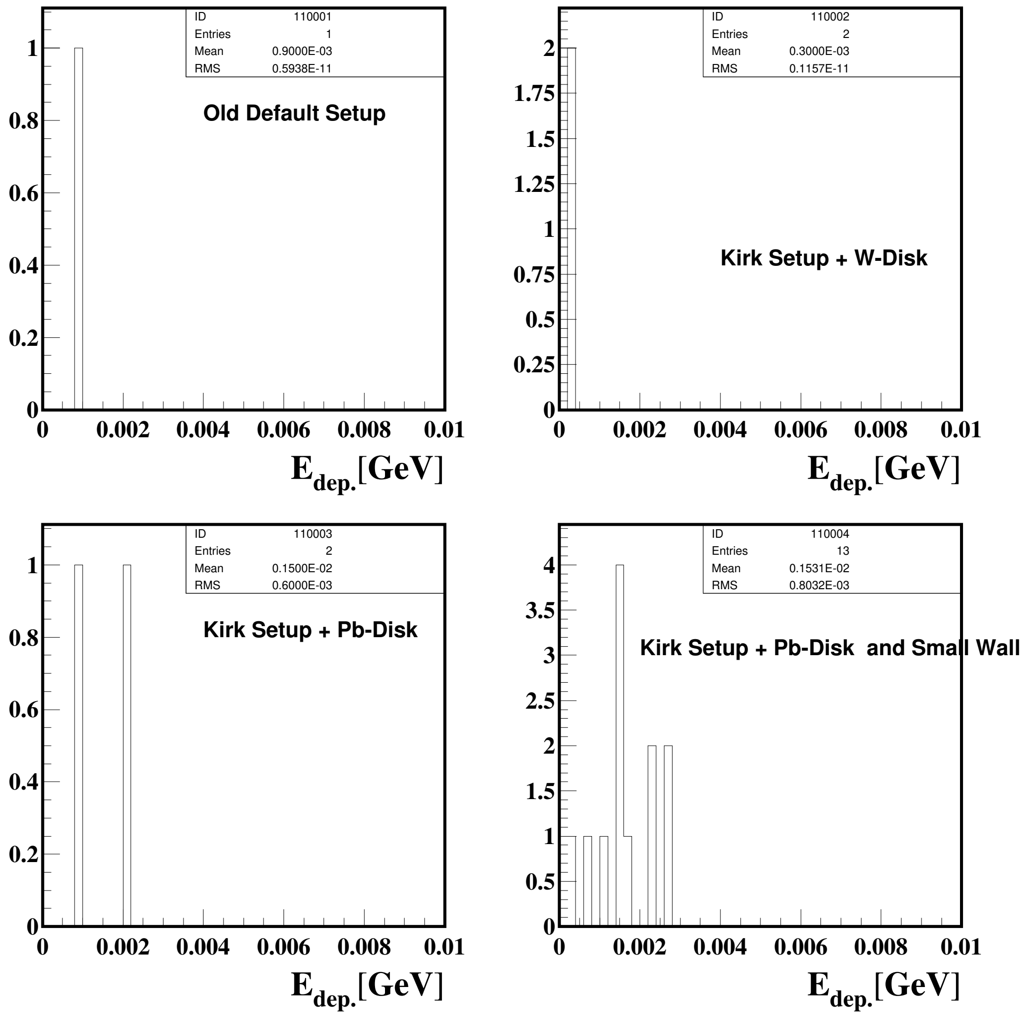

Figure 3: Energy spectra and energy depositions photons in the CsI for different layouts of the spectrometer as described in the text. The numbers are obtained for a bunch of 10^8 photons starting behind the conversion. They have to be scaled up by 40 corresponding to the number of $4 \cdot 10^9$ photons expected in the real experiment.