TRD studies with spare package in the fall 2015 run

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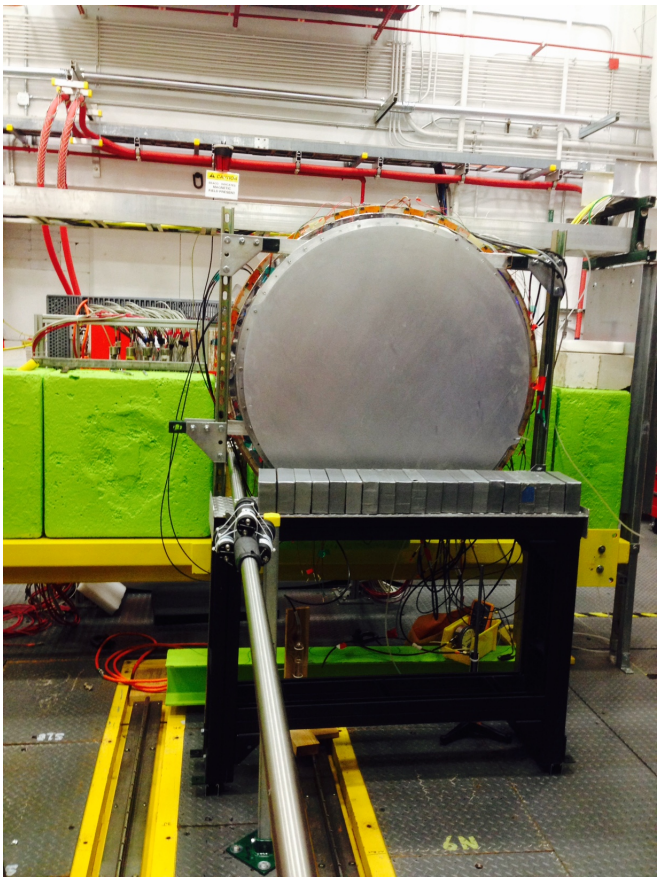

Figure 1: Spare package installed on the platform behind the pair spectrometer

The spare FDC package will be used in the fall 2015 run as a prototype of a future Transition Radiation Detector (TRD). We plan to study the yield of Transition Radiation (TR) photons produced by electrons/positrons in a radiator placed in front of the detector and the efficiency of their detection in an Ar gas mixture.

The package has been installed on the platform behind the left (north) arm of the pair spectrometer (Fig.1). Additional lead brick shielding was erected behind

the package to cover the opening in the shielding in front of the package. The package is installed so that it doesn't obstruct future work, leaving possible extraction of the target, work at the upstream end of the magnet, and the passage to the platform from the north side of the hall all available without moving the TRD. The gas is supplied from a pre-mixed bottle located at the ground floor directly under the detector, and the HV and LV supply comes from extra channels/modules in the FDC/CDC supplies.

For our studies we will use 192 channels with three fADC125 modules inserted at the left side of the Start Counter (ST) VME crate. These modules will be readout by the pair spectrometer trigger, running parasitically whenever the trigger is used in the DAQ.

The two upstream cells of the spare package have been modified by increasing the thickness of the spacer ring from 0.5 cm to 3.5 cm. In addition, the upstream cathode of the most upstream cell has been removed to avoid photon absorption from the copper in the cathode. As a result, the drift gaps of the two cells were increased to 3.5 and 4 cm, resulting in a drift time up to 9 μsec with a gas mixture of 90/10 Ar/CO_2. Therefore, the trigger coming to the ST crate will be delayed additionally in the fADCs by about 6 μsec to accommodate for the longer drift times.

The TR photon yield and detector efficiency will be studied for a variety of different radiator thicknesses, electron energies, and sense wire HV. The package completely covers the momentum acceptance of the pair spectrometer arm of 3-12 GeV, corresponding to about 32 cm at the upstream side of the package. We plan to divide this length into four sections of different electron energies. For each energy range from 1 to 4 (low to high) we plan to take measurements with three radiator thicknesses (5, 10, and 15 cm) and without the radiator. This results in four different configurations of the radiator in front of the detector (Table.1). The plan is to change the configuration during day access in the Hall and do opportunistic measurements over the night.

Configuration	Energy range 1	Energy range 2	Energy range 3	Energy range 4
1	no radiator	5 cm	10 cm	15 cm
2	5 cm	10 cm	15 cm	no radiator
3	10 cm	15 cm	no radiator	5 cm
3	15 cm	no radiator	5 cm	10 cm

Table 1: Radiator thicknesses for the different energy ranges