CVS: docs/shift/BoNuS/BoNuS_ESAD.tex
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Experimental Safety Assessment Document for the BoNuS test run

1 Running Conditions

The Hall B BoNuS experiment (run group e8, E03-12) is scheduled to run from October 13 to December 22, 2005. The goal of the experiment is to measure electron scattering from a neutron in deuterium with simultaneous detection of a slow, backward moving spectator proton. It requires the use of a new detector inside CLAS, the Radial Time Projection Chamber (RTPC) with its integrated gaseous pressurized hydrogen target and ancillary electronics, as well as the "DVCS solenoid" to suppress Møller electrons and measure momenta. The run begins with a 7 day commissioning period. The energy of the electron beam will be set initially to 2.14 GeV (2 pass). This will be followed by polarized 4 pass beam (4.22 GeV) and then 5 pass beam (initially 5.26 GeV, later to be increased to the maximum available, with full polarization). Beam currents will be up to 200 nA. The target is a 6 mm diameter, 27 cm long Kapton tube filled with about 100 psi (7.5 atm) hydrogen or deuterium gas. The target-detector system will be located about 58 cm upstream of the CLAS center, centered on the "DVCS solenoid" (see below). The expected luminosity is rather small, up to $2 \cdot 10^{33}$ cm^{-2}s^{-1}.

There are two new elements installed as a part of the CLAS apparatus: (1) The RTPC and (2) the superconducting solenoid magnet at the target location, to shield from Møller background.

The RTPC is a concentric drift chamber surrounded by 3 layers of Gaseous Electron Multiplier (GEM) foils. The ionization tracks drift radially outward and are read out via a grid of readout pads. Using the time sequence of registered charge, one can reconstruct the tracks in three dimensions. The RTPC is optimized to detect, identify and measure the momentum of protons in the range 70 - 100 MeV/c ("VIPs"). The RTPC is operated with a 10%/90% mixture of DME (di-methyl-ether) and ^{4}He (Helium) at atmospheric pressure. Via a HV distribution scheme, the drift region as well as each of the GEM foils and the regions between them are biased at their appropriate voltages. The pads are read out by on-board electronics connected via ribbon cables to custom electronics (CERN ALTRO system). The RTPC surrounds the pressurized target. The volume between the outer radius of the target tube and the inner radius of the RTPC is filled with inert Helium gas.

The operating and safety procedures for the target, the HV system and the RTPC gas system are attached as separate documents.

The RTPC–target combination is centered inside the "Saclay DVCS solenoid" which was used during the e1-DVCS run. It will be run at somewhat lower magnetic field (about 3-4 T at its center, at about 400 A current). Its purpose is to both suppress Møller electrons and to bend low-momentum particles so we can identify them and measure their momentum.

The operational and safety procedures for the solenoid magnet are attached. Max operating current is 534 A. At that current magnet will generate 4.6 T longitudinal field in the center of the solenoid at the beam level. Field value at the distance ~ 1 m is 0.06 T. Working conditions are similar to the normal polarized target runs in Hall B. Besides the main coil that generates field along the beam, the solenoid has compensation coil, wired in reverse direction. This is to minimize forces on the torus magnet. All controls and the monitoring will be done through EPICS. The magnet has been well studied during the DVCS run.

The calorimeter attached to the solenoid during the DVCS run will not be installed. The EG1 "bullet" lead shield will be installed downstream of the solenoid to stop all electromagnetic background coming from the target region from reaching the CLAS drift chambers.

All other CLAS detector elements will be used in the usual manner.