Review of backgrounds for E166

A signal readout from the SiW photon polarimeter will be of order 50TeV (10**7 5MeV photons) whereas the signal readout from the CsI positron polarimeter will be of order 2GeV (10**3 2MeV photons). Thus a background of 2.5TeV in the SiW and 100MeV in the CsI would constitute a 5% error. This sets a scale for the background studies.

Discussing background issues is a bit complicated by the fact that it is a kind of “7-dimensional space”. What follows is an attempt to list the various items that have been discussed so far and their disposition by breaking the discussion down into its various “dimensions”.

1) The location origin of the background:
   a) The sections of the beamline where the beam passes through air.
   b) The beam dump.
   c) The bending magnets, particularly dump magnet D1.
   d) Beam line elements including and downstream of the undulator collimator.
   e) Beam line elements upstream of the undulator collimator.

2) The type of radiation:
   a) RF from beam in air
   b) Neutrons from the beam dump and from beam electrons hitting beamline elements.
   c) Synchrotron photons from bending magnets, particularly D1.
   d) Muons from beam electrons hitting beamline elements
   e) Photons and electrons from beam electrons hitting beamline elements.

3) The possible experimental systems impacted:
   a) The readout of electronic signals affected by air gap rf.
   b) The aerogel and SiW photon polarimeter affected by photons and electrons from beamline “splat”.
   c) The CsI positron polarimeter affected by muons and neutrons from beamline “splat” and synchrotron radiation from D1.

4) The tools used to measure backgrounds:
   a) Bill’s GCal
   b) Clive’s Cherenkov monitor.
   c) Two CsI crystals, one with a PMT and the other with a diode readout.
   d) One or two aerogel blocks.

5) The techniques used to mitigate it:
   a) The rf impact on electronic readouts will be dealt with by shielding, special cabling, chokes, etc. as we setup and test the equipment. Also, some of the currently exposed beam will be placed inside beam pipe for our runs.
   b) According to radiation physics experts (Sayed, et al) the concrete shielding at the end of FFTB will reduce beam dump neutrons and photons far below a minimal acceptable level. The only concern may what can come back up the tube the beam goes down.
   c) Beam tuning will be the primary method to minimize all forms of backgrounds due to beam electrons impinging on beam line elements.
   d) Lead shielding around the two detectors will be used to mitigate random ambient photons and electrons from any source that does cannot work its way down the open beamlines to the detectors.
   e) Boron-plastic will be used to mitigate thermal neutrons.
   f) For photons and electrons that can reach a detector following the beamline carefully simulations will be done to identify mitigation methods based on geometry of beamline and collimators.
   g) Random muons and neutrons are very penetrating but conversely do not deposit much energy so they may only be a concern in the CsI Cal. Beam tuning will be the only available technique to mitigate these backgrounds.
6) Modeling backgrounds for the backgrounds test run – most of the experimental elements downstream of the undulator will not be present for the test run. Thus, the job here is to try to predict what backgrounds will be seen in the test setup.
   a) Energetic photons and electrons coming out of HSB2 along the photon beam line.
   b) Synchrotron radiation at the position of the positron polarimeter coming out of a simplified positron beam line.
   c) Neutrons and muons at the position of the positron polarimeter coming from upstream splat.

7) Modeling backgrounds for the experimental run:
   a) Energetic photons and electrons produced by beam hitting elements upstream of the collimator immediately upstream of the undulator – how should the undulator collimator and downstream collimators be designed and located to mitigate this background in the photon polarimeter?
   b) Energetic photons and electrons produced by off axis beam electrons hitting the undulator wall – how should the downstream geometry and collimation be designed to mitigate this background in the photon polarimeter?
   c) Reprise and extend Ties’ simulation of beam splat hitting the photon target and producing tertiary radiation in the positron polarimeter.
   d) Synchrotron photons from the D1 magnet – how should the beam path and collimation be designed to mitigate this background in the positron polarimeter?