UPV Geometry & Channel Count

Paul Eugenio

Florida State University

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The purpose of the UPV is to detect backward going photons of energy greater than 20 MeV emerging from the target region. The design of the UPV employs a traditional lead-scintillator sampling calorimetry with wavelength shifting fiber read. The total detector thickness is 8.91 radiation lengths with a design sampling fraction of 24%.

The UPV container is box is made of 1cm thick Aluminum. The upstream/downstream, top/bottom, and left/right walls are identical. Upstream/downstream walls have a square 25.5x25.5 beam hole. The UPV volume has dimensions 240cm x 240cm x 26cm, hight, width, and depth respectively. The depth (Z) consists of 18*1cm(Scint) + 24*0.25cm(Lead) + 2*1cm (Al). The hight consists of 56*4.25cm(Scint) + 2*1cm(Al). The width consists of 238cm(Scint) + 2*1cm(Al).

The UPV is composed of 56 segments each composed of 18 layers. Each layer consists of a plane of scintillators and a plane of lead. The 12 downstream layers are single-width whereas 6 upstream layers are double-width. A UPV single layer has 1 plane of scintillators and 1 sheet of lead. A UPV double layer has 1 plane of scintillators and 2 sheets of lead. The UPV lead sheet is 0.25cm think(0.36 radiation lengths), and its geometry is square with a 25.5cm x 25.5cm square center beam. The UPV scintillator plane is 1cm thick and has 56 vertically stacked paddles(See Figure 1). The 6 middle paddles are cut for the beam hole. Therefore, each scintillator plane consists of 25uncut + 6cut + 25uncut paddles.

The scintillation light is collected from the left/right ends of a scintillator strip. A total of 112 (2*56) electronic channels will be readout via FADCs.
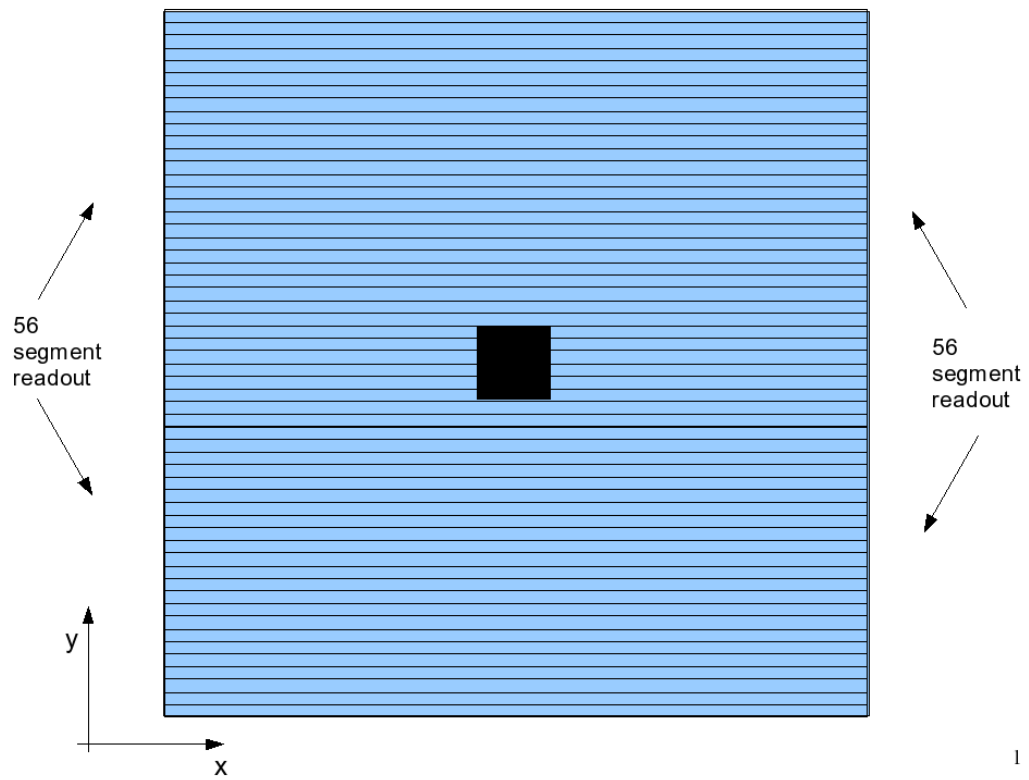
Figure 1: UPV detection plane formed with 56-4.25cm wide segments with readout on both ends