FDC Geometry and Channel Count

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The following description of the FDC geometry and channel count is still tentative because we are still working on the mechanical drawings and optimizing the package design.

The Forward Drift Chamber detector array consists of four packages of 6 chambers, each chamber consisting of a wire plane flanked on either side by cathode planes divided into strips. One chamber unit consists of a support frame, a cathode plane, a wire plane inside a 1 cm thick gas volume, another cathode plane, and another support frame. Adjacent layers are electrically separated from each other by a 25 micron layer of conducting material such as aluminized Mylar (density = 1.39 g/cm^3). The various layers are illustrated in figure 1. The wires are attached to a 5 mm thick G10/FR4 frame (density = 1.7 g/cm^3). In the current design the outer radius of the frame is 60 cm and the inner radius is 52.4 cm. The outer radius is determined by the inner radius of the BCAL (65 cm) and the dimensions of the rails and likely cable configuration from a drawing generated by Ravi Anumagalla (figure 2). There are 103 sense wires per wire plane. The region within a radius of 3.5 cm from the nominal beam line is inactive: the wires will most likely be slightly thickened in this region to kill the gain. A 5 mm thick spacer of G10/FR4 separates the wire plane from the adjacent cathode plane. The cathode planes are 50 μm thick layers of Kapton (density = 1.42 g/cm^3) covered by a 5 μm layer of copper (density = 8.96 g/cm^3). There are 210 strips per cathode plane. The strips are at $\pm 45^\circ$ with respect to the wires

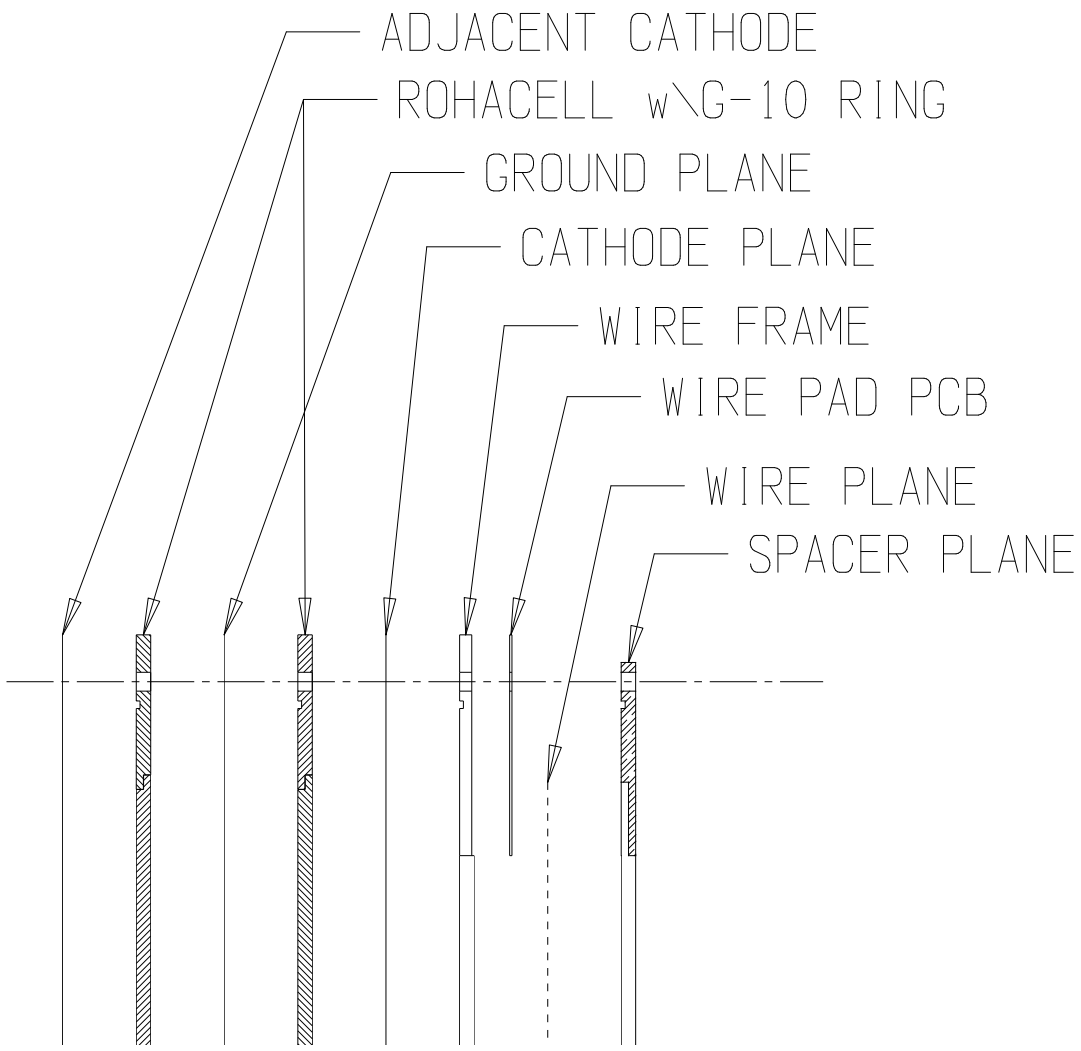

Figure 1: Components of an FDC unit.

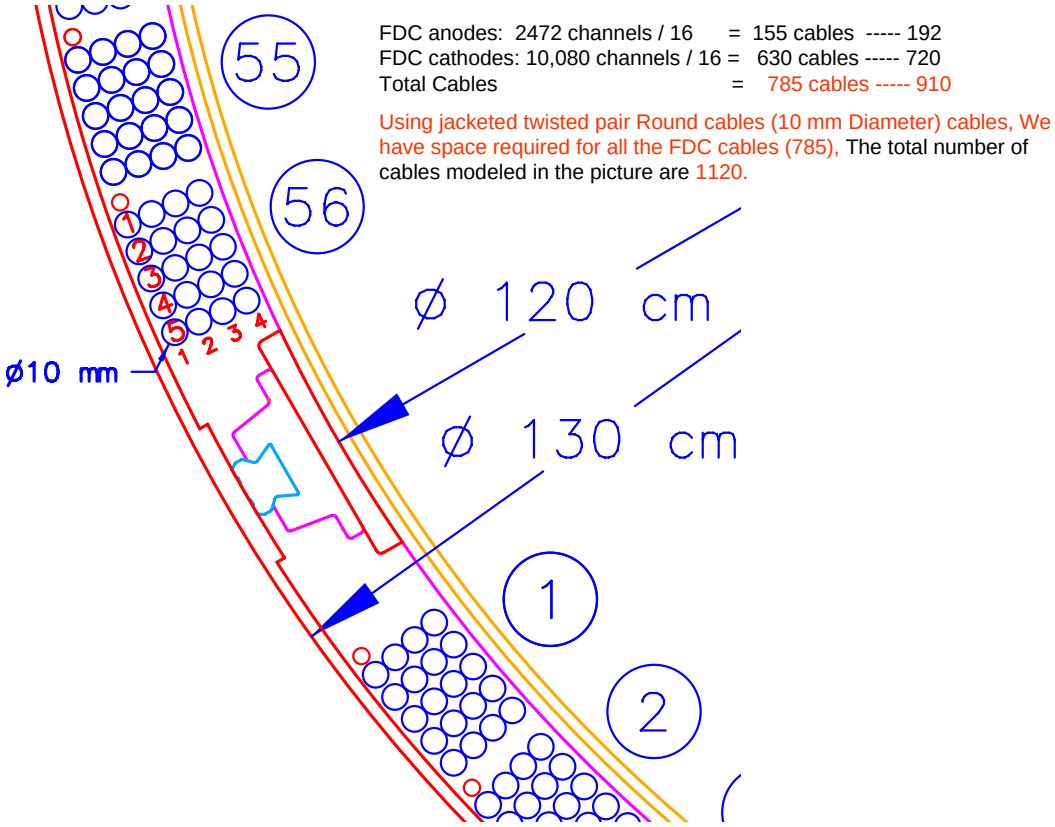

Figure 2: Region between outer radius of FDC and inner radius of BCAL.

(90° with respect to each other) in a given chamber. The cathode planes are attached with on the order of 25 μm of epoxy (density$\sim$1 g/cm^3) to 5 mm thick G10/FR4 support rings with roughly the same dimensions (inner radius $\sim$54.8 cm) as the wire support rings.

We are considering a couple of ways to maintain the separation between the wire and cathode planes. One possible solution (shown in figure 1) is to use 5 mm thick layers of Rohacell, a low density foam (0.032 g/cm^3), within the active radius of the detector. We need MC studies to determine if we can afford this extra material.

Each package will have a mass of preamp chips and PC boards extending beyond the 1.2 m outer diameter. The dimensions of these boards have not been specified. As a crude first approximation we suggest modeling this with a ring composed of a mixture of silicon and FR4 with an inner radius of 60 cm, an outer radius of 60.2? cm, and a thickness of 12 cm. We estimate that we will need 785 thirty-four-conductor cables, which can be modeled as 1 cm diameter tubes filled with an appropriate mixture of plastic and metal. We also need about 300 cables for HV; the model can be the same for these.

The first unit in a package has wires oriented in the vertical direction. The second has the wires oriented at +30° with respect to the vertical direction. The third has the wires oriented at -30° with respect to the vertical direction. The pattern repeats.

The position of each of the packages along the z-direction probably needs to be optimized. In Ravi's current drawings, the first package starts at 227 cm from the origin (the center of the target is at 65 cm from the origin) and the fourth package ends at 403 cm. The packages are evenly spaced with respect to each other.

Two rails for positioning/supporting the FDC packages need to be added to the detector model.