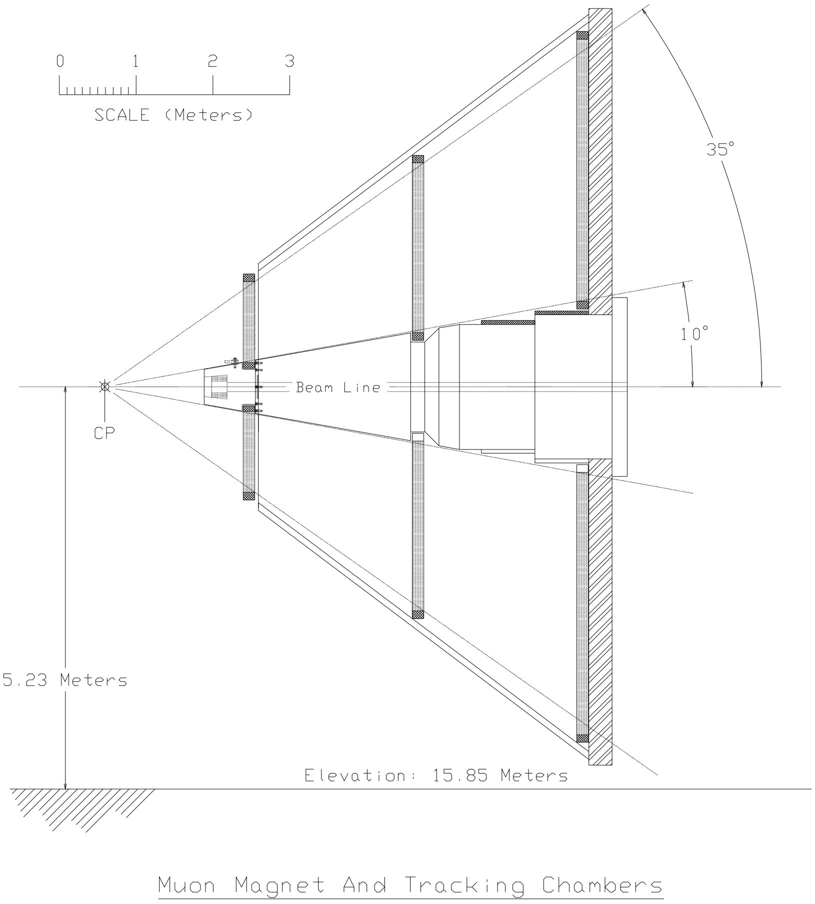

Figure 10.13: Elevation view of muon arm tracking chambers and their position relative to the muon magnet elements.

of the cathode and ground. Outside of the screen frames are frames carrying aluminized mylar sheet to provide a ground plane and gas tightness. The entire assembly is mounted on a strongback made of aluminum plate. Steel dowel pins in this frame are used to position the frames relative to one another. The strongback also includes the chamber mounting fixtures, survey reference points, and elements of the active surveying system. Measurement accuracies of 250 μm per plane have been achieved with large chambers of this type. [12].

The radial size of station #3 has led us to consider splitting its wires in radius in order to keep individual wire lengths close to 2 m. Not doing this would require winding, positioning, and tensioning wires that are in excess of 4 m in length. A schematic view of how such a septum would be placed into station #3 is shown in Fig. 10.18. The septum would have to be several cm wide, but needs to be kept small to minimize the solid angle lost. The two segments of a wire would still be connected electrically as indicated in order to not double the number of required electronics channels. Occupancies in station #3 are less than 5%

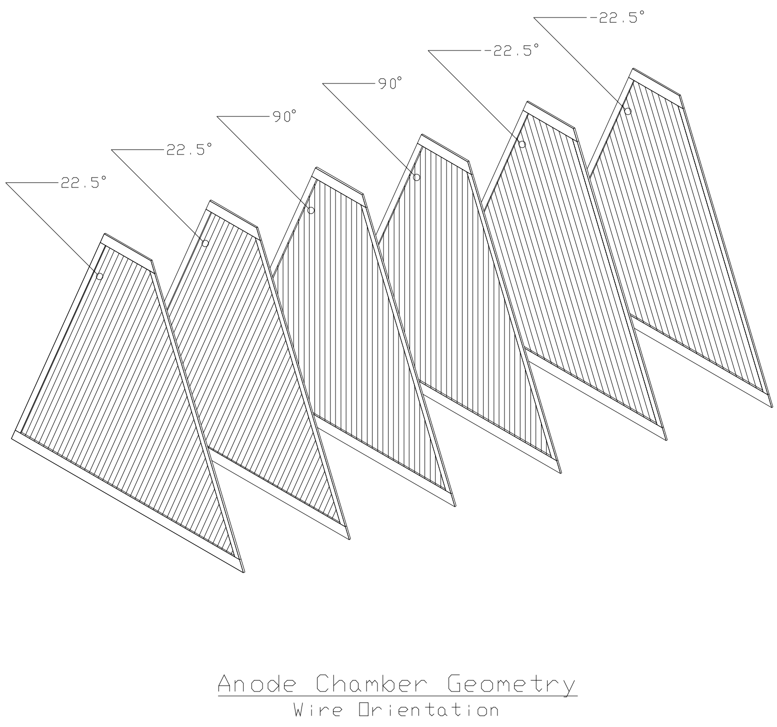

Figure 10.14: Schematic view of the organization of one octant of one station of the muon arm tracking chambers, showing the normal and stereo planes.

even for central Au + Au events, so there is no need to segment wires for occupancy reasons.

The chamber anode wire spacing was chosen considering the trade-off among per wire occupancy, maximum drift time to a wire and system cost. The present design has an anode to anode spacing of 1 cm in station #1, and a spacing of 2 cm in both station #2 and #3. The resulting maximum drift times are of the order of 100 and 200 ns. The hit rate per wire will be rather constant, at about one hit every 3–4 ms, independent of beam species circulating in RHIC, assuming standard RHIC "Blue Book" luminosities. The mean time between events ranges from 1–100 μs in going from p + p to Au + Au collisions, meaning that hits overlapping in time do not appear to be a problem with these wire spacings. (Further discussion of data rates is in Section 10.3 and in Chapter 11.) The drift cell geometries for the three stations are shown in Fig. 10.19. The resulting station thicknesses are 155 mm for #1 and 295 mm for #2 and #3. Preliminary electrostatics calculations show that such an aspect ratio for the drift cell gives a linear drift-time to drift-distance relationship with no dead zones near cell boundaries. A choice of chamber gas has not been made, but the resolution requirements shown in Fig. 10.30 dictate that an important consideration is a flat relation between electron drift velocity and reduced electric field in order to minimize systematic errors arising from variations in drift velocity. The relative orientation of external magnetic

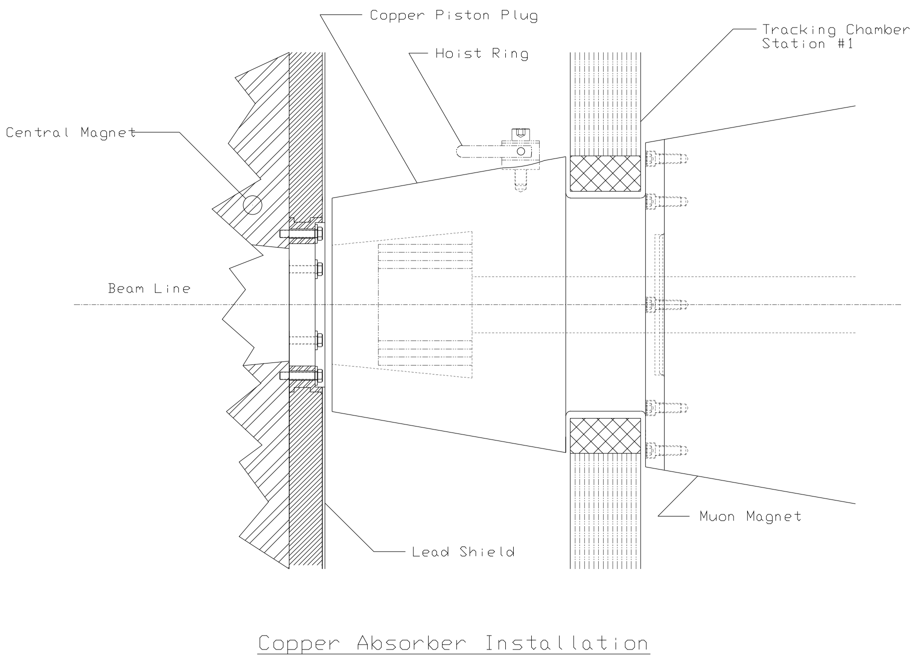

Figure 10.15: View of the muon piston face region showing the relation of tracking station #1 and the copper piston plug.

field and drift chamber electrostatic field is not fixed with the piston magnet, requiring a careful calculation and measurememt of the resulting contours corresponding to constant drift time in a drift cell.

10.2.4 Muon Identifier

The muon identifier consists of three layers of inert absorber interleaved with Iarocci-type streamer tubes read out via capacitive pad pickups. The first absorber layer is the 30-cm thick steel return yoke for the muon magnet. The other two layers are 100-cm thick concrete blocks forming two 10.3-m tall by 12.4-m wide walls downstream of the muon magnet return yoke. They sit just at the downstream end of the major facility hall. A side elevation of the muon identifier is shown in Fig. 10.20.

The streamer tubes are mounted in eight large panels which are suspended from the concrete walls. The hanger detail is shown in Fig. 10.20 and the arrangement of the panels is shown in Fig. 10.21. This arrangement permits access to the end of the muon magnet piston and to RHIC beamline components and magnets which must be installed in this region.

A cross section of a streamer tube layer with associated readout pads is shown in Fig. 10.22. The actual streamer tubes are mounted in extruded plastic “supertubes” which

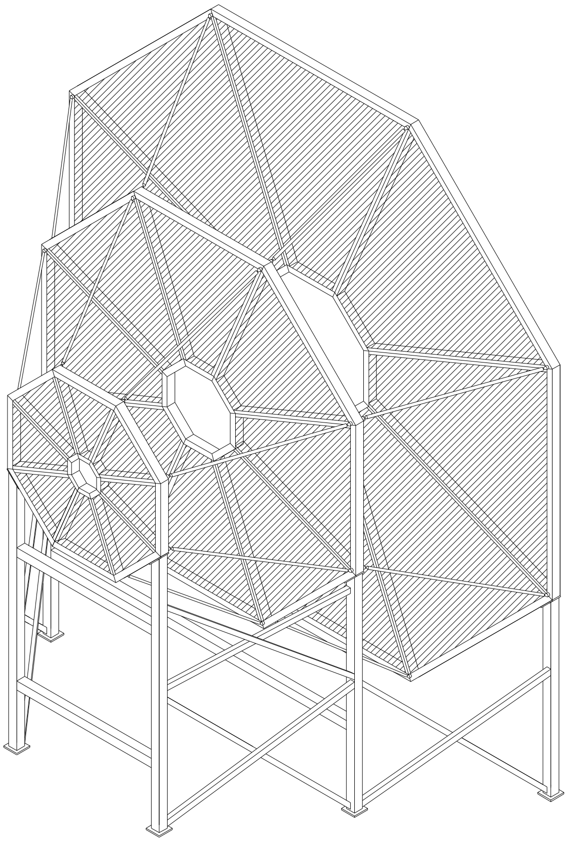

Figure 10.16: Isometric view of chamber supports.

permit removal of an individual streamer tube without disturbing the pad readout structure. The pad layers will be installed on each side of the streamer tubes. One side is instrumented with 768 radial strips (azimuthal segmentation), which are "or"ed in groups of three to form 256 inputs per layer into the LVL-1 trigger logic. The other side is instrumented with pads finely segmented in radius and coarsely in azimuth to provide the transverse coordinate to the strips on the other side.

The streamer tubes use a gas mixture with a mass composition of 25% Ar and 75% isobutane. The anode wires are biased to 4600 V for a gas pressure of one standard atmosphere. Bench tests have shown this provides a stable operating plateau of about 500 V extent with minimal tendency to spark given proper initial high voltage burn-in of the streamer tubes. A high voltage burn-in proceedure has been developed. Timing tests have shown that the arrival time distribution of pad pulses relative to particle passage is somewhat broader than desired, having a full width at tenth maximum of $\sim$ 110 ns for normally incident particles.

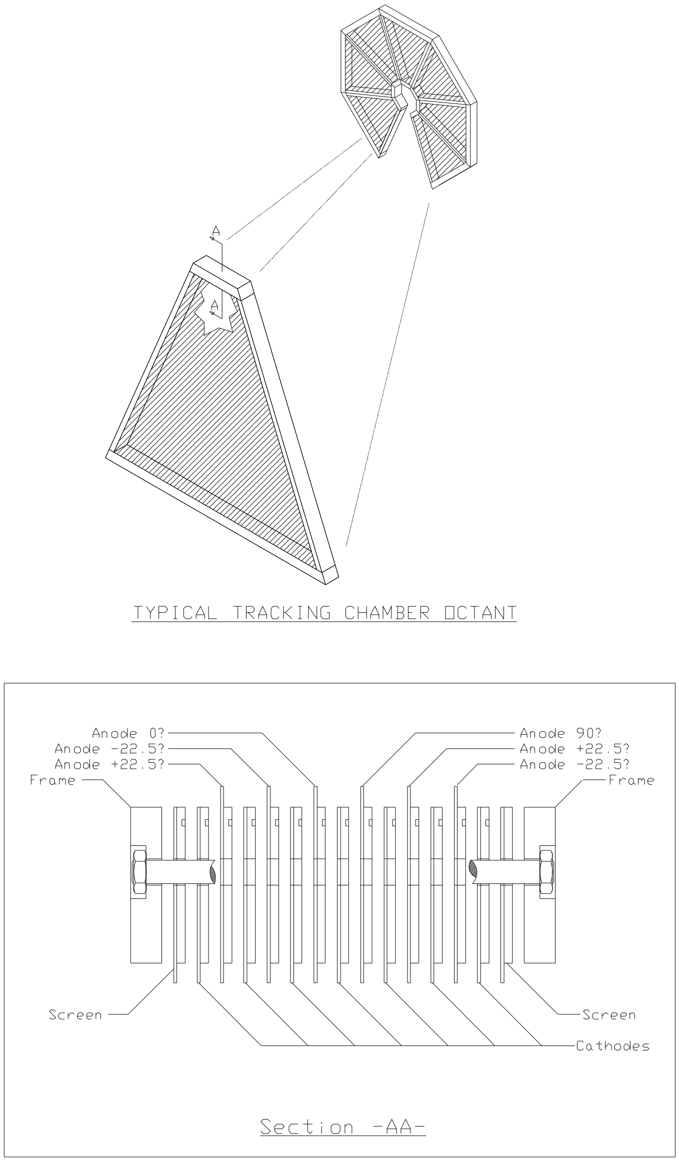

Figure 10.17: Cross-sectional view of the wire planes in one octant of a muon arm tracking station.

This is quite close to the RHIC bunch crossing time of 112 ns for the anticipated future 2×57 bunch filling of the two RHIC rings. Because the muon identifier forms the LVL-1 trigger for the muons and because this trigger is pipelined and deadtimeless, as described in Chapter 11, some developement work is required to reduce this arrival time distribution. Different gas mixtures will be studied, and the possibility of using streamer tubes with smaller cell sizes than the standard $9 \times 9\text{mm}^2$ will be explored, in order to reduce the electron drift distance to the anode wire.

A side elevation view of the concrete walls are shown in Fig. 10.23. The walls are stabilized