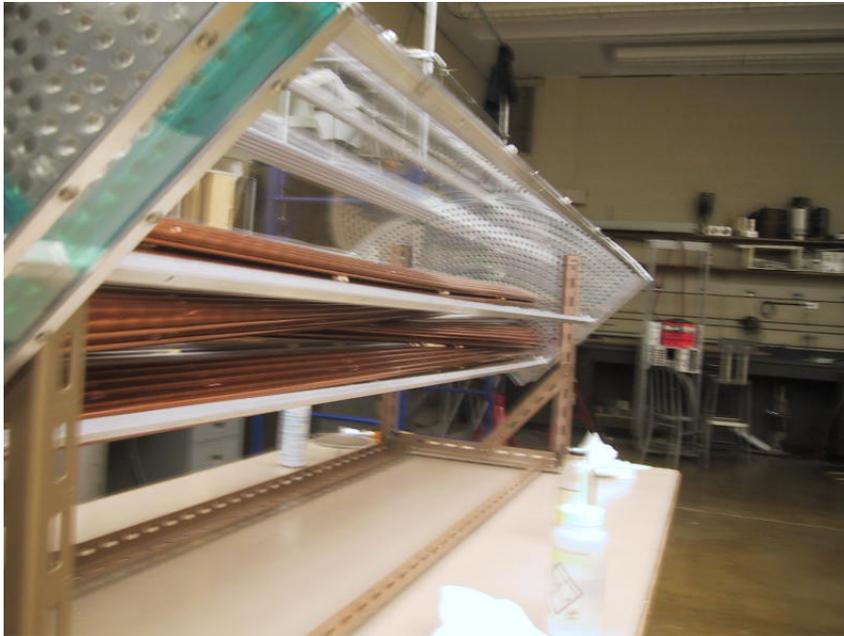
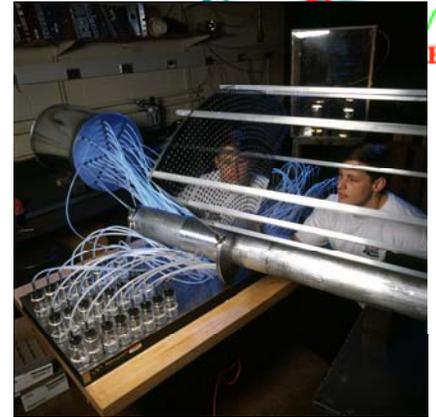


The GlueX Central Drift Chamber

Curtis A. Meyer, Carnegie Mellon University



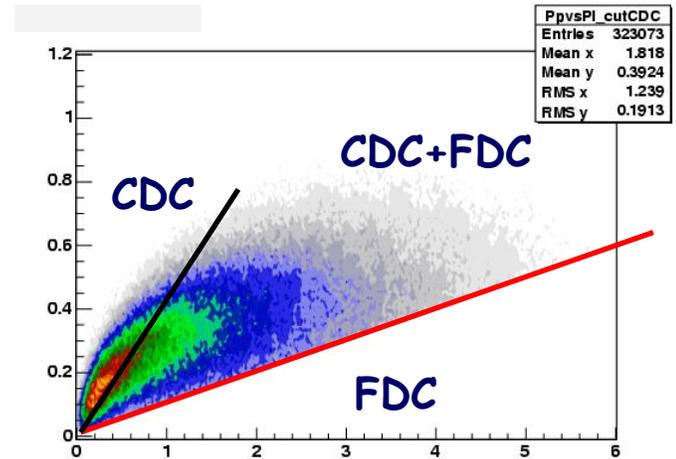
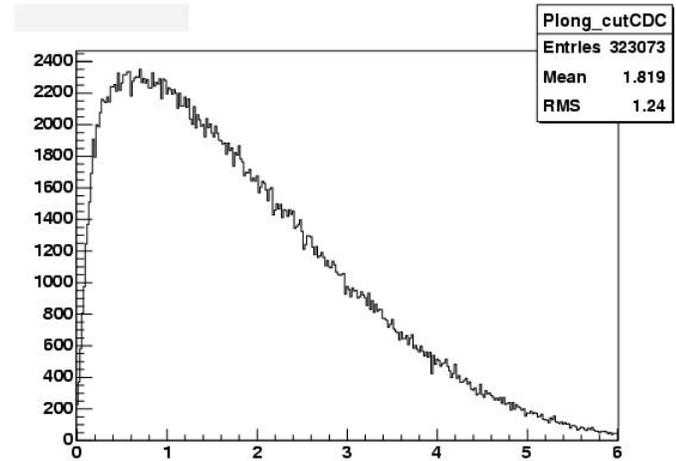
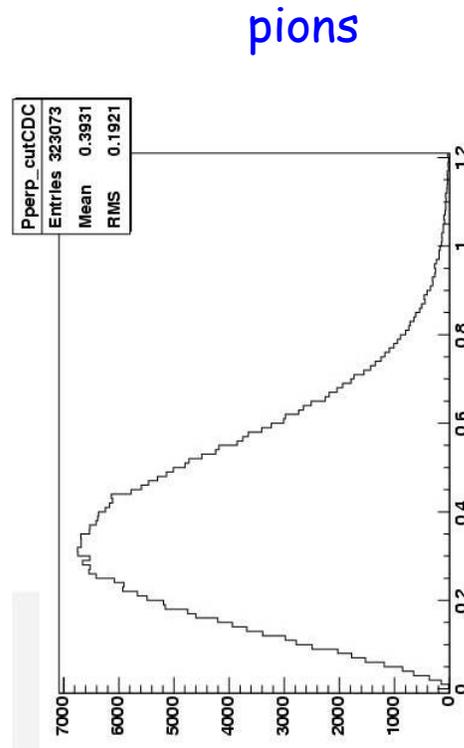
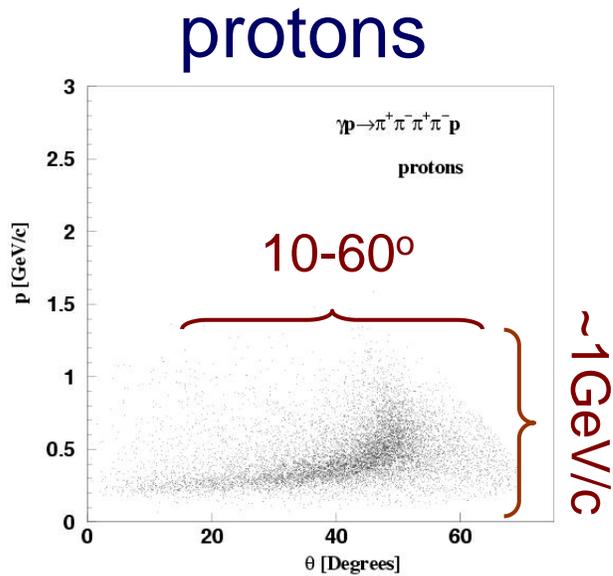
Outline



Physics Requirements

99% Charged particle acceptance
98% Photon acceptance

Momentum of tracks in the CDC



Chamber Requirements

To achieve the overall momentum and vertex goals of the experiment, the CDC needs to achieve:

$$\sigma_{r\phi} \sim 150-200 \mu\text{m} \quad \sigma_z \sim 2 \text{mm}$$

Stereo Layers $\sigma_z = \sigma_{r\phi} / \tan(\theta_{st}) \sim 1.4 \text{ mm}$

Charge Division $\sigma_z \sim 1.5\% (2L) \sim 6 \text{ cm}$

Sweep time should be as short as possible $\sim 600-700 \text{ ns}$

Electrostatics need to be very well understood and regular due to the large Lorentz Angle.

Particle ID using dE/dx for $p \leq 450 \text{ MeV}/c$ (proton/ pion)

Resolution

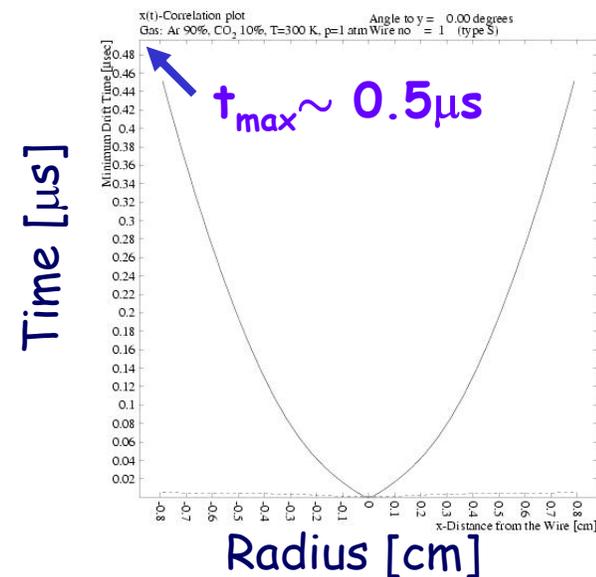
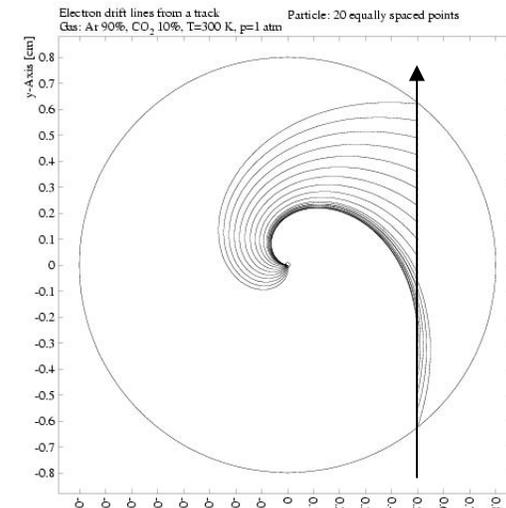
Contributions to Resolution

Geometrical Precision	40 μm
Gravitational Sag	56 μm
Timing Resolution	45 μm
Electrostatic Deflection	10 μm
Gas Diffusion	120 μm
Total	$\sim 145\mu\text{m}$

We have a gas mixture that should work, but we would like to optimize this .

Would like to use the same gas in both the FDC and the CDC.

90-10 Ar-CO₂



Chamber Geometry

After detector review, did a vertex study. Indicated that the layers should be shifted closer to the beam line and the stereo layers brought in. This could lead to a substantially better vertex resolution.

However, the background rates increase rapidly (in a long tube) as the tube is brought in.

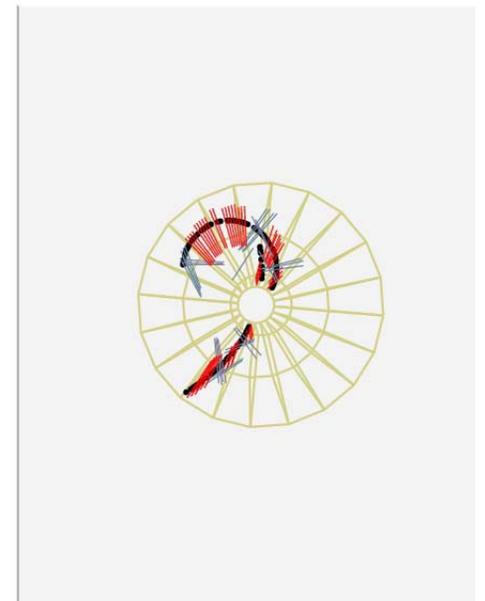
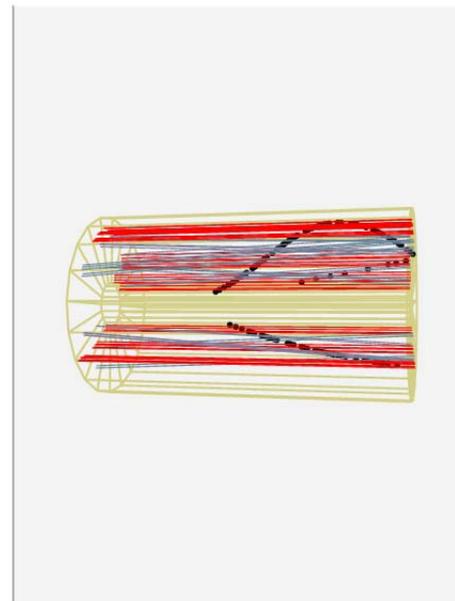
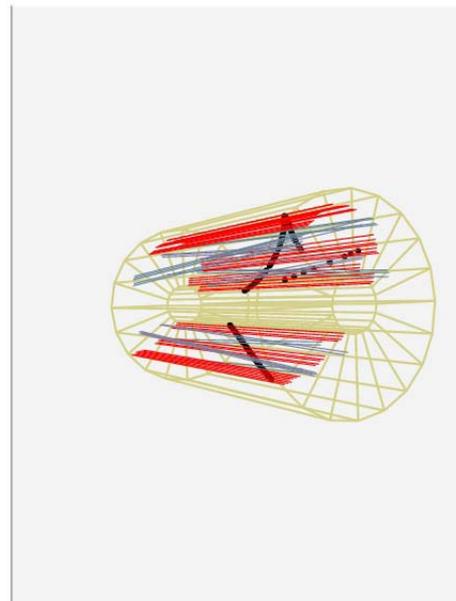
We also found that we could shorten the CDC from 2m (active) to 1.75m (active) and give the space to the FDC for better lever arm.

Active Length:	175cm
Radius of inner layer	~10cm
Radius of outer layer	~58cm

Layers = 25 with about 3200 wires

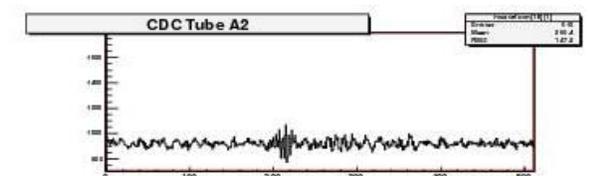
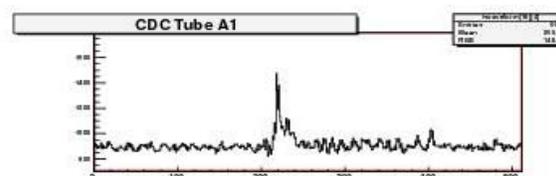
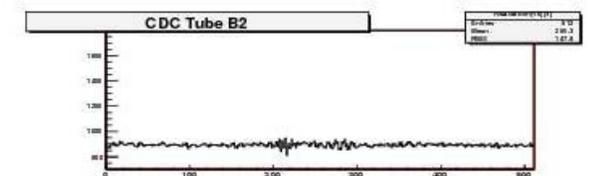
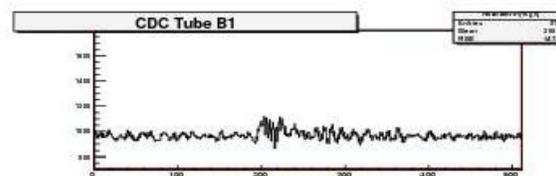
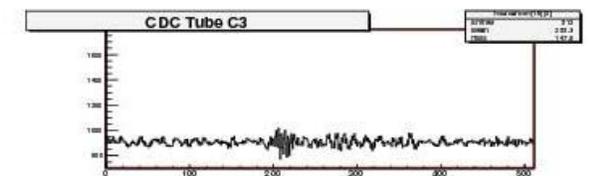
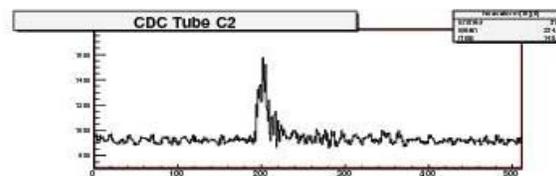
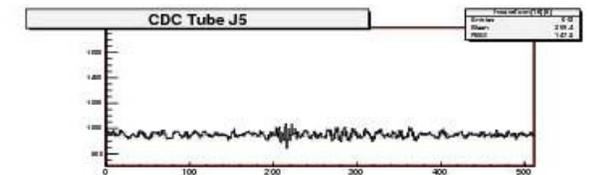
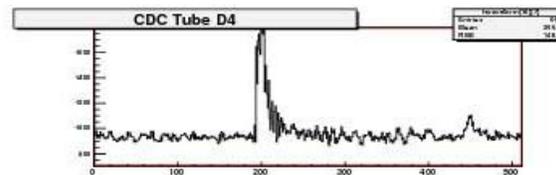
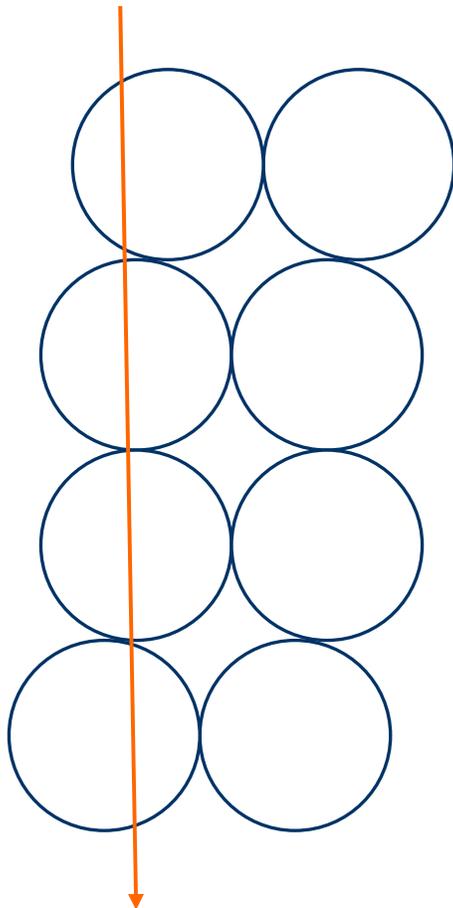
Loose charge division to help pattern recognition.

Simulations



Cosmic Rays

Currently setup with 16 instrumented tubes. This is from a case where we had eight tubes instrumented.



Electronics

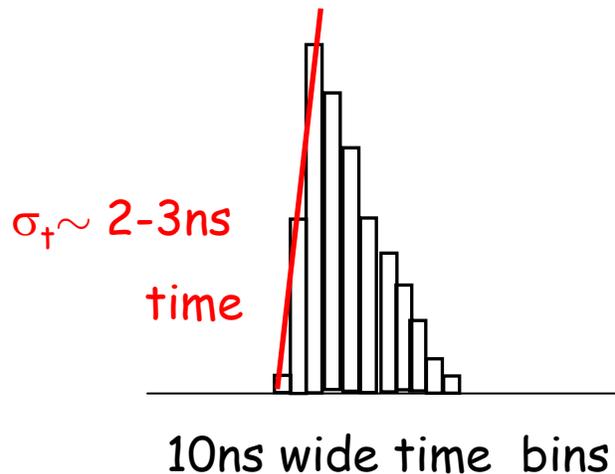
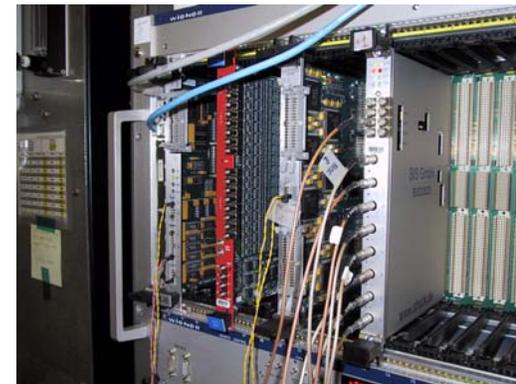
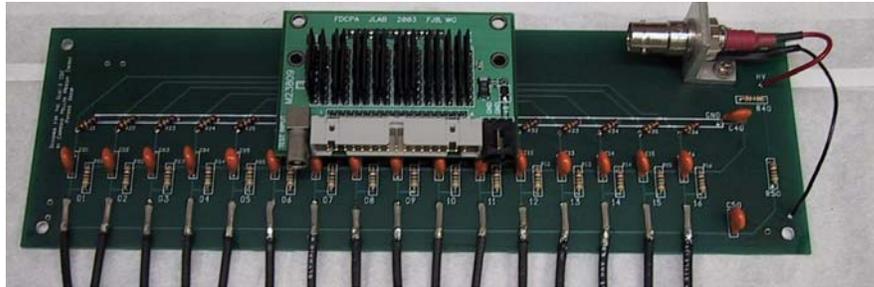
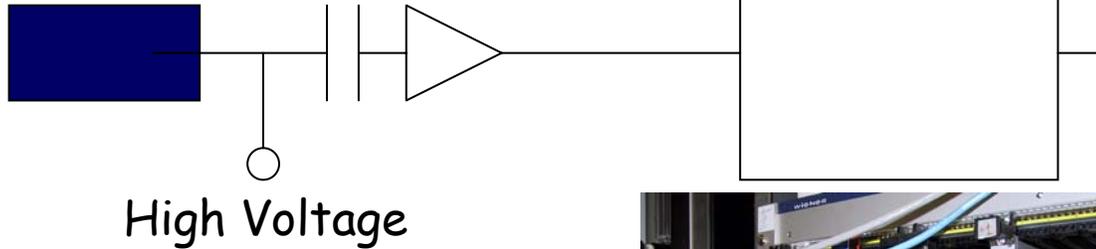
FADC: JLab/IU

Preamp: Alberta/JLab

Straw Tube

Pre-Amp

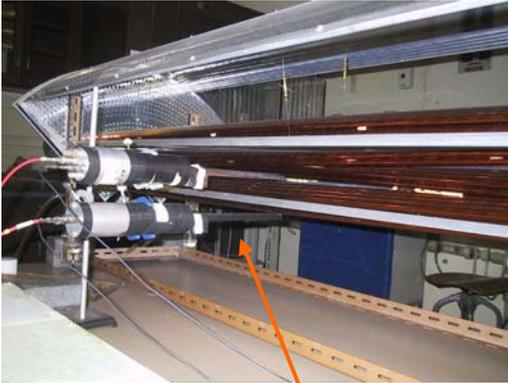
~100 MHz FADC



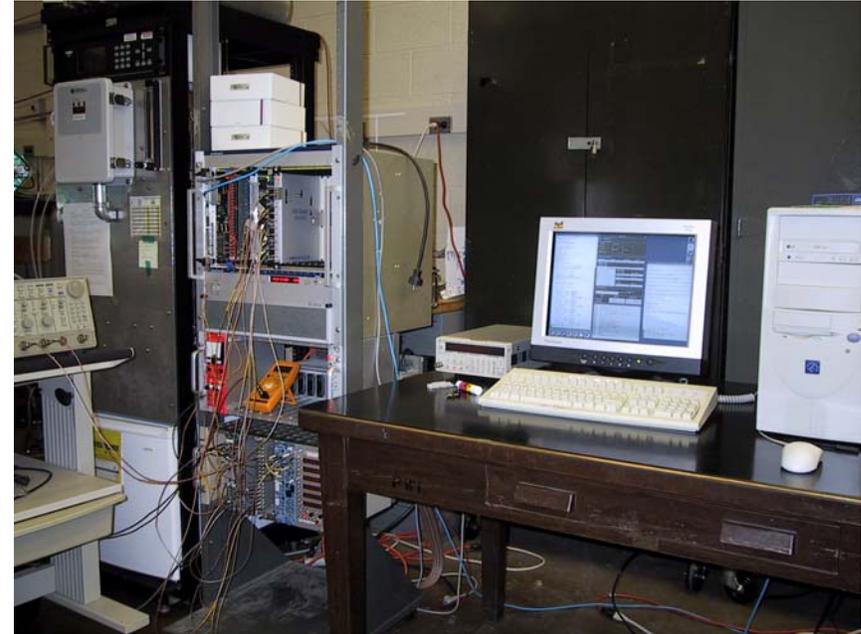
ADC yields dE/dx information

JETSET: NIM A367, 248 (1995)
 dE/dx at 10% resolution in straw tubes.

Data Acquisition System



Trigger Scintillators



Insert details of system.

200 MHz FADC
(Expect that ~100 MHz
will work. Can simulate it
with the 200 MHz system).

Cosmic Ray Tests

Add plots of time zero calculations.

Add plot of time-to-distance relation

Add plot of “radius” of hit.

Discussion of reconstruction algorithm

Building the Chamber

Stringing The Chamber

Select tube



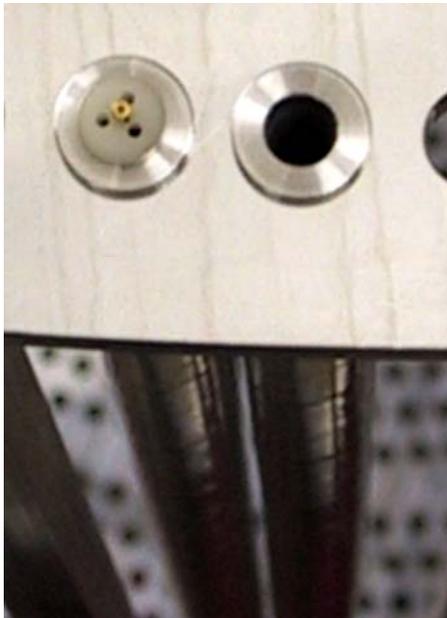
Cut to length



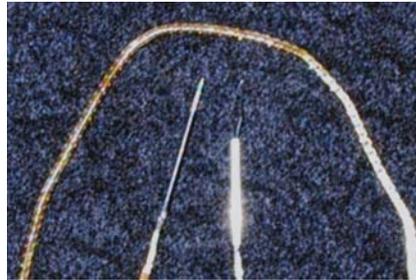
Glue donut



Glue in chamber



Magnetic Feeds



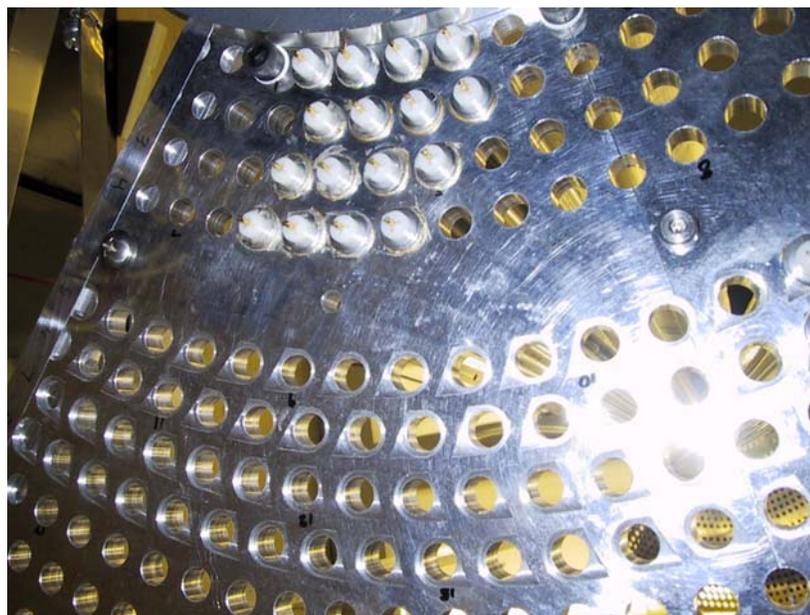
Pneumatic crimper



Vertical stringing



Prototype Construction

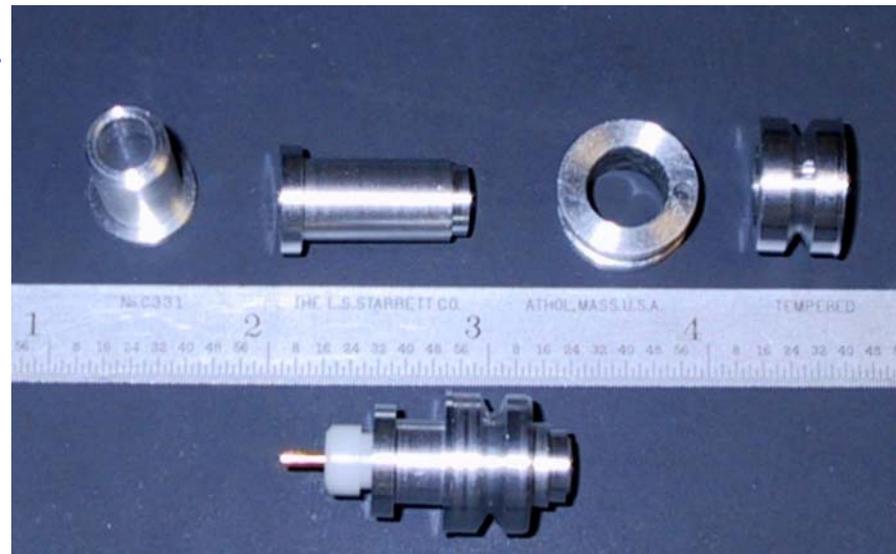
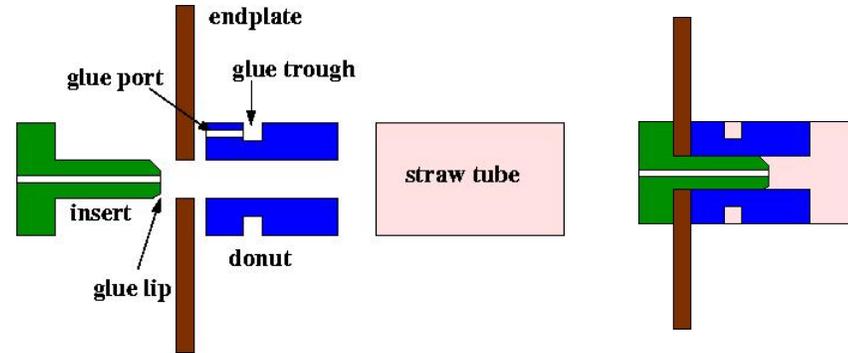


Gas Leaks

A problem with straw tube chambers is that the glue joints leak.

Designed, built and tested a feed through system that forms a solid glue seal.

System has held several psi overpressure for nearly a year.



Building the Final Chamber

Machine Endplates in industry
Acquire Shells
Machine Al and Delrin Donuts
Acquire Crimp pins
Acquire Straw tubes
Acquire Wire

Parts need to be spec'd, ordered and checked.

Tube building takes about 15 minutes per tube (1 person)

Tube installation takes about 15 minutes per tube (2 people)

Tube stringing takes about 15 minutes per tube (2 people)

Electrical and gas hookup times are still not definitive.

3 to 3.5 year to build the final chamber