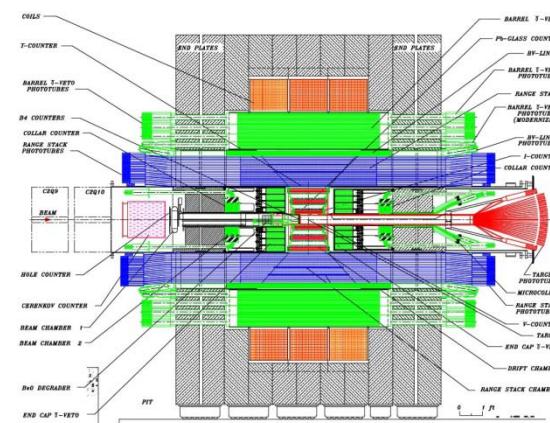
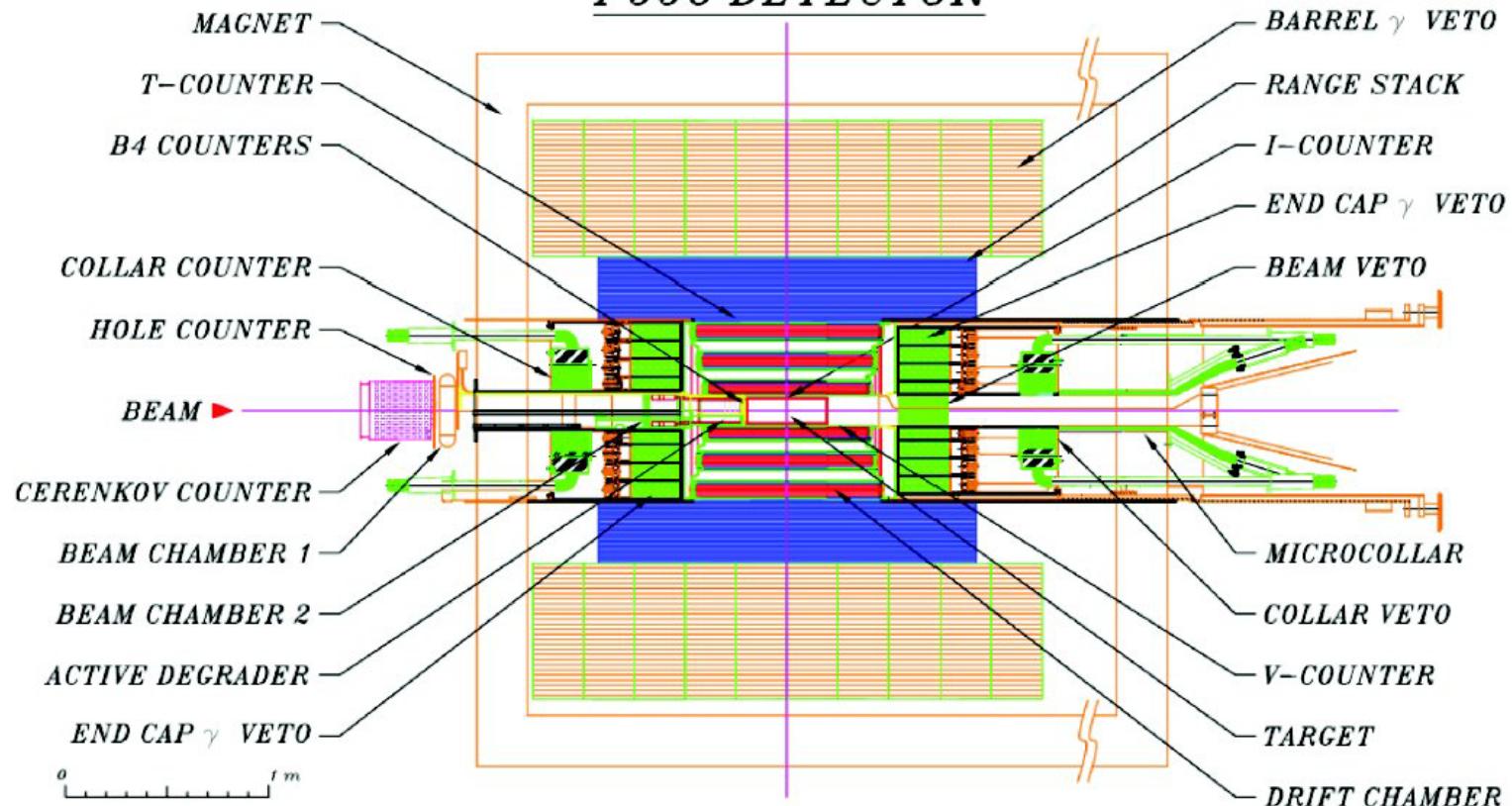


# ORKA Drift Chamber

## ---from E949 to ORKA---

Toshio Numao  
TRIUMF

# P996 DETECTOR



# Requirements

- Single track with  $p=100-250$  MeV/c

- R/P, P/E for particle ID

- Define P acceptance by  $P + \Delta T_g$

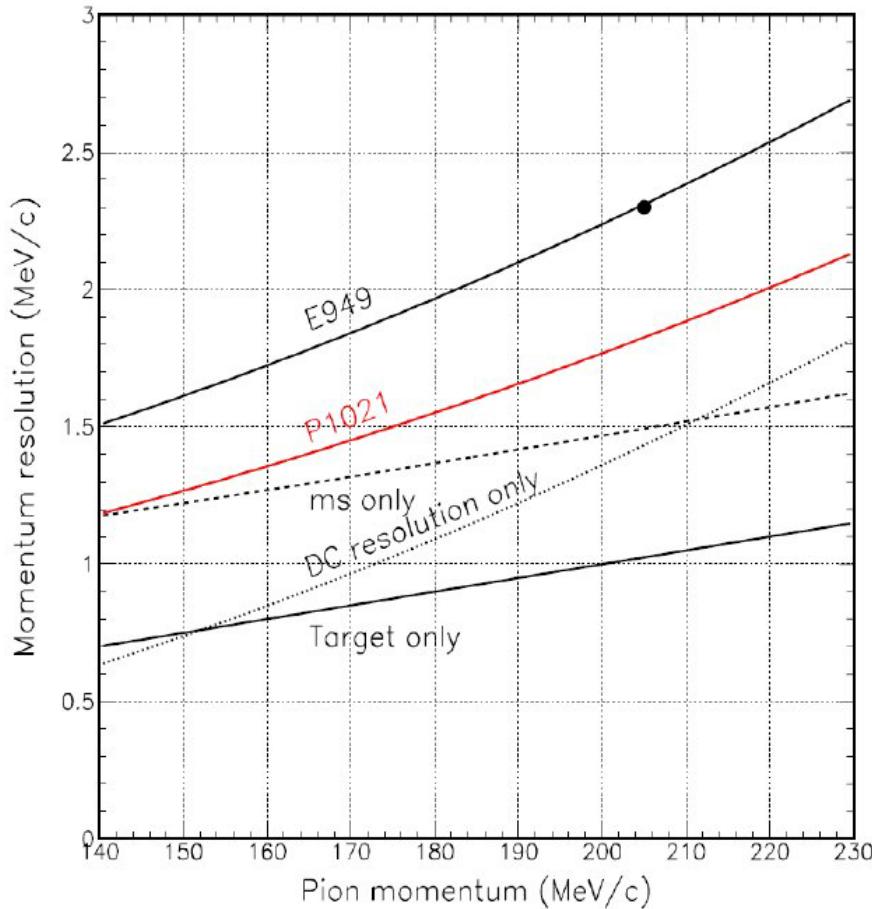
- Detect extra tracks

Improvements over E949

- $\Delta p = 0.9 * E949$

- Dip angle up to  $\pm 45$  degrees.

- Rate = E949 \* 10 (may be 3)

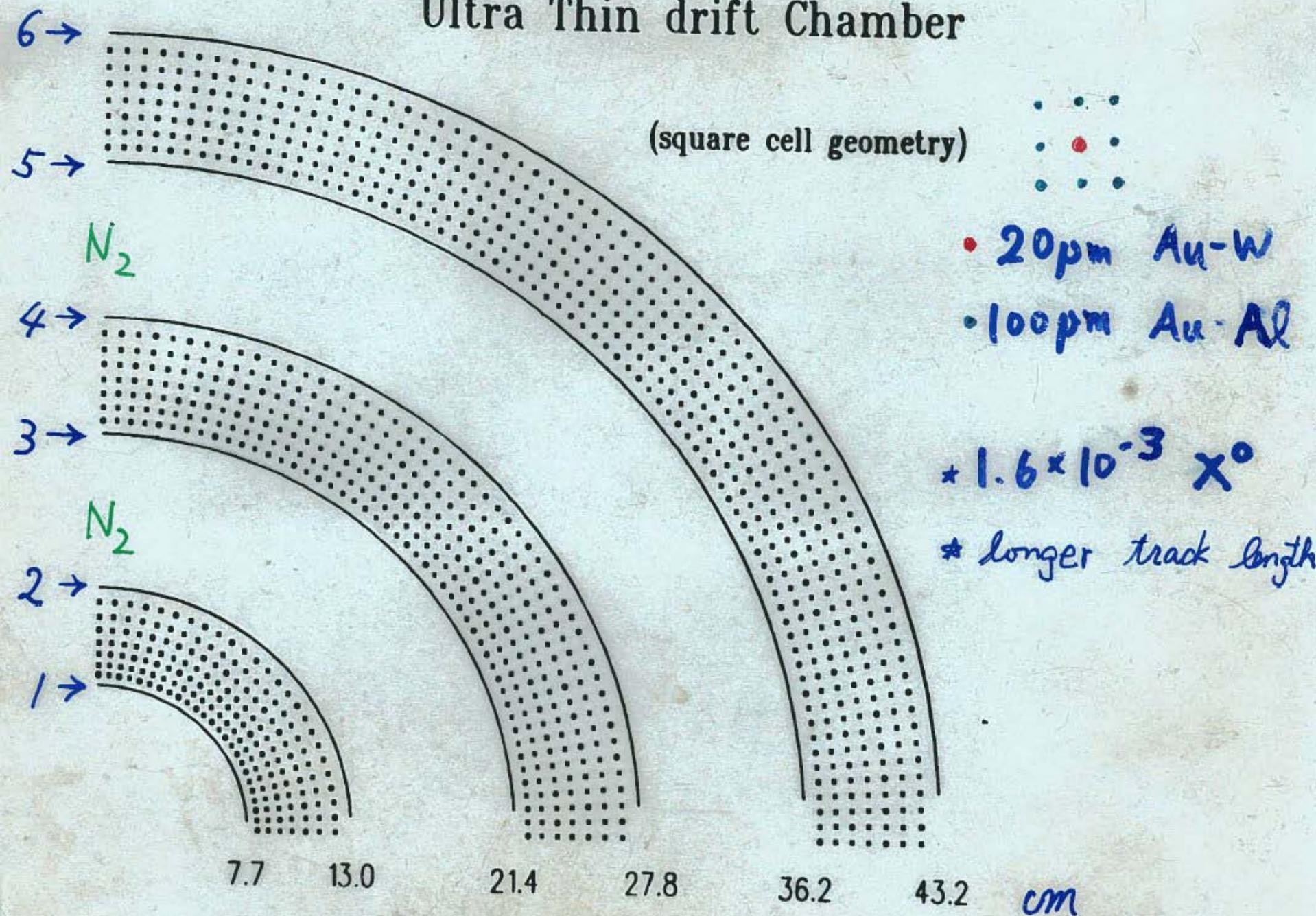


# E949 DC Design Principle

Learned from E787 chamber (5-Super-Layer JET chamber)

- Limited by MS
- Stereo Super Layers (2,4) → poor z-resolution ( $\sigma=2.5$  mm)
- Additional inner wire chamber → Inner region available  
10 % improvement in  $\Delta P$
- 3 super layers each with 4 layers.
- Fill the gaps with light gas (Ar is a bad gas).
- Leave a possibility of He based gas for the active region.
- Cathode readout for z-measurement.
- No support structure in the middle.  
(self-supporting foils by differential pressures)

# Ultra Thin drift Chamber



# Summary of radiation length

Single layer of foil (6-8 mm wide strips)

1mil Mylar  $9 \times 10^{-5}$

2000 A Cu  $1.4 \times 10^{-5}$

Single layer of Al-wire cathode plane

2 100- $\mu\text{m}$  diameter Al wires / cm  $1.8 \times 10^{-5}$

Single layer of anode plane

1 100- $\mu\text{m}$  diameter Al wire /cm  $0.9 \times 10^{-5}$

1 20- $\mu\text{m}$  diameter of W wire /cm  $0.4 \times 10^{-5}$

E949 chamber Total

Foils 4 middle foils  $0.4 \times 10^{-3}$

Wires 3 x 4 cathode planes  $0.2 \times 10^{-3}$

4 x 4 anode planes  $0.2 \times 10^{-3}$

Gas 15 cm Ar/Ethan  $0.9 \times 10^{-3}$

16 cn N2  $0.4 \times 10^{-3}$

# Mechanical structure

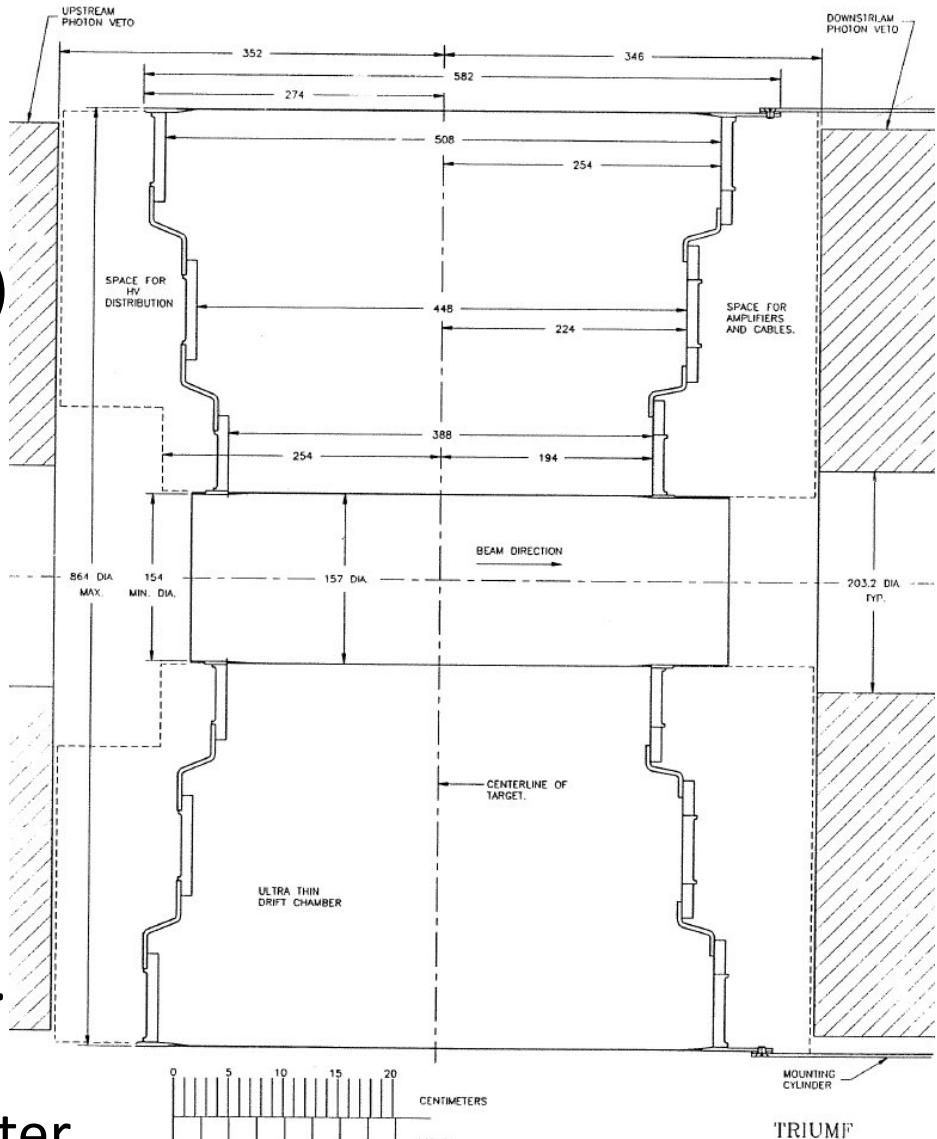
End plates: 1.2cm Ultem (inner)  
1.2cm Noryl (mid,out)  
0.4cm Al

Inner cylinder: 0.04 cm G10  
Outer cylinder: 0.01cm C-fiber

Wire load: 400kg (A:40g, C:100g)

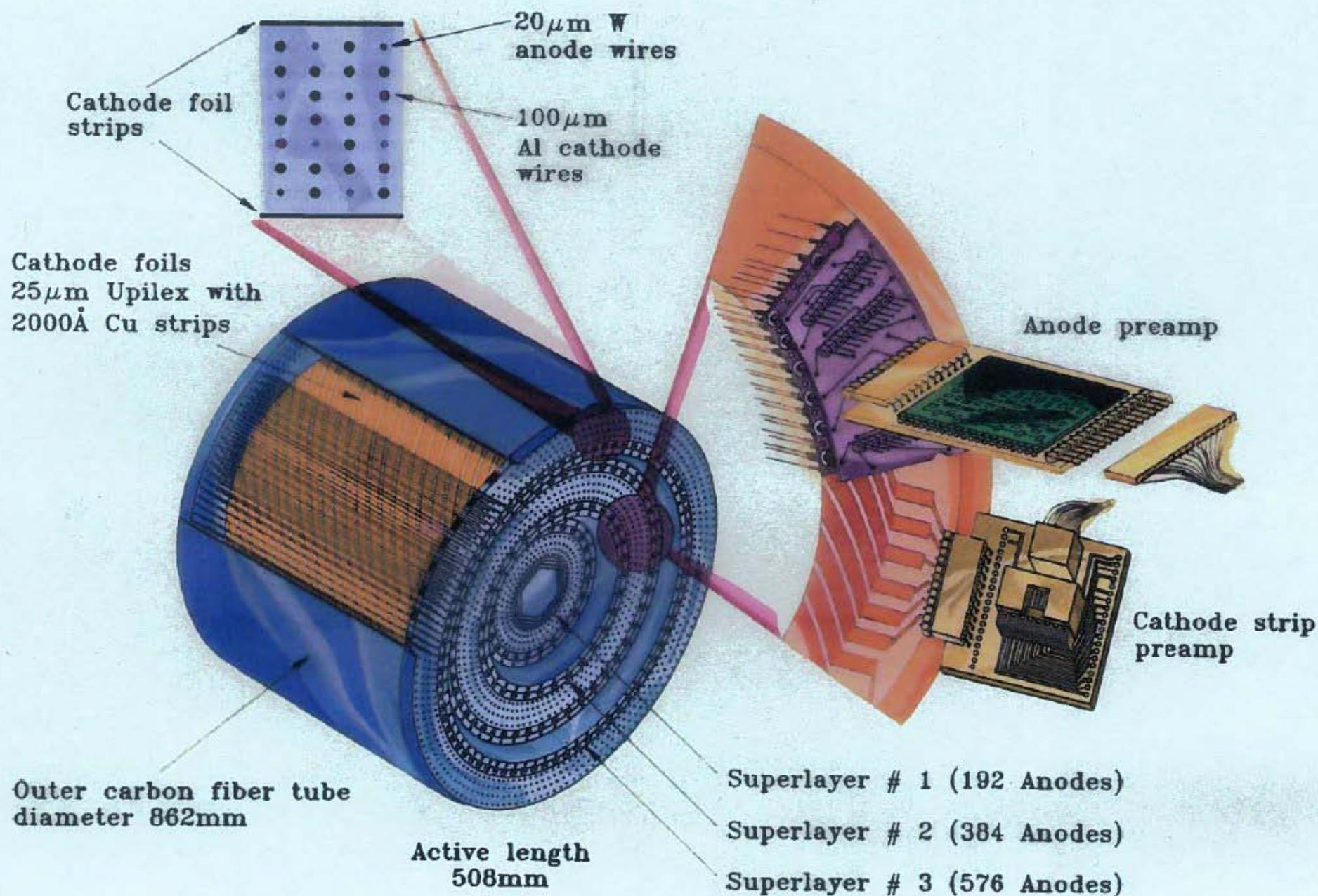
Support rods while stringing.  
Pre-stressed by compression rods.

Vertical stringing from inner to outer.

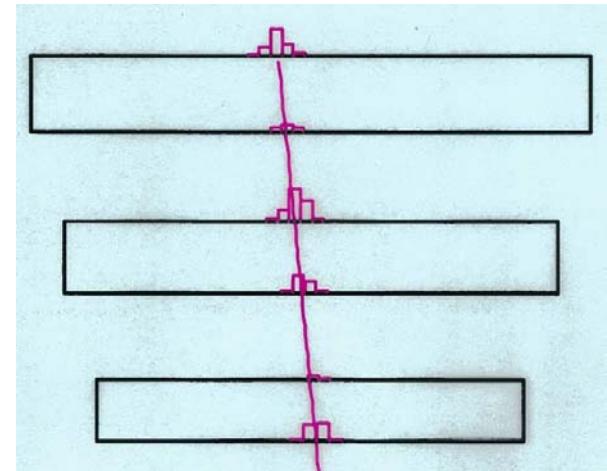
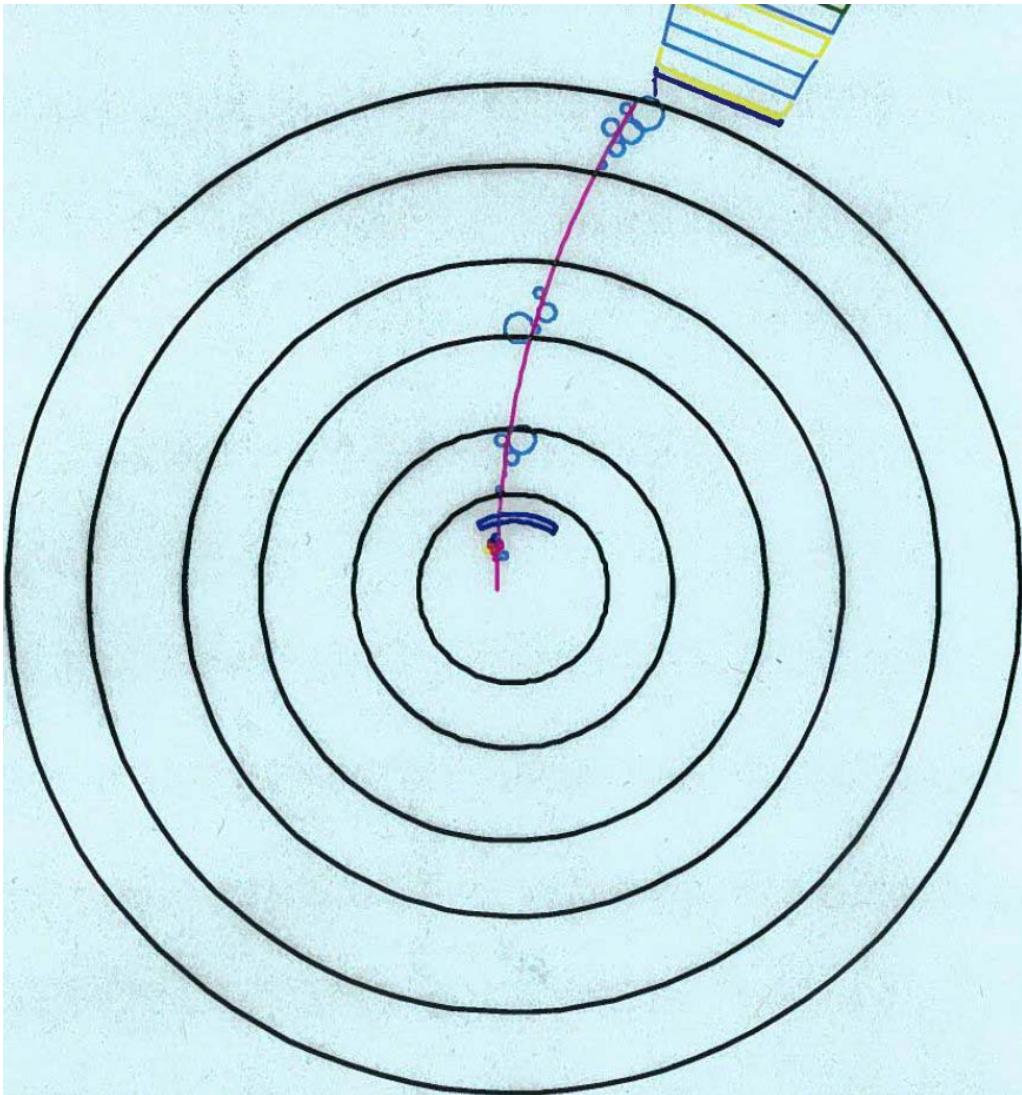


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# E787 Central Tracking Drift Chamber

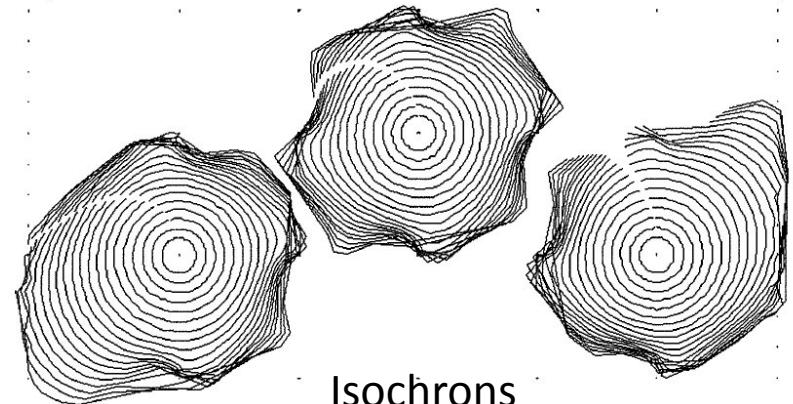
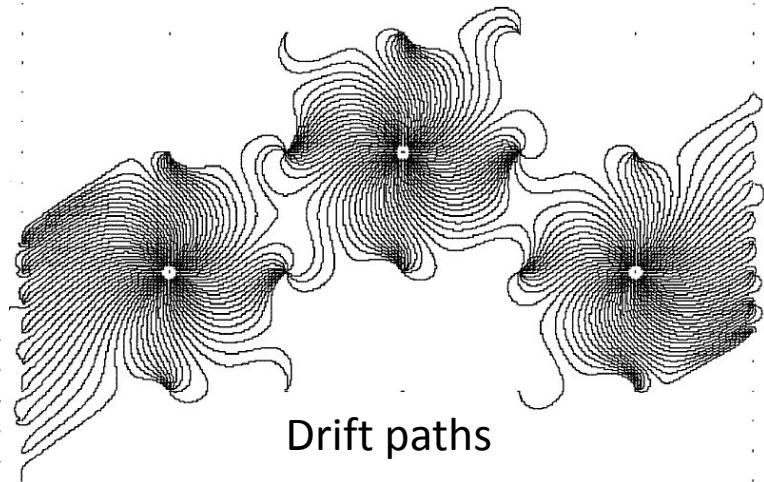
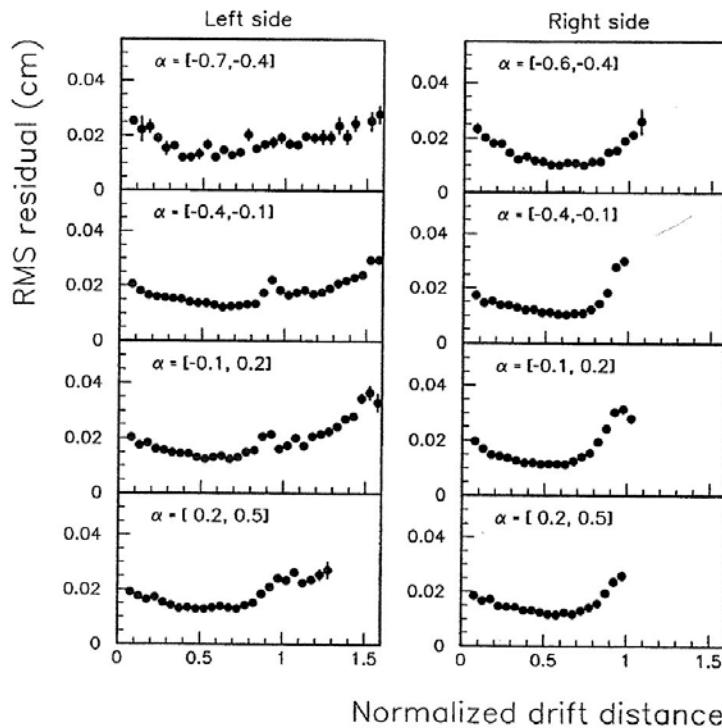
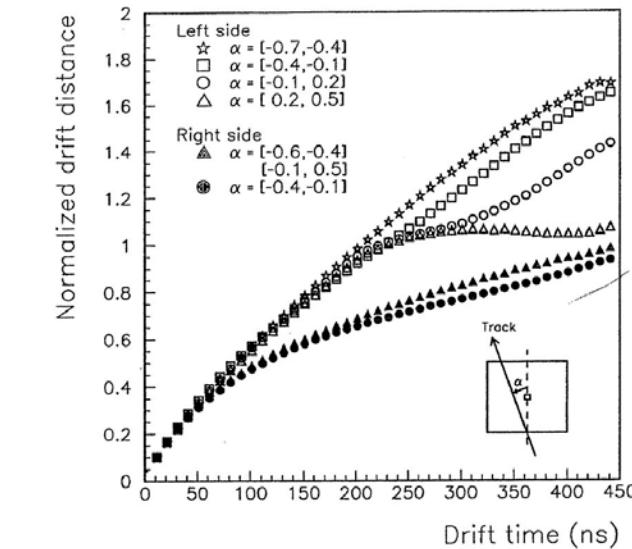


# Typical track



Anodes: # of hits  $> 4/\text{SL}$   
99% efficient  
# of Cathode hits: 2-5  
At high rate: less efficient

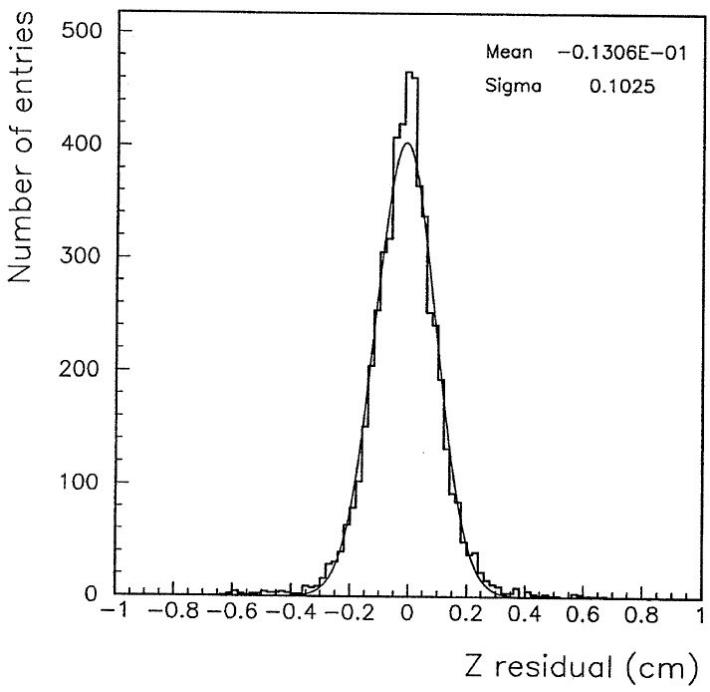
# Space-time relation



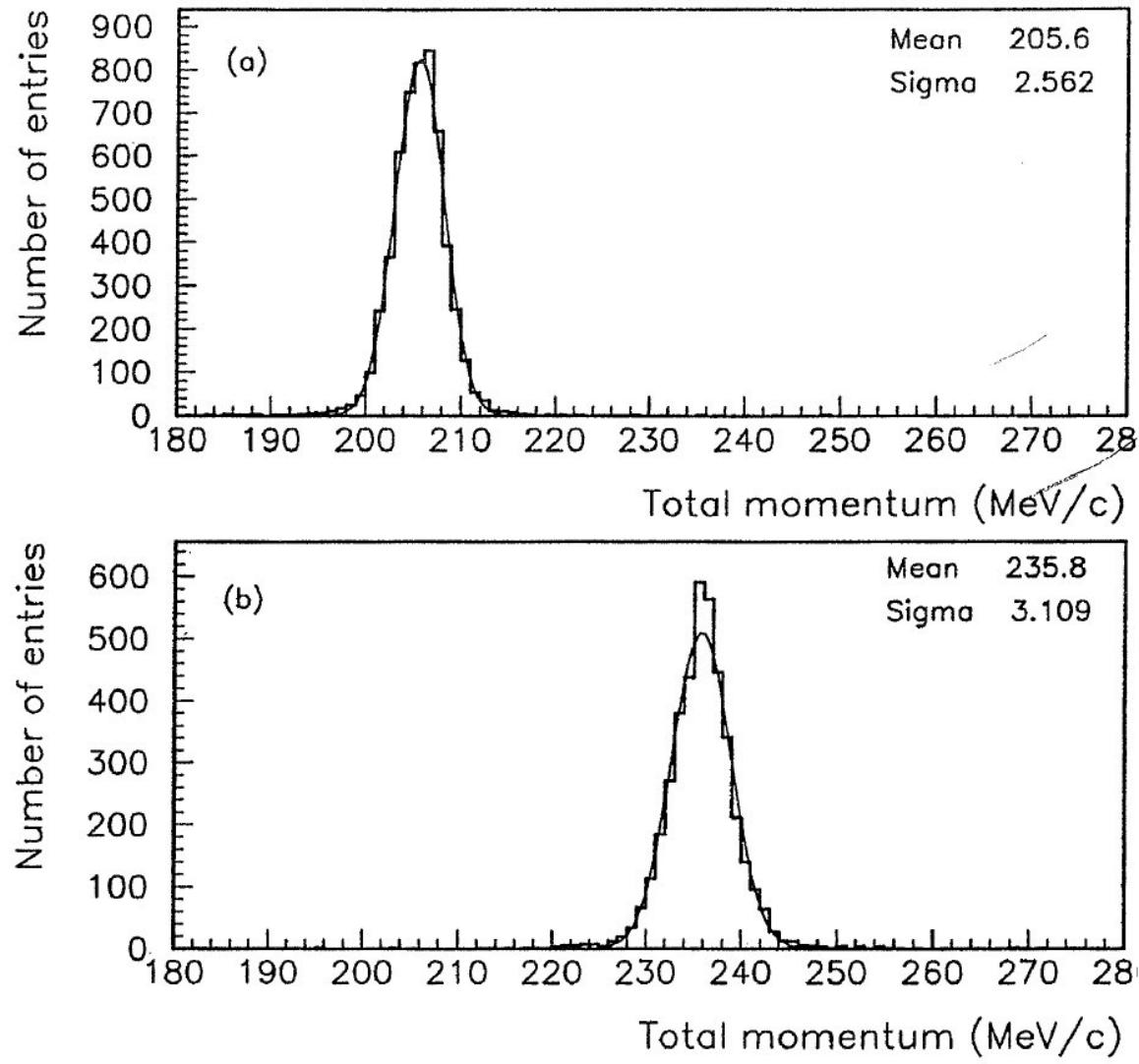
Not symmetric at the foil layer.

# Resolutions

Consistent with MC (2.3)  
including 1.8 from Target



Z-resolution



# Improvements toward ORKA

Better resolution beyond the higher B-field effect?

- Longer path length?
  - Larger OD possible?
- He based gas to reduce MS?
  - (Very small improvement by filling the N2 layers with He).
- Smaller/hexagonal cells? Thinner super-layers → less Ar.
- GEM or Si-strip detectors at inner/outer radius?

Higher rates

- Cathode shaping time is too long.
  - Also, AC coupled → DC coupled? Record waveform?
- Thinner cathode strips to match the cell size?
  - Better s/n ratio?

Longer Chamber

- Z-resolution ok? Wire stability? Foil angle? Attenuation?

Photon veto

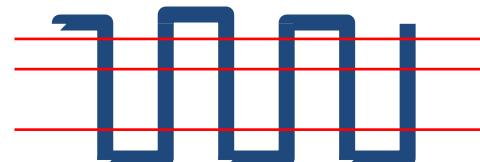
- Active end plates? Mixing active material in the endcap?

# Range Stack Chamber

Located around layers 10 and 14.

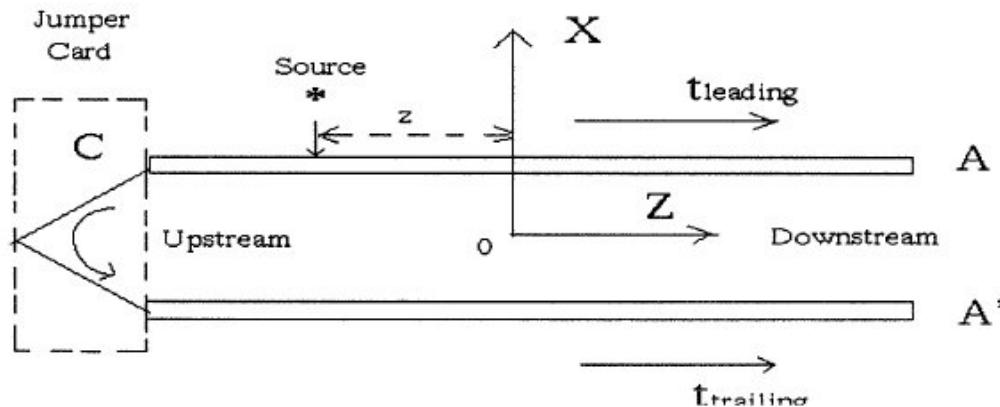
Provides axial coordinate (wire) and z coordinate.

E787 Proportional wire chamber with serpentine cathode strips (delay line).



- Efficiency variation
- strip-strip cross talk (more direct path)

E949 Straw chambers (delay in wire provided Z).



# RSSC

Operated in self-quenching streamer mode

- Large pulse

## Problems

- Position dependent resolution due to attenuation
- Nonlinearity
- Cross talk effect
- New amp/discriminator. Resolution = 3 cm.

## ORKA

Wire chamber is Ok, but

- 3 cm z-resolution good enough?
- Longer chamber → more attenuation.
- Wire sagging, instability?

Other possibilities?