

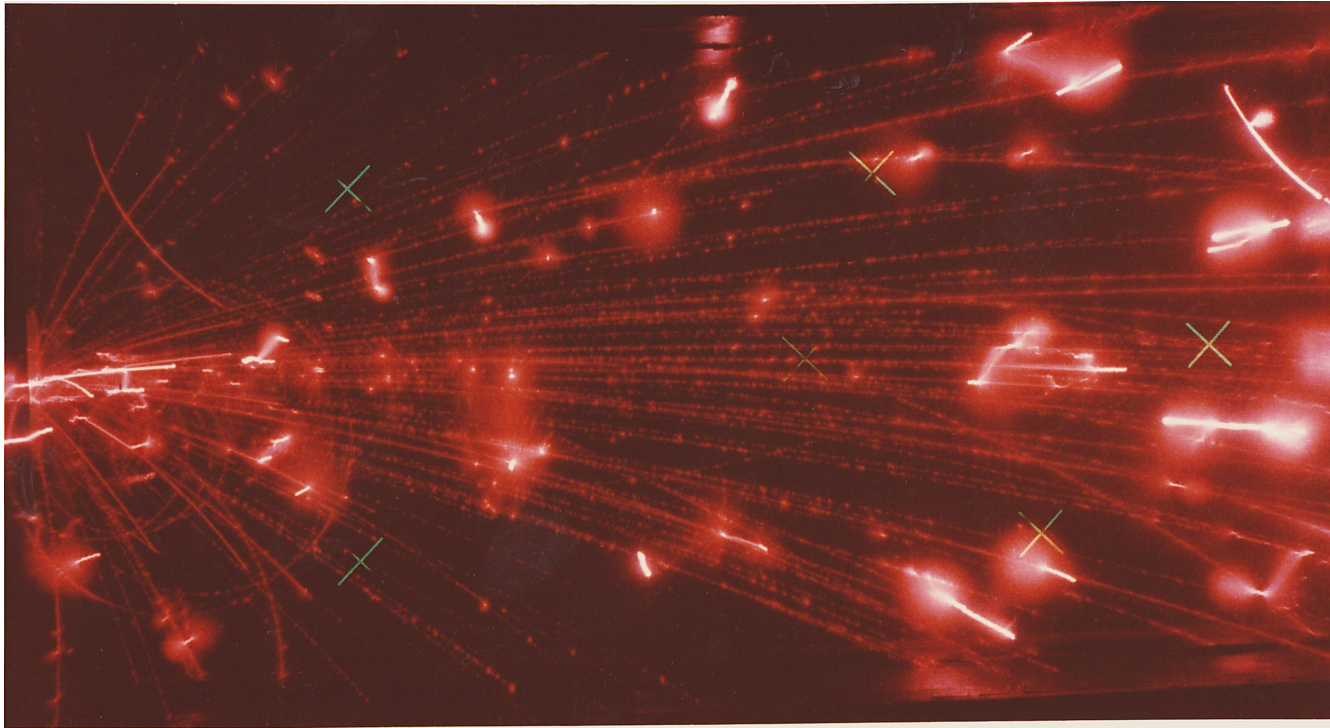
# **Beginnings at BEVALAC and AGS**

**Hans Georg Ritter  
LBNL**



Dec. 1, 2023

# Streamer Chamber



**960 MeV/nucleon U-U**

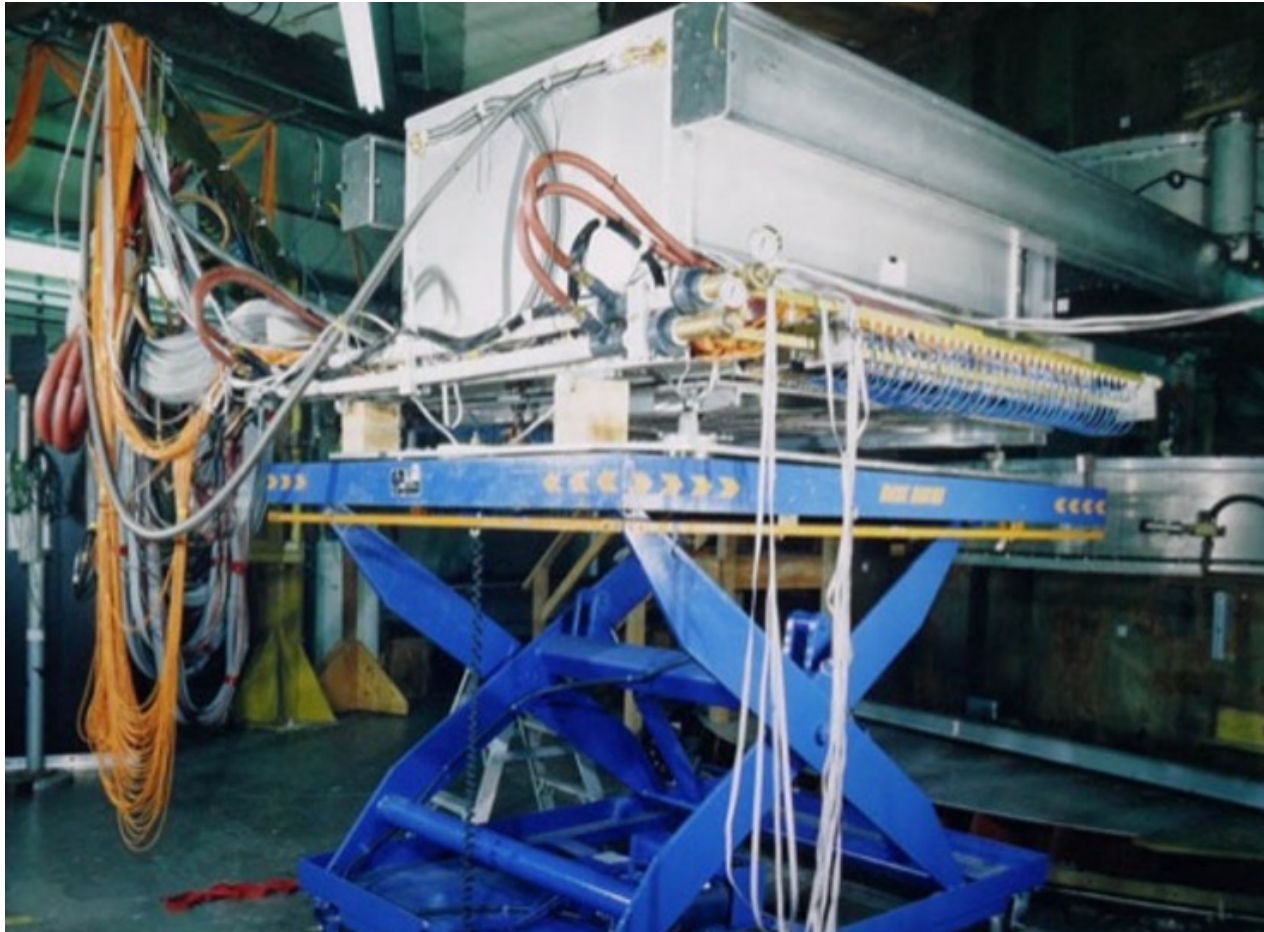
Exp. 739H-U.C. Riverside  
LBL Streamer Chamber

Feb. 18, 1984





# EOS TPC



**Study heavy ion collisions between 200 and 2000 AMeV  
Declan was spokesperson for the low energy part of the  
program**

# EOS TPC – A TPC with many Innovations

Howard Wieman designed and built a TPC for HI

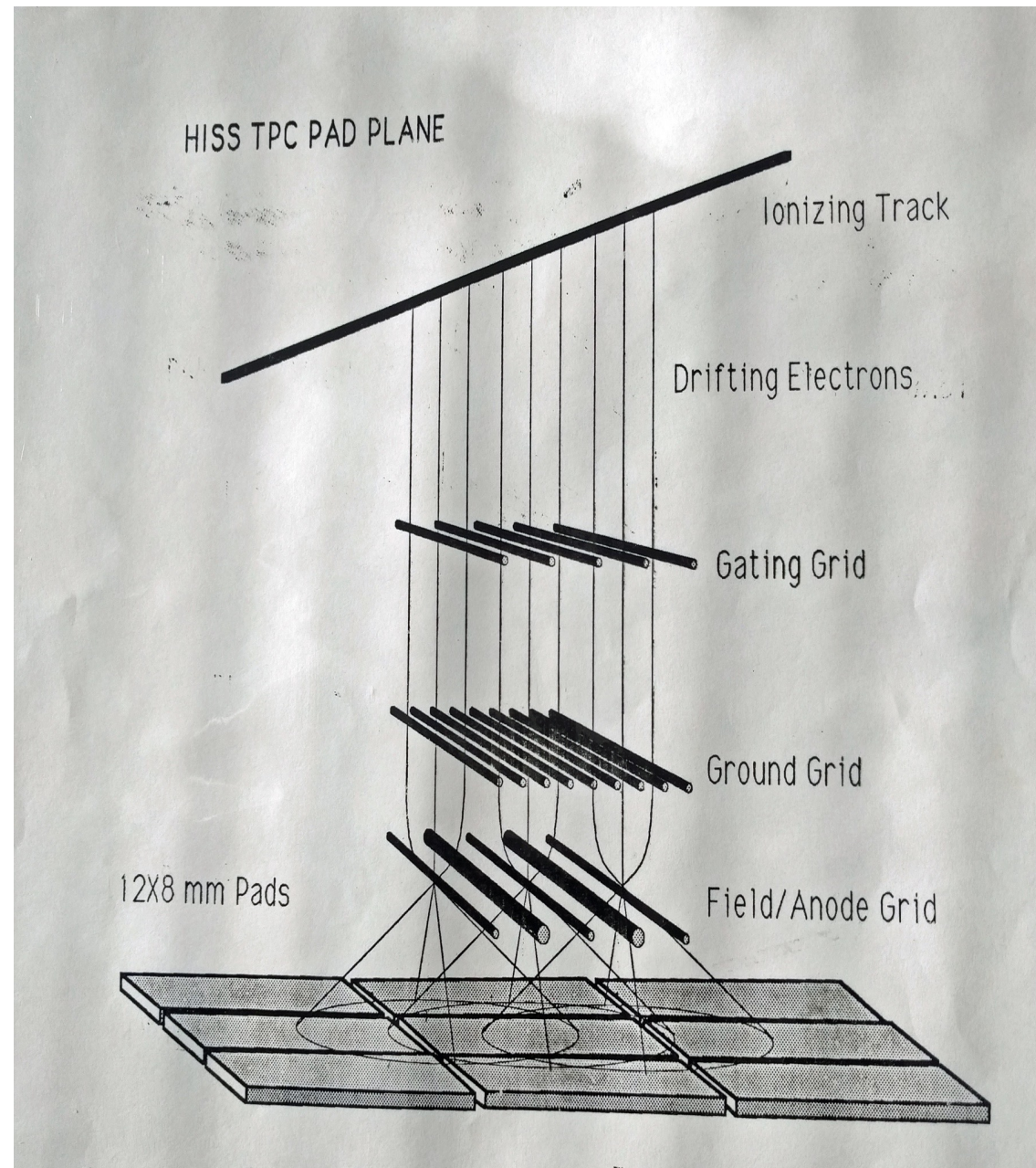
3D coordinate info from drift time and shape of signal induced on pad plane

All electronics on pad plane

Stuart Kleinfelder designed microelectronics (switched capacitor array) for storing time development of pad signals

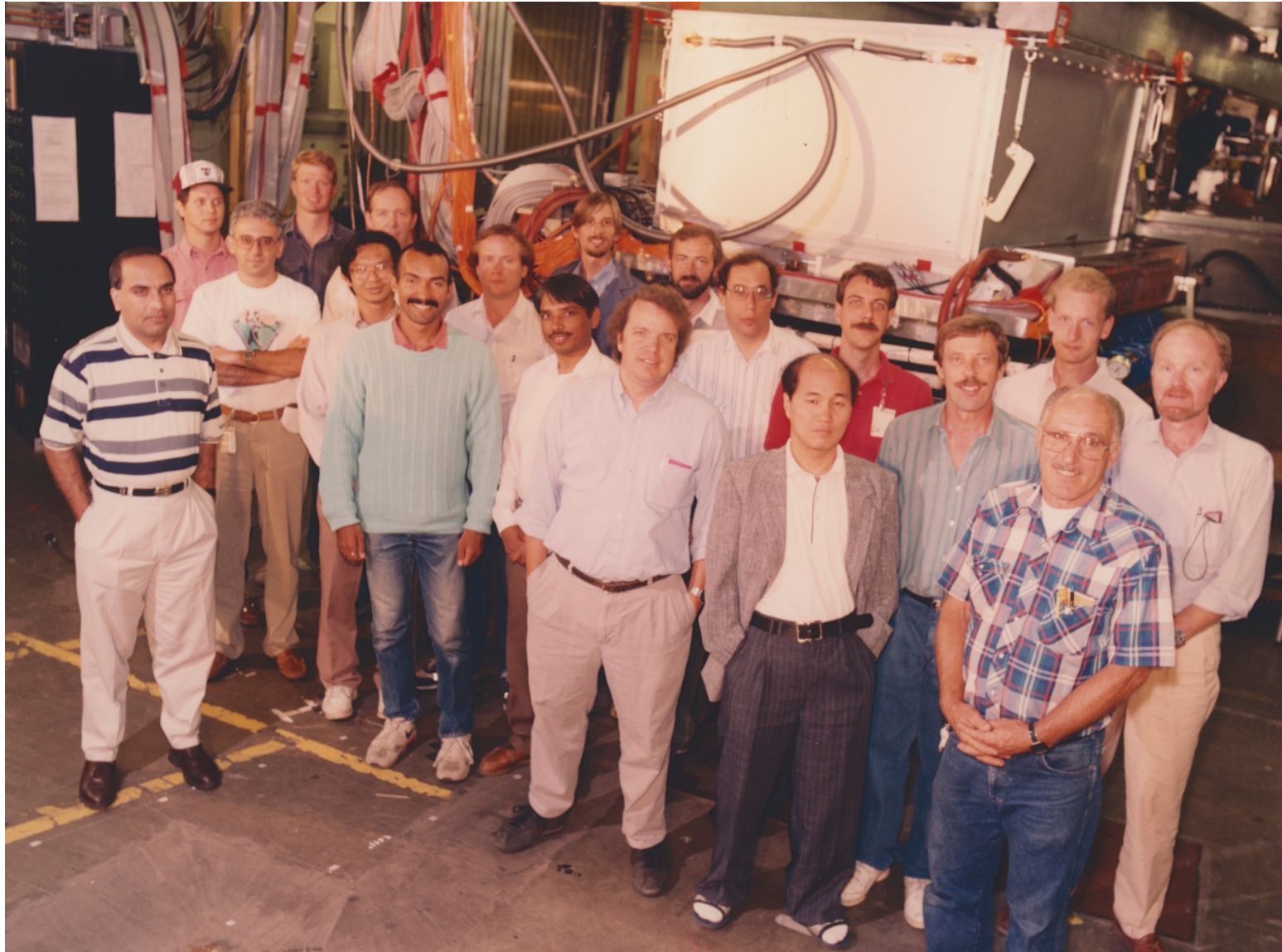
Signals transferred by fiber optic cables from pad plane to counting house

EOS TPC was prototype for STAR. STAR added integrated preamplifier



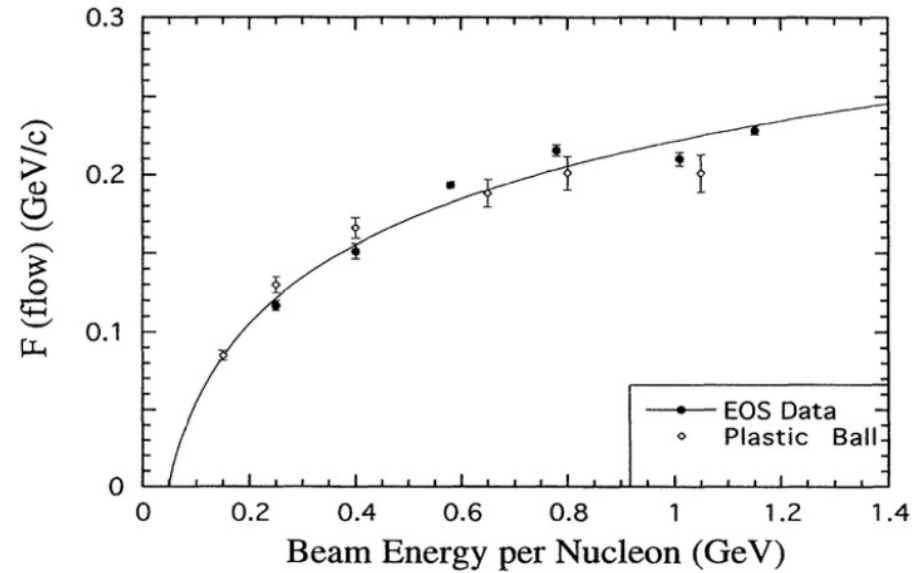
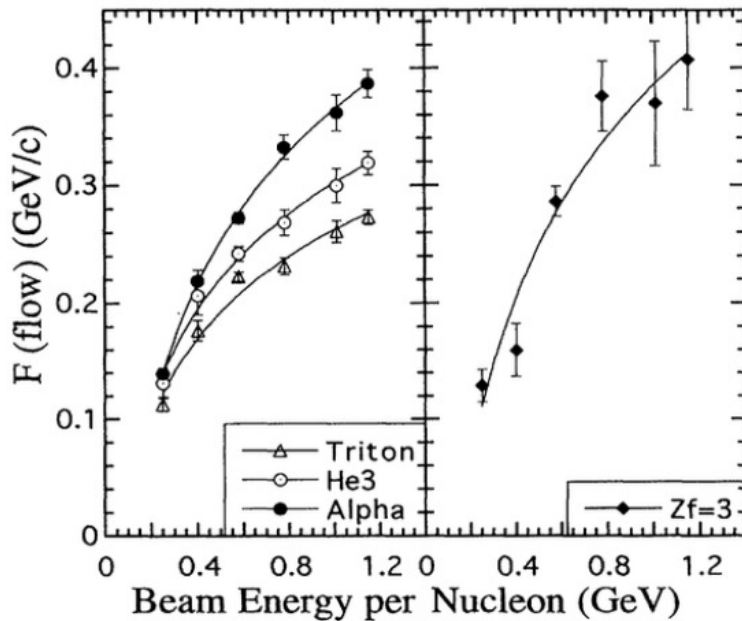


# EOS Group



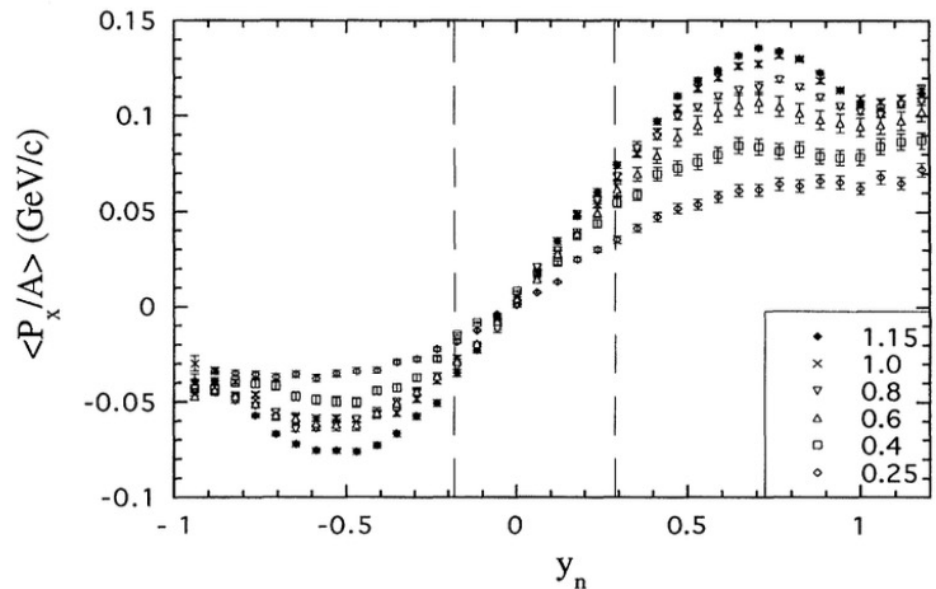
# Fragment Flow ( $v_1$ ) in Au + Au Collisions

M.D. Partlan et al., EOS Collaboration. PRL 75. 2100 (1995)

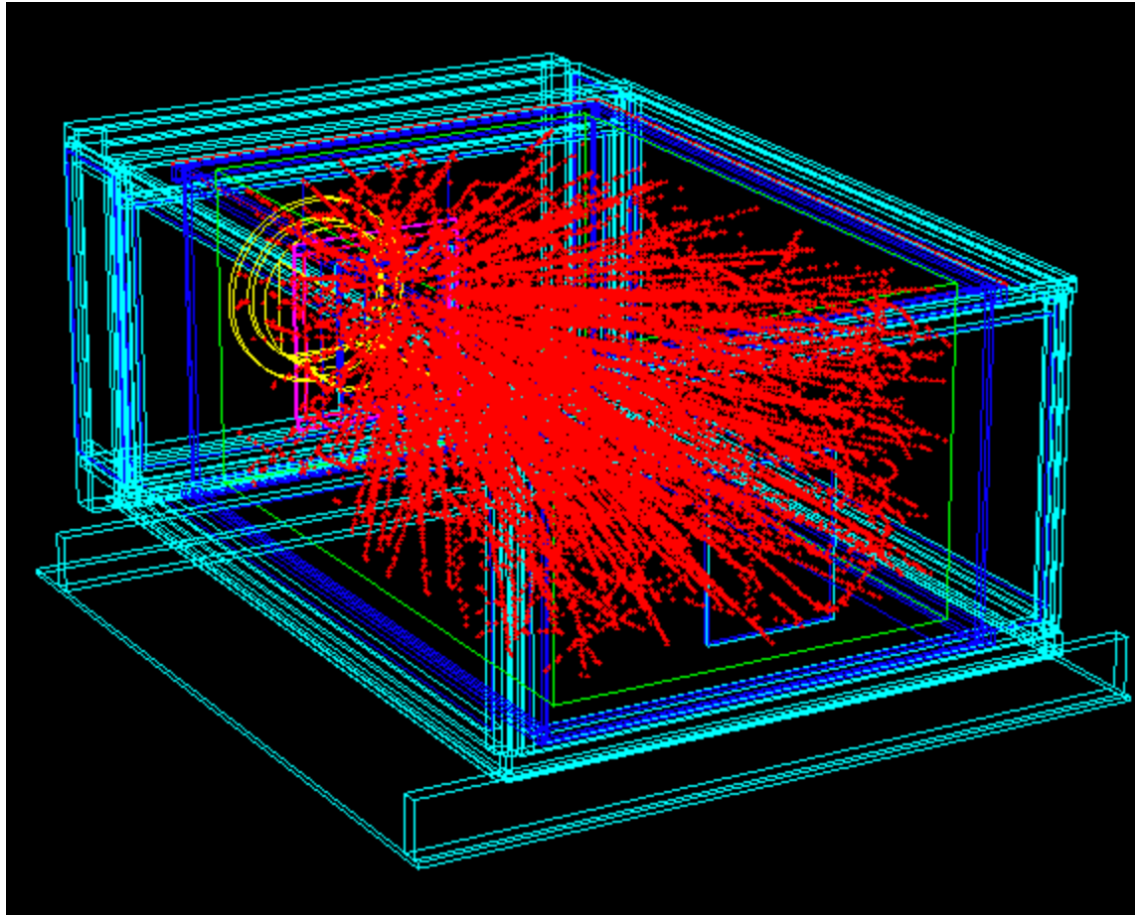


$$F = d\langle p_x/A \rangle / dy_N$$

**F increases with beam energy**  
**F increases with fragment mass**



# E895 – EOS TPC @ AGS



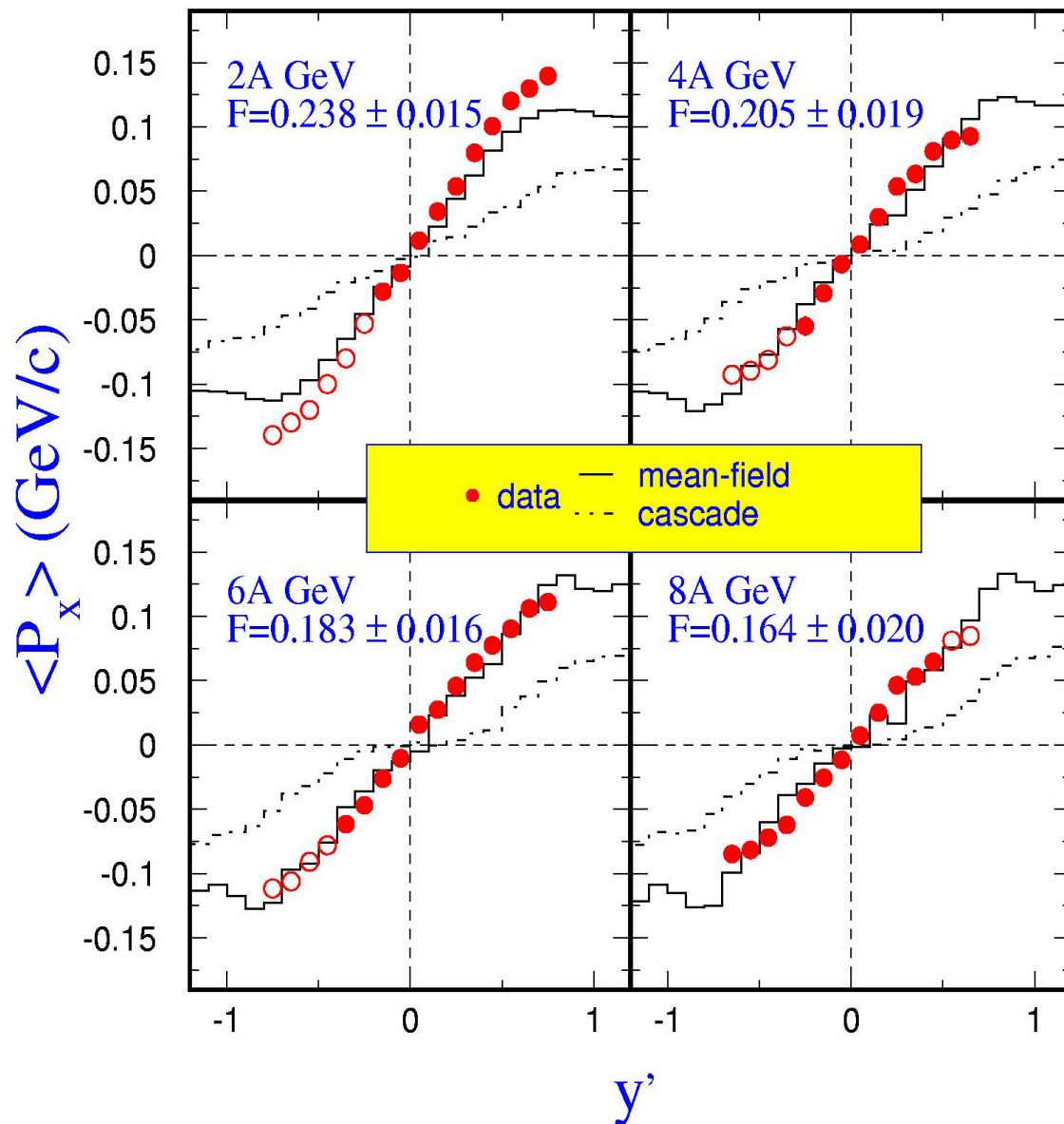
**Au + Au 4AG**

- **Study energy dependence of flow between 2 – 8 AGeV**
- **Search for collapse of flow due to phase transition**
- **G. Rai spokesperson**
- **Declan became spokesperson for the analysis of data**



# Proton Directed Flow ( $v_1$ )

H. Liu et al., E895 Collaboration, PRL 84, 5488 (2000)



Sideward flow is large

Mean field seems to be important

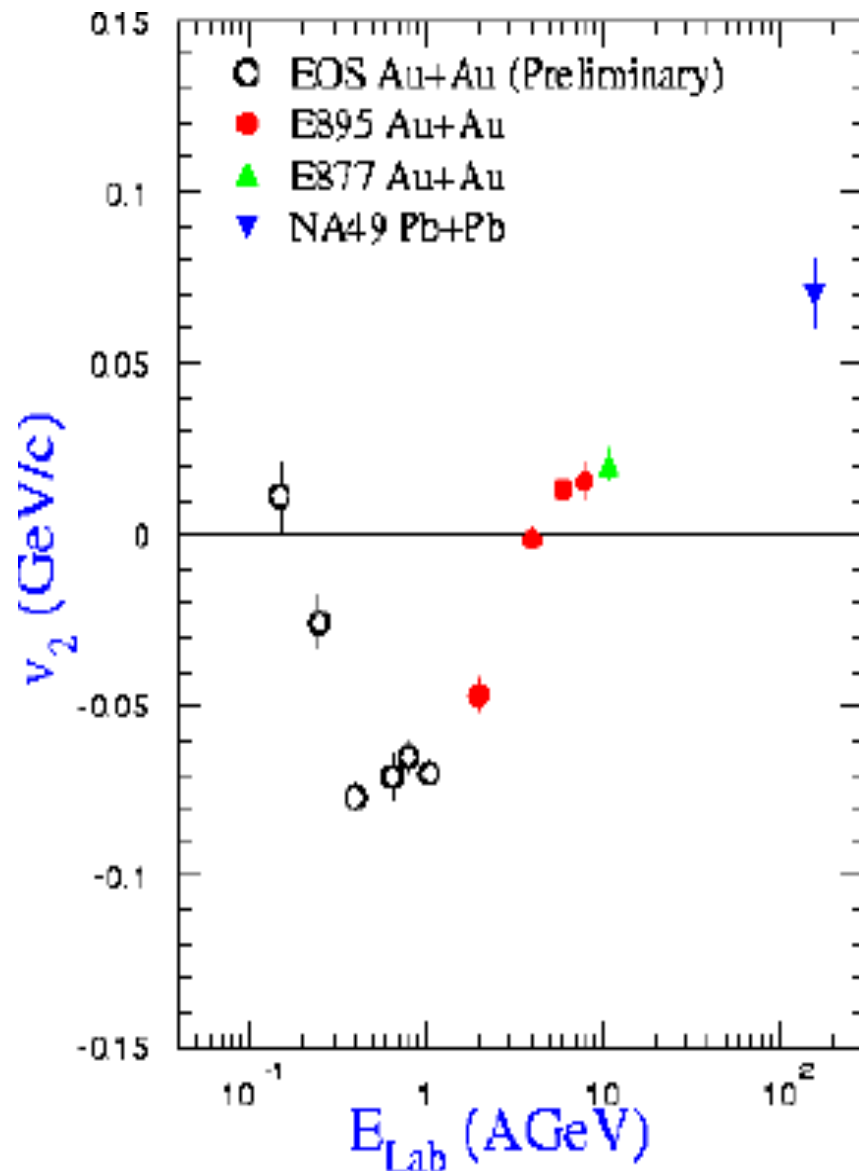
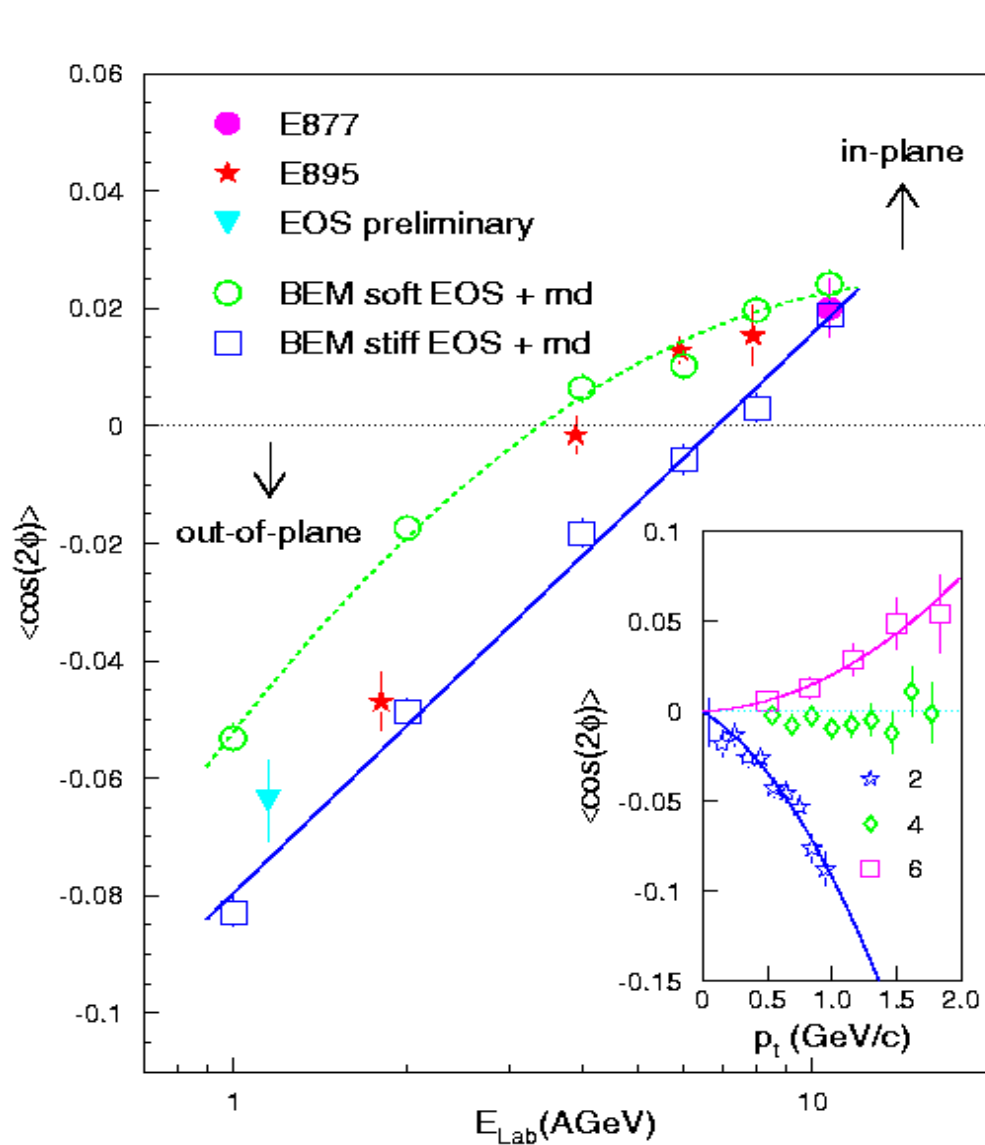
Define flow parameter  $F$   
as slope at mid-rapidity

$$F = \left. \frac{\Delta \langle P_x \rangle}{\Delta y'} \right|_{y'=0} \quad y' = y/y_b \text{ in cm}$$

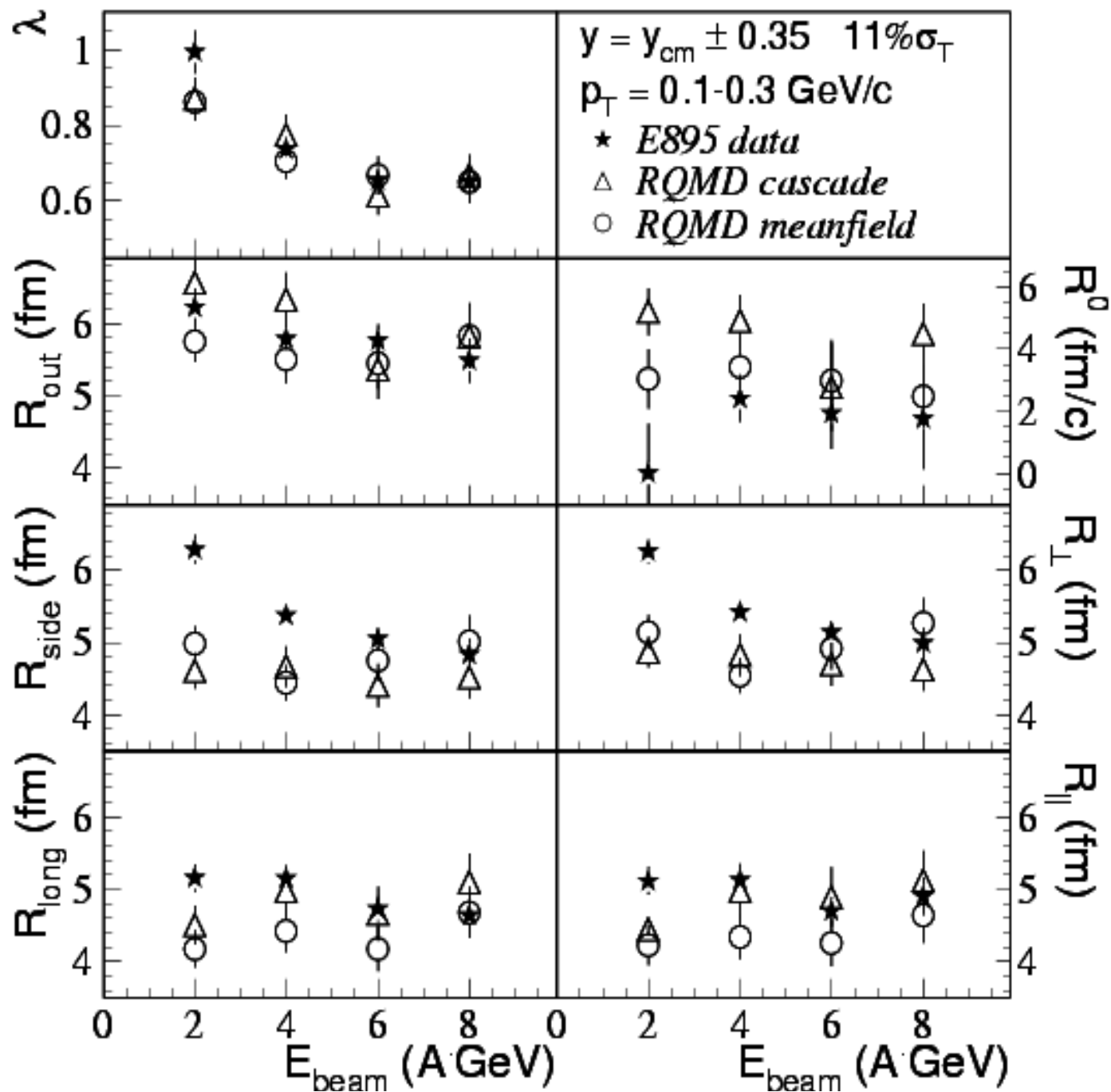


# Elliptic Flow ( $v_2$ ) Transition from Out-of-Plane to In-Plane

C. Pinkenburg et al., E895 Collaboration, PRL 83, 1295 (1999)



# Pion HBT excitation function



Mike Lisa et al.,  
PRL 84, 2798  
(2000)

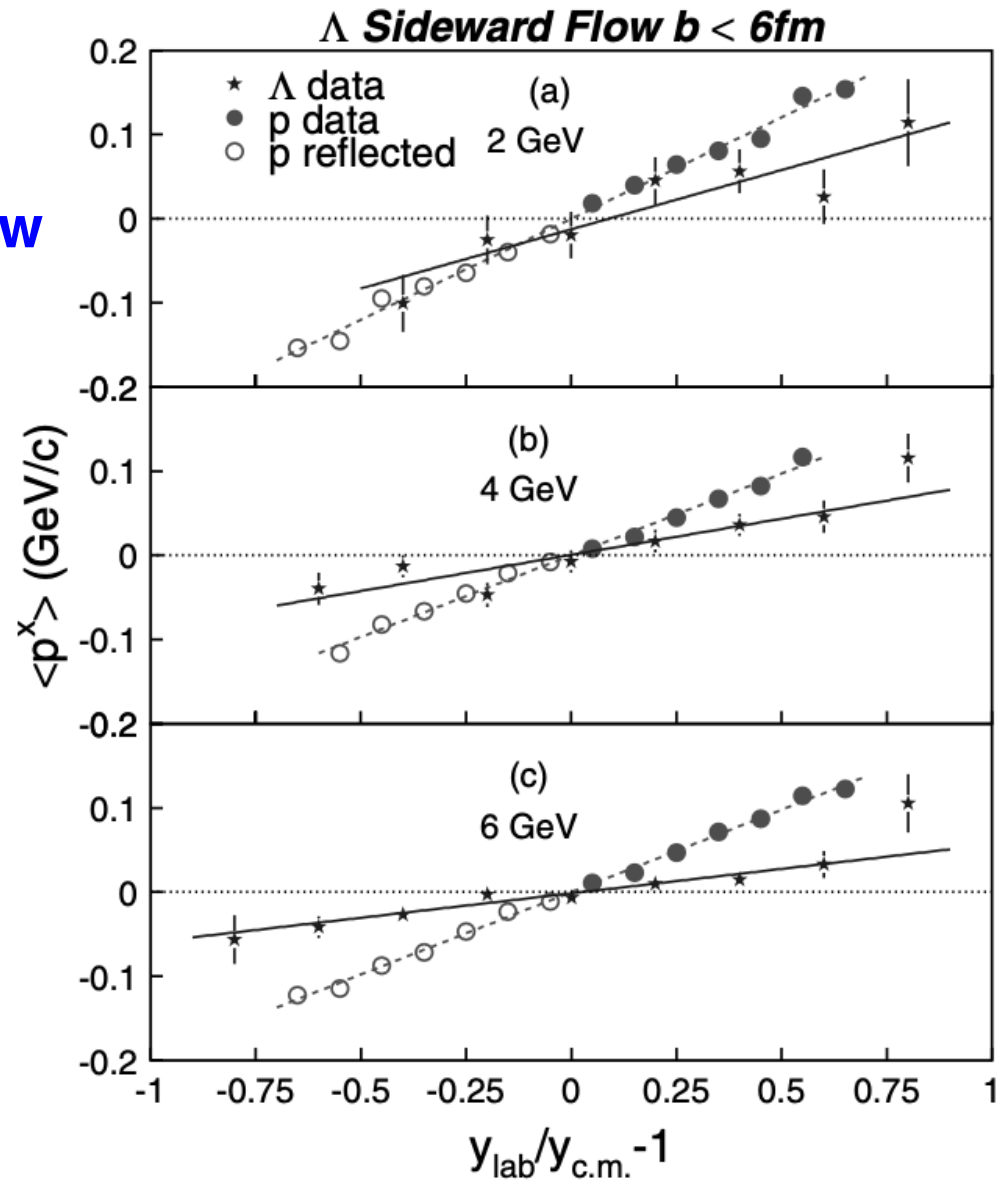
Compilation of  
HBT parameters at  
2, 4, 6, and 8 AGeV



# $\Lambda$ Flow

P. Chung et al., E895 Collaboration, PRL 86, 2533 (2001)

$\Lambda$  Flow is weaker than proton Flow

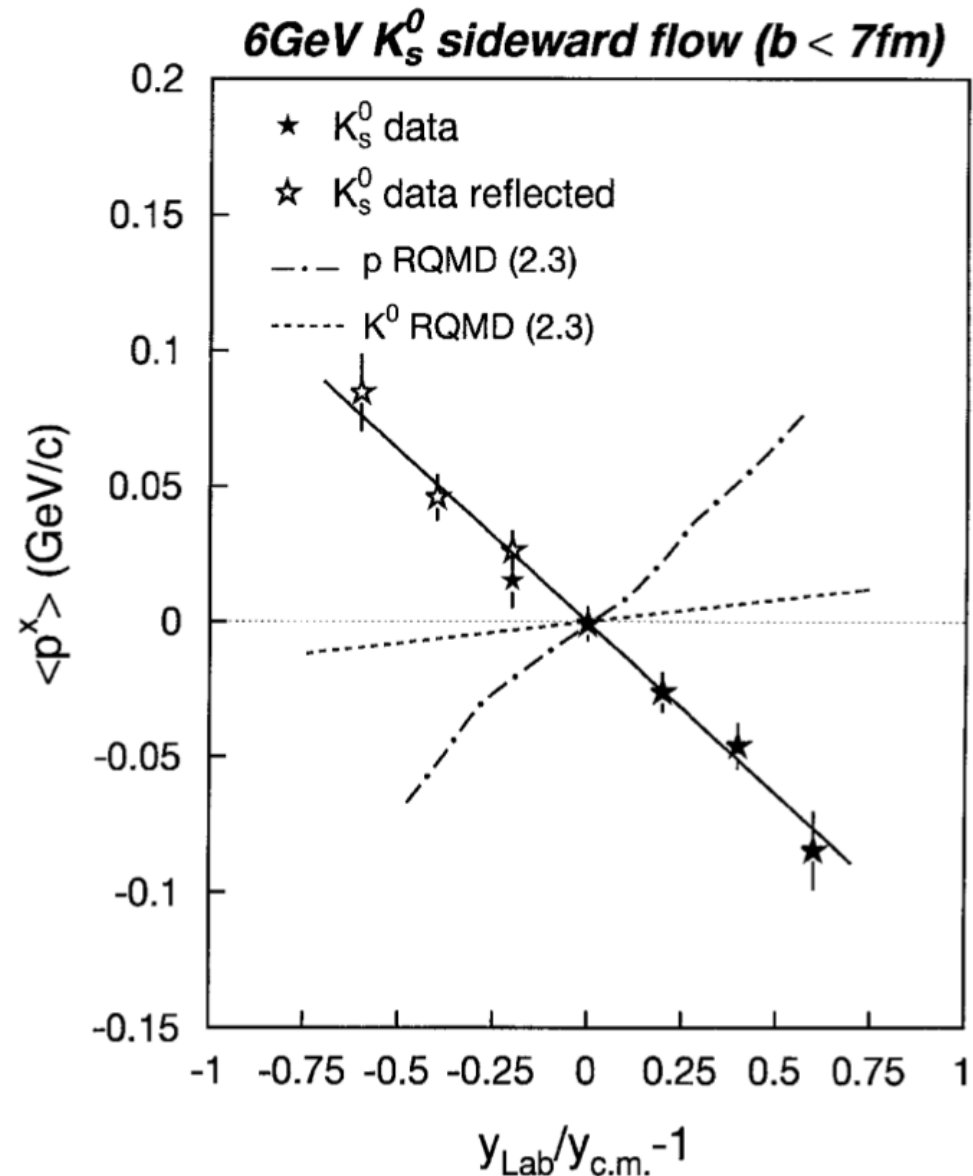


# $K^0$ Antiflow

P. Chung et al., E895 Collaboration, PRL 85, 940 (2000)

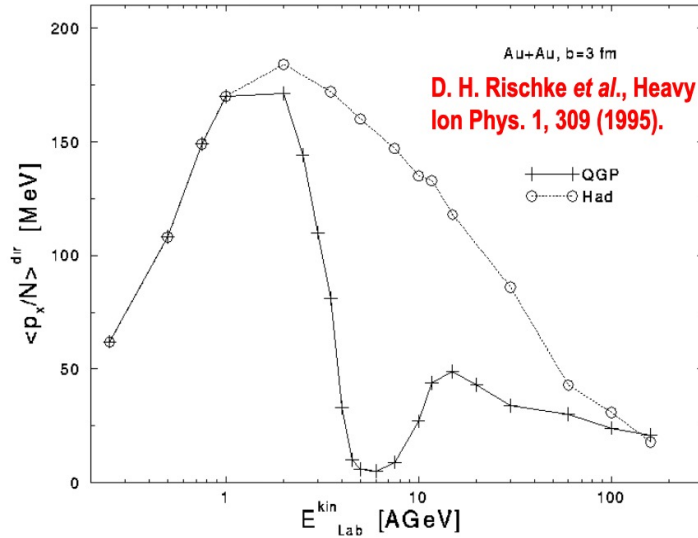
No good explanation  
for antiflow

Challenge for future  
experiments



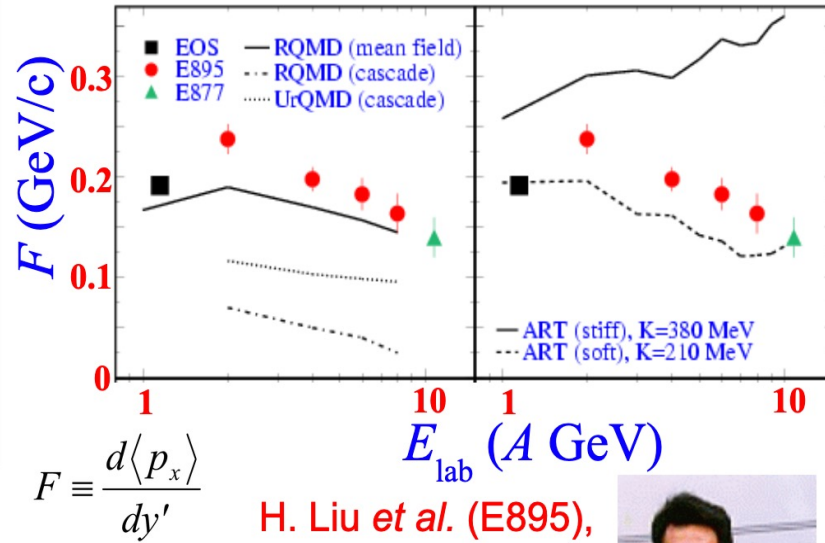


# AGS Beam Energy Scan (E895)



Horst Stoecker calls this a "softest point collapse"

E895 produced more PRLs than any of the expts at top AGS beam energy, for only ~1% of the cost.



H. Liu *et al.* (E895), PRL 84, 5488 (2000)

★ Predicted collapse of flow not observed

Heng Liu, 1998 PhD



# Happy Birthday, Declan!

- **Congratulations to your achievements**
- **Thank you for your contributions**
- **Thank you for your friendship**
- **All the best for your future endeavors**

