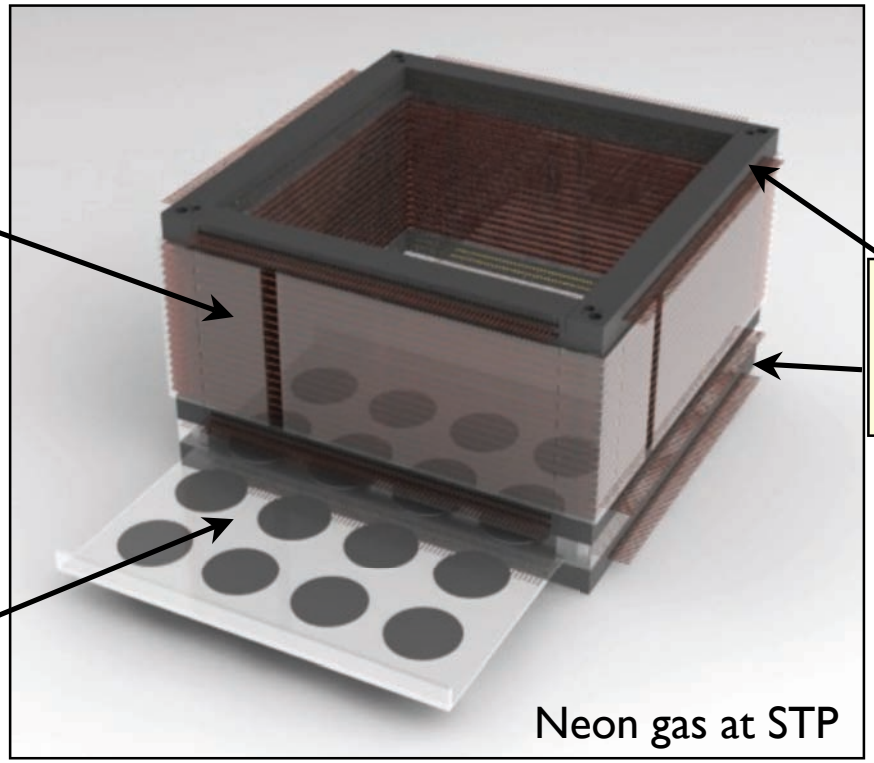
BetaCage Status and Plans

Richard Schnee

Syracuse University

BetaCage

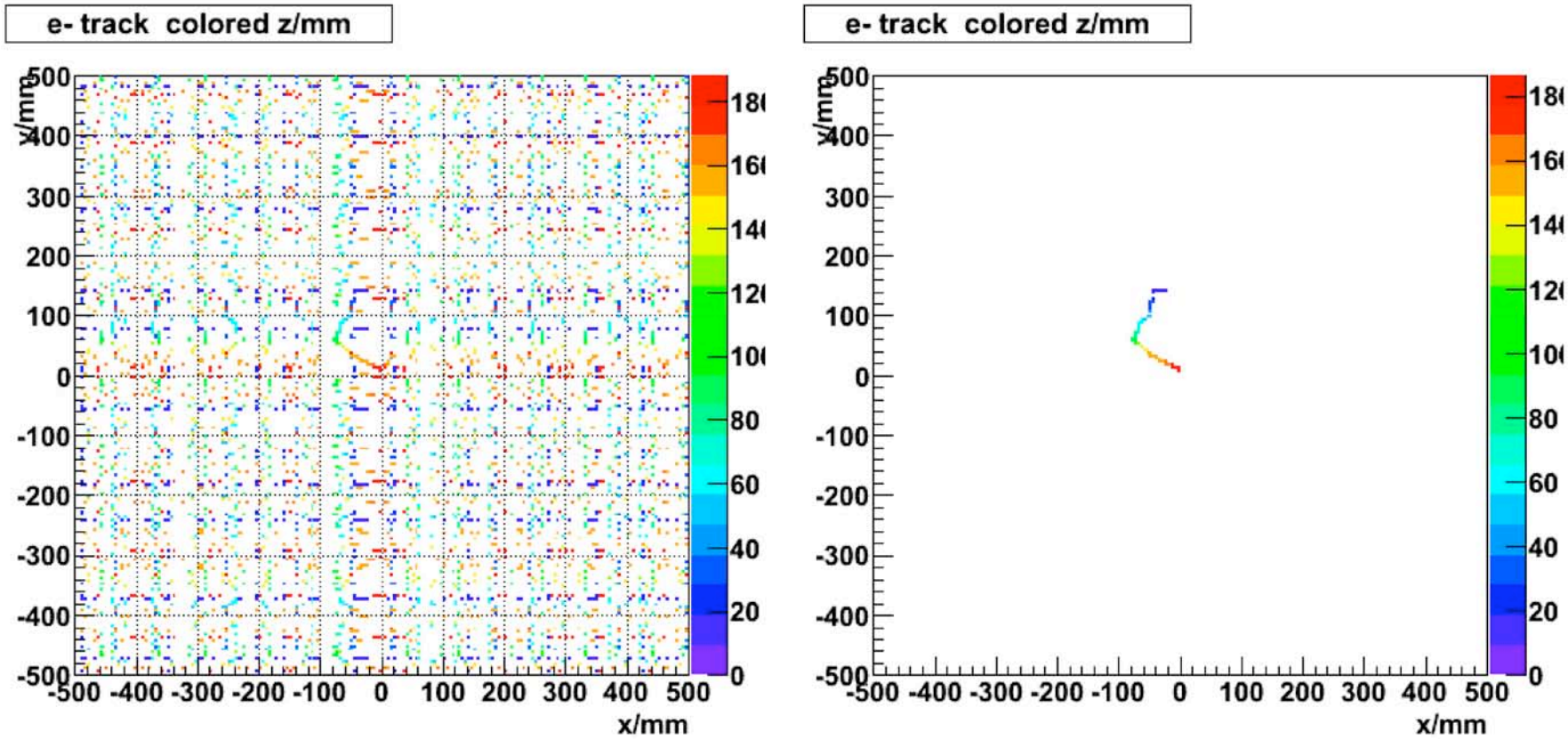
Time Projection Chamber
optimized for counting
alphas and low-energy betas



Alas, only a CAD drawing

Building "ProtoCage" (non-radiopure, half-size detector, ETA Fall 2011), which I hope will be even more sensitive than XIA for alphas.

Simulation/Reconstruction

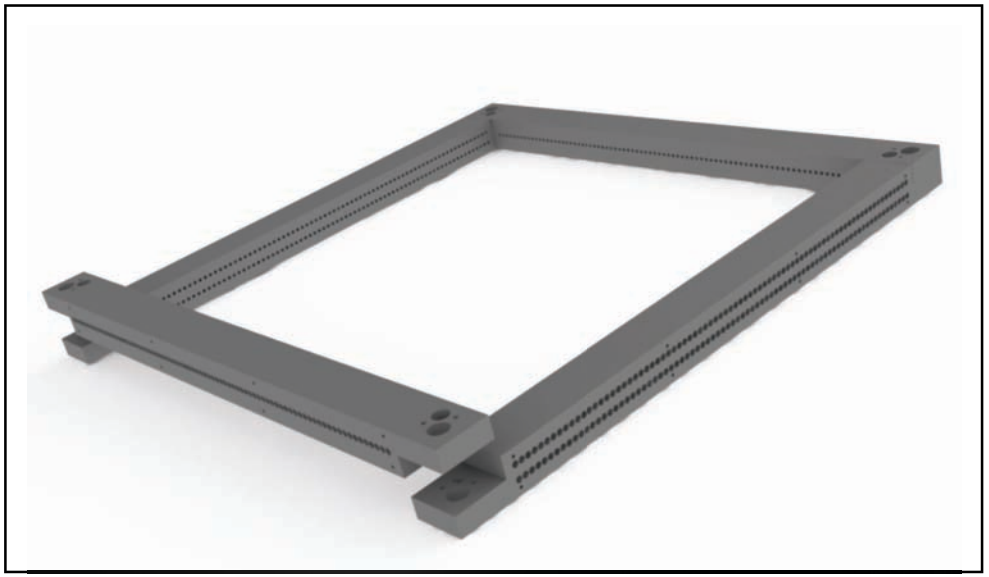


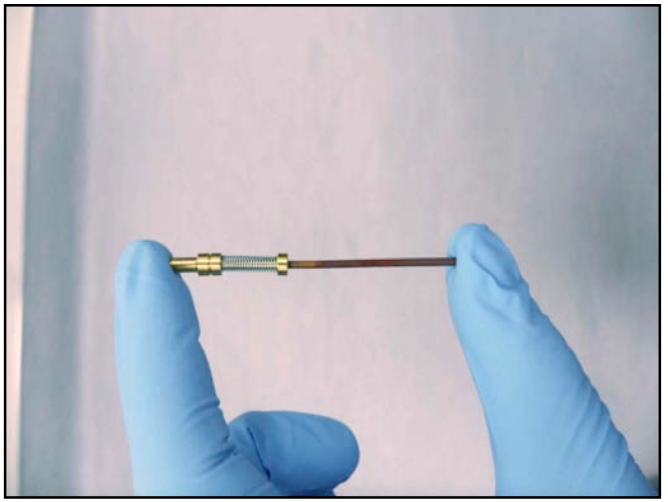
- With semi-random ganging together of 10 wires, can still reconstruct track
- Also determined fraction of tracks fully contained in detector as functions of energy and position.

B. Wang, SU

MWPC Design

–Calculated required mechanical tolerances
–Performed complete noise analysis of wire frames & readout
–Performed detailed GARFIELD simulations of the electric fields
–Devised frame design that is strong enough with clean plastic
–Designed/tested/chose spring-loaded crimp-style wire connectors



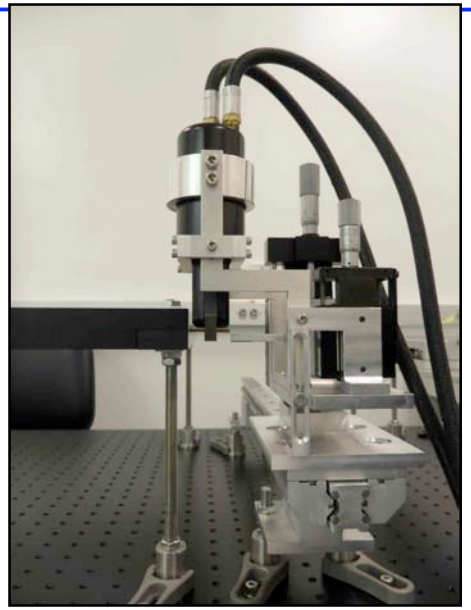


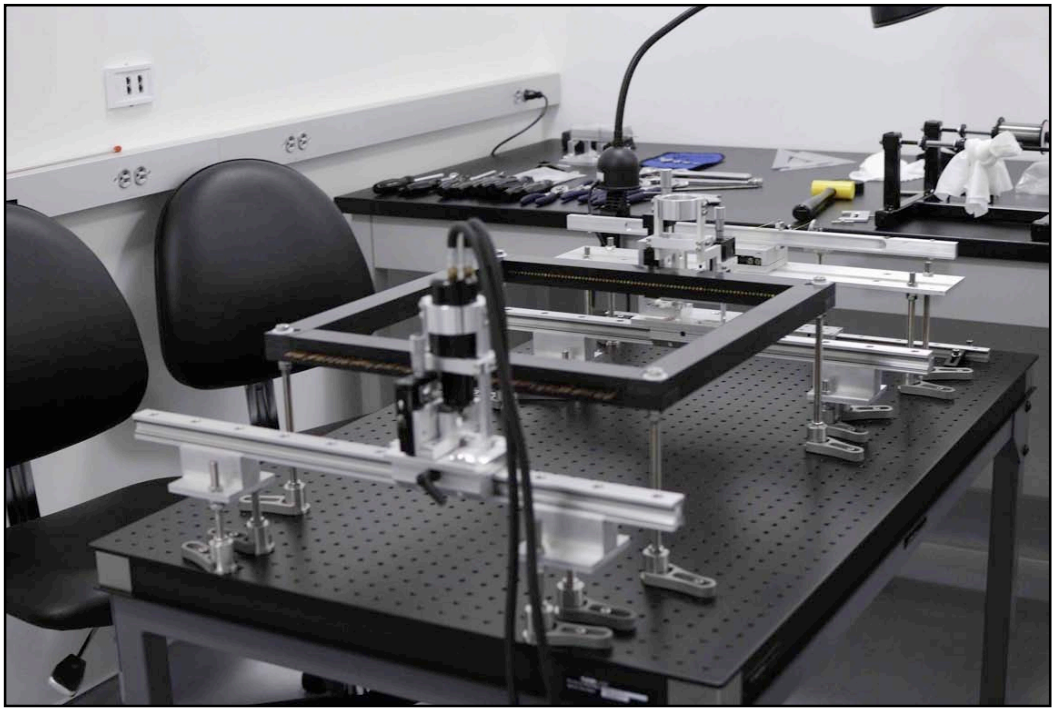
Dr. Z. Ahmed, Caltech

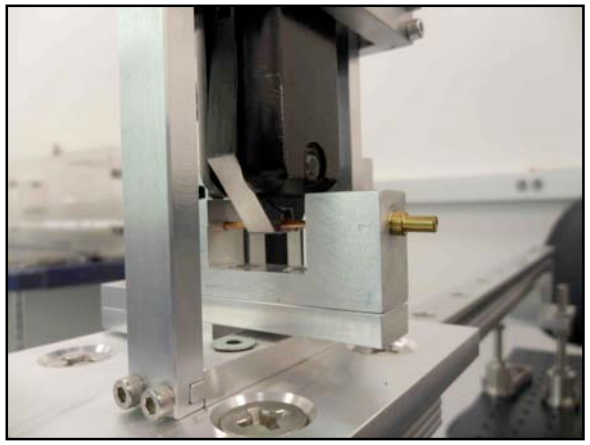
MWPC Construction

Designed and built custom assembly jig

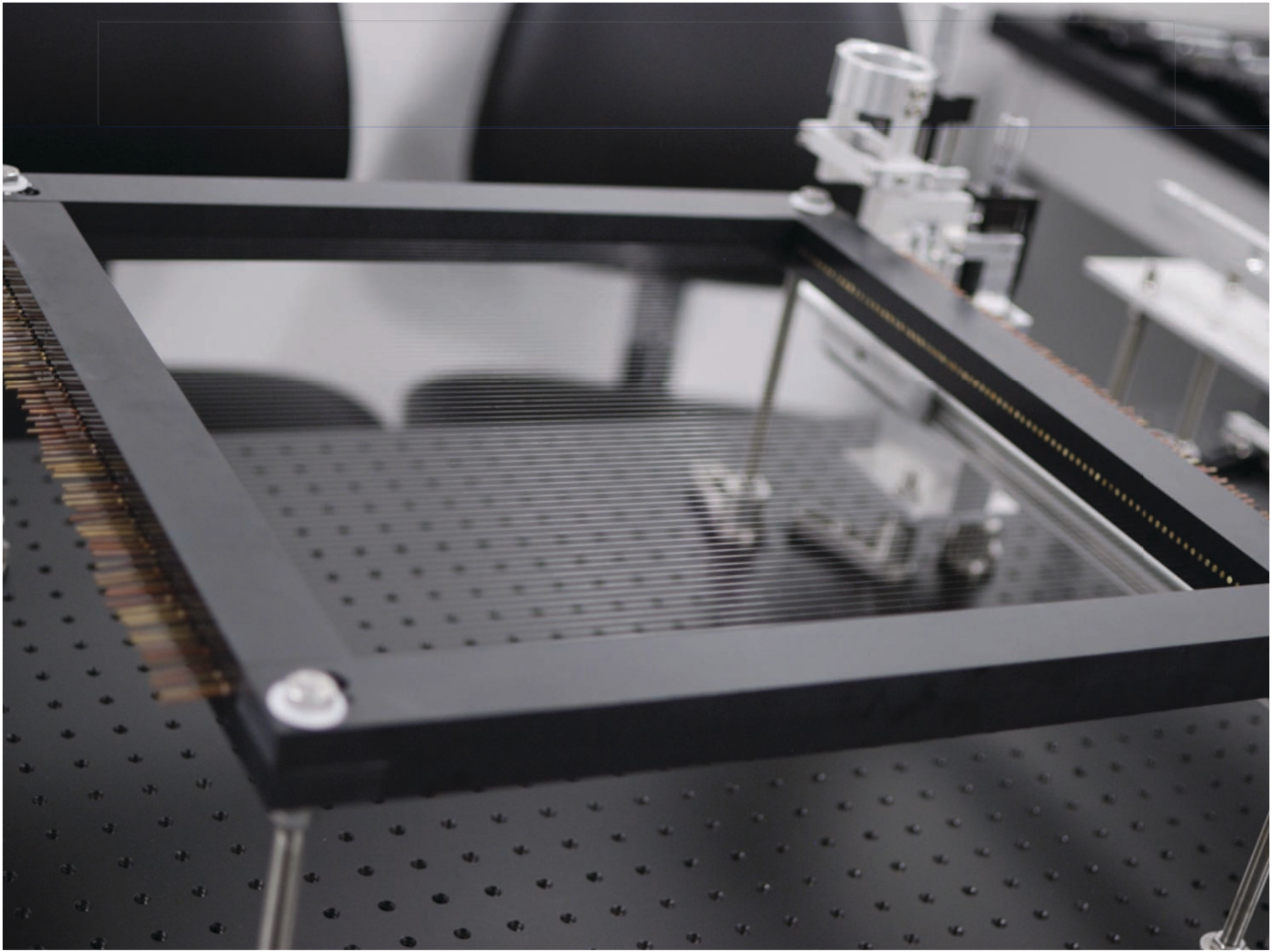
- Optical bench with positioning tools for crimping and tensioning in Caltech cleanroom







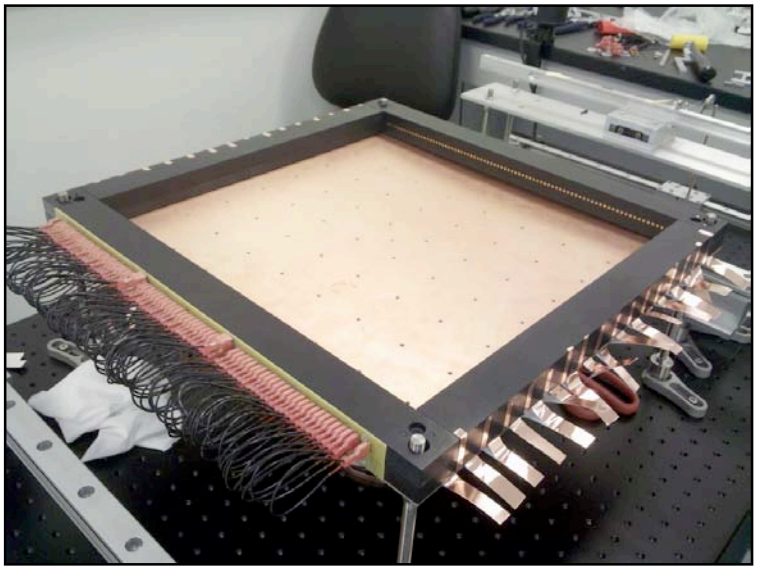
Dr. Z. Ahmed, B. Nelson, Caltech

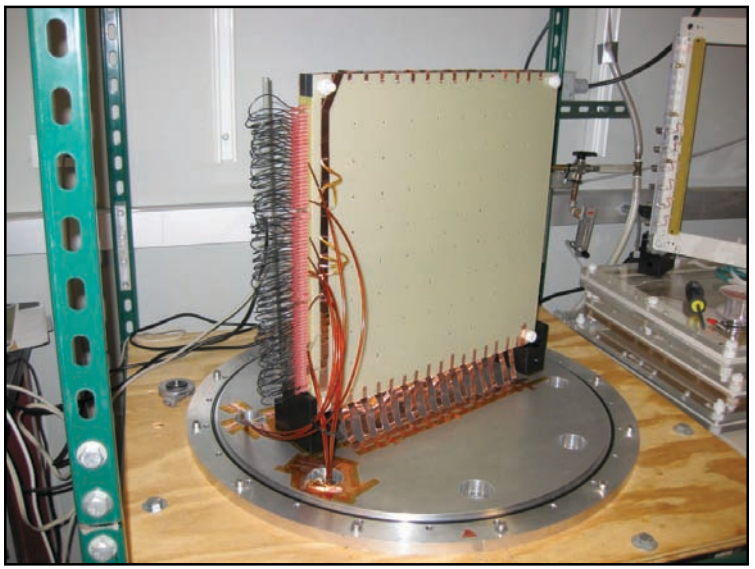


Test MWPC

Conducting first tests with prototype design

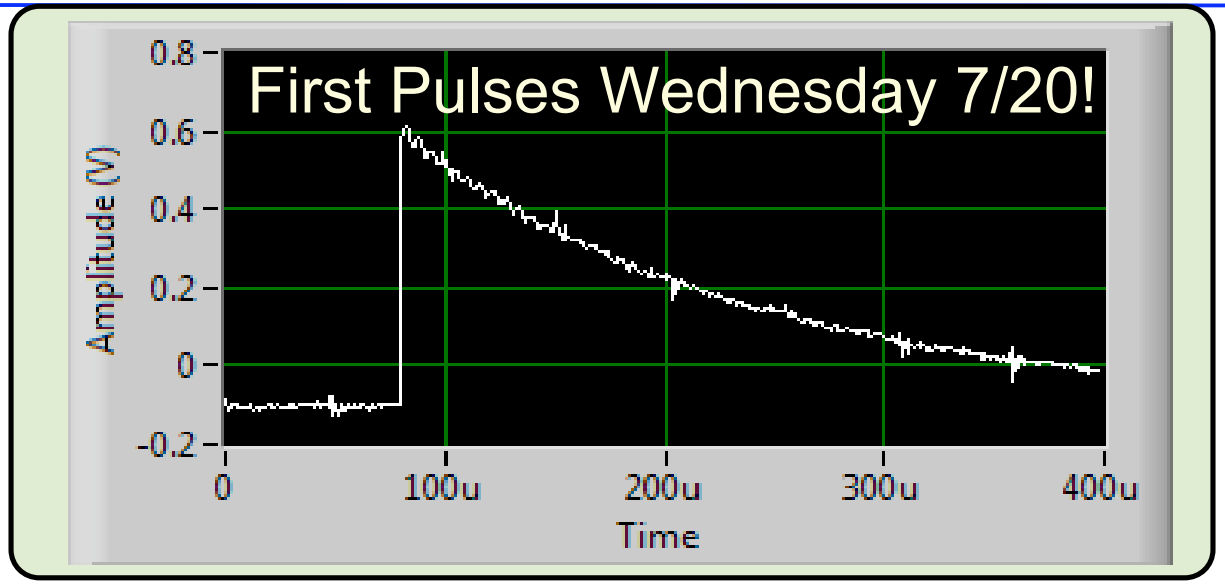
- Using copper sheets as cathodes
- Pressure vessel with SHV connections
- HV supply, filtering similar to full BetaCage
- Basic LabView DAQ with commercial 60 MSa/s 12-bit 8-channel digitizer
- Radioactive Sources Cd-109, Fe-55 for gamma and beta lines

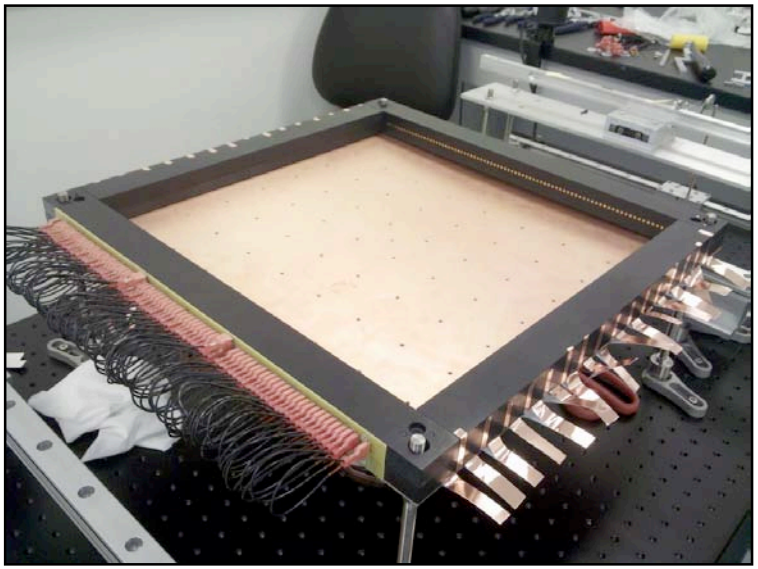


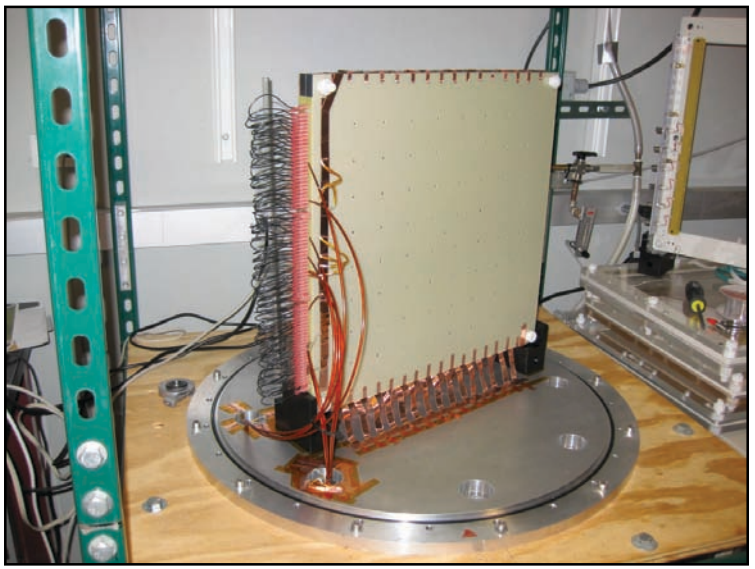


Dr. B. Nelson, Caltech

Test MWPC







Dr. B. Nelson, Caltech

BetaCage Plans

- Machining for protocage in progress
  - Noryl wire frames completed 3/10
  - U. Alberta machine shop has been closed since then
  - Started feedthroughs at SU last week
- If all goes smoothly, wire up one (of six) frames per week at Caltech August 1 - September 15
- Specified/ordered electronics
- Test ProtoCage with sources as early as October 1
- Determine if changes needed for full BetaCage
- Machining/construction in Winter 2012
- Assembly Spring 2012

AARM BetaCage Plans

- Work to determine how to reduce backgrounds beyond BetaCage proposal
- Incoming graduate student Michael Bowles
  - Summer 2011 perform tests of electropolishing <1 μm stainless steel to remove implanted 210Pb (expect 210Pb on wires to be dominant internal background)
  - Summer 2011, Summer 2012 perform simulations of gamma-induced backgrounds with the goal of determining how to optimize shielding
  - Has already started both tasks