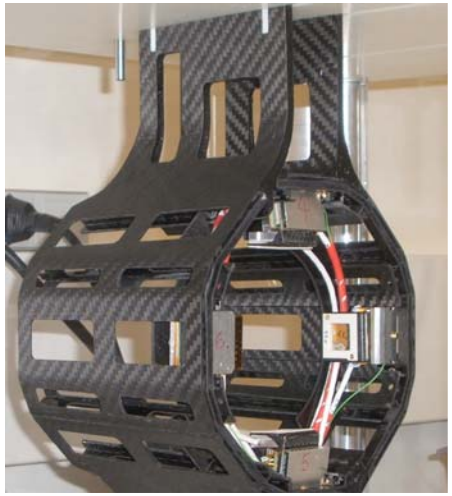
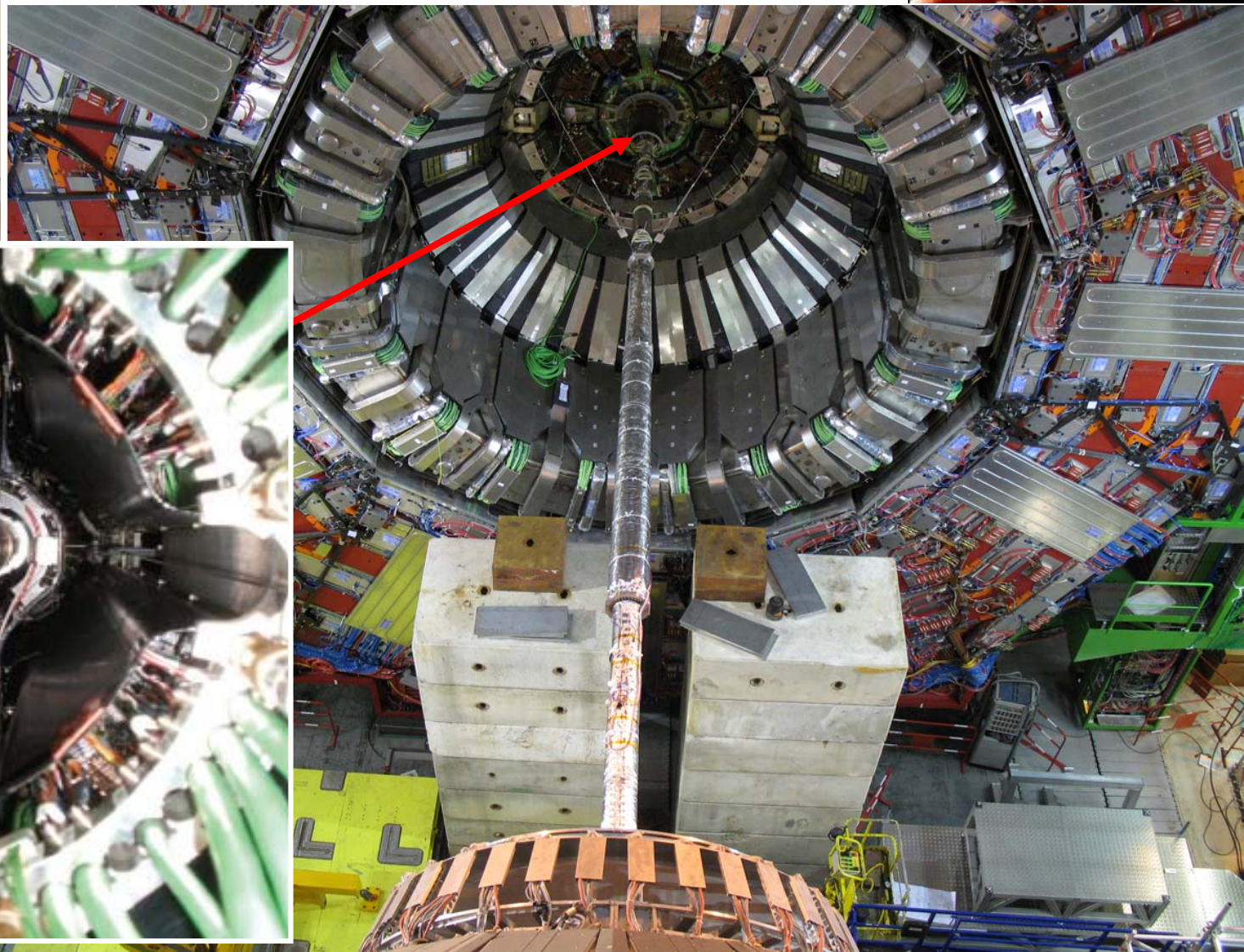
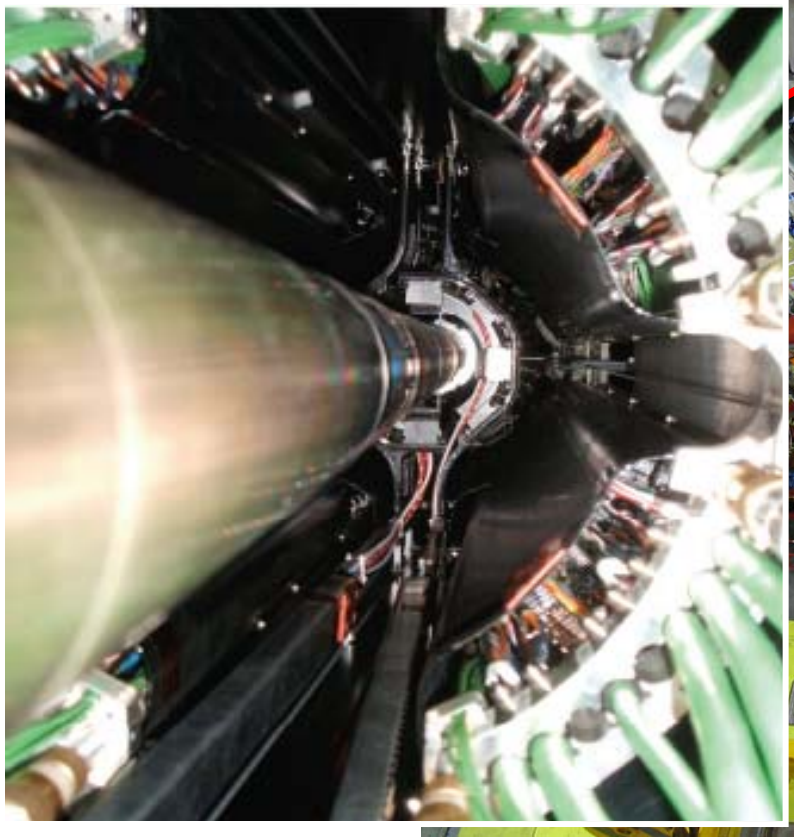
Diamond Detectors – New Technology



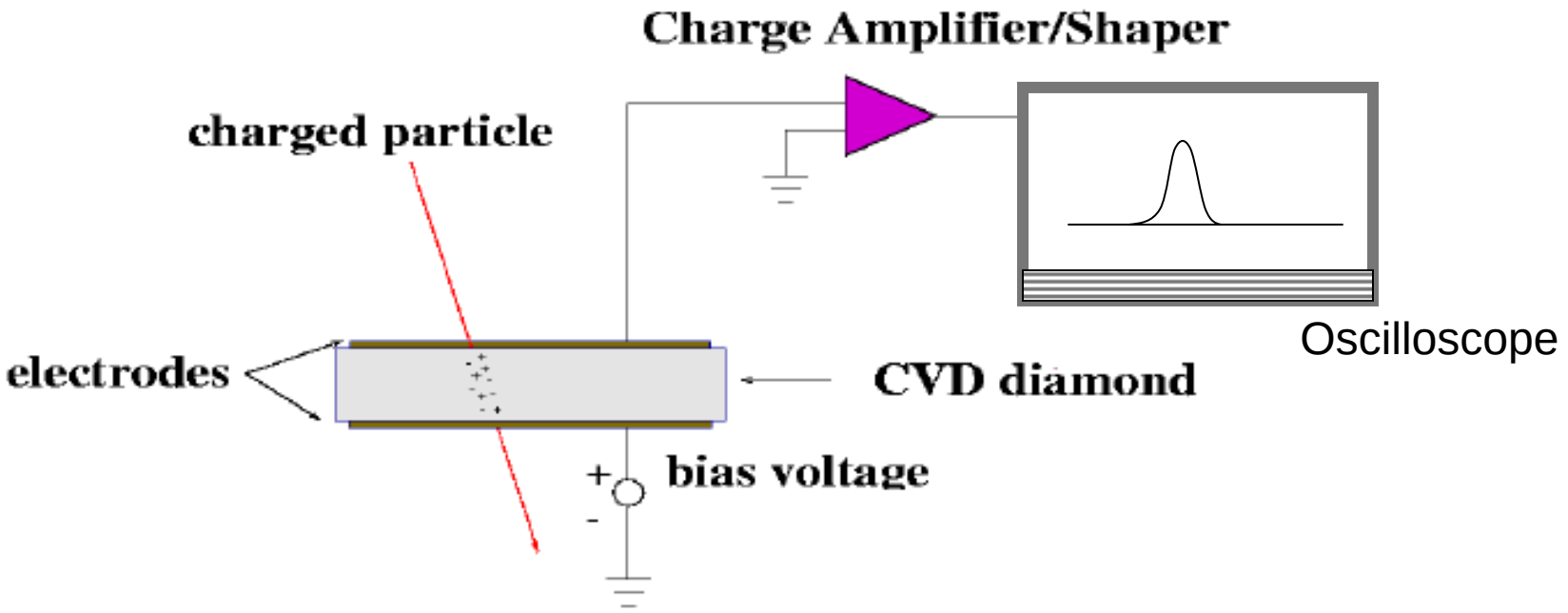
Diamond detectors are installed close to the beam-pipe to monitor radiation from the two proton beams and to measure collision rates.





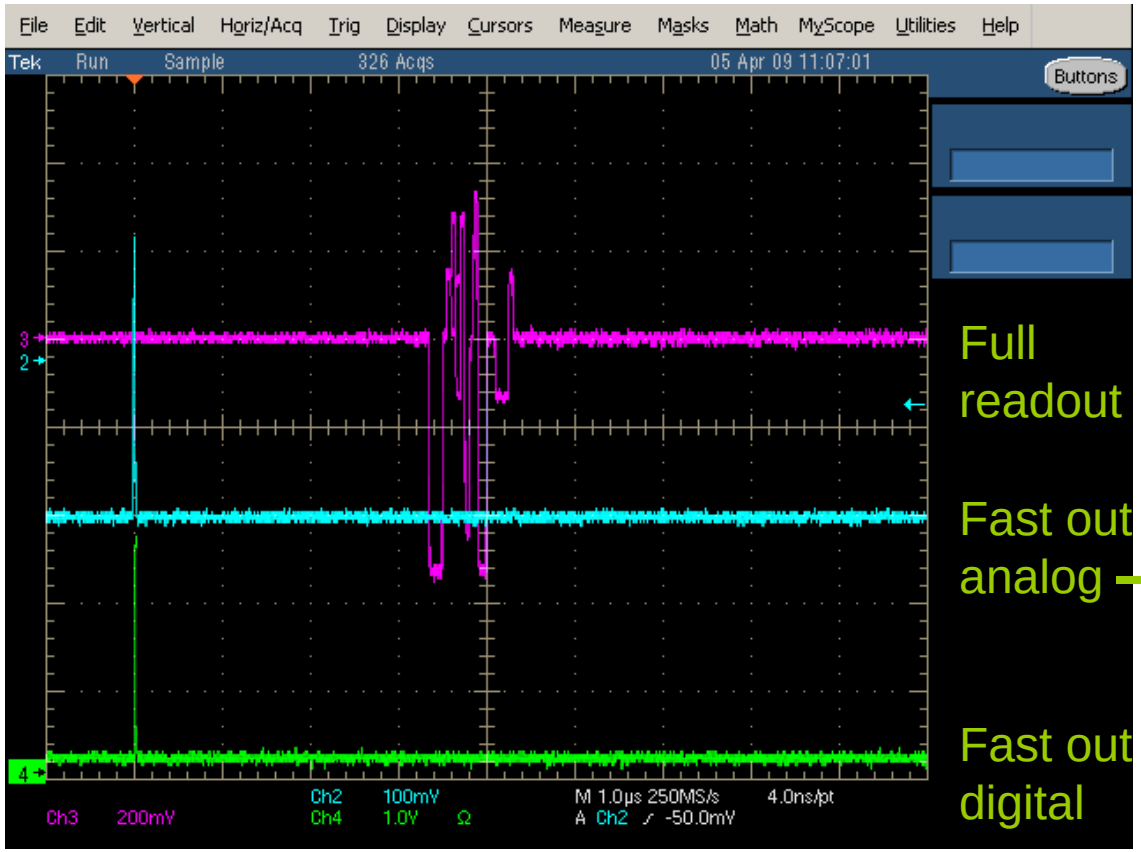


Diamond Detector Principle



- No reverse–bias PN junction: Diamond is an extremely good insulator, leakage current is negligible
- Charge deposited: 36 e- hole pairs / micron thickness
- Signal collected can be reduced due to charge trapping

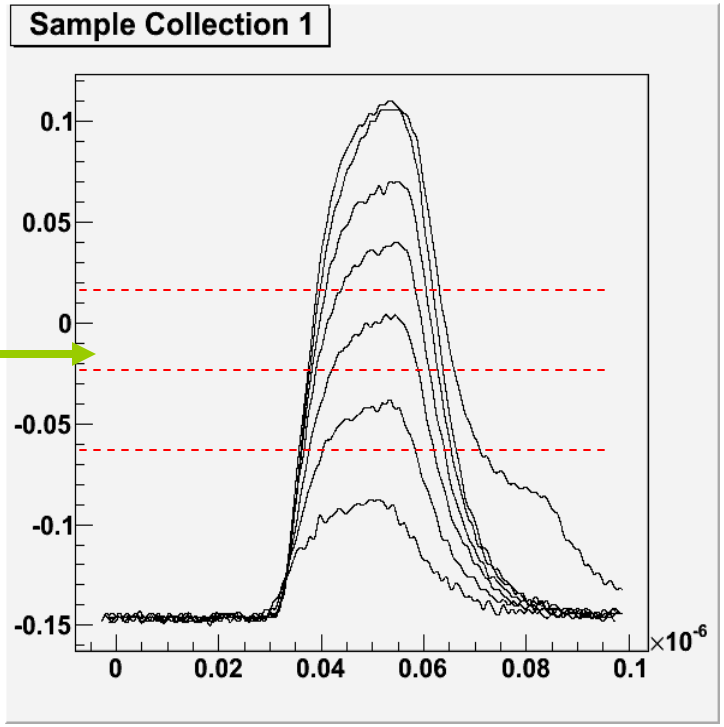
Diamond Detector Readout



Full readout

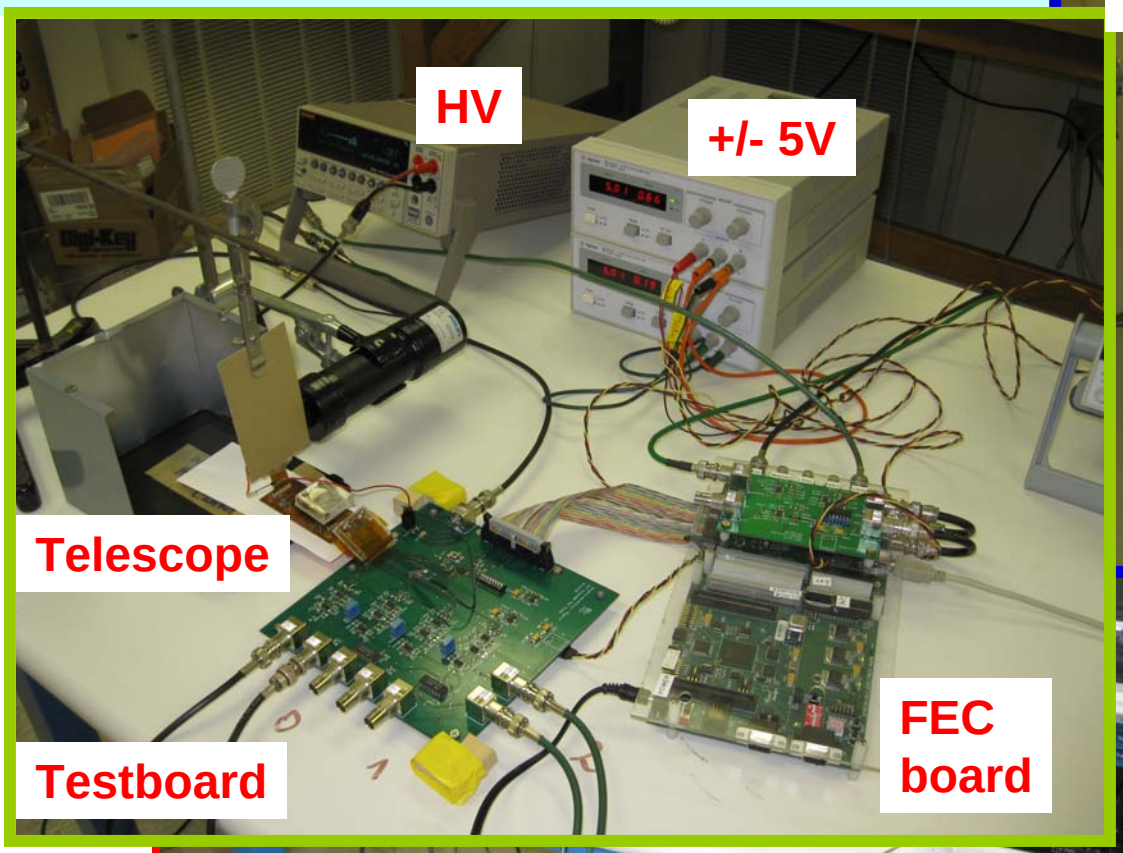
Fast out analog

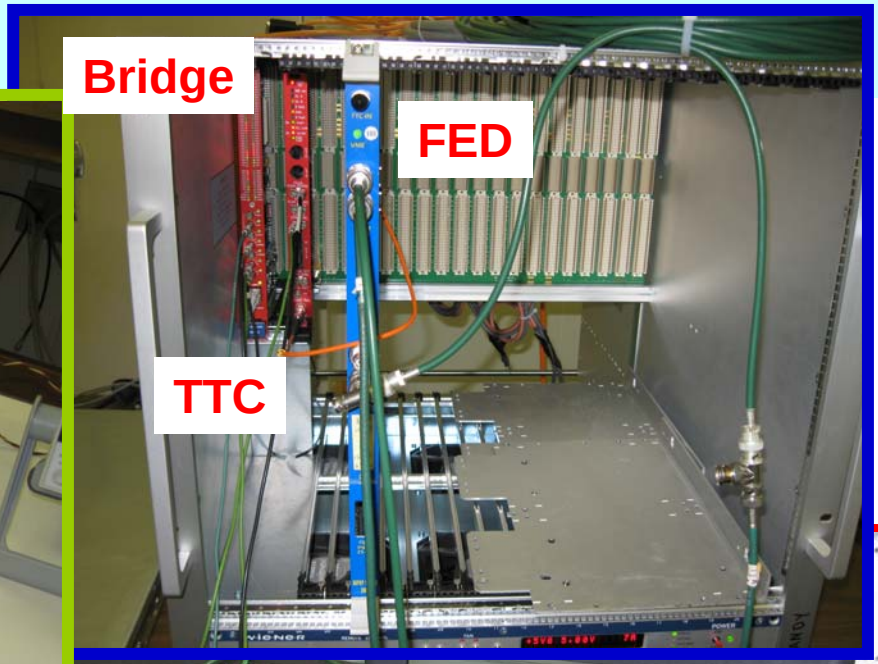
Fast out digital

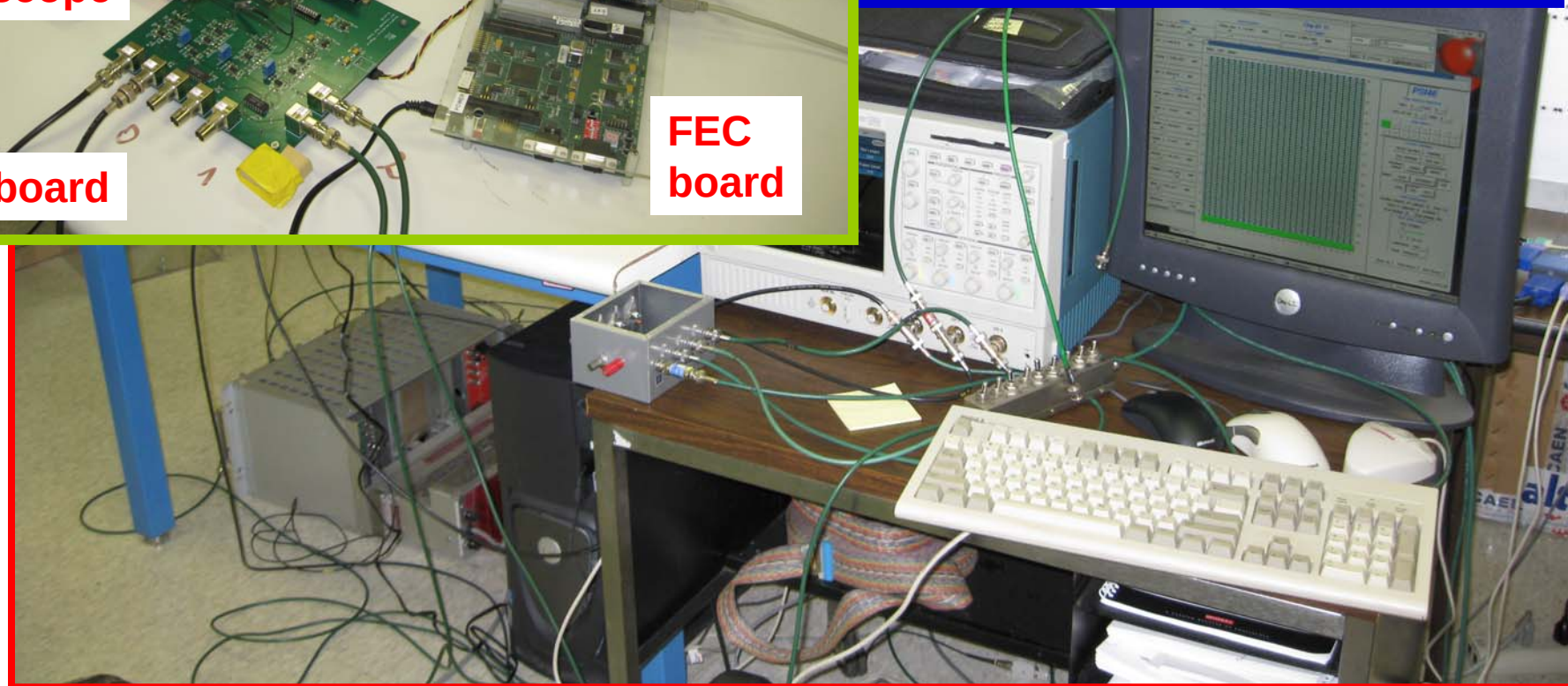


- Adjust fast out analog range – 680 Ohm attenuation, 50 Ohm input to FED
- original: -1.4V .. 1.2V → 0V .. by small capacitance

Diamond Lab at UTK

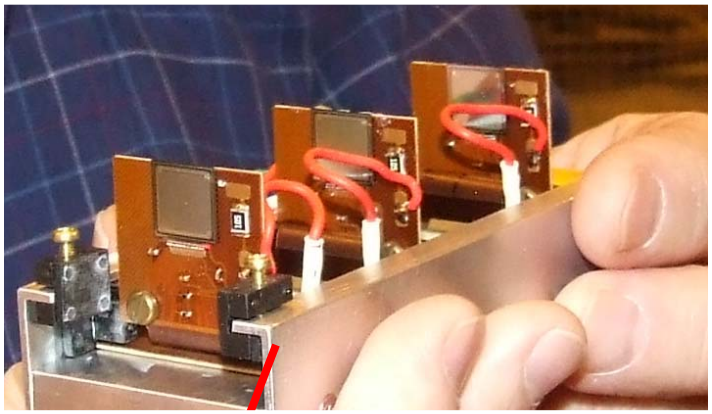


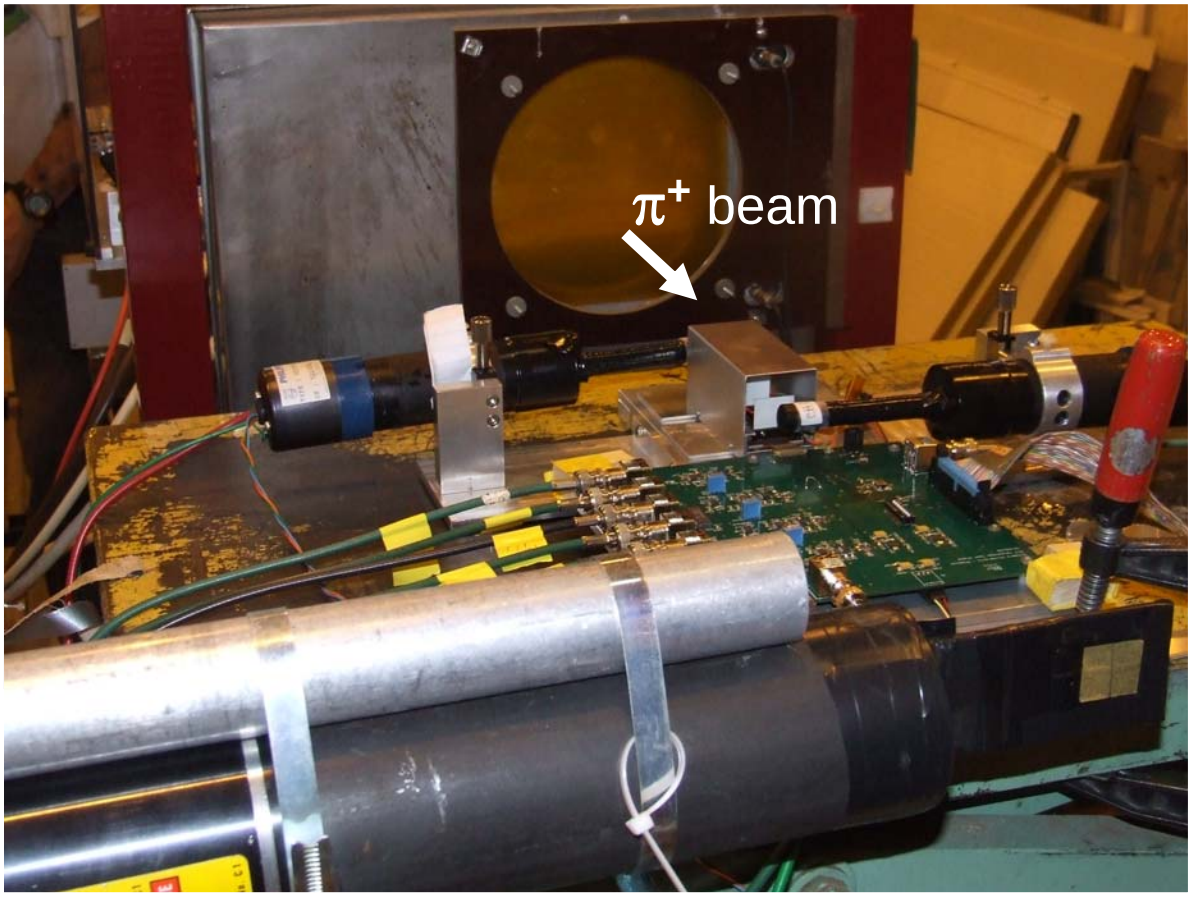




Test of Diamond Pixels in a Pion Beam







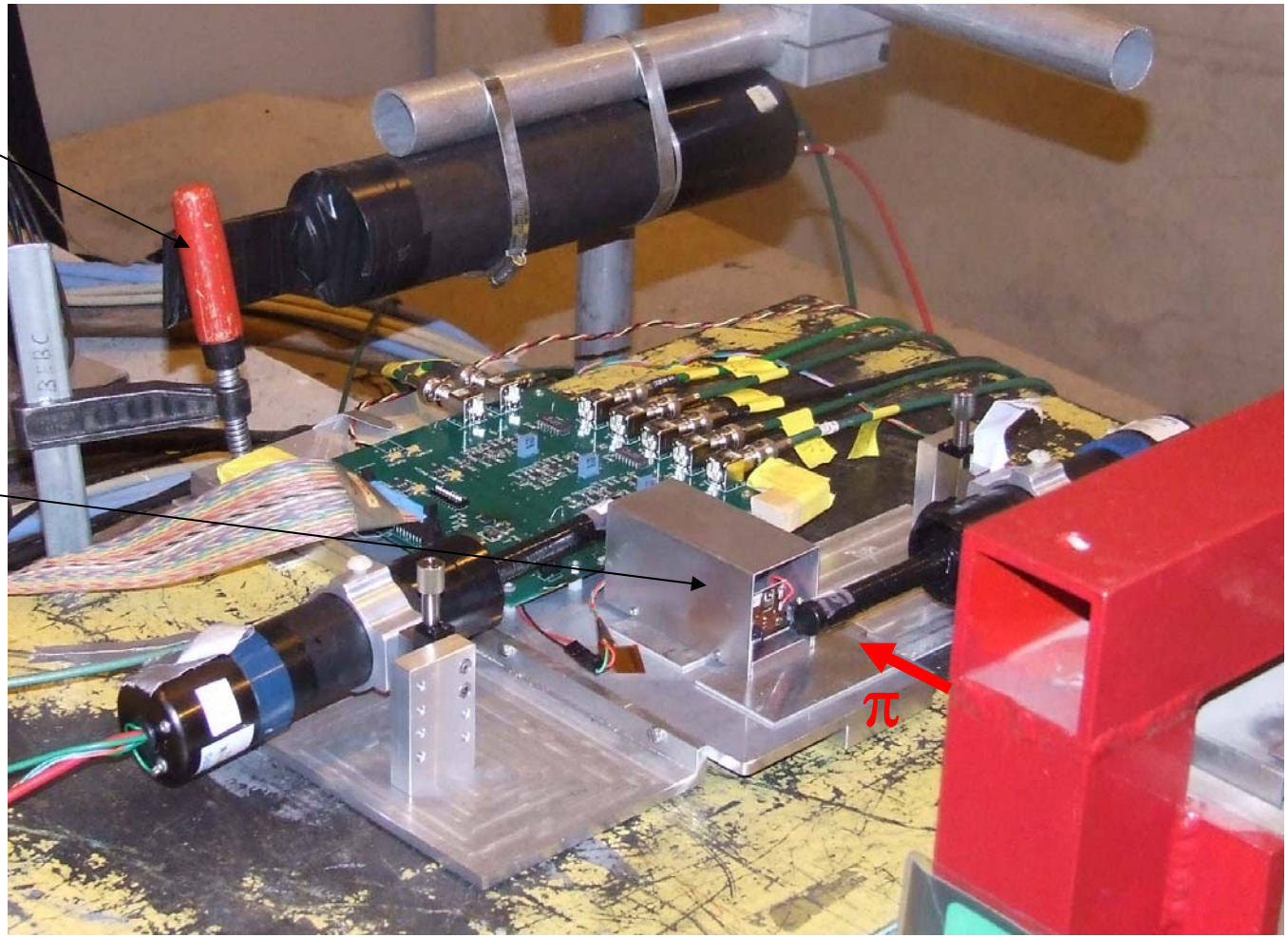
Professor emeritus Bill Bugg at the Super Proton Synchrotron beam test at CERN

Test of Diamond Pixels in a Pion Beam

Two square 6mm x 6mm scintillators up/down stream of telescope
- adjustable in height
- fixtures rotate with telescope

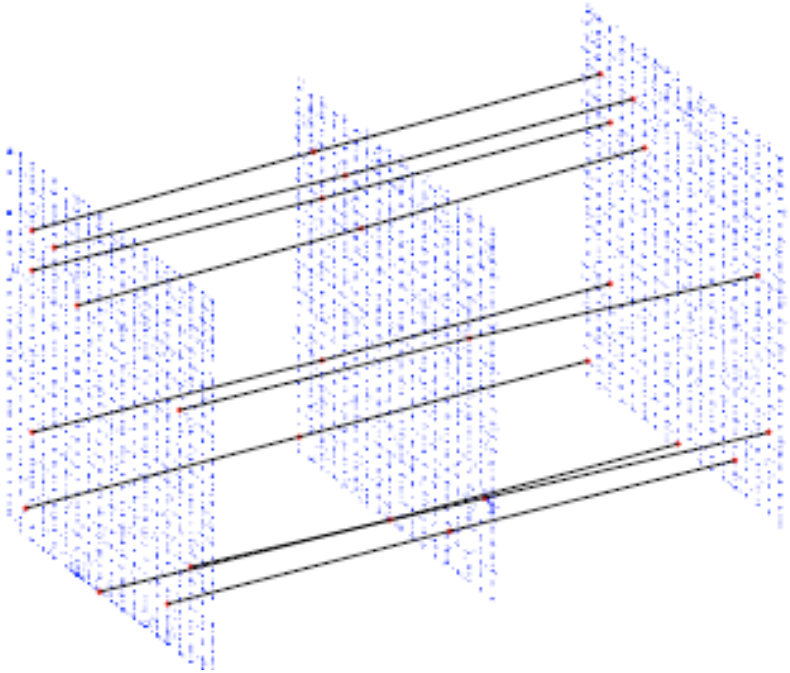
exit counter downstream of telescope for beam projection /steering

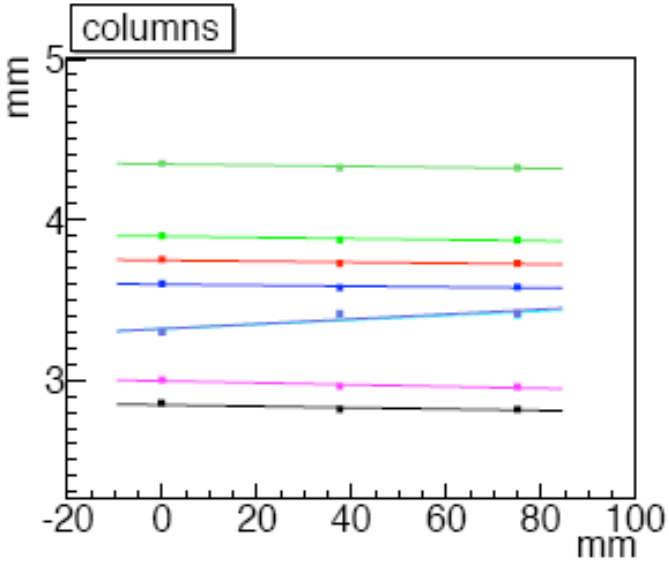
Telescope
3 planes of
diamond pixel
detectors

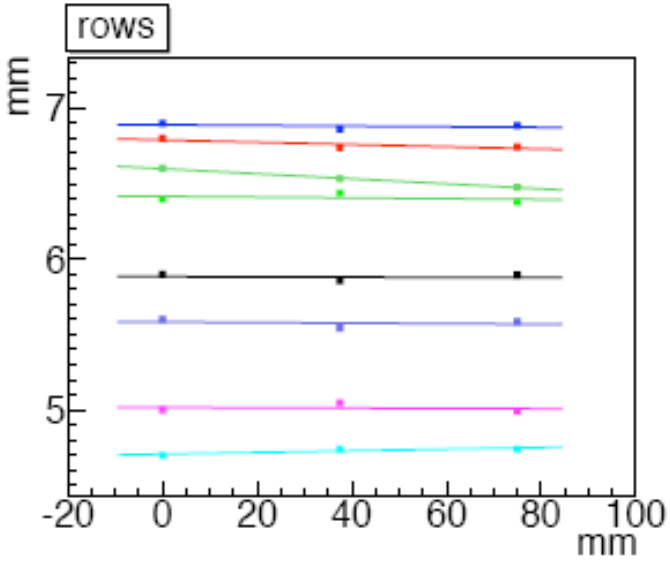


Test of Diamond Pixels in a Pion Beam

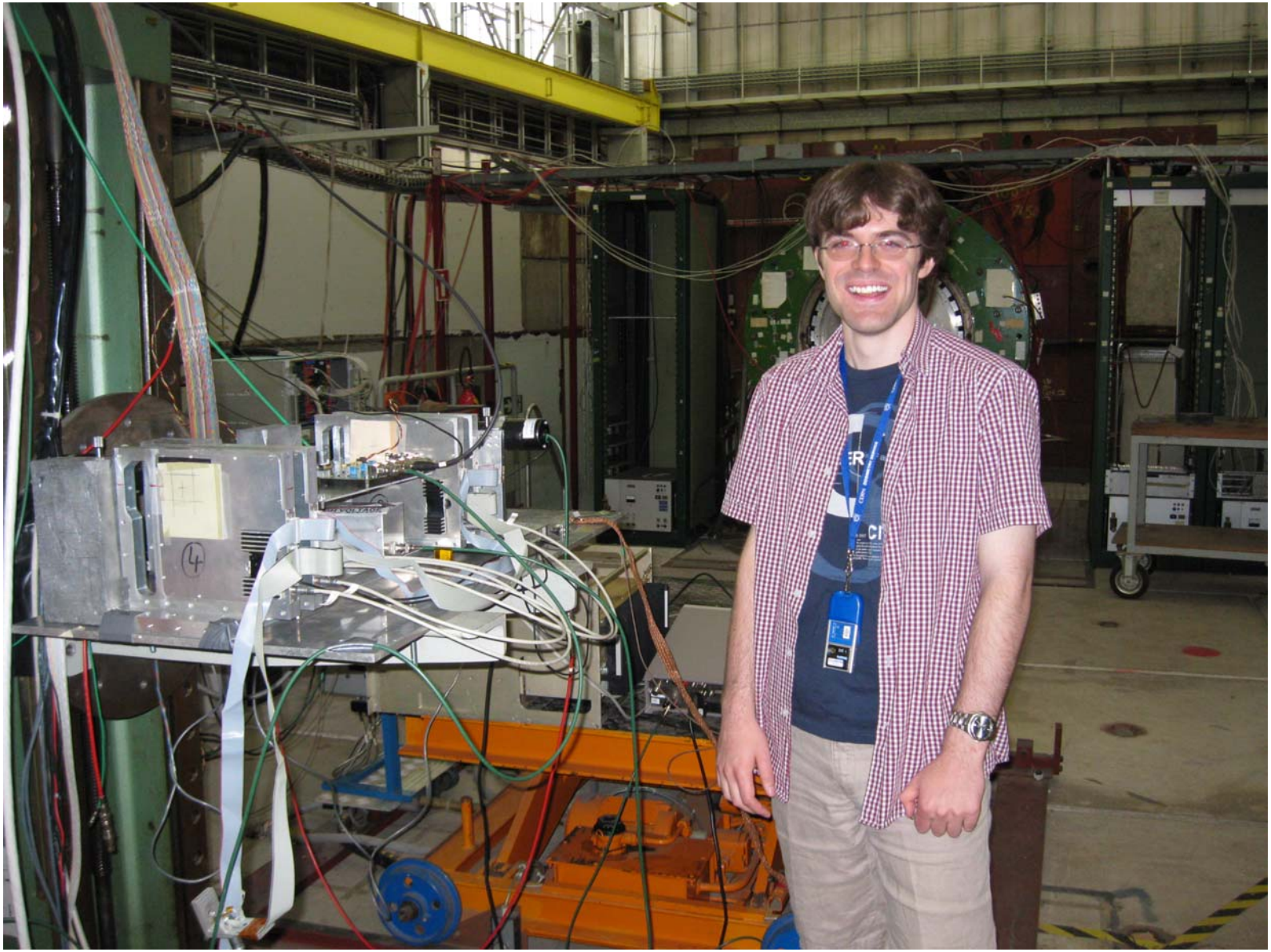
- Incident beam nearly perpendicular
- Hit position defined as the "center of charge" (charge sharing)
- Correct for relative plane offset
  (beam climbs 8 rows from plane 1 to plane 3)
- Correct for relative plane rotation
- Only one cluster per plane
  (89% of events have hits in all three planes)







Our graduate student Matt Hollingsworth in front of the instrument before it went into a particle beam at CERN, Geneva, Switzerland, to measure the spatial resolution capabilities of single crystal diamond pixel detectors.



Our graduate student Matt Hollingsworth, the undergraduate student Lisa Agle, and our postdoc Zongchang Yang at the test beam facility at CERN's proton synchrotron preparing to test diamond pixel detectors.

