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Diamond Detector Beam Tests

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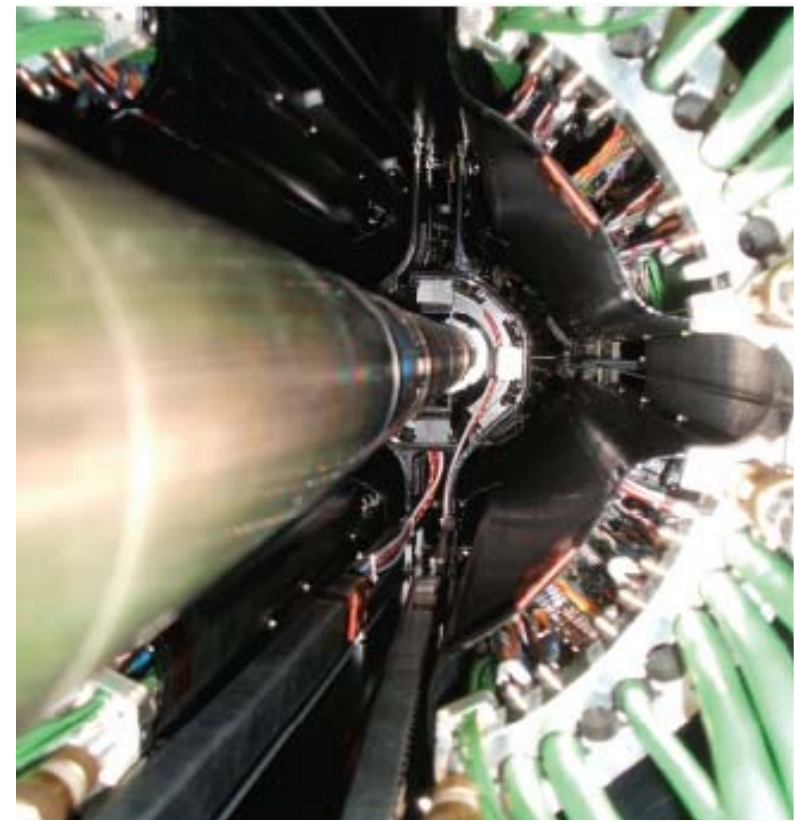
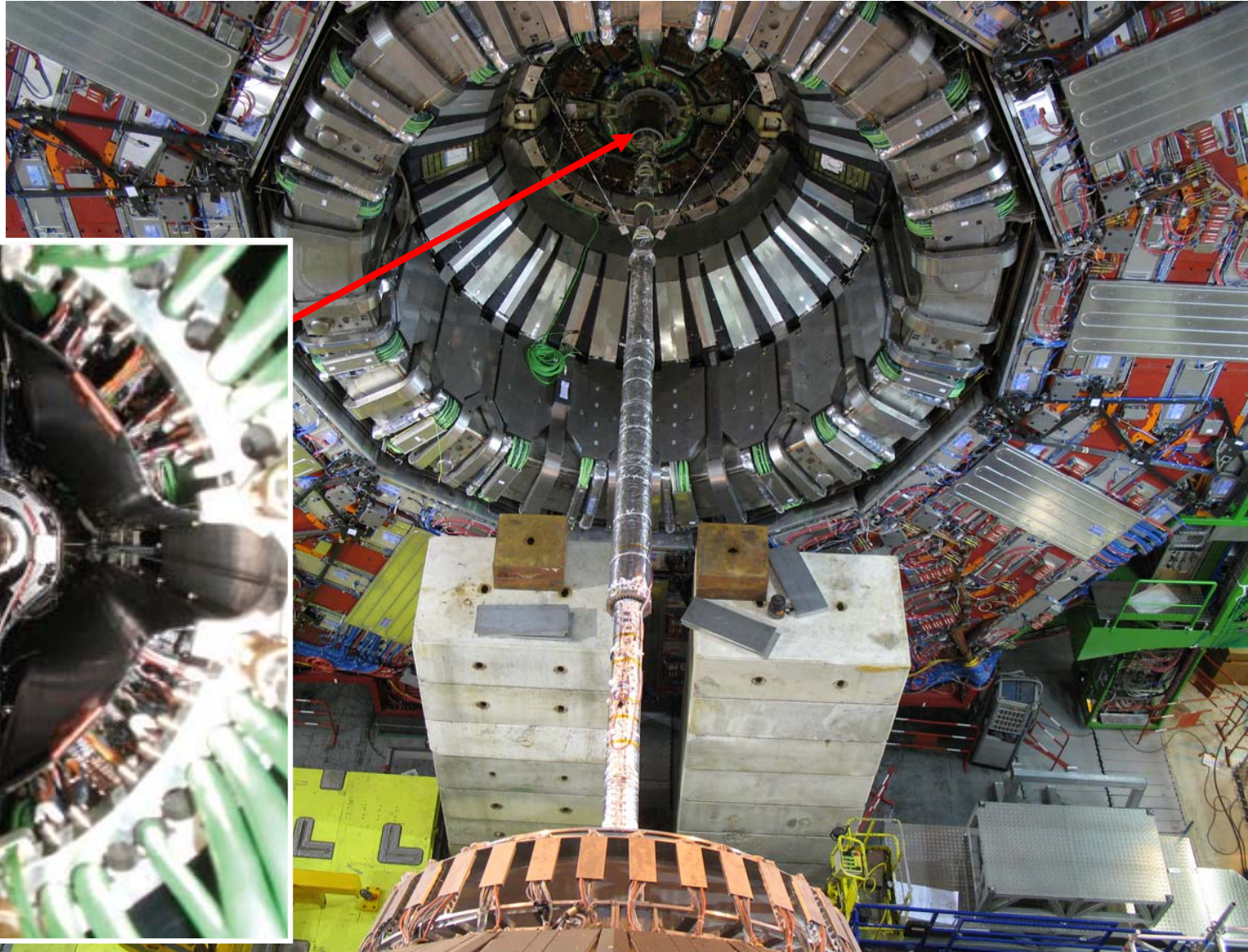
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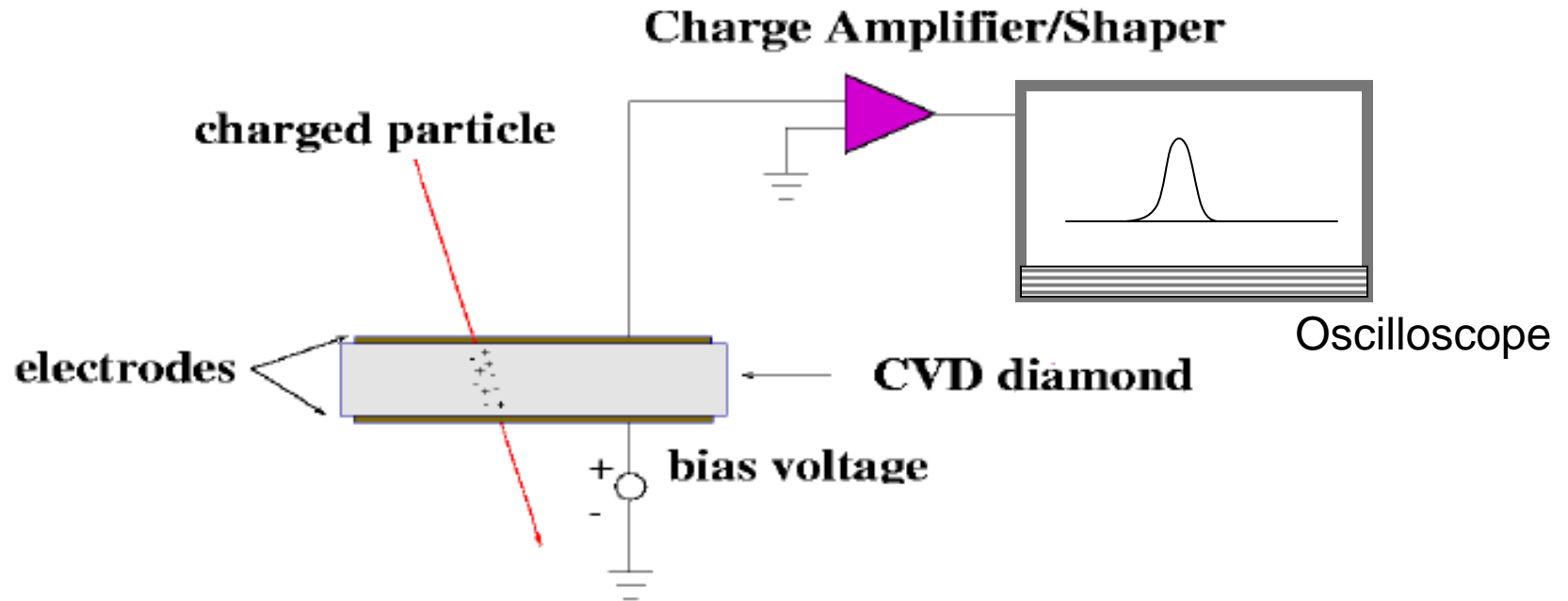
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Diamond Detectors – New Technology

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

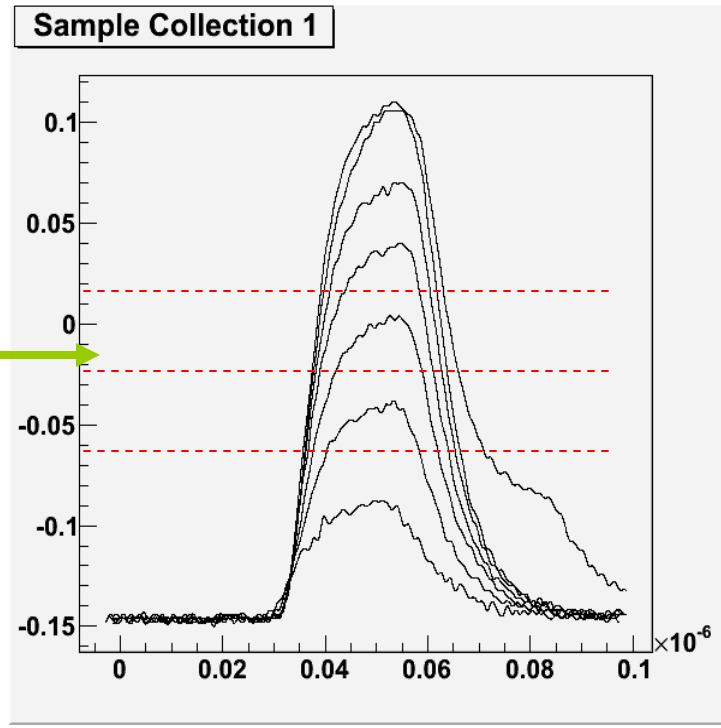
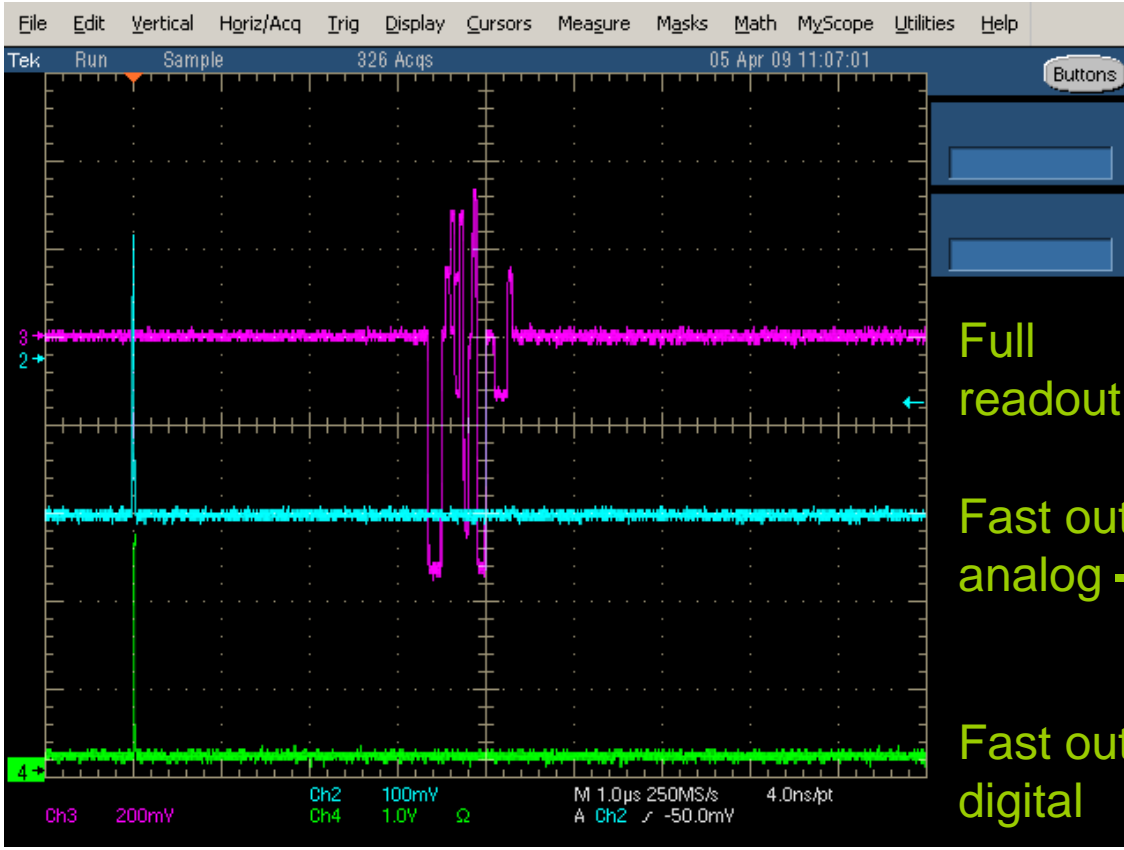


Diamond Detector Principle



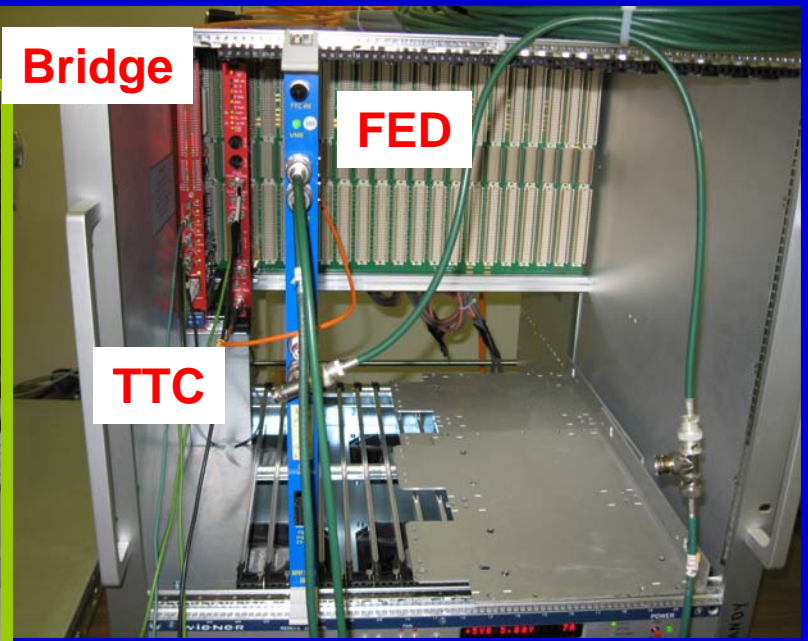
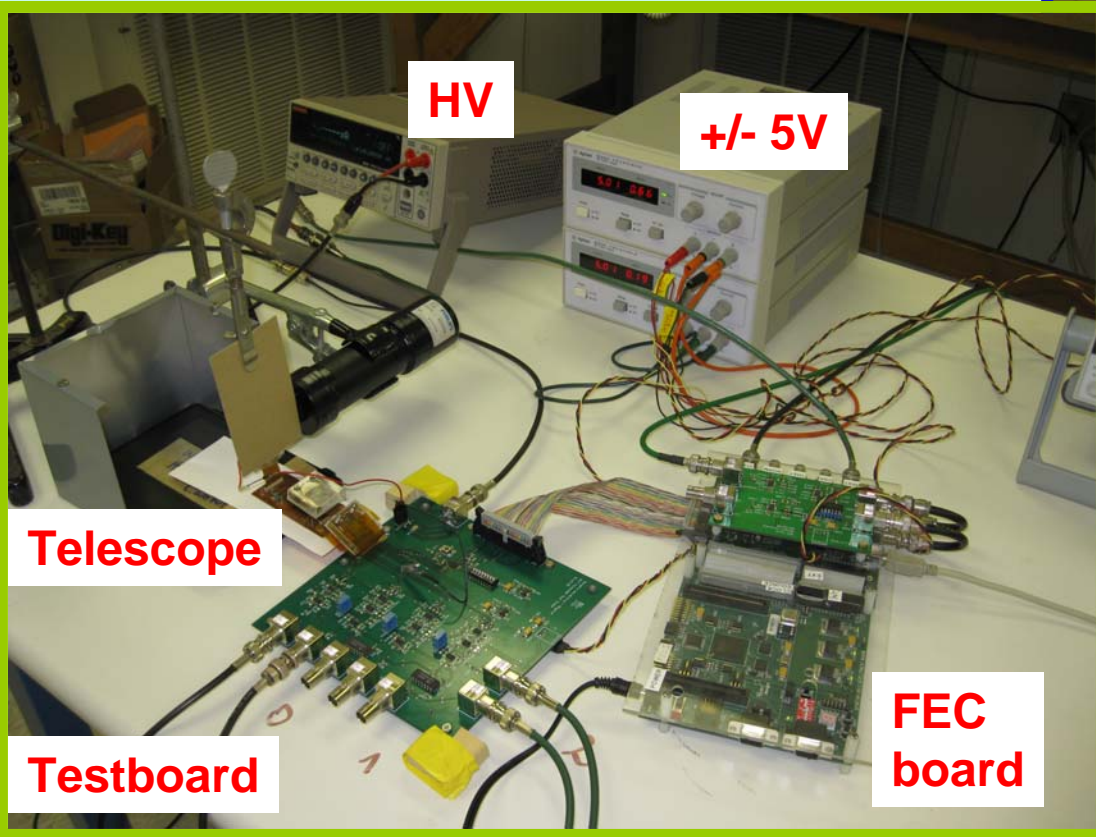
- No reverse-bias PN junction: Diamond is an extremely good insulator, leakage current is negligible
- Charge deposited: 36 e- hole pairs / micron thickness
- Signal collected can be reduced due to charge trapping

Diamond Detector Readout



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

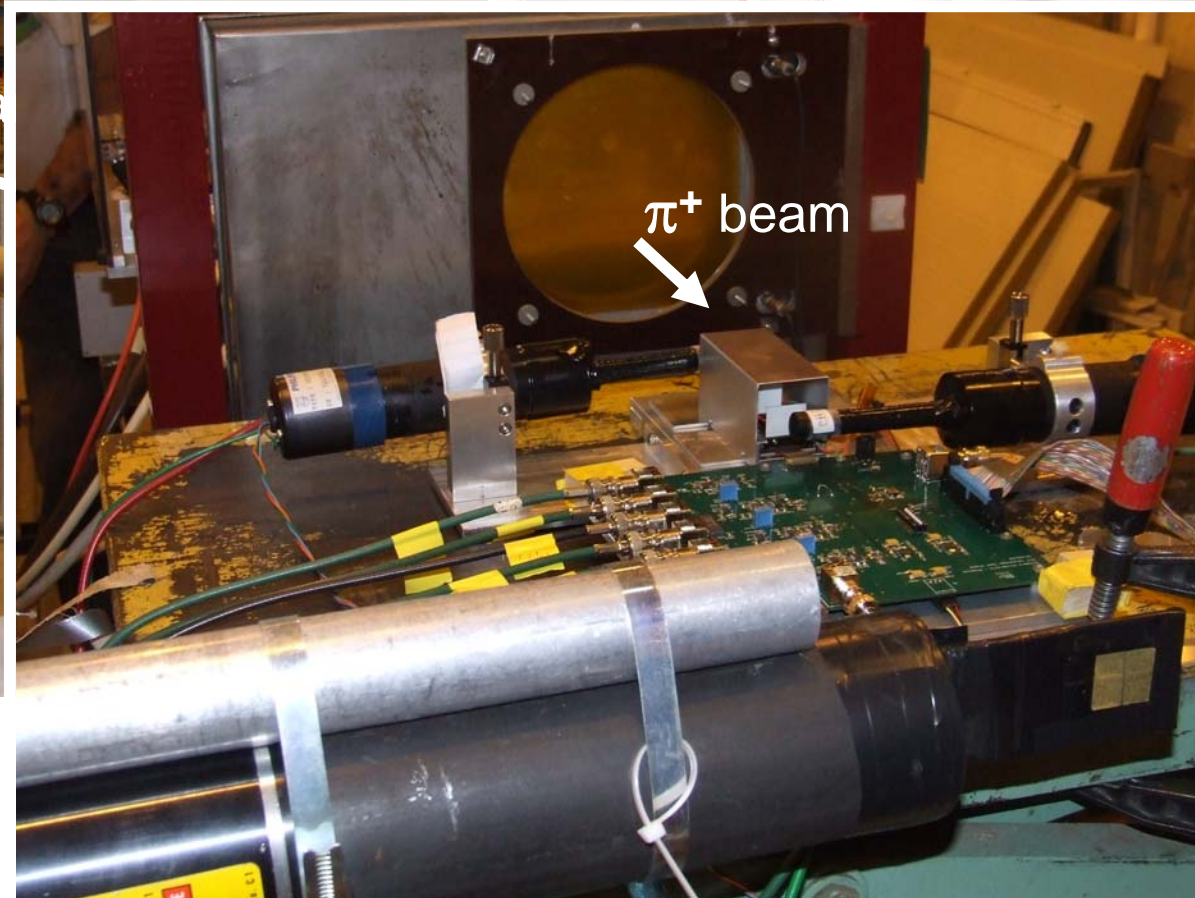
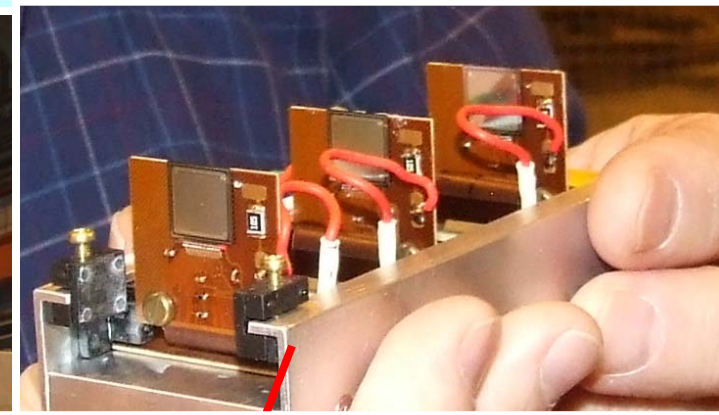
Diamond Lab at UTK



Test of Diamond Pixels in a Pion Beam



π^+ beam



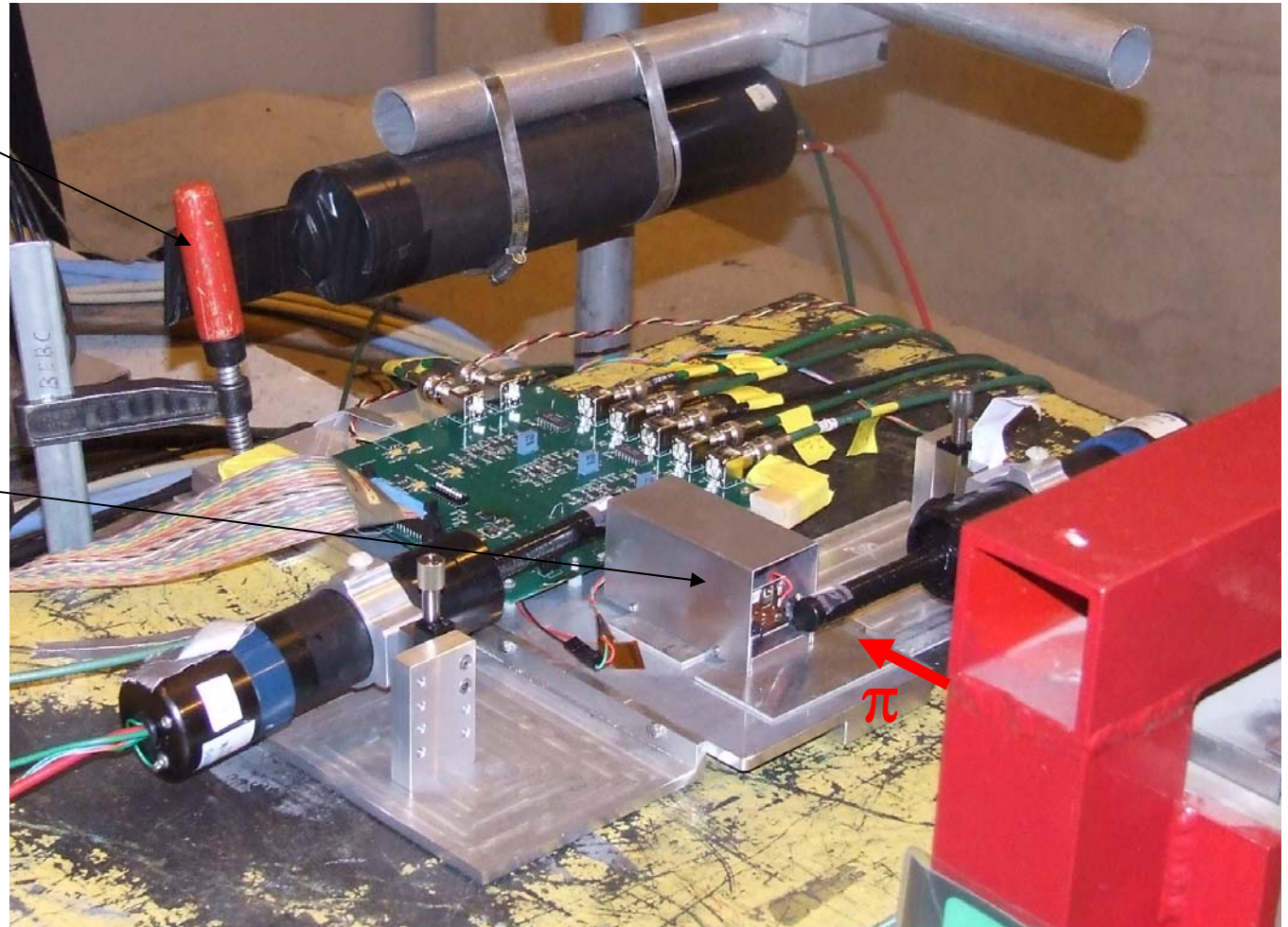
π^+ beam

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

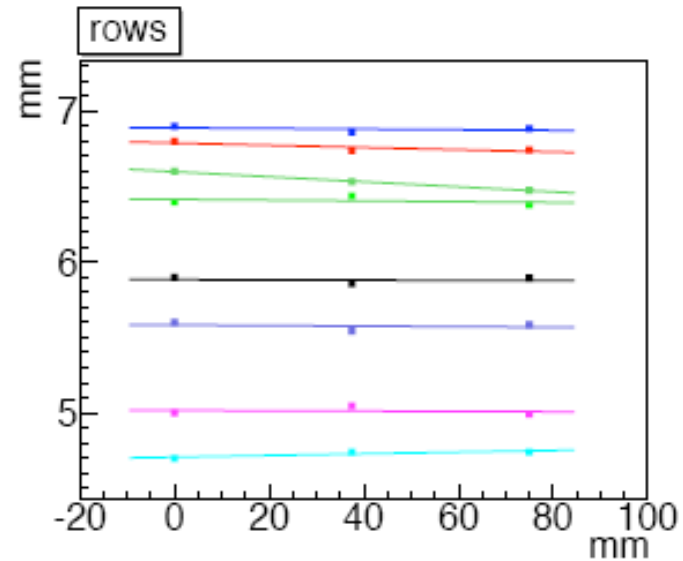
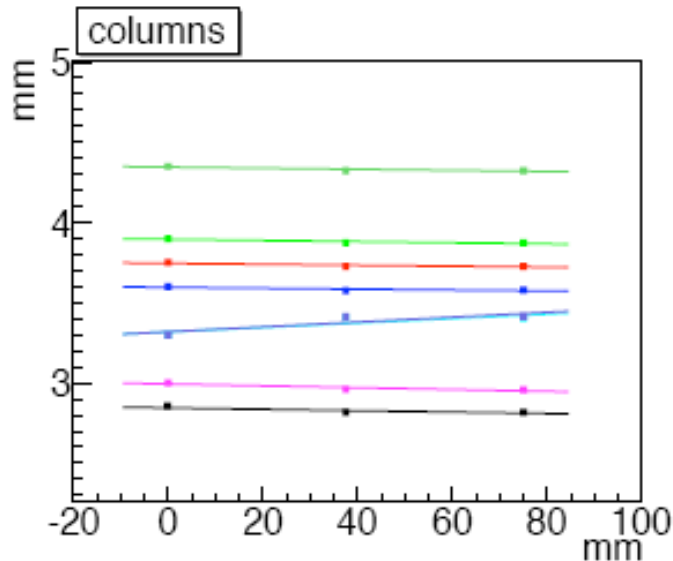
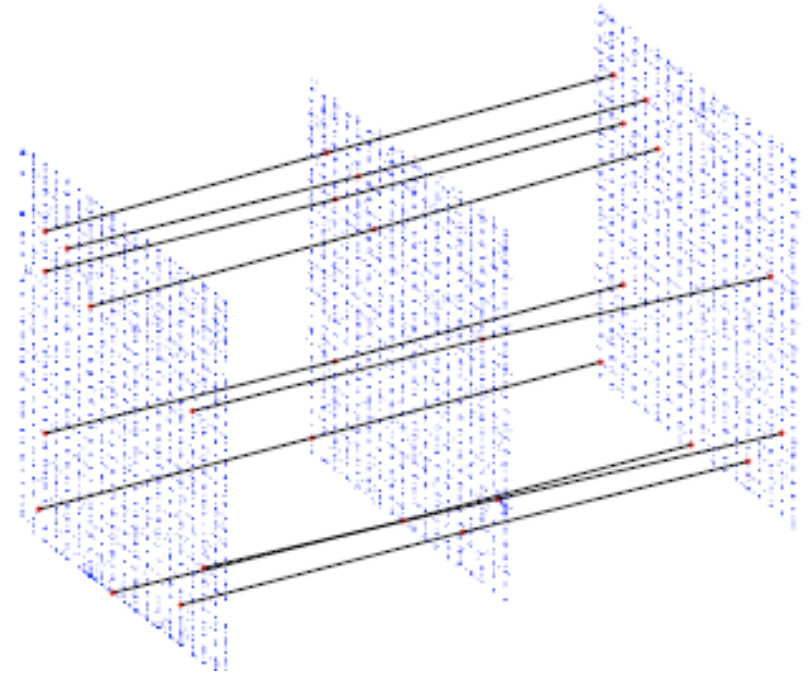
exit counter downstream of telescope for beam projection /steering



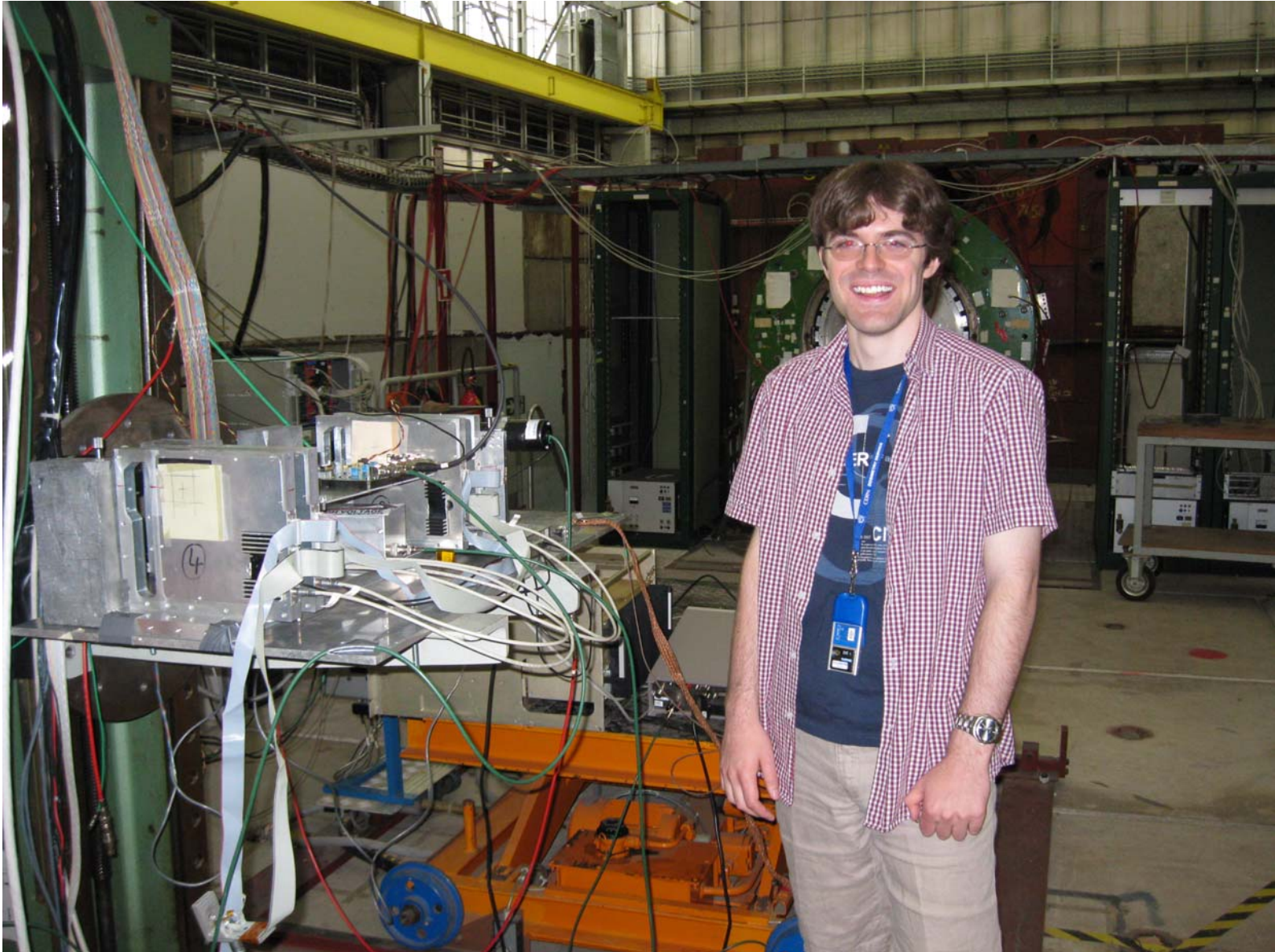
Telescope
3 planes of
diamond pixel
detectors

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.

