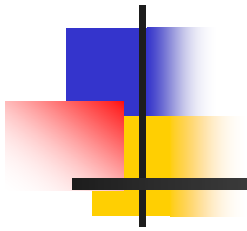


International Tracking Testbeam Needs

Bruce Schumm
UC Santa Cruz
Paris LCWS
April 19-23, 3004

R&D Thrusts

Primary activities:

- Si sensor development (Korea)
- Gaseous tracking (TPC) R&D, including readout, electronics, gas mixture, etc. (multi-regional)
- Long shaping-time silicon readout (US, Europe)

European/Asian Projections

Korean Si tracking groups foresee ~3 months running in 2005; hope to make use of KEK, CERN, and FNAL facilities, although not much detail yet specified.

Asian/European gaseous tracking R&D: roughly five groups seeking testbeam within next year

- In few GeV range; mostly hadrons, some electrons
- Envision using CERN, DESY, KEK facilities
- One group (Matsuda; KEK) requests magnetic field (strength?)

European (SiLC) testbeam needs not yet thought through.

North-American Test Beam Projections

Tracking groups were polled in Fall, 2002

Most groups responded at some level, some more concretely than others

Nonetheless, some trends arose that gave a good picture of upcoming needs.

Some tracking groups anticipated need for test beam facilities as early as January 2004, but now it's clear that those needs won't arise until 2005.

Beam Requirements

Primary need is for several GeV/c π/μ to limit multiple scattering and showering for resolution studies (5 out of 7 responding groups)

Several groups also interested in momentum-analyzed non-relativistic hadrons for dE/dX and PID studies

Rep-rate not that carefully thought out yet, but requests ranged between 1 kHz and 1 MHz

Running Periods and Duration

All groups request ~2 week runs (1 wk setup, 1 wk actual running with various conditions

Requests vary from once/year to 2-3 times/year, with intervals to be used for studying acquired data

Anticipation of need for first beams now a bit vague, but probably some in 2005 and most in 2006.

Facilities Requests

One group (MIT) will use local beams (BATES e^-)

At this point, other groups cite proximity as only concern

Requested services (roughly in order of demand):

- [Large-bore (25 cm) 5T magnet] ←see further discussion
- Fast trigger
- Spectrometer
- External trajectory definition (combine Si/TPC tests?)
- Particle identification
- Gas supply and servicing

High-Field Magnets

DESY in possession of a 30cm bore x 60cm axis high-field (5T) magnet, but seems not possible to implement on beamline for high-field test beam.

North American facility? Would be nice to explore possibilities (FNAL?)

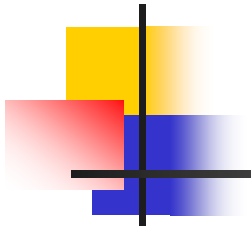
Or: How badly do we really need high-field test beams? See below…

Guesstimate Use Schedule (North-American Groups)

For 3-year period 2004-6; corrected for under-reporting

YEAR	ANTICIPATED WEEKS OF RUNNING
2004	0
2005	16
2006	24

A word on high-field testbeam facilities



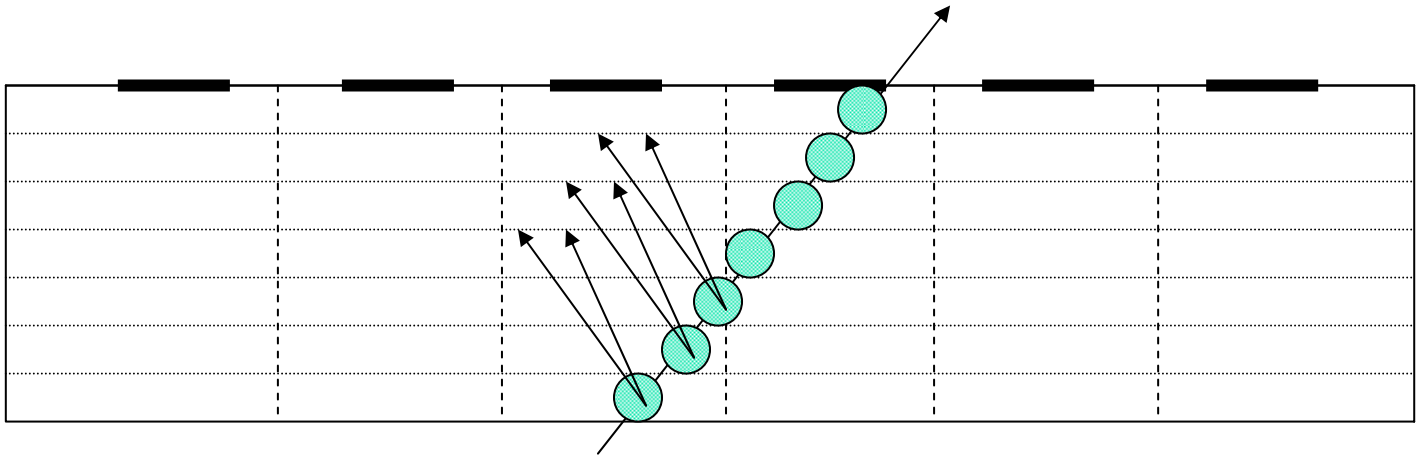
At UCSC, we have looked into tilting Si sensors to simulate the Lorentz angle, which is the predominant effect associated with large magnetic fields.

We have made use of a pulse-development simulation that we developed to optimize parameters and architecture of a long shaping-time readout ASIC.

Pulse Development Simulation

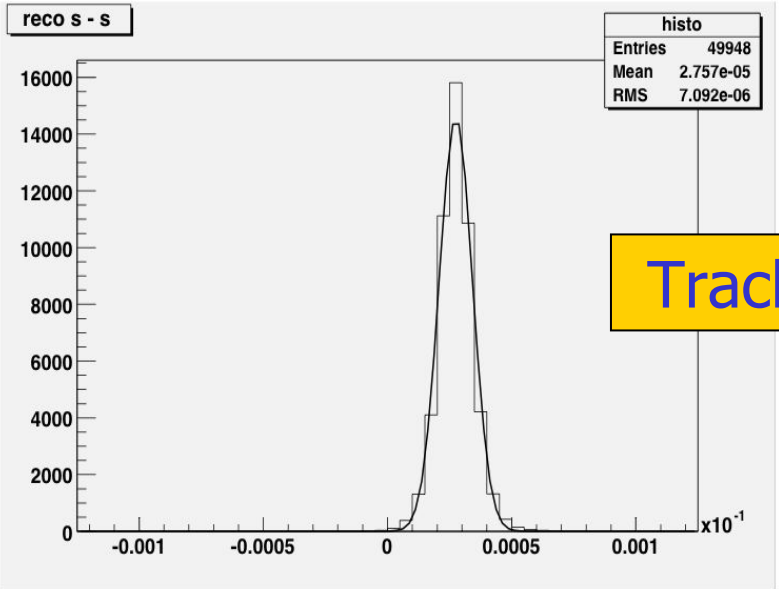
Long Shaping-Time Limit: strip sees signal if and only if hole is collected onto strip (no electrostatic coupling to neighboring strips)

Incorporates: Landau statistics (SSSimSide; Gerry Lynch LBNL), detector geometry and orientation, diffusion and space-charge, Lorentz angle, electronic response

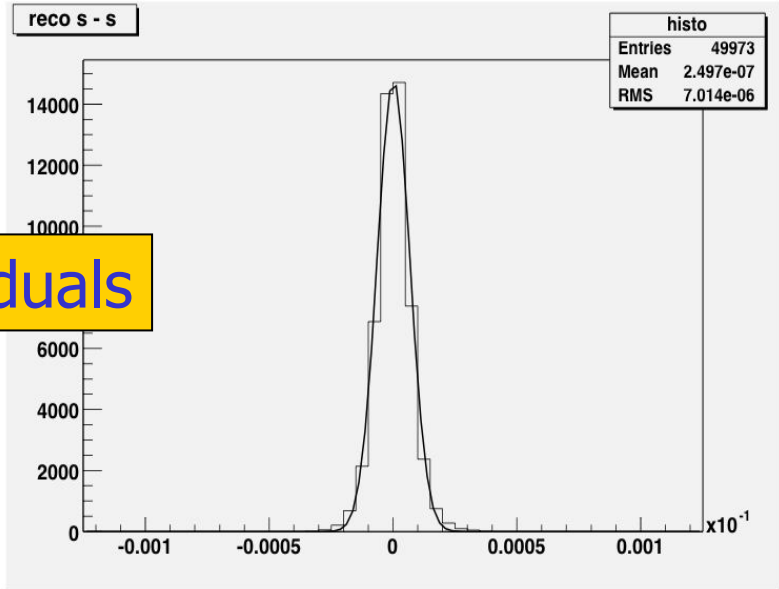


Faking the Magnetic Field

Michael Young, UCSC



Track Residuals

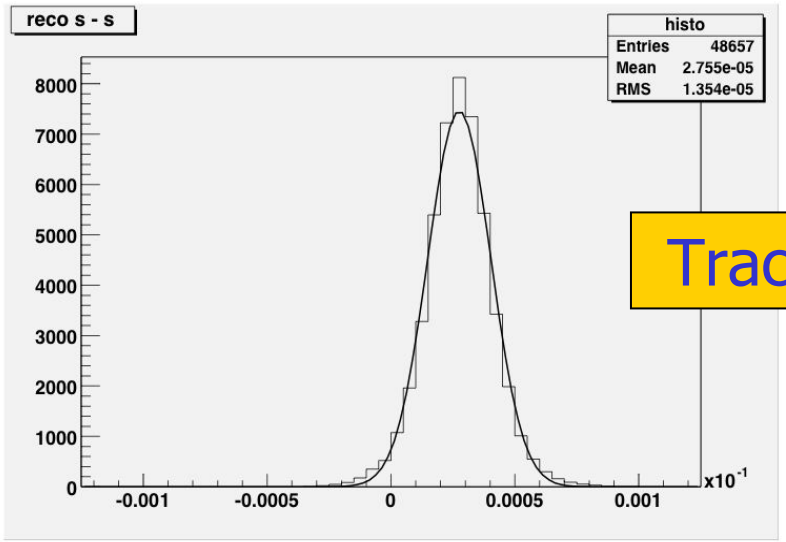


B = 5 T;
straight-through
track

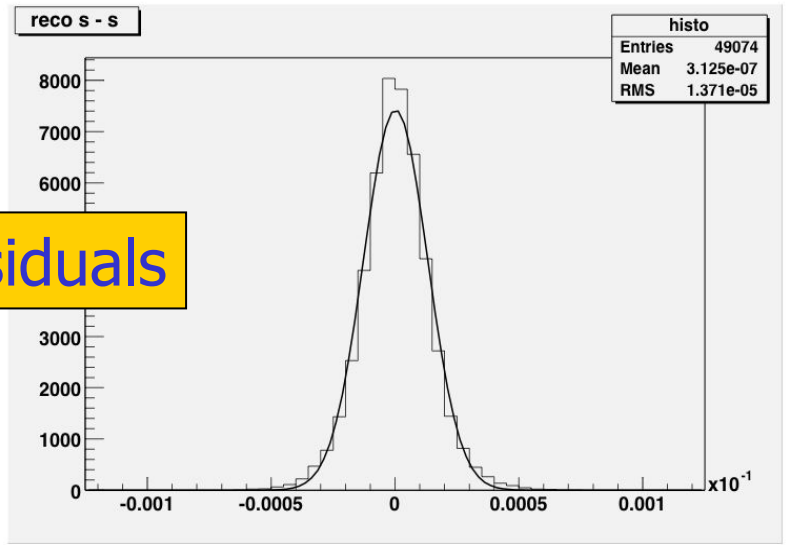
B = 0; 180 mrad tilt
(Lorentz angle for 5T)

Faking the Magnetic Field

Michael Young, UCSC



Track Residuals

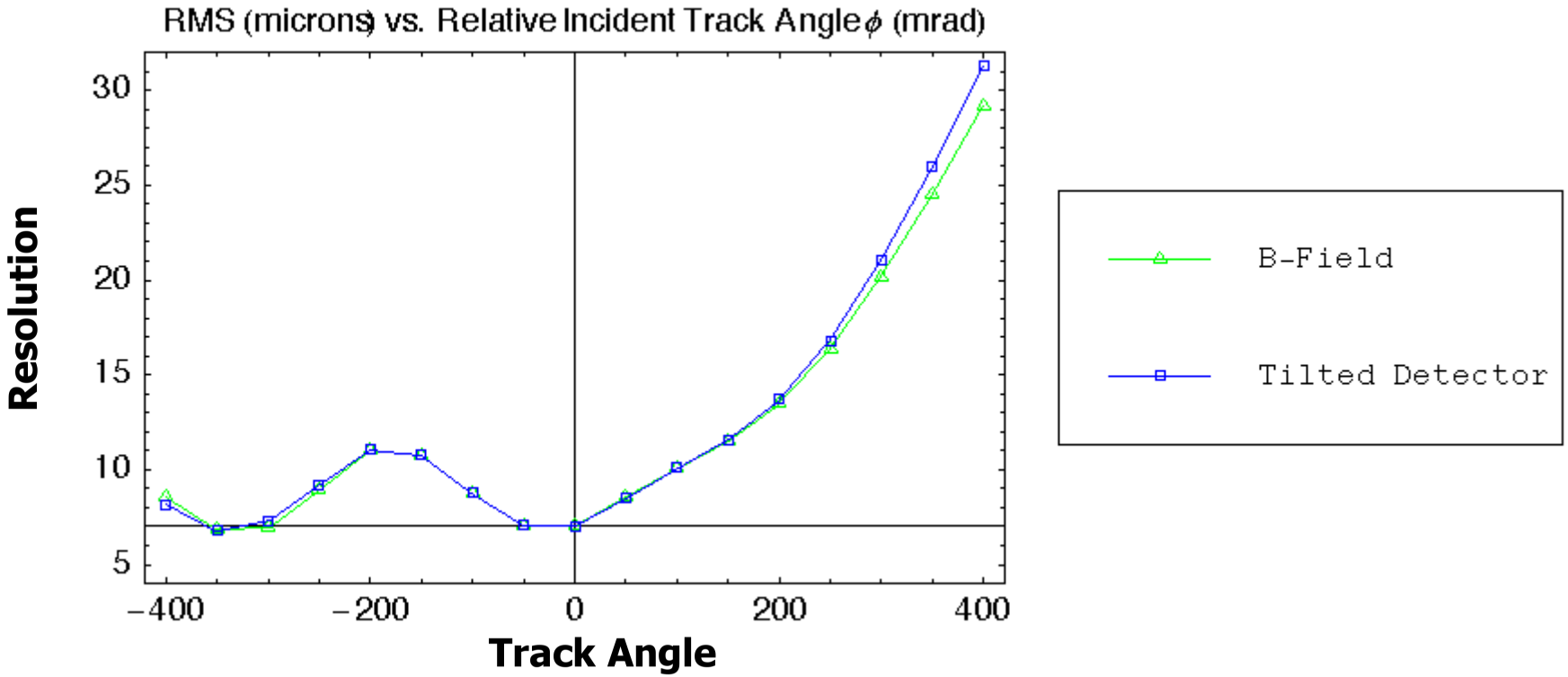


B = 5 T;
track with 200
mrad incidence

B = 0; 180 mrad tilt
track with 200
mrad incidence

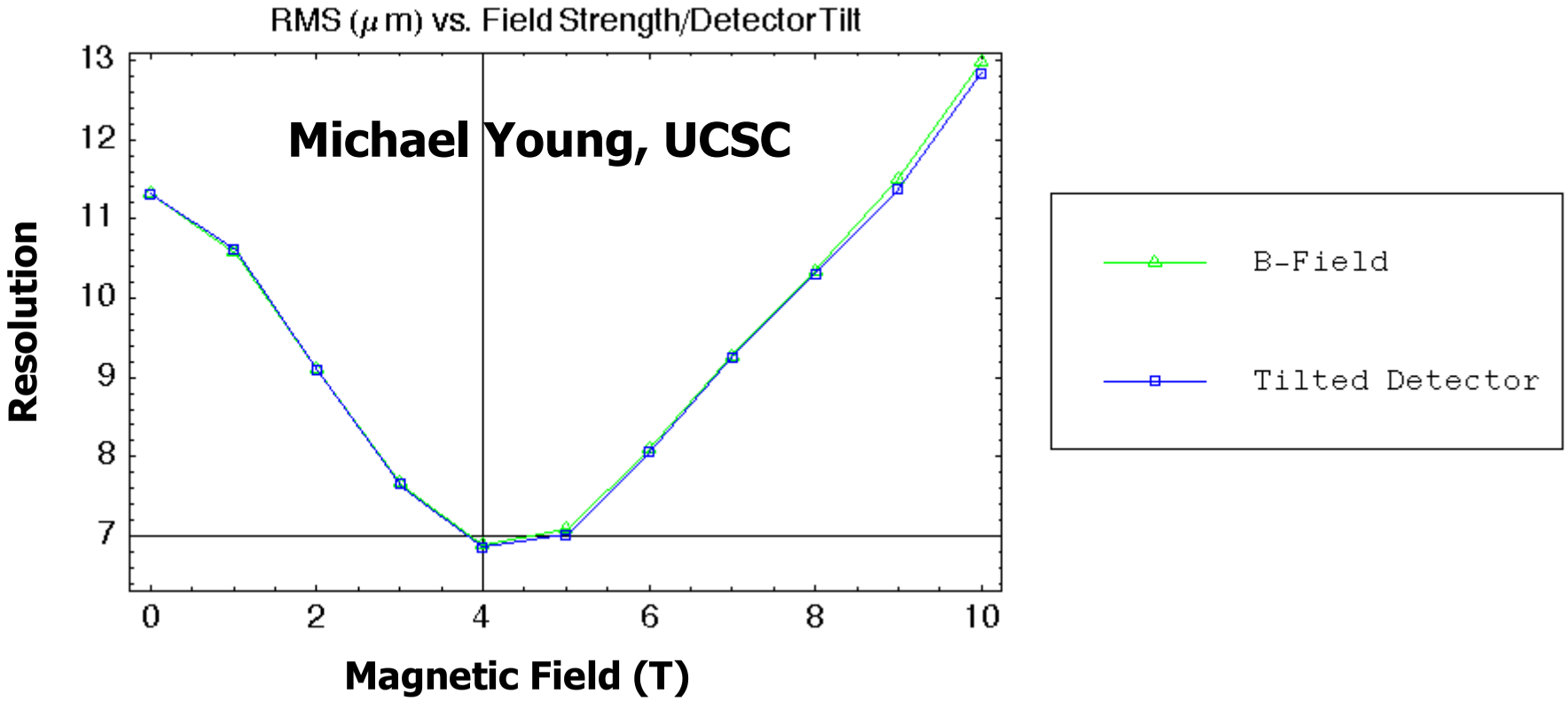
Faking the Magnetic Field

Michael Young, UCSC



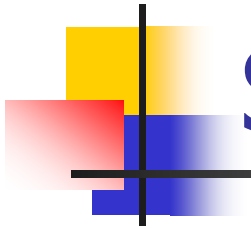
Different track angles for 5T field (B-Field) or 180 mrad tilt with no B-field (Tilted).

Faking the Magnetic Field



Different B-Fields (B-field) or detector tilt to simulate Lorentz angle (Tilted)

➔ Do we need high-field test beam facilities?



Summary

International tracking group anticipates testbeam needs beginning in late 2004

Very rough guesstimate is 75-100 weeks of facilities time between now and beginning of 2006

Most-requested beam is few GeV hadrons or muons

Need for high-field magnet on test-beam line is an open question. UCSC has addressed this for Si; what about others techonolgies?