

Silicon detector alignment study

POL analysis meeting
3rd November 2004

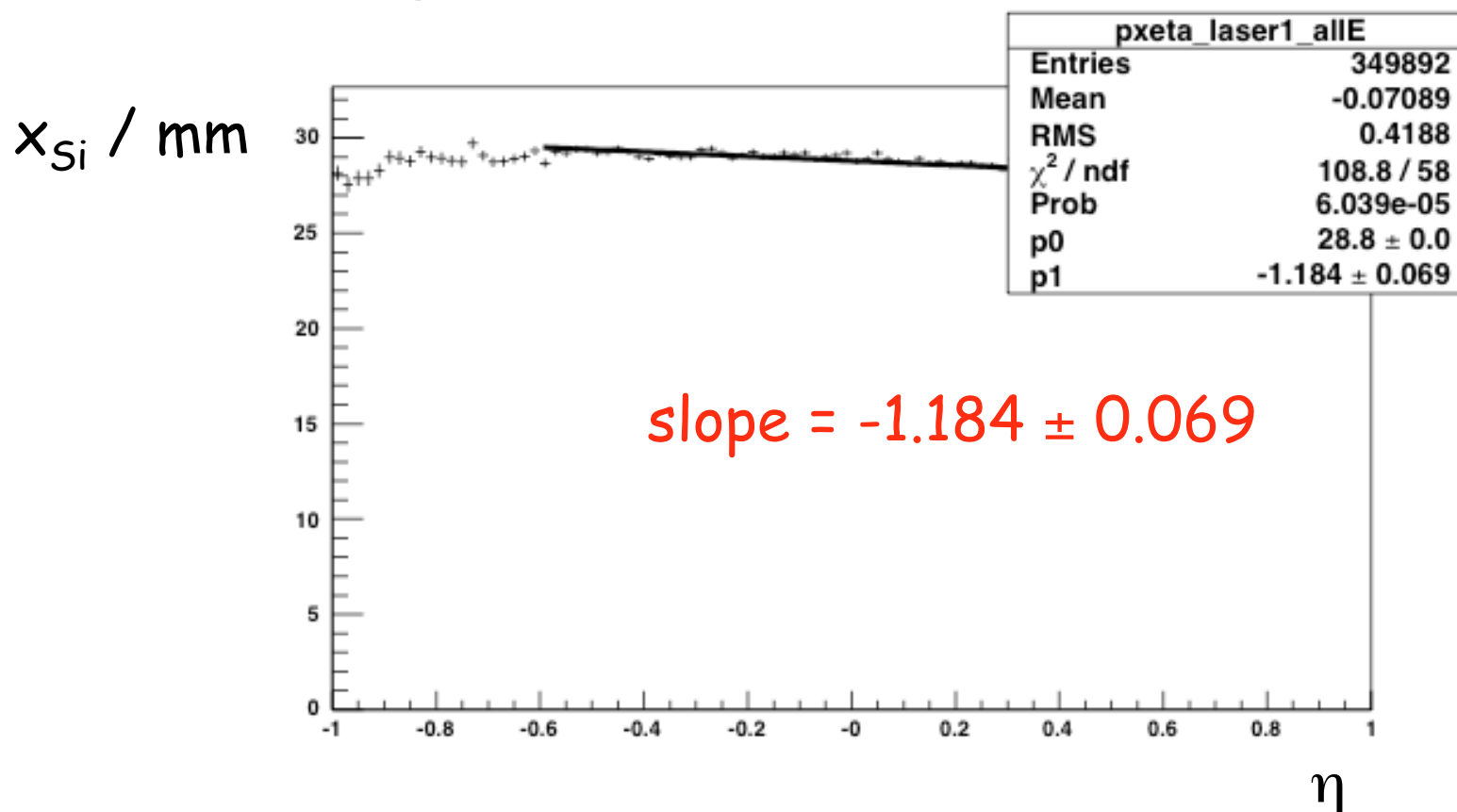
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Outline of study

- If calorimeter and silicon perfectly aligned:
 - x_{Si} should be flat plotted against η_{cal}
- Plot $x_{Si} - \eta_{cal}$ distribution - this is not flat!
- Convert η_{cal} to y_{cal} using $y(\eta)$
- Then measure slope of $y_{cal} - x_{Si}$ distribution and calculate angle between silicon and calorimeter
- Also generated MC with range of angles between Si and cal and looked for which angle had same slope in $x_{Si} - \eta_{cal}$ as the data

Silicon data: $x - \eta$

- Laser on and $nclusx=1$ and no cut on energy
- Fit straight line: $-0.6 < \eta < 0.6$

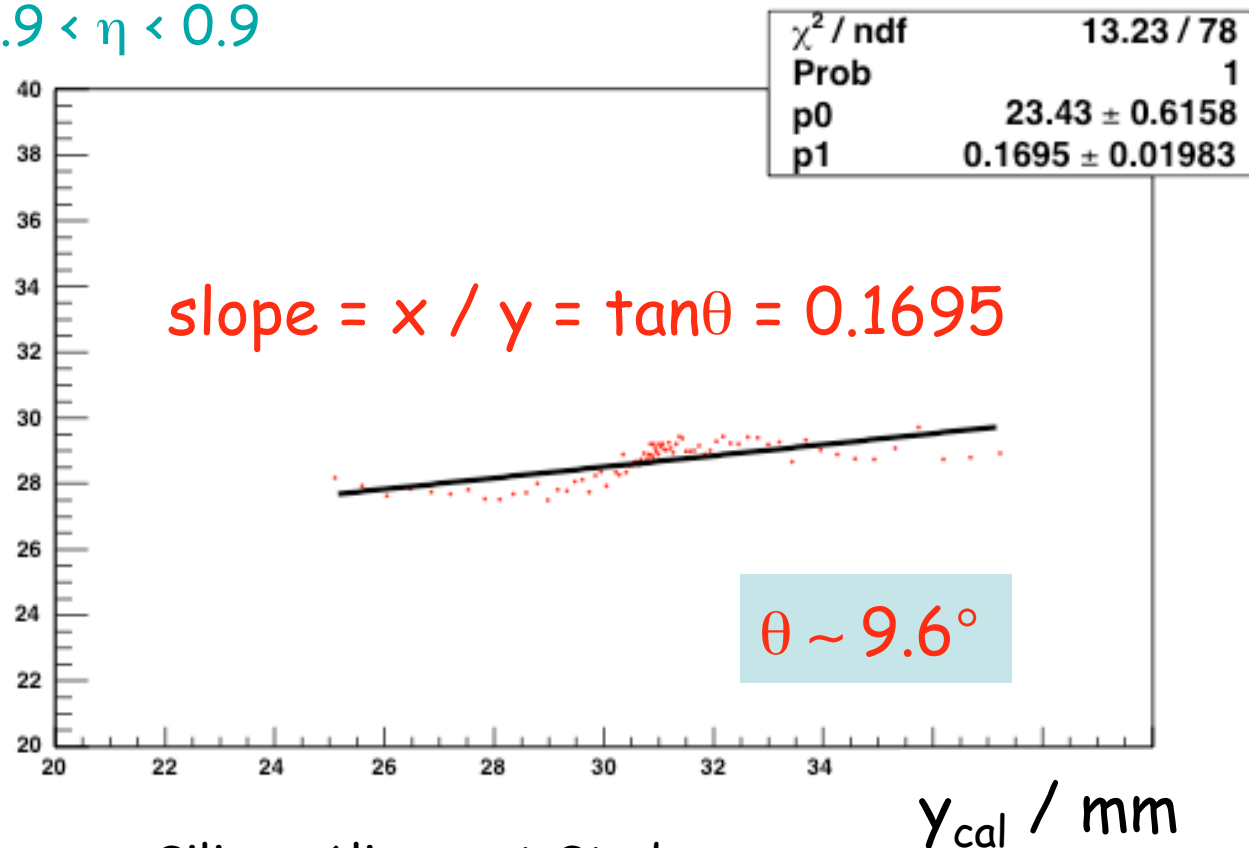


Convert η to y and calc. tilt

- To convert η to y_{cal} use:
 - $lg = \ln((1 + \eta) / (1 - \eta))$
 - $y(\eta) = y_0 + lg(P_0 + P_1 * lg^2 + P_2 * lg^4 + P_3 * lg^6)$
- Use range: $-0.9 < \eta < 0.9$

x_{Si} / mm

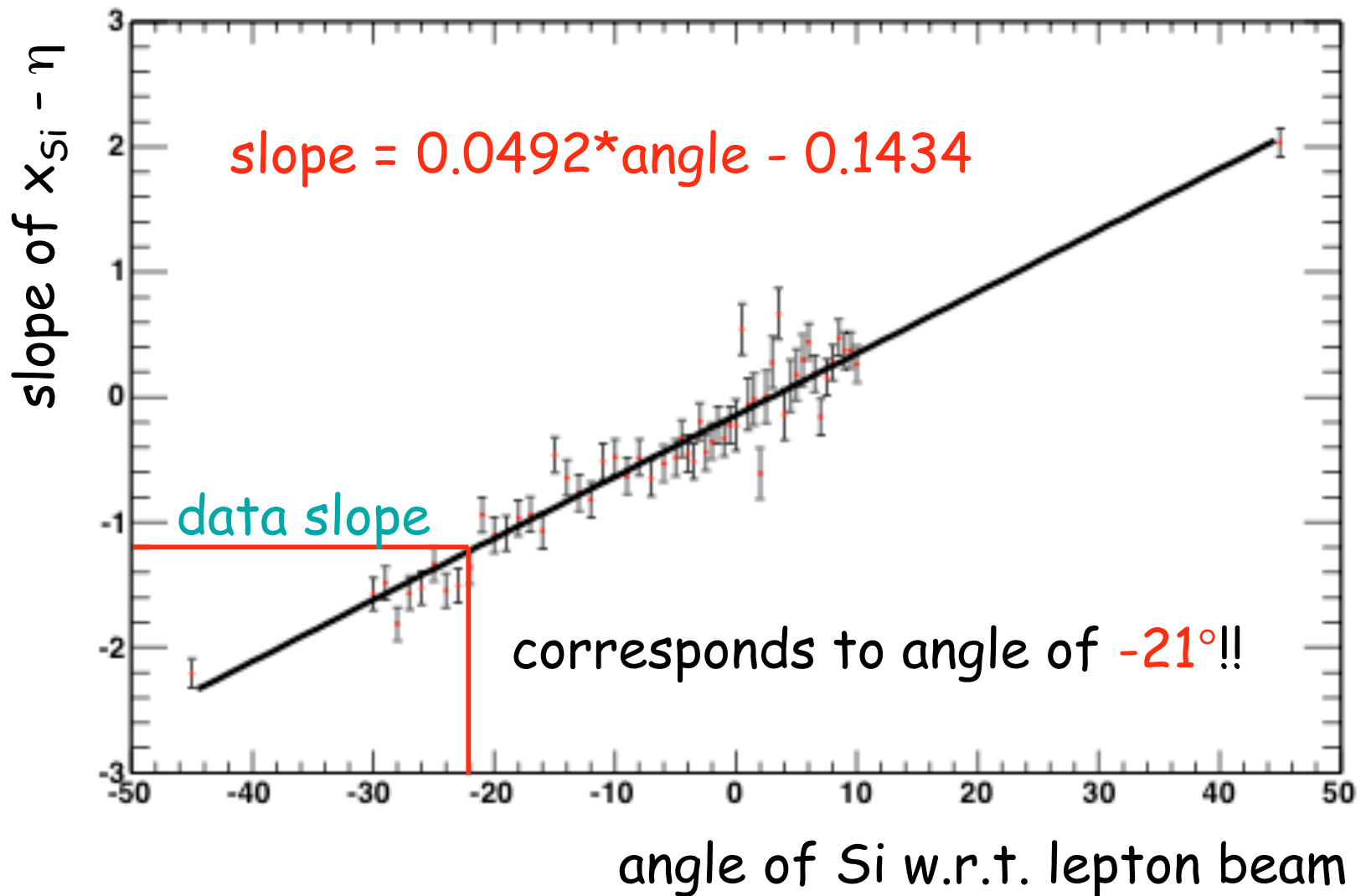
Not yet
calculated
errors
properly



MC simulation

- Simulate 100k or 200k events at silicon angles between $\pm 45^\circ$ w.r.t. lepton beam
- Leave calorimeter angle set to 0.06° w.r.t. lepton beam
- For each Si angle: fit straight line to $x - \eta$ profile with $nclusx=1$ for $-0.6 < \eta < 0.6$
- Plot gradient of fit vs. angle...

MC results



Summary and future plans

- Converting η to y_{cal} using $y(\eta)$ suggests 9.6° (sign?) between calorimeter and silicon x-axes
- Using MC to find silicon angle which best matches the $x - \eta$ slope from the data suggests -21° between silicon and the lepton beam
- Clearly these two **do not agree** and seem **too large**
- Want to consider:
 - Could the **beam tilt** (measured to be $\sim 5^\circ$ with ellipse fitting method) be having an effect? Is this in the simulation?
 - Can we really calculate y_{cal} with a method involving information from the silicon detector, $y(\eta)$, to deduce the angle between the calorimeter and the silicon?
 - Check **parameters of $y(\eta)$**
 - Proper **error calculation** from $y(\eta)$ method