

Understanding L00 Efficiency

J. Reid Mumford
Johns Hopkins University

April 9, 2004

L00 Efficiency: Current Status

- Without clustering cuts, only about 80% efficient for tracks pointed into active area.
- about 59% efficient with high quality clusters.
- Can anything be done to recover the 20% hit in efficiency?
 - SiStripMask
 - Pedestal fits

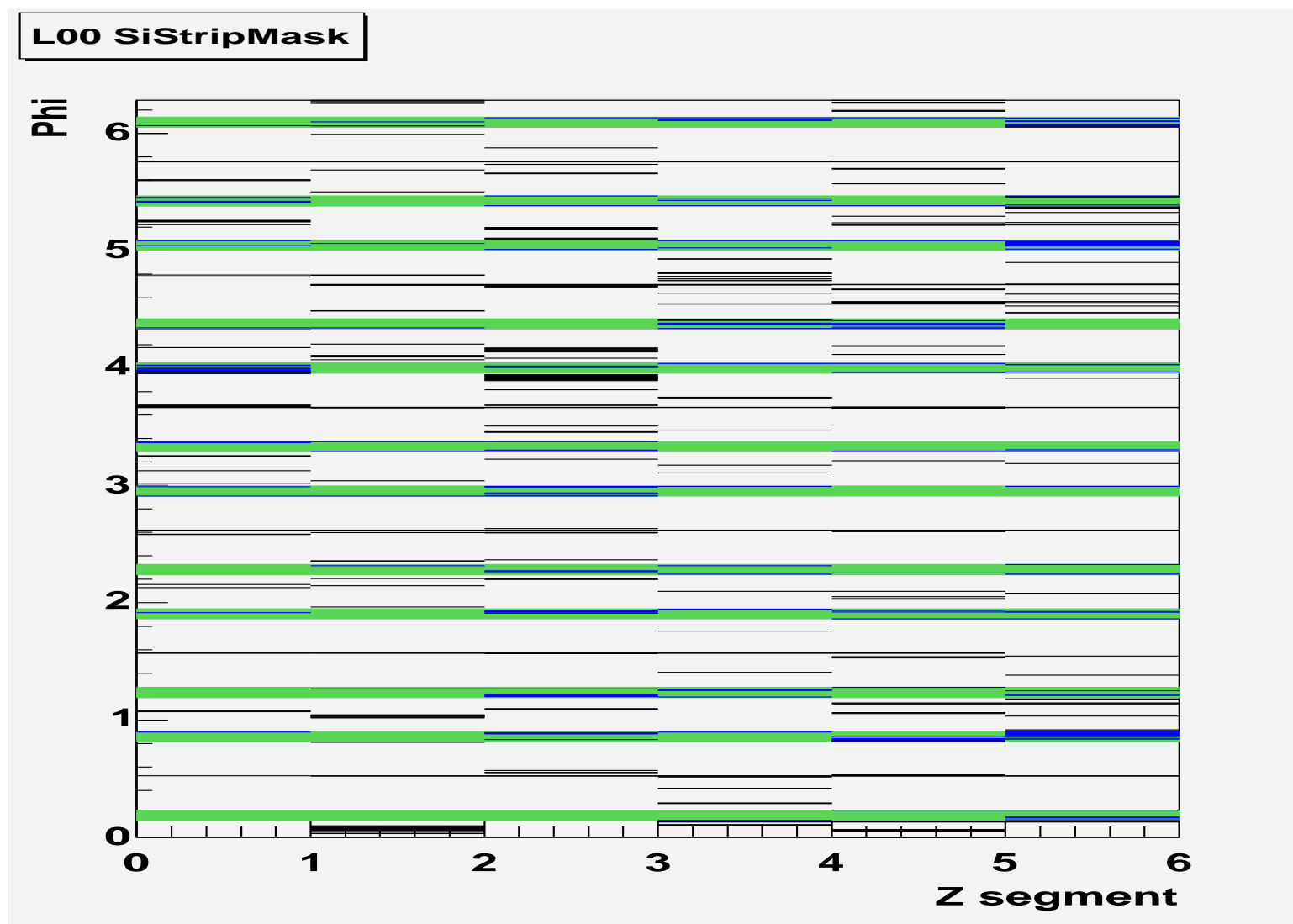
SiStripMask

Originally created by Auke-Pieter to mask bad channels that confused the pedestal fit.

- The original table masked 649 strips in 44 of 48 ladders.
- The current table (run 111122) masks 560 strips in 48 of 48 ladders.
 - reworked by Igor Volobouev starting with a list of disconnected wire-bonds and strips on the edge of each ladder.
 - strips were added or removed to get residual pedestals as close to 0 as possible.
 - May be worth revisiting this table – may expect a few more dead channels
- Masked strips only account for 2.4% of total L00 strips
- Furthermore, $\sim 20\%$ of masked strips have overlapping strips

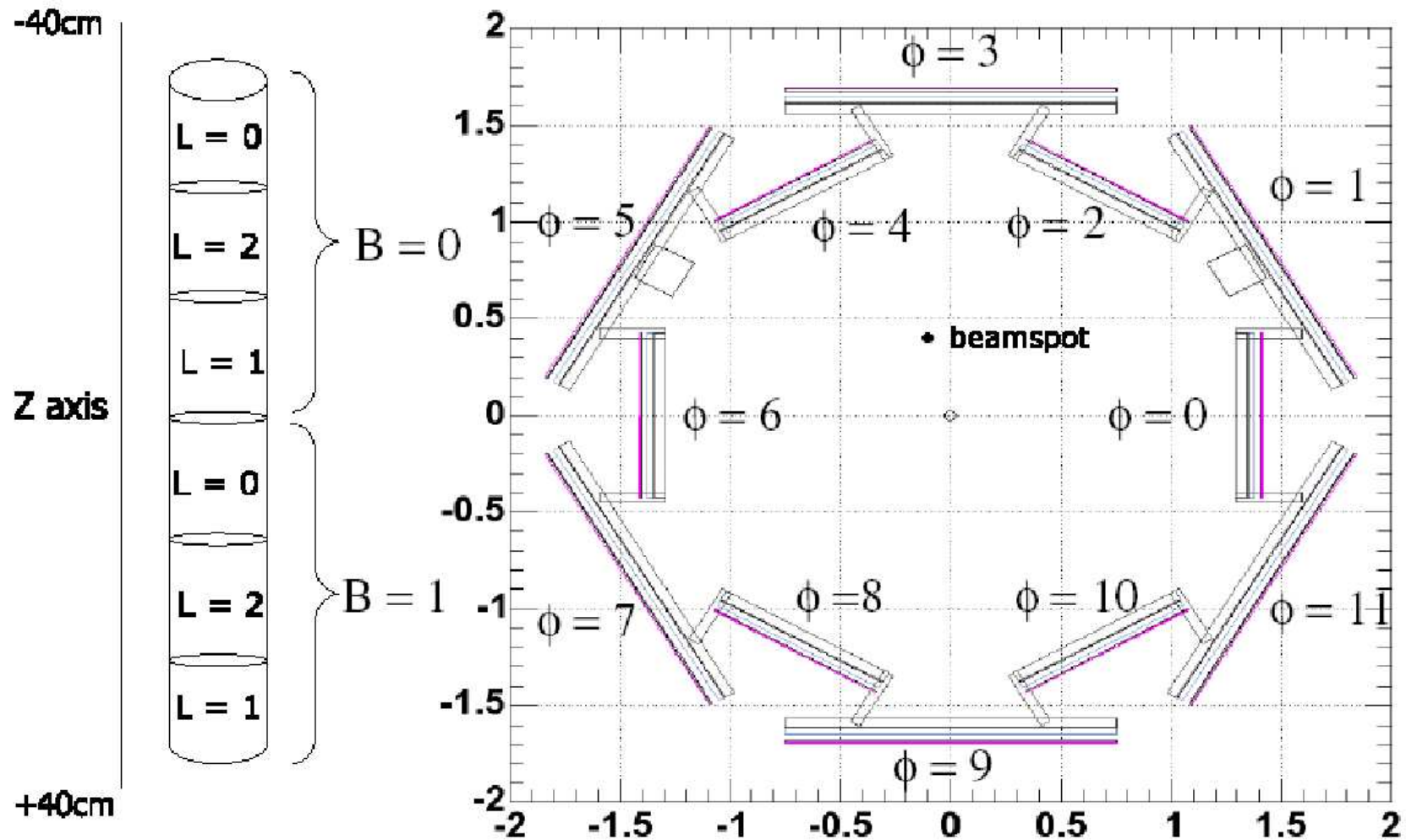
Z-Phi Map of SiStripMask

KEY: **Overlap regions:** Masked strips with possible overlap: Masked strips with no overlap



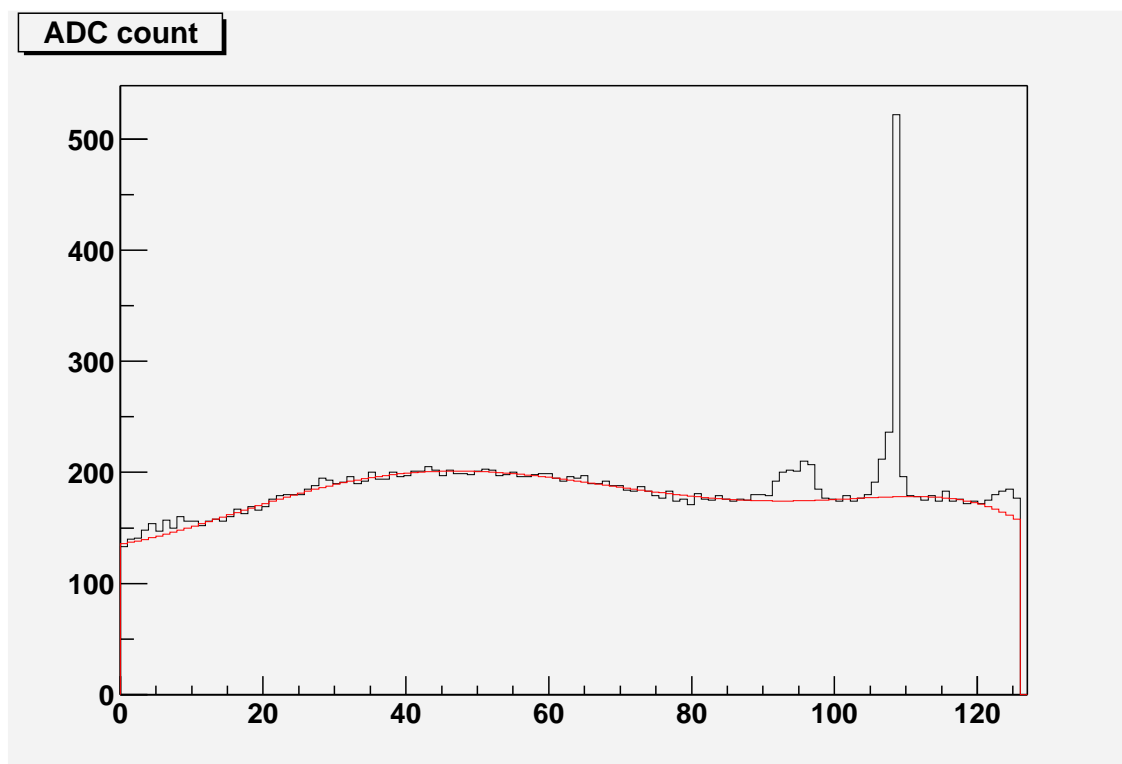
L00 Geometry

Diagram taken from Stephen Levy's L00 efficiency talk from 10/29/2003 Tracking meeting



Another Possibility: Pedestal Fit

- Auke-Pieter's Chebyshev fit (described in CDF Note 5891).
- Pedestal distributions fitted to a 6th-order Chebyshev polynomial on a chip-by-chip basis.
- The fit is iterated several (default = 5) times, excluding strips where $ADC - PED > 7.5$



Pedestal Fit Failures

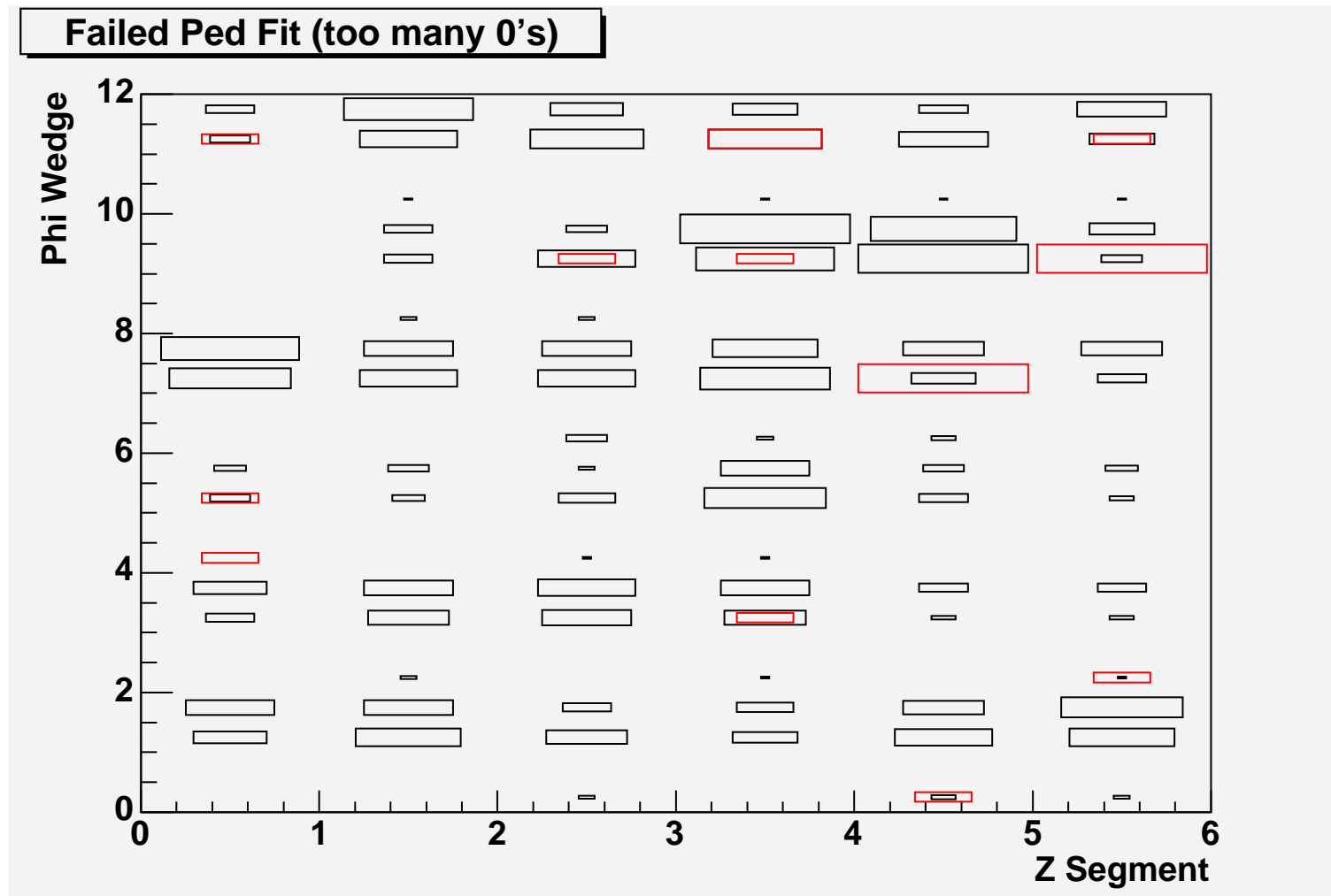
How often does the fit fail?

Chips	%	Description
20776		Total chips ran through L00Corrector
20052	96.5	Chips were successful
706	3.4	Chips failed because of "too many 0 channels"
18	0.09	Chips failed because the error matrix was non-invertible.

- Chips must have at least 51-non-zero strips for the pedestal fit to be attempted.
- Large pedestal fluctuation for a DPS-off chip to fluctuate from 60 counts to below 0 counts.
- What causes these fluctuations?

Pedestal Fit Failures

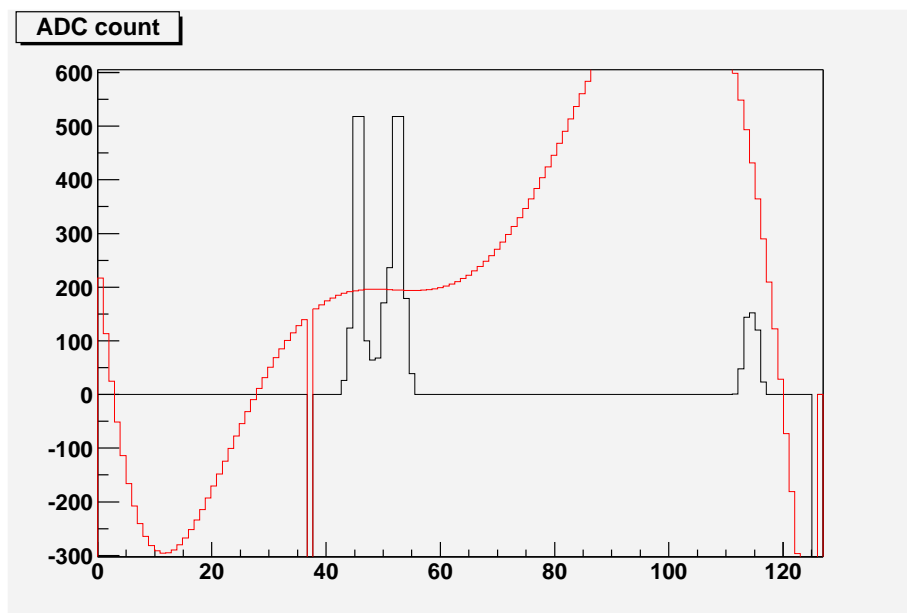
Where does the Auke-Pieter fit fail?
KEY: **Matrix inversion:** Too many zero strips.



Forcing the Pedestal Fit

What happens if we force the pedestal fit even with an excessive number of zero strips?

- Many fail on matrix inversion
- The others fail the fit miserably.



Possible remedy

- verify that large fractions of a chip are fluctuating low
- are there events where the chip saturates?
- if not, raise ramp pedestal for the chip in HDWDB.

Summary

- Progress has been made towards understanding the efficiency of L00
- 2 – 3% efficiency hit from SiStripMask.
- $\sim 3.5\%$ effect from failed pedestal fits.
- $\sim 5\%$ effect from under-biased ladder (b2 & f8).
- Still doesn't account for the missing 20% of efficiency
- Will pursue pattern recognition issues next (variable search windows)

Thanks to Matt Herndon, Jason Neilsen, Igor Volobouev, and Tim Nelson for their input.