3)Realizing that the 120 GeV protons from the FNAL test beam are not minimum ionizing particles, describe the expected VTX S/N for a mip. Discuss how the VTX sensor response for a mip is to be modeled in GEANT.

Current ADC calculation in PISA (GEANT):

$$ADC = dE(GEANT) \times 0.28\ eV^{-1} \times ADC_GAIN$$

where 0.28 is inverse ionization potential for Si, and ADC_GAIN is charge to ADC conversion coefficient, hard-coded in the software (currently 0.0038).

ADC_GAIN was determined from a simulation using pions with pT from 5 to 20 GeV, hitting only one strip.

5-20 GeV pions are not MIPs! 120 GeV proton deposits the same energy as 20 GeV pion (see slide 4).

BEFORE beam test at FNAL (slide by Manabu Togawa)

vtx-software_20080523.pdf - Adobe Reader

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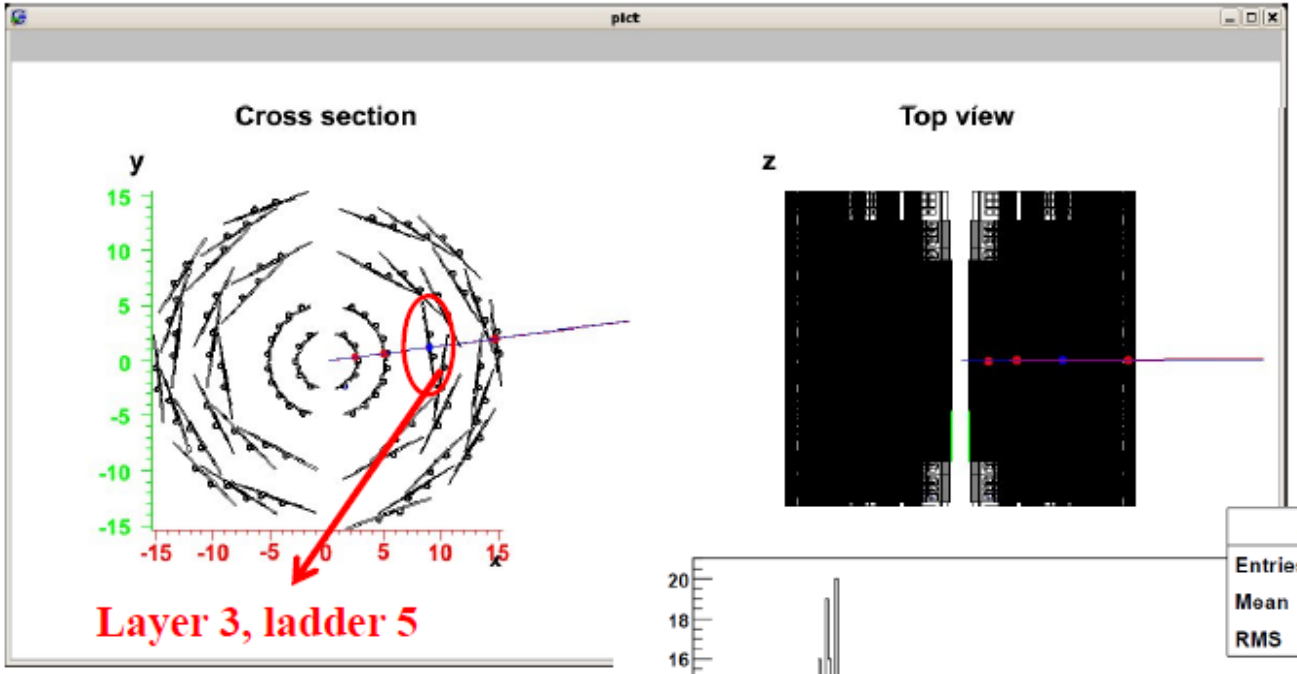
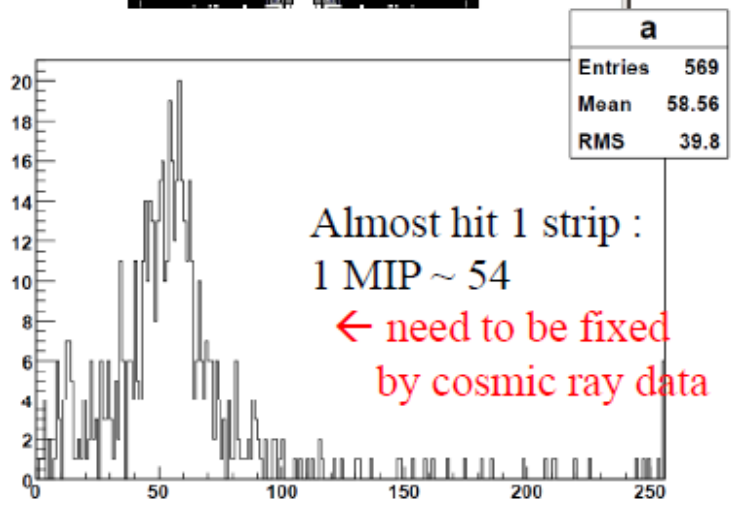
How much is ADC value for 1 MIP in PISA?





Almost hit 1 strip :
1 MIP ~ 54
← need to be fixed
by cosmic ray data

Single π^+ simulation
$5<p_T<20$ GeV/c
$-0.01<\eta<0.01$, $0.15<\phi<0.16$
vtx pos : x=y=z=0

AFTER beam test at FNAL (slide by Manabu Togawa)

vtx-software_mtogawa_20080612.pdf - Adobe Reader

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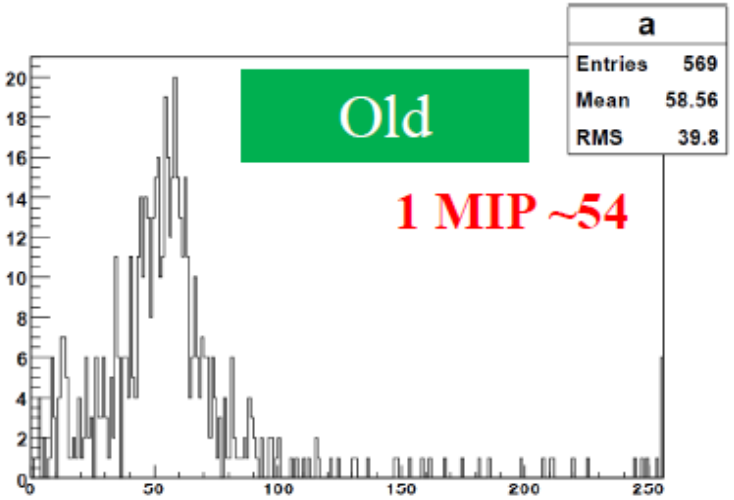
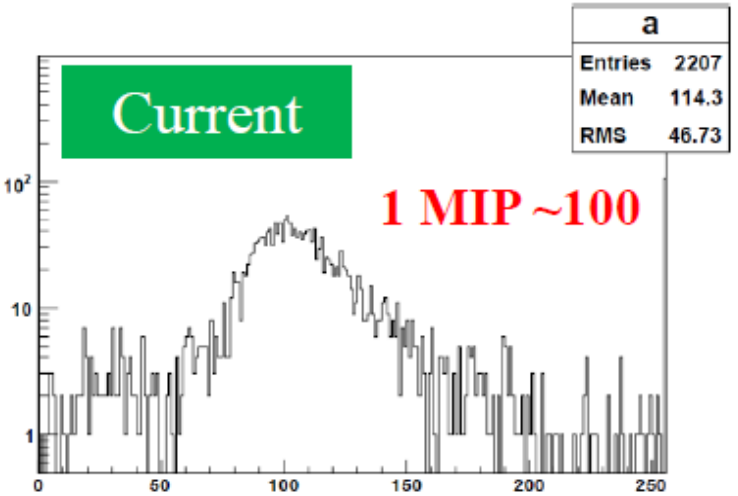
Change gain

- 1MIP ~ 100 ch for each read out from cosmic data
- Looked MIP peak after from the single pion simulation (almost no sharing btw strips)





- dE/dx (GeV) / 3.6 (eV) * 0.0038 ~ 200 ch for 1 MIP

  0.0038 is hard coded as adcgain in SvxStripixel.C

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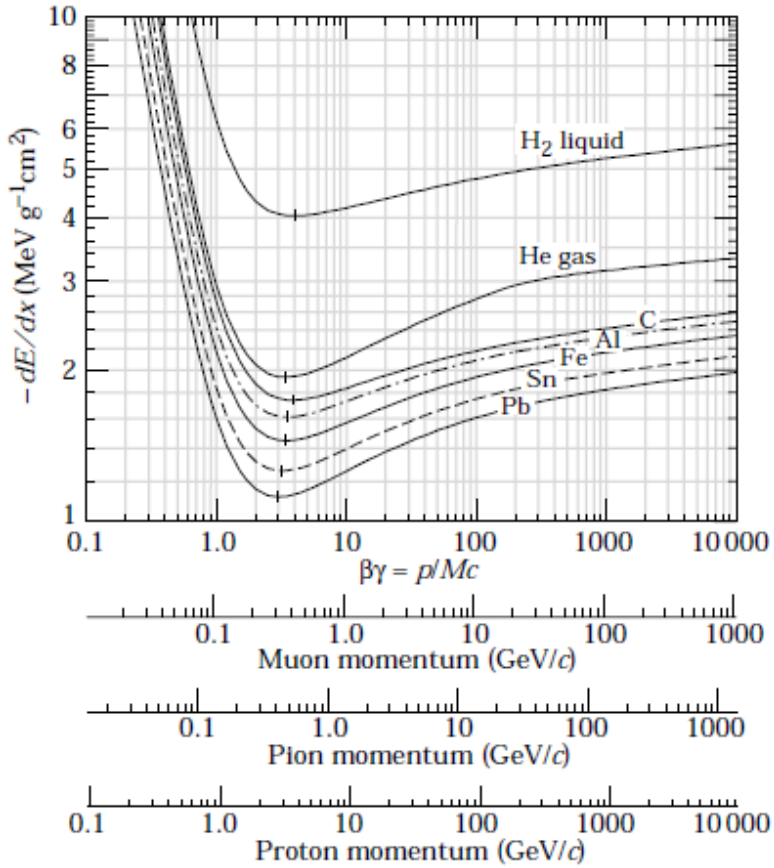

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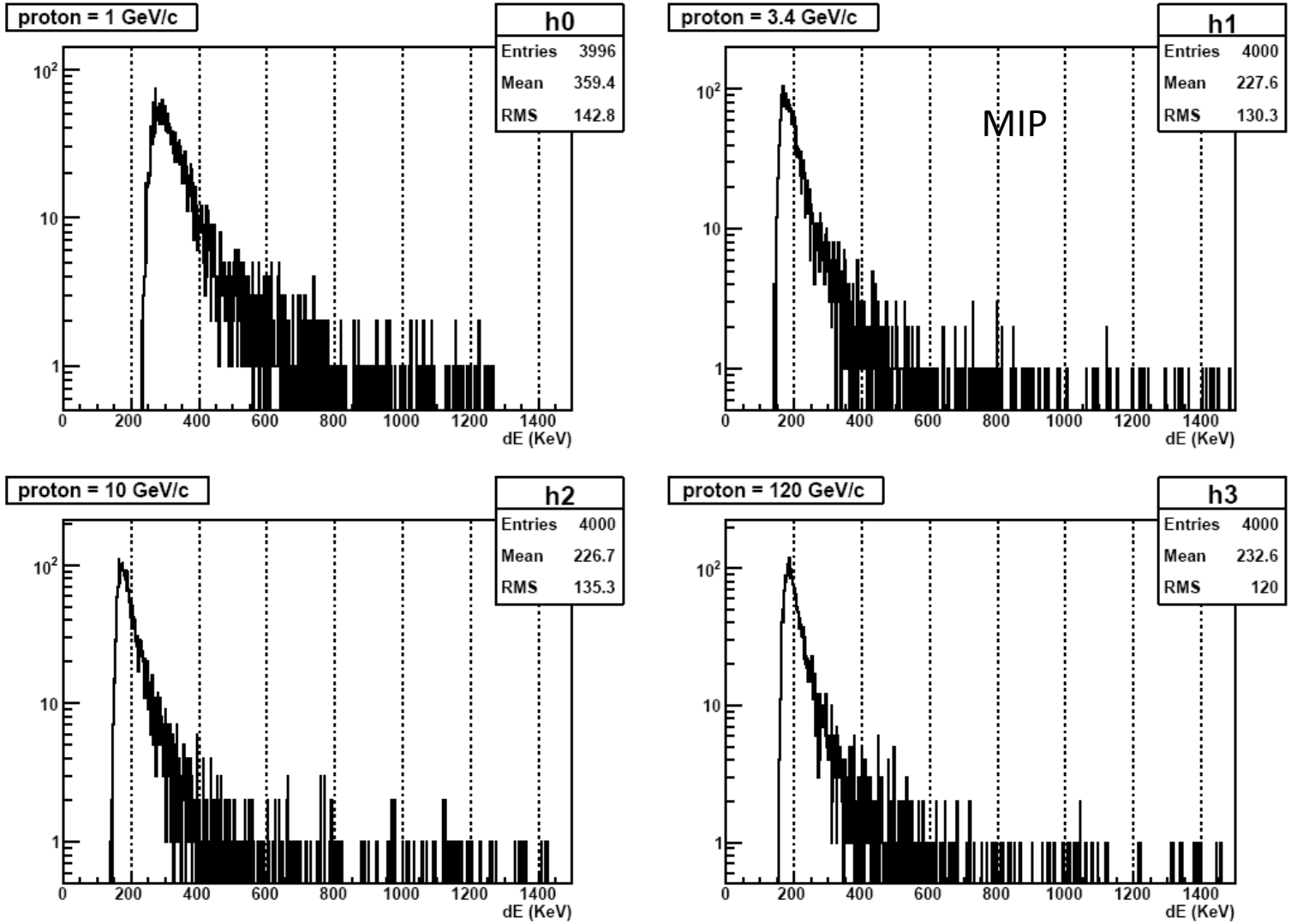
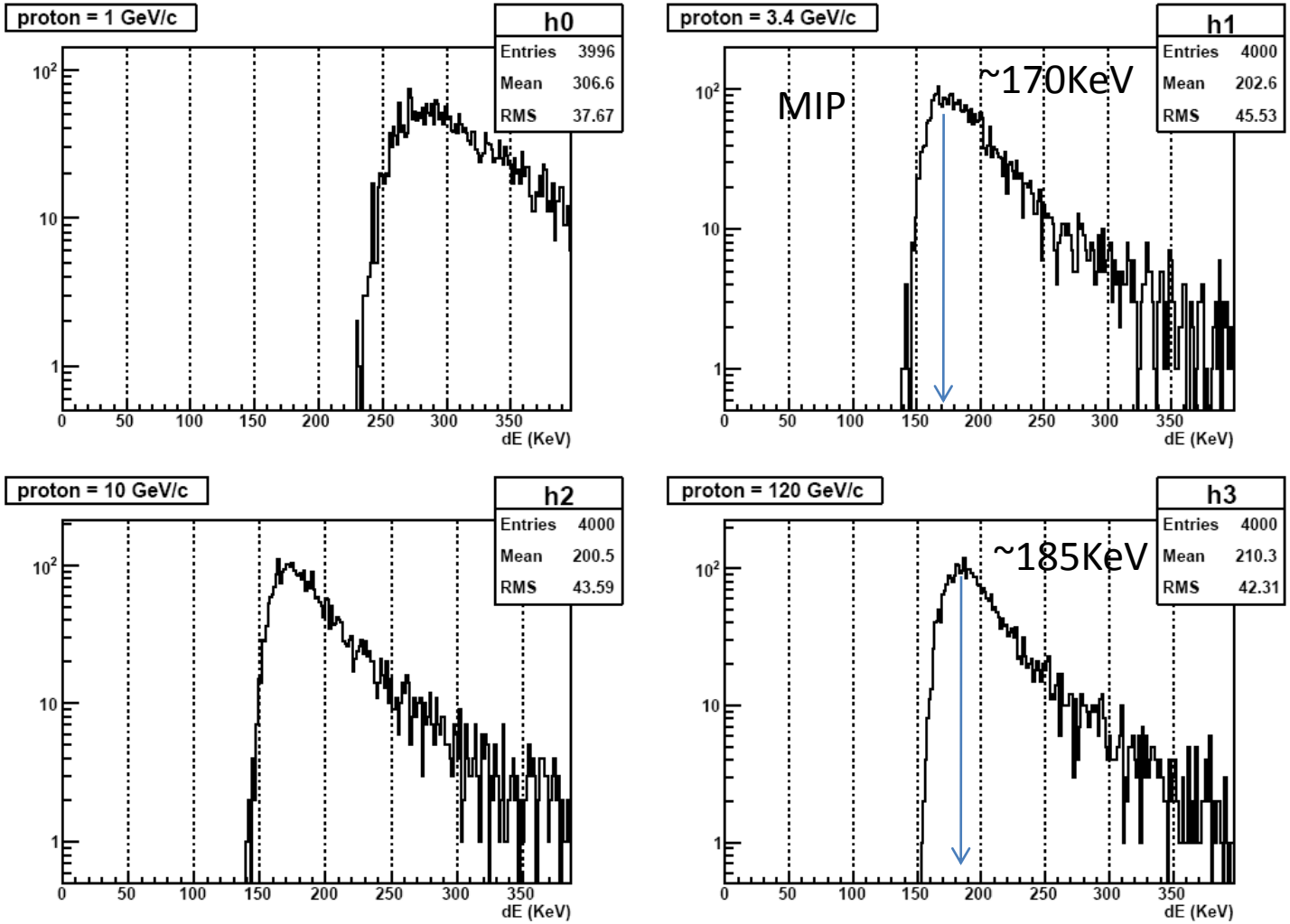
Energy loss of proton (GEANT)



- ΔE in 625 micron silicon in GEANT

Energy loss of proton (GEANT)



- ΔE peak of MIP (3.4 GeV/c) is ~170KeV
- ΔE peak of 120 protons is ~185 KeV, only ~10% higher than MIP

Conclusion

The correction due to the fact that 120 protons are not MIPs is, essentially, negligible, because software was calibrated by pions with approximately the same dE/dX.

However, we should “recalibrate” our software with 120 GeV protons.