Reconstruction software integration status of ScECAL and its applications to FNAL 2009

15 / Sep 2011 CALICE collaboration meeting at Heidelberg

KEK/DESY k. kotera on behave of CALICE-ASIA group

Status at previous CALICE meeting May2011 at CERN

Inputs for analysis	Current status
DAQ-strip Mapping	Data base class▶not yet
adc/MIP conversion factor	- class for data has been already made - read by using a calibration processor - Data base was already uploaded
Inter calibration constants	- class for data has been already made - read by using a calibration processor - Upload tools OK, uploaded
Gain (one p.e. sensitivity)	- class for data has been already made - read by using a calibration processor - Upload tools OK, uploaded
Temperature (stand alone meas. for 2009)	- class for data is under construction - read by using a calibration processor - Data base upload has not been yet done.
MPPC Npix	Basic study is on going in Shinsu

Recent progress on DB

Inputs for analysis	Current status
DAQ-strip Mapping	- Done and uploaded
adc/MIP conversion factor	- class for data has been already made - read by using a calibration processor - Data base was already uploaded
Inter calibration constants	- class for data has been already made - read by using a calibration processor - Upload tools OK, uploaded
Gain (one p.e. sensitivity)	- class for data has been already made - read by using a calibration processor - Upload tools OK, uploaded
Temperature (stand alone meas. for 2009)	- class for data is under construction - read by using a calibration processor - Upload tools OK, uploaded
MPPC Npix	Basic study is on going in Shinsu

Recent progress on utilities

Inputs for analysis	Current status
DAQ-strip Mapping	- Done and upload
adc/MIP conversion factor	- MIP analysis processor in CALICE soft has been made including temperature coefficients also ▶ DB also updated inc. Tem.coeff.
Inter calibration constants	- not yet but the same way as Gain and MIP const.
Gain (one p.e. sensitivity)	- Gain analysis processor in CALICE soft has been made, Including measurement of temperature dependence
Temperature (stand alone meas. for 2009)	- Temp. readout processor (Temp.Getter) for each event has been made and DB was uploaded.
MPPC Npix	Basic study is on going in Shinsu

MIP measurement Processor

- First step, using Temp.Gettor :

  Fit landau function convoluted with gaussian to the energy distribution of MIP events, and then determine #adcs between pedestal and MPV (in ScECLMIPCalibrationProcessor)
  - data by this processor:
    - layer : strip : adc/MIP : adc/MIP Err : Temperature,
    - Temperature is averaged one during data taking.

- Second step :

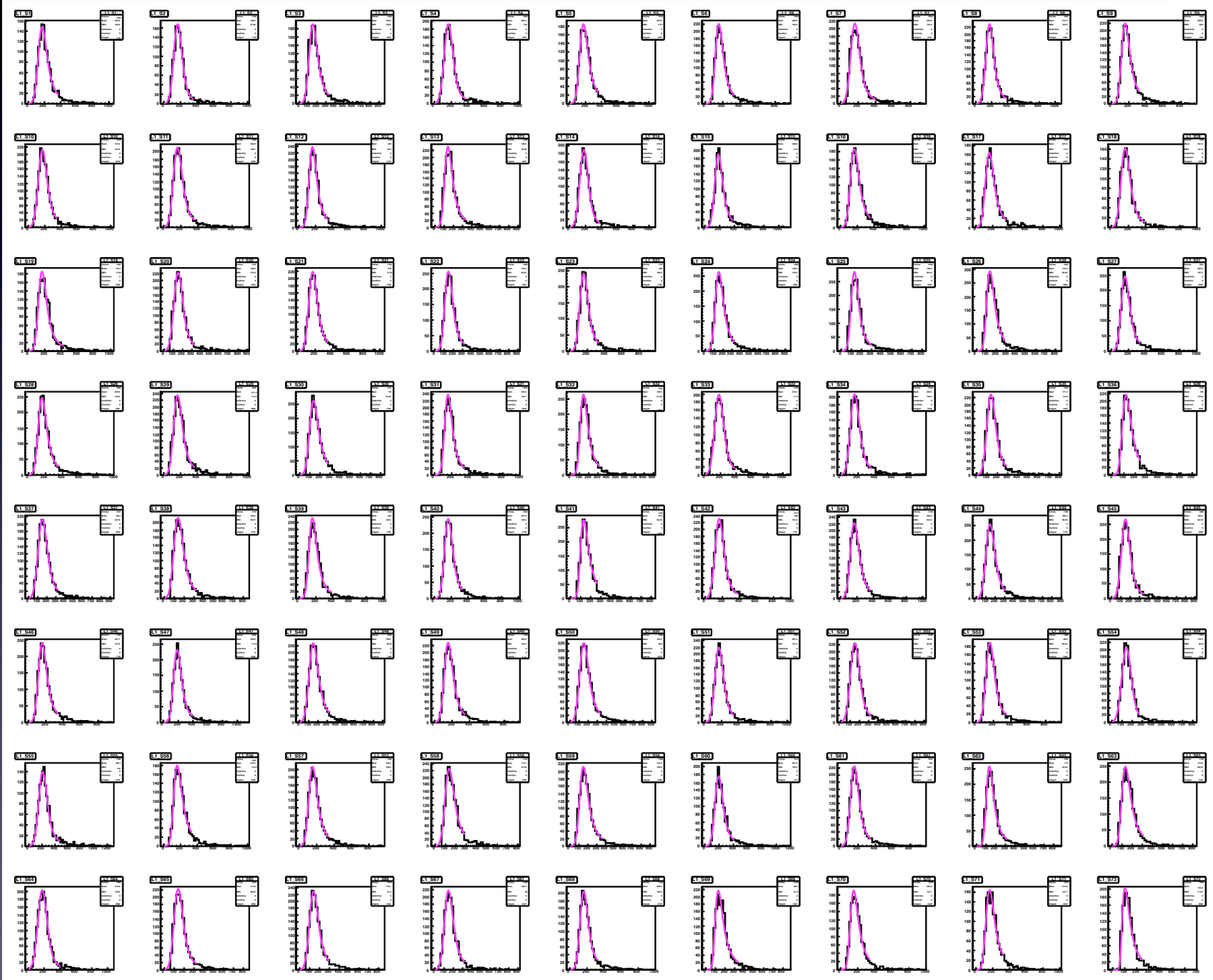
  using above data of some runs with varied temperature, temperature dependences of adc/MIP are measured (in ScECALMipTempDependProcessor)

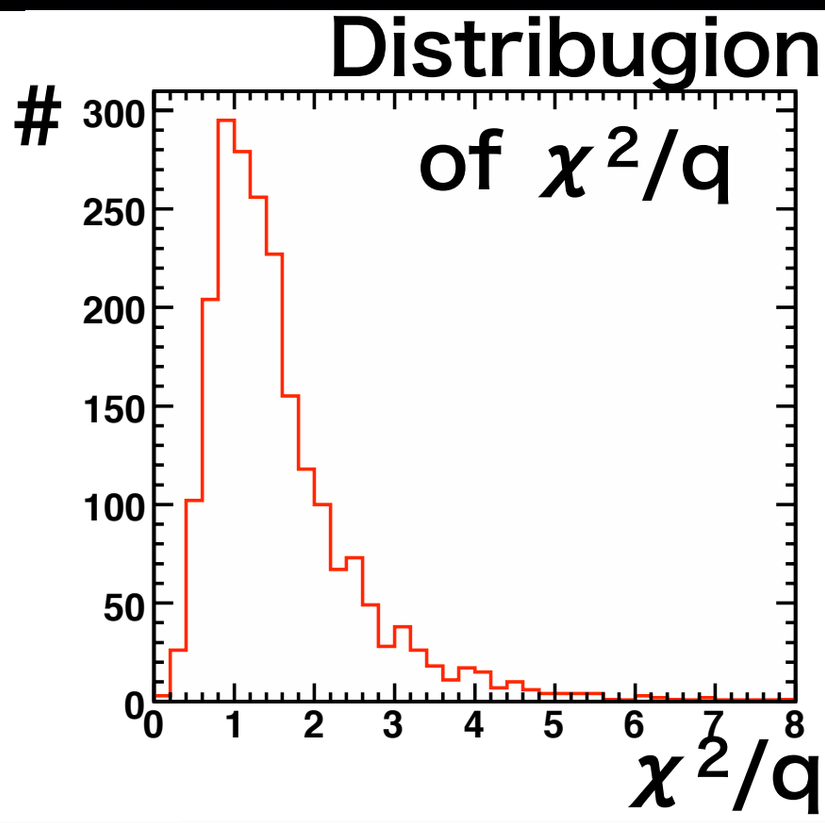
  CALICE DB

  - data by this processor:
    - layer : strip : adc/MIP(T) : d(adc/MIP)/dT) : ← Err : T
      - T=Temperature can be set as you like to express adc/MIP as a function of temp. with the slope.
      - we can set any T in steering

Measurement of MPV of landau function

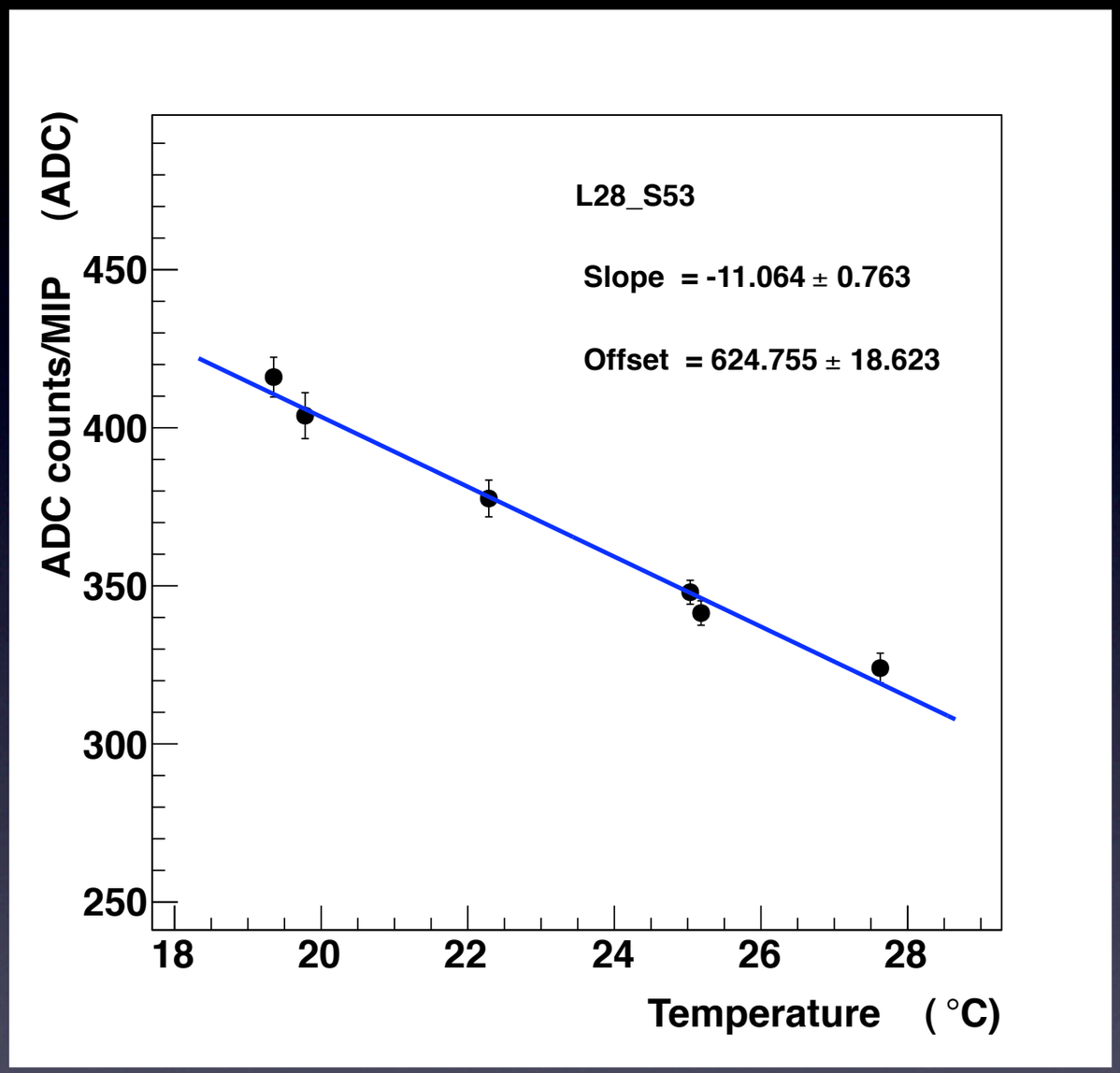
Fitting to 72 strips in a layer (× 30)

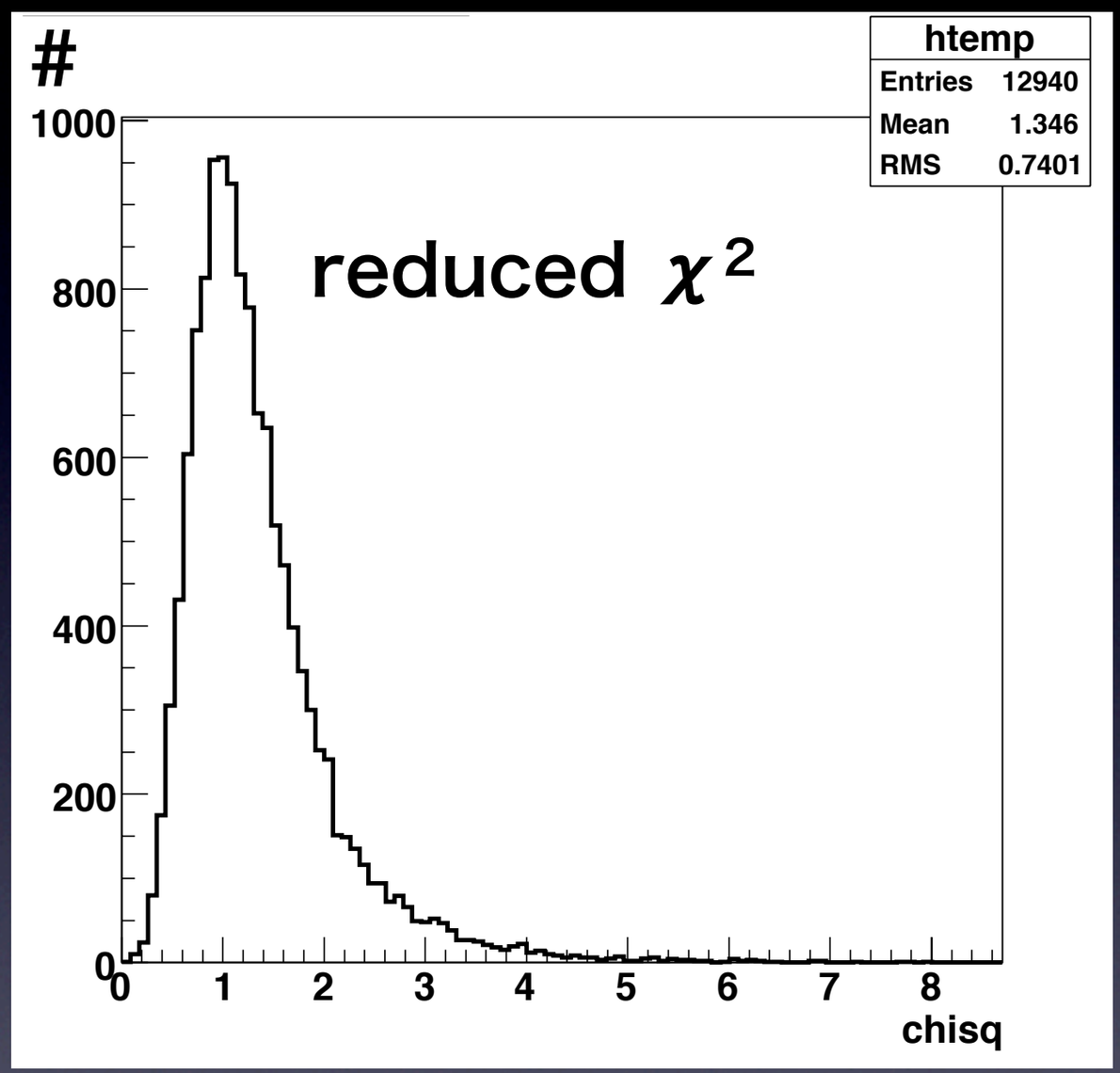




Distribution of Reduced χ^2 shows fittings are reasonable.

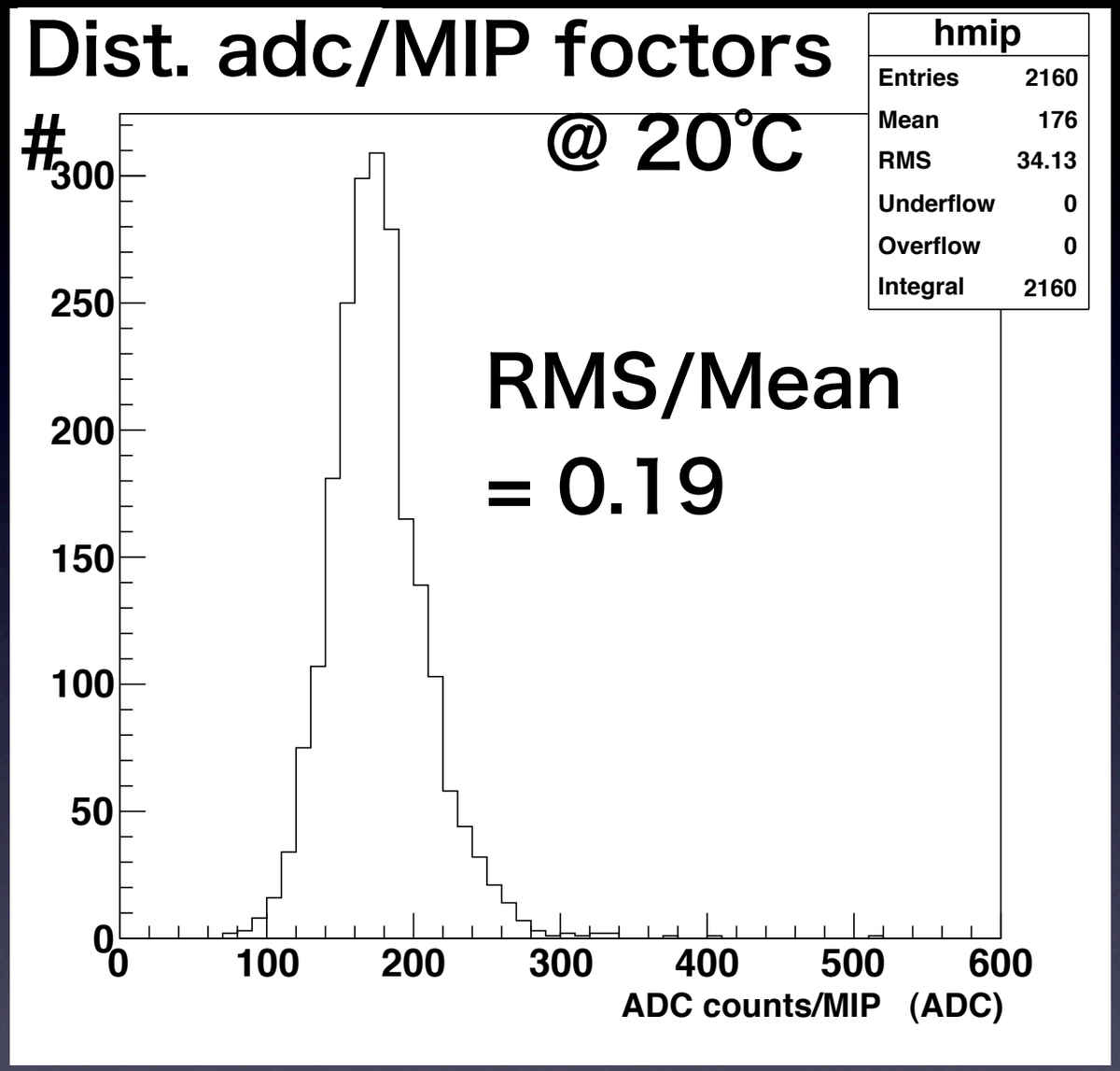
Measurement of adc/MIP conversion factor as a function

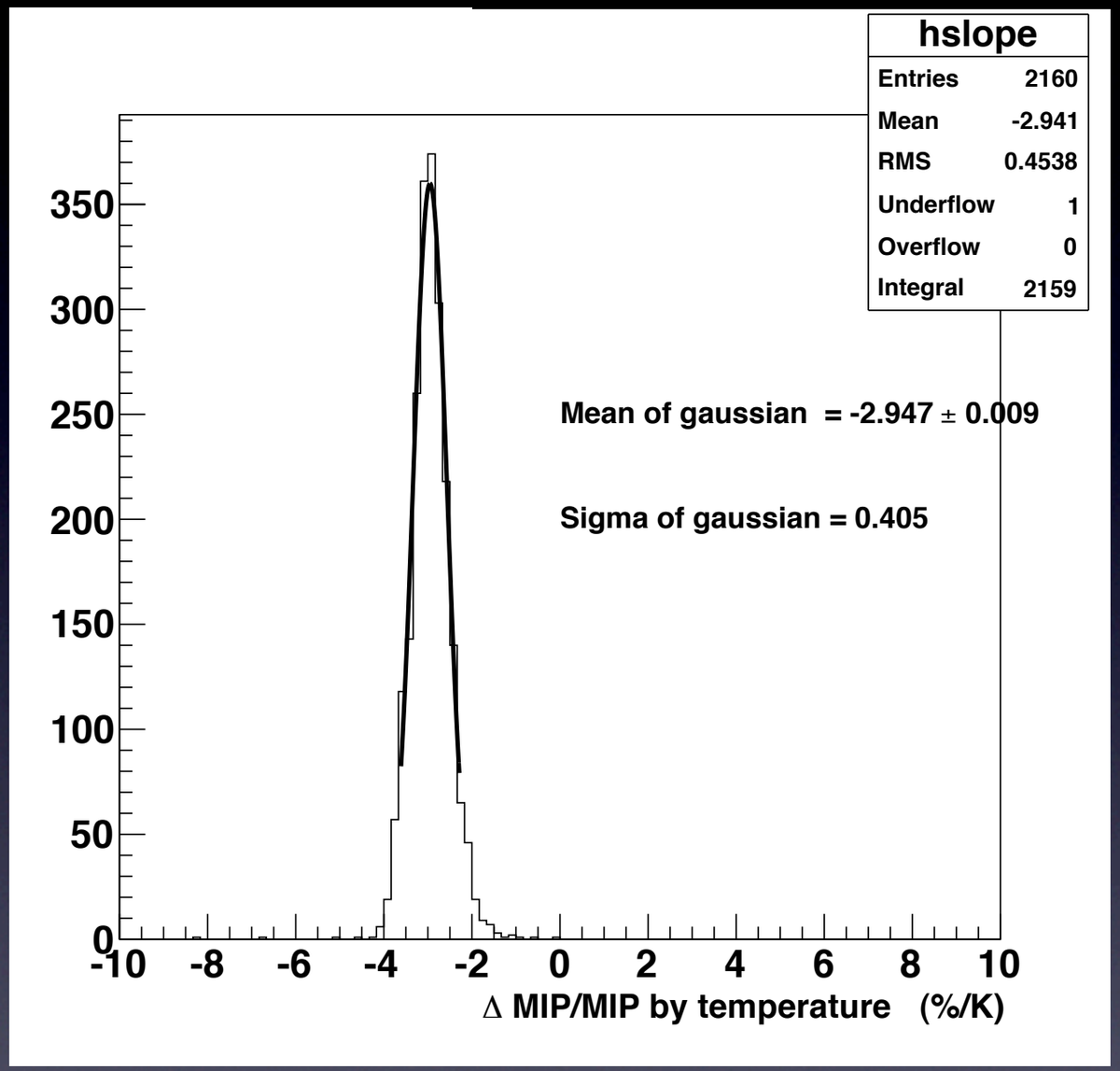




an adc/MIP conversion factor can be expressed as a linear function of temperature well.

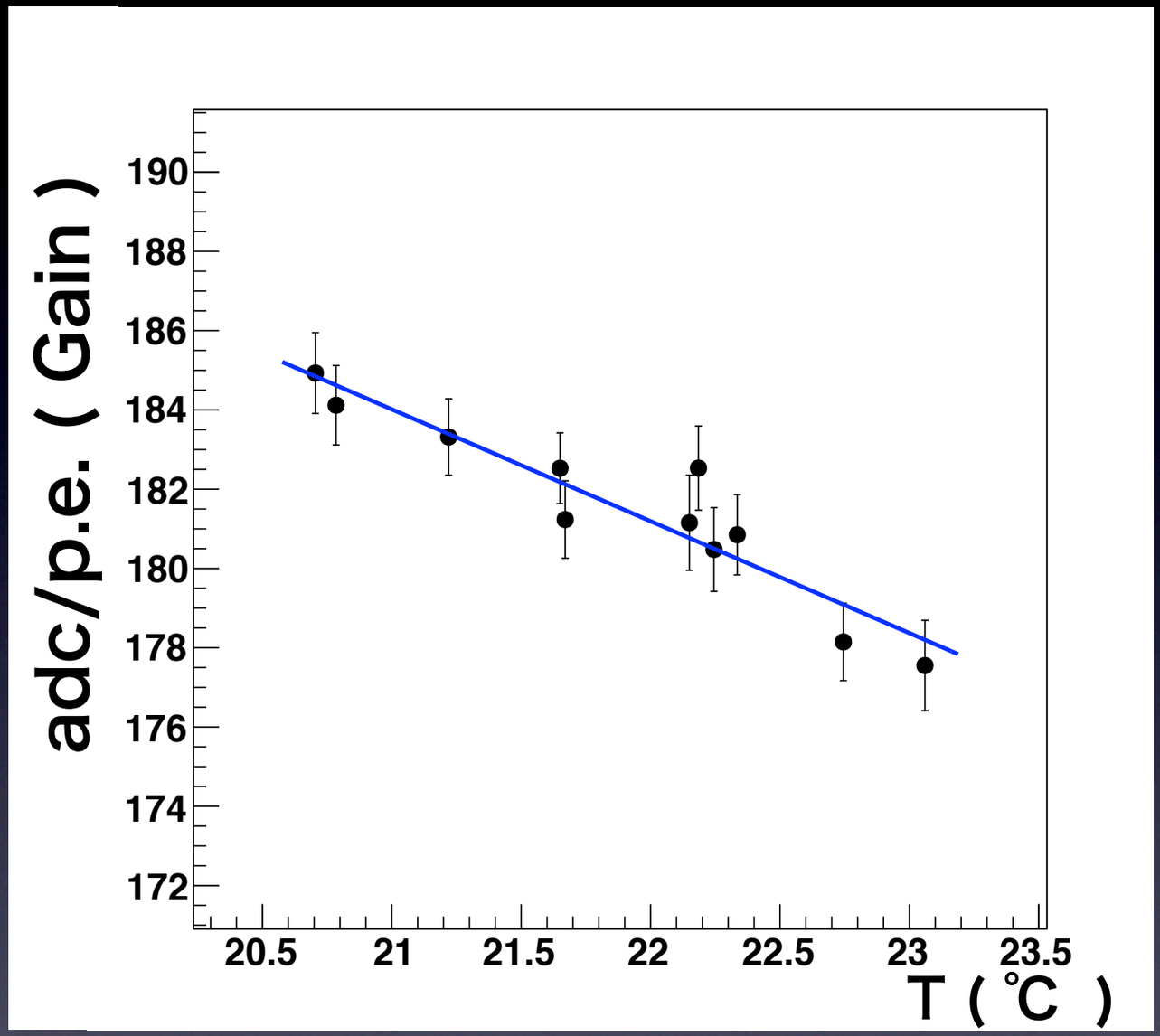
Distribution of adc/MIP conversion factors and slopes



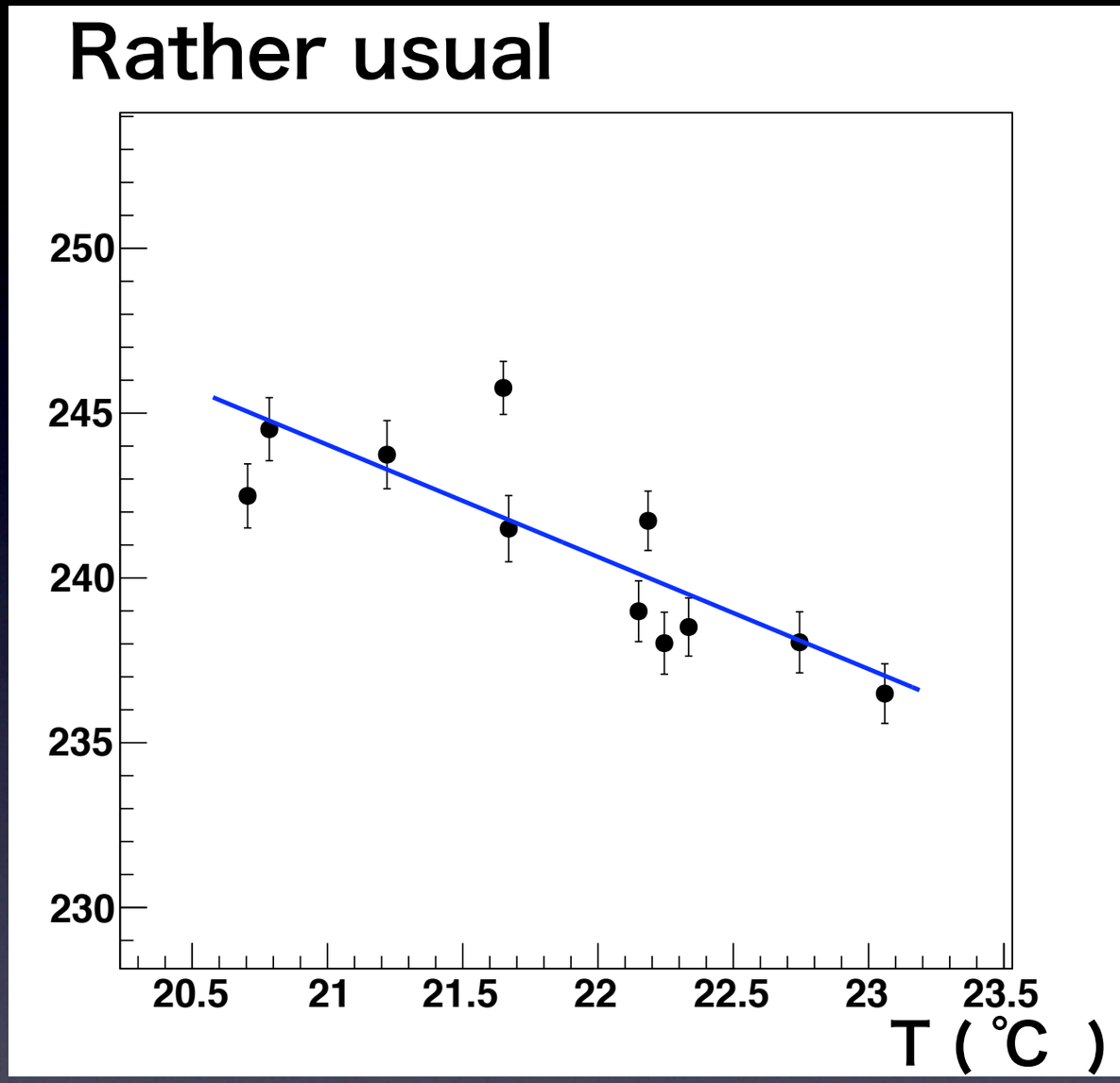


- RMS/Mean of MPPC gains is less than a few % ▶ 19% of spread of adc/MIP factors should come from variations of scintillator quality, MPPC fiber miss matching and so on.
- except 3 channels(noisy) slopes of 2157 channels are in this narrow distribution

Gain also by the same way ...

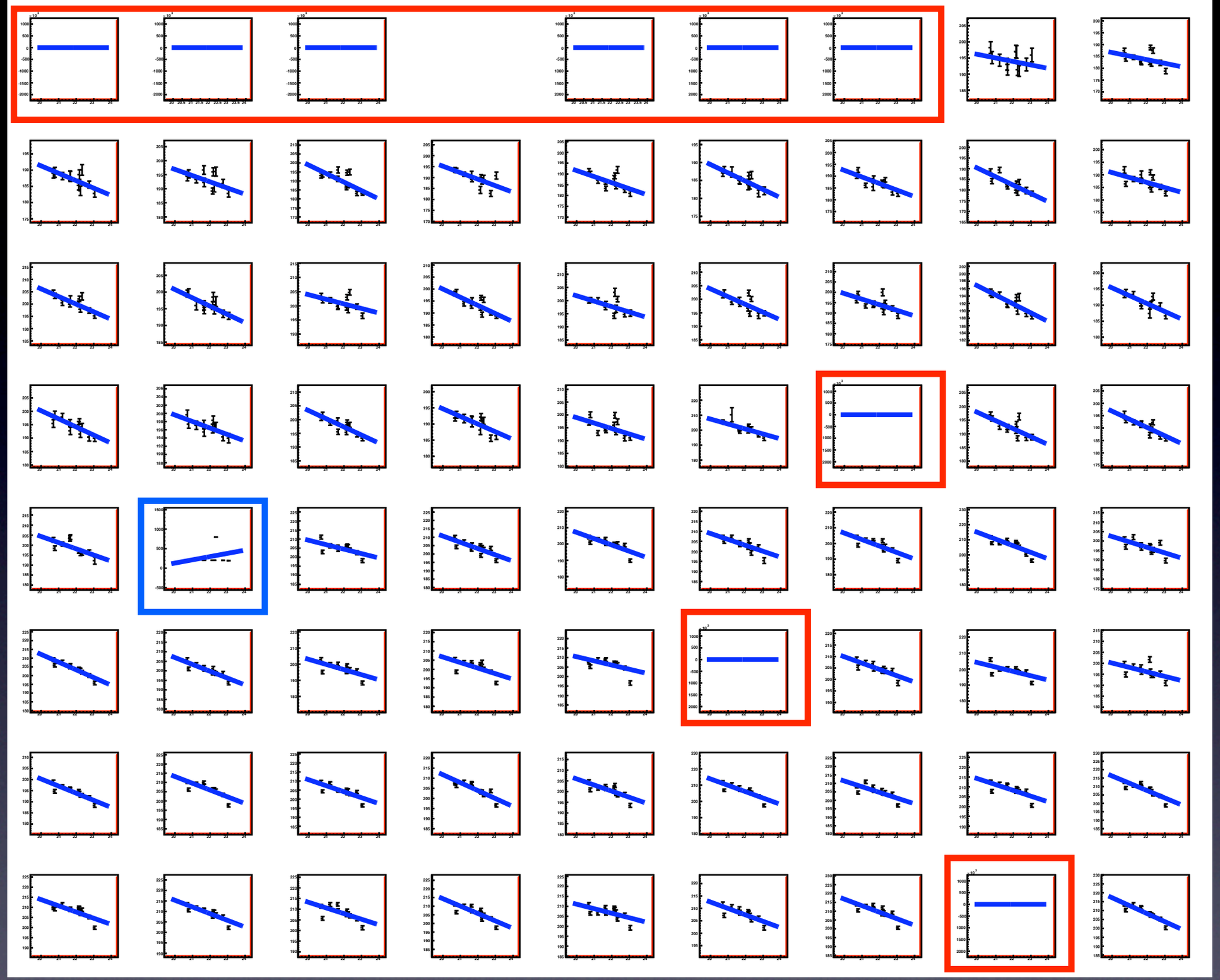


Rather usual



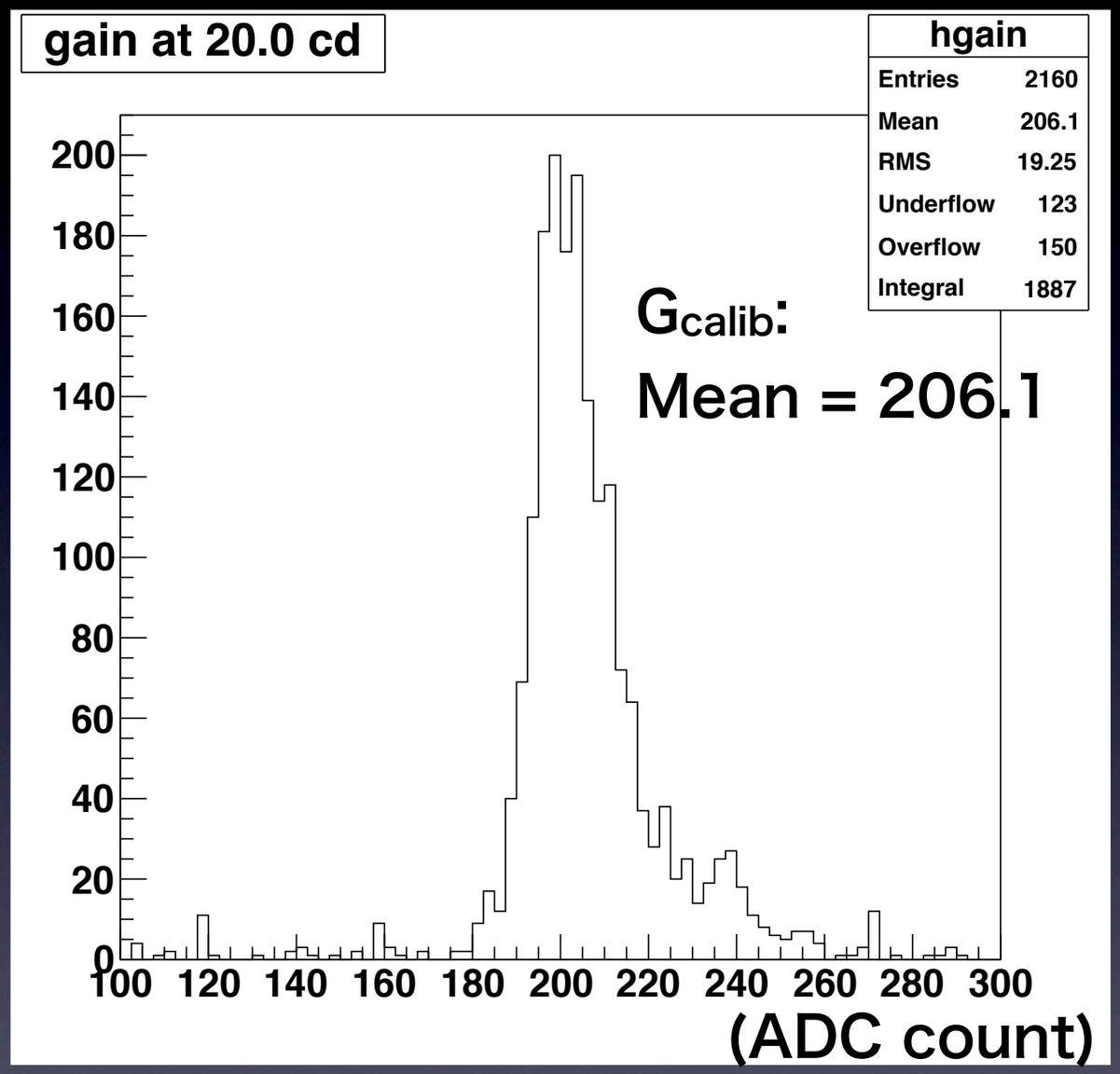
- Using three gaussian fitting
- Gain Fitting is more difficult than the case of adc/MIP

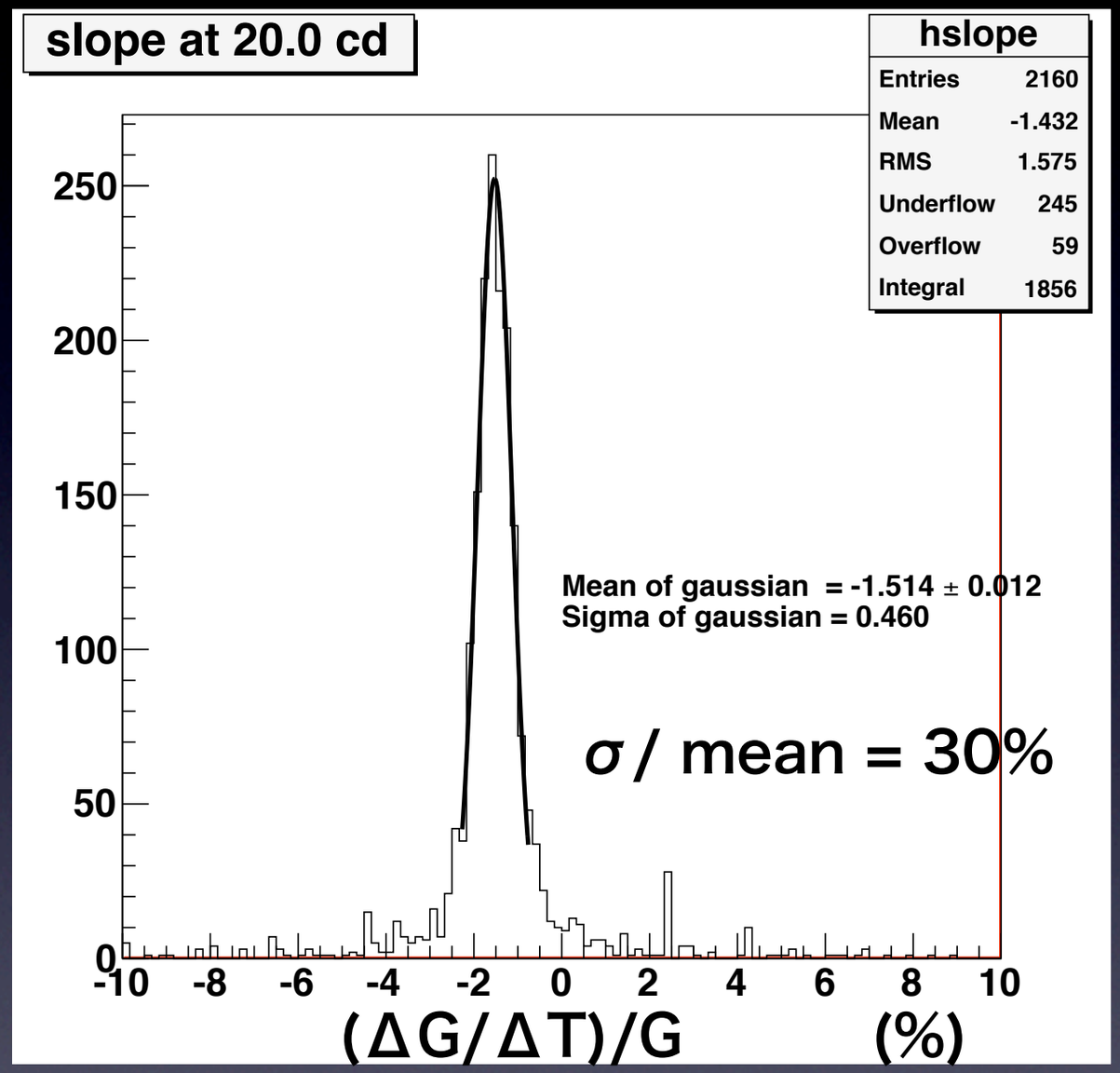
Some problems



For 88% of channels, Gain temperature function could be measured but more improvement is required.

Distribution of Gain constants and slopes



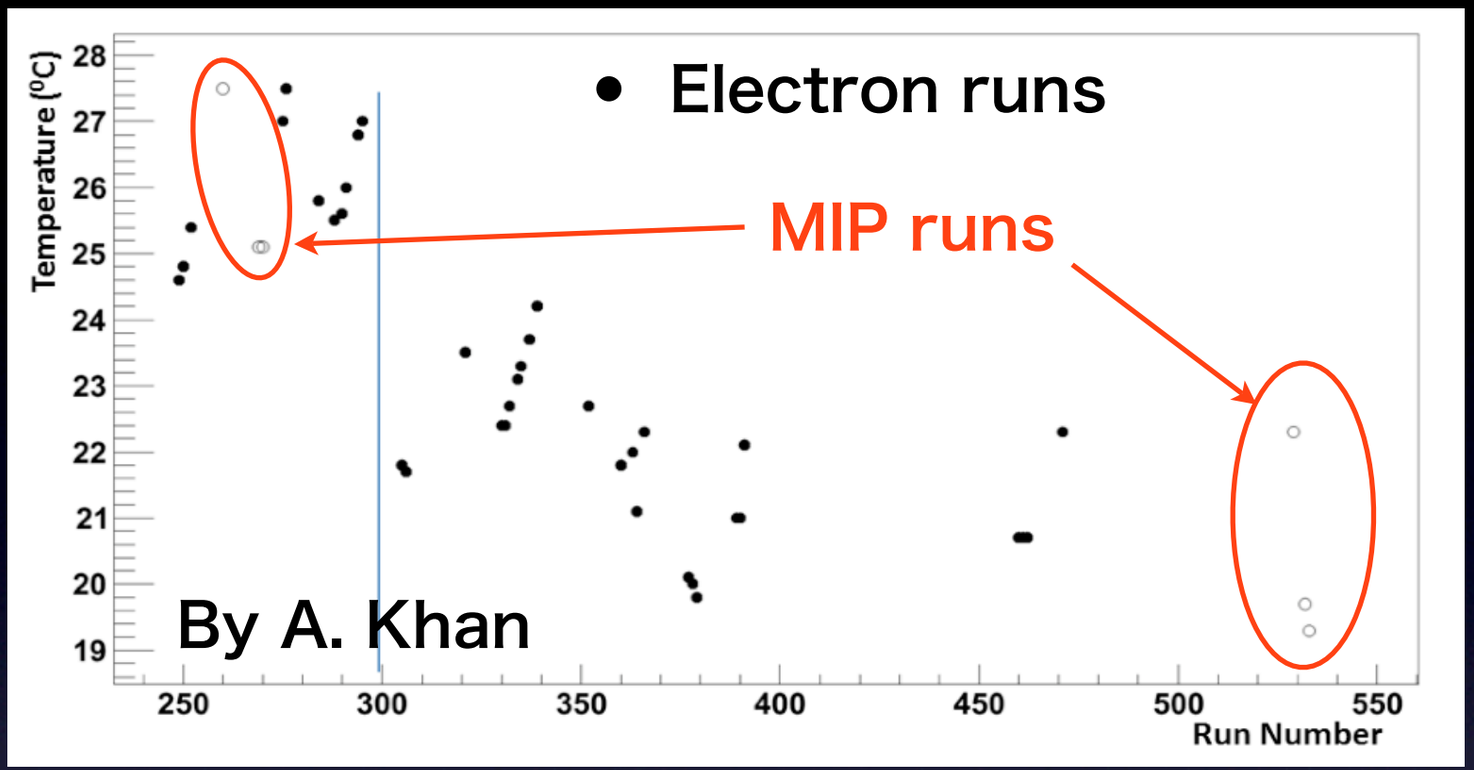


- RMS/Mean of gain distribution is 9%, after modification of fitting method, this should be a few %
- mean of ΔG/ΔT)/G = (- 1.514 ± 0.012)%
  - ▶ apply for all channels, so far

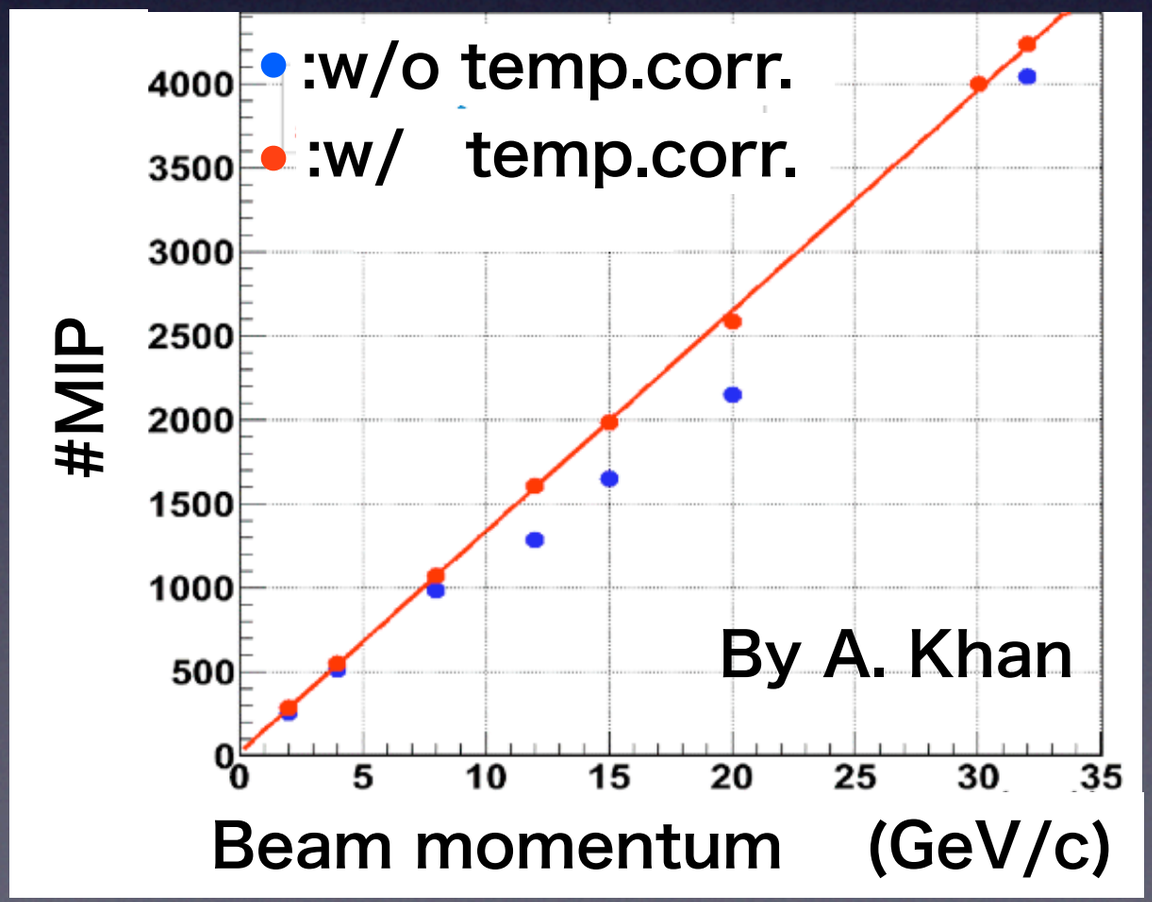
applying to May 2009 TB data

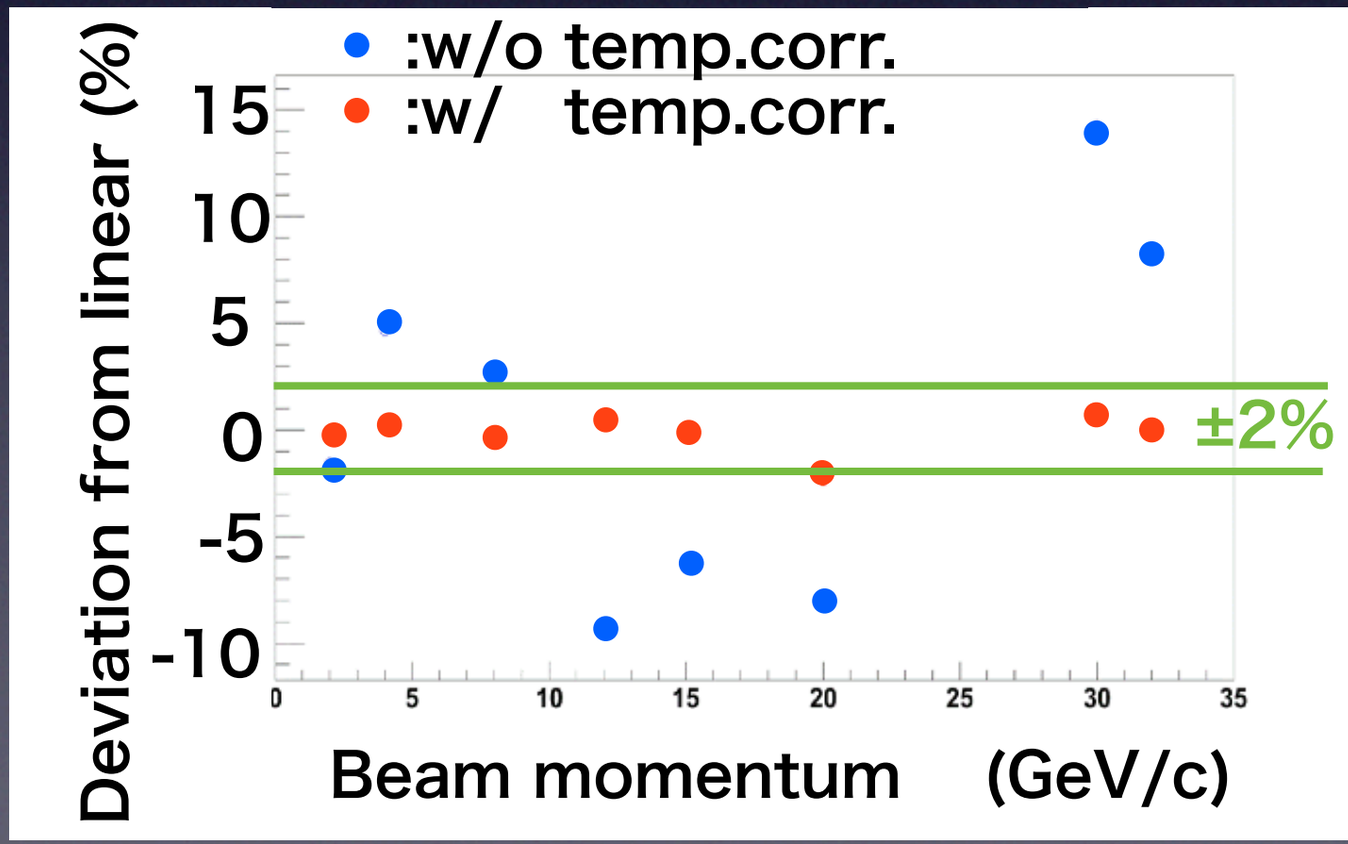
- An adc/MIP factor comprehensively includes temperature dependence of Gain constant.
- Gain constants are used only for MPPC saturation correction (Inverse function of MPPC saturation curve is a function of the number of detected photo-electrons) ▶ effect of change by temperature is small,
- Only adc/MIP factor was updated in result I will show in next slide

May 2009 FNAL TB: E. of electron

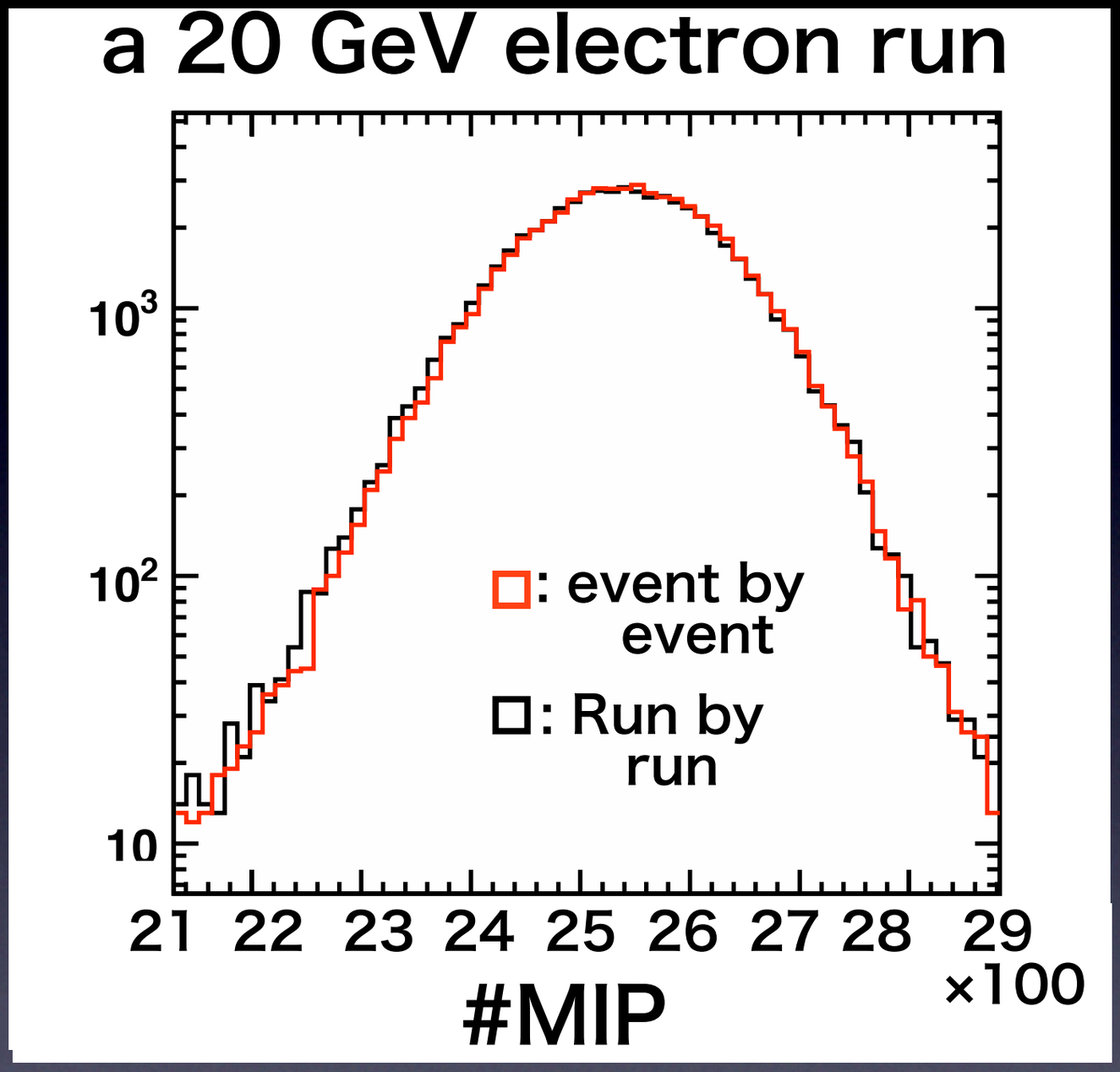


- Temperature varied 19℃ ~ 28℃
- Chance to study temperature effect
- Using new adc/MIP factor : function of temperature
- details are in Granada





Run by run vs. Event by Event



Previous Page:

- MIP-temperature was implemented, but,Temperature for electron data is applied for run by run (using averaged temperature in run)

With event by event temperature(byTempGetter):

- Very small or negligible effect

Energy resolution 20 GeV electron:

(3.909 ± 0.017)% ▶ (3.777 ± 0.017)%

mean : 2583.3 ± 0.6 ▶ 2540.0 ± 0.5 (1.6%↓)

Summary

- Construction of CALICE software for ScECAL has got a progress:
  - DATA base:
    - Mapping, adc/MIP factor(Temp), Gain(Temp), Intercalibration, temperature ,
  - Processors:
    - To make Gain constants,
    - To make adc/MIP factor,
    - Temperature Getter,
  - Using adc/MIP factor as a function of temperature
    - Improvement of linearity is drastically,
    - Run by run vs. event by event temperature corr,
      - very small or negligible effect
- After release of those update of ScECAL software, every one can analyse ScECAL easily.

Backup

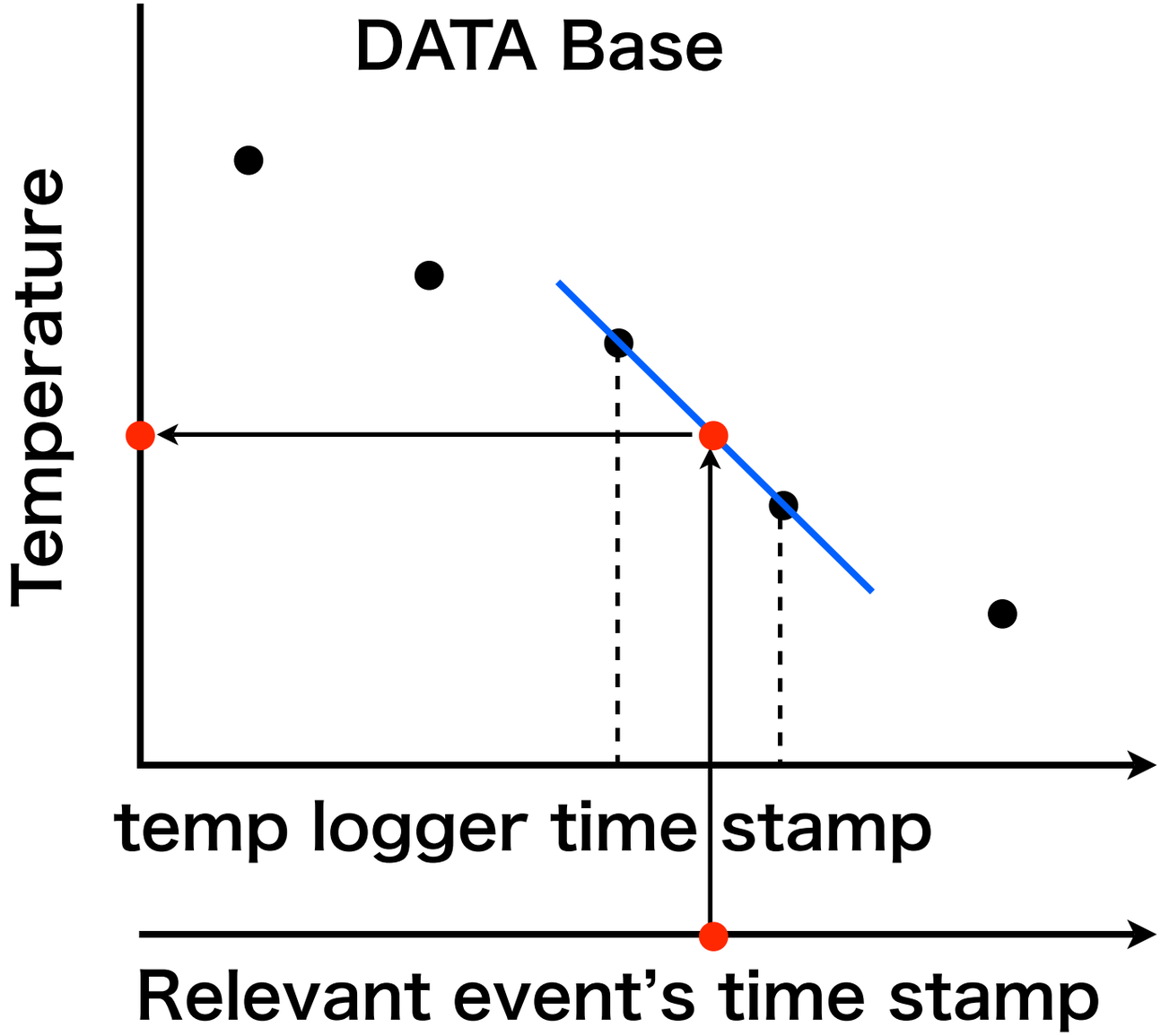
Criteria

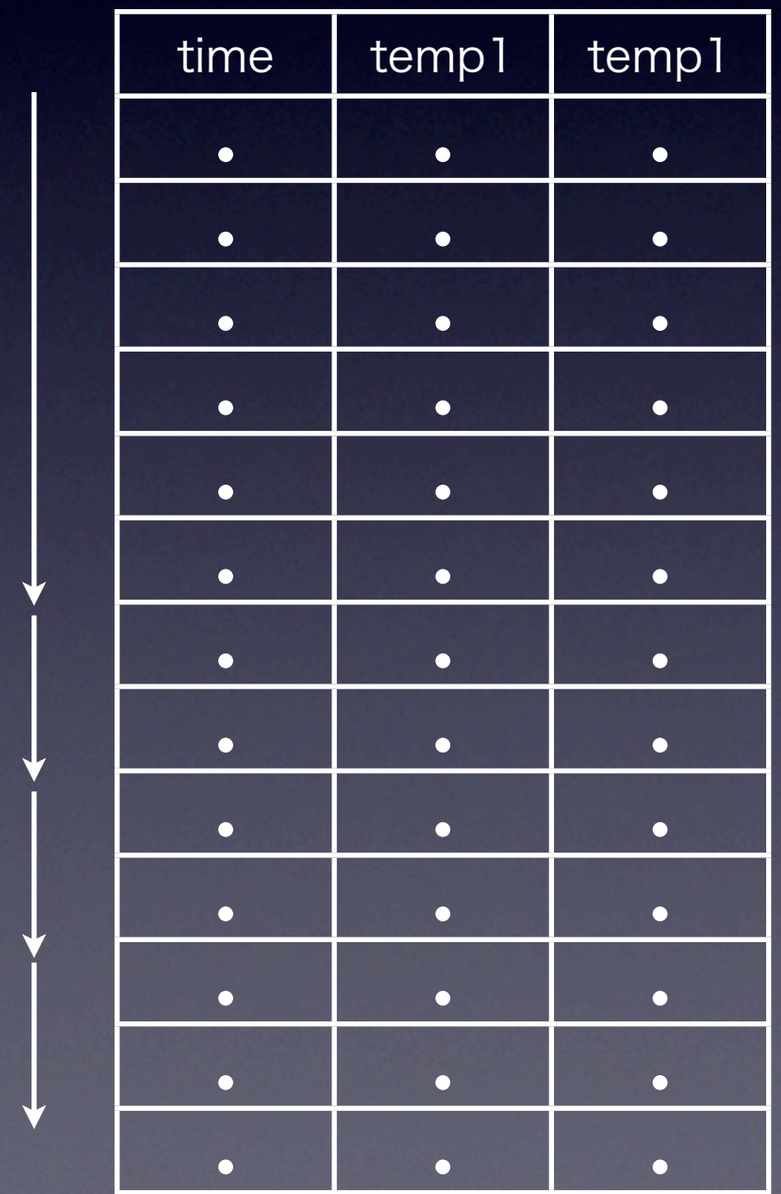
- Function has :
  - a peak for pedestal
  - a valley between pedestal and 1 p.e.
  - 1 p.e. has down slope before 2 p.e. comes.
- reduced chi2 < 5
- three peak height (ped, 1 p.e., 2 p.e.) < upper limit
- RMS - mean of total histogram < pedestal peak mean < RMS + mean of total histogram
- sigma of gaussian < RMS of total histogram

ScECAL Temp DATA in 2009

trivial

- 2008 temperature data taking through slow control -> failed
- 2009 May, standalone (temperature logger)
  - two points temperature data everyone minute.
    - pair of timestamp and temp1, temp2 --> DB





ScECALGainCalibrationProcessor

66 channels have doubled pedestal peak

- gain could not be measured

Data @ FNAL

Sep 2008

Energy scan

e^- Uniform:1,3,6,12,16,25,32 GeV
Center: 1,3,6,12,16,25,32 GeV

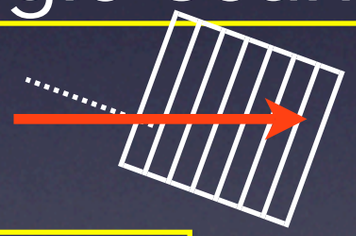
π^- Center: 3,6,12,16,25,32 GeV

Position scan

$e^-\pi^-$ mixed 32 GeV

Tilt angle scan

10°: e^-1,3,6,16,25,32 GeV
π^-3,6,16,25,32 GeV



π^0 run

π^- 16, 25, 32 GeV

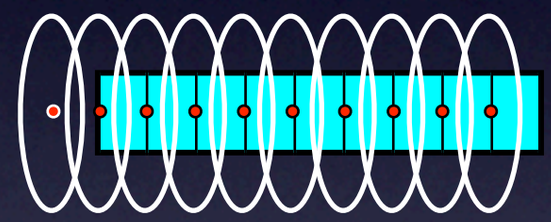
MIP calibration

~ @ 20℃

May 2009

e^- Center:
1,2,4,8,12,15,20,30,32 GeV

π^- Center:
2,4,12,15,20,32,60(+) GeV



e^- 15 GeV

20°: e^- 2,4,8,15,20,32 GeV
π^- 8,15,32 GeV

π^+ 60 GeV

@ 20℃, 25℃,
Tilt angle 20° @ 20℃

MIP measurement Processor

- First step:

Fit three gaussian function to the LED calibration run data, and then determine #adcs corresponding to one p.e. (in ScECLGainCalibrationProcessor)

  - data by this processor:
    - layer : strip : adc/p.e. : adc/p.e. Err : Temperature,
    - Temperature is averaged one during data taking.

- Second step:

uses above data of some runs with varied temperature, temperature dependences of gains are measured (in ScECALGainTempDependProcessor)

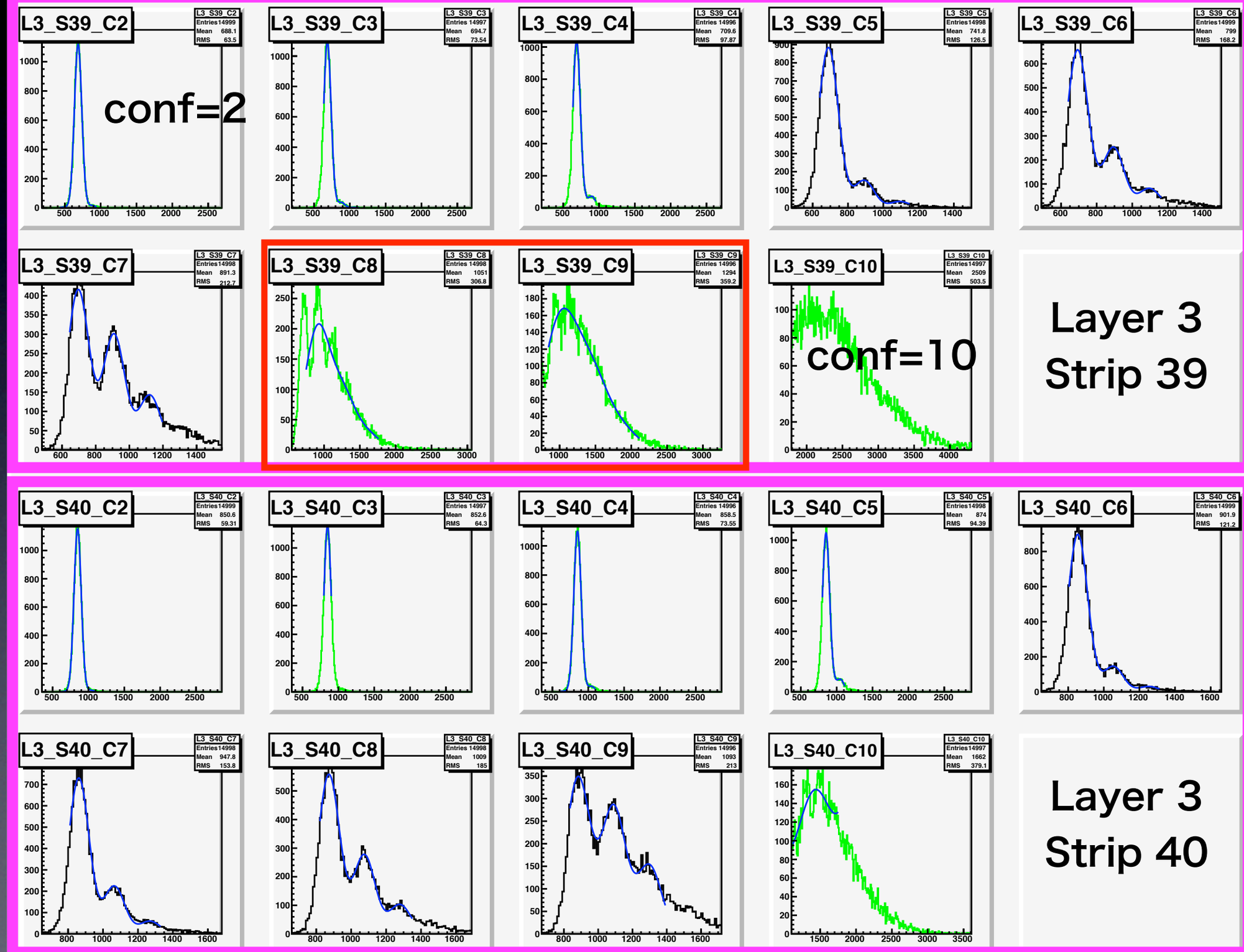
  - data by this processor:
    - layer : strip : adc/p.e.(T) : d(adc/p.e.)/dT) : ← Err : T

CALICE DB

    - T=Temperature used to calibrate adc/MIP(T)
    - we can set any T in steering file

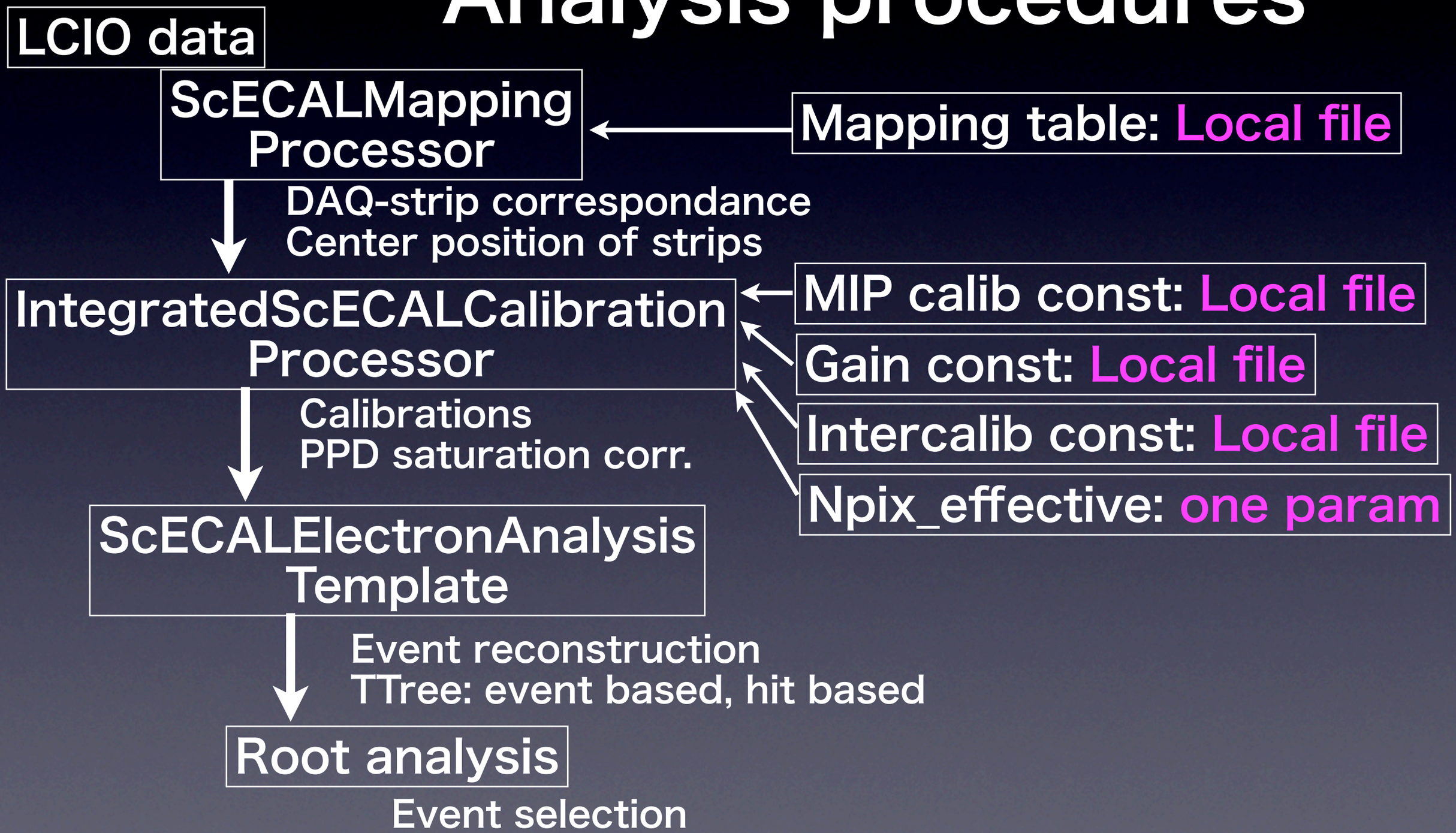
ScECALGainCalibrationProcessor

- Fit three gaussian functions to LED data in high gain mode, and then determining Gain = distance between mean of gaussians.



Of course in a automatic process

Status of analysis
Released result in CAN_016:
Analysis procedures



Status of analysis
Released result in CAN_016:
Mapping

Layer:30 × Strip:72 → position

2160 strips

18ch	Chip		Chip	18ch	
18ch	Chip		Chip	18ch	
18ch	Chip		Chip	18ch	
18ch	Chip		Chip	18ch	
18ch	Chip		Chip	18ch	
18ch	Chip		Chip	18ch	

2 x 10 boards

FE Slot

specified

A Local Mapping file is read out

```
for(int ii=0;ii<2160;ii++){

file>>layer>>strip>>slot>>fe>>chip>>channel;
  _ScECALmap[slot][fe][chip][channel]
                              .first=layer;
  _ScECALmap[slot][fe][chip][channel]
                              .second=strip;
}
```

layer --> CellID0
strip --> CellID1

Some times DAQ-Strips ware changed!