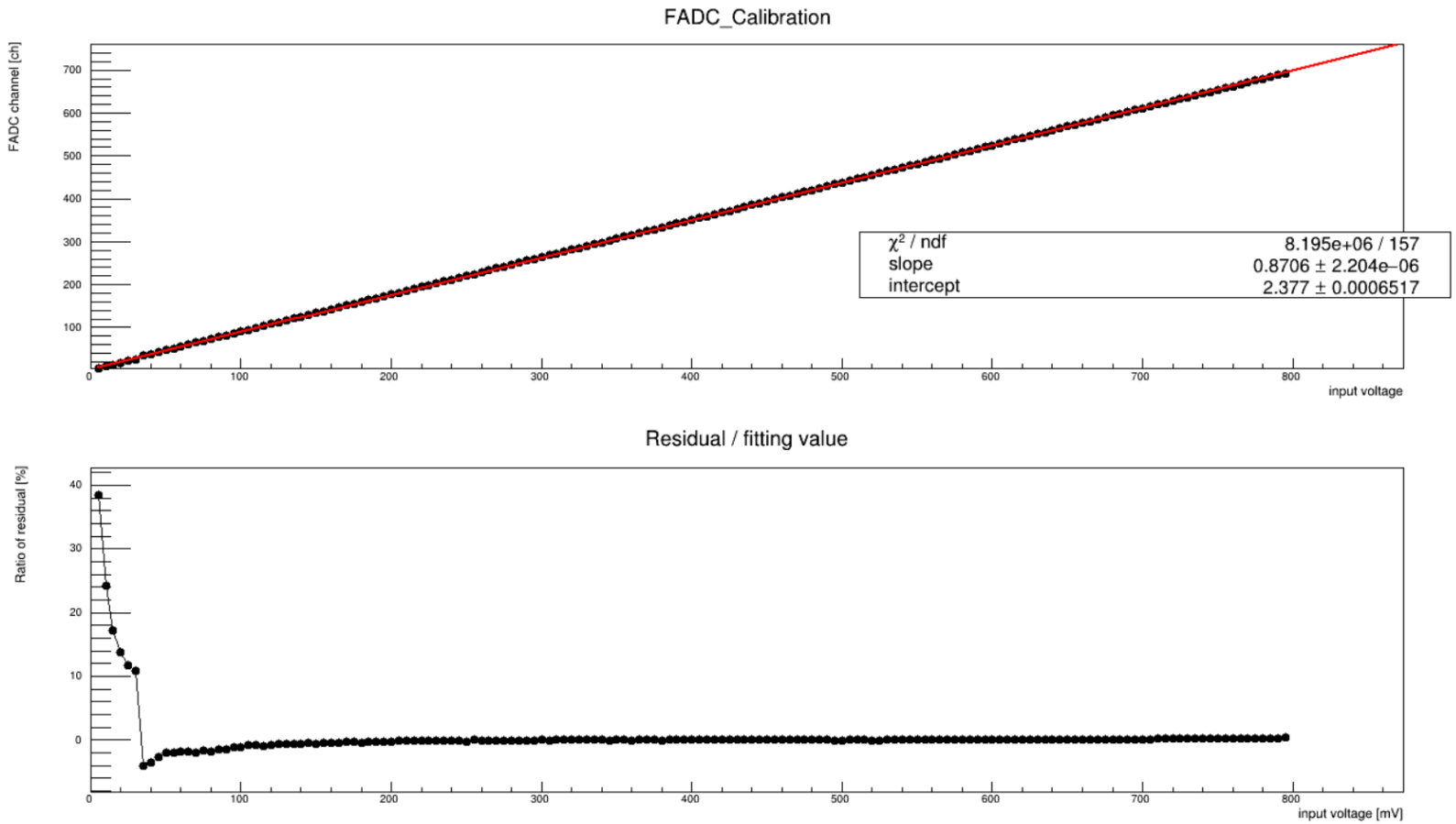
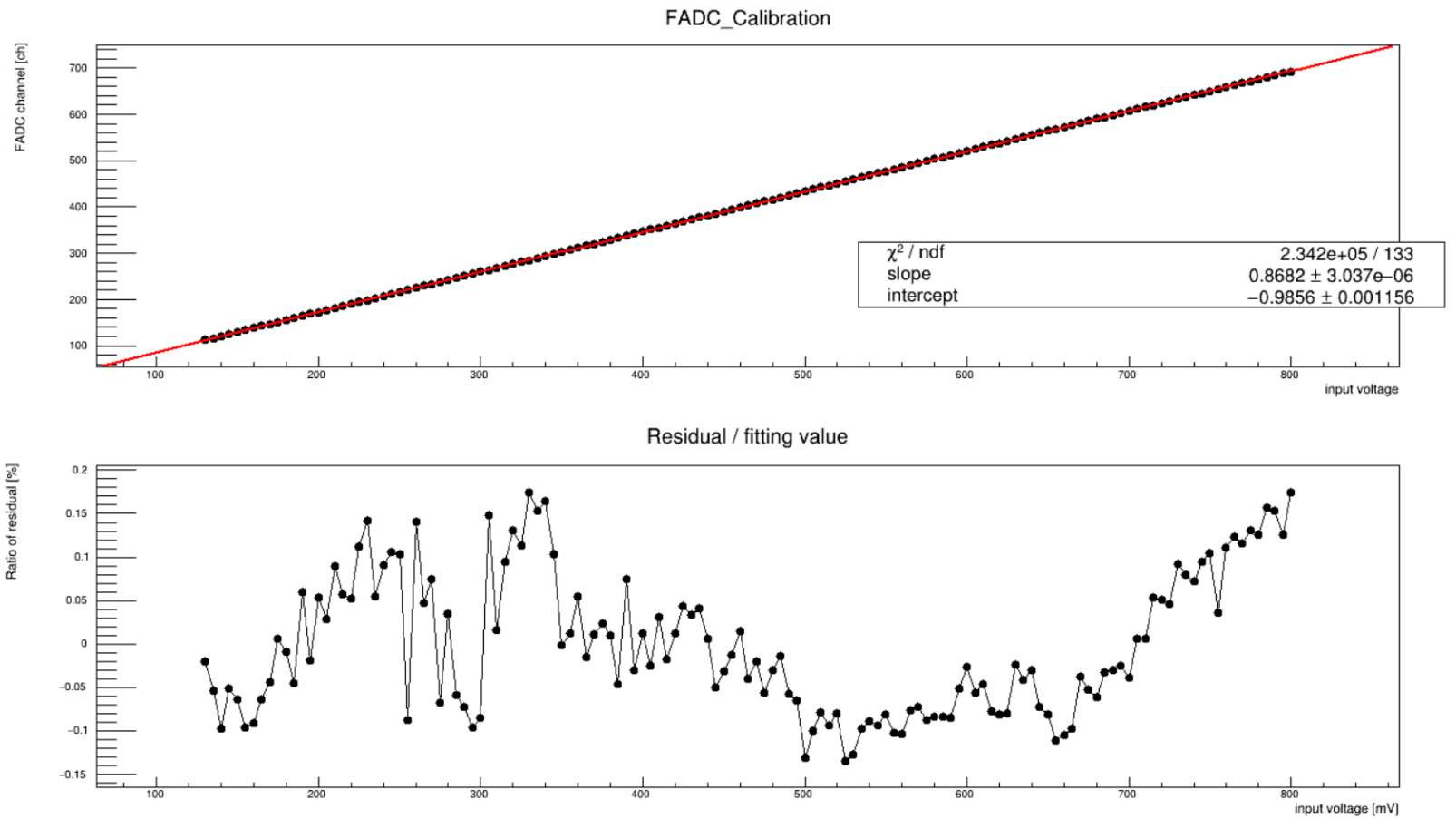
FADC test

The whole

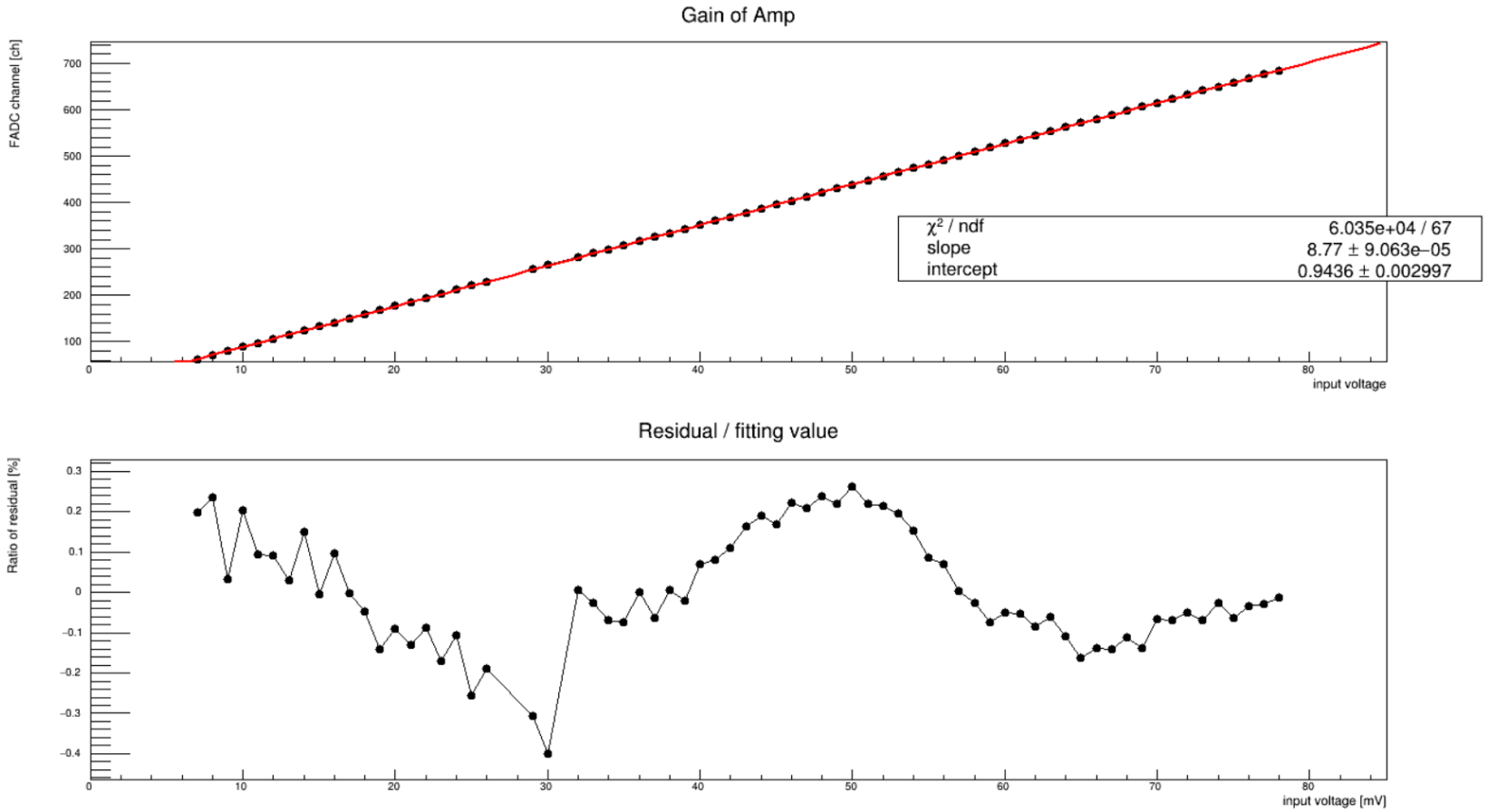

FADC_Calibration
FADC channel [ch]
input voltage
χ² / ndf 8.195e+06 / 157
slope 0.8706 ± 2.204e−06
intercept 2.377 ± 0.0006517
Residual / fitting value
Ratio of residual [%]
input voltage [mV]

From 110 mV to 800 mV



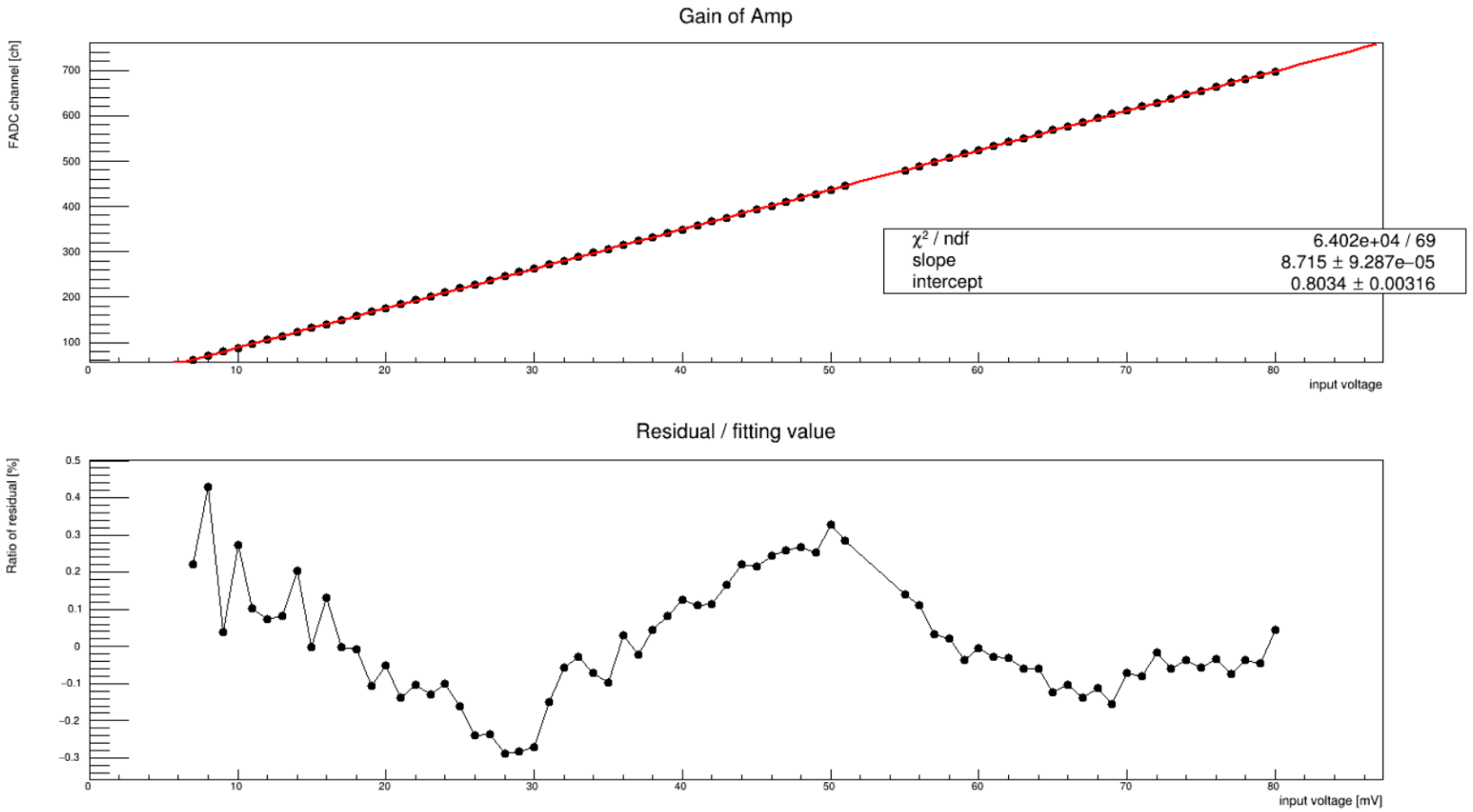
Amp7 test

7 mV ~ 80 mV


Gain of Amp
FADC channel [ch]
input voltage
χ² / ndf 6.035e+04 / 67
slope 8.77 ± 9.063e−05
intercept 0.9436 ± 0.002997
Residual / fitting value
Ratio of residual [%]
input voltage [mV]

Amp8 test

7 mV ~ 80 mV


Gain of Amp
FADC channel [ch]
input voltage
χ² / ndf 6.402e+04 / 69
slope 8.715 ± 9.287e−05
intercept 0.8034 ± 0.00316
Residual / fitting value
Ratio of residual [%]
input voltage [mV]

Conclusion

- Considering the result of FADC calibration, gain of Amp7 is about 10.10 (= 8.77 mV / 0.8682 mV) and gain of Amp8 is about 10.03 (= 8.715 mV / 0.8682 mV)

Gain of MPPC

Fitting Function

- Assumption

- The number of photon from thermoemission is smaller than the number of photon from LED

- 실제 신호

- LED에서 발생되는 photon 중 일부만이 MPPC에 도달하므로 Poisson distribution을 따른다.

- Avalanche 에 의해 만들어지는 신호는 Gaussian distributio을 따른다.

- 따라서, 두 함수의 Convolution으로 표현된다.

- Noise 신호

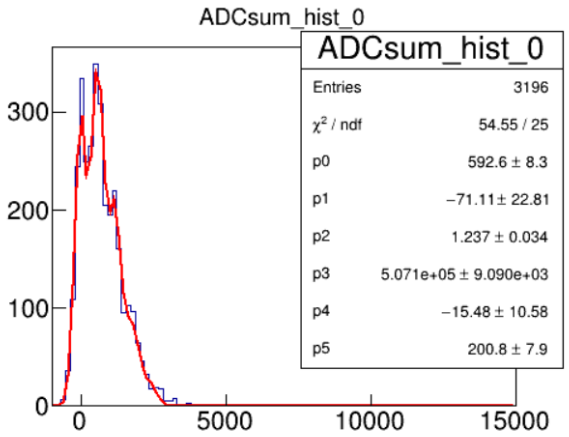
- 가정에 의해 pedestal을 만드는 noise 신호만 고려하면 되고, 이 경우 Gaussian distribution을 따른다.

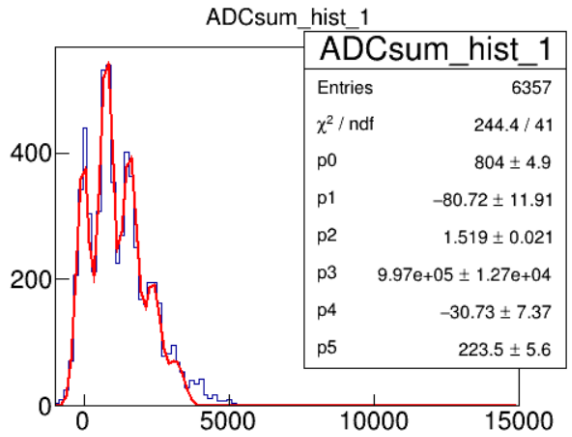
Fitting Function

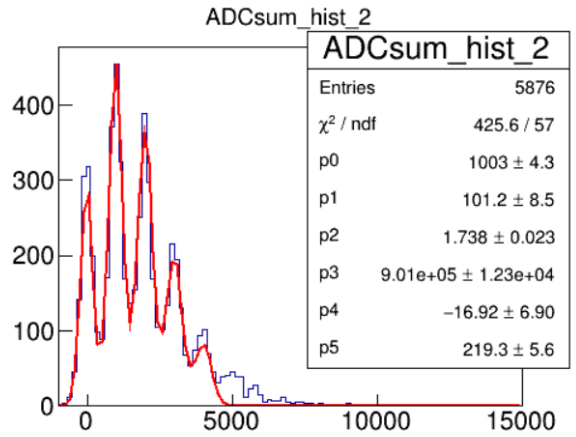
```
par[0] : single photon ADC sum
par[1] : sigma for single photon
par[2] : parameter for Poisson distribution(mean and variation of Poission distribution)
par[3] : normalization factor
*/
double pedestal_mean = -5.493;
double pedestal_sigma = 260.3;

double fitting_function = TMath::Poisson(0, par[2]) * TMath::Gaus(x[0], pedestal_mean, pedestal_sigma, 1);
double fitting_function = 0;
for (int i = 0; i < 5; i++)
{
    double n = (double)i;
    fitting_function += TMath::Poisson(n, par[2]) * TMath::Gaus(x[0], pedestal_mean + n * par[0], TMath::Sqrt(pedestal_sigma * pedestal_sigma + n * par[1] * par[1]), 1);
}

fitting_function = par[3] * fitting_function;

return fitting_function;
```

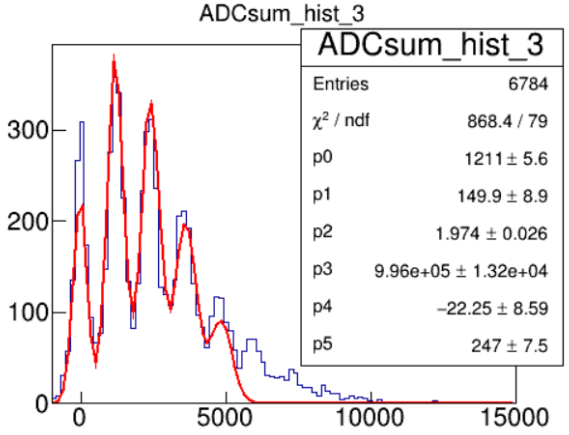
Reference : Absolute calibration and monitoring of a spectrometric channel using a photomultiplier

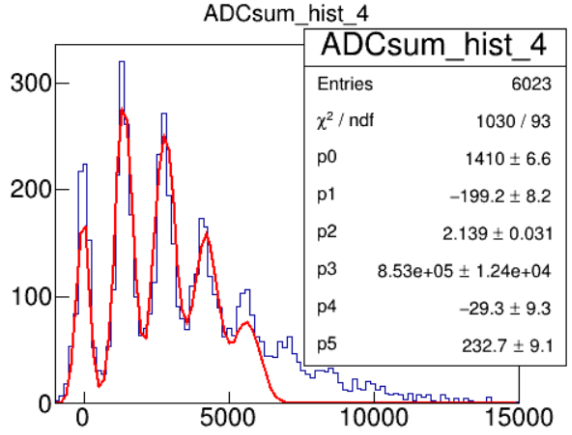
Fitting results



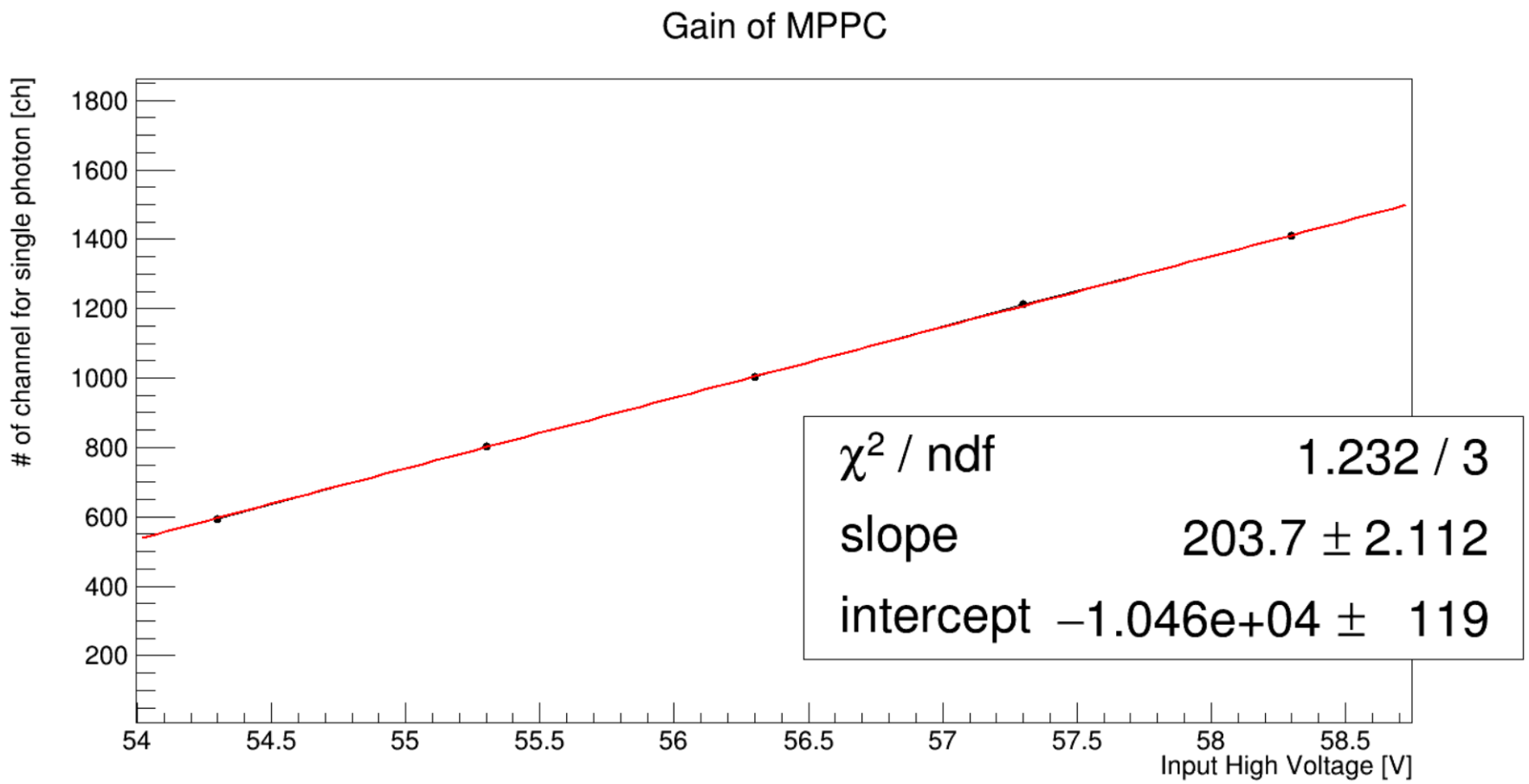








Gain


Gain of MPPC
# of channel for single photon [ch]
1800
1600
1400
1200
1000
800
600
400
200
54
54.5
55
55.5
56
56.5
57
57.5
58
58.5
Input High Voltage [V]
χ² / ndf 1.232 / 3
slope 203.7 ± 2.112
intercept −1.046e+04 ± 119