Weekly Report

Content: Transmission with correction(Temperature and Pressure)

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Measurement position of each environmental data

↓↓ part of e-mail from Oliver-san

<u>Atmospheric pressure</u>

- in the gas rack in the neighboring area T24; this sensor is not well calibrated.

<u>System pressure</u>

- in measurement hose that goes from the TPC to the gas rack.
- For the physical processes in the chamber, the system pressure is relevant.

<u>Temperature</u>

- in metal hoses to the gas inlet and outlet of the TPC.
- basically monitor the room temperature.

<u>H2O and O2</u>

- when the gas flows back from the TPC to the gas rack,
  first the water content is measured and afterwards the oxygen content.

■ The electron transmission rate I reported at the last week's meeting has been corrected using pressure sensor data that is not well calibrated(Atmospheric pressure).

■ So, I corrected the transmission rate using calibrated sensor data(System pressure).

Correction method

- I added the following sentences to Charge.C (macro which outputs charge(y) for each drift distance) and got the corrected charge value.

```
#ifdef GAIN_CORRECTION
     double corr =  rinfo.GetGainCorrection(run);
     y /= corr;
     dy /= corr;
#endif
```

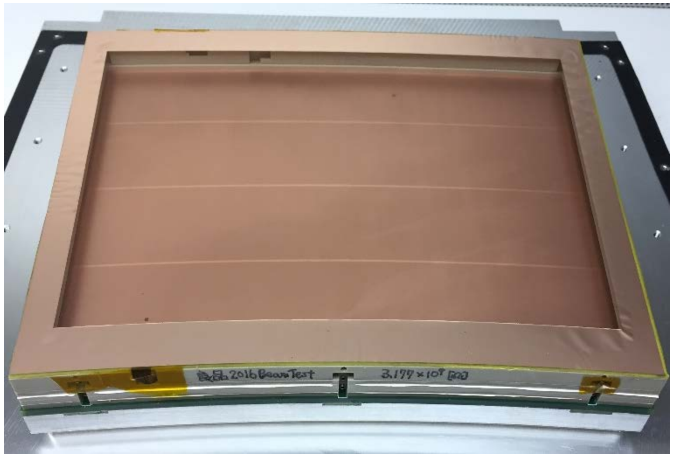
- The correction coefficient(corr) is calculated in Runinfo.h (header file in which information of Run data is written).
- Considering that the gain(charge) depends on P/ T (Pressure/Temperature), the correction coefficient is defined by the following equation.

$$corr = \exp\left[A_1\left(\frac{P_0/T_0}{P/T}\right) - 1\right] \cdot \exp\left[A_2\left(\frac{P_0/T_0}{P/T}\right) - 1\right]$$

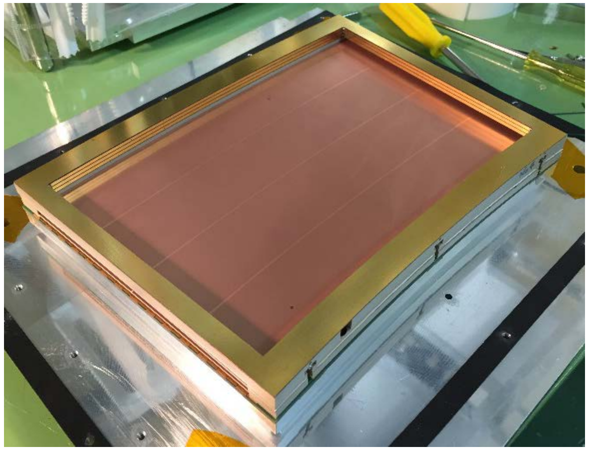
A_1:Gain at upper GEM's voltage = 355 V P_0/T_0: reference(at Run19972)

A_2:Gain at lower GEM's voltage = 315 V

Transmission rate



w/ Gate-GEM



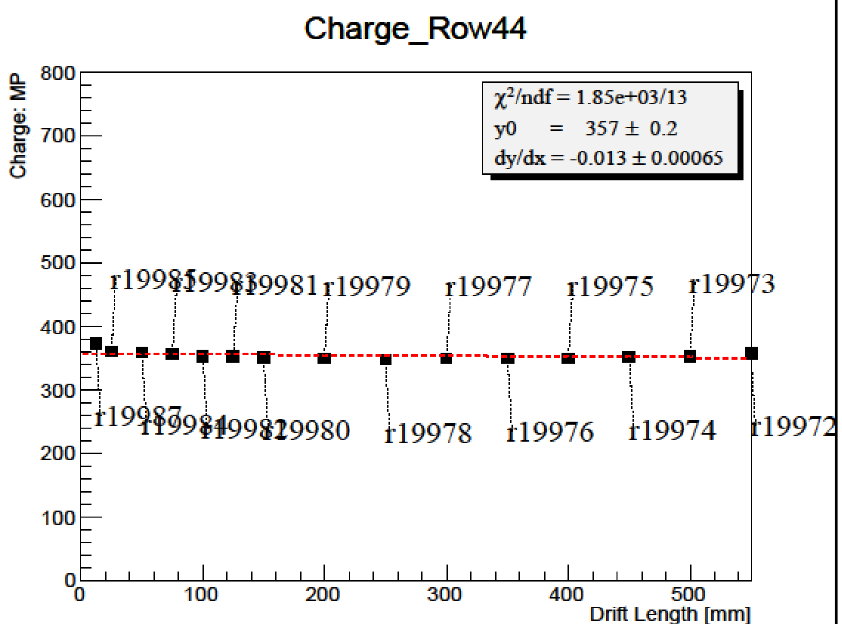
w/ Field Shaper

$$(Transmission) = \frac{(ADC\ channel\ at\ w/Gate)}{(ADC\ channel\ at\ w/oGate)} \times 100\ [\%]$$

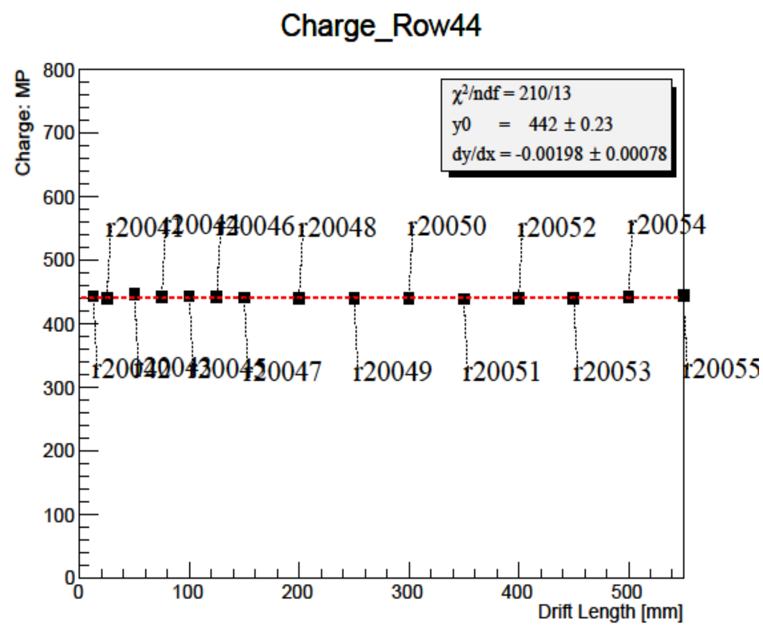
i.e. $ADC\ channel\ w/FieldShaper$

Result(None Correction)

Gate GEM (w/)



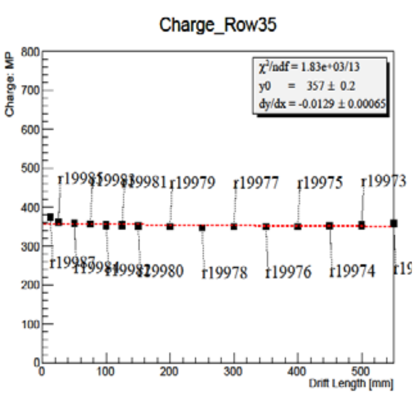
Field Shaper(w/o Gate GEM)

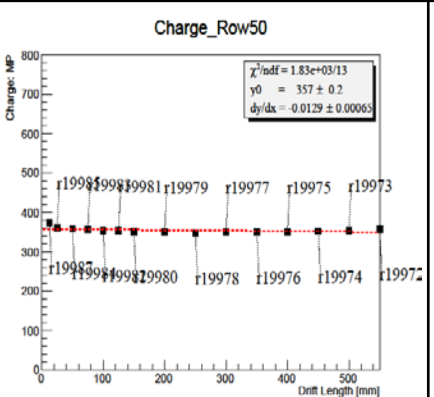


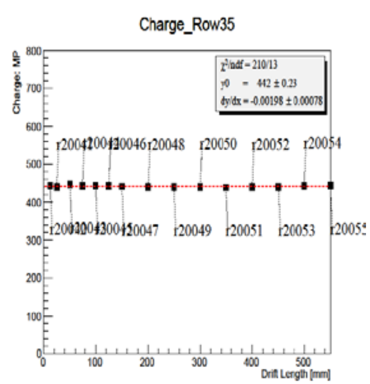
Transmission

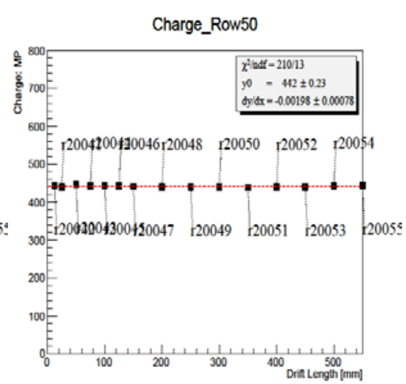
$$\frac{357(GG)}{442(FS)}$$

= 80.8 %
±0.00062





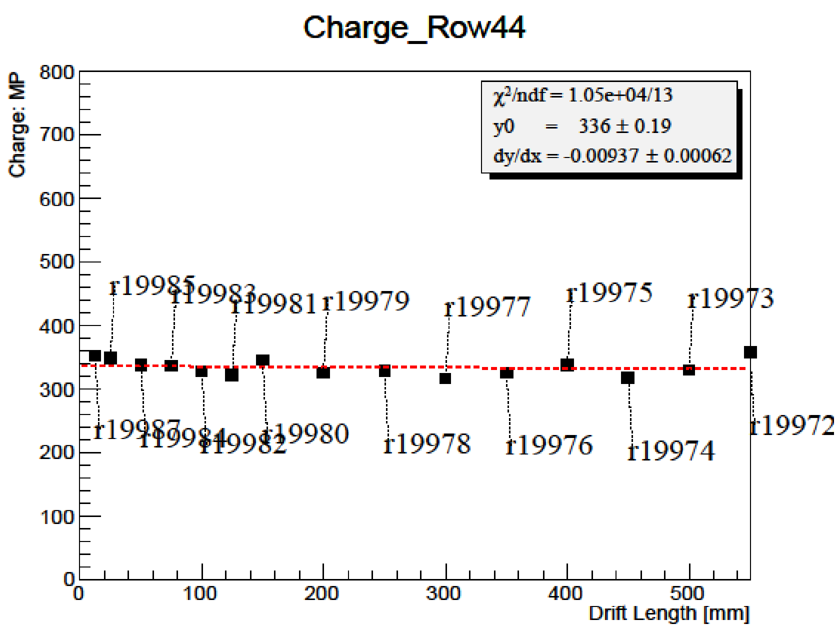
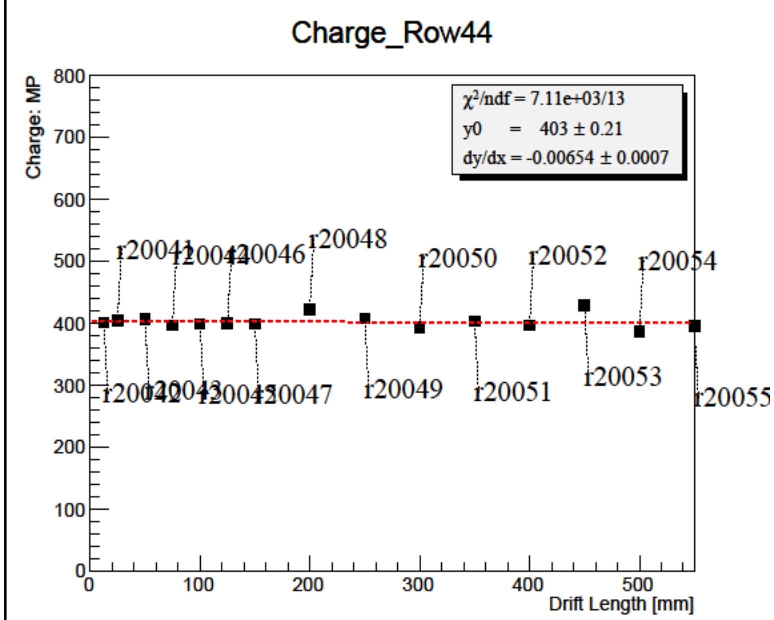
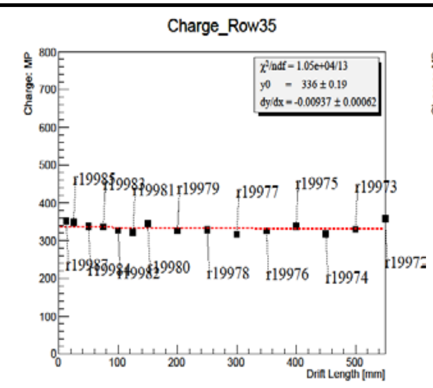
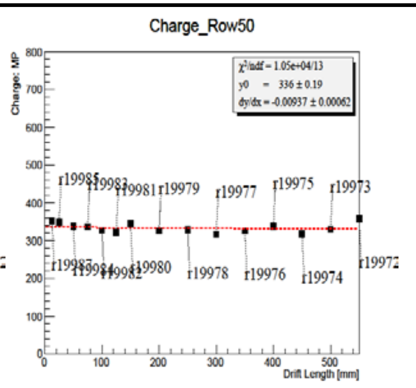
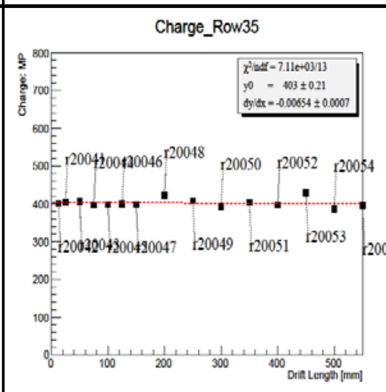
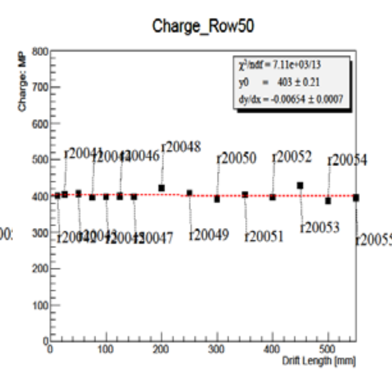




Other row (Row 35&50)

Charge was similarly plotted in other row.

Result(Correction)

Gate GEM (w/)	Field Shaper(w/o Gate GEM)	Transmission
		$\frac{336(GG)}{403(FS)}$ = 83.4 % ±0.00064
 	 	Other row (Row 35&50)

After correction the gain is decreasing overall. Charge was similarly plotted in other row.

Summary

Electron Transmission rate

None Correction	80.8 %±0.00062
Correction	83.4 %±0.00064

The target value of 80% or more is achieved, with or without correction.

Next Step

- I'm simulating Cd(Transverse Diffusion Constant) with GarField ++, but it seems that it will take time until the statistics accumulate (around the beginning of February?) -> finish -> compare Cd of Padres.C

Thank you for your attention.

Fin.

Correction method


```
double GetGainCorrection(int run)
{
        double tk = GetTemperature(run);
        double hp = GetPressure(run);

        double tk0 = GetTemperature(19972); //reference GateGEM
        double hp0 = GetPressure(19972);    //reference GateGEM

        static const double A1 = 0.0316 * 355.; // katamuki * UpperGEM Voltage
        static const double A2 = 0.0263 * 315.; // katamuki * LowerGEM Voltage

        double R1 = exp(A1 * ((hp0 / tk0) / (hp / tk) - 1.));
        double R2 = exp(A2 * ((hp0 / tk0) / (hp / tk) - 1.));

        return R1 * R2;
}
```

```
#ifdef GAIN_CORRECTION
    double corr =  rinfo.GetGainCorrection(run);
    y /= corr;
    dy /= corr;
#endif
```

Correction method

$$G = \alpha e^{\beta V}$$

$$G_0 = \alpha e^{\beta V_0}$$

$$\frac{G}{G_0} = \frac{\alpha e^{\beta V}}{\alpha e^{\beta V_0}} = e^{\beta(V - V_0)}$$

$$\log \frac{G}{G_0} = \beta(V - V_0)$$

$$= \beta V_0 \left(\frac{V'}{V_0'} - 1 \right)$$

$$V : {}^{P}/_{T} = V' : {}^{P_0}/_{T_0}$$