Content: Transmission with correction (Temperature and Pressure)

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

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

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

H2O and O2
  - 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.

```c
#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
- \(A_2\): Gain at lower GEM’s voltage = 315 V
- \(P_0/T_0\): reference (at Run19972)
Transmission rate

\[ \frac{\text{ADC channel at } w/\text{Gate}}{\text{ADC channel at } w/o\text{Gate}} \times 100 \% \]

i.e. ADC channel w/FieldShaper
**Result (None Correction)**

<table>
<thead>
<tr>
<th>Gate GEM (w/)</th>
<th>Field Shaper (w/o Gate GEM)</th>
<th>Transmission</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Charge_Row44</strong>&lt;br&gt;$\chi^2/\text{ndf} = 1.85 \times 10^{-3}$/13&lt;br&gt;$y_0 = 357 \pm 0.2$&lt;br&gt;$dy/dx = -0.013 \pm 0.00065$</td>
<td><strong>Charge_Row44</strong>&lt;br&gt;$\chi^2/\text{ndf} = 210/13$&lt;br&gt;$y_0 = 442 \pm 0.23$&lt;br&gt;$dy/dx = -0.00198 \pm 0.00078$</td>
<td>$\frac{357(GG)}{442(FS)} = 80.8 %$&lt;br&gt;$\pm 0.00062$</td>
</tr>
</tbody>
</table>

Other row (Row 35&50)

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

Electron Transmission rate

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>None Correction</td>
<td>80.8 %± 0.00062</td>
</tr>
<tr>
<td>Correction</td>
<td>83.4 %± 0.00064</td>
</tr>
</tbody>
</table>

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.
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

\[ G = \alpha e^{\beta V} \]

\[ G_0 = \alpha e^{\beta V_0} \]

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

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

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

\[ V : \frac{P}{T} = V' : \frac{P_0}{T_0} \]