New PMT Test

Xue Bai

July 25, 2009

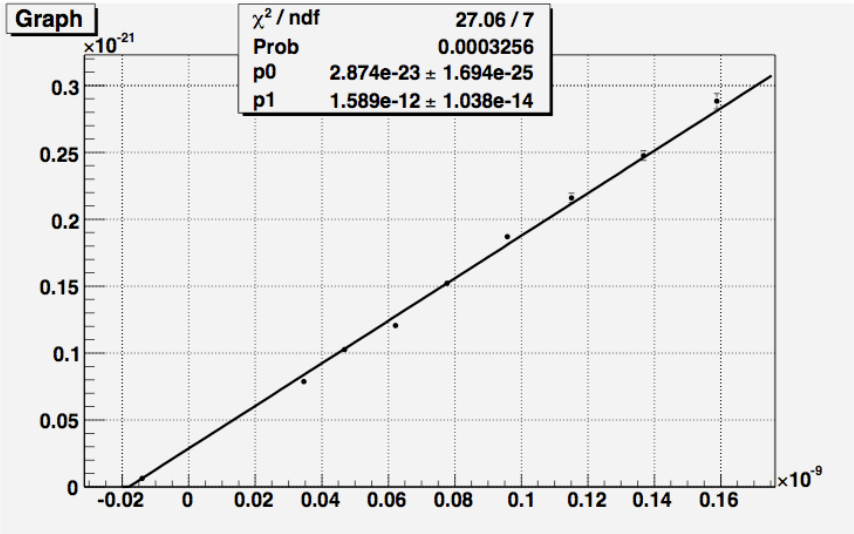
Setup

- Small Cryostat with 2L LXe
- PMTs
  - Reference PMT : TC1411

    QE= 0.115 , Gain= 1.845×10^6 @800V (measured in LP)
  - New PMT : ZB3129, ZB3131
- Calibration
  - Alpha source (241Am, 5.5MeV)
  - LED

Gain Measurement

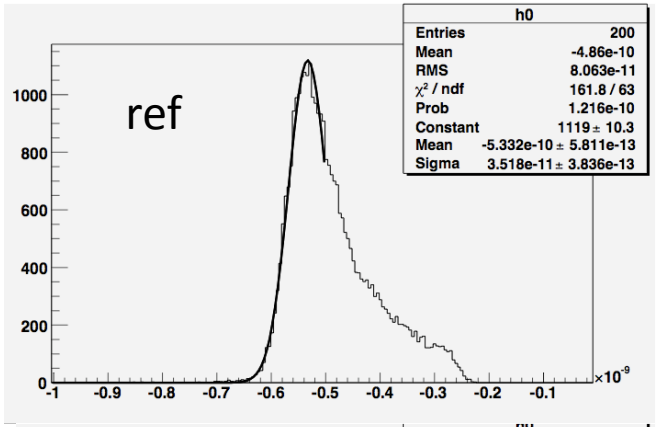
- Gain Calculation using LED
- Measured both at 165K (HV=800V) and room temperature (HV=800V for reference PMT and HV=900V for new PMT)
- Gains of reference PMT at low temp. consistent with results from previous measurement

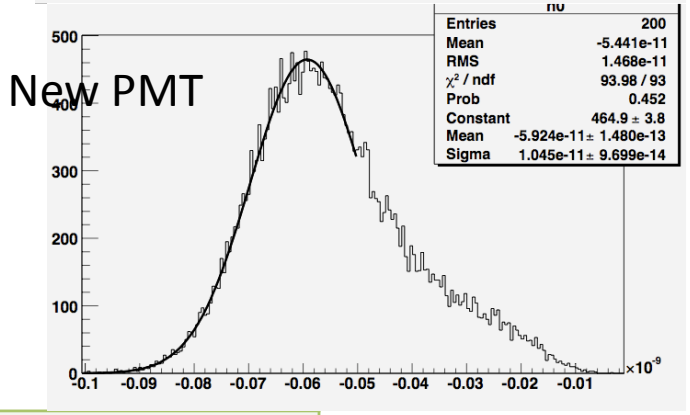


	LXe (T=165 K)	Room Temp.
TC1411	3.3×10^{6}	2.63×10^{6}
ZB3129	4.73×10^{6}	0.927×10^{7}
ZB3131	5.41×10^{6}	1.22×10^{7}

QE Measurement in LXe

- QE was measured using alpha event in LXe.
  - ➢ Absolute calculation
    - Assuming Wph for alpha particle (19.6eV)
    - Using solid angle
  - ➢ Relative calculation
    - Assuming QE of the reference PMT which was obtained in the previous test.
    - Calculated with ratio of solid angles btw reference PMT and new PMT
  - ➢ Light absorption in LXe is not taken into account.



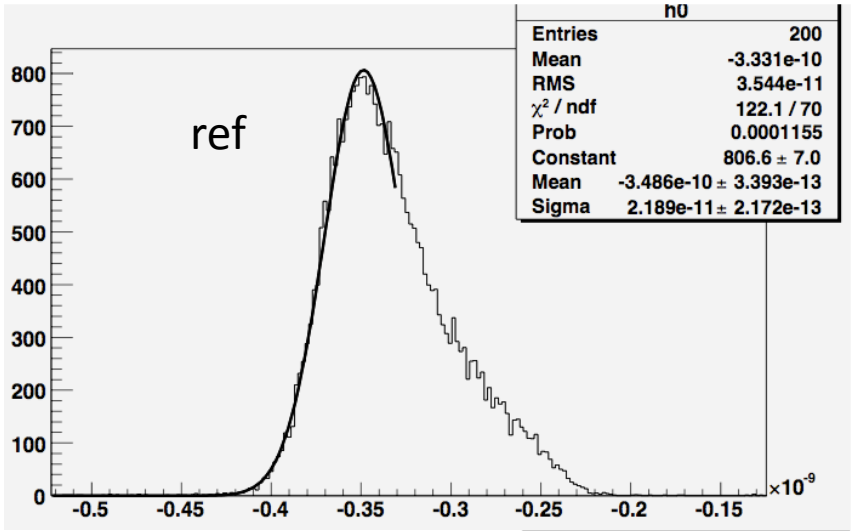


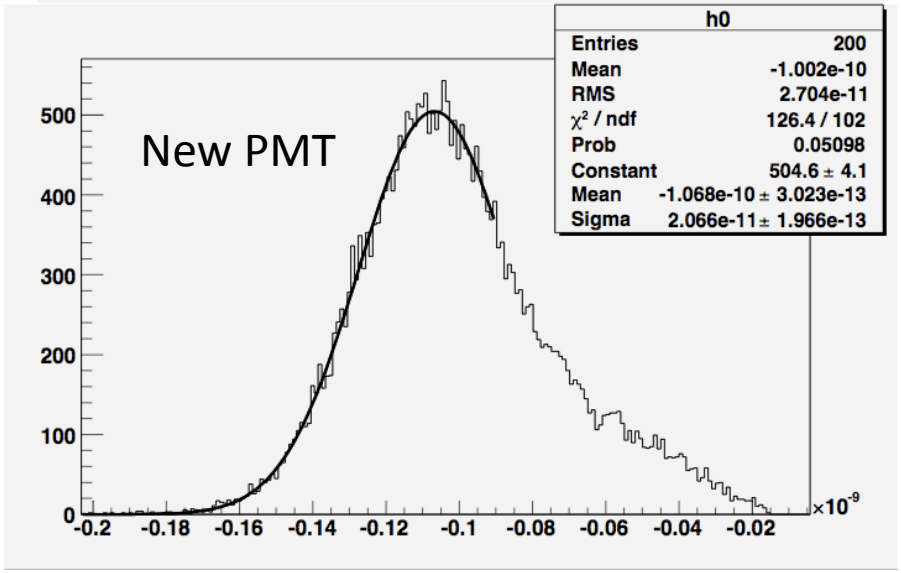
	Absolute	**Relative**
TC1411	19.9%	(11.5%)
ZB3129	28.9%	16.7%
ZB3131	24%	13.79%

QE Measurement in GXe

- QE was measured using alpha event in gaseous Xe (0.189MPa)
- At room temperature
- Absolute calculation only
  - ➢ Assuming Wph = 49.6eV
- Unbelievably high result, to be investigated.

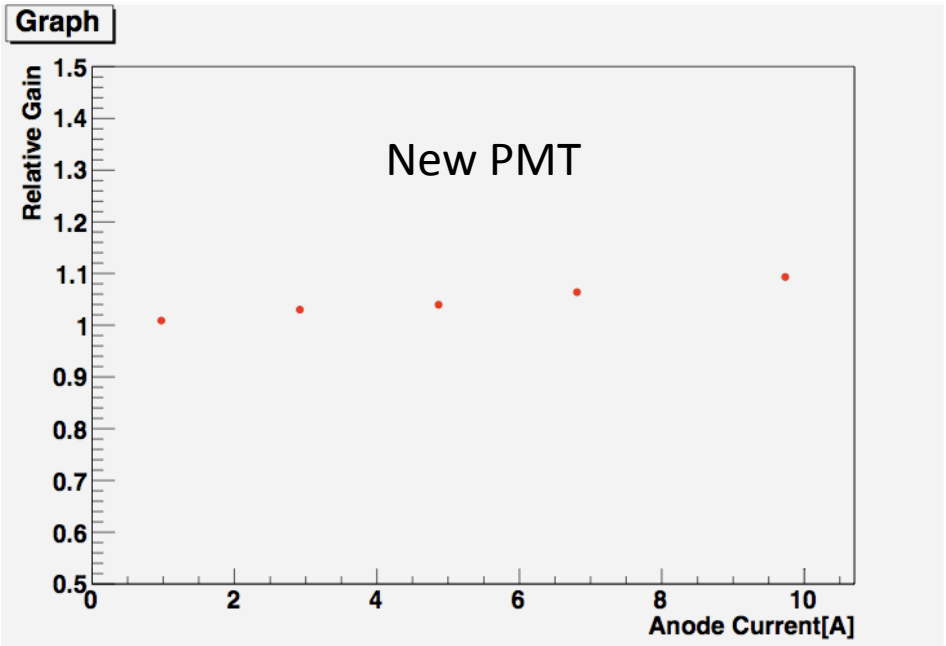
	QE (Absolute)
TC1411	47.8%
ZB3129	67.3%
ZB3131	45.1%

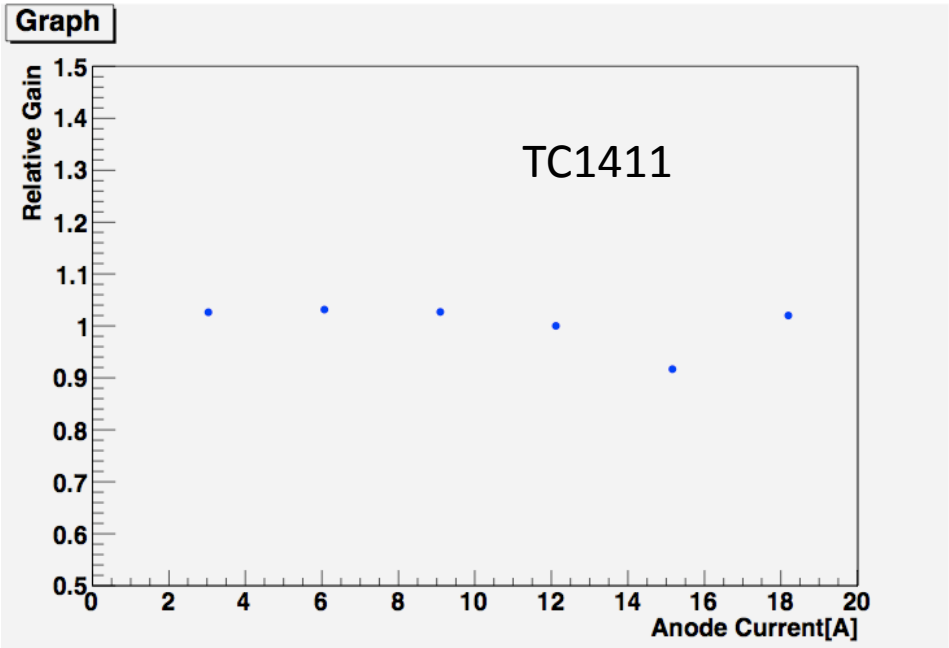




Saturation at low temperature

- PMT gain was monitored with flushing background LED constantly.
- Measured in GXe at 187K (higher than LXe)
- Anode current for reference PMT is set up to over 10μA.
- For new PMT, the effective area is about 1/20th that of the reference PMT. Hence the currents are adjusted to the same level of backgrounds in the case of reference PMT (i.e. multiplied by 20).





Saturation at room temperature