

# Gain vs. Dark Current/Dark Rate

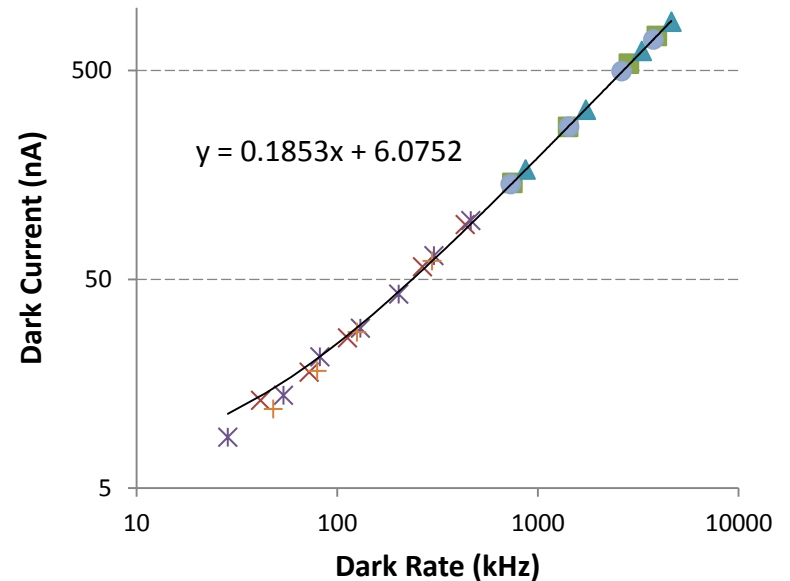
Yi Qiang 2012/1/19

- **1 mm<sup>2</sup> 50 um SiPM (S10362-11-050C)**

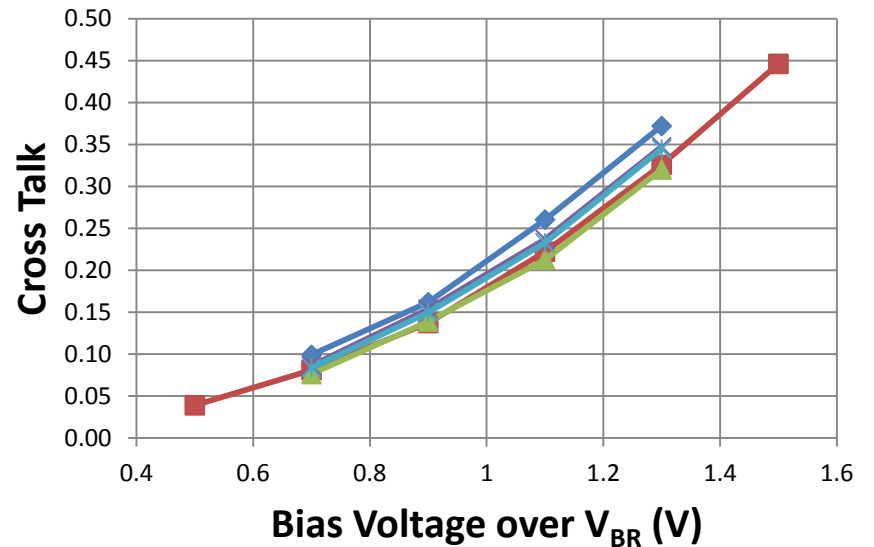
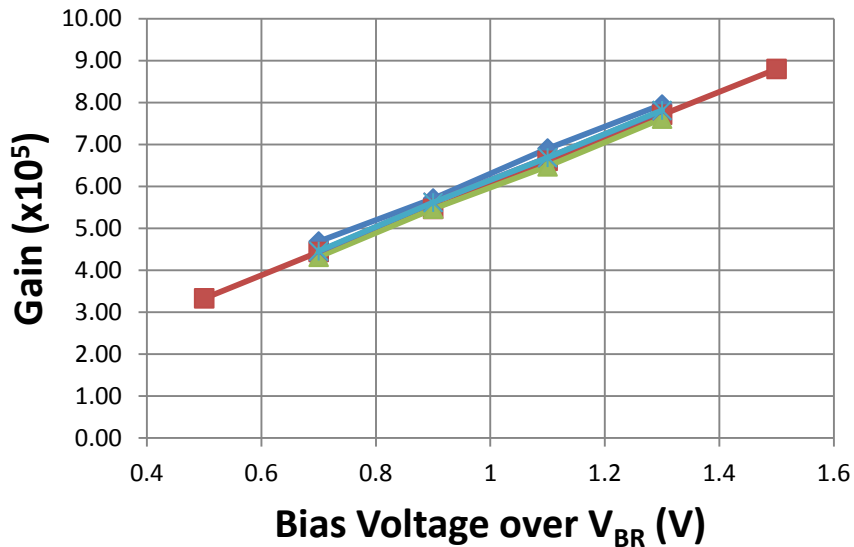
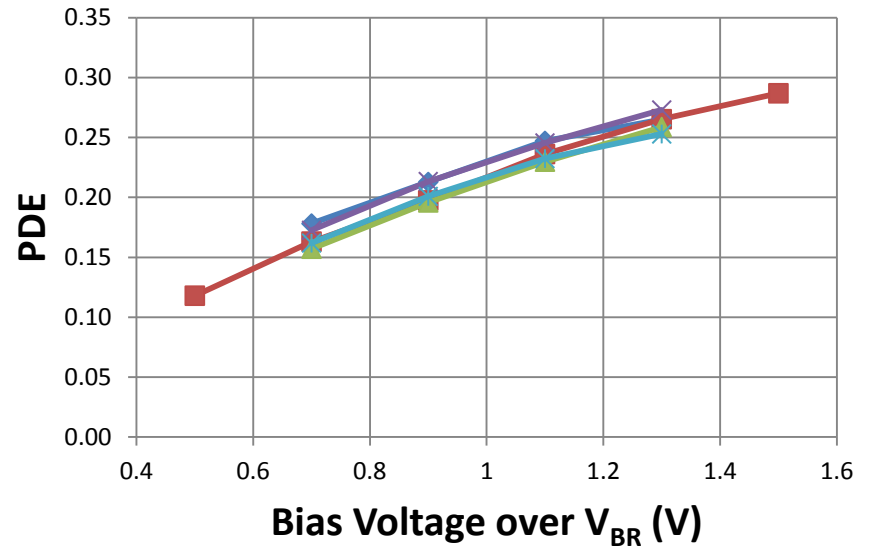
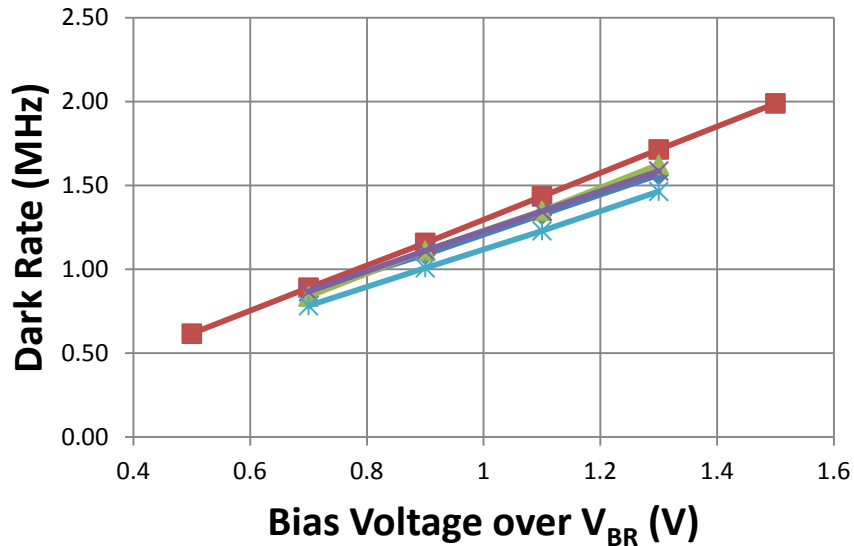
- FADC 250: 12-bit covers 0-0.5 V, 50 Ω, 4 ns, ×66 pre-amplifier:
  - 1 channel =  $0.5\text{V} \cdot 4\text{ns} / 4096 / 66 / 50\Omega = 1.48 \times 10^{-16} \text{ C} = 925 \text{ e}$
- Average gain: 909 channels ->  **$0.84 \times 10^6$**
- Gain from current/rate fit:  **$1.16 \times 10^6$**
- Difference: 38%, could be explained by cross-talk and after pulsing

- **First Article Units**

- QDC V792: 100 pC/Channel
- ×66 pre-amplifier
- Average gain from 3 samples:  **$0.56 \times 10^6$**
- Dark current/Dark rate = 1.84 uA/15.1 MHz:  **$0.76 \times 10^6$**
- Difference: 36%, similar to 1 mm<sup>2</sup> case, but much smaller deviation is expected due to smaller cross-talk and after-pulsing with lower bias.

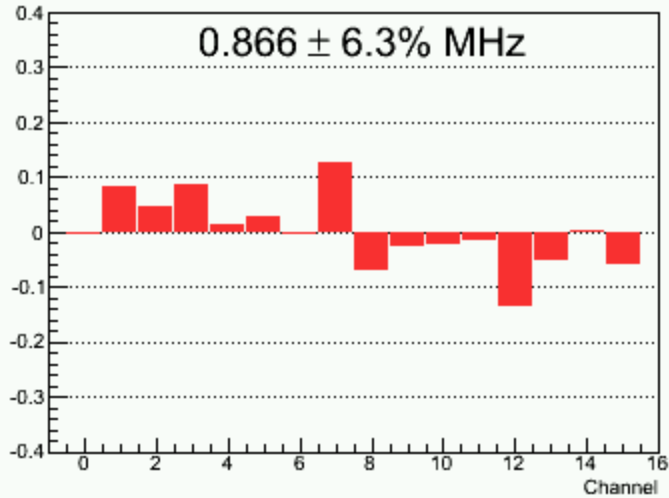


# Voltage Dependence

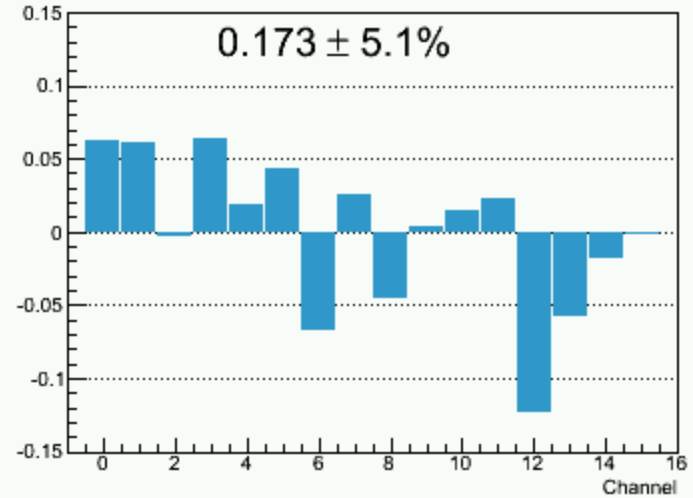


# Uniformity @ 0.7 V (SiPM#73)

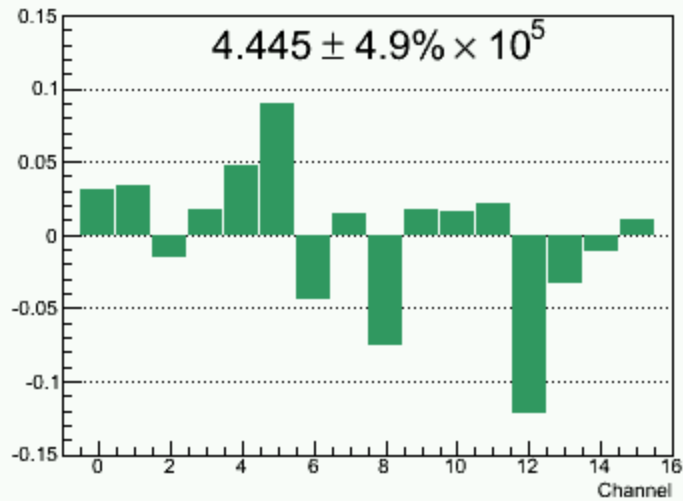
Dark Rate Uniformity



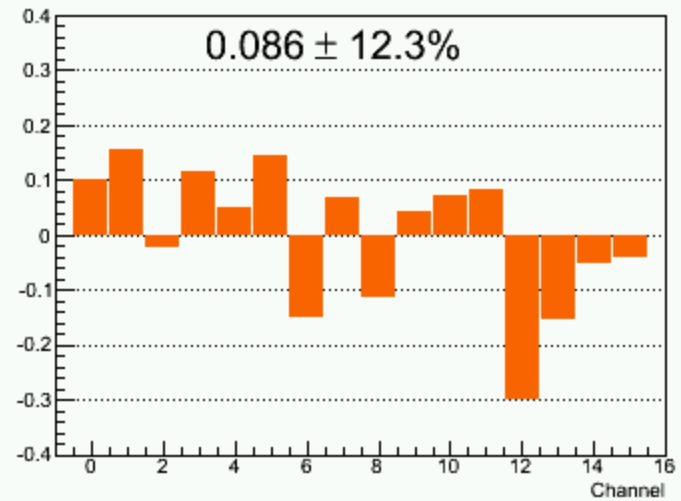
PDE Uniformity



Gain Uniformity

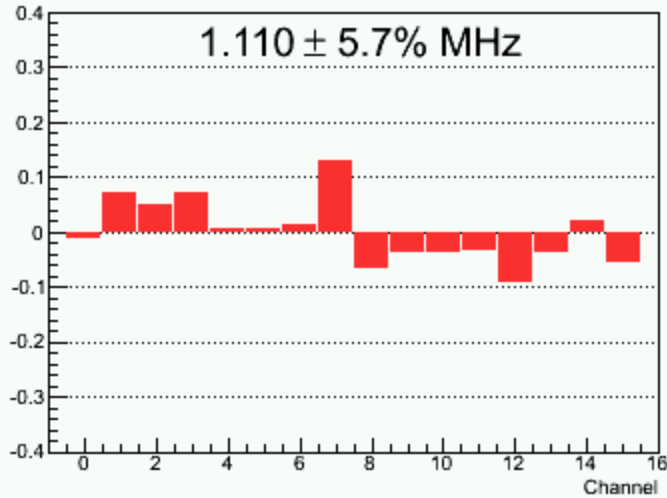


Cross-Talk Uniformity

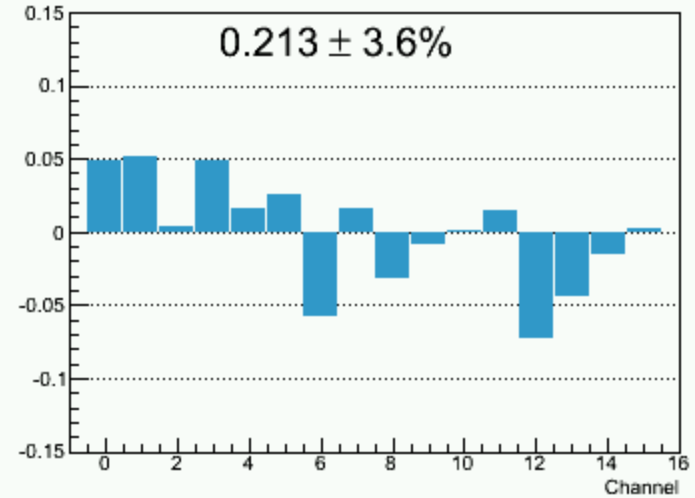


# Uniformity @ 0.9 V (SiPM#73)

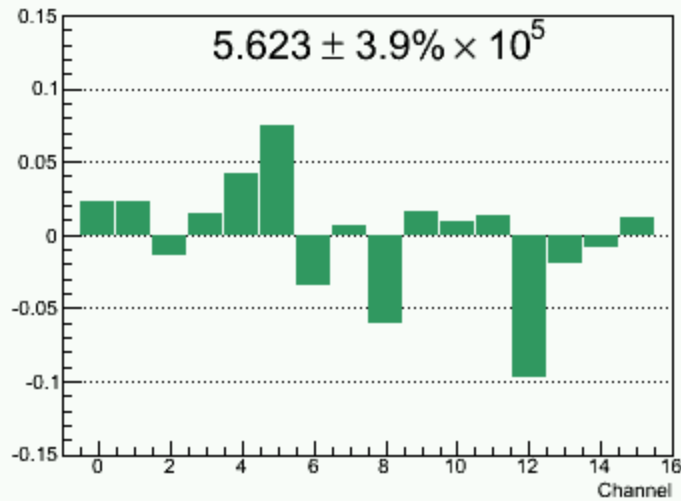
Dark Rate Uniformity



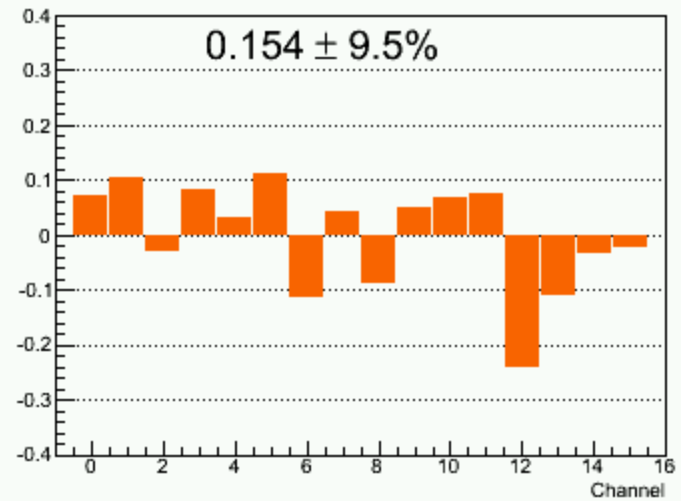
PDE Uniformity



Gain Uniformity

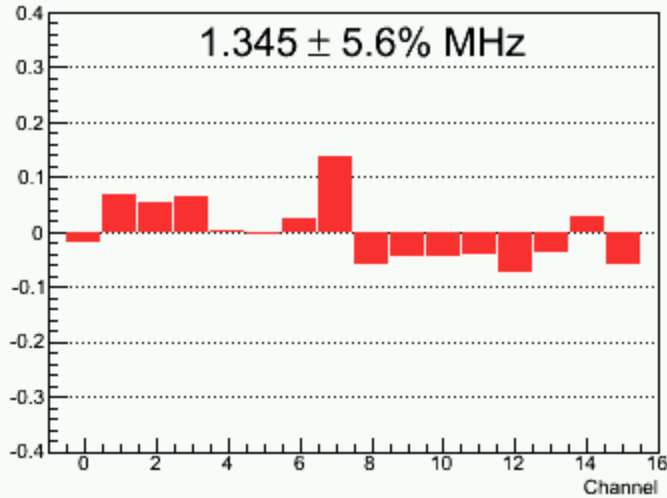


Cross-Talk Uniformity

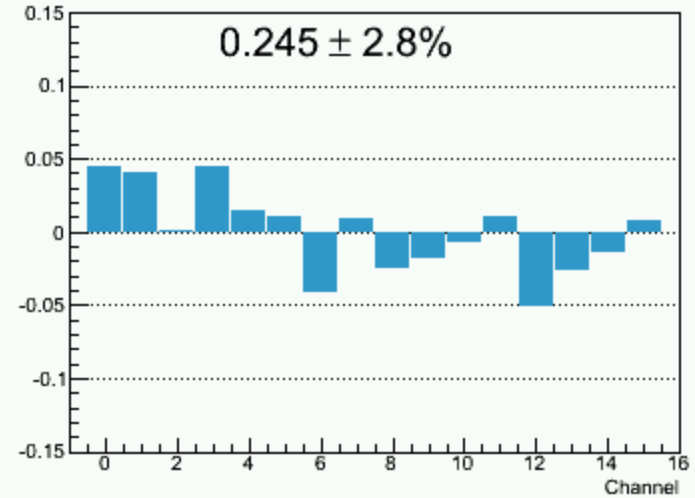


# Uniformity @ 1.1 V (SiPM#73)

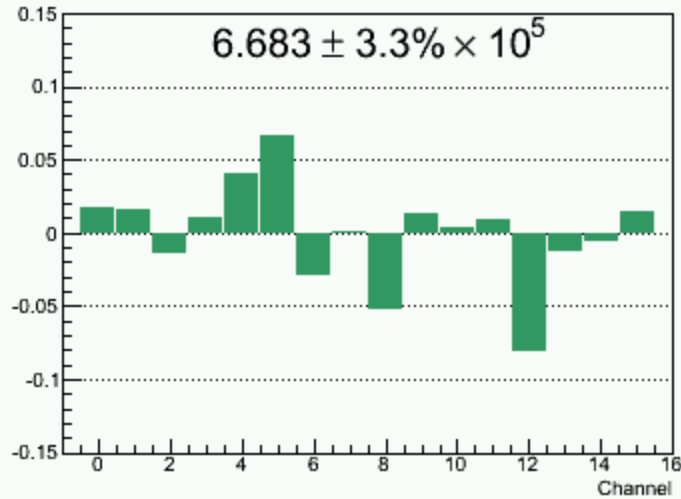
Dark Rate Uniformity



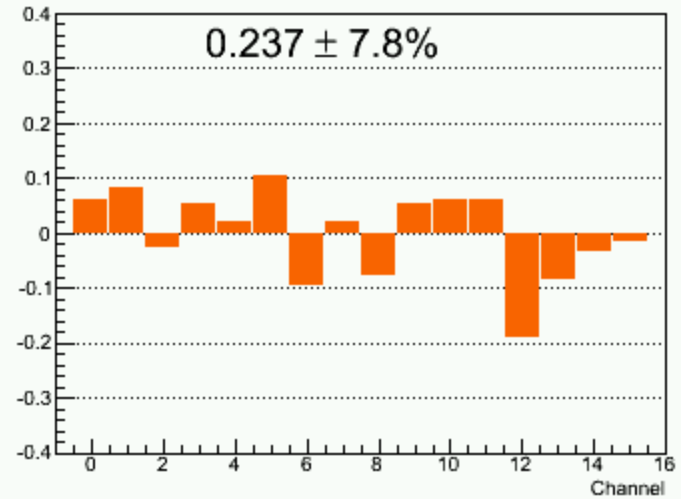
PDE Uniformity



Gain Uniformity

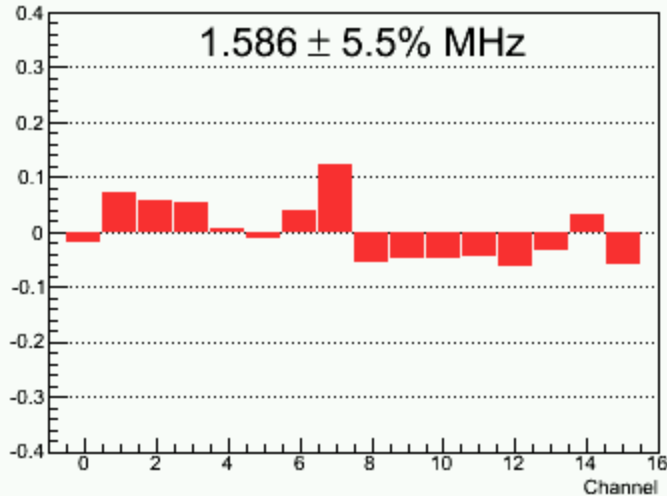


Cross-Talk Uniformity

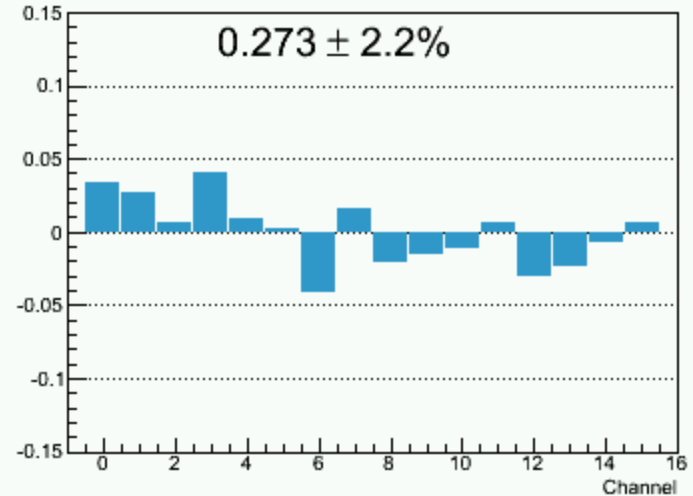


# Uniformity @ 1.3 V (SiPM#73)

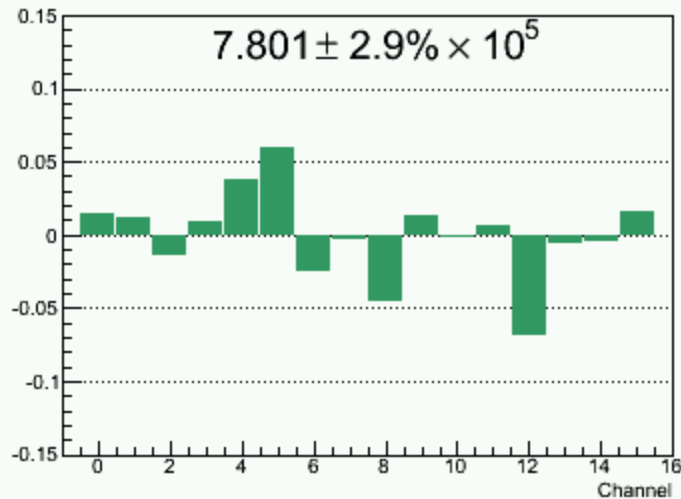
Dark Rate Uniformity



PDE Uniformity



Gain Uniformity



Cross-Talk Uniformity

