HCAL Biweekly Meeting Minutes 12.15.20

Nominal agenda:

- **Review LED voltage scans**
    - Sebastian
    - Vanessa
    - Scott

Attendance:

1. Sebastian Seeds
2. Bogdan Wojtsekhowski
3. Brian Q
4. Donald Jones
5. Juan Carlos Cornejo
6. Scott Barcus
7. Vanessa Brio

Actual:

Vanessa

- Finalizing presentable material.
- NPE calculations appear to follow correct pattern
- Low end voltage produces fractional NPE for low LED settings
    - Needs update
- Cosmic run polynomial fits work better for CMU than for JLab
    - Would be good to swap axes: Peak Response vs. HV Setting
- May be worth checking exponential fit
    - Doubles in gain every 50 V.
    - Straight line on log plot.

Sebastian's Presentation

- Use photoelectron maxima per pmt and LED photon maxima to determine appropriate highest HV
- Sebastian: to improve analysis with NPE calculation

Scott's Presentation

- Determination of fit function: Discuss whether the exponential parameter p3 (from f(HV)=p1*(HV)^p3) can exceed the number of dynodes. Literature can be found here:
    - https://psec.uchicago.edu/library/photomultipliers/Photonis_PMT_basic.pdf
- Better to use sRAU than maxRAU by fits and by eye.
- sRAU linearly correlated to maxRAU. Spread in sRAU vs maxRAU still exists – source of spread needs explained. Can be 4 ns bin jitter. It may be best to use maxRAU and accept jitter due to window chopoff.

- Should extend ADC window beyond 30 bins since pulse is being chopped off. Can only take sRAU where confident that full pulse in window.
- Landau not appropriate: should be convolution function – need to check. Search **Alton Smith** thesis/publications. **Eric Fuchey** also has fit in digitization which can also be a check.
- Suggestion to obtain calibration parameters without full analysis treatment.
    - Scott: to look into iterative approach to obtain fit parameters
- LED peaks plotted per module across all LED settings to check NPE sanity. Each LED setting should roughly double.
- Average ADC vs NPE to check saturation can be performed.
- Should include reduced Chi Sqr with correct error
- Fit y-offset parameter can cause different gains at the same voltage! Should not use this one.

Juan Carlos and Amplifier Concerns

- Max value for linearity? Nominally -3V (output, after gain). 3 V on amplifier is 1.5 V on ADC. Should either study linearity or reduce RAU to obtain from 1.5V (not current setting at 2.0V).
- Mean of gaussian vs NPE is non-linear where amplifier is saturated.
    - Juan Carlos to look at this plot
- Low voltage shift (2.0 V to 1.5 V) will affect QE, not linearity. Need to look at NPE vs HV to assess.
    - Scott, Vanessa, Sebastian to look at this
- Lowest HV setting in logbook is 1300V