Detector activities/work plan at Stony Brook University

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Ongoing efforts at SBU

- Analysis of the 2015 beam test data at Mainz
  - ➢Quartz data
  - ➢Gas scintillation data
- Geant4 simulation to match/understand the data
  - ➢Scintillation simulation first, then Quartz simulation
- PMT test
  - ➢3 inch PMTs have arrived at SBU, Preparing for the gain test
    - ✓ R11410 SEL, S/N KC0009
    - ✓ R6233-100 MOD, S/N ZE7468
    - ✓ R6041-406 SEL ASSY, S/N VA0021
- New prototype design based on simulation
  - ➢Will order new quartz before Feb 10
  - ➢Finish the prototype design before April 10

Need some inputs for our study

- For quartz G4 simulation:
  - Need sketch for 4 prototypes
  - I only have the code from Jie, need to dig out the geometry from it
- For scintillation G4 simulation:
  - I got the sketch from Pei Qing, thanks Pei Qing!

Fitting formula to the scintillation data

$$S_{\text{ideal}}(x) = P(n;\mu) \otimes G_n(x)$$

$$= \sum_{n=0}^{\infty} \frac{\mu^n e^{-\mu}}{n!} \frac{1}{\sigma_1\sqrt{2\pi n}} \exp\left(- \frac{(x - nQ_1)^2}{2n\sigma_1^2} \right). \quad (5)$$

$$B(x) = \frac{(1-w)}{\sigma_0\sqrt{2\pi}} \exp\left(- \frac{x^2}{2\sigma_0^2} \right) + w\theta(x)\alpha \exp(-\alpha x), \quad (6)$$

$$S_{\text{real}}(x) = \int S_{\text{ideal}}(x') B(x - x')\, dx'$$

From NIM A 339 (1994) 468-476

Additional two free parameters due to clock trigger:

- Par[8] for normalization of light related PMT response
- Par[7] for normalization of clock trigger related PMT response: should be pure Ped

par[8]*S_real + par[7]*B(x)

6 floating parameters in this formula:
W ->probability of exponential pedestal (due to thermoemission etc.)
Q0, sigma0 -> parameters of Gaussian pedestal (due to current leakage)
Q1, sigma1-> single P.E parameters
Mu-> mean P.E

A fitting sample

Still working on it to understand the data