

# **OD Tuning: SK-IV**

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TMC Meeting 20090423**

- **Status of OD Tuning**

## **SK-IV : Tuning Samples**

- **Muons taken from the SK-III data**
  - **Fit with Muboy and convert to kinematics files**
  - **Muons are then run through skdetsim**
  
- **Four samples, based on geometry of the Muboy fit in the data**
  - **Stopping and entering the wall**
  - **Stopping and entering the top**
  - **Through-going entering the top exiting the bottom**
  - **Through-going entering the wall and exiting the bottom**
  
- **SPE distributions are now drawn from the data distributions using root**
  - **previously modeled using Plateau+Exponential and Gaussian functions**
  - **Method extendable to saturation curves**
  
- **OD Dark Rate is set by region of the detector ( top, wall, bottom )**

# SK-IV Tuning Parameters

## Tyvek:

DS-DSTYVKRTOP	0.90	0.73	- Top Tyvek Reflectivity ( in/out)
DS-DSTYVKRBOT	0.85	0.73	- Bottom Tyvek Reflectivity (in/out)
DS-DSTYVKRWAL	0.89	0.89	- Wall Tyvek Reflectivity (in/out)
DS-DSSEGRTOP	0.85		- Top Segmentation Tyvek Reflectivity
DS-DSSEGRBOT	0.85		- Bottom Segmentation Tyvek Reflectivity
DS-PROBTT	0.03		- Prob. Transmission Top Segmentation Tyvek
DS-PROBTB	0.08		- Prob. Transmission Bottom Segmentation Tyvek

## Efficiencies:

DS-APMTCOR	0.24		- Global PMT collection efficiency
DS-ADSTHRF	0.01		- Ratio of Old / New Tube Efficiency
DS-APMTEFT	0.89		- Top Tube Collection Efficiency
DS-APMTEFB	0.90		- Bottom Tube Collection Efficiency
DS-APMTEFW	0.80		- Wall Tube Collection Efficiency
DS-AWLSCOR	0.0055		- Wavelength Shifter Collection Efficiency

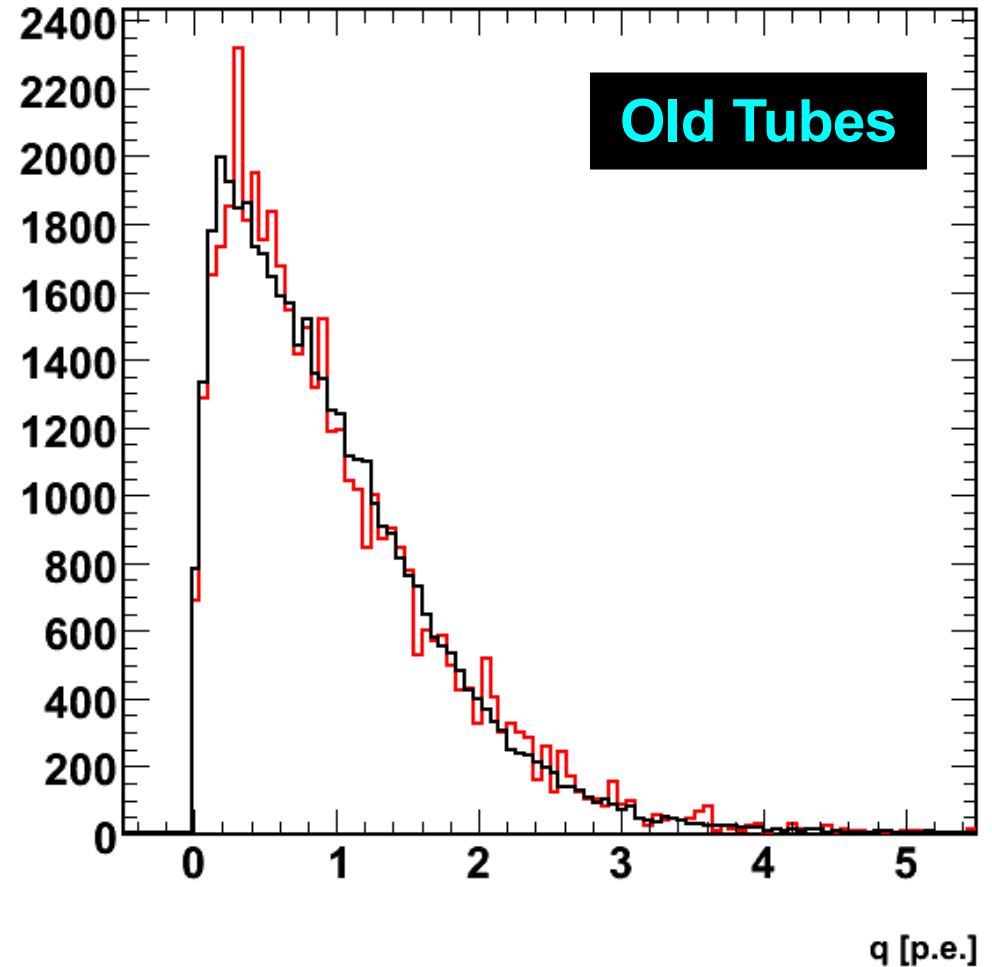
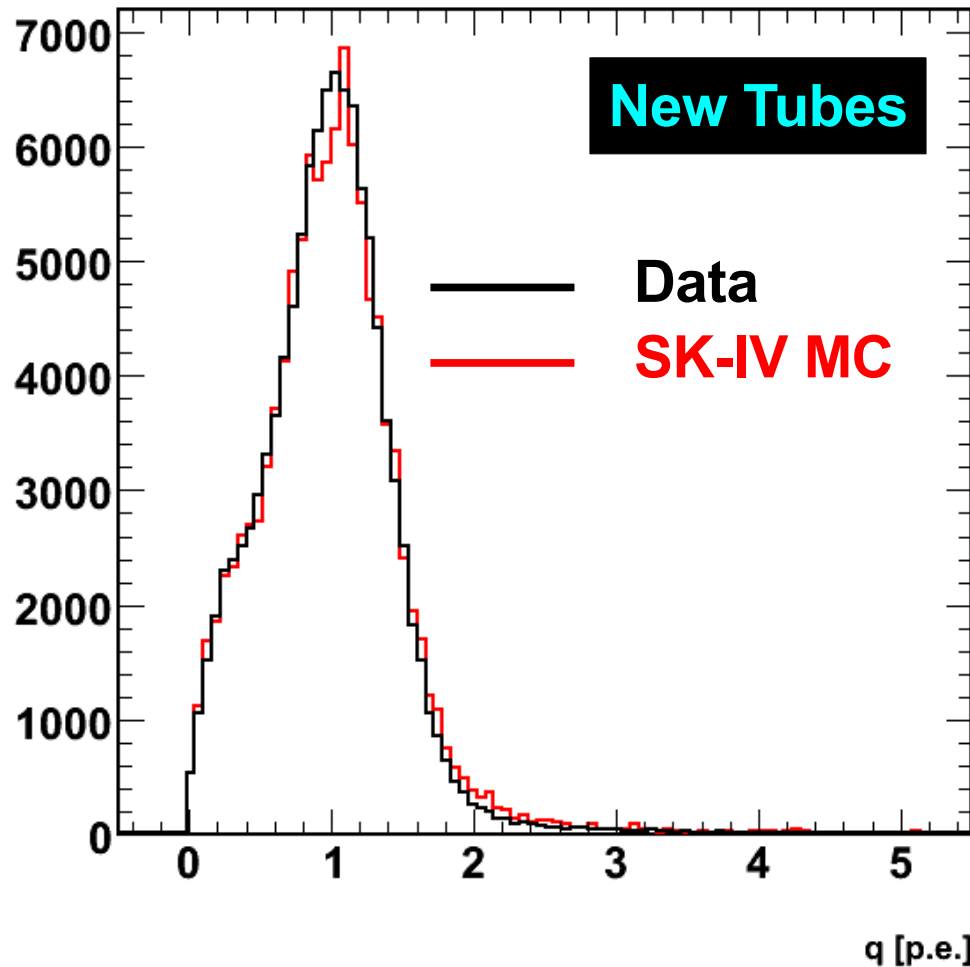
## Electronics:

DS-ADSCTHR		0.1	- Discriminator Threshold
DS-ADSAPO	1. 0.001	0.0003	- Old Tube Saturation Parameters
DS-ADSAPN	1. 0.001	0.0003	- New Tube Saturation Parameters
DS-DARKDSA		4.9	- OD Dark Rate

- Several parameters are used to tune the response of the OD

# SK-IV: Single photoelectron Distributions

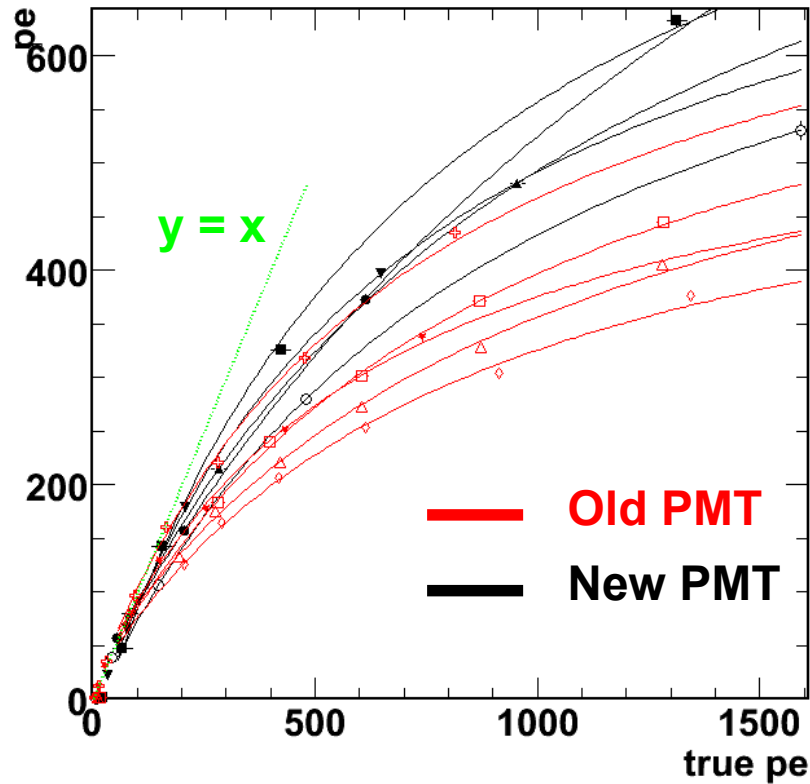
( normalized to equal area )



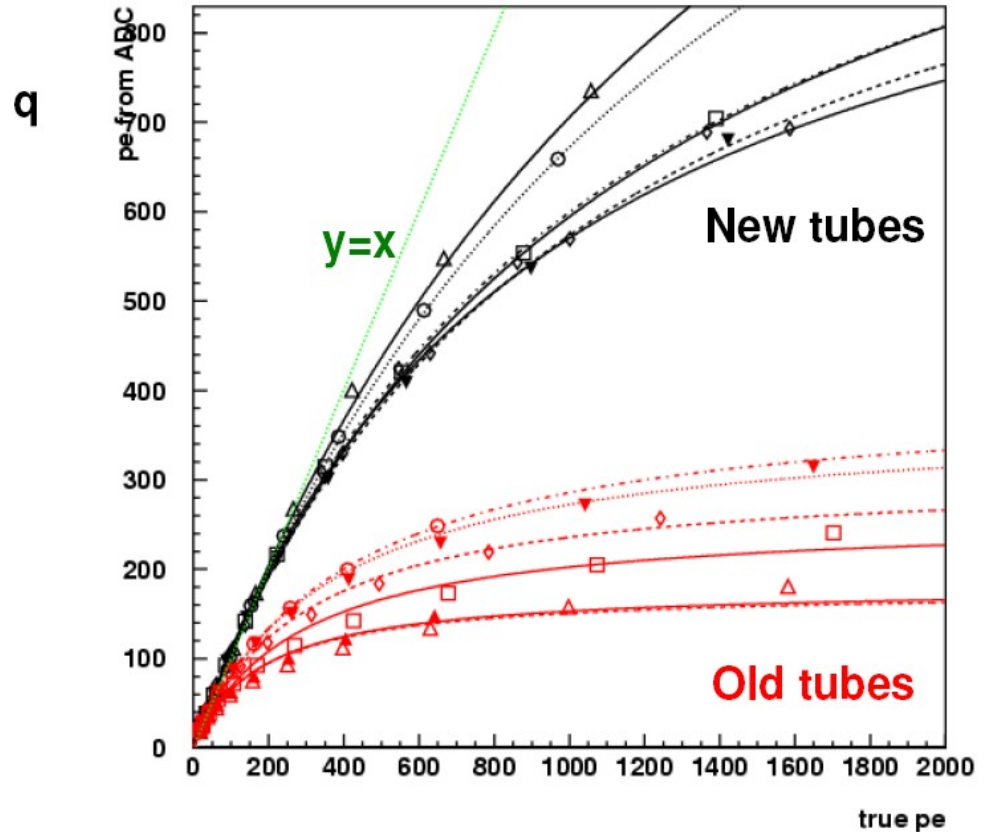
- Using root to draw from data distribution to get MC spe
- Distributions agree well

# OD Laser Data: Saturation Model

March 2009



May 2005



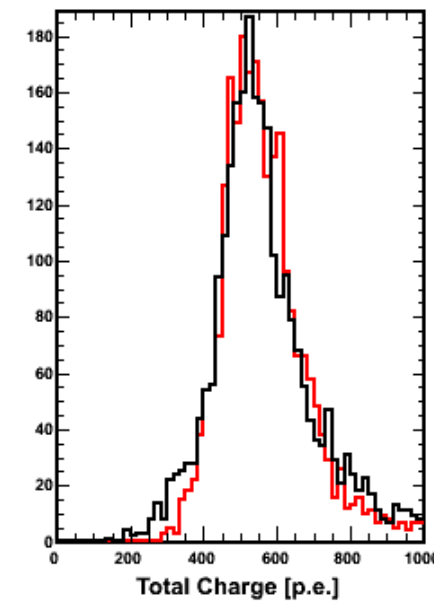
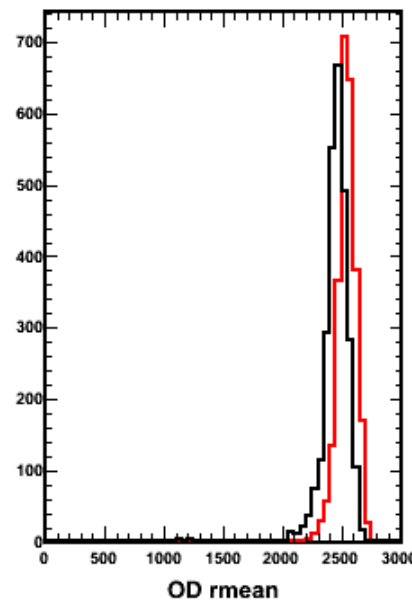
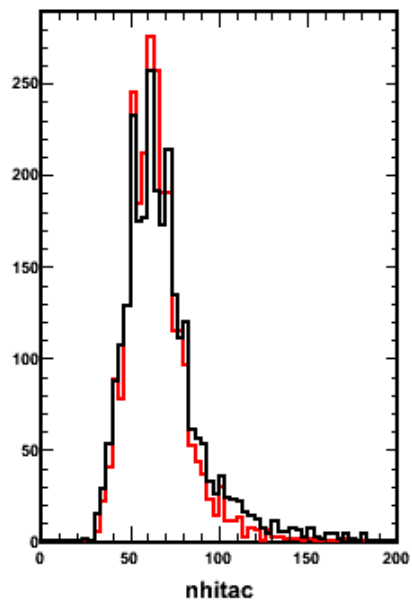
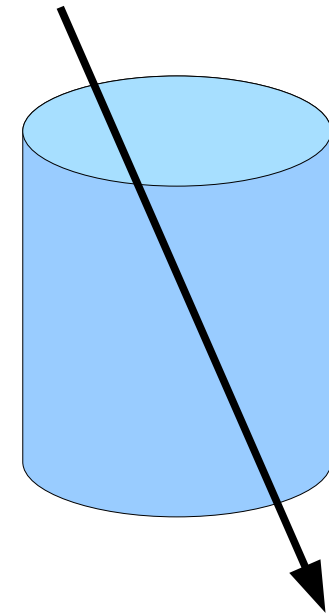
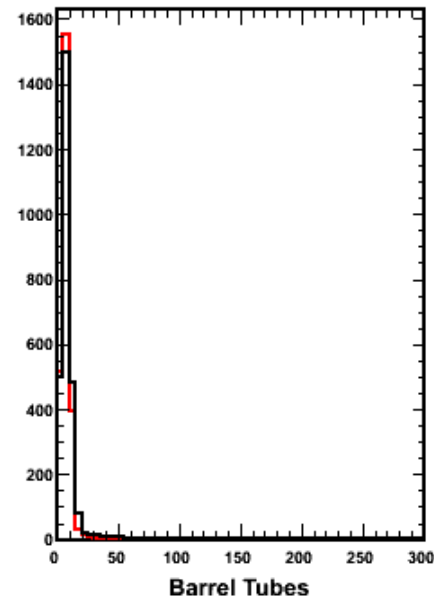
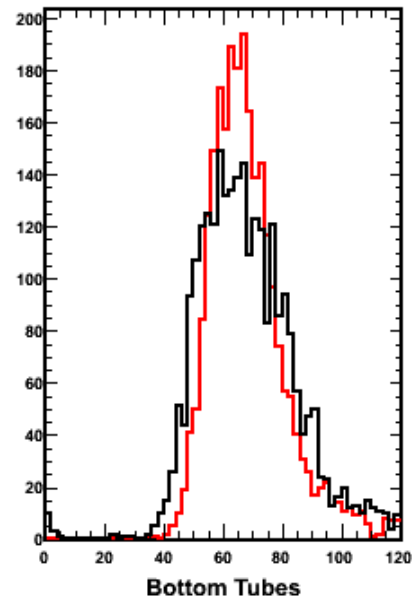
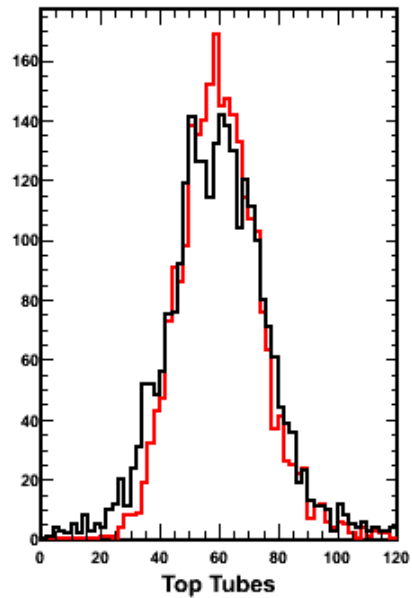
- OD Laser data taken at the end of March on Top / Bottom
- Shape change relative to '05 is consistent with gain changes in SK-IV
  - All curves fit well by:

$$\text{measured } q = \frac{(\text{true pe})}{1 + k(\text{true pe})}$$

( This model used in the simulation)

# **Tuning Distributions with Muon Samples**

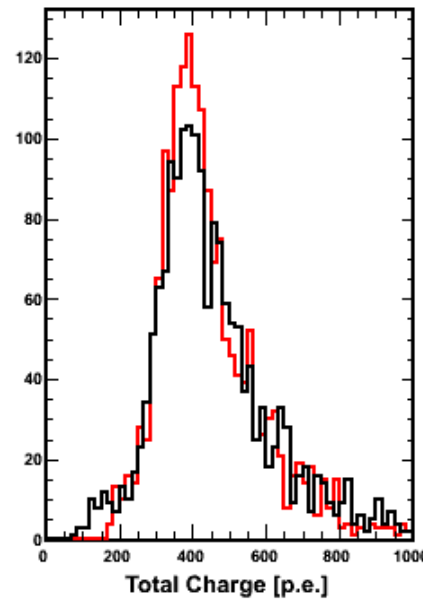
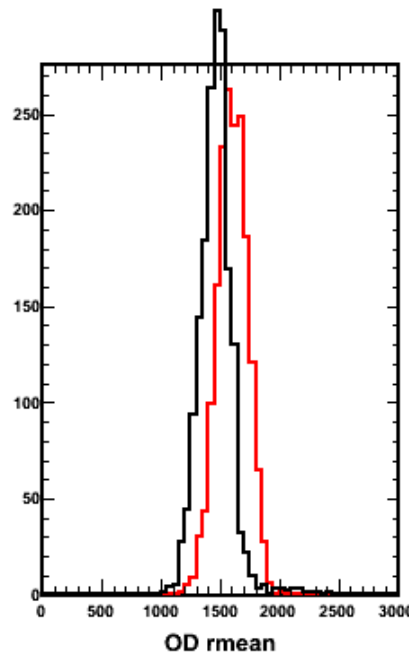
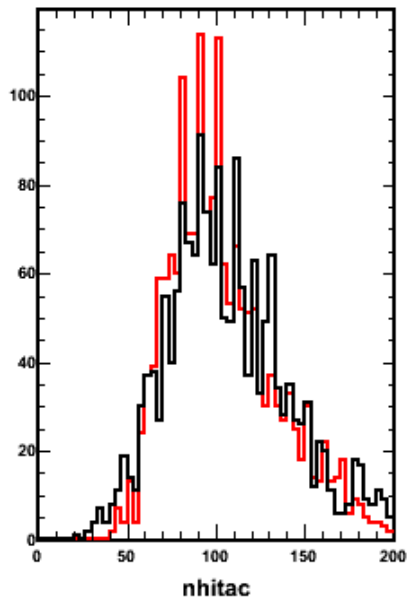
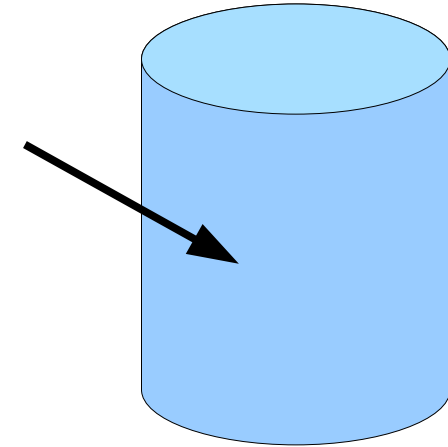
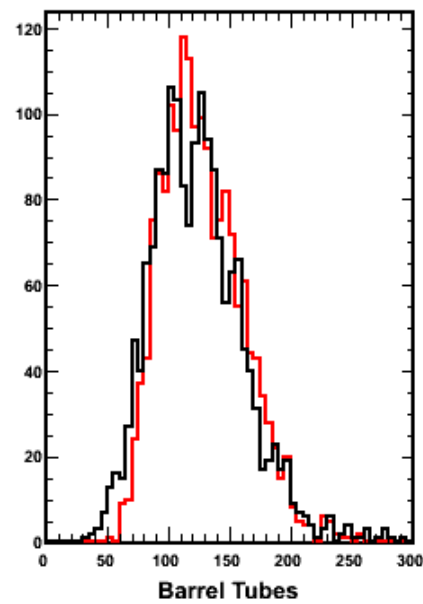
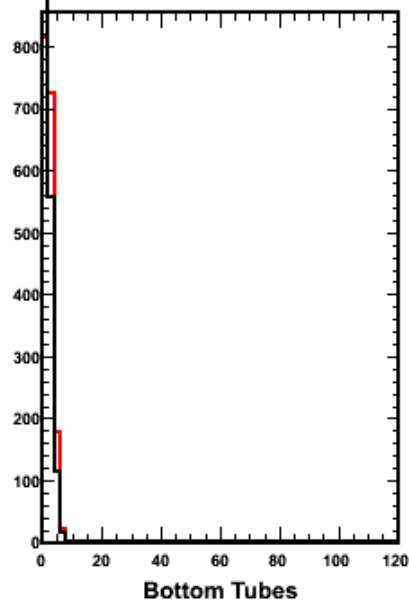
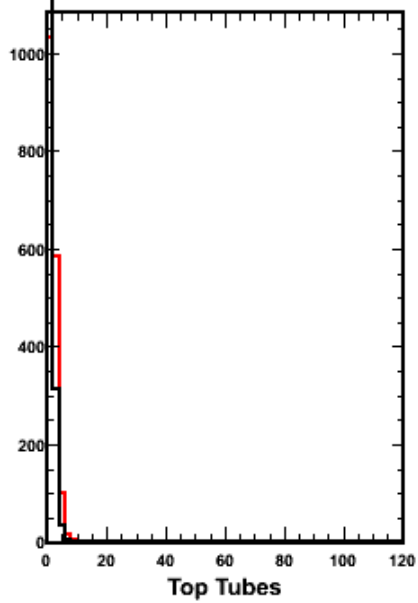
# SK-IV OD Tuning : Through-going $\mu$ top - bottom



— Data  
— SK-IV MC

- Most distributions OK
- OD rmean is too high

# SK-IV OD Tuning : Stopping $\mu$ wall



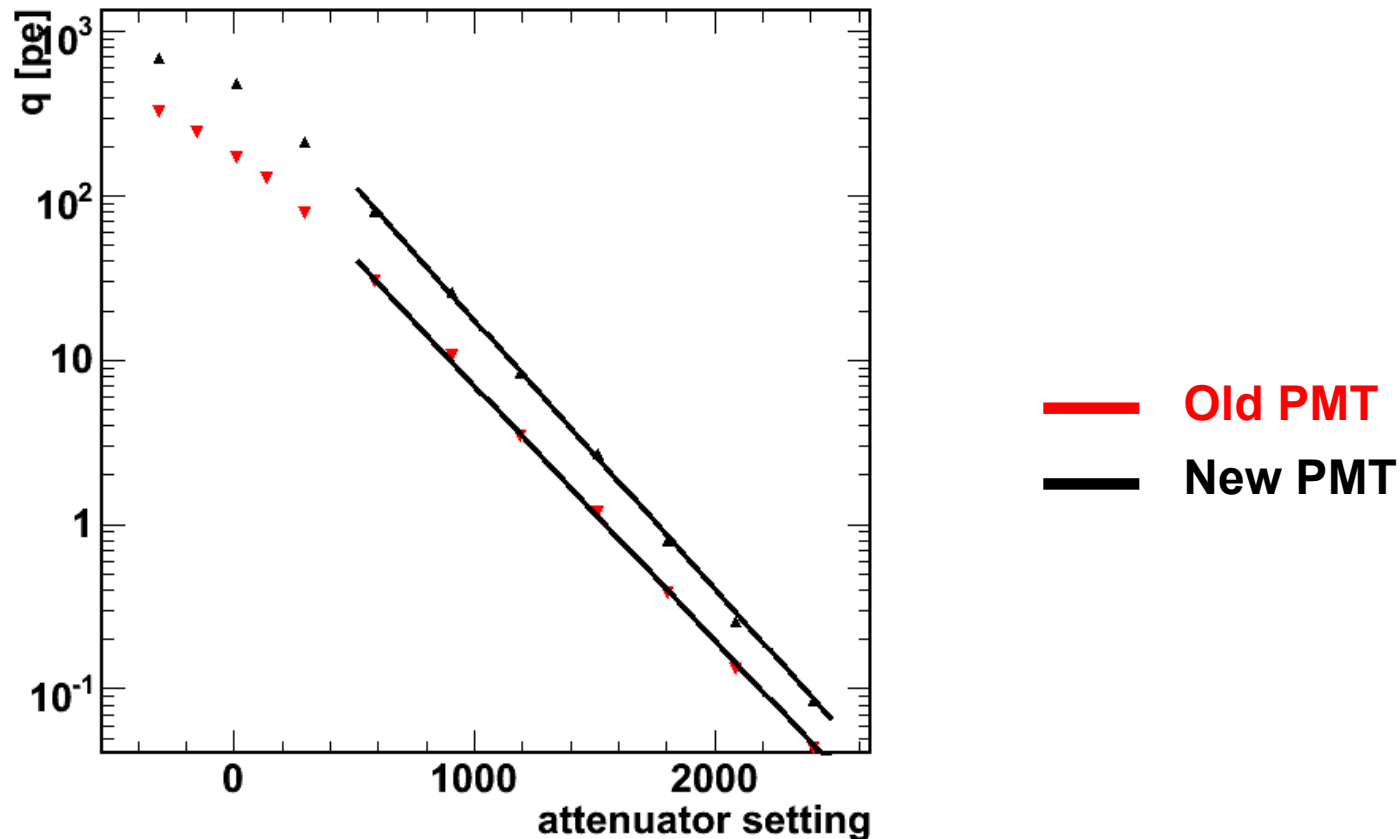
— Data  
— SK-IV MC

- Most distributions OK
- OD rmean is too high

# Summary

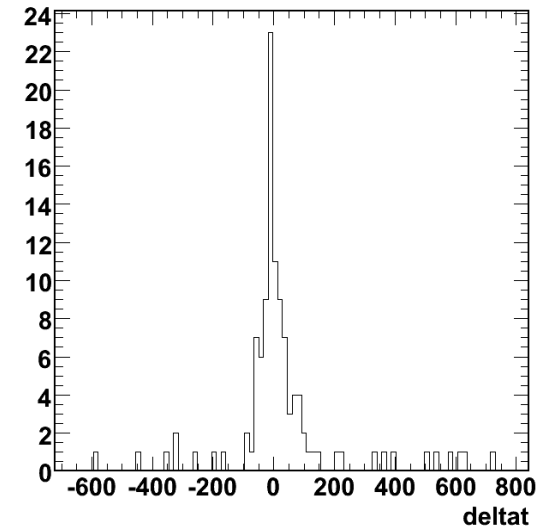
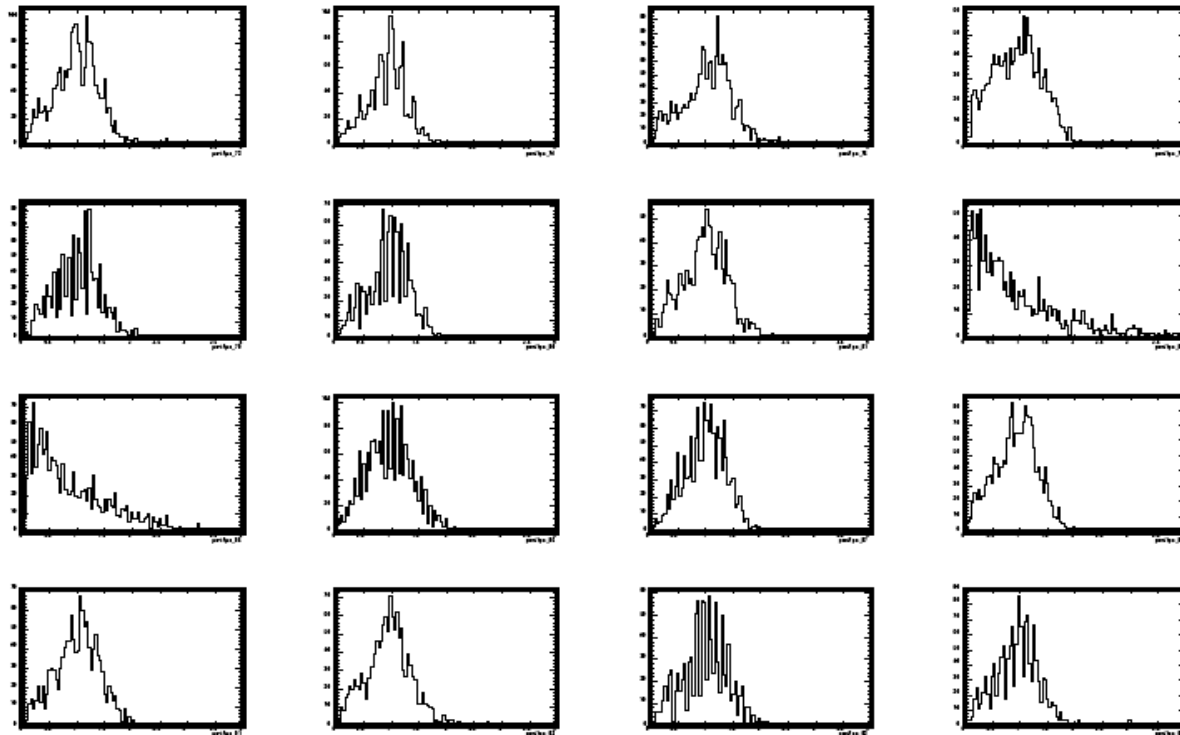
- **OD simulation is being tuned with OD muons**
  - **For the most part the tuning is going well, though some parameters still need tweaking (odrmean)**
  - **Tuning is still underway**
- **As part of this programme laser data was taken to verify the saturation model used in the simulation**

# OD Laser Data:



- OD Laser data taken with two fibers on March 20<sup>th</sup>
  - runs 063816 (top, 3 fibers), 063817 (bottom, 1 fiber)
- Plot is in-time change, for all hits the tubes laser triggered events
  - No monitor PMT: Fit linear region to power law to extract “true pe”  $\sim A(10^{(-\text{setting} / x)})$

# SK-IV OD Tuning : SPE Distributions



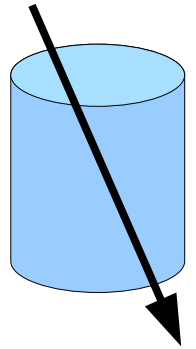
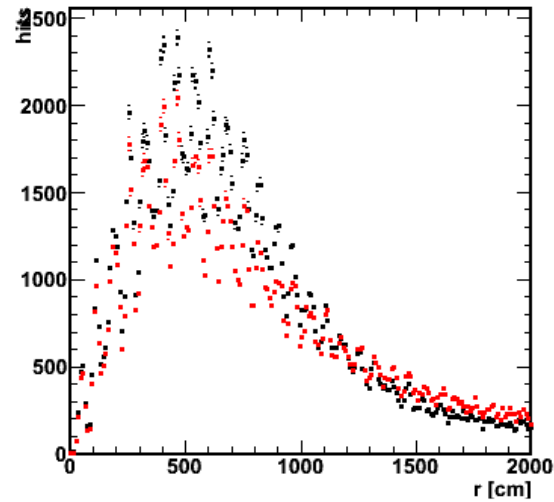
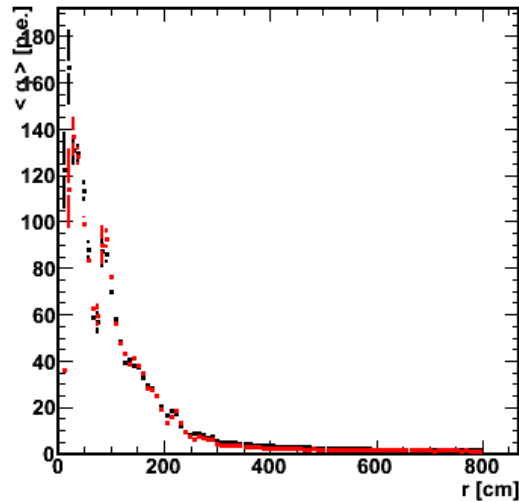
Distribution of execution time (s) difference for drawing spe from root or generating by function for ~100 runs : mean 26.2 seconds slower

- proof of principle for saturation curves
- Tubes have varied spe distributions
  - Generate SPE distribution for each tube and draw from it in the MC
  - No real decrease in speed
- Definitely possible to improve simulation in this way given enough calibration info

# SK-IV OD Tuning : Through-going $\mu$ top – bottom Entry, Exit

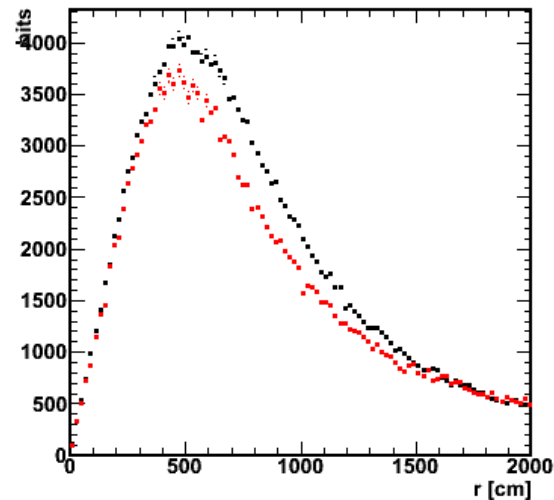
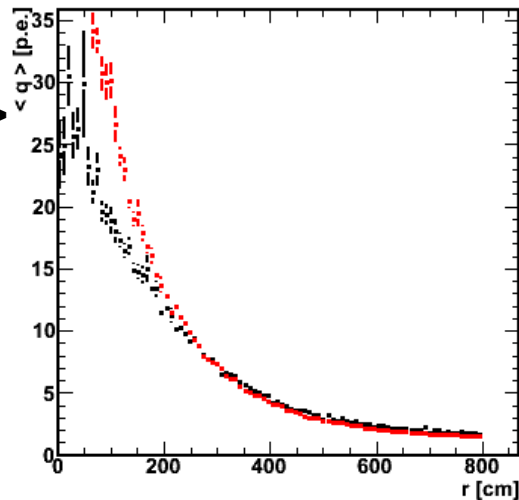
Entry

$\langle q \rangle$



Exit

$\langle q \rangle$



— Data  
— SK-IV MC

- Left column is average charge vs. distance from
- Right column is the raw number of tube hits by distance