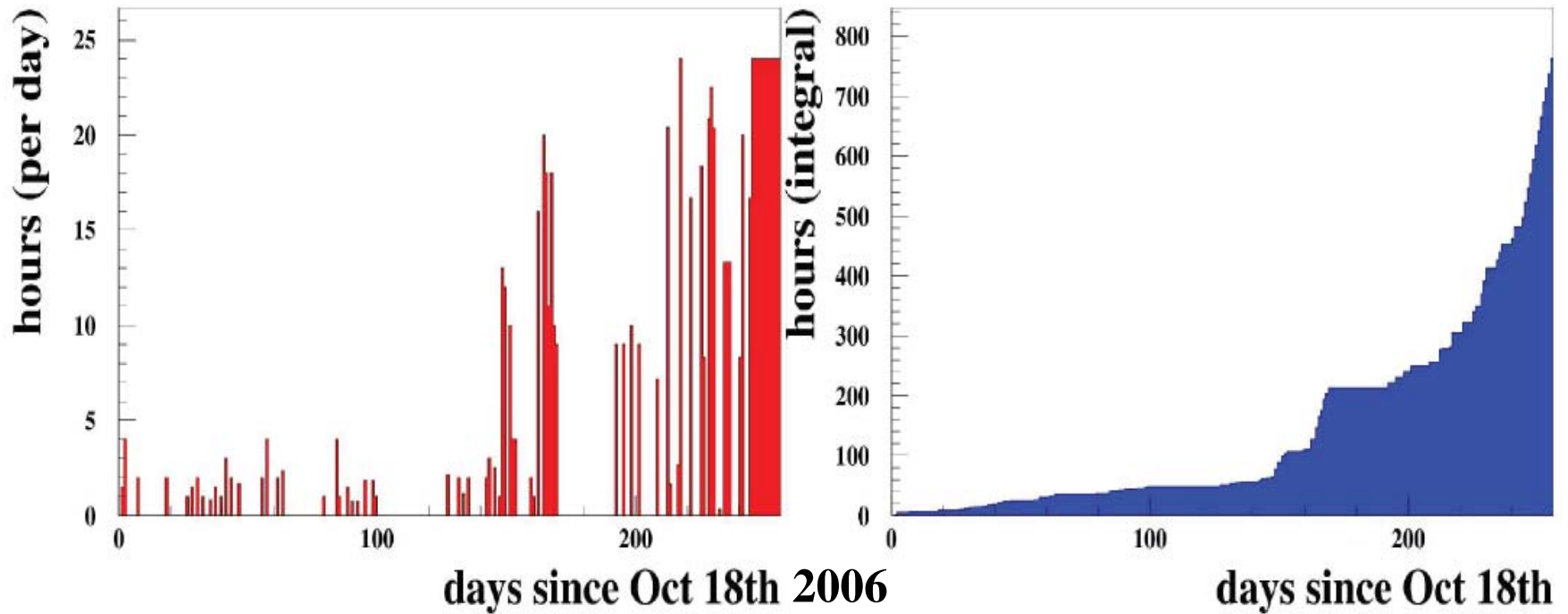


# Status of Cavity Data Analysis

LPOL cavity group

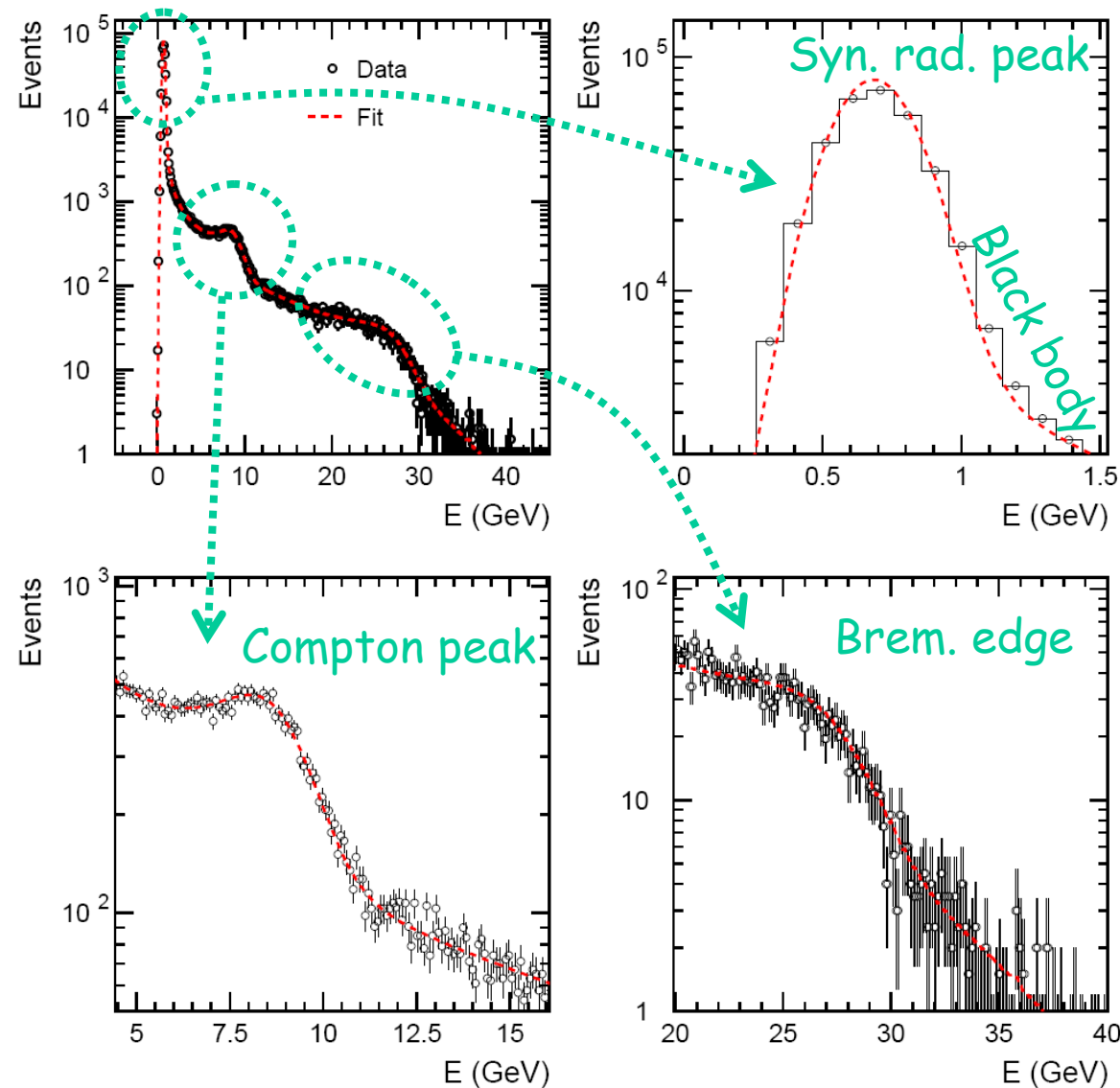
- Introduction
- Offline data analysis
- Systematic studies
- New development and Plan

# Data Taking and Samples



- Increasing data taking frequency towards the end
- Quasi full-time operation in the low-medium proton energy runs
- Some data loss due to various hardware problems

# Measured Energy Spectrum & Fits



## Measured E spectrum:

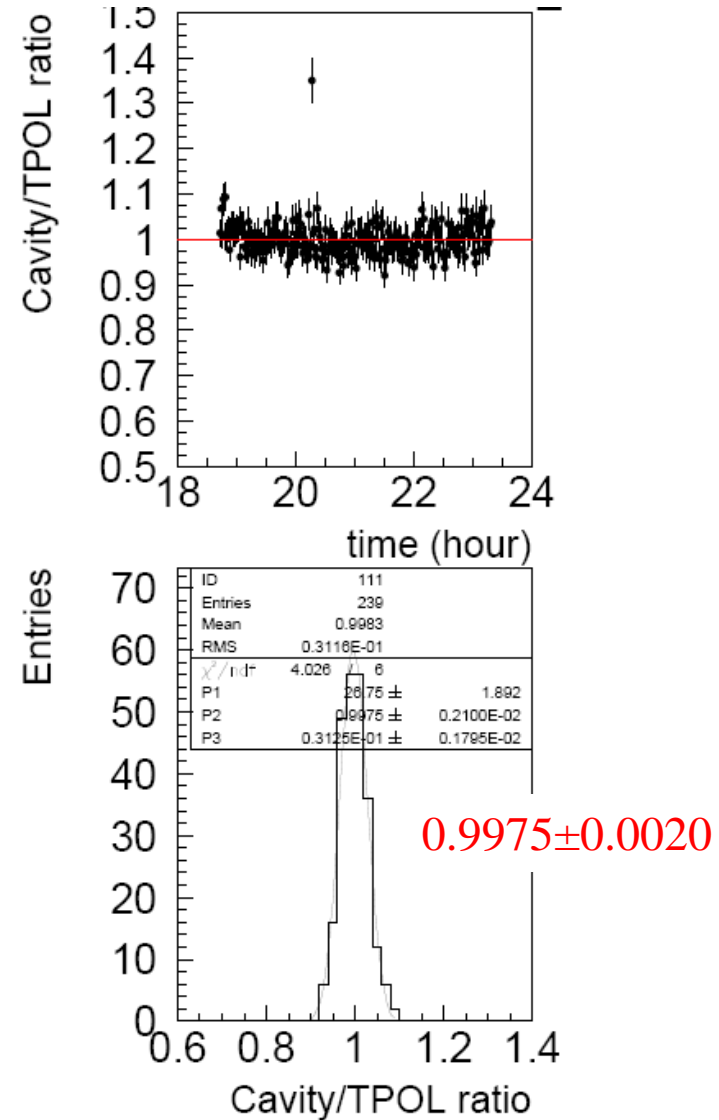
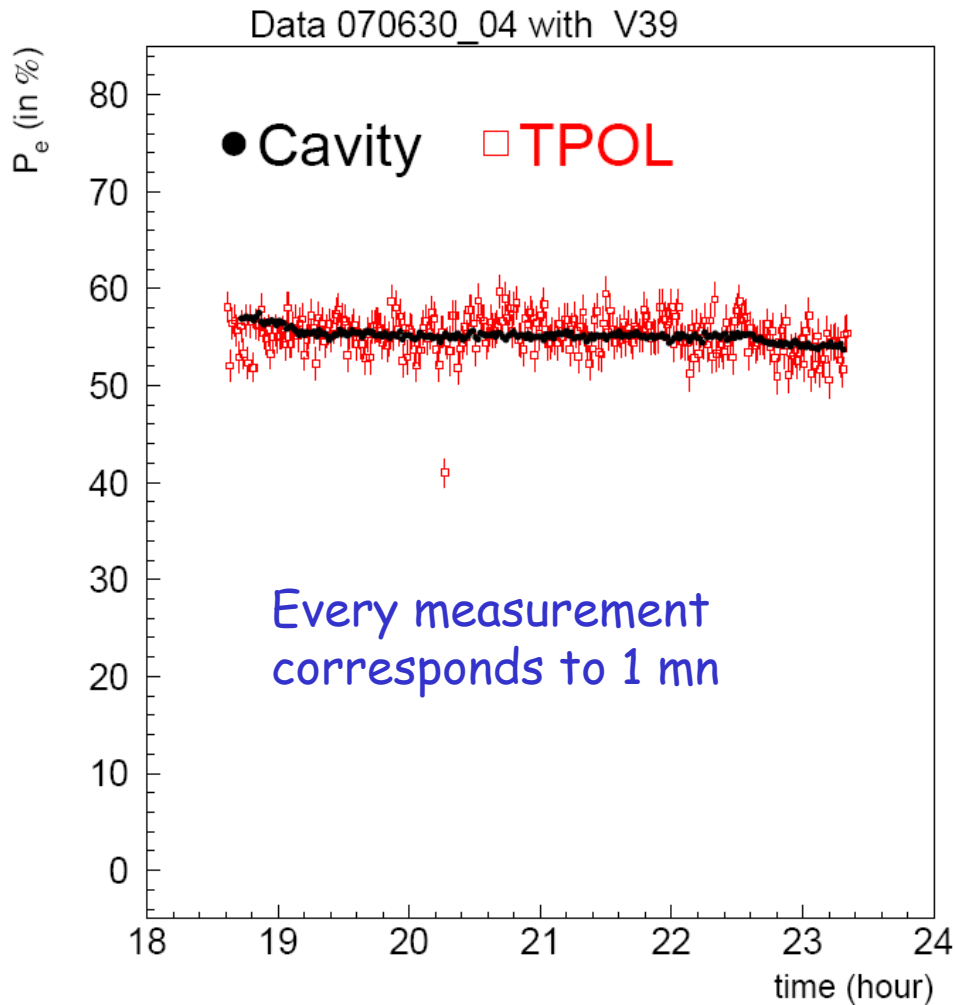
- Synchrotron radiation peak
- Black body
- Compton peak
- Bremstrahlung edge

- \* Each spectrum/bunch/ $\sim 10$ s
- \* Matches with left/right circular polarized laser beam

## Fits:

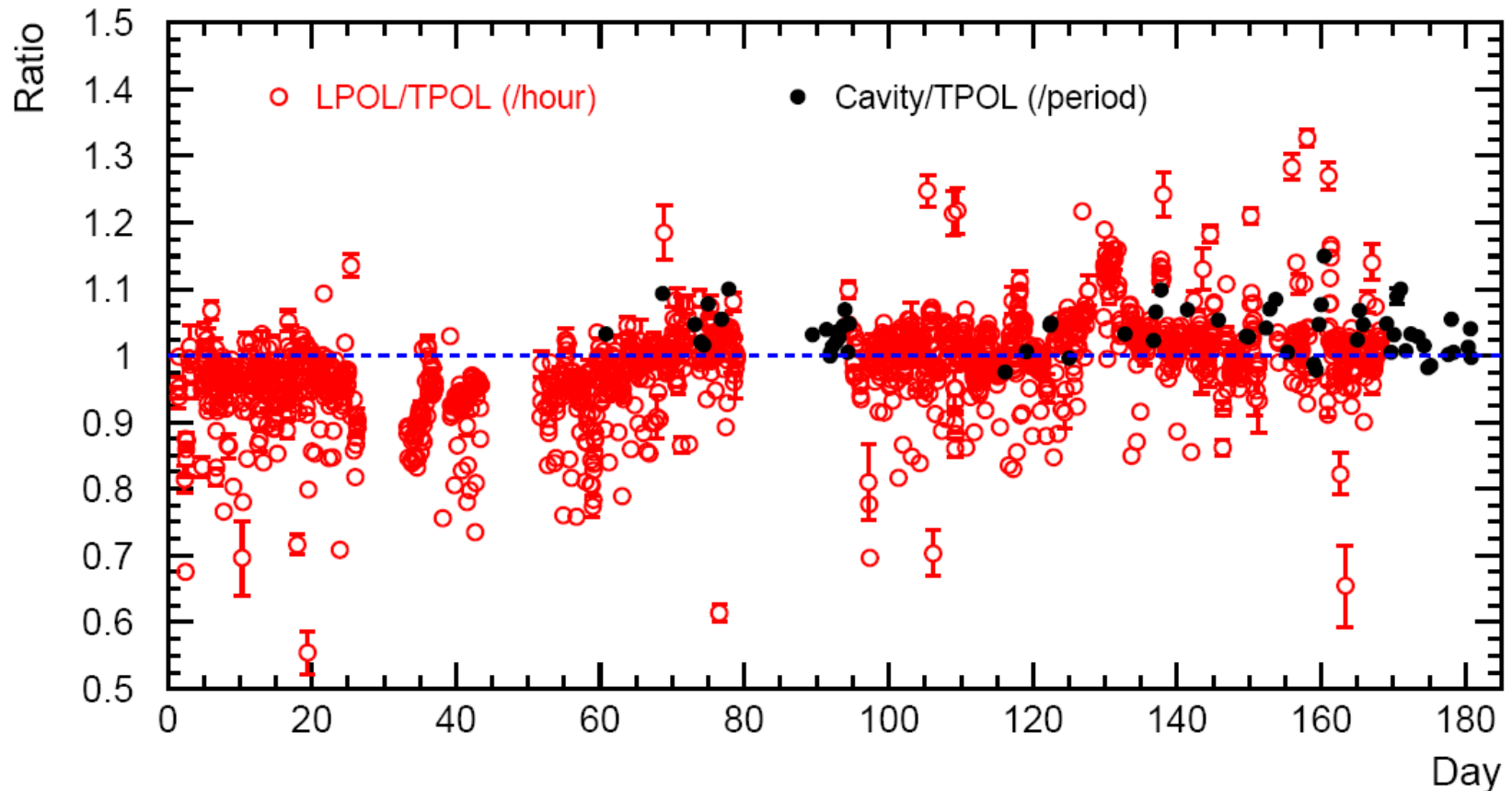
- Electronic noise
- Detector resolution + non-linearity parameters
- Synchrotron radiation
- Black body
- Bremstrahlung rate left/right
- Compton rate left/right
- e-beam polarization

# One Example Comparison Cavity-TPOL



# LPOL-TPOL-Cavity Comparison 2007

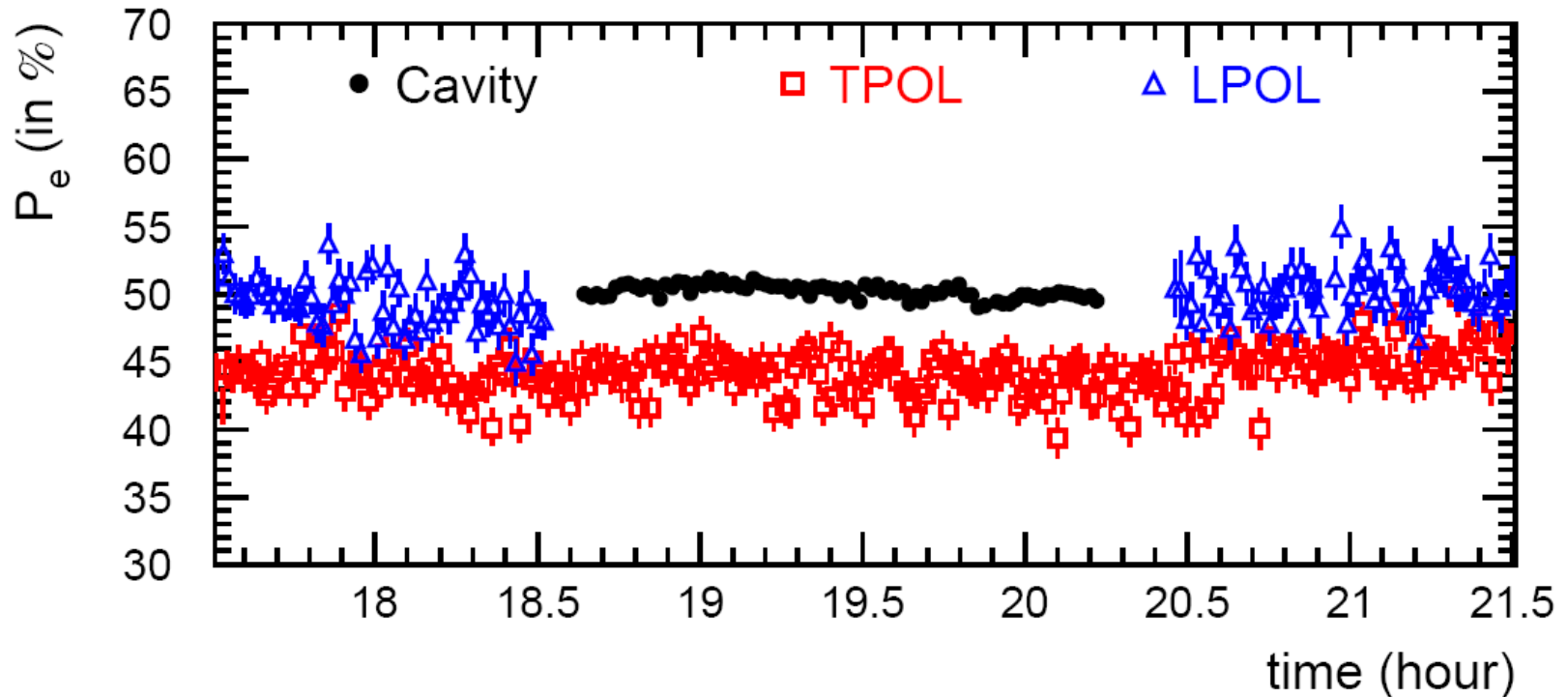
!!! All cavity results (fit v39) are still preliminary !!!



- Special rise-time data are not included
- Very short periods ( $\ll 1$  h) are not shown

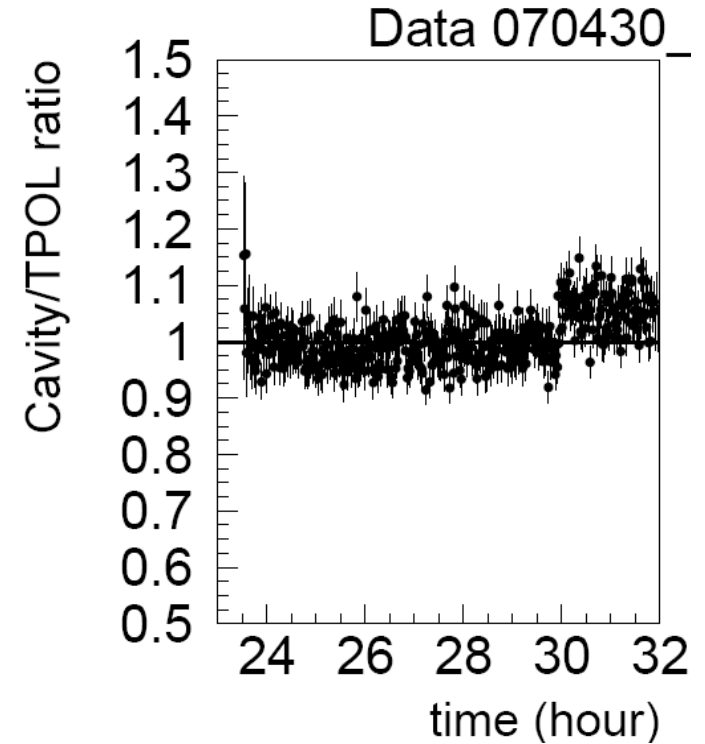
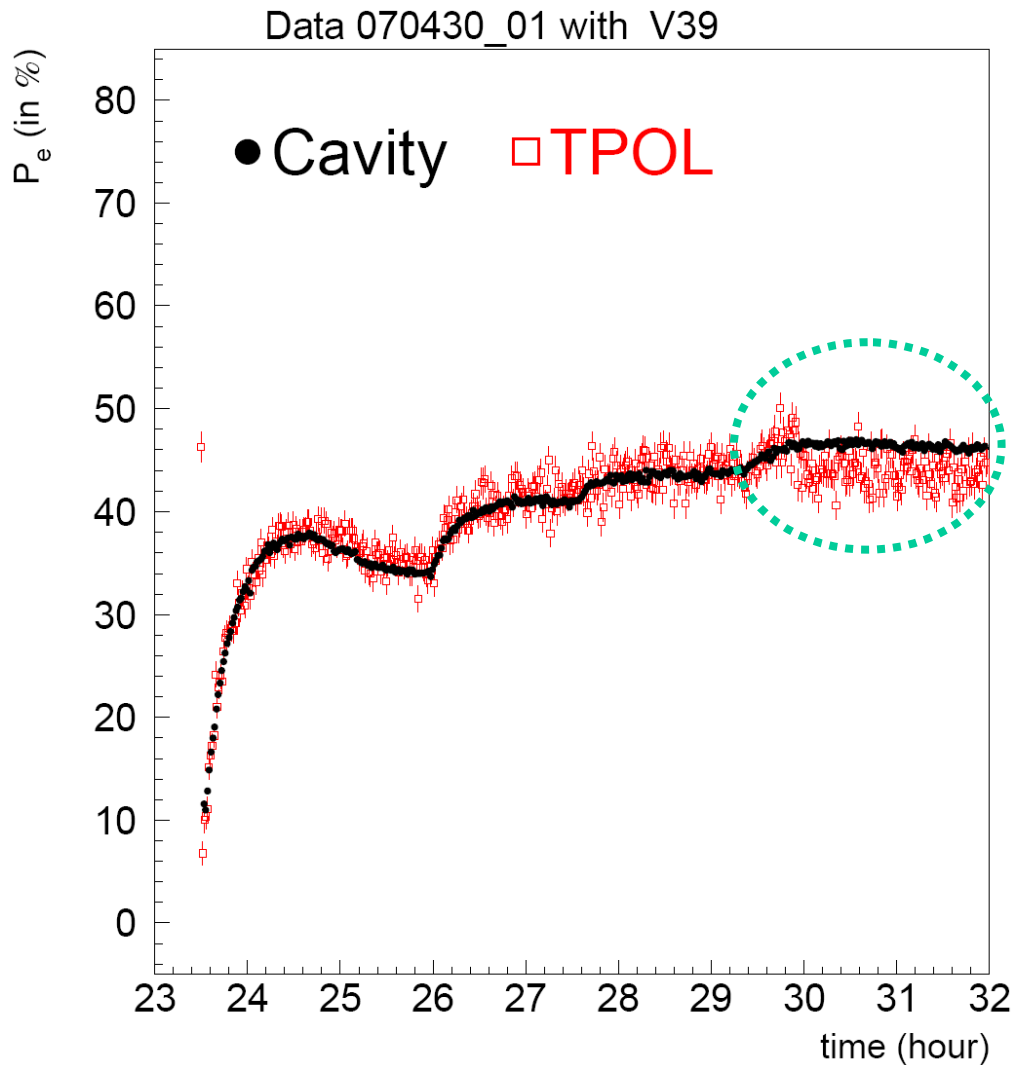
# One Cavity/TPOL Deviation Period

Data of 070518\_02



For this particular period, the cavity seems to agree more with LPOL than with TPOL

# Another Comparison With TPOL



Agreement for most of the period but disagreement observed toward the end

# Preliminary Systematic Studies

Source	$\delta P_e$ (%)
Laser polarization uncertainty	$\leq 0.50$
Laser circularity [MOCO position scan]	$\leq 0.44$
Laser power variation	$\leq 0.37$
Electronic Noise [C_empty (1.43-1.35)]	0.20
Detector parameters [ $\pm 1\sigma$ ]	0.12
Dead material in front of calorimeter?	0.17
Calorimeter position scan in x & y	$\leq 0.58$
Synchrotron radiation cut [0.05 $\rightarrow$ 0.01-0.1]	0.29
Blackbody temperature [300K $\rightarrow$ 500K]	0.29
Beam position scan	$\leq 0.32$
e beam energy uncertainty (27.6GeV $\rightarrow$ 27.5GeV)	0.21
<b>Total</b>	<b><math>\leq 1.2</math></b>

Most of the errors are conservatively estimated.

Some of the error sources are redundant (e.g. calo position scan with beam position scan).

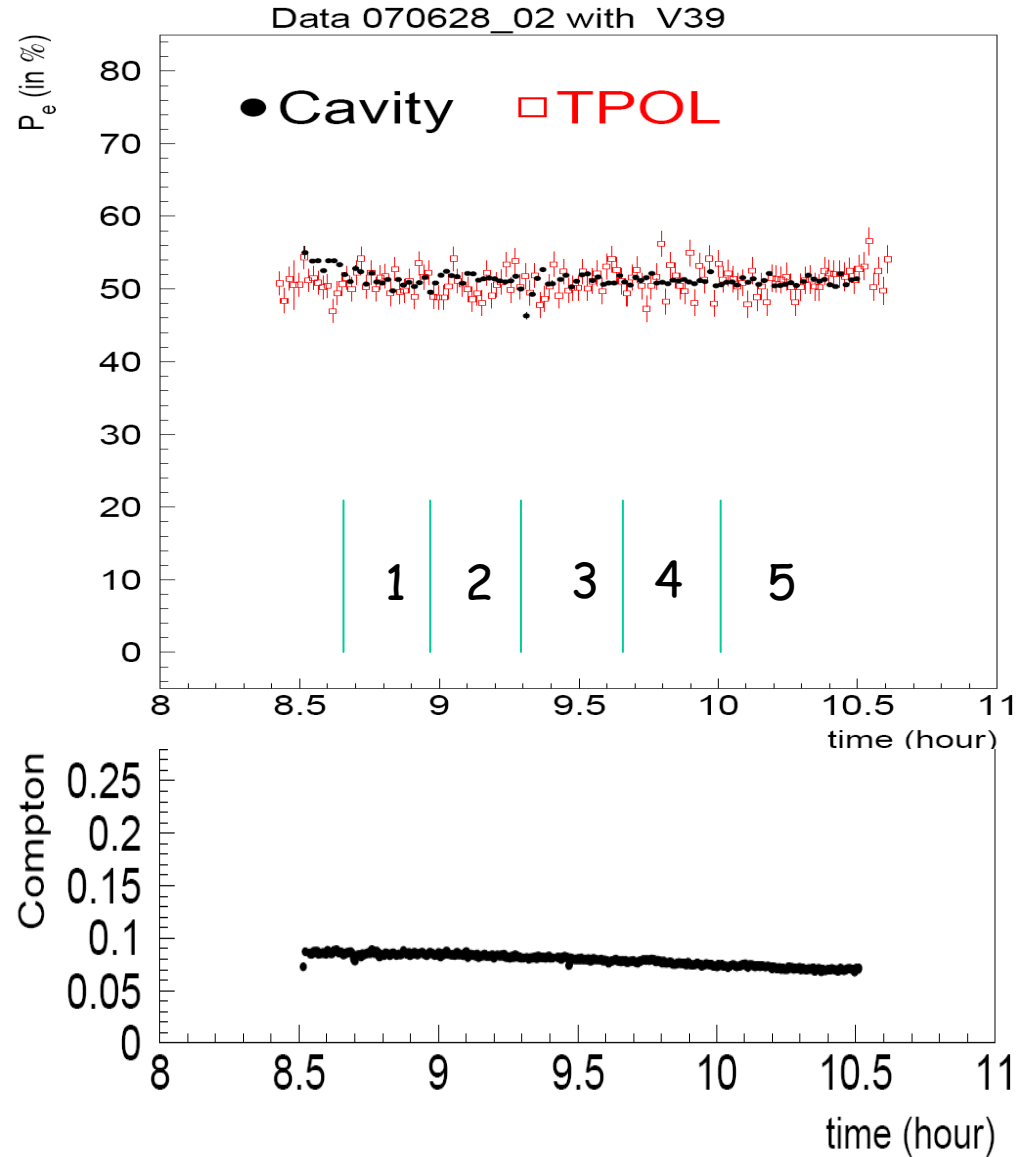
Error reduction is expected in the future with improved fit program.



# MOCO Position Scan

Position ( $S_\gamma$ )	$\langle P_e \rangle$ (%)
1 (0.9936/-0.9834)	51.48 ± 0.09
2 (0.9936/-0.9909)	51.67 ± 0.08
3 (0.9973/-0.9968)	51.12 ± 0.08
4 (0.9842/-0.9968)	51.45 ± 0.08
5(default) (0.9957/-0.9950)	51.23 ± 0.06

→  $\delta P_e \leq 0.44\%$



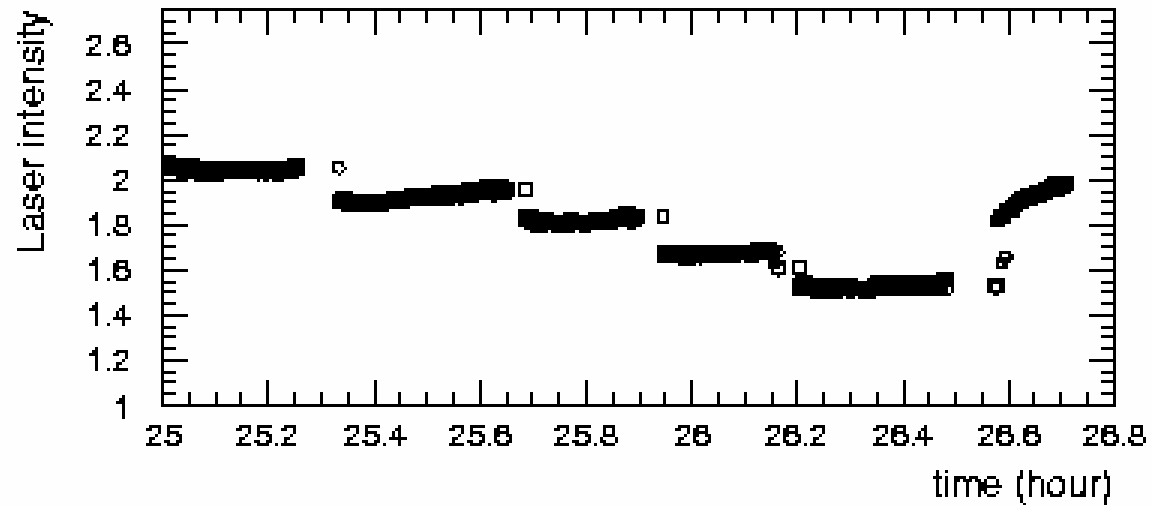
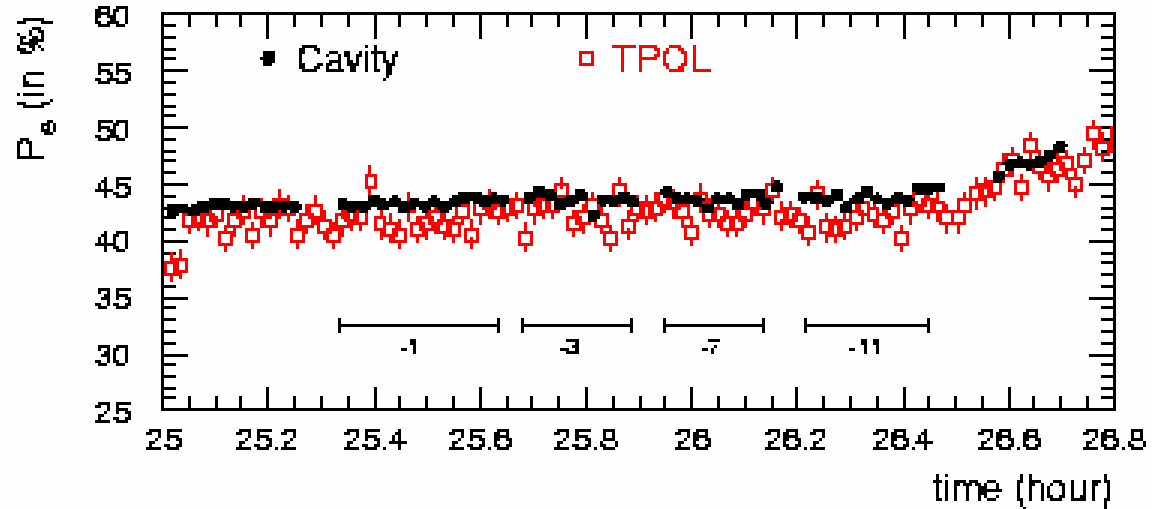
# Laser Power Scan

Power	$\langle P_e \rangle$ (%)
-------	---------------------------

Standard	$43.44 \pm 0.05$
-1	$43.70 \pm 0.04$
-3	$44.07 \pm 0.05$
-7	$44.09 \pm 0.05$
-11	$44.21 \pm 0.05$

$\rightarrow \delta P_e \leq 0.37\%$

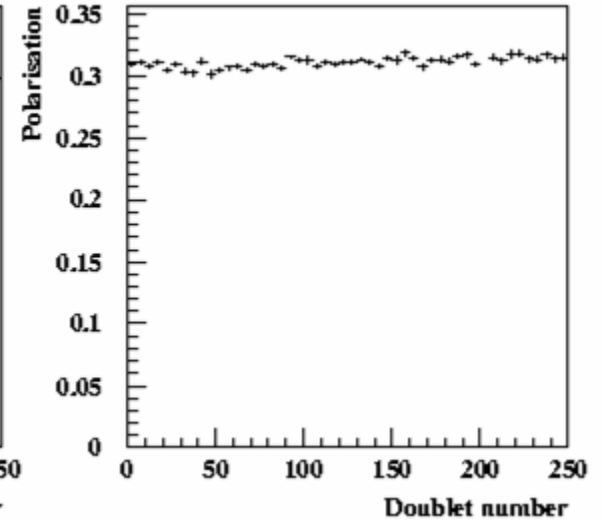
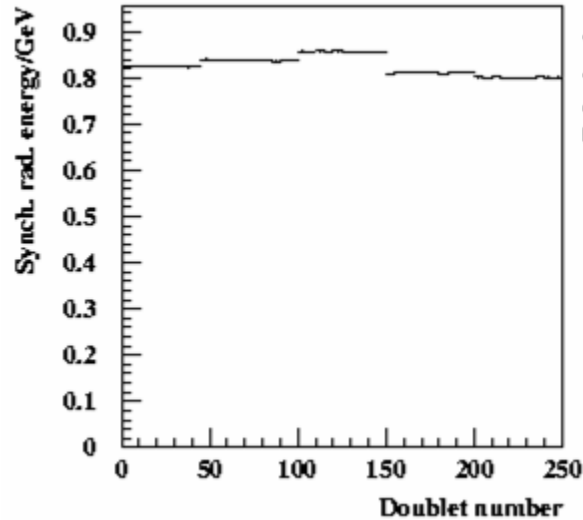
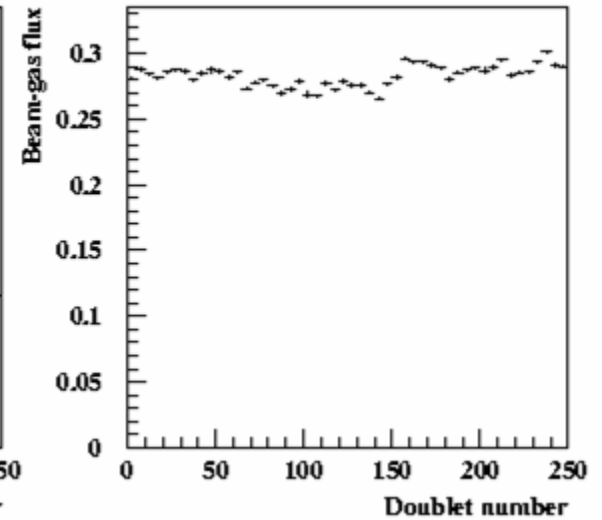
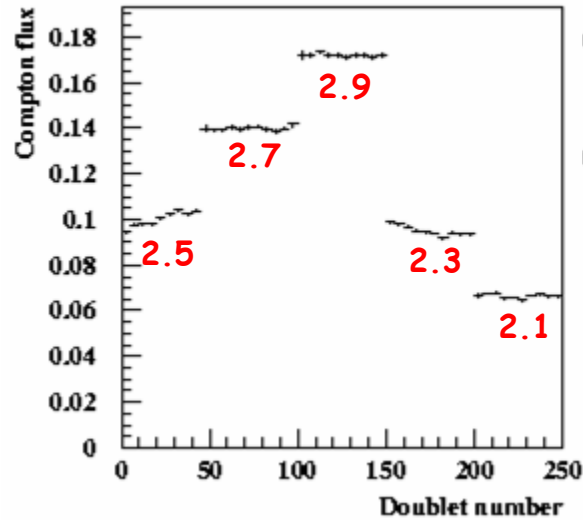
## Laser Power Scan (070614\_01)



# e Beam Position Scan

Position (mm)	$\langle P_e \rangle$ (%)
2.5	$30.98 \pm 0.06$
2.7	$31.03 \pm 0.05$
2.9	$31.20 \pm 0.04$
2.3	$31.45 \pm 0.07$
2.1	$31.77 \pm 0.09$

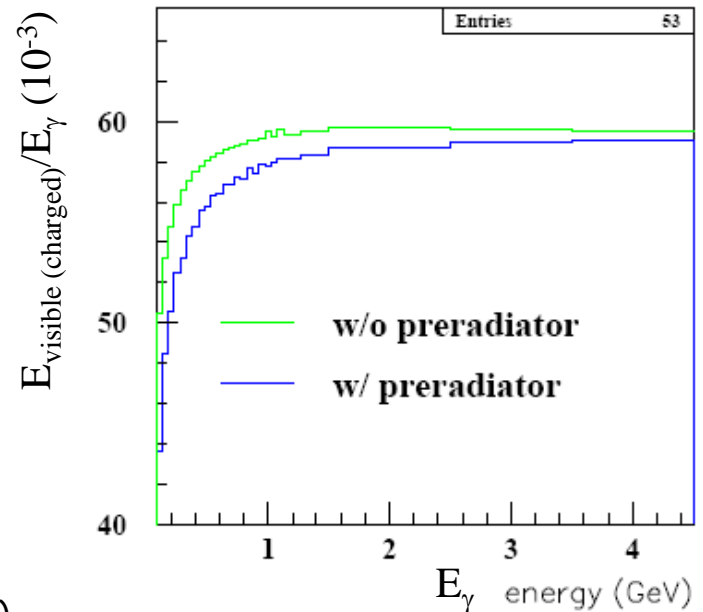
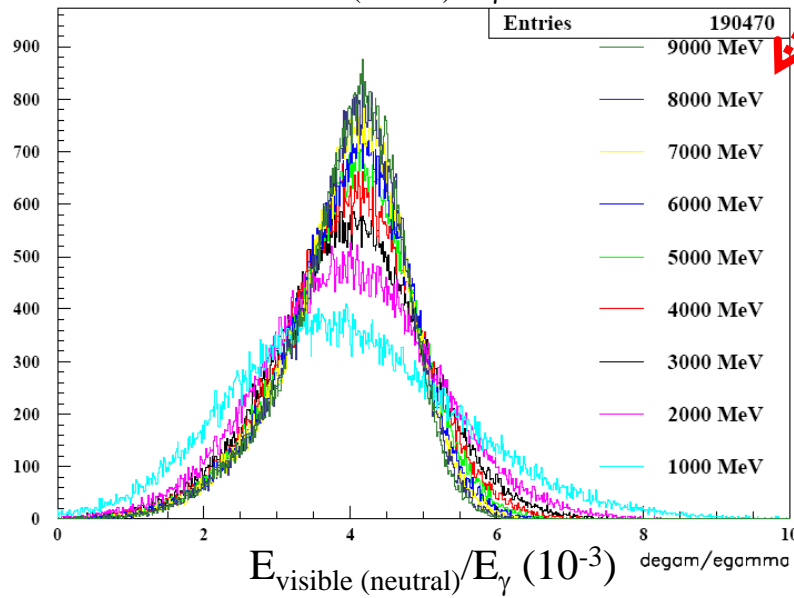
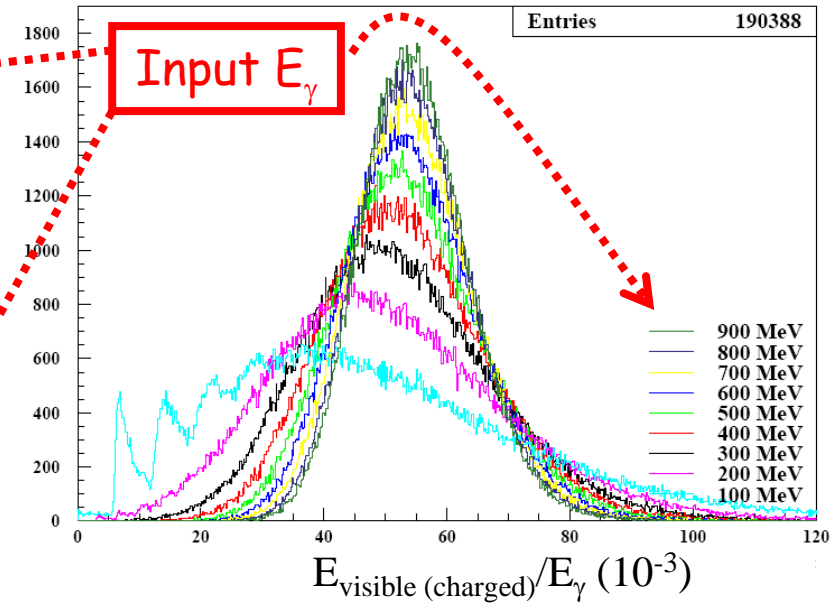
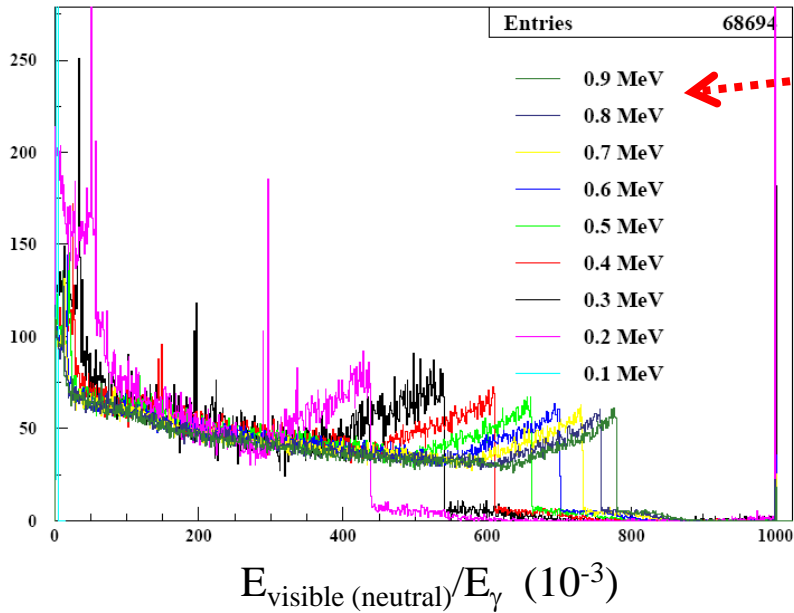
$\rightarrow \delta P_e \leq 0.32\%$



# New Development

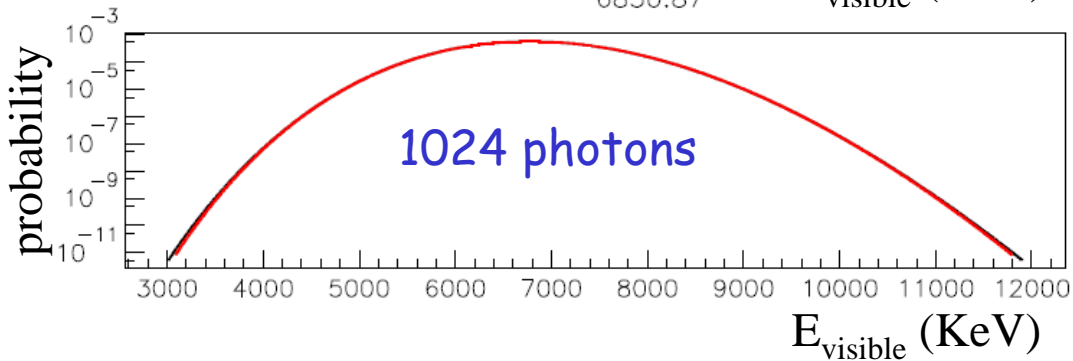
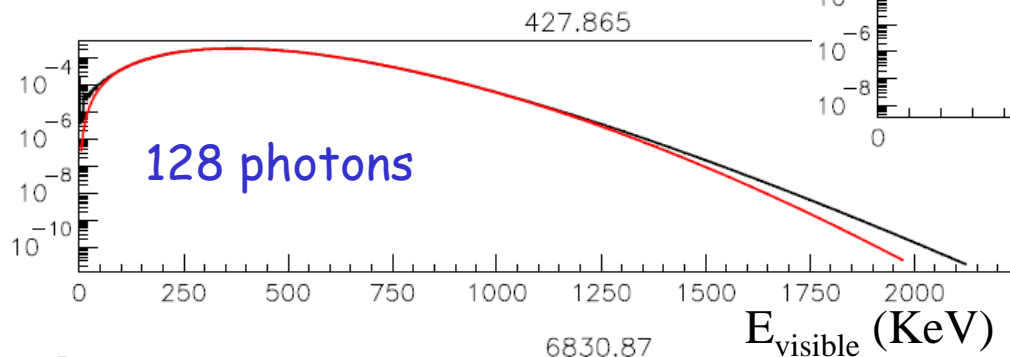
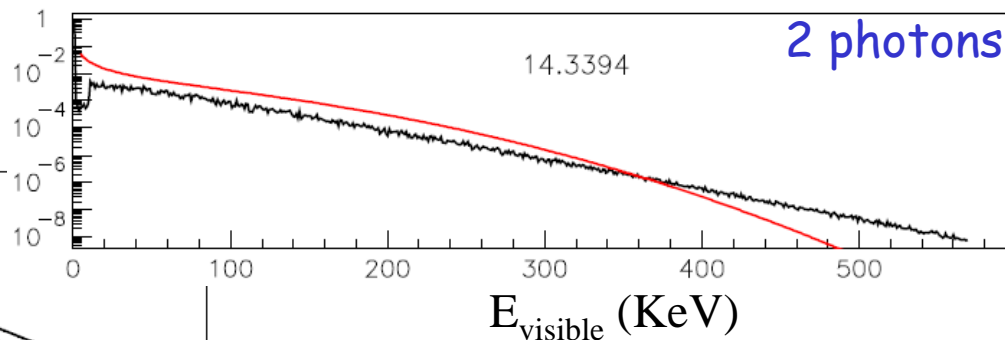
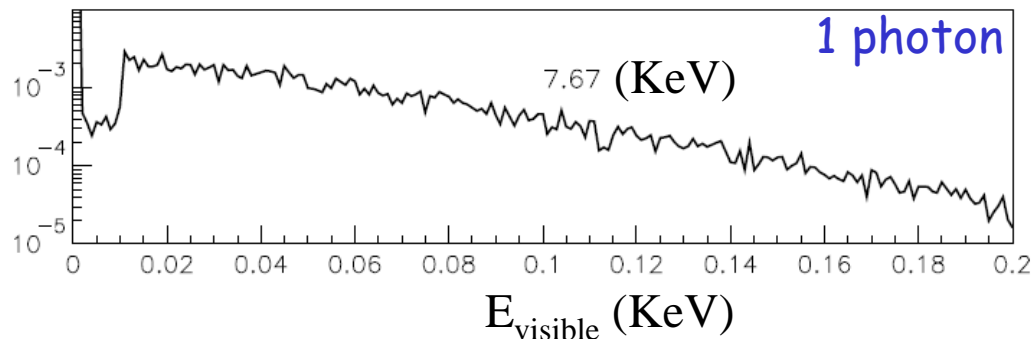
- Detailed MC simulation of the calorimeter response carried out
- New description of the synchrotron radiation peak using MC input & other improvement in the fitting program being tried

# Detailed Monte Carlo Simulation (Examples)



# Simulation Input versus Model

Starting from one photon of 7.7KeV the deposited visible energy in the calo becomes more Gaussian-like when many photons are added together



The energy distribution can be nicely modeled (red curve) for many photons case

This model will be implemented in new fit program to improve the synchrotron radiation description

# Summary & Plan

- Majority of the cavity data analyzed
- Preliminary (conservative) systematic studies performed (~1.2%)
- Detailed MC simulation performed
- New fitting program being tested
- Final data analysis and precision expected before summer 2008