

# PS flux update

**Justin Stevens**

**Beamline Meeting: 10.15.18**



**WILLIAM & MARY**

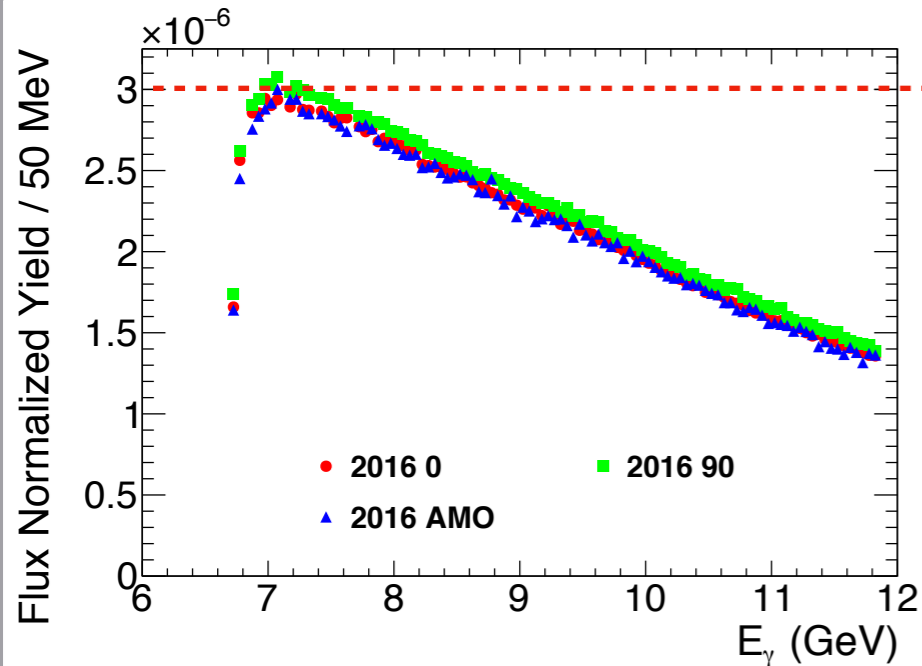
CHARTERED 1693

# Update for latest REST production

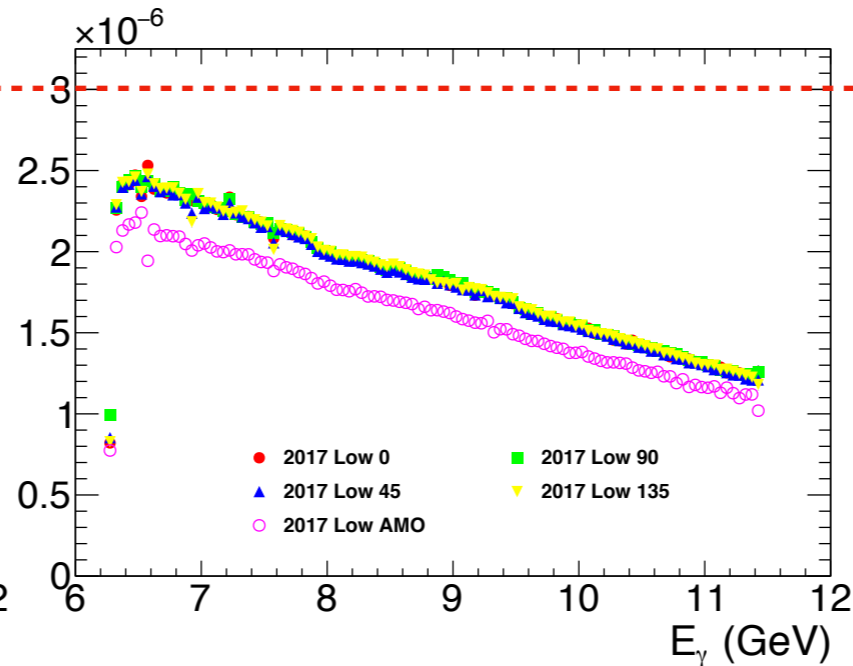
- \* New REST production requires update tagged flux as calibrations for TAG may have changed
- \* RunPeriod-2016-02: REST ver06
- \* RunPeriod-2017-01: REST ver03
- \* Sasha implemented PS acceptance from TAC runs in CCDB table, now using as default

# Flux normalized yields: $\rho$

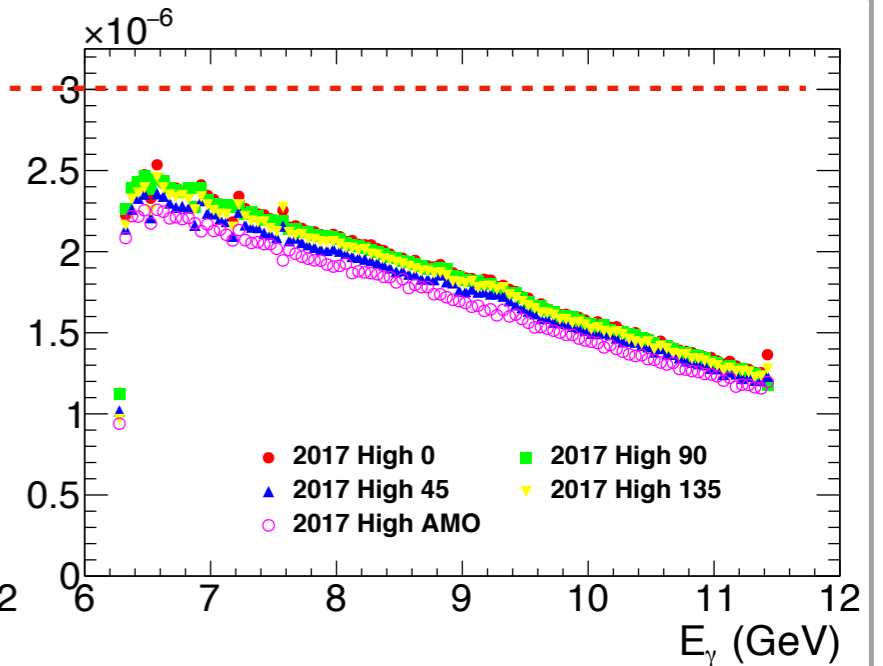
## 2016 Golden



## 2017 Low Intensity



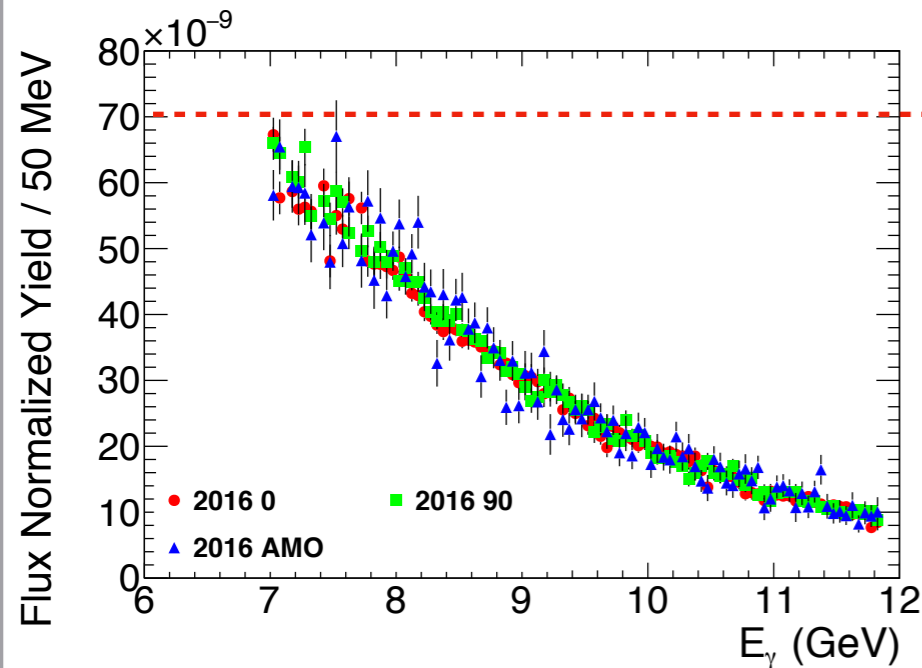
## 2017 High Intensity



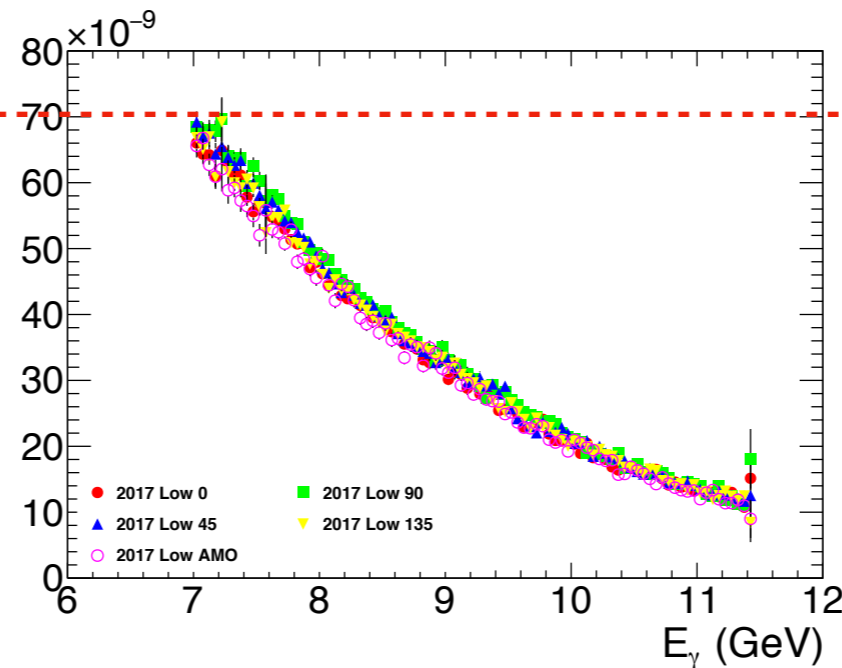
- \* No efficiency correction applied, which we know depend on run conditions (beam current, voltages)
- \* Flux normalized yields larger for 2016 than 2017

# Flux normalized yields: $\pi^0$

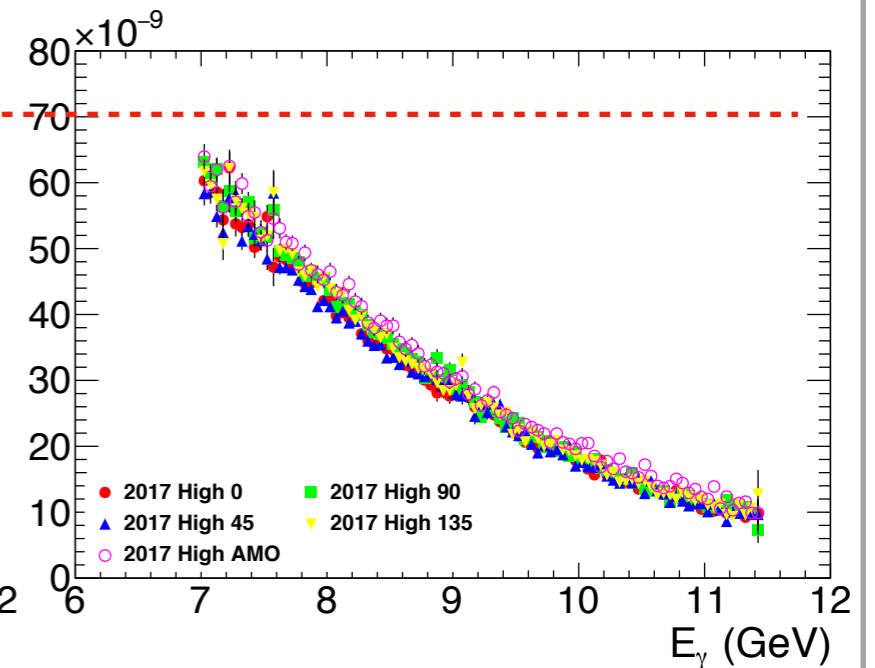
## 2016 Golden



## 2017 Low Intensity



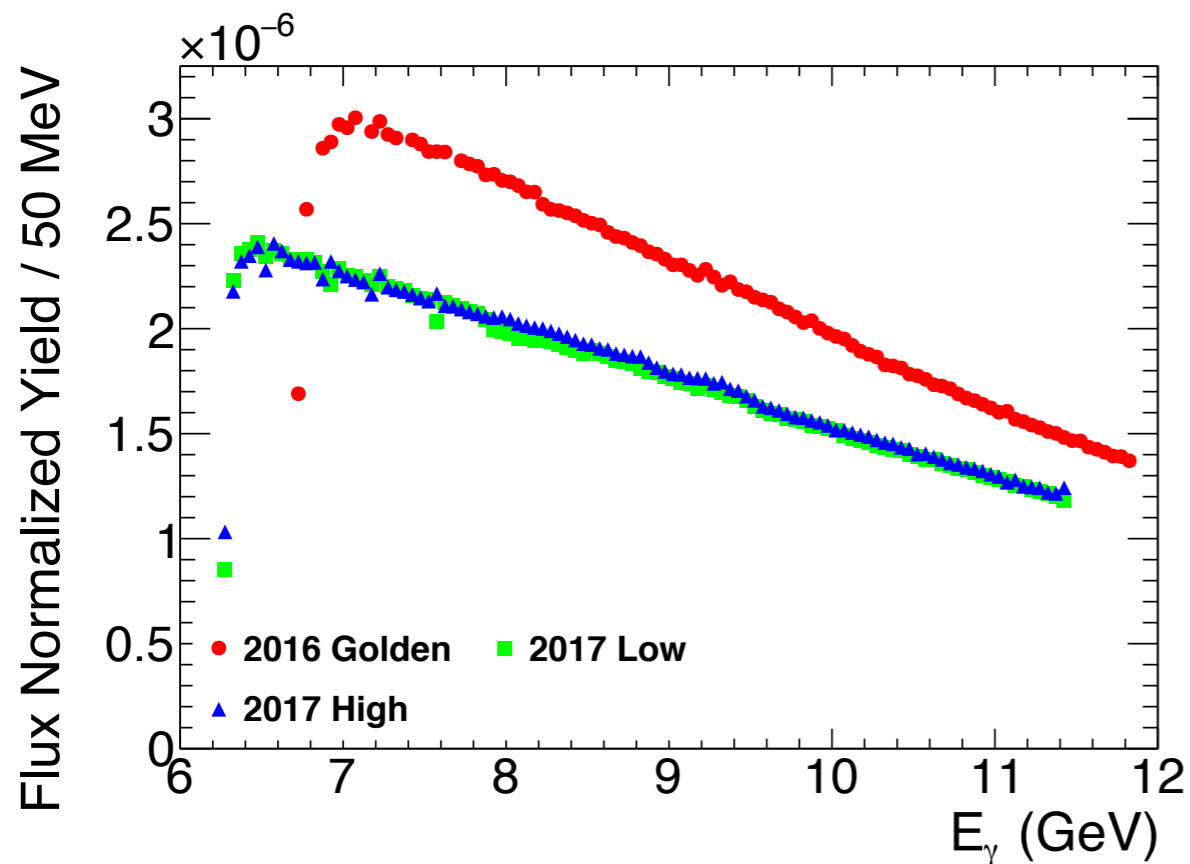
## 2017 High Intensity



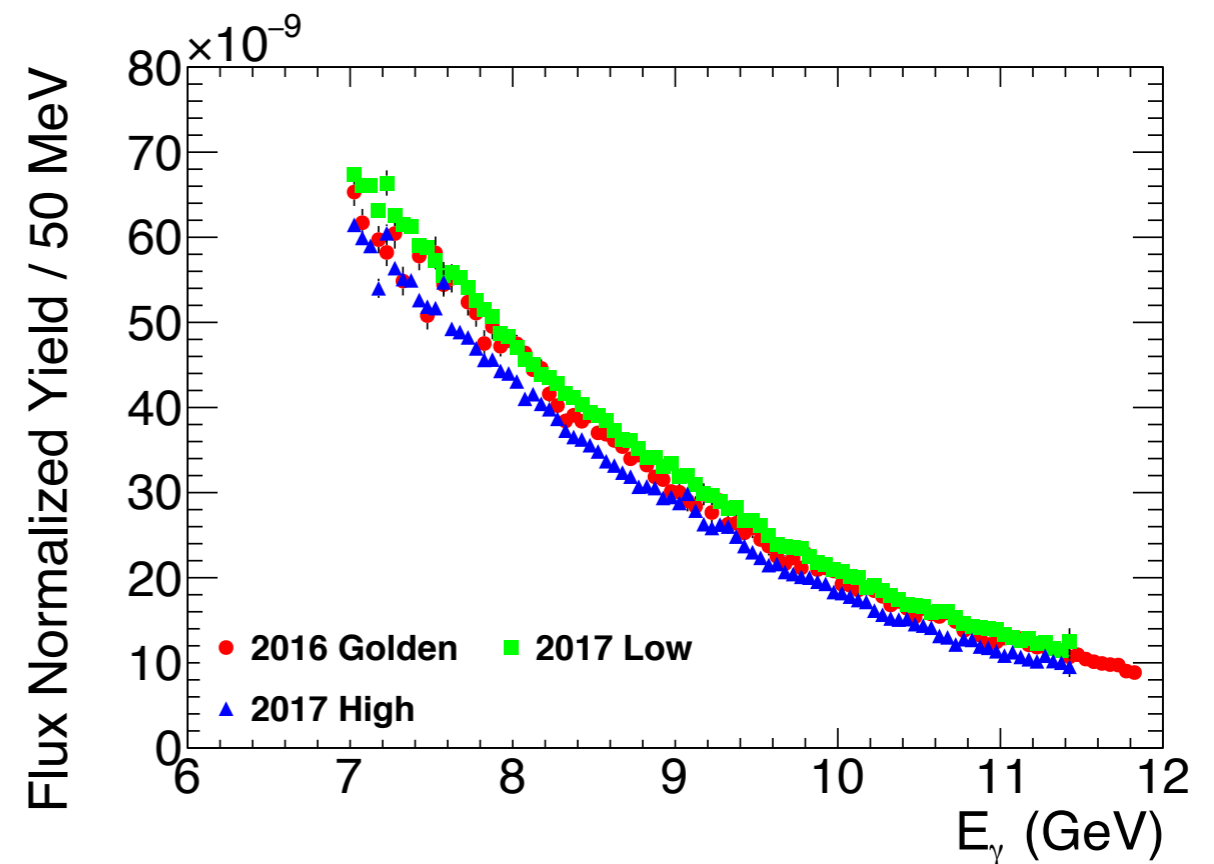
- \* No efficiency correction applied, which we know depend on run conditions (beam current, voltages)
- \* Flux normalized yields comparable for 2016 and 2017

# Comparison of 2016 and 2017

## Normalized $\rho$



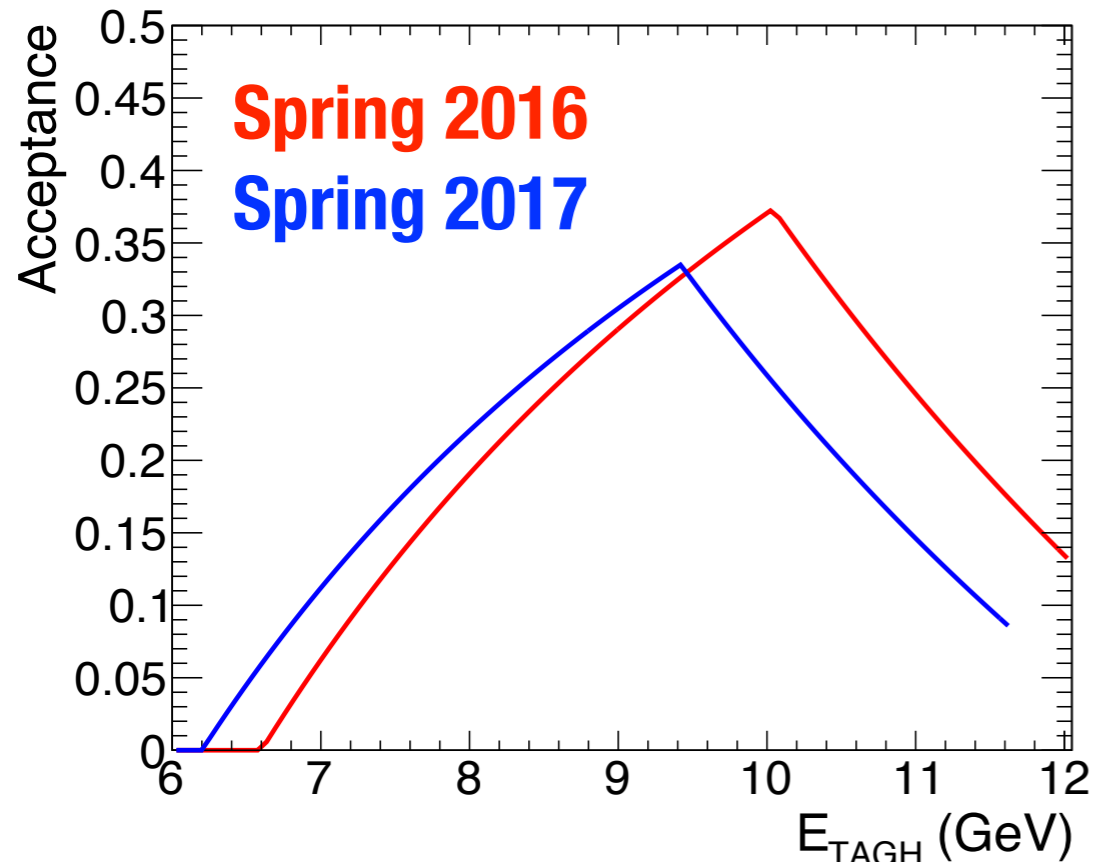
## Normalized $\pi^0$



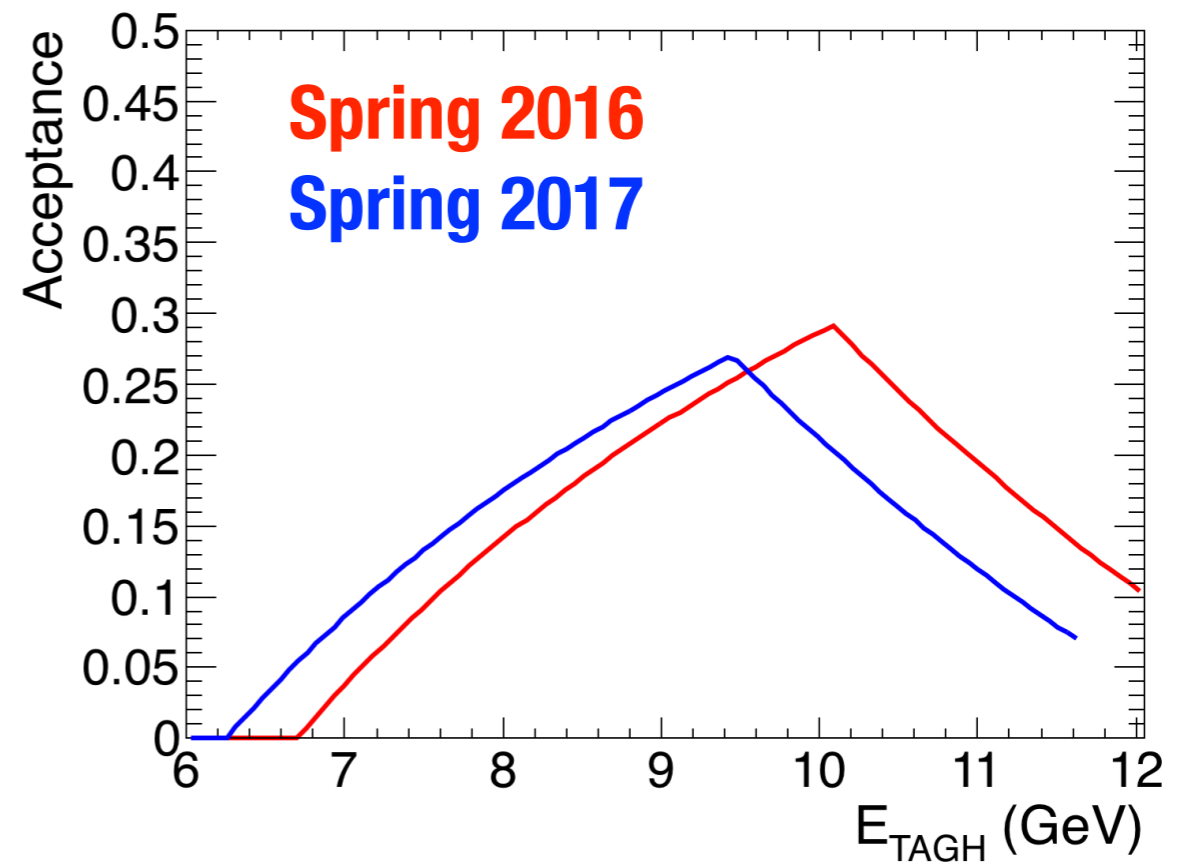
- \* Agreement between years for  $\pi^0$  much better than  $\rho$ , not understood. Different efficiency, trigger?
- \* Compare with other channels using using these update fluxes

# Current acceptance from CCDB

**Previous acceptance  
(assumed PSC only)**



**Current CCDB:  
PS+PSC acceptance**



- \* Preliminary acceptances from Sasha were for PSC only (mis-communication in my usage of constants)
- \* Acceptance reduced when include PS fine counters, now used by default in flux calculation

# Backup

# Beam photon flux: definitions

## \* **Un-tagged flux:**

- \* Flux of photons through the collimator, incident on the target
- \* Useful for comparison to predictions for collimated rate from coherent bremsstrahlung generators

$$Flux(E_\gamma) = \frac{N_{PS}(E_\gamma)}{Acceptance_{PS}(E_\gamma) \cdot Livetime_{PS}} \cdot \frac{1}{\frac{7}{9} RL_{conv}}$$

## \* **Tagged Flux:**

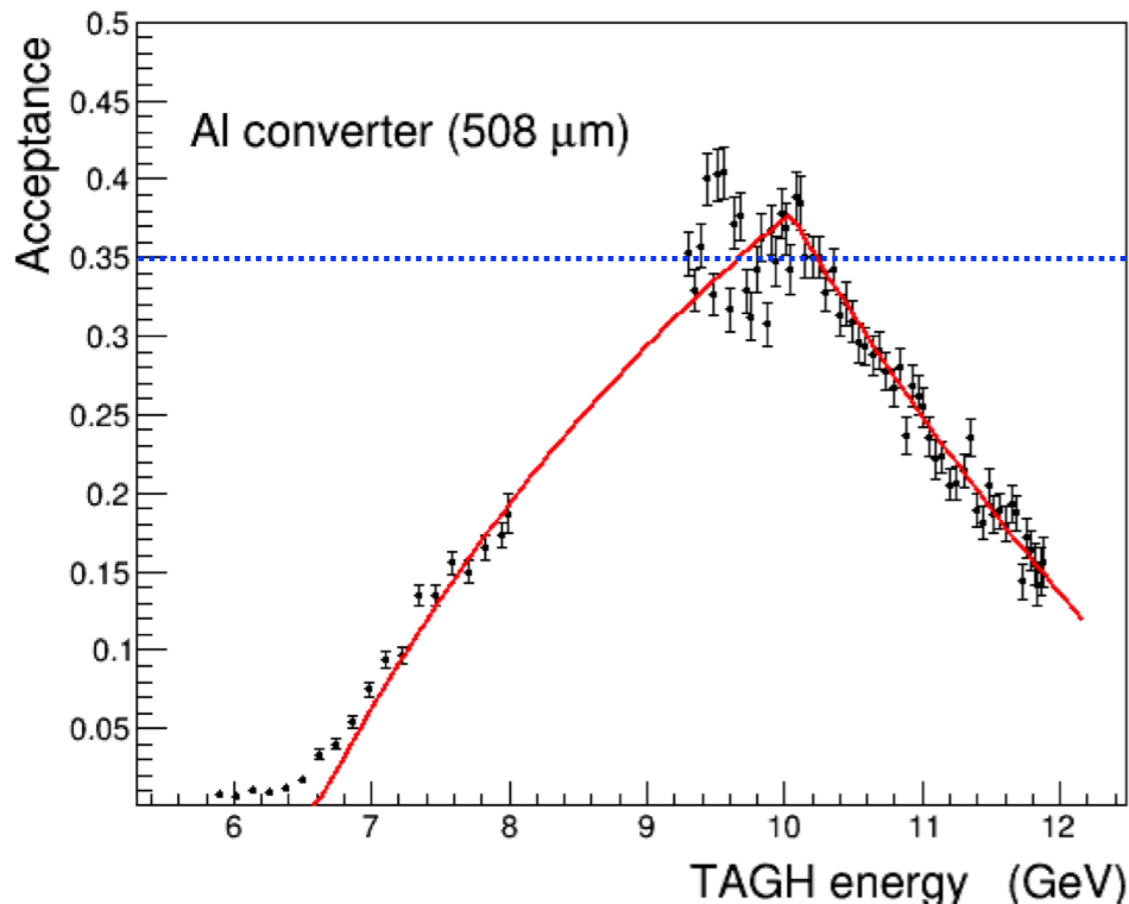
- \* Flux of photons through the collimator, incident on the target, **with a coincident TAGM/TAGH hit**
- \* The relevant quantity for cross section measurements

$$Flux(E_\gamma) = \frac{N_{PS+TAG}(E_\gamma)}{Acceptance_{PS}(E_\gamma) \cdot Livetime_{PS}} \cdot \frac{1}{\frac{7}{9} RL_{conv}}$$



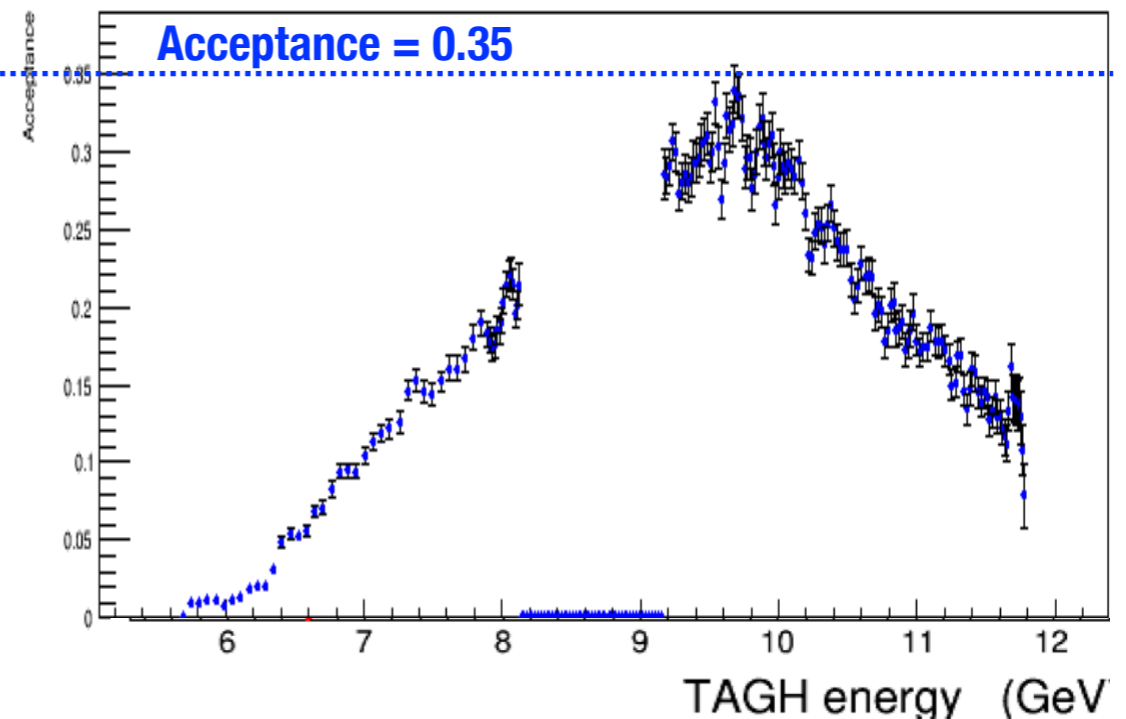
# Preliminary PS acceptance: 2016/2017

**Spring 2016**



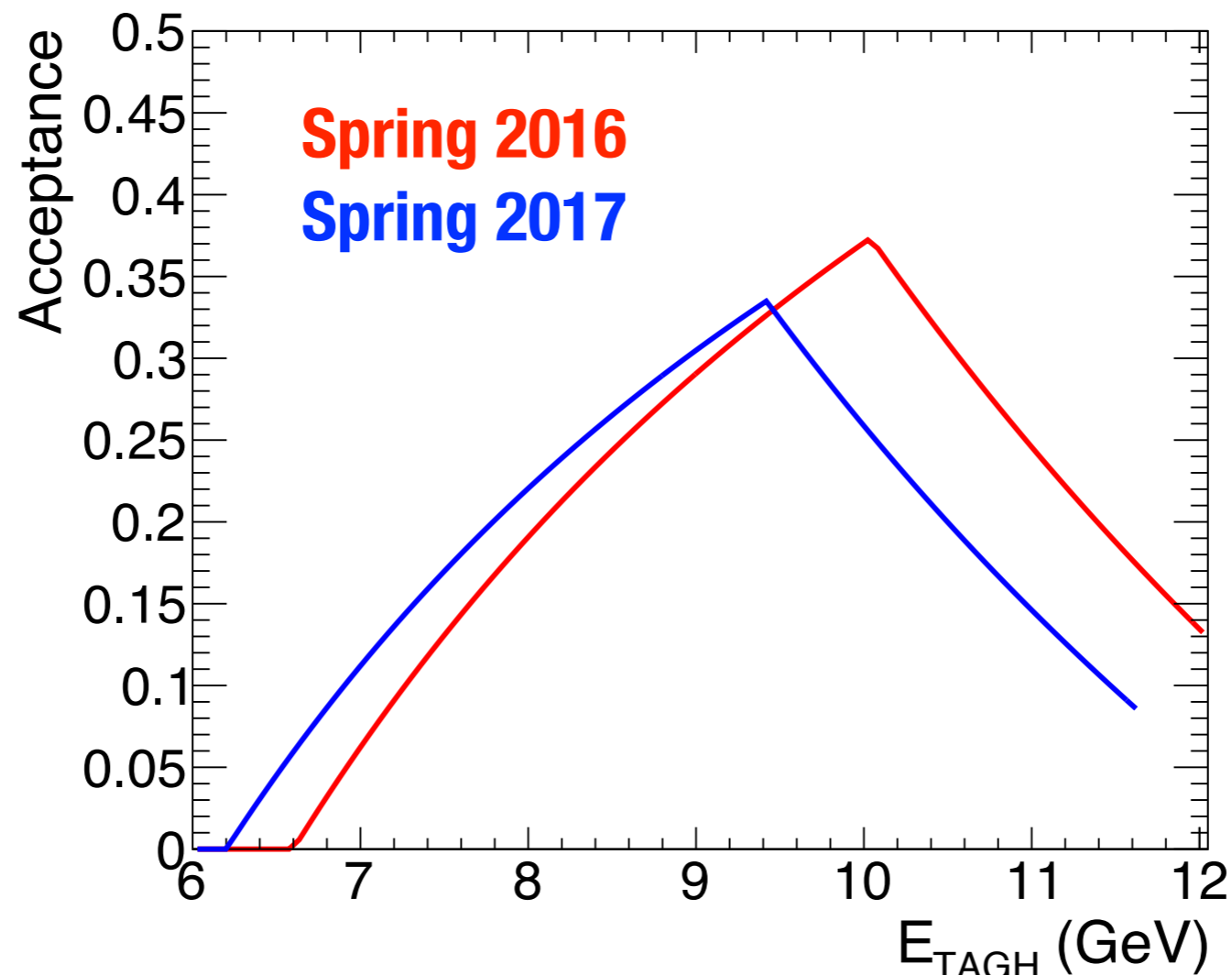
**Preliminary Spring 2017**

<https://logbooks.jlab.org/entry/3466753>



- \* Lower acceptance in Spring 2017 and peak shifted to lower energy as expected for lower field setting
- \* Appears 2017 TAGH energy scale is incorrect (old e<sup>-</sup> beam endpoint?)
  - \* For flux estimates rescale x-axis by ratio of endpoints (11.65/12.05)

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# Cross sections and Normalization

$$\sigma = \frac{N}{\epsilon \cdot \mathcal{L}} = \frac{N}{\epsilon \cdot \text{Un-tagged flux} \cdot \text{Target thickness}}$$

$$\frac{\text{Tagged Flux}}{\text{Un-tagged Flux}} = \frac{N_{PS+TAG}(E_\gamma)}{N_{PS}(E_\gamma)} = \epsilon_{TAG}$$

- \* Tagger efficiency cancels when normalizing event yield ( $N$ ) by tagged flux

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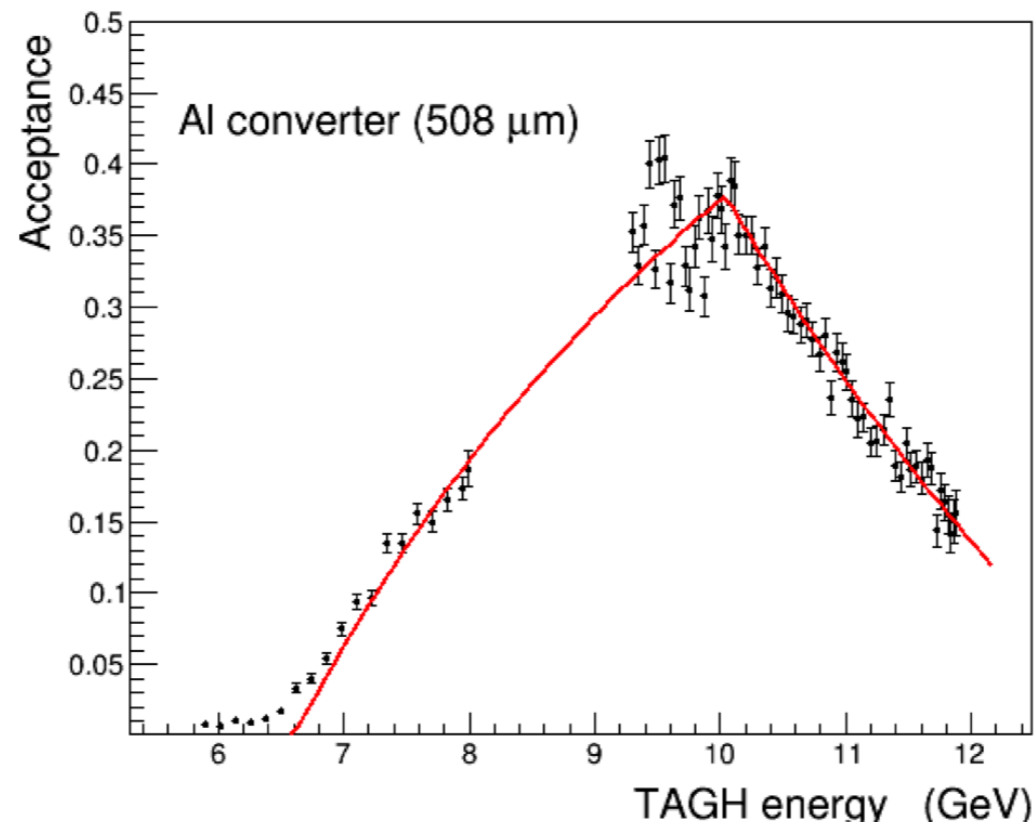
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- \* Provide Tagged Flux (or luminosity) in bins of  $E_\gamma$  for each run, and analyzers determine **yield** and **non-tag efficiency**
- \* Target thickness  $\sim 1.22 \text{ b}^{-1}$  for a 29.2 cm LH<sub>2</sub> target

# Preliminary PS acceptance correction

$$Flux(E_\gamma) = \frac{N_{PS}(E_\gamma)}{Acceptance_{PS}(E_\gamma) \cdot Livetime_{PS}} \cdot \frac{1}{\frac{7}{9} RL_{conv}}$$



- \* Acceptance function from Sasha's TAC analysis, presented at PrimeX review (slide 10 of link below)
- \* Radiator thickness not explicitly measured, so ratio of 508 μm Al and 75 μm Be converters is an uncertainty in the flux determination (2016 only)

[https://cnidlamp.jlab.org/RareEtaDecay/JDocDB/system/files/biblio/2016/07/beamline\\_trigger.pdf](https://cnidlamp.jlab.org/RareEtaDecay/JDocDB/system/files/biblio/2016/07/beamline_trigger.pdf)