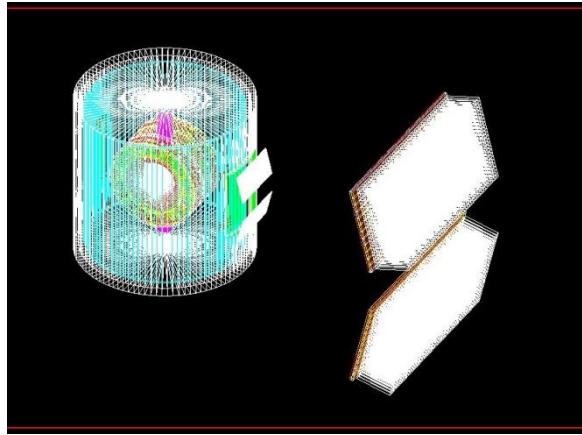
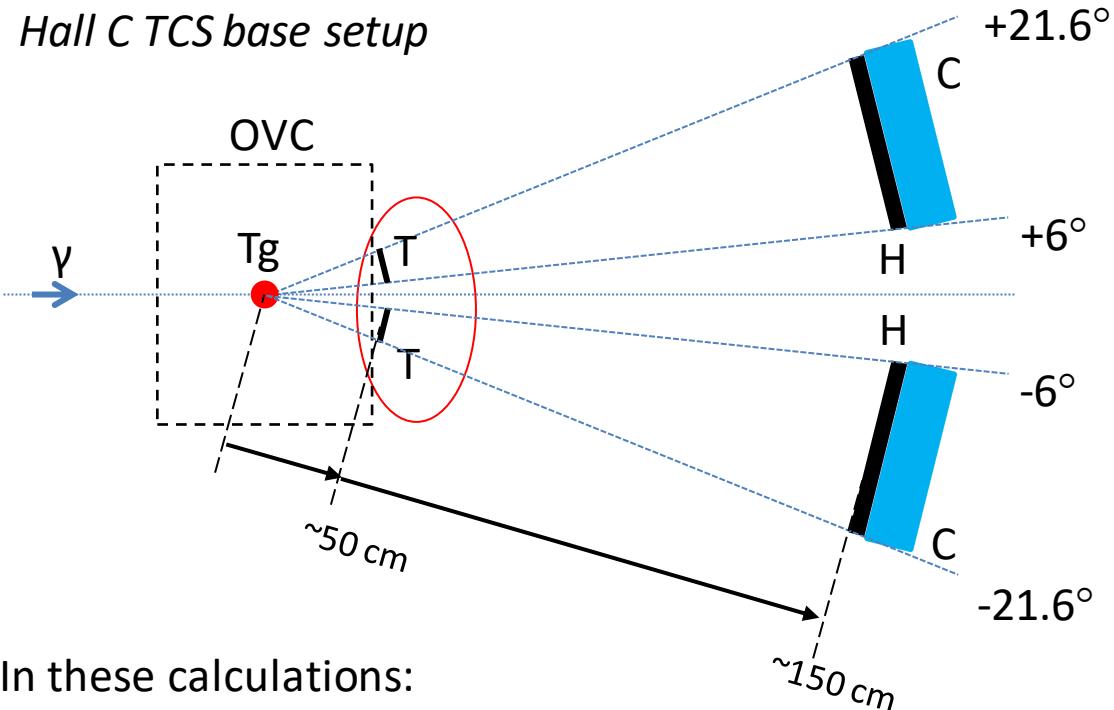


Gamma conversion backgrounds from target in Hall C TCS setup

V.Tadevosyan

NPS meeting
04/05/2018

Hall C TCS base setup



Geant4 rendering

In these calculations:

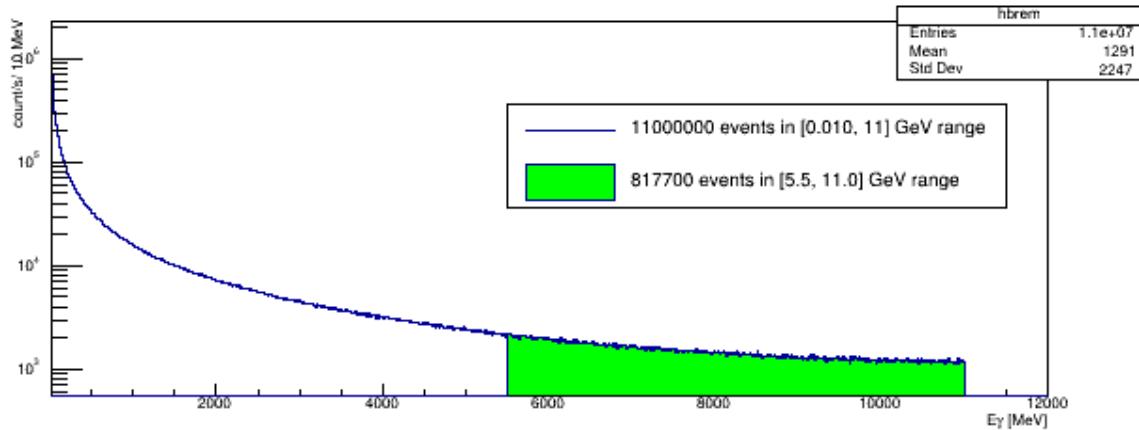
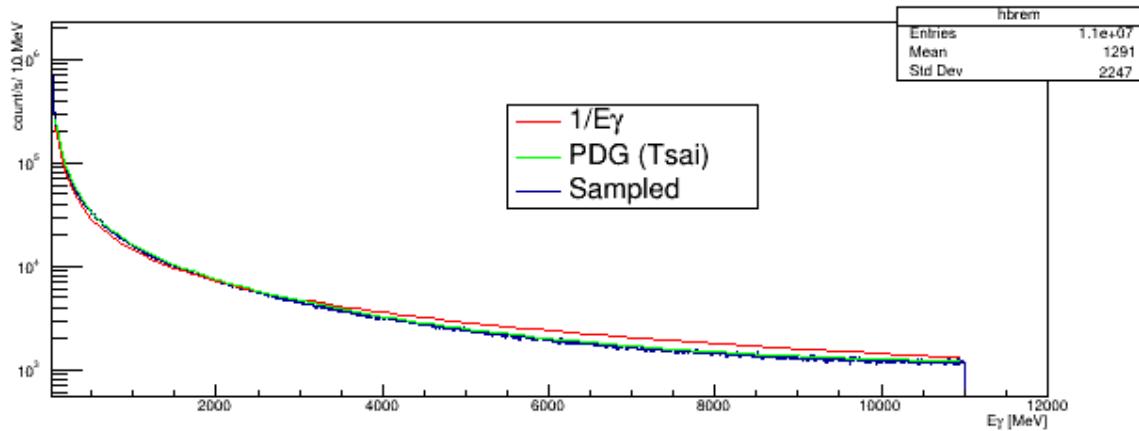
- Brem. photon beam from 11 GeV e-, $2.0 \times 10^{13} \text{ s}^{-1}$ CPS intensity (see next slides)
- UVA polarized ammonia target
- 36.5 mil (0.25 g/cm^2) Al before Trackers

Trackers 30 cm wide, 15 cm high.

TrackerX: 332 1 mm thick, 15 cm long scint-s

TrackerY: 150 1 mm thick, 33.2 cm long scint-s

Bremsstrahlung photon spectrum from 11 GeV e-



CPS intensity :

- From 5.5 GeV to 11 GeV -- $1.5 \times 10^{12} s^{-1}$ (WACS proposal);
- From 10 MeV to 11 GeV -- $1.5 \times 10^{12} \times (11000000 / 817700) = 2.02 \times 10^{13} s^{-1}$

UVA target cell:

- 3 cm long, 0.7 mil Al endcaps;
- NH_3 bits in $lHe \rightarrow$ homogenous material in Geant4;
- 0.6 packing fraction, $\rho_{NH_3} = 0.817 \frac{g}{cm^3}$, $\rho_{lHe} = 0.125 \frac{g}{cm^3} \rightarrow \rho = 0.548 \frac{g}{cm^3}$;
- $X_0(NH_3) = 50.037 \text{ cm}$, $X_0(lHe) = 754.7 \text{ cm}$
- $w(N) = 74.63\%$, $w(H) = 16.11\%$, $w(He) = 9.26\% \rightarrow X_0 = 78.7 \text{ cm}$.
- 3 cm / 78.7 cm \rightarrow **3.8% rad. length target**

For not mixed NH_3 and lHe :

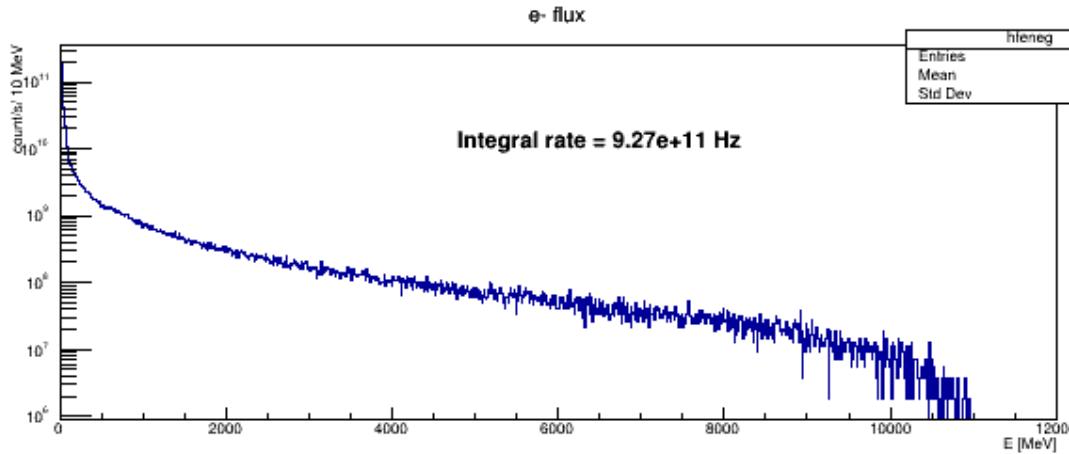
$$X_0(NH_3) = 40.87 \frac{g}{cm^2}, X_0(lHe) = 94.32 \frac{g}{cm^2} \rightarrow$$

$$L_{NH_3} = 3 \text{ cm} \cdot f_{pac} \cdot \rho_{NH_3}/X_0(NH_3) = 3.6\%;$$

$$L_{lHe} = 3 \text{ cm} \cdot (1 - f_{pac}) \cdot \rho_{lHe}/X_0(lHe) = 0.16\%;$$

$$L = L_{NH_3} + L_{lHe} = 3.8\%.$$

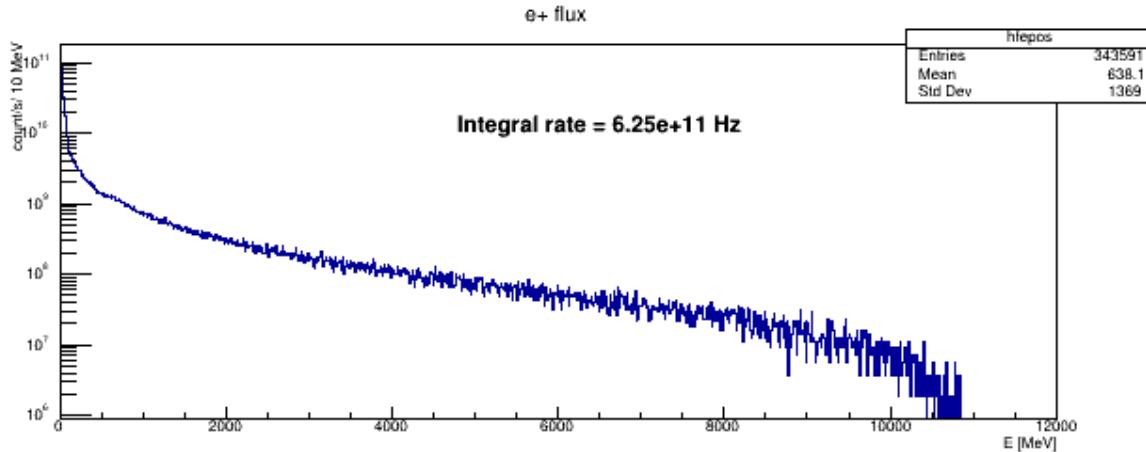
CPS brem. photon beam on UVA target, e- & e+ fluxes from target



$$e^- \text{ yield} = 4.6\%/\gamma$$

$$e^+ \text{ yield} = 3.1\%/\gamma$$

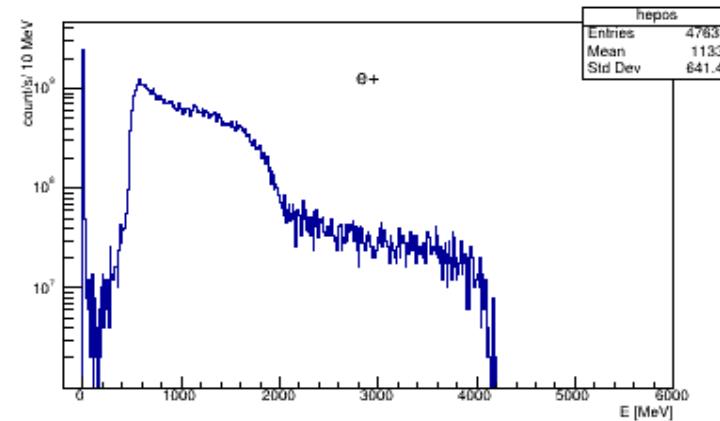
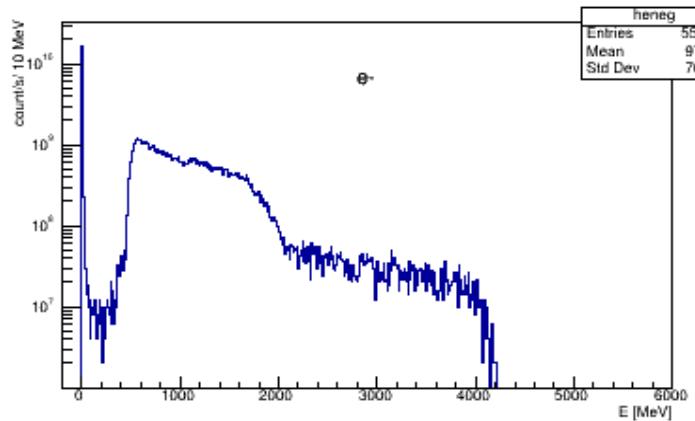
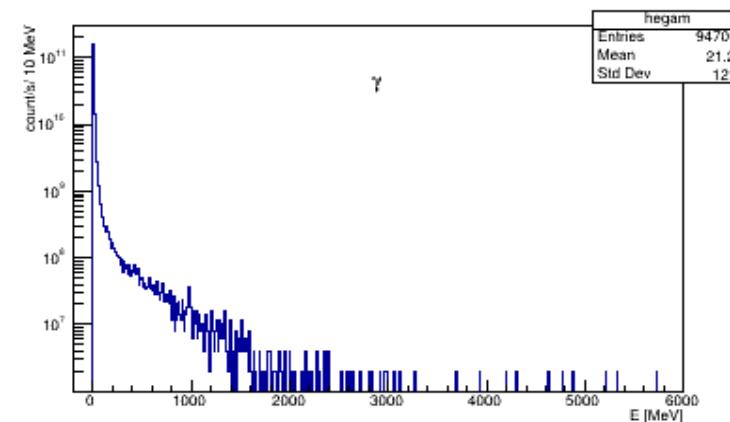
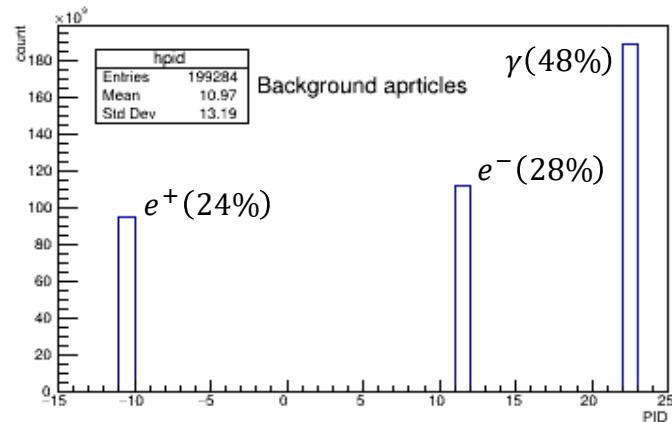
Based on PDG (complete screening, high energy limit ($E > 1\text{GeV}$)):



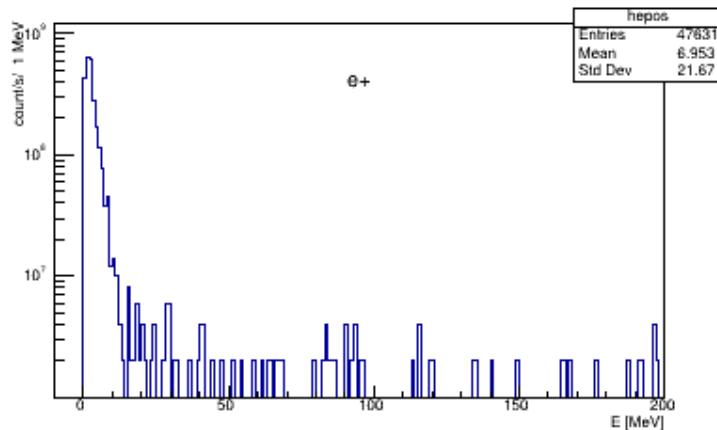
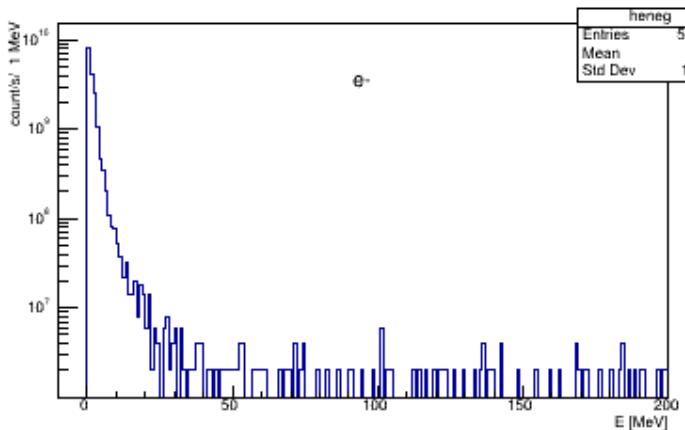
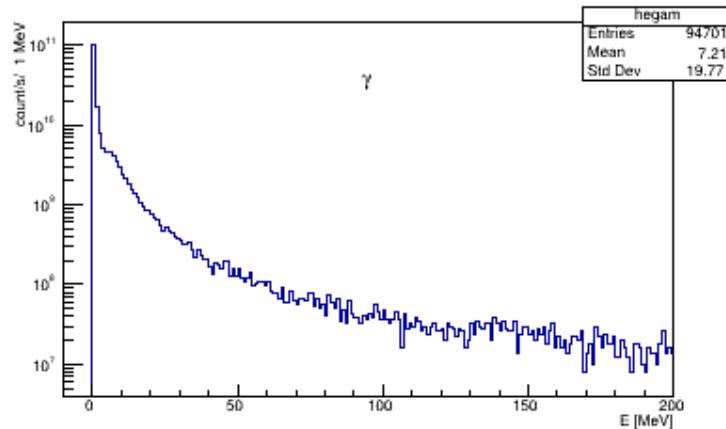
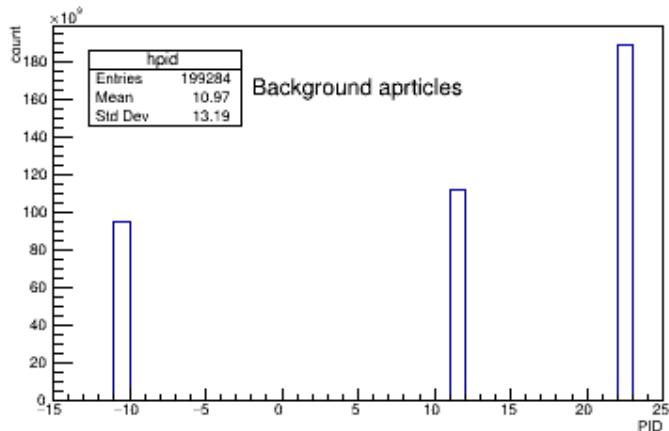
$$\sigma_{e^+e^-} = \frac{7}{9} \frac{A}{X_0 N_A} \rightarrow$$

$$Y_{e^+e^-} = \frac{7}{9} \frac{l}{X_0} = 3\%/\gamma$$

CPS brem. photon beam on UVA target, background fluxes on tracker X

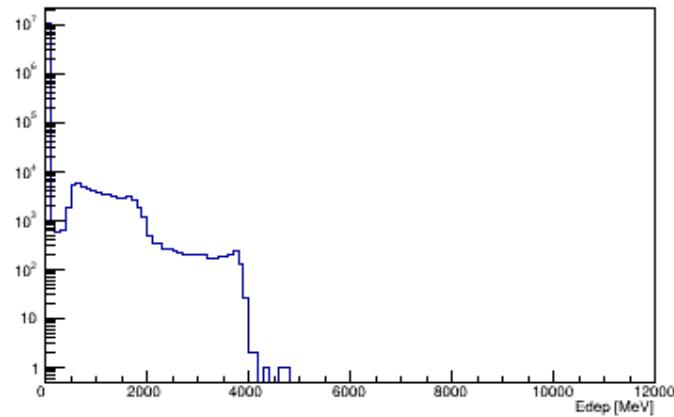


CPS brem. photon beam on UVA target, background fluxes on tracker X

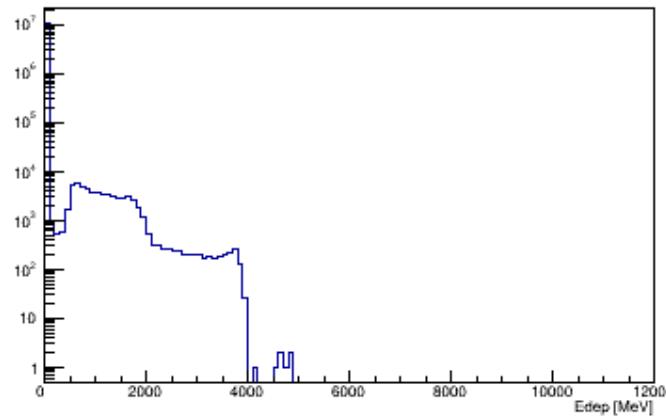


CPS photon beam on UVA trans.pol. target, Edep in calorimeters

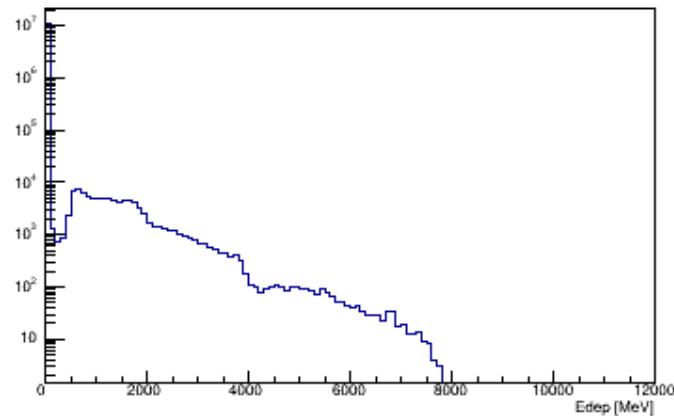
Top calo



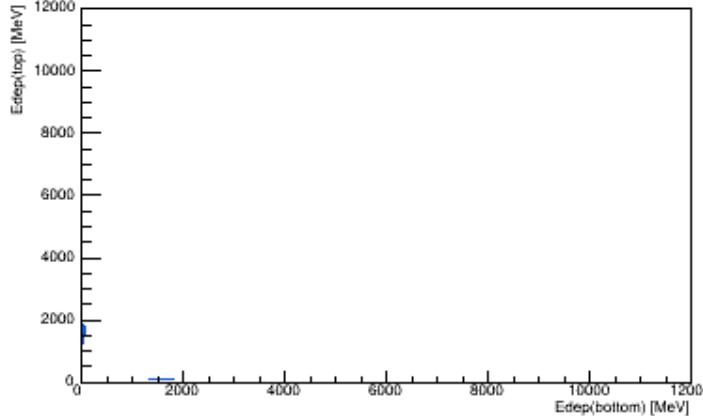
Bottom calo



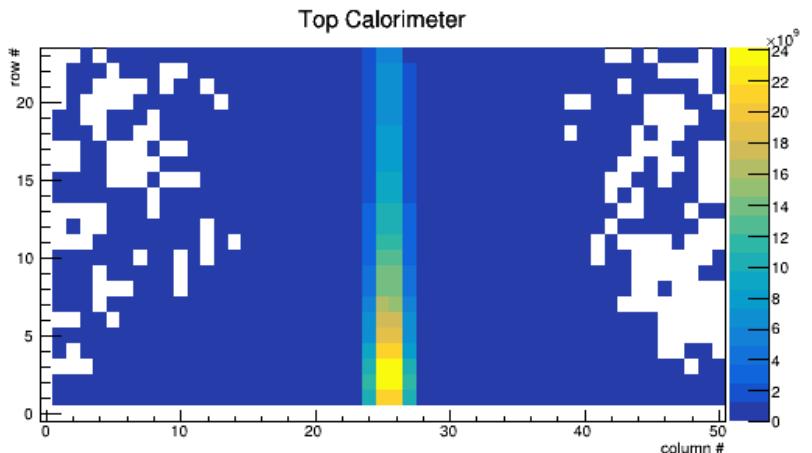
Top calo + Bottom calo



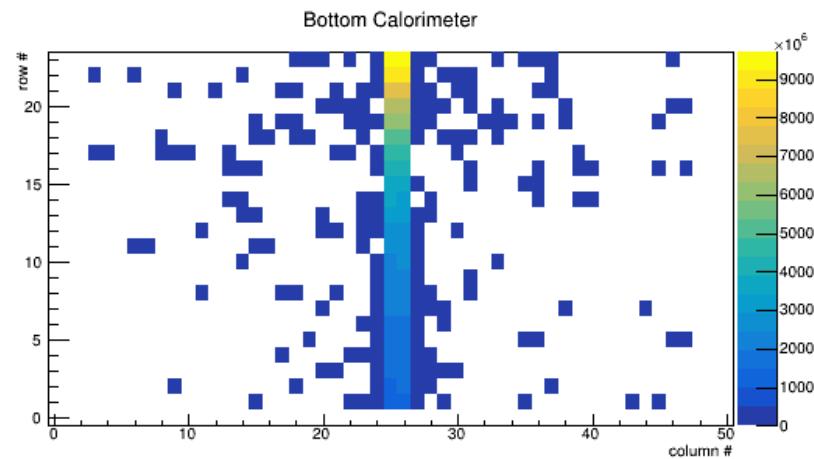
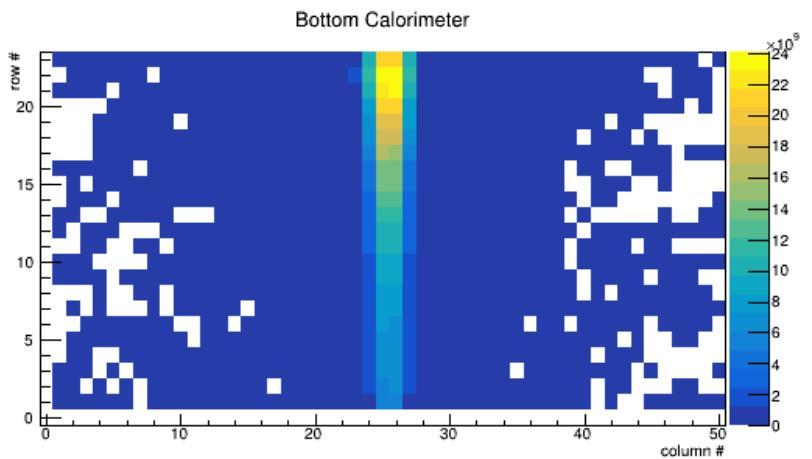
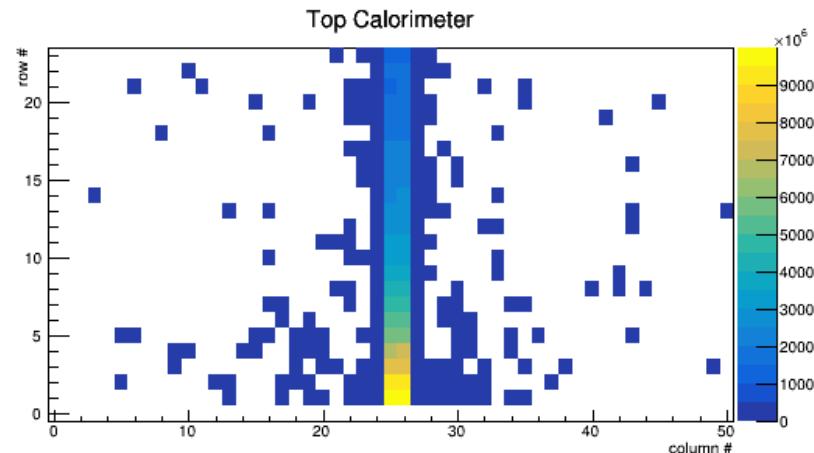
Top calo vs Bootom calo



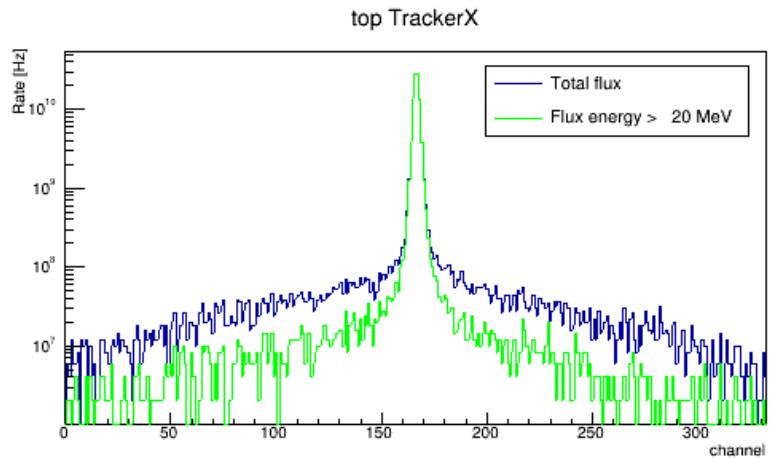
CPS brem. photon beam, UVA trans. pol. target, Edep > 10 MeV, rates [Hz]



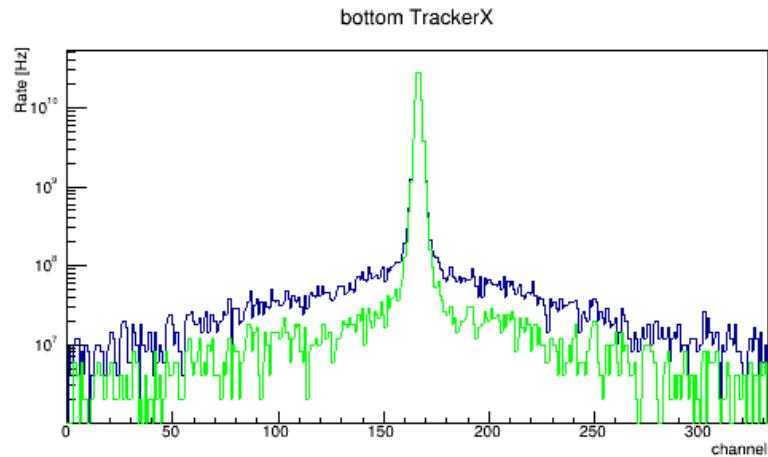
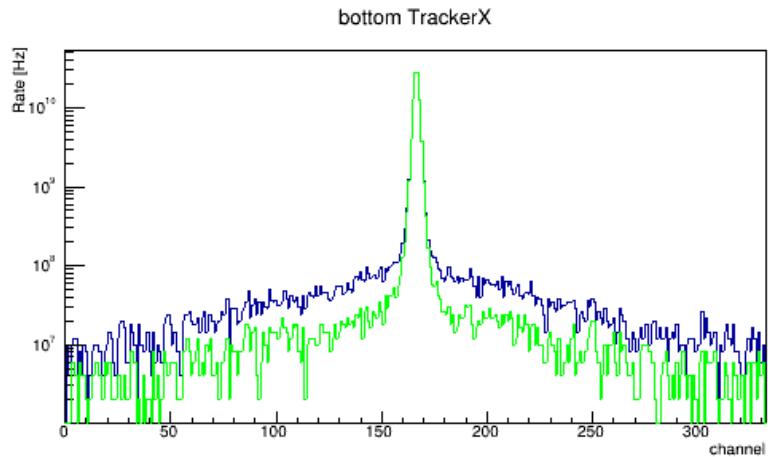
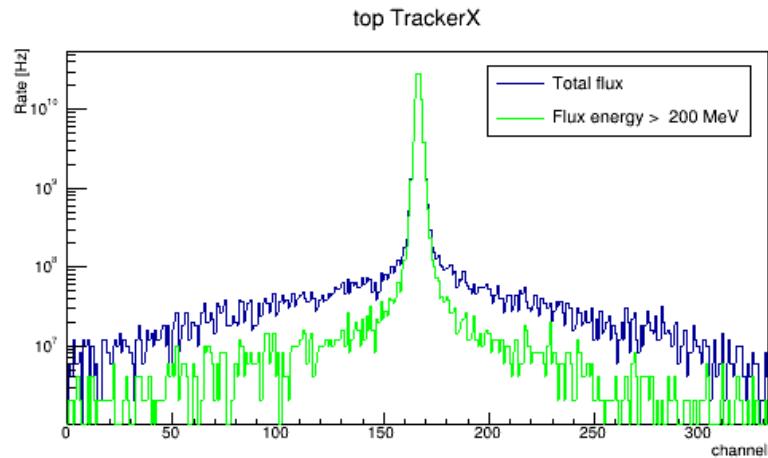
CPS brem. beam, UVA trans.pol. target, Edep > 200 MeV, rates[Hz]



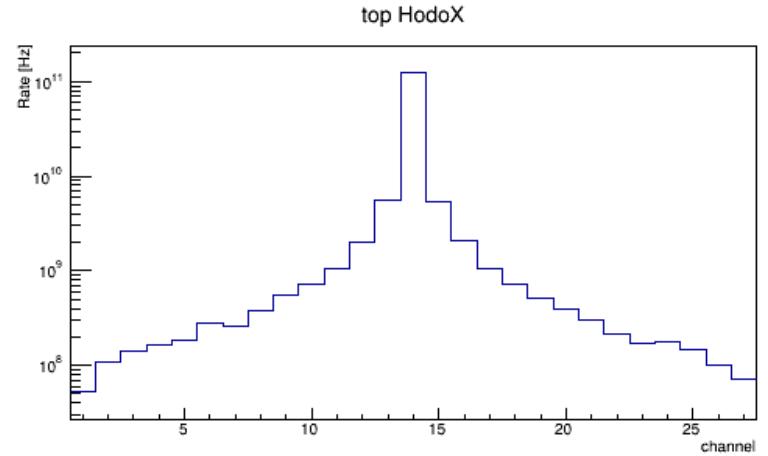
CPS brem. photon beam, UVA trans. pol. target, rates [Hz]



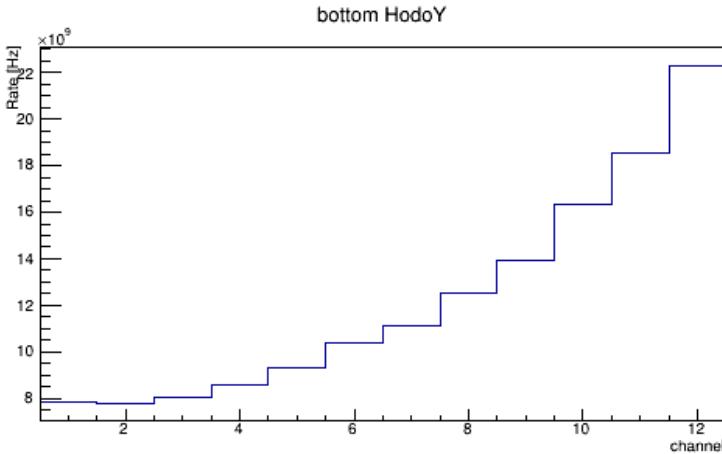
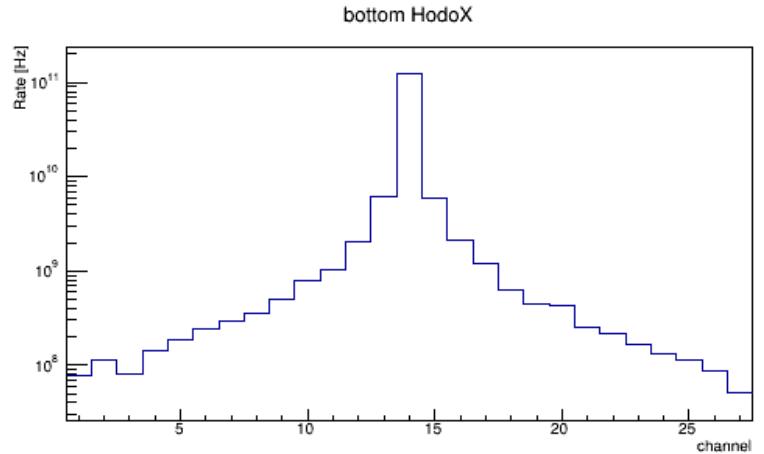
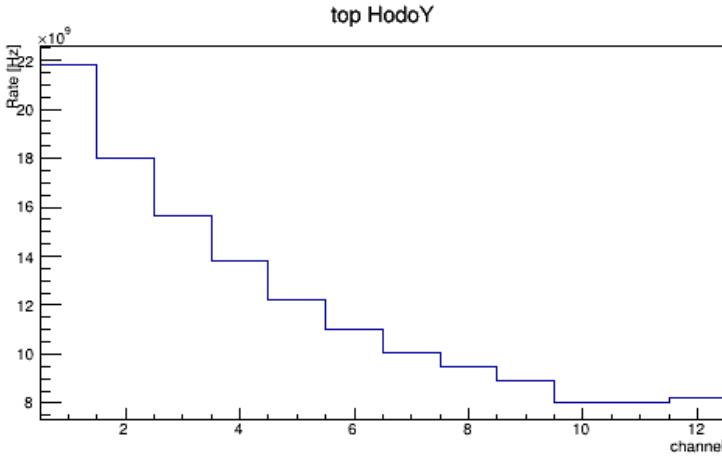
CPS brem. photon beam, UVA trans. pol. target, rates [Hz]



CPS brem. photon beam, UVA trans. pol. target, Edep > 1 MeV, rates [Hz]

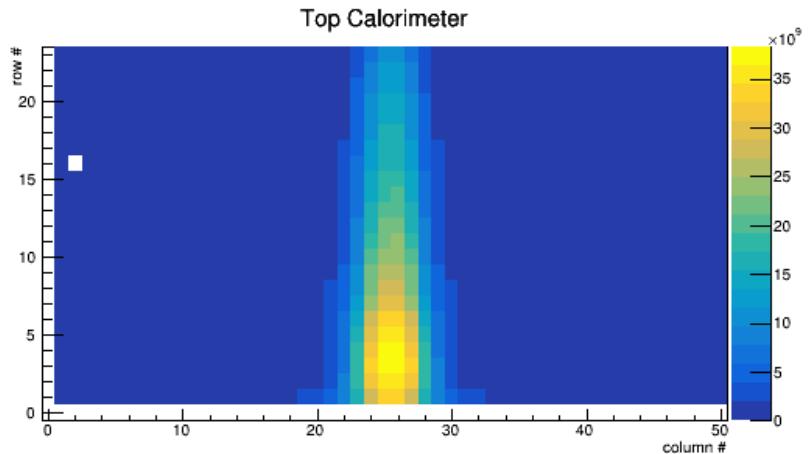


CPS brem. photon beam, UVA trans. pol. target, Edep > 1 MeV

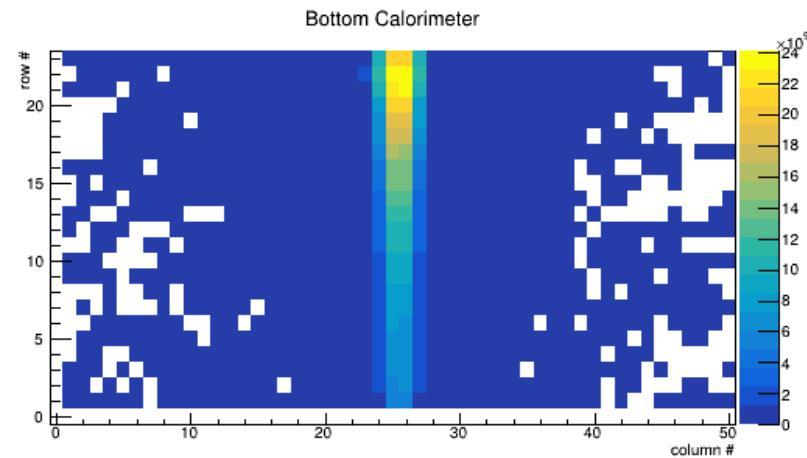
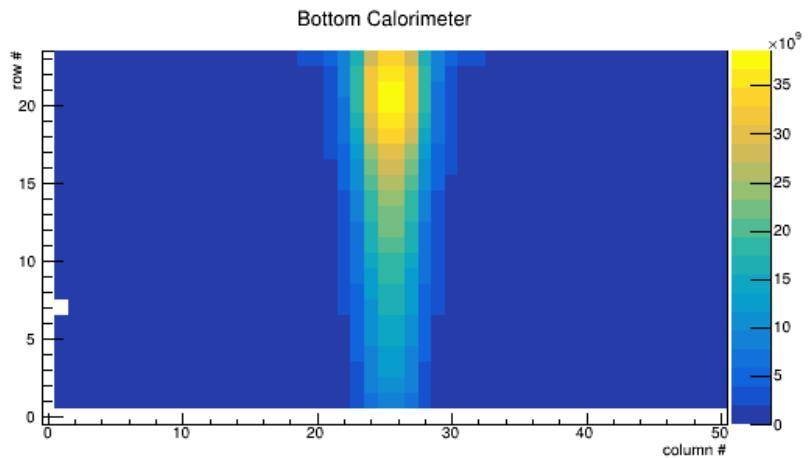
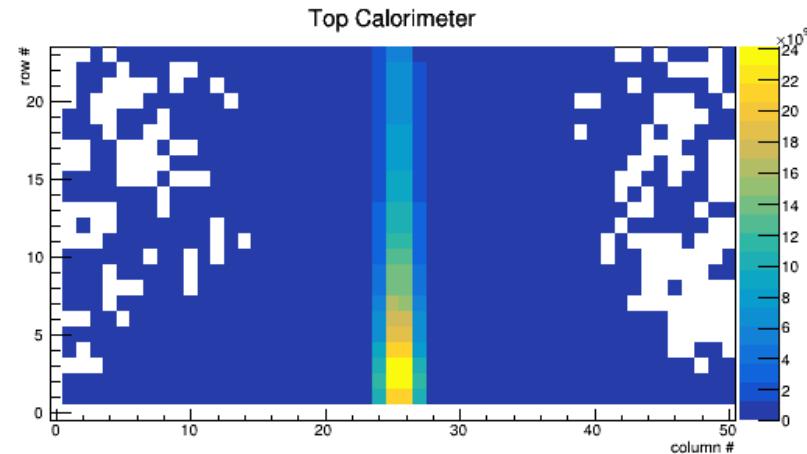


Backup slides

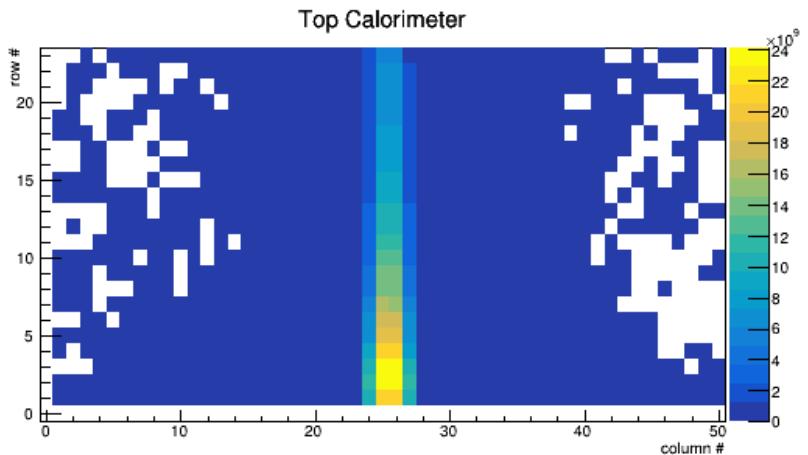
CPS brem. photon beam, UVA trans. pol. target, Edep > 1 MeV, rates [Hz]



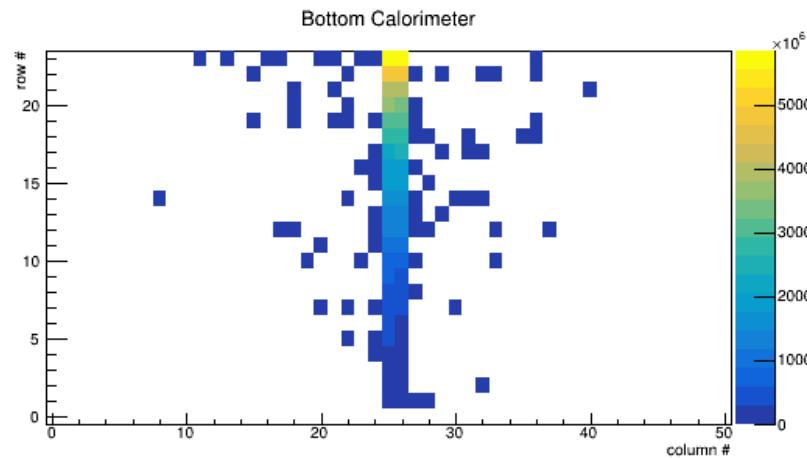
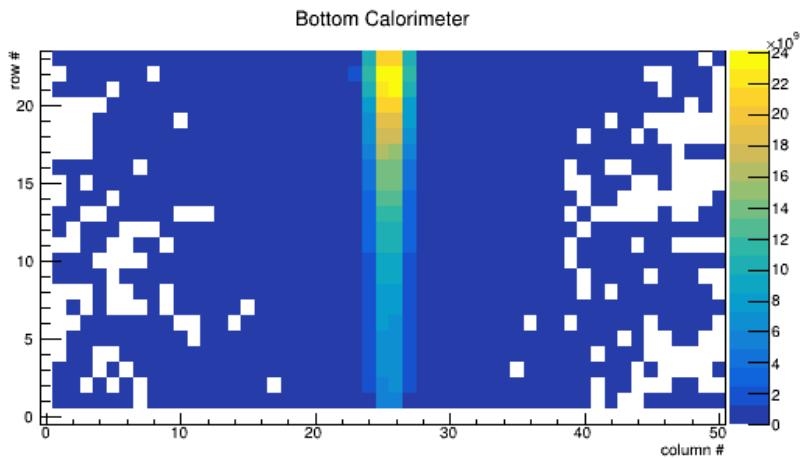
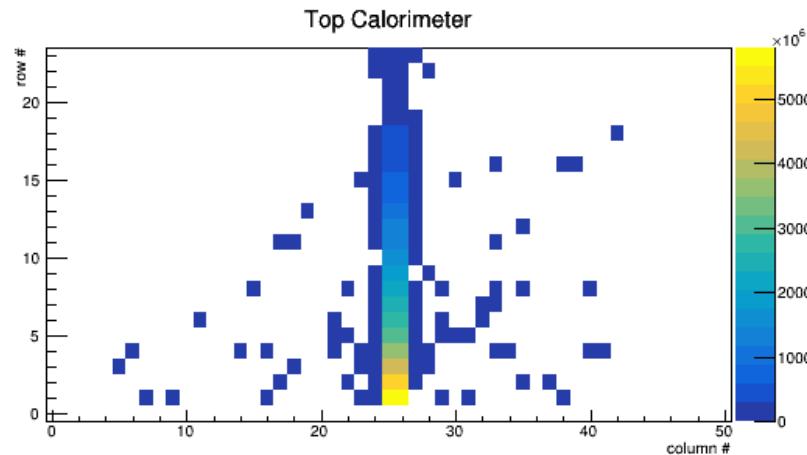
CPS brem. photon beam, UVA trans. pol. target, Edep > 10 MeV, rates [Hz]



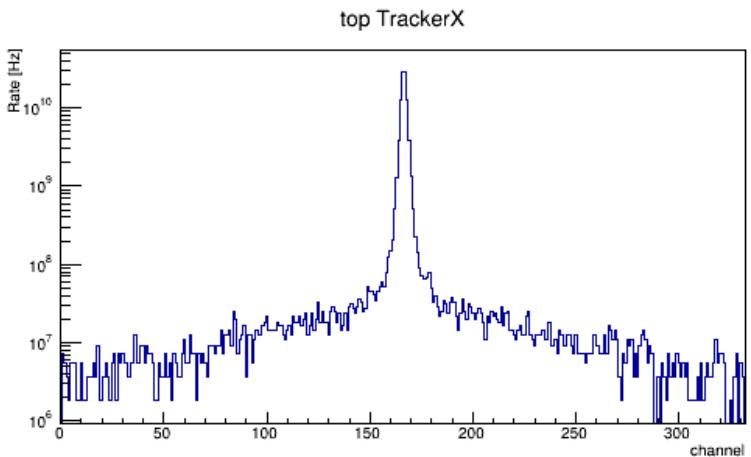
CPS brem. photon beam, UVA trans. pol. target, Edep > 10 MeV, rates [Hz]



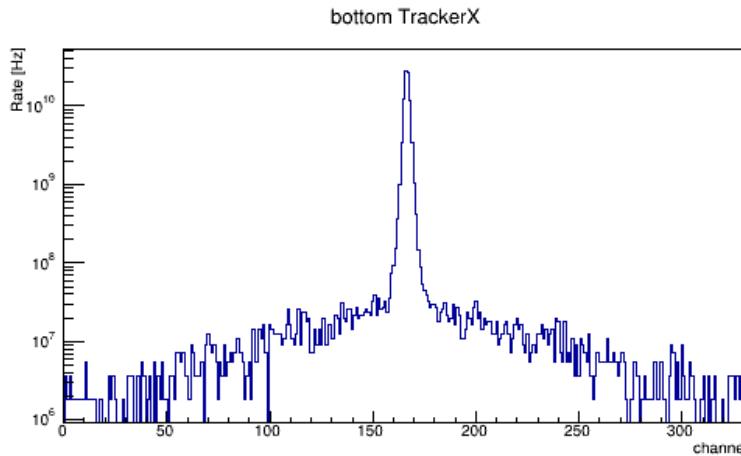
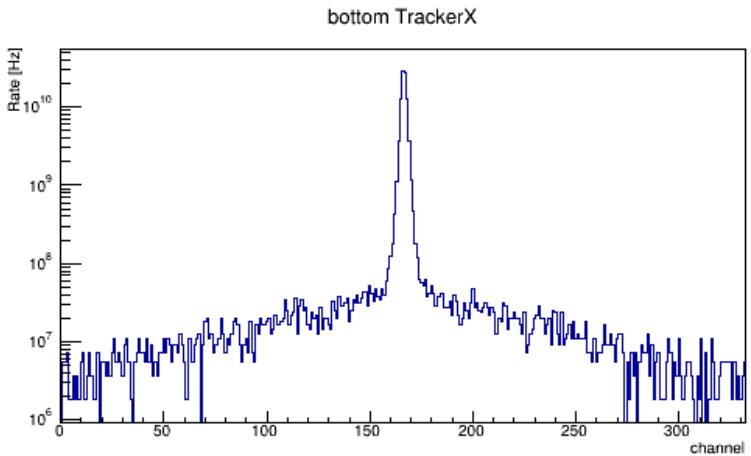
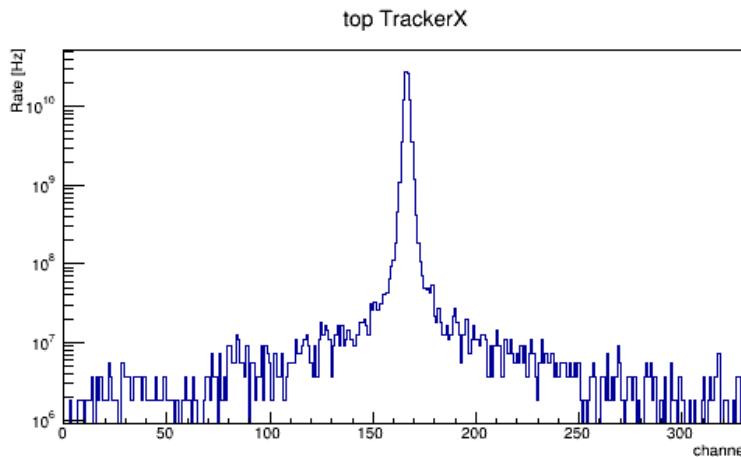
CPS brem. photon beam, UVA trans. pol. target, Edep > 500 MeV, rates [Hz]



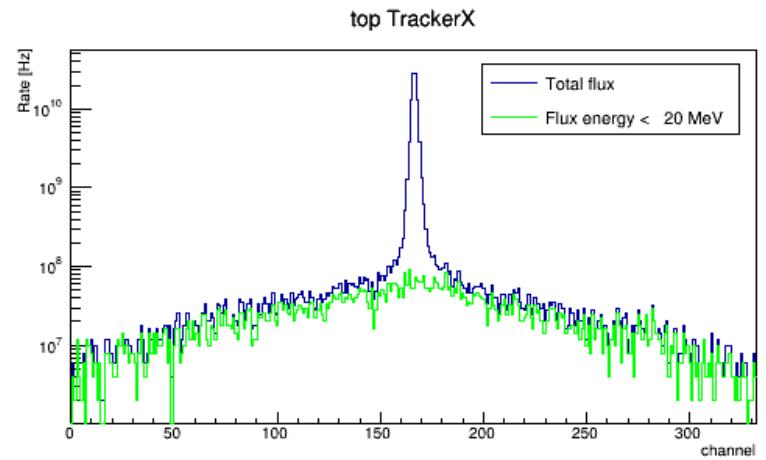
CPS brem. photon beam, UVA trans. pol. target, Ecalo > 0.1 MeV, rates [Hz]



CPS brem. photon beam, UVA trans. pol. target, Ecalo > 500 MeV, rates [Hz]



CPS brem. photon beam, UVA trans. pol. target, $E_{thr} = 200$ MeV, rates [Hz]



CPS brem. photon beam, UVA trans. pol. target, $E_{thr} = 200$ MeV, rates [Hz]

