$\gamma p \to \gamma\gamma p$
Beam asymmetry

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Motivation

- Key reactions in hadron physics
  - excite nucleon resonances
  - test predictions of Regge theory
- Hall D data at JLab is a perfect sample

Data sample

- /volatile/halld/offline_monitoring/ RunPeriod-2015-03/ver23/REST/
- Run 3185, 3179, and 3180
- Beam energy is less than 6 GeV

Pre-selection

- Set_KinFitType(d_NoFit);
- The Energy of the shower $E_{\mathrm{shower}} > 0.1\mathrm{GeV}$
- Set_MaxPhotonRFDeltaT(0.5*4.008)
- PIDDeltaT
  - 1.0 SYS_TOF $\Delta t = (t_{\mathrm{TOF}} - t_{\mathrm{RF}}) < 1.0\mathrm{ns}$
  - 10.0 SYS_BCAL $\Delta t = (t_{\mathrm{BCAL}} - t_{\mathrm{RF}}) < 10.0\mathrm{ns}$
  - 10.0 SYS_FCAL $\Delta t = (t_{\mathrm{FCAL}} - t_{\mathrm{RF}}) < 10.0\mathrm{ns}$

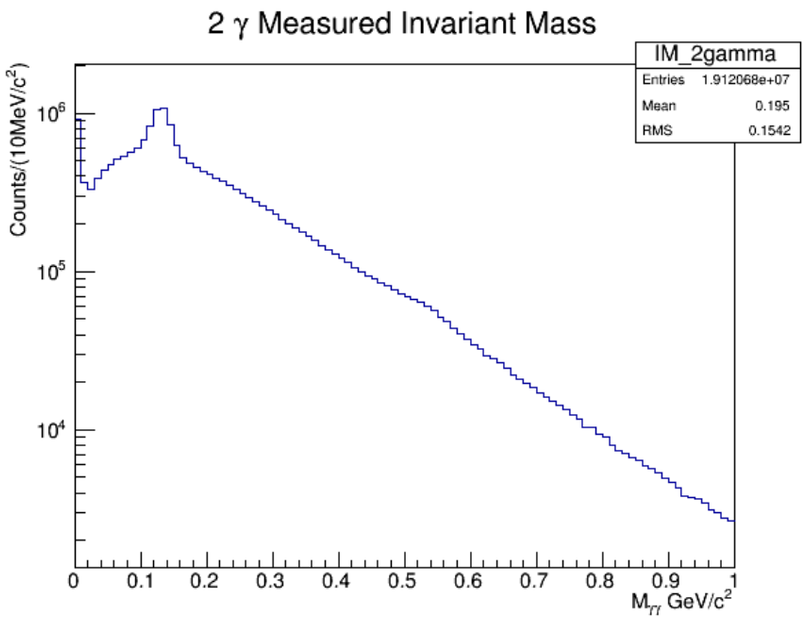
The Cuts in Selector

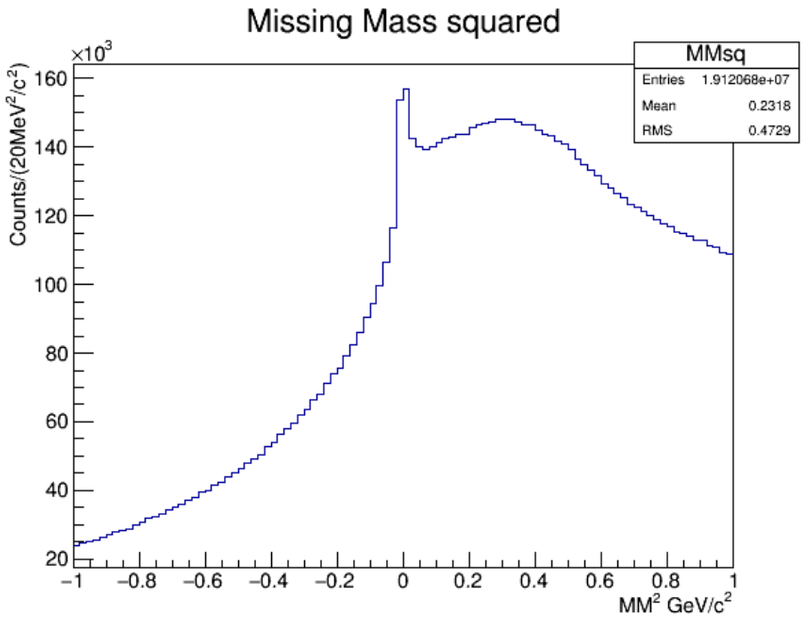
Cuts number	Cuts conditions	Events
No Cuts		1.912E+07
Cut1	$\lvert(\phi_{2\gamma} - \phi_p) - 180.0\rvert < 5.0$	1.087E+06
Cut2	$-0.015 < MM^2 < 0.01$	6.476E+04
Cut3	$ME < 0.36$	3.881E+04
Cut4	$p > 0.25$	3.879E+04
Cut5	$47.5 < z < 80.5, r < 1$	3.773E+04
Cut6	$\mathrm{UnusedEnergy} < 0.08$	3.133E+04
Cut7	$MM(\gamma p \to pX) > 0.85$ or < 0.7	3.034E+04

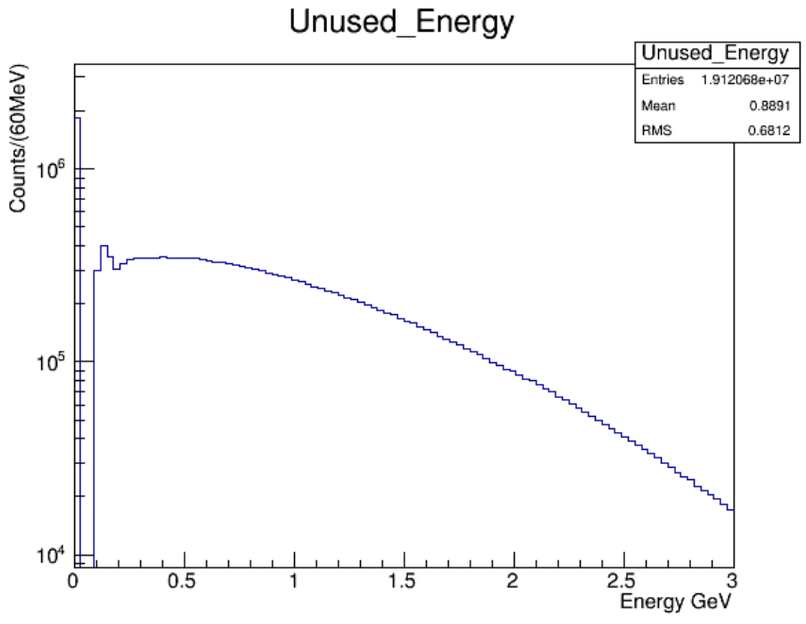
Bishnu's MC analysis

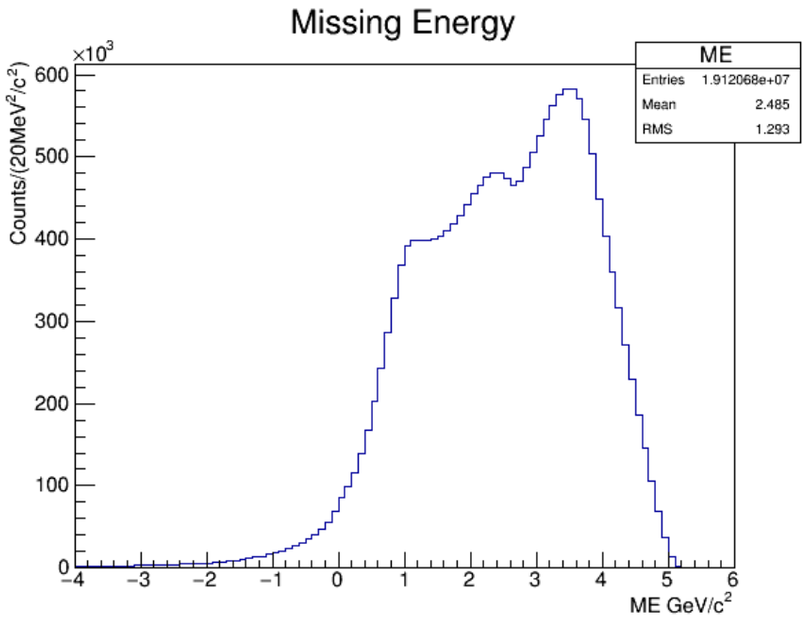
Simon's multi-photon analysis

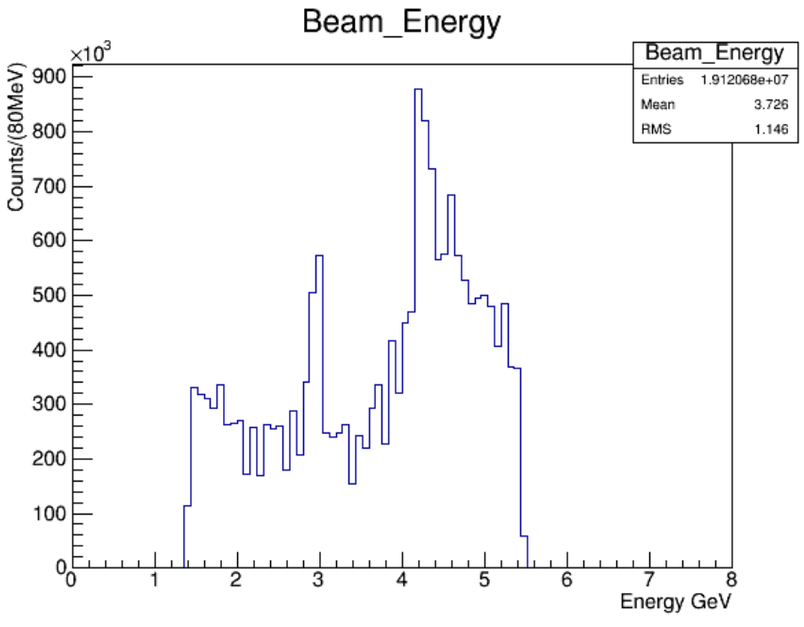
The distributions without any cuts

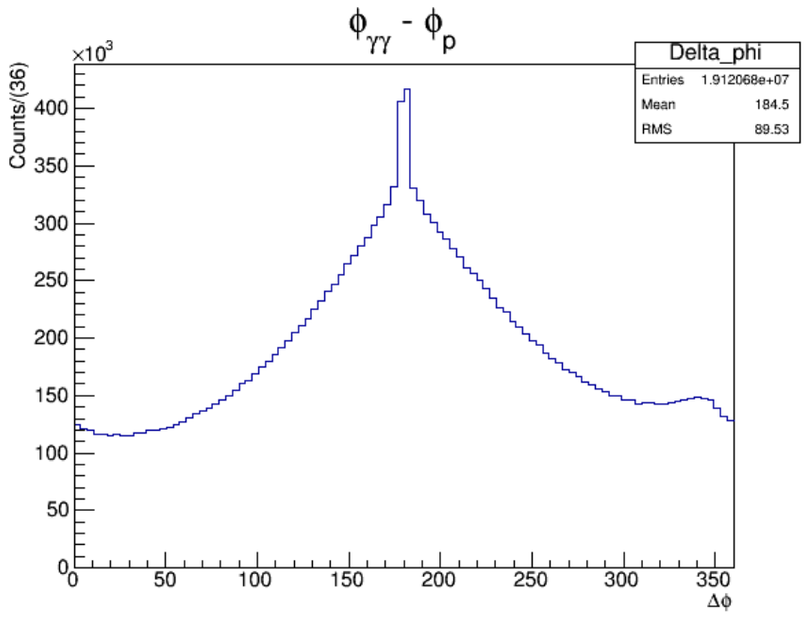




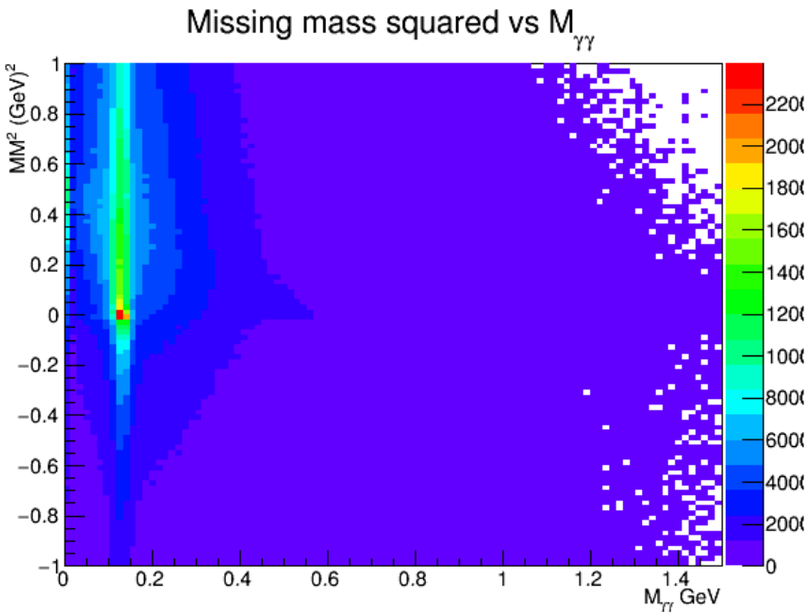


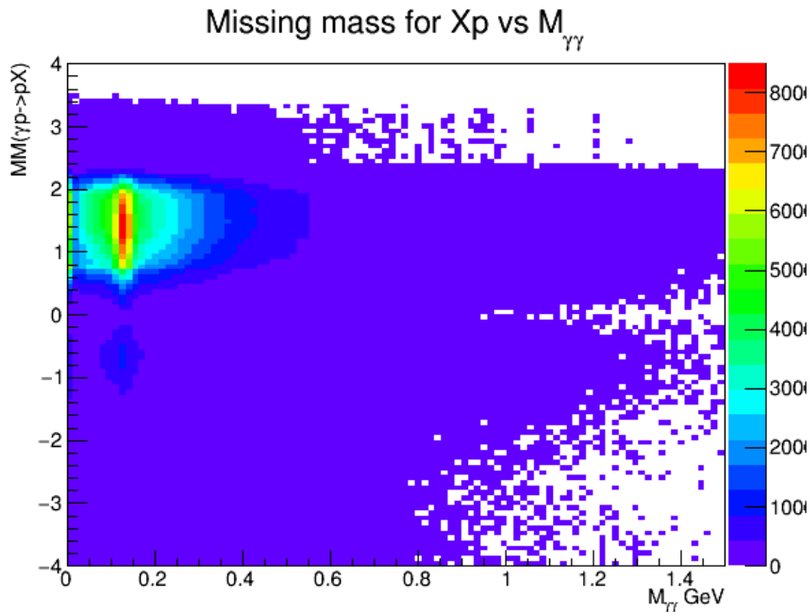


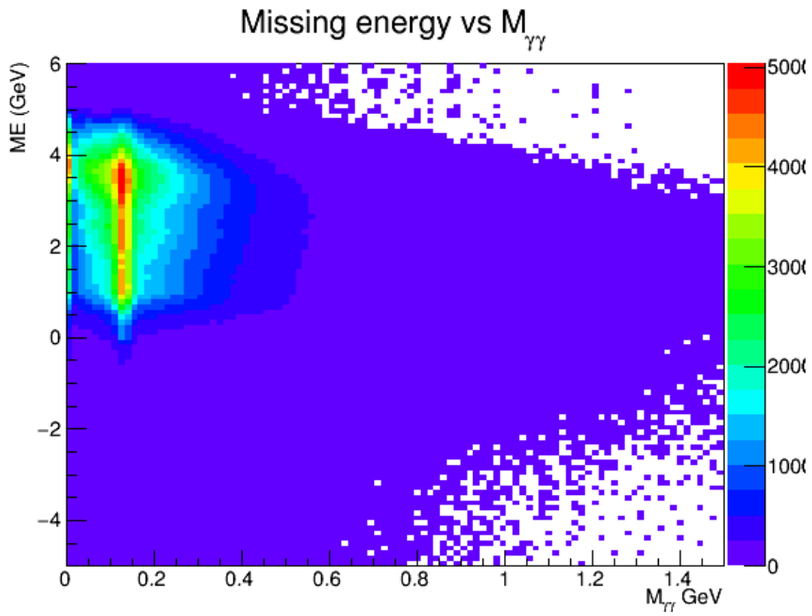


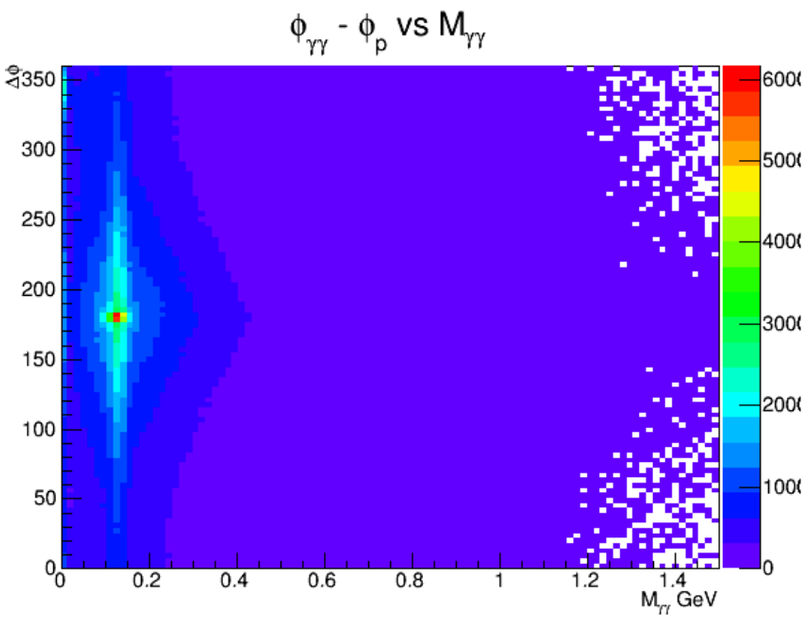


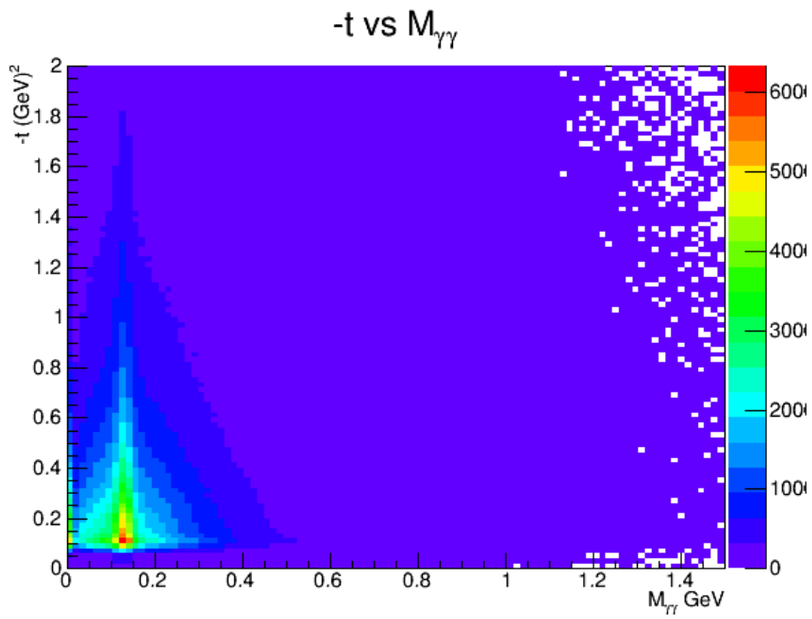
The distributions without any cuts

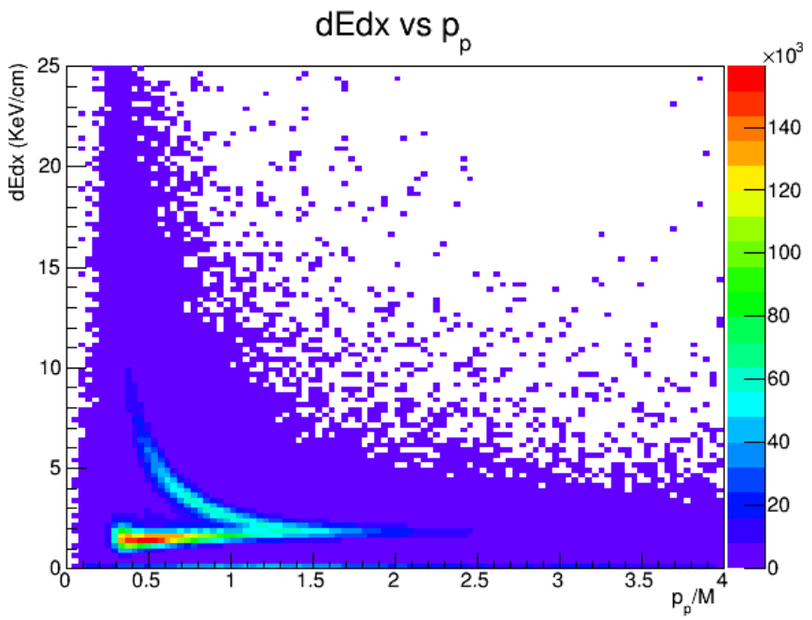




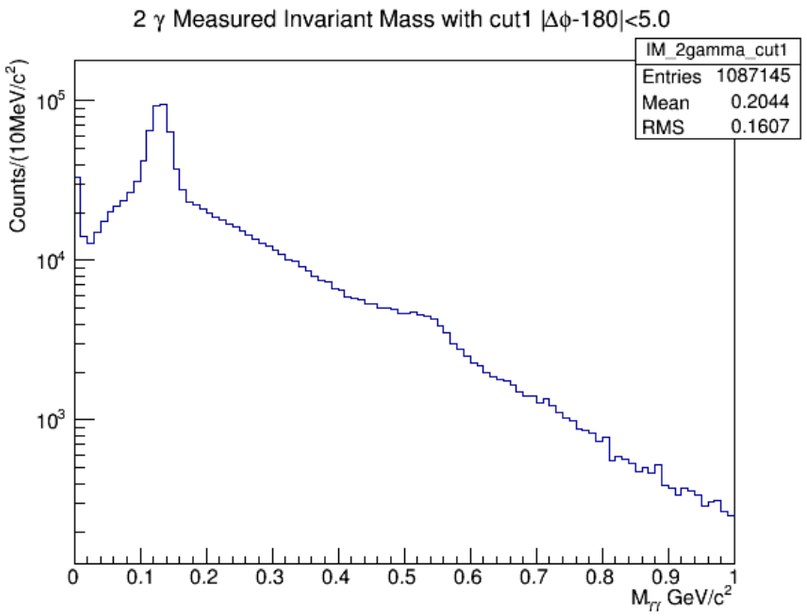


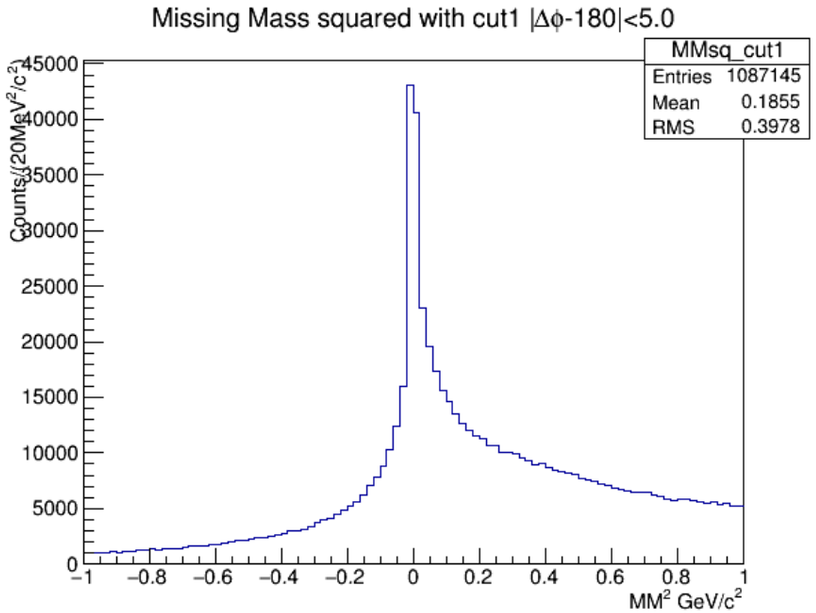


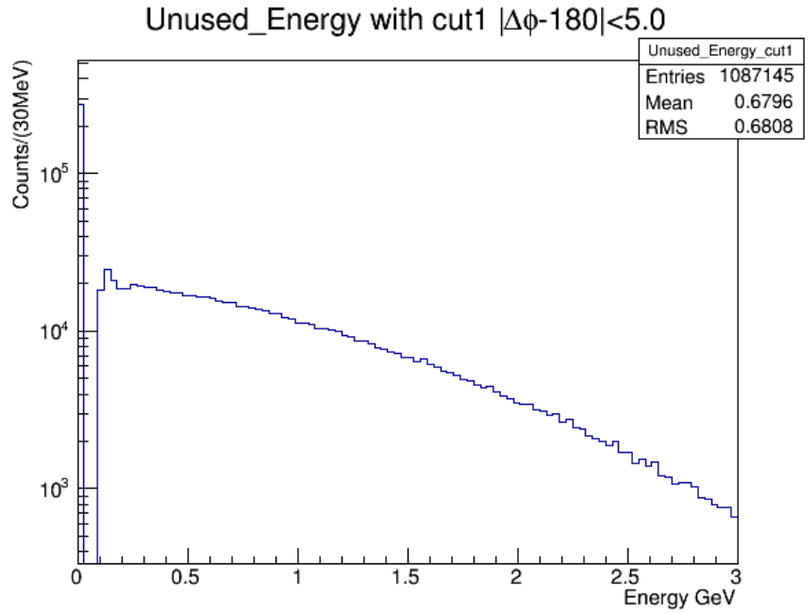


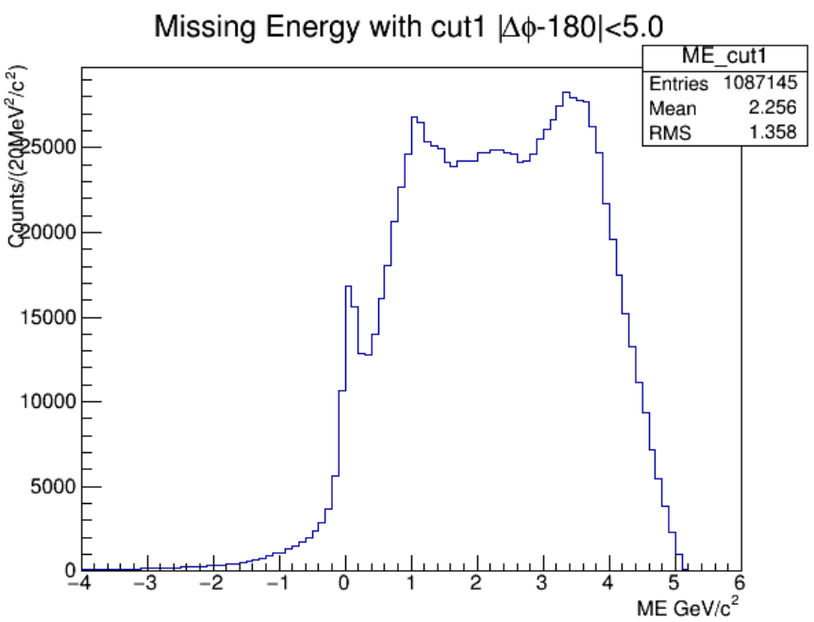


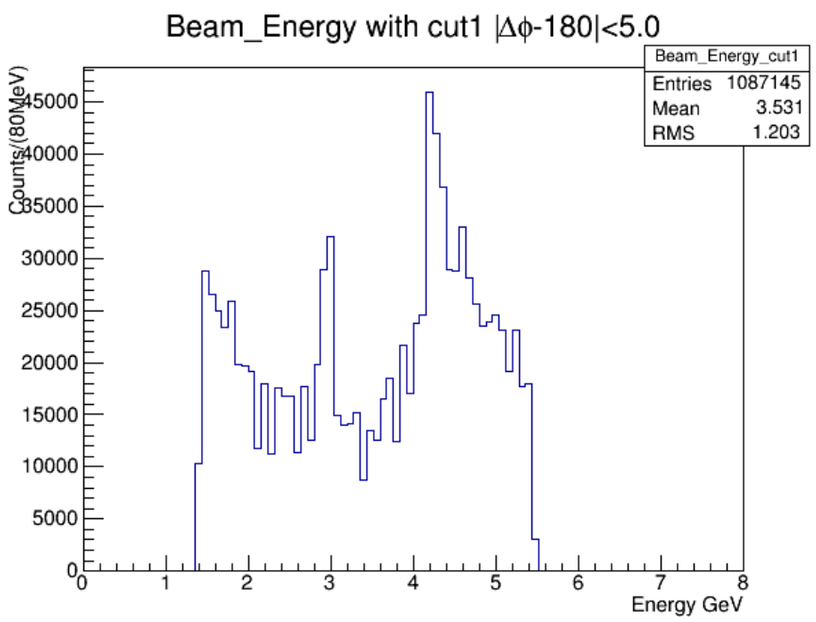
The distributions after cut 1

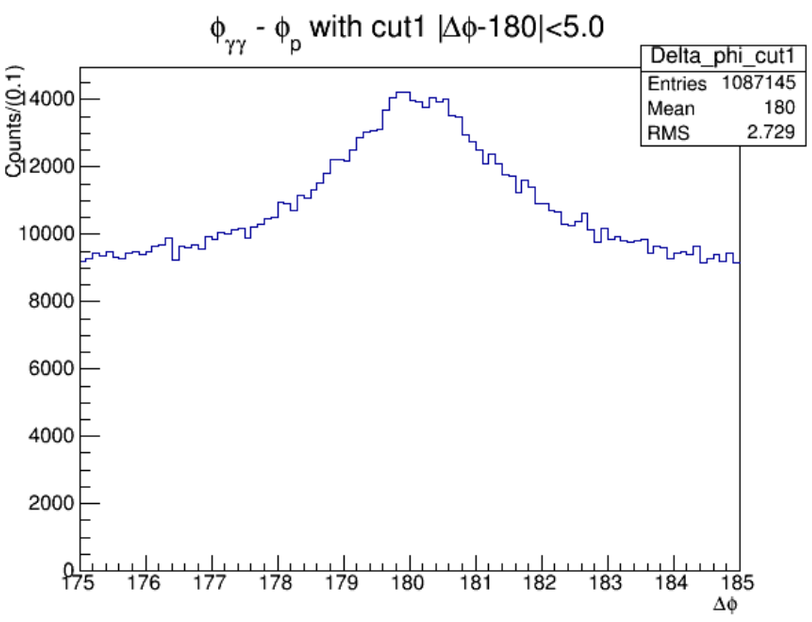






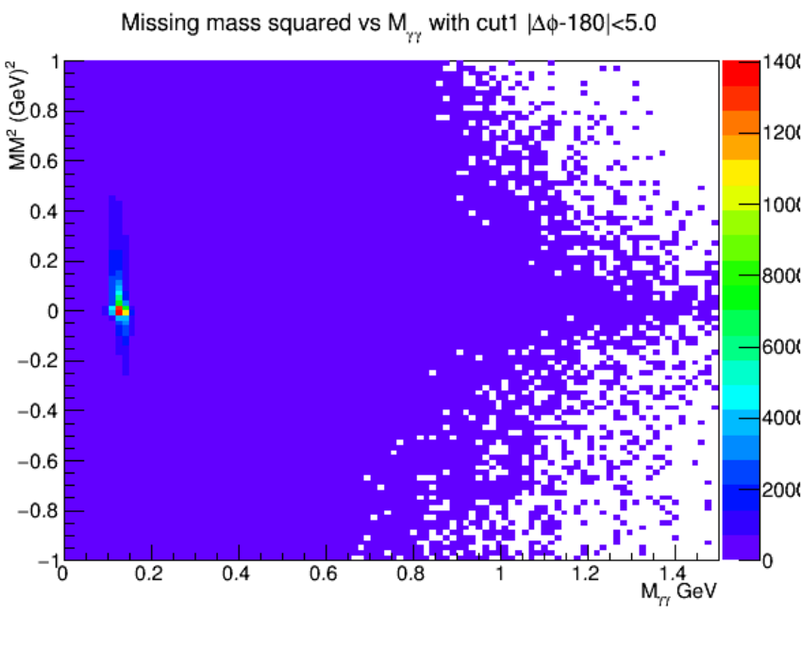


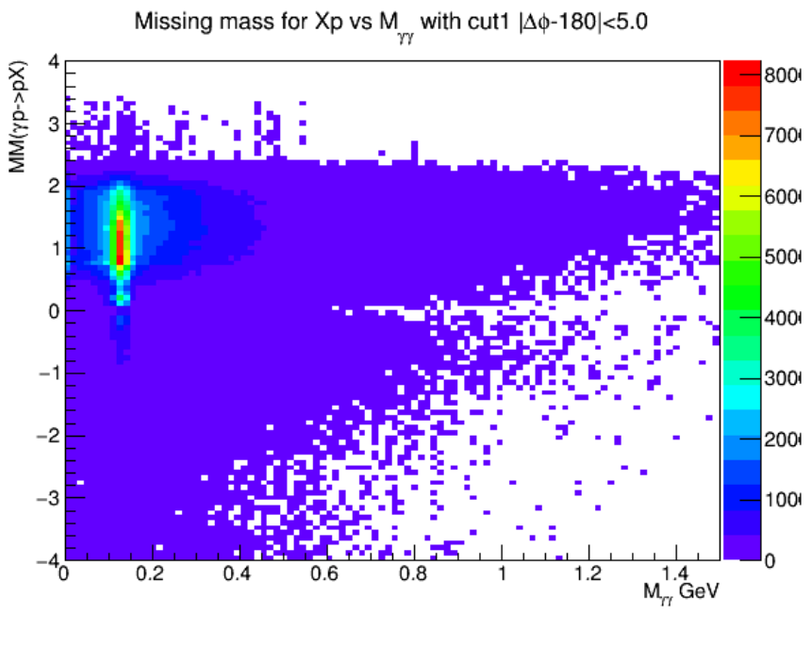


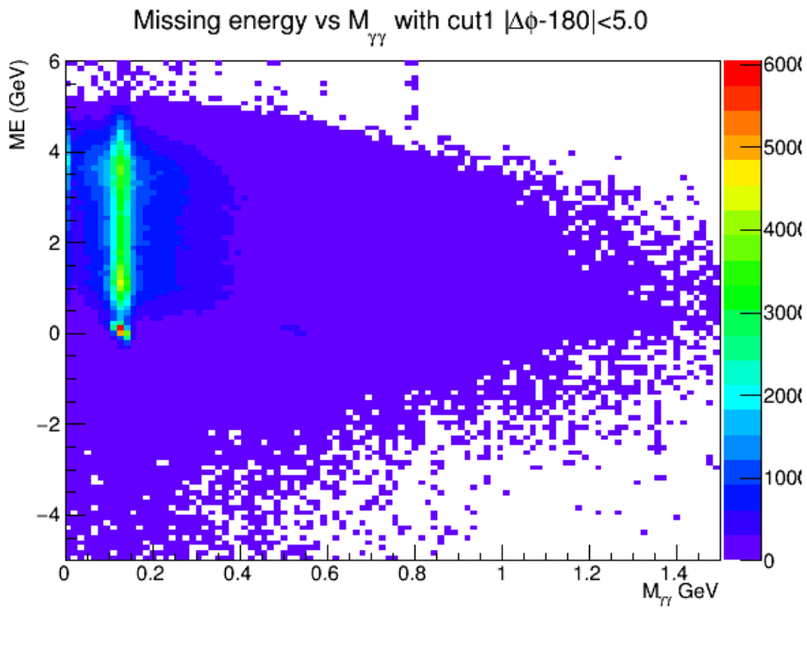


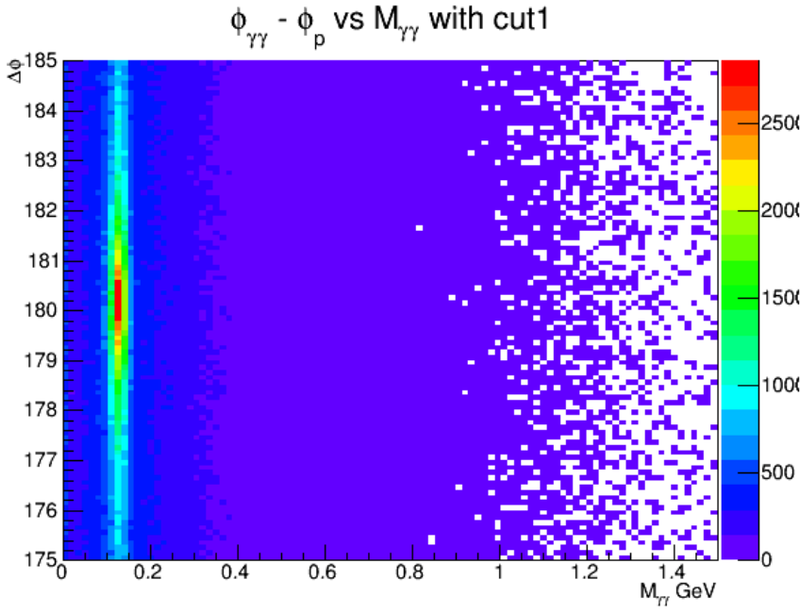
$$\left|(\phi_{2\gamma} - \phi_p) - 180.0\right| < 5.0$$

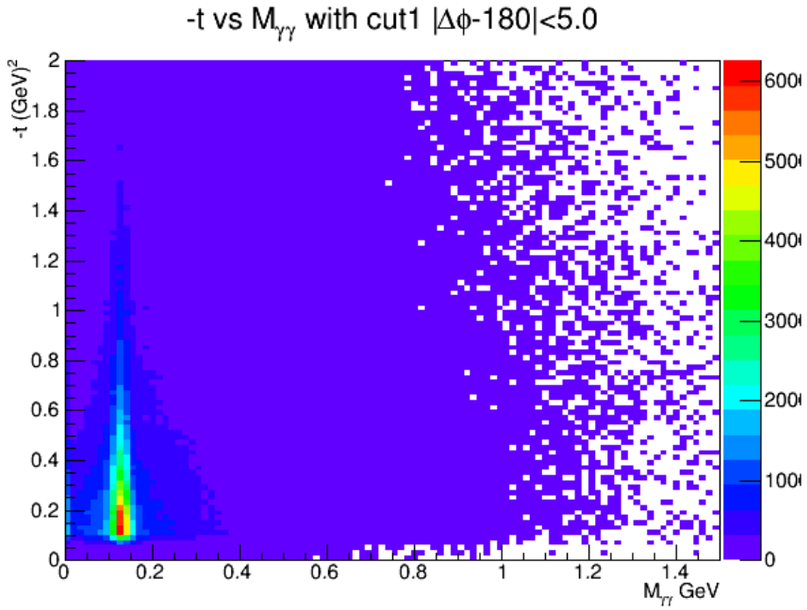
The distributions after cut 1

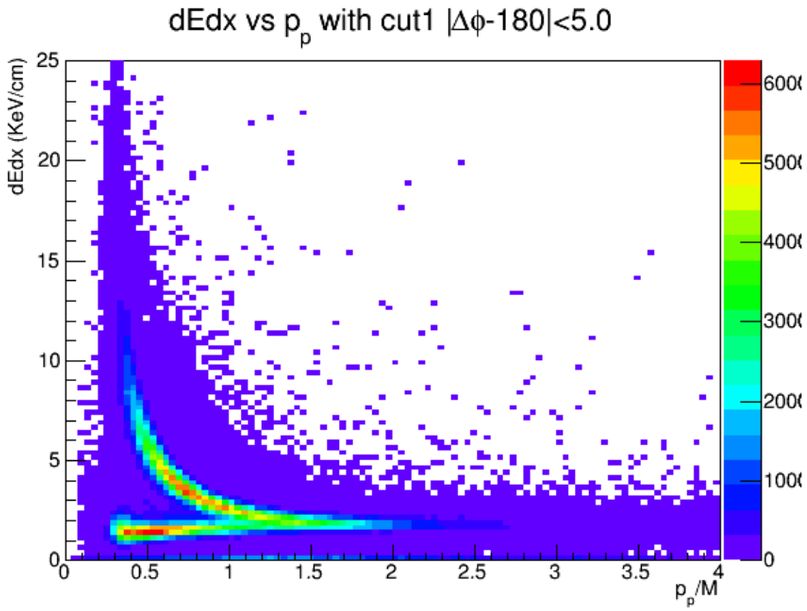






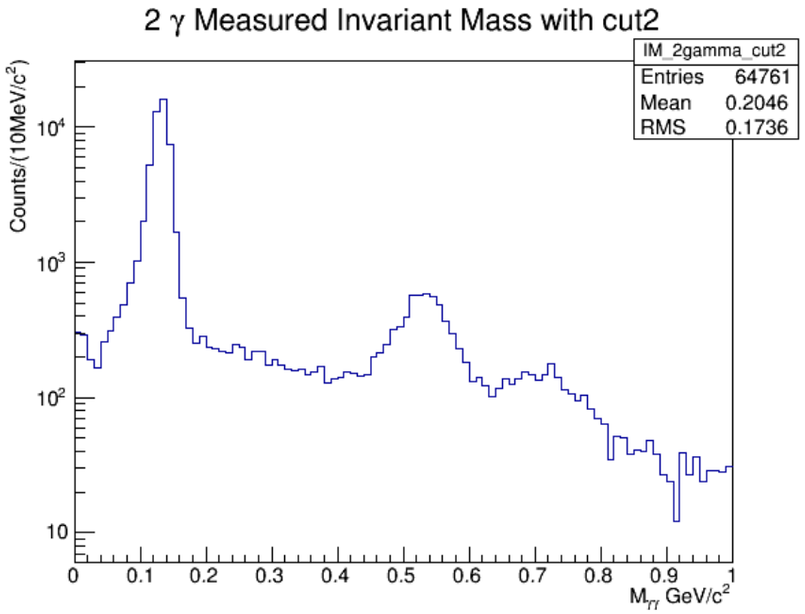


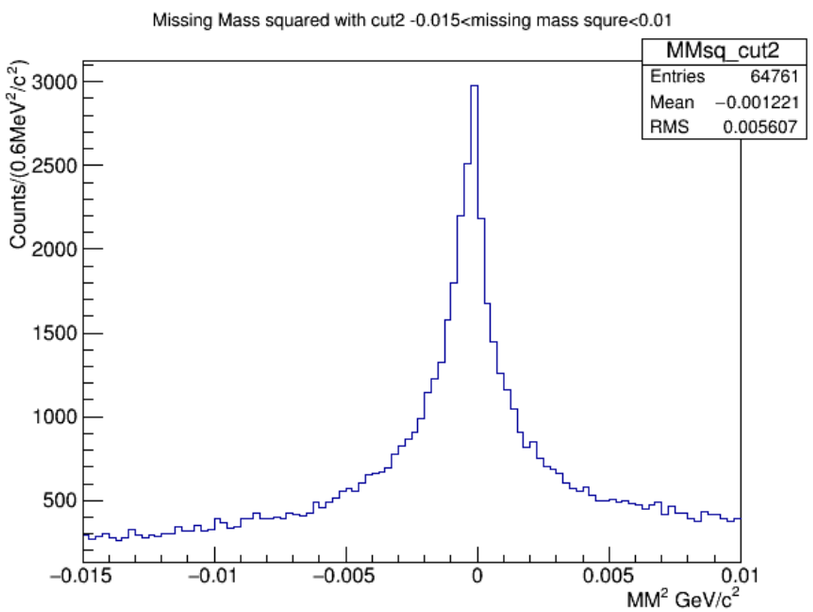


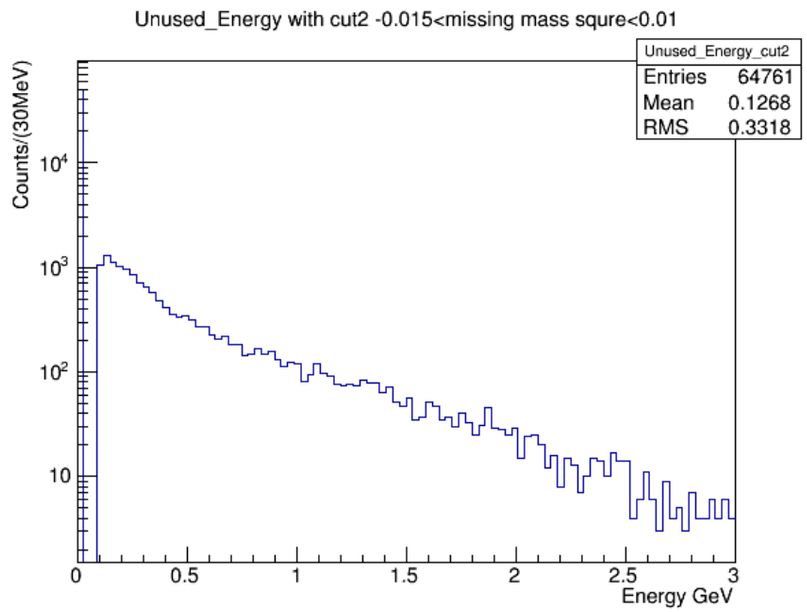


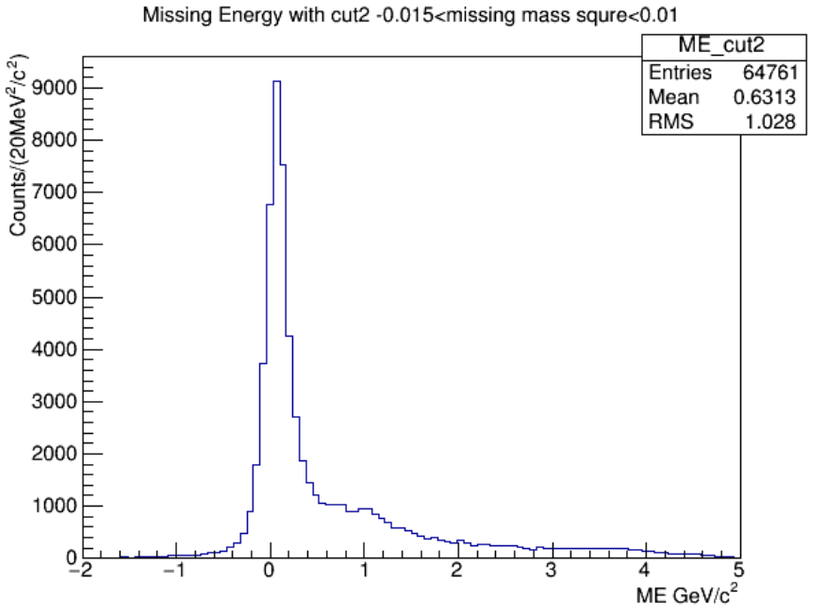
$$|(\phi_{2\gamma} - \phi_p) - 180.0| < 5.0$$

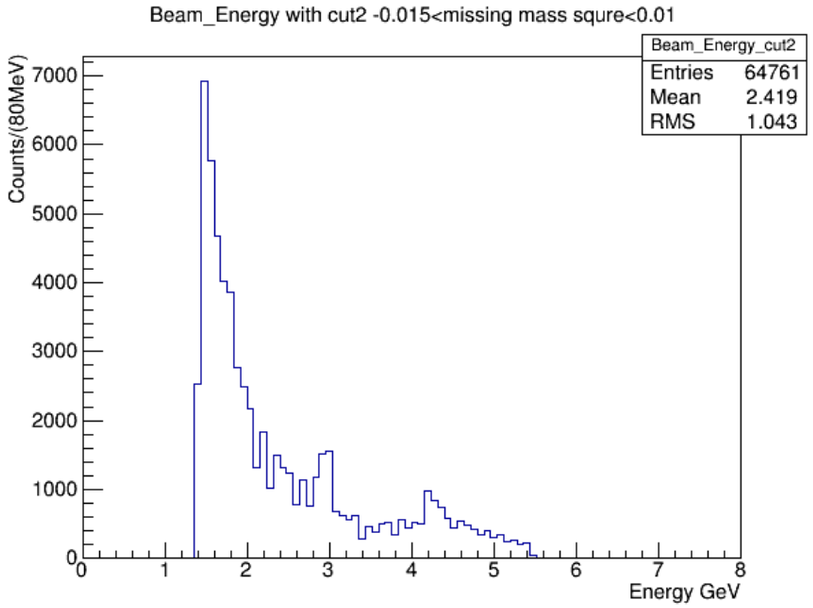
The distributions after cuts 1-2

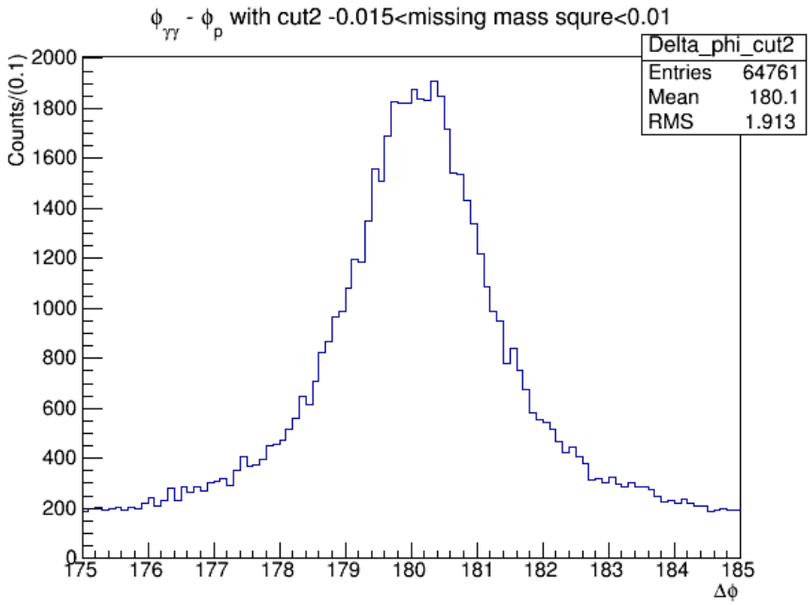






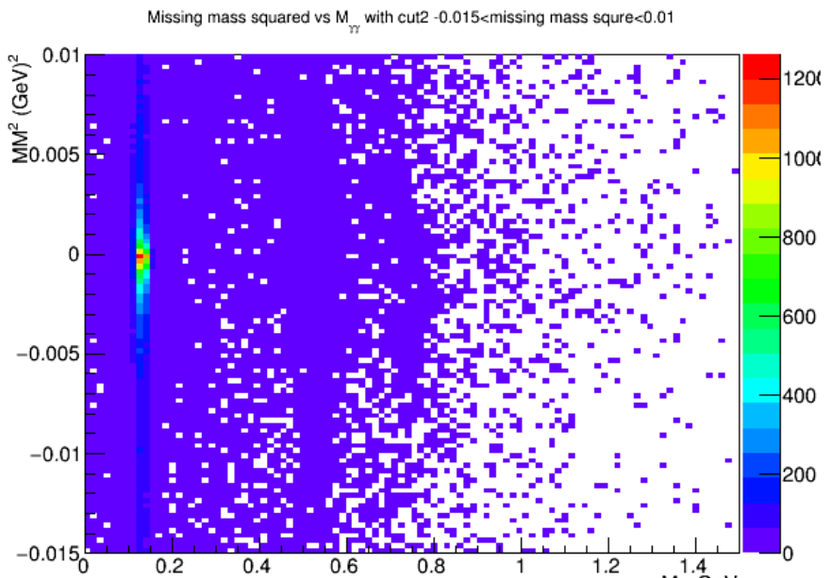


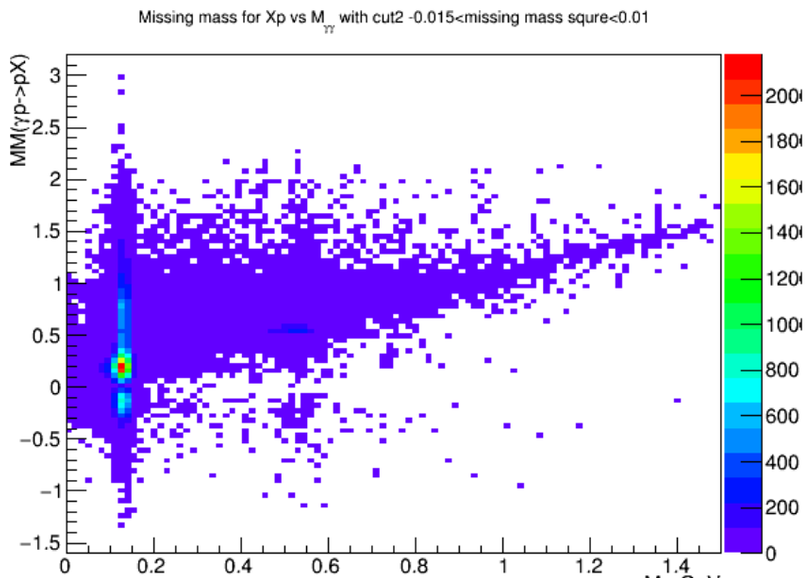


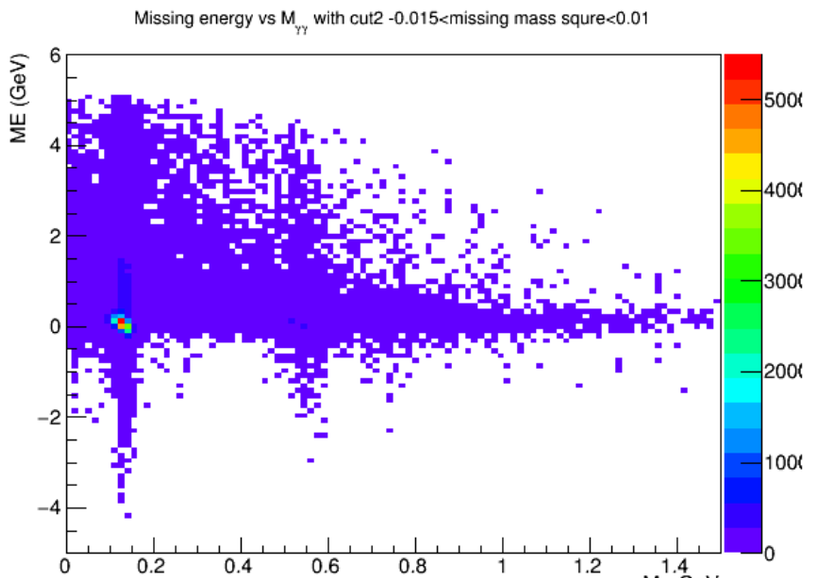


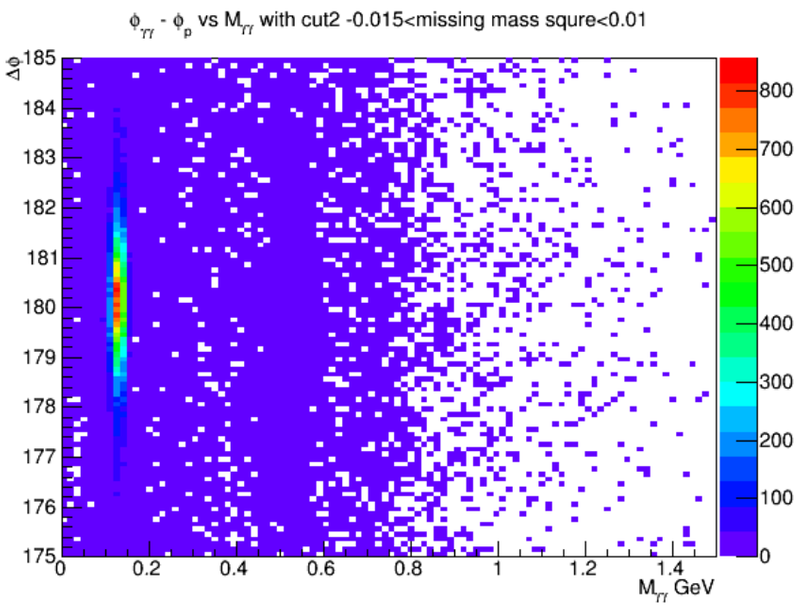
$$-0.015 < MM^2 < 0.01$$

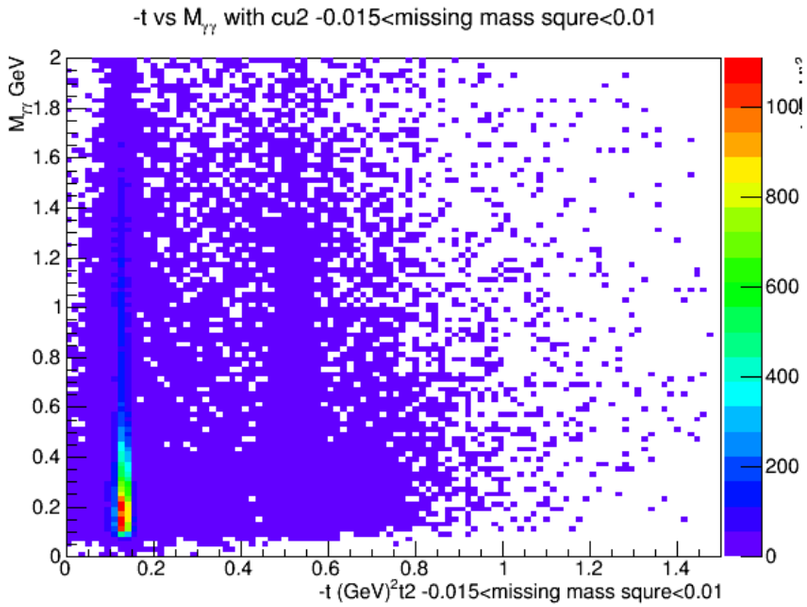
The distributions after cuts 1-2

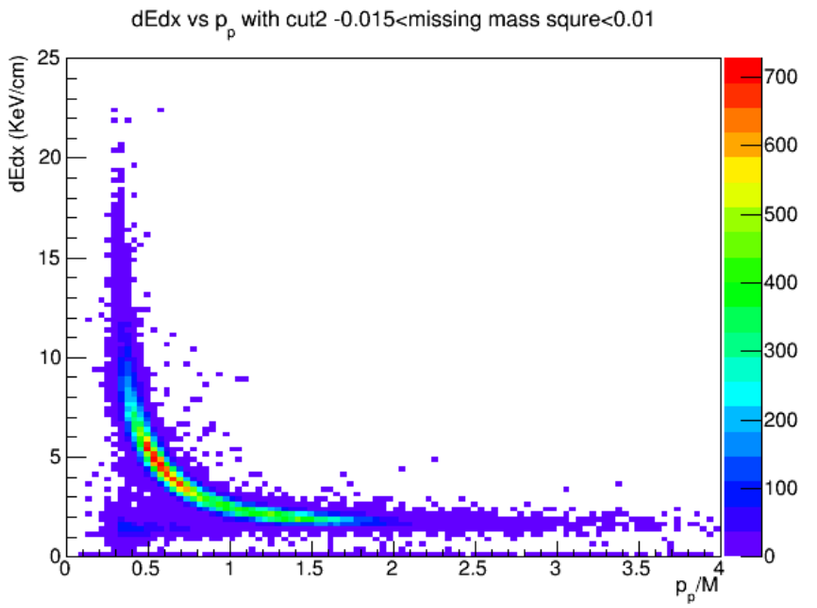






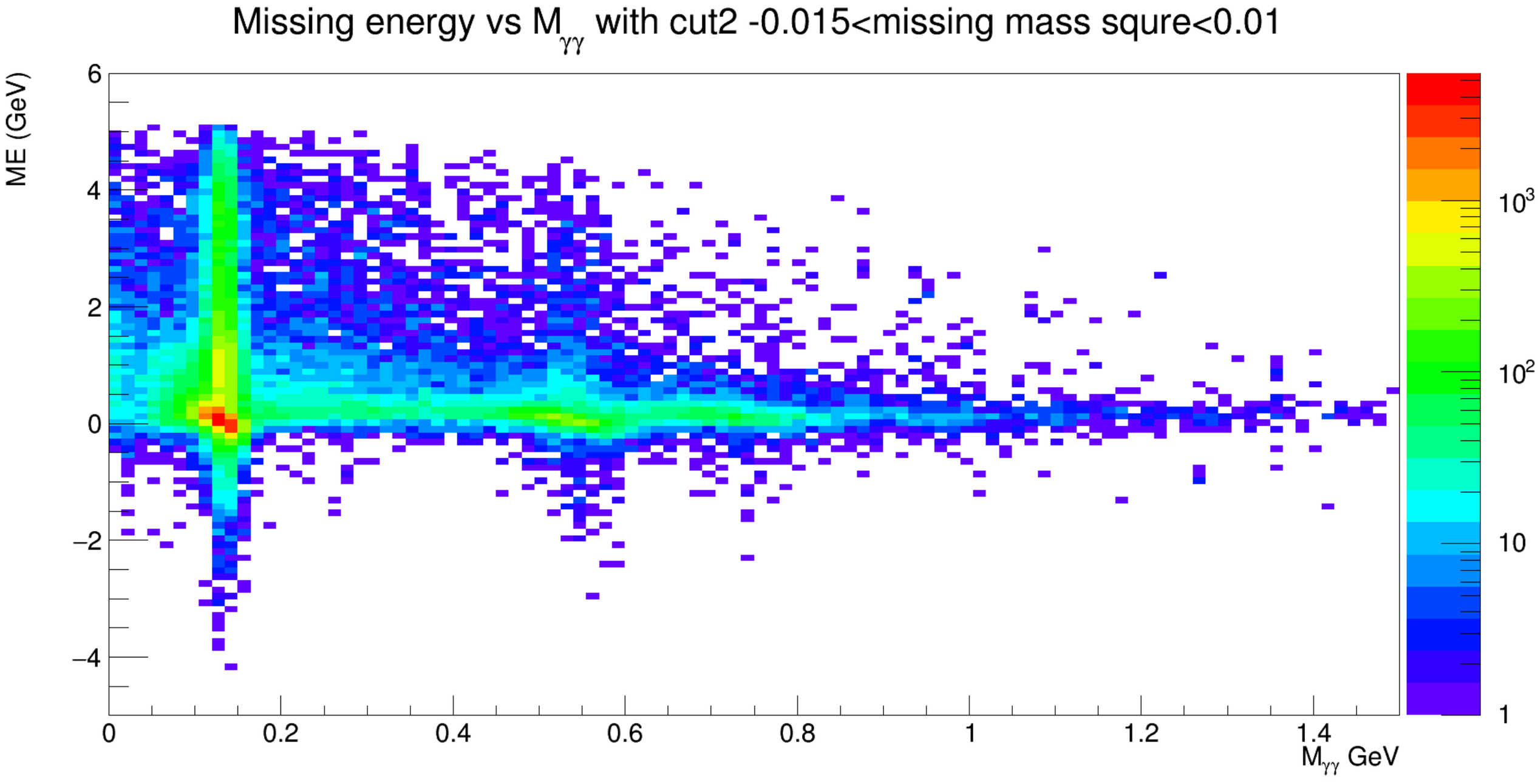






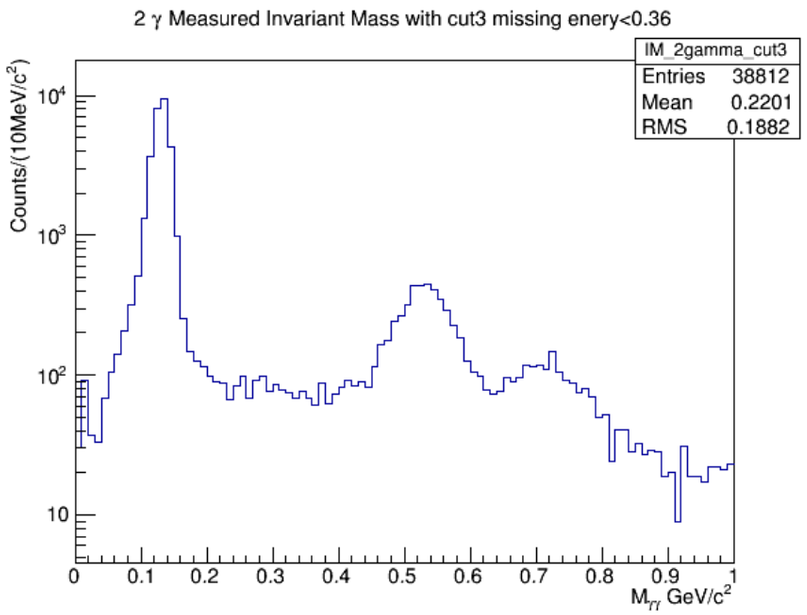
$$-0.015 < MM^2 < 0.01$$

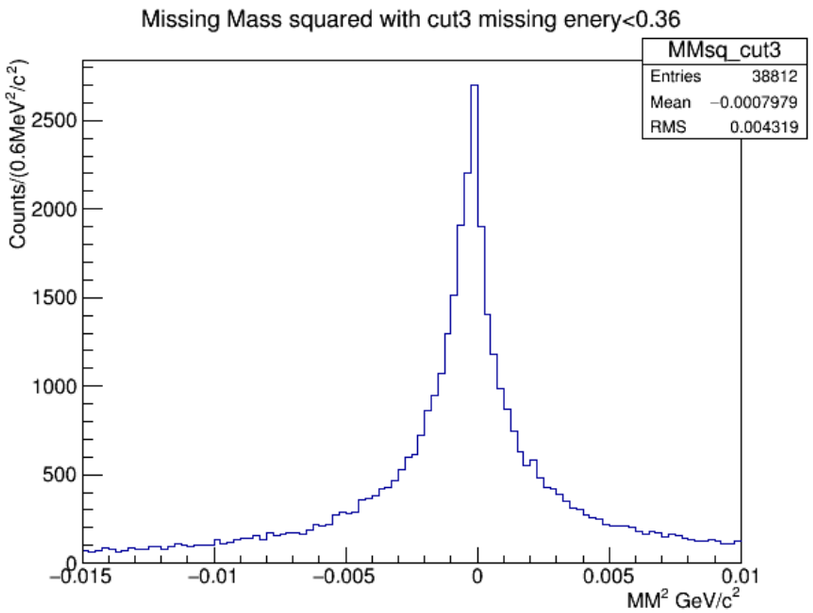
The distributions after cuts 1-2

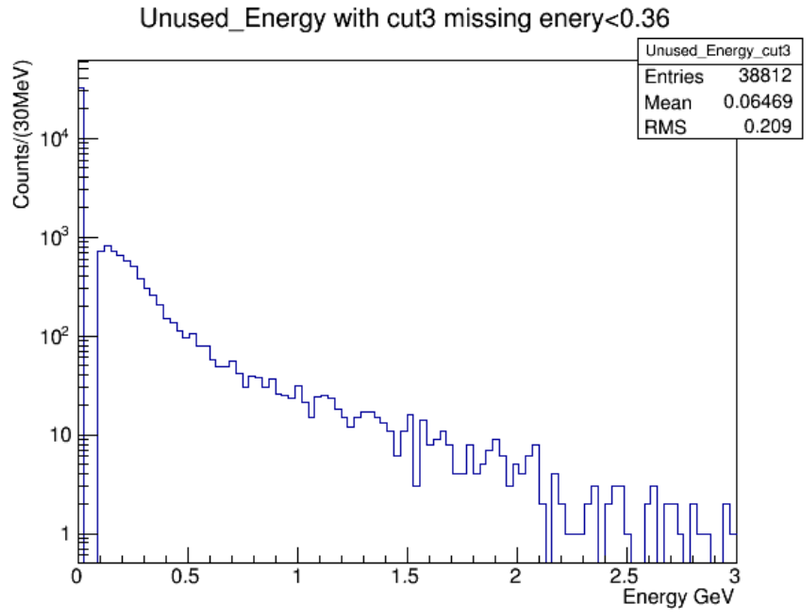


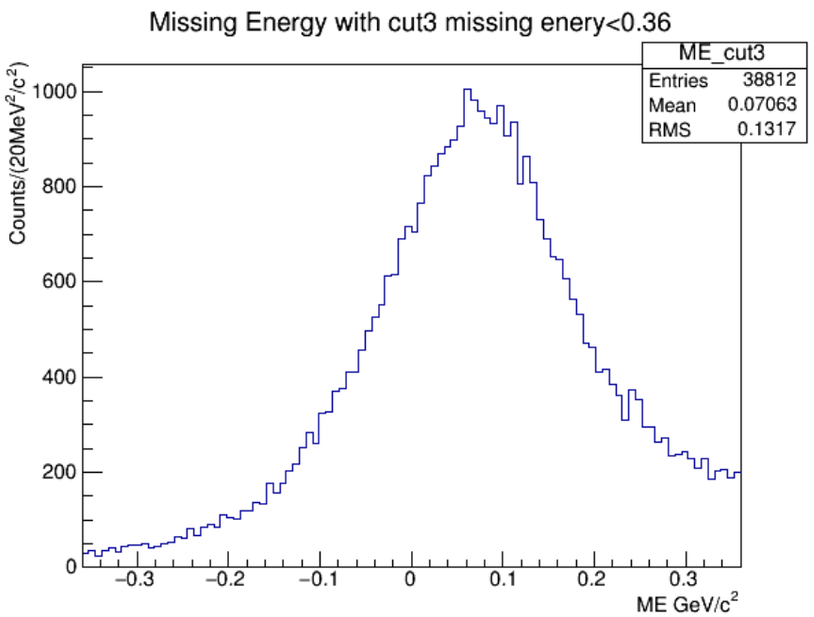
$$-0.015 < MM^2 < 0.01$$

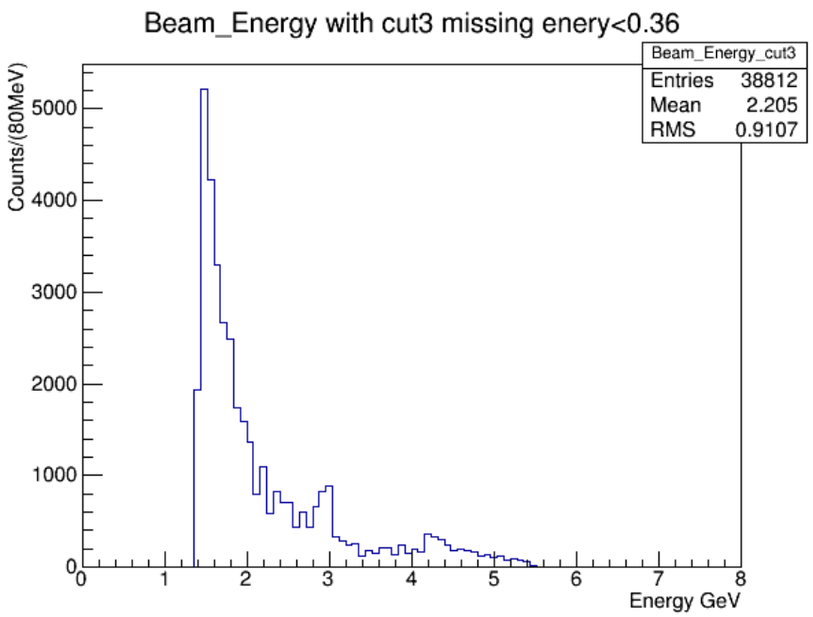
The distributions after cuts 1-3

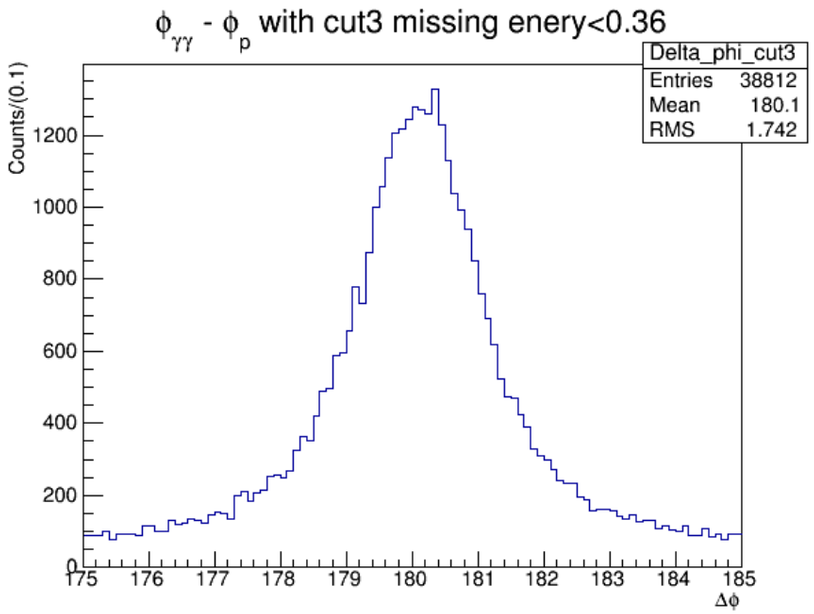






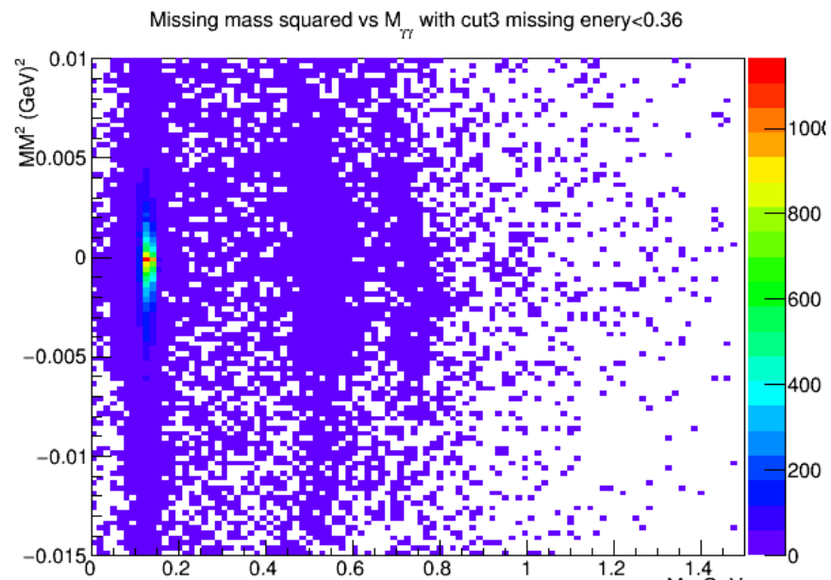


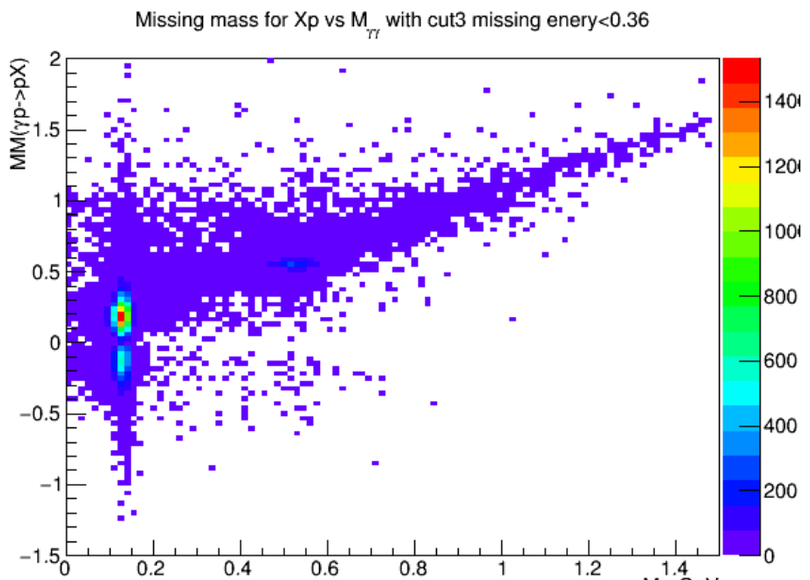


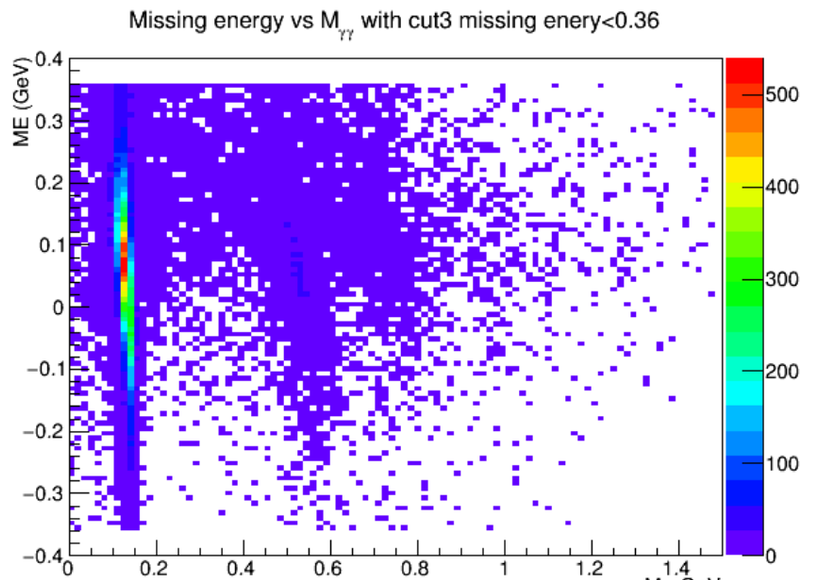


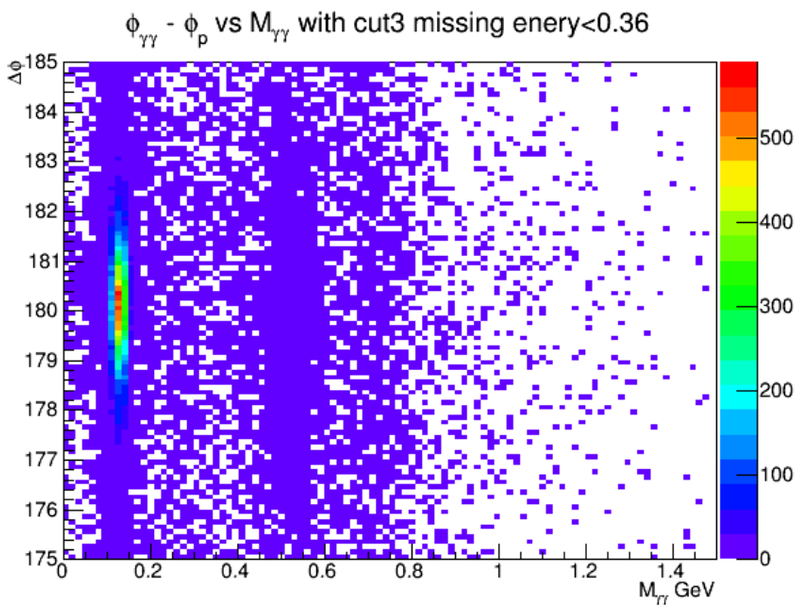
$$ME < 0.36$$

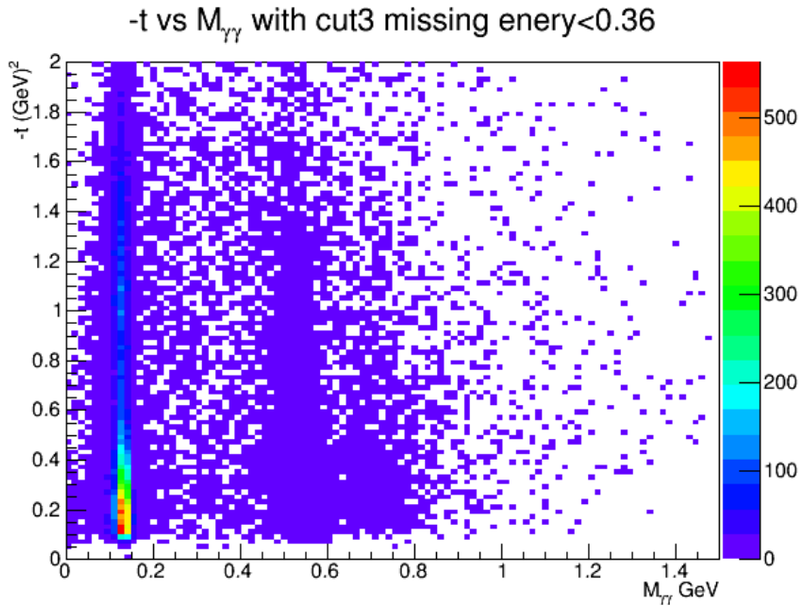
The distributions after cuts 1-3

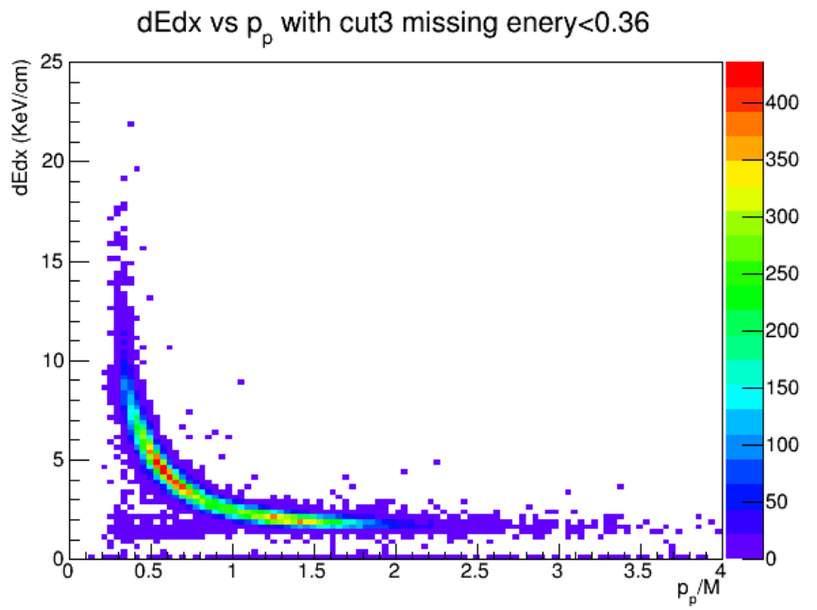






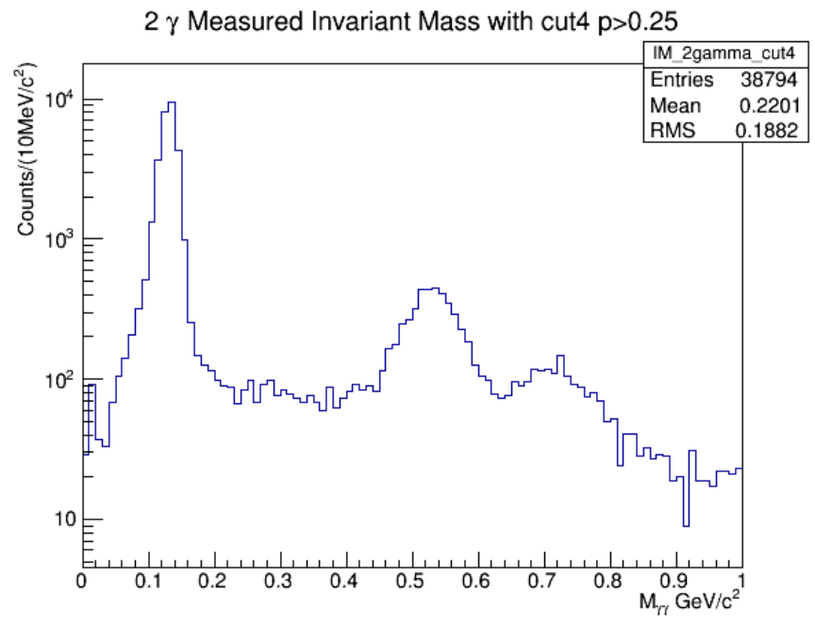


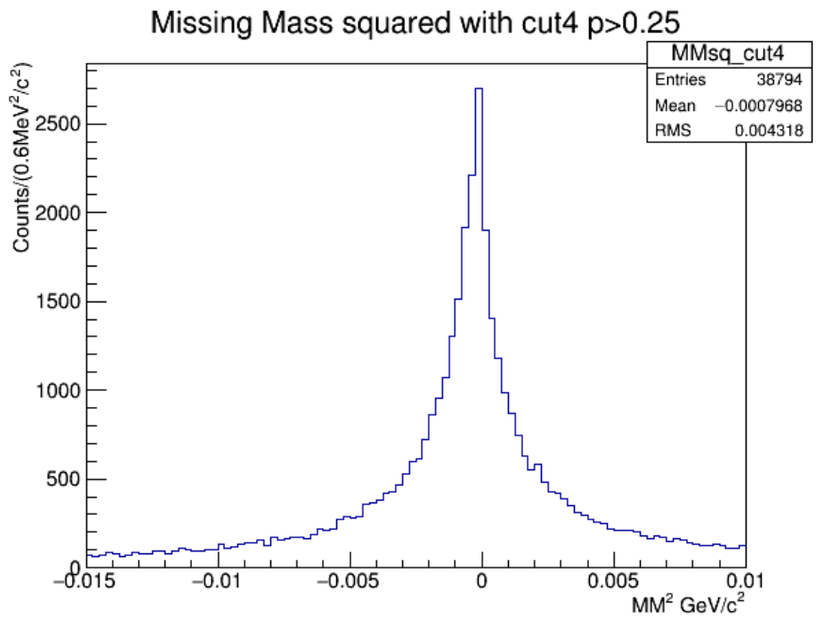


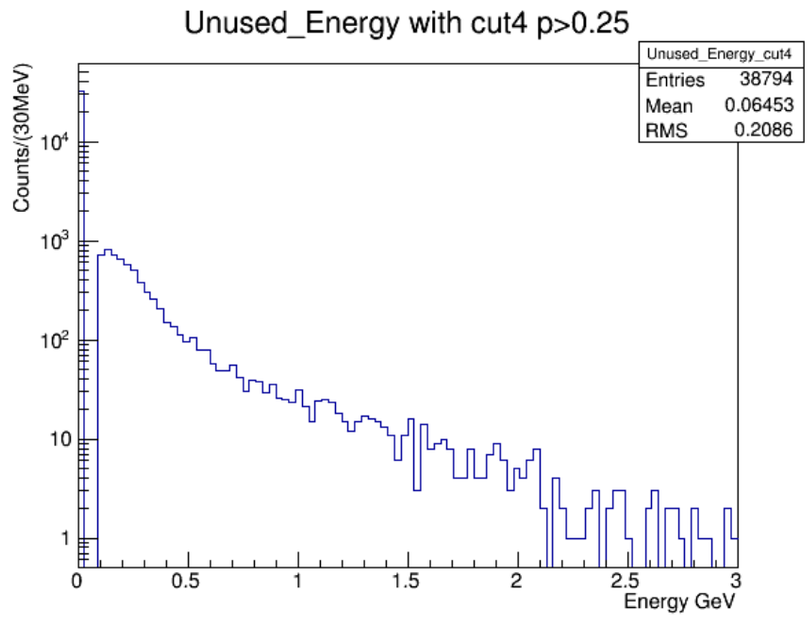


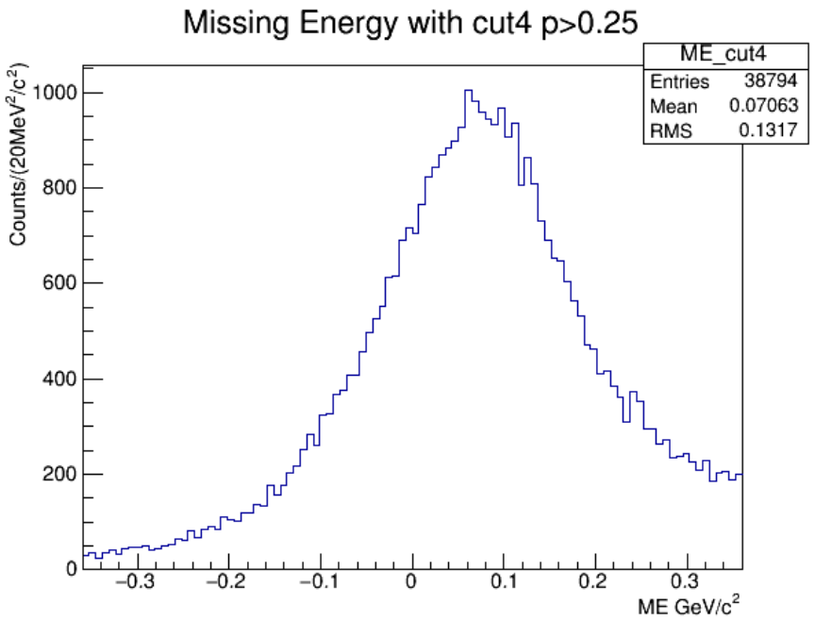
$$ME < 0.36$$

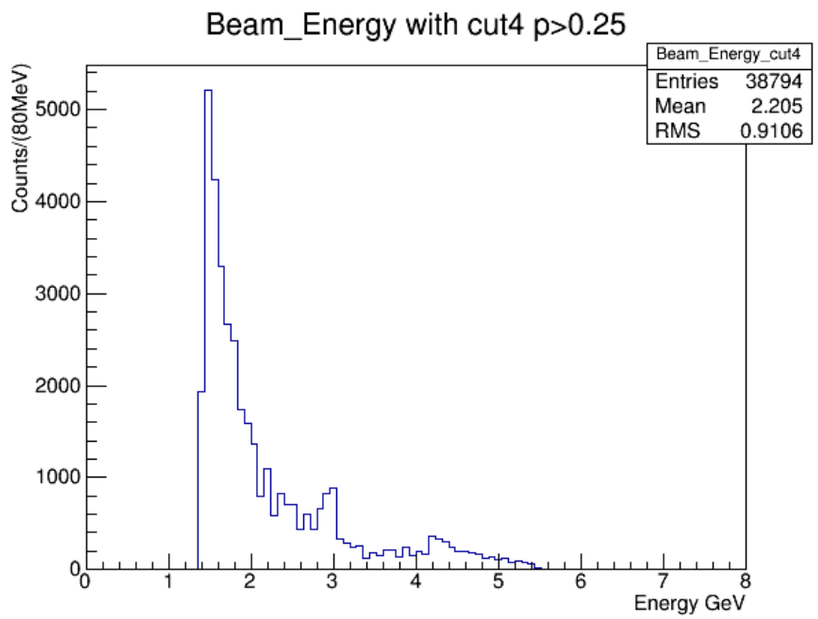
The distributions after cuts 1-4

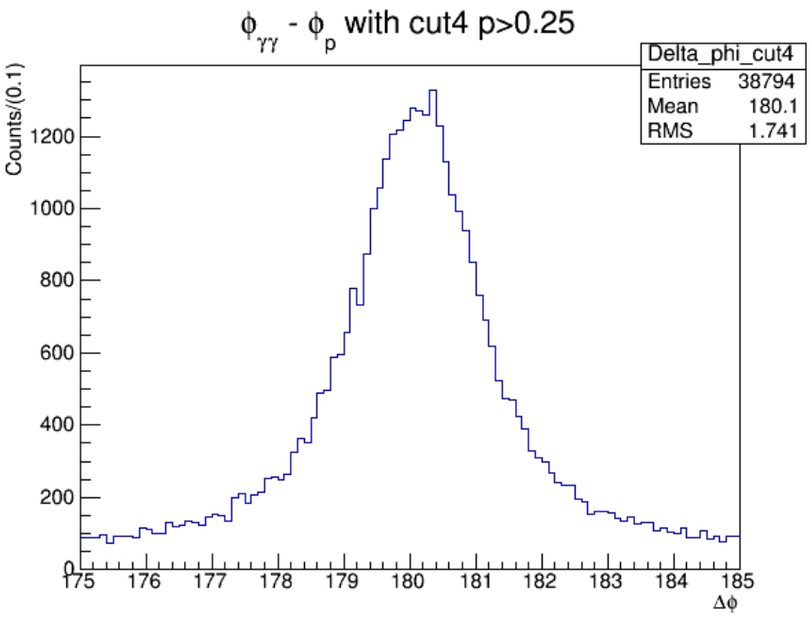






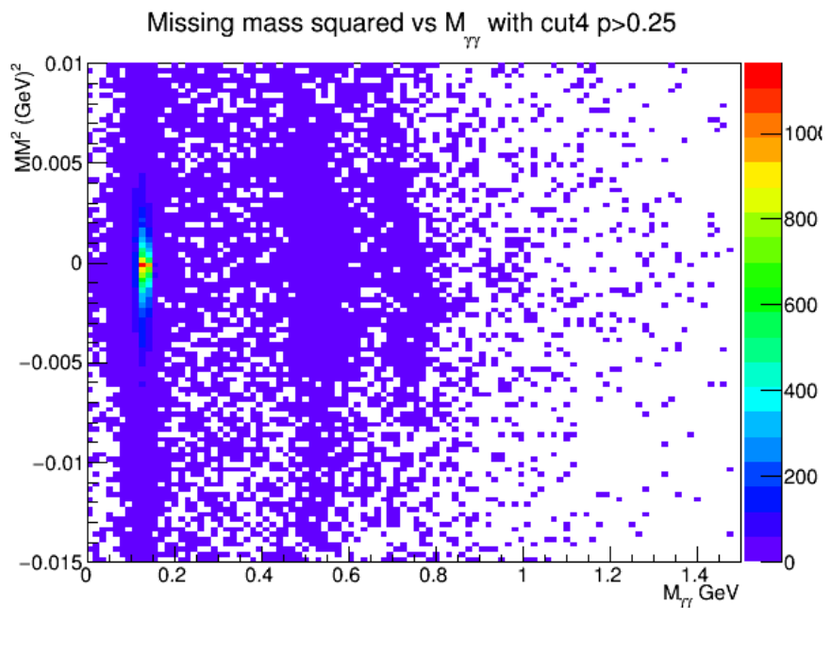


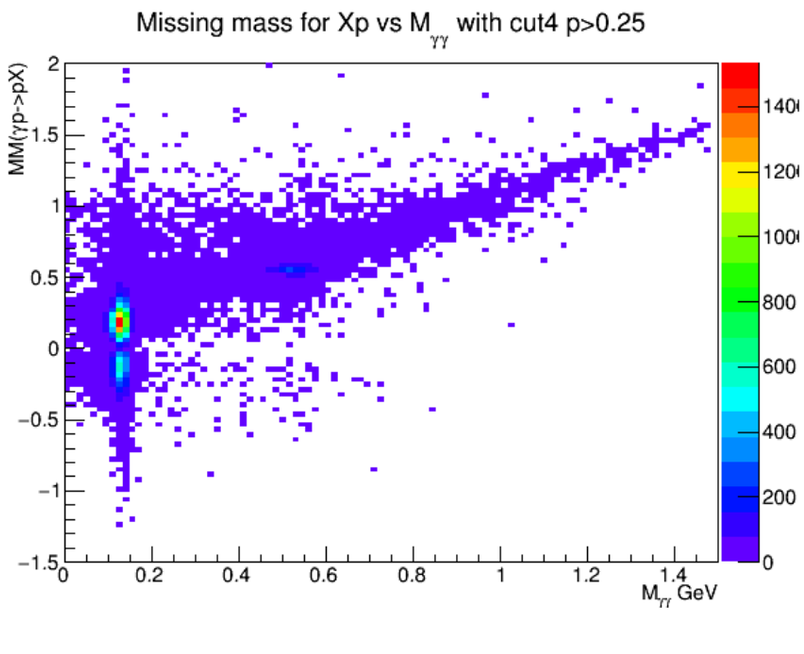


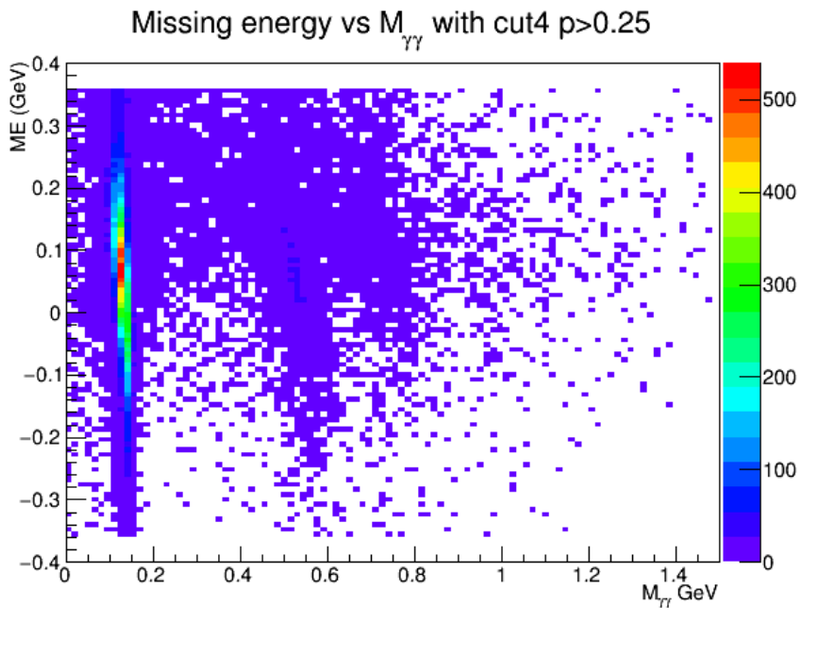


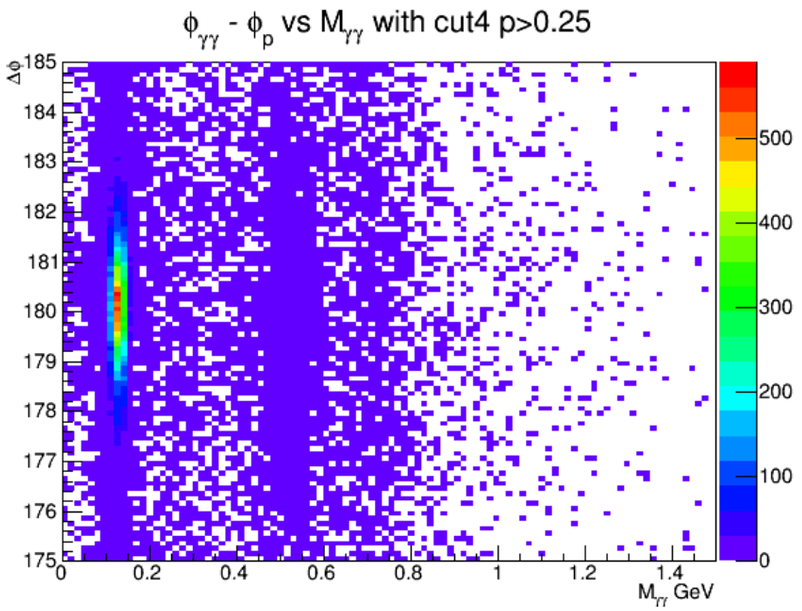
$$p > 0.25$$

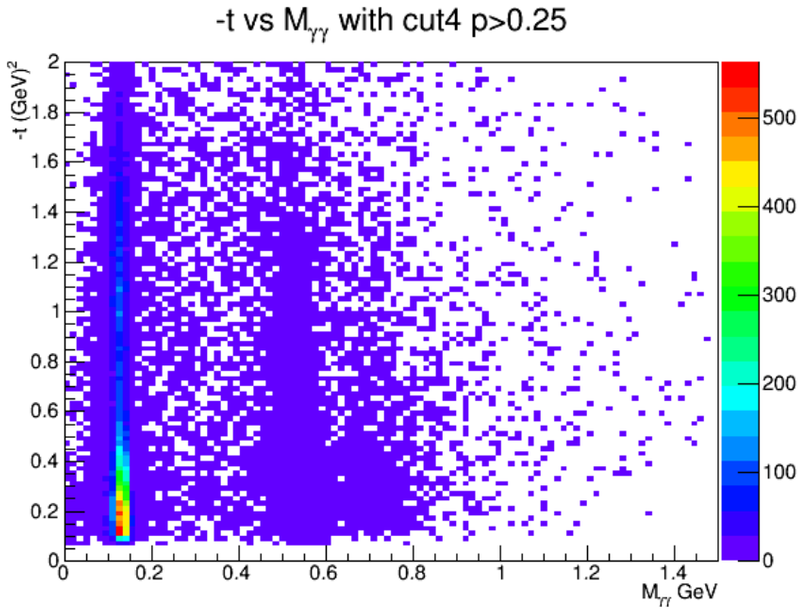
The distributions after cuts 1-4

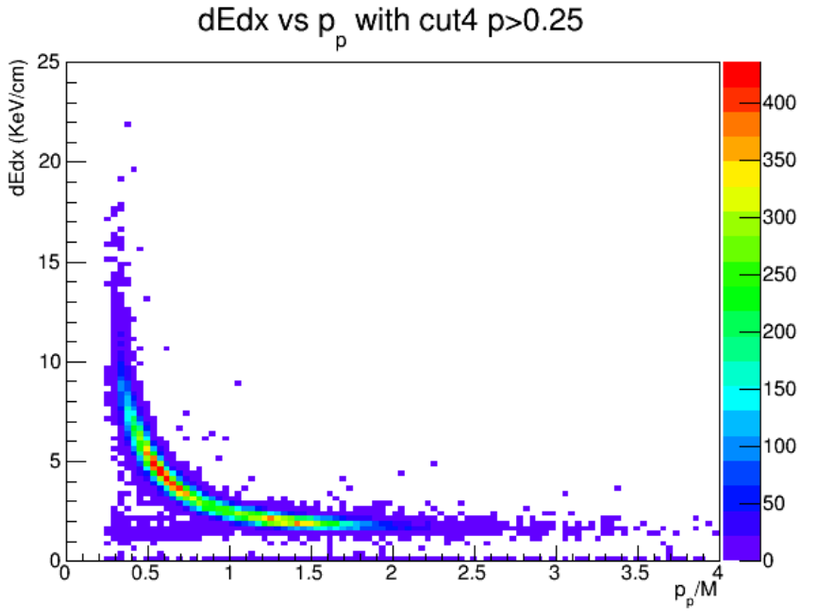






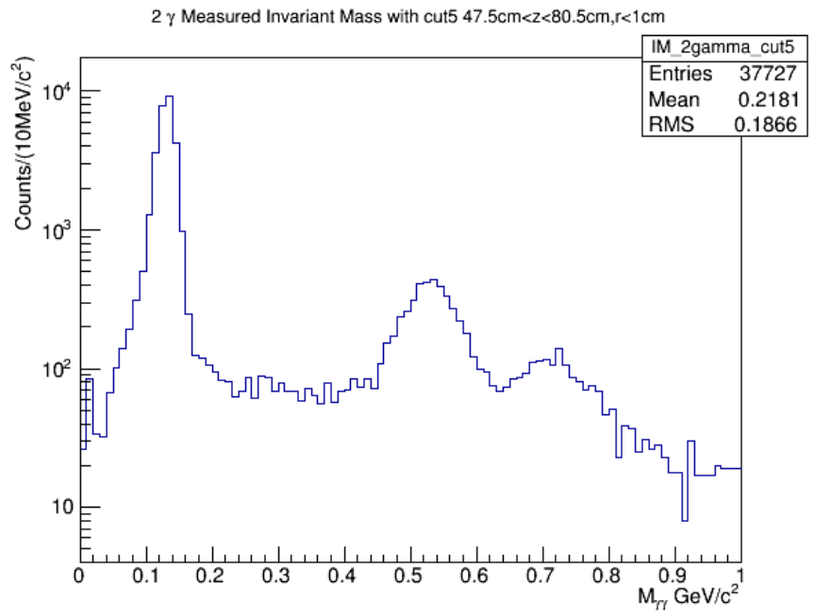


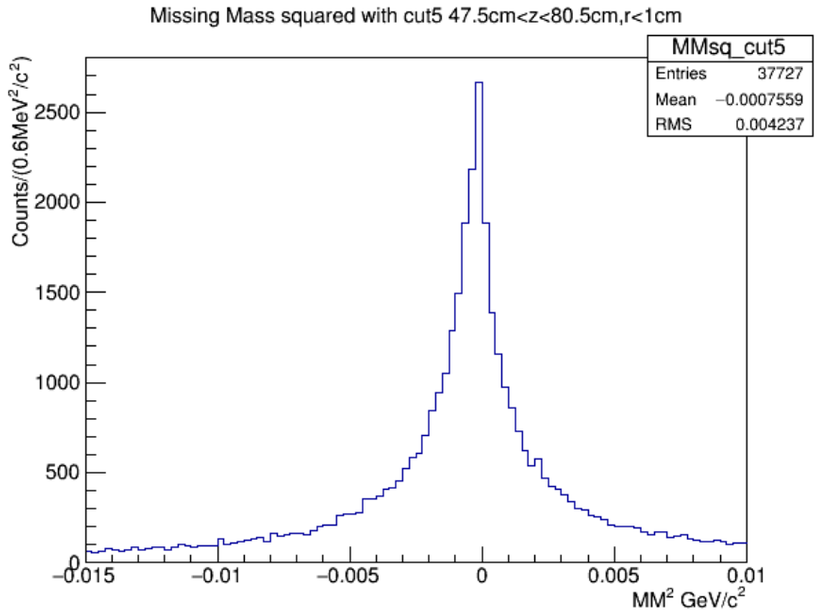


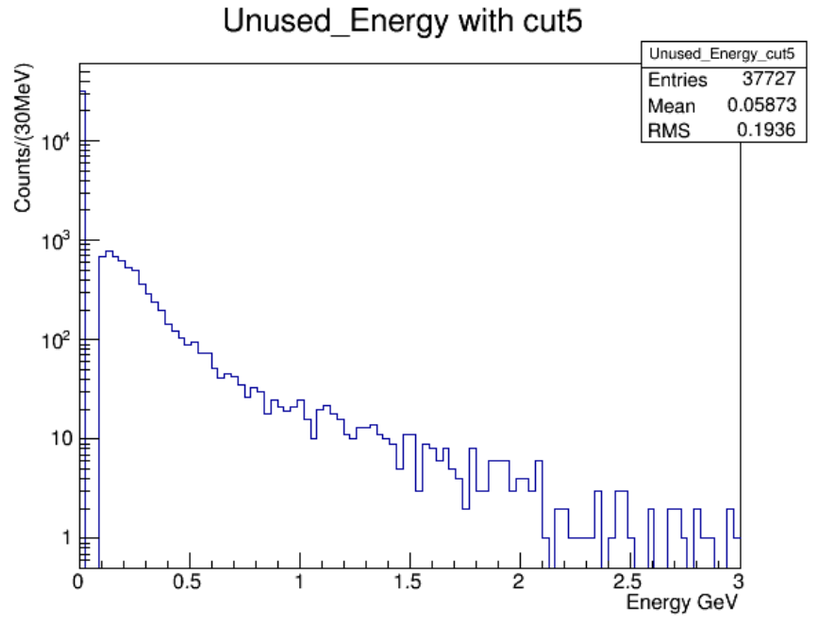


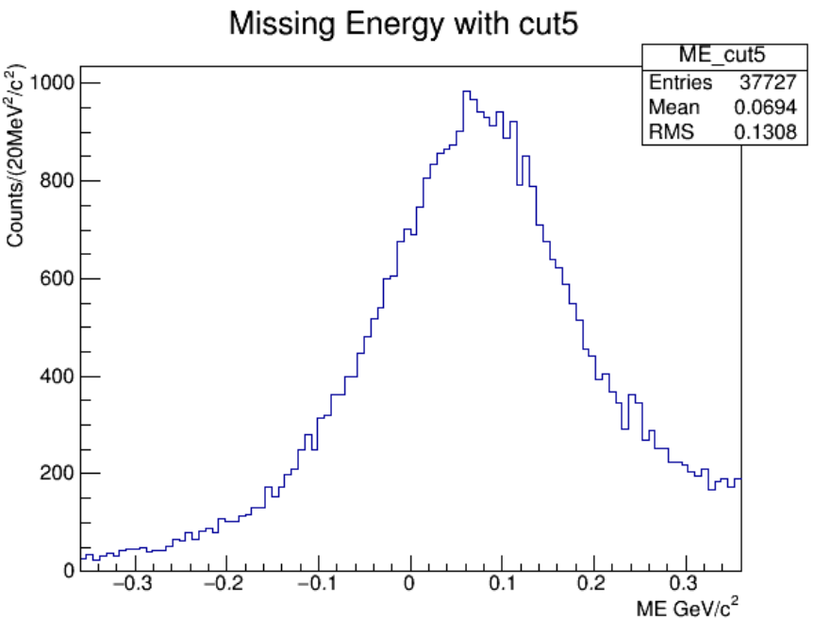
$$p > 0.25$$

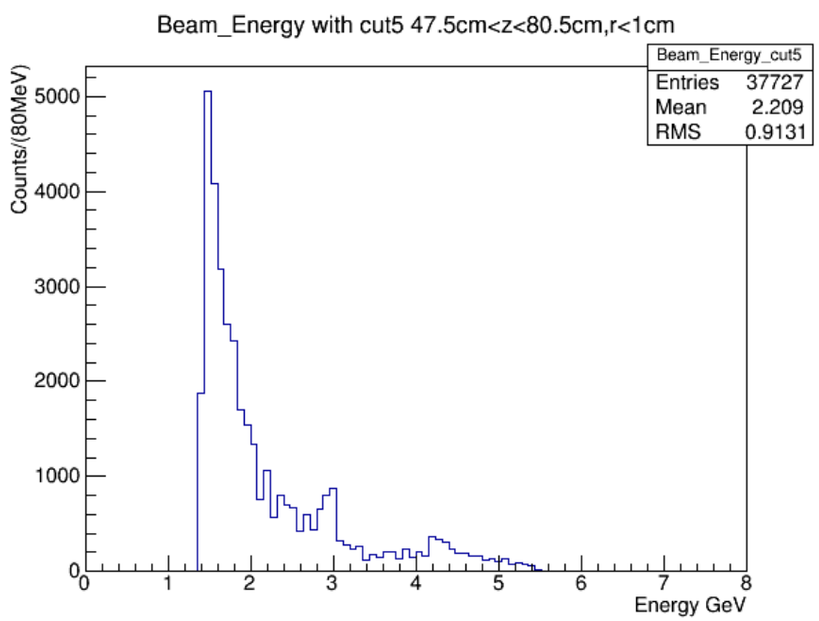
The distributions after cuts 1-5

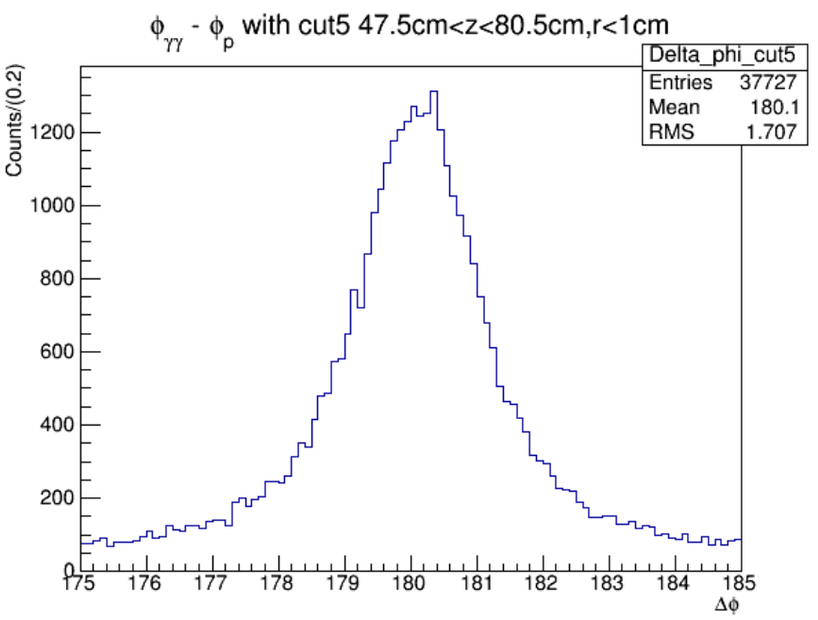






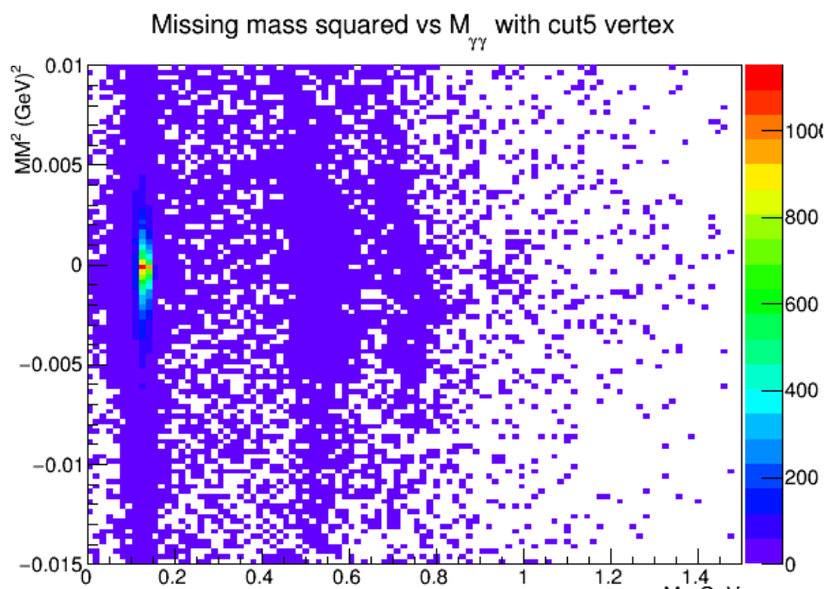


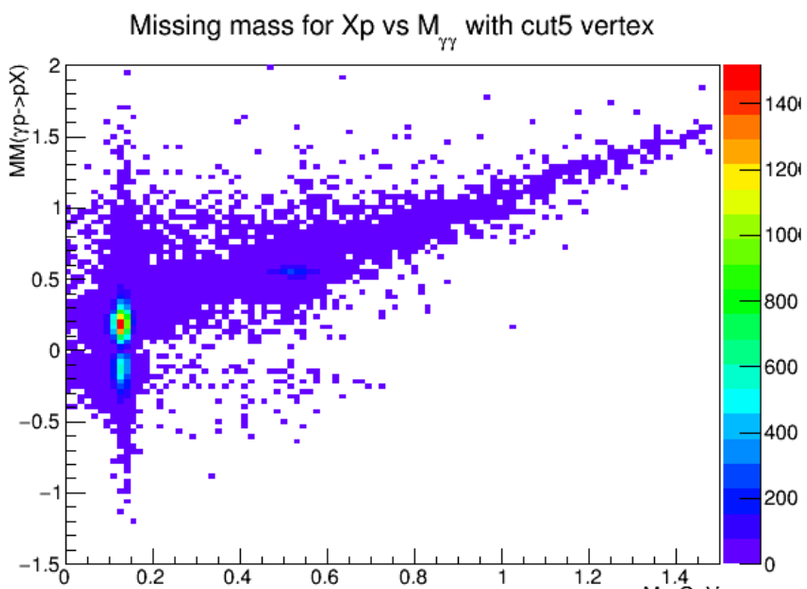


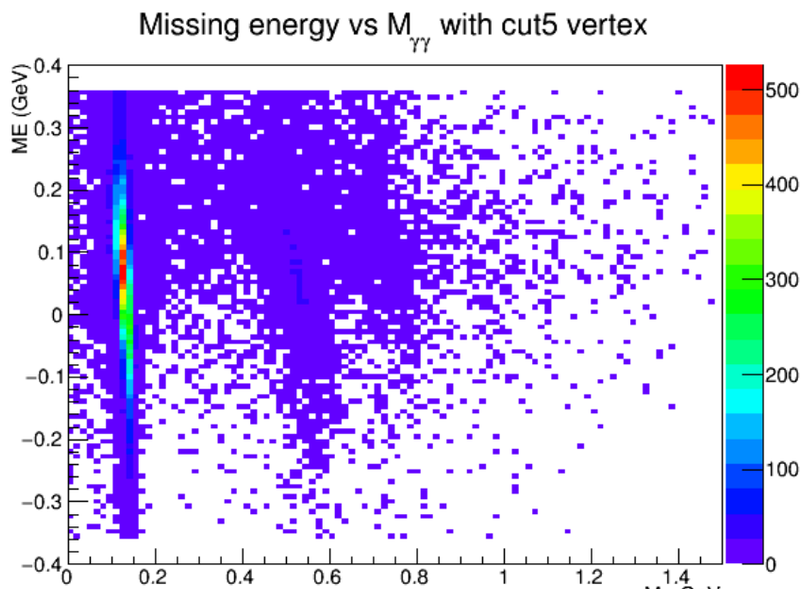


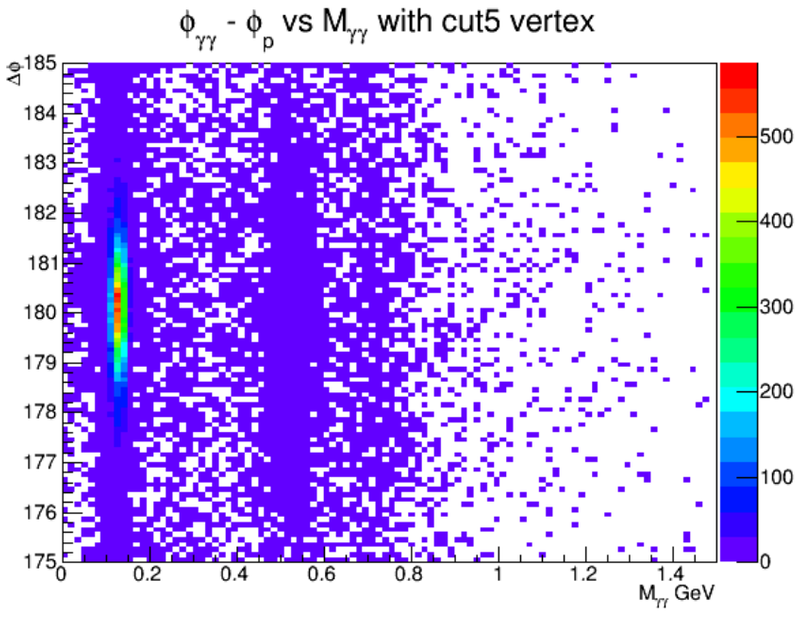
$$47.5 < z < 80.5, r < 1$$

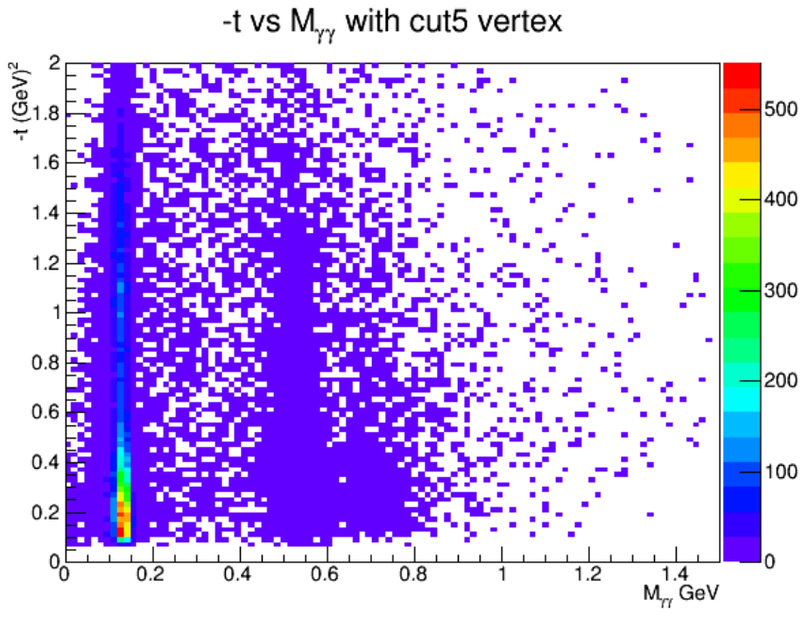
The distributions after cuts 1-5

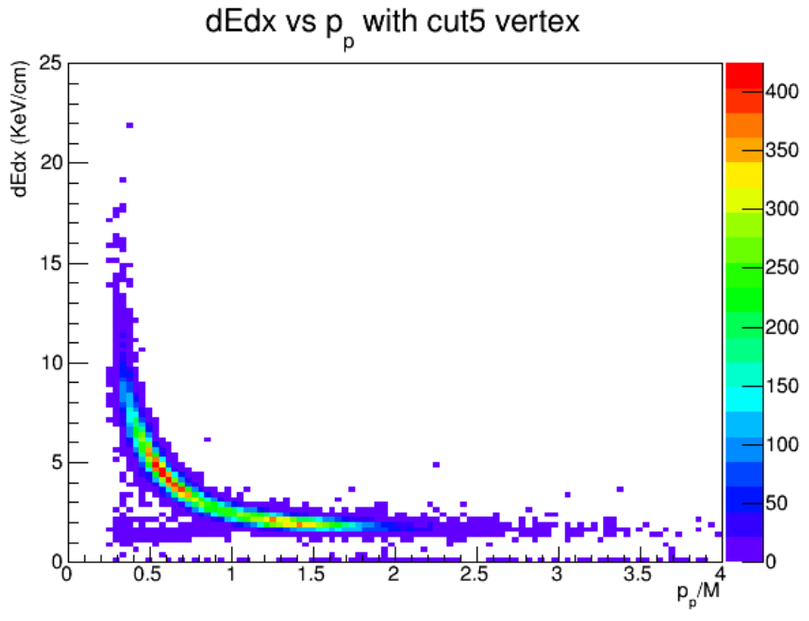






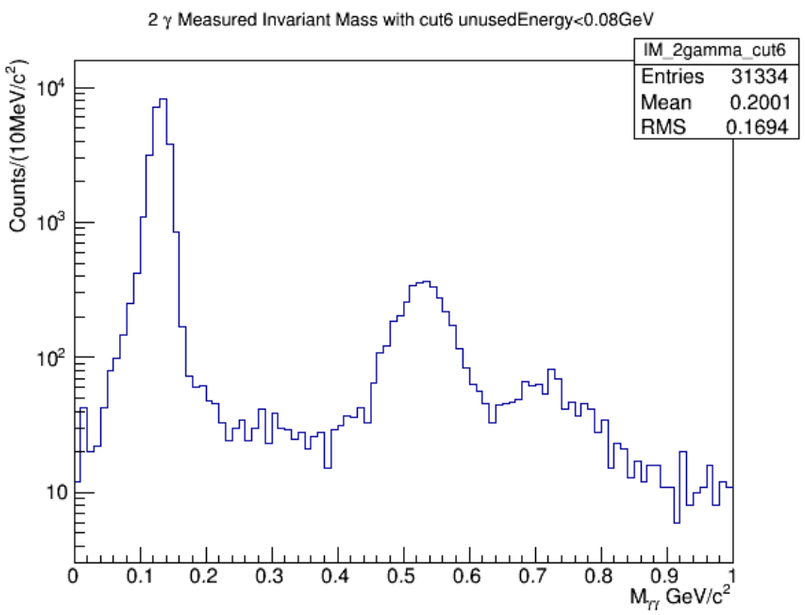


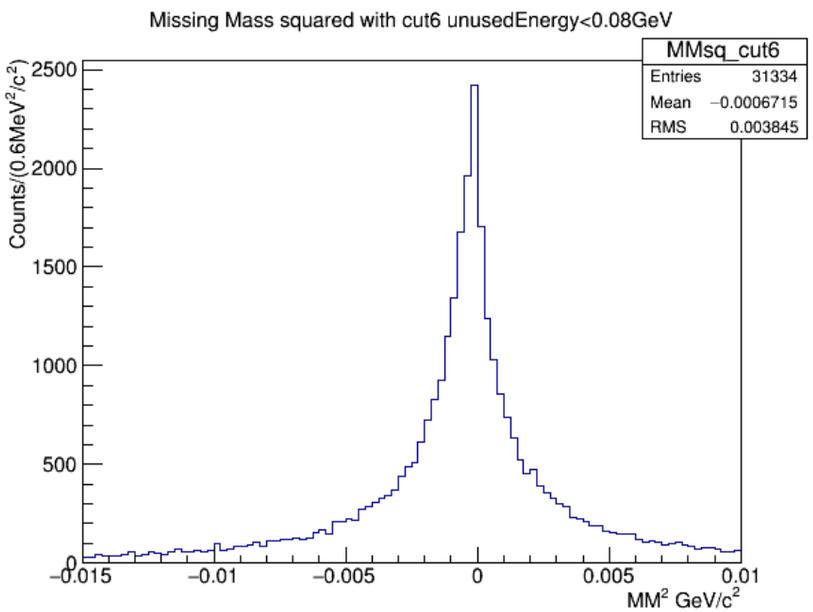


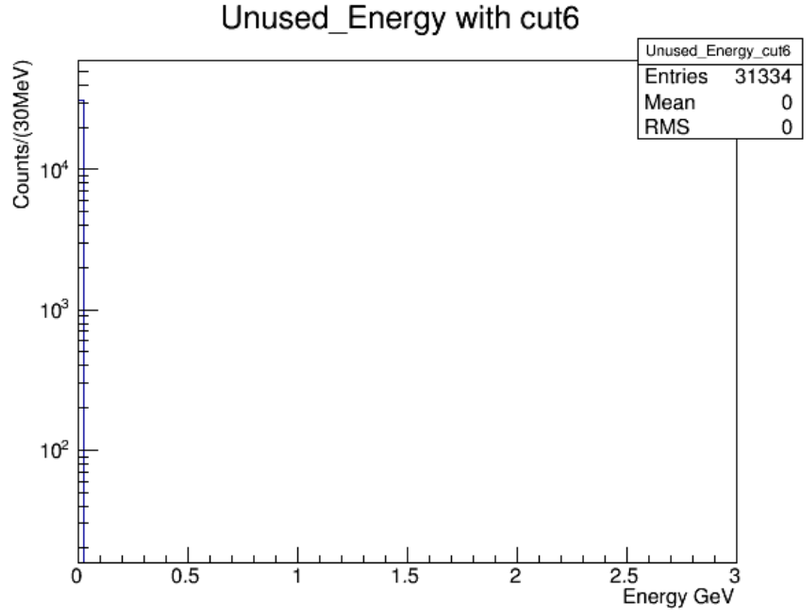


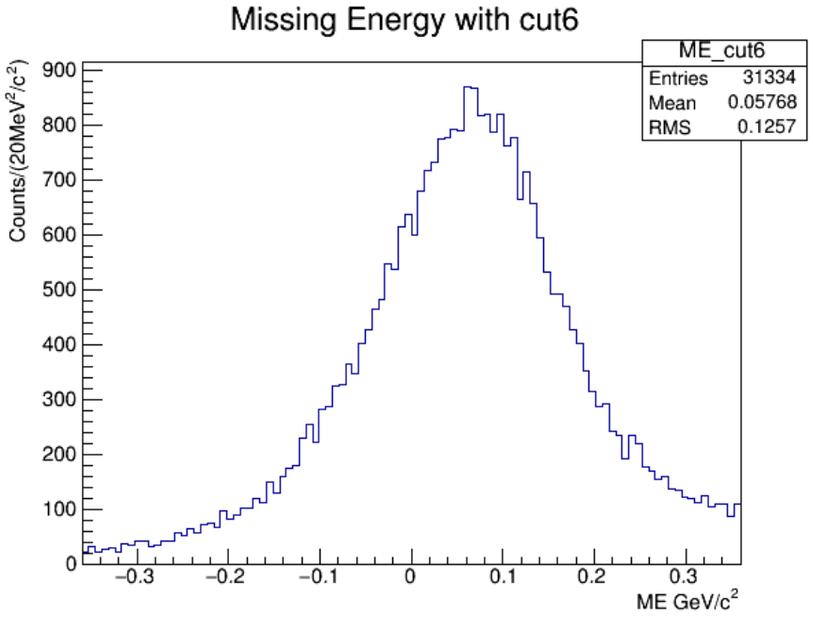
$$47.5 < z < 80.5, r < 1$$

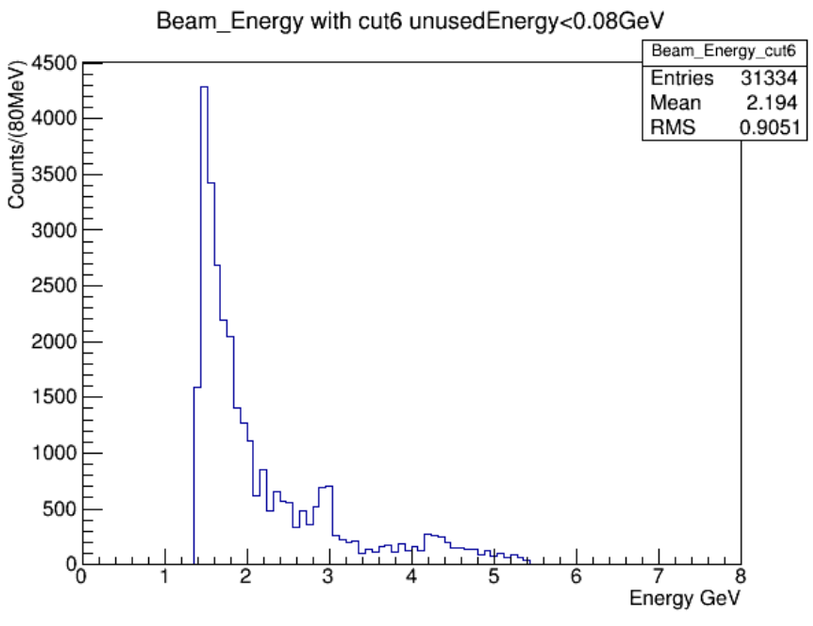
The distributions after cuts 1-6

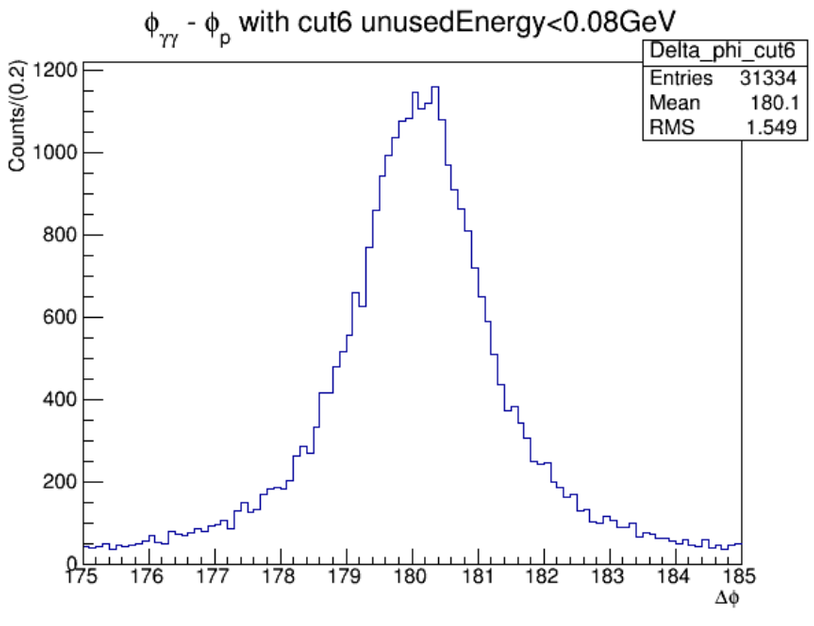






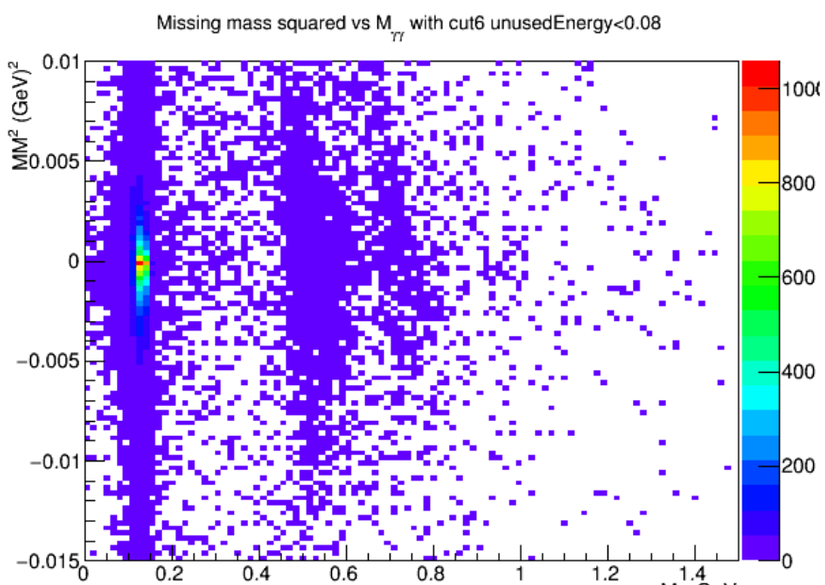


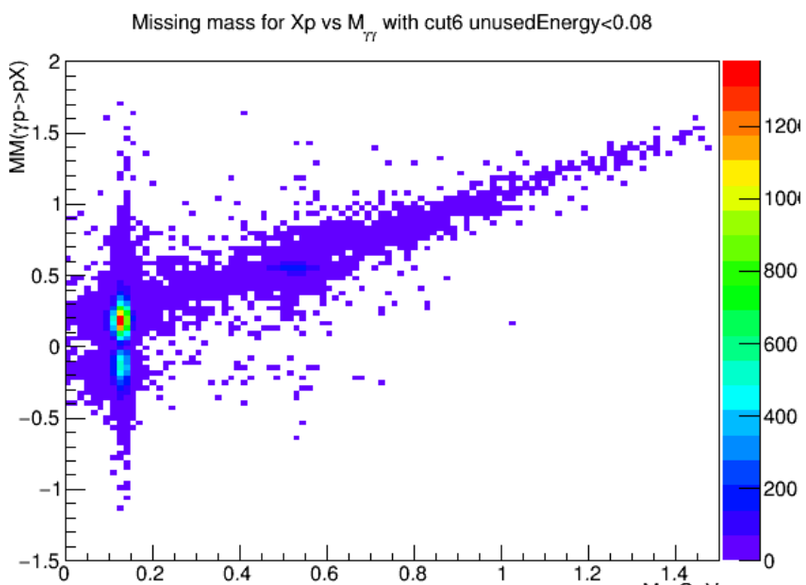


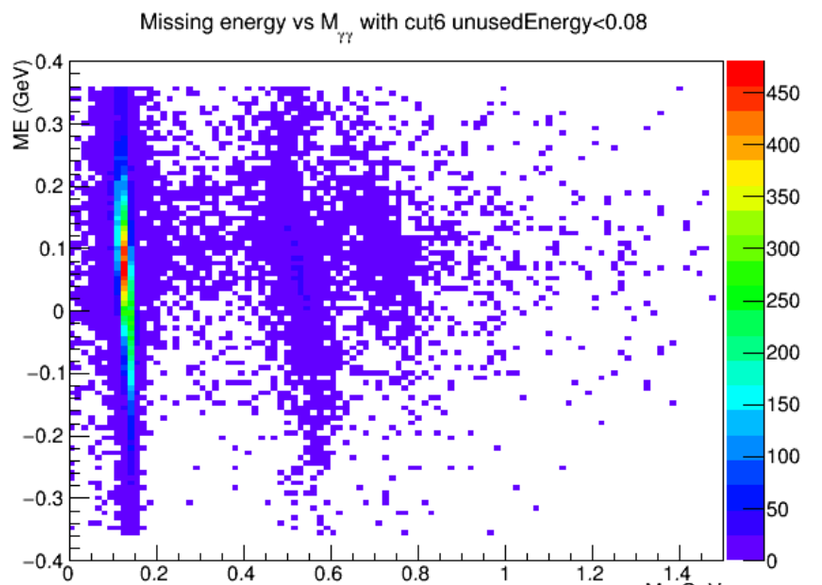


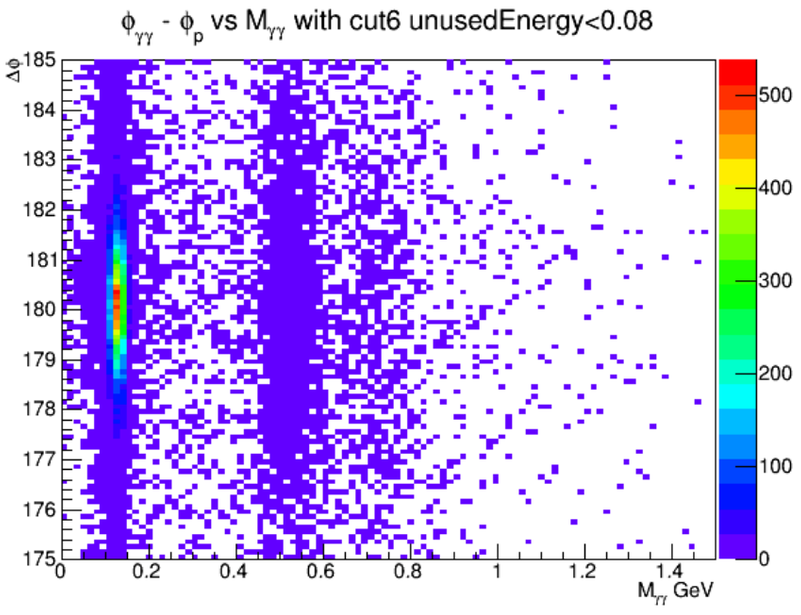
UnusedEnergy < 0.08

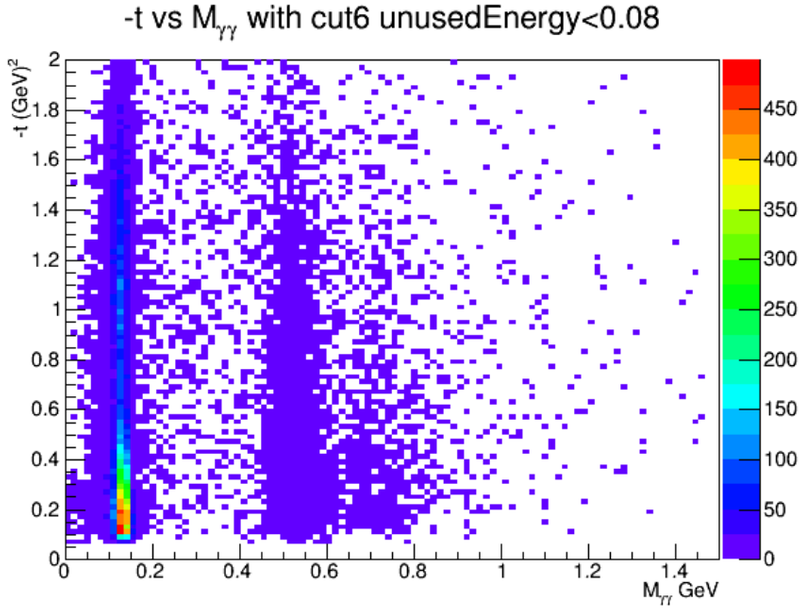
The distributions after cuts 1-6

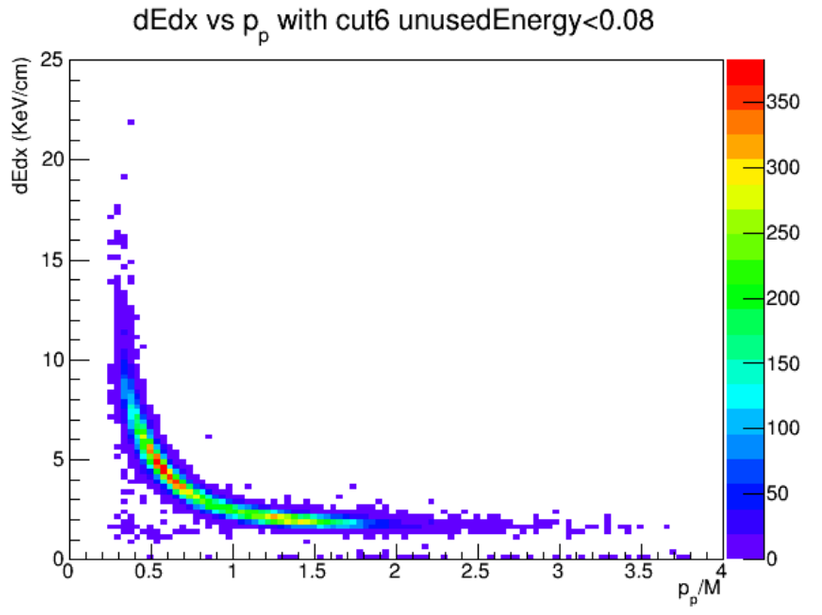






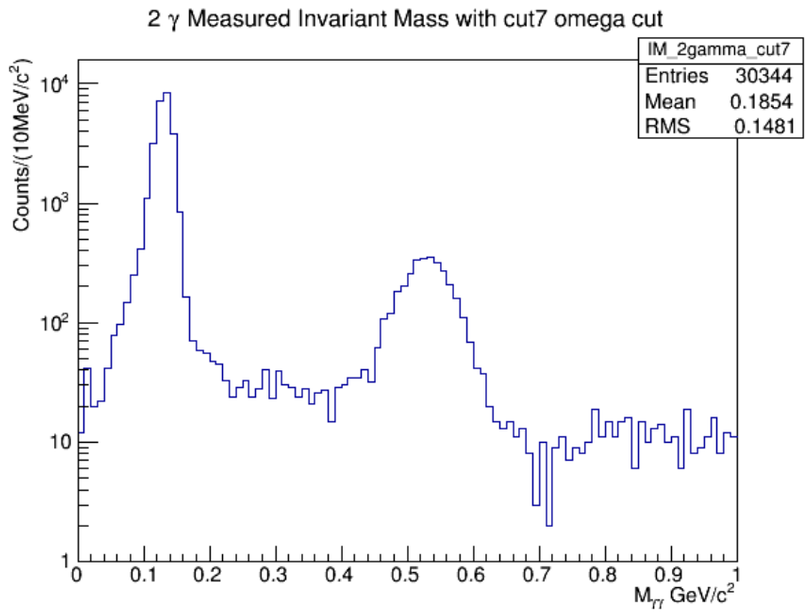


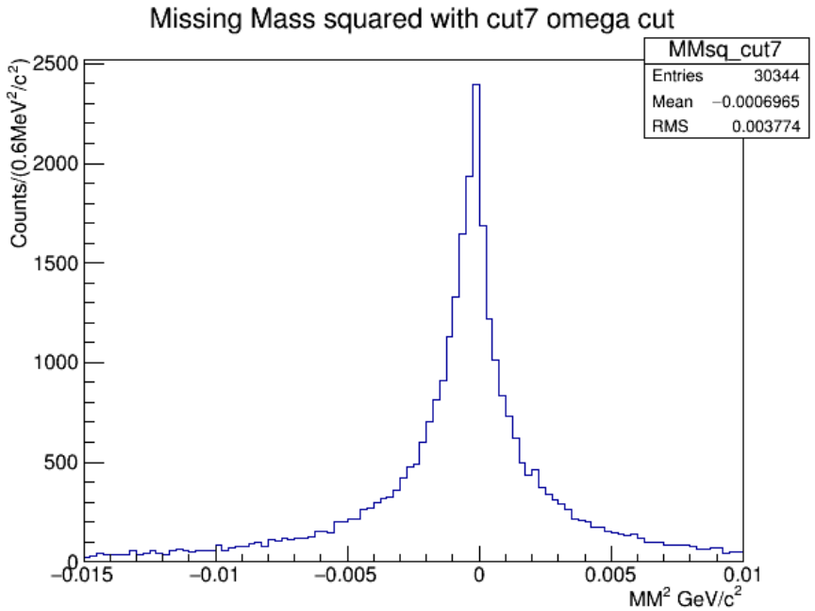


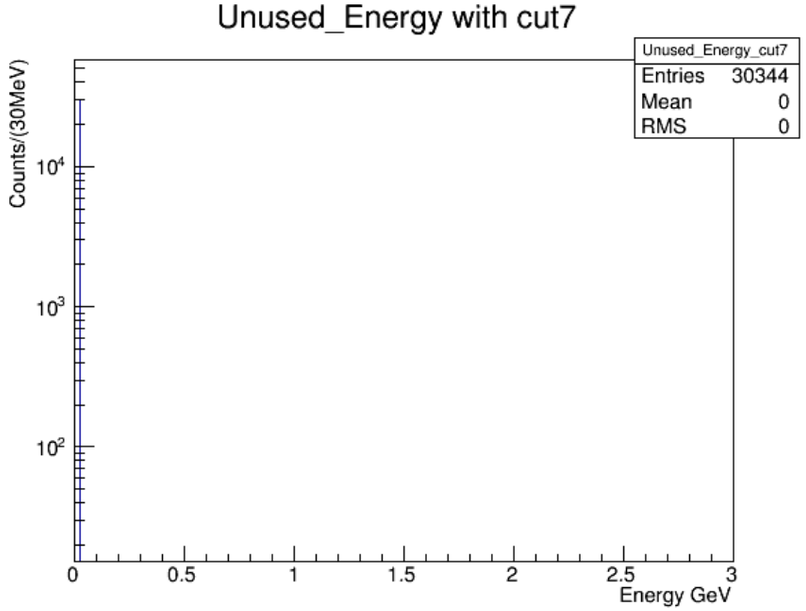


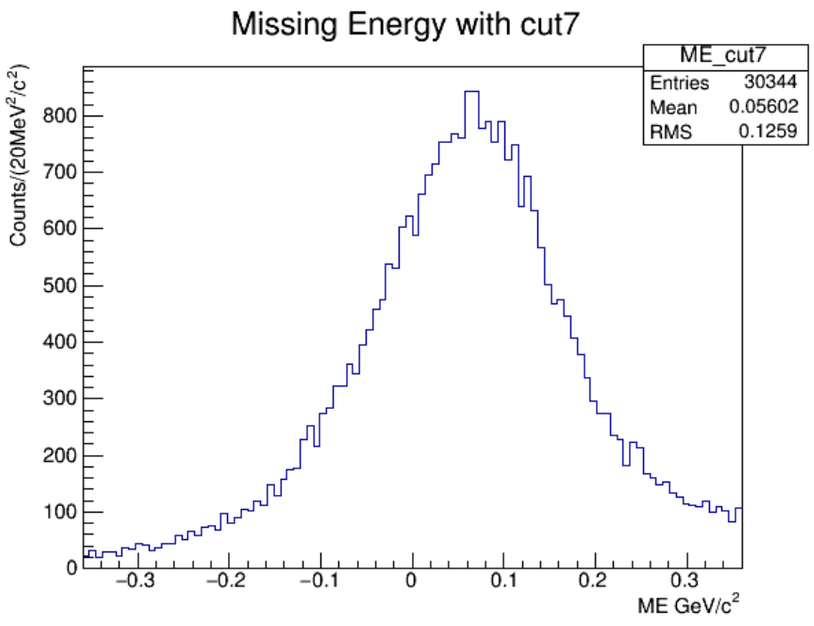
UnusedEnergy < 0.08

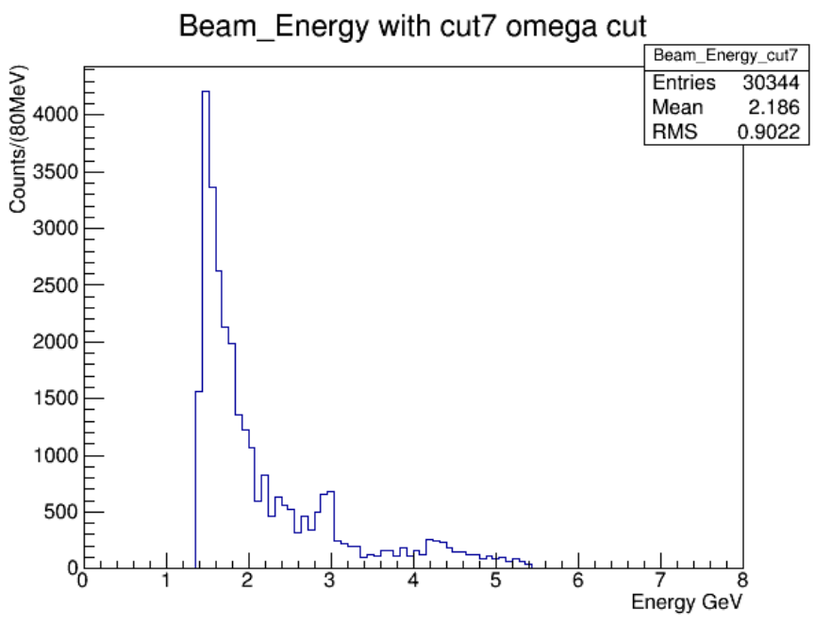
The distributions after cuts 1-7

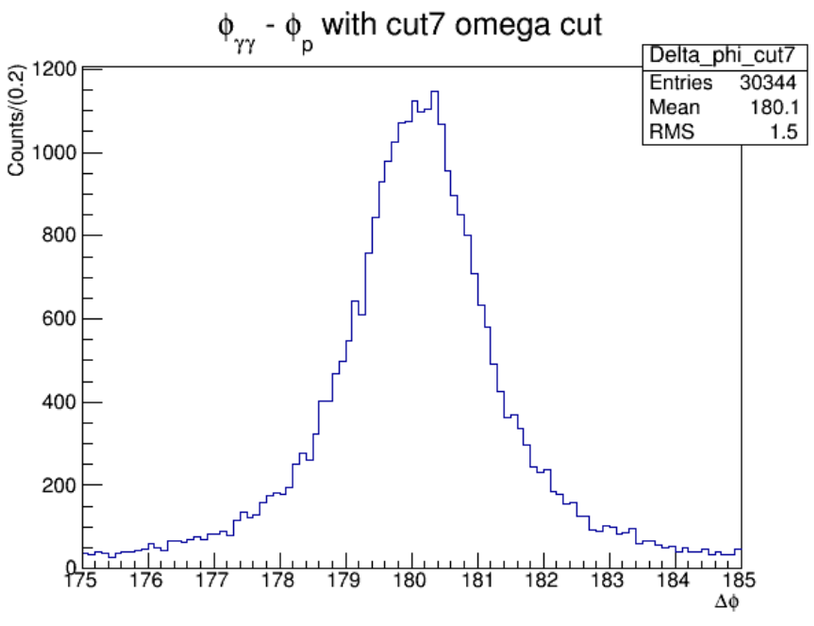






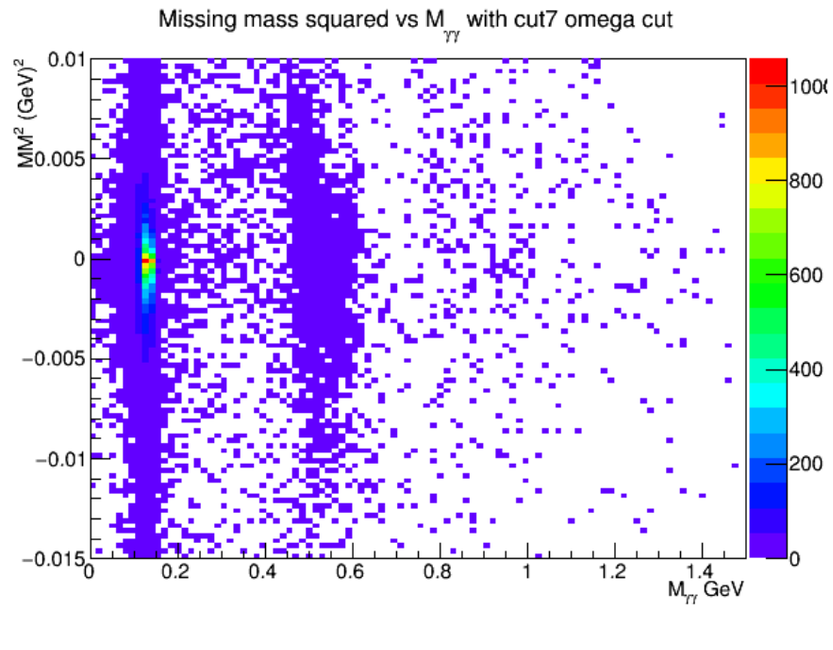


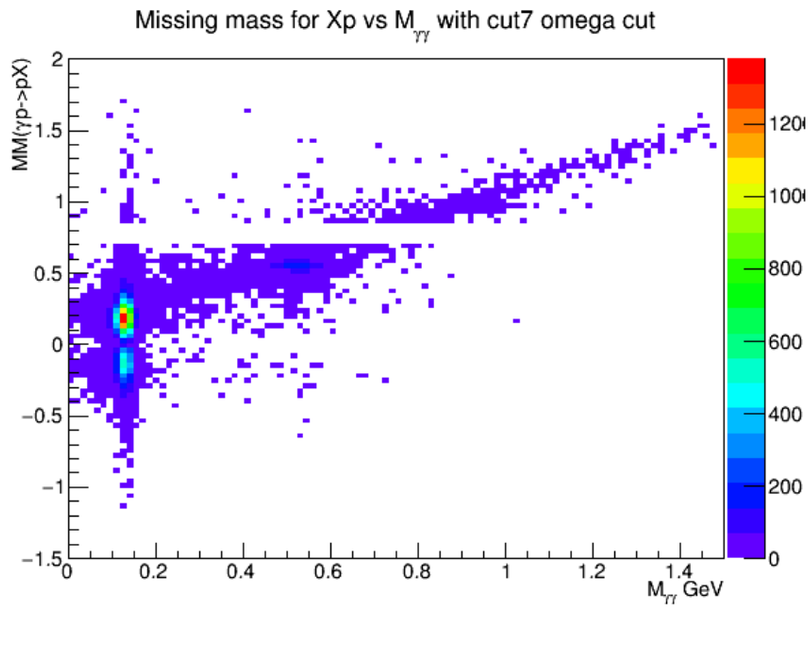


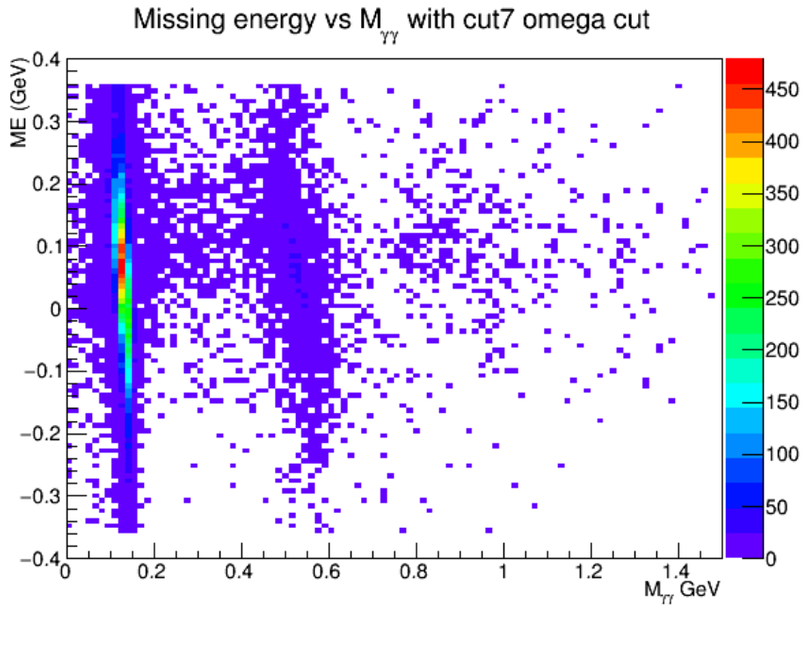


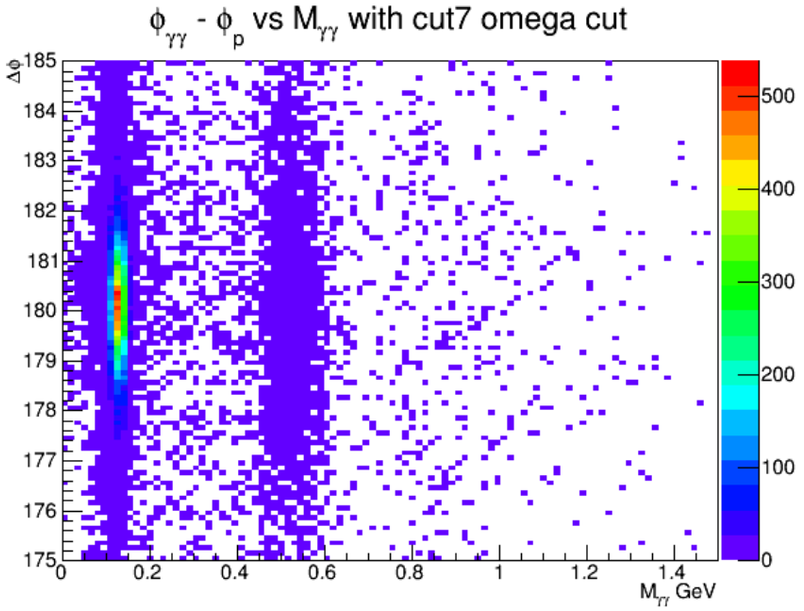
$$MM(\gamma p \to pX) > 0.85 \text{ or } < 0.7$$

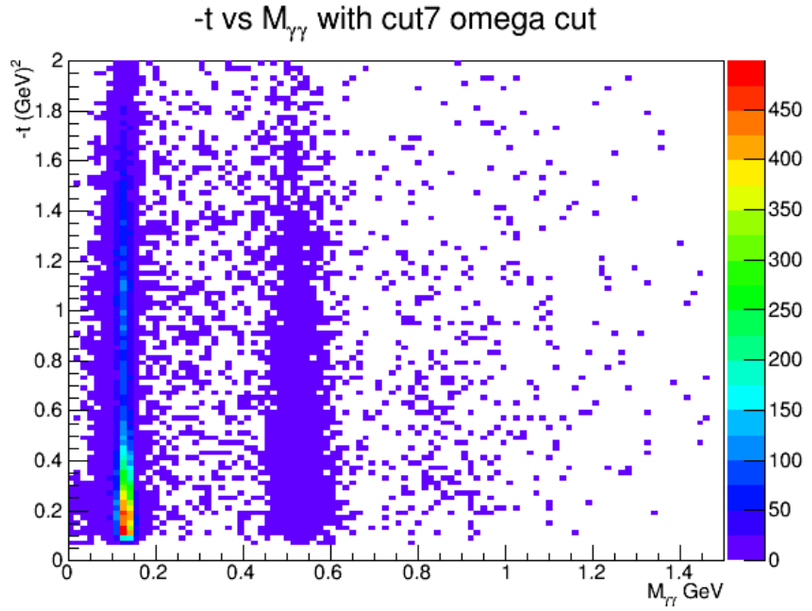
The distributions after cuts 1-7

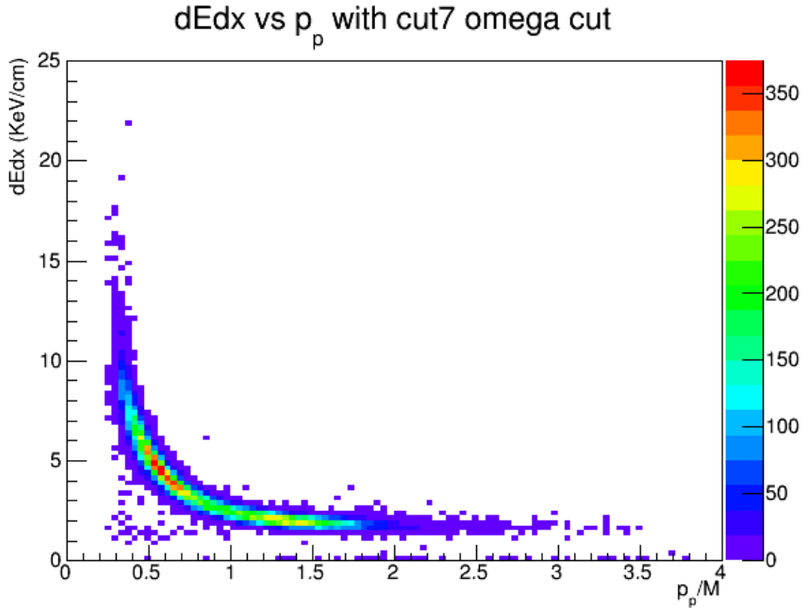






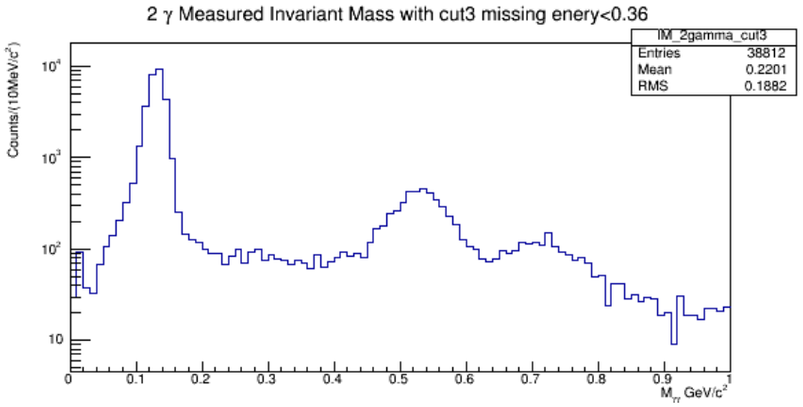


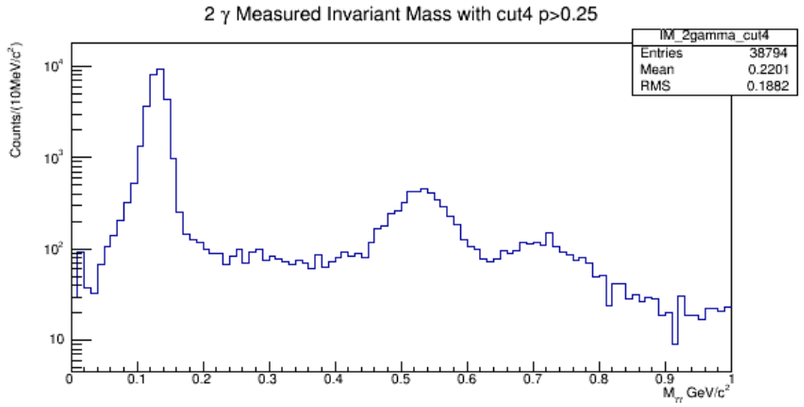


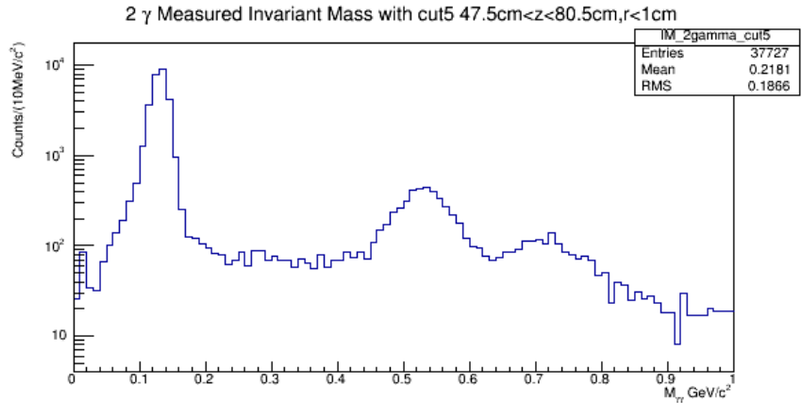


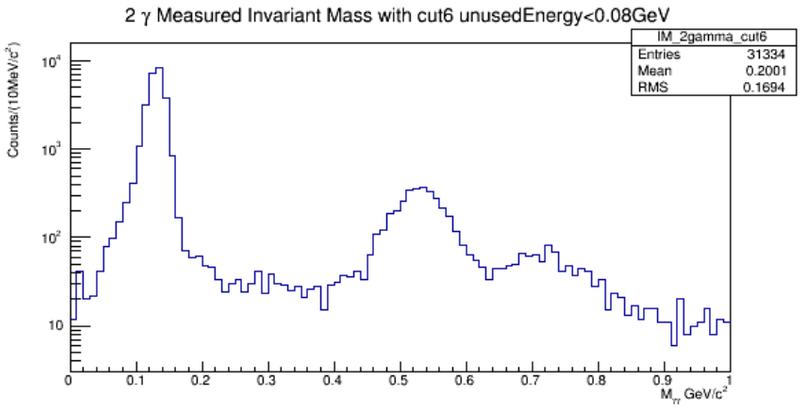
$$MM(\gamma p \to pX) > 0.85 \text{ or } < 0.7$$

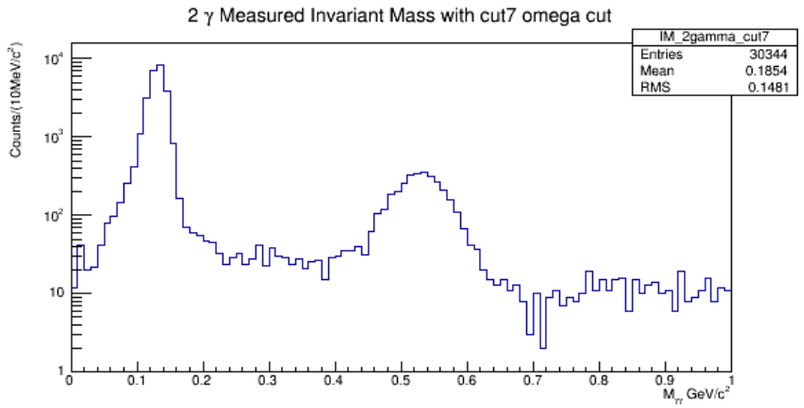
The distributions of the Invariant mass of 2 photons



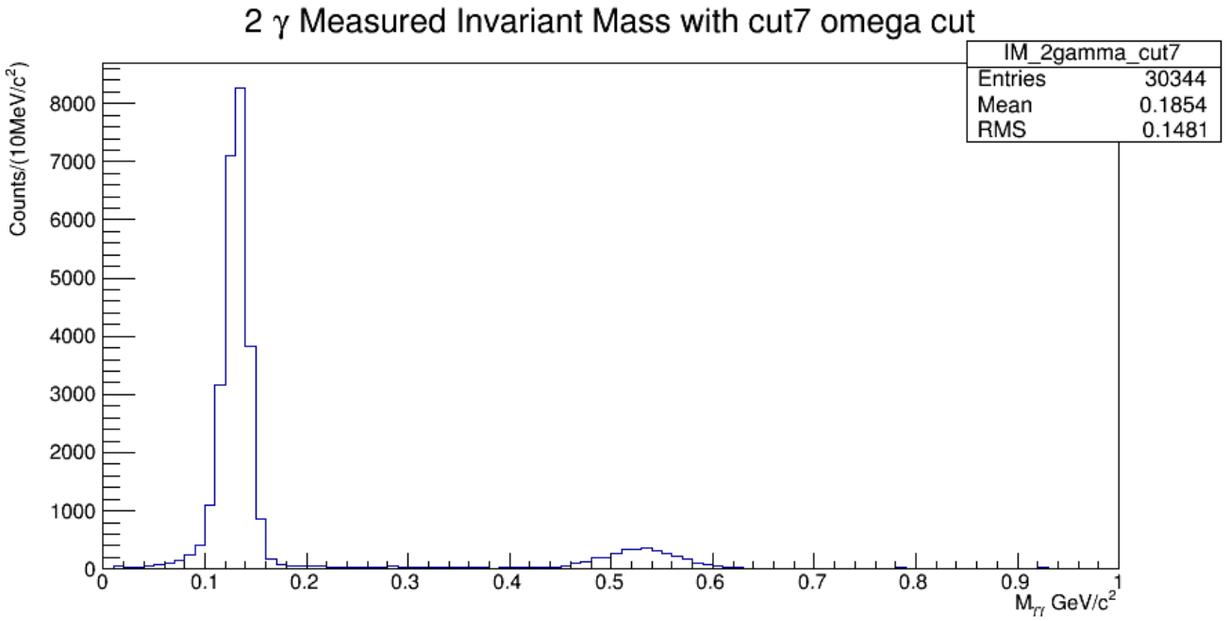


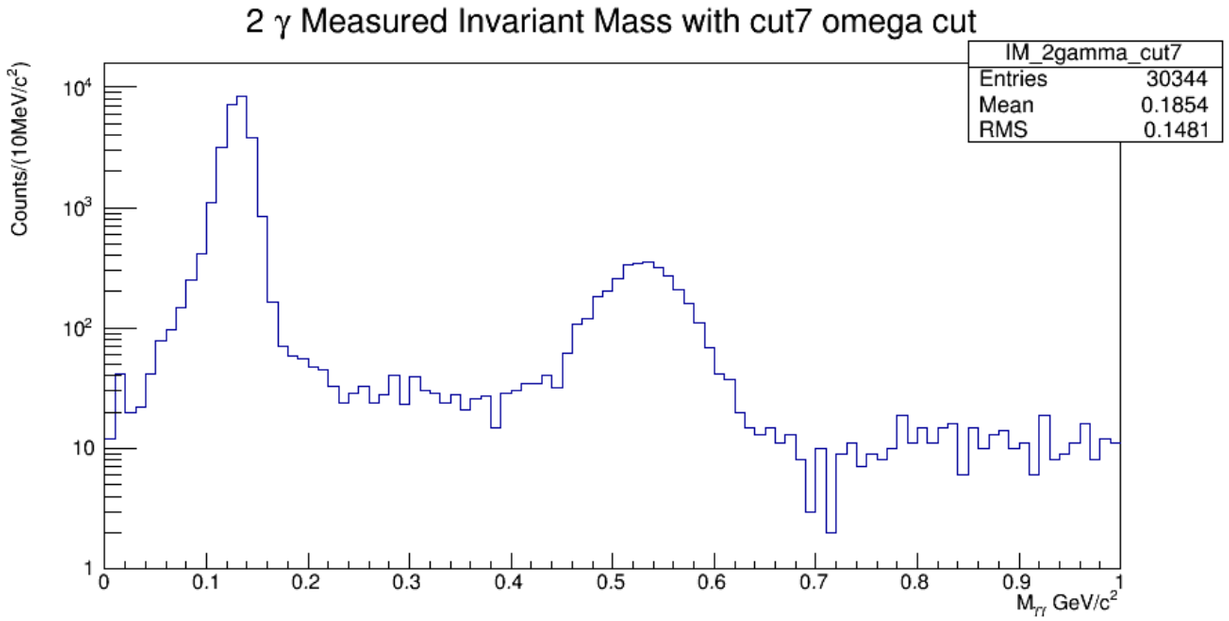


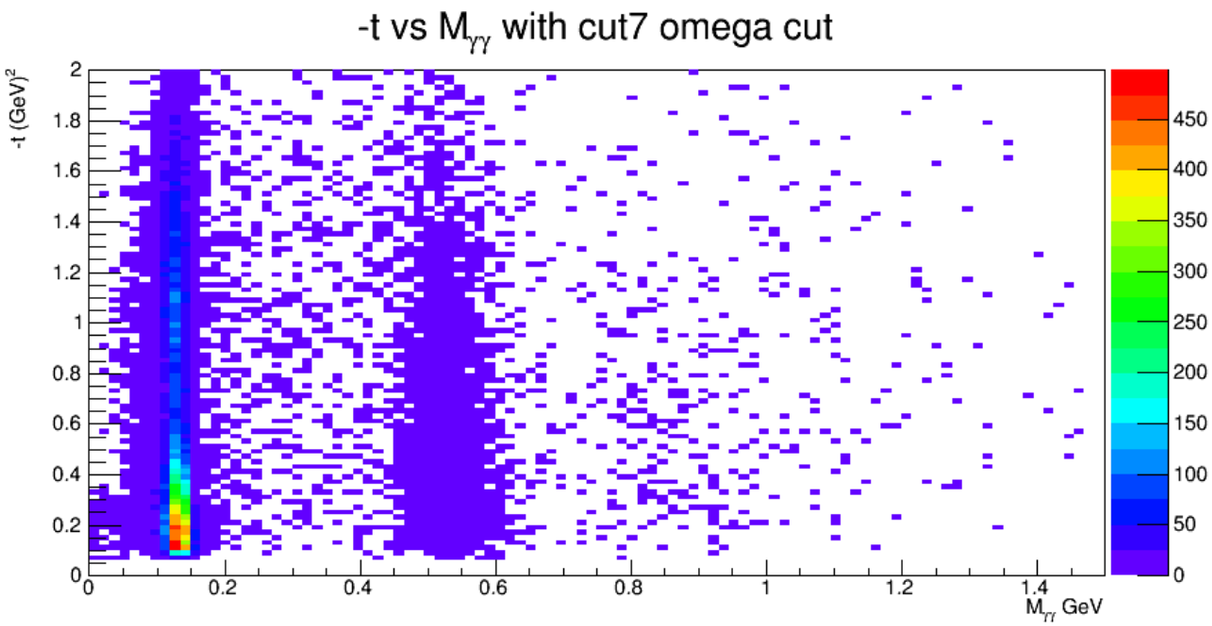


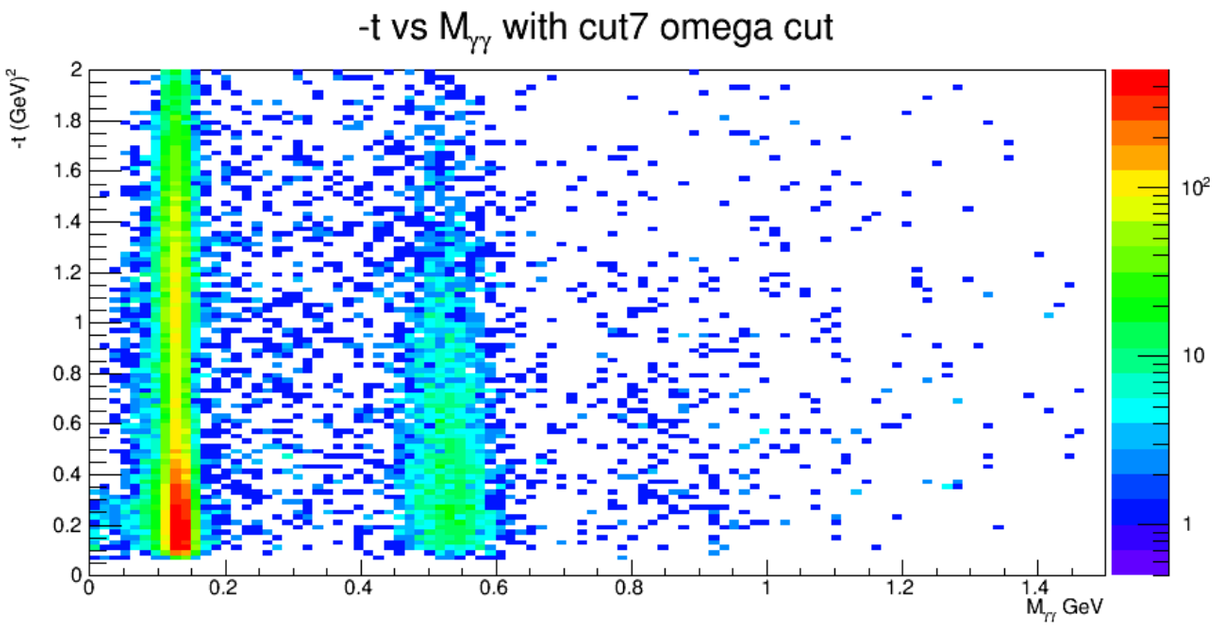


Some distributions after all 7 cuts









To be continue…

Thanks!