Result of Tau event selection

Cut order

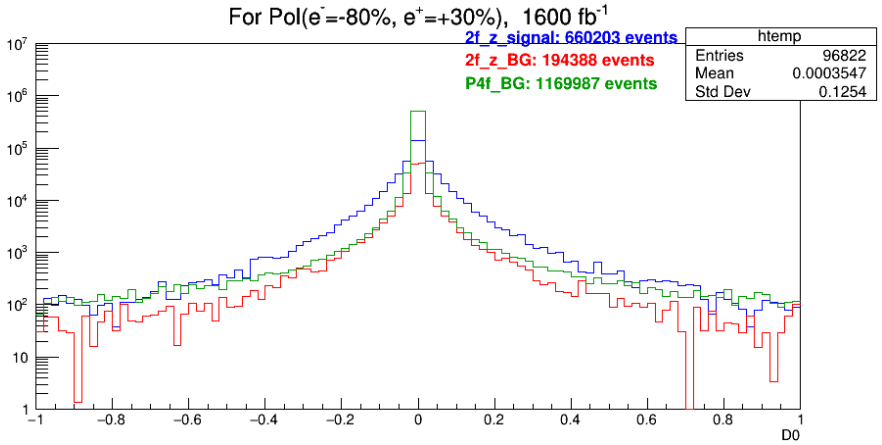
Tau Event	2f signal	2f BG	4f BG
Original	776,143(100.00%)	4,254,790(100.00%)	10,184,055(100.00%)
Jet clustering	736,410(94.88%)	3,541,240(83.23%)	7,080,720(69.52%)
Opening angle	716,410(92.30%)	1,089,018(25.60%)	1,737,498(17.06%)
Energy	699,889(90.18%)	207,841(4.90%)	1,254,822(12.32%)

Very large number of about twice as much as 2f sig

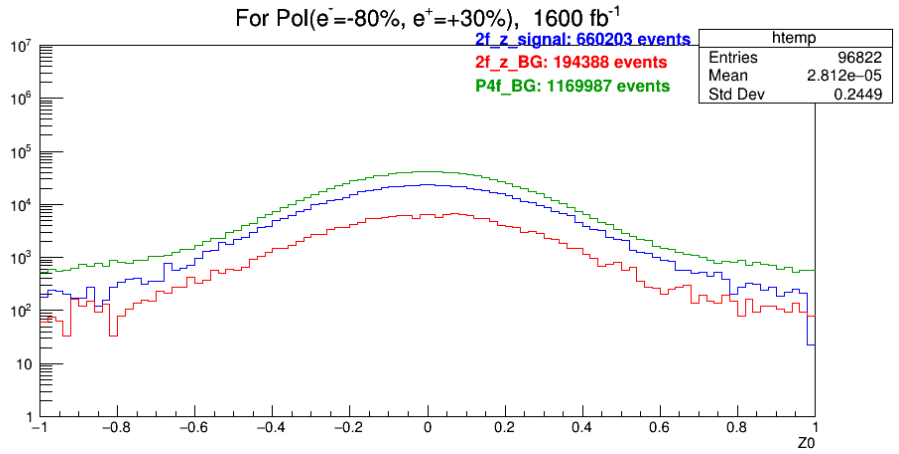
so, I consider decreasing the number of 4f BG events by cuts using the impact parameter D0, Z0 and D0 significance, Z0 significance.

Impact parameter plot after opening angle & energy cuts

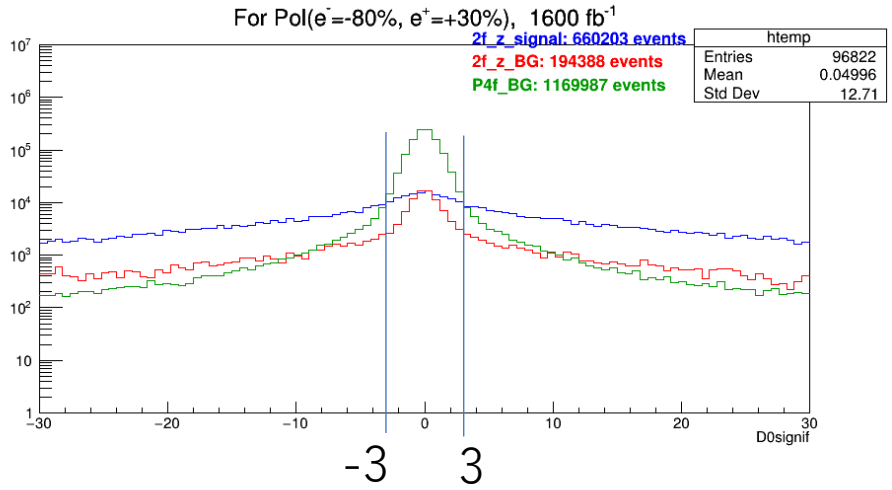
D0



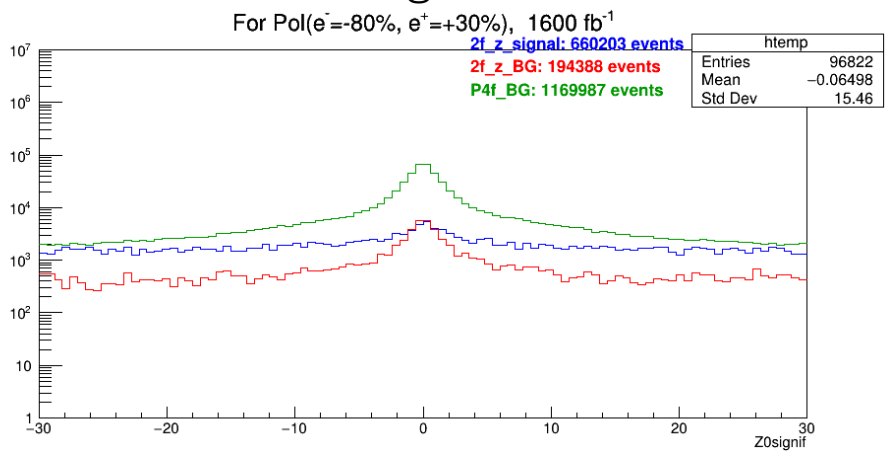
Z0



D0 significance



Z0 significance



- I think cut the event from -3 to 3 in D0 significance would reduce the BG without reducing the 2f sig too much.
- I will do the result plot after cutting by impact parameter later.

Impact parameter: D0, Z0

- Impact parameter: D0, Z0

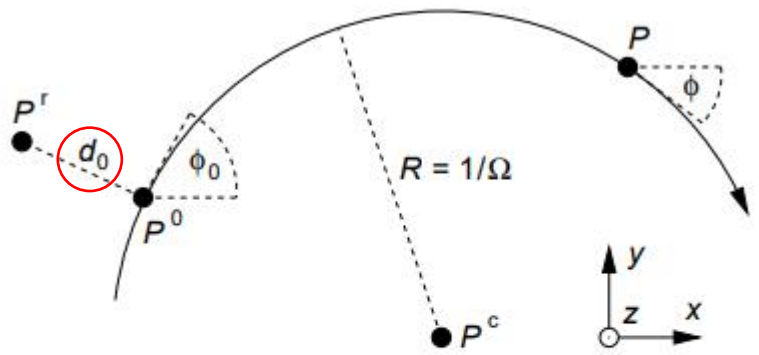


Figure 1: The projection of a helix segment in the xy plane is a part of an arc with centre $\boldsymbol{P}^c$ and radius R. The direction of the particle is shown with the arrow at the arc. All track parameters are given relative to the reference point $\boldsymbol{P}^r$.

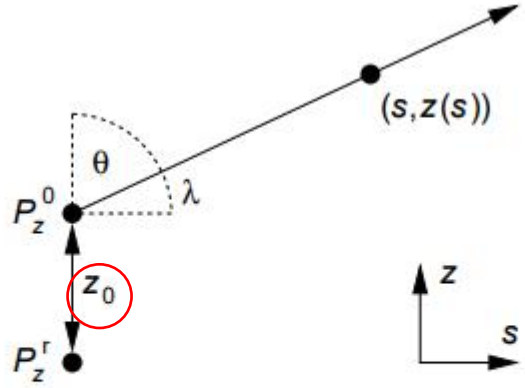
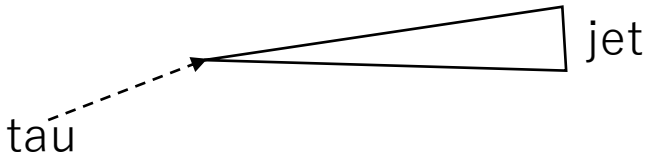


Figure 2: The projection of a helix in the sz plane is a straight line (see Eq. 10). The variable s at a point $\boldsymbol{P}$ is the arc length in the xy plane from $\boldsymbol{P}^0$ to $\boldsymbol{P}$. This also implies that $s = 0$, if $z = z_0$.

Since tau has a finite lifetime (ctau = 87 um), particles generated by tau decay fly a short distance from the IP. -> D0, Z0 will be large.



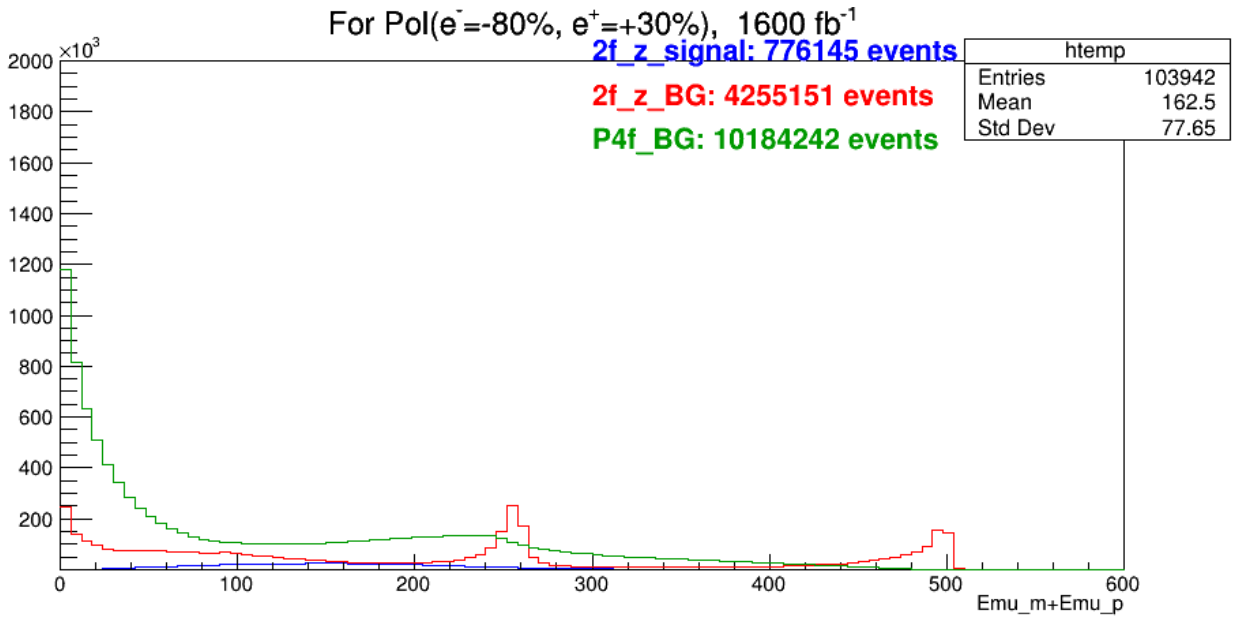
backup

Tau event

Signal events and BG events

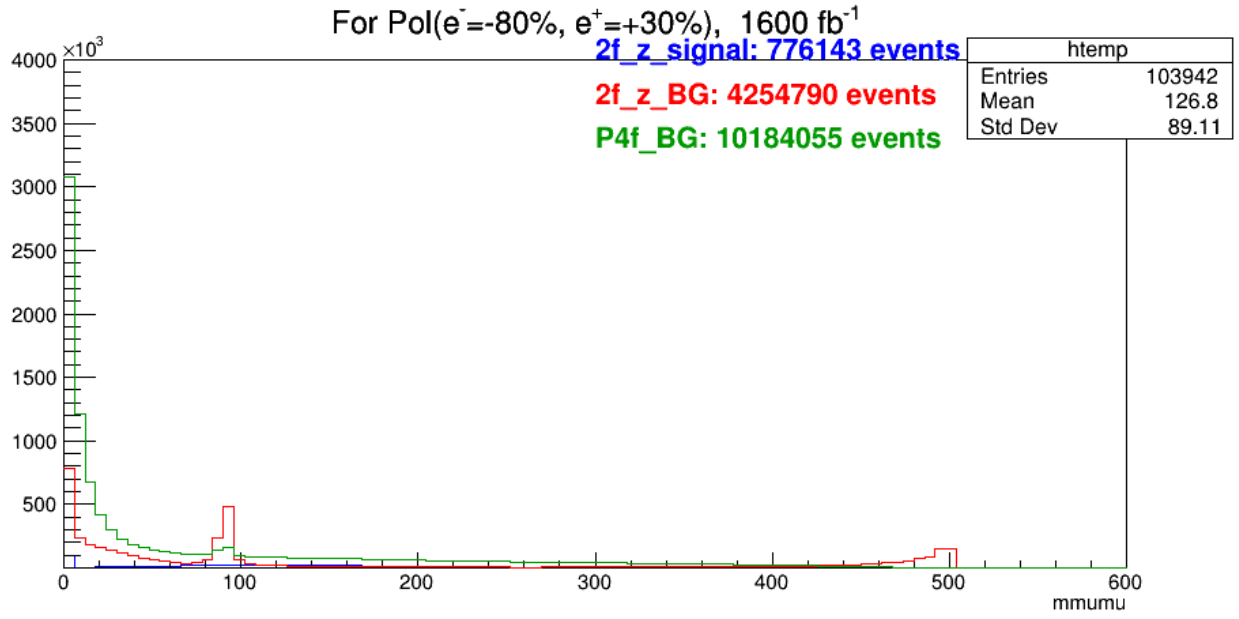
- No clustering & cuts : Original

$l^- + l^+$ $Energy$
highest energy



Energy GeV

mass

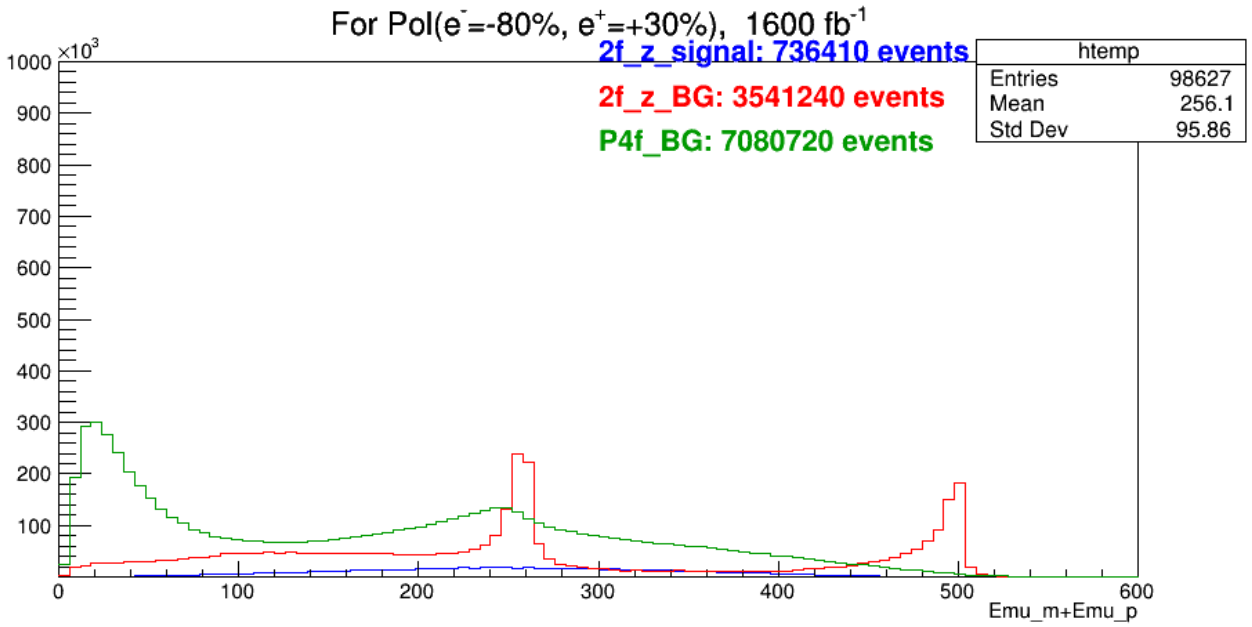


mass GeV

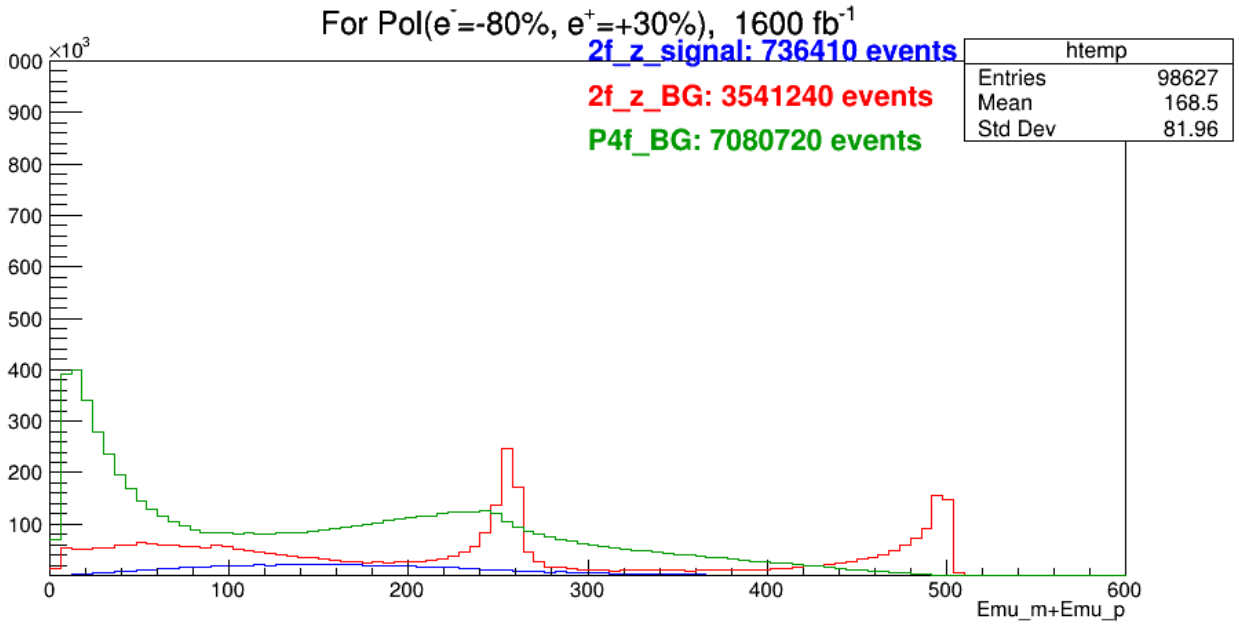
Tau jet clustering

- Tau jet clustering　Use TauFinder/TaJetClustering.cc

2 jets' highest energy for all particles in tau jet

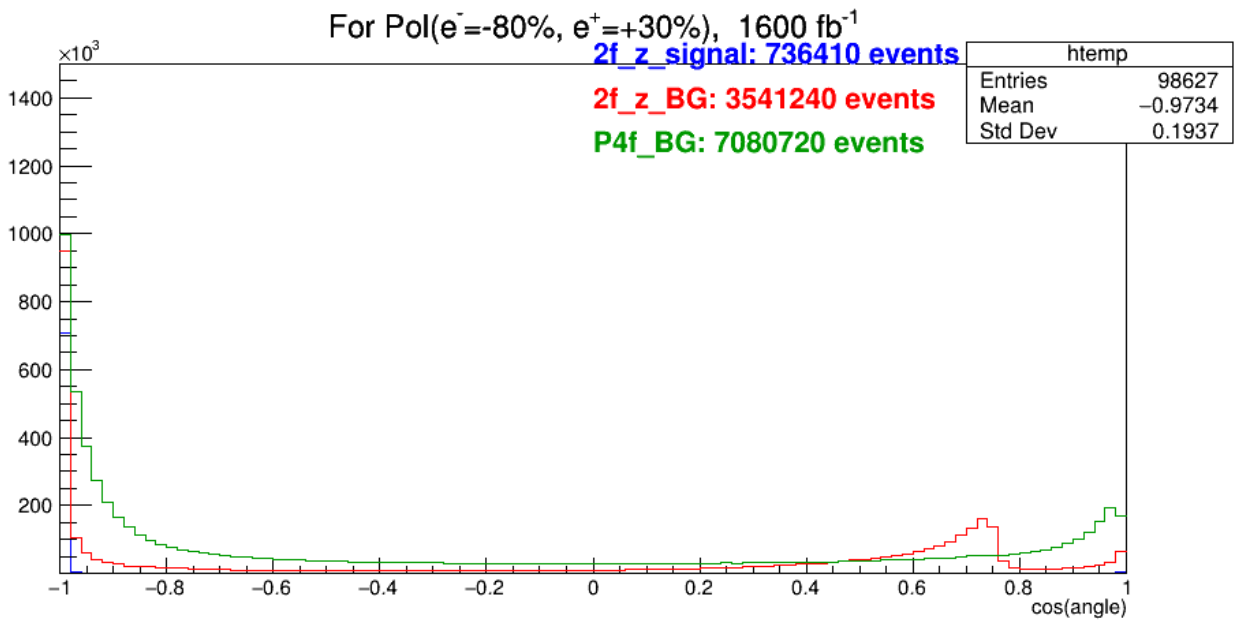


For charged particles in tau jet



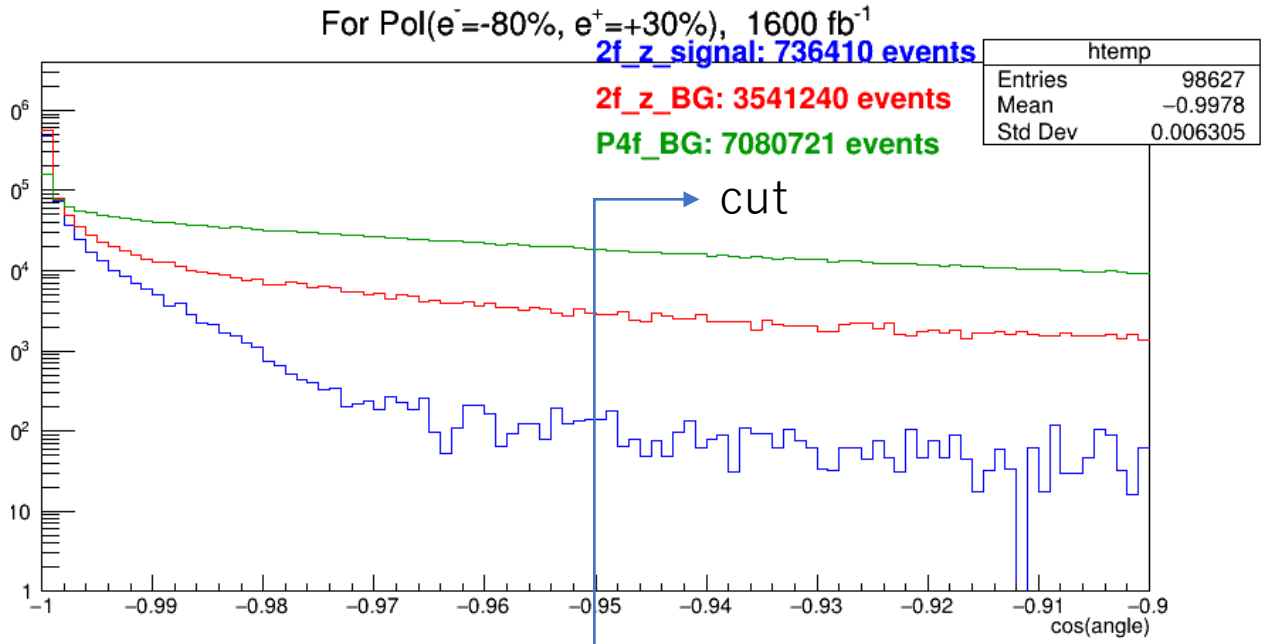
Opening angle cut

overall



$\cos\theta_{2jet}$

Around 180°

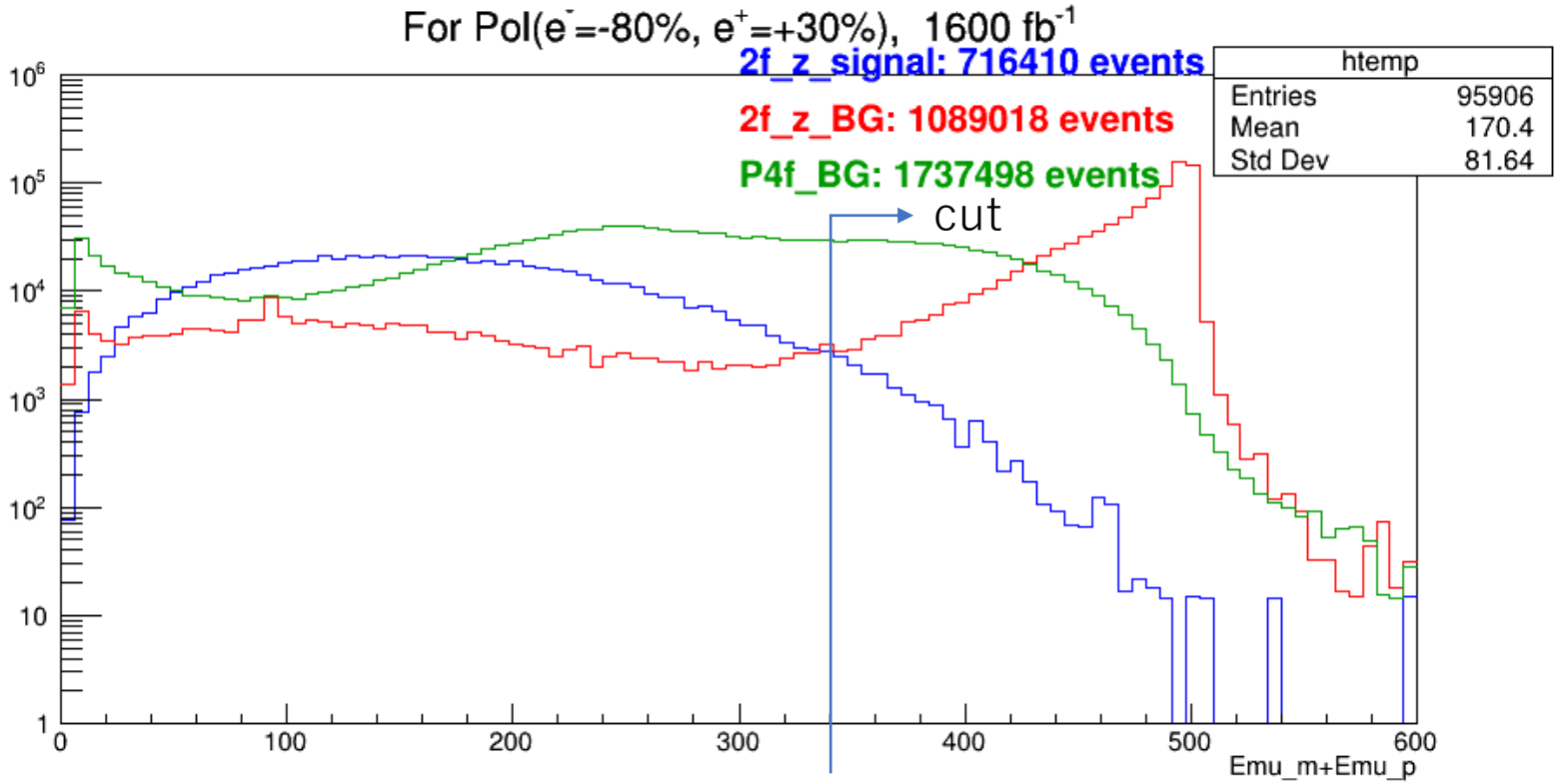


Candidate -0.95

$\cos\theta_{2jet}$

Energy cut

- Energy cut : 2 jets' highest energy
  - $l^- \, Energy + l^+ \, Energy$



Candidate 340 GeV Energy GeV