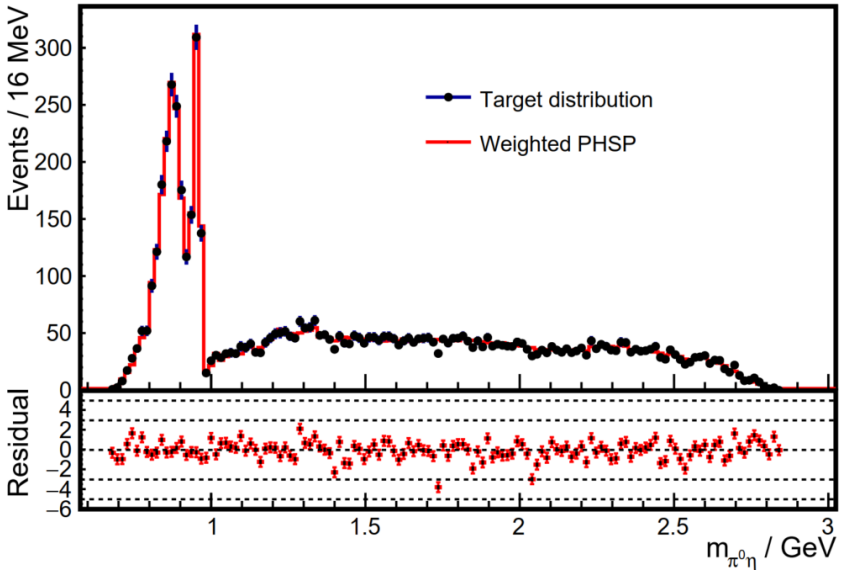
Construction of target function

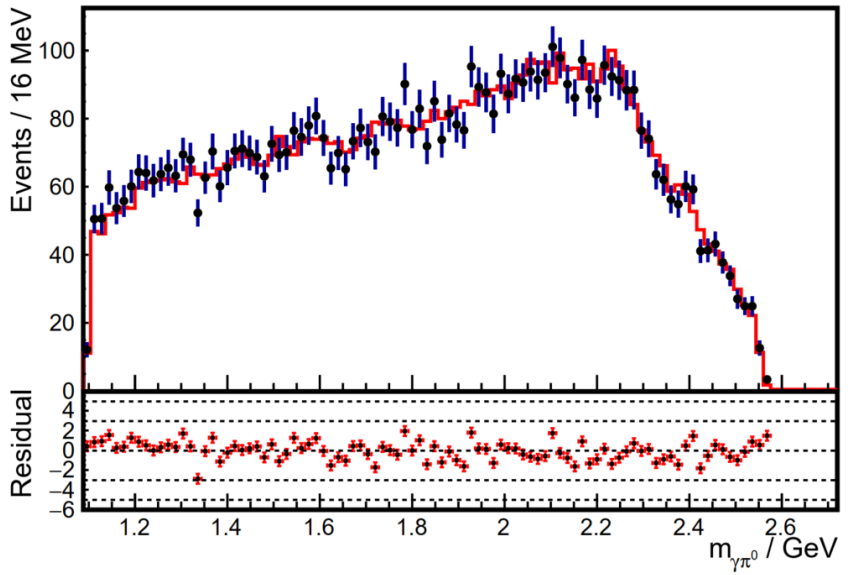
- Previous: $S = \ln\mathcal{L}_{data} - \ln\mathcal{L}_{bkg}$
- Now: $S = \ln\mathcal{L}(c)$, $\mathcal{L}(c) = C\prod_{j=1}^{N_{data}}\left(f_s\frac{S(\boldsymbol{x}_j;c)}{I(c)} + (1-f_s)B(\boldsymbol{x}_j)\right)$
- c: PWA parameters
- f_s: Signal ratio in data
- $\boldsymbol{x}_j$: representation of a event in PHSP
- $S(\boldsymbol{x}_j;c)$: PWA cross section
- $B(\boldsymbol{x}_j)$: BKG p.d.f. obtained from ML
- $I(c)$: normalization integral

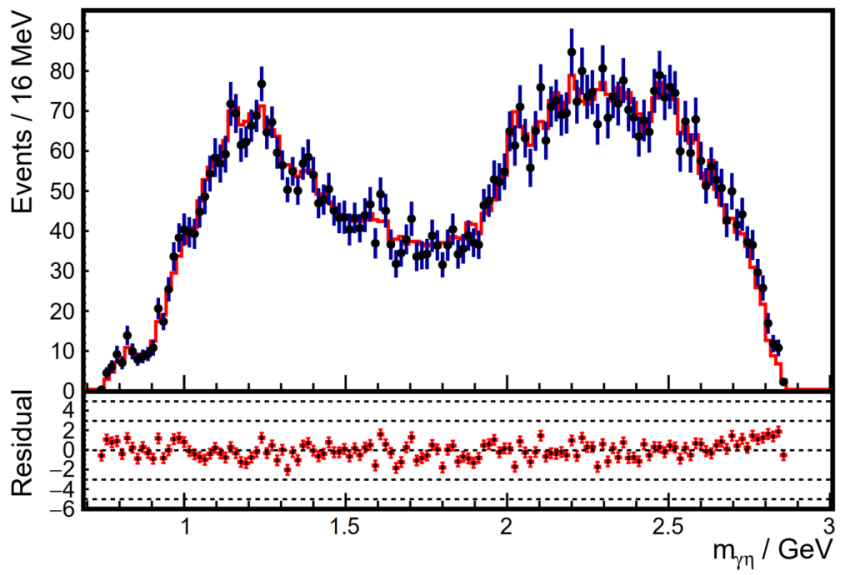
Determination of $B(x_j)$:

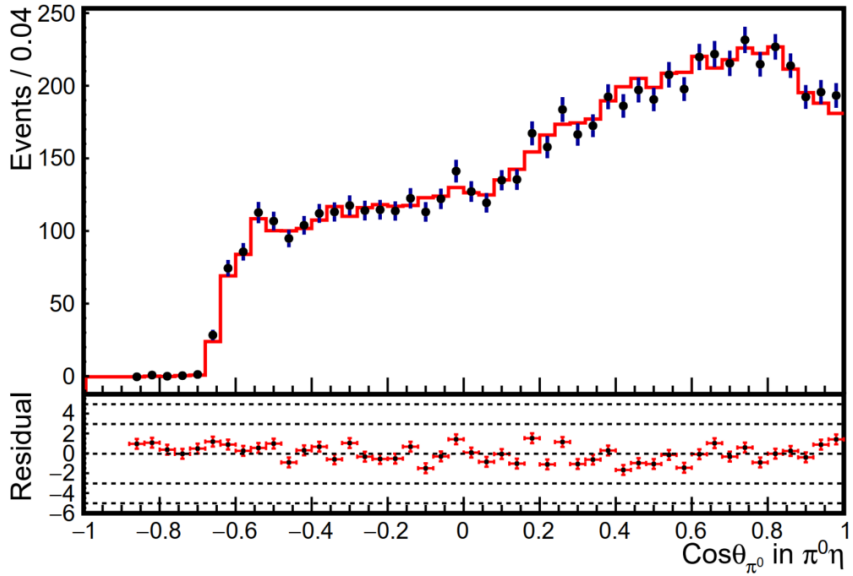
- Similar to PWA's p.d.f $\frac{S(\boldsymbol{x}_j;c)}{I(c)}$, $B(x_j)=\frac{\mathrm{b}(\boldsymbol{x}_j;c)}{I(c)}$
- If we apply PHSP MC here, $B(\boldsymbol{x}_j)=\omega(\boldsymbol{x}_j)$. ω weights PHSP MC to BKG distribution at truth level
- Normalization: $\sum_{i=1}^{N_{\mathrm{PHSP}}}\omega(\boldsymbol{x}_i)=N_{\mathrm{PHSP}}$
- How to get ω? To avoid binning problem, use ML (XGBoost).
- Train sample: PHSP MC with efficiency. Target sample: BKG sample (BKG MC and Q-weight estimated BKG distribution)

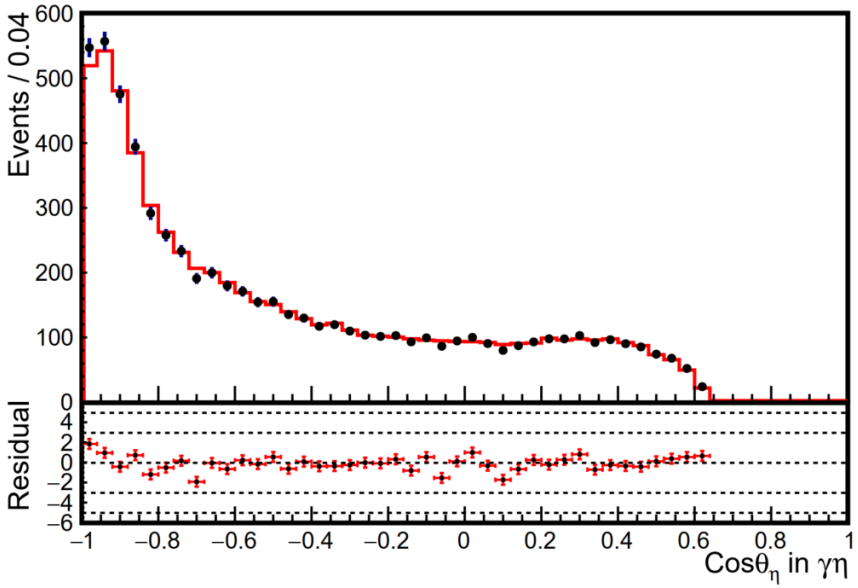
Variables for training



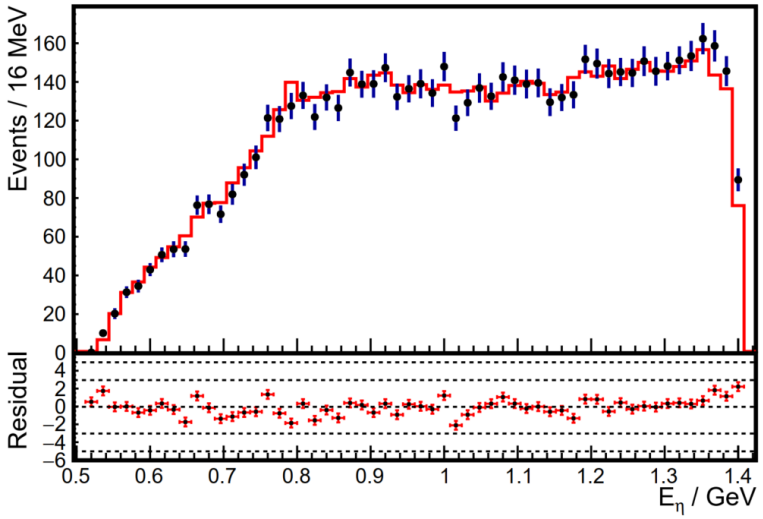


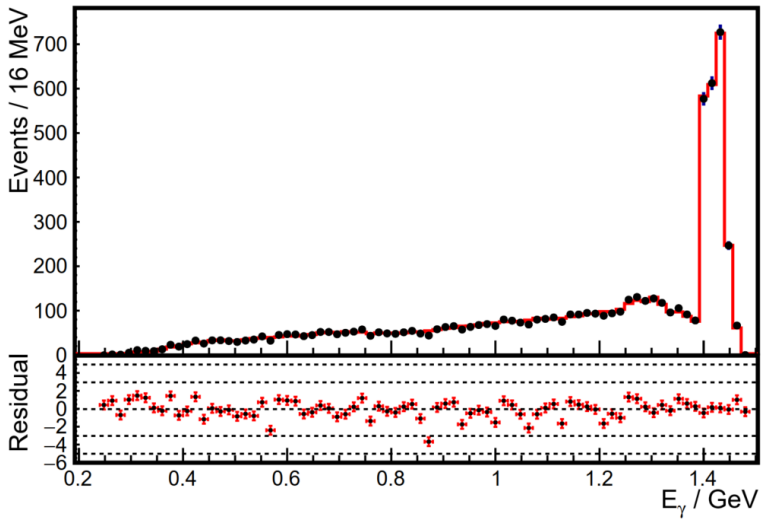


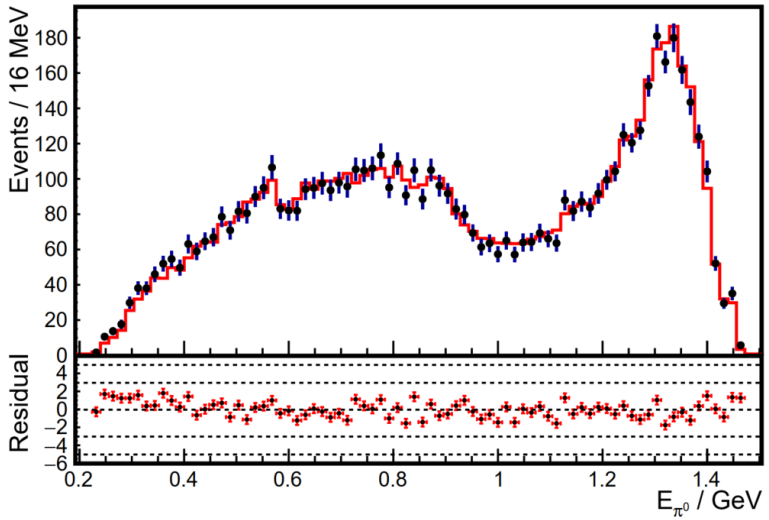


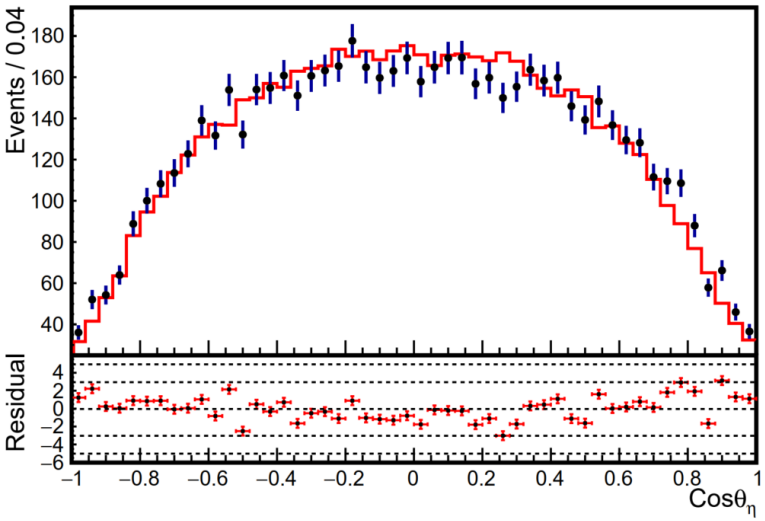


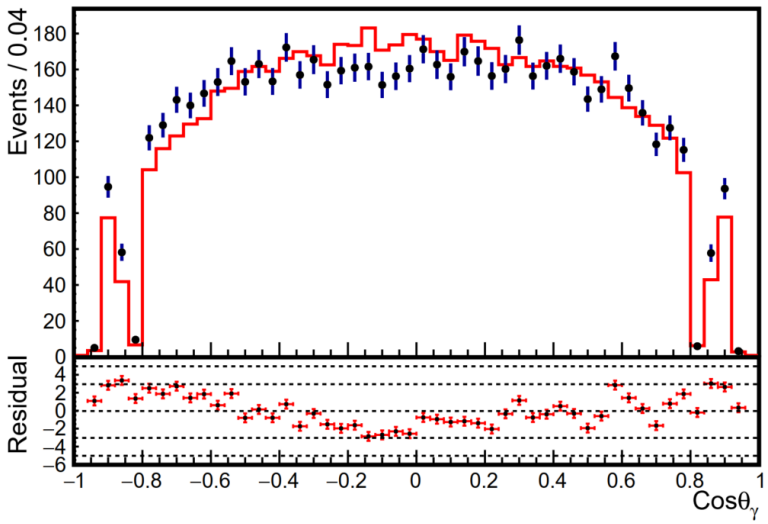
Other Variables' distribution

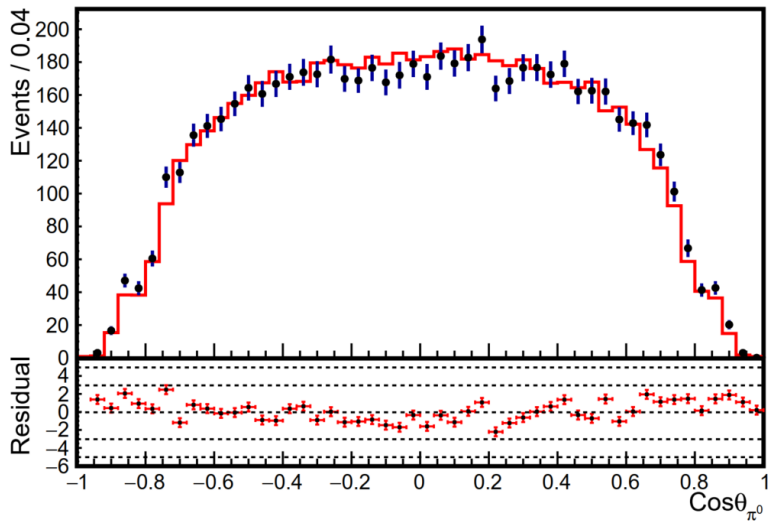












How to get the value of $\omega(x_j)$ for events in data?

- LHCb method: find neighbors of x_j in PHSP MC (x_i) and get the average value of $\omega(\boldsymbol{x}_i)$ using Hyperplot
- Current method: Use trained classifier to predict the value of $\omega(\boldsymbol{x}_j)$
- How to visualize/validate the result? Crosscheck the result under two methods?