



1

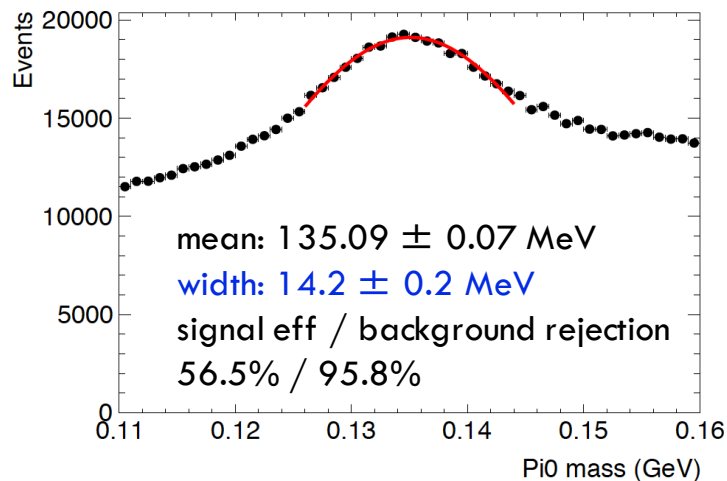
Pi0 selection in MC9

ECL italia, 24/10/17

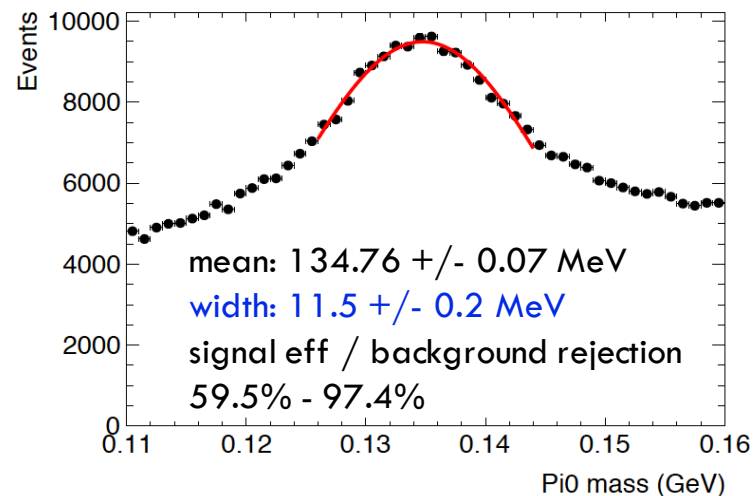
- Current Pi0 selection:
<https://confluence.desy.de/display/BI/Physics+Pi0Reco>
 (optimized for $B \rightarrow \tau \nu$)

	Cut points		
Detector region	forward	barrel	backward
Energy (MeV)	> 58	> 62	> 40
abs(timing) (ns)	< 18	< 21	< 38

generic B^+B^- MC9, bgx1



$B \rightarrow \tau \nu$ MC9, bgx1





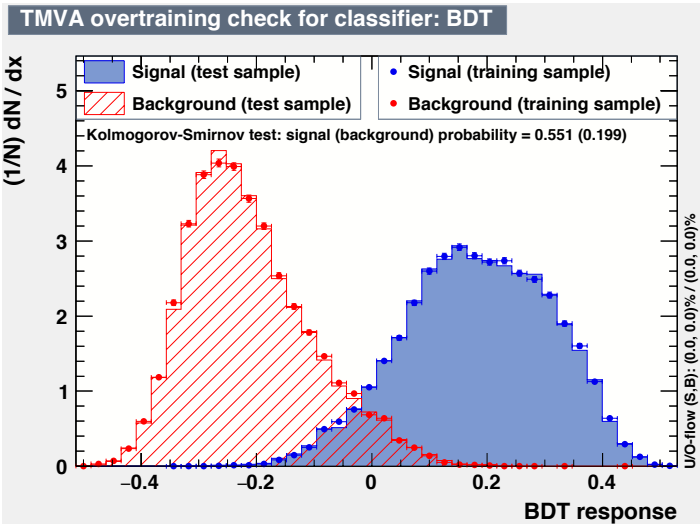
MVA for π^0 selection



3

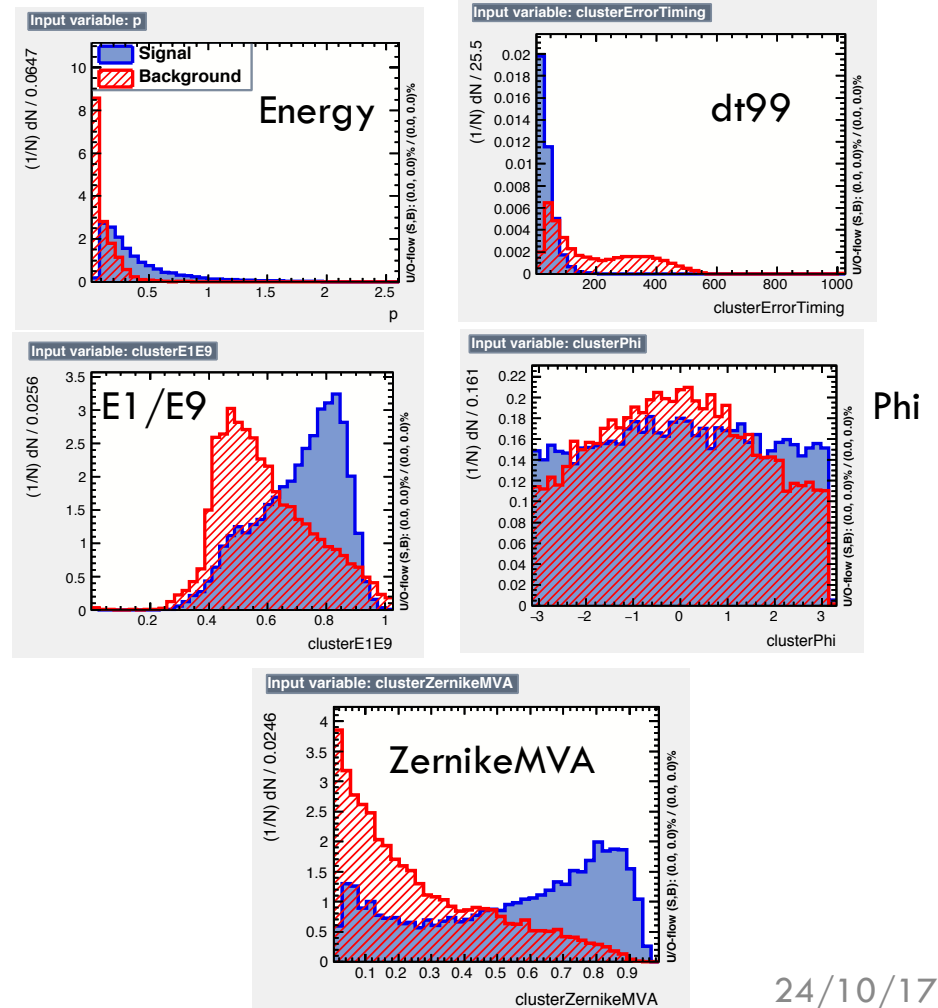
- Define two photon categories at MC truth level: **beam background photons**, **physics photons**
- Train a BDT with $B \rightarrow \tau \nu$ events from MC9 production bgx1 (using TMVA)
- Some of the variables included in the training are : energy, timing, dt99 (time containing 99% of the signal, at ECLCaIDigit level), cluster region (bwd, barrel, fwd), cluster phi, E1/E9, and Zernike moments (exploiting the energy distribution in a plane perpendicular to the shower)

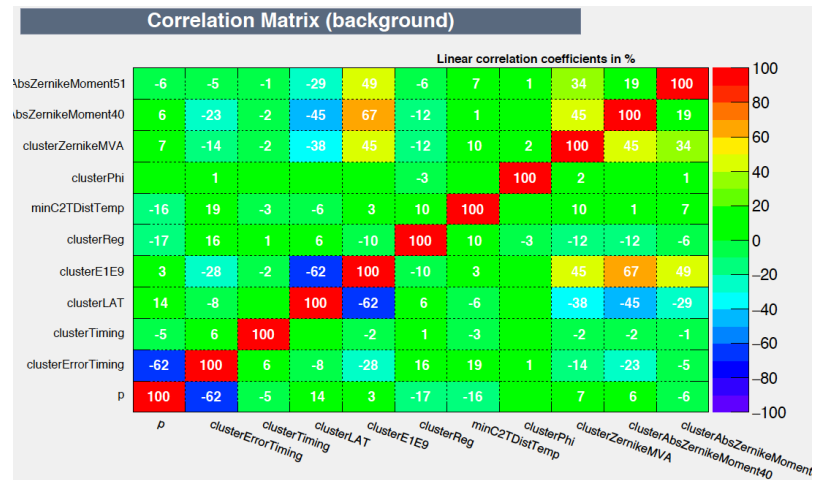
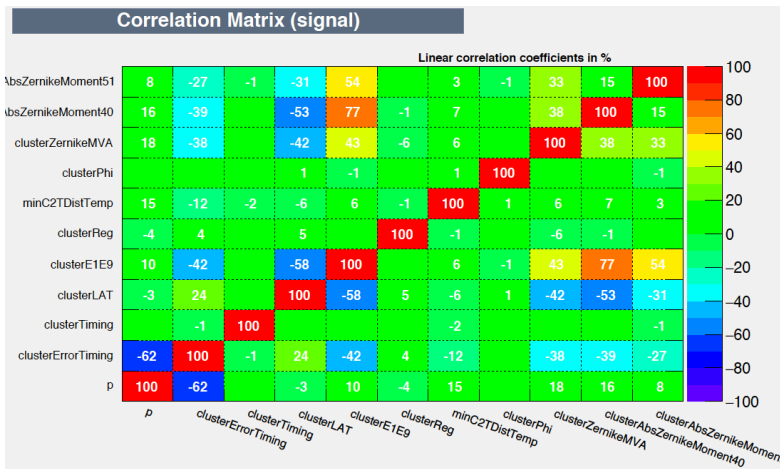
BDT output classifier for **signal** (physics photons) and **background** (photons from beam bkg)



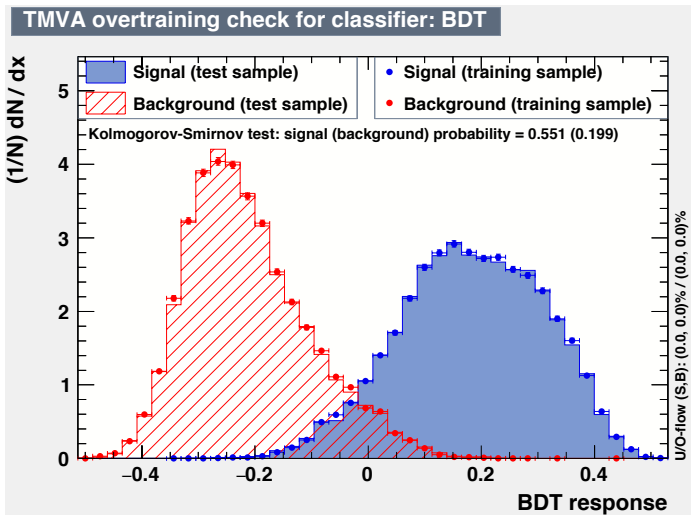
- Ranking: timing, dt99, ZernikeMomentMVA, cluster phi, minDistC2T, Lateral distribution, ZernikeMoment40, ZernikeMoment51, E1/E9, energy, cluster region

Input variables



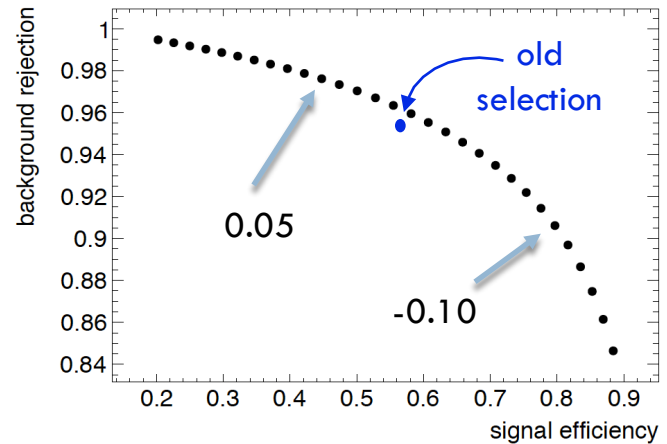


- Shower shape variables slightly correlated (E1 /E9, Zernike and LAT)
- Some level of correlation between dt99 and the cluster energy

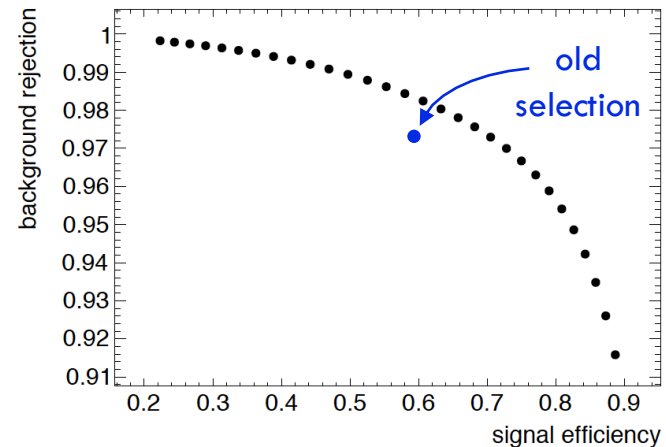


Perform a scan of the BDT from -0.15 to 0.15 with step of 0.01, and plot the signal efficiency vs background rejection

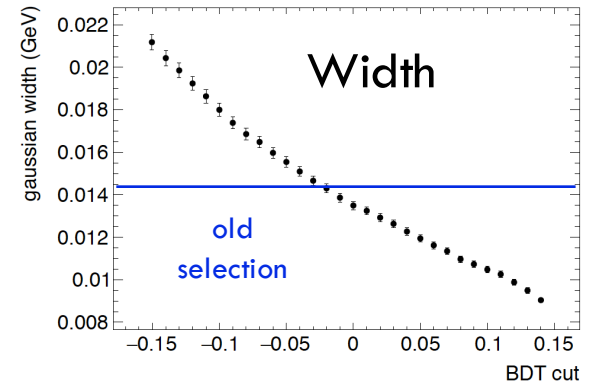
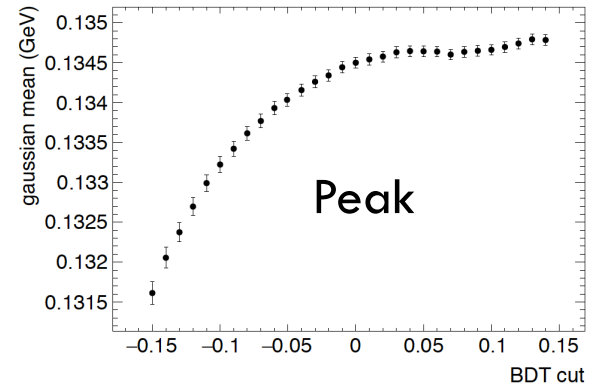
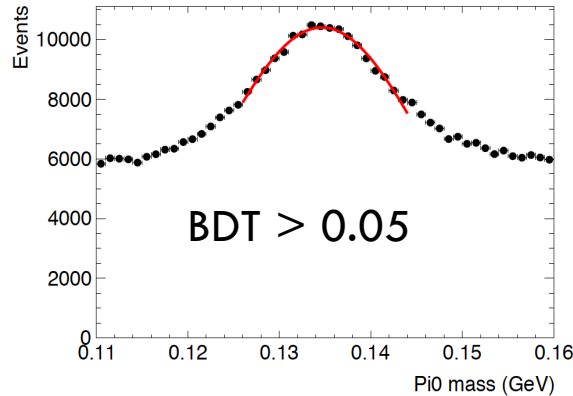
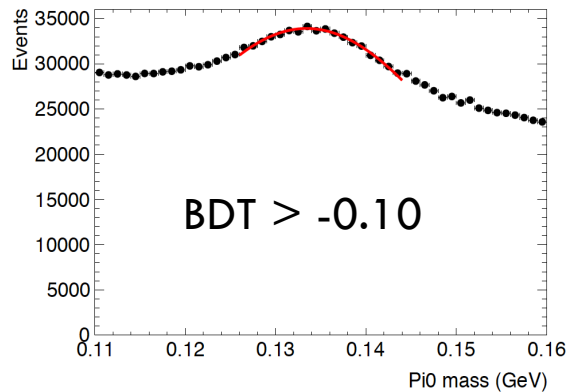
B^+B^- events



$B \rightarrow \tau \nu$ events

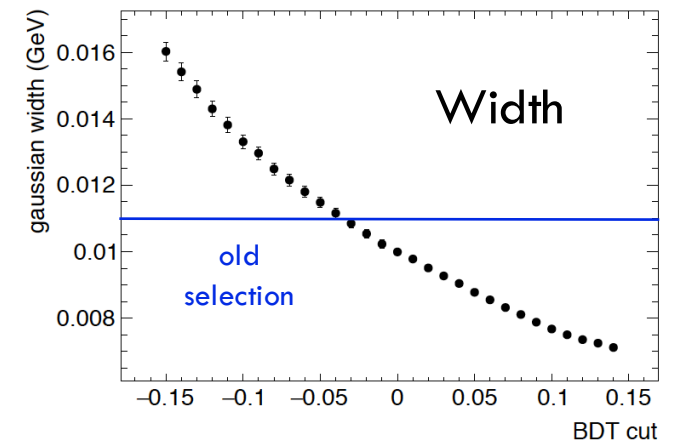
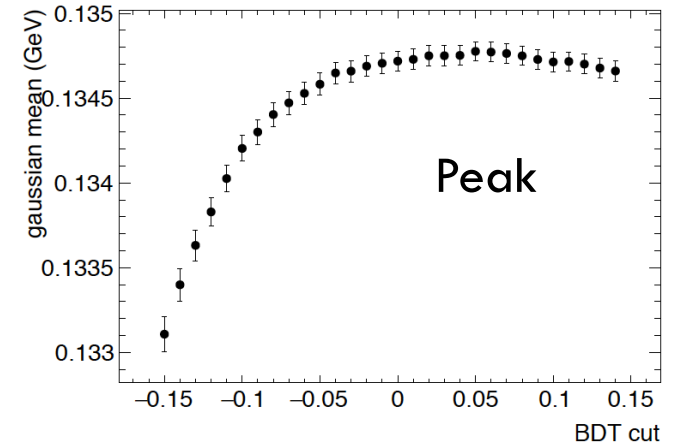
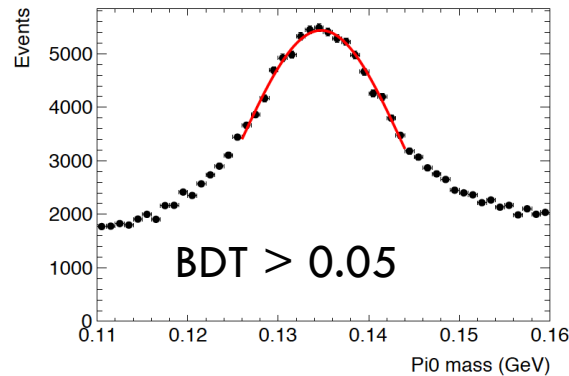
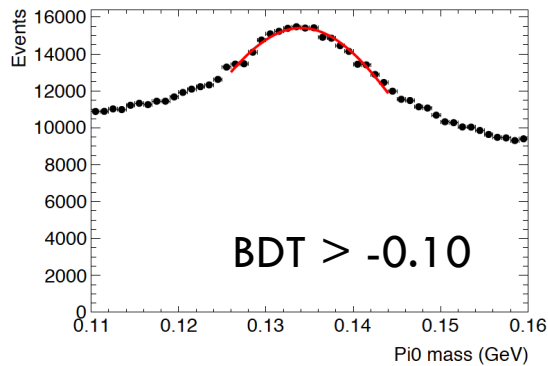


- Fit to the pi0 invariant mass (simple gaussian) in the range 125-145 MeV and plot the peak position and width varying the BDT cut point
- Example fits



- Tighter the BDT cut, narrower the pi0 width

- Simple gaussian fit to the pi0 invariant mass in the range 125-145 MeV
- Example fits





Backup

