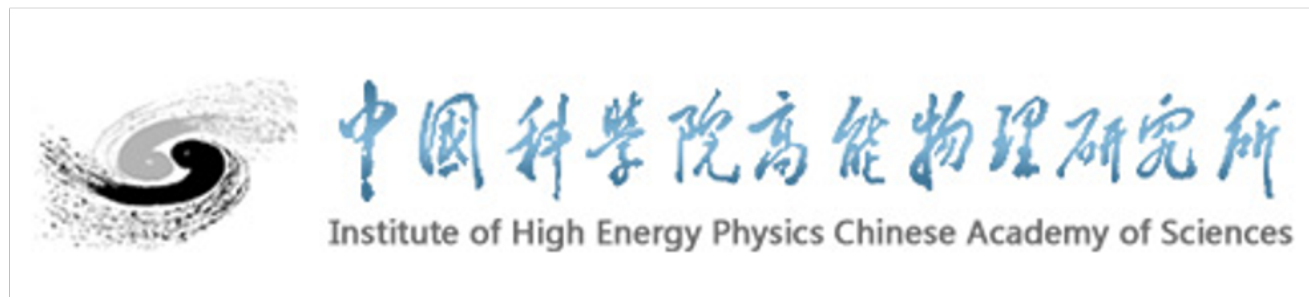




Parameterized workspace in VBF $H \rightarrow \gamma\gamma$ CP

Fangyi Guo, IHEP

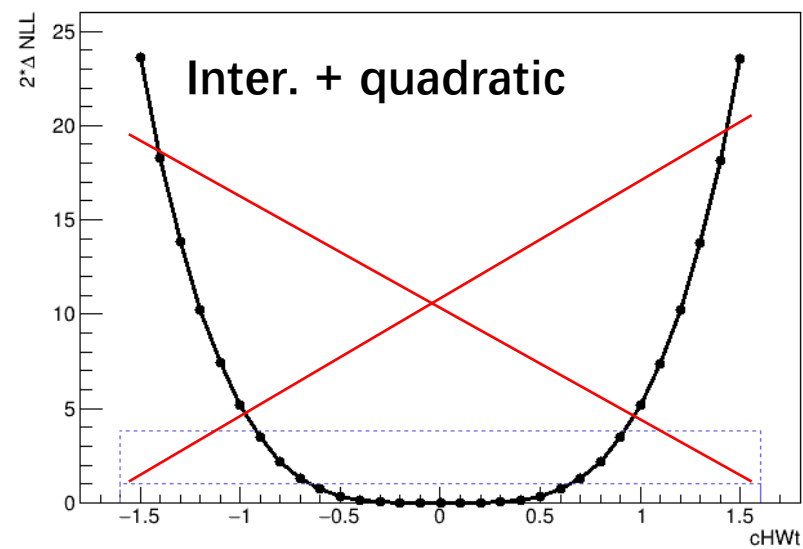
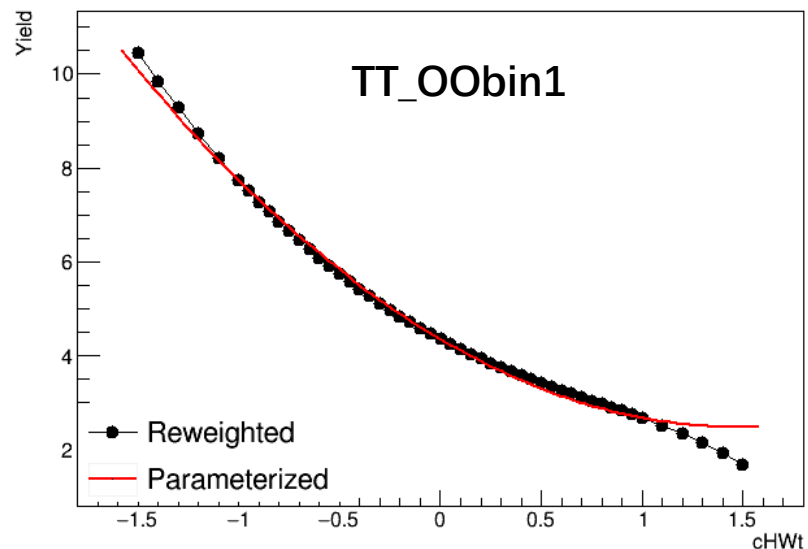


Introduction



- **Review:**

- Last time we show poly2 can not describe the inter+quad yield perfectly.
- Parameterized workspace shows different results with template fit in analysis.



Expected	HGam result	All float	Fix mu=1
cHWt linear	[-0.48, 0.48]	[-0.477, 0.475]	[-0.477, 0.475]
cHWt quad.	[-0.48, 0.48]	[-0.651, 0.651]	[-0.651, 0.652]

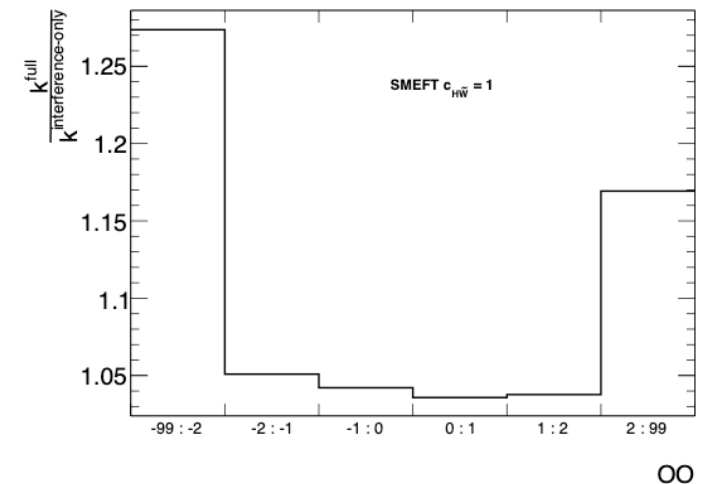
A stupid bug in the workspace.
Already fixed.

Event yield check



• Review of event yields in SMEFT: k-factor method.

- Interference only:
 - Requested 9 full-sim MG5 BSM DAOD and derive the weights: $c_{H\tilde{W}} = 0, \pm 0.1, \pm 0.5, \pm 1, \pm 2$. (event-by-event weight)
 - Extrapolate to all $c_{H\tilde{W}}$ points.
 - ➡ Interference results are fully reliable.
- Inter+quad:
 - Generate truth-level MG5 BSM samples.
 - Calculate a ratio in each *truth* OO bin: $r_{c_{HWt}}(OO) = \sigma_{c_{HWt}}^{int.+quad}(OO) / \sigma_{c_{HWt}}^{int}(OO)$.
 - Apply this ratio to inter-only *reco-level* OO.
 - ➡ Truth and reco level phase space MAY have mis-match.
 - ➡ Non-quadratic relation between yield and cHWt.

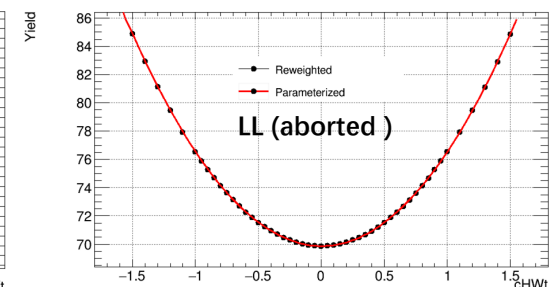
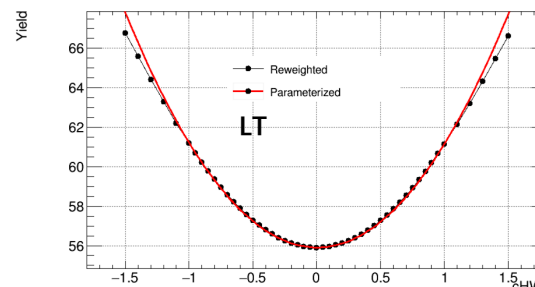
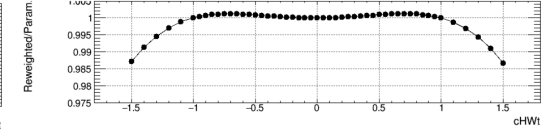
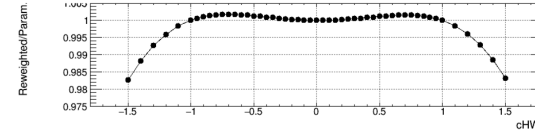
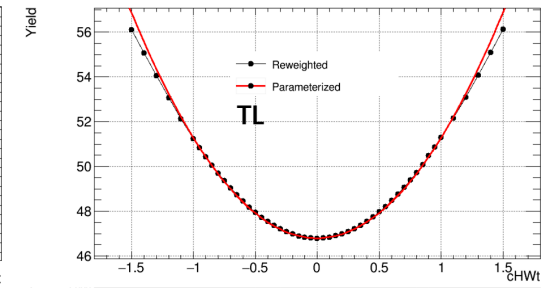
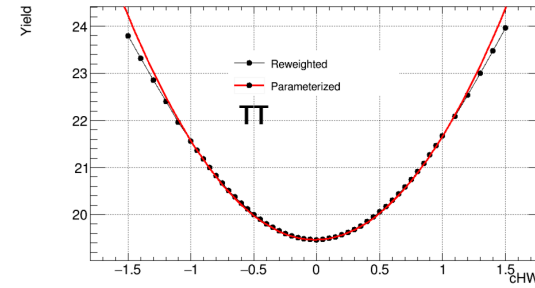
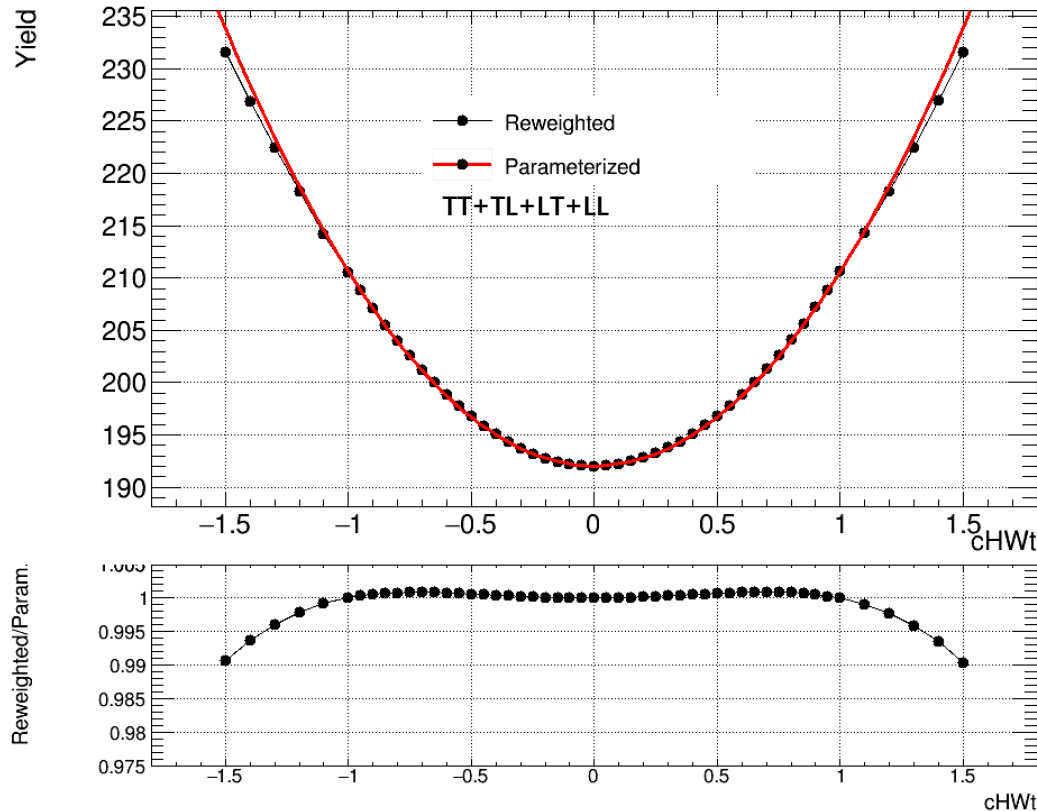


Event yield check



- **Total VBF event yields in all BDT categories:**

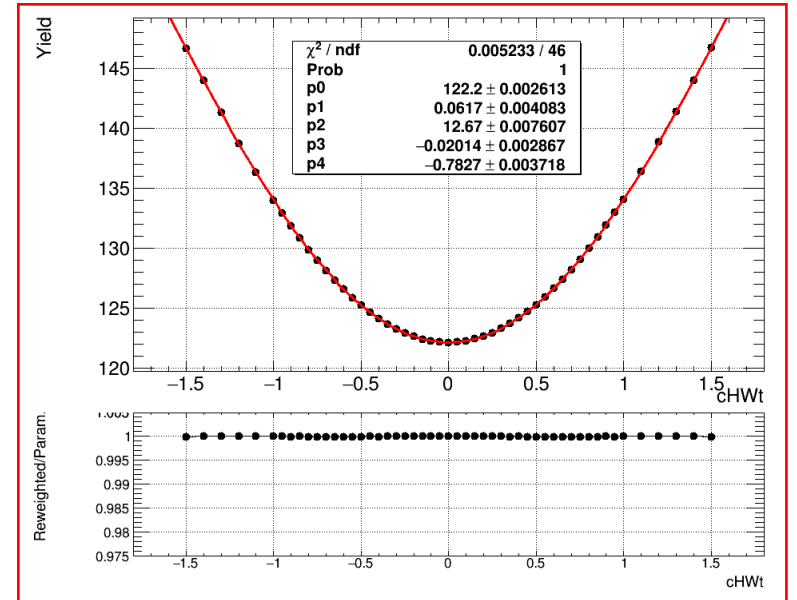
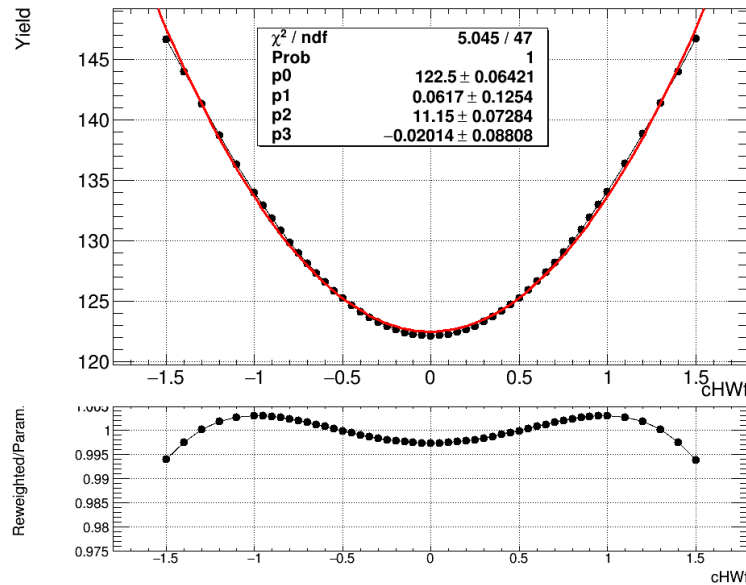
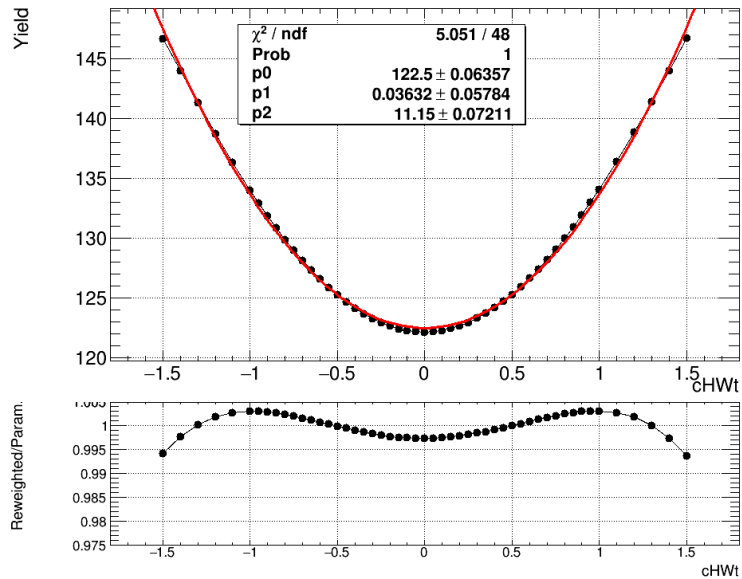
- (Left) Common cuts in HGam + 2 γ + 2 jets + $|\Delta\eta_{jj}| > 2 + |\eta^{Zep}| < 5$. (=TT+TL+LT+LL)
- (Right) Yields in 4 categories.



Event yield check



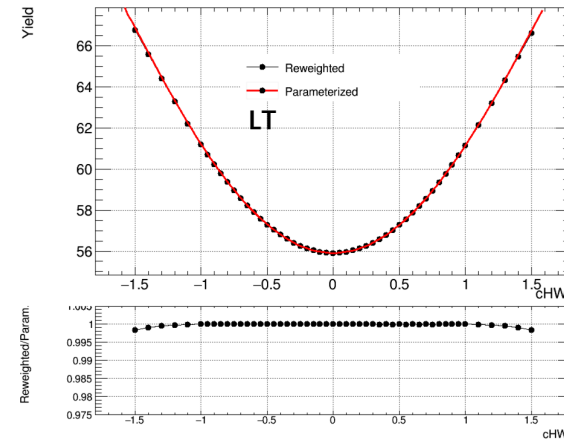
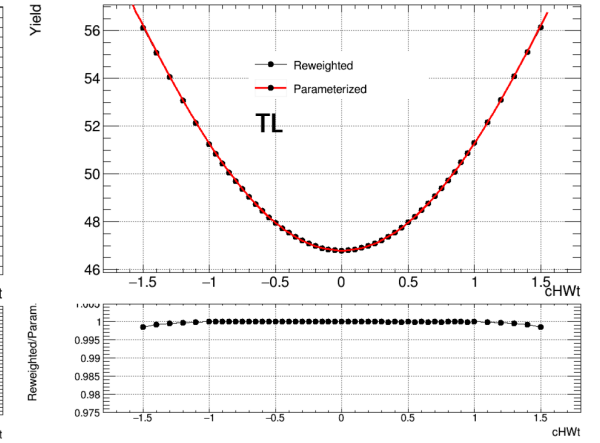
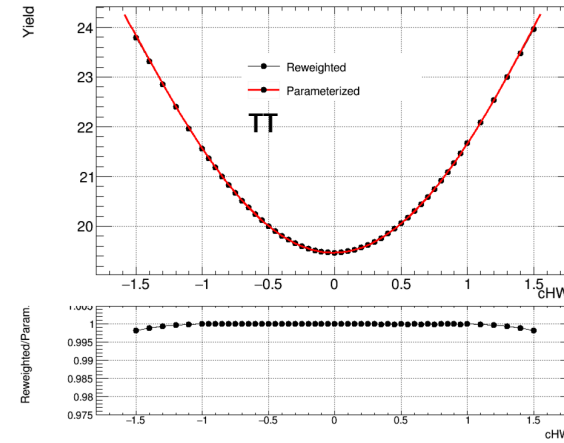
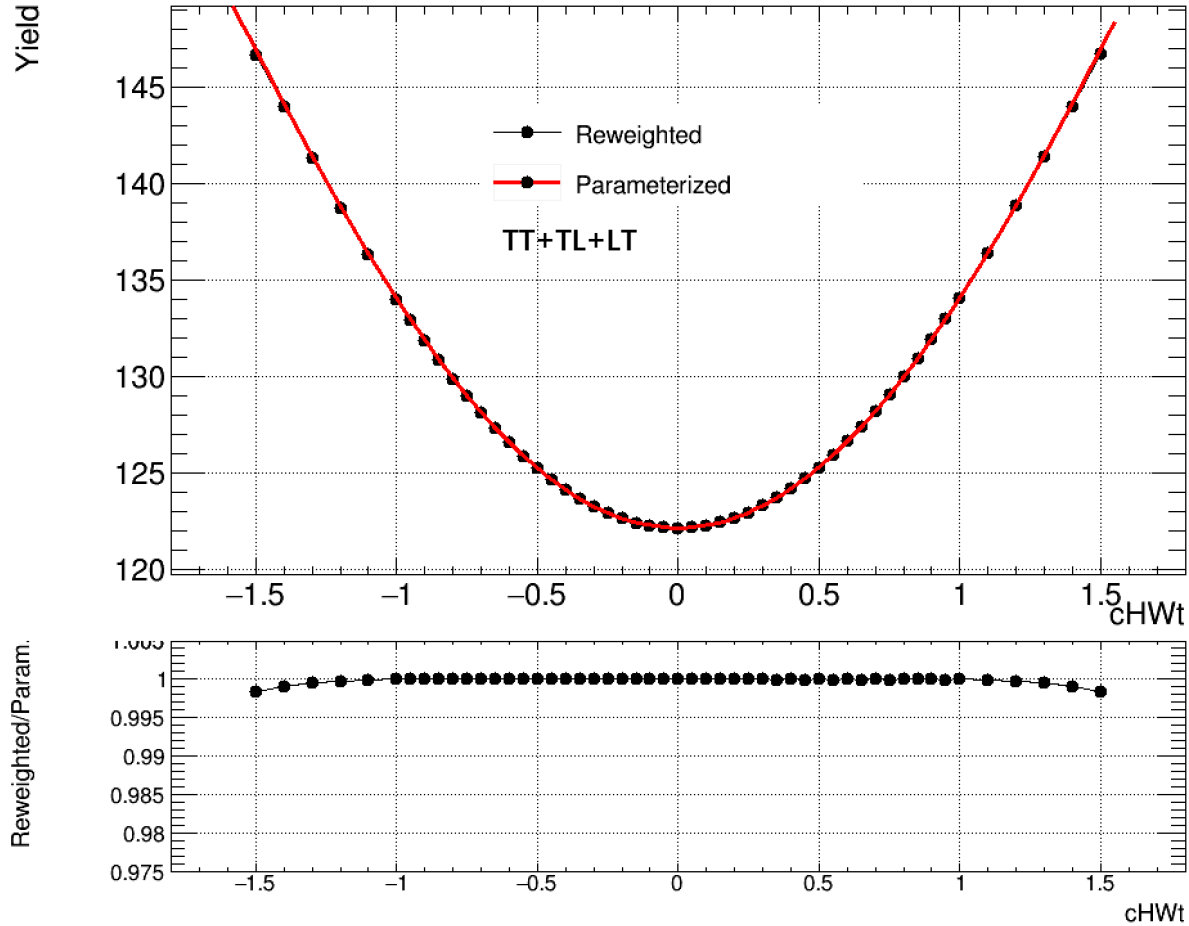
- Try to use a higher order function to parameterize:
 - Fit the yields with poly. function with TT+TL+LT.
 - Order-4 is good enough.



Event yield check



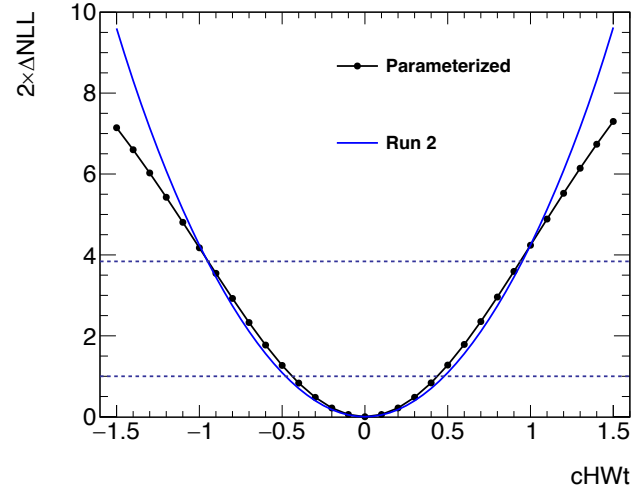
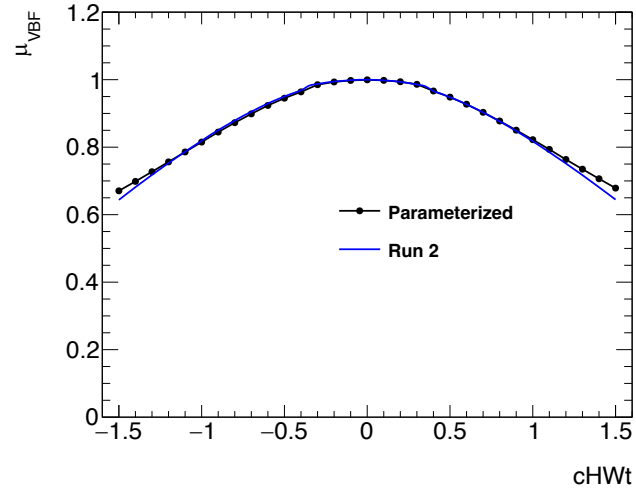
- Cross-check: poly4 parameterization with 5 points: $c_{H\bar{W}} = 0, \pm 0.5, \pm 1$.



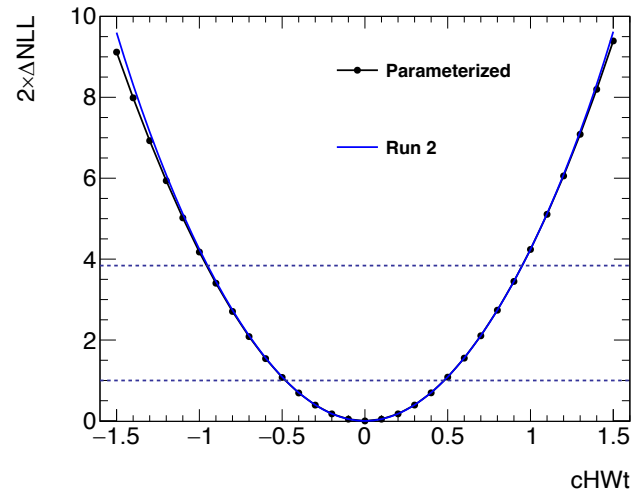
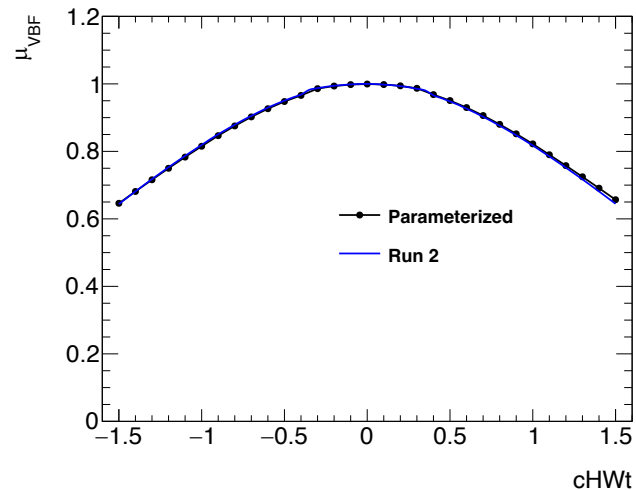
Parameterized workspace fitting



- Fit with parameterized workspace



Poly. 2 parameterization (after fix a bug)



Poly. 4 parameterization.
Perfectly repeated Run 2 results.

Summary



- **Parameterized the VBF $H \rightarrow \gamma\gamma$ workspace**
 - Can repeat the published result for both linear and linear+quad constrain in $c_{H\tilde{W}}$.
 - Workspaces are ready, created a [MR](#) in git.



Backup

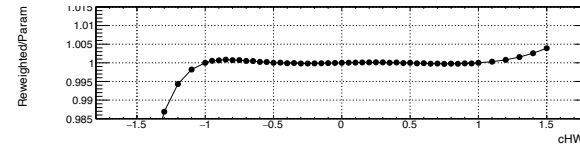
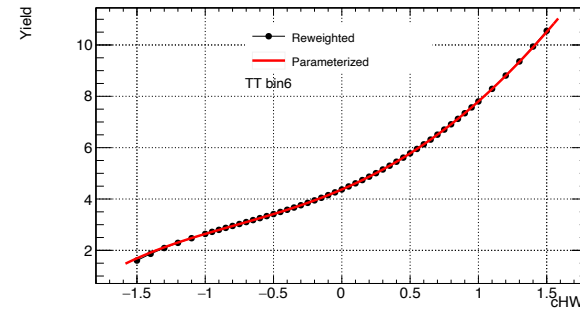
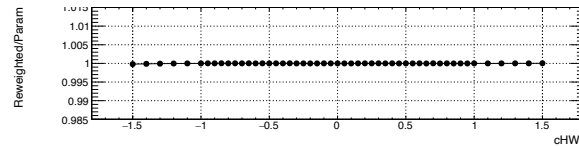
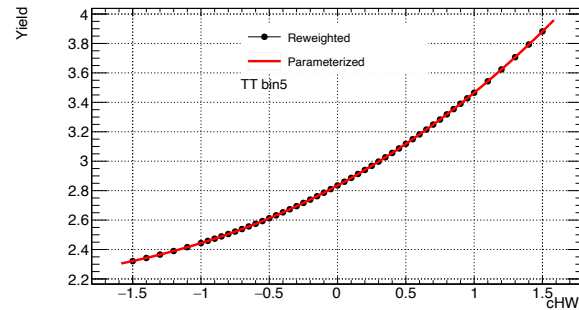
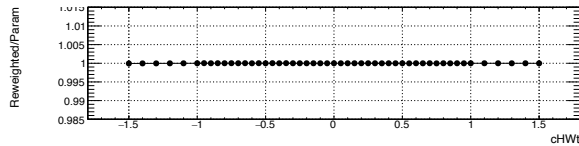
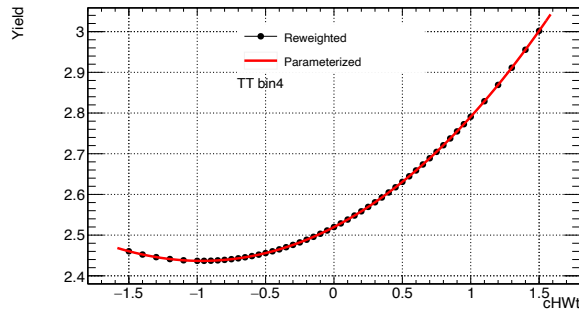
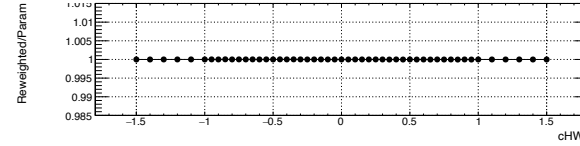
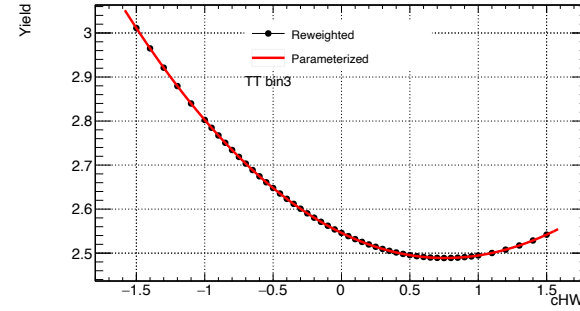
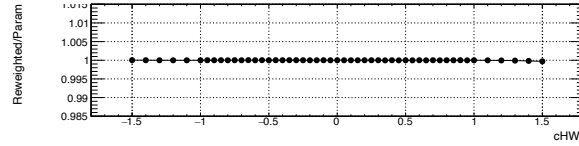
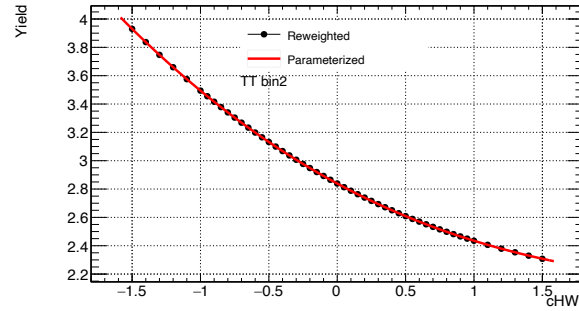
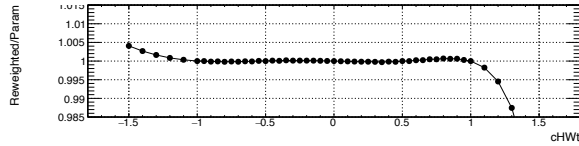
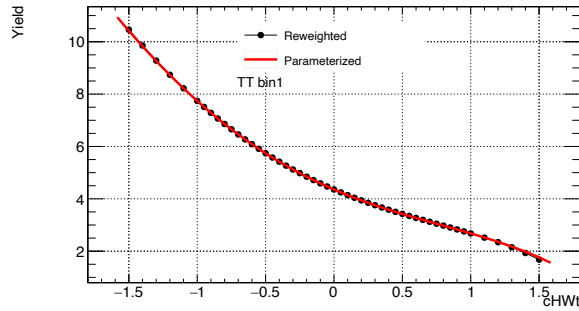


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Yields in categories



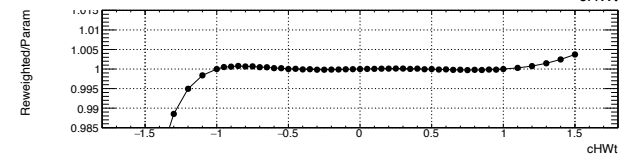
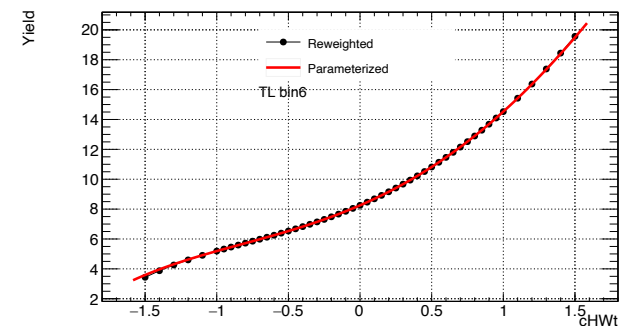
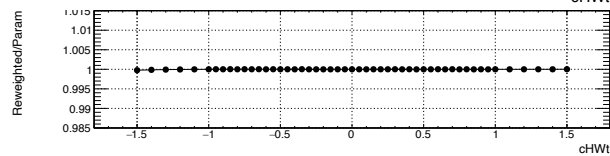
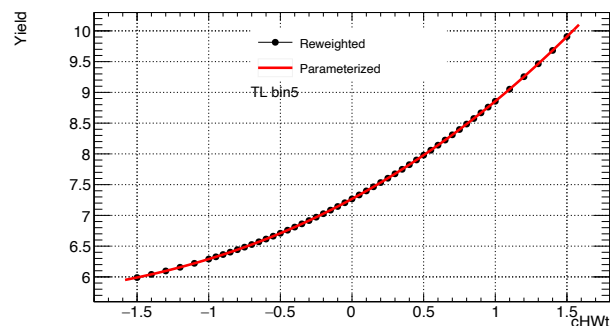
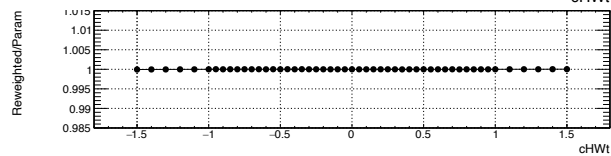
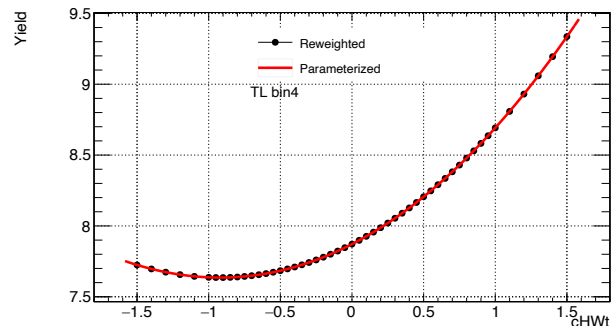
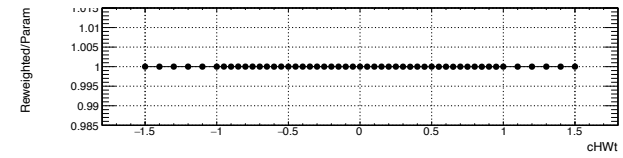
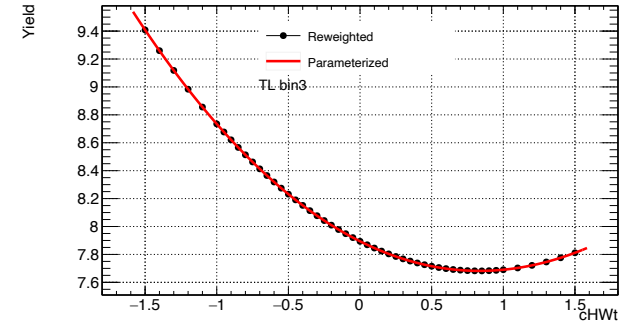
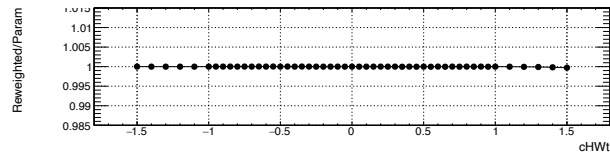
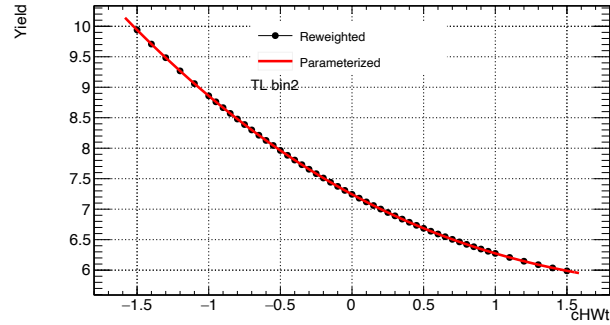
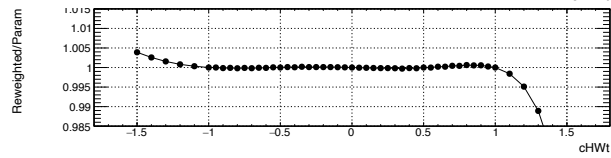
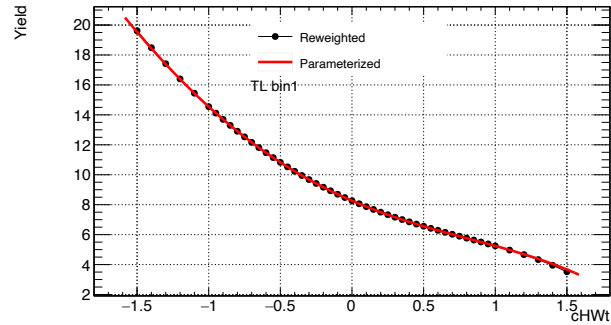
• TT



Yields in categories



• TL



Yields in categories



• LT

