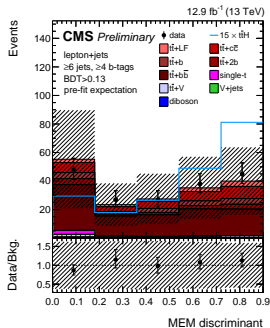
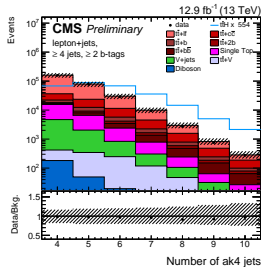


# CMS Search for $t\bar{t}H(b\bar{b})$ (CMS-PAS-HIG-16-038)

- $\approx 13 \text{ fb}^{-1}$  of  $\sqrt{s} = 13 \text{ TeV}$  data
- Targeting semi- and dileptonic  $t\bar{t}$  decays: 1 or 2 isolated leptons
- Events categorised in jet and b-tag multiplicity



- Per category: information of several variables combined
  - Step 1: BDT separating  $t\bar{t}H$  vs  $t\bar{t}$
  - Step 2: Splitting category into 2 sub-categories with low and high BDT-classifier value
  - Step 3: Per sub-category, MEM classifier output as final discriminant
- Final fit across all categories

- Result dominated by systematic unc.:  
bkg. modelling and b-tagging
- Background **dominated by  $t\bar{t}$** 
  - Challenge: **large  $t\bar{t}$  + HF bkg.** with associated theory uncertainties
- Modelling:
  - **Powheg+Pythia8**, normalised to **NNLO+NNLL** prediction
  - Separate templates for  $t\bar{t} + b$ ,  $t\bar{t} + b\bar{b}$ ,  $t\bar{t} + 2b$ ,  $t\bar{t} + c\bar{c}$ ,  $t\bar{t} + LF$
  - **50% rate uncertainty per process**, uncorrelated in final fit
  - Additional uncertainties: incl.  $t\bar{t}$  xs, PDF, QCD scales, ISR/FSR

