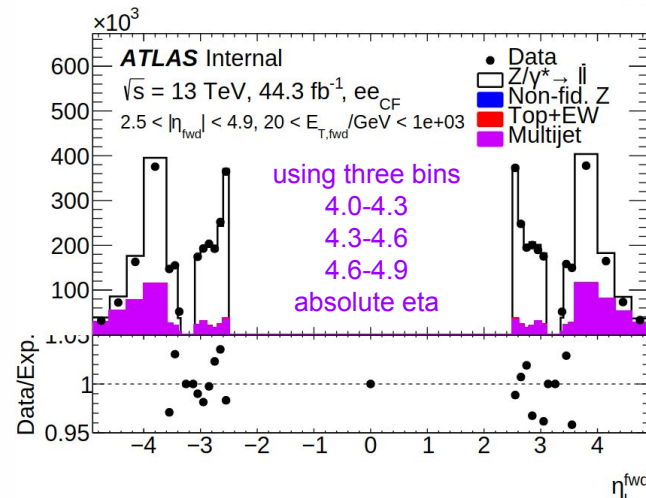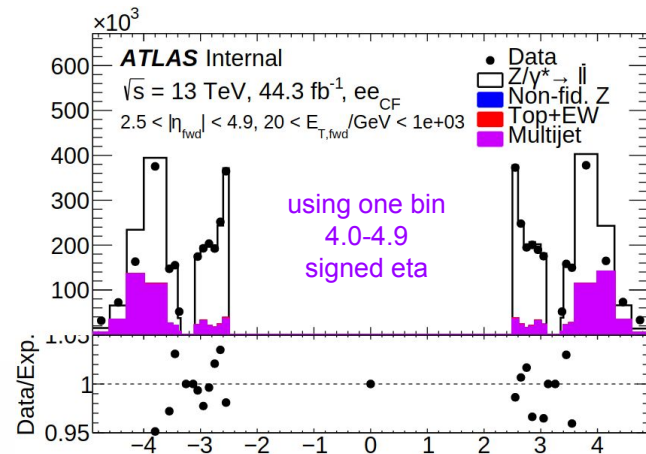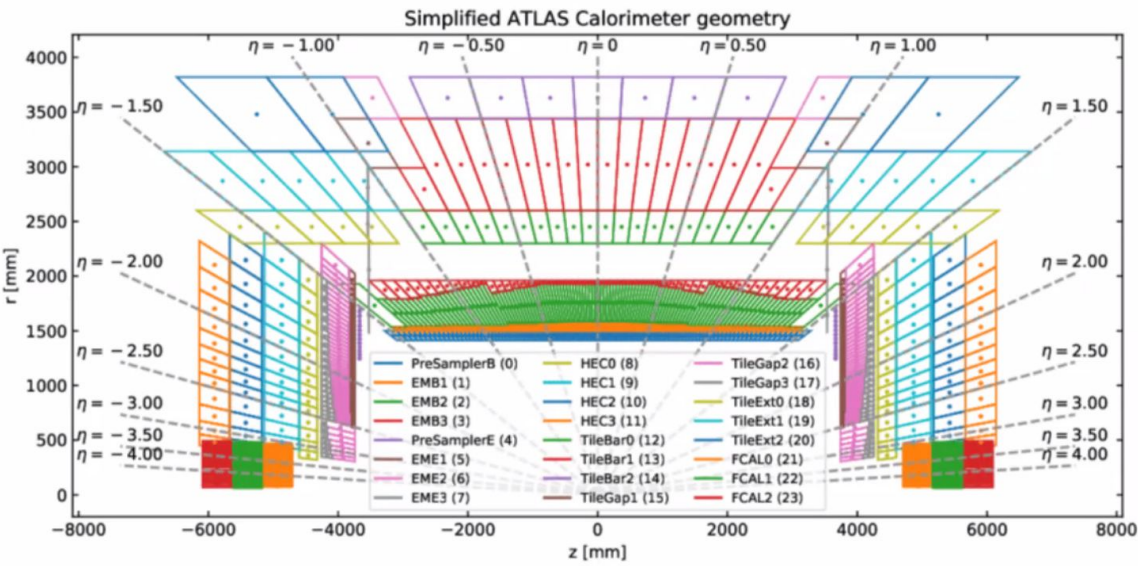# ZAi Analysis in eeCF channel

multijet estimation with fake factor method

$$N_{MJ}^{SR} = F N_{MJ}^{CR} = \tilde{N}_{MJ}^{CR} = \tilde{N}_{data}^{CR} - \hat{\mu} \tilde{N}_{MC}^{CR}$$

$$F = \frac{N_{MJ}^{IDoff}}{N_{MJ}^{nLoff}} \qquad \hat{\mu} = \frac{N_{prompt}^{SR}}{N_{MC}^{SR}} = \frac{N_{data}^{SR} - \tilde{N}_{data}^{CR}}{N_{MC}^{SR} - \tilde{N}_{MC}^{CR}}$$



Simplified ATLAS Calorimeter geometry



**ATLAS** Internal

$\sqrt{s}$ = 13 TeV, 44.3 fb$^{-1}$, ee$_{CF}$

$2.5 < |\eta_{fwd}| < 4.9$, $20 < E_{T,fwd}/GeV < 1e+03$

- Data
- $Z/\gamma^* \to \tilde{l}\tilde{l}$
- Non-fid. Z
- Top+EW
- Multijet

using one bin
4.0-4.9
signed eta

using three bins
4.0-4.3
4.3-4.6
4.6-4.9
absolute eta

# ZAi Analysis in eeCF channel
## multijet estimation with fake factor method

most recent multijet estimates (displayed with fine binning)
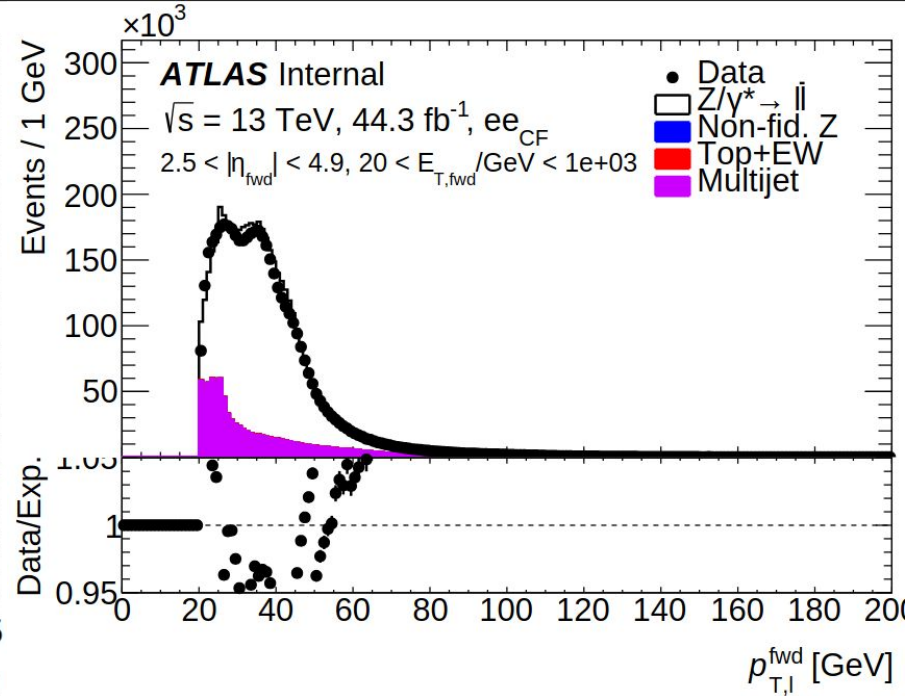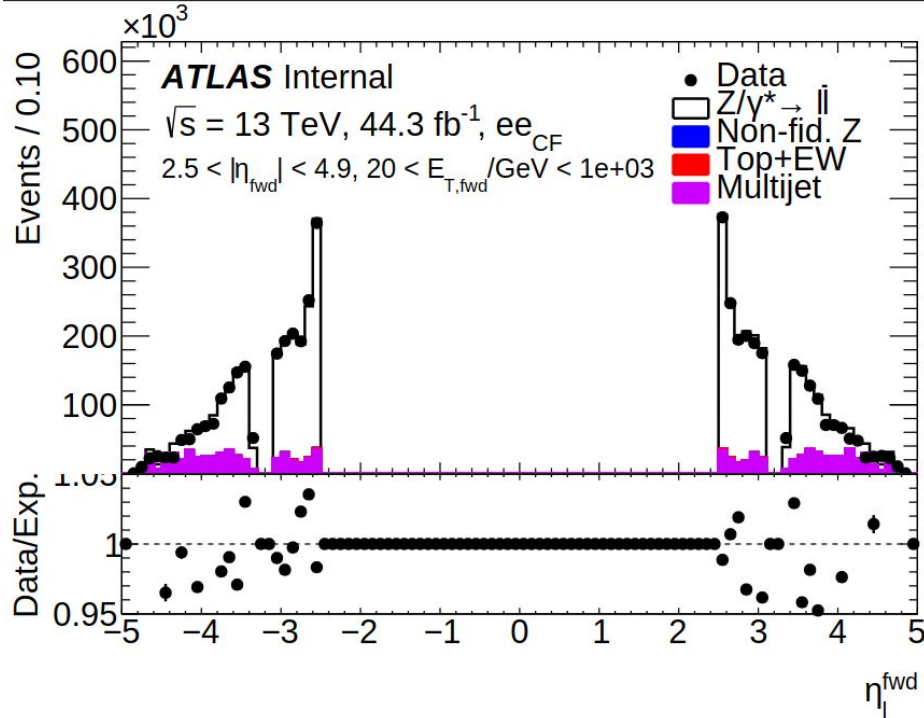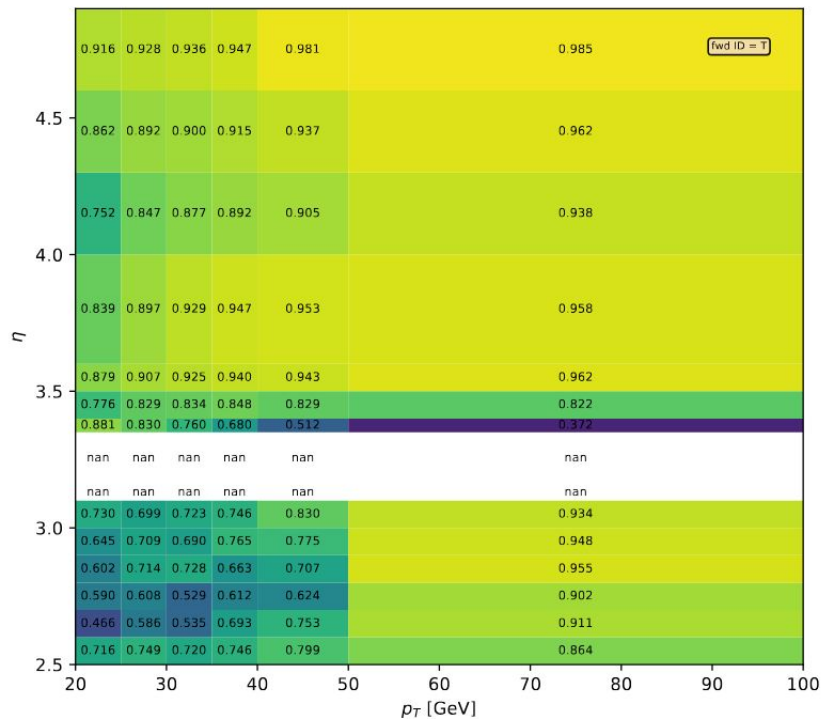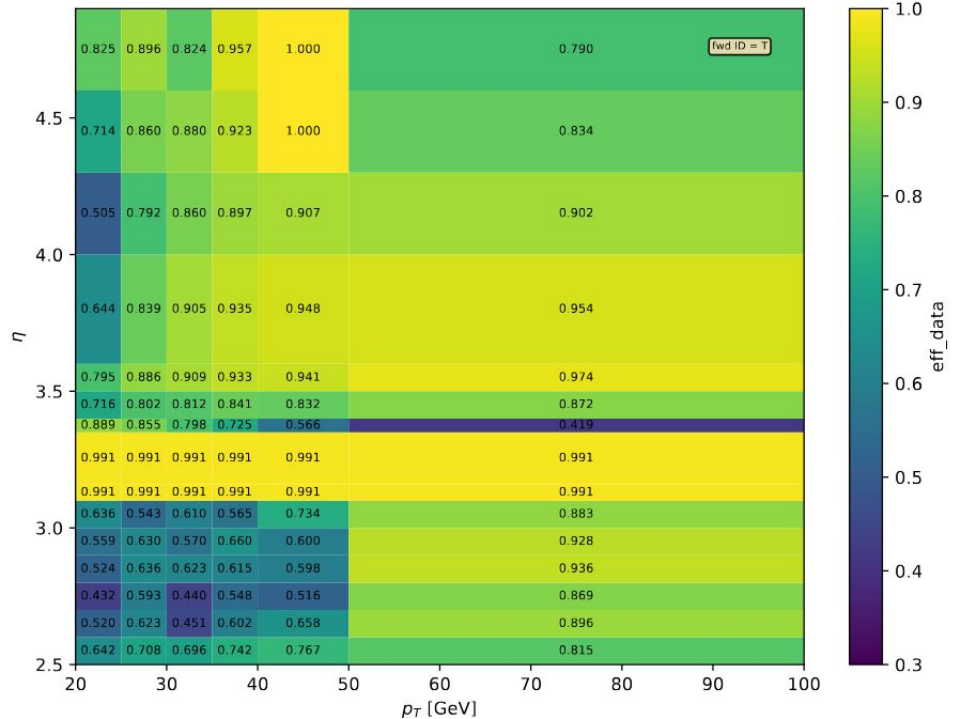
# ZAi Analysis in eeCF channel
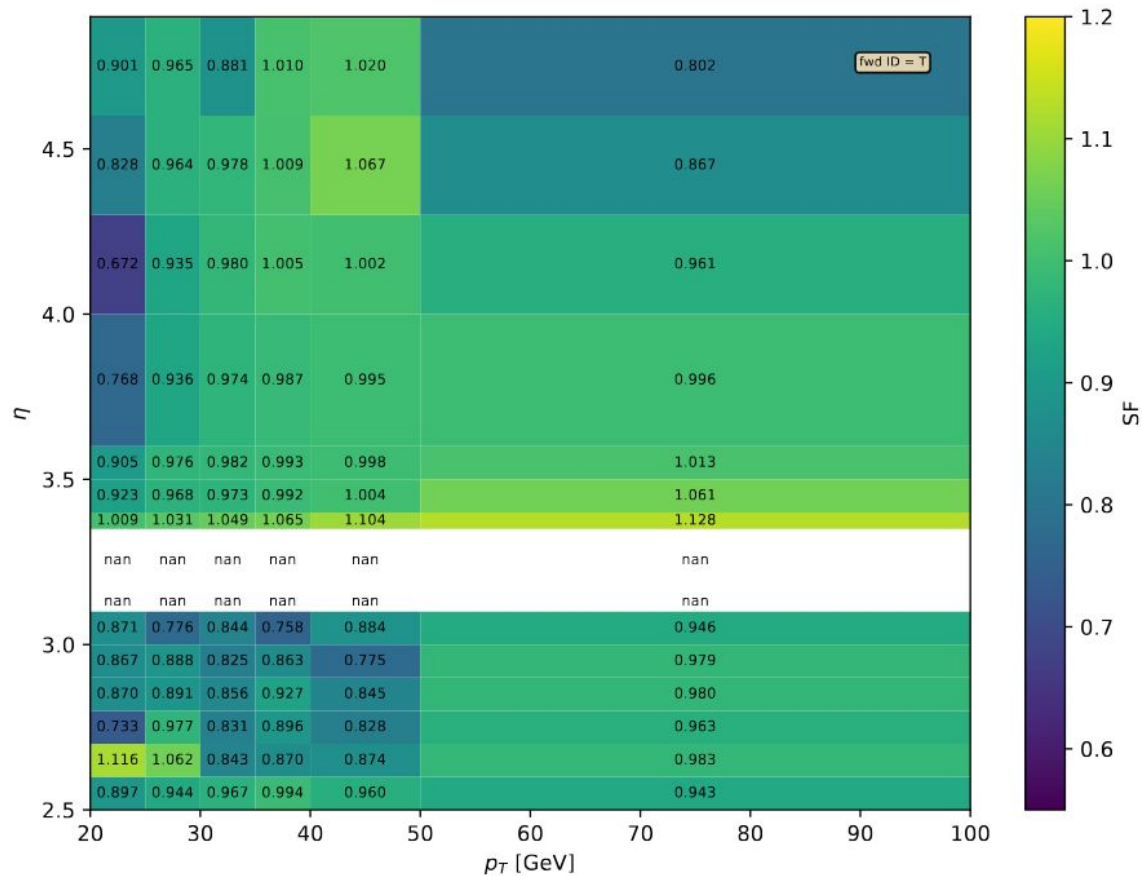electron identification-efficiency tight

## Monte-Carlo

| | | | | | | fwd ID = T |
|---|---|---|---|---|---|---|
| 0.916 | 0.928 | 0.936 | 0.947 | 0.981 | 0.985 | |
| 0.862 | 0.892 | 0.900 | 0.915 | 0.937 | 0.962 | |
| 0.752 | 0.847 | 0.877 | 0.892 | 0.905 | 0.938 | |
| 0.839 | 0.897 | 0.929 | 0.947 | 0.953 | 0.958 | |
| 0.879 | 0.907 | 0.925 | 0.940 | 0.943 | 0.962 | |
| 0.776 | 0.829 | 0.834 | 0.848 | 0.829 | 0.822 | |
| 0.881 | 0.830 | 0.760 | 0.680 | 0.512 | 0.372 | |
| nan | nan | nan | nan | nan | nan | |
| nan | nan | nan | nan | nan | nan | |
| 0.730 | 0.699 | 0.723 | 0.746 | 0.830 | 0.934 | |
| 0.645 | 0.709 | 0.690 | 0.765 | 0.775 | 0.948 | |
| 0.602 | 0.714 | 0.728 | 0.663 | 0.707 | 0.955 | |
| 0.590 | 0.608 | 0.529 | 0.612 | 0.624 | 0.902 | |
| 0.466 | 0.586 | 0.535 | 0.693 | 0.753 | 0.911 | |
| 0.716 | 0.749 | 0.720 | 0.746 | 0.799 | 0.864 | |

$\eta$ axis; $p_T$ [GeV]; colorbar: eff_MC

## Data

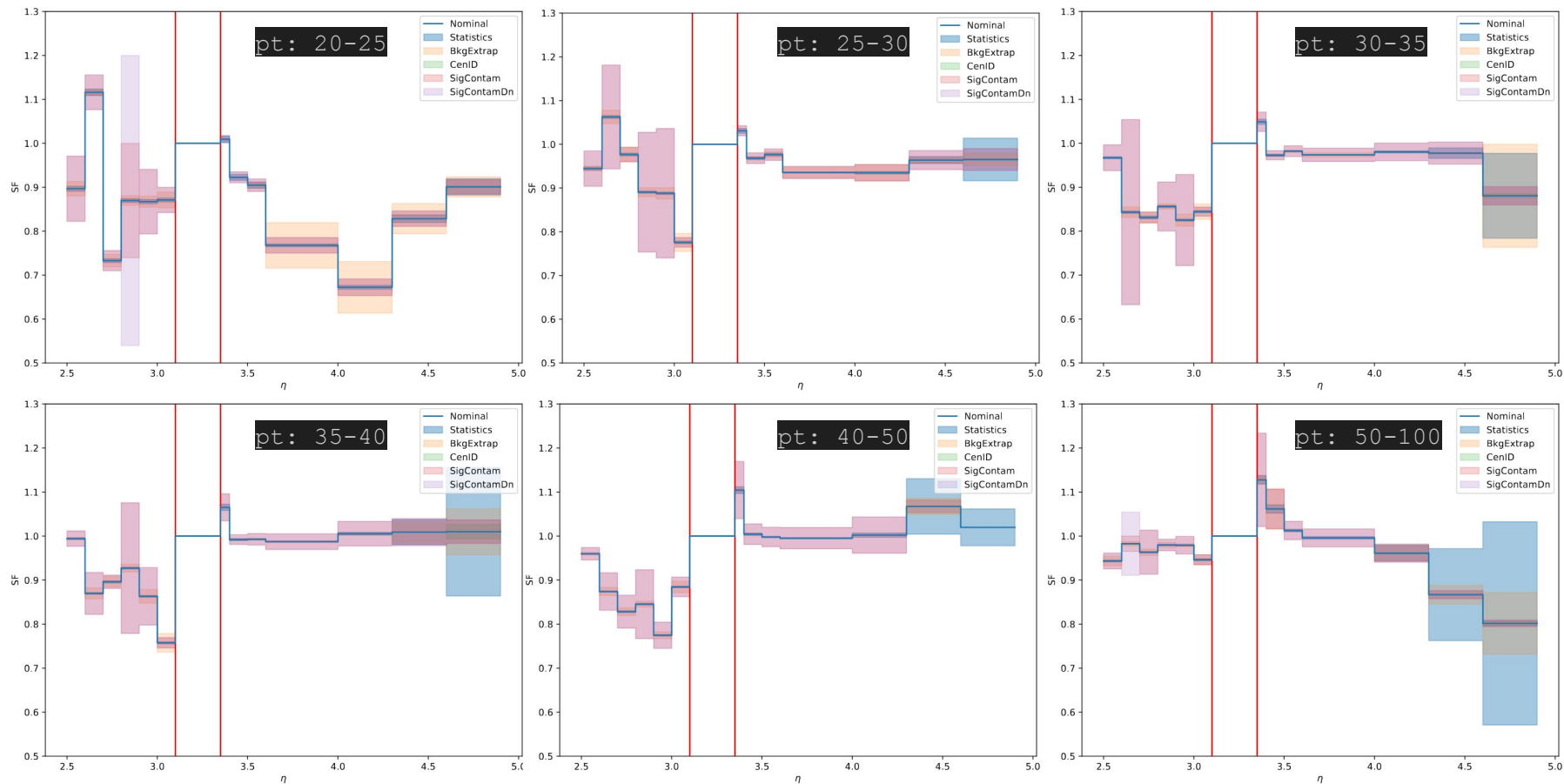| | | | | | | fwd ID = T |
|---|---|---|---|---|---|---|
| 0.825 | 0.896 | 0.824 | 0.957 | 1.000 | 0.790 | |
| 0.714 | 0.860 | 0.880 | 0.923 | 1.000 | 0.834 | |
| 0.505 | 0.792 | 0.860 | 0.897 | 0.907 | 0.902 | |
| 0.644 | 0.839 | 0.905 | 0.935 | 0.948 | 0.954 | |
| 0.795 | 0.886 | 0.909 | 0.933 | 0.941 | 0.974 | |
| 0.716 | 0.802 | 0.812 | 0.841 | 0.832 | 0.872 | |
| 0.889 | 0.855 | 0.798 | 0.725 | 0.566 | 0.419 | |
| 0.991 | 0.991 | 0.991 | 0.991 | 0.991 | 0.991 | |
| 0.991 | 0.991 | 0.991 | 0.991 | 0.991 | 0.991 | |
| 0.636 | 0.543 | 0.610 | 0.565 | 0.734 | 0.883 | |
| 0.559 | 0.630 | 0.570 | 0.660 | 0.600 | 0.928 | |
| 0.524 | 0.636 | 0.623 | 0.615 | 0.598 | 0.936 | |
| 0.432 | 0.593 | 0.440 | 0.548 | 0.516 | 0.869 | |
| 0.520 | 0.623 | 0.451 | 0.602 | 0.658 | 0.896 | |
| 0.642 | 0.708 | 0.696 | 0.742 | 0.767 | 0.815 | |

$\eta$ axis; $p_T$ [GeV]; colorbar: eff_data

ZAi Analysis in eeCF channel
electron identification-efficiency scale-factors

# ZAi Analysis in eeCF channel
electron identification-efficiency scale-factors

# fwdID SFs systematics

| variation | nID | cenID | ineffSF |
|-----------|-----|-------|---------|
| Nominal | nVVL | TIC | 1 |
| CenID | nVVL | MC | 1 |
| BkgExtrap | nVL | TIC | 1 |
| SigContam | nVVL | TIC | 2 |
| SigContamDn | nVVL | TIC | 0 |
| BkgShape | we decided not to use this, because we don't understand it (yet) | | |

# ZAi Analysis in eeCF channel
electron identification-efficiency scale-factors

**DONE**
- created new FFs for 2017 after Filips changes to trigger and central ID
- created new SFs for 2017 after Filips changes to trigger and central ID
- …now including systematics
- improved FFs in FCAL by splitting the bin and switching to absolute eta
- found CF events with fwdEta < 2.5 causing errors when trying to load FFs

**TO-DO**
- cut out events with fwdEta < 2.5
- try even finer FF binning
- create FFs for 15/16 and 2018 (need lists and weights from Craig)
- create SFs for 15/16 and 2018 (need lists and weights from Craig)
- create control plots with and without SF application → compare
- (possibly) create SFs with coarser binning for all years → compare to Luxin's results
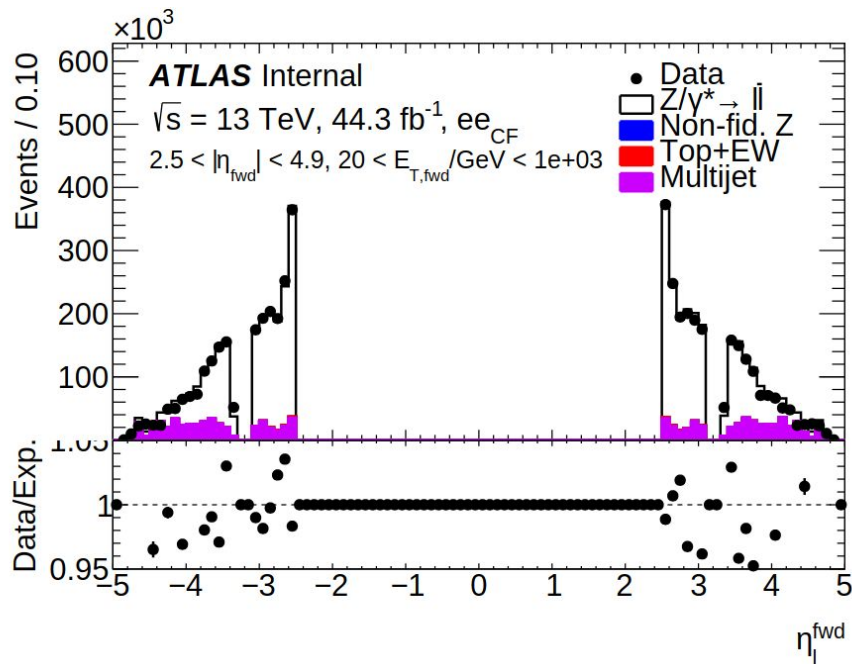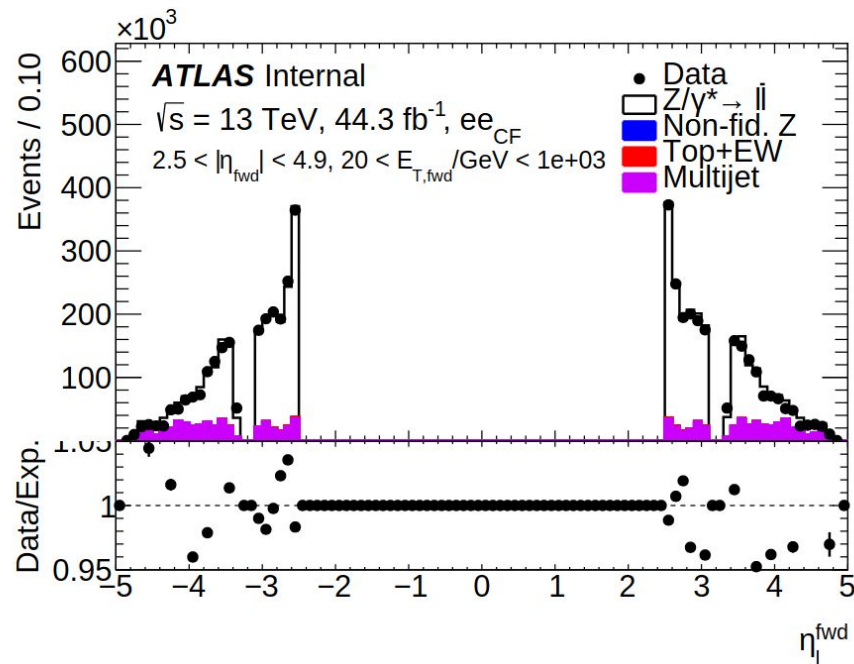
# ZAi Analysis in eeCF channel
UPDATE 22.03.2024

# ZAi Analysis in eeCF channel
multijet estimation - eta binning

# ZAi Analysis in eeCF channel

## multijet estimation - pt binning
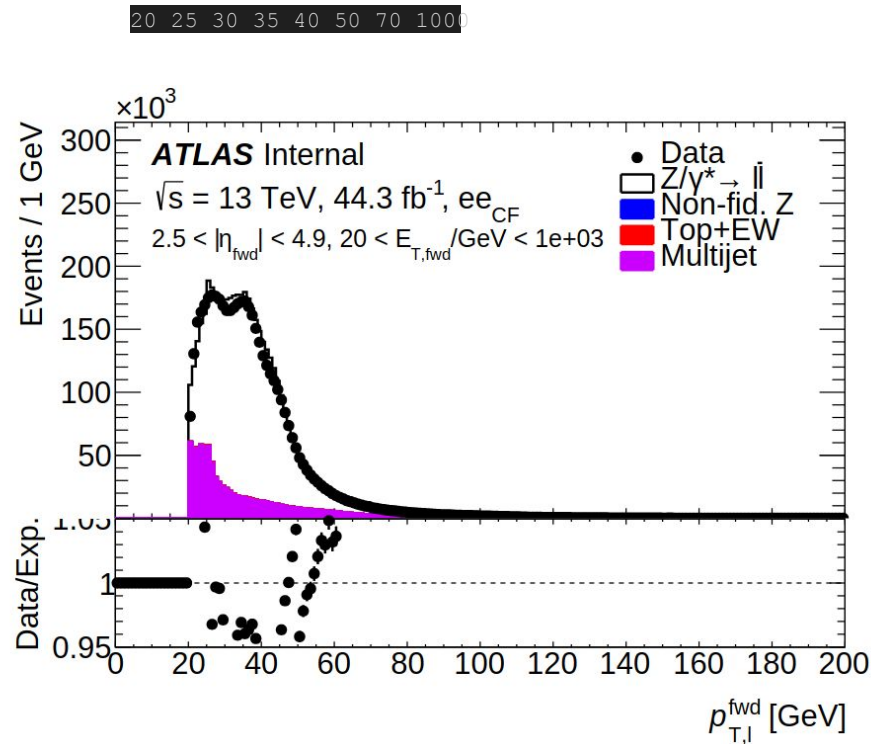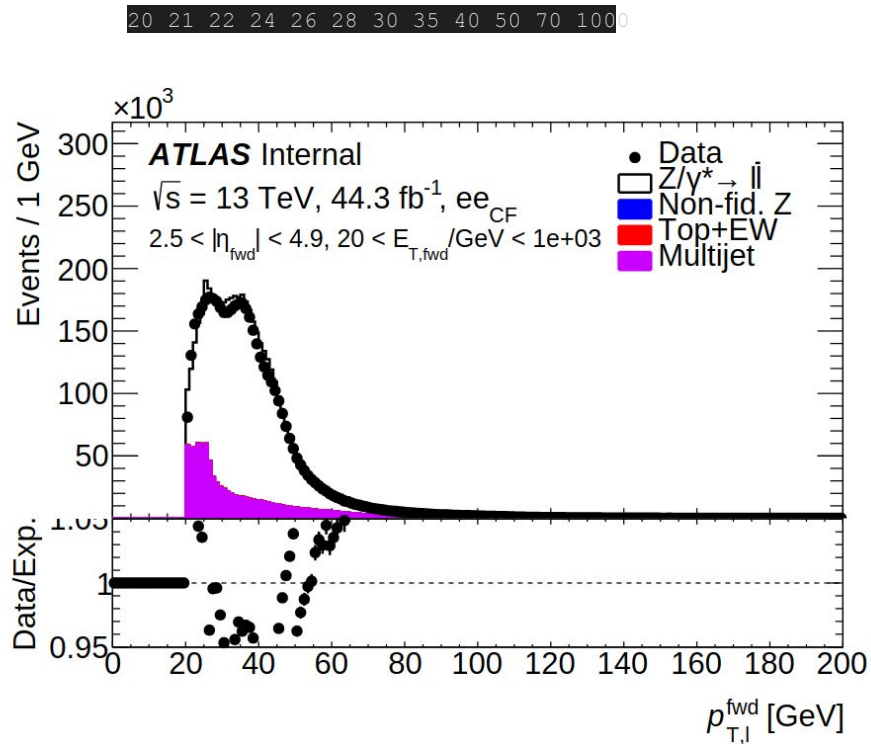
# fwdID SFs systematics

**changed systematics**

| variation | nID | cenID | ineffSF |
|-----------|-----|-------|---------|
| Nominal | nVVL | TIC | 1 |
| CenID | nVVL | MC → TC | 1 |
| BkgExtrap | nVL | TIC | 1 |
| SigContam | nVVL | TIC | 2 ≙ +100% → +50% |
| SigContamDn | nVVL | TIC | 0 ≙ −100% → −50% |
| BkgShape | we decided not to use this, because we don't understand it (yet) | | |

# ZAi Analysis in eeCF channel
## **before**
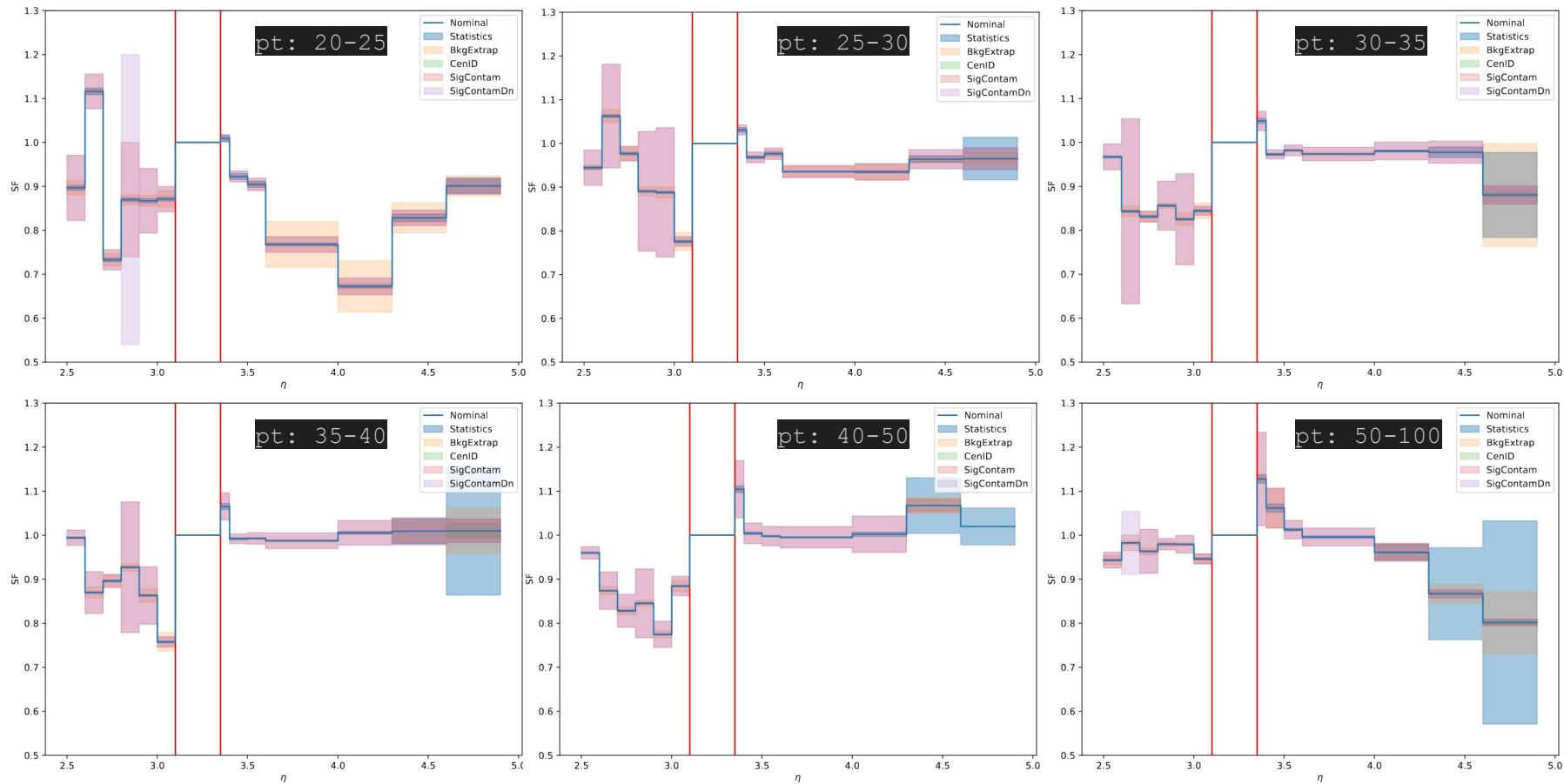
# ZAi Analysis in eeCF channel
## **after**

no time to prepare :(
→ look at plots in vscode