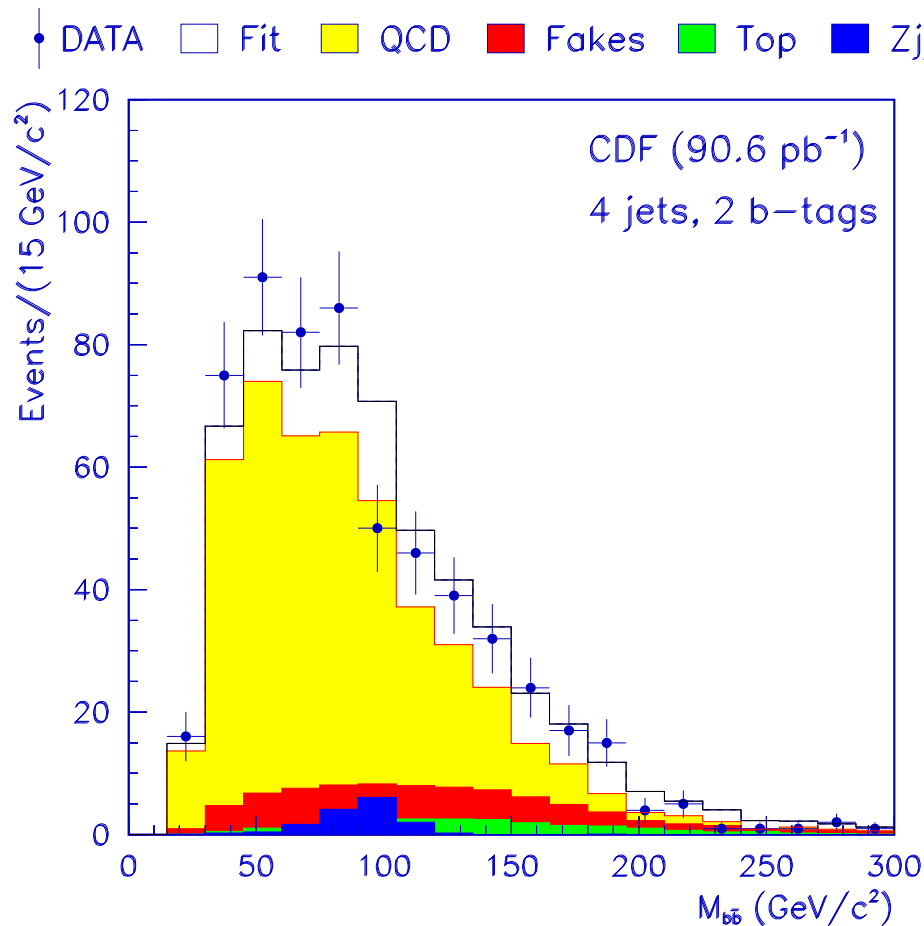


Fake Double Tags Needed for Measuring QCD Bkg



- Run1 4b search used 2-tag events to measure “fakes” and “QCD” contribution to 2-tag events. This fake rate was measured in data.
- bbjj MC was used for “QCD.” This rate was left free.
- With other small bkg’s fixed, the templates were fitted to data $M_{b\bar{b}}$ spectrum of double tagged dijets.
- MC ratio of bbbb/bbjj was used to get QCD prediction in 3-tagged sample

HOWTO Estimate Fake Double Tags

- Fake double tag defined to be **positively tagging two light flavored jets**
- To measure from data, use the fake rate matrix.
- In RunI, Juan Valls figured out the trick:

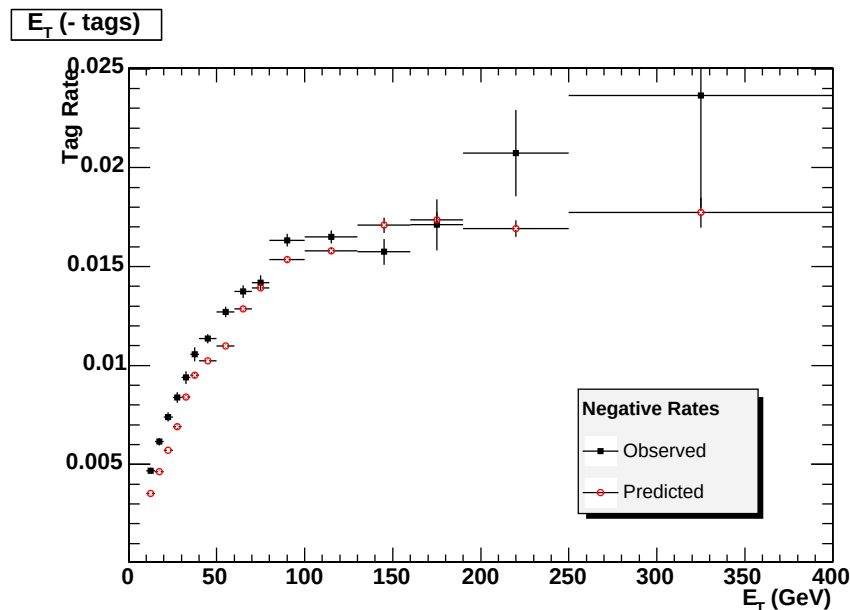
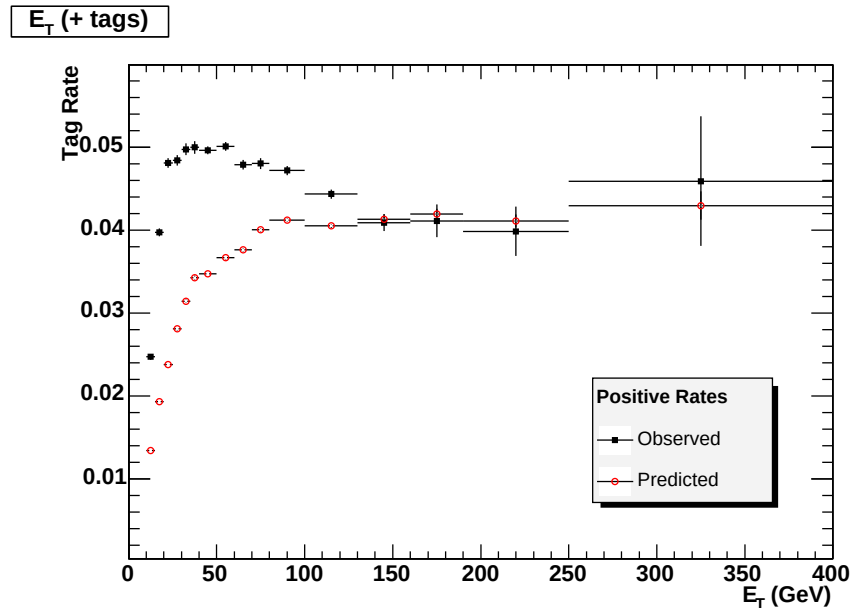
$$N_{++(\text{fakes})}^{\text{pred}} = N_{+-}^{\text{pred}} - N_{--}^{\text{pred}}$$

- (See [cdf4129](#) and [cdf3447](#) for somewhat clear explanations)
- $N_{+-,--}^{\text{pred}}$ are to be estimated using **single-tag fake rate matrix**, like in top analysis.
- Must **remake fake rate matrix** to account for change in b-fraction due to **SVT trigger** in our events.

Remaking the Fake Rate Matrix

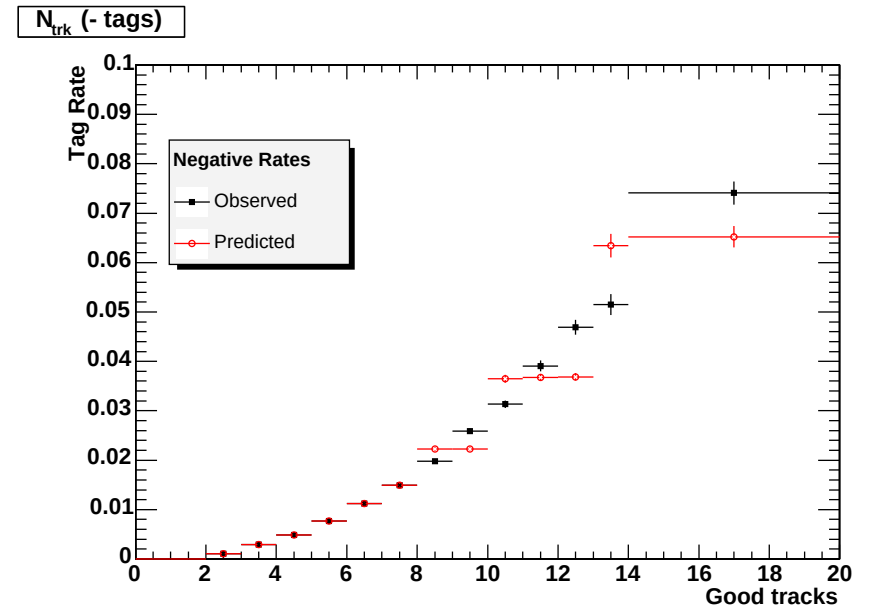
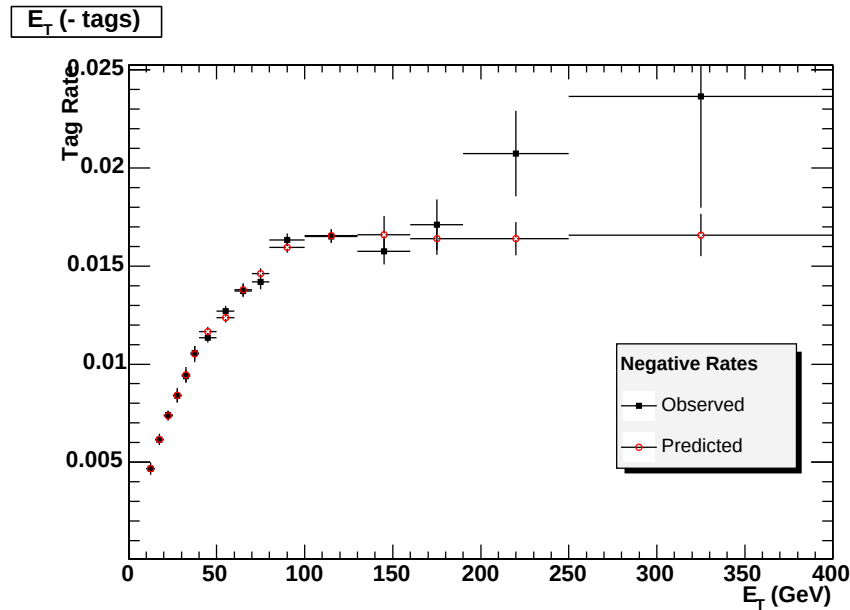
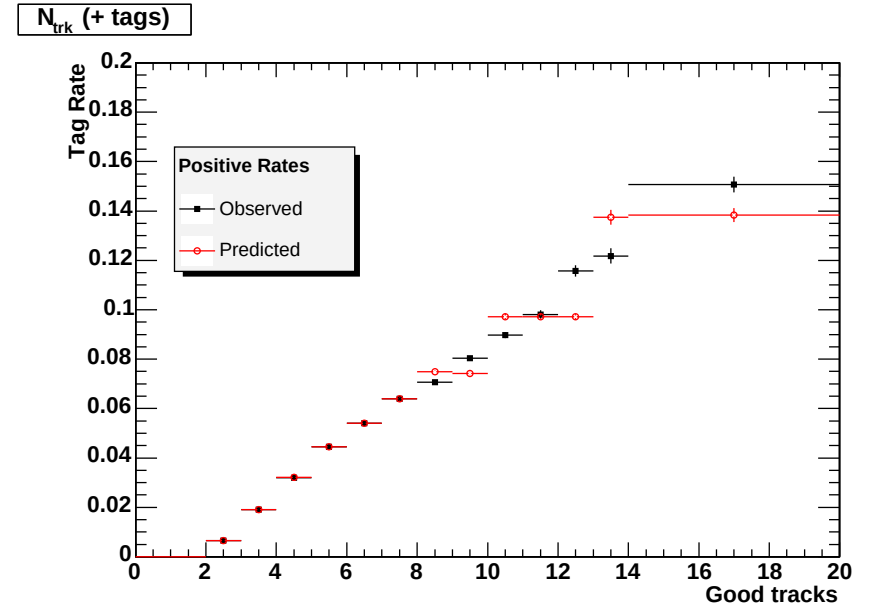
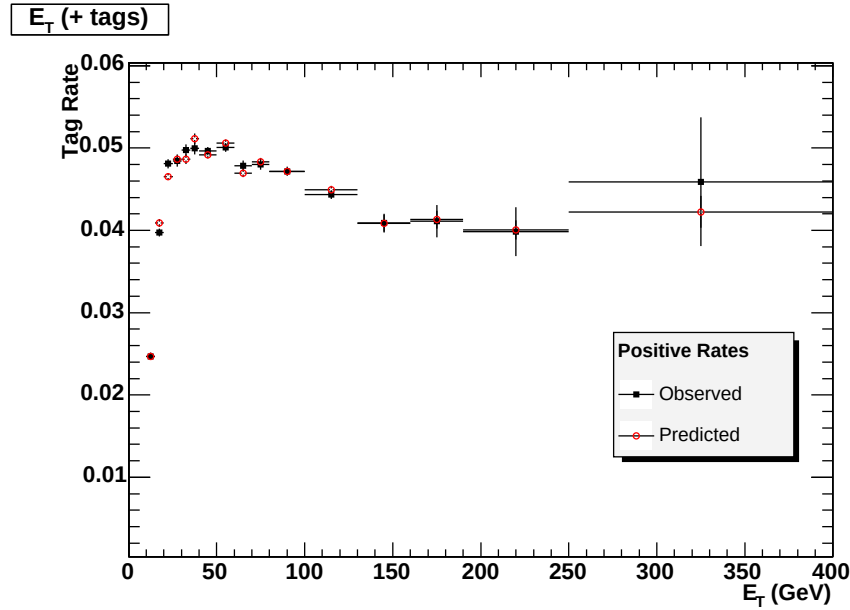
- Using STNTUPLE, remake the fake rate matrix just like we did for lepton+jets top analysis, but must deal with SVT
- Using inclusive jet events (JET20-100), accept only events with two SVT tracks with $|d_0^{\text{SVT}}| > 100 \mu\text{m}$, plus other nominal SVT requirements.
- Out of 13M good (unique) inclusive jet events, 1M pass SVT requirement.
- This is barely enough with current parameterization in [cdf6533](#)

Why We Must Remake Fake Matrix

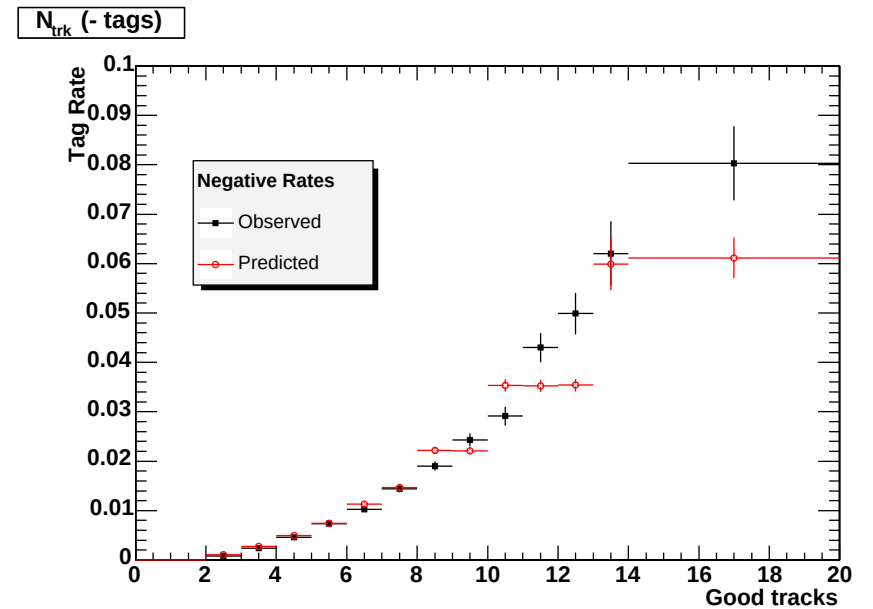
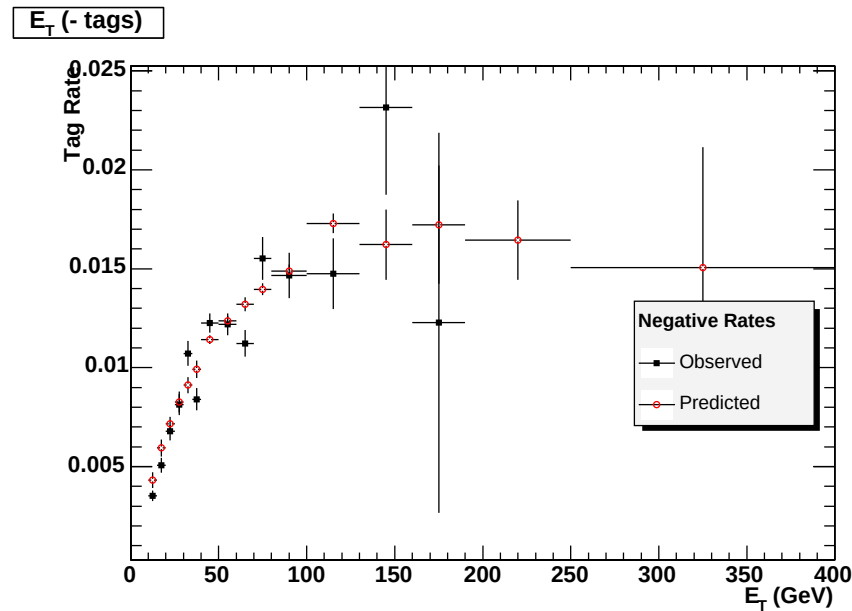
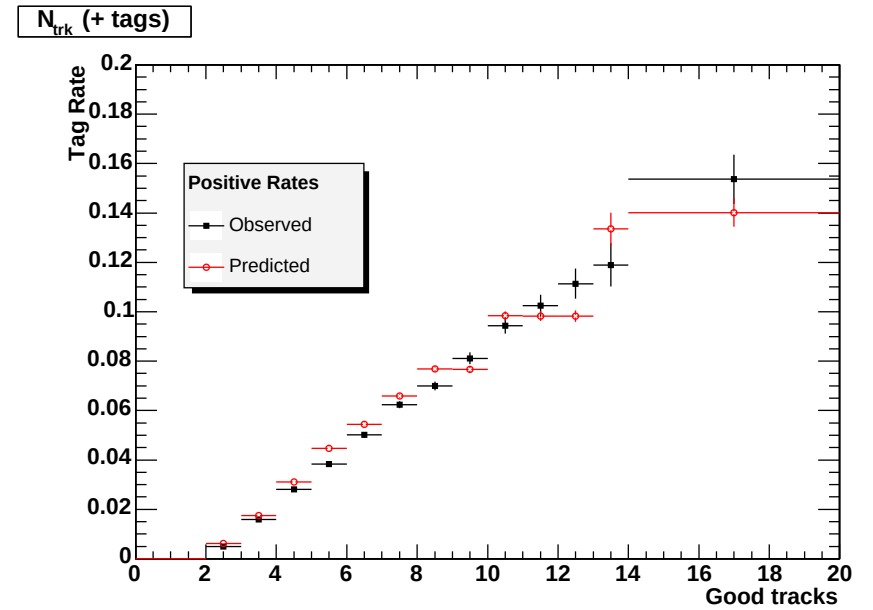
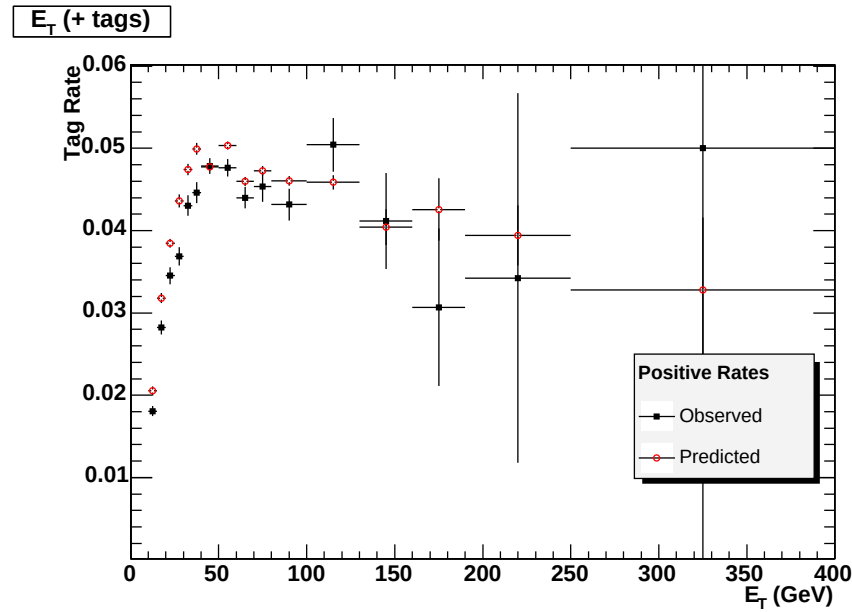


- Mistag matrix is made from basic inclusive jet events
- Doesn't predict positive tag rates in SVT events
- Doesn't even predict negative rates in SVT events

Remade Fake Matrix Predicts SVT Incl Jet Events Well



Remade Matrix Predicts HIGGS_MULTI_JET Neg Rate Well



Summary of Matrix Predictions

Sample & Mtx	Pos Pred	Pos Obs	Pos Ratio
Incl. Jets SVT old Mtx	0.031313 ± 0.00007	0.04463 ± 0.0002	1.425 ± 0.006
Incl. Jets SVT new Mtx	0.0446 ± 0.0002	0.0446 ± 0.0002	1.000 ± 0.005
HIGGS_MULTI_JET new Mtx	0.0411 ± 0.0002	0.0382 ± 0.0003	0.928 ± 0.009
Sample & Mtx	Neg Pred	Neg Obs	Neg Ratio
Incl. Jets SVT old Mtx	0.00984 ± 0.00004	0.01096 ± 0.00008	1.113 ± 0.009
Incl. Jets SVT new Mtx	0.0110 ± 0.0001	0.01095 ± 0.00008	1.00 ± 0.01
HIGGS_MULTI_JET new Mtx	0.0094 ± 0.0001	0.0092 ± 0.0002	0.97 ± 0.02

Use New Fake Matrix to Predict Double Tag Combos

The number of fake tag *combinations*

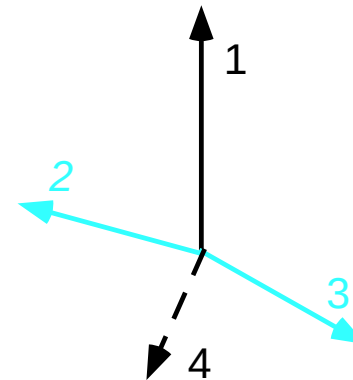
$$N_{+-}^{\text{pred}} = \sum_{\text{events}} \sum_{N_+^c} \sum_j r_-^j ,$$

N_+^c is number of distinct combinations of taggable jets with at least one pos tag

$$N_{--}^{\text{pred}} = \sum_{\text{events}} \sum_{N_-^c} \sum_j r_-^j$$

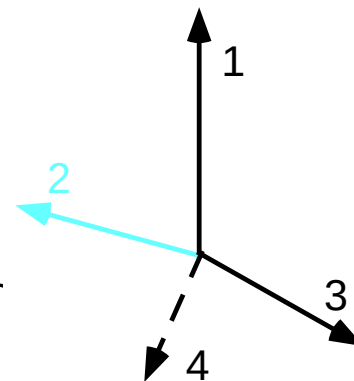
for double neg predicted number of combinations.

r_-^j is neg tag rate prediction from fake matrix for “away” jet j .



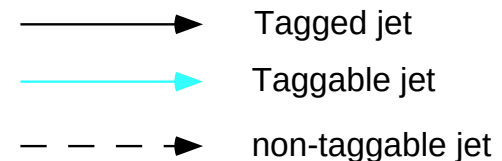
Event with 3 taggable jets.
Jet 1 is positively tagged.

$$N = r(2) + r(3)$$



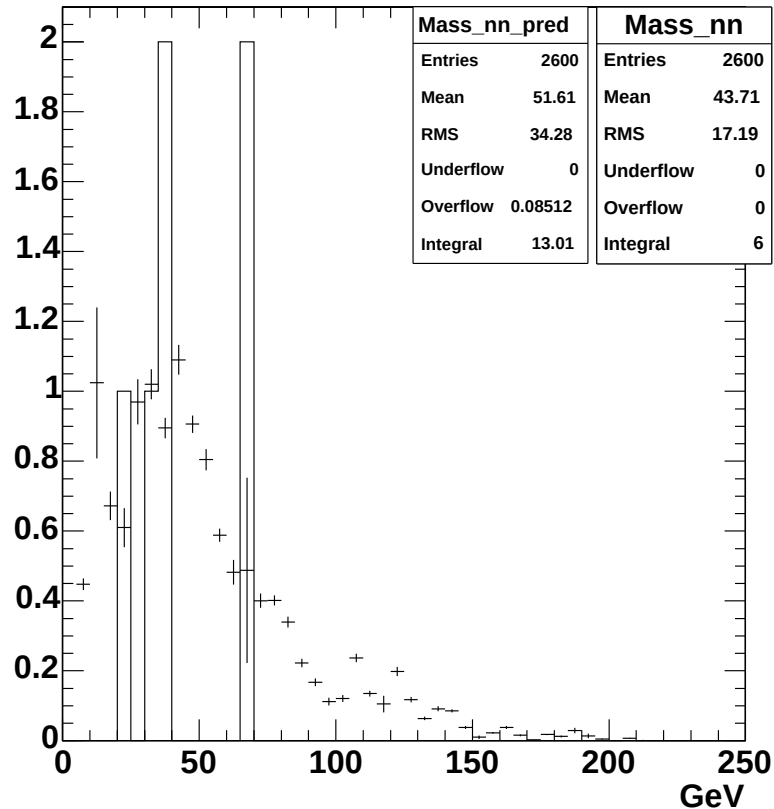
Event with 3 taggable jets.
Jets 1 and 3 are positively tagged.

$$N = r(2) + r(3) + r(2) + r(1)$$



Fake Double Tags in Incl Jet Events with 3+ Taggable

Mass of -- tagged jet pairs



Fake -- Tag Rate

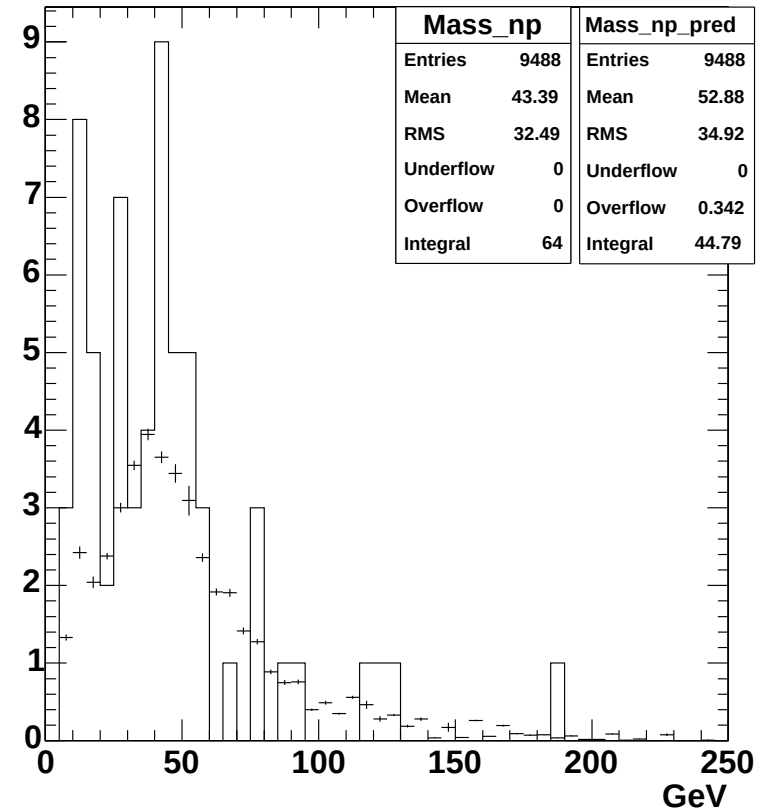
Predicted: 13.10 ± 0.38

Observed: 6 ± 2.4

Obs/Pred: 0.46 ± 0.18

Cheap counting gives 6 obs and 6.558 pred.

Mass of -+ tagged jet pairs



Fake -+ Tag Rate

Predicted: 45.13 ± 0.39

Observed: 64 ± 8

Obs/Pred: 1.42 ± 0.18

Cheap counting gives 64 obs and 51.256 pred.

Other News

- Still need to understand discrepancy in predicted/obs double tags. Looks like a bug...
- Carsten found and fixed a number of inconsistent options used for SecVtx tagging in STNTUPLE
- He made a new tag `dev_240a`, which should be used with `4.11.2` by anybody doing SecVtx-tagging in STNTUPLE's
- Jared has generated 10M 4b events with GRAPPA on Rutgers farm
- Pete has figured out how to possibly correct $N_{++(\text{fakes})}^{\text{pred}}$ for asymmetric neg tag distribution in light jets (15% eff according to Henri & Sal)
- I've committed a bunch of scripts to run `cdfSim`, `TRGSim++`, `SvtFilter`, `ProductionExe` in `4.11.2` with patches to properly simulate our `L1` and `L2` triggers