Forward Electron Truthmatching

28.10.2024

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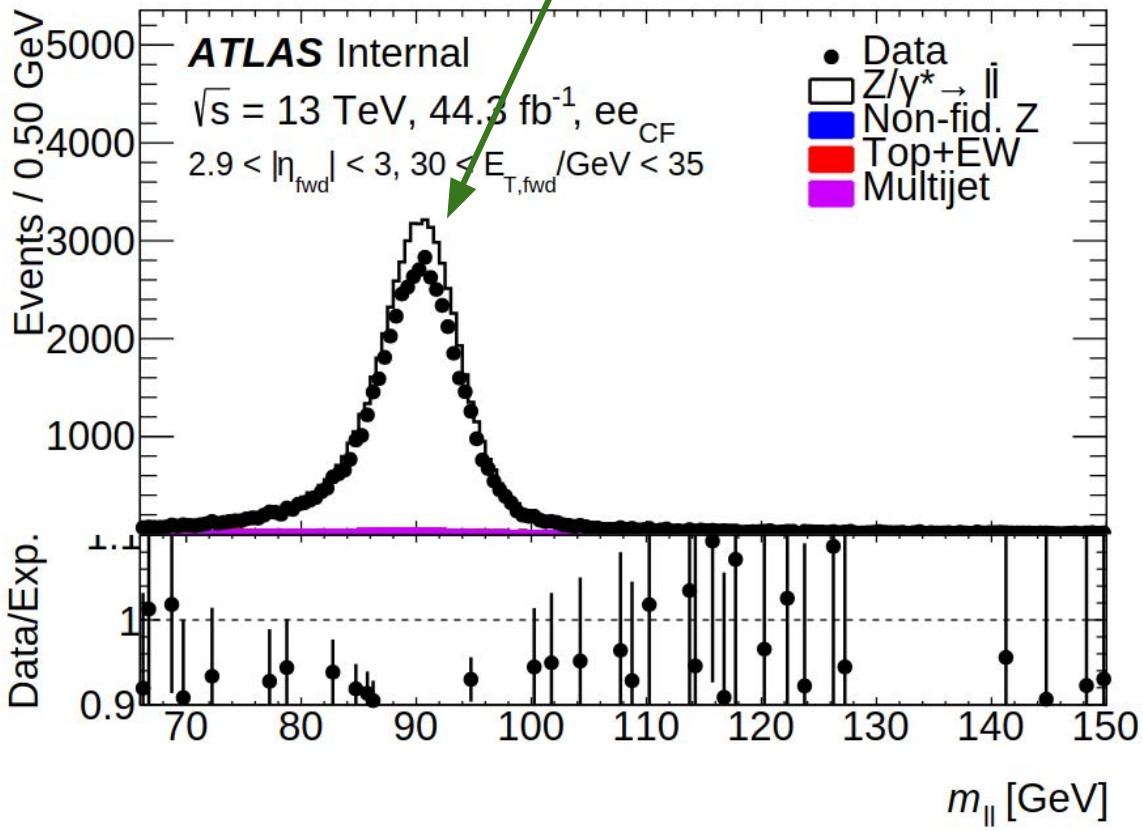
DESY.

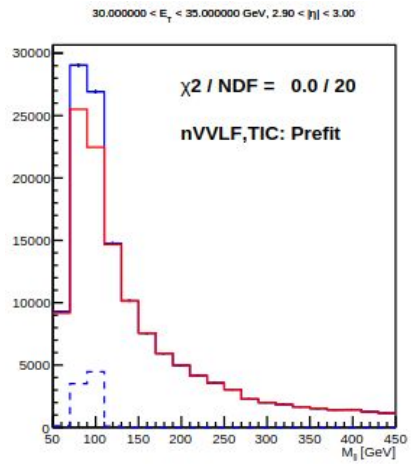
Control Plot vs SF Fit Plot

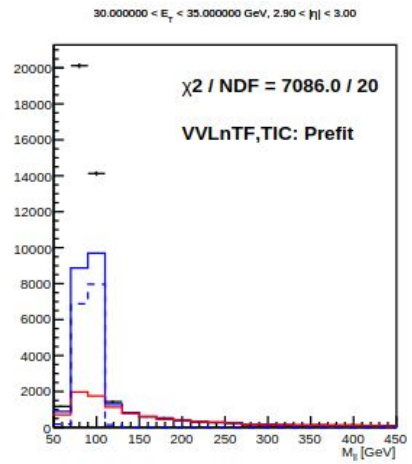
observed differences

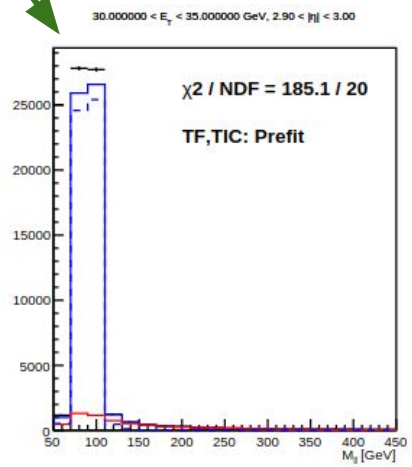
MC > data

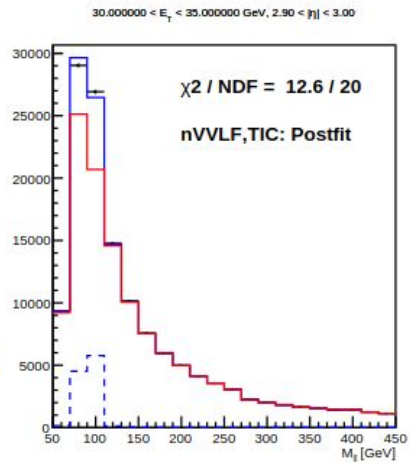
data > MC

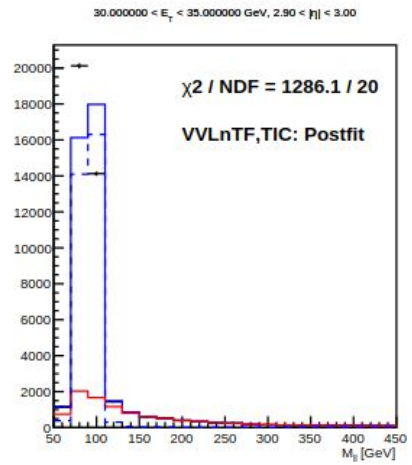


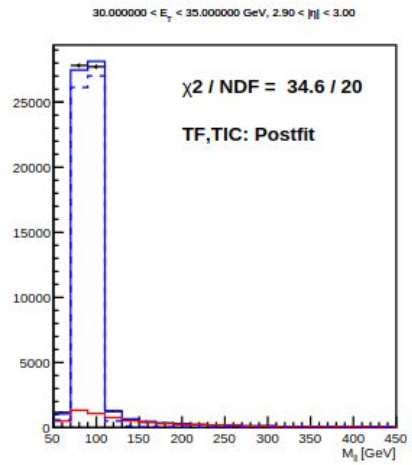












Control Plot vs SF Fit Plot

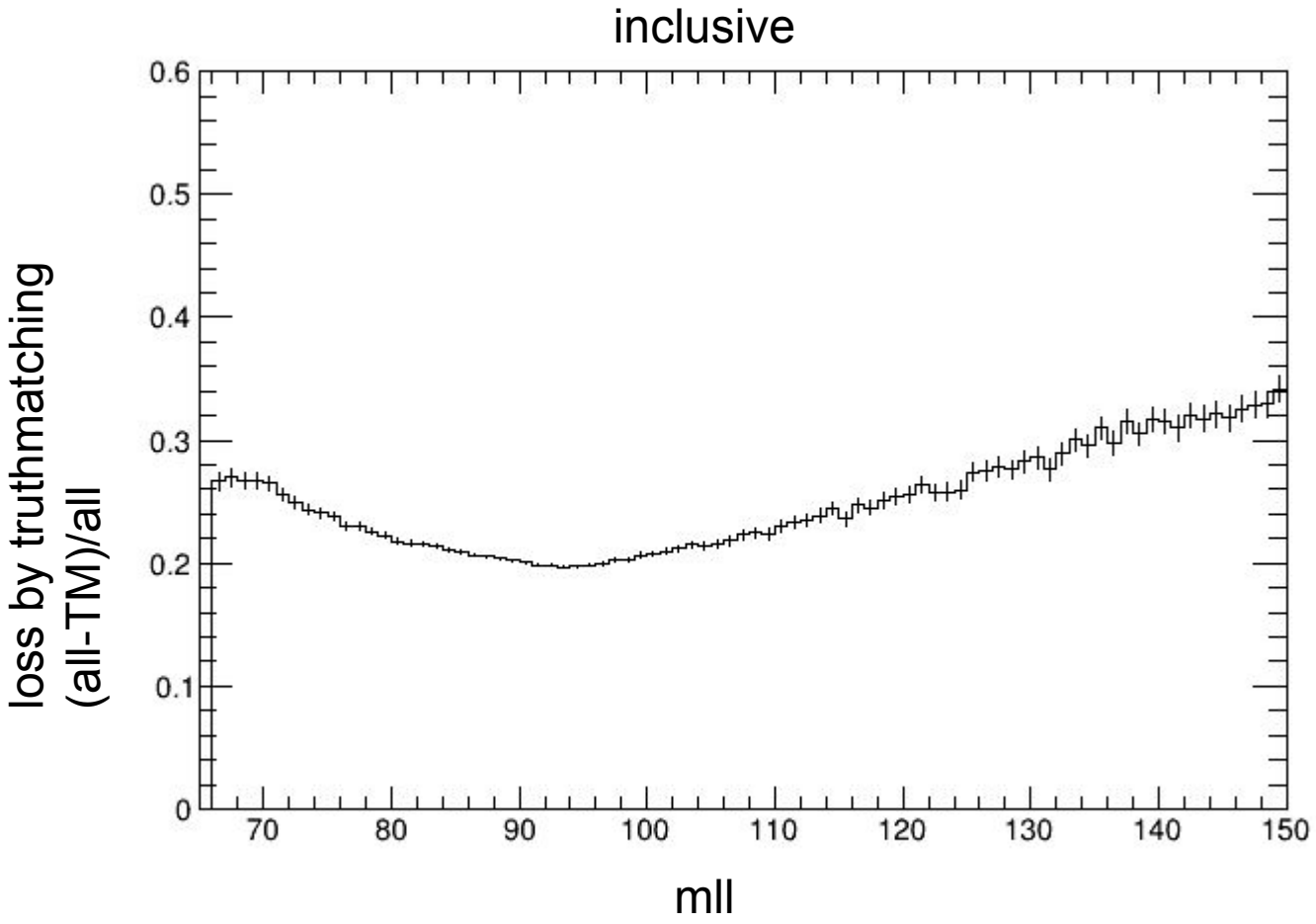
differences in selection

Criteria \ Inputs for:	**SF Fits**	**Control Plots**
central electron ID	tight + isolation (only tight is sys variation)	tight
forward electron truthmatching	required	not required

- cenID difference is okay
  - eID_SFs are determined with tag-and-probe → tight cut on tag required
  - difference of including isolation covered in sys variations
- truthmatching difference is problematic
  - SF fits treat non-truthmatched MC events as background
    → calculates SFs **only** for truthmatched events
  - analysis scans / control plots treat non-truthmatched MC events as signal
    → SFs are applied to **all** MC events

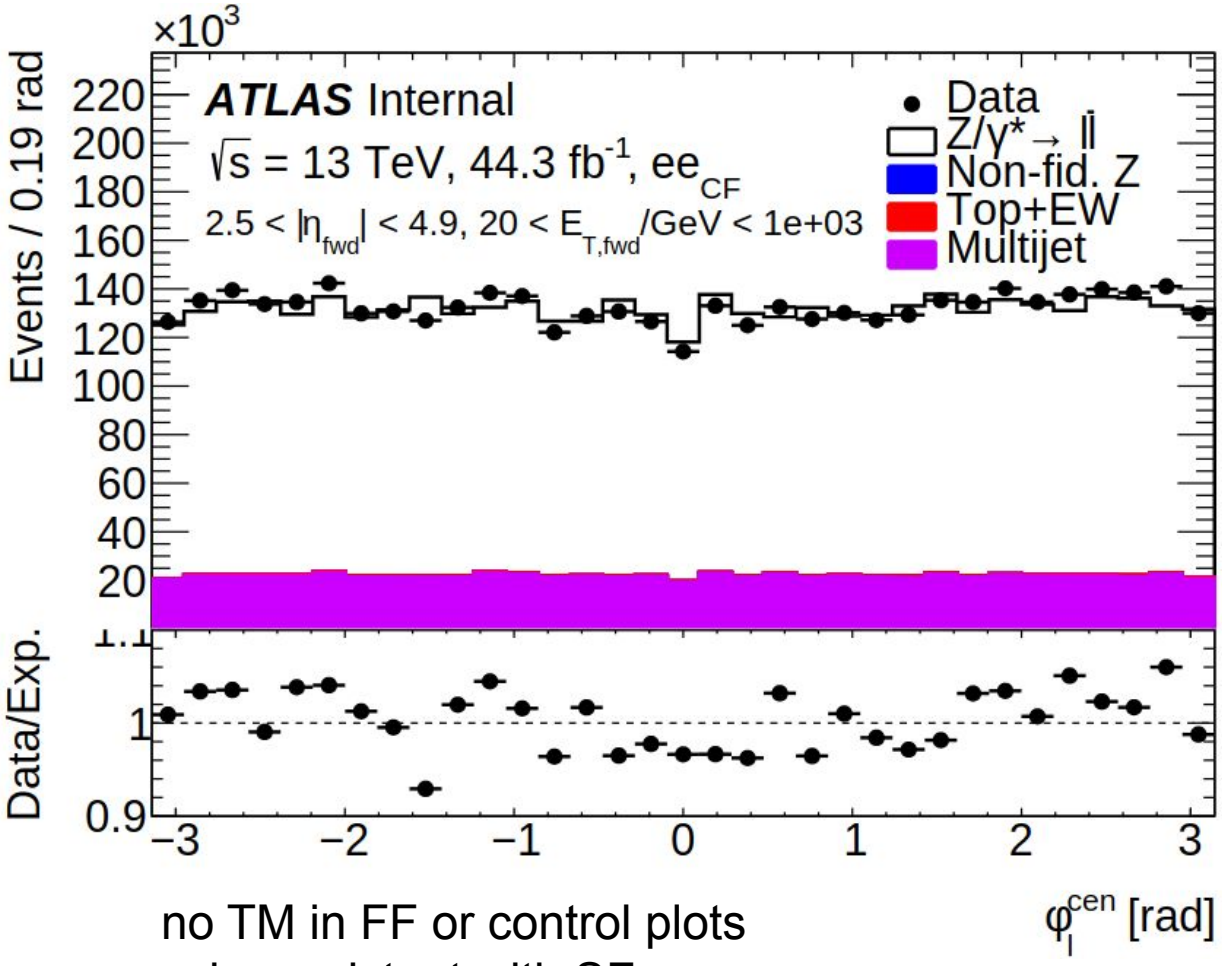
Truthmatching

How large is the effect of the trithmatching cut?

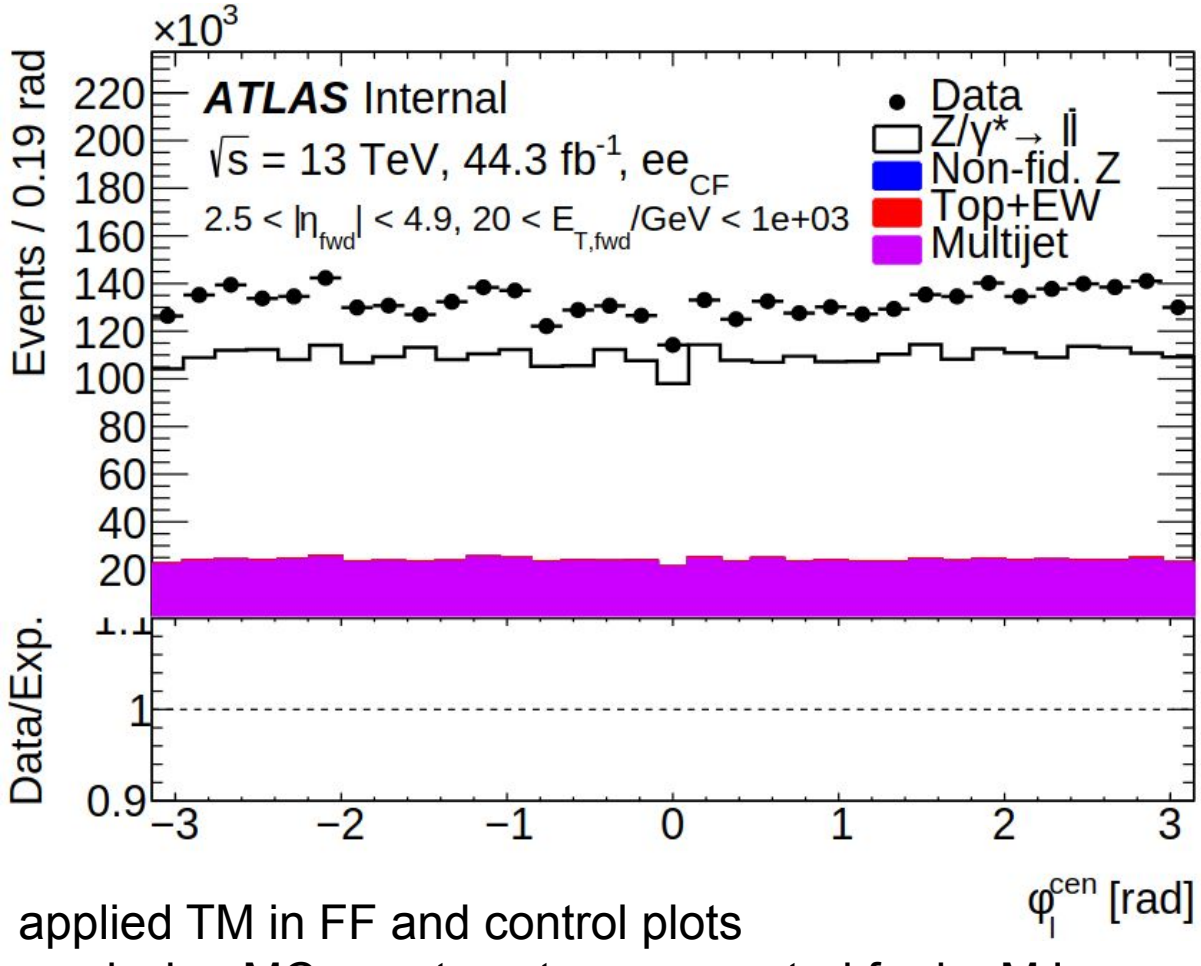


Control Plots

(applied SF have been determined with truthmatching)



no TM in FF or control plots
→inconsistent with SF



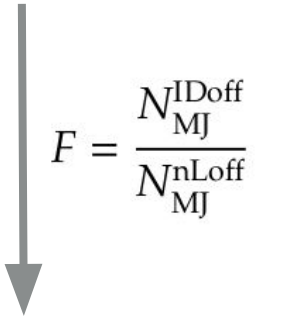
applied TM in FF and control plots
→missing MC events not compensated for by MJ

MJ Estimation

with Fake Factor Method

control region

MJ = data - signalMC



$$F = \frac{N_{\mathrm{MJ}}^{\mathrm{IDoff}}}{N_{\mathrm{MJ}}^{\mathrm{nLoff}}}$$

(almost invariant to truthmatching)

signal region

MJ estimate

MJ Estimation

with Fake Factor Method

control region

MJ = data - signalMC

$$F = \frac{N_{\mathrm{MJ}}^{\mathrm{IDoff}}}{N_{\mathrm{MJ}}^{\mathrm{nLoff}}}$$

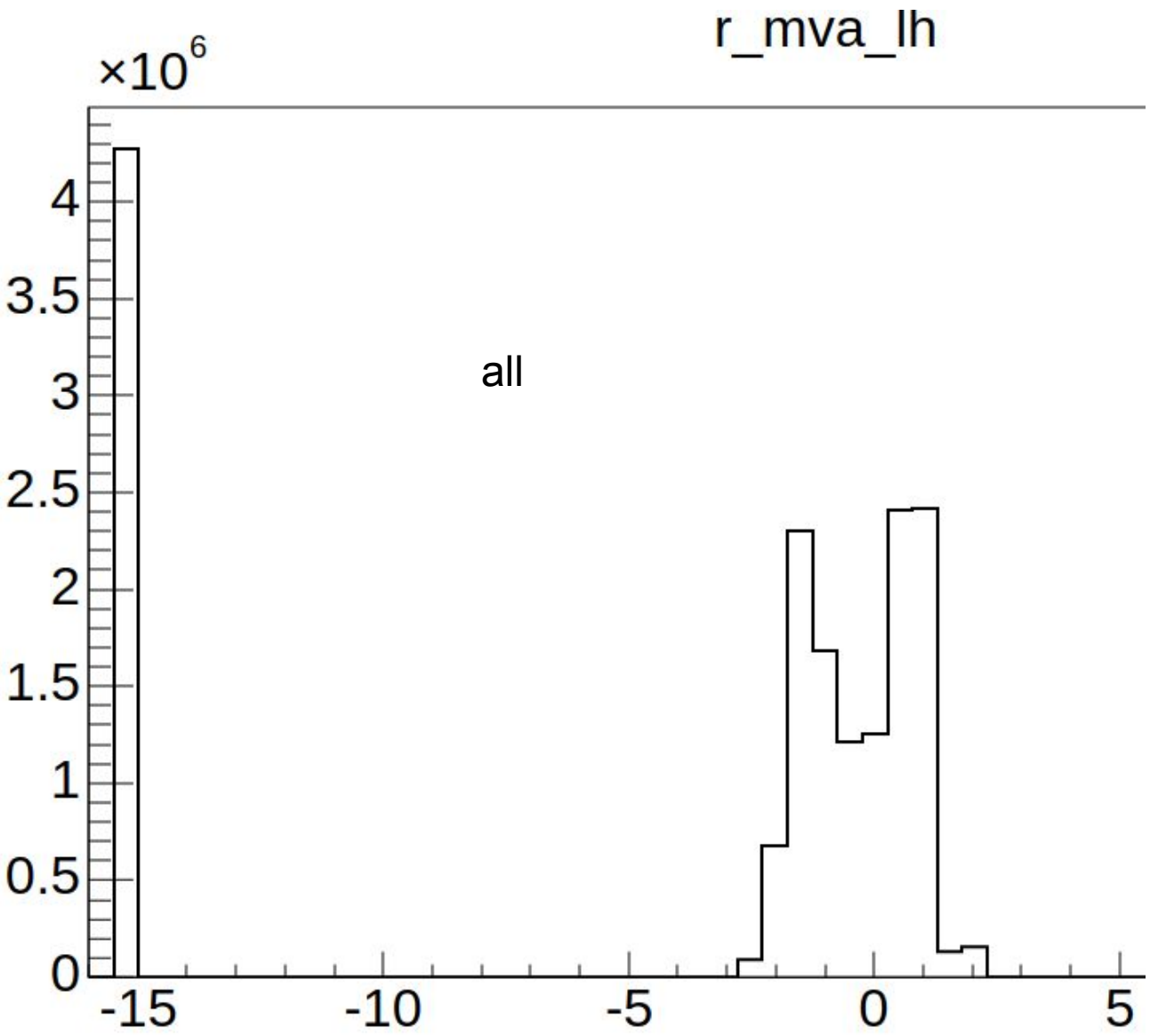
signal region

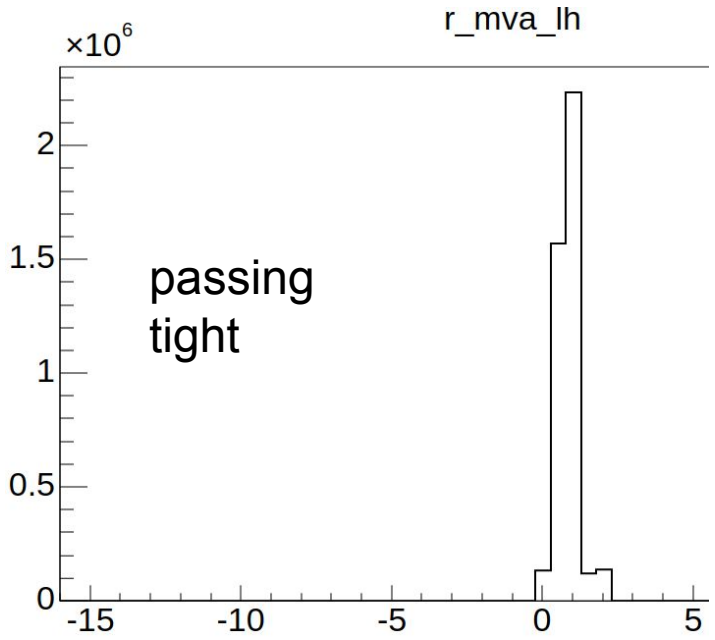
MJ estimate

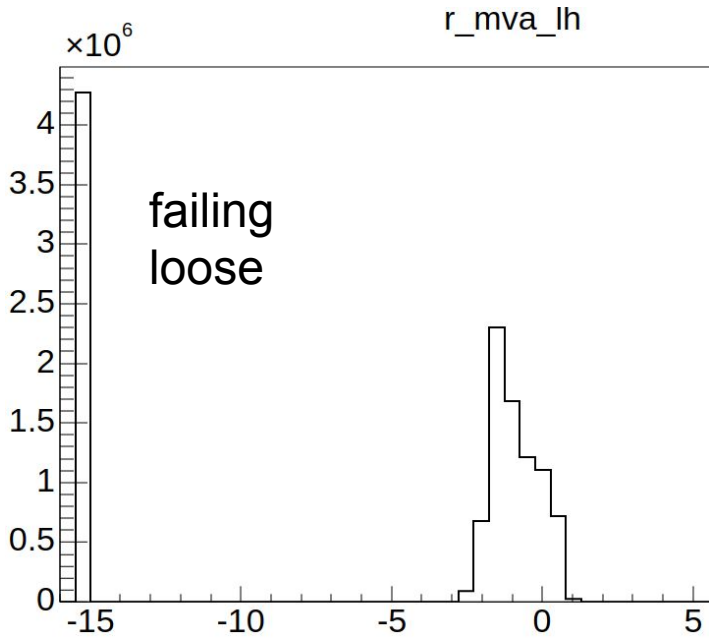
to include fTM events in MJ estimate:
ratio of ID/nL needs to be the same for MJ and fTM
→ LH distribution needs to be the same
→ SPOILER: that's not the case

Electron ID LH

Distribution in Data

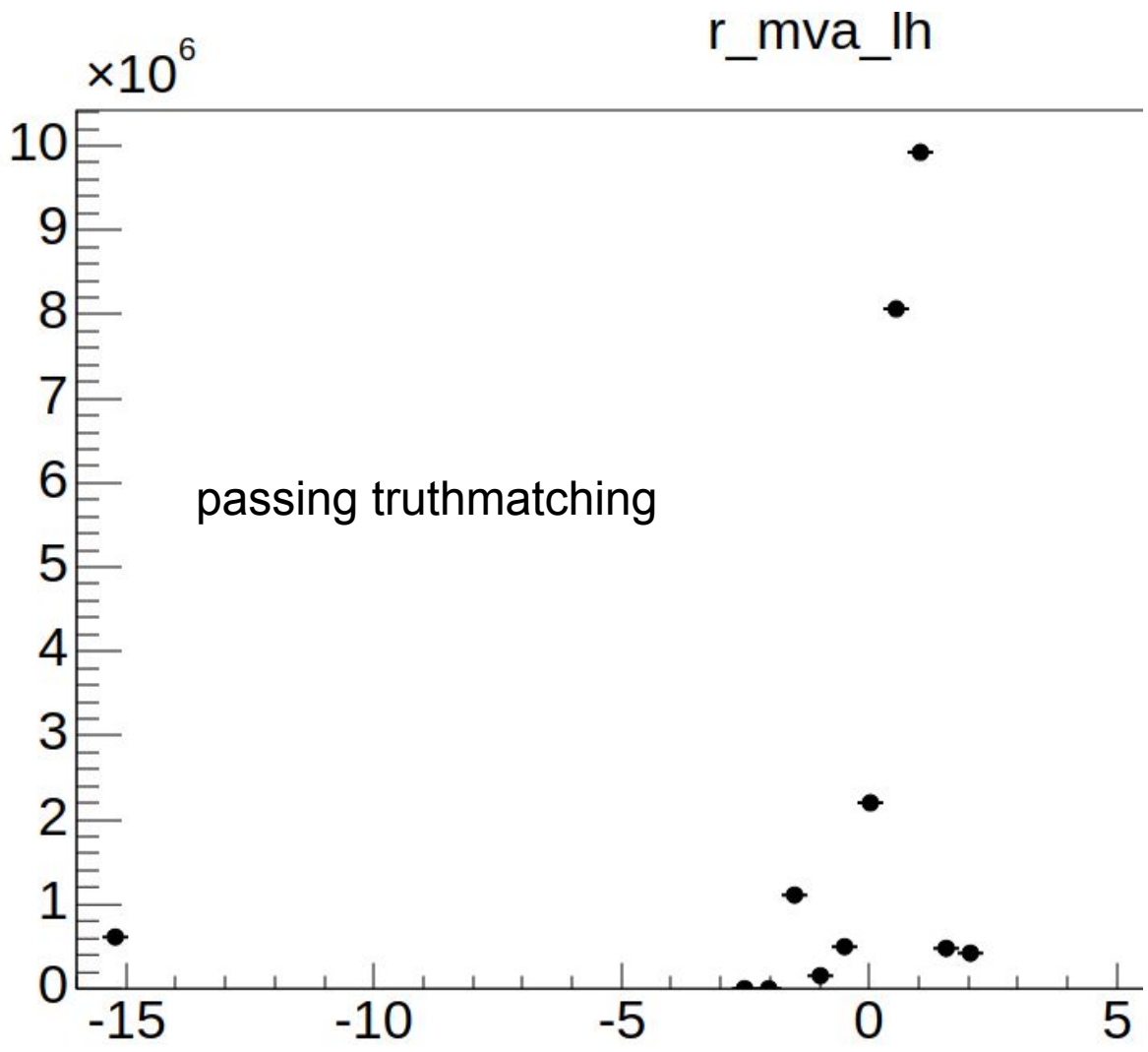


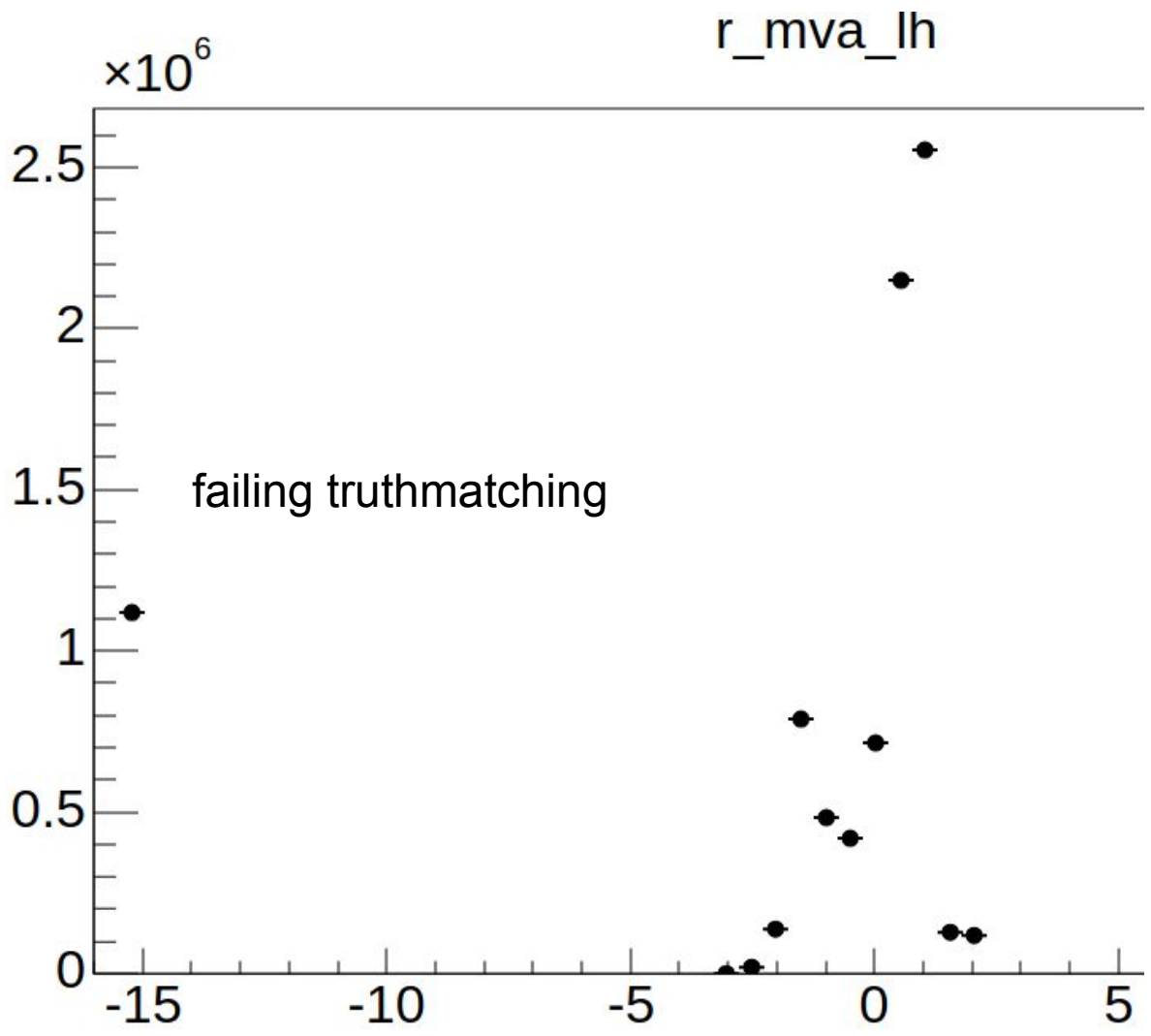




Electron ID LH

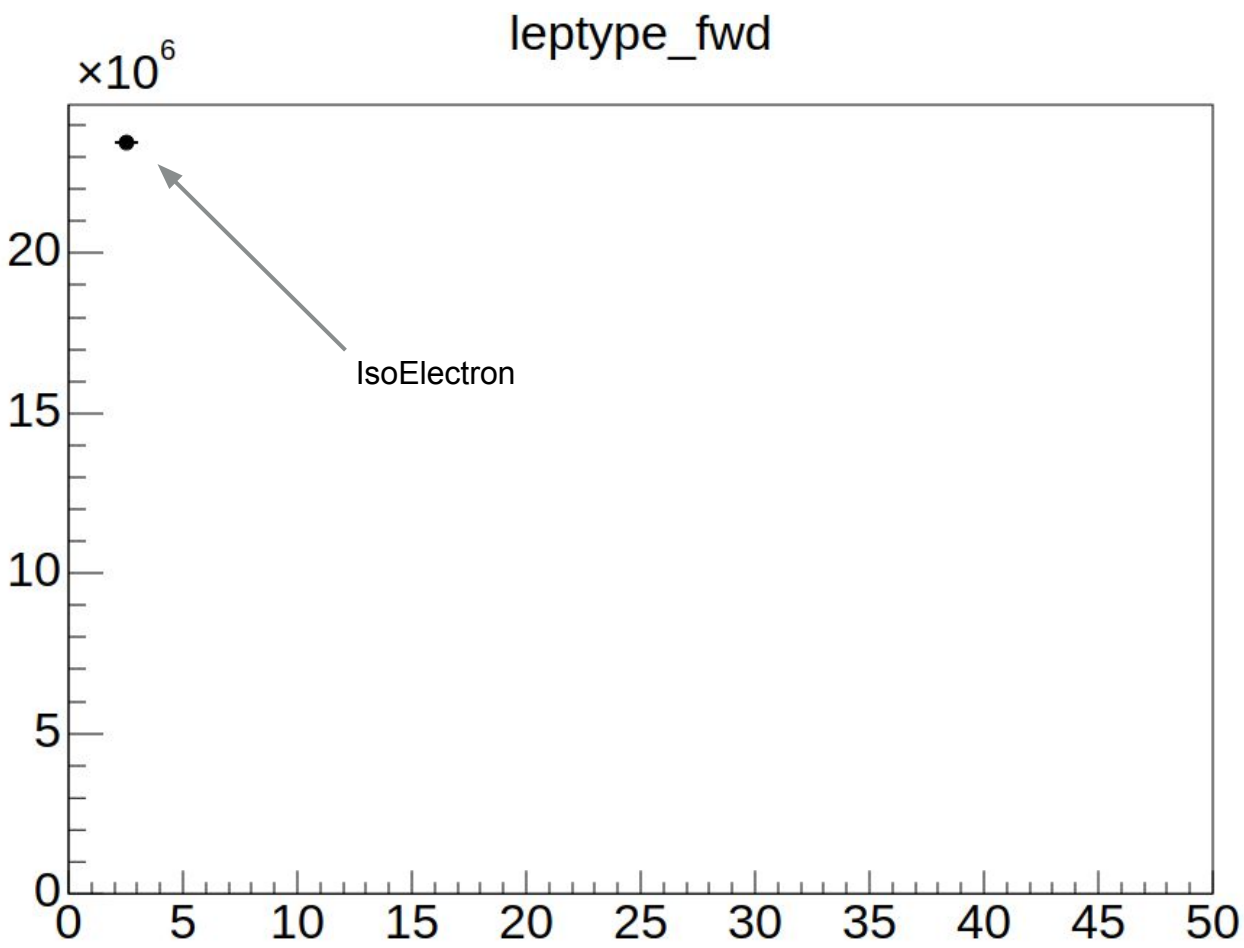
Distribution in MC



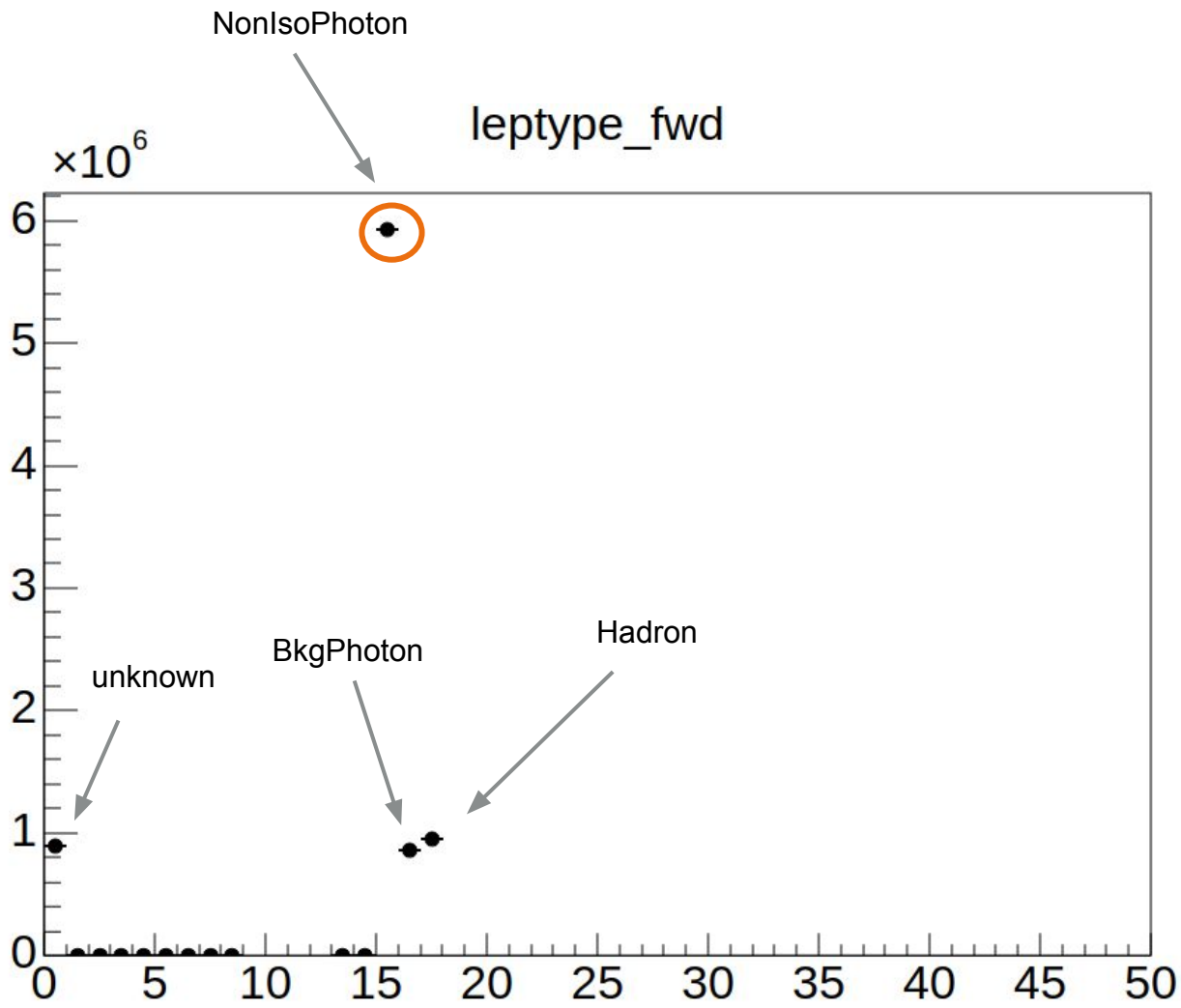


Truthmatching

lepton type



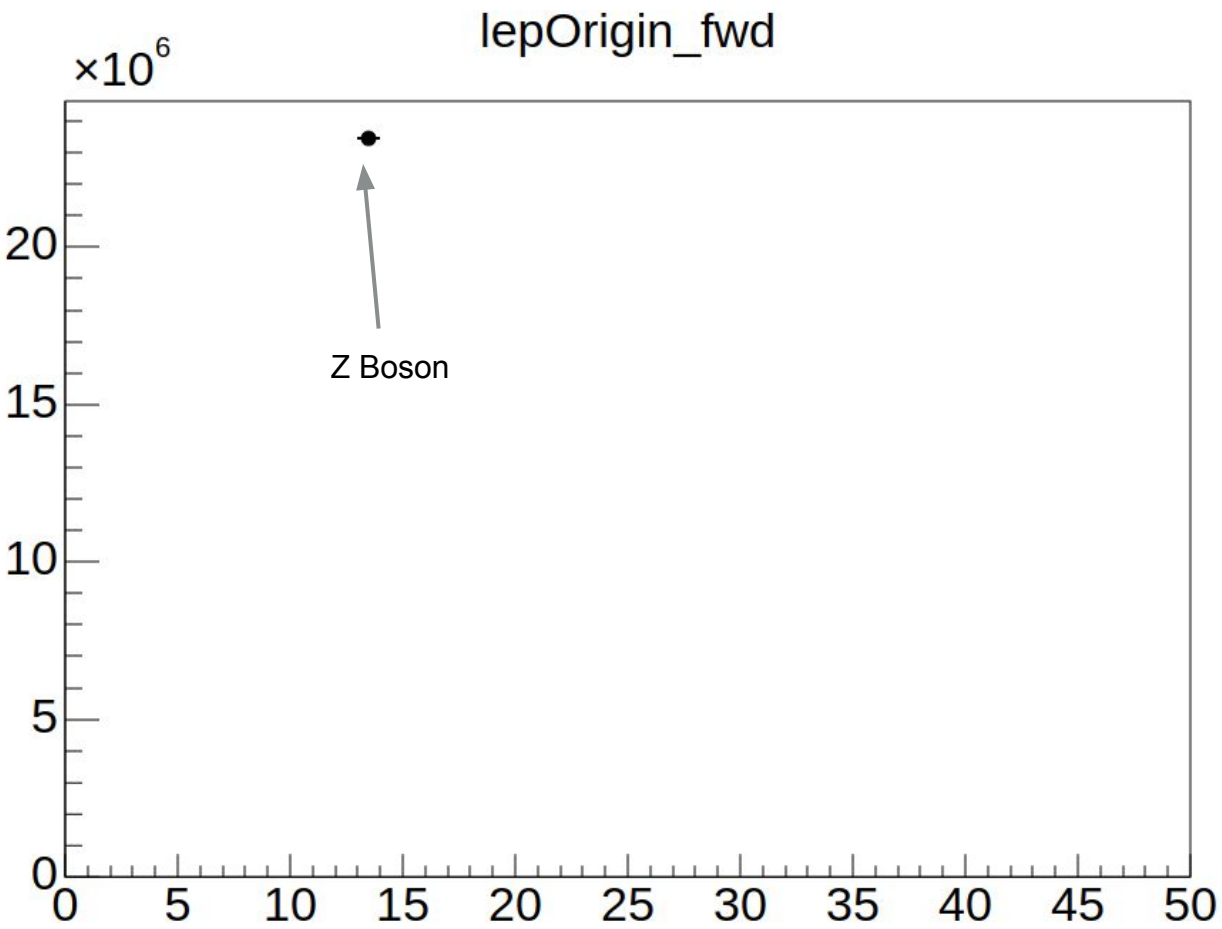
passing truthmatching



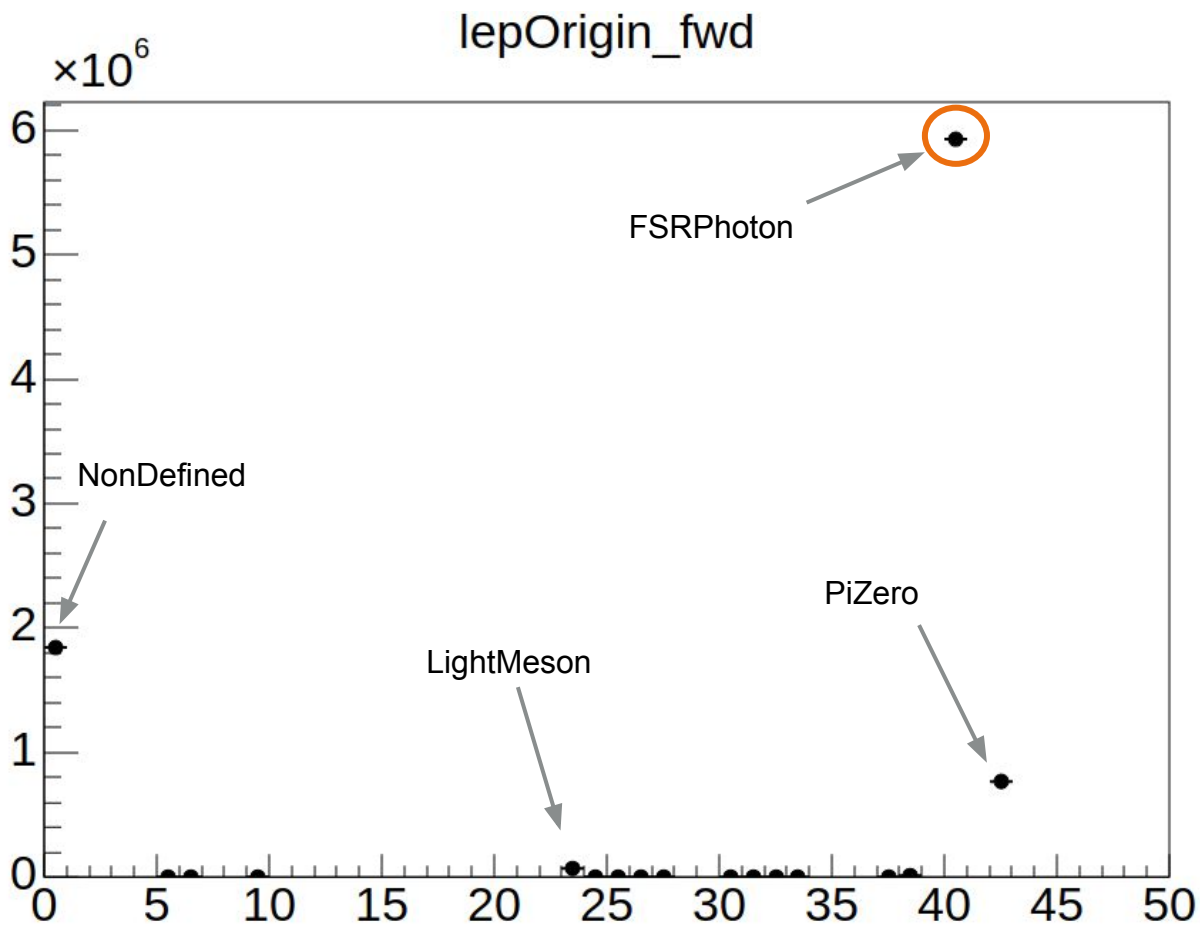
failing truthmatching

Truthmatching

lepton origin



passing truthmatching

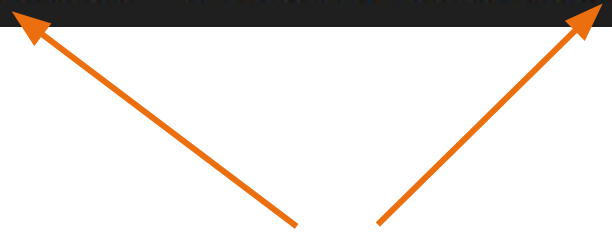


failing truthmatching

Truthmatching

FSR Photons

```
if (!(fwdType == IsoElectron && (fwdOrigin==ZBoson || fwdOrigin==ZorHeavyBoson)) &&
    !(fwdType == IsoPhoton && (fwdOrigin==ZBoson || fwdOrigin==ZorHeavyBoson)) &&
    !(fwdType == BkgElectron && (fwdOriginBkg==ZBoson|| fwdOriginBkg==FSRPhot))) pass = false;
```



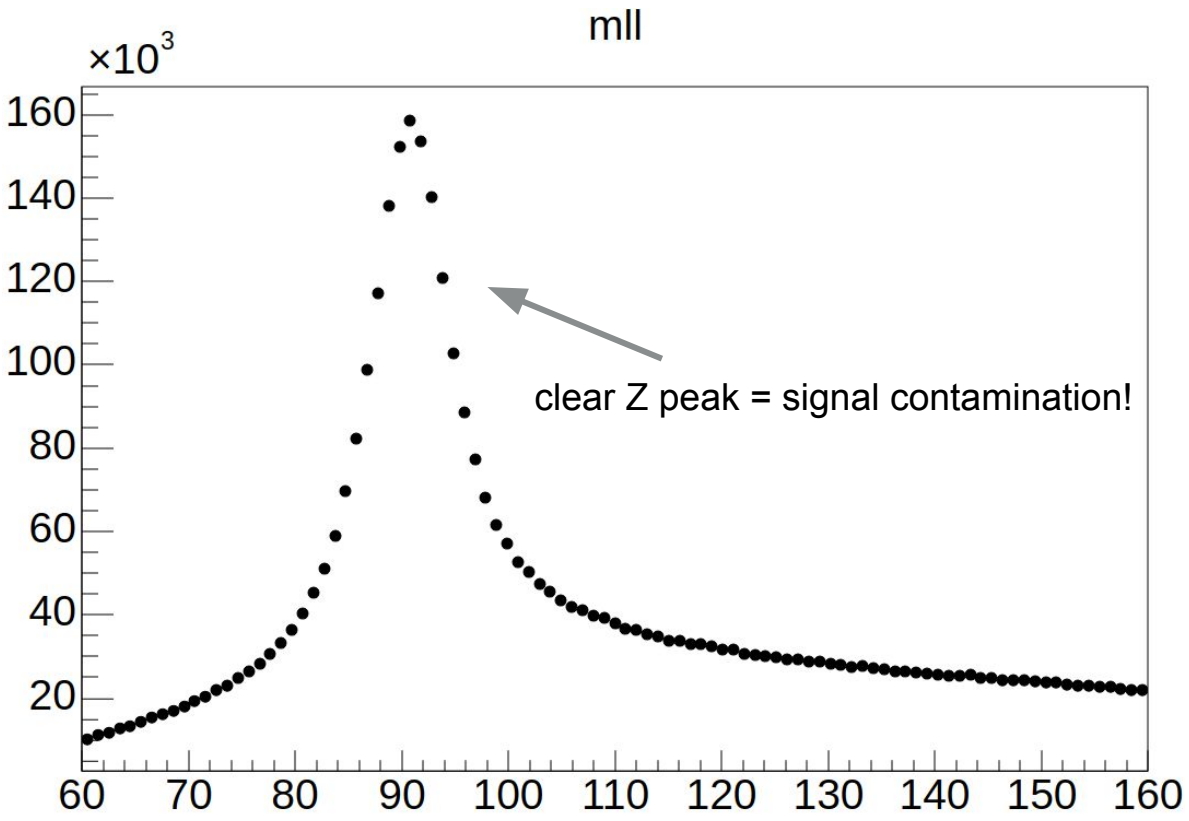
does not exist in ntuples for 13 TeV !!!

include fwdType == NonIsoPhoton && fwdOriginBgk == FSRPhot into truthmatching

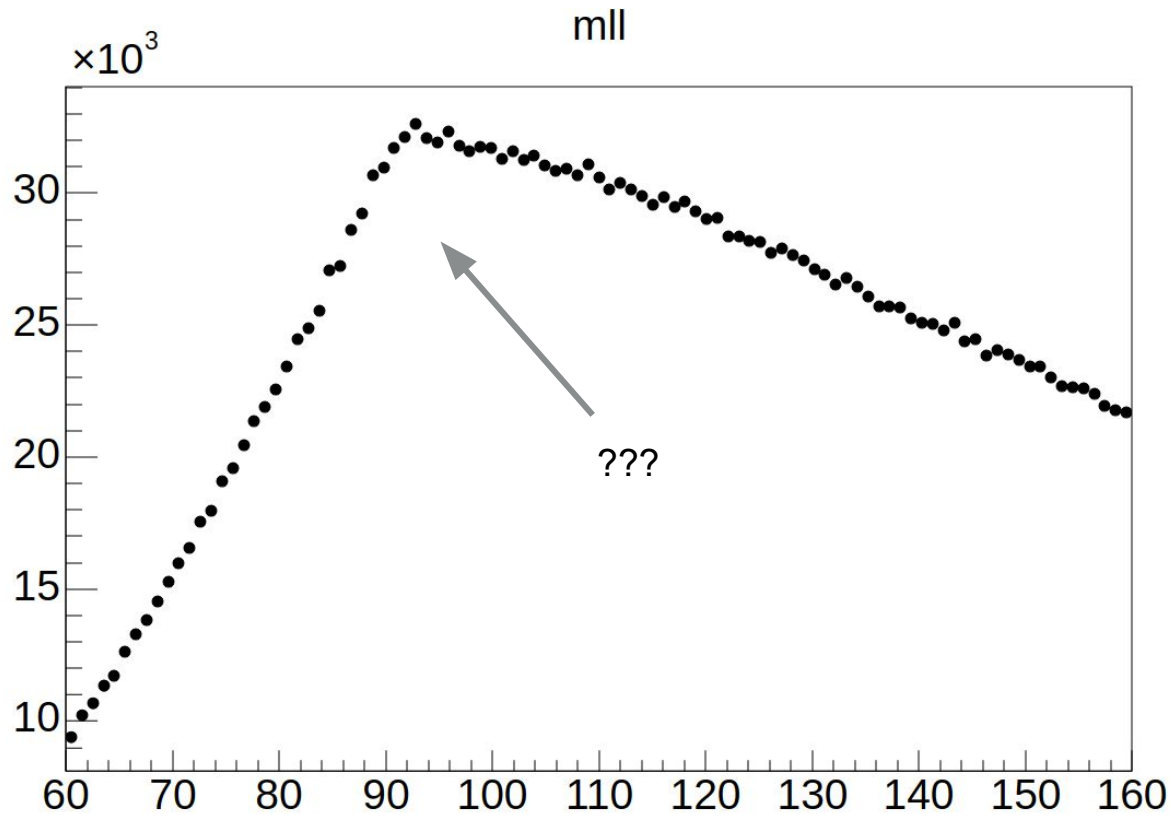
Truthmatching

events failing truthmatching and failing VVL

expect only (mostly MJ) background in that region



FSR Photons failing truthmatching



FSR Photons passing truthmatching