Trigger studies with UL2016 pre/postVFP

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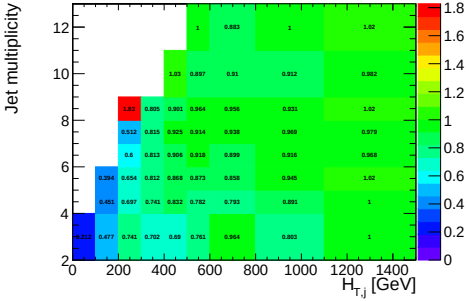
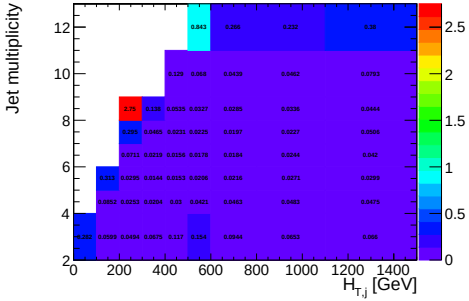
March 2, 2022

Introduction

- Goal is to **repeat previous trigger studies**
- Hopefully no major changes when switching to UL
- **UL2016 pre/postVFP** are downloaded and ready $\Longrightarrow$ start from them
- Today's **plots** are **almost final**
- **Apply** needed **SFs**:
  - Muon ID
  - **No ele ID**: select events with $==$ 1 leptons, $==$ 1 muon
  - Tau ID
  - b tagging
  - Evt weight, PU weight, prefiring weight
- **Missing ingredients**:
  - Applying BTagShapeCalibration SF, should be FixedWP instead
  - Apply ttbb correction
  - **Bug in reading of JSON file** spotted by ZhangYu. Fixed, thanks!

Pre-UL results

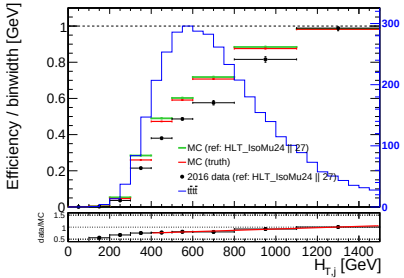


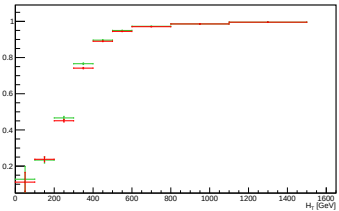


- nJets vs H_T trigger efficiency
- Left: data/MC efficiency ratio; right: corresponding errors
- **Add $H_T > 400$ GeV cut to analysis selection** to make trigger efficient
- Use these histograms as **trigger efficiency scale factors and uncertainties**

UL2016 preVFP

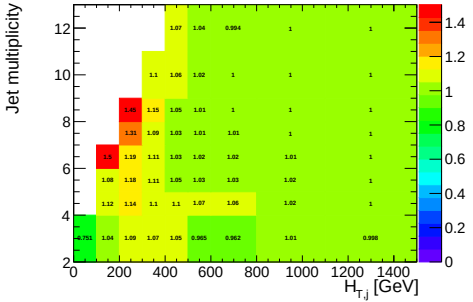
1D trigger efficiency plots

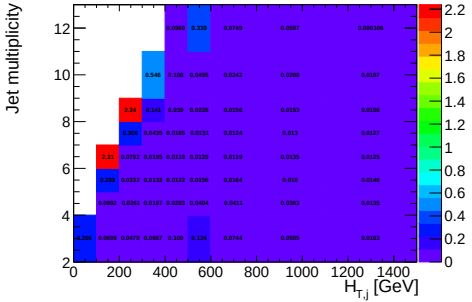




- Trigger choice: unchanged wrt preUL
- OR of:
  - `HLT_PFHT450_SixJet40_BTagCSV_p056`
  - `HLT_PFHT400_SixJet30_DoubleBTagCSV_p056`
  - `HLT_PFJet450`
- Reference triggers: OR of
  - `HLT_IsoMu24`
  - `HLT_IsoMu27`
- Selection:
  - Preselection
  - $== 1\ \ell$, $== 1\ \mu$
  - Designed to have reference firing

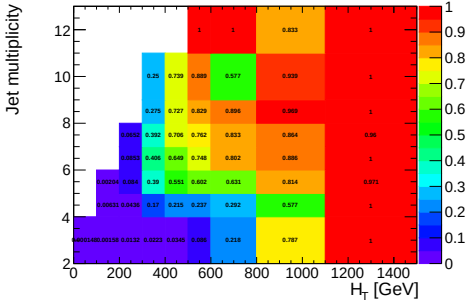
2D plots: checking the reference trigger

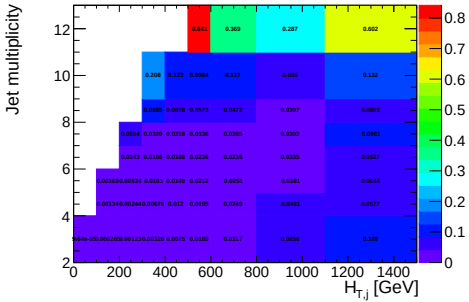




- nJets vs H_T trigger efficiency
- Left: MC/MCtruth efficiency ratio; right: corresponding errors
- The reference is unbiased in 2D too above 400/500 GeV

2D plots: trigger efficiency in data





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- Left: trigger efficiency; right: corresponding errors
- Some bins have low efficiency

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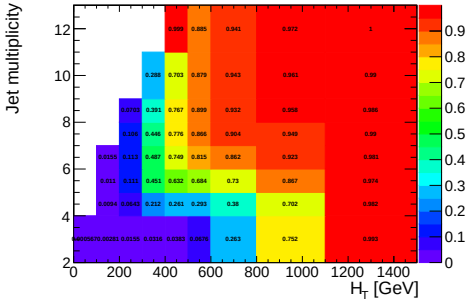

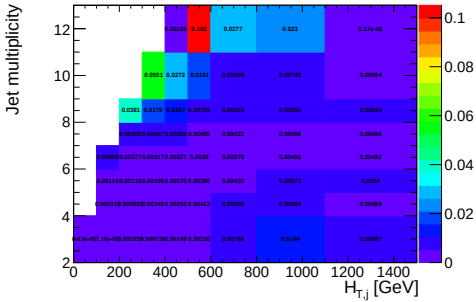

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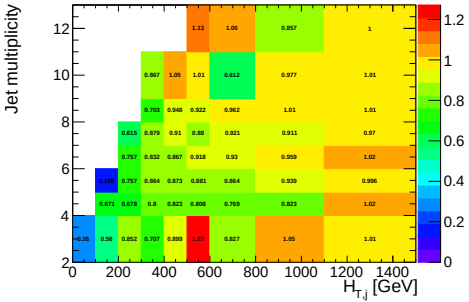
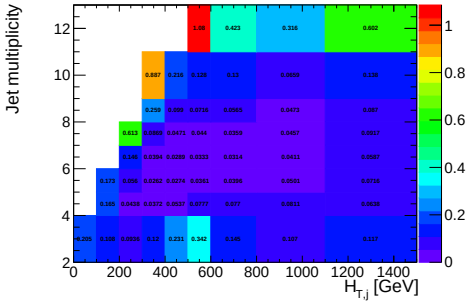
- Left: trigger efficiency; right: corresponding errors
- Efficiency higher in MC

2D plots: data/MC efficiency ratio





- nJets vs H_T data/MC efficiency ratio
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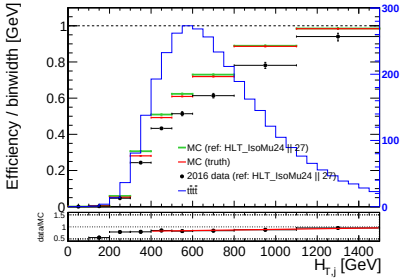
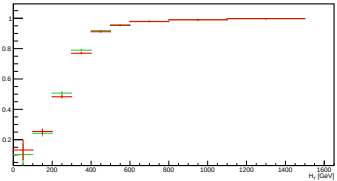
- Not very different from previous results
- Somehow bigger errors and a bit more spiky (lower data stats?)

UL2016 postVFP

1D trigger efficiency plots





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  - `HLT_PFJet450`
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- Selection:
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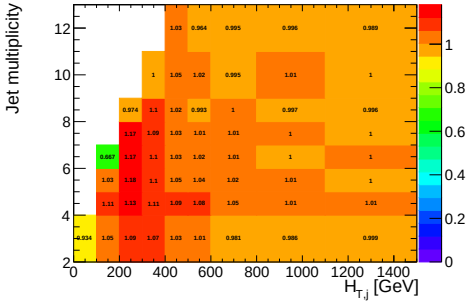

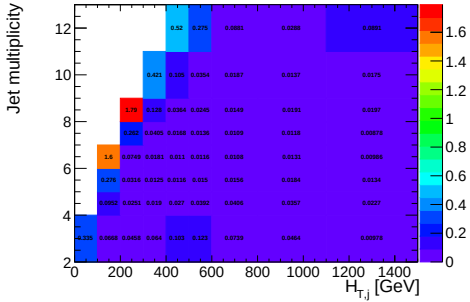

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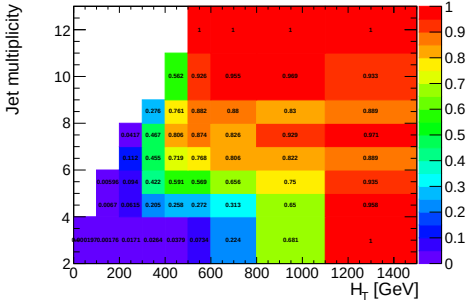

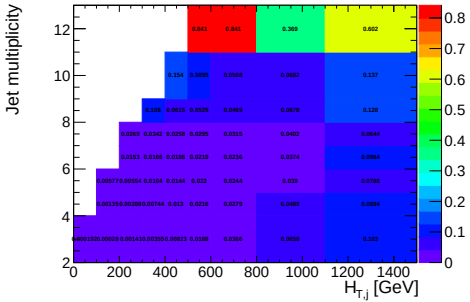

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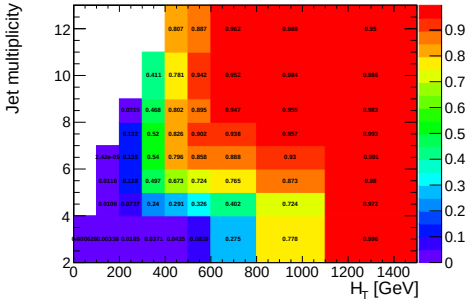

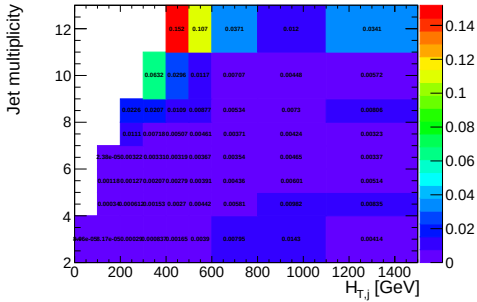

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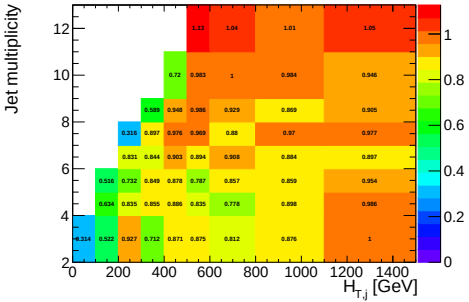

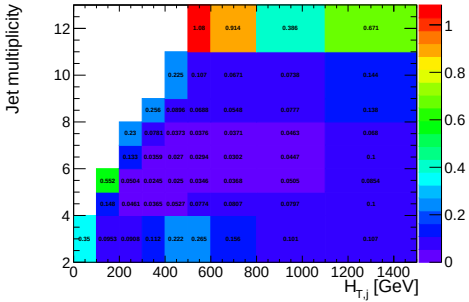

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Summary and next step

- **Results** look **simila to** what we saw in **pre-UL**
- Plots **a bit more spiky** and having bigger uncertainties
  - Most likely due to splitting of data samples
  - Also, bug when reading JSON: I think we are loosing some data! Fixing it will probably help
- **Plans**:
  - **Update** that couple of open items (b tag SFs, ttbb)
  - **Run on fixed data**
  - Do not expect dramatic changes
  - **2018** is ready: submit jobs and **repeat study** there