Trigger studes (third part)

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Trigger efficiency studies

- **Goal**: compute **trigger efficiency as a function of H_T**
- **Compare** results for **data and MC**, **extract** trigger **SF** if needed
- Trigger efficiency definition:

$$\varepsilon(H_T) = \frac{\mathrm{N}_{\mathrm{trig+presel}}}{\mathrm{N}_{\mathrm{presel}}}(H_T)$$

- **N.B.**: **in data, we never have all the events that pass the offline preselection**
- In data, events are **always** collected with a trigger
  - In other words, denominator meaningless for data

Trigger efficiency studies

- We need an **unbiased sample of events**
- This should be **collected with a reference trigger** with looser and (if possible) orthogonal criteria
- Then the efficiency definition becomes

$$\varepsilon(H_T) = \frac{\mathrm{N}_{\mathrm{trig+presel+reference}}}{\mathrm{N}_{\mathrm{presel+referece}}}(H_T)$$

  which makes sense for data as well
- Obviously the **reference should be unbiased**, i.e., should not change MC efficiency distribution

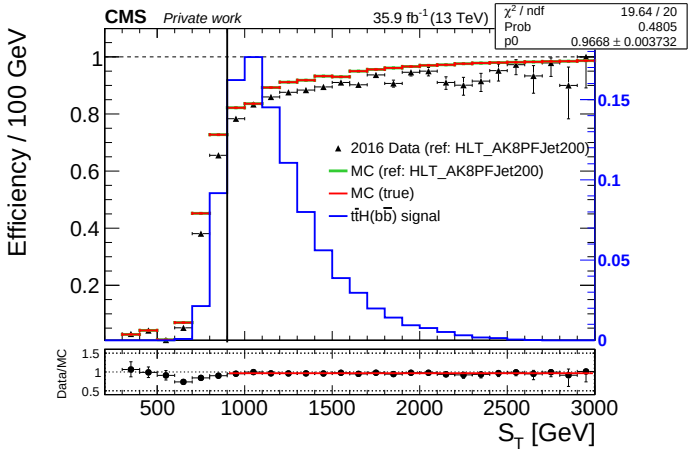
Issues with this task

- **Choice of reference trigger**
  - Reference must be chosen in JetHT PD (I guess)
  - In ntuples _v3 I only found `HLT_PFJet450` and `HLT_AK8PFJet360_TrimMass30` which do not seem reasonable as references
  - This must be discussed (add more triggers in _v4?)
- Possible triggers to use (found here)

HLT_PFHT125_v	36.47	0.0037	273158	284044	v1.1	JetHT
HLT_PFHT200_v	36.47	0.0065	273158	284044	v1.1	JetHT
HLT_PFHT250_v	36.47	0.0096	273158	284044	v1.1	JetHT
HLT_PFHT300_v	36.47	0.0390	273158	284044	v1.1	JetHT
HLT_PFHT350_v	36.47	0.0779	273158	284044	v1.1	JetHT
HLT_PFJet140_v	36.47	0.0243	273158	284044	v1.1	JetHT
HLT_PFJet200_v	36.47	0.10	273158	284044	v1.1	JetHT
HLT_PFJet260_v	36.47	0.59	273158	284044	v1.1	JetHT
HLT_PFJet320_v	36.47	1.78	273158	284044	v1.1	JetHT
HLT_PFJet400_v	36.47	5.22	273158	284044	v1.1	JetHT
HLT_PFJet40_v	36.47	0.0003	273158	284044	v1.1	JetHT
HLT_PFJet450_v	36.47	36.47	273158	284044	v1.1	JetHT
HLT_PFJet500_v	36.47	36.47	273158	284044	v1.1	JetHT
HLT_PFJet60_v	36.47	0.0007	273158	284044	v1.1	JetHT
HLT_PFJet80_v	36.47	0.0028	273158	284044	v1.1	JetHT

An example of final result

- This is an example of what I would like to get in the end:



Final considerations

- I'm currently **lacking the needed information** to perform a more refined trigger study
- Main **missing items**:
  - Reference triggers
  - Data samples (?!? @Huiling)
- To have **new ntuples** will be **time consuming**
  - Switch to a different task and come back to this once the information is available? Let's discuss