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Tag & probe method

We would give a short introduction about the Tag and Probe method, we will use it in the following measurements on trigger efficiency and ID efficiency.

Produce preliminary tag & probe pair

First of all, we will produce a preliminary tag & probe pair, the "preliminary" means that the cut on tag and probe are not fully applied, because we would like to use these pairs as base of more than one measurements, so some other cuts will be added in related steps.

Here we loop each event and ask the following requirements for tag:

ET > 35 GeV

In barrel region

Pass HEEP ID

If there are more than one tags in the event, we will store all possible tag & probe pair.

Here we have provided a python script as an example.

```
python xxx.py
```

The output root file is also provided since this step will take a lot of time without queue:

```
path : xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx
```

Measure trigger efficiency:

We will measure single electron trigger efficiency for HEEP electron in this step.

First we will add some cuts based on preliminary T&P pairs:

tag must be matched with Ele35_WPTight trigger

T&P must be in [60, 120] GeV

These cuts can make sure that we are making unbiased measurements on real electron.

Trigger efficiency = number of probe match with trigger final filter and pass HEEP ID /
number of probe pass HEEP ID

We loop each pair of T&P, get the number of denominator and numerator, we can of course split the events into different bins to get trigger efficiency curve as functions of different values, such as eta, ET, phi, number of vertex et al.

Here is an example python script to draw the plot:

```
python xxx.py
```

For double electron trigger, such as DoubleEle25_MW, it is a bit more complicated, there are two legs in this trigger, one is L1 seeded leg, the other is unseeded leg. So if we want to measure efficiency, we need to add

cuts:

tag must be matched with Ele35_WPTight trigger

tag must be matched with L1 filter of DoubleEle25

T&P must be in [60, 120] GeV

And as we know, each trigger has many filters, for example, L1, ET, ISO, ID, they are in linear, it means the object must pass the filters one by one. If we want to measure the efficiency of one of that filter, we can just change the cut on probe:

For example:

Trigger DoubleEle25 ID efficiency = #probe pass HEEP, match with unseeded ID filter /
#probe pass HEEP, match with unseeded ET filter

Measure HEEP ID efficiency:

We will measure the HEEP ID efficiency for GSF electron in this step.

First we will add some cuts based on preliminary T&P pairs:

tag must be matched with Ele35_WPTight trigger

T&P must be in [70, 110] GeV

These cuts can make sure that we are making unbiased measurements on real electron.

HEEP ID efficiency = #probe pass HEEP ID / #probe

Sometimes, we would like to do some more detailed study for each cut, then we can measure N-1 efficiency (N means all cut):

HEEP ID N-1 efficiency = #probe pass HEEP ID / #probe pass HEEP ID except for one cut

This topic: [Sandbox > XuyangGaoSandbox](#)

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