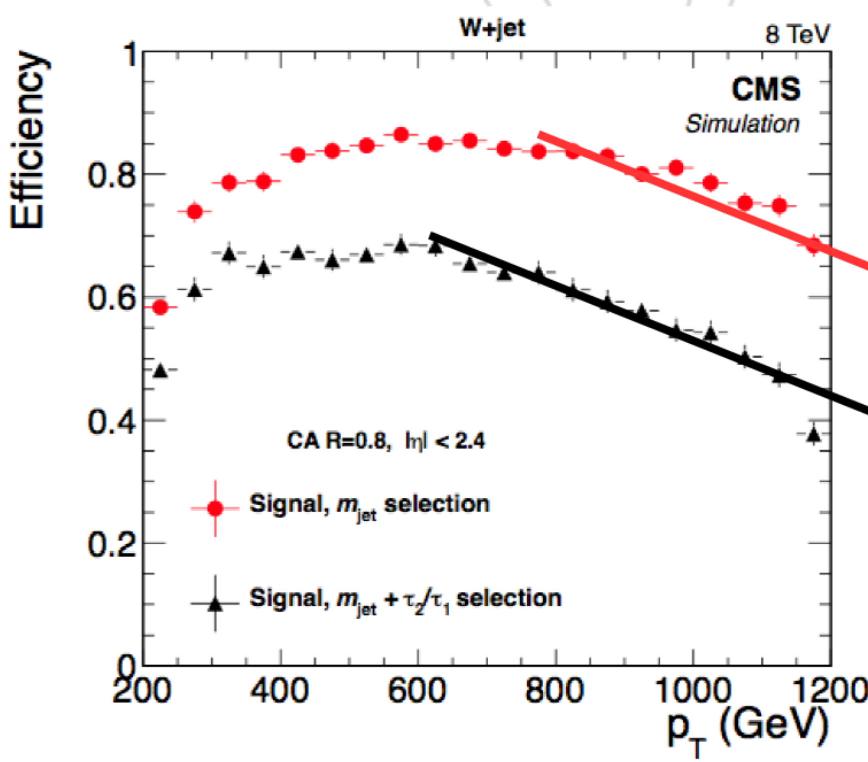
More boost

- Lets recount a story from last year

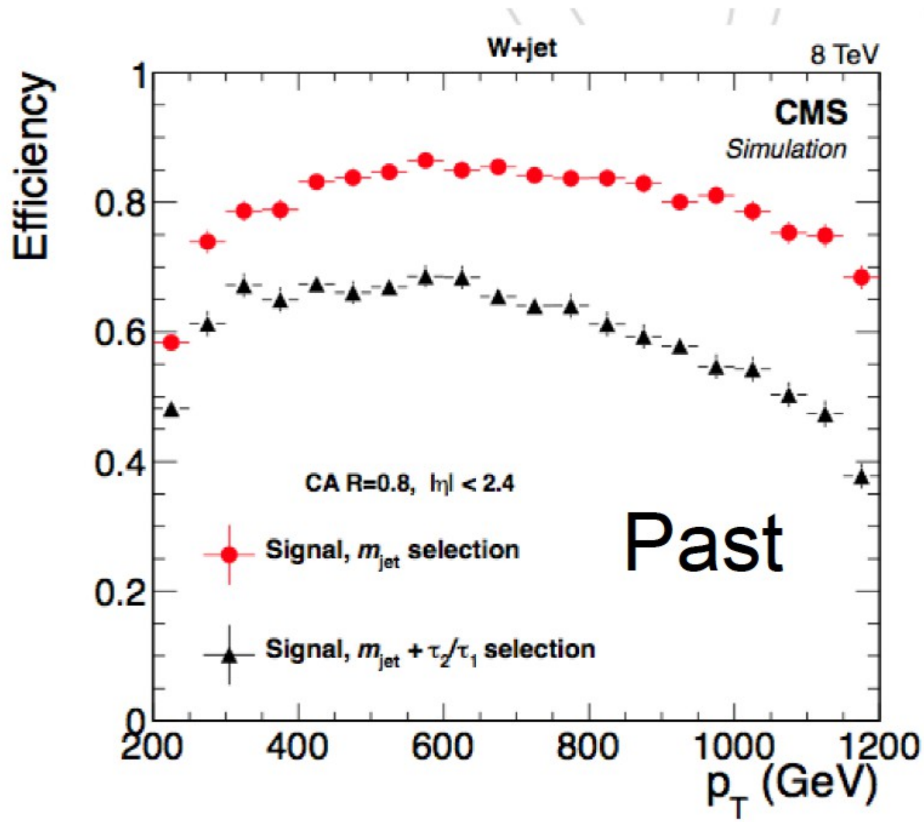


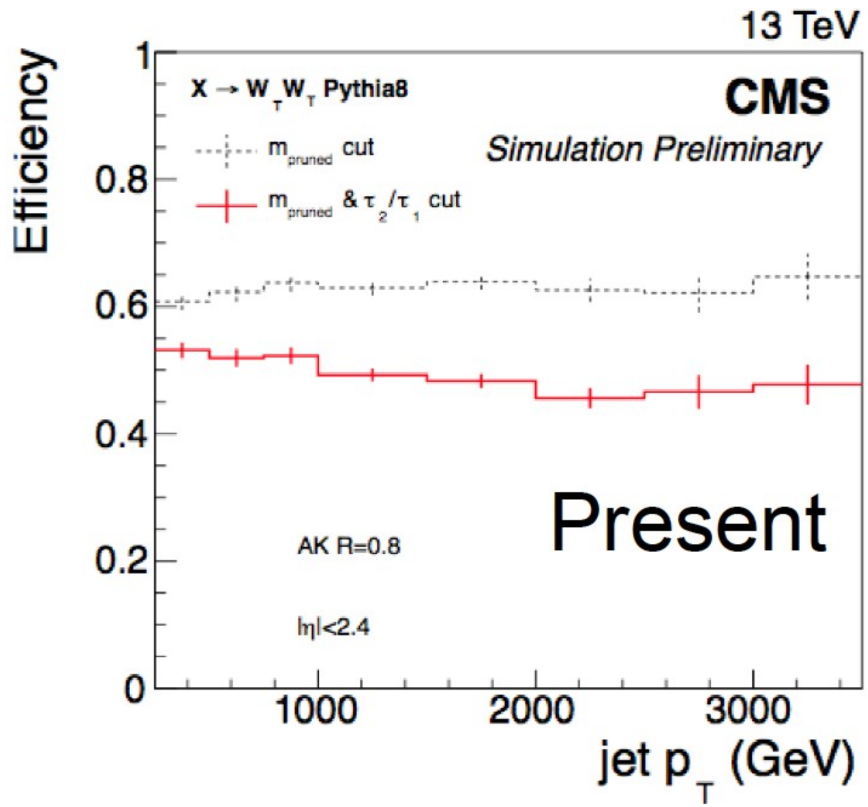
In CMS at 8 TeV
Boosted V Tagging Efficiency
starts to drop down

Effect is substantial at high p_T

Was a major concern from Run II jet reconstruction

After fix





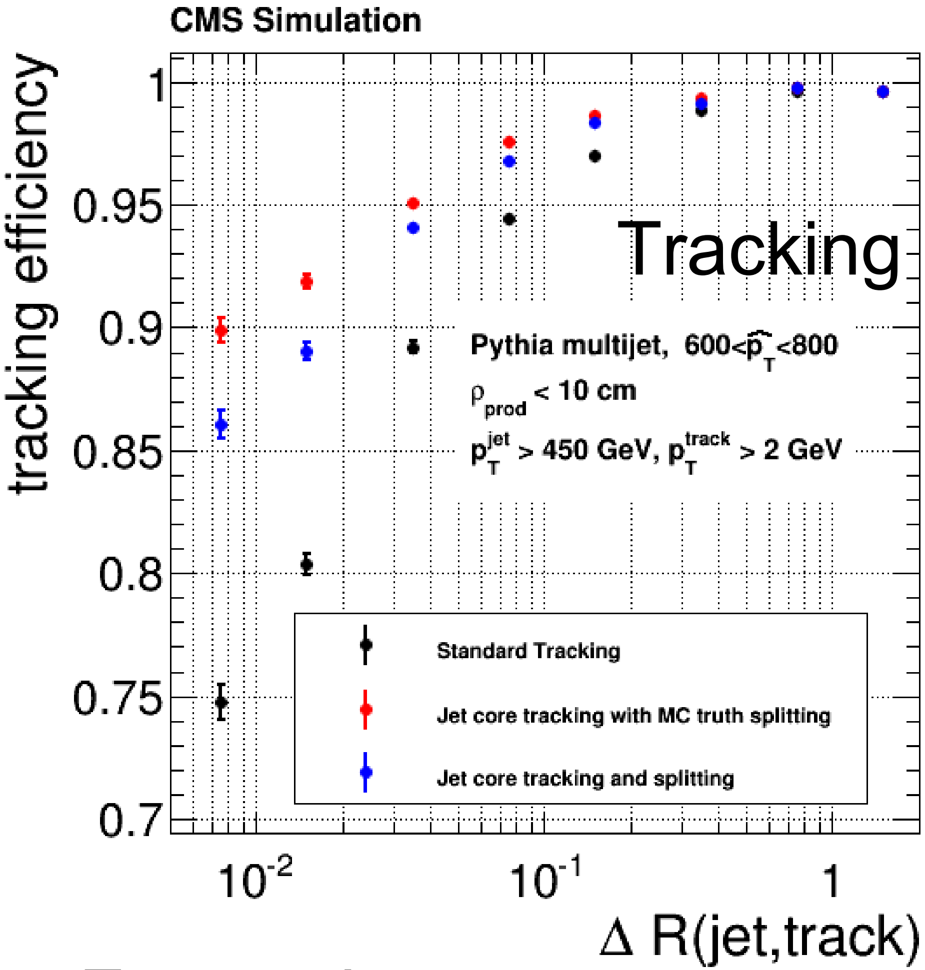
Reconstruction robust up to 4 TeV

Going beyond will be a challenge

Main fix came from maximizing the granularity

Tracking : 60%
Ecal : 30%
Hcal : 10%

Size Metrics



Current LHC :
Ecal 0.02x0.02 in η φ 2x2cm(Moliere)
Hcal 0.08x0.08 in η φ 10x10cm(λ_I)

Future LHC :
Ecal 0.01x0.01 in η φ 1x1cm
Hcal 0.01x0.01 in η φ 1x1cm

Sub Moliere/Nuclear interaction
Resolved by resolving the shower

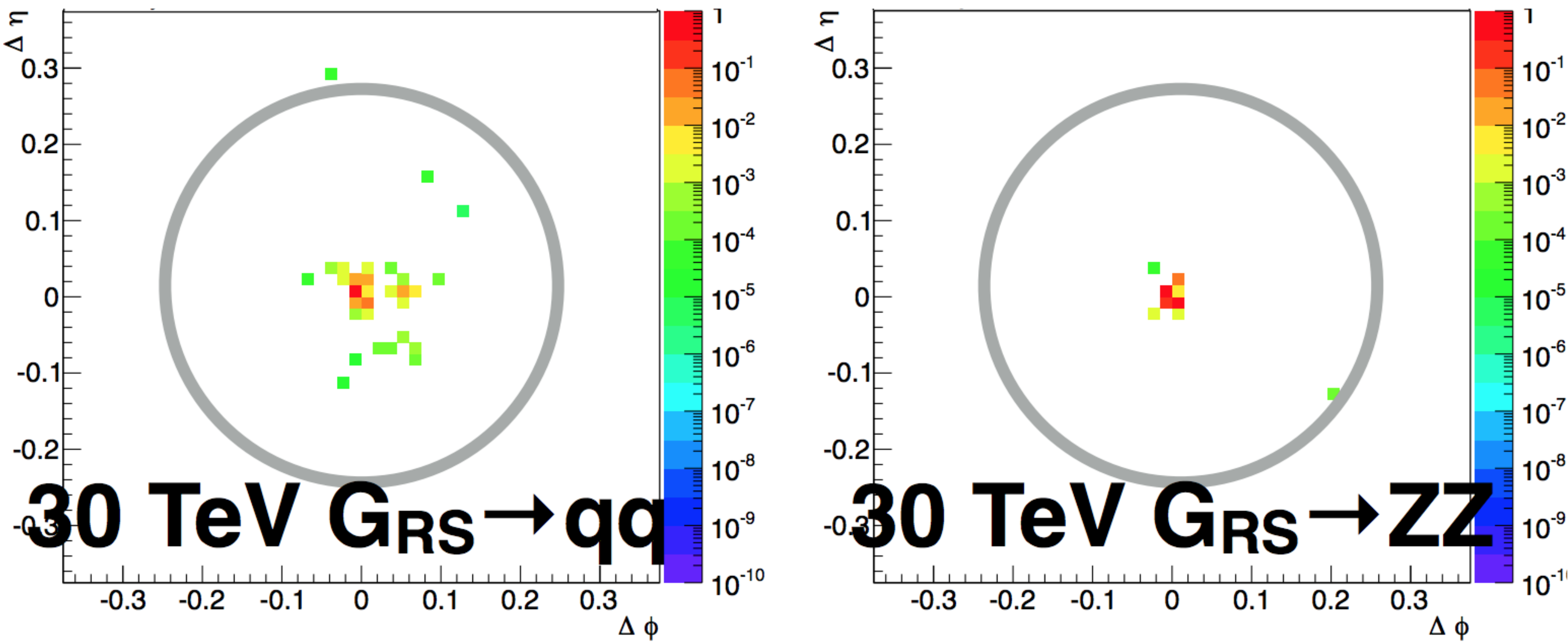
fundamental limit in LHC is 0.01

Future detector :
Tracking => scales < 1/R (depends on rate of hit sharing)
Ecal/Hcal => scales with 1/R

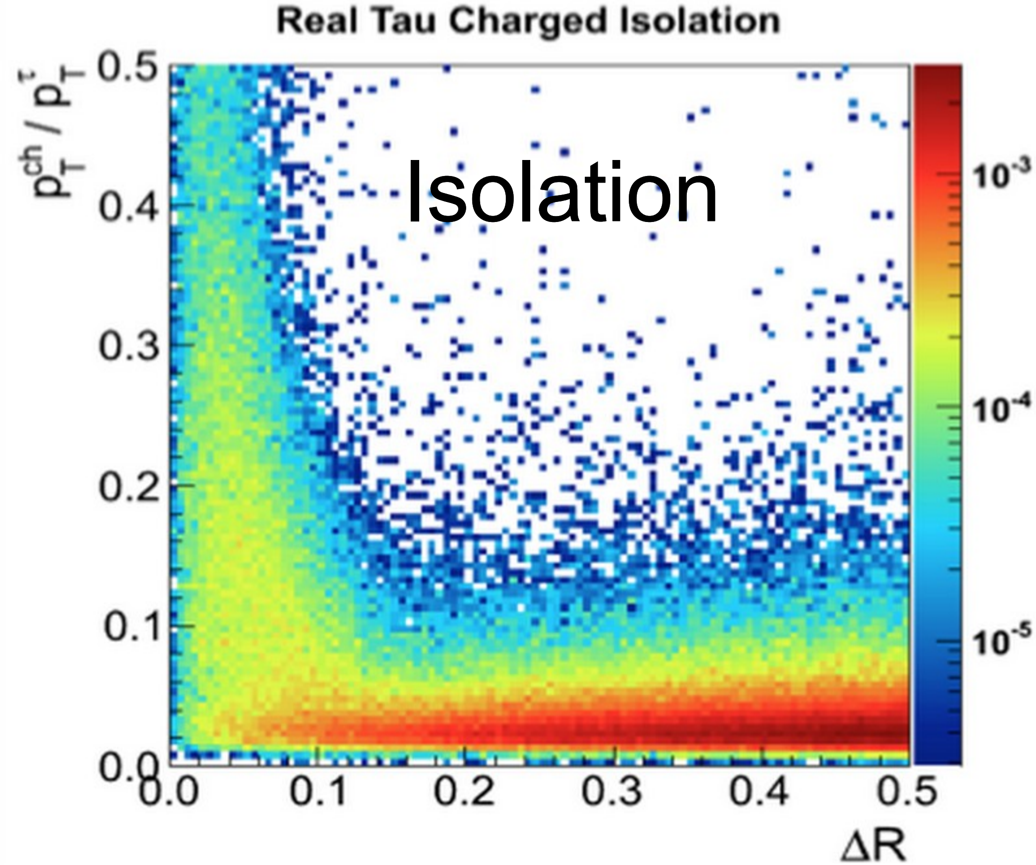
What is the physics motivation?

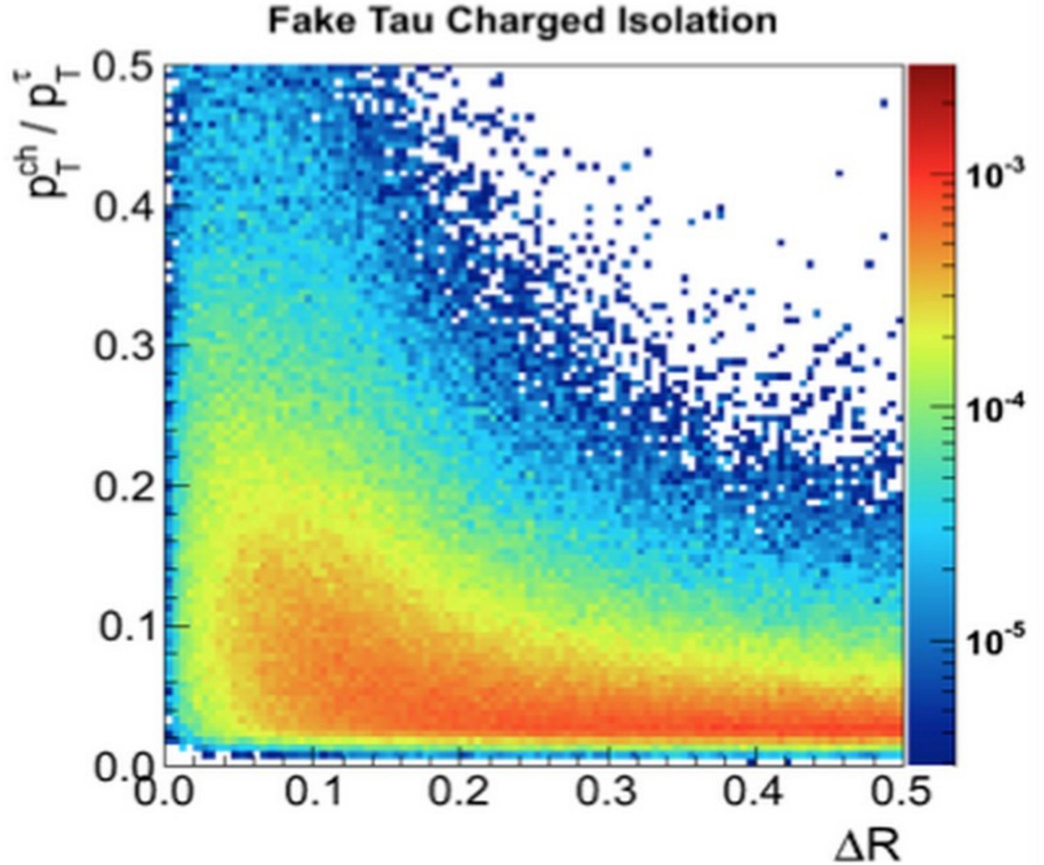
Boosted objects become points at very high boost

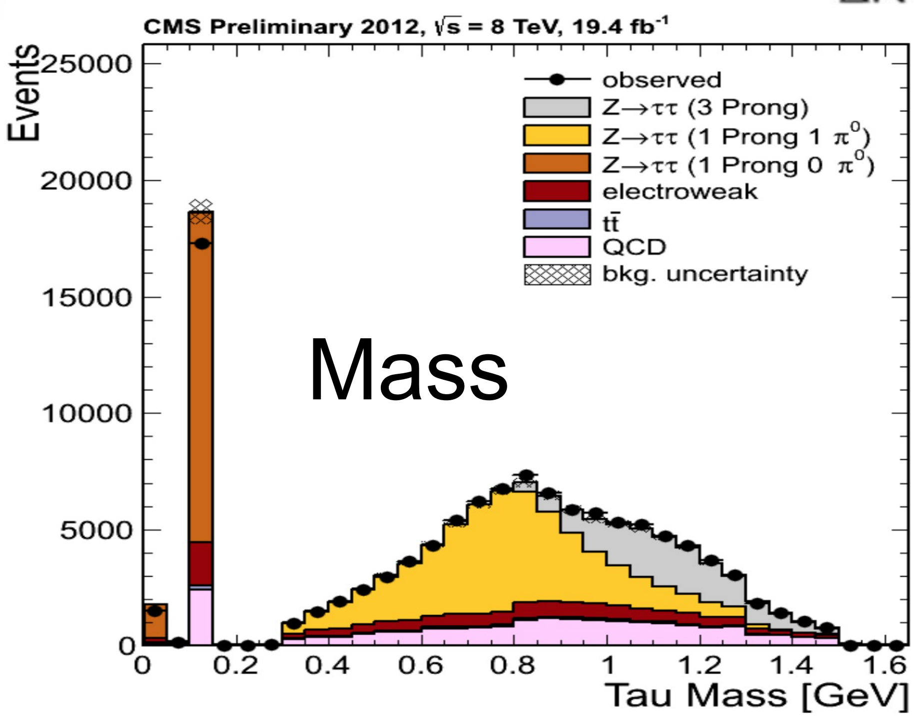
High boost means a very small size



http://indico.cern.ch/event/340703/session/97/contribution/121





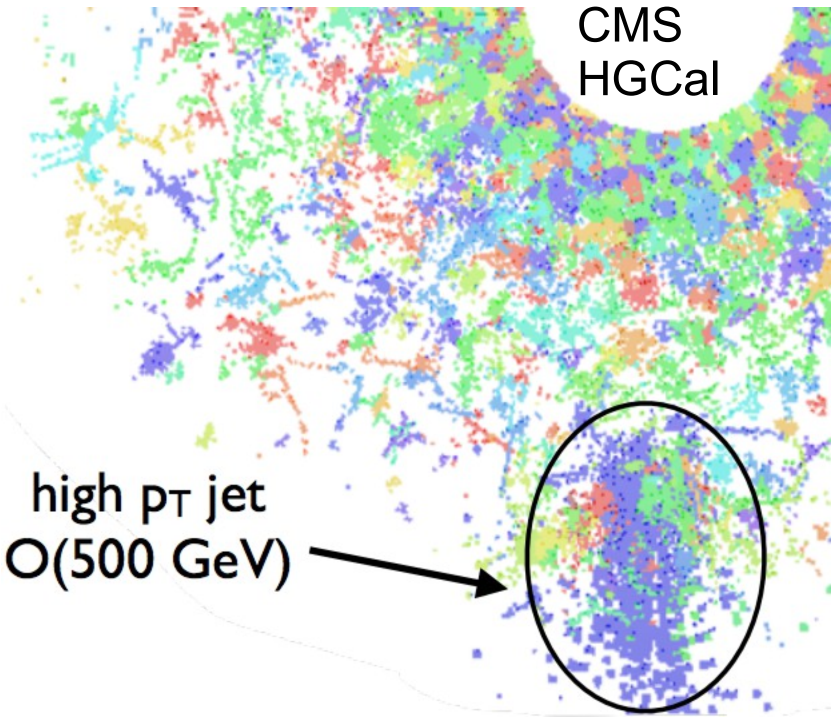


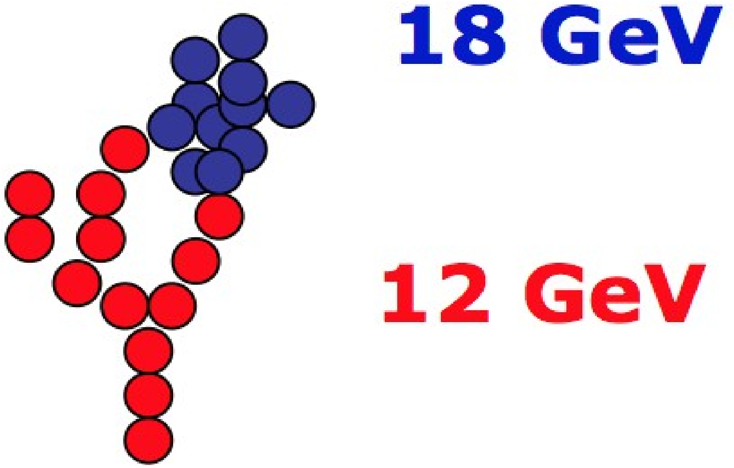
Boost of tau @ 8 TeV is similar
As the boost of a W at 100 TeV

Tau id poses an alternative approach

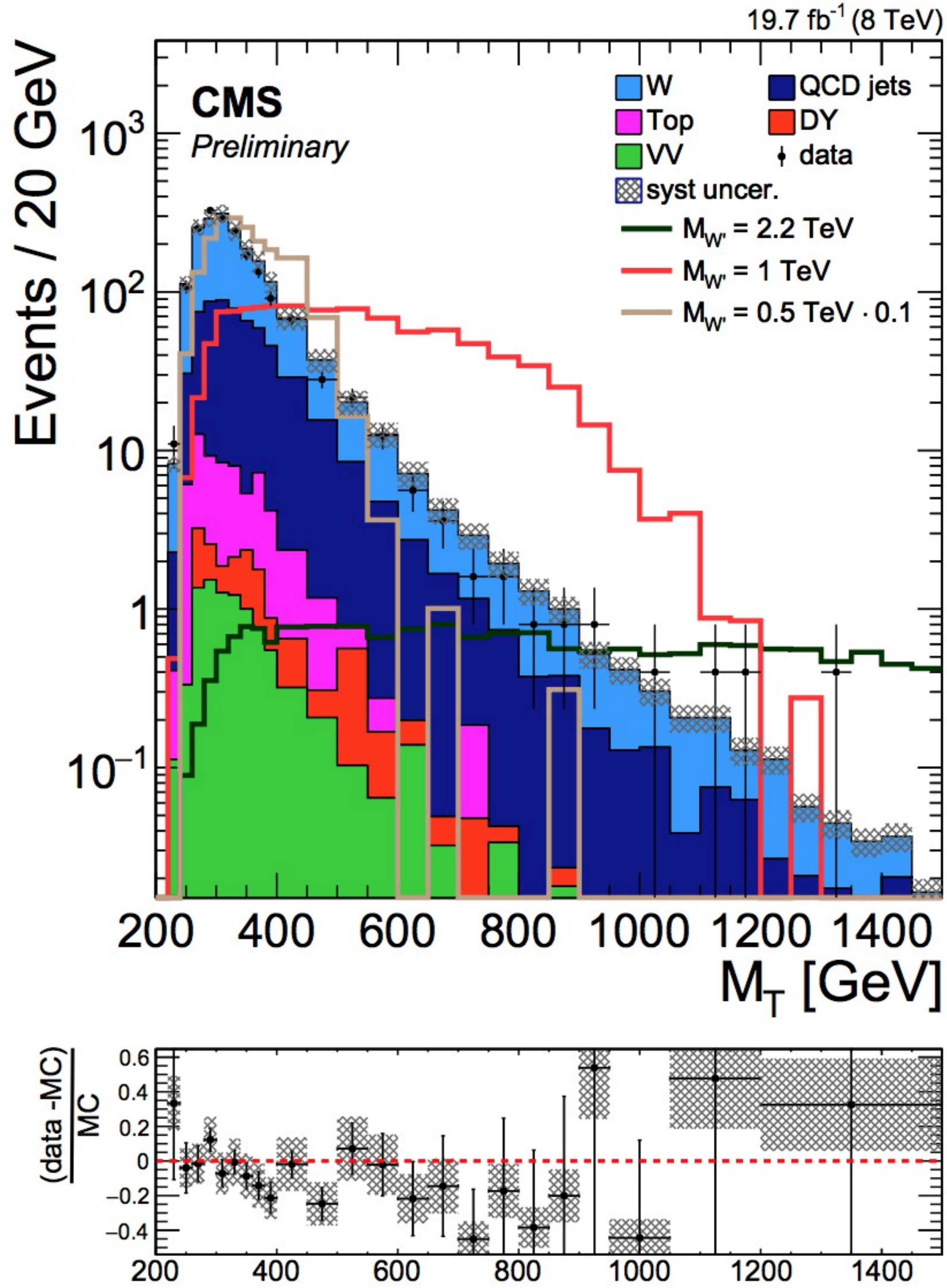
Questions

- Is there a benchmark we can study? (τ)
- What needs to be proved for high granularity calo?
- Are their other ways to tag the high pT?
- What are the right fake rates?/efficiencies?
  - If QCD is lower we can go loose





Backup



Highest p_T taus

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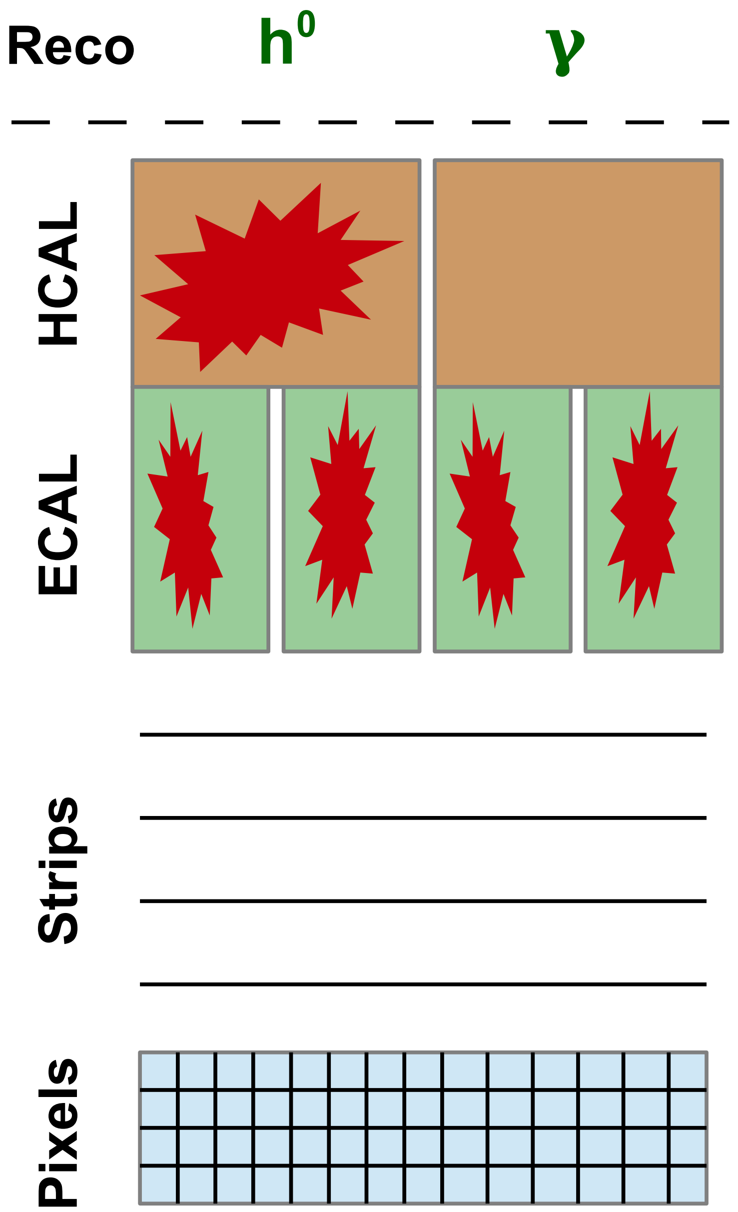
(Northwestern Univeristy)

How we fixed it



- Three ways to assign PF candidates to account for calorimeter excess:
  1) **Merged Neutrals**
     - **ECAL only ⩾1 photon**
     - **ECAL+HCAL ⩾1 neutral hadron**
  2) Split Photons
  3) Split Neutrals

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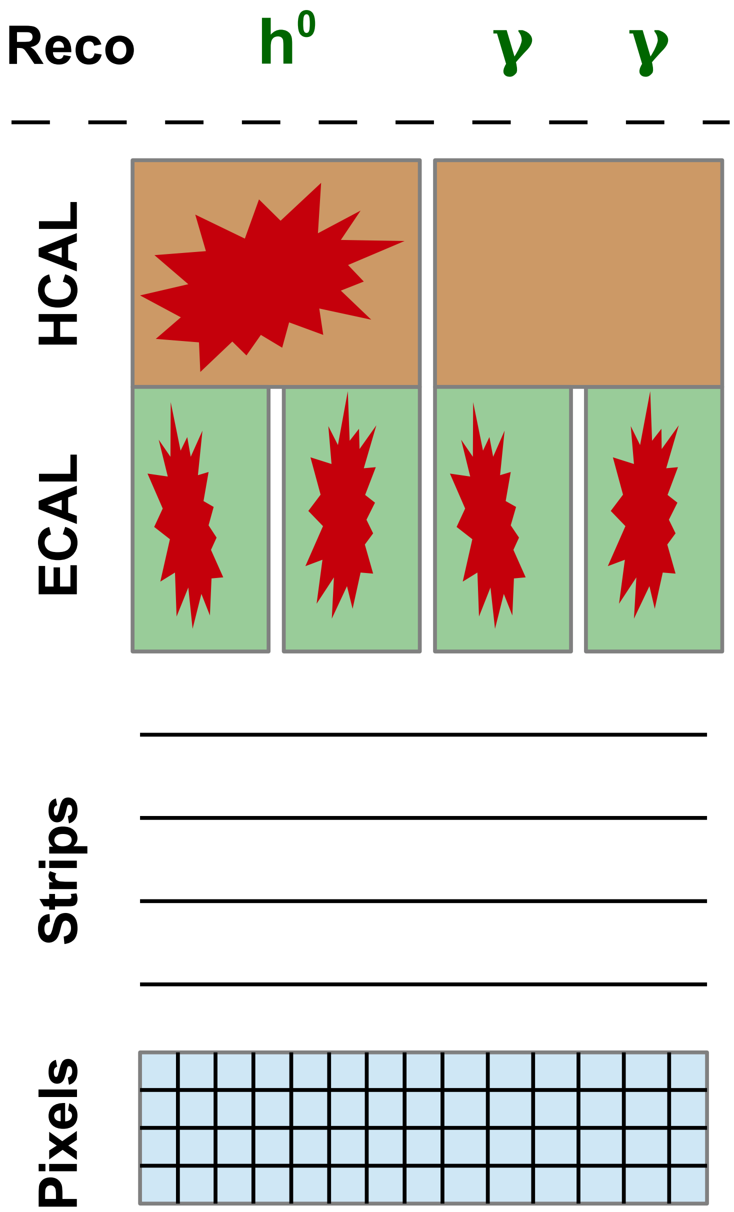
How we fixed it



- Three ways to assign PF candidates to account for calorimeter excess:
  1) Merged Neutrals
  2) **Split Photons**
     - **Assign number of γ based on number of ECAL clusters**
  3) Split Neutrals

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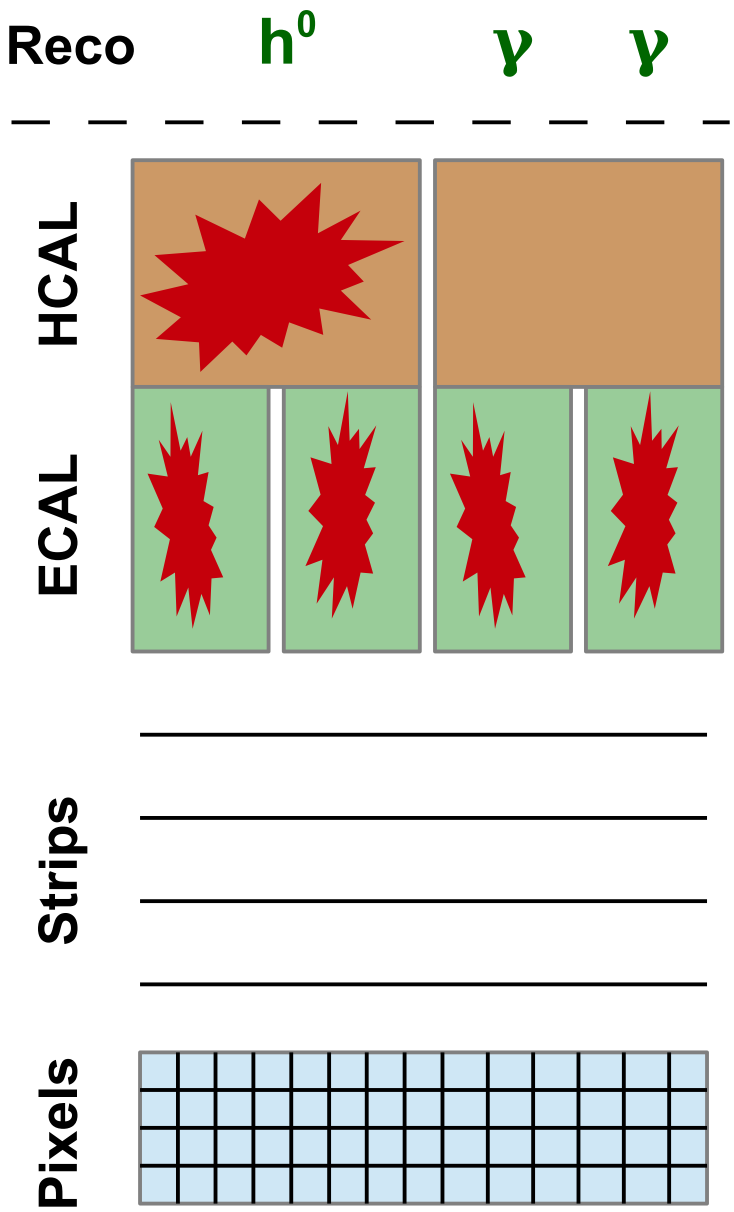

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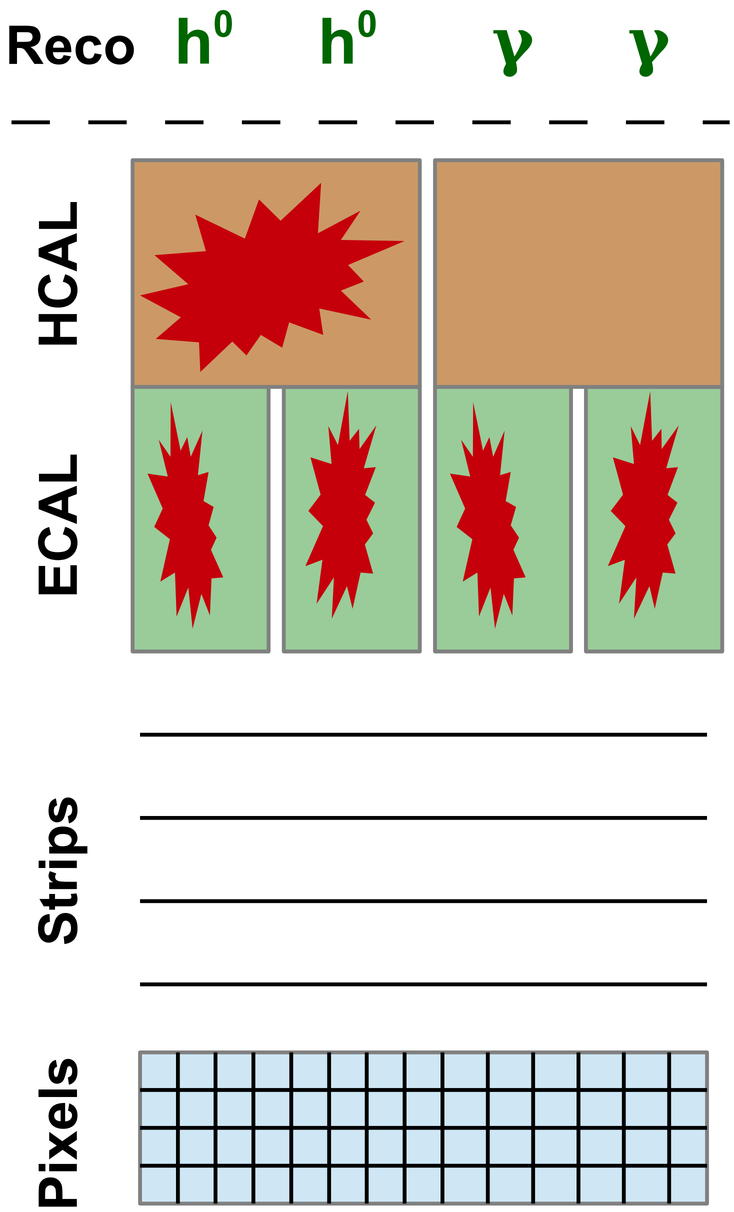

- Three ways to assign PF candidates to account for calorimeter excess:
  1) Merged Neutrals
  2) Split Photons
  3) **Split Neutrals**
     - **Assign number of h^0, γ based on number of ECAL clusters**

Note :
we only split neutrals with $p_T > 50$ GeV

Low p_T :
made resolution worse

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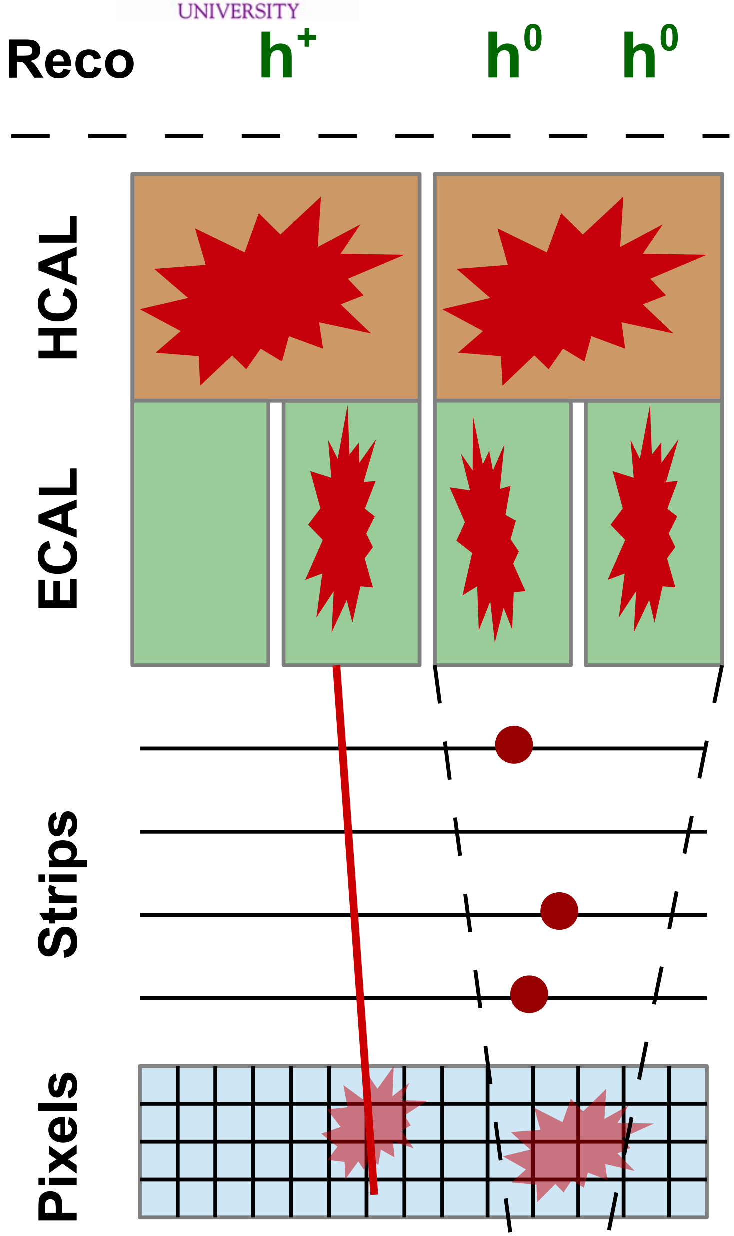
(Northwestern Univeristy)

Tracking Fixes



- Improve tracking after Split Neutrals procedure:
  - Jet core tracking
    - After default iterative tracking, look for hits consistent with jet axis

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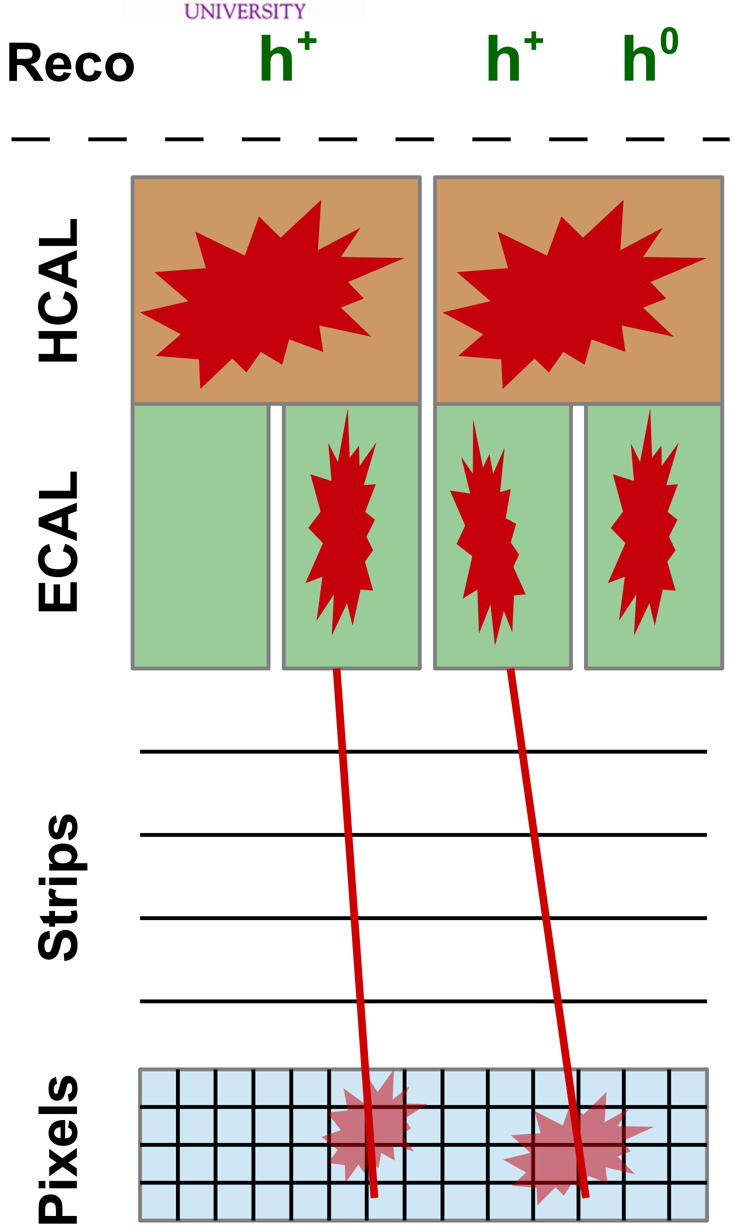
Tracking Fixes



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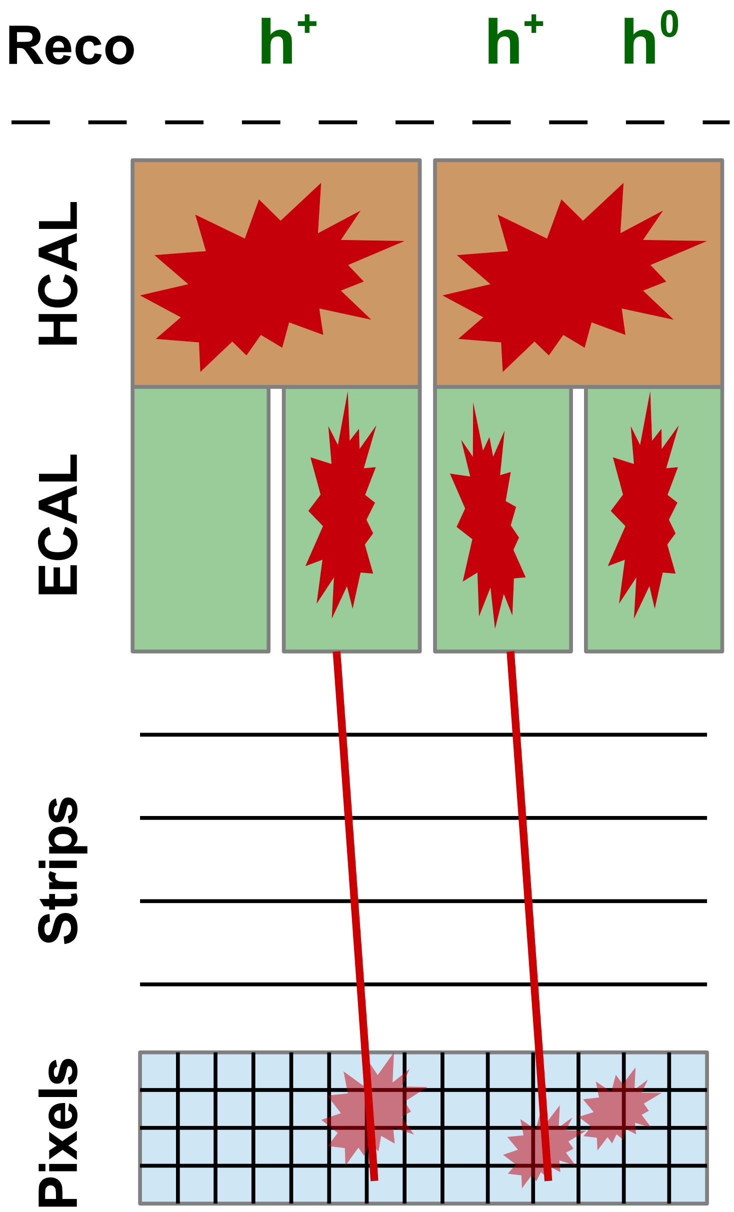

- Improve tracking after Split Neutrals procedure:
  - Jet core tracking
    - After default iterative tracking, look for hits consistent with jet axis
  - Pixel cluster splitting
    - Split merged pixel clusters consistent with jet core
    - Improves p_T measurement