A step towards tagging of quenched jets

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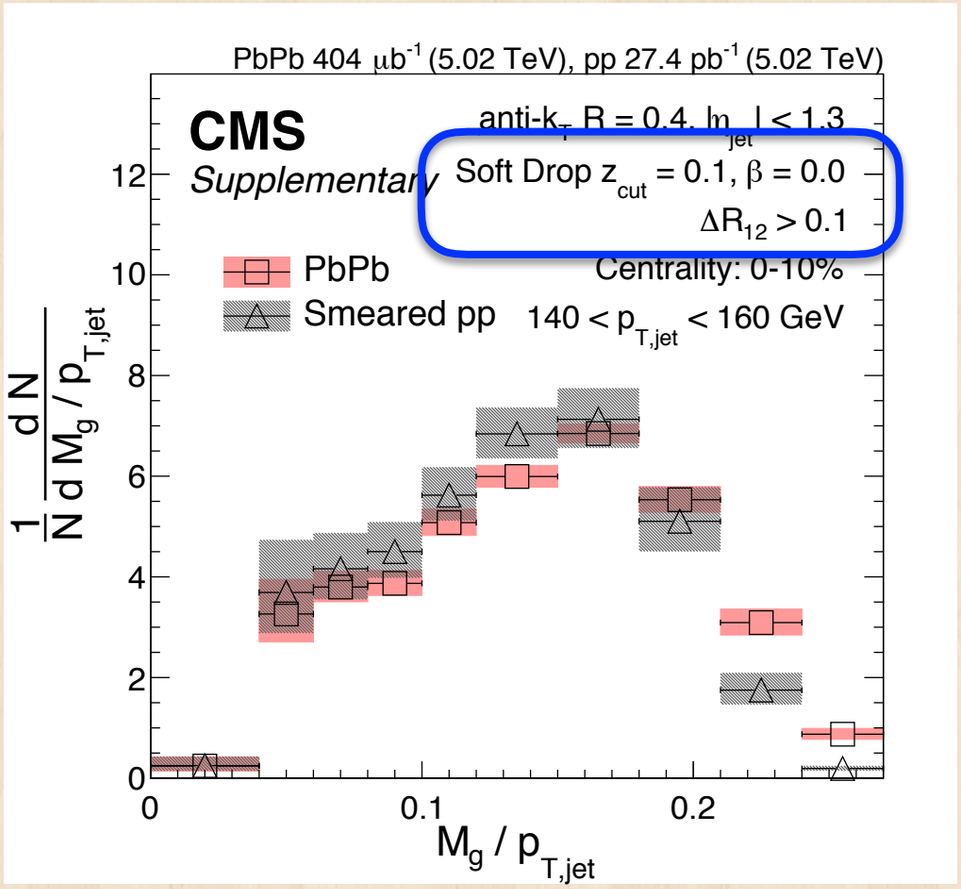
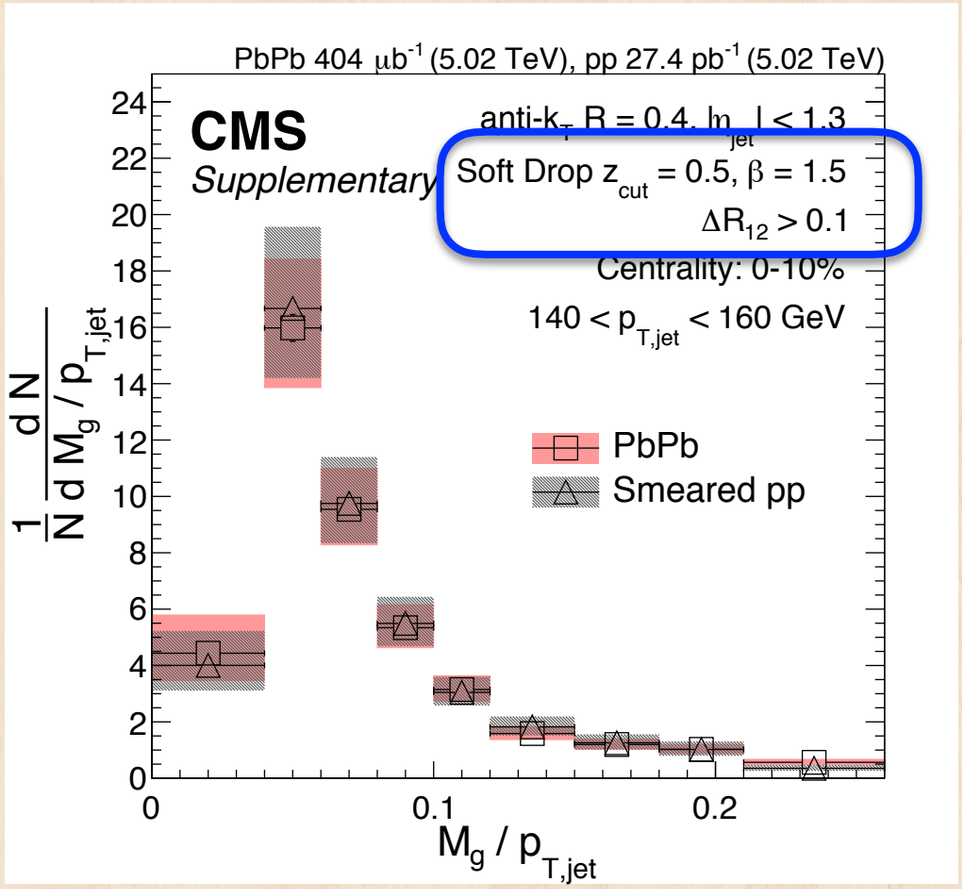
Different aspects of jet



?



Different algorithm = different phase space
= different behavior

Correlations

- What can we learn by correlating different observables?

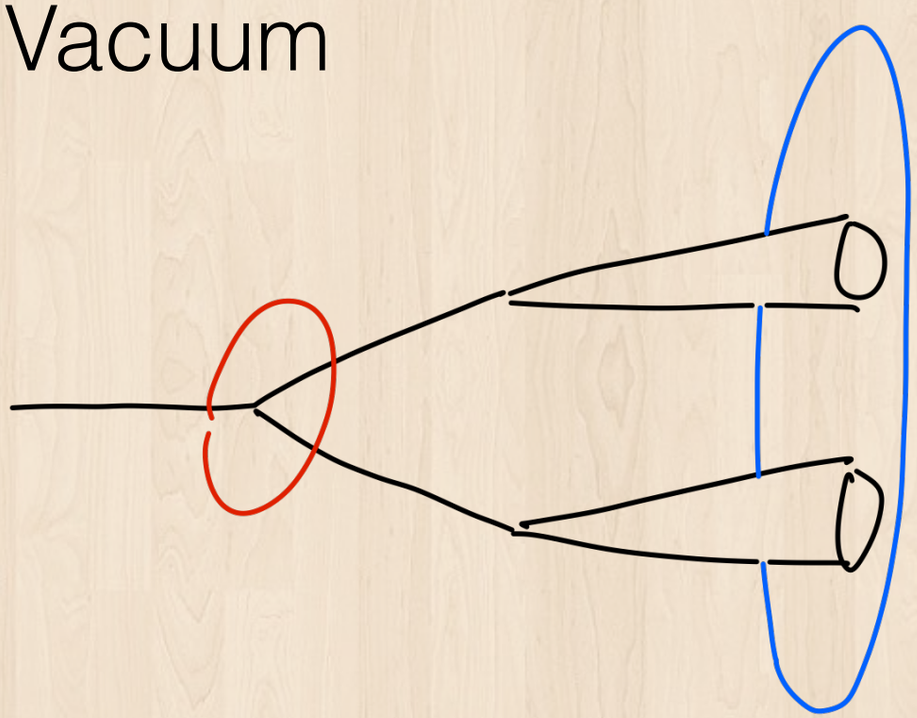
- Can we use one to classify jets and another one to extract physics?

- If we have an observable on the initial opening angle, we can access for example coherence/ incoherence effect

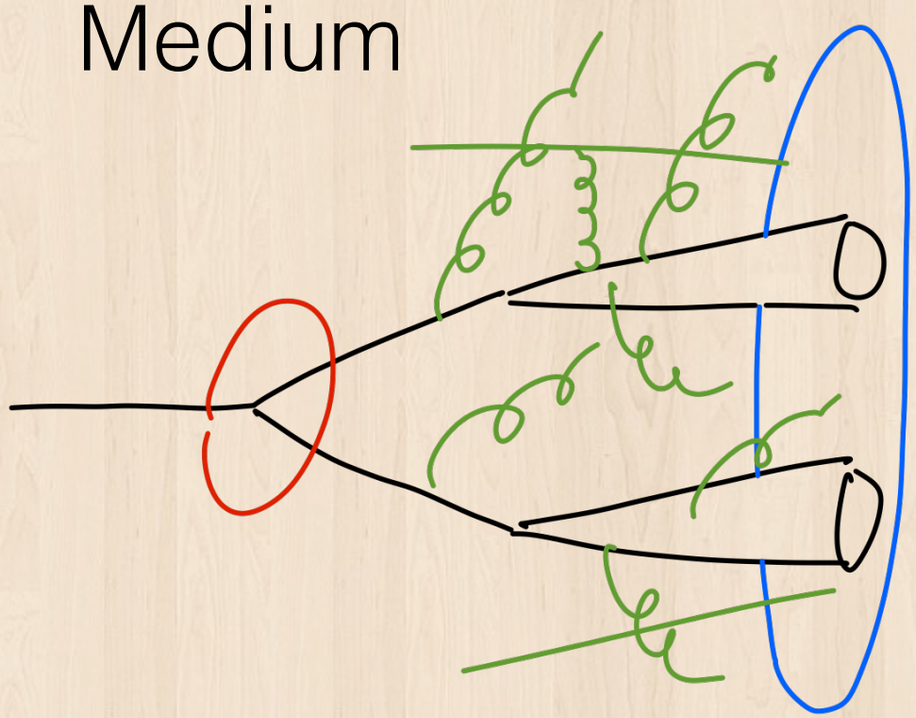
Can we “tag” the initial shower shape?

The goal

Vacuum

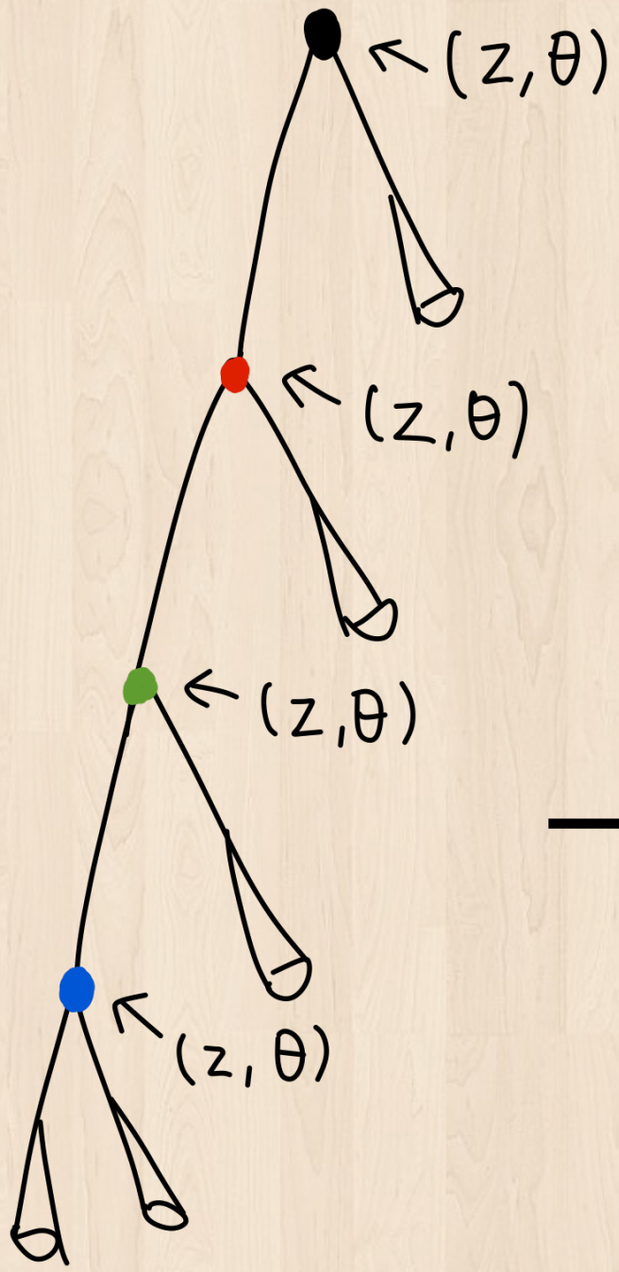


Medium

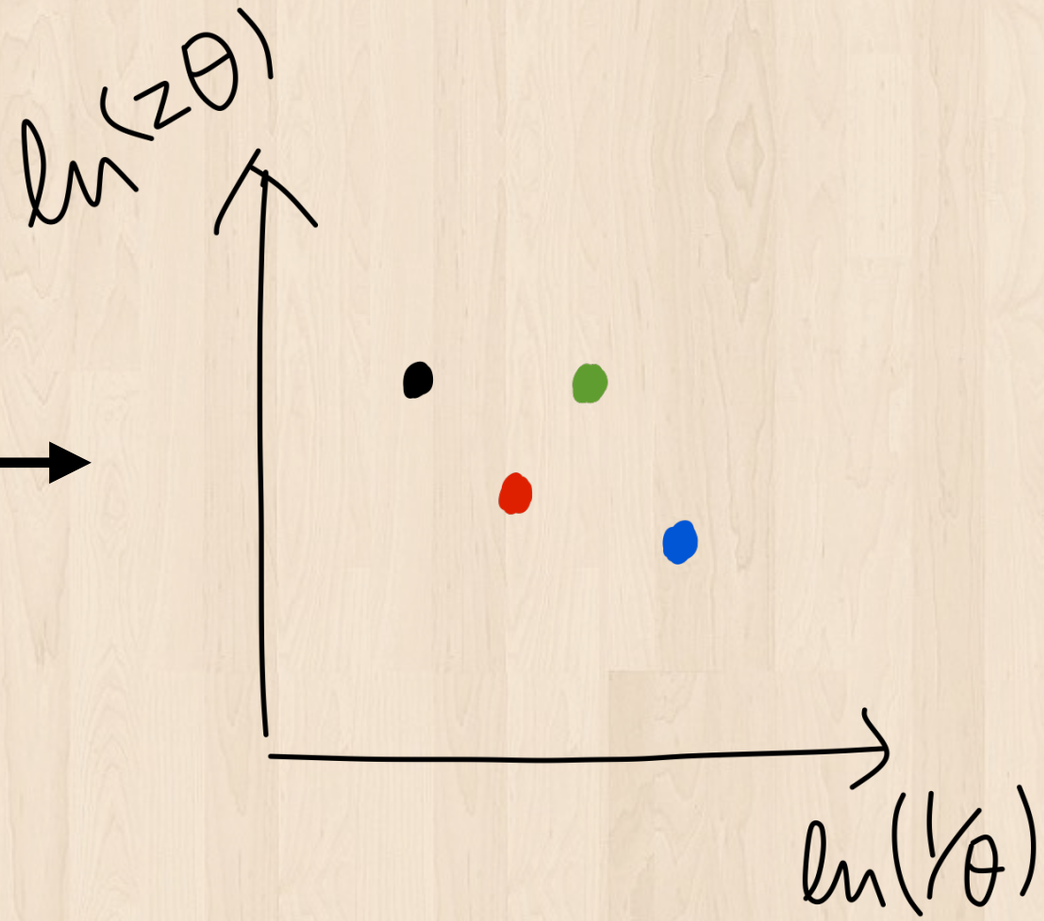


Find some set of observables that reproduce the properties of the hard splitting, both in vacuum and in medium

Mapping jet splittings



Decluster jet (C/A) and follow harder branch

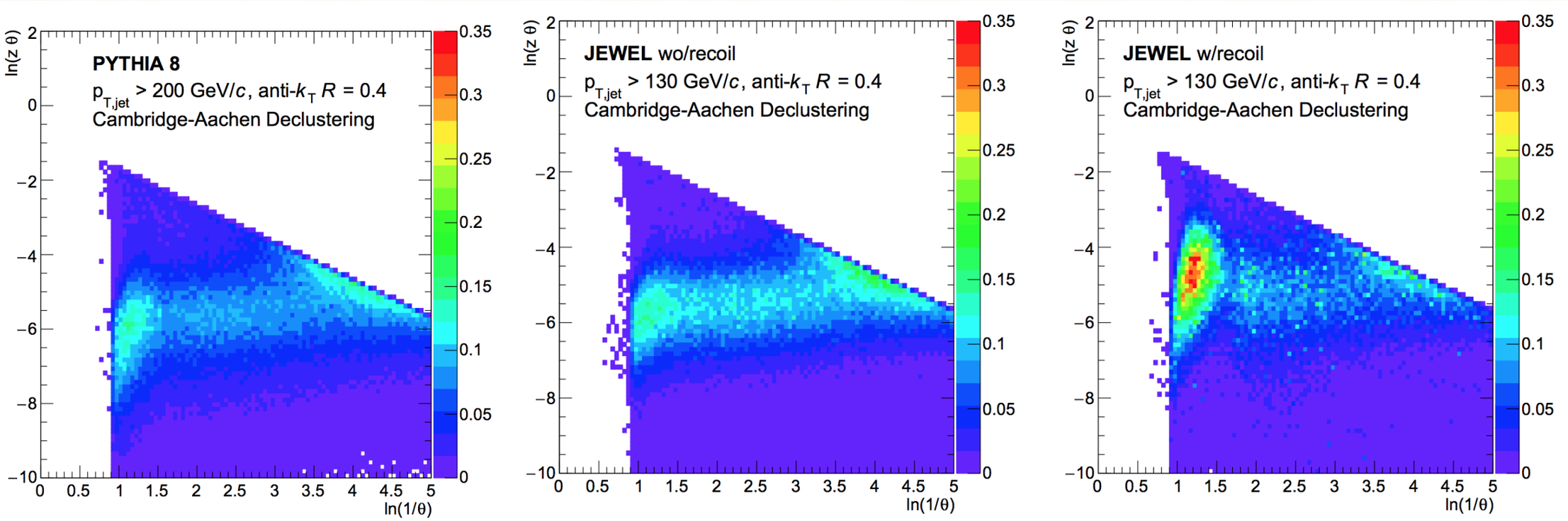


Jewel: a case study

Vacuum

Jewel: no recoil

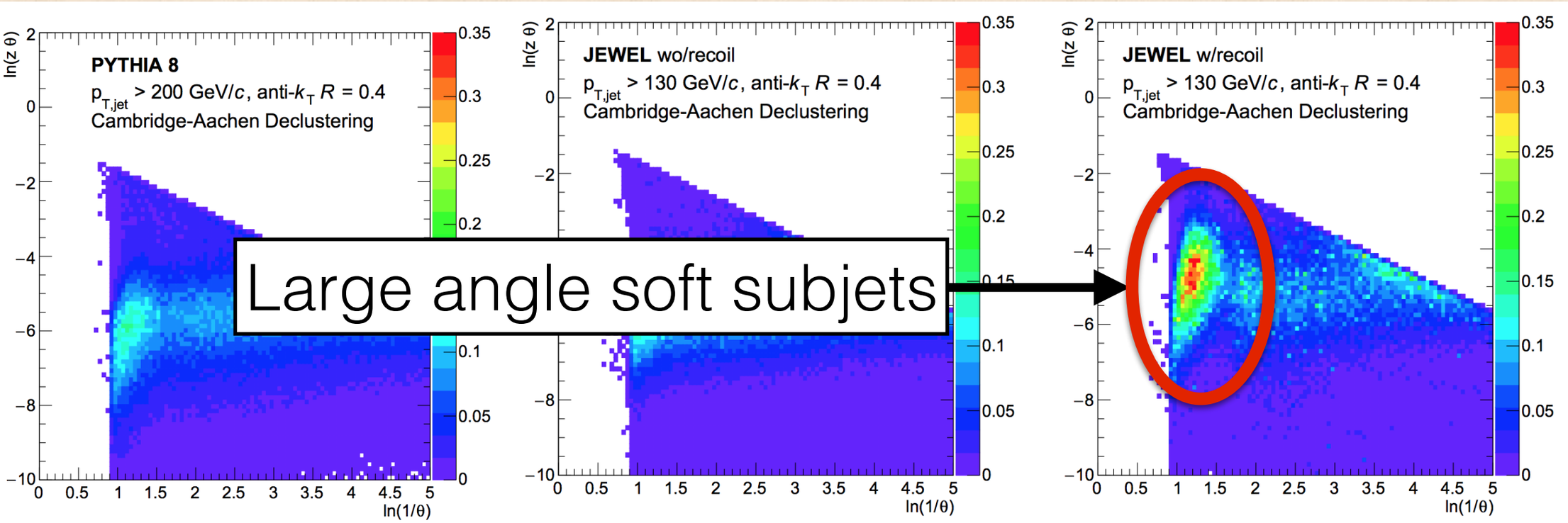
Jewel: recoil



First step: find a way to slice this plane so that vacuum and jewel results look similar

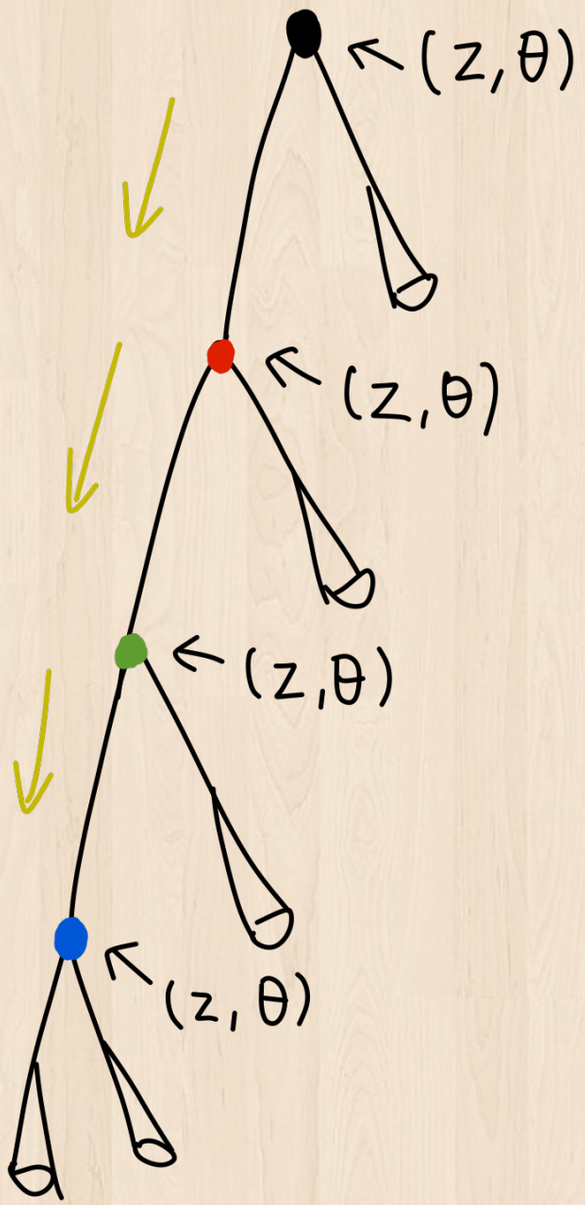
Jewel: a case study

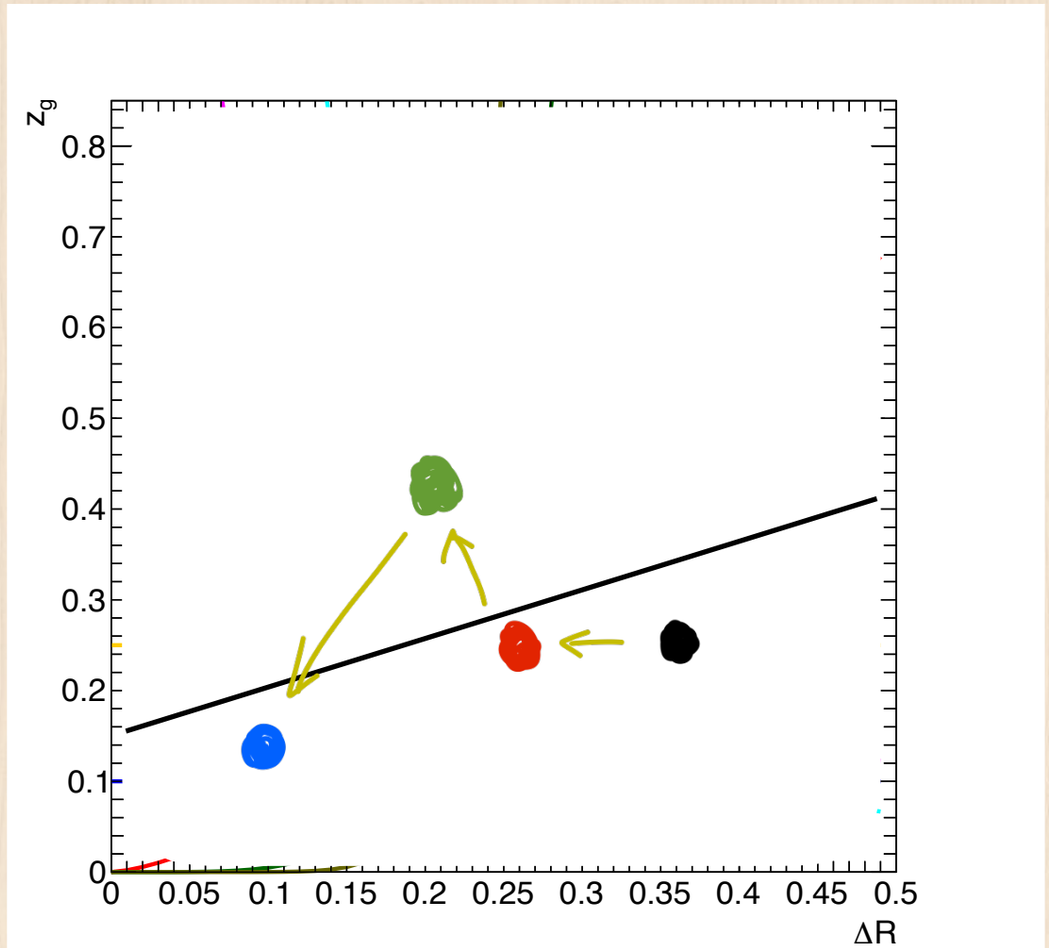
Vacuum | Jewel: no recoil | Jewel: recoil



First step: find a way to slice this plane so that vacuum and jewel results look similar

Soft drop grooming



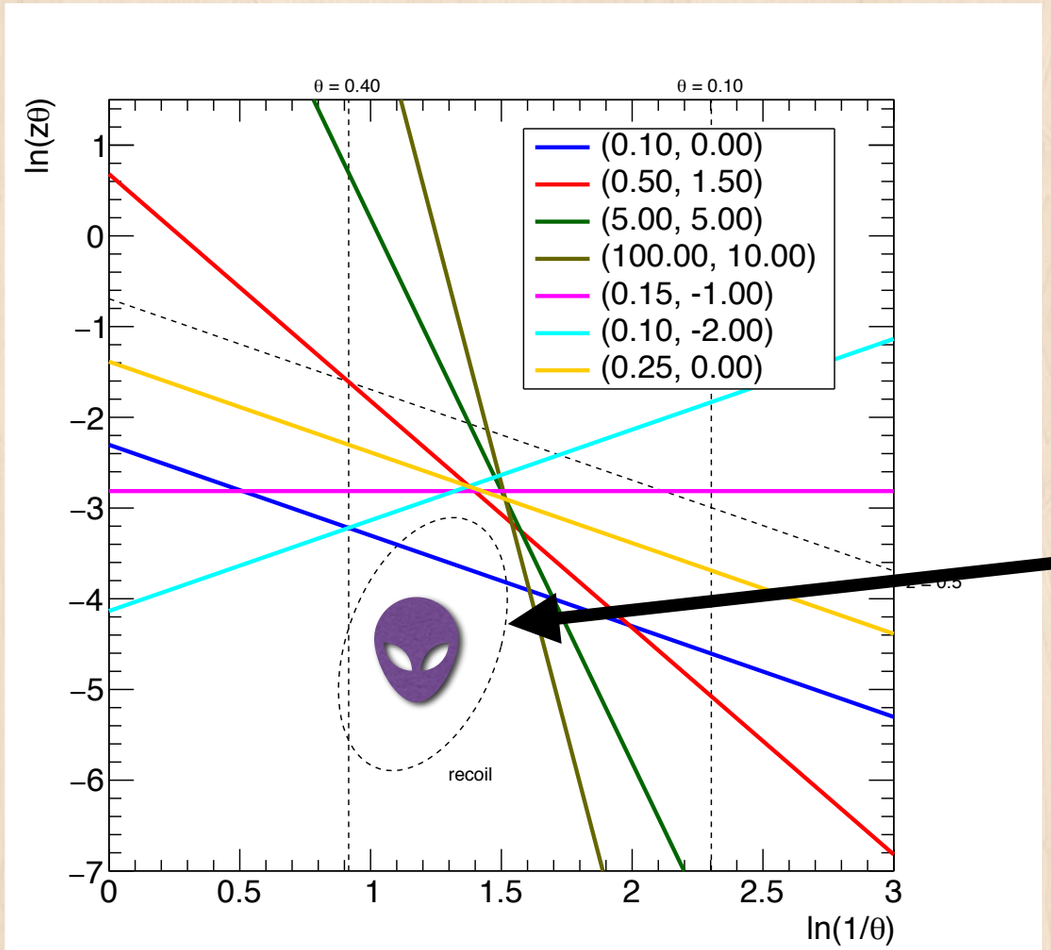


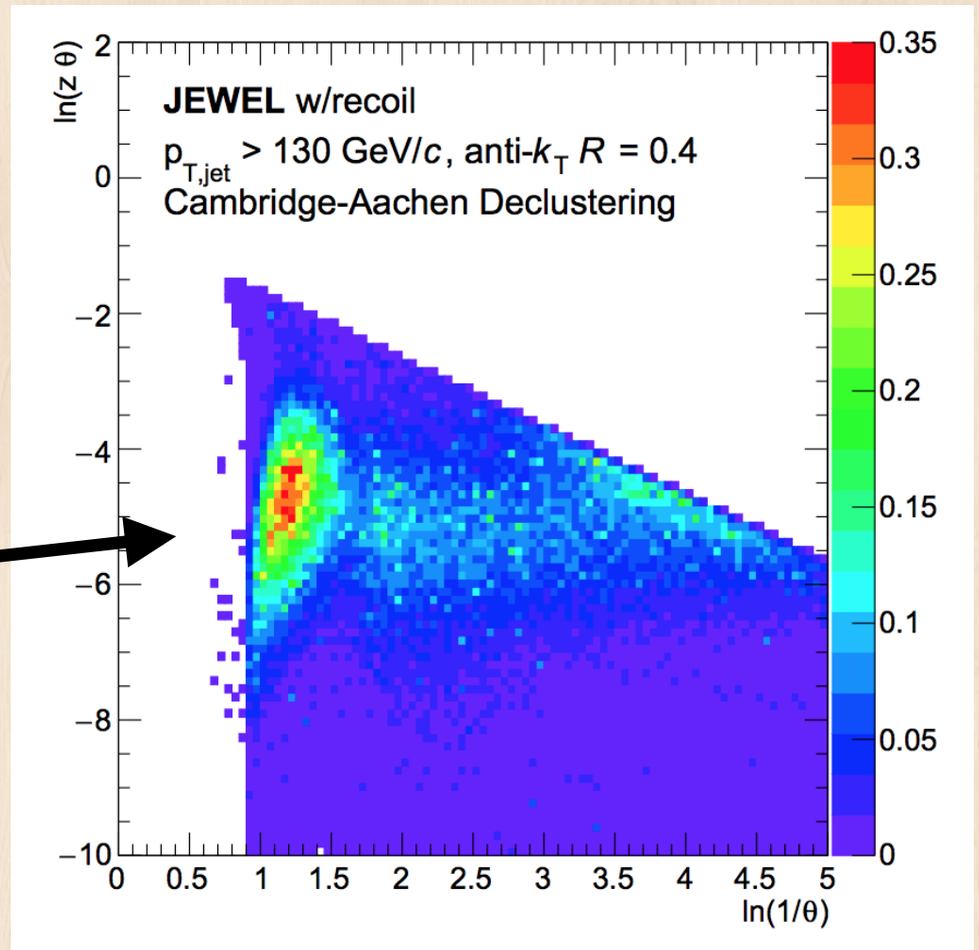
Above line: accepted by grooming

Below line: groomed away

Soft drop grooming

Is there a soft drop grooming setting (z_{cut}, β) that can achieve the goal?





Soft drop condition: $z_g > z_{cut} (\Delta R/R_0)^{\beta}$

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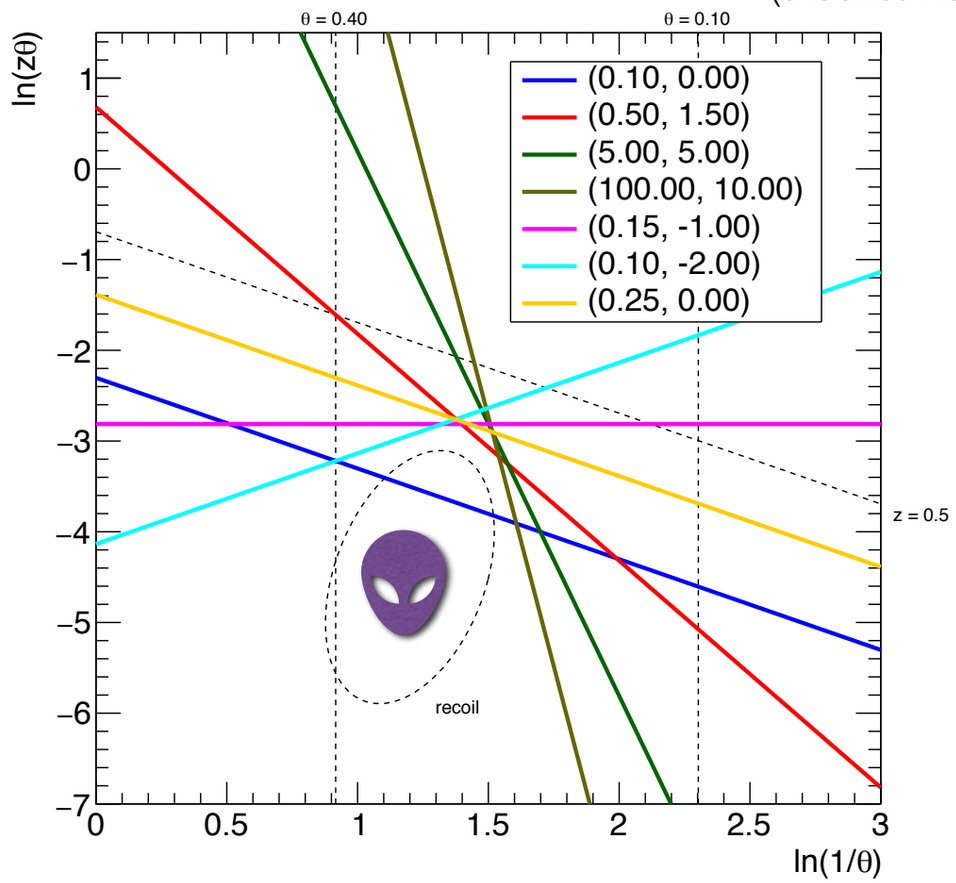
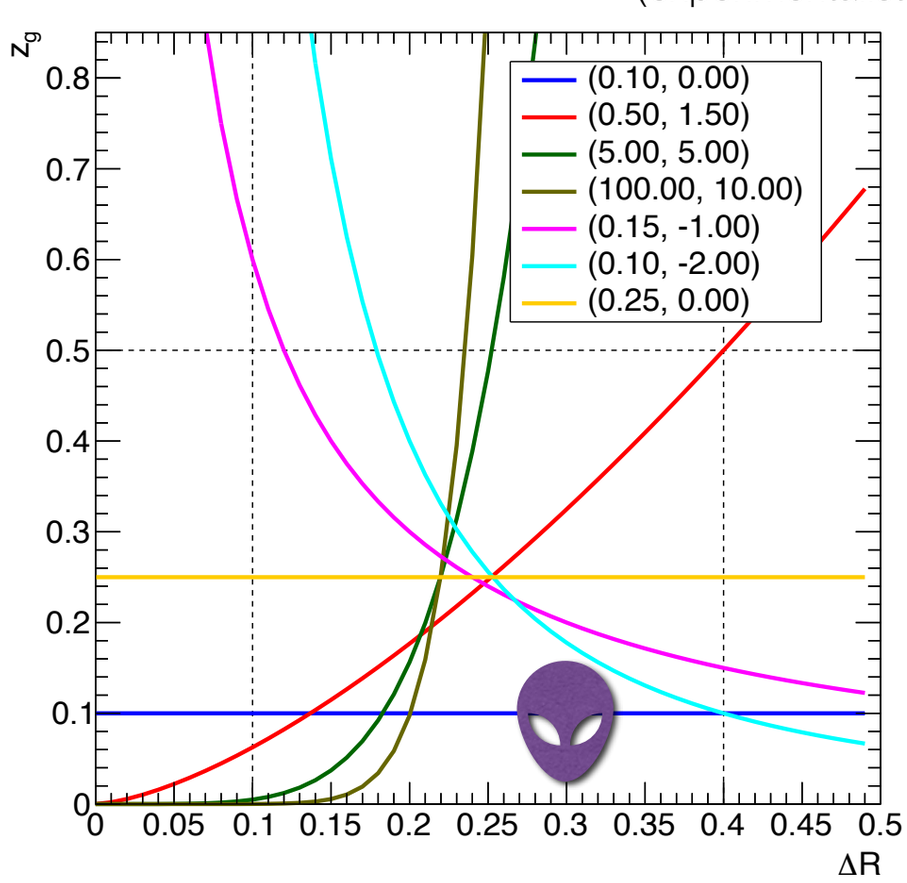
(theorist view)

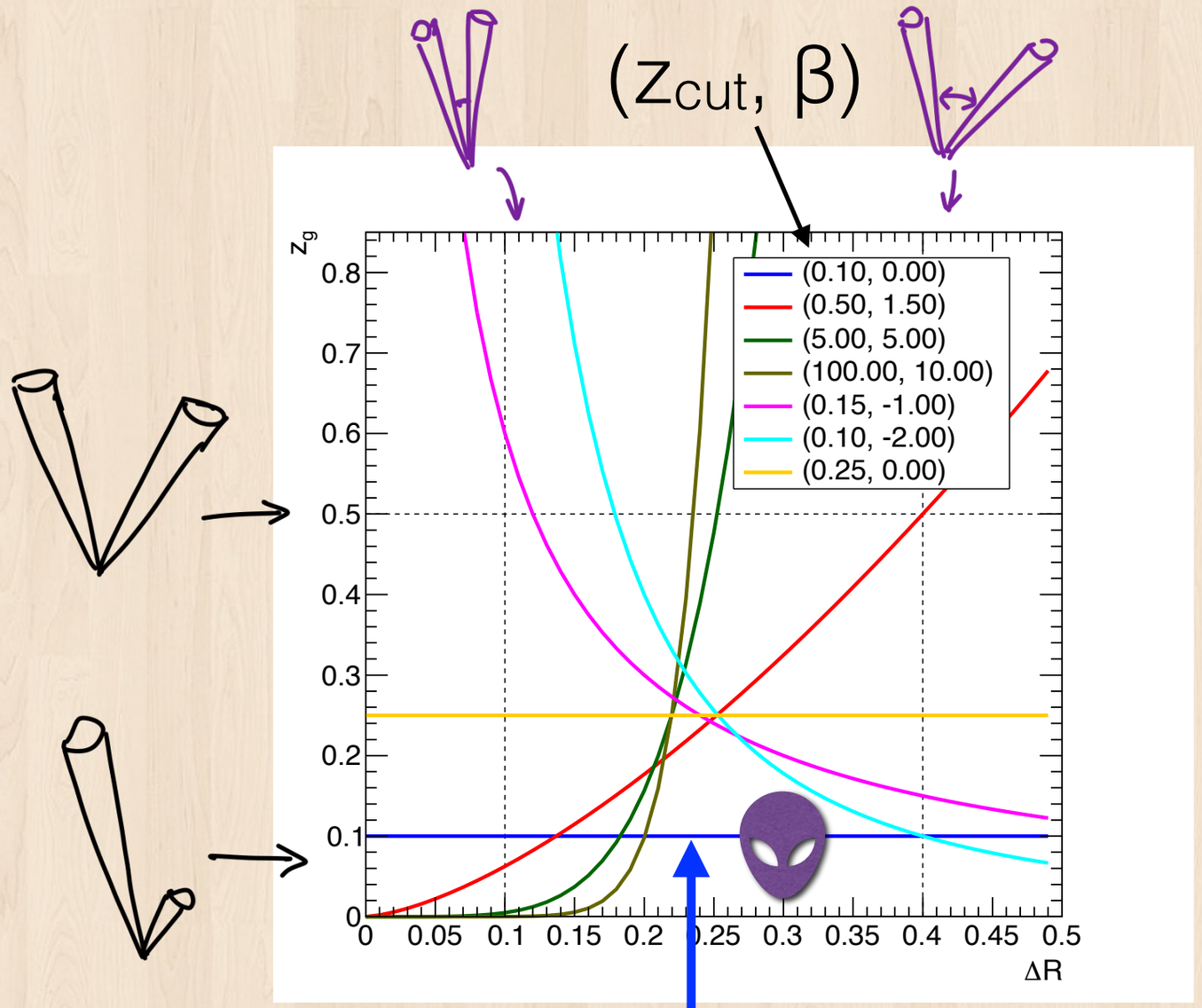


(experimentalist view)



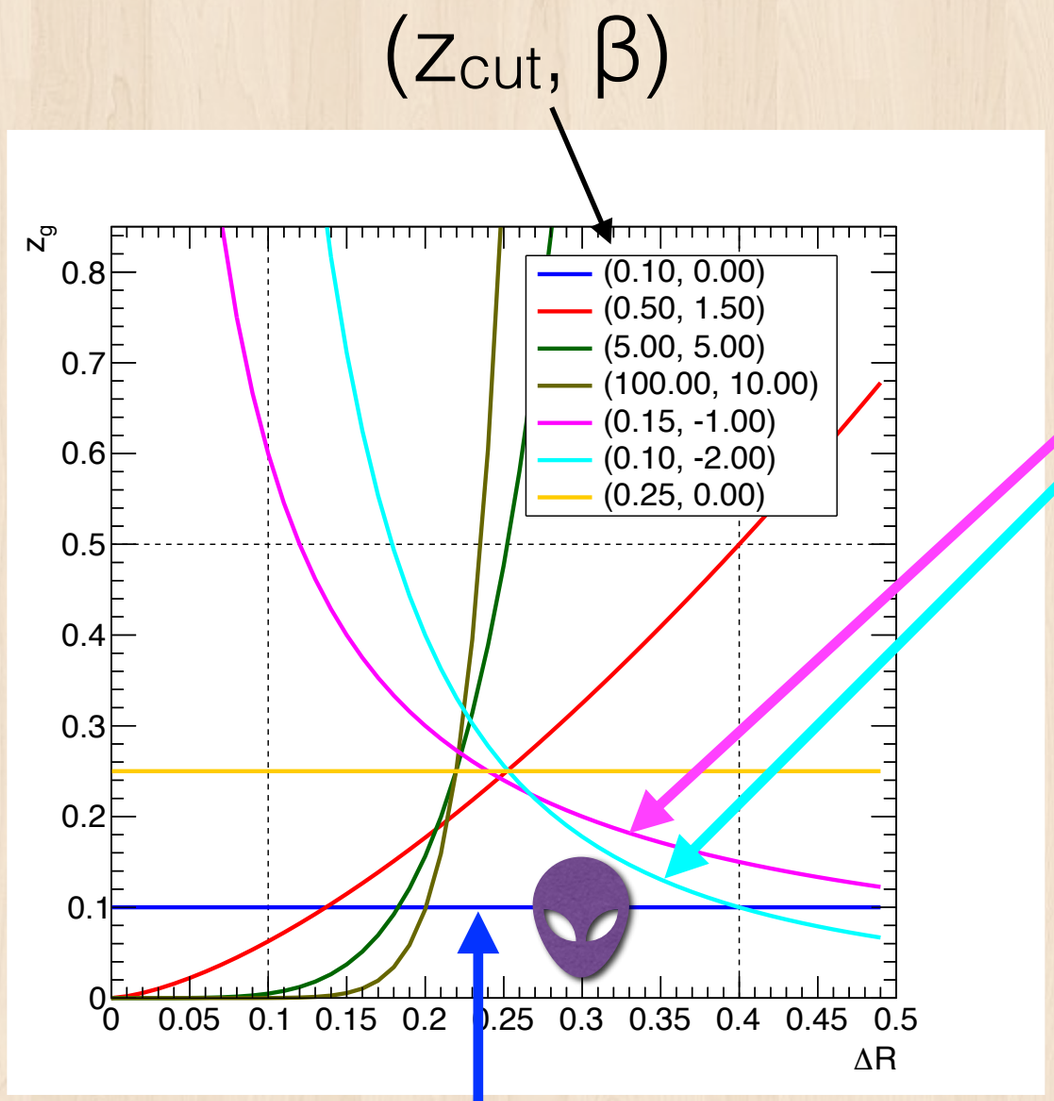
Soft drop condition: $z_g > z_{cut} (\Delta R/R_0)^{\beta}$

Classic grooming



Classic: Catches large angle soft particles

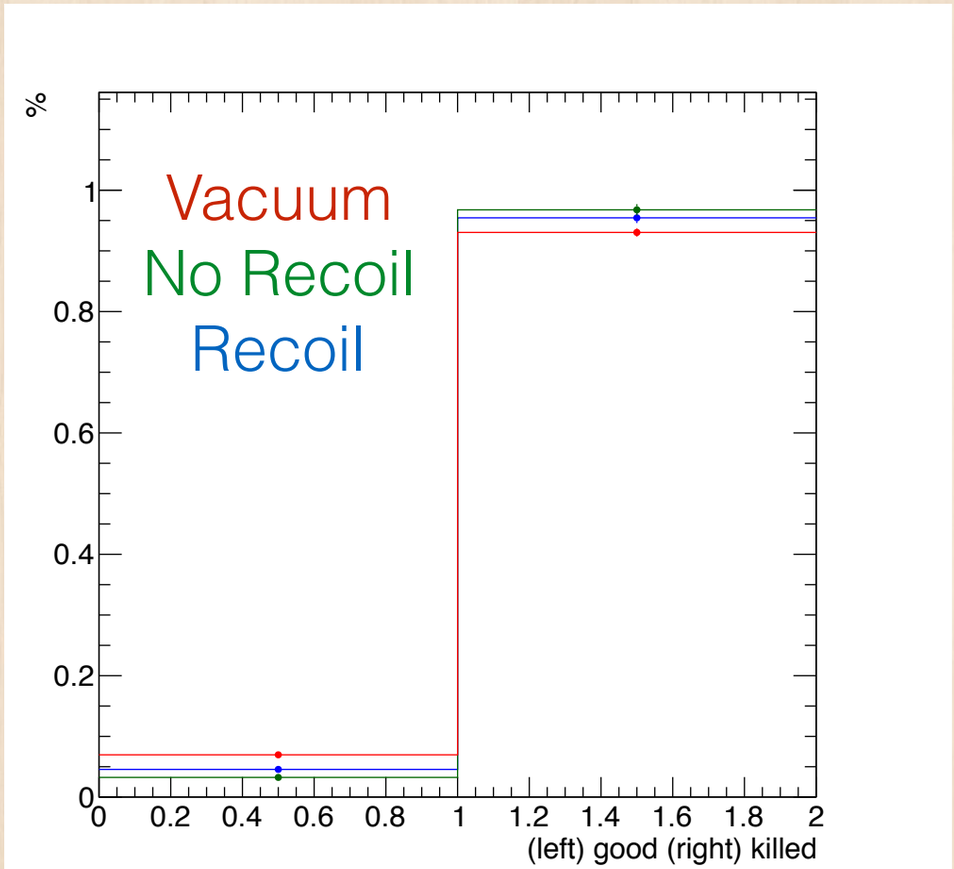
Pros and cons



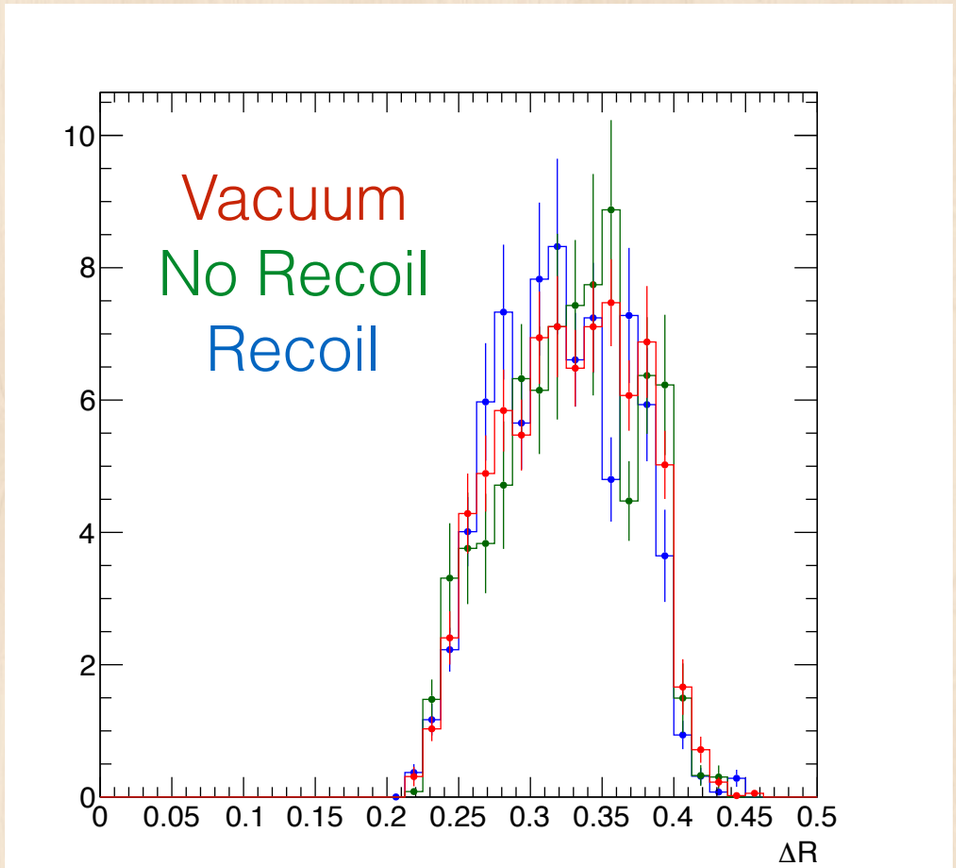
Limited to large angles; groomed-away rate large

Classic: Catches large angle soft particles

β < 0 (0.15, -2.00)



> 90% jets completely groomed away

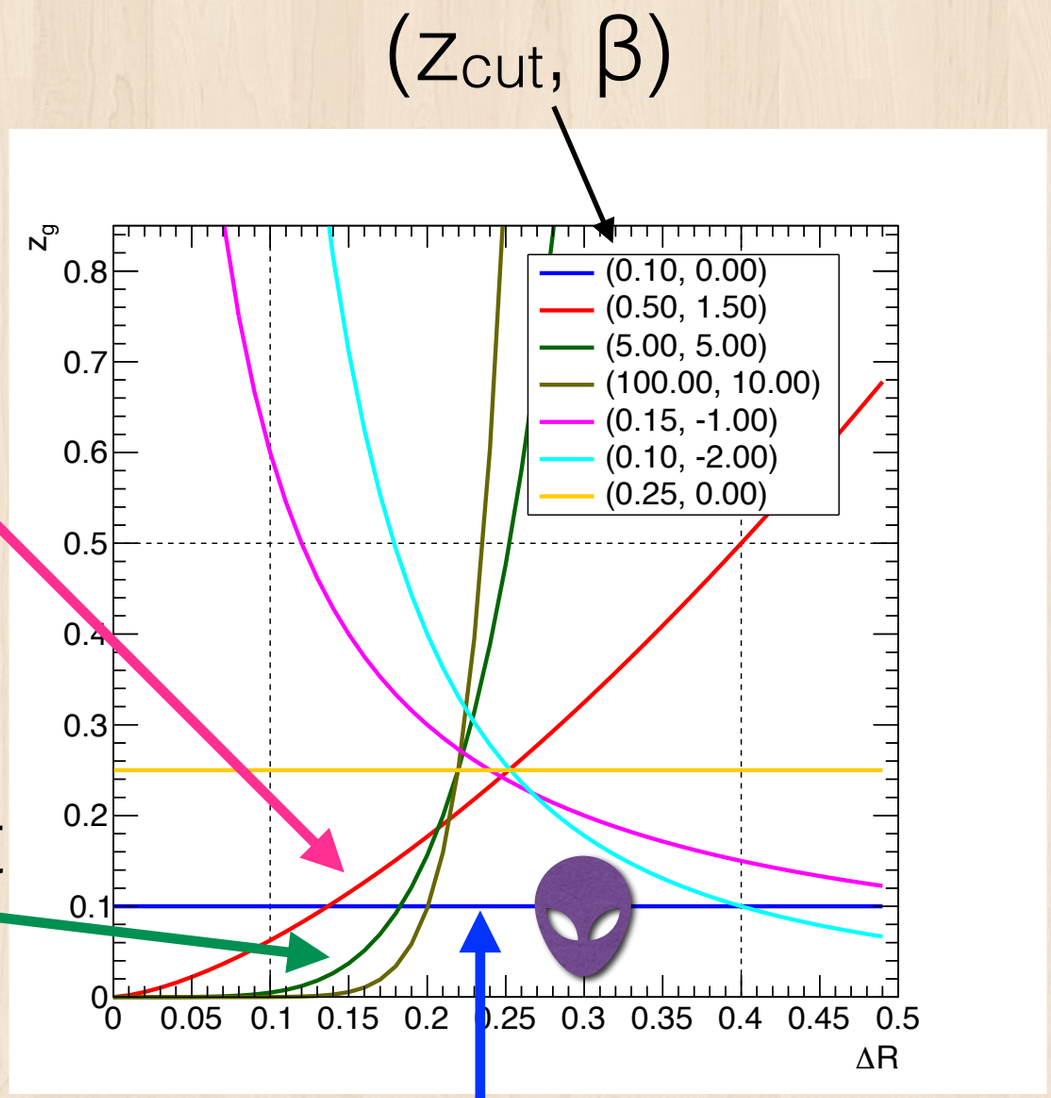


Only span part of opening angles

Pros and cons

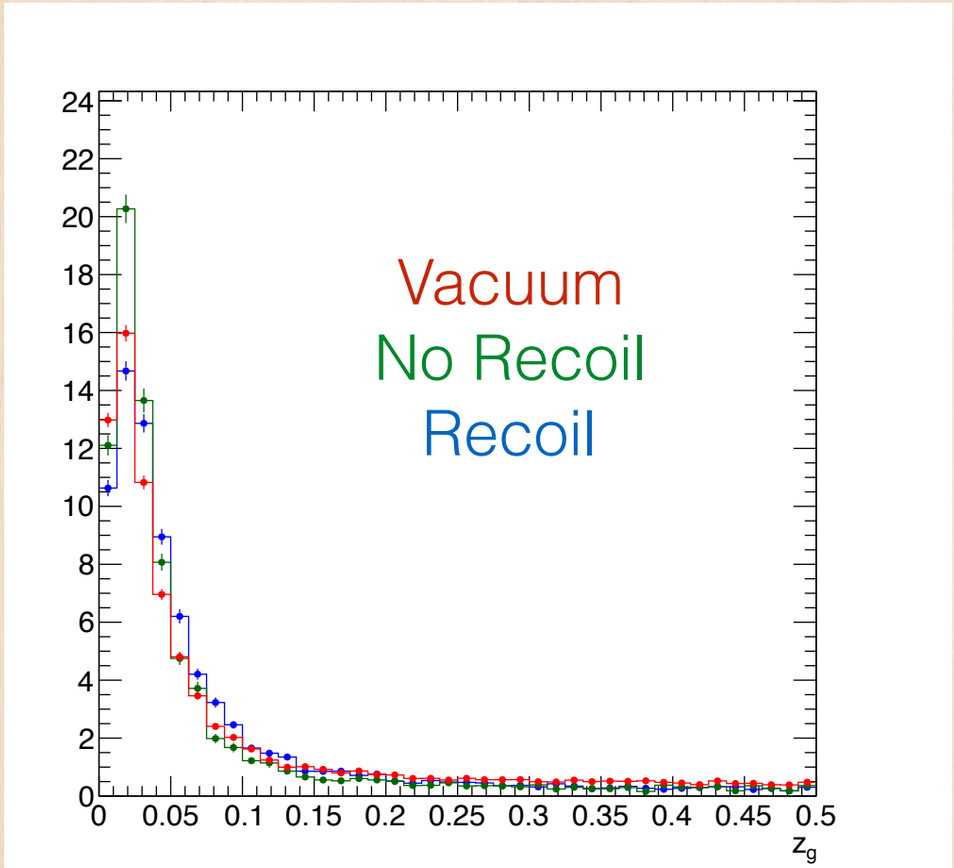
Focuses on small angle

Very small zg; not experiment friendly

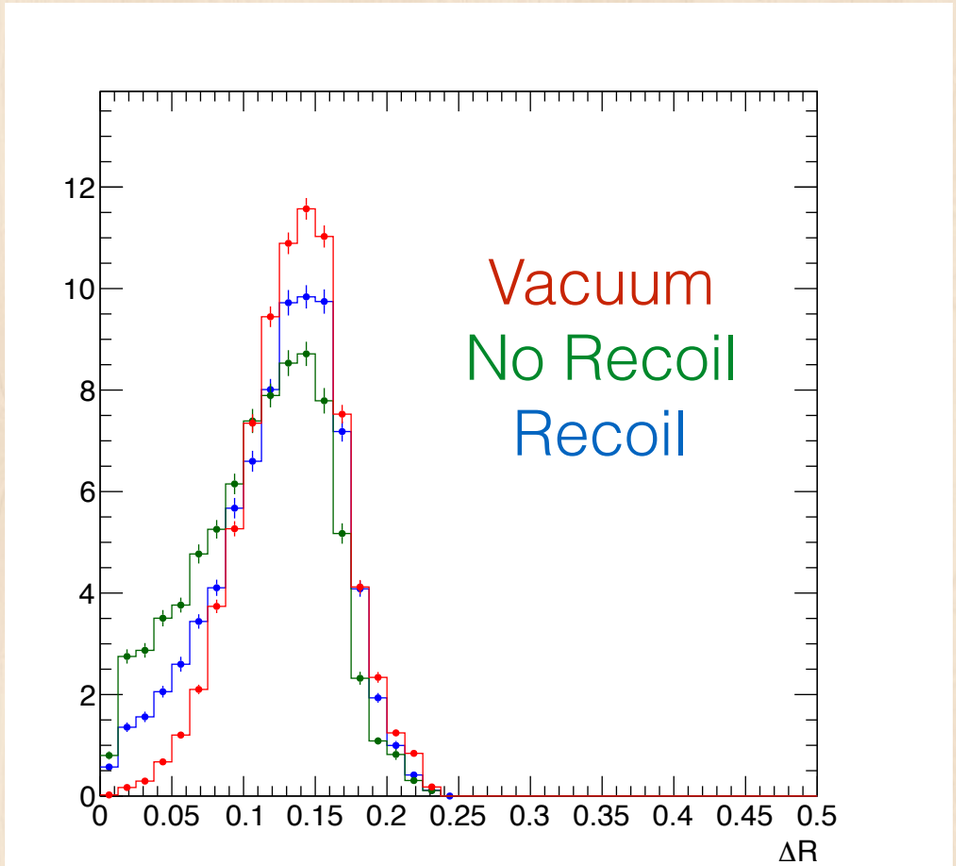


Classic: Catches large angle soft particles

Large β



Very small z_g, hard to control experimentally



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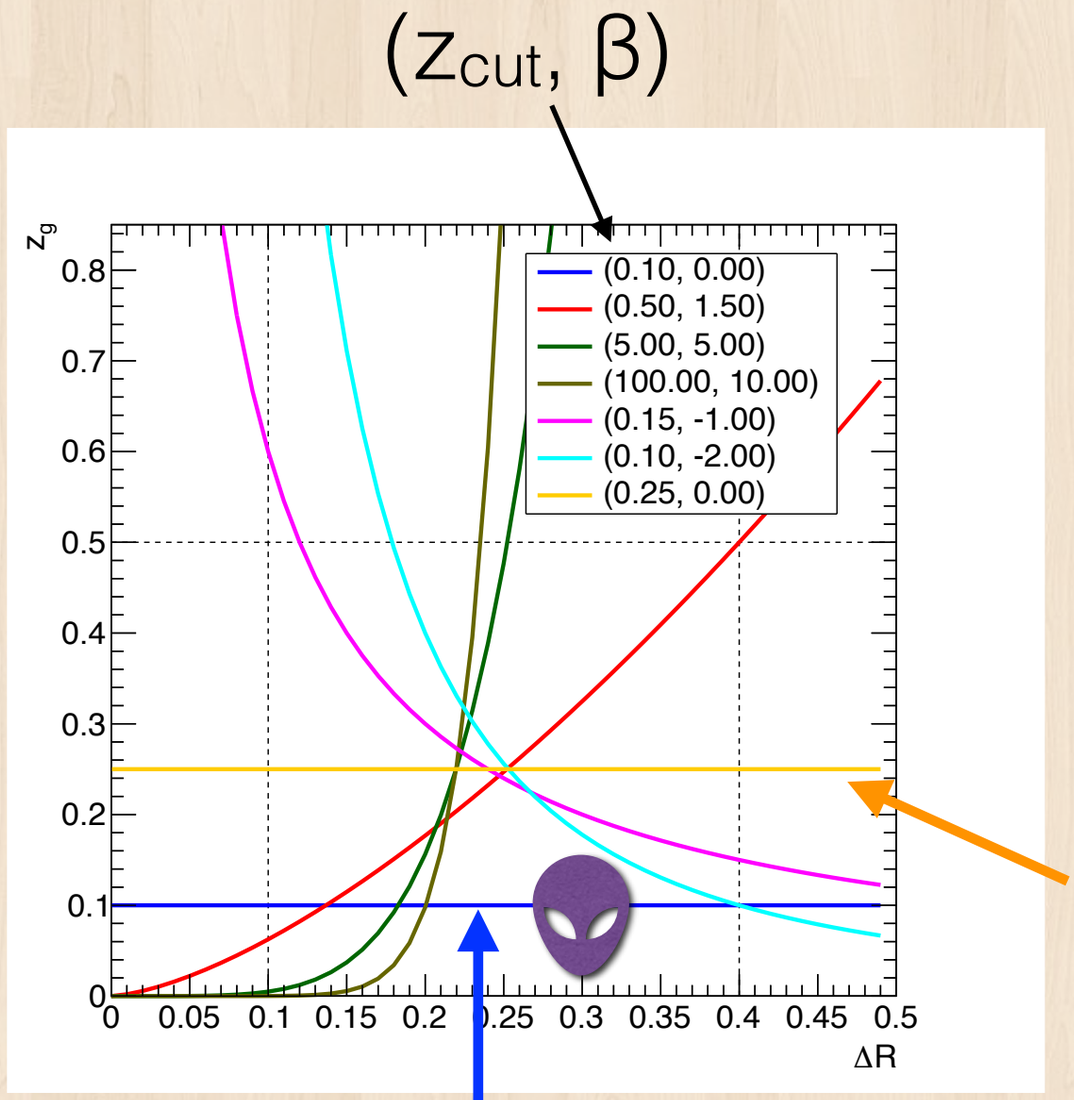
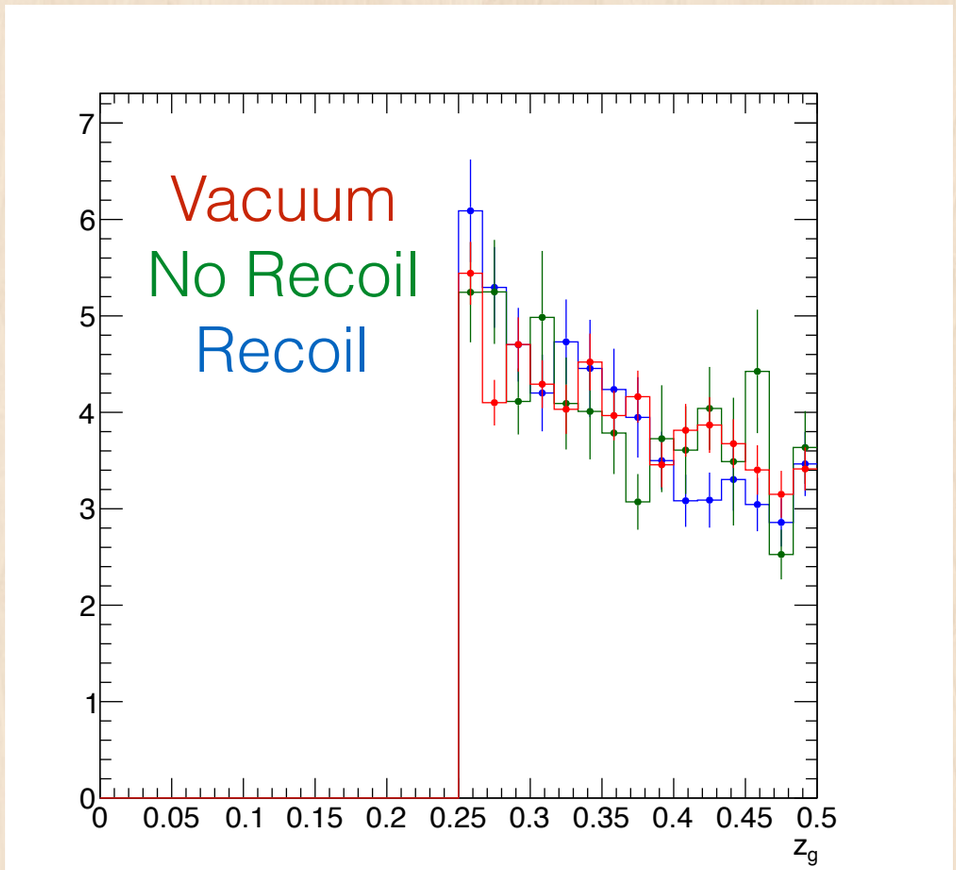
Pros and cons

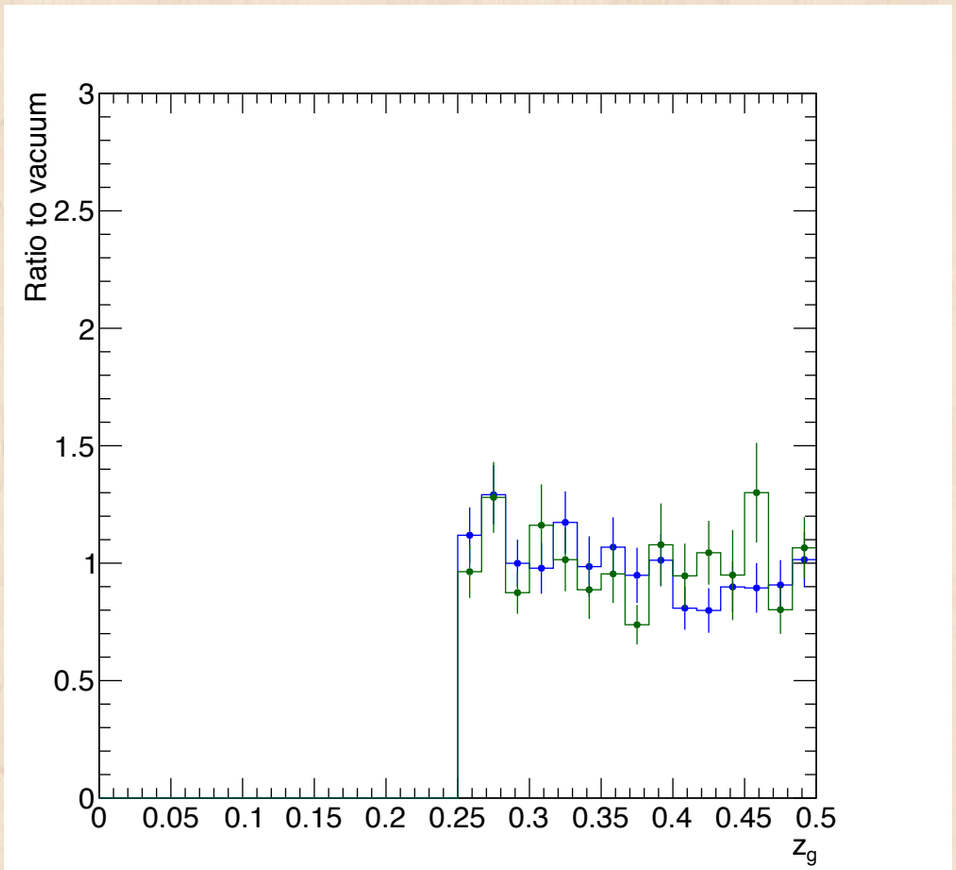


Avoids most soft radiation

Classic: Catches large angle soft particles

($z_{cut} = 0.25, \beta = 0.00$)





Grooming: flat as a function of opening angle

Has potential to “tag” the initial angle

Distribution looks similar between vacuum and jewel

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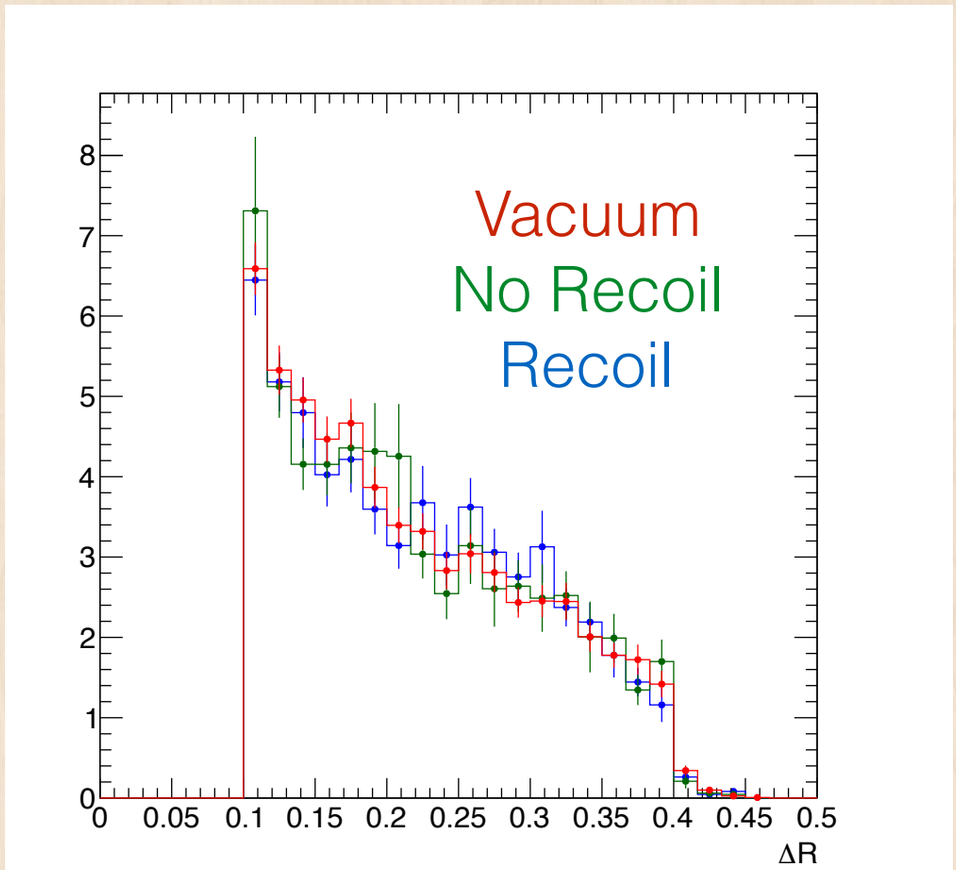
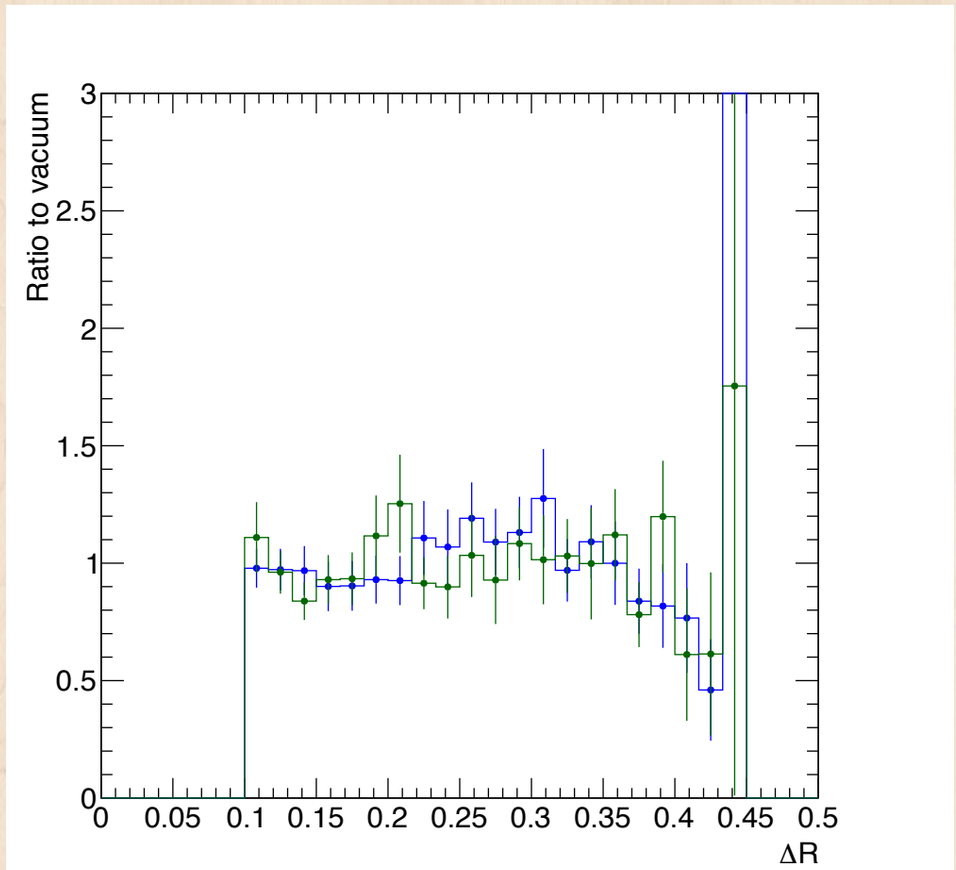




Grooming: flat as a function of opening angle

Has potential to “tag” the initial angle

Distribution looks similar between vacuum and jewel

What can we study?

V-tagged jets, Jet R_{AA}
fragmentation function, mass, radial profile

ΔR

Balanced splitting
at small angle

Structure of the “recoil”;
Coherent emission

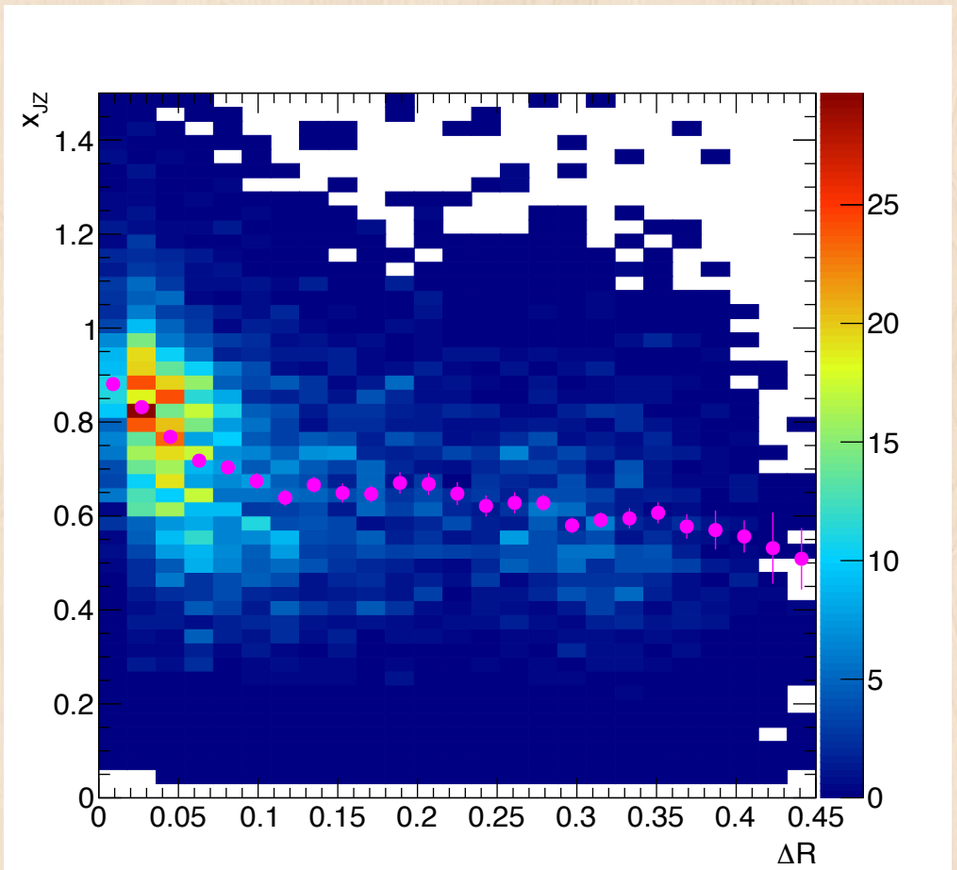
Balanced splitting
at large angle

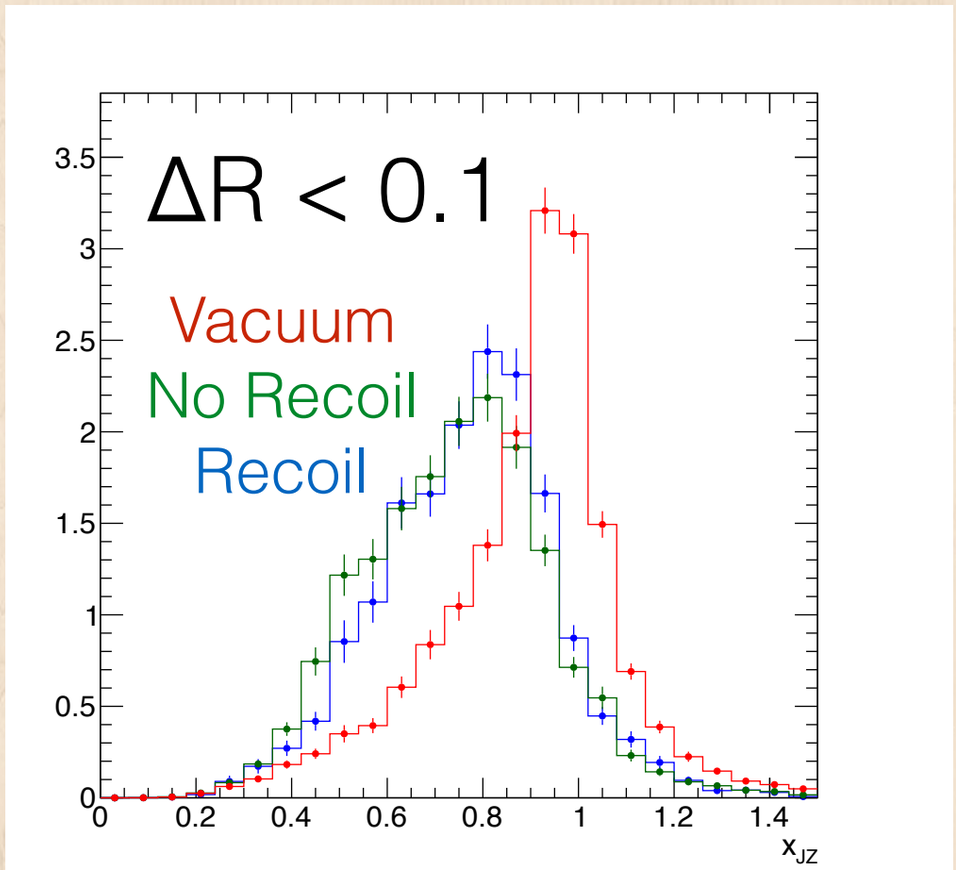
Correlate with grooming
with $\beta > 0$ to study
protected structures

Correlation with other observables: examples

Z-tagged jet

Identify Z boson and look at away-side jet energy





Jets with large-angle balanced splitting lose more energy compared to those with smaller angle

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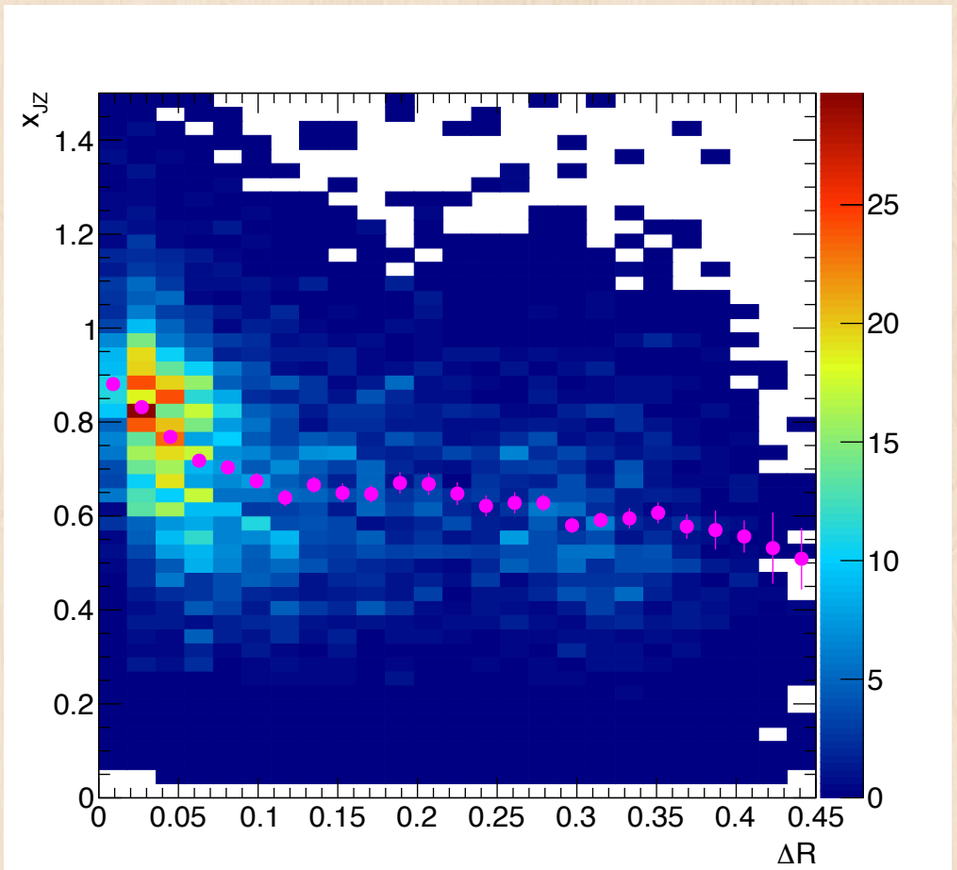
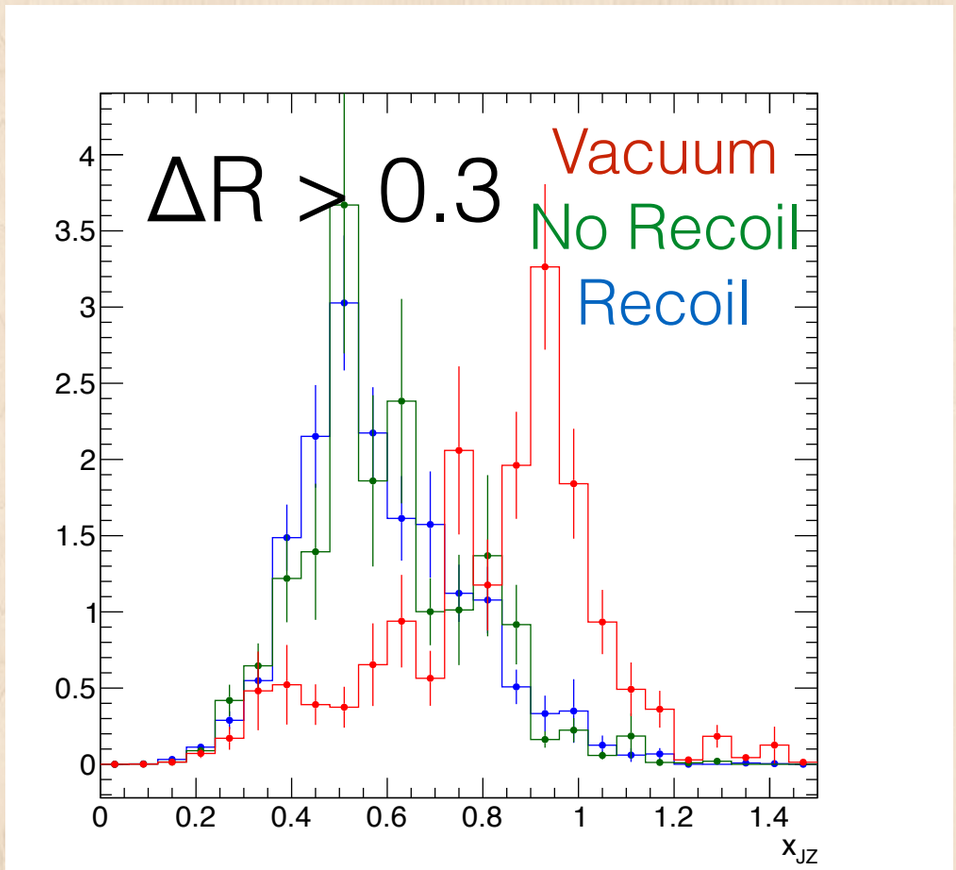
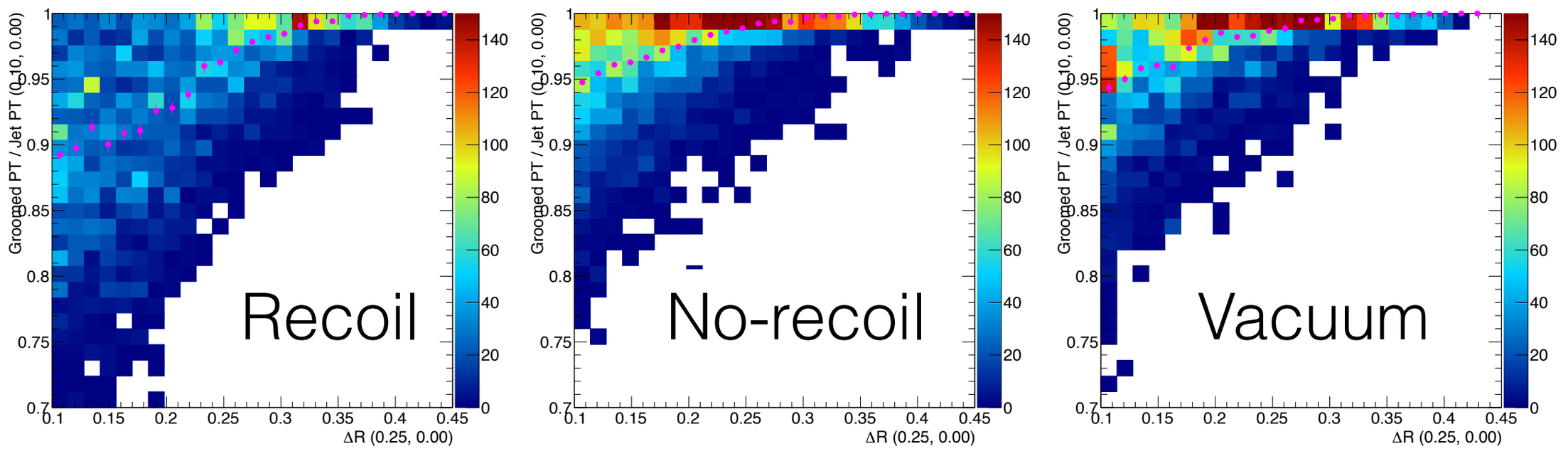




Jets with large-angle balanced splitting lose more energy compared to those with smaller angle

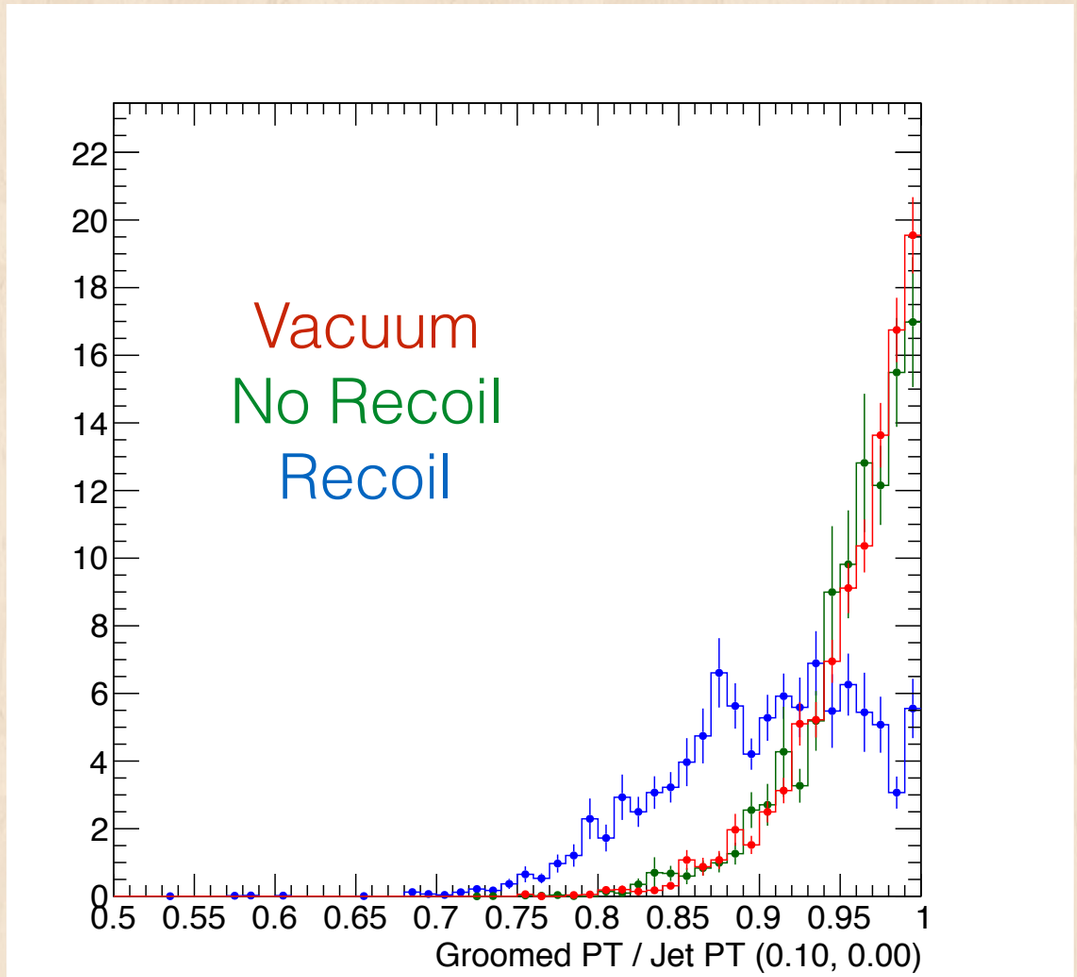
Groomed PT (0.10, 0.00)



Groomed jet PT with (0.10, 0.00) as a function of opening angle of first uniform splitting

In vacuum, regardless of the opening angle, groomed-away energy is minimal

Groomed PT (0.10, 0.00)



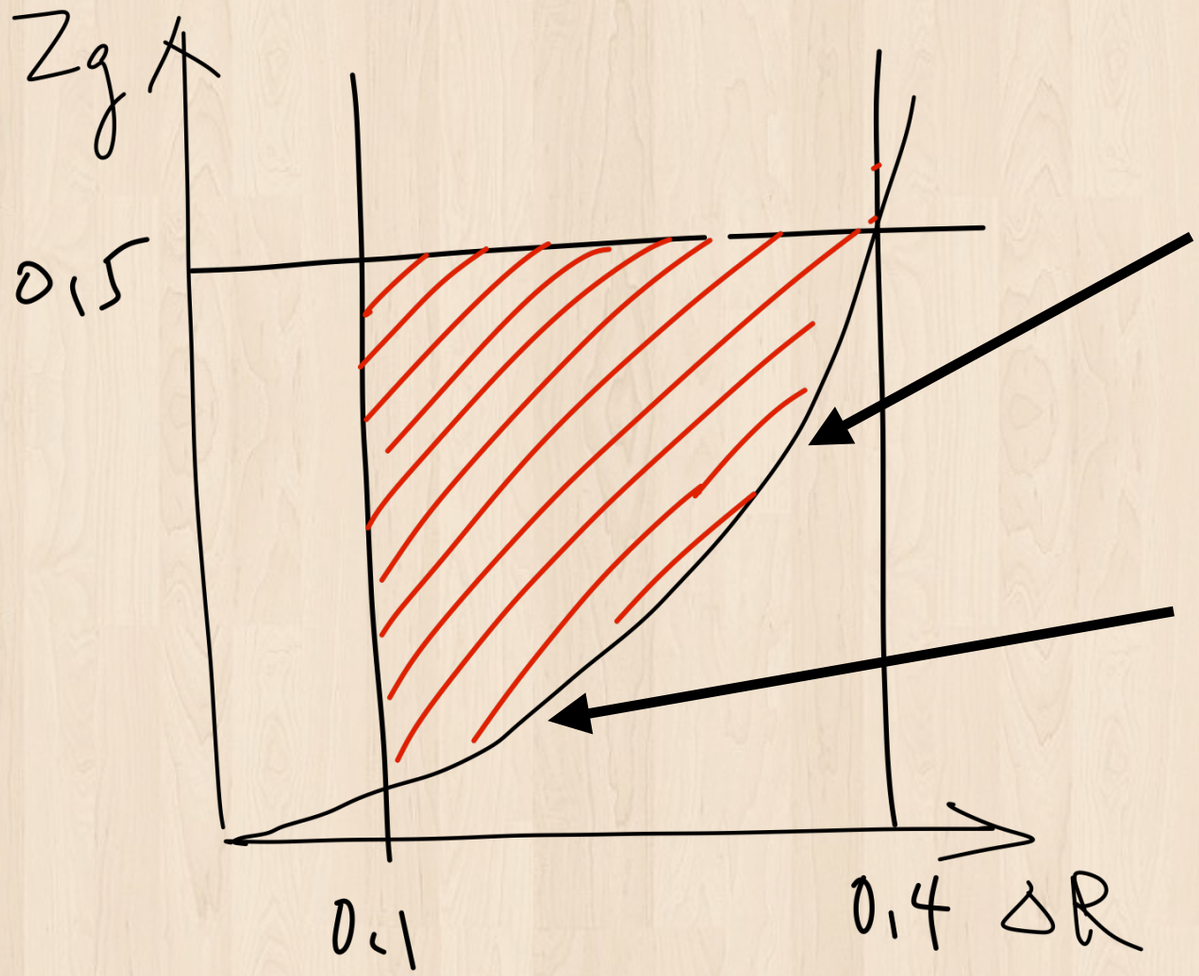
Opening angle of first balanced splitting = 0.1-0.2

Select only jets with small opening angle, examine groomed jet PT with (0.10, 0.00)

Vacuum ~ no-recoil > recoil

A measure of the **amount of recoil**

(0.5, 1.5) grooming setting



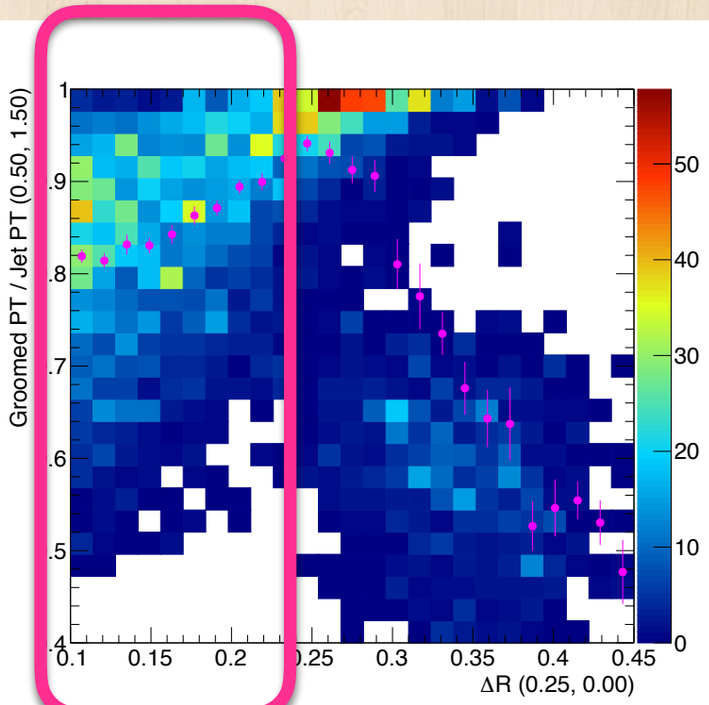
Stronger grooming
at large angle

Weak grooming
at small angle

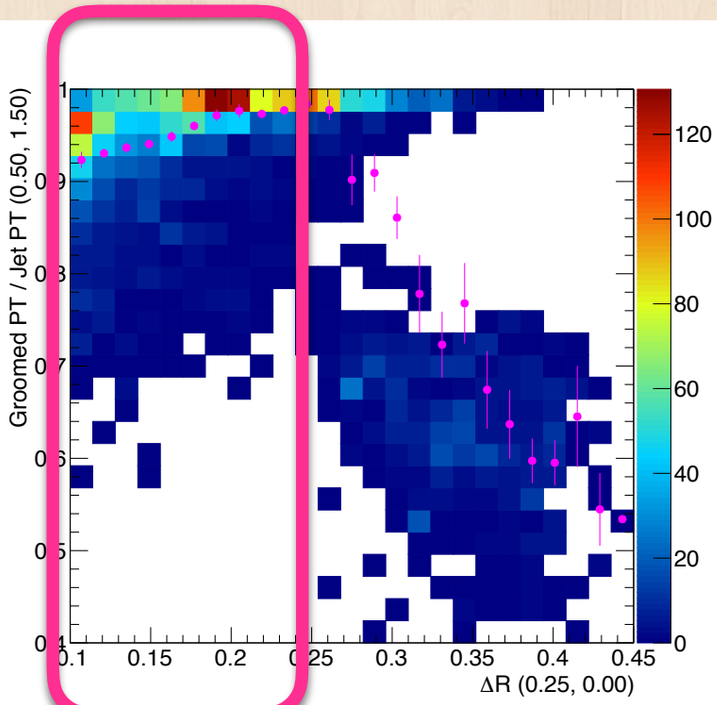
Focus on the
core of the jet

Groomed PT (0.50, 1.50)

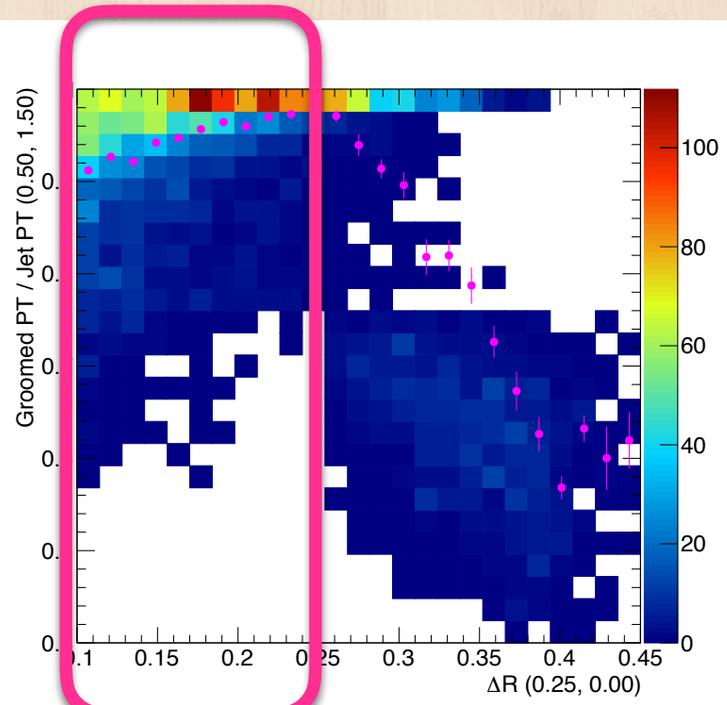
Recoil



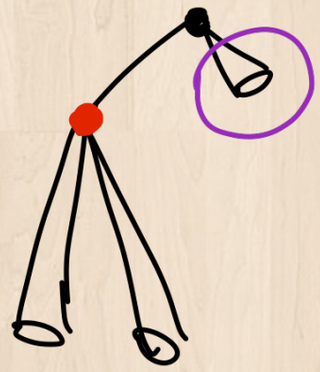
No-recoil



Vacuum

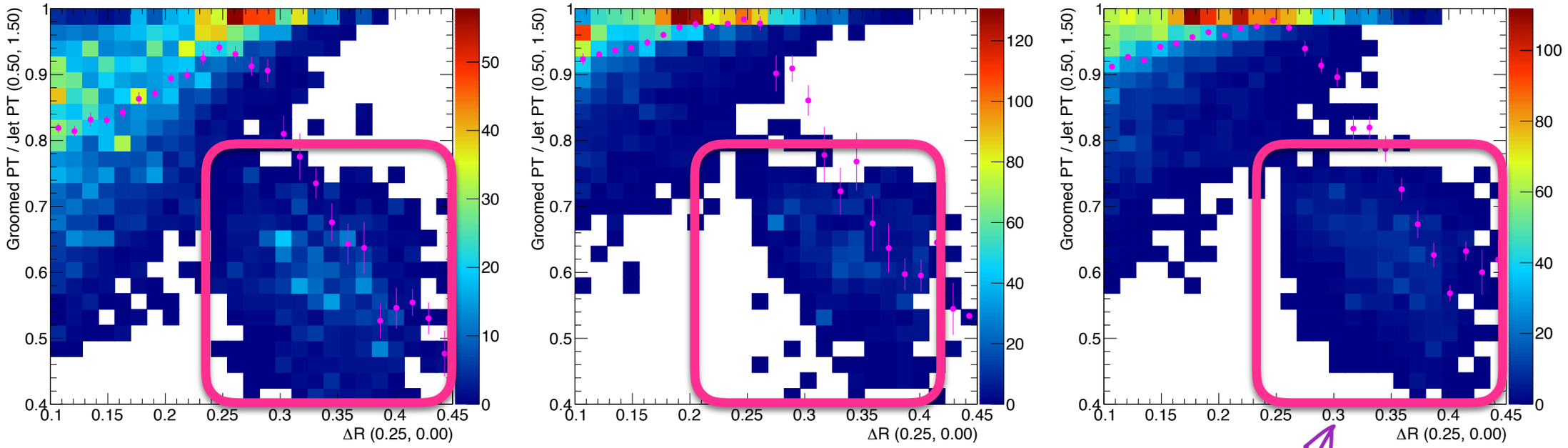


First balanced splitting at small angle: measure of the amount of recoil

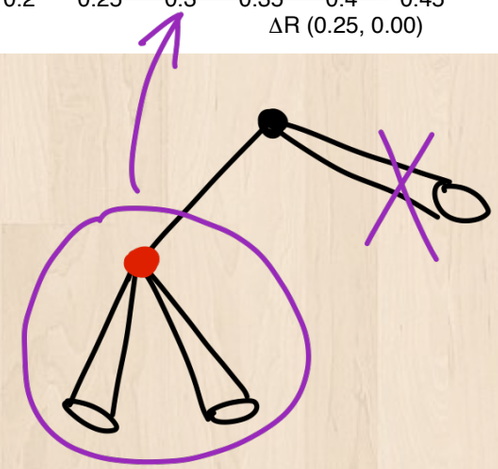


Groomed PT (0.50, 1.50)

Recoil | No-recoil | Vacuum



First balanced splitting at large angle: how is the **leading subjet** modified when there is large scale structure?



Summary

Summary and outlook

- There is potential in tagging initial splitting properties with one observable and looking at other observables
  - Potential probe of coherence emission and many other aspects of jets
- Work is ongoing to search for better taggers, and to strengthen the tagging properties
- Apply on other types of generators
- Study of effect from background subtraction

Backup Slides Ahead