Tutorials - Key Findings

from left to right

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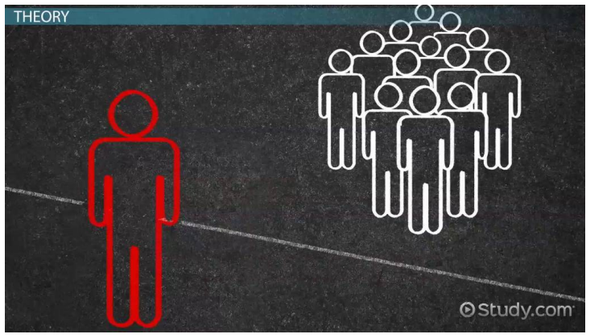
MONASH University

MCnet

ATLAS EXPERIMENT

COMPASS

+ 1 Theorist of no known affiliation. Here's a logo



12th MCNet Summer School, Prato, July 27th, 2018

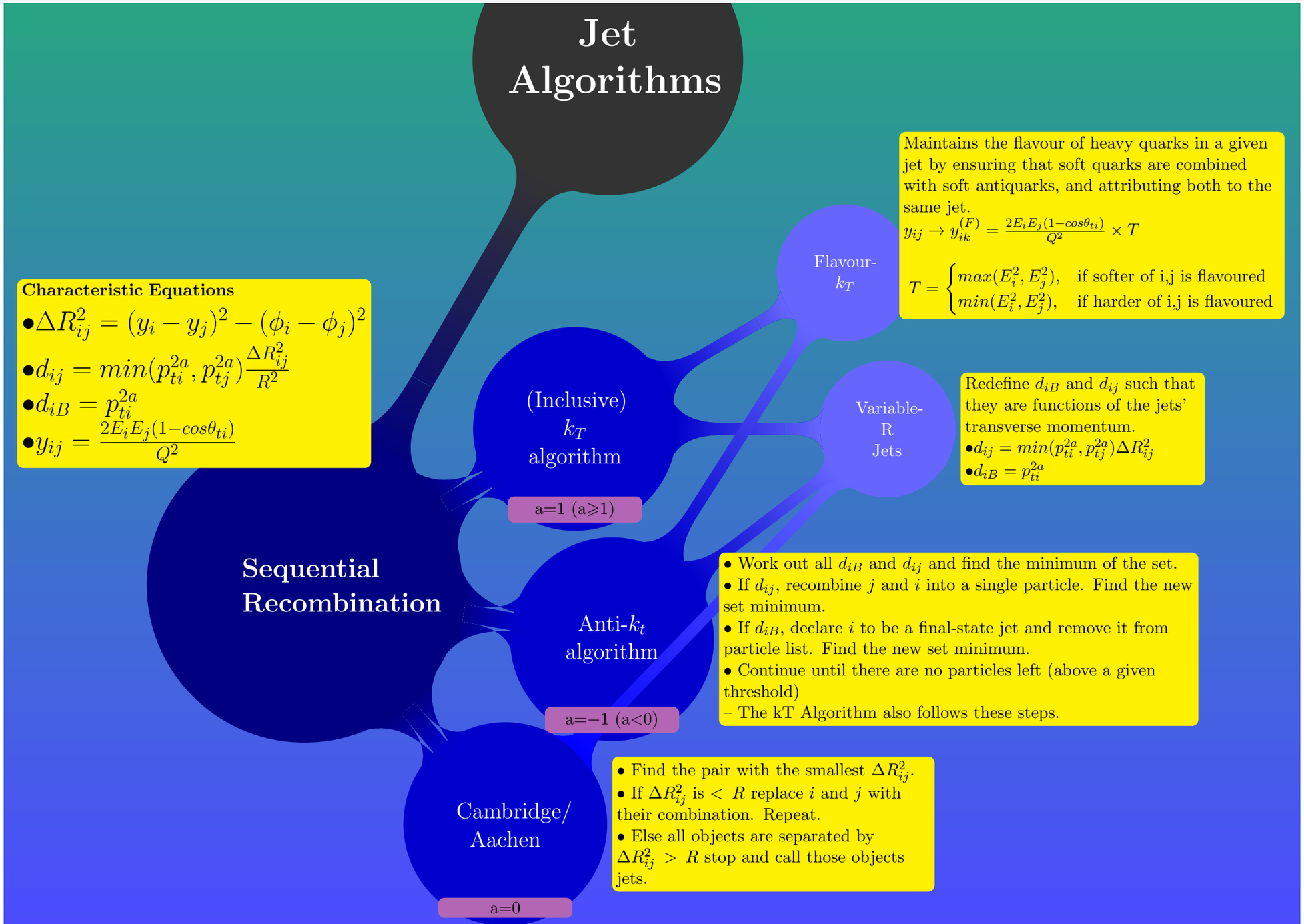
Talk Outline

Tutorials

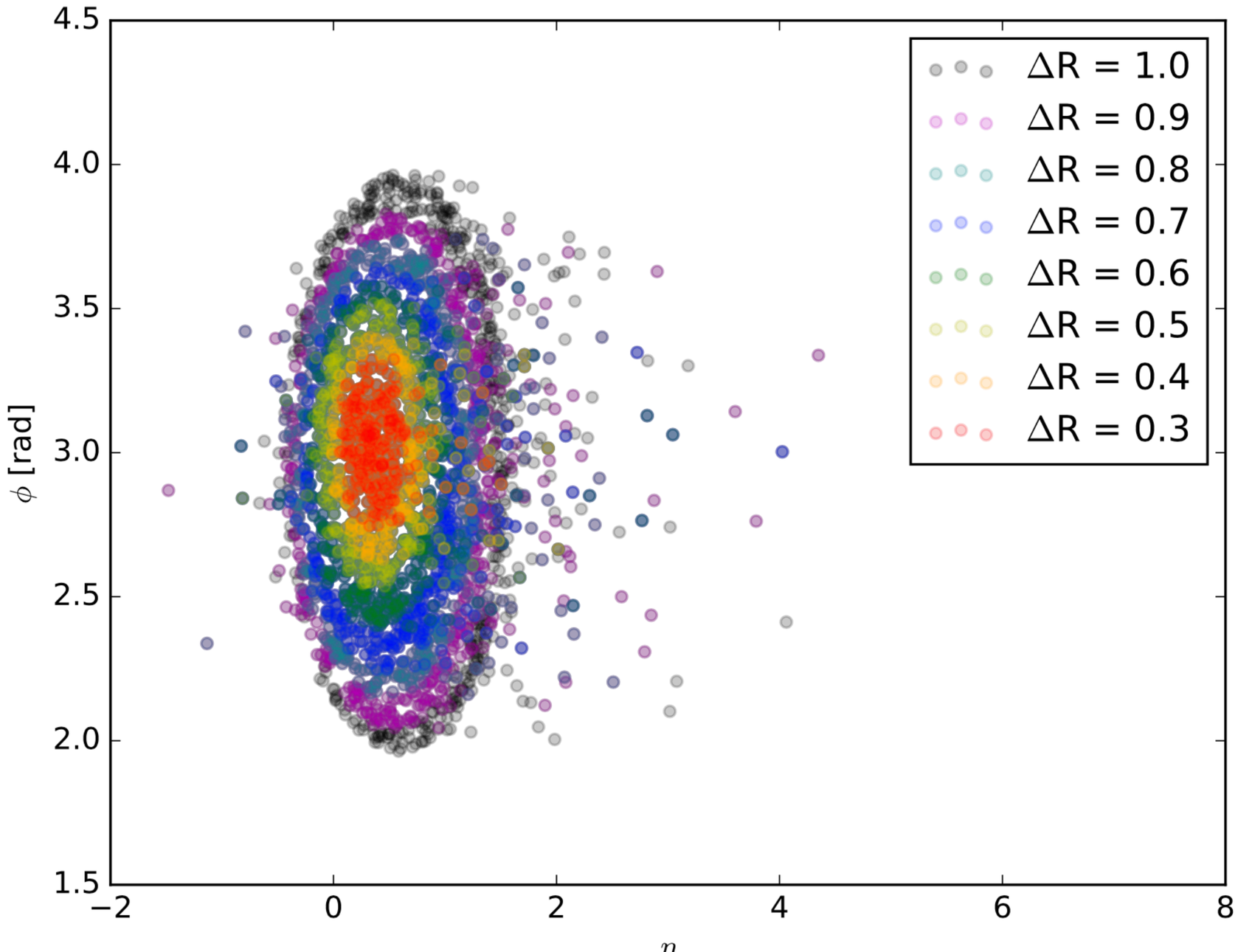
Day 1: Getting to know the generators
Day 2: Seeding Distributions and p-Pb collisions
Day 3: Jet Algorithms in Heavy ion events

Vary various parameters in a selection of jet algorithms and see what happens

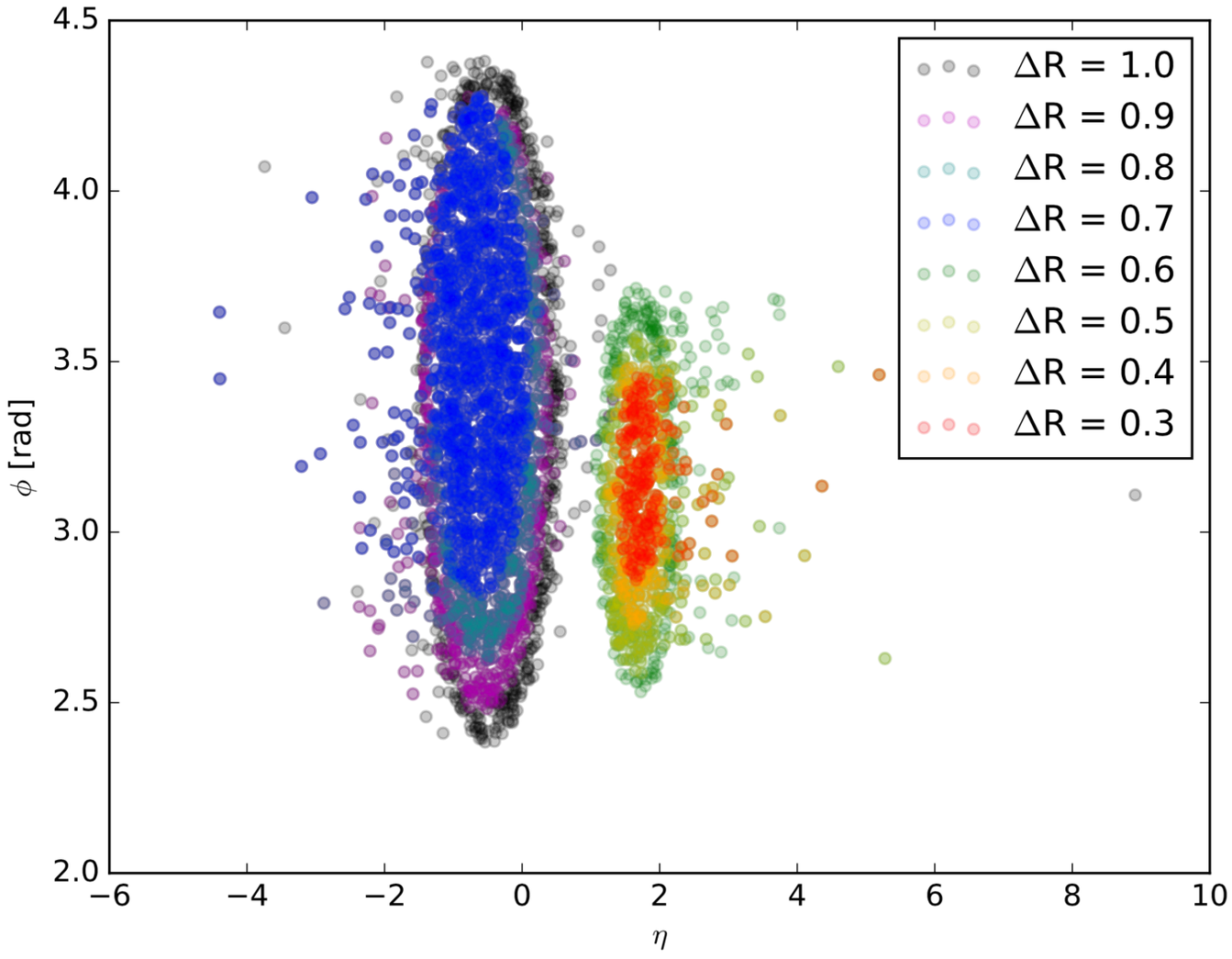
Jet Algorithm Definitions

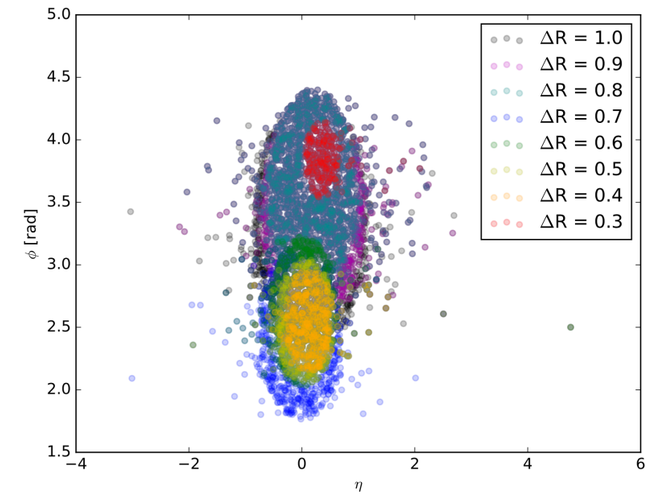


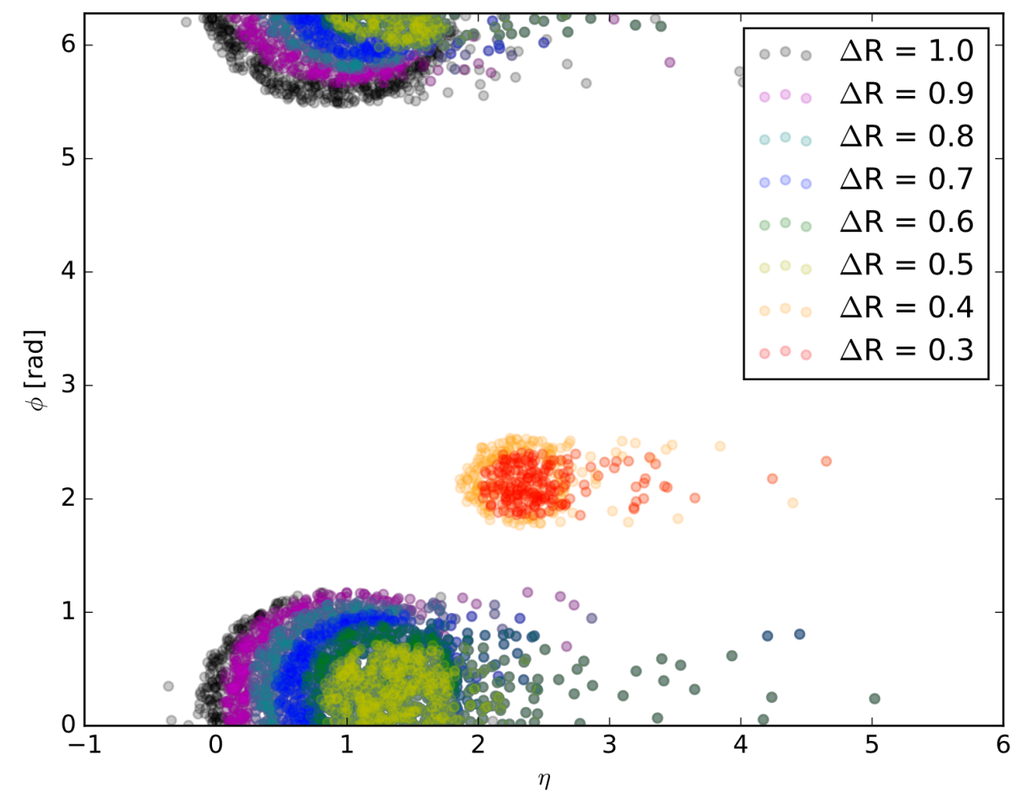
Anti-K_t in Heavy Ion Events



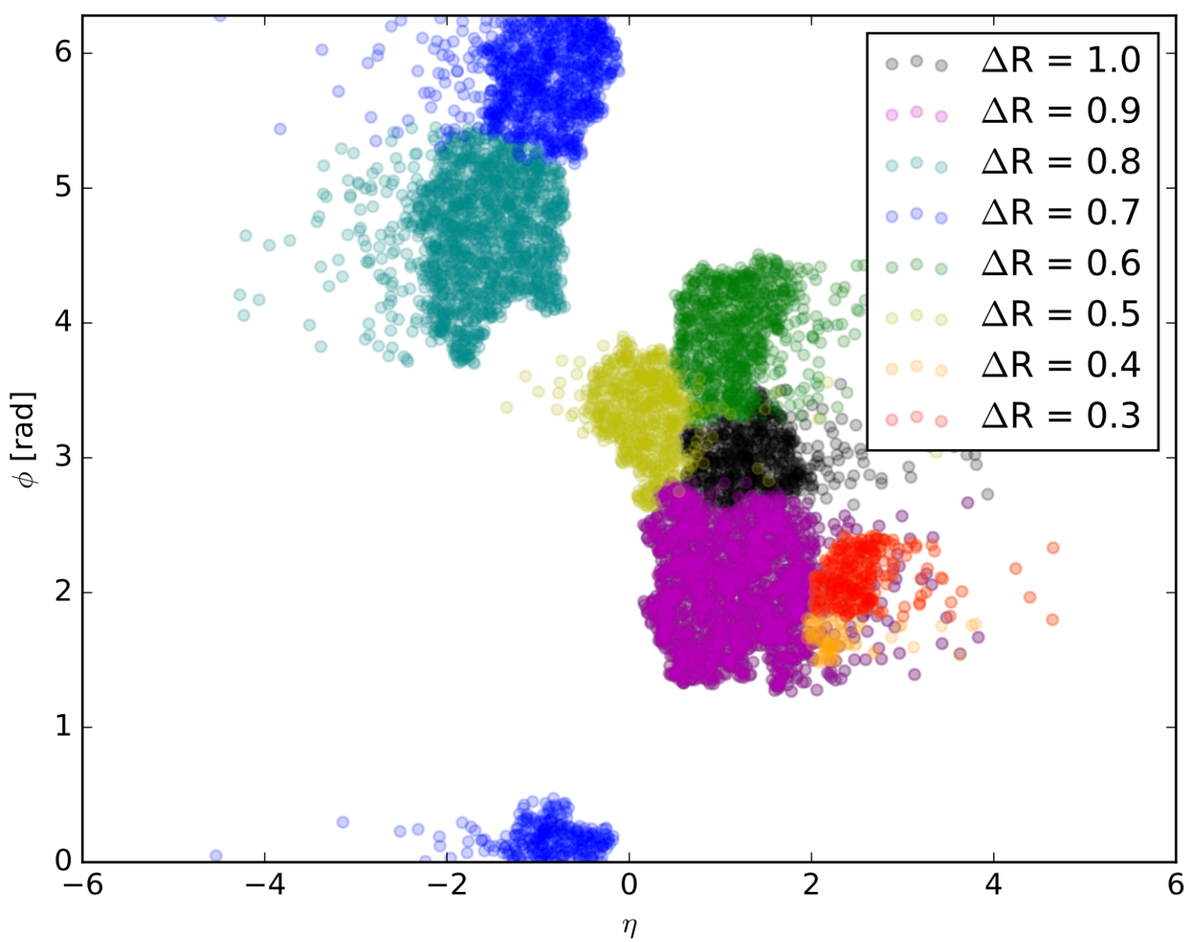
Anti-K_t - Why must you be like this?

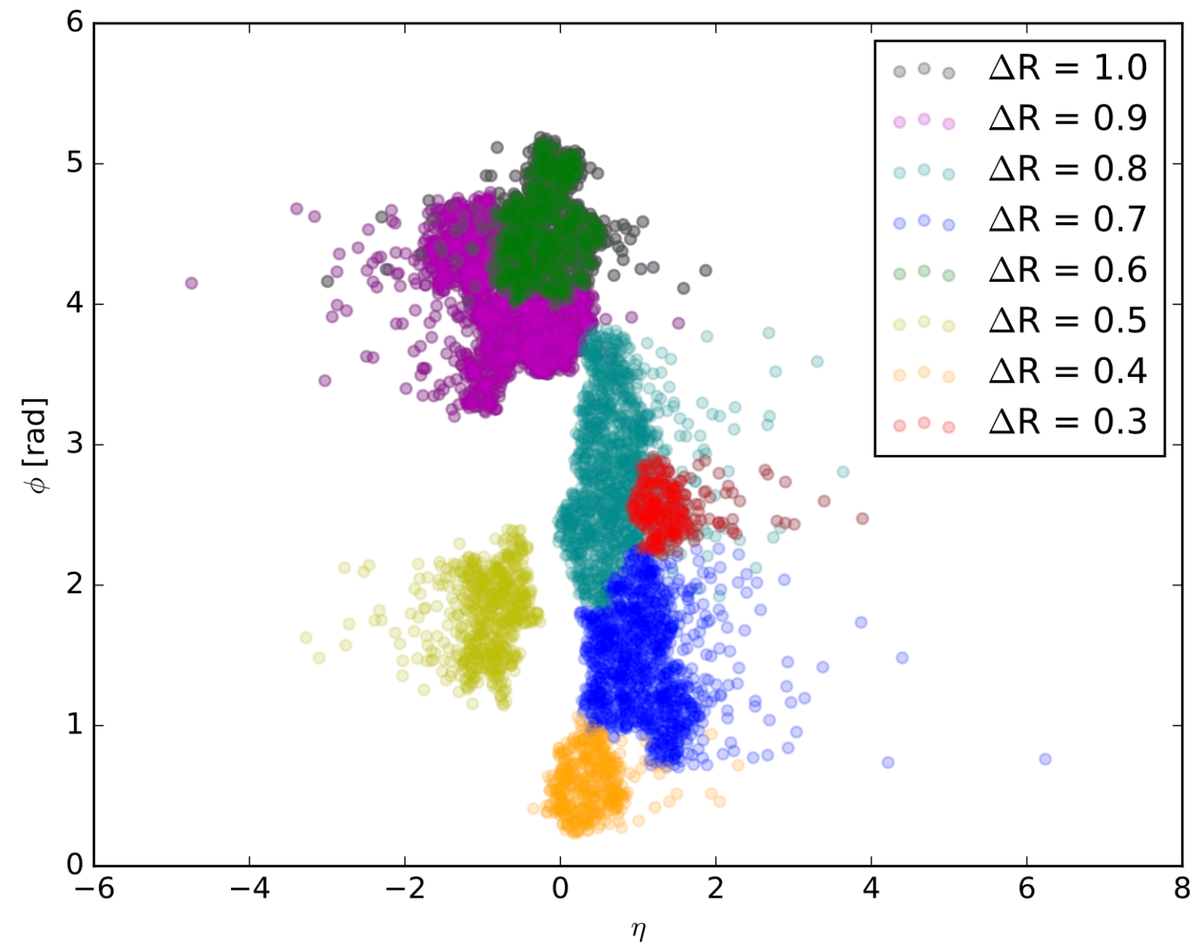






K_t - Reproduces Maps of Europe





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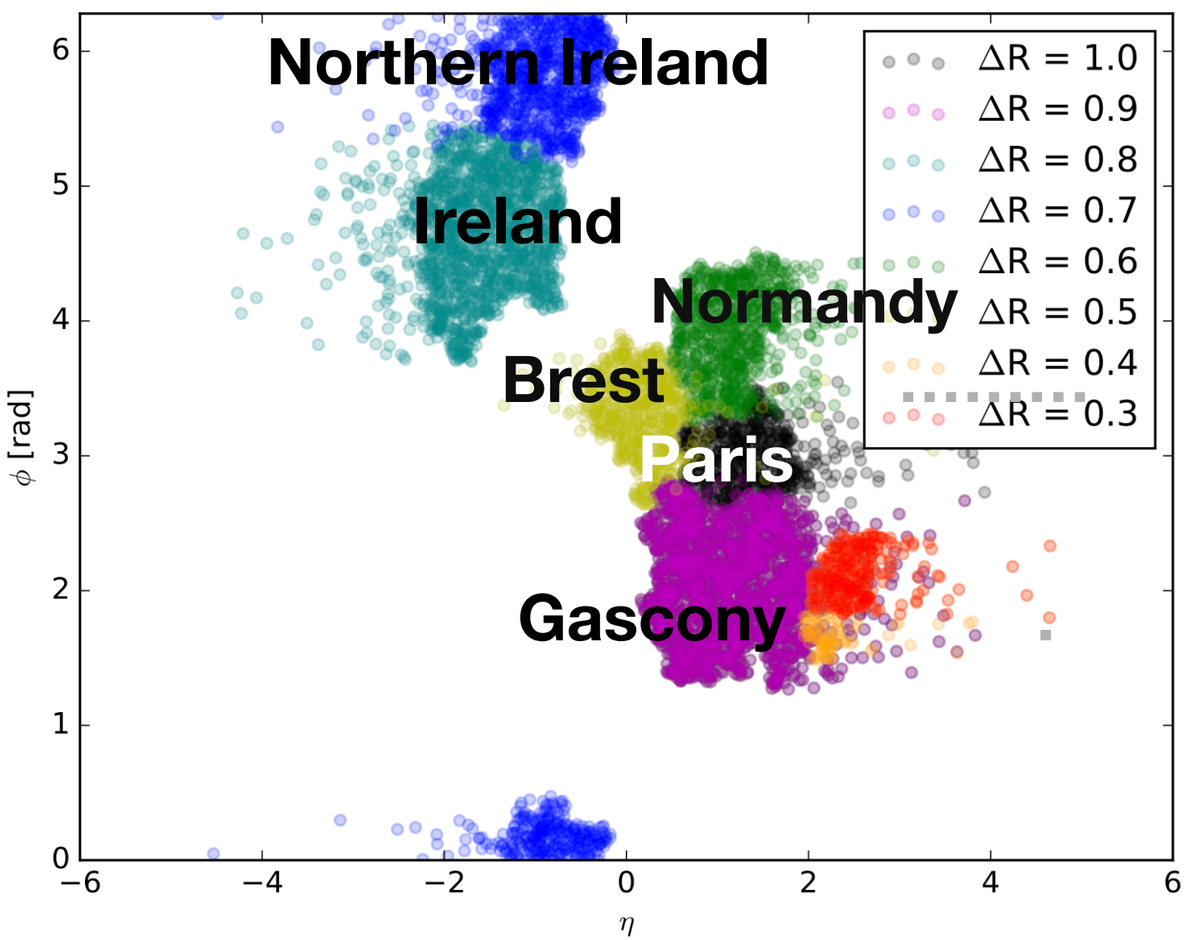
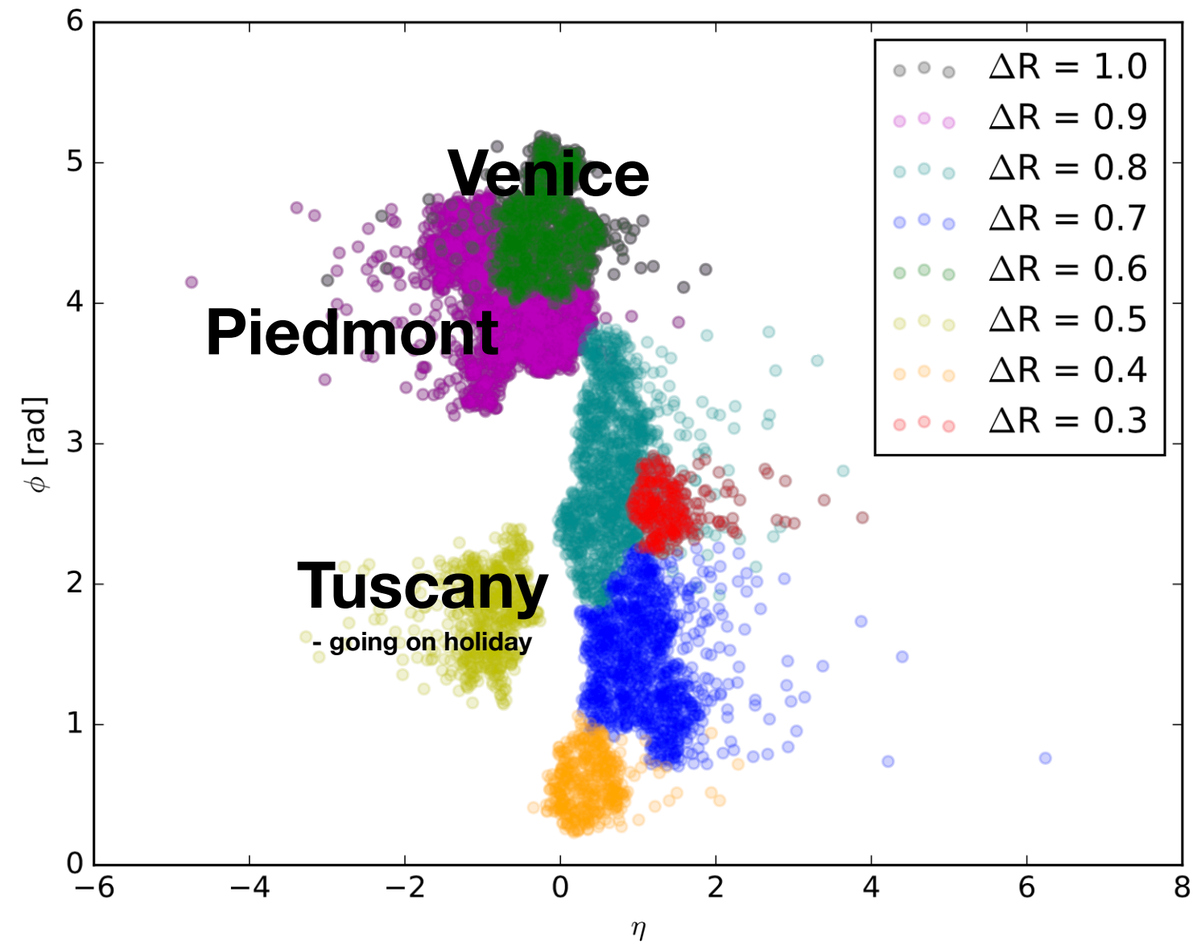
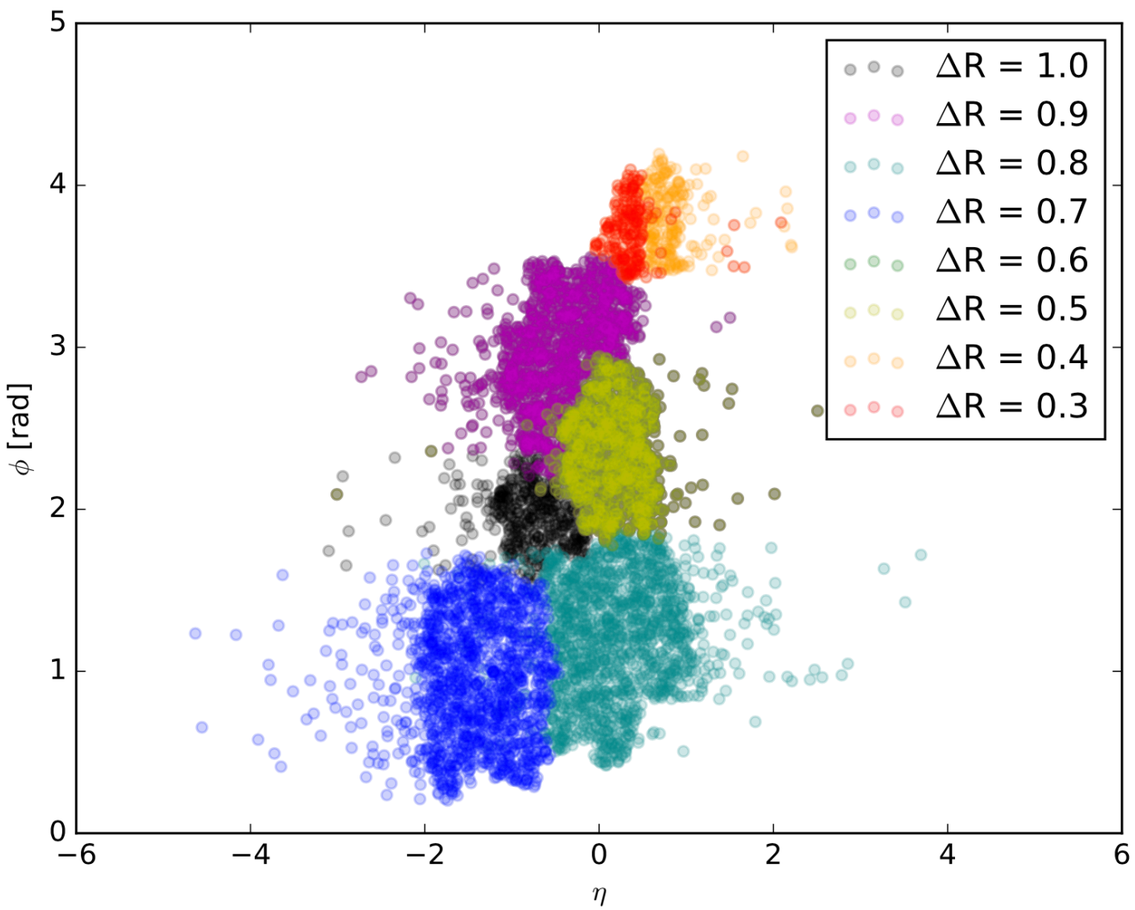
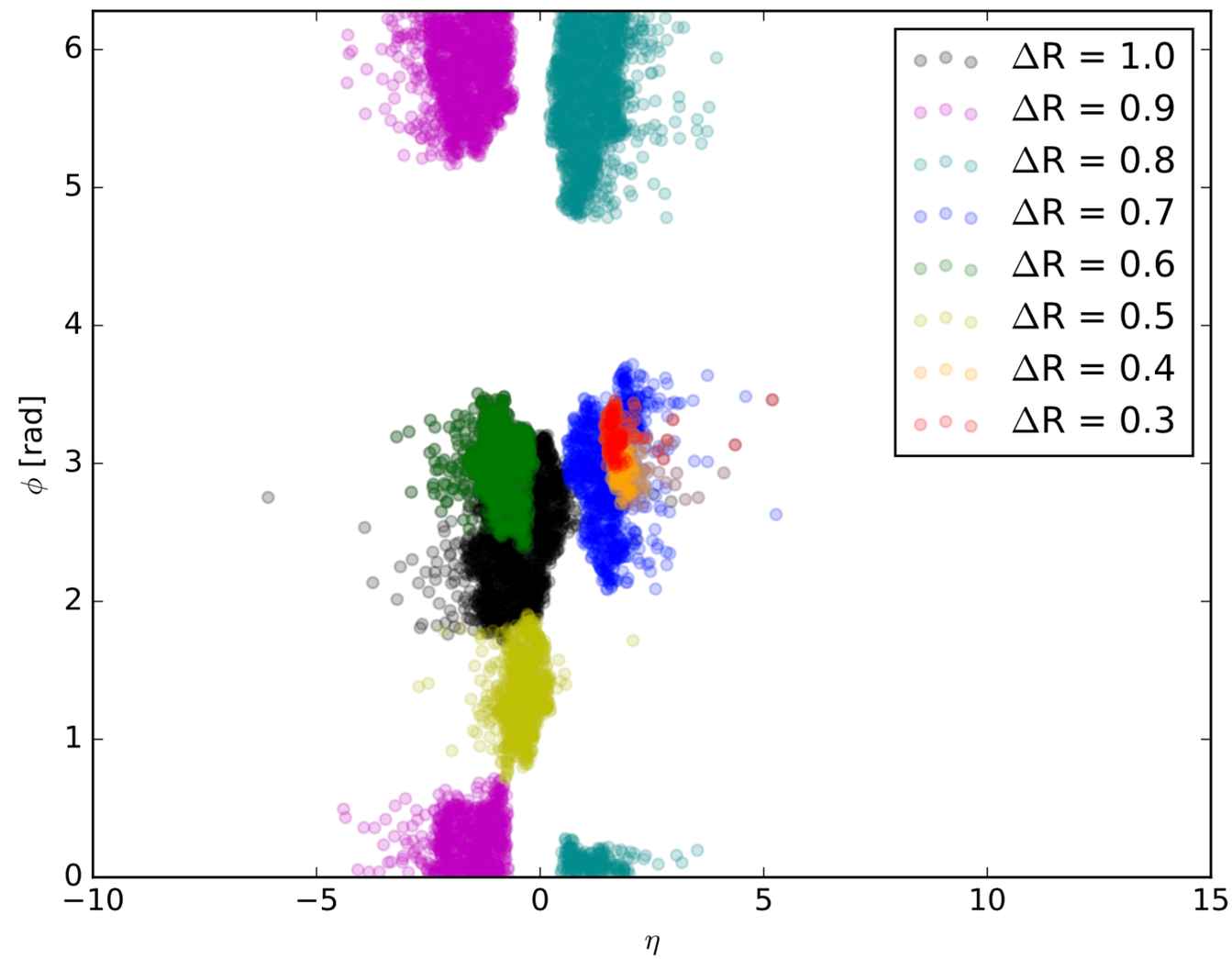


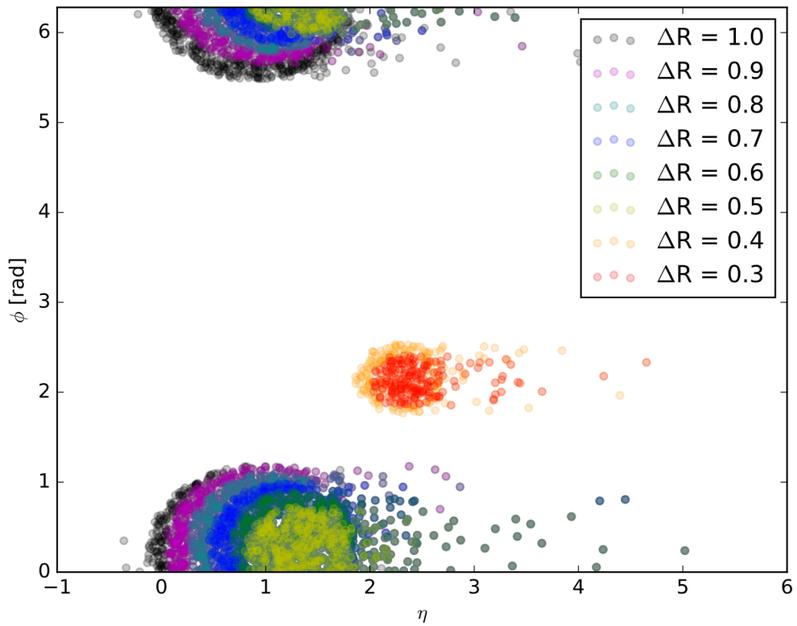


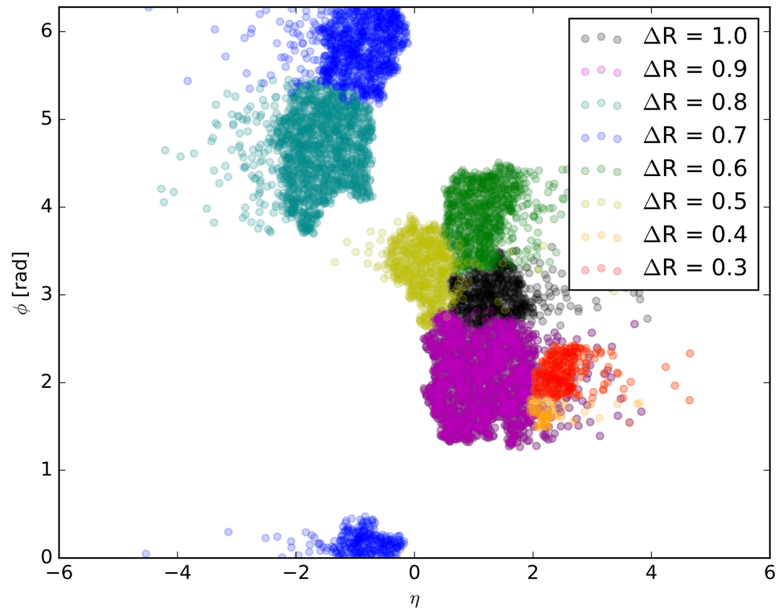
Cambridge-Aachen - Small angles first





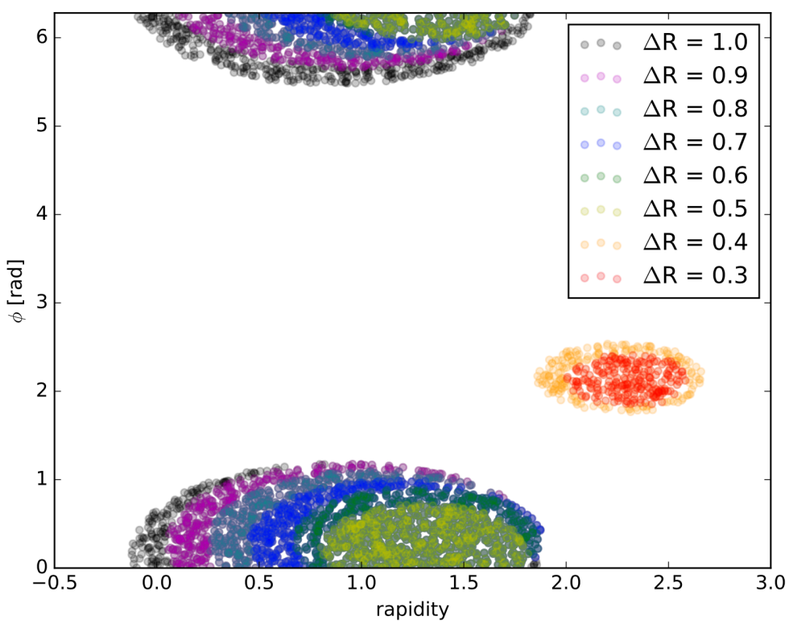
Rapidity vs Psuedorapidity

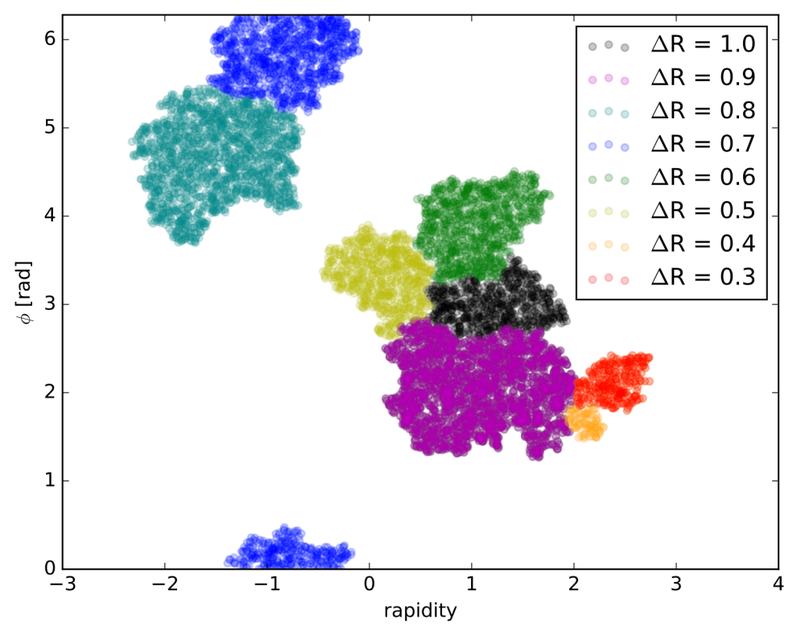




Plotting against rapidity gives nicer jet shapes as it depends on the jet mass.

$$Y_H = \frac{1}{2} log \left(\frac{E_H + P_{H,L}}{E_H - P_{H,L}} \right)$$





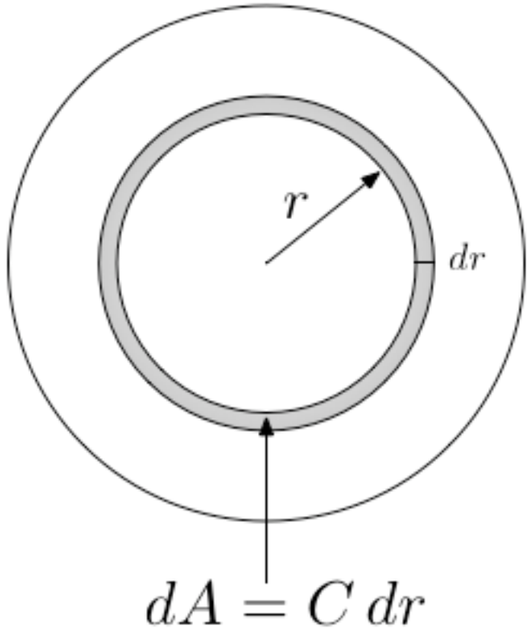
$$\begin{aligned} M_T^2 &= M^2 + P_T^2 \\ &= E^2 - P^2 - P_T^2 \\ &= E^2 - P_L^2 \\ &= (E - P_L)(E + P_L) \end{aligned}$$

$$Y_H = log \left(\frac{E_H + P_{H,L}}{M_T} \right)$$

Check Relations between Jet Variables

Assuming Constant Particle Density

$$dN \sim dA = CdR, \quad C = 2\pi R$$
$$N \sim R^2$$

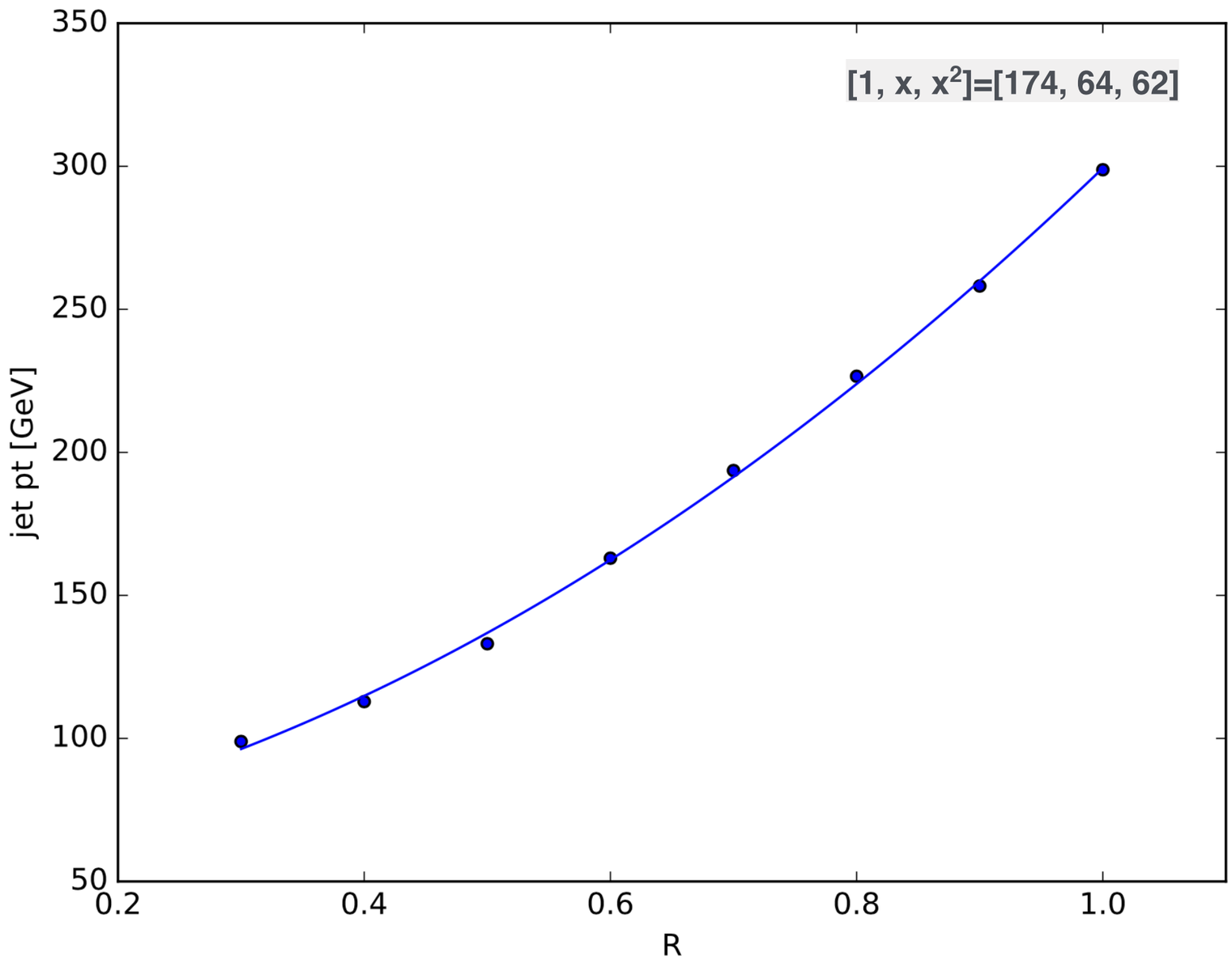


$$P_T^{Jet} = \Sigma_i P_T^i = < P_T > \Sigma_i 1 = N < P_T >$$

Hence we expect

$$P_T^{Jet} \sim R^2$$

Check Relations between Jet Variables



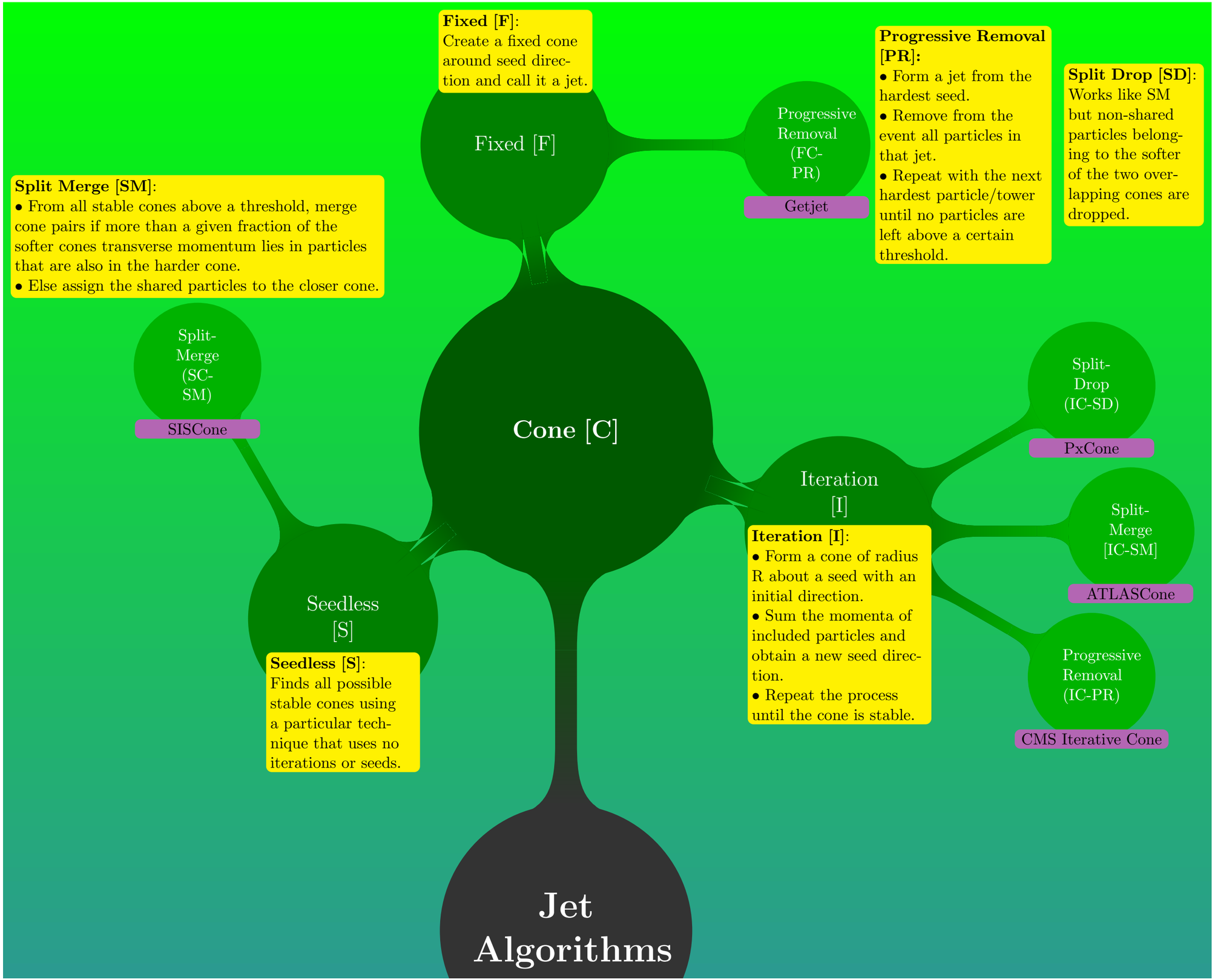
Important Notice

Today is my birthday. Happy Birthday me right

Current Plan for the day

- Birthday Lunch (1pm)
- Prato Il Duomo Fresco (2pm)

Backup


Jet Algorithms
Cone [C]
Fixed [F]
Fixed [F]: Create a fixed cone around seed direction and call it a jet.
Progressive Removal (FC-PR)
Getjet
Progressive Removal [PR]:
• Form a jet from the hardest seed.
• Remove from the event all particles in that jet.
• Repeat with the next hardest particle/tower until no particles are left above a certain threshold.
Split Drop [SD]: Works like SM but non-shared particles belonging to the softer of the two overlapping cones are dropped.
Split-Merge (SC-SM)
SISCone
Split Merge [SM]:
• From all stable cones above a threshold, merge cone pairs if more than a given fraction of the softer cones transverse momentum lies in particles that are also in the harder cone.
• Else assign the shared particles to the closer cone.
Seedless [S]
Seedless [S]: Finds all possible stable cones using a particular technique that uses no iterations or seeds.
Iteration [I]
Iteration [I]:
• Form a cone of radius R about a seed with an initial direction.
• Sum the momenta of included particles and obtain a new seed direction.
• Repeat the process until the cone is stable.
Split-Drop (IC-SD)
PxCone
Split-Merge [IC-SM]
ATLASCone
Progressive Removal (IC-PR)
CMS Iterative Cone