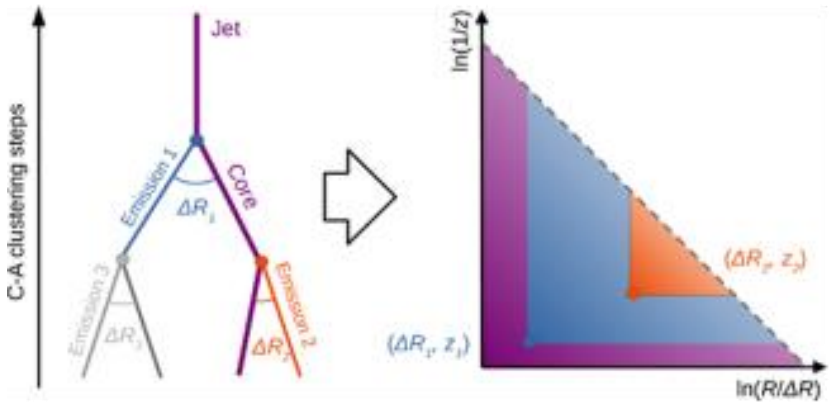
Jet substructure discussion
Lund Planes, dead cone etc.

Mario Campanelli (UCL) et al.

The Lund Jet Plane

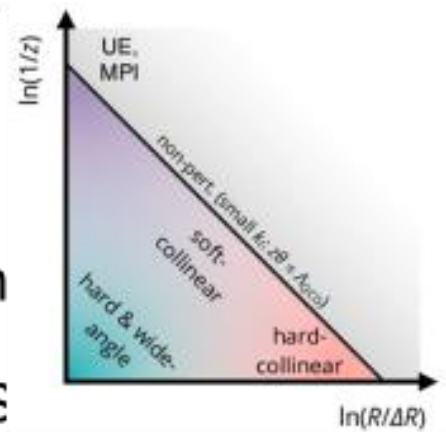


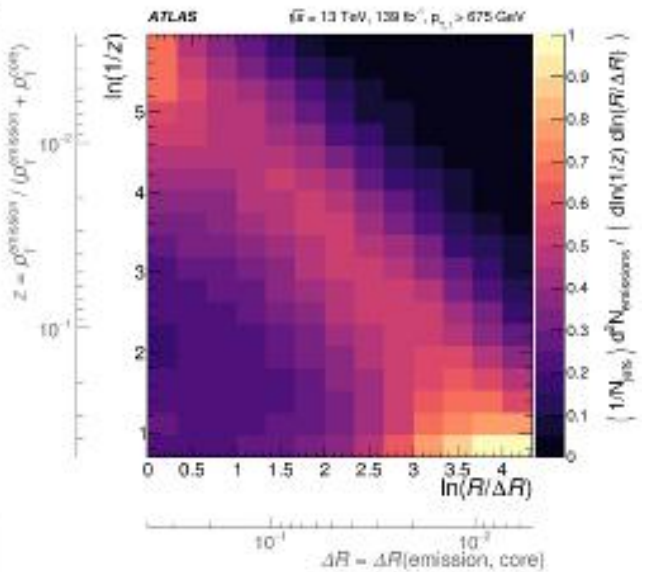
The Lund Diagram ([Z. Phys. C 43, 625–632 (1989)] is an abstract representation of the jet formation, where each branching is a point in a ln(ΔR/R), ln(1/z), ln(kT) space, usually projected in a 2D plane

Notice, ATLAS uses ln(1/z) CMS ln(kT)

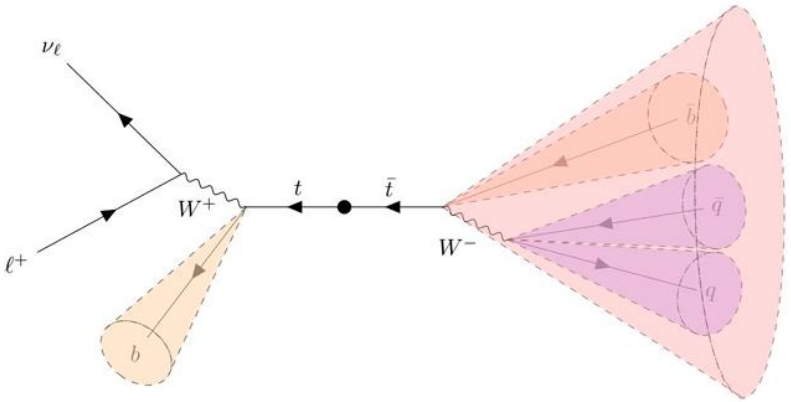
$$z = \frac{p_T^e}{p_T^e + p_T^c}; \qquad \Delta R = \sqrt{(y_e - y_c)^2 + (\phi_e - \phi_c)^2}$$

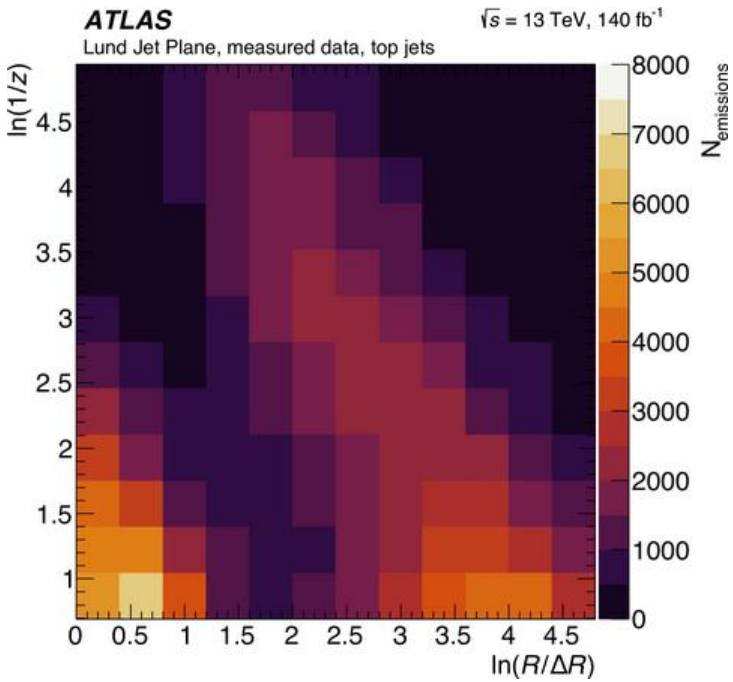
Experimentally, it can be reconstructed by running backwards the Cambridge /Aachen clustering algorithm.
Each region of the plane corresponds to a different phase of jet evolution, allowing to disentangle them and analyse them separately.
Charged particles LJP already measured by ATLAS for dijet events (Phys. Rev. Lett. 124, 222002)

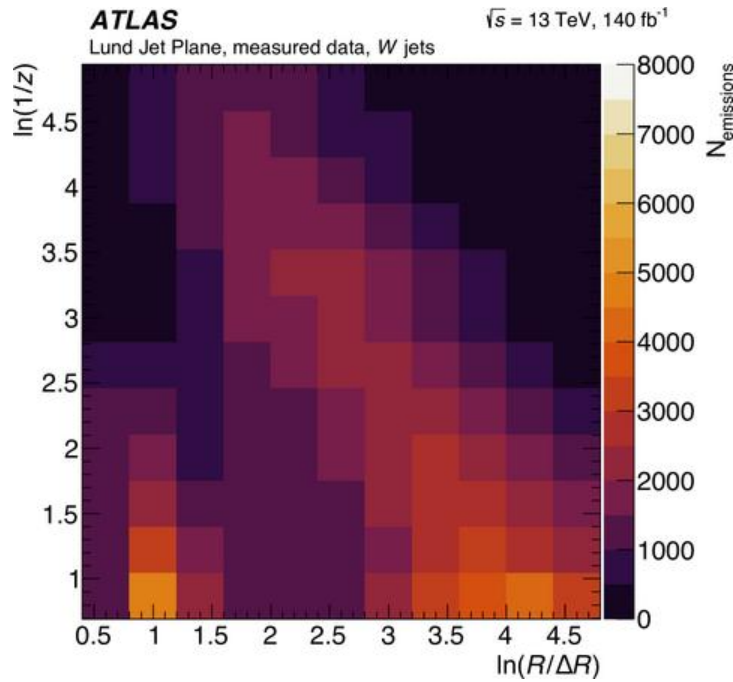


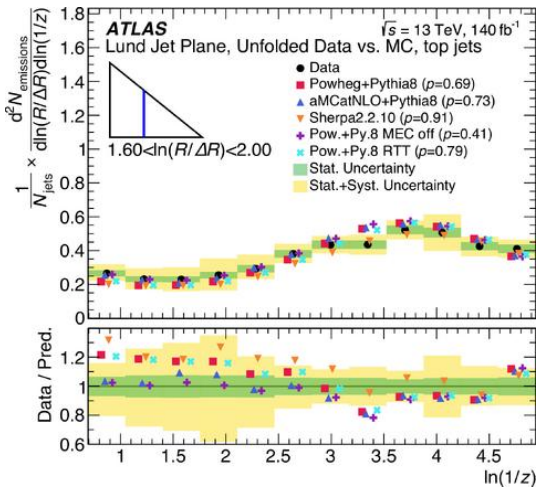


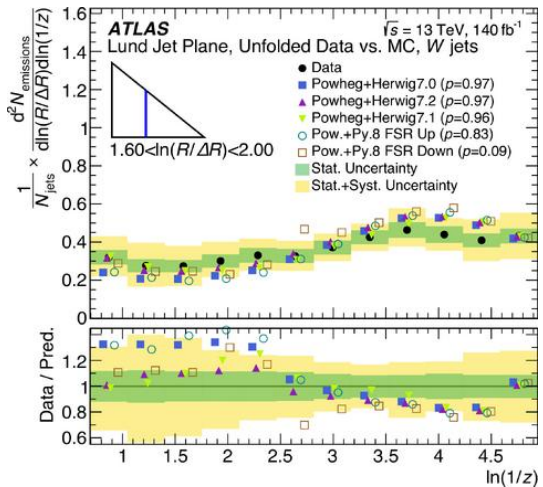
ATLAS measurement on top and W jets from semileptonic tt decays







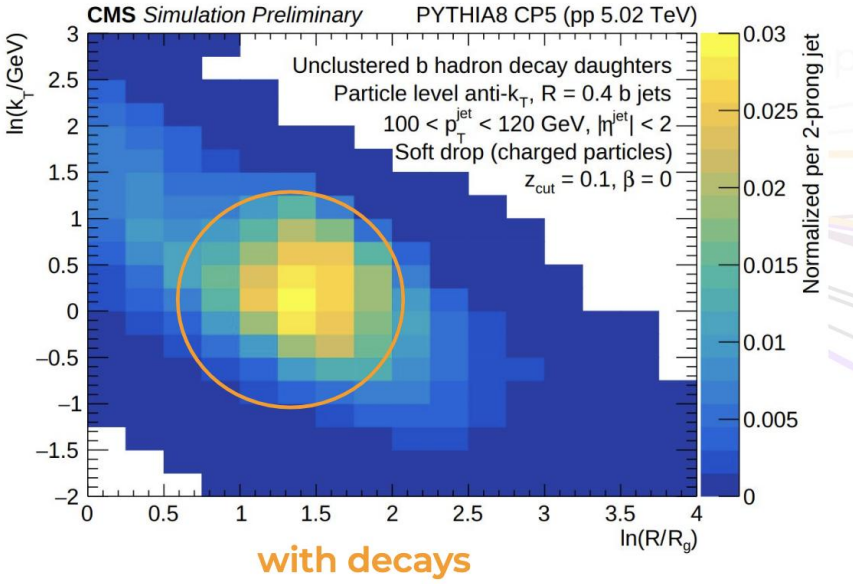


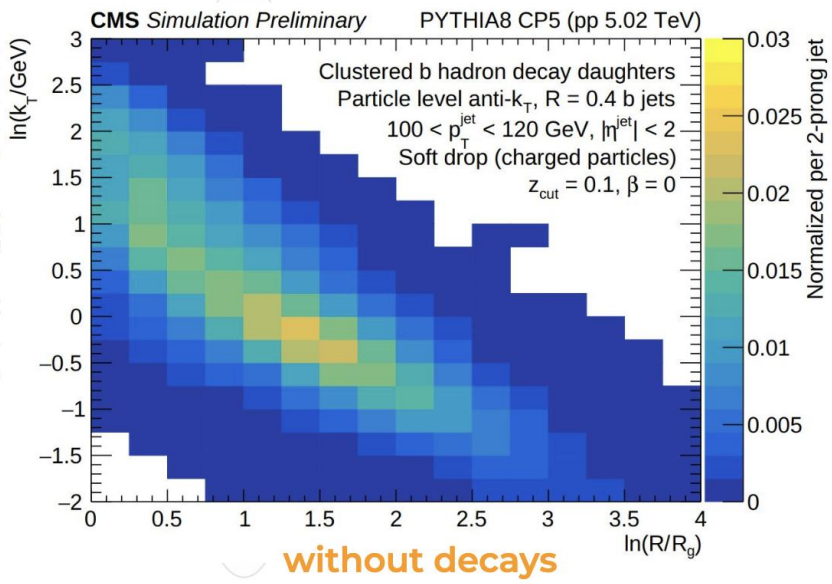


Fully unfolded, and for some slices there is discrimination power mong models.

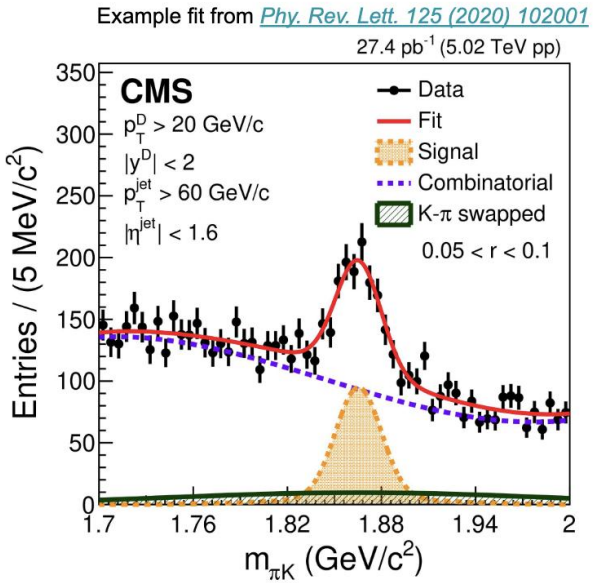
measuring heavy flavours

Measure b and c in CMS: remove HF decays



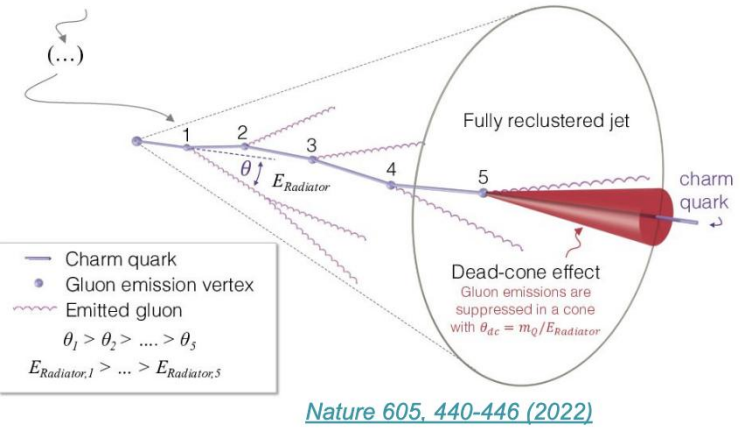


For b: use b-tagging, and remove tracks from secondary vertex



For charm: estimate BG from sidebands, remove non-prompt decays and remove D0 decay products

Dead-cone effect



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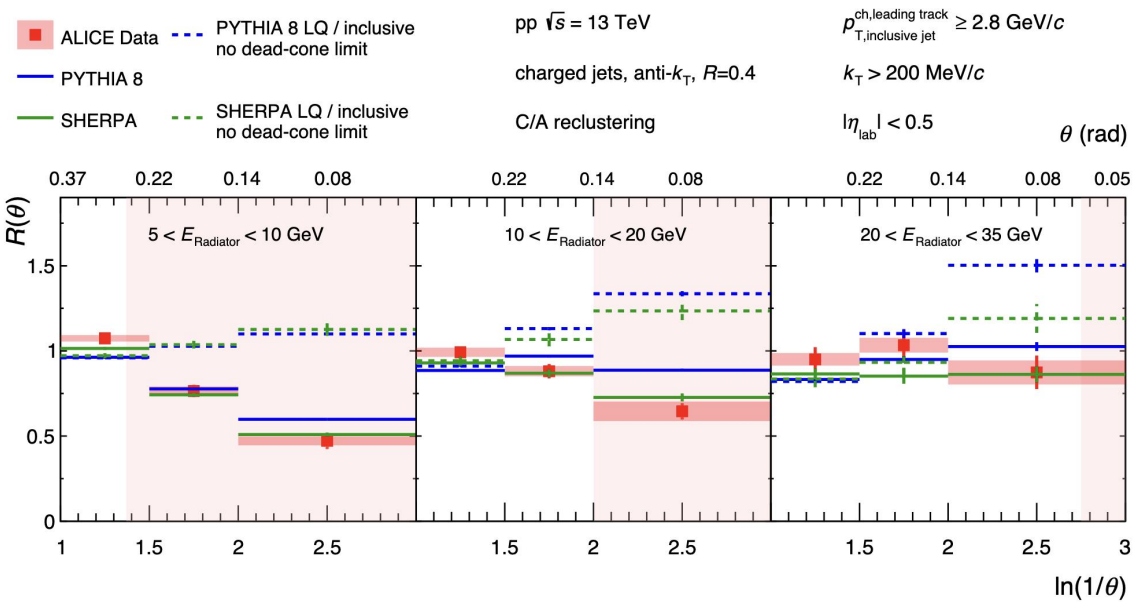
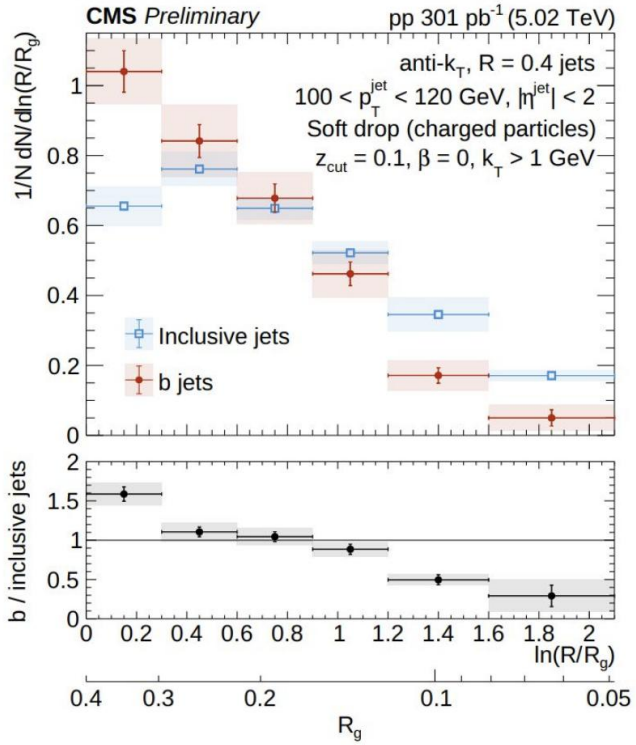
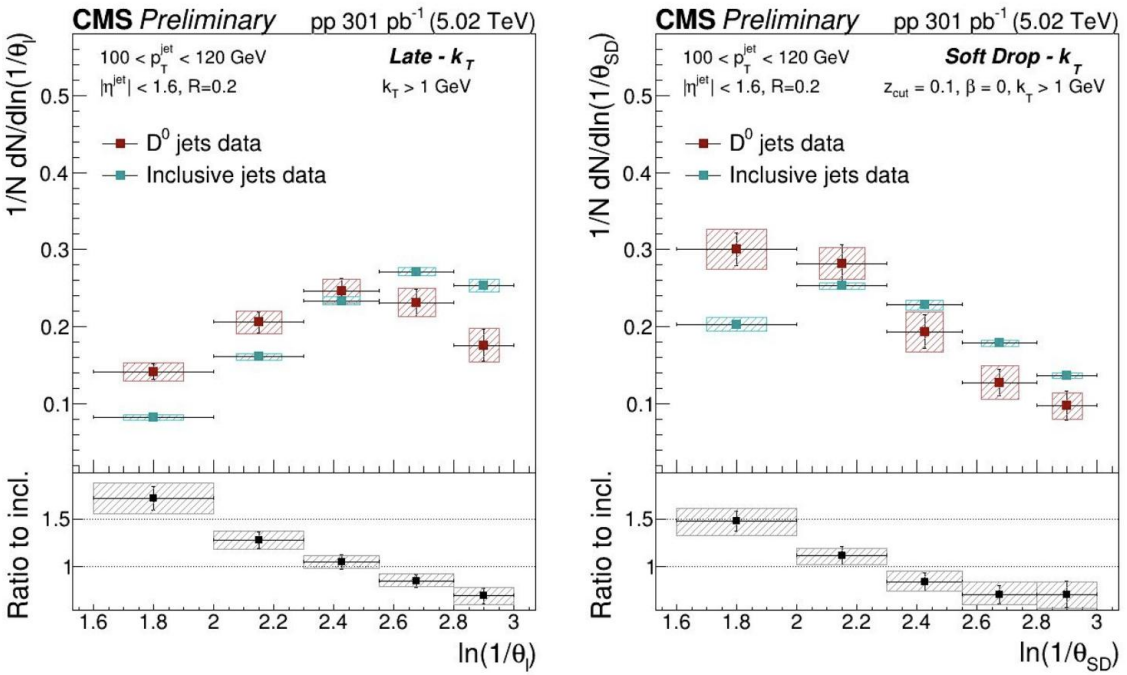
ALICE charm





CMS b-tagged

CMS charm



Discussion points

- CMS measurment of b LJP done in a narrow pT range (100-120 GeV) with b tagging.
  - how much does tagging bias the masurement?
  - to look at other sistems (eg top) with weaker b-tagging?
  - extend pT range?
  - What level of precision is important?
- Charm measurements so far use exclusive final states
  - higher pt?
  - inclusive charm from charm tagging?
  - W decays vs QCD?
- What is the reference to measure the dead cone?
  - Comparing to light jets does not account for different fragmentation
  - No proper way to generate “massless b” for comparison
  - How to have a clean measurement and prediction?
- Which measurements are the most relevant for theory? (tuning, hard scattering, matching etc.)?