Medium response in JEWEL: recent developments

Guilherme Milhano[1,2], Korinna Zapp[3]

1 Physics Department, Theory Unit, CERN, CH-1211 Genève 23, Switzerland
2 CENTRA, Instituto Superior Técnico, Universidade de Lisboa, Av. Rovisco Pais, P-1049-001 Lisboa, Portugal
3 Theoretical Particle Physics, Department of Astronomy and Theoretical Physics, Lund University, Sölvegatan 14A, SE-223 62 Lund, Sweden

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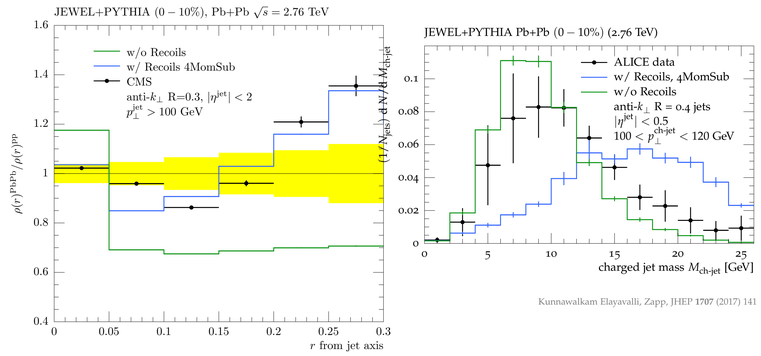
Starting point: a puzzle



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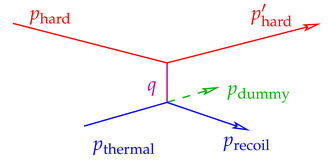
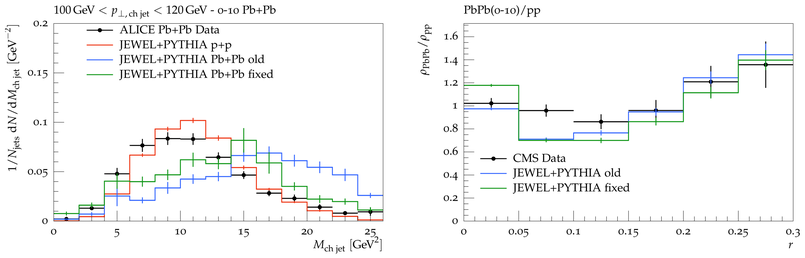
- both are sensitive to medium response
- hybrid model describes jet mass but fails for jet profile



First step: fix a bug

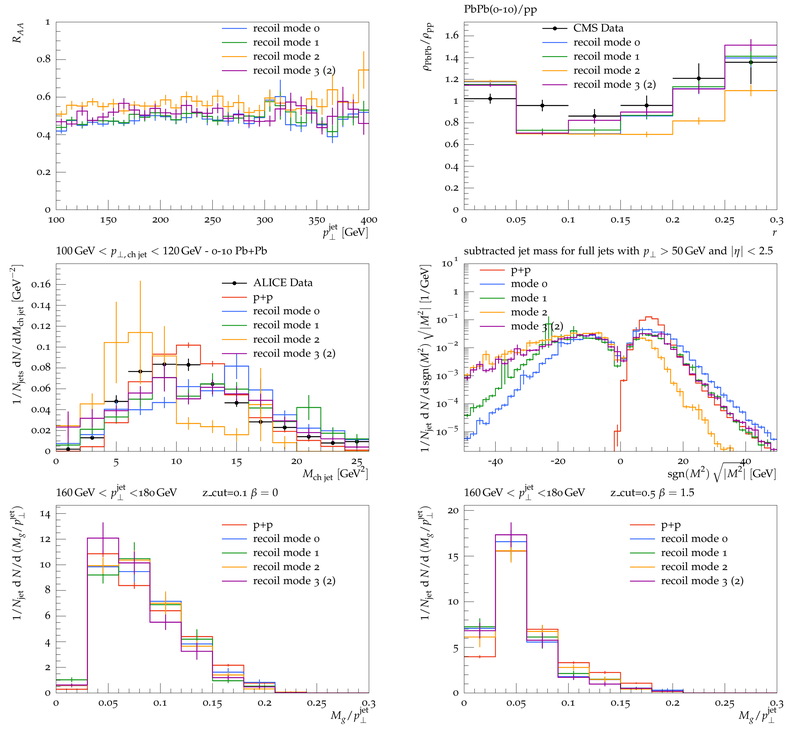
- dummy particles for 4-momentum subtraction should be placed at same **rapidity** as subtraction momentum (not pseudo-rapidity)
- practically irrelevant for other observables (like jet $p_\perp$)



Second step: thoughts on MC–data comparison

- jet mass receives large non-perturbative corrections
  not the most solid part of the model
- hadronisation not retuned with JEWEL parton shower
  usually fine, as JEWEL parton shower similar to PYTHIA's
- ALICE measures charged jet mass – cannot be calculated in JEWEL
  requires ad-hoc rescaling
- ALICE's area based subtraction for jet mass cannot be paralleled in JEWEL
  sounds dangerous to me: background doesn't contribute linearly to jet mass

Summary of results



- naive jet mass is tricky in JEWEL
  - undesired behaviour due to subtraction of thermal momenta
    squared mass can become negative
  - depends on details of recoil modelling
  - comparison to data not straightforward
- groomed jet mass seems to be more robust
  but unfolding seems to be challenging
- jet profile robust observable sensitive to medium response
- more options for recoil handling to be released soon

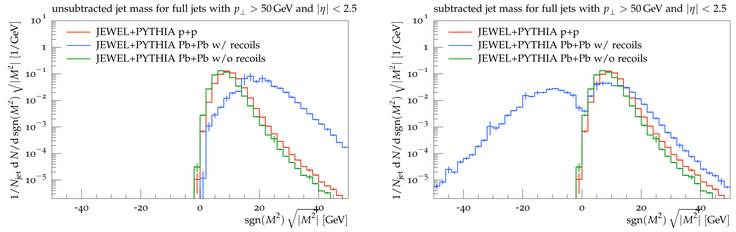
Fifth step: more options for recoil treatment

- **mode 0** (default): subtract thermal momentum if in jet
- **mode 1**: subtract thermal momentum if corresponding recoil in jet
- **mode 2**: add $q = p_{\text{rec}} - p_{\text{th}}$ to jet if q in jet
- **mode 3**: mode 0 for hard recoils and mode 3 for soft recoils
- rescattering of hard recoils

doesn't lead to significant changes, plots not shown

Third step: a closer look at the jet mass in JEWEL

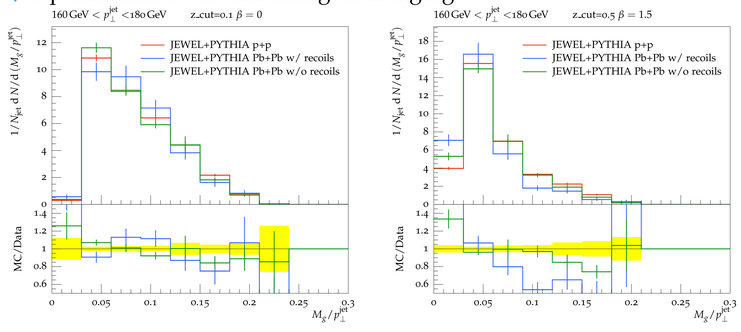
- squared jet mass can become negative
- happens when
  - jet contains subtraction momentum but not the recoil
    not likely, the opposite happens more frequently
  - the jet parton gets kicked out of jet but recoil and subtraction stay inside
    not that unlikely
  - this case should exist in nature, but details are specific to JEWEL's treatment of medium response



Fourth step: groomed jet mass

looking at CMS's version of defining groomed jet mass

- more robust and better behaved than naive jet mass
- reduced sensitivity to medium response
- experimental issue: unfolding challenging



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