Jets and Heavy Quark Update

JHQ Conveners

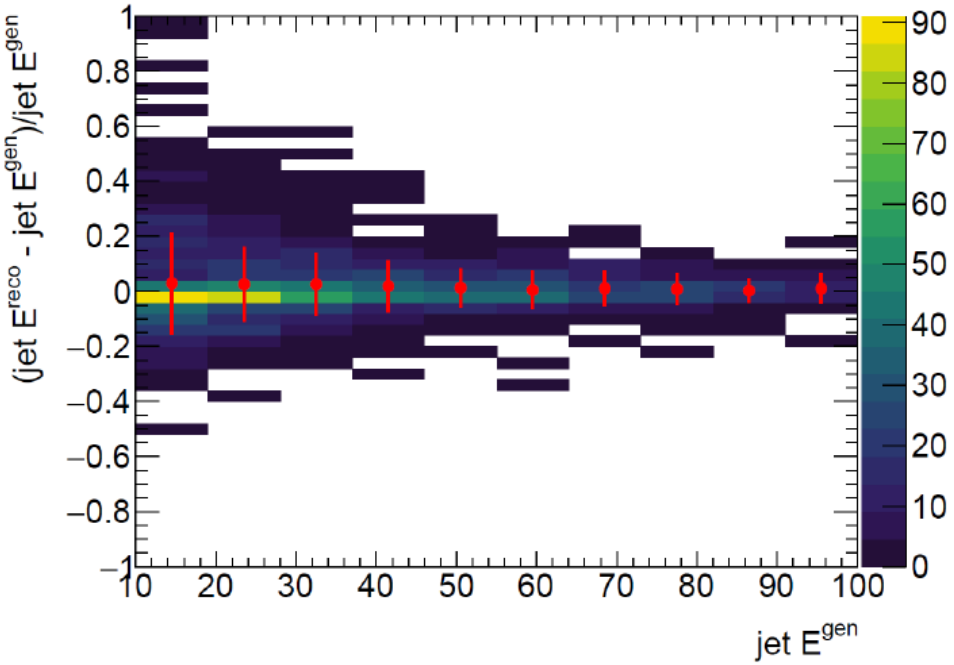
YR Physics Conveners Meeting

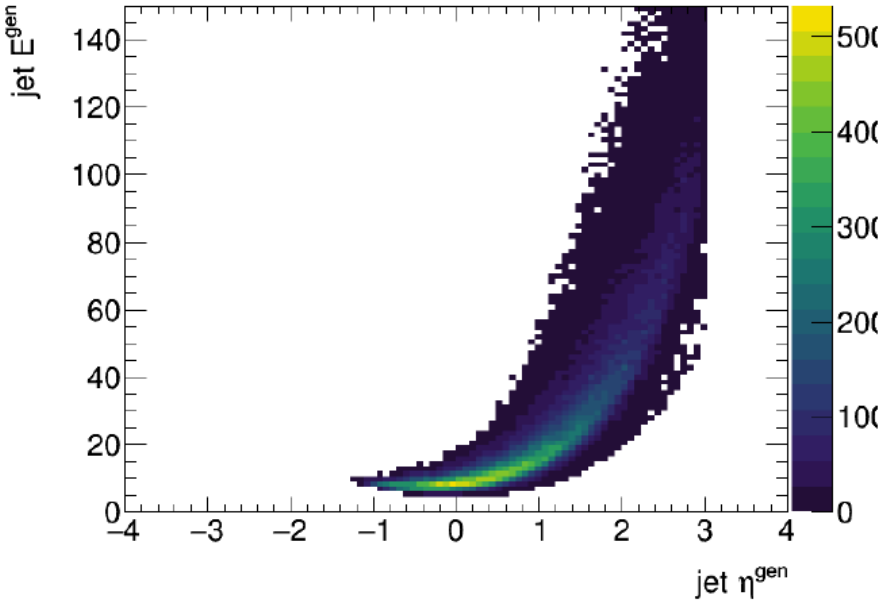
05/06/2020

Jets for 3-D Imaging - Miguel Arratia

Jet performance

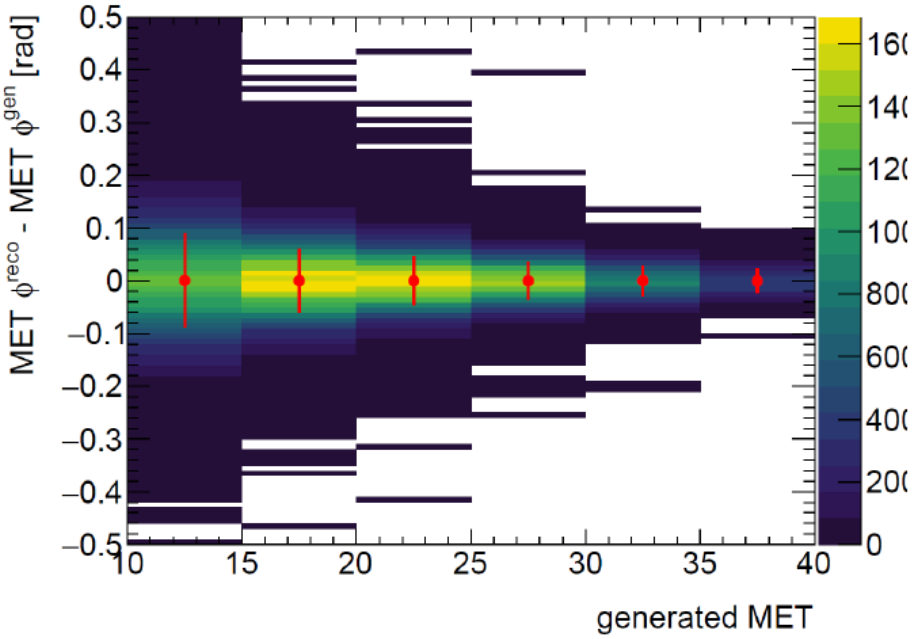
anti-kT R=1.0, particle-flow

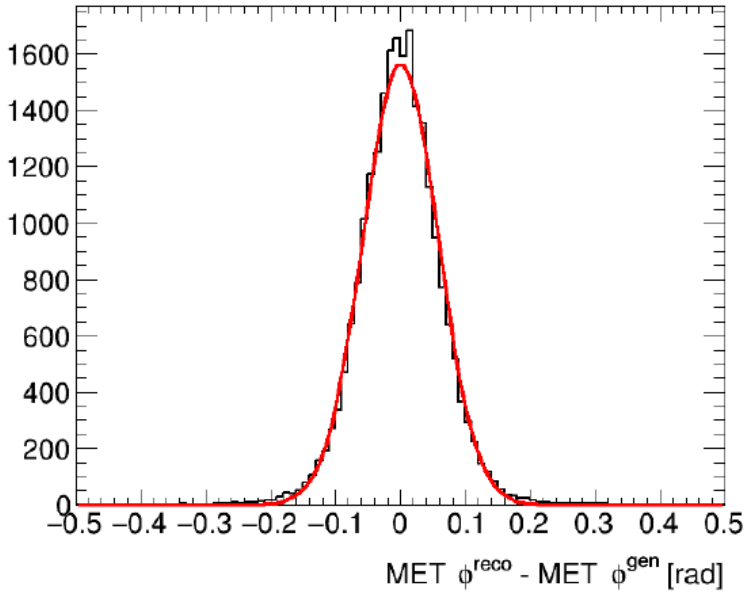




~20% at 10 GeV, ~10% at 50 GeV

Neutrino azimuthal angle

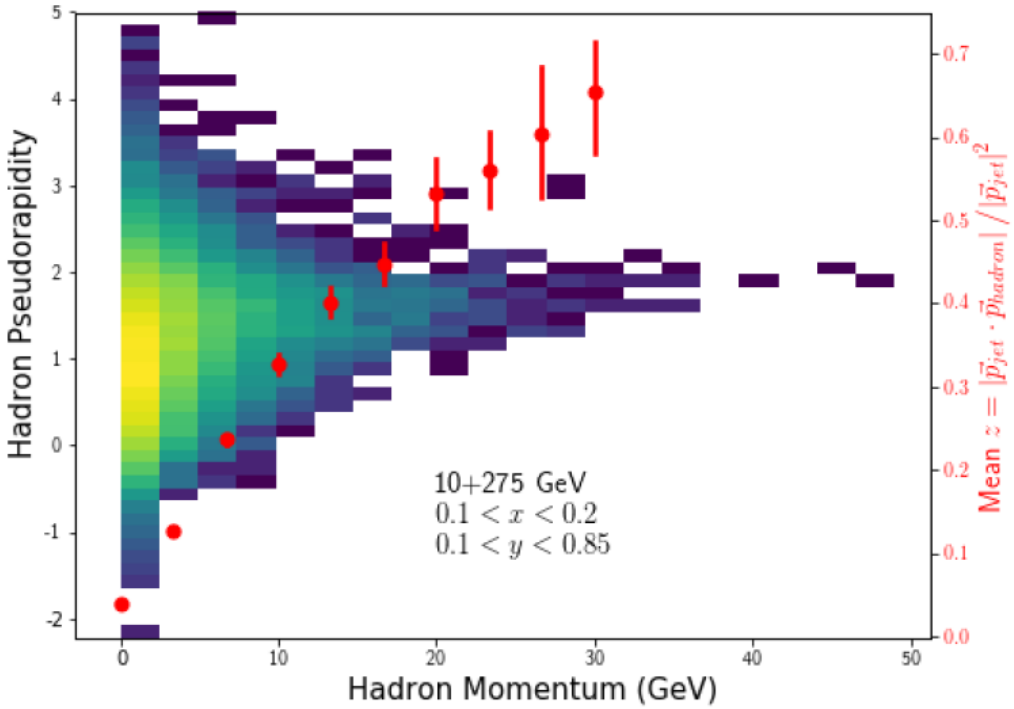




~ 0.10 rad at 10 GeV, ~0.05 rad at 30 GeV

Jets for 3-D Imaging - Miguel Arratia

PID requirements:



- Charged pions separation from Kaons and protons up to ~30 GeV

Jets for 3-D Imaging - Miguel Arratia

EIC detector in Delphes

https://github.com/miguelignacio/delphes_EIC/blob/master/delphes_card_EIC.tcl

Tracking resolution, EMCAL resolution and HCAL resolution as in detector handbook.

In addition:

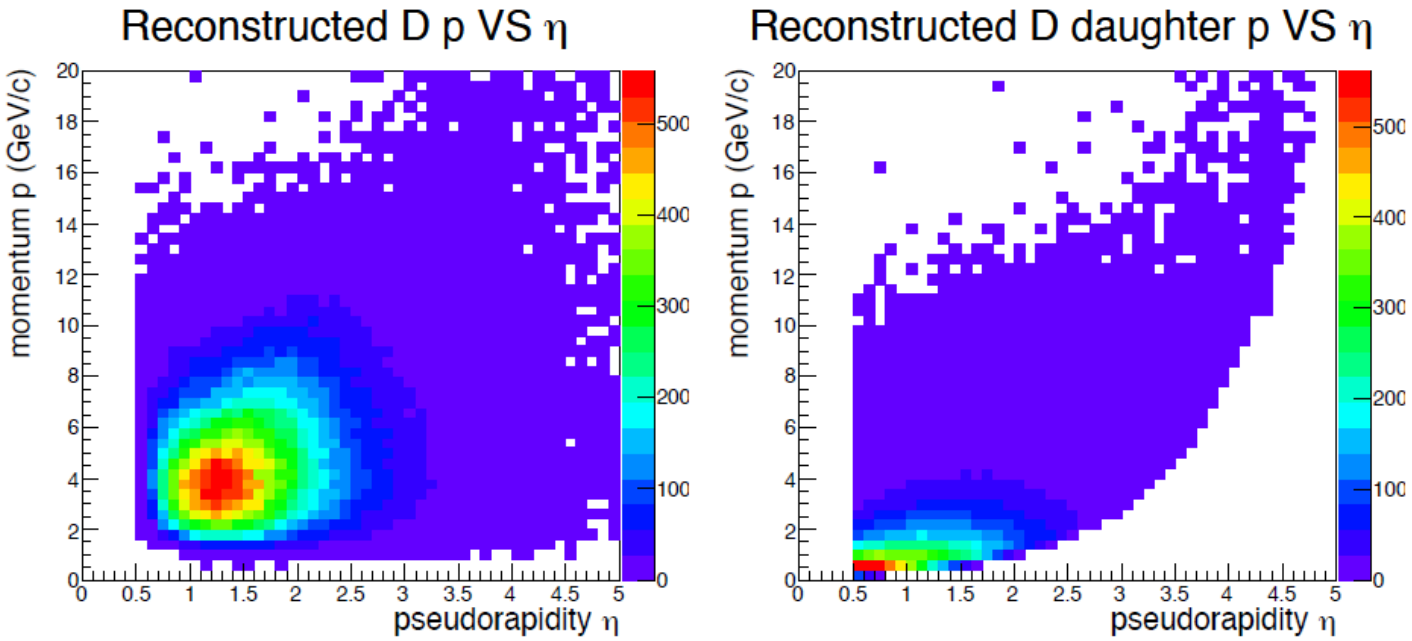
- B=1.5 T, R=0.80 m, L = 1 m
- EMCAL granularity (dphi x deta):
  0.02 x 0.02 for |eta|<3.5
- HCAL granularity (dphi x deta):
  0.1 x 0.1 for |eta|<1.0
  0.025 x 0.025 for 1.0 |eta|<4.0
  (10x10 cm2 at 3.6 m, suggested by O. Tsai)
- HCAL resolution:
  100%/sqrt(E) + 10% in barrel (0.0—1.0)
  50%/sqrt(E) + 10% in encap (1.0—4.0)
- Tracking threshold 100 MeV pT;
  EMCAL threshold of 200 MeV; (noise ~ 30 MeV per tower)
  HCAL threshold of 500 MeV; (noise ~100 MeV per tower)
- No PID yet, but it can be included (LHCb is in Delphes).
  Need parametrization of efficiency and mis-identification matrix

- Other quantities, such as hadron-in-jet azimuthal angle resolution also explored
- Currently, analysis carried out in Delpes framework using detector parameters shown

Open Heavy Flavor With FST – Xuan Li

Kinematic distributions of reconstructed D-mesons

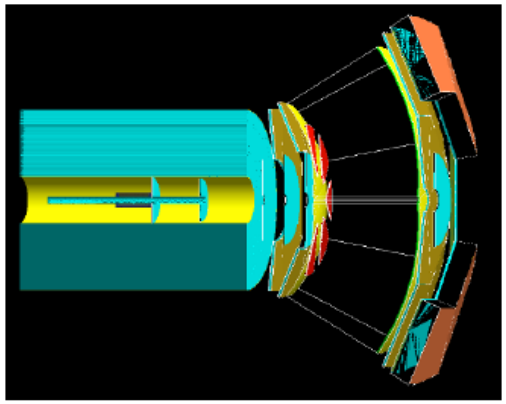
- 18GeV electron + 100 GeV proton collisions with Integrated luminosity: 10 fb^{-1} .
- Reconstructed D-meson momentum VS pseudorapidity (left) and the momentum VS pseudorapidity distribution for the D-meson decayed daughters (right).



Open Heavy Flavor With FST – Xuan Li

EIC Pavia plan

- The updated FST geometry has been implemented in the Fun4All framework with the Barbar magnet with the help from Jin Huang (BNL).



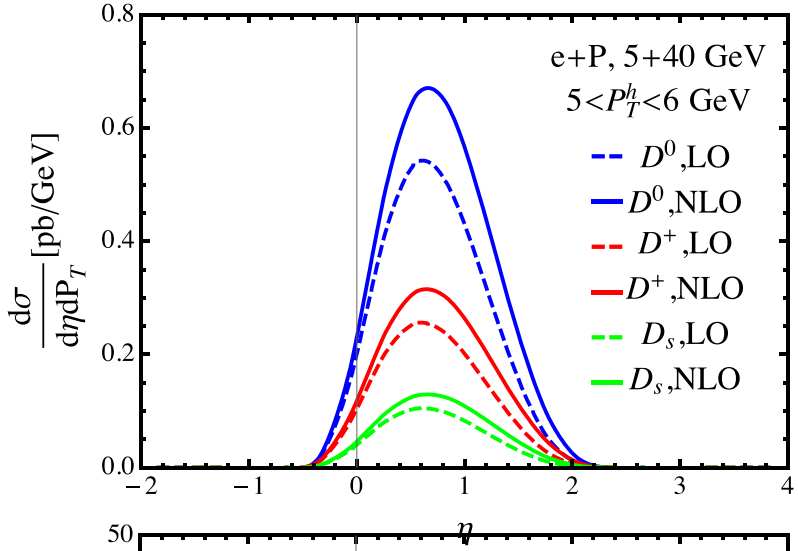
- We will continue optimize the design/geometry of the forward silicon tracker and evaluate the tracking performance.
- In the EIC Pavia meeting, we will report
  - Updated heavy flavor reconstruction with updated detector design and performance.
  - Updated physics projection such as R_{eA}.
  - Provide detector performance requirements for tracking and PID detector.

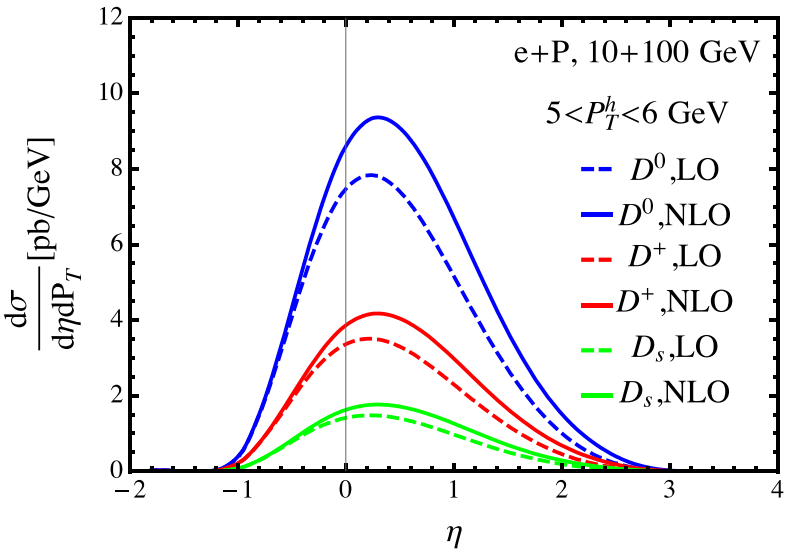
Kinematic maps at NLO for various D and B mesons

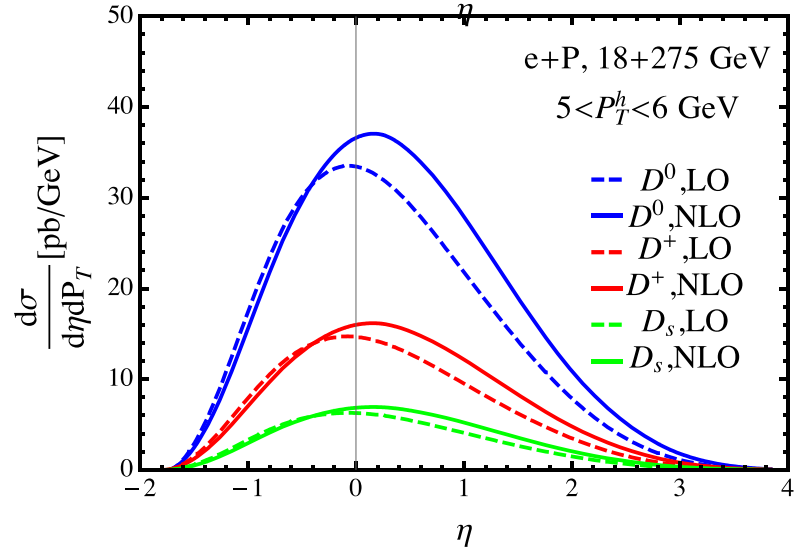
Haitao Li, Zelong Liu, Ivan Vitev

Note – results preliminary

Evaluated using NLO code over all Q^2 range







Example of D mesons at 5 GeV for 2 different energy configurations

Uncertainties to be estimated

Rough estimate of charm baryons ~ 10% of the mesons

Kinematic maps at NLO for various D and B mesons

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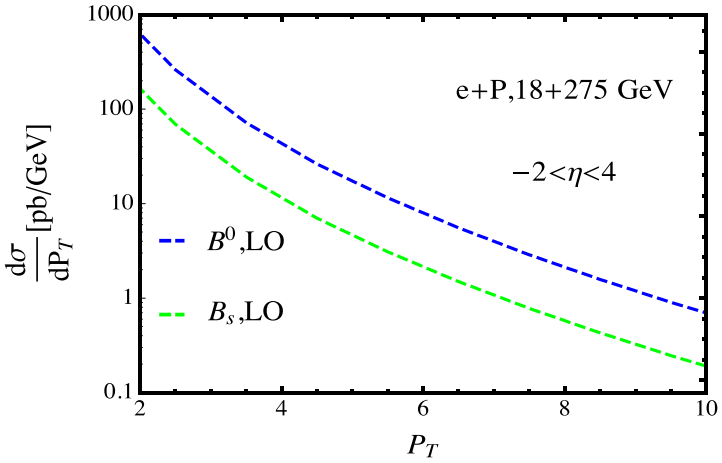
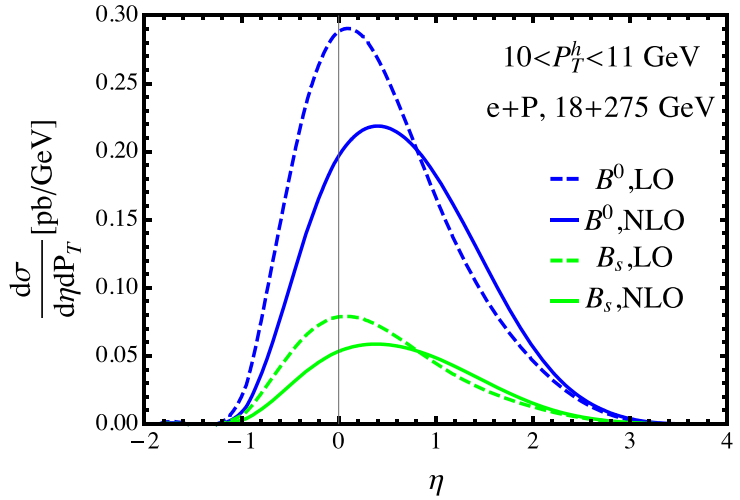
Integrated in the rapidity interval -2 < eta < 4



B mesons we still have at LO in some cases



	5+40 GeV			10+100 GeV			18+275 GeV		
p_T^h [GeV]	[2,3]	[5,6]	[10,11]	[2,3]	[5,6]	[10,11]	[2,3]	[5,6]	[10,11]
π^+	1.4×10^7	136123	61	3.2×10^7	989140	26624	5.4×10^7	2.4×10^6	145501
π^0	8.0×10^6	72980	31	2.0×10^7	578330	14523	3.4×10^7	1.5×10^6	86560
π^-	3.3×10^6	16572	4	1.0×10^7	232546	3734	1.9×10^7	768976	36313
D^0	1.9×10^6	8490	1	9.0×10^6	173922	2432	2.4×10^7	924804	37115
D^+	854390	4057	1	3.9×10^6	78303	1145	1.0×10^7	406404	16632
D_s	360778	1646	0	1.7×10^6	32940	469	4.4×10^6	173427	7015
B^0	39712	647	0	566160	16915	346	2.6×10^6	115150	5376
B_s	10717	181	0	151256	4592	98	692331	30905	1472

TABLE I: Event number of hadron production at the EIC at selected p_T bins of hadron with luminosity 10 fb^{-1} at different collision energy. The event number of B^+ is totally the same as B^0.

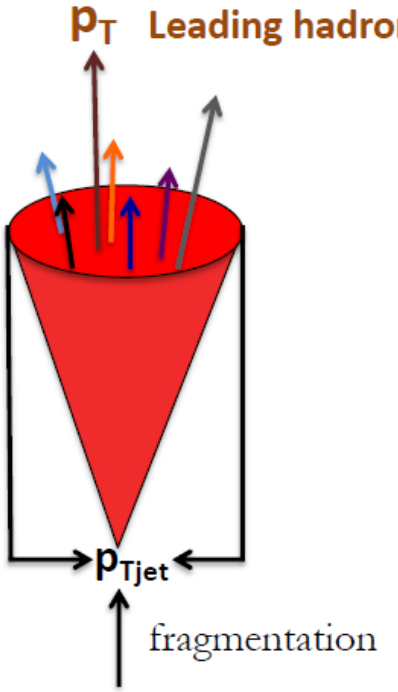
Note – results very preliminary

Can be compared to light hadrons, for example pions.

For Pavia – finalize the kinematic distributions

Jet Flavor Tagging – Xiaoxuan Chu

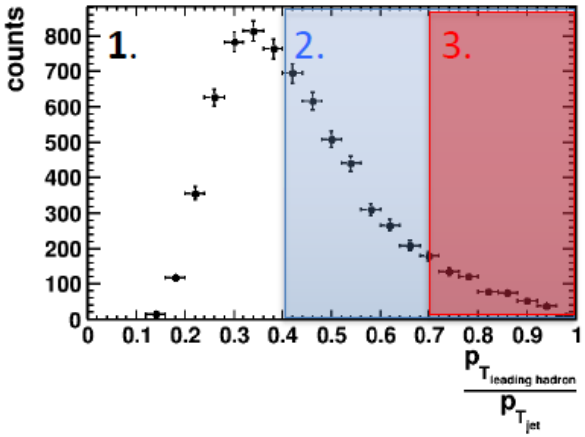
Flavor tagging



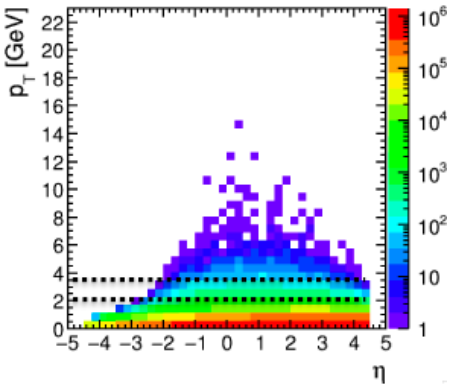
parton: g/q

Leading charged hadron inside (Kaon, pion, proton)

Photon side jet: highest p_T hadron



Final charged hadrons

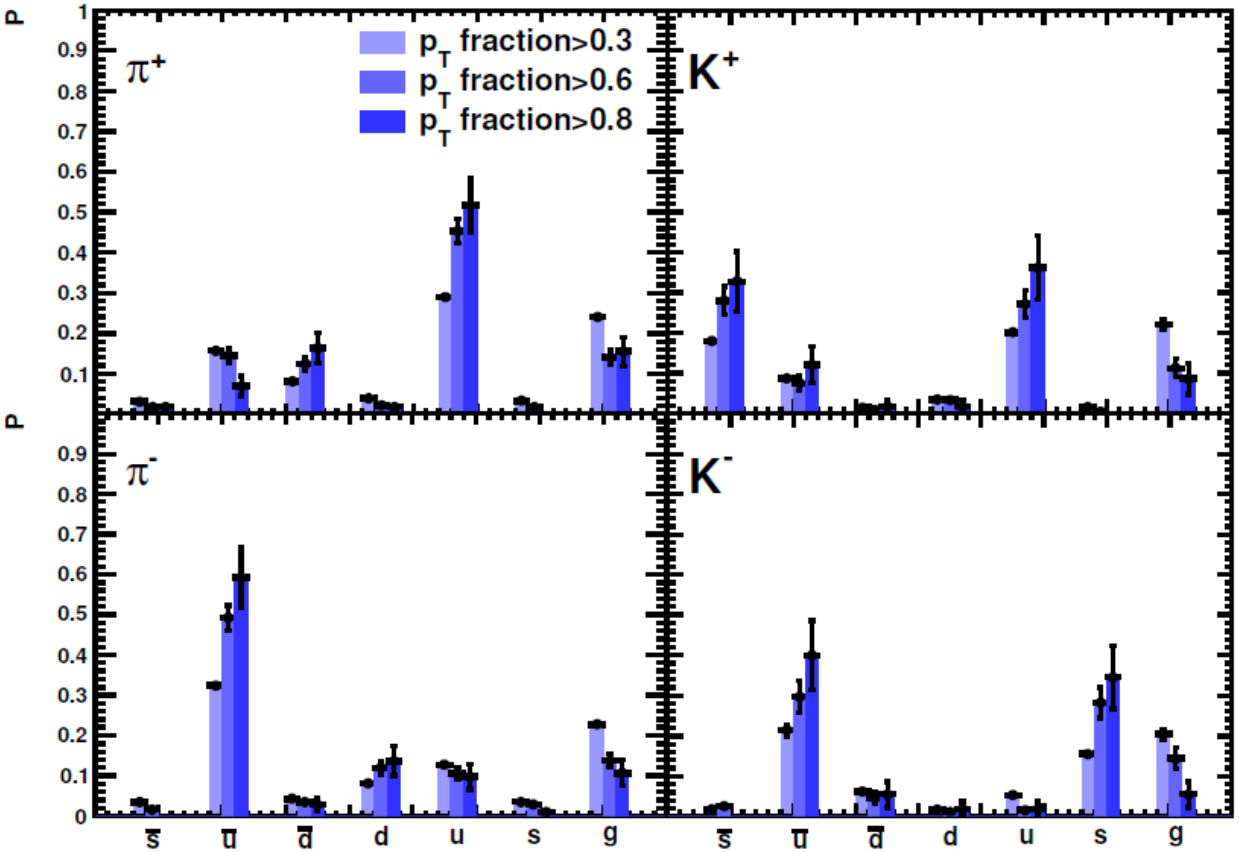


1. p_T fraction: no cut
2. p_T fraction: >0.4, ~p_T of leading hadron>2-2.4 GeV, -3<eta<4
3. p_T fraction: >0.7, ~p_T of leading hadron>3.5-4 GeV, -2<eta<3.5

Jet Flavor Tagging – Xiaoxuan Chu

Flavor tagging (2)

The correlation between the beamparton flavor and the type of the leading hadron inside photon side jet.



Precious PID is needed. Measuring high p_T of leading particle is also required.

Additional Analyses:

- Dijet Sivers – Liang Zheng
- Angularity – Brian Page
- 1-Jettiness – Leticia Mendez

Conclusions:

- Active work on many channels with several simu / smearing packages
- Should have kinematic maps ready for Pavia
- Focus on joint sessions for Pavia – SIDIS, Inclusive, Detector Groups (Calorimeters, Tracking, PID)