Jets and Heavy Flavor WG Summary

Olga & Brian

Ides of March, 2024

Group Information and Contacts

- Mailing List: eic-projdet-jethf-l@lists.bnl.gov
  - https://lists.bnl.gov/mailman/listinfo/eic-projdet-jethf-l

- Meeting Indico Pages: https://indico.bnl.gov/category/420/

- Wiki Page: https://wiki.bnl.gov/eic-project-detector/index.php/JetsHF

- Mattermost Chat: (sign-up link)
  https://eic.cloud.mattermost.com/signup_user_complete/?id=i8gnmob4stdrpjfrezhegxs3ew

- Conveners
  - Olga Evdokimov – evdolga@uic.edu
  - Brian Page – bpage@bnl.gov

- Meetings
  - Wednesdays 12 pm time slot - Biweekly

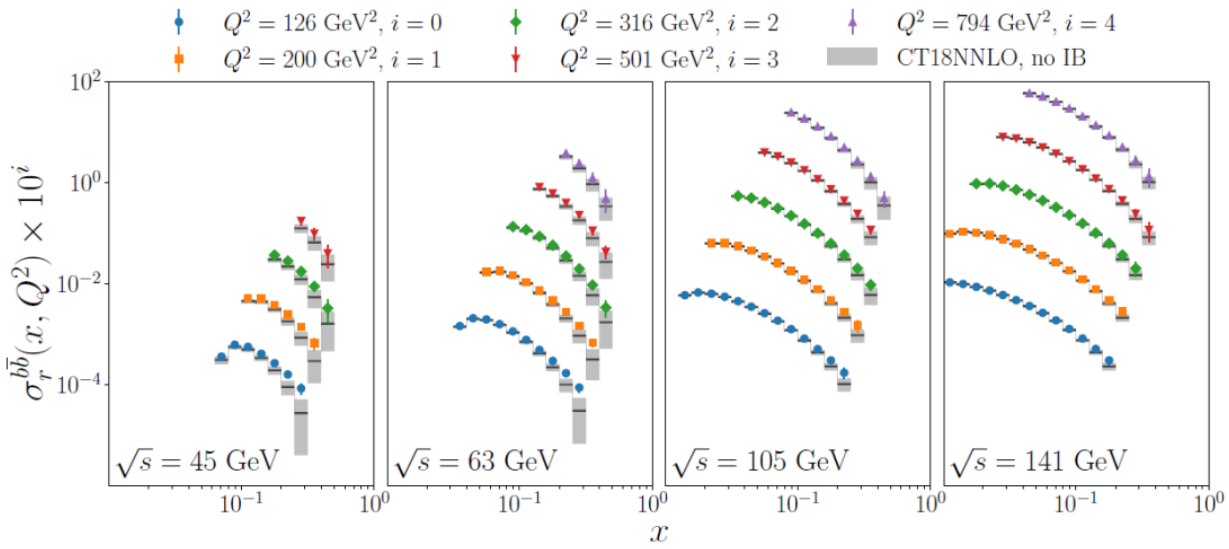
Updates Since Last Meeting

- Our last WG meeting was March 6 (https://indico.bnl.gov/event/22593/)

- Topics included
  - Presentation on HF tagging and intrinsic bottom from Thomas Boettcher (U. of Cincinnati)
  - Update on hadron-in-jet plots for the TDR
  - Introduction from the University of Central Haryana
  - Discussion of open tasks list

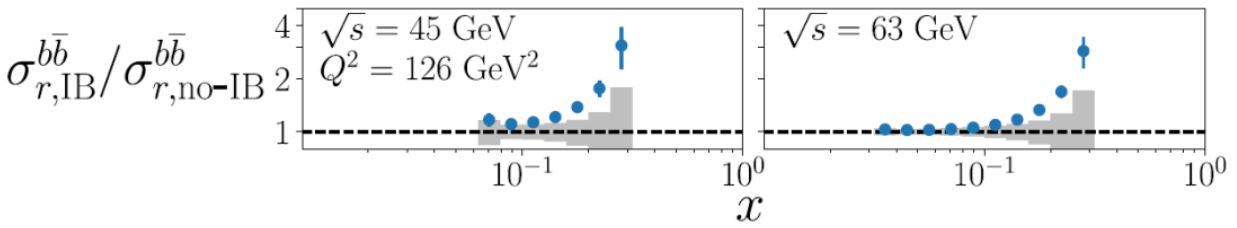
B-Tagging and Intrinsic Bottom

The EIC can precisely study b-hadron production (arXiv:2402.11344)



- Interesting talk on some recent work exploring the impact an LHCb style topological HF tagging scheme could have at the EIC
- May be sensitive to intrinsic bottom contribution to proton wf

The EIC could be sensitive to intrinsic bottom (arXiv:2402.11344)



Using topological jet tagging from the LHC, the EIC has the potential to discover intrinsic bottom quarks.

Introduction from Central U. of Haryana

Central University of Haryana

https://phonebook.sdcc.bnl.gov/eic/client/

Central University of Haryana
Department of Physics and Astrophysics, Central University of Haryana
Mahendergarh -123031
District Mahendergarh, Haryana 123031
INDIA

Collaboration members:
Ramandeep Kumar, Meenu Thakur

Institution representative(s) on EIC User Group Council: **Meenu Thakur**

- **140 km from National Capital: New Delhi**
- **300 km from State Capital: Chandigarh**

- 34 Departments & ~5k Students
- Diverse campus (students from almost all Indian states & few countries)

Courses:
1. Integrated B.Sc. M.Sc. (Physics) [Five-year]
2. M.Sc. (Physics) [Two-year]
3. Ph.D.

Student Contribution:
- One PhD student and two or more MSc students (for one semester dissertation work) may join
- Looking forward to involvement of few undergrad students with good programming skills

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- ❑ Interested in contributing to DAQ and physics/detector simulation
- ❑ Primary physics interest is in jet substructure

- ❑ Prof. Ramandeep Kumar provided an overview of workforce, experience, and physics interest of the Central University of Haryana

Faculty Profile

Dr. Meenu Thakur
PhD: Panjab Univ.
PDF: Florida State Univ.

Previous Work:
- Detector instrumentation for detection of low energy neutrons produced in inverse kinematics using RESONEUT setup at FSU, US
- Fission studies of super-heavy nuclei: mass gated neutron multiplicity measurements performed using India's largest neutron detector array (NAND) at IUAC, New Delhi

Skills (Hardware & Software):
- Tools: FORTRAN, C, C++, ROOT, FLUKA, GEANT4
- Target fabrication and characterization
- Hands on experience with different detector systems and related electronics
- Experience of using NIM, CAMAC, and VME based DAQ systems

Previous Work:
- Fabrication & Characterization of Resistive Plate Chambers (for CMS detector)
- Study of Double Parton Scattering processes using CMS data at the LHC
- DPS studies (phenomenological) using jet fragmentation properties

Skills:
- Tools: C++, Python, ROOT
- MC Event Generators: PYTHIA8, MADGRAPH, SHERPA, POWHEG, HERWIG++

Dr. Ramandeep K.
PhD: Panjab Univ.

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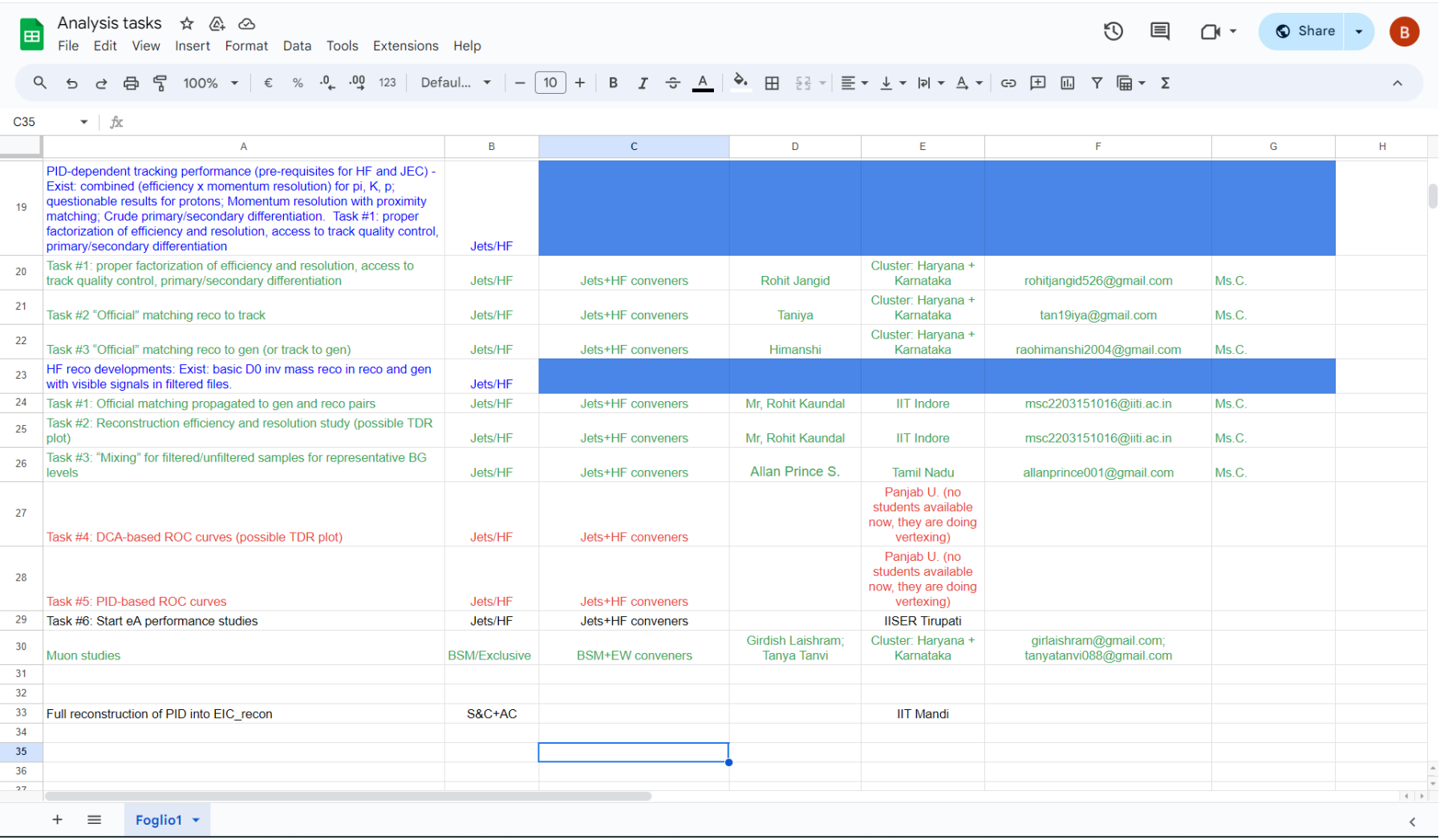
Task List Discussion


Analysis tasks

File Edit View Insert Format Data Tools Extensions Help

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	A	B	C	D	E	F	G	H
19	PID-dependent tracking performance (pre-requisites for HF and JEC) - Exist: combined (efficiency x momentum resolution) for pi, K, p; questionable results for protons; Momentum resolution with proximity matching; Crude primary/secondary differentiation. Task #1: proper factorization of efficiency and resolution, access to track quality control, primary/secondary differentiation	Jets/HF						
20	Task #1: proper factorization of efficiency and resolution, access to track quality control, primary/secondary differentiation	Jets/HF	Jets+HF conveners	Rohit Jangid	Cluster: Haryana + Karnataka	rohitjangid526@gmail.com	Ms.C.	
21	Task #2 "Official" matching reco to track	Jets/HF	Jets+HF conveners	Taniya	Cluster: Haryana + Karnataka	tan19iya@gmail.com	Ms.C.	
22	Task #3 "Official" matching reco to gen (or track to gen)	Jets/HF	Jets+HF conveners	Himanshi	Cluster: Haryana + Karnataka	raohimanshi2004@gmail.com	Ms.C.	
23	HF reco developments: Exist: basic D0 inv mass reco in reco and gen with visible signals in filtered files.	Jets/HF						
24	Task #1: Official matching propagated to gen and reco pairs	Jets/HF	Jets+HF conveners	Mr, Rohit Kaundal	IIT Indore	msc2203151016@iiti.ac.in	Ms.C.	
25	Task #2: Reconstruction efficiency and resolution study (possible TDR plot)	Jets/HF	Jets+HF conveners	Mr, Rohit Kaundal	IIT Indore	msc2203151016@iiti.ac.in	Ms.C.	
26	Task #3: "Mixing" for filtered/unfiltered samples for representative BG levels	Jets/HF	Jets+HF conveners	Allan Prince S.	Tamil Nadu	allanprince001@gmail.com	Ms.C.	
27	Task #4: DCA-based ROC curves (possible TDR plot)	Jets/HF	Jets+HF conveners		Panjab U. (no students available now, they are doing vertexing)			
28	Task #5: PID-based ROC curves	Jets/HF	Jets+HF conveners		Panjab U. (no students available now, they are doing vertexing)			
29	Task #6: Start eA performance studies	Jets/HF	Jets+HF conveners		IISER Tirupati			
30	Muon studies	BSM/Exclusive	BSM+EW conveners	Girdish Laishram; Tanya Tanvi	Cluster: Haryana + Karnataka	girlaishram@gmail.com; tanyatanvi088@gmail.com		
31								
32								
33	Full reconstruction of PID into EIC_recon	S&C+AC			IIT Mandi			
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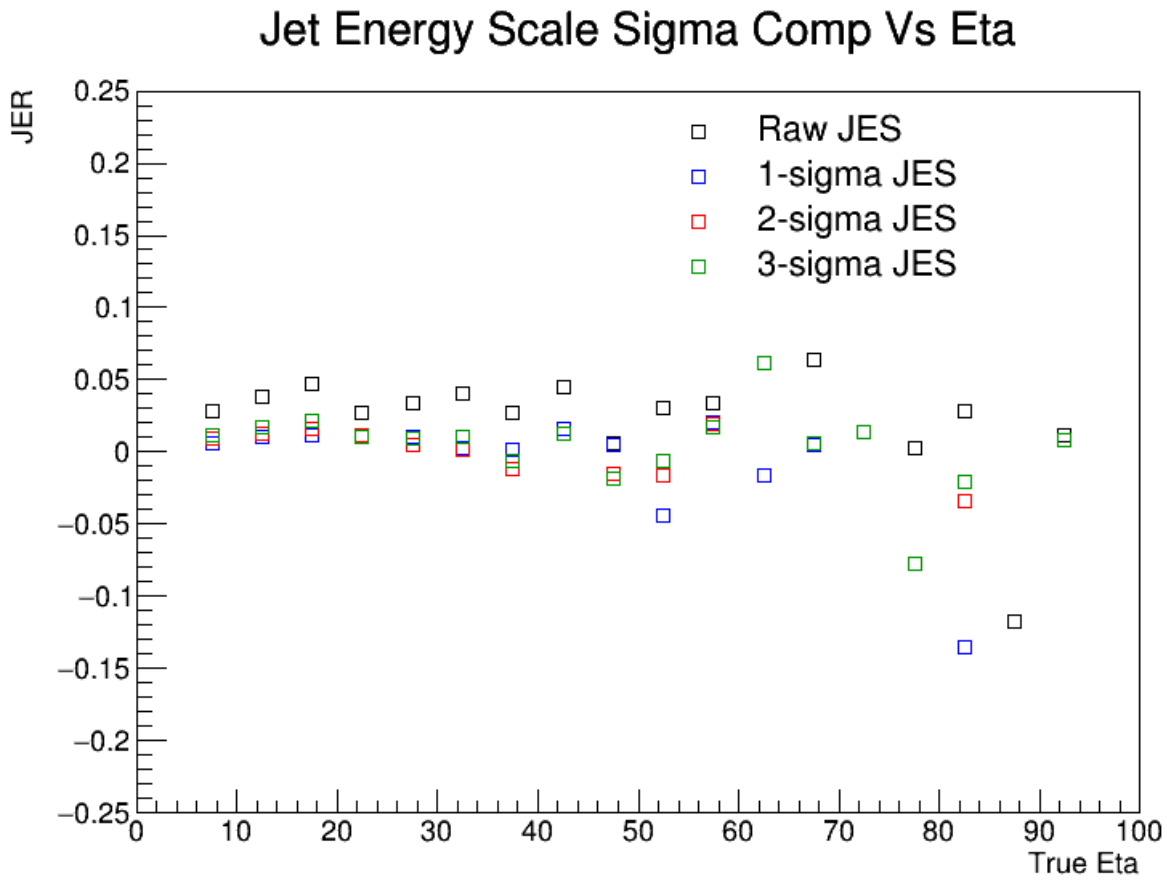
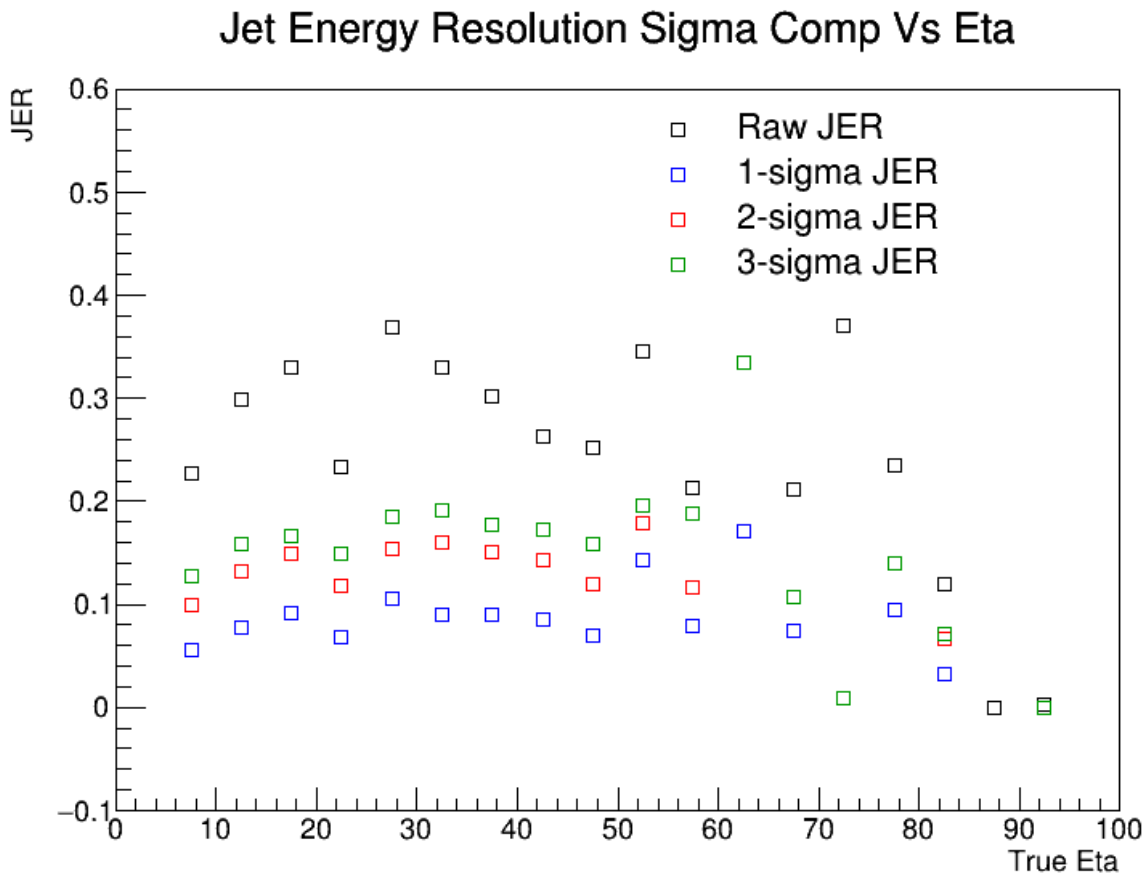
- WG generated list of open tasks to provide point of entry for new collaborators
- Flurry of activity in the last ~week have seen many groups (mainly Indian universities) express interest in Jets and HF – many tasks now have names attached
- Also received interest from individuals at BNL and SBU
- Will need to think carefully about how to onboard and supervise new person power to maximize their contributions

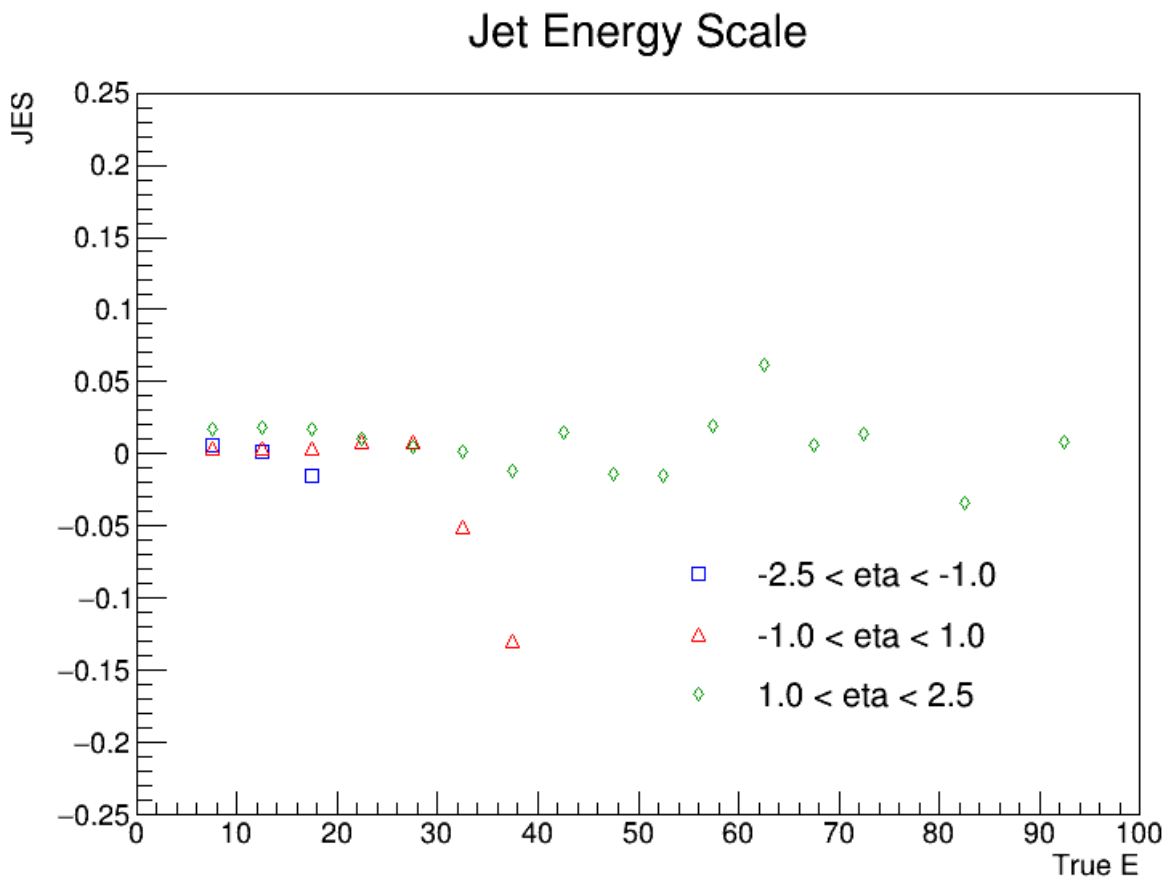
Jet Performance TDR Plots: Characterizing Tails

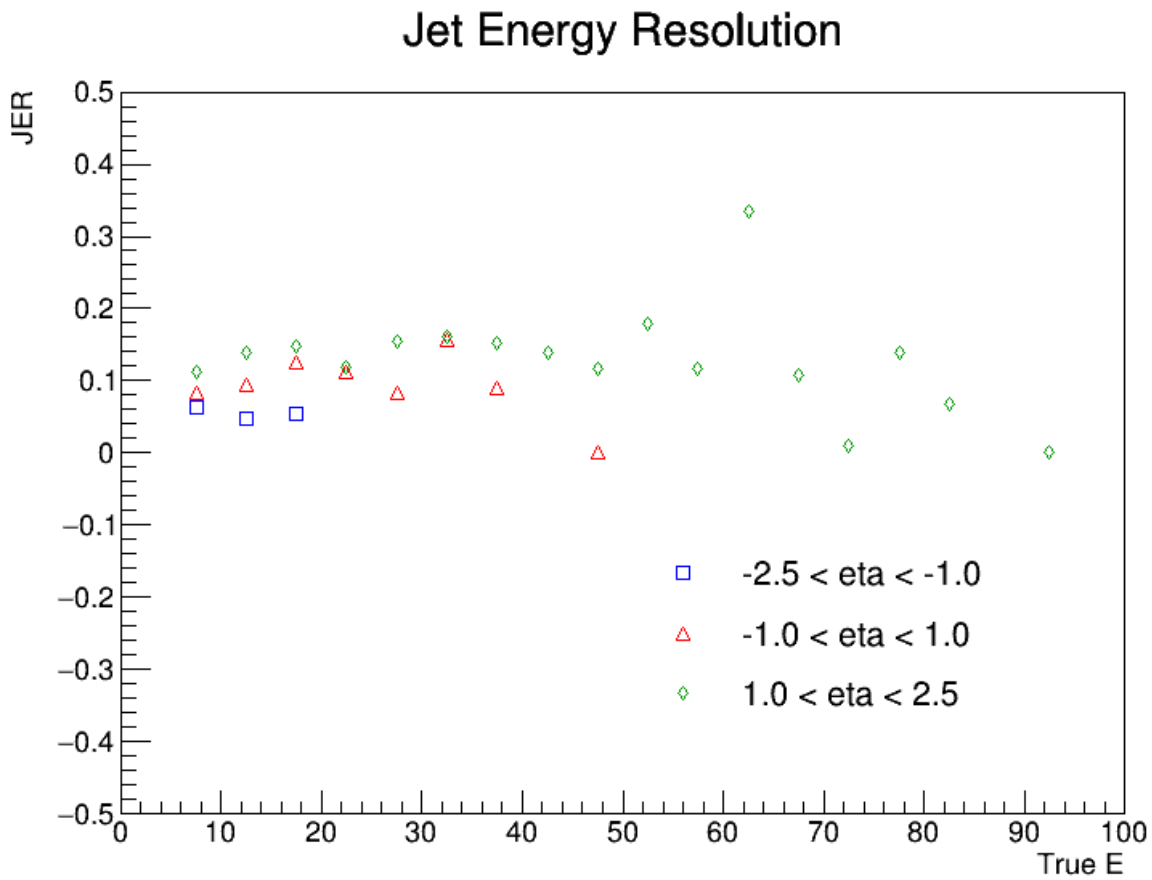




- See effect of different n*RMS truncations on JES and JER
- JER more sensitive to this choice
- Use 2*RMS for now

Jet Performance TDR Plots: Money Plots





- Money plots are JES and JER as a function of energy for different jet eta bins