Jets & Bosons Subgroup report

LHC EW WG General Meeting, 17.02.2022

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Stephen Farry         Will Barter

James Mulligan        Nima Zardoshti

Marek Schoenherr
Our group

- Twiki: https://twiki.cern.ch/twiki/bin/view/LHCPhysics/EWWG2
- Meeting time: Monday 16:30, twice a month (indico)
- Mailing list: lhc-ewwg-vjets
- E-mail: lhc-ewwg-vjets-admin

Group activities

- Mini-workshops and invited talks on timely topics
- Benchmark comparisons (towards yellow report)
- Collection of RIVET routines
- Intrinsic kt tunes (towards LHC tune)
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Invited talks

- Benchmark Comparisons (M. Ambrozas): https://indico.cern.ch/event/1029811
- Jet Angularities (S. Caletti): https://indico.cern.ch/event/1029811
- Benchmark Comparisons (L. Martikainen): https://indico.cern.ch/event/1029808
- Resummation with multijets (F. Hautmann): https://indico.cern.ch/event/1029808
- NNLO for three-jet (R. Poncelet): https://indico.cern.ch/event/1097252
- Event shapes, TEECs and $\alpha_S$ (M. Alvarez Estevez): https://indico.cern.ch/event/1097252
- $\alpha_S$ and PDFs from jets and ttbar (K. Lipka): https://indico.cern.ch/event/1097252

Mini-workshops

https://indico.cern.ch/event/1083894/

- **Introduction**
  - Speaker: William Barter (Imperial College (GR))

- **LHCb results**
  - Speaker: Daniel Charles Craik (Massachusetts Inst of Tec)

- **CMS results**
  - Speaker: Juan Pablo Fernandez Ramos (Centro de Investiga)

- **ATLAS results**
  - Speaker: Federico Sforza (University and INFN Sannoi)

- **Theory: charm PDF and implications for Z+charm**
  - Speaker: Juan Rojo (VU Amsterdam and Nikhgf)

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https://indico.cern.ch/event/1083875/

- **Introduction**
  - Speakers: James Mulligan (University of Cali

- **Jet angularities: SCET calculations**
  - Speaker: Kyle Lee

- **Jet angularities: ALICE**
  - Speaker: Ezra Douglas Lesser (University of

- **Jet angularities: CMS**
  - Speaker: Andreas Hinzmann (Hamburg Univ

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Highlights: Benchmark

- Performing V+Jets benchmark comparisons
- Currently focusing on scale choice dependence
- 3 different scale choices: $H_T$, $\frac{H_T}{2}$, $p_T^{\text{max}}$


Theory systematic effects / tunes properly understood and documented across experiments

Marijus Ambrozas
Heng Yang
Laura Martikainen
Andrius Juodagalvis
Hannes Jung
**Highlights: Benchmark**

- Performing Benchmark comparisons with $\sqrt{s} = 13$ TeV jets
- Using central files (aMC@NLO, pdf NNPDF30NNLO)
  - Three scales: $H_T$, $H_T/2$ and $p_{T,\text{max}}$

**arXiv:2111.10431**

**JHEP 05 (2018) 195**

Theory systematic effects / tunes properly understood and documented across experiments
Current focus on:

- **Breakdown of systematics in hepdata** (comparisons across experiments)
- **Handling of ratio observables in Rivet**
Highlights: TMD merging

- Key findings: i) reduced systematic uncertainty with respect to merging parameters; ii) improved description of high-order
- Applicable to merging schemes other than MLM - e.g. CKKW
- Possible extensions to NLO merging algorithms


F Hautmann
Highlights: Vector boson + HF

- Better understanding of proton structure
- Intrinsic charm
- Test of HF masses
Highlights: Jet substructure

- Understanding of perturbative QCD
- Measurement of SM parameters ($\alpha_S$, $m_t$)
- Improvement of non-perturbative models in MC event generators
  - Important for many searches and measurements relying on jet substructure tagging to distinguish boosted W/Z/H/top jets from q/g jet background
- Understanding of QGP (PbPb vs. pp)

- How does the QGP modify the jet angularities?
  - $\rightarrow$ how can we study the QGP with the jet angularities?

Figure: Salvatore Aiola, Yale University
Highlights: Towards an LHC tune (Pythia8)

- Baseline tune
- Avoid overparametrization
- Consider reducible products of the kind:

\[
\text{UE} \quad \times \quad \text{Intrinsic } k_t
\]

- Starting from the intrinsic $k_t$

COM dependence spotted!

Work ongoing, targeting also the Benchmark yellow report

Mikel Mendizabal
Hannes Jung
Highlights: Towards an LHC tune (Pythia8)

A. Bermúdez Martínez

Work ongoing

UE \[\times\] Intrinsic \(kt\)
Conclusions and Outlook

- Jets & EW bosons working towards a combined document
- Benchmark studies: focus on having breakdown of systematics in hepdata, and treatment of observable ratios in Rivet
- Progress in the search for an LHC tune
- Likely improvement of Pythia8 intrinsic kt model arising from the studies
Thank you