PB TMD meeting

10.09.2020

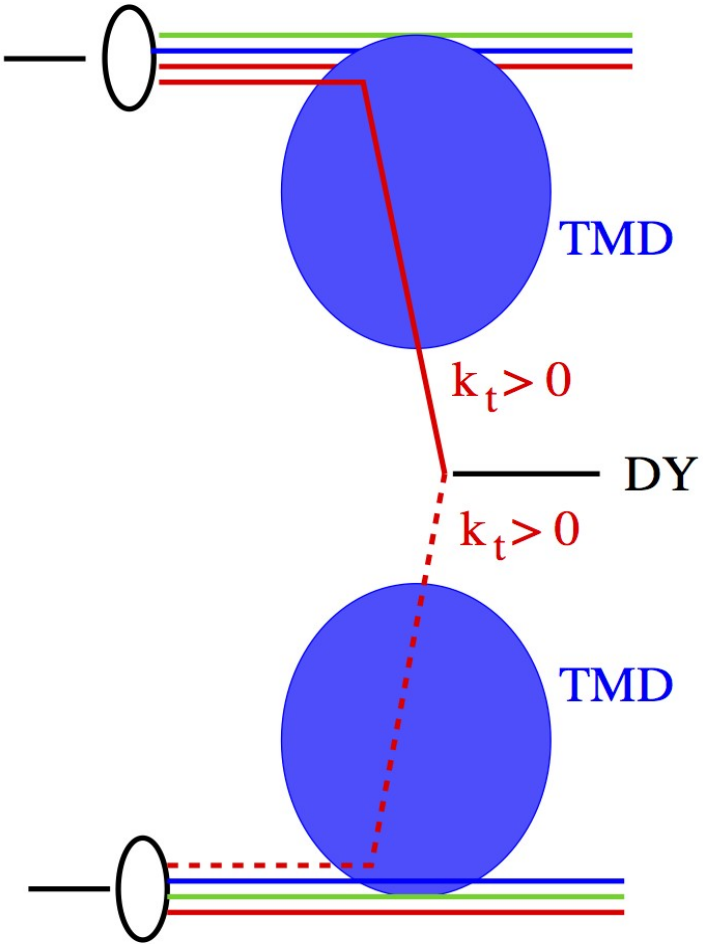
PB-MLM merging systematics

A. Bermúdez Martínez in collaboration with F. Hautmann and M. Mangano

PB-MLM method

see previous presentation

- Evaluate the ME for n-jet cross sections
- Reweight the strong coupling according to shower history
- **Evolve the ME using the TMD PB evolution**
- **Shower the events using the backward PB evolution for ISR**
- **Apply the MLM(*) prescription between the PB-evolved ME and the showered events**



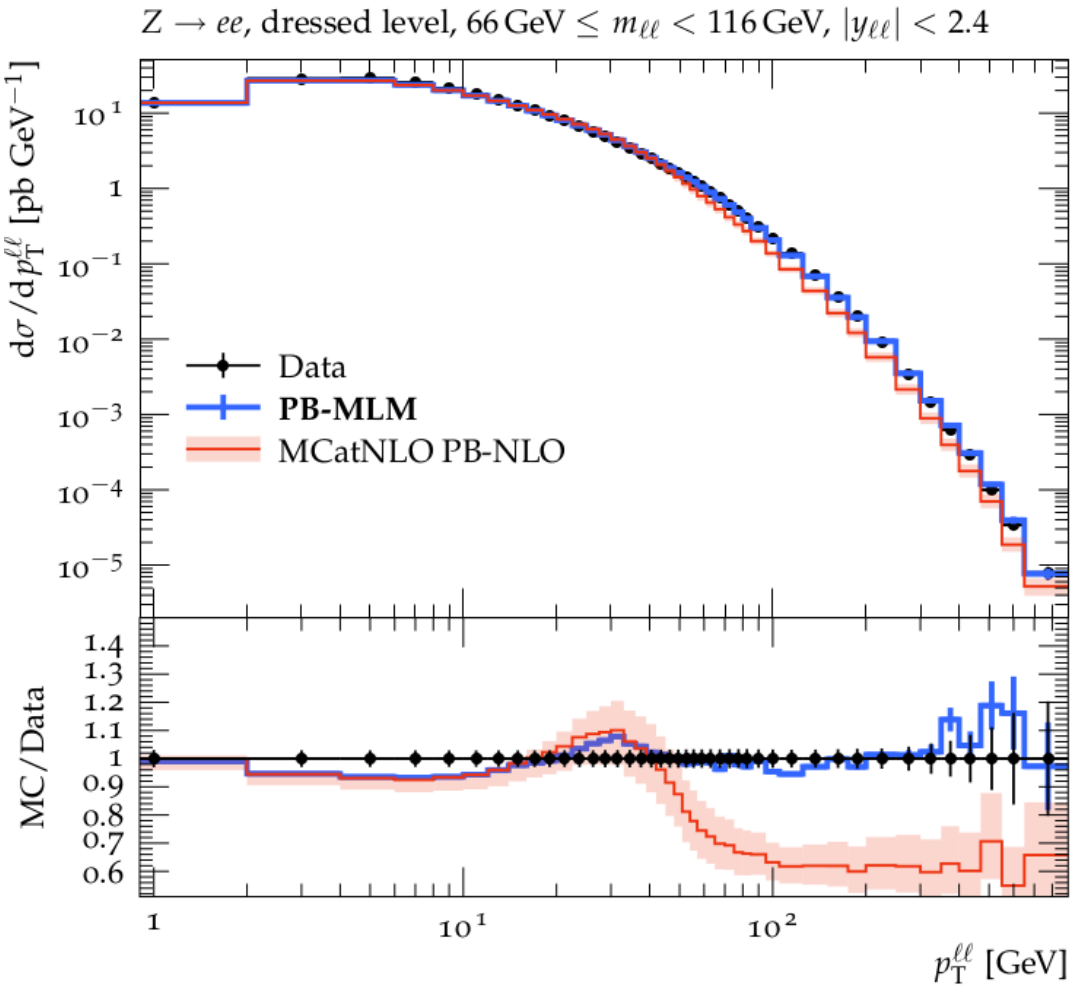
New merging procedure applicable to TMDs!

(*) M. L. Mangano [NPB 632 (2002) 343–362]

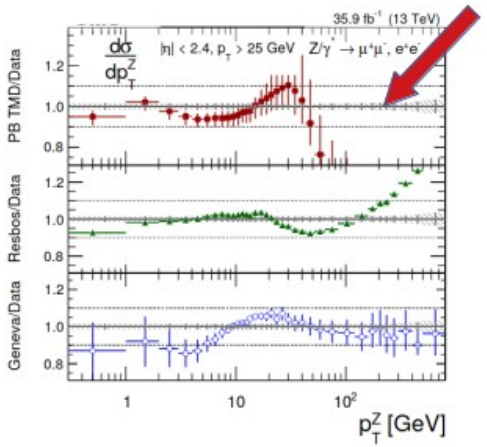
Results

see previous presentation

Z transverse momentum



Recall:

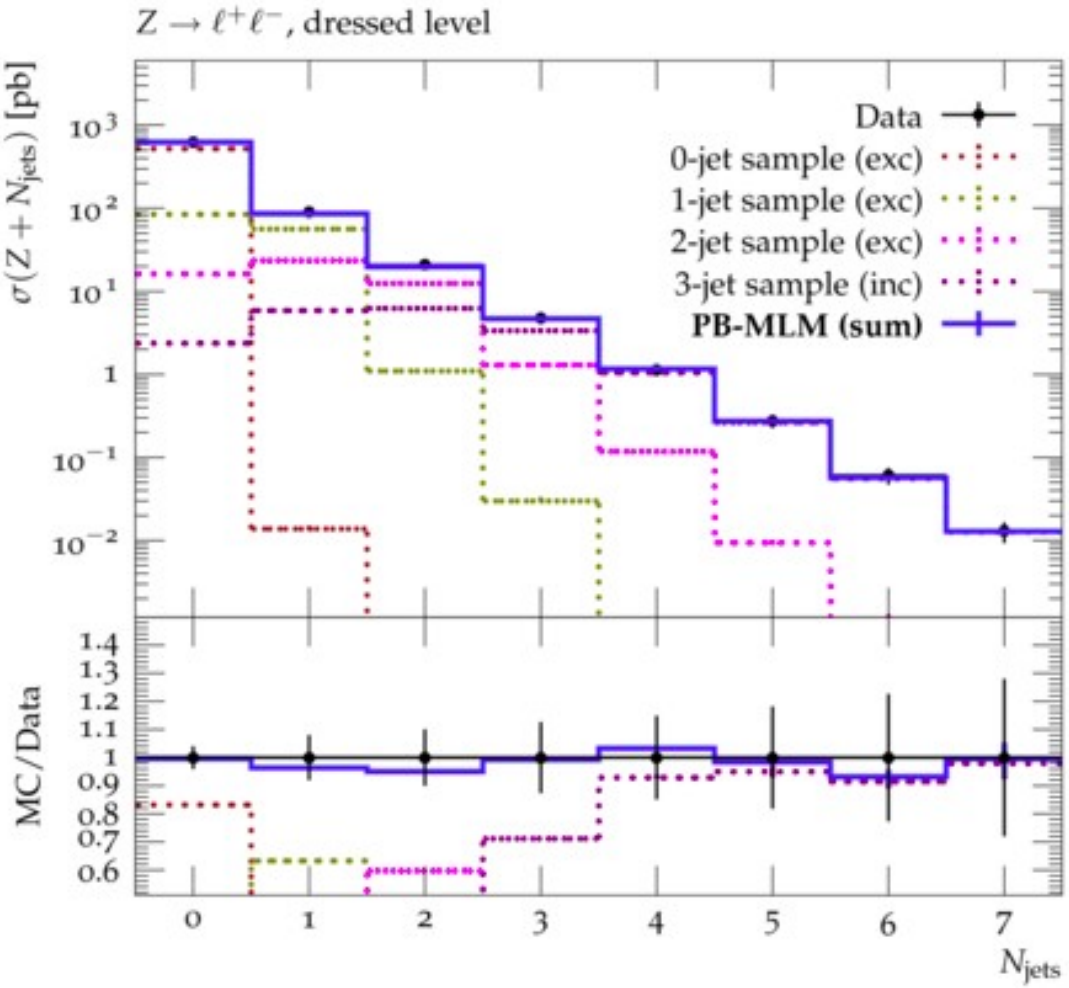


- **Low as well as high-pt** now nicely described
- Consistent with MCatNLO PB-NLO at low pT

Results

see previous presentation

Exclusive jet multiplicity in Z events



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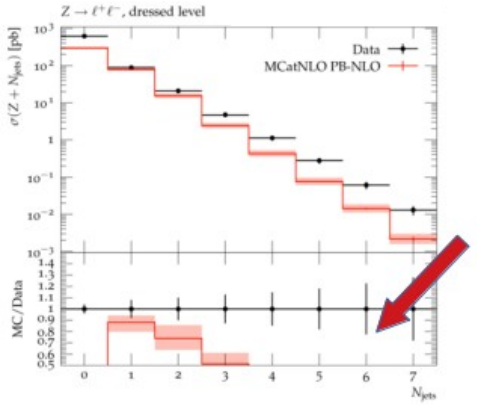
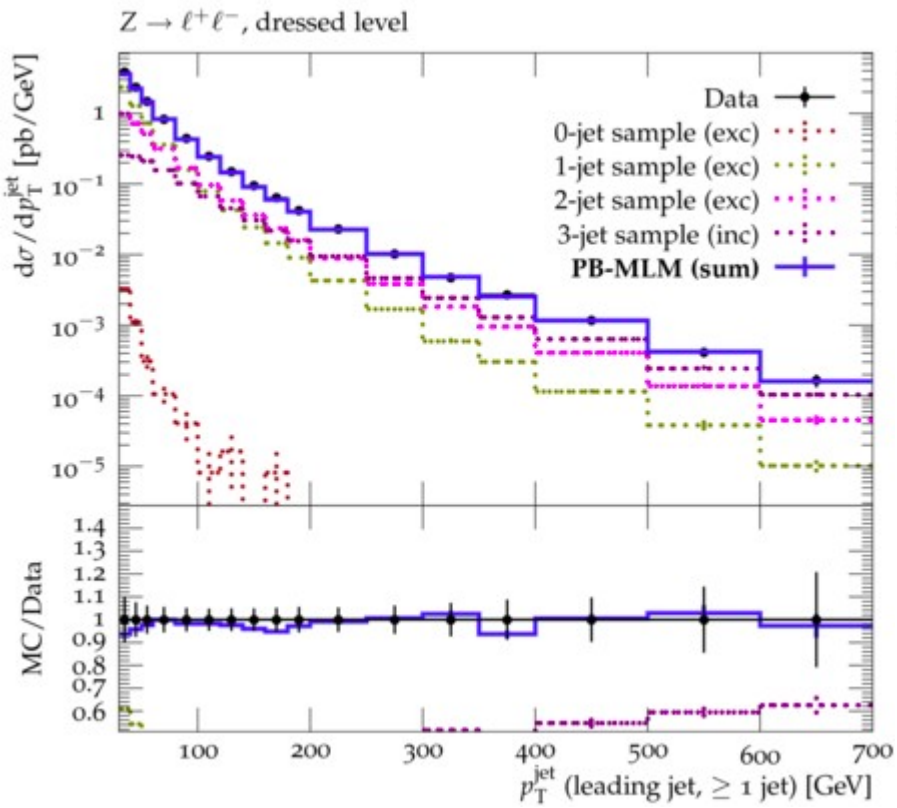


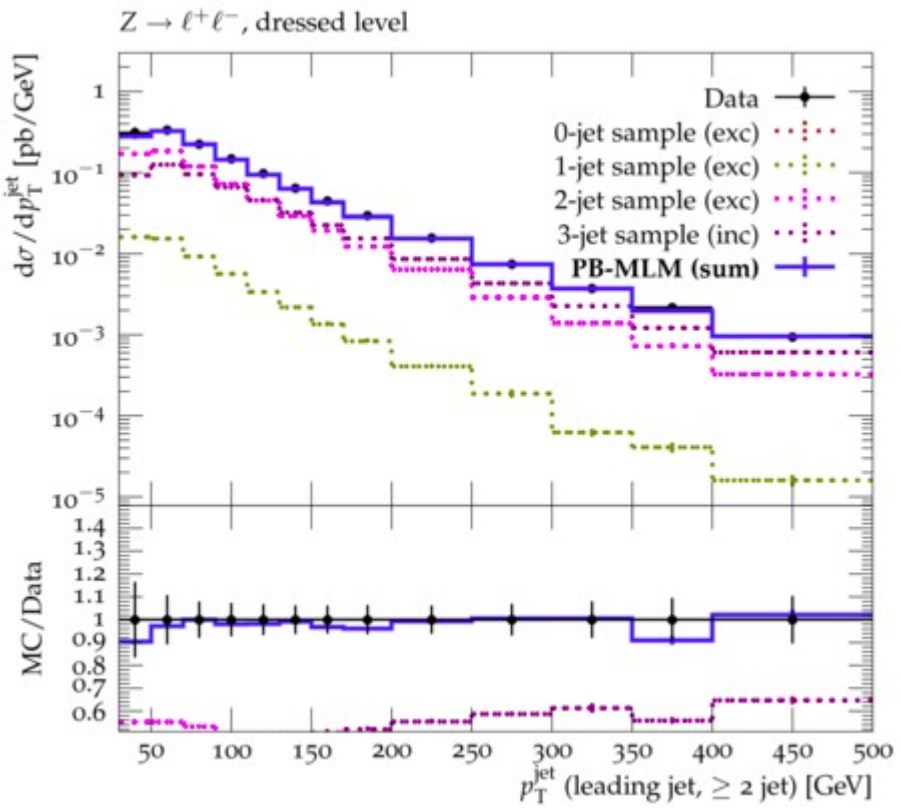
- **Not only the overall recoil but also the number of jets are described**

Results

see previous presentation

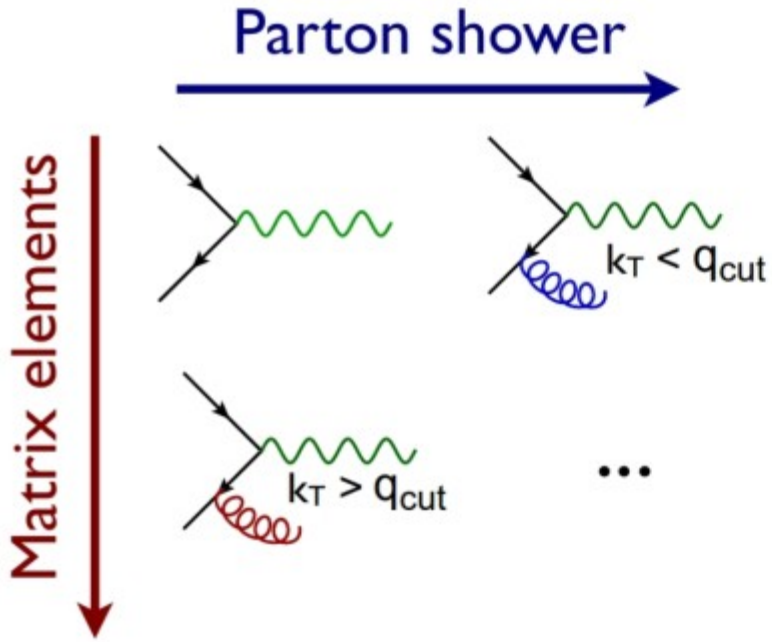
pT of leading jet in Z events

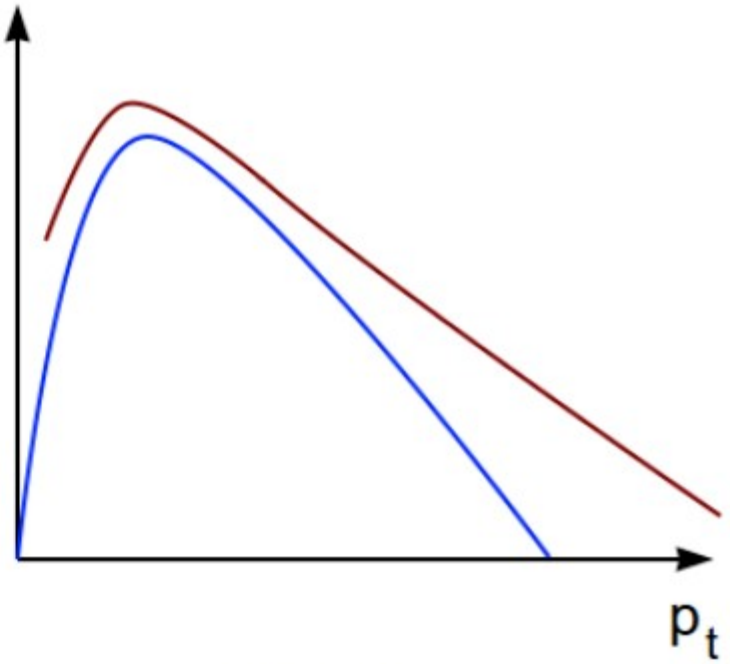




- **Fine combination of jet samples** gives a very good description of the jet pT

Multi-jet merging





- 1st emission PS: $\mathcal{R}^{PS}(p_t^2) \times \exp\left[-\int_{p_t^2} dp_t'^2 \frac{\mathcal{R}^{PS}(p_t'^2)}{\mathcal{B}}\right]$

- 1st emission ME: $\mathcal{R}(p_t^2) \longrightarrow \mathcal{R}(p_t^2) \times \exp\left[-\int_{p_t^2} dp_t'^2 \frac{\mathcal{R}^{PS}(p_t'^2)}{\mathcal{B}}\right]$

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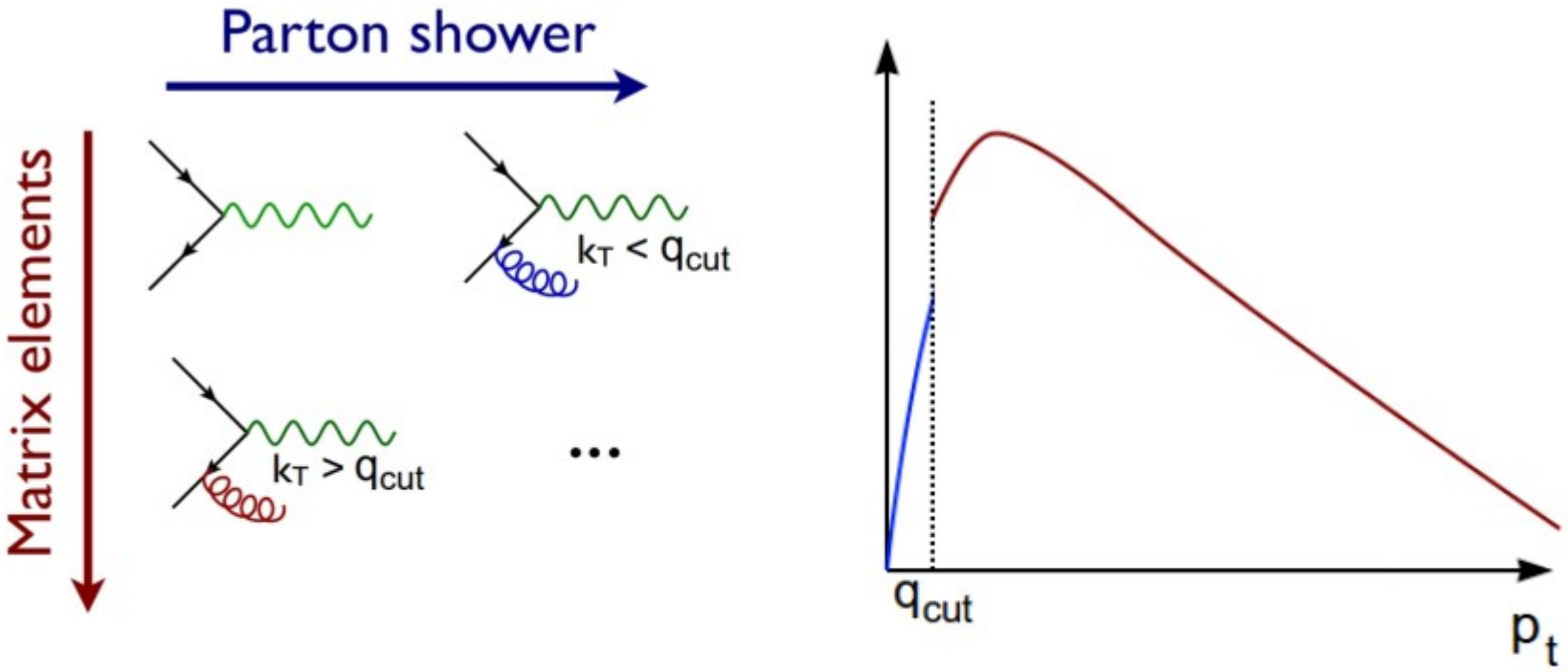

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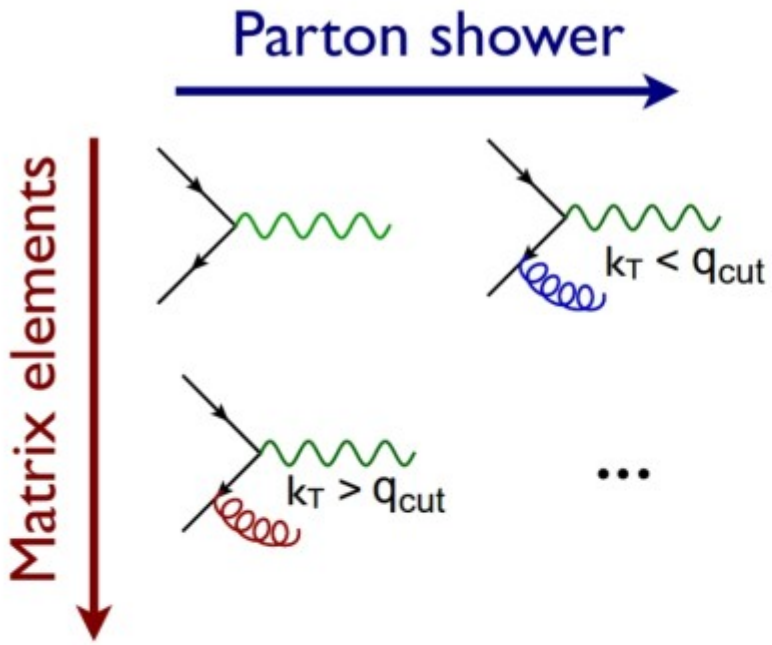
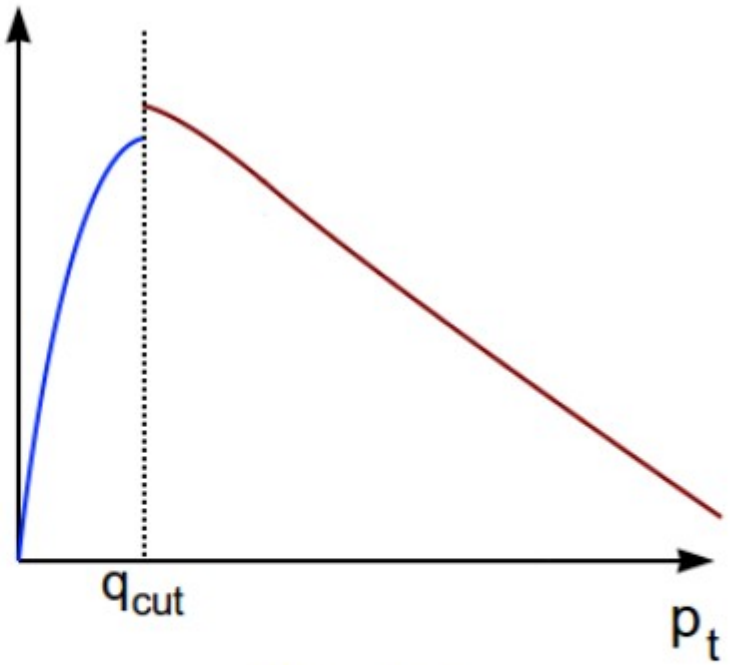
Multi-jet merging





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Systematics

Multi-jet cross sections

- Nominal value of the merging scale: 23 GeV
- We study 10 GeV variation in order to compare with the work here for standard MC

Systematics

Multi-jet cross sections

Merging scale [GeV]	σ[tot] [pb]	σ[≥ 1 jet] [pb]	σ[≥ 2 jet] [pb]	σ[≥ 3 jet] [pb]	σ[≥ 4 jet] [pb]
23	1145.95	174.51	40.53	9.67	2.36
33	1126.07	172.30	40.95	9.72	2.38

- 10 GeV variation gives **< 2% change** in jets cross sections
- Standard merging algorithms can give over 10 % change for the same variation of the merging scale CF: J. Alwall et al. [EPJC 53, 473–500 (2008)]

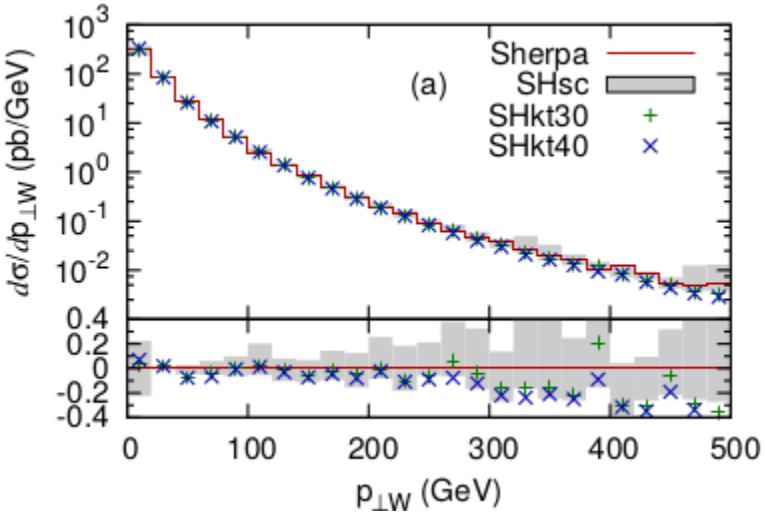
→ Dependence on merging scale reduced by treating transverse momentum in the initial state

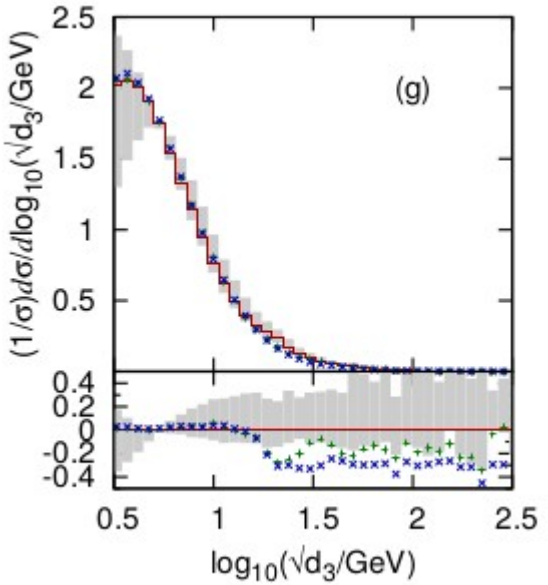
Systematics

Differential distributions for standard approaches

- Nominal value of the merging scale: 23 GeV
- We study 10 GeV variation in order to compare with the work here for standard MC

CF: J. Alwall et al. [EPJC 53, 473–500 (2008)]

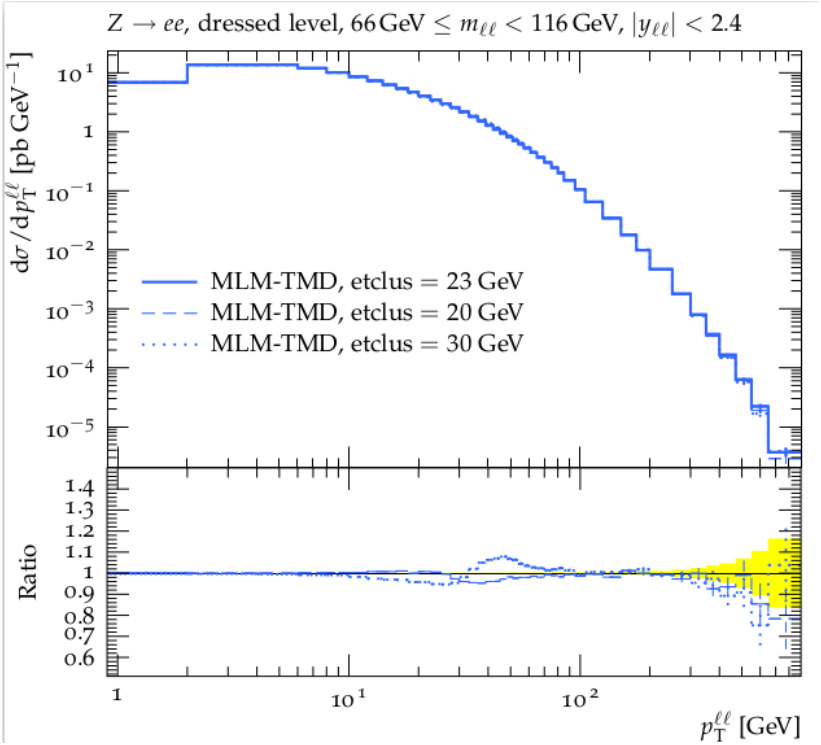


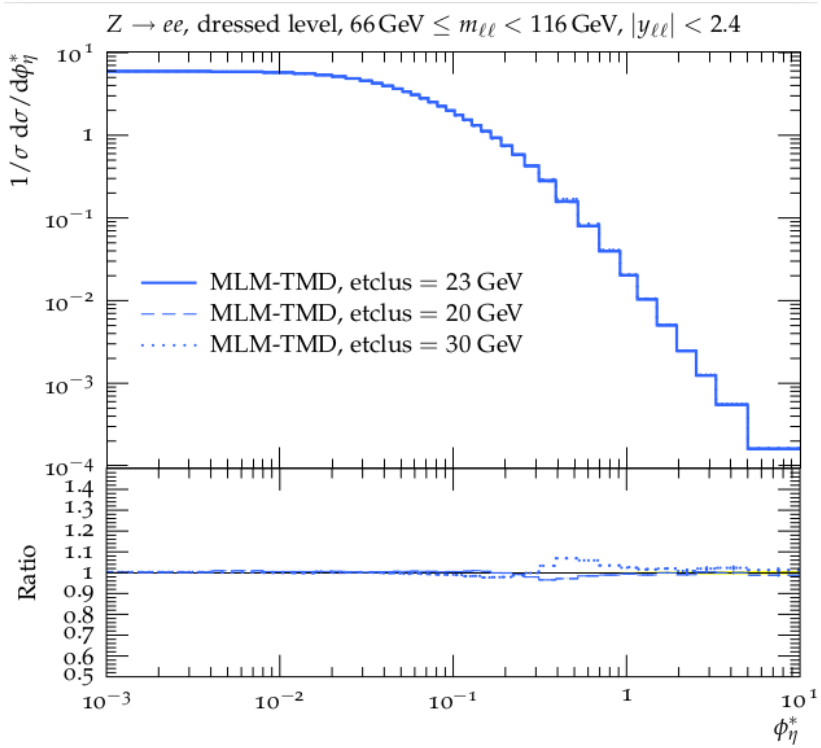


Standard merging algorithms can give over 20 % difference for a 10 GeV variation

Systematics

Z pt and phi*

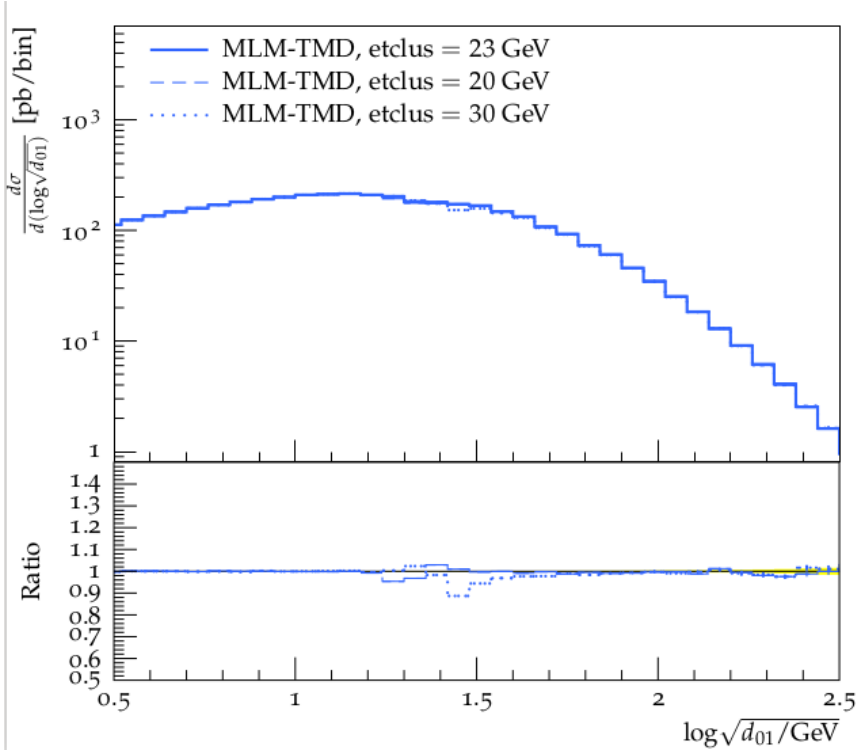


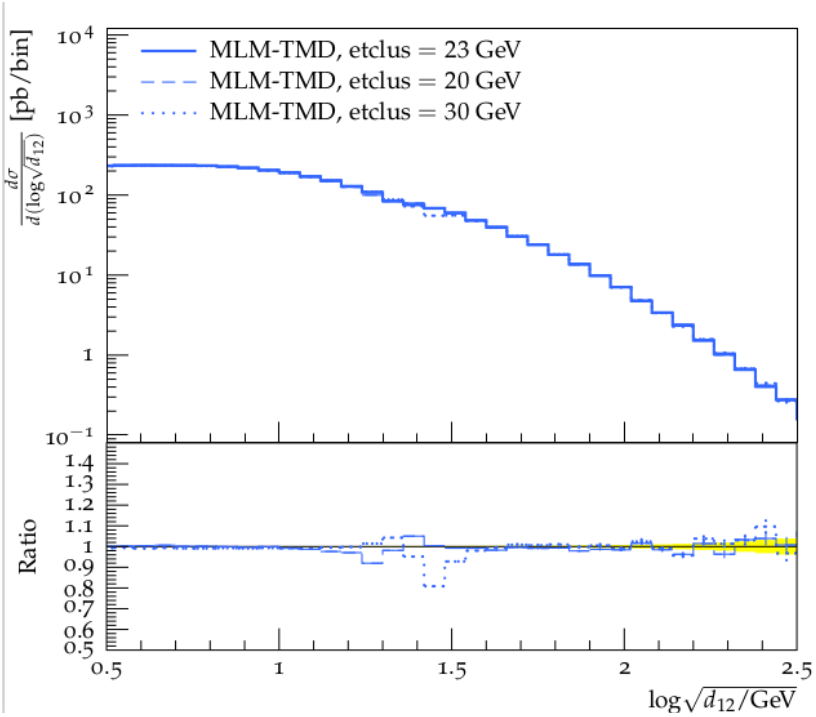


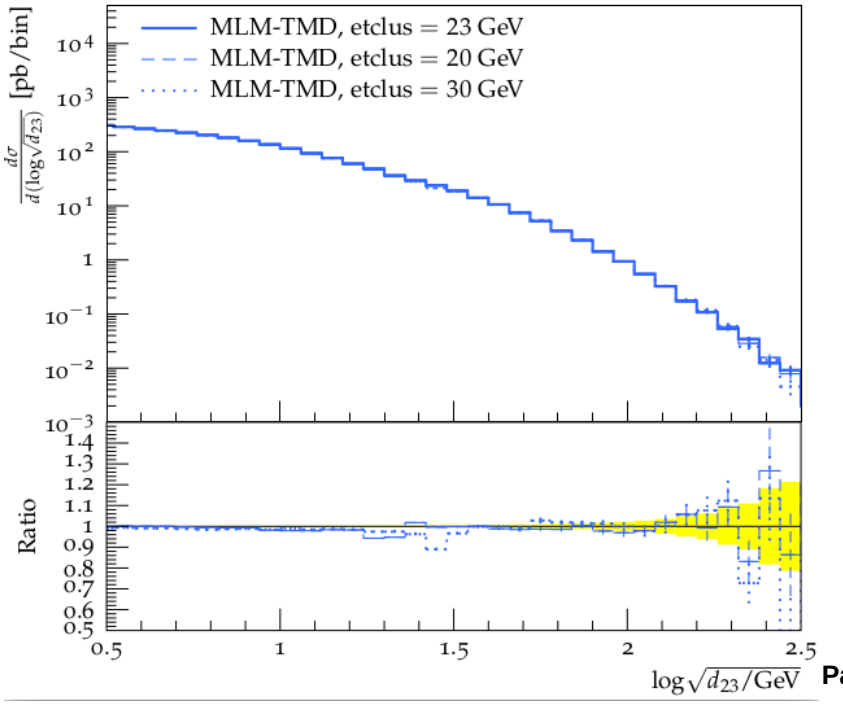
Less than 10% difference is found, only around the merging scale

Systematics

Differential jet rates







Systematics

Pt of the jets