

Energy Flow and Charged Particle Spectra in DIS

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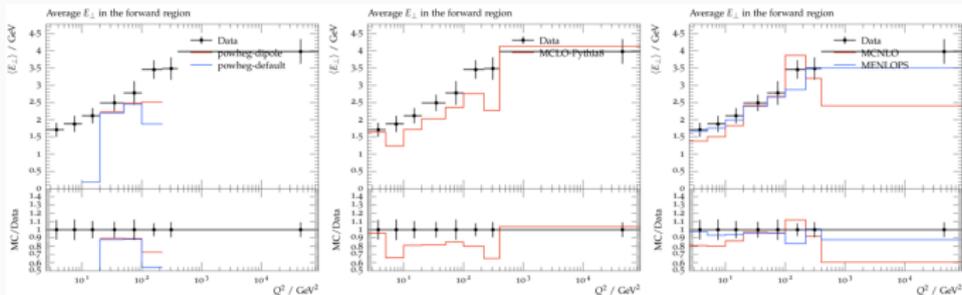
Study of the global properties of the hadronic final states in deep inelastic scattering events.

- Average Transverse Energy
- Transverse Energy Flow
- Transverse Energy-Energy Correlation
- Scaled Charged Particle Spectra

Reference: HERA H1-1994-S2919893 and H1-2000-S4129130

- Different higher-order corrections are applied to the parton-shower in Pythia8
- Powheg default and dipole shower comparison in Herwig
- Matrix-Element Parton Showers in Sherpa

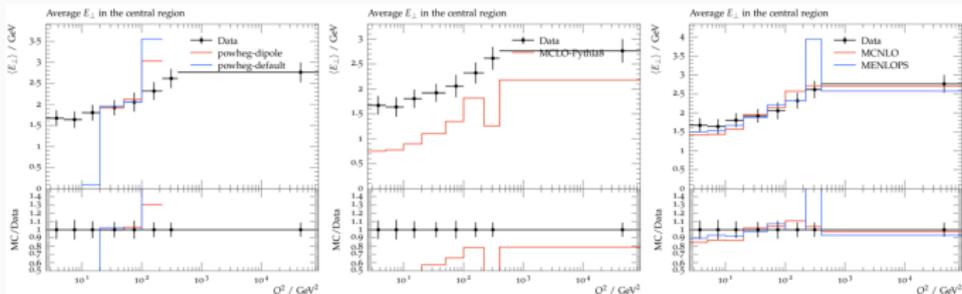
Average E_T as function of Q^2



(1) Herwig7

(2) Pythia8

(3) Sherpa2



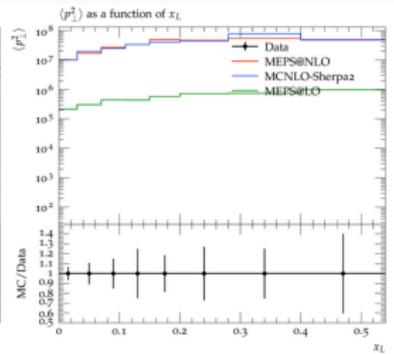
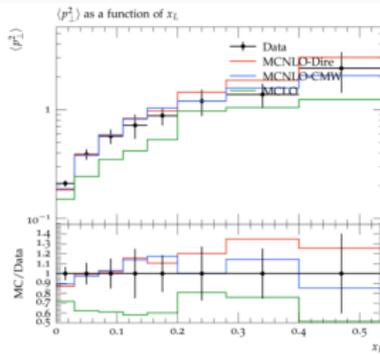
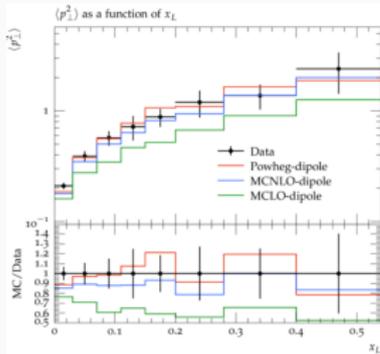
(4) Herwig7

(5) Pythia8

(6) Sherpa2

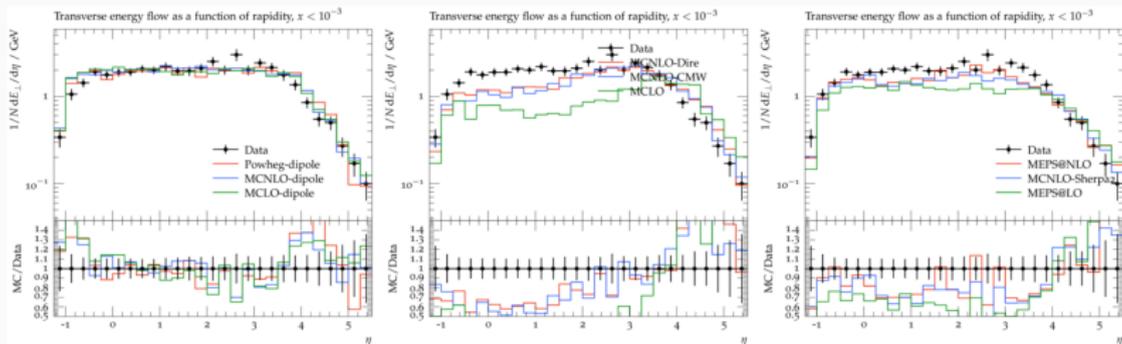
- sherpa2 comparatively better fitting then pythia8 in both region
- in Herwig7 MC generated data deviating substantially

Average p_T^2 as function of x_L



- MCLO correction in pythia8 and Herwig7 has good matching

Transverse Energy Flow ($x < 10^{-3}$ region)



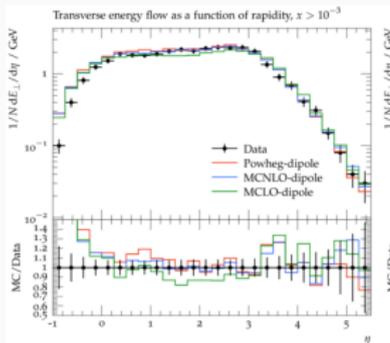
(10) Herwig7

(11) Pythia8

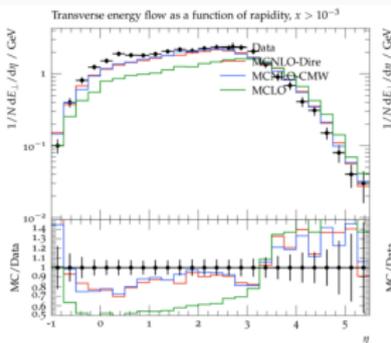
(12) Sherpa2

- Dipole correction are very close to the data in $0 < \eta < 2$ regions in Herwig7
- Sherpa simulations are close to data in $\eta > 3$ regions
- $-1 < \eta < 0$ pythia8 correction close to data

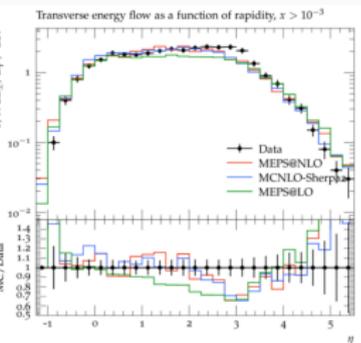
Transverse Energy Flow ($x > 10^{-3}$ region)



(13) Herwig7



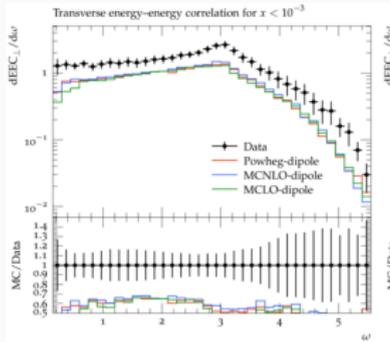
(14) Pythia8



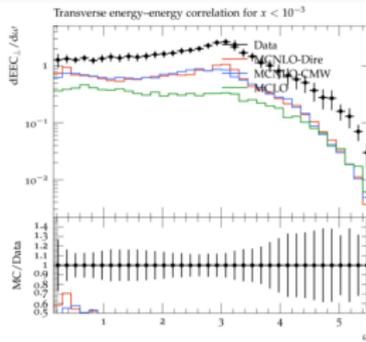
(15) Sherpa2

- Data in higher x regime is well compared with all the MCs
- still all correction close to $\eta = -1$ in Herwig7 do not fit with the real data.
- MCLO in pythia8 deviating significantly

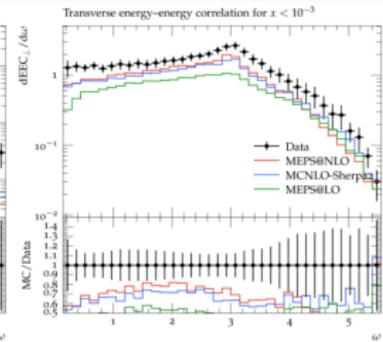
Transverse Energy-Energy Correlation ($x < 10^{-3}$ region)



(16) Herwig7



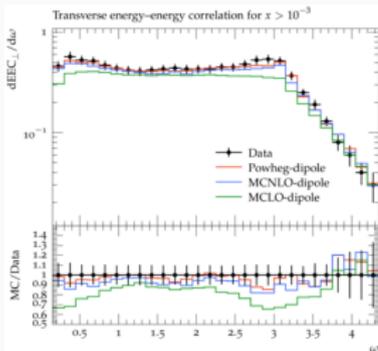
(17) Pythia8



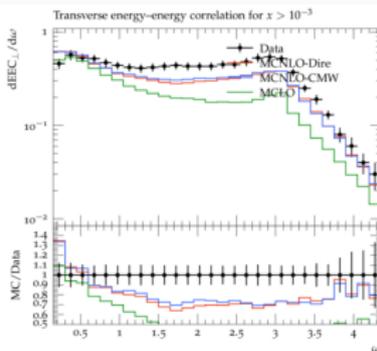
(18) Sherpa2

- All the MCs in this low x -regime fails to explain the data.
- Herwig 7 did not showing any significant difference in all dipole correction

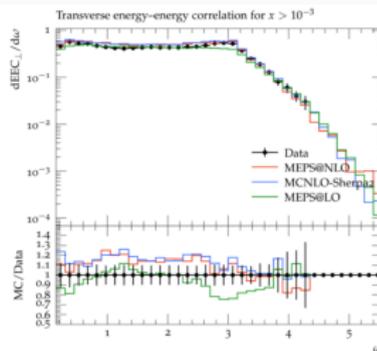
Transverse Energy-Energy Correlation ($x > 10^{-3}$ region)



(19) Herwig7



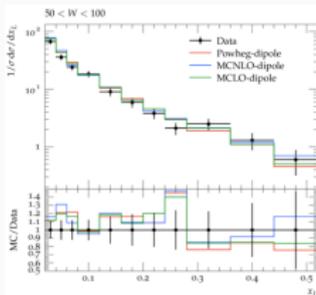
(20) Pythia8



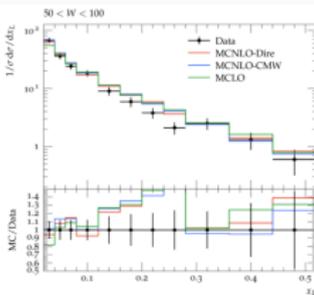
(21) Sherpa2

- MCL0 correction in Sherpa2 has a good matching and fitting
- Pythia8 has a good matching but MCL0 correction in Herwig 7 has good fitting

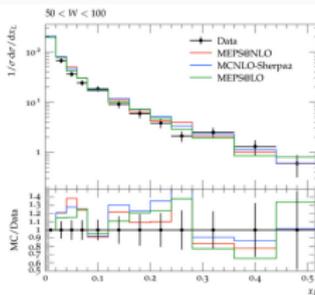
Scaled Longitudinal Momenta for different W ranges



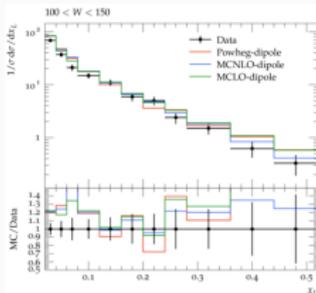
(22) Herwig7



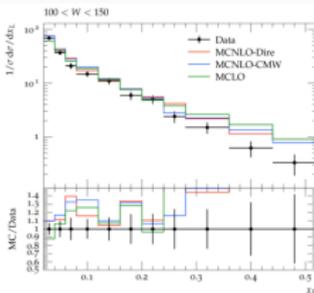
(23) Pythia8



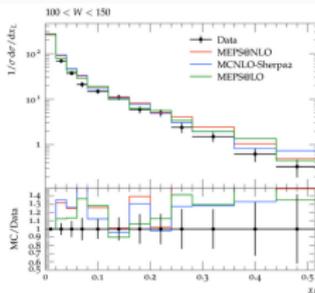
(24) Sherpa2



(25) Herwig7

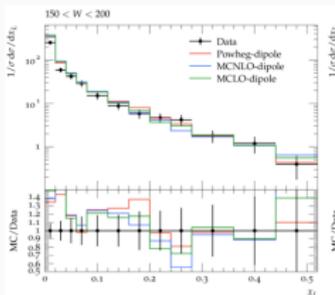


(26) Pythia8

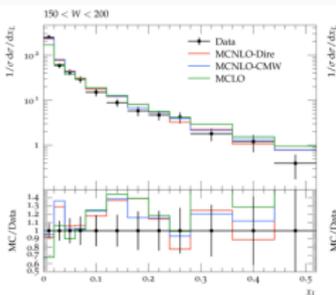


(27) Sherpa2

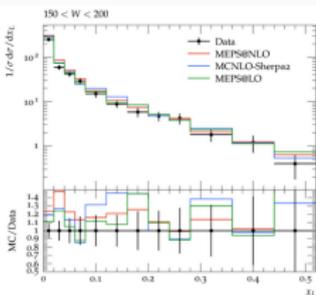
Scaled Longitudinal Momenta for different W ranges



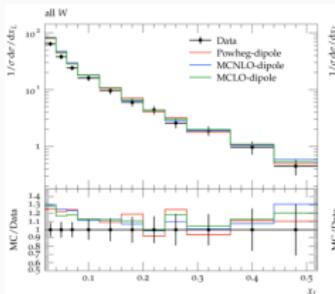
(28) Herwig7



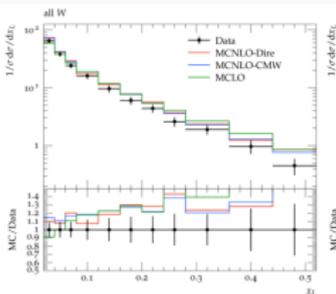
(29) Pythia8



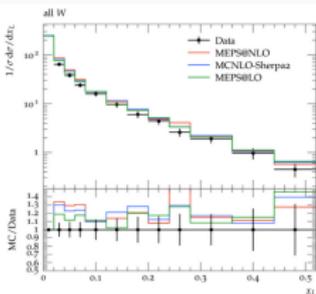
(30) Sherpa2



(31) Herwig7



(32) Pythia8



(33) Sherpa2

- There is not so much significant difference in all correction in different MCs

THANK YOU

Event Kinematics

The event kinematics are determined using information from both the scattered electron(positron) and the final hadronic system.

- $Q^2 = 4E_e E_e' \cos^2(\theta_e/2)$
- $y = \sum \frac{E_h - p_{z,h}}{2E_e}$
- $x = \frac{Q^2}{ys}$
- $W^2 = m_p^2 + sy - Q^2$
- Scaled Longitudinal Momentum: $x_L = \frac{p_z^*}{2W}$
- Energy-Energy Correlation:
$$\Omega(\omega) = \frac{1}{N\Delta\omega} \sum_N \sum_{ij, i \neq j} \frac{E_{Ti} E_{Tj}}{(p_{Te})^2} \int_{\omega - \frac{\Delta\omega}{2}}^{\omega + \frac{\Delta\omega}{2}} \delta(\omega' - \omega_{ij}) d\omega'$$
- Omega: $\omega_{ij} = (\eta_i - \eta_j)^2 + (\phi_i - \phi_j)^2$