

# Discussion session - hadronization

Yuri Kovchegov - Andrea Signori

Argonne National Laboratory

QCD evolution 2019

May 15, 2019



# Hadronization - general

- ▶ can we link FFs to fundamental quantities in QCD?



# Hadronization - general

- ▶ can we link FFs to fundamental quantities in QCD?
- ▶ can LQCD have a word? Quasi/Pseudo-FFs, good lattice cross sections?  
Or other methods like DSEs?



# Hadronization - experiments

- ▶ Present and upcoming measurements at Belle/BES/JLab/LHC(b), ... :  
which observable?
- ▶ “EIC without input from B-factories? Unlikely” (R. Seidl)
- ▶ ...



# Hadronization - pheno/extractions

- ▶ what's the agreement between JAM19 and the previous extractions? (we discussed only PDFs on Monday)



# Hadronization - pheno/extractions

- ▶ what's the agreement between JAM19 and the previous extractions? (we discussed only PDFs on Monday)
- ▶  $e^+e^- \rightarrow hX$  with  $q_T$ -dependence wrt thrust axis: theory = ?



# Hadronization - pheno/extractions

- ▶ what's the agreement between JAM19 and the previous extractions? (we discussed only PDFs on Monday)
- ▶  $e^+e^- \rightarrow hX$  with  $q_T$ -dependence wrt thrust axis: theory = ?
- ▶ issues at large transverse momentum (not only in  $e^+e^-$ )
- ▶ ...



# Hadronization - jets/1

- ▶ TMD FFs: “standard” and in-jet (defined wrt a certain axis - multiple definitions)
- ▶ besides the definition at the perturbative level (soft functions, etc.), are there non-perturbative parts (intrinsic  $k_T$ )? Are they universal?
- ▶ E.g.: are the NP corrections for the unpolarized TMD FF  $D_1$  the same for the in-jet  $D_1$  and the “standard”  $D_1$ ?





# Hadronization - jets/1

- ▶ TMD FFs: “standard” and in-jet (defined wrt a certain axis - multiple definitions)
- ▶ besides the definition at the perturbative level (soft functions, etc.), are there non-perturbative parts (intrinsic  $k_T$ )? Are they universal?
- ▶ E.g.: are the NP corrections for the unpolarized TMD FF  $D_1$  the same for the in-jet  $D_1$  and the “standard”  $D_1$ ?
- ▶ to which extent should we pursue processes that involve jet functions wrt to standard fragmentation functions? (such as jet-SIDIS vs 1h-inclusive SIDIS)



# Hadronization - jets/1

- ▶ TMD FFs: “standard” and in-jet (defined wrt a certain axis - multiple definitions)
- ▶ besides the definition at the perturbative level (soft functions, etc.), are there non-perturbative parts (intrinsic  $k_T$ )? Are they universal?
- ▶ E.g.: are the NP corrections for the unpolarized TMD FF  $D_1$  the same for the in-jet  $D_1$  and the “standard”  $D_1$ ?
- ▶ to which extent should we pursue processes that involve jet functions wrt to standard fragmentation functions? (such as jet-SIDIS vs 1h-inclusive SIDIS)
- ▶ new in-jet correlations inspired by the di-hadron formalism? (discussed in FF2019, Duke U.)



# Hadronization - jets/1

- ▶ TMD FFs: “standard” and in-jet (defined wrt a certain axis - multiple definitions)
- ▶ besides the definition at the perturbative level (soft functions, etc.), are there non-perturbative parts (intrinsic  $k_T$ )? Are they universal?
- ▶ E.g.: are the NP corrections for the unpolarized TMD FF  $D_1$  the same for the in-jet  $D_1$  and the “standard”  $D_1$ ?
- ▶ to which extent should we pursue processes that involve jet functions wrt to standard fragmentation functions? (such as jet-SIDIS vs 1h-inclusive SIDIS)
- ▶ new in-jet correlations inspired by the di-hadron formalism? (discussed in FF2019, Duke U.)
- ▶ what progress is needed in the factorization (see also Z. Kang’s, H. Li’s talks today)
- ▶ ...



# Hadronization - jets/2

- ▶ twist-3 FF and the quark/jet mass  $M_j$ : observable? Is there a  $\delta(z)$ ?



# Hadronization - jets/2

- ▶ twist-3 FF and the quark/jet mass  $M_j$ : observable? Is there a  $\delta(z)$ ?
- ▶ concept of jet mass in SCET; what about sub-leading twist structures?



# Hadronization - jets/2

- ▶ twist-3 FF and the quark/jet mass  $M_j$ : observable? Is there a  $\delta(z)$ ?
- ▶ concept of jet mass in SCET; what about sub-leading twist structures?
- ▶ contribution of  $M_j$  to  $g_2$ : a contribution from hadronization [subtract mass-related effects from the measurements to compare with (future) lattice calculations]
- ▶ ...

