



Contribution ID: 86

Type: **not specified**

## Multivariable evolution in parton showers with initial state partons

*Monday 31 October 2022 15:00 (15 minutes)*

One can use more than one scale variable to define the family of surfaces in the space of parton splitting parameters that define the evolution of a parton shower. In parton shower with initial state parton we need a more sophisticated analysis because the evolution of parton distribution functions must be coordinated with the parton shower evolution. We make the needed connections more precise than in our earlier work, even for the case of just one scale variable. Then we develop an example with three scale variables, which leads to advantages compared to the usual shower formulation with only one scale variable. We provide results for Drell-Yan muon pair production.

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**Session Classification:** Parton shower systematics and TMDs