

- Arrived at CERN in January 2014 (for 5y), on leave from Oxford University
- Various minor projects (WW excess, heavy-quark mass effects in Higgs production, improved description of various VBF processes and implementation of BSM effects through effective operators ...)
- But main focus of coming years will be on the HICCUP project (High Impact Cross-Section Calculations for LHC) funded via consolidator ERC grant 2013

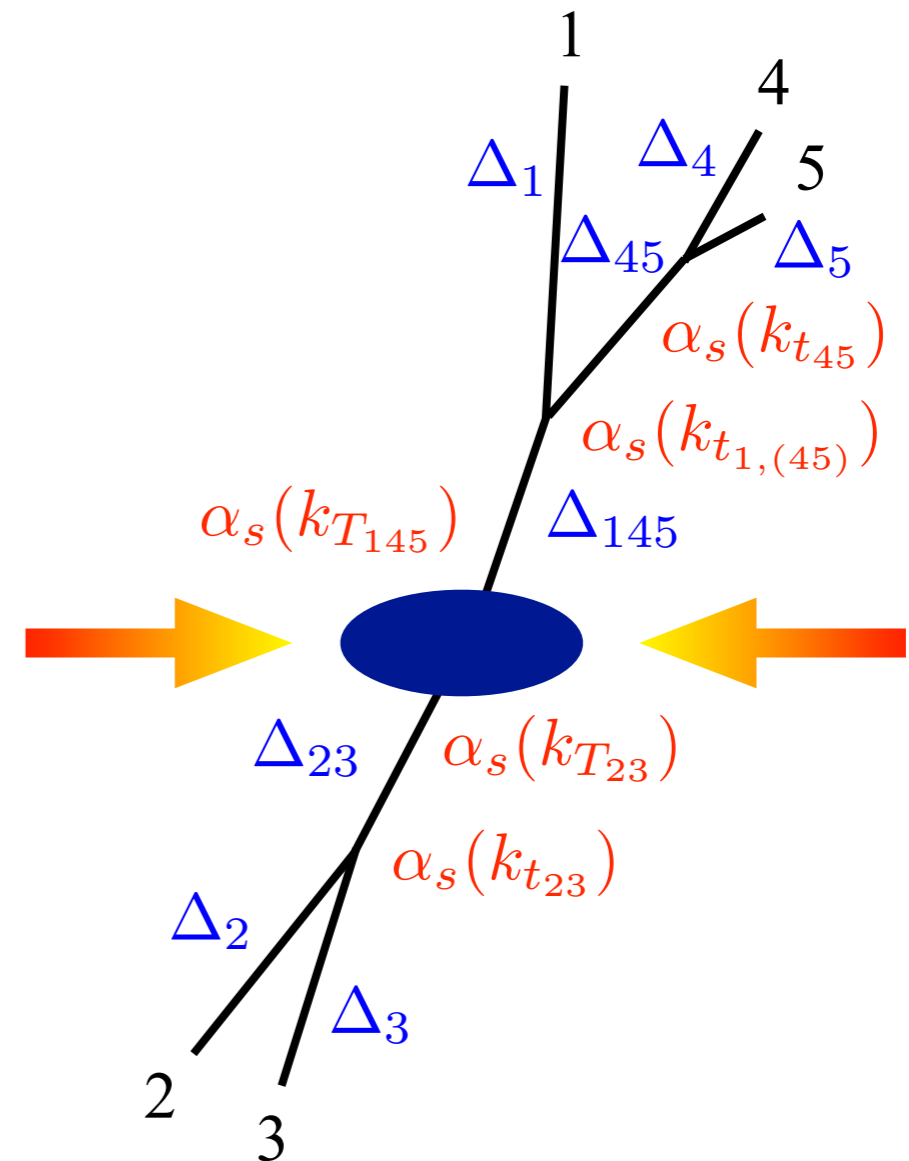
Goals of HICCUP

- merge $X, X+1, X+2\dots$ jet NLO calculations ($X = H, W, Z, tt \dots$) using MiNLO
- first event generator accurate at NNLO level including all-order parton-shower effects for generic $2 \rightarrow 1$ and $2 \rightarrow 2$ processes (NNLOPS already done for Higgs and Drell Yan)
- design an algorithm for automated NNLL resummation of final state observables

Reduction of theory uncertainties by a factor 2-4 for key LHC observables + match high accuracy at future colliders

MiNLO (Multi-scale Improved NLO) method:

- **scales set a priori** according to the kinematics of the underlying event (à la CKKW)
- **appropriate Sudakov form factor are included** to improve the description of low transverse momentum regions



Reminder: a Sudakov form factor Δ encodes the probability to evolve from one scale to the next without a resolvable branching above a given resolution

Key features of MiNLO predictions

- result is NLO accurate (scale dependencies NNLO)
- accuracy in Sudakov regions is leading logarithmic (or better)
- procedure simple to implement in any NLO calculation
- $X + n$ jet cross-sections are finite without any jet cut
- merging without merging scale: e.g. $H + 1$ jet calculation can be made NLO accurate also for inclusive spectra (without jet cuts)

MiNLO+POWHEG deals simultaneously with three issues of pure NLO calculations (scale choice, merging different NLO calculations, merging to parton shower) + provides **a way to achieve NNLO+PS** (very timely given recent remarkable progress in NNLO)

Example: let's take

- Higgs at NLO+PS: **H-NLOPS**
- Higgs + one jet at NLO+PS: **HJ-NLOPS**
- a merged generator that is NLO+PS for H and HJ: **H+HJ-NLOPS**
- Higgs at NNLO+PS: **H-NNLOPS**

and compare the accuracies of these generators

	inclusive H	H+ 1jet (inclusive)	H+2jets (inclusive)
H-NLOPS	NLO	LO	soft-col. approx
HJ-NLOPS	divergent	NLO	LO
H+HJ-NLOPS	NLO	NLO	LO
H-NNLOPS	NNLO	NLO	LO

Conclusion: the merged H+HJ-NLOPS generator almost does the right job.

Future: understand merging with higher jet multiplicity + better way to go to NNLO+PS (now computing intensive, feasible only for “simple” processes)