Objective Performance Metrics for Event Generator Tuning

Scientific Achievement

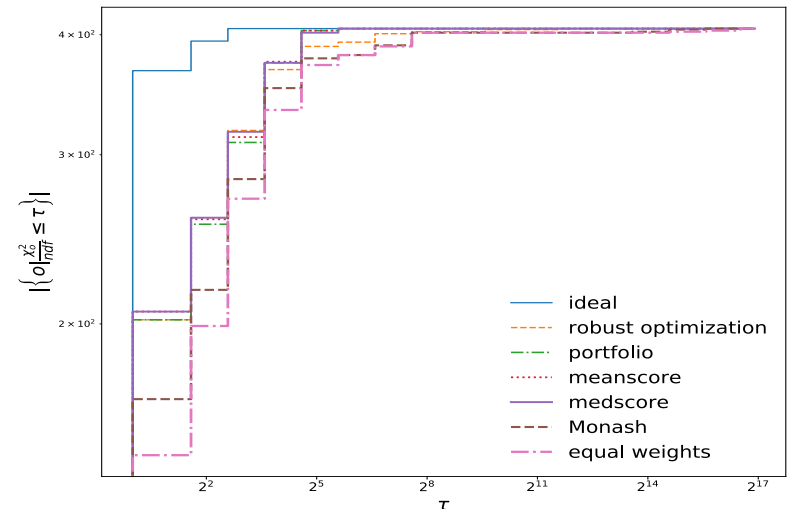**Developed objective metric for comparing the quality of different HEP event generator tunes that is based on multi-objective optimization theory.**

Significance and Impact

Objective metric and automated optimizations replace subjective expert opinion and achieve improvements over state-of-the-art tunes.

Research Details

- Rigorous definition of ideal and worst-case tune using multi-objective optimization.
- Graphical representation based on performance profiles
- Definition of objective metrics based on area enclosed between (unattainable) ideal tune and optimized tune

Comparison of best-case ("ideal"), state-of-the-art ("Monash"), equal weight, and optimized (others) tunes in terms of multi-objective metric.

Model	Objective Metric Area
Medscore	4.2200e+02
Meanscore	4.2400e+02
Portfolio	4.3600e+02
Robust Optimization	4.7000e+02
Monash	6.5100e+02
Equal Weights	7.3300e+02

Objective metric that allows us to compare the quality of different tunes. Cells with lighter color are closer to the ideal case.