

Model-Independent Partial Wave Analysis using GooFit

The GooFit framework has been extended to fit the real and imaginary components of the S -wave amplitude of a three-body decay using a spline interpolation at a fixed number of “control points”.

- A GPU-friendly, model-independent PWA algorithm has been studied using nVidia GPUs to evaluate the likelihoods of (toy Monte Carlo) data and calculate the normalization integrals numerically. The same algorithm runs (more slowly) on Intel CPUs under OpenMP.
- An older generation mobile GPU (the nVidia GeForce GT 650M with 384 cores) provides excellent performance; a newer HPC GPU board (the Tesla K40c with 2880 cores) provides better performance, but not in proportion to the number of cores.
- Increasing the number of phase space points used to evaluate the normalization integrals numerically substantially improves the determination of the fit parameters. Although time-consuming, the high speed of the GPUs makes this tractable.

Fit Approach and Some Results

- 30 “control points” are chosen as anchors for the spline fit, as indicated in the figure below;
- The input values (black markers) and fitted values (red markers) from fitting 100K toy MC events are shown in the top plots to the right.
- The lower plots to the right show the improvement in fit quality as the grid spacing is reduced from 0.01 GeV^2 (purple) to 0.004 GeV^2 (red) to 0.001 GeV^2 (blue).

