Contribution ID: **14** Type: **not specified**

SysVar: Consistent and scalable treatment of systematic uncertainties in template-based analyses

Tuesday, 8 September 2026 11:15 (15 minutes)

SysVar is a Python package offering a complete workflow for handling and propagating systematic uncertainties in high-energy physics analyses that rely on templates built from simulated data.

Propagating systematic uncertainties from correction weights into templates, while keeping the correlations in the signal extraction variables intact, requires increased bookkeeping as analyses grow in complexity. SysVar addresses this with a lightweight API that abstracts away most of the bookkeeping involved in applying correction weights to simulated events, building systematic variations, and histogramming both nominal and varied templates. This simplifies and automates essential workflows for high-precision measurements. Uncertainties are propagated consistently by building the full covariance matrix over the multidimensional analysis space and using Principal Component Analysis to obtain orthogonal eigenvariations for the subsequent statistical fits. Correlations are retained through a controlled compression of the systematic space, which reduces the number of nuisance parameters. Analyses are specified entirely through a declarative configuration, supporting reproducibility and scalability, and built-in visualization tools aid diagnostics, debugging, and studies of uncertainty models.

SysVar is intended as a drop-in layer between reconstruction ntuples and model-building frameworks, with native output for cabinetry and pyhf. In this talk we illustrate its use by combining two orthogonal and independent pseudo-measurements that profit from the consistent treatment of systematic correlations encoded in the template shapes. While it was developed in the Belle II context, SysVar is open-source, pip-installable, and experiment-agnostic.

Primary authors: TSAKLIDIS, Ilias; AGGARWAL, Agrim

Co-authors: ALEXANDRIS, Georgios; FILLINGER, Tristan; DE PIETRO, Giacomo; AKDAG, Melisa-Melek; PRIM, Markus; BERNLOCHNER, Florian

Presenter: AGGARWAL, Agrim

Session Classification: Talks