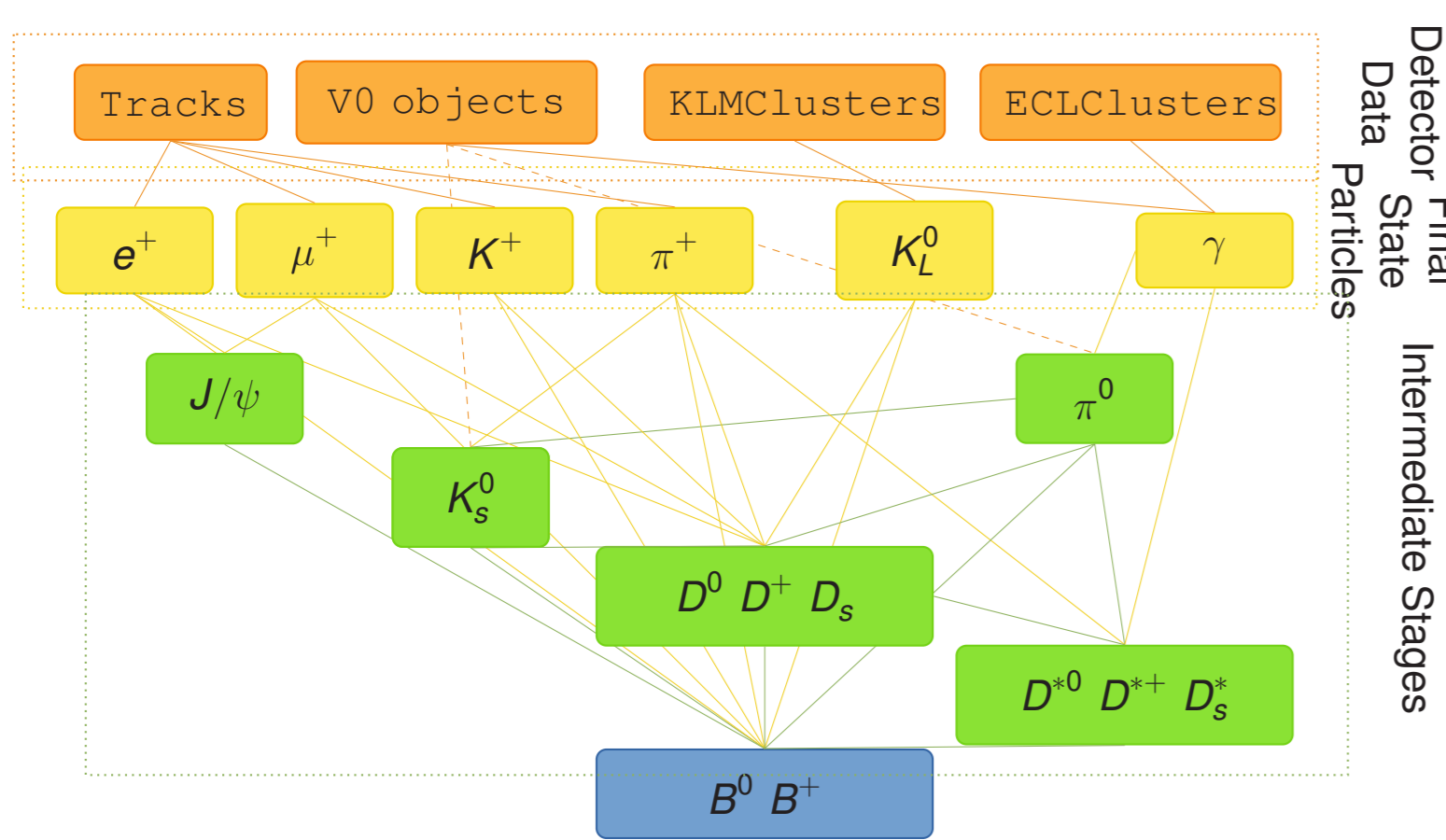
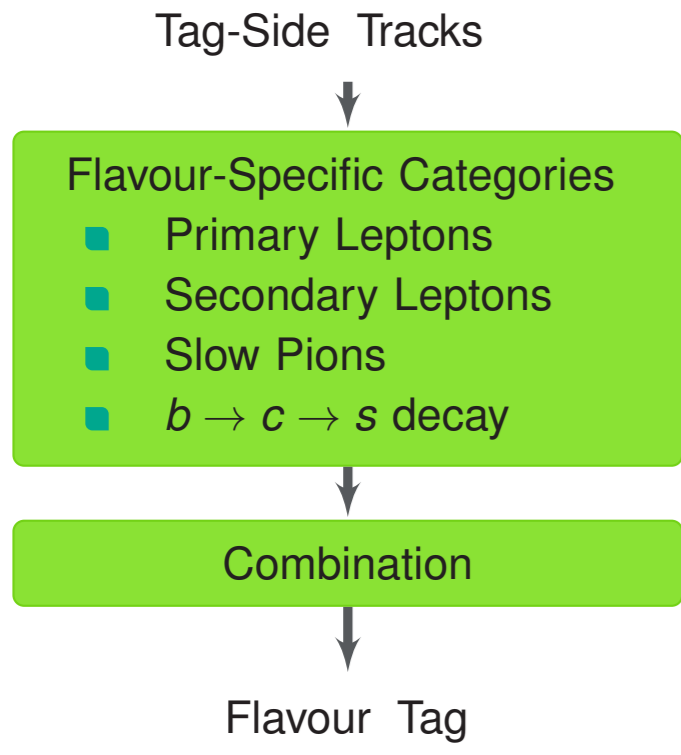


Full Event Interpretation¹

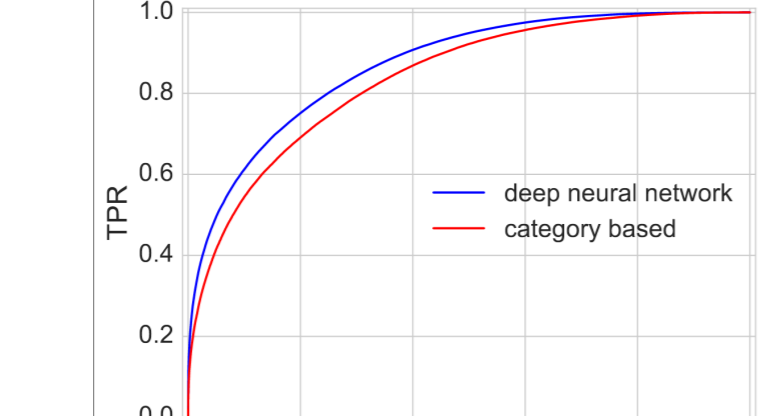


Flavour Tagging

Category-based²

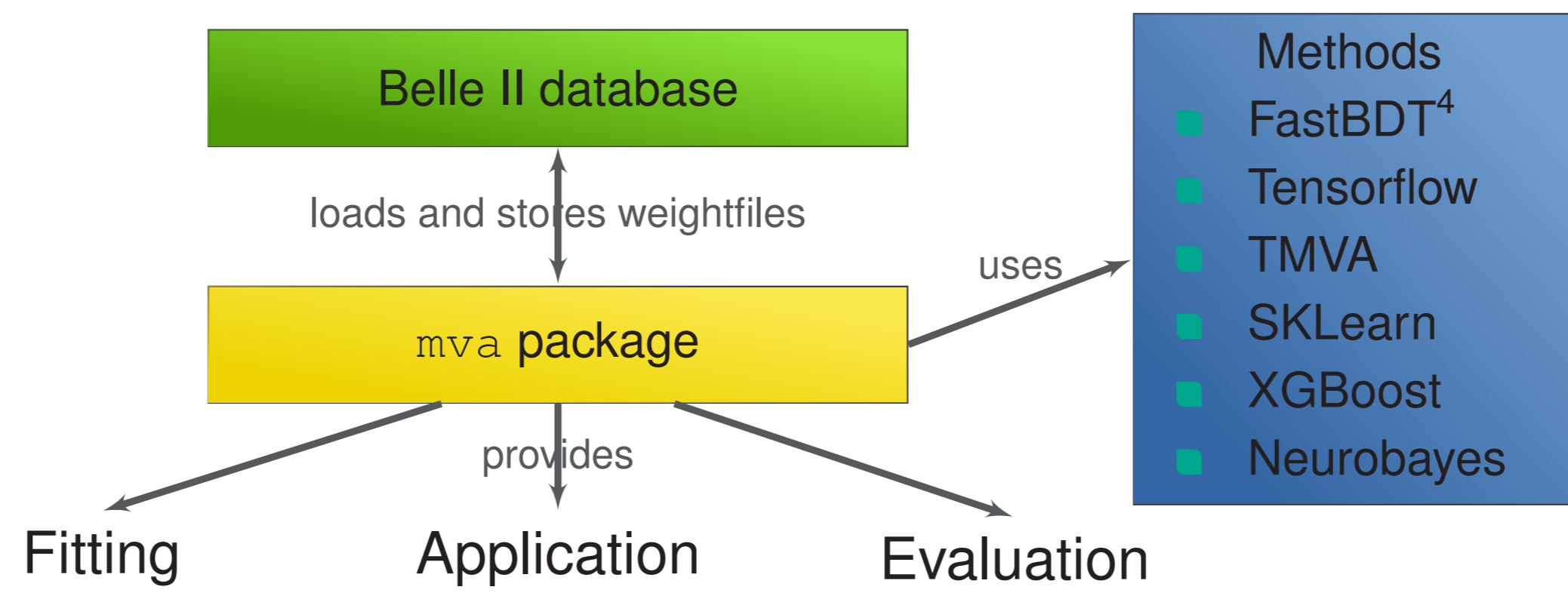


Deep-Learning³



- Deep neural network
- Low-level features (momenta, pid)

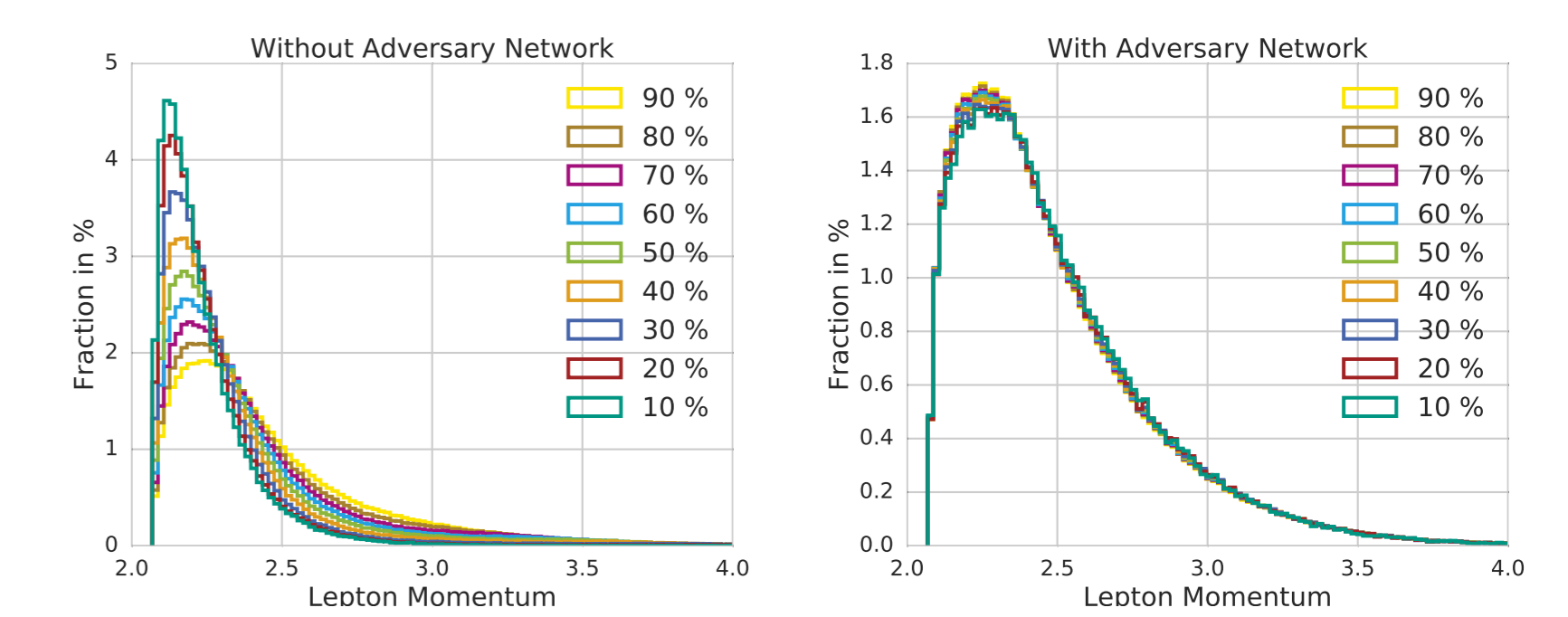
Multivariate Analysis Algorithms



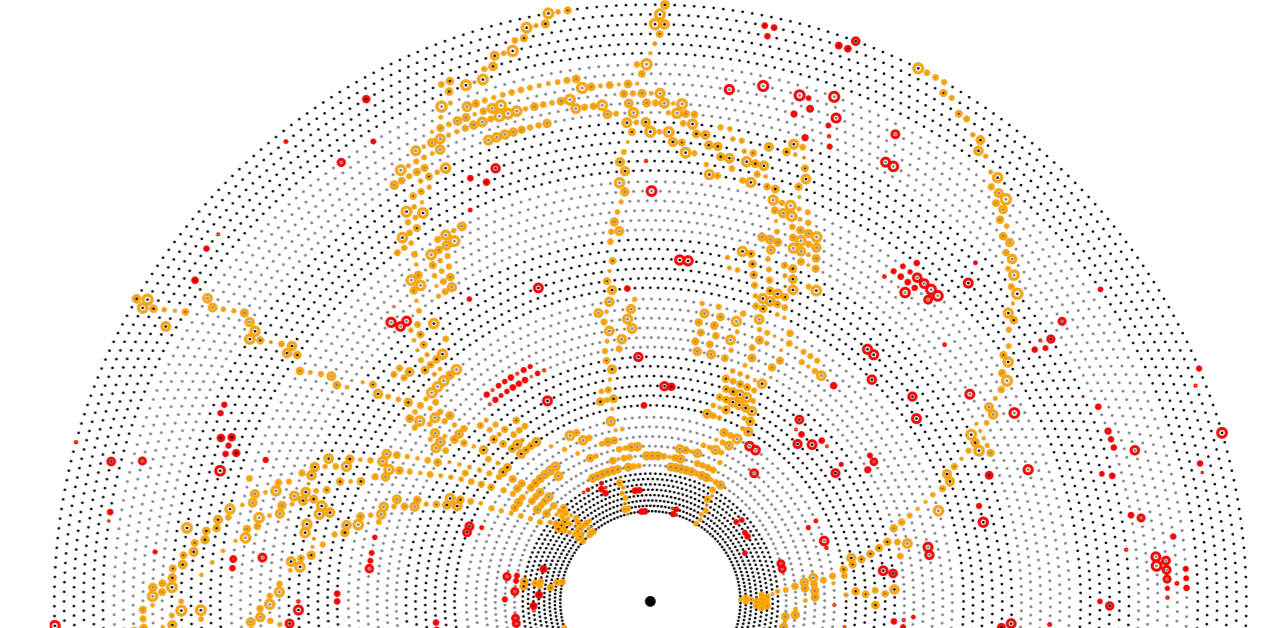
- All major mva frameworks are supported
- Run-dependent method-agnostic weightfiles
- Automatable fitting, application and evaluation
- Used in reconstruction and final analysis
- Data-driven fitting techniques like sPlot
- Speed-optimized and cache-friendly BDTs as standard method

Continuum Suppression

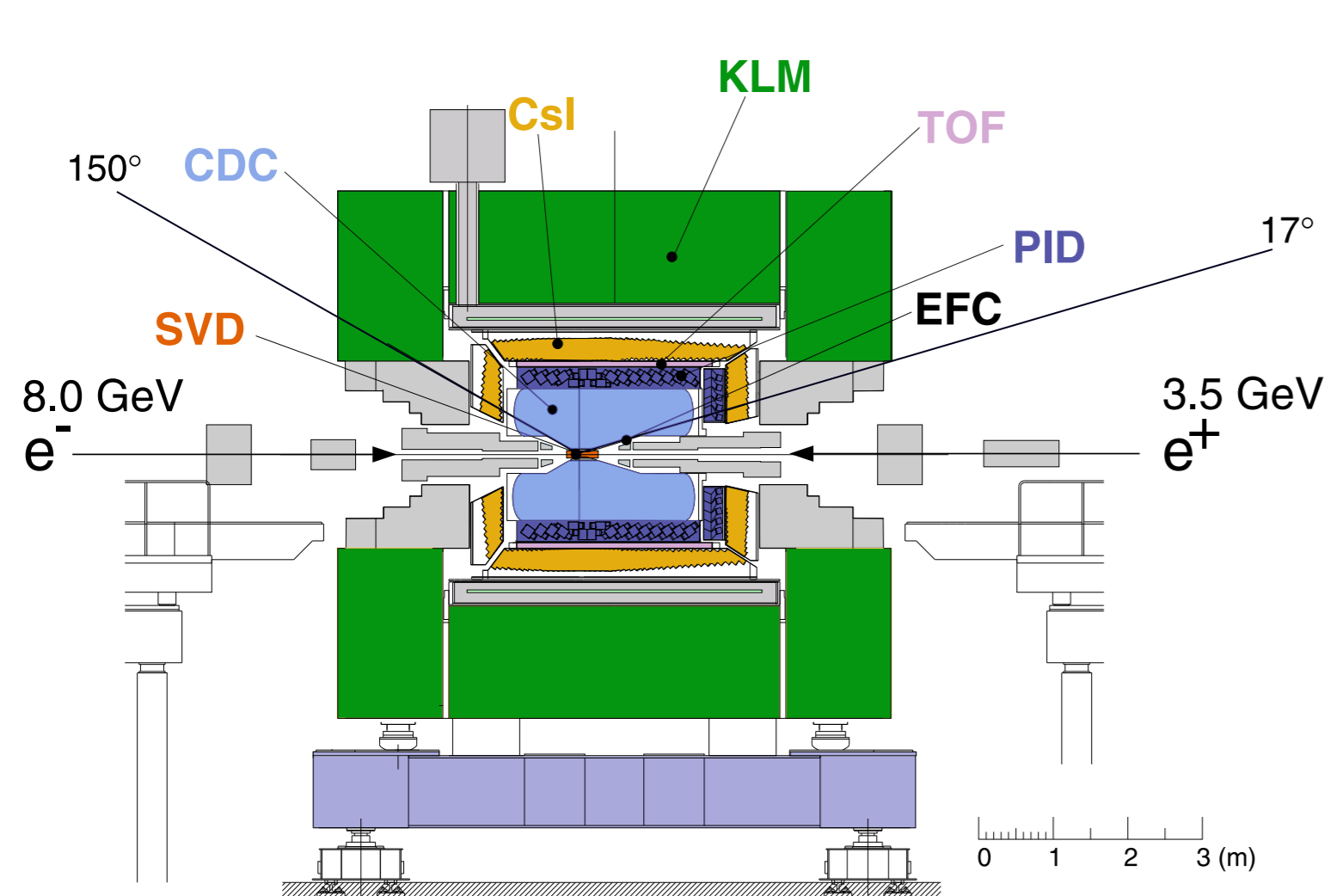
- Deep-learning with low-level features
- Problem: Dependency on fit variable z
- Learning to pivot⁵ $P(\hat{y}|z) = P(\hat{y}|z')$



Background Hit Rejection⁶

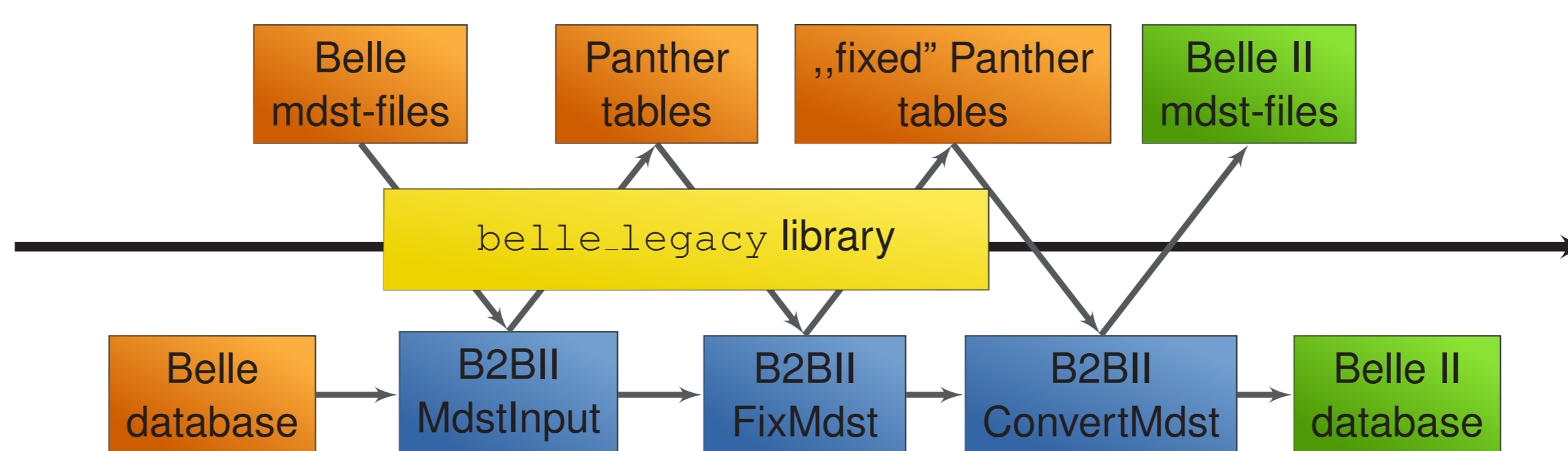


Belle

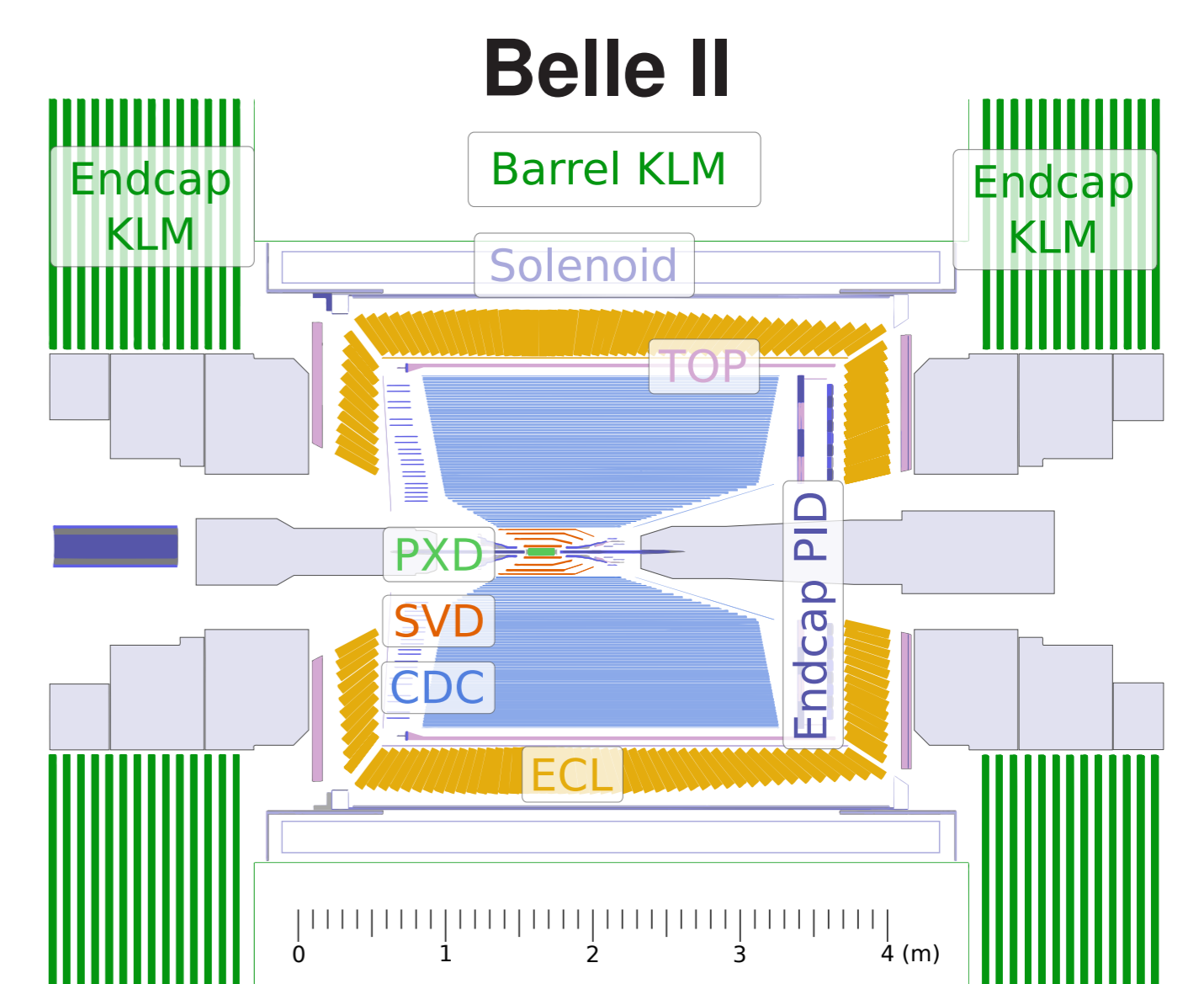


- $\approx 1\text{ab}^{-1}$ recorded data
- $> 6\text{ab}^{-1}$ Monte Carlo simulation
- > 10 years of machine condition data

Belle to Belle II Conversion

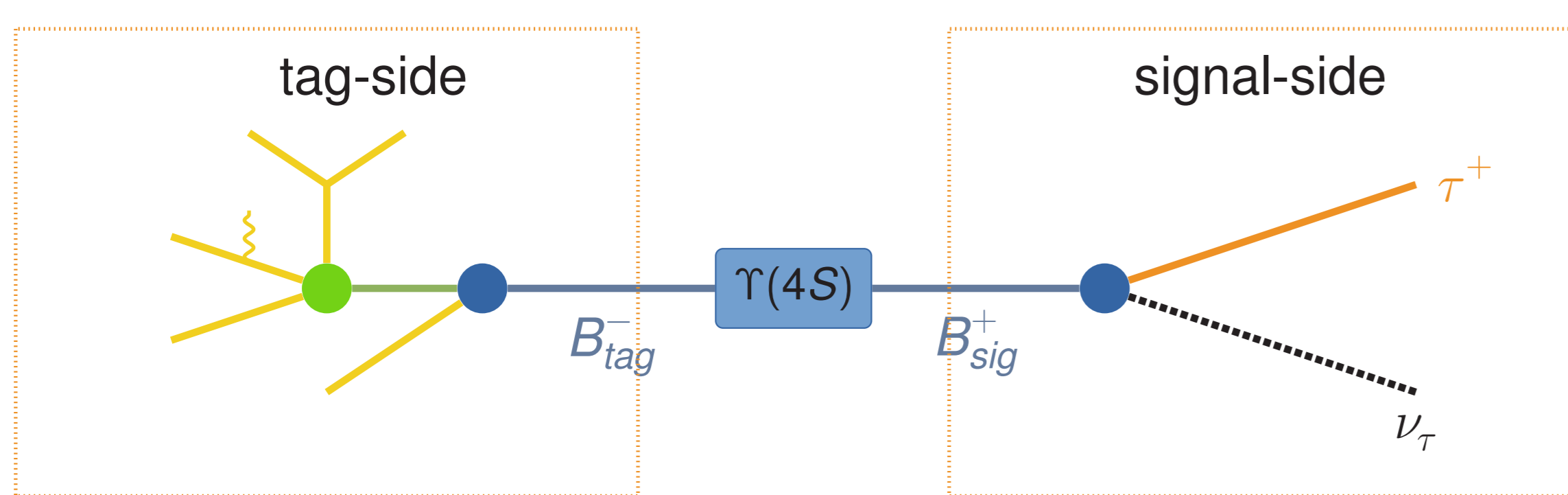


- Access to old data-format via `belle_legacy`
- Conversion of PANTHER-tables to ROOT-objects
- Validation of physical quantities before and after



- Validation of new software on data
- Calibration of new algorithms on data
- Replication of Belle measurements

Measurement of $B \rightarrow \tau \nu$



- Performed on Belle data (via `b2bii`) and Belle II MC
- Relies on `mva` package for FEI and CS
- Two tagging methods and five channels allow extensive crosschecks
- Extract branching fraction from fit on extra energy in the ECL

Measurement on full the Belle dataset and sensitivity-study on Belle II MC, using two disjunct tagging methods and five mutually exclusive decays

Used Tagging methods with efficiency (Belle / Belle II) in %

- hadronic 0.52 / 0.62
- semi-leptonic 1.20 / 1.45

Improvement with respect to Belle's Full Reconstruction⁷ in %

- hadronic 85 / 120
- semi-leptonic 84 / 123

Used τ decay modes with branching fraction in %

- $\tau^+ \rightarrow \mu^+ \nu_\mu \bar{\nu}_\tau$ 17.4
- $\tau^+ \rightarrow e^+ \nu_e \bar{\nu}_\tau$ 17.8
- $\tau^+ \rightarrow \pi^+ \bar{\nu}_\tau$ 10.8
- $\tau^+ \rightarrow \rho^+ (\rightarrow \pi^+ \pi^0) \bar{\nu}_\tau$ 25.5
- new channel (3-prong) $\tau^+ \rightarrow a_1^+ (\rightarrow \pi^+ \pi^+ \pi^-) \bar{\nu}_\tau$ 9.3

