KFPartcle Unit Test Development

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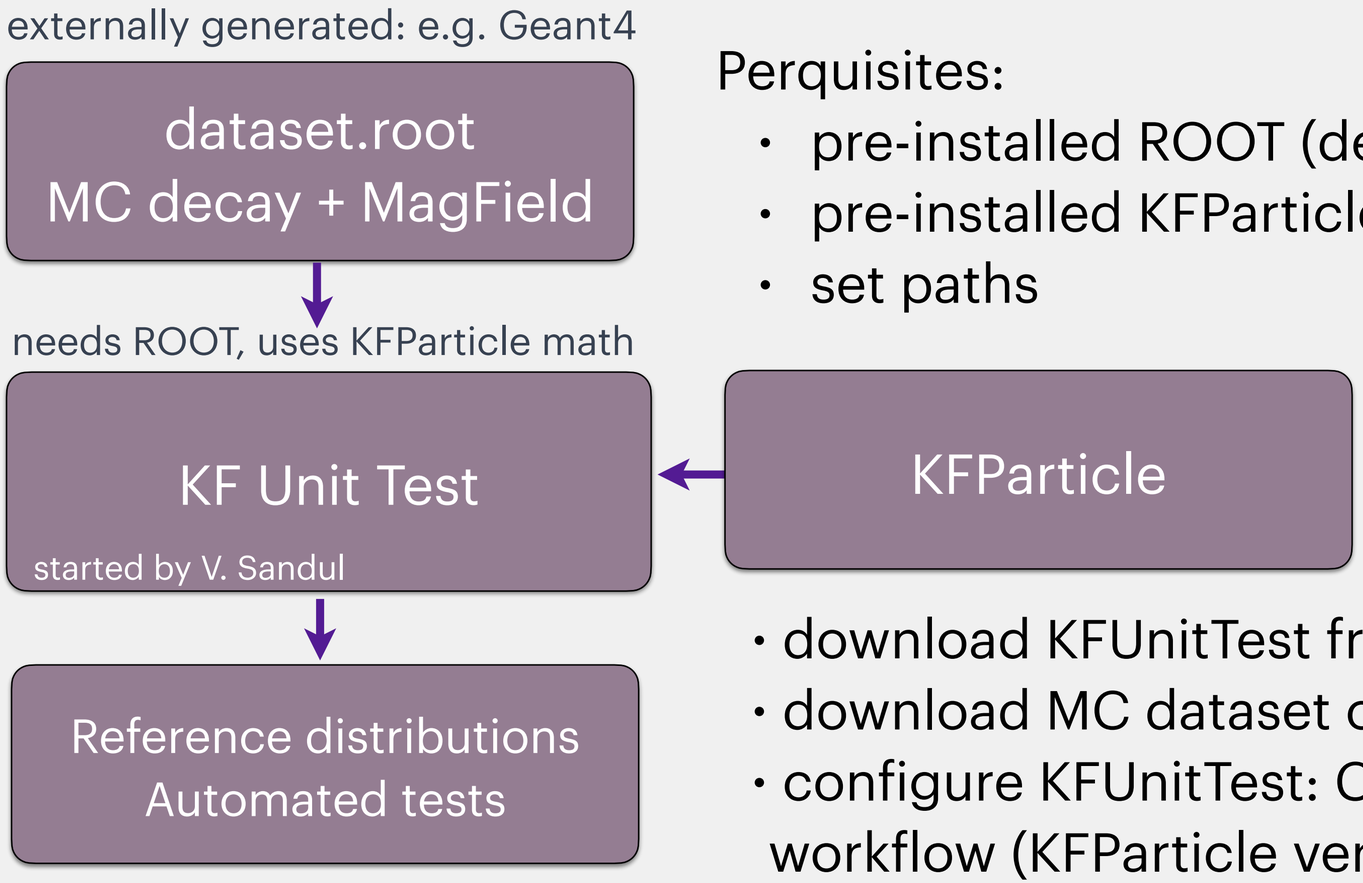
Outline

- Motivation
- KFUnitTest structure & concept
- Output structure
- Test automation
- Recent developments & Plans

Motivation

- Ensuring correctness of KFParticle algorithms
- Verifying performance under various conditions
- Development control: during KFParticle restructuring or new feature implementation
- Implementation of automated tests
- Identify and address edge cases: e.g. check the math at all decay angles

QA framework KFUnitTest



Perquisites:

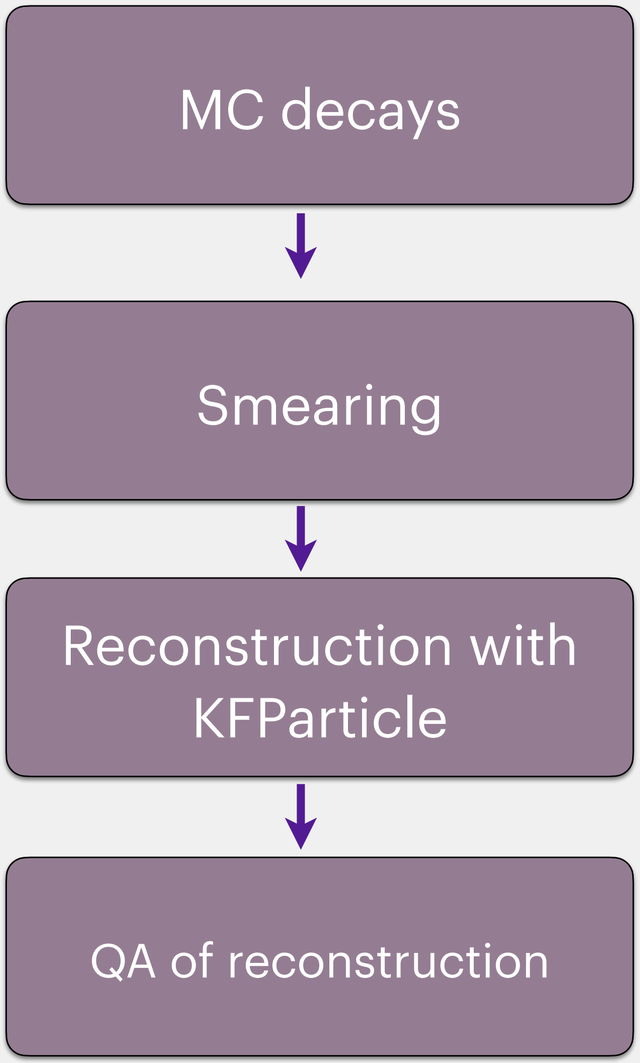
- pre-installed ROOT (developed and tested with ROOT v.6.26.04)
- pre-installed KFParticle Installation
- set paths

- download KFUnitTest from the git repository: no compilation needed
- download MC dataset or generate a dataset with GEANT4
- configure KFUnitTest: ConfigConstants.h — main configuration file for workflow (KFParticle version, reconstruction options, file names)

```
// Mass and topological constraints
const bool SET_MASS_CONSTRAINT_MOTHER = false;//
const bool SET_MASS_CONSTRAINT_DAUGHTERS = true;// set up nonlinear mass constraint

const bool SET_TOPOLOGICAL_CONSTRAINT_MOTHER = true;//must know covmat of primary vertex
const bool SET_TOPOLOGICAL_CONSTRAINT_DAUGHTERS = true;//
```

QA Framework Concept



available MC-dataset or user-generated with e.g. GEANT4

detector-independent smearing inside KFUnitTest

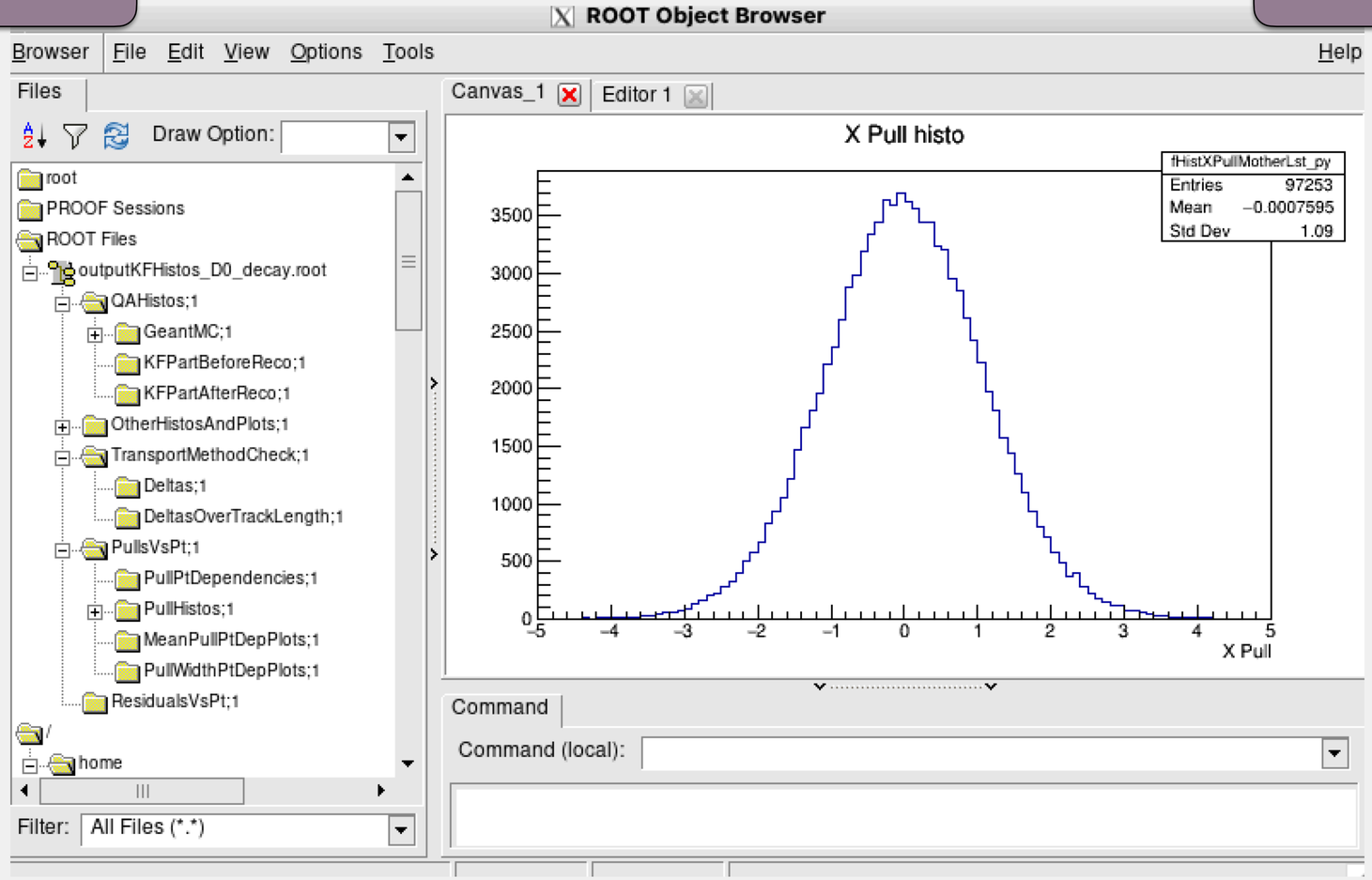
user-defined simple reco scenario (e.g. constraints) with KFParticle math

compare reco against mc-data: pulls, residuals, transport

Output file structure

QA histograms

Reconstruction trees



Output file structure

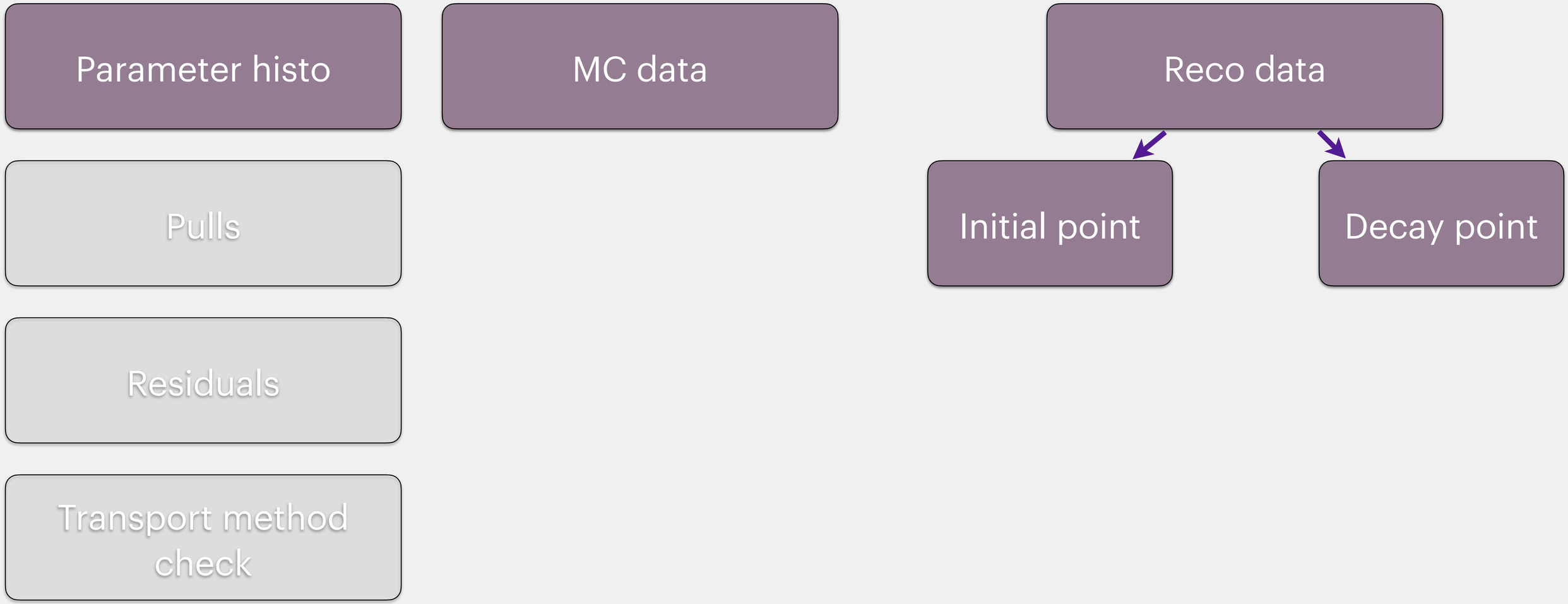
Parameter histo

Pulls

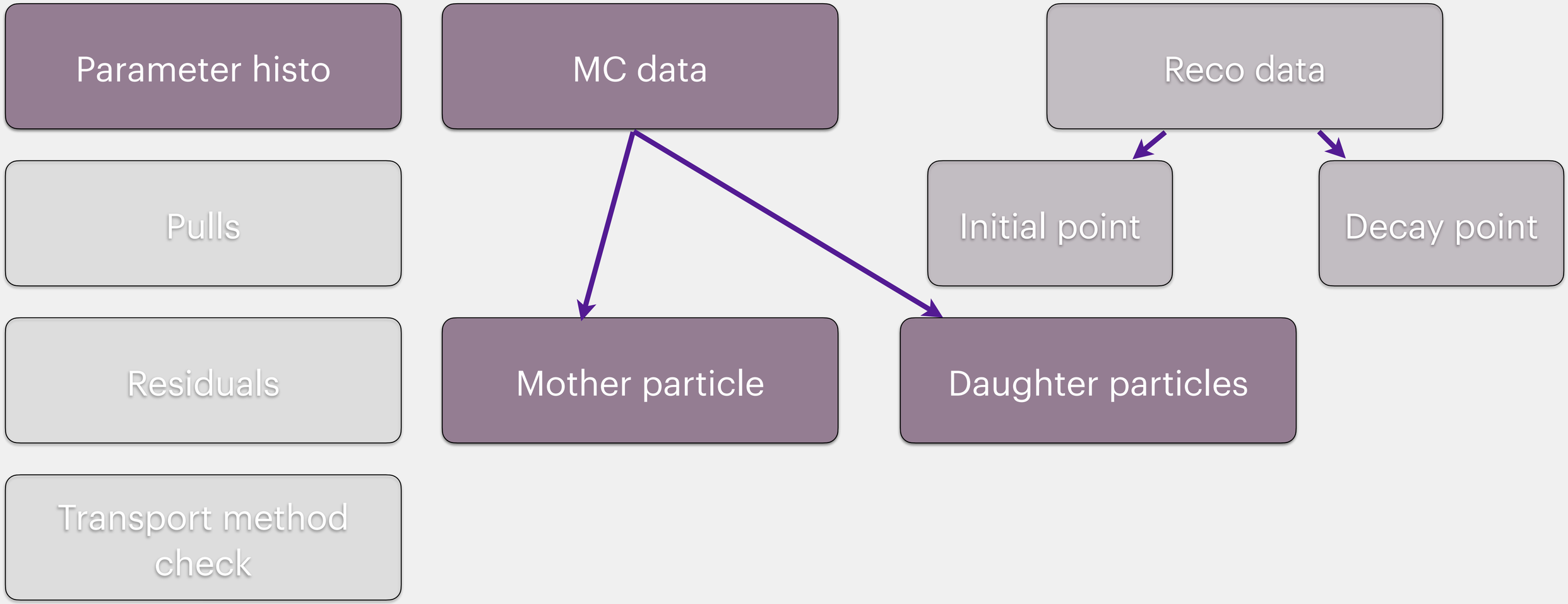
Residuals

Transport method check

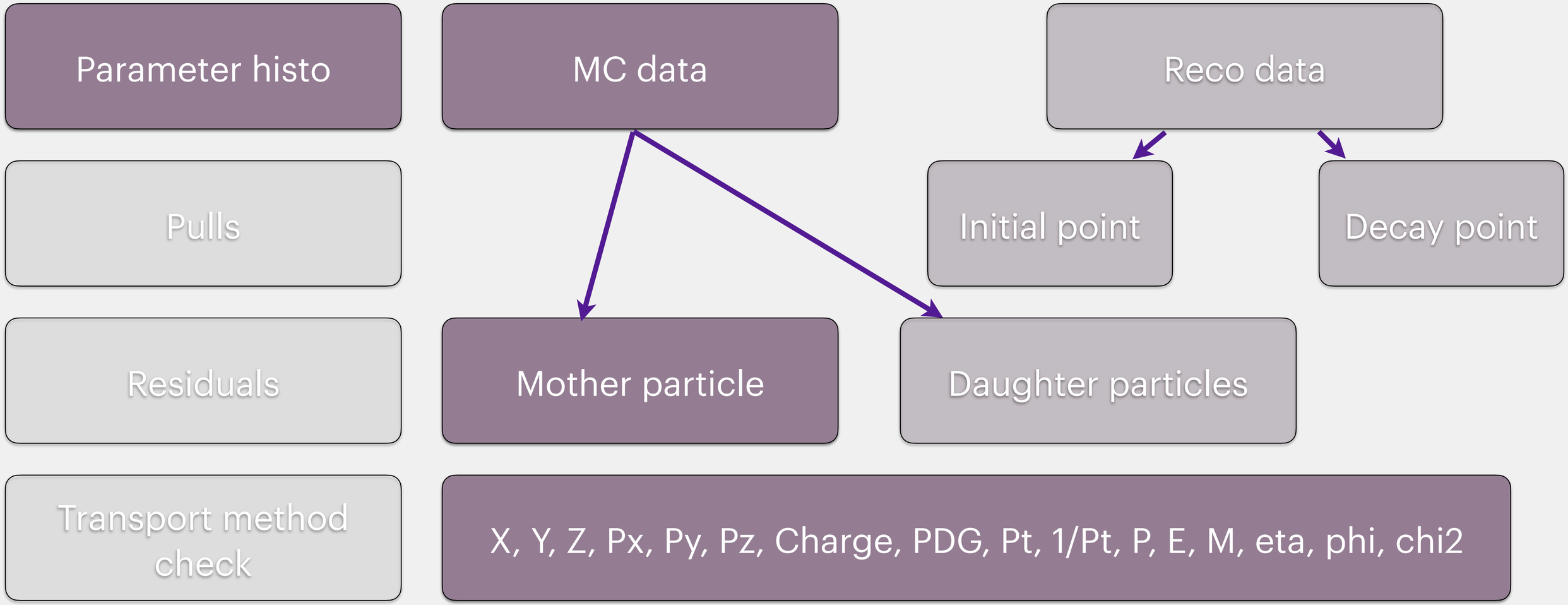
Output file structure



Output file structure



Output file structure



Output file structure

Parameter histo

Pulls

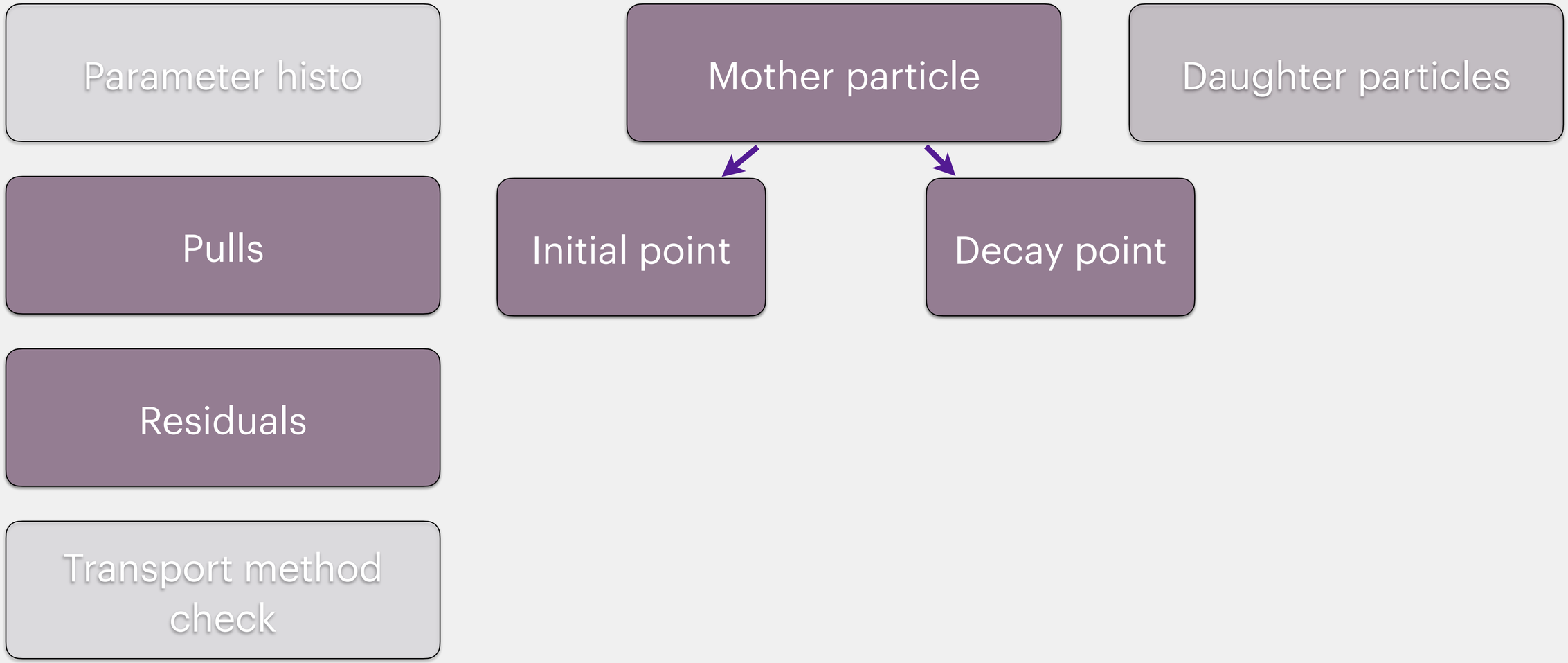
Residuals

Transport method check

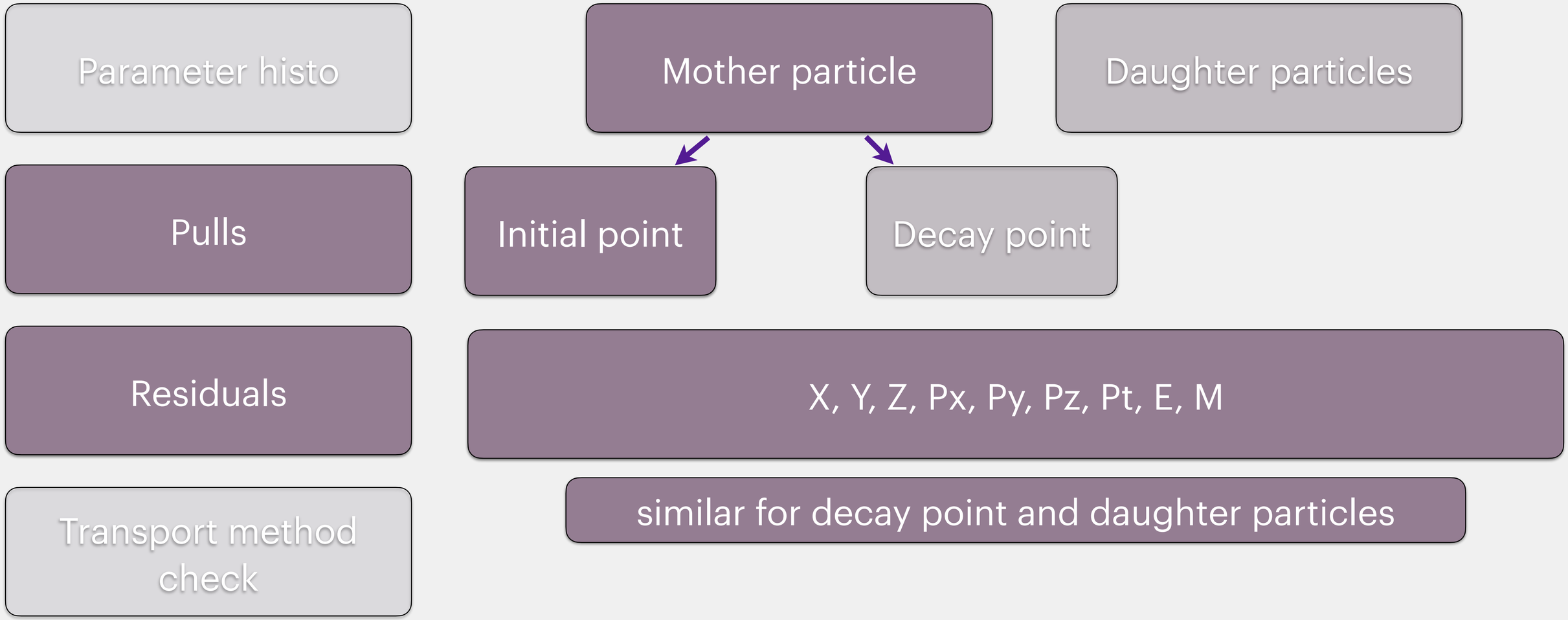
Mother particle

Daughter particles

Output file structure



Output file structure



Output file structure

Parameter histo

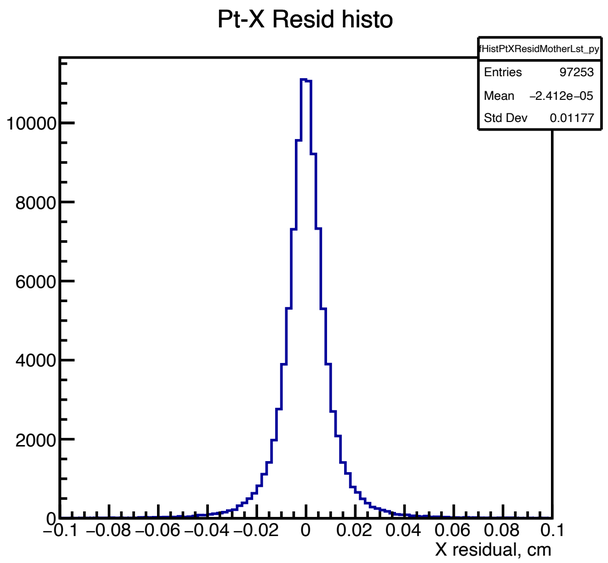
Pulls

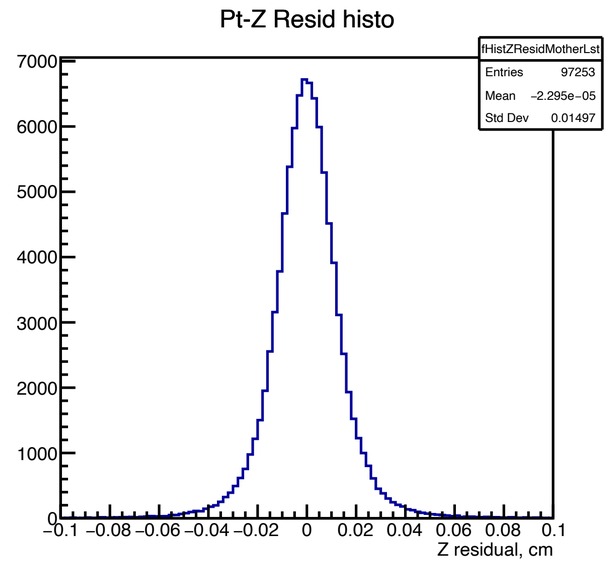
Residuals

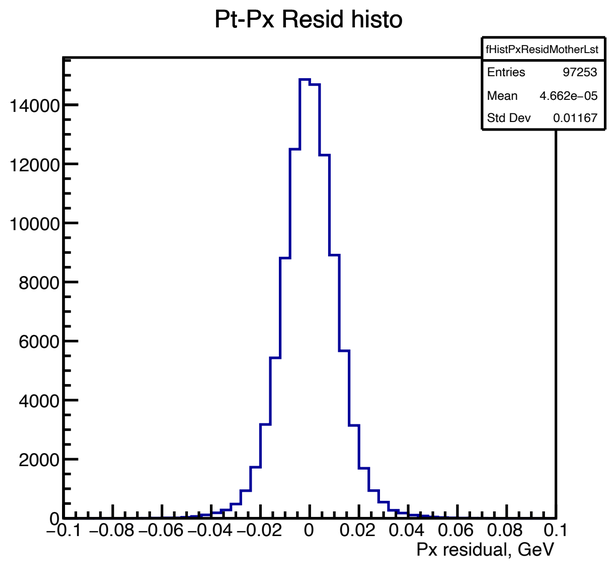
Transport method check

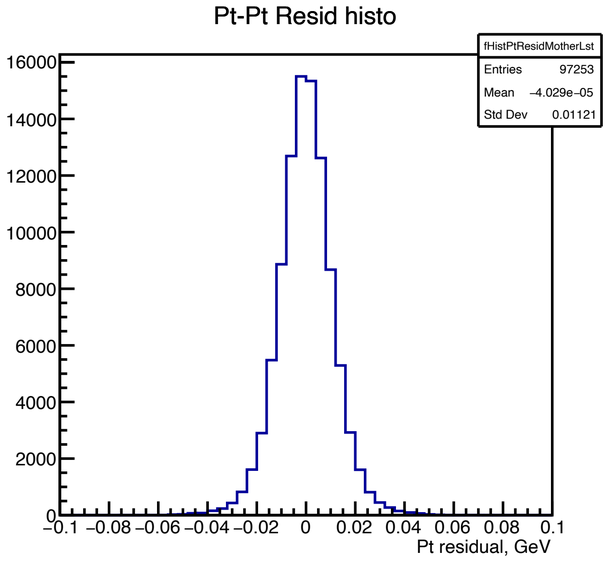
Extrapolation errors, extrapolation errors over distance (X, Y, Z, R, Px, Py, Pz, Pt, E, M)

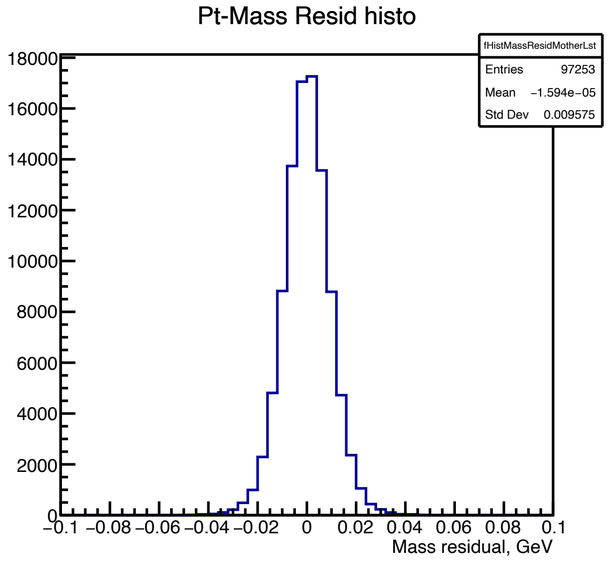
Residuals of D0 at decay point

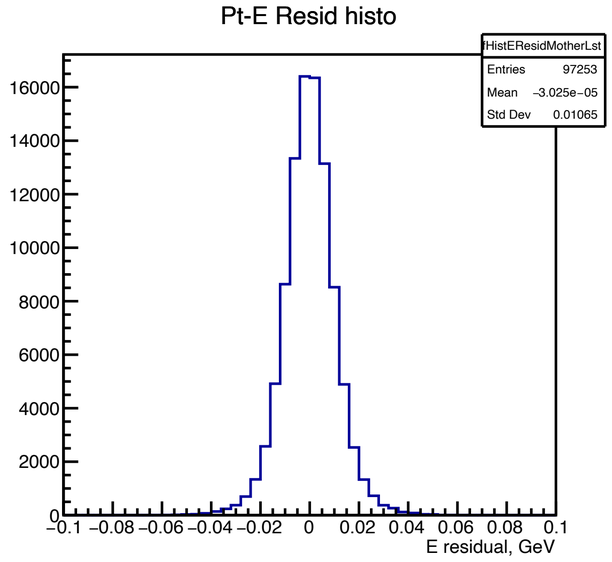




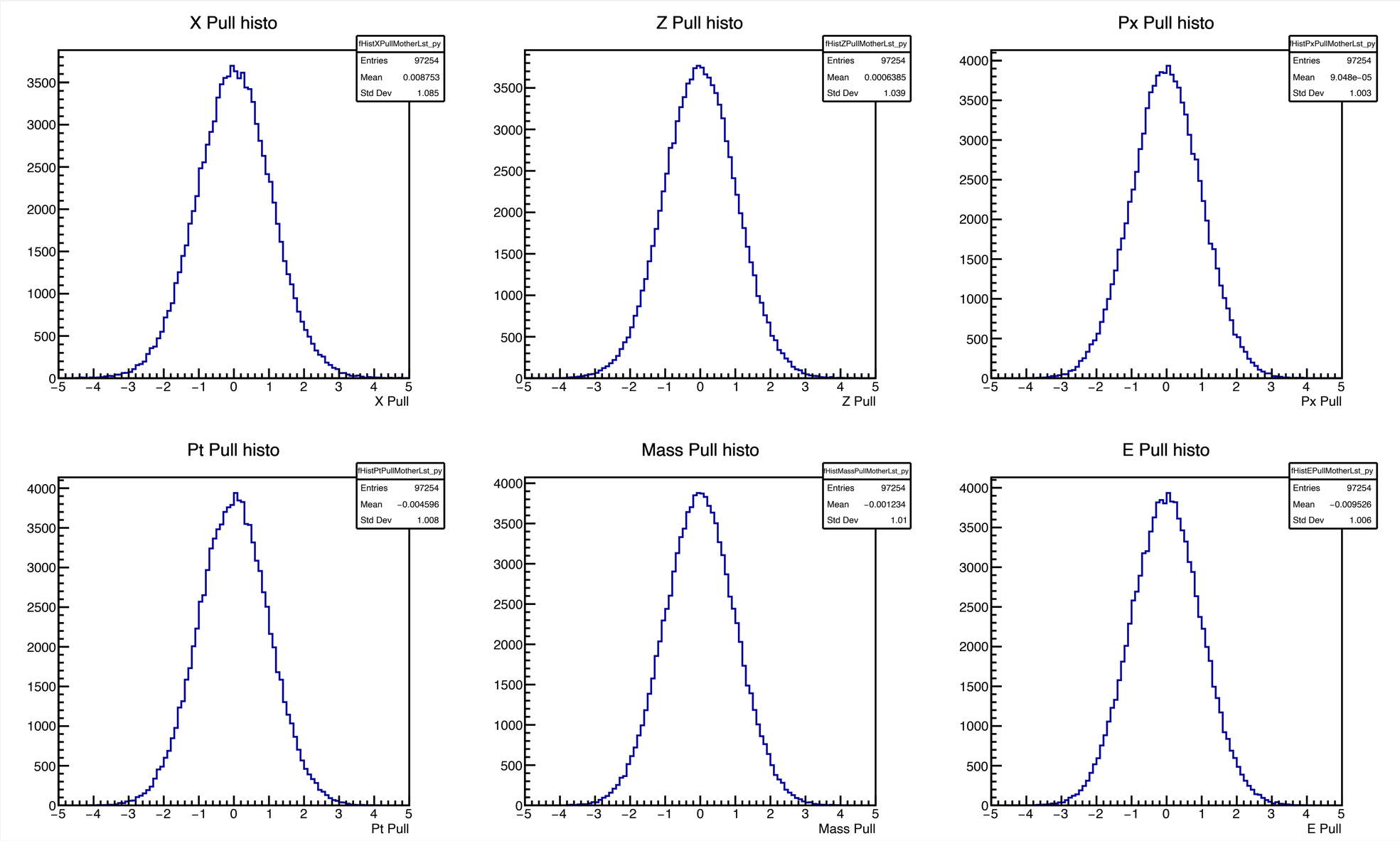




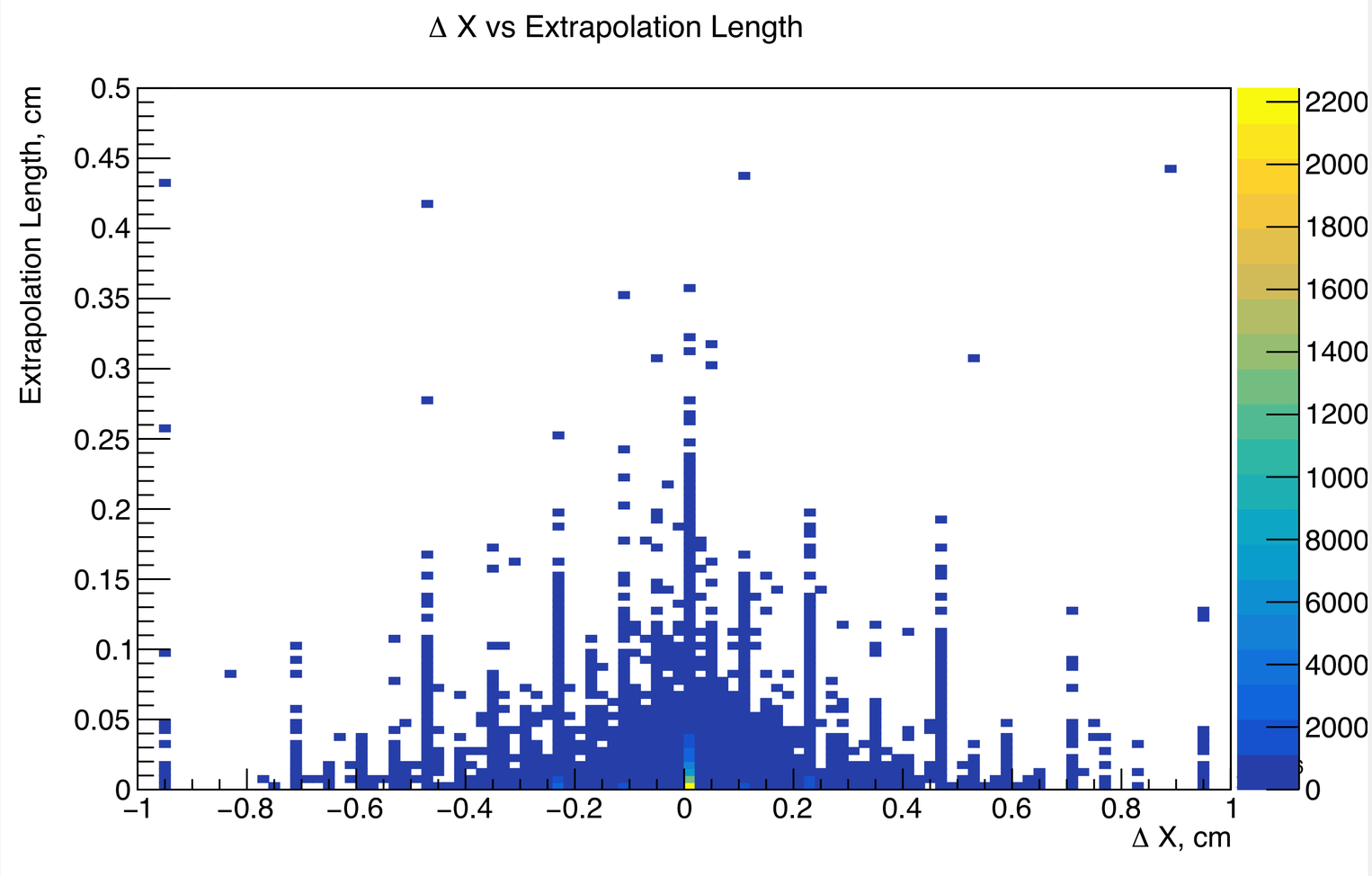




Pulls of D0 at decay point



Transport method check



Test Automation

- Automatic tests implemented using CTest
- Reference distributions currently checked:
  - Residuals and Pulls at initial and decay points (unbiased and width)
  - Extrapolation Errors (Pulls and absolute value)

Future plans:

- continuous Integration (CI) setup
- tracking test results with code changes

work in progress

```
bash-4.2$ cd build/
bash-4.2$ make test
Running tests...
Test project /home/alidock/alice/KFParticleGit/build
    Start 1: KFUnitTest
1/1 Test #1: KFUnitTest .....................***Failed   22.37 sec

0% tests passed, 1 tests failed out of 1

Total Test time (real) =  22.37 sec

The following tests FAILED:
          1 - KFUnitTest (Failed)
Errors while running CTest
make: *** [test] Error 8
```

Recent development & Plans

- Features:
  - Pulls and residuals at initial point are added
  - Automatic test, included in the CTest
- Improvements:
  - Bug in covariance matrix generation
  - Bug in KFParticle function usage
- Plans:
  - Generate pseudo particles to test edge cases
  - Change parameter set
  - Add additional automated checks
  - Cleanup, improve documentation, naming