PPS Progress Report

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Objectives

- Develop and implement analysis modules to apply physics and calibration cuts to the CTPPS Monte Carlo generated data.
- Create dedicated plotters to visualize the effects of these cuts and present key distributions.

What's Been Done?

- The analysis was performed using the modified configuration file `Validation/CTPPS/test/simu/simu_2018_cfg.py`.

Core Components

- **Producer:** `CTPPSGregDucer.cc`
- **Analyzer:** `CTPPSGregPlotter.cc`

Plotting Scripts

- `plotGreg.py`
- `plotProtons.py`
- `plotTracks.py`

Producer: Core Functionality

- Developed based on the existing framework: `SimPPS/DirectSimProducer/plugins/PPSDirectProtonSimulation.cc`.
- Its primary function is to apply a cut to the input data (HepMC).
- The cut parameters are defined in a separate files (calibration and physics), provided by `Mario Deile`, with the following convention:
  1. The first line specifies the number of ϕ steps, followed by their values (doubled per step).
  2. Subsequent lines define the cut specifics, starting with a ξ value, then θ_{min} and θ_{max} for each ϕ step.
- The process pipeline involves three key steps:
  - The ‘getCut()‘ method reads the cut file.
  - The ‘produce()‘ method processes the data and interpolates it to match the cut using ‘interpolate()‘ and ‘interpolate_step()‘.
  - The ‘applyCut()‘ method filters the data and returns the modified output.

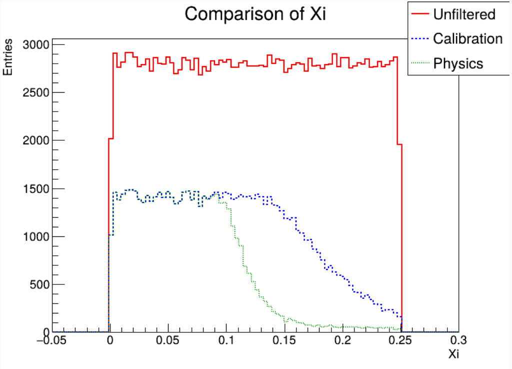
Analyzer: Histograms and Data Flow

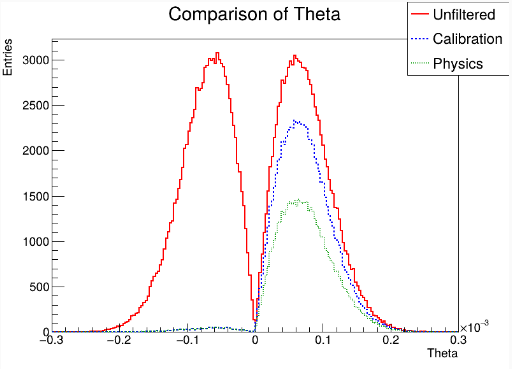
- Developed based on the existing framework: `Validation/CTPPS/plugins/CTPPSProtonReconstructionPlotter.cc`.
- The analyzer is executed twice in the workflow: once before applying the cut and again after.
- The ‘analyze()‘ method is responsible for filling a variety of histograms:
  - **1D Histograms**: ϕ, energy, p_T, and ξ.
  - **3D Histograms**: p_T-ξ-ϕ and θ-ξ-ϕ.
- These 3D histograms are later projected to create 2D histograms, which can be adjusted according to different ϕ slices.
- The analyzer saves the data in the *.root* file.

Plotting Scripts: ‘plotGreg.py‘

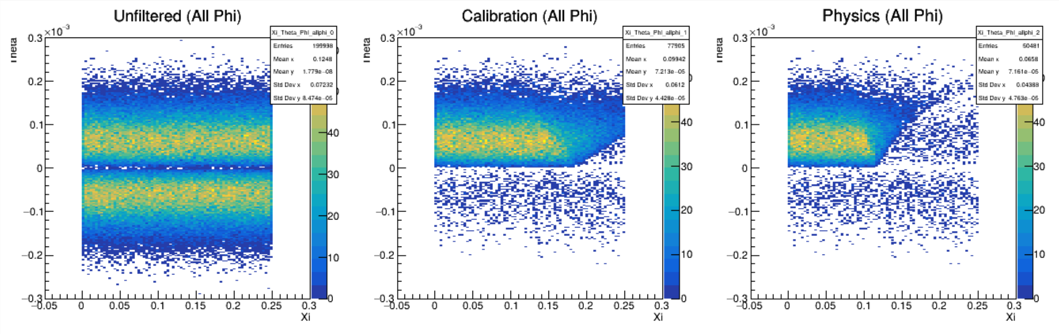
- The ‘plotGreg.py‘ script is designed to plot and compare three datasets:
  - **Unfiltered data**: Initial data saved by the analyzer.
  - **Calibrated data**: Data processed by the producer using a calibration file and saved using the analyzer.
  - **Physics data**: Data processed by the producer using a physics file and saved using the analyzer.
- **1D Histograms**:
  - Plots three histograms (one for each dataset) side-by-side on a single canvas.
  - These are then merged into a single histogram for better visualization and comparison.
- **3D Histograms**:
  - 2D projections are created for all ϕ and plotted side-by-side.
  - For ϕ slices, 12 separate histograms are displayed on a single canvas.
- All plots are saved in ‘.png‘ format within a dedicated output directory.

Example Plots: ‘plotGreg.py‘

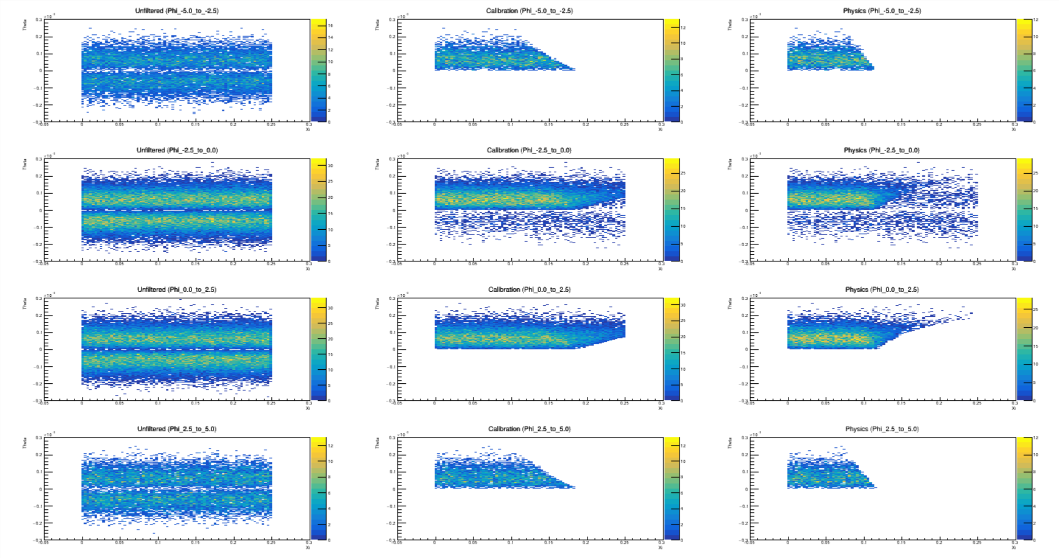




Example Plots: ‘plotGreg.py‘



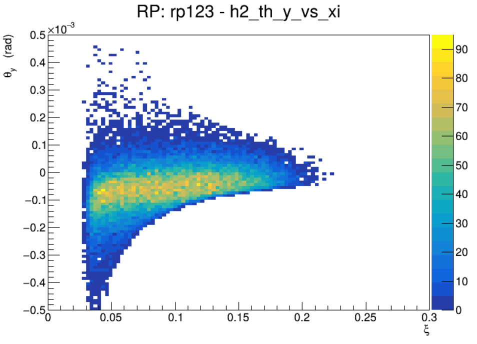
Example Plots: ‘plotGreg.py‘

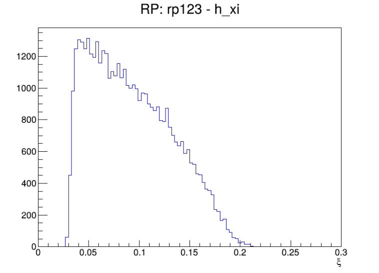


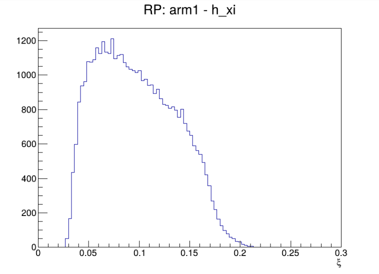
Plotting Scripts: ‘plotProtons.py‘

- The ‘plotProtons.py‘ script is designed to access and plot data generated by ‘Validation/CTPPS/plugins/CTPPSProtonReconstructionPlotter.cc‘.
- It processes data from individual Roman Pot (RP) units:
  - It accesses RPs 3, 23, 103, and 123.
  - It plots the ”h_xi” and ”h2_th_y_vs_xi” histograms for each of these RPs.
- It also handles multi-RP data from both arms (Arm 0 and Arm 1), and for each arm, it draws the combined ”h_xi” histogram.
- All plots are saved to a dedicated output directory in ‘.png‘ format.

Example Plots: ‘plotProtons.py‘



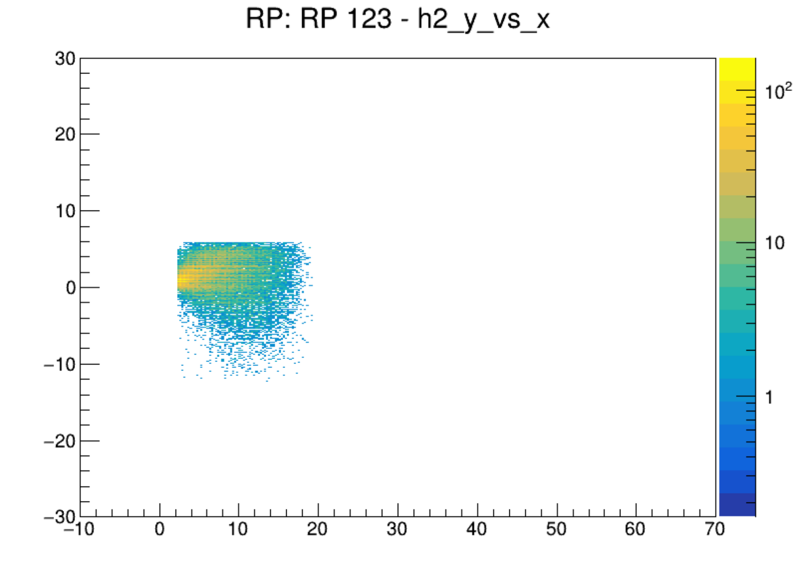




Plotting Scripts: ‘plotTracks.py‘

- The ‘plotProtons.py‘ script is designed to access and plot data generated by ‘Validation/CTPPS/plugins/CTPPSTrackDistributionPlotter.cc‘.
- It processes data from individual Roman Pot (RP) units:
  - It accesses RPs 3, 23, 103, and 123.
  - It plots the ”h2_y_vs_x” histogram for each of these RPs.
- All plots are saved to a dedicated output directory in ‘.png‘ format.

Example Plots: ‘plotTracks.py‘



Compilation and Execution Procedure

1. **Set Up the Environment**
   - Fork the repository on GitHub.
   - Create a CMSSW release: `cmsrel CMSSW_15_0_11` (or other).
   - Add the required packages: `git cms-addpkg CTPPS SimPPS`.
2. **Integrate the Code**
   - Download the files from **GitHub repository**.
   - Place the source files in the appropriate `plugins` directories of each package.
   - Place the Python configuration files in the relevant `python` directories.
3. **Build the Project**
   - In `CMSSW_15_0_11/src` build the entire project: `scram b -j 16` (or `scram b`).
4. **Run the Analysis**
   - Navigate to the simulation directory: `cd Validation/CTPPS/test/simu/`.
   - Set up the cmsenv: `cmsenv` and run the simulation: `cmsRun simu_2018_cfg.py`.
   - Plot the results using the provided Python scripts, ensuring your environment can use python.

Contact

Questions?

If you have any questions, feel free to contact me:

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