Progress on alignment with CTB data

- Alignment strategy
- Results and comparison
- Conclusion

Alignment strategy

- Obtain one set of alignment parameters with a sample of pion runs (with and w/o magnetic field)

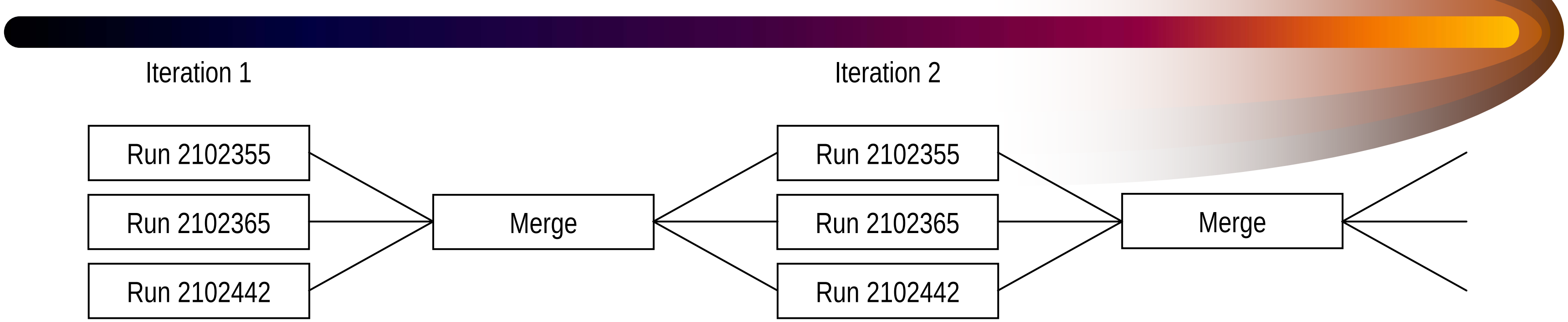
Run	beam	Mom (GeV/c)
2102355	π^+	no B-Field
2102365	π^+	100
2102442	π^+	20

- Validation with runs / events not used for alignment parameter calculation

Chi2AlignAlg + modifications

- Chi2AlignAlg (in release 11.5.0)
  - PixelTestBeamDetDescr-00-00-35
  - No track selection
  - Momentum constraint with GlobalChi2Fitter
  - Hit Bookkeeping with BookKeepTool (400 none overlap)
  - Damping during iterations with InDetSurveyConstraintTool
  - GangedPixels = False
  - No module fixed
  - All six degrees of freedom of a rigid body are aligned
  - Starting from nominal alignment (no applied alignment corrections)
  - Use newly developed functionality of distributed alignment

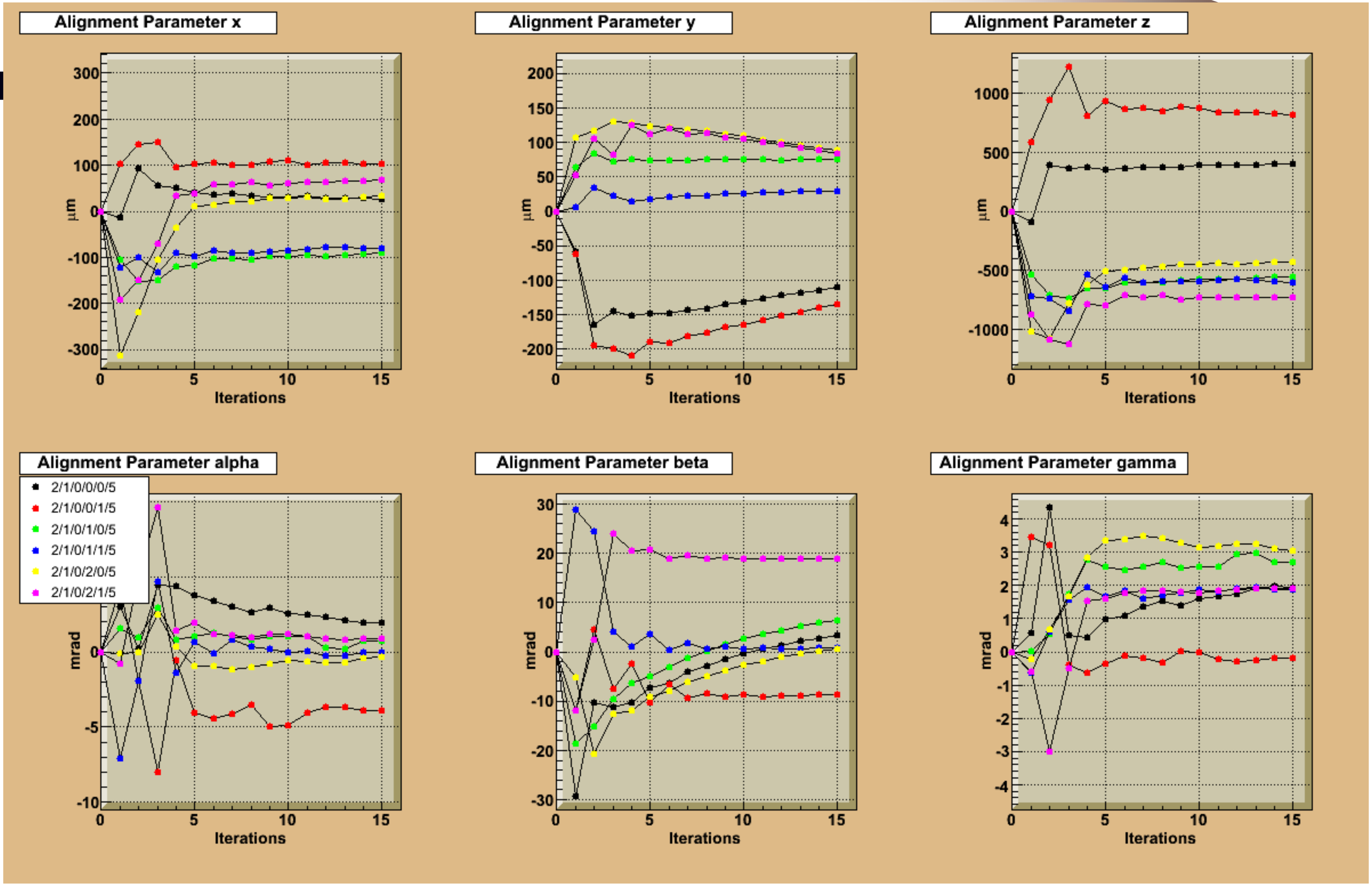
Distributed local χ^2 alignment



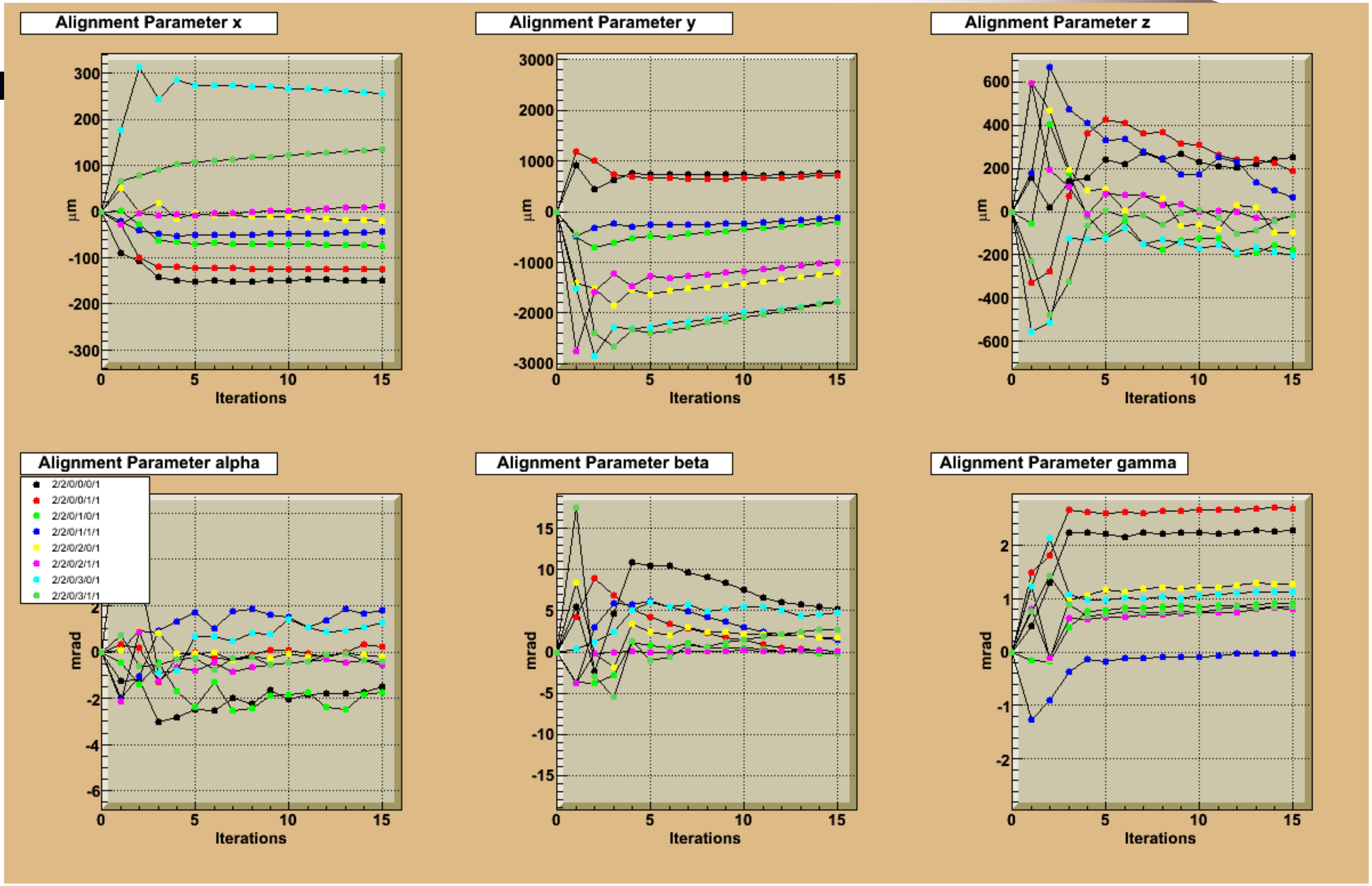
- Parallel architecture allows “individual” job options in each stream, e.g. individual momentum constraints
- Should yield consistent set of alignment parameters for whole energy range
- Computing load is distributed over several CPUs (fast iteration cycles)

$$\Delta a_i = \left[\sum_{tracks}\left(\frac{2}{\sigma^2}\frac{\partial r}{\partial a_j}\frac{\partial r}{\partial a_i}\right)\right]^{-1} \cdot \sum_{tracks}\left(\frac{2}{\sigma^2} r \frac{\partial r}{\partial a_i}\right) \longrightarrow \Delta a_i = \left[\sum_{runs}\sum_{tracks}\left(\frac{2}{\sigma^2}\frac{\partial r}{\partial a_j}\frac{\partial r}{\partial a_i}\right)\right]^{-1} \cdot \sum_{runs}\sum_{tracks}\left(\frac{2}{\sigma^2} r \frac{\partial r}{\partial a_i}\right)$$

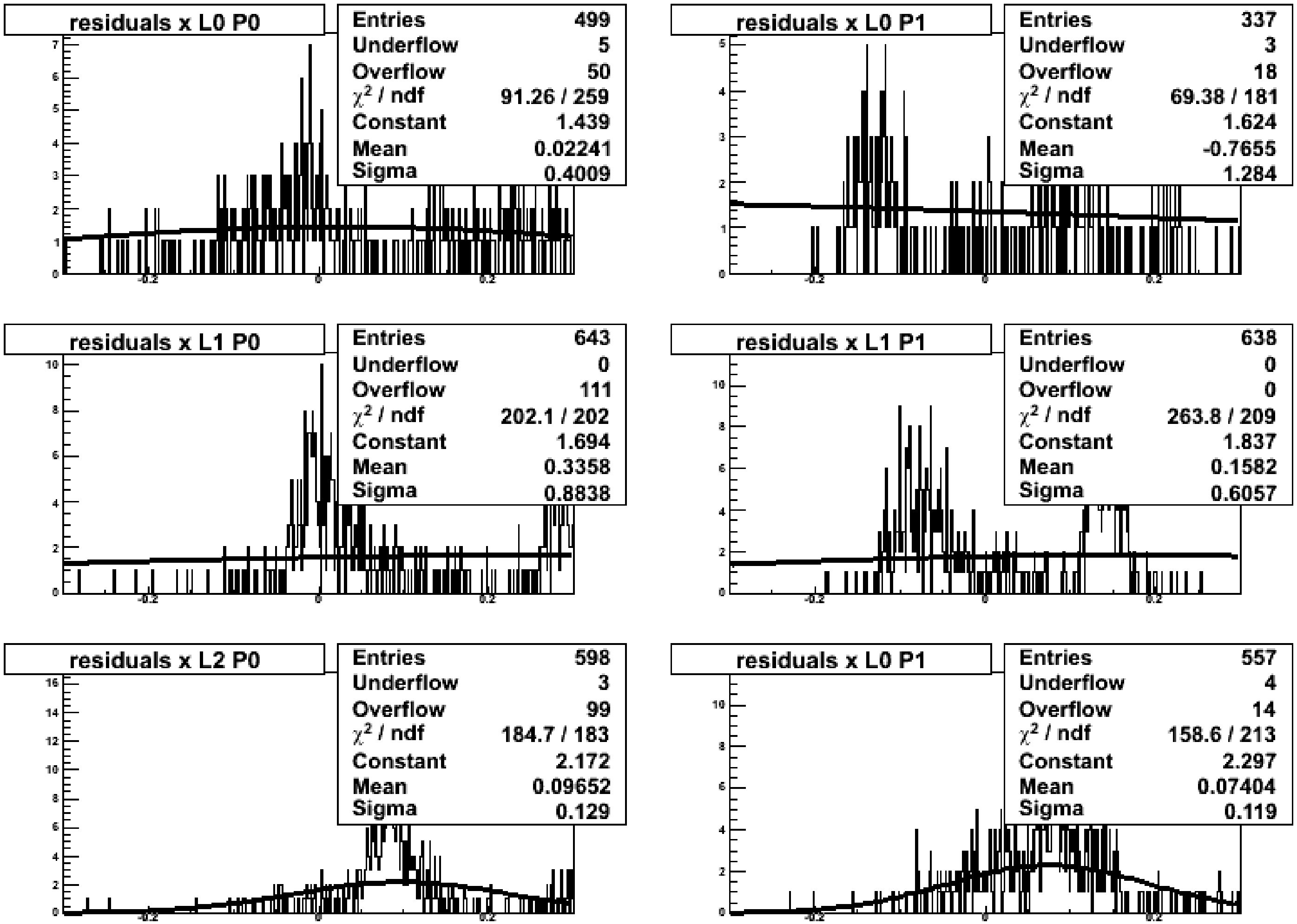
Alignment parameter flow Pixel



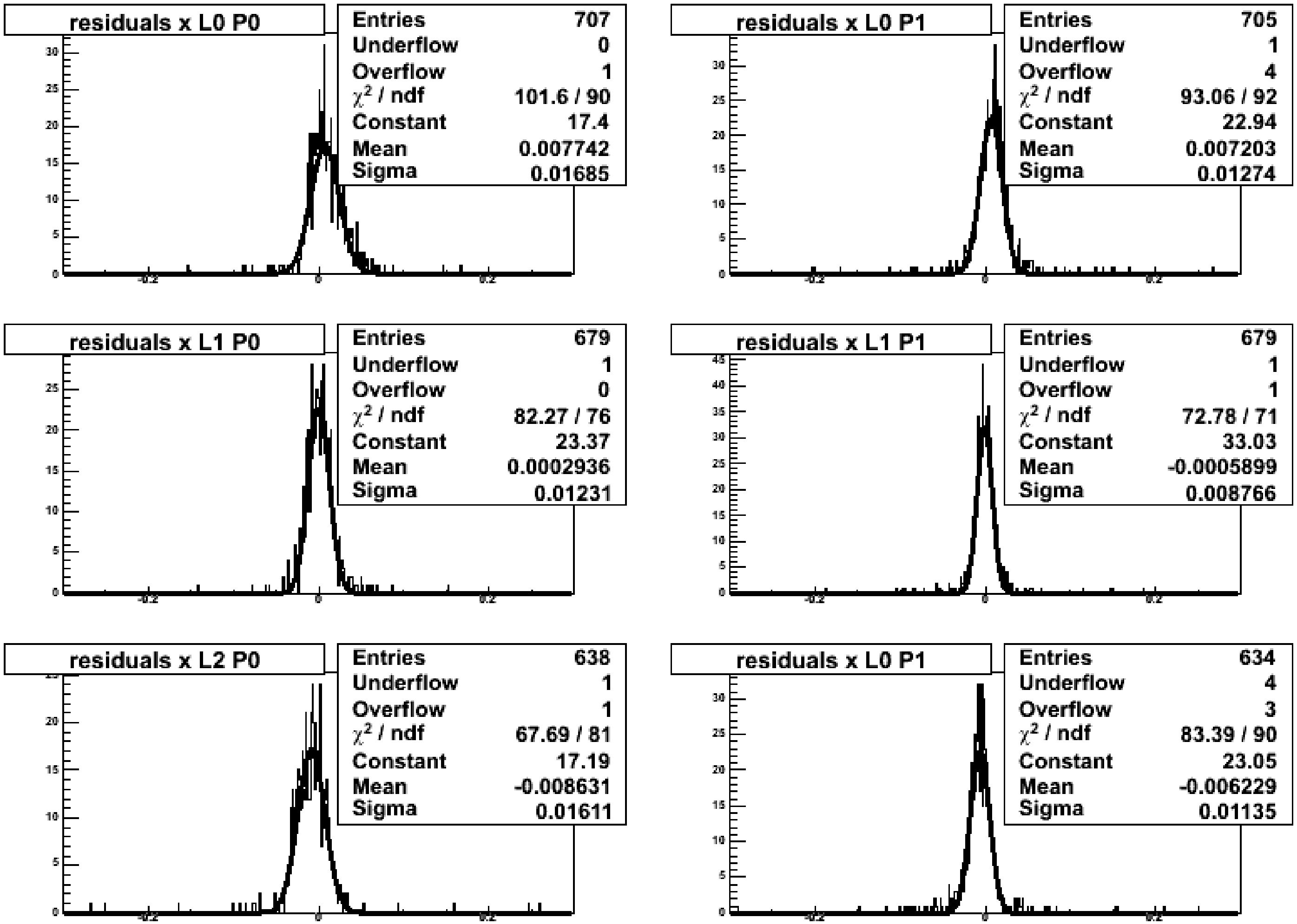
Alignment parameter flow SCT



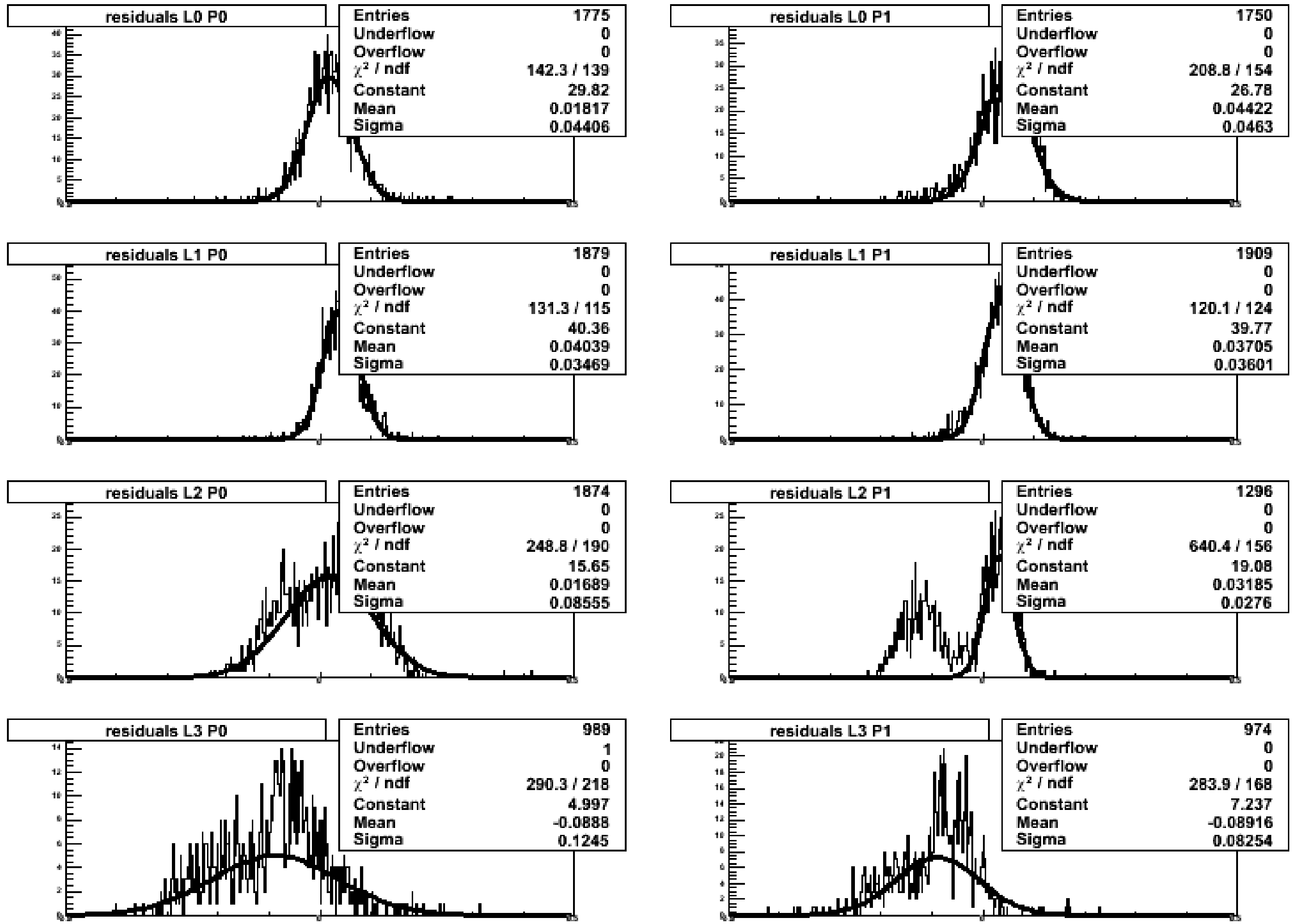
Residuals Pixel – run 2102365 Iteration 1



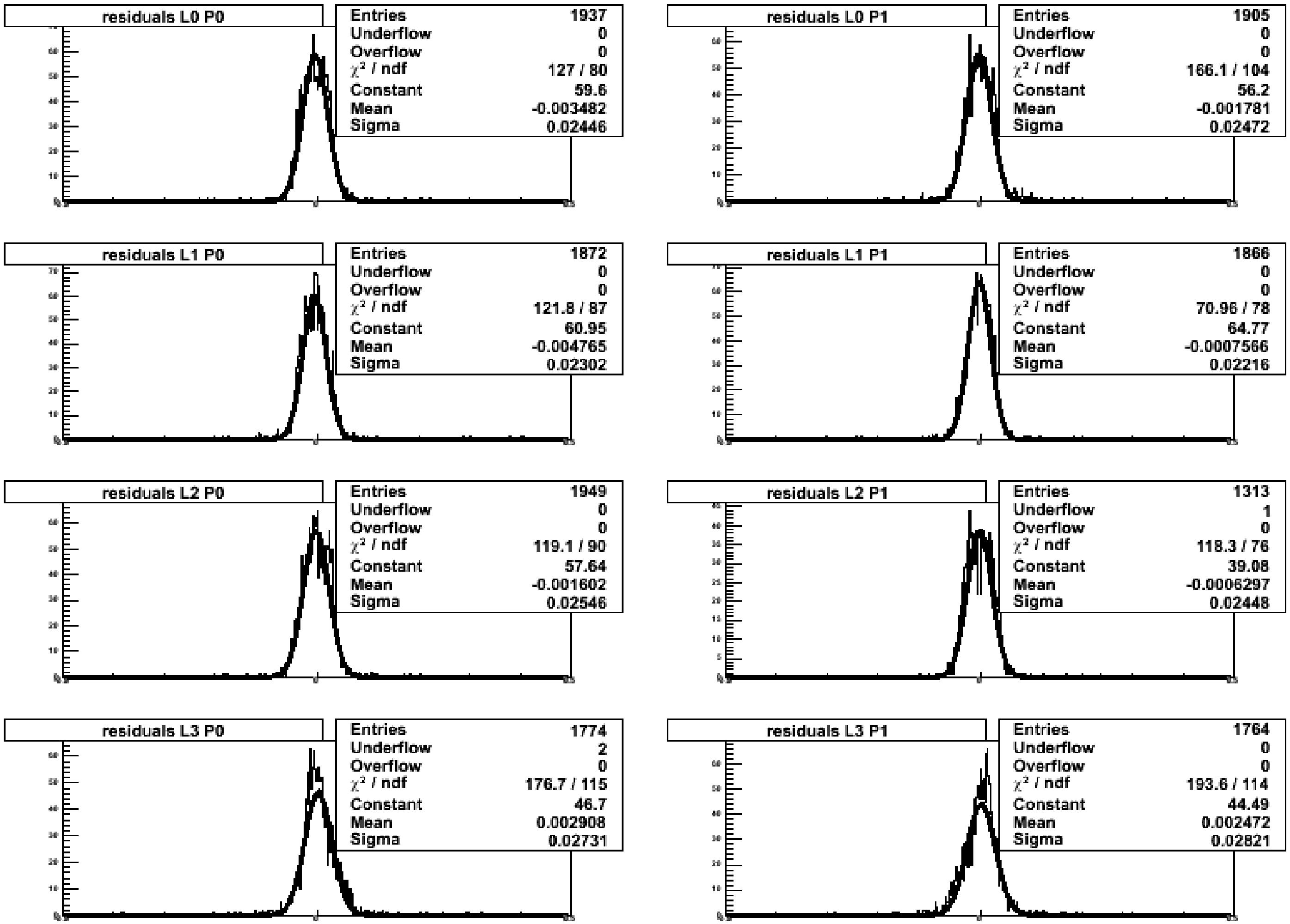
Residuals Pixel – run 2102365 Iteration 15



Residuals SCT – run 2102365 Iteration 1

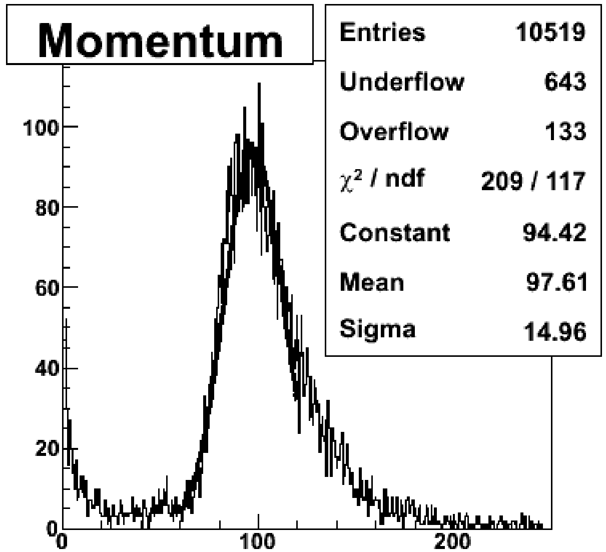


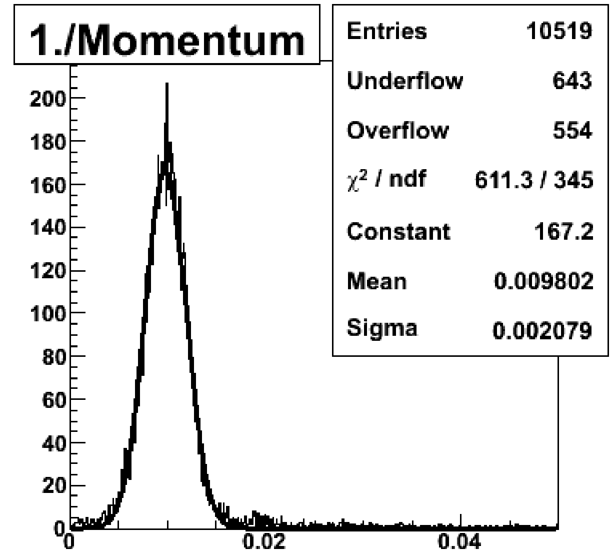
Residuals SCT – run 2102365 Iteration 15



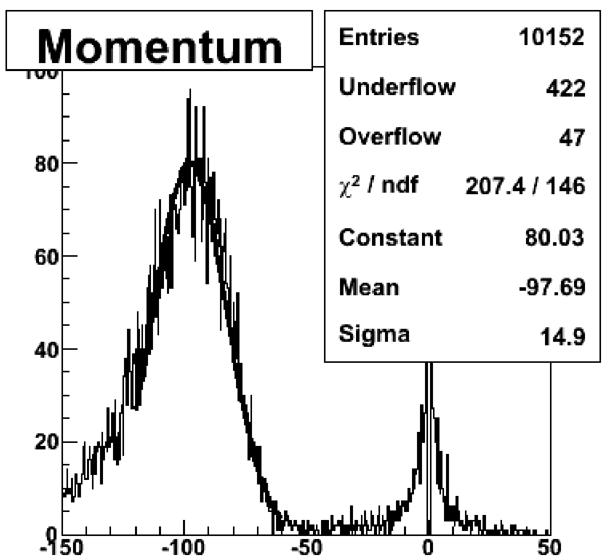
Momentum – run 2102365

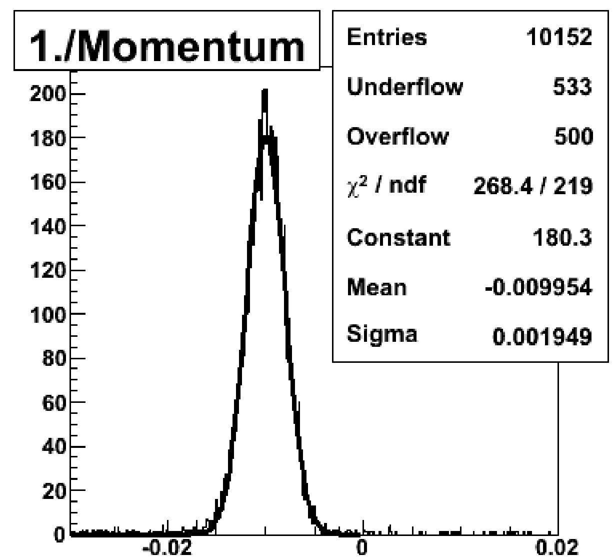
Data



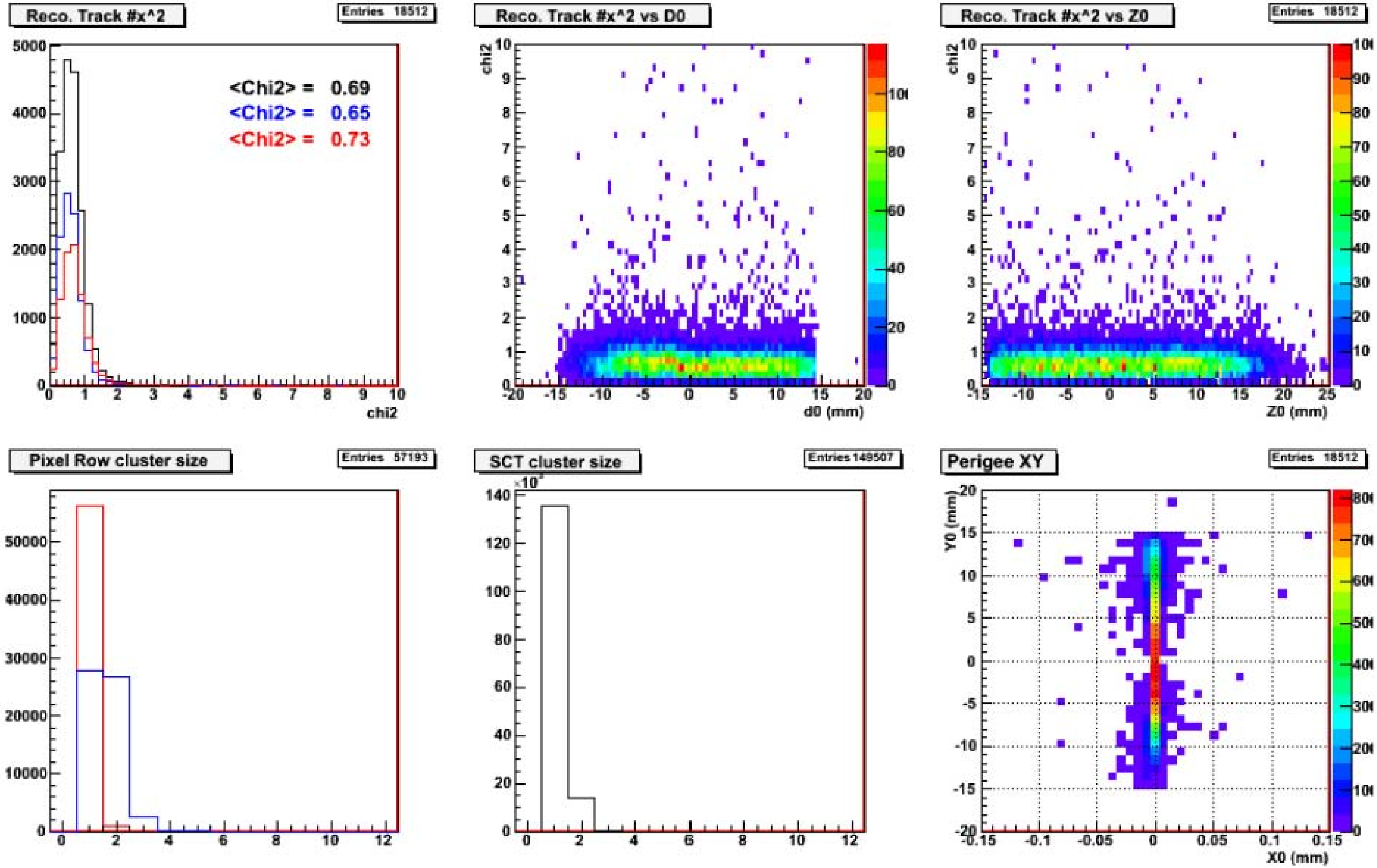


MonteCarlo

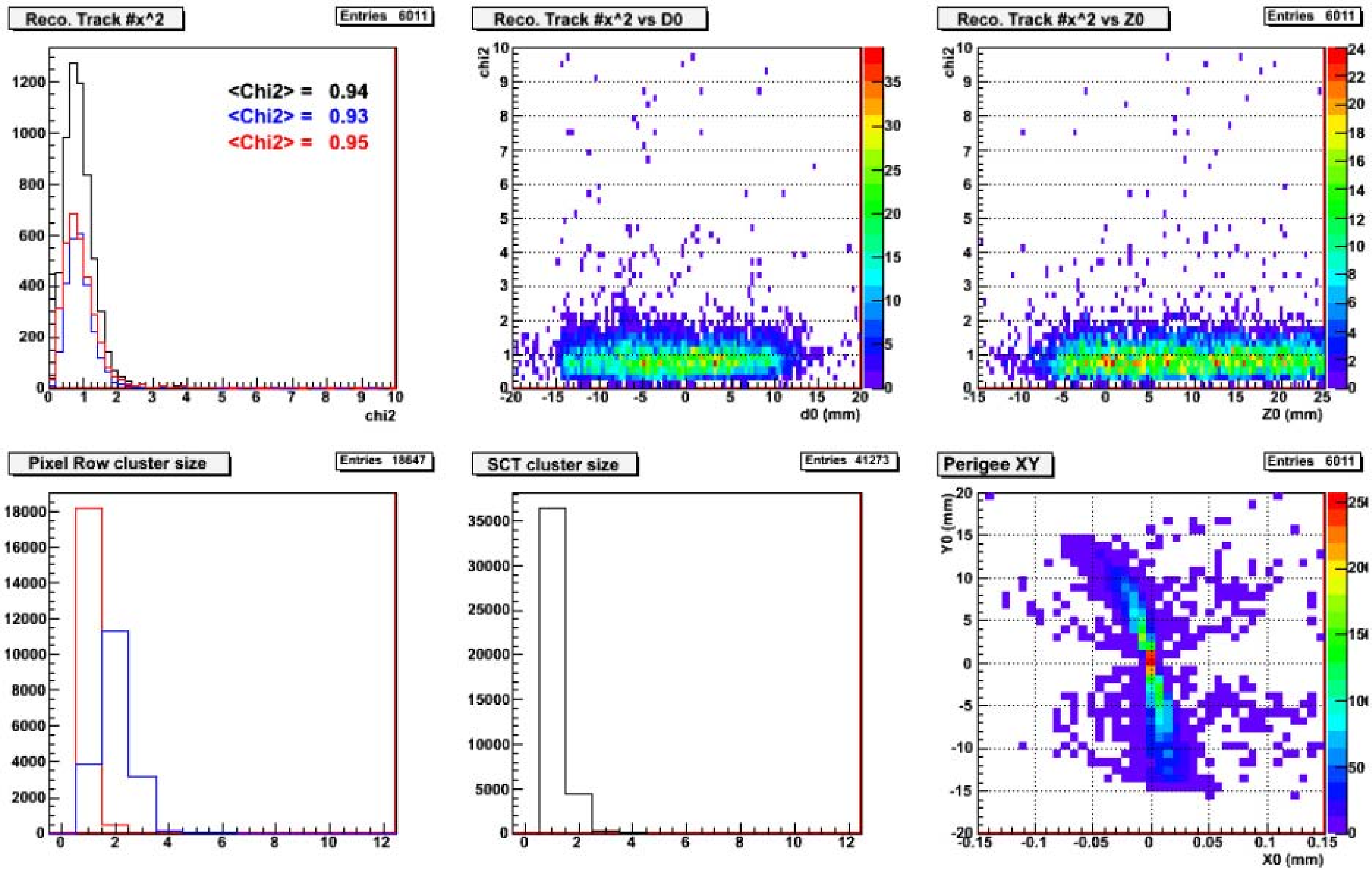




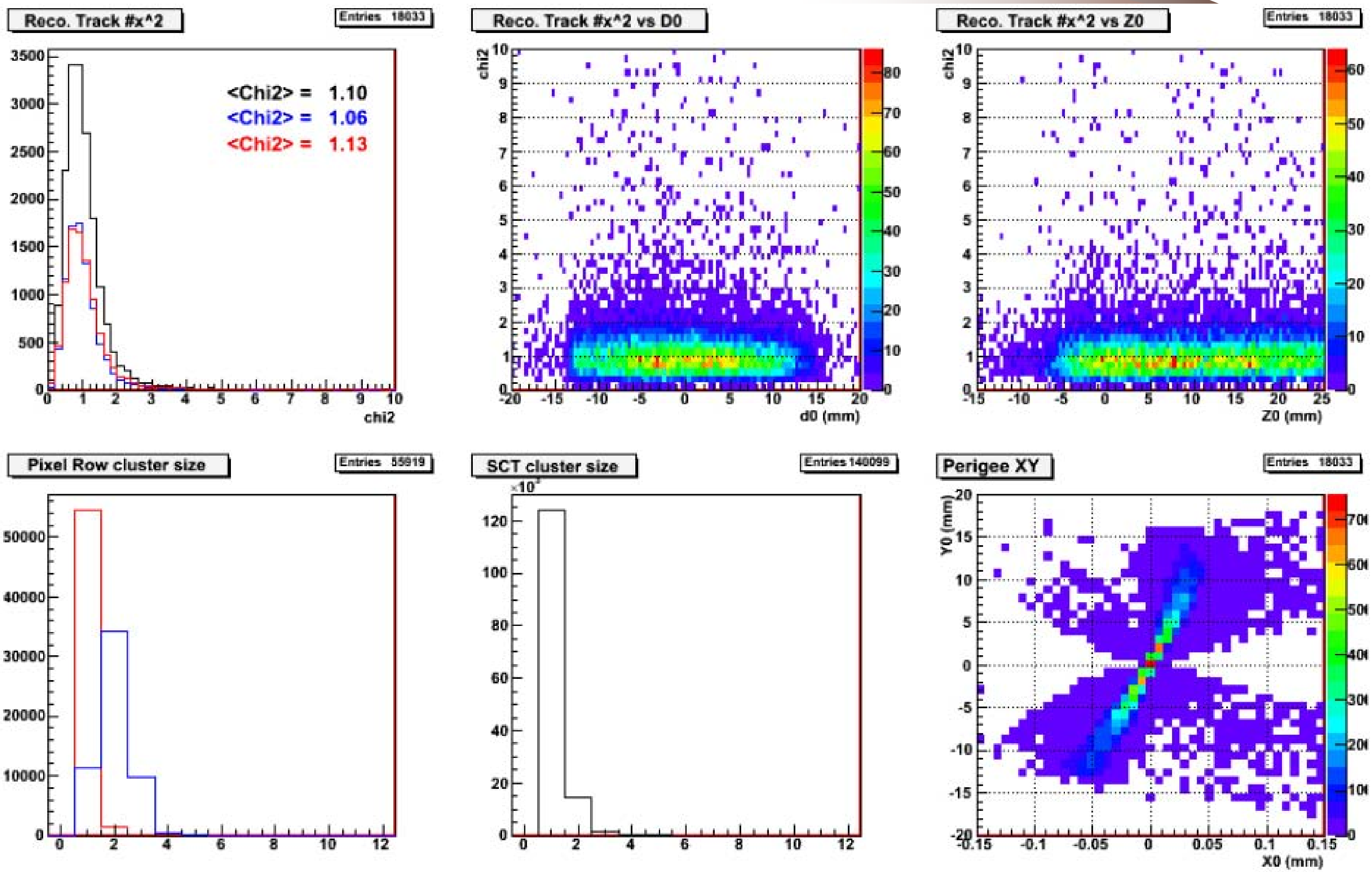
Track properties - Simulation



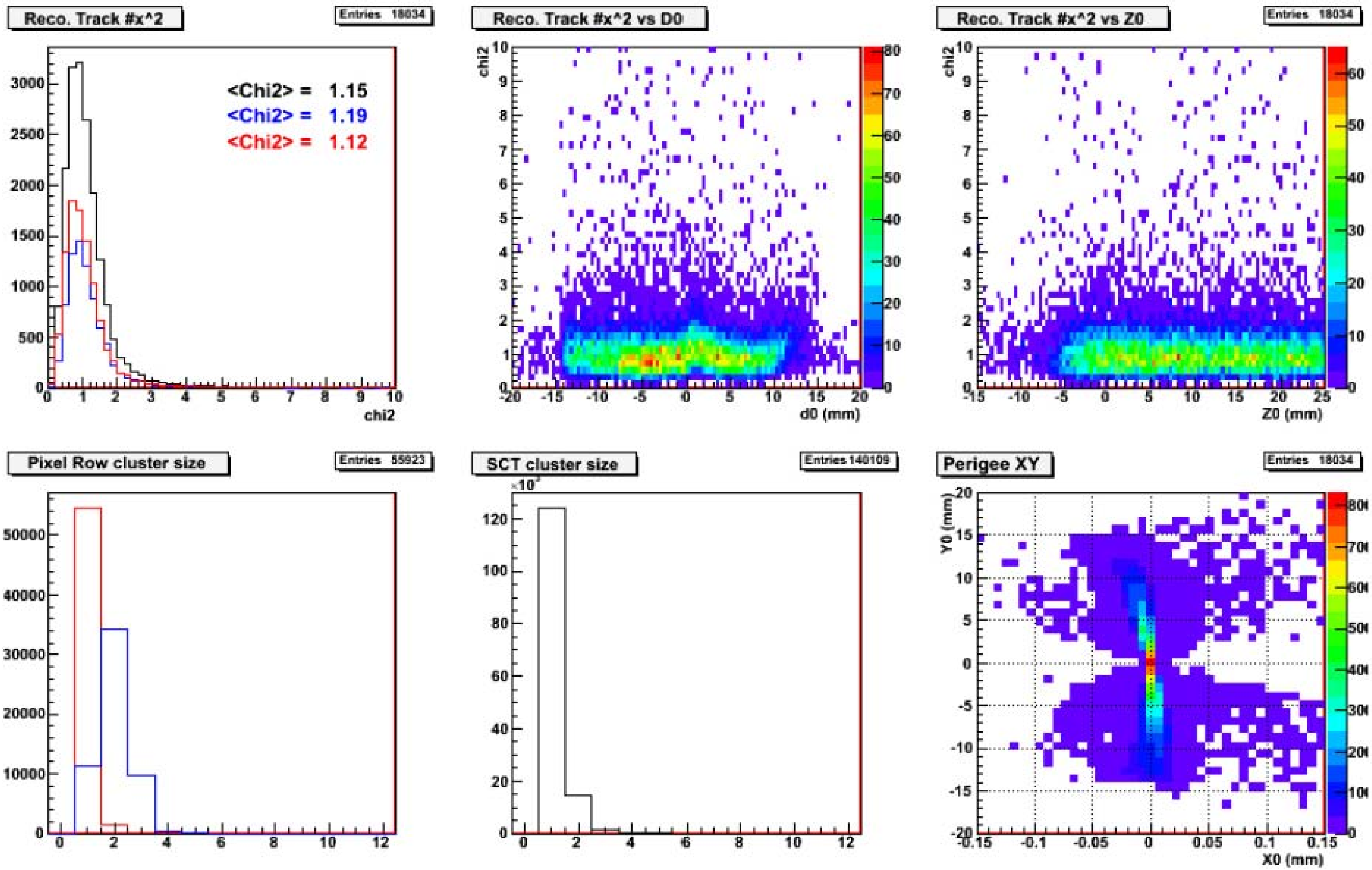
Track properties – local χ^2



Track properties – Valencia approach



Track properties – global χ^2



Conclusions

- Robust and straightforward alignment strategy that produces one set of alignment parameters which is valid over range of runs/energies/particle types
- Absolute performance and comparison with other alignment approaches very promising

- Silicon CTB alignment about to be finished, ATLAS note in preparation