Central Tracking Task Force

Goal

To identify issues in current CLAS12 central tracking software and propose a path forward to obtain the maximum efficiency, resolution, and speed.

Members

- Yuri Gotra (PI)
- Veronique Ziegler (core)
- Mac Mestayer (core)
- Maurizio Ungaro (external, MC expert)
- Rafayel Paremuzyan (external)
- Maxime Defurne (external)

Charge

- Assess the current CLAS12 central tracking efficiency, resolution, and execution speed
- Assess limitations in hardware, reconstruction software, calibrations, tracking algorithms, ...
- Quantify the expected improvement in efficiency, resolution, and execution time provided by the proposed solutions
- Define a work plan to move forward provide a time chart and milestones for:
  1. assessment
  2. definition of alternative solutions
  3. validation (data and Monte Carlo)
  4. implementation in the current reconstruction framework
- Estimate resources needed in the different phases of the project
- Evaluate synergies with other projects at the lab providing a list of shared resources and common goals

https://clasweb.jlab.org/wiki/index.php/Hall-B_Task_Forces_2020#tab=Central_Tracking

CVT Software Group Organization

Resources:

- Tracking code development
  - Veronique, Raffaella
- Alignment
  - Miguel, Sebouh
- Validation
  - Yuri, Rafayel, Achyut, Jose, Trevor, Geraint
- Coordination with Micromegas experts
  Maxime, Francesco
- Coordination with GEMC expert
  Maurizio

Weekly group meetings (Tuesdays, 2 pm) https://bluejeans.com/4139603937
Monthly reports at the Hall Task Force meetings (Fridays, 1:30 pm)
Wiki with minutes of the meetings:
https://clasweb.jlab.org/wiki/index.php/CLAS12_CVT_software
Web page (technical documentation, CLAS notes, papers, talks, software):
https://www.jlab.org/Hall-B/cvt/svt/

Join our group for an exciting opportunity
to gain experience with CLAS12 central tracking

Synergies With Other Projects

- **Common goals with other CLAS Task Forces**
  - **CLAS12 Software**
    - Central tracking and geometry service are listed as high priority tasks
  - **Analysis Framework**
    - Kinematic fitting, momentum corrections, fiducial cuts, vertexing
  - **Forward Tracking**
    - Algorithms for alignment, efficiency, resolution, vertexing
  - **BG Merging and Efficiency**
    - Realistic MC simulations, understanding tracking efficiencies
  - **High Lumi**
    - Studies essential for understanding CVT performance in future data taking
  - **Nuclear Target Test**
    - Background rates, integrated doses, occupancies, MC tuning
  - **Artificial Intelligence**
    - Pattern recognition, speed up track reconstruction
- **Shared Resources**
  - **Manpower**
    - Members of the central tracking TF are also contributing to other CLAS TFs
  - **Software validation tools**
  - **Code development**
    - Common algorithms can be used (i.e. tracking efficiency)
  - **MC samples** can be shared among the TFs

It is essential to keep the CVT software project at high priority

CVT Task Force Report

Central tracking improvement goals from the task force charge:

1. Improve track momentum and angular resolution
2. Improve tracking efficiency
3. Tune MC simulation of the tracker to match the data in efficiency and resolution
4. Reduce the event reconstruction time
5. Validate tracking software and implement correction procedures

Priorities assigned to the tasks: HIGH, MEDIUM, LOW

Resource estimates for identified tasks:

- priority
- duration
- FTE
- CY2020 timeline for high priority track reconstruction tasks

Tasks flagged with an asterisk can be assigned as a service work for the collaboration

CVT Task Force Report

July 17, 2020

Central Tracking Improvement Task Force Report

Members: *Yuri Gotra (PI), Veronique Ziegler (core), Mac Mestayer (core), Maurizio Ungaro (external, MC expert), Rafayel Paremuzyan (external), Maxime Defurne (external)*

Abstract
This document identified areas in which the CLAS12 central tracking can be improved in terms of tracking efficiency, momentum resolution, and execution speed, and provides estimates of the time-scale and manpower requirements of the various tasks.

Tracking Improvement Goals
We have identified five work areas to improve CLAS12 central tracking:

- **Improve track momentum and angular resolution**
- **Improve tracking efficiency**
- **Tune MC simulation of the tracker to match the data in efficiency and resolution**
- **Reduce the event reconstruction time**
- **Validate tracking software and implement correction procedures**

We identified specific studies listed below to accomplish our five goals. We characterize each task by time priority: **HIGH** (CY2020), **MEDIUM** (1-2 yrs), **LOW** (3-5 yrs). ***Note:*** *tasks flagged with an asterisk can be assigned as service work items for the collaboration.*

- **Improve track momentum and angular resolution**

Geometry and Local Reconstruction

- Standardize helix definition and properties, geometry plugin for MeasVecs, covariance matrix numeric initialization, HIGH priority, 2 weeks, 0.5 FTE
- Implement and validate the methods for automatic plugin of the CVT geometry package in CLAS12 geometry framework, HIGH priority, 2 months, 0.5 FTE
- Improve cluster selection (BMT centroid estimate, skipped hits due to status hit linking validation, Lorentz angle corrections), HIGH priority, 3 months, 0.2 FTE

CVT Calibration

- Finish updating and validating the CCDB channel status tables *, MEDIUM priority, 4 months, 0.2 FTE
- Document SVT/BMT calibration procedures, upload calibration tools to the repository, HIGH priority, 2 months, 0.2 FTE
- Study calibration stability *, MEDIUM priority, 4 months, 0.2 FTE

Central Tracker Alignment and Solenoid Field

- **Stage 1**: define initial SVT internal alignment using module survey data; using SVT standalone tracking define global SVT alignment in X and Y coordinates, align BMT tiles (translations) using SVT standalone tracking, validate beam position corrections, HIGH priority, 4 months, 0.5 FTE
- **Stage 2**: using DC alignment approach refine stage 1 alignment constants by allowing BMT rotations, MEDIUM priority, 7 months, 0.2 FTE
- **Stage 3**: develop and validate Kalman Filter-based central tracker alignment procedure *, MEDIUM priority, 12 months, 0.5 FTE
- Quantify CVT misalignments on cosmic and alignment runs *, HIGH priority, 3 months, 0.2 FTE
- Study effects of misalignments and Lorentz angle corrections on momentum and angular resolution, define most important degrees of freedom *, HIGH priority, 4 months, 0.2 FTE
- Study CVT momentum, angular, vertex, and mass resolution on elastic peak and exclusive channels *, MEDIUM priority, 6 months, 0.5 FTE *(with Forward Tracking task force)*
- Devise procedure to align CVT relative to DC *, HIGH priority, 5 months, 0.3 FTE *(with Forward Tracking task force)*
- Study effects of track propagation in the solenoid field on residuals *, MEDIUM priority, 6 months, 0.2 FTE *(with Software task force)*

Beamline and Shielding Improvements

- Study tagger dump shielding options considering the results of the Nuclear Target Test *, MEDIUM priority, 6 months, 0.2 FTE *(with High Lumi and Nuclear Target Test task forces)*

- **Improve tracking efficiency**

Track Finding and Fitting Algorithms

- Implement and validate CVT/SVT straight track reconstruction, HIGH priority, 2 weeks, 0.2 FTE
- Develop and validate standalone Kalman Filter, HIGH priority, 2 weeks, 0.5 FTE
- Validate SVT geometry and standalone tracking, HIGH priority, 1 month, 0.2 FTE
- Improve track seeding (rejecting duplicate and ghost tracks), HIGH priority, 3 months, 0.2 FTE
- Study of possible background rejection algorithms *, HIGH priority, 4 months, 0.5 FTE *(with High Lumi & Background Merging task forces)*
- Validate MC truth matching code. Evaluate and document efficiency algorithms *, HIGH priority, 2 months, 0.5 FTE *(with High Lumi & Background Merging task forces)*
- Study multi-track reconstruction efficiency *, MEDIUM priority, 6 months, 0.2 FTE *(with High Lumi & Background Merging task forces)*
- Validate reconstruction of prompt and secondary vertices *, MEDIUM priority, 6 months, 0.2 FTE *(with Analysis Framework task force)*
- Study effects of multiple scattering on tracking efficiency *, MEDIUM priority, 6 months, 0.2 FTE

Hardware Improvements

- Validate background reduction using hit timing information, HIGH priority, 4 months, 0.5 FTE
- Study dependence of tracking performance on HV settings (SVT under-depleted sensors, BMT trips) *, MEDIUM priority, 6 months, 0.2 FTE
- Study design, technology, and readout to allow CVT operations at higher luminosities *, LOW priority, 18 months, 0.2 FTE *(with High Lumi task force)*

- **Tune MC simulation of the tracker to match the data in efficiency and resolution**

- Tune GEMC digitization to match data hit resolution and efficiency *, HIGH priority, 3 months, 0.3 FTE *(with Software task force)*
- Study momentum and vertex resolution of data and Monte Carlo *, MEDIUM priority, 3 months, 0.2 FTE *(with Forward Tracking task force)*
- Study dependence of tracking efficiency on luminosity *, HIGH priority, 3 months, 1.0 FTE *(with Background Merging task force)*
- Validate background and dose rate estimates based on the nuclear target test data *, MEDIUM priority, 4 months, 0.5 FTE *(with Nuclear Target Test task forces)*

- **Reduce event reconstruction time**

- Reduce track seeding memory footprint, HIGH priority, 3 months, 0.2 FTE
- Study possible improvements of the track swimming algorithm *, HIGH priority, 4 months, 0.3 FTE
- Use profiler to establish current speed. Study trade-offs between execution speed and algorithm efficiency *, MEDIUM priority, 6 months, 0.2 FTE *(with Software task force)*
- Evaluate pattern recognition and reducing combinatorics strategies, develop artificial intelligence algorithms for tracking *, LOW priority, 18 months, 0.4 FTE *(with AI task force)*
- Study feasibility and performance of streaming readout *, LOW priority, 24 months, 0.1 FTE *(with Streaming Readout task force)*

- **Validate tracking software and implement correction procedures**

- Implement kinematic fitting for central tracking *, MEDIUM priority, 6 months, 0.2 FTE *(with Software task force)*
- Develop a common package for momentum corrections *, HIGH priority, 5 months, 1.0 FTE *(with Momentum Corrections task force)*
- Implement/study energy loss corrections in tracking *, HIGH priority, 1 month, 0.5 FTE *(with Software task force)*
- Review current tracking algorithm and assumptions, MEDIUM priority, 3 months, 0.5 FTE
- Implement fiducial cuts, MEDIUM priority, 6 months, 0.5 FTE FTE *(with Analysis Framework task force)*

https://clasweb.jlab.org/wiki/images/c/cc/2020_07_17_cvt_tf_report.pdf

Improve track momentum and angular resolution

Central Tracker Alignment and Solenoid Field

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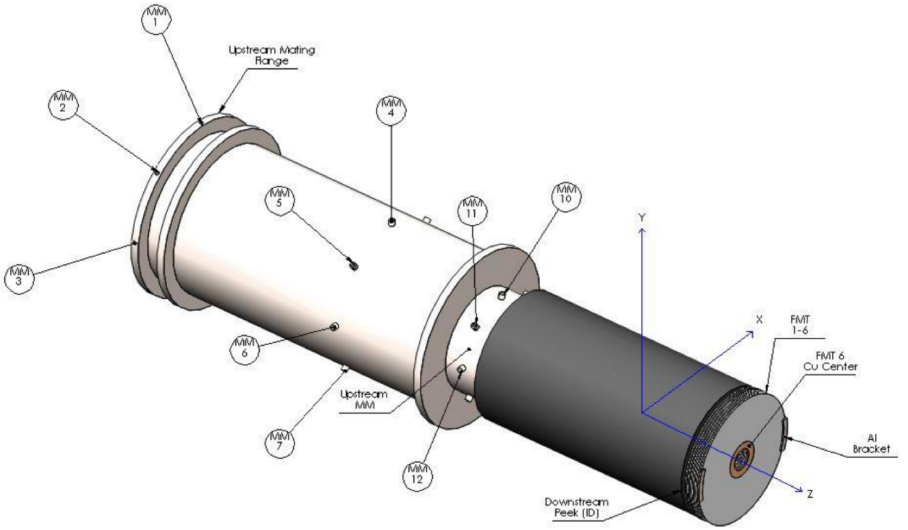
- **Stage 2**: using DC alignment approach refine stage 1 alignment constants by allowing BMT rotations, MEDIUM priority, 7 months, 0.2 FTE
- **Stage 3**: develop and validate Kalman Filter-based central tracker alignment procedure *, MEDIUM priority, 12 months, 0.5 FTE
- Quantify CVT misalignments on cosmic and alignment runs *, HIGH priority, 3 months, 0.2 FTE
- Study effects of misalignments and Lorentz angle corrections on momentum and angular resolution, define most important degrees of freedom *, HIGH priority, 4 months, 0.2 FTE
- Study CVT momentum, angular, vertex, and mass resolution on elastic peak and exclusive channels *, MEDIUM priority, 6 months, 0.5 FTE *(with Forward Tracking task force)*
- Devise procedure to align CVT relative to DC *, HIGH priority, 5 months, 0.3 FTE *(with Forward Tracking task force)*
- Study effects of track propagation in the solenoid field on residuals *, MEDIUM priority, 6 months, 0.2 FTE *(with Software task force)*

Global CVT Survey Misalignment Constants



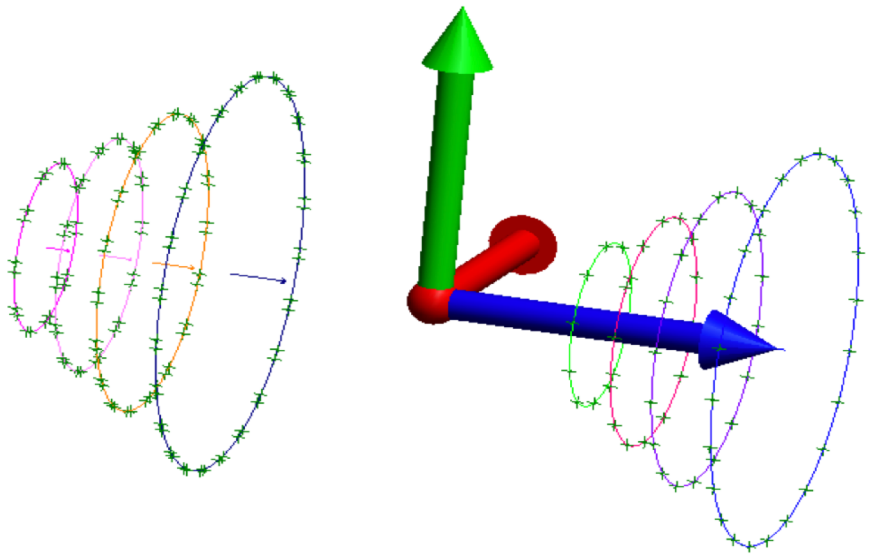
	Cebaf Coordinates Ideal			Beam Following [millimeters]			BFS Angular [degrees]		
Component	**ideal X[m]**	**ideal Y[m]**	**ideal Z[m]**	**bfs dx**	**bfs dy**	**bfs dz**	**dYaw**	**dPitch**	**dRoll**
TARGET	-80.60000	103.35526	-398.82153	0.13	-0.31	-29.97	0.0012	-0.0043	-0.0198
SVT	-80.60000	103.35526	-398.82153	-0.03	-0.38	-0.17	0.0083	-0.0115	0.0120

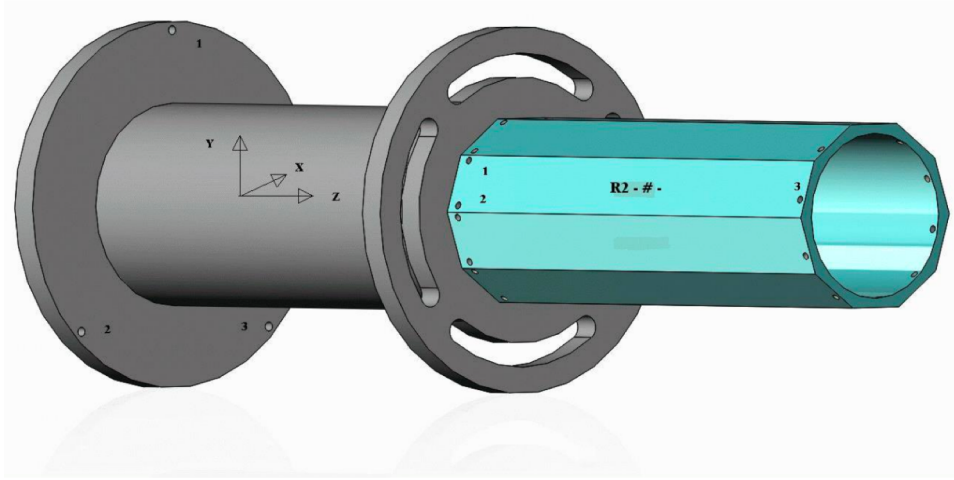
Cebaf coordinates FOUND			
Component	**fnd X[m]**	**fnd Y[m]**	**find Z[m]**
TARGET	-80.60013	103.35495	-398.79156
SVT	-80.59997	103.35488	-398.82136

Not used in current geometry

		BFS		
		X	**Y**	**Z**
MVT	**MM1**	-0.06	318.42	-1661.29
	MM2	-225.68	224.97	-1660.48
	MM3	-319.19	-0.61	-1660.20
	MM4	-0.35	258.26	-977.11
	MM5	-183.79	184.18	-975.78
	MM6	-259.84	-0.92	-976.05
	MM7	-184.12	-184.50	-976.55
	MM8	-0.25	-261.38	-976.76
	MM9	260.55	-1.26	-977.04
	MM10	0.93	198.55	-593.07
	MM11	-140.31	140.10	-593.12
	MM12	-198.87	-0.86	-593.18
	MM13	0.43	-200.38	-593.47
	MM14	141.90	140.10	-593.24
	MM15	318.89	-0.69	-1661.46
	MM16	225.49	224.95	-1661.51
	MM17	-0.21	-319.76	-1661.18
	MM18	-225.84	-226.26	-1660.57

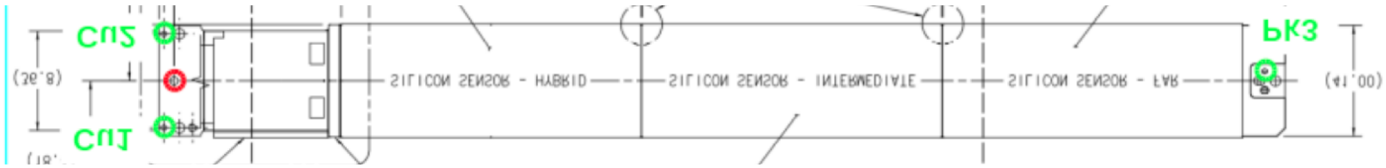
Validating the SVT Survey Misalignment Corrections





By Chris' survey group during SVT integration
(FaroArm, precision 20 μm)

SVT Region 1				
	R111	-16.78	-68.19	-286.13
	R112	17.89	-68.14	-286.08
	R113	4.63	-68.46	122.70
	R121	-53.66	-44.88	-286.11
	R122	-25.59	-65.26	-286.08
	R123	-36.17	-57.66	122.75
	R131	-69.68	-4.52	-286.16
	R132	-58.94	-37.51	-286.10
	R133	-62.83	-25.07	122.76
	R141	-58.94	37.67	-286.17
	R142	-69.63	4.73	-286.11
	R143	-65.21	17.10	122.70



tag	tx	ty	tz	rx	ry	rz	ra
R1S01	0.177	0.184	0.183	0.312	0.000	0.950	0.164
R1S02	0.134	0.100	0.190	0.243	-0.177	0.954	0.102

tx, ty, tz: components of the translation shift (x,y,z) (mm)
rx, ry, rz: components of the axis vector (x,y,z)
ra: angle (degrees) of the rotation shift, centered on the midpoint of the three ideal fiducial points

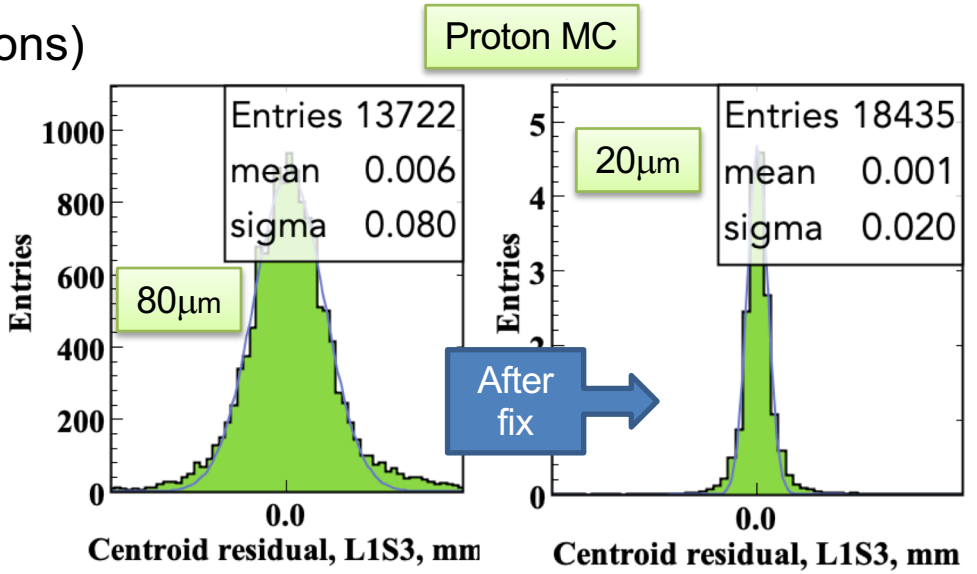
By Jerry's students (Peter and Charles)

Recent Improvements in Central Tracking

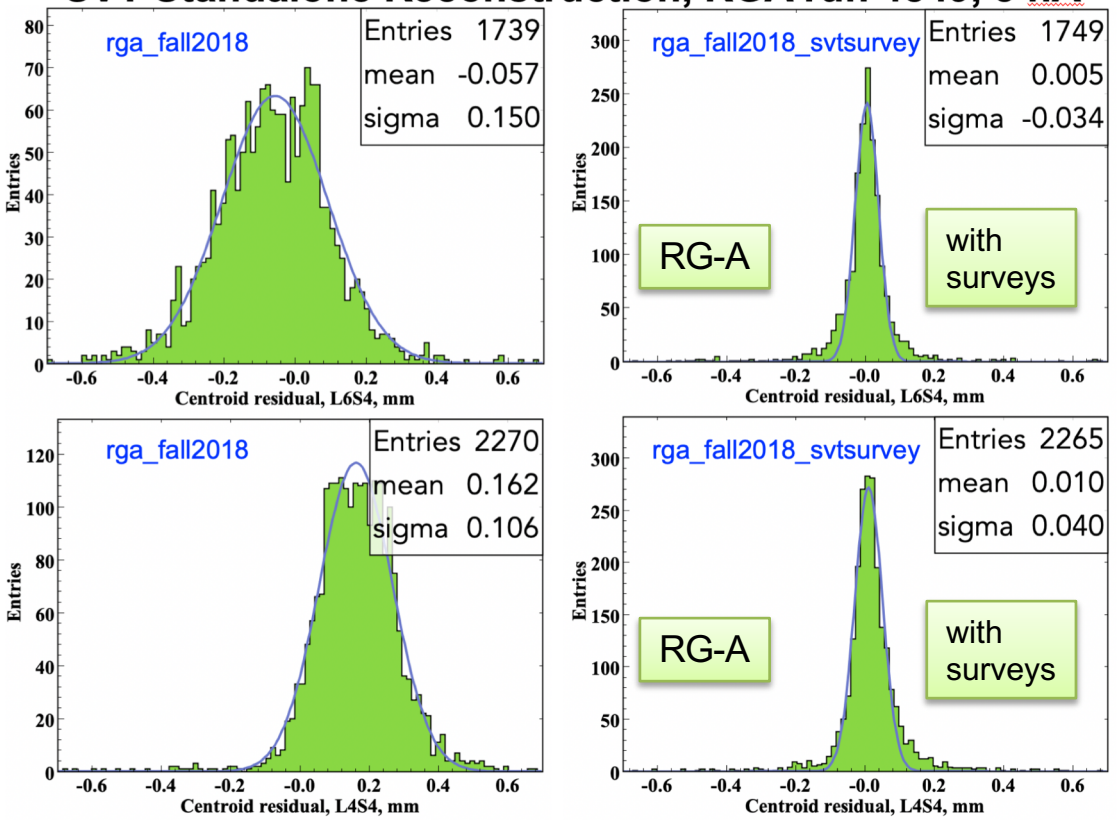
- Fix in CVT cross position transformation to lab identified by Raffaella running SVT standalone
- Validations of SVT surveys

* Now working on fixing the BMT residuals

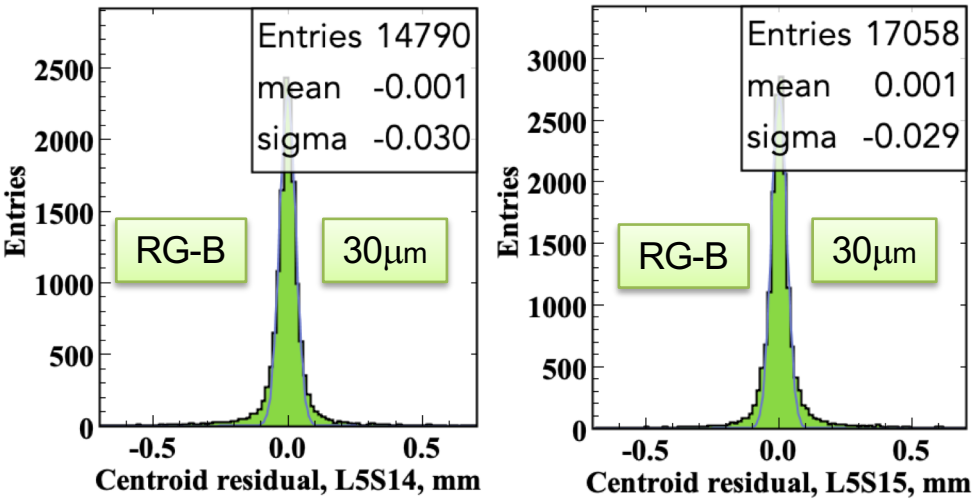
- Resolves issue with spatial residuals (MC validations)
- SVT survey implementation in geometry validated
- Preliminary alignment tested



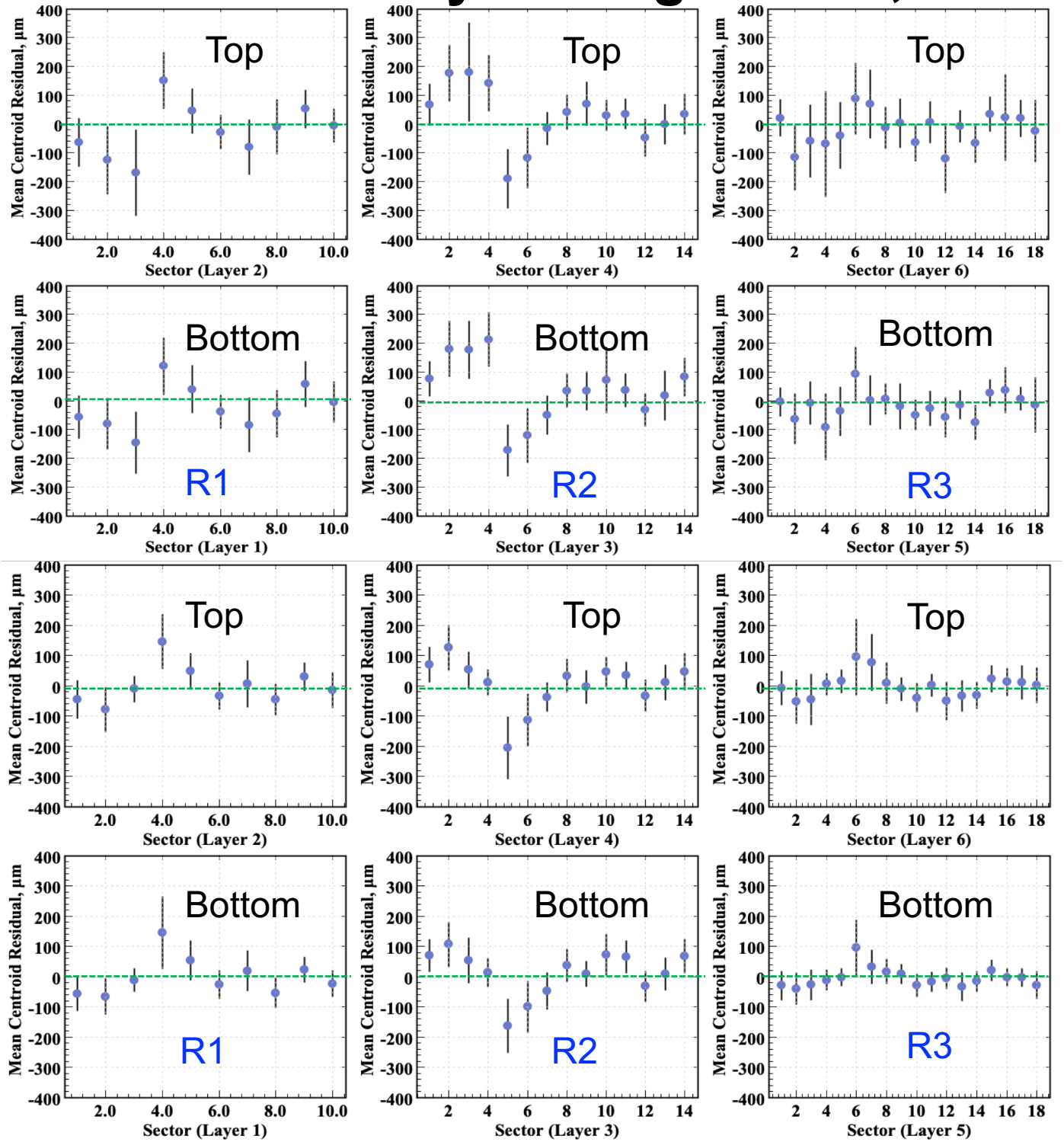
SVT Standalone Reconstruction, RGA run 4849, 5 nA



SVT Standalone Reconstruction RGB run 11014, 5 nA



SVT Survey Misalignments, RGA run 4849, 5 nA



Production release

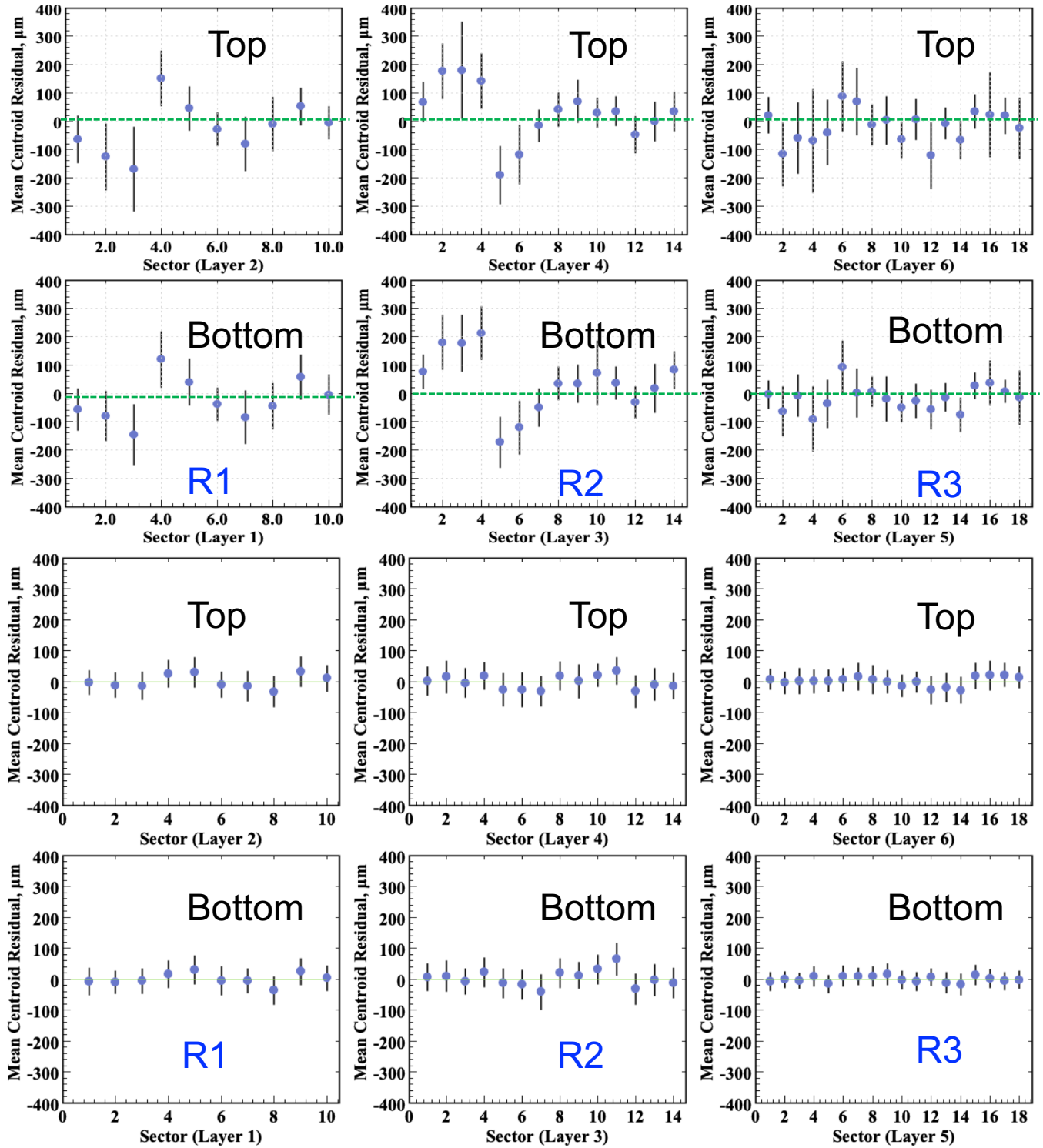
rga_fall2018

- Points: mean of the fit
- Error bars: ±σ

rga_fall2018_svtsurvey

Development branch
SVT standalone tracking

SVT Survey Misalignments, RGA run 4849, 5 nA



Production release

rga_fall2018

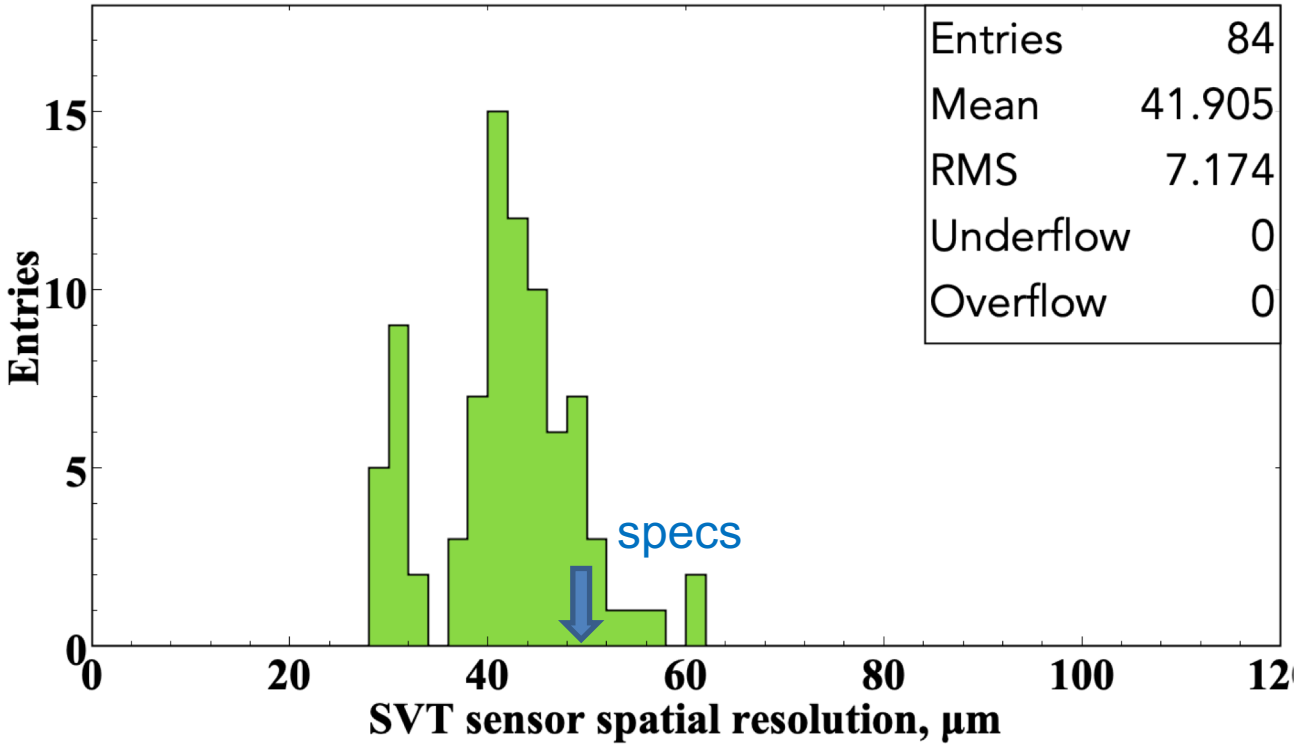
- Points: mean of the fit
- Error bars: ±σ

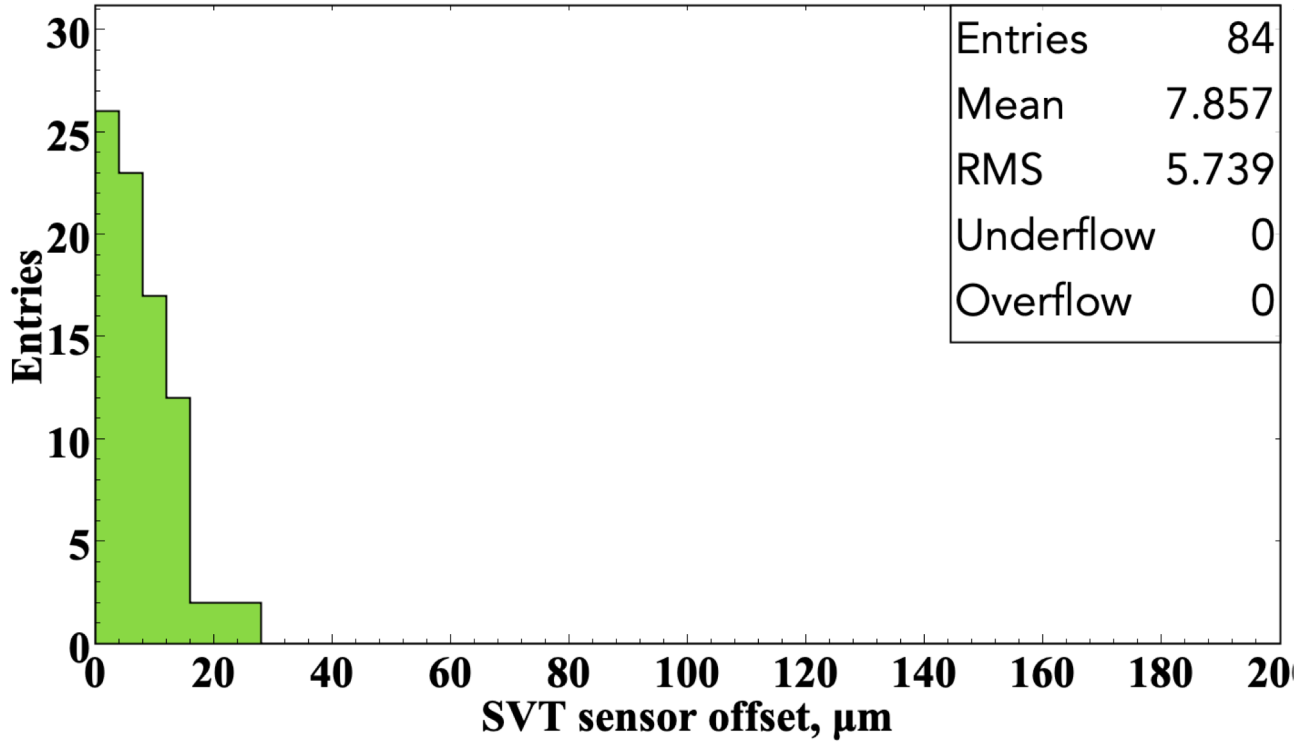
rga_fall2018_svtsurvey

Development branch
SVT standalone tracking
Pre-alignment

Performance of the SVT standalone tracking allows it to be used for BMT alignment

Stage 1: Initial SVT Alignment

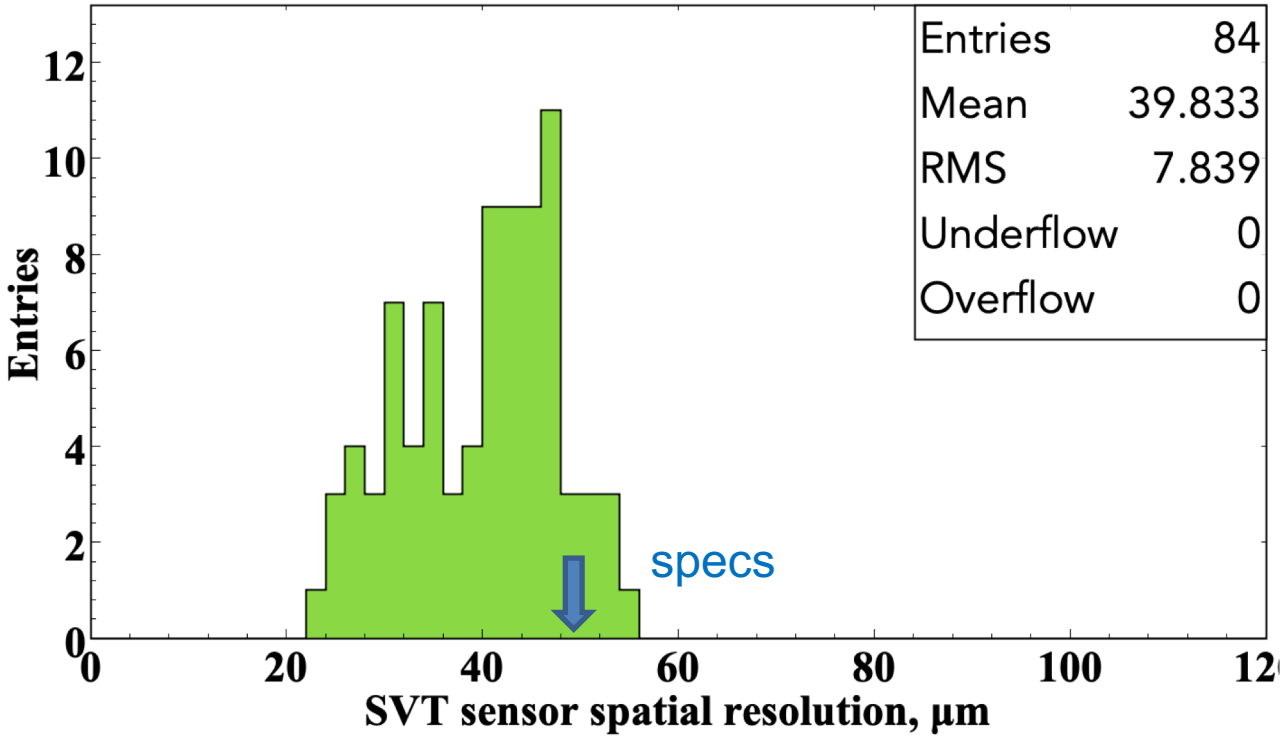


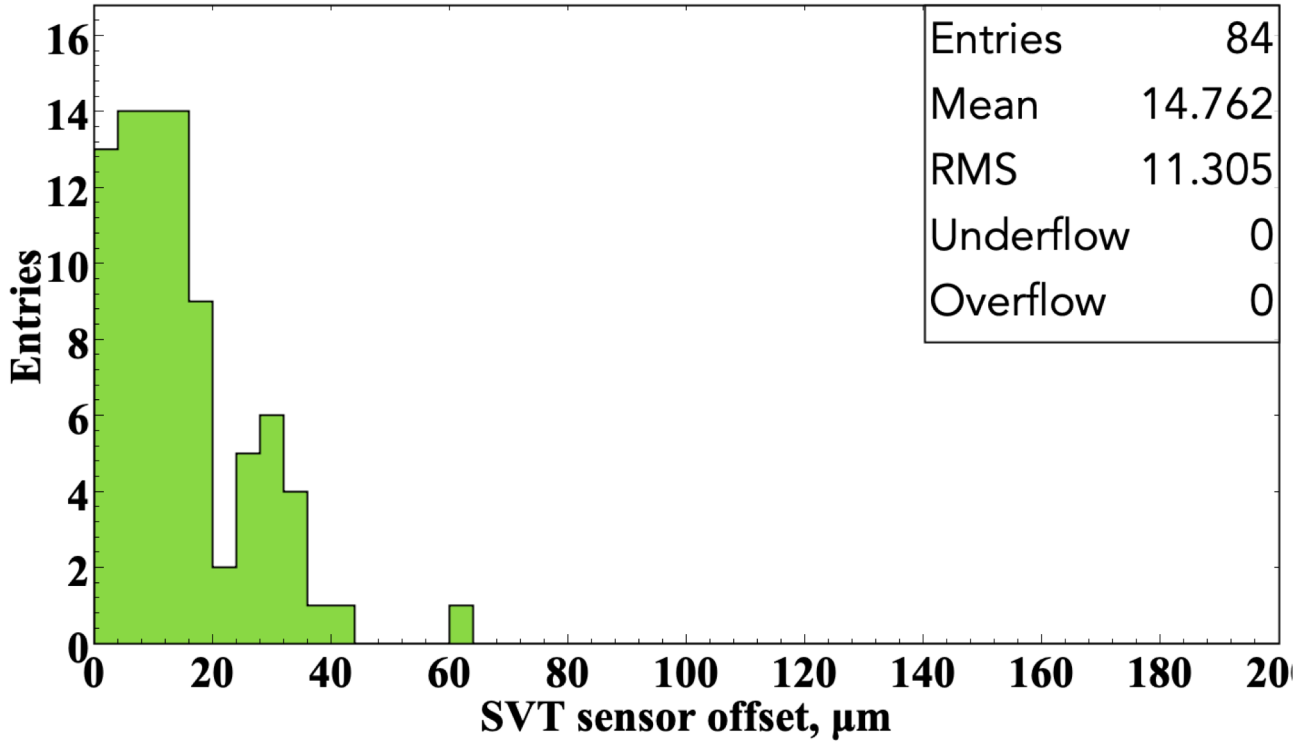


SVT Standalone Reconstruction
RGB run 11014, 5 nA, outbending
All tracks

Meeting the SVT performance specs

Stage 1: Initial SVT Alignment

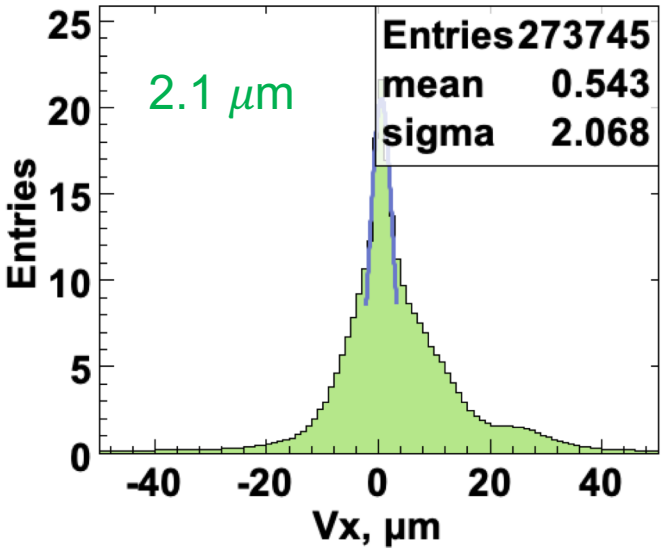


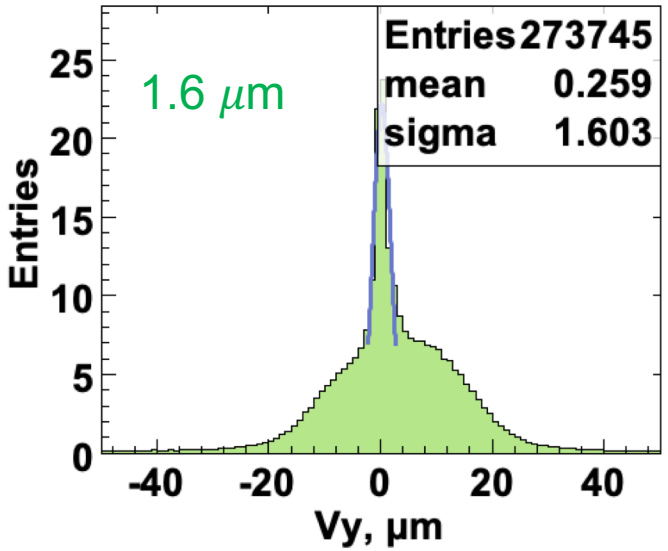


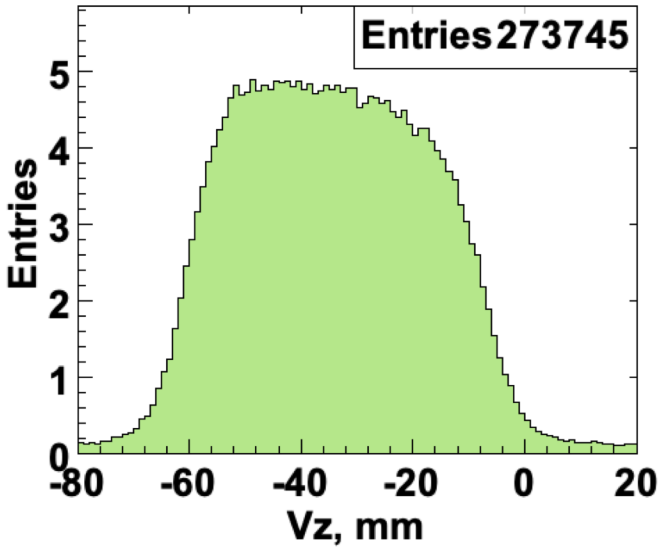
SVT Standalone Reconstruction
RGA run 4849, 5 nA, inbending
All tracks

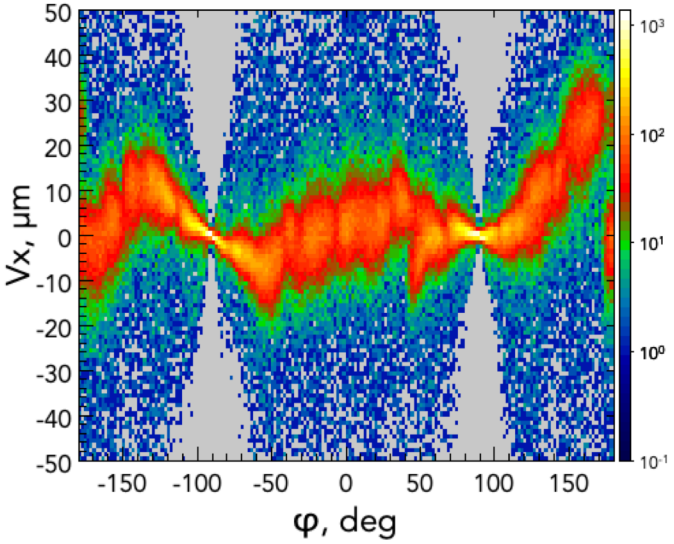
Meeting the SVT performance specs

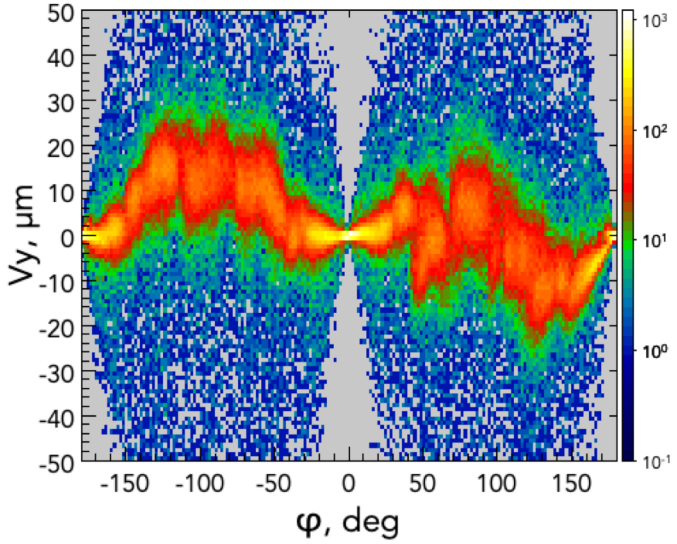
SVT Vertex Reconstruction, RGB run 11014, 5 nA, outbending

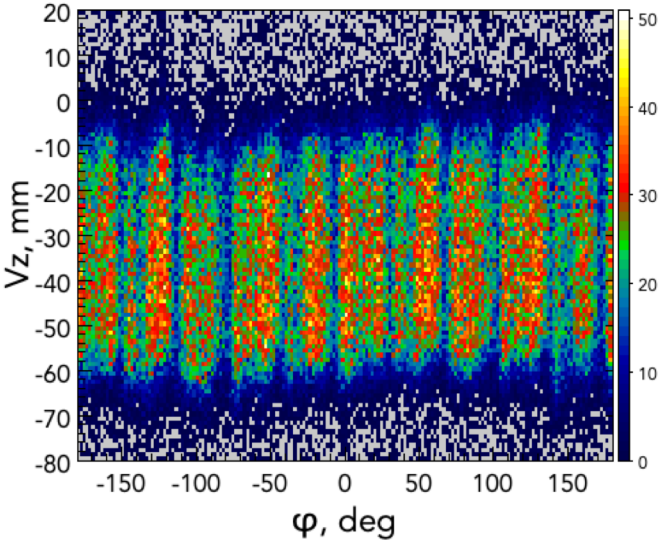










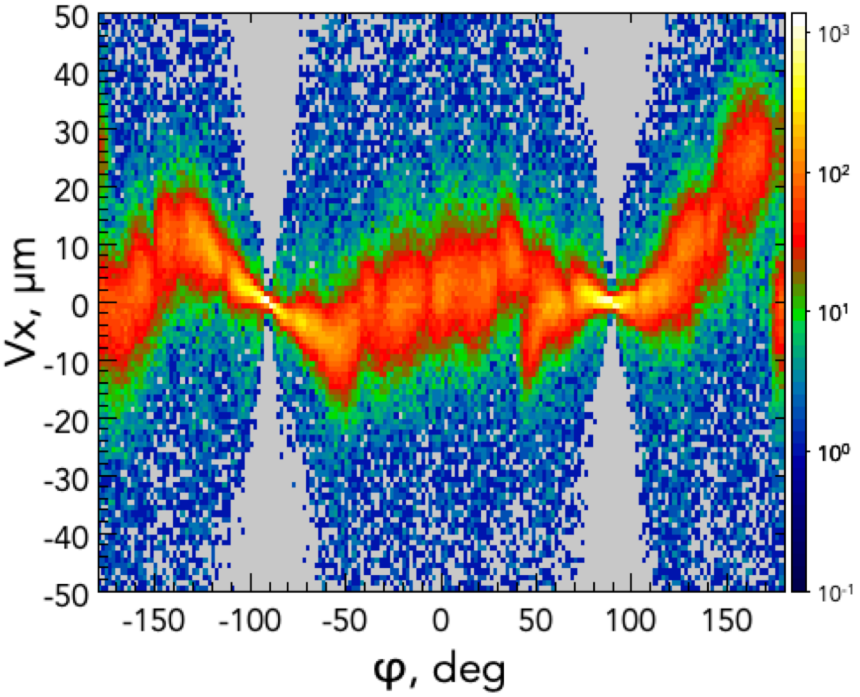


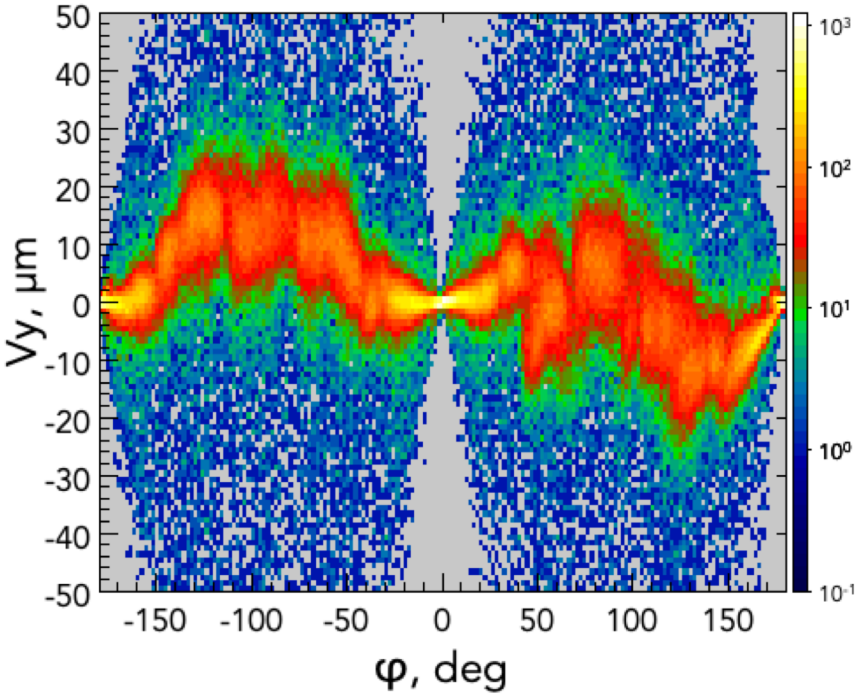
SVT standalone, all tracks

No beam spot correction

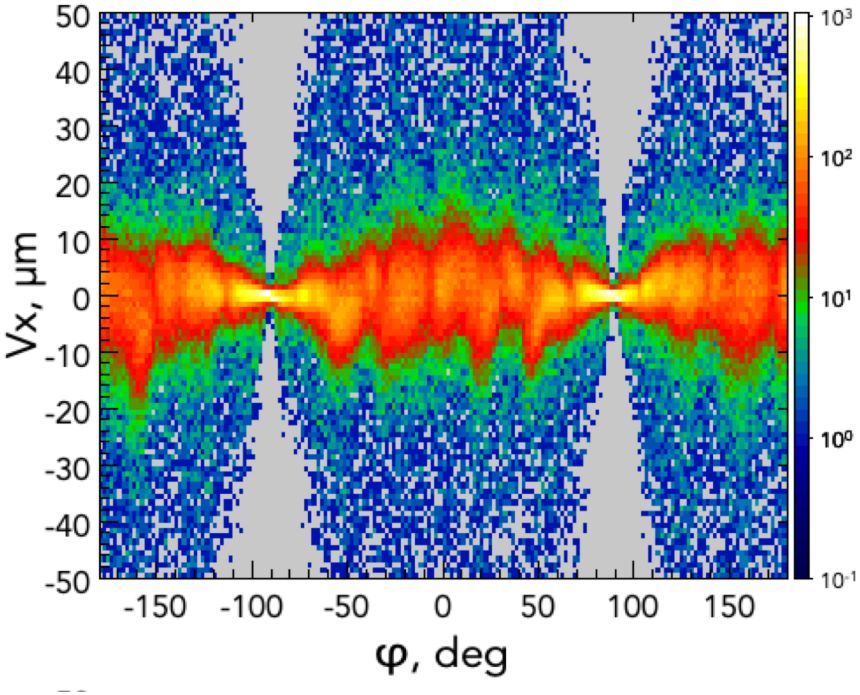
rga_fall2018_svtsurvey

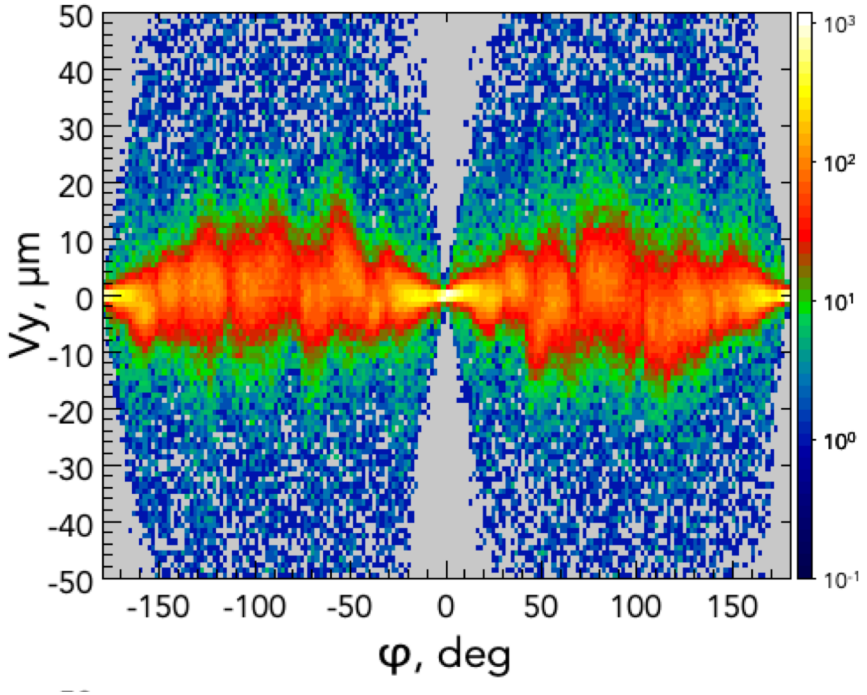
SVT Vertex Reconstruction, RGB run 11014, 5 nA, outbending





SVT survey

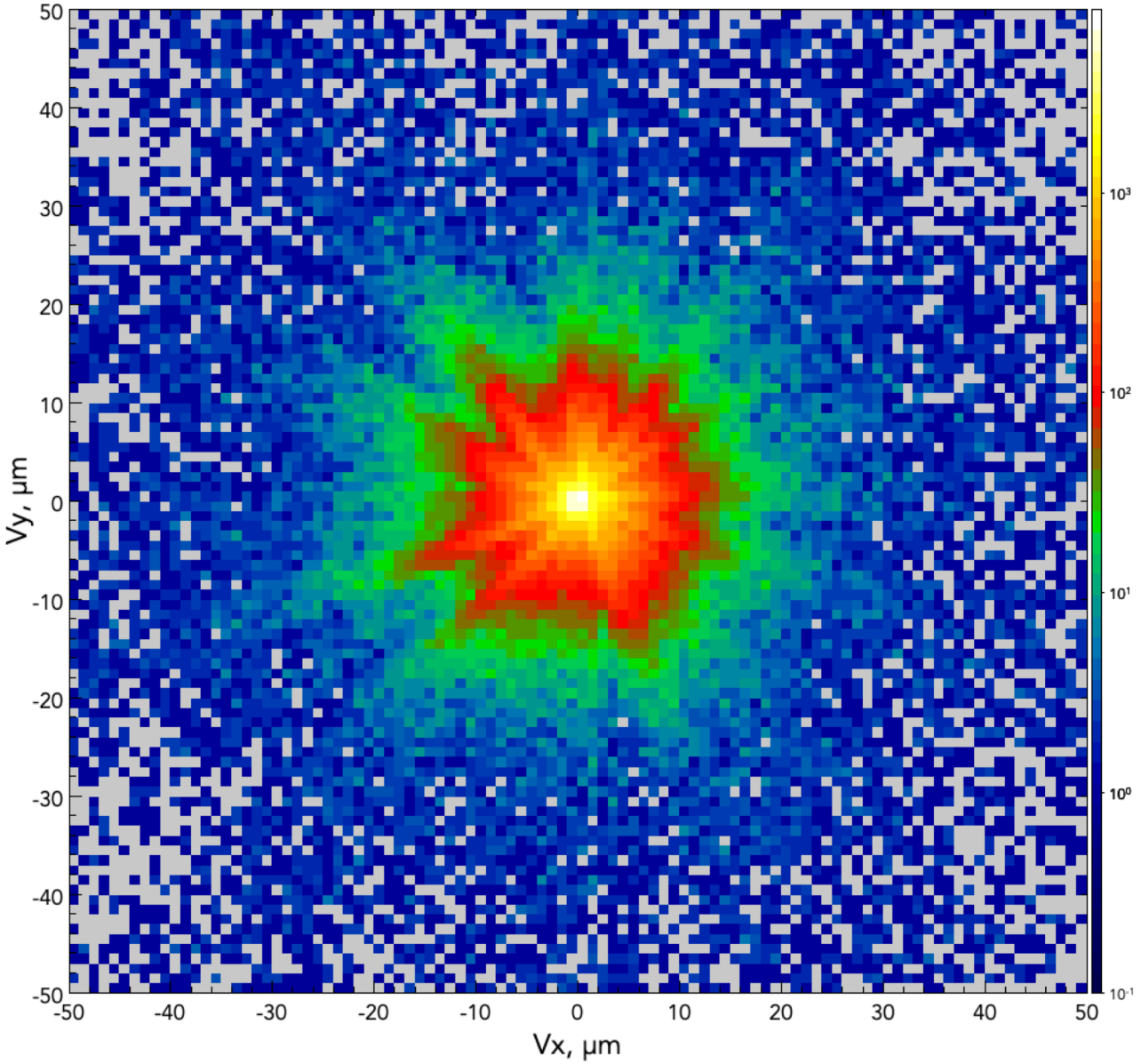




Pre-alignment

SVT standalone, all tracks, no beam spot correction

SVT Primary Vertex Reconstruction



RGB run 11014, 5 nA, outbending
all tracks, SVT standalone

Stage 2: Timothy's DC Alignment code in GitHub

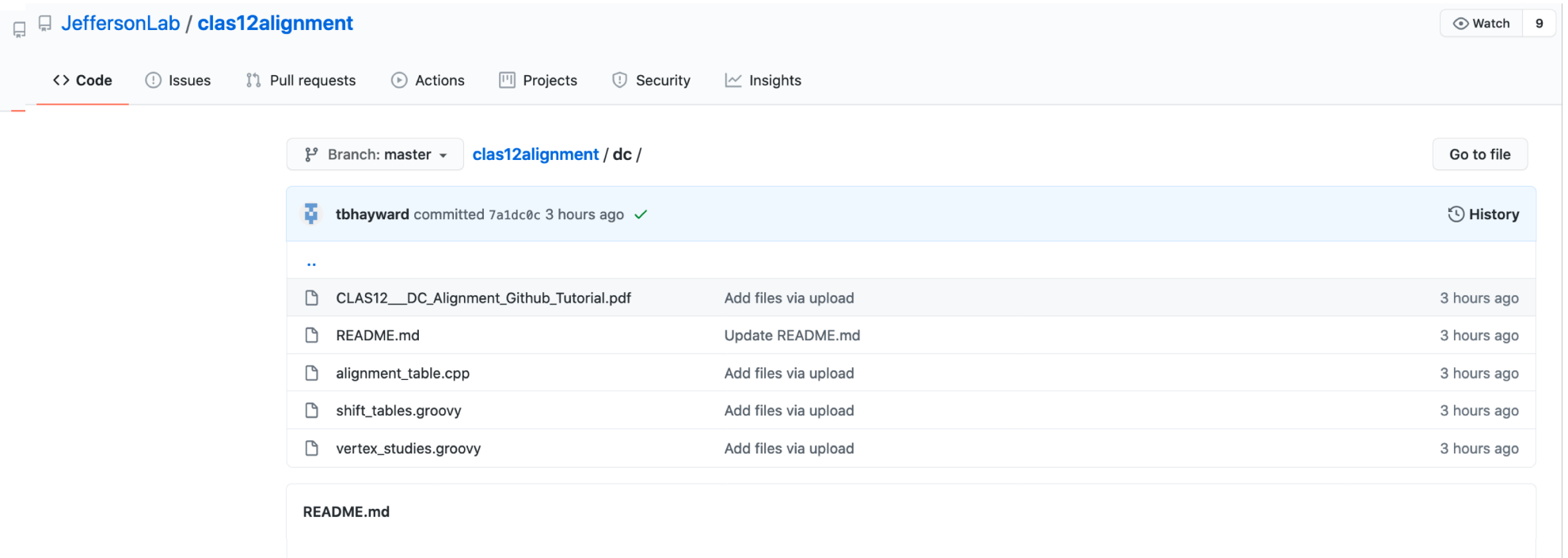
I. ANALYSIS PROCEDURE

A. Preparing the Unit Distortion Tables

It was determined that the optimal way in which to build the unit distortion tables was with real data instead of Monte Carlo. An empty target Monte Carlo sample would have to be carefully tuned in order to have the same angular distributions as real data in order to accurately reflect the fact that tracks at different angles change in different ways under each shift/rotation. This requires the reconstruction of the alignment runs with each of the separate shifts and rotations. The following ccdb tables have been created and can be reused in future alignments:

1) `nominal_shift_r1_localx_0p2cm`
2) `nominal_shift_r2_localx_0p2cm`
3) `nominal_shift_r3_localx_0p2cm`
4) `nominal_shift_r1_localy_0p2cm`
5) `nominal_shift_r2_localy_0p2cm`

https://github.com/JeffersonLab/clas12alignment/tree/master/dc



Improve track momentum and angular resolution

Geometry and Local Reconstruction

- Standardize helix definition and properties, geometry plugin for MeasVecs, covariance matrix numeric initialization, HIGH priority, 2 weeks, 0.5 FTE
- Implement and validate the methods for automatic plugin of the CVT geometry package in CLAS12 geometry framework, HIGH priority, 2 months, 0.5 FTE
- Improve cluster selection (BMT centroid estimate, skipped hits due to status hit linking validation, Lorentz angle corrections), HIGH priority, 3 months, 0.2 FTE

CVT Calibration

- Finish updating and validating the CCDB channel status tables *, MEDIUM priority, 4 months, 0.2 FTE
- Document SVT/BMT calibration procedures, upload calibration tools to the repository, HIGH priority, 2 months, 0.2 FTE
- Study calibration stability *, MEDIUM priority, 4 months, 0.2 FTE

Beamline and Shielding Improvements

- Study tagger dump shielding options considering the results of the Nuclear Target Test *, MEDIUM priority, 6 months, 0.2 FTE *(with High Lumi and Nuclear Target Test task forces)*

Improve tracking efficiency

Track Finding and Fitting Algorithms

- Implement and validate CVT/SVT straight track reconstruction, HIGH priority, 2 weeks, 0.2 FTE
- Develop and validate standalone Kalman Filter, HIGH priority, 2 weeks, 0.5 FTE
- Validate SVT geometry and standalone tracking, HIGH priority, 1 month, 0.2 FTE
- Improve track seeding (rejecting duplicate and ghost tracks), HIGH priority, 3 months, 0.2 FTE
- Study of possible background rejection algorithms *, HIGH priority, 4 months, 0.5 FTE *(with High Lumi & Background Merging task forces)*
- Validate MC truth matching code. Evaluate and document efficiency algorithms *, HIGH priority, 2 months, 0.5 FTE *(with High Lumi & Background Merging task forces)*
- Study multi-track reconstruction efficiency *, MEDIUM priority, 6 months, 0.2 FTE *(with High Lumi & Background Merging task forces)*
- Validate reconstruction of prompt and secondary vertices *, MEDIUM priority, 6 months, 0.2 FTE *(with Analysis Framework task force)*
- Study effects of multiple scattering on tracking efficiency *, MEDIUM priority, 6 months, 0.2 FTE

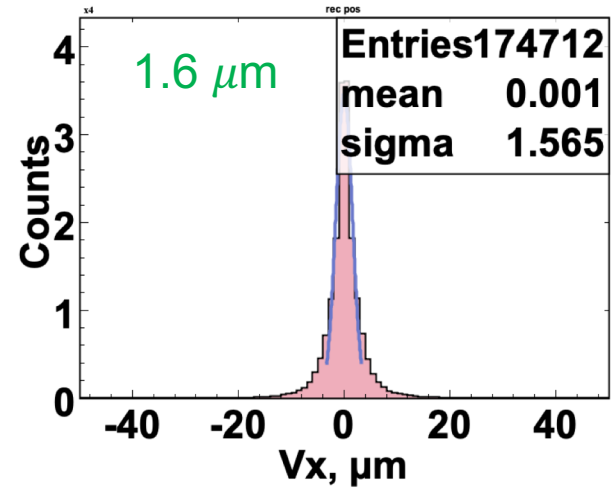
Hardware Improvements

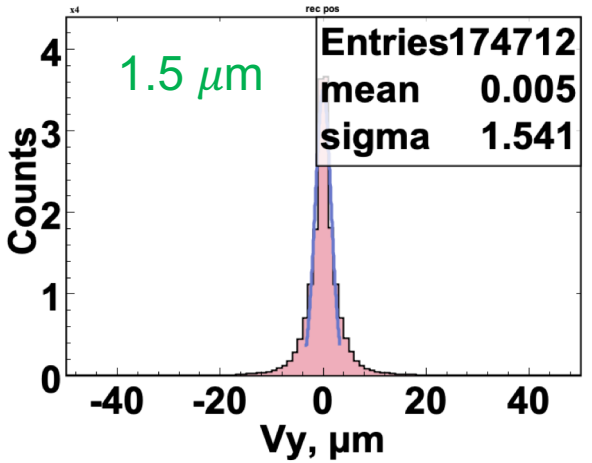
- Validate background reduction using hit timing information, HIGH priority, 4 months, 0.5 FTE
- Study dependence of tracking performance on HV settings (SVT under-depleted sensors, BMT trips) *, MEDIUM priority, 6 months, 0.2 FTE
- Study design, technology, and readout to allow CVT operations at higher luminosities *, LOW priority, 18 months, 0.2 FTE *(with High Lumi task force)*

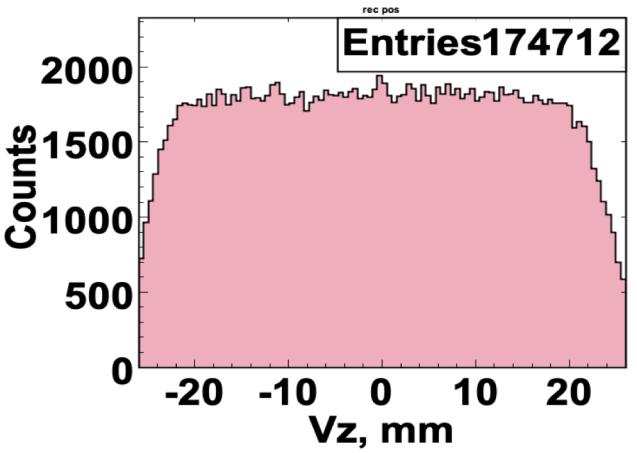
Tune MC simulation of the tracker to match the data

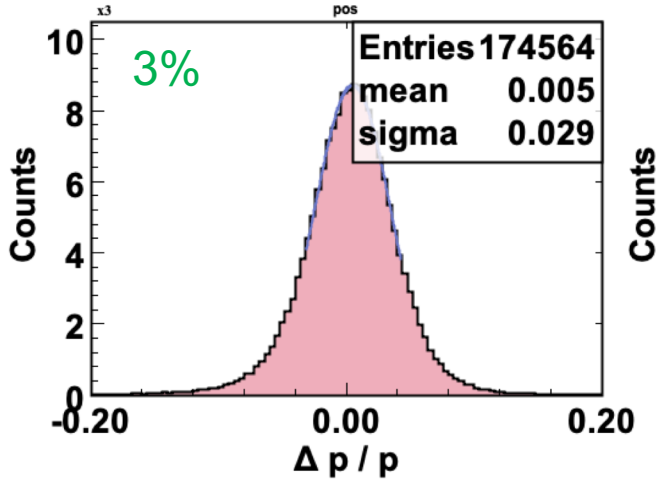
- Tune GEMC digitization to match data hit resolution and efficiency *, HIGH priority, 3 months, 0.3 FTE *(with Software task force)*
- Study momentum and vertex resolution of data and Monte Carlo *, MEDIUM priority, 3 months, 0.2 FTE *(with Forward Tracking task force)*
- Study dependence of tracking efficiency on luminosity *, HIGH priority, 3 months, 1.0 FTE *(with Background Merging task force)*
- Validate background and dose rate estimates based on the nuclear target test data *, MEDIUM priority, 4 months, 0.5 FTE *(with Nuclear Target Test task forces)*

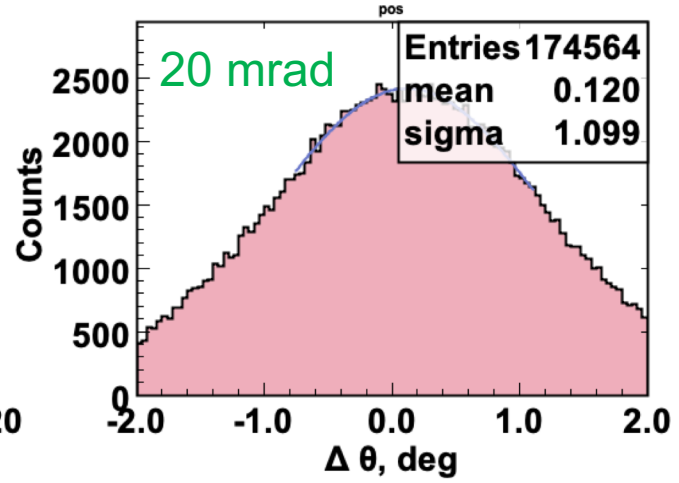
SVT Standalone Reconstruction, proton MC

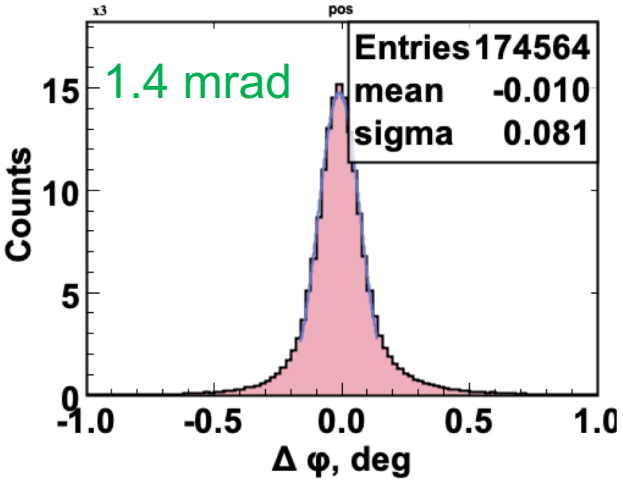


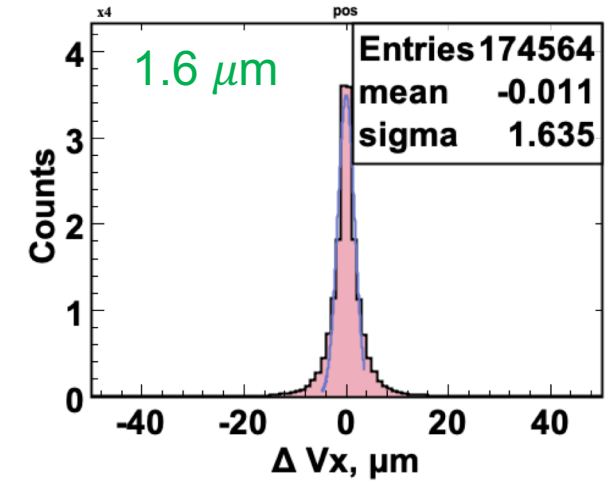


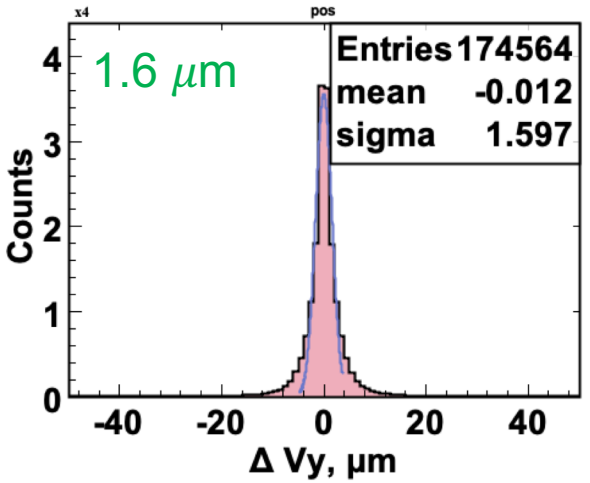


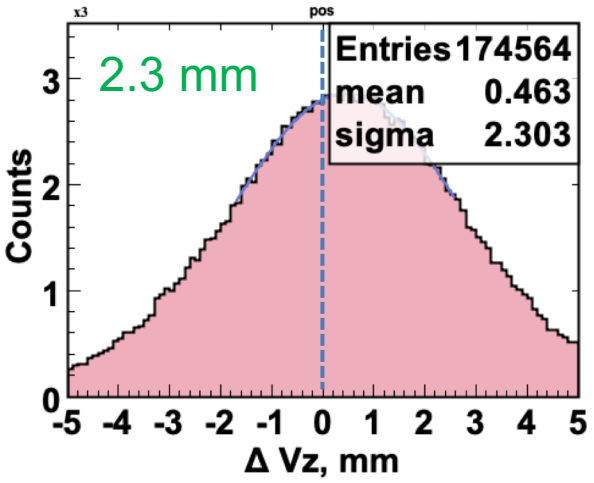




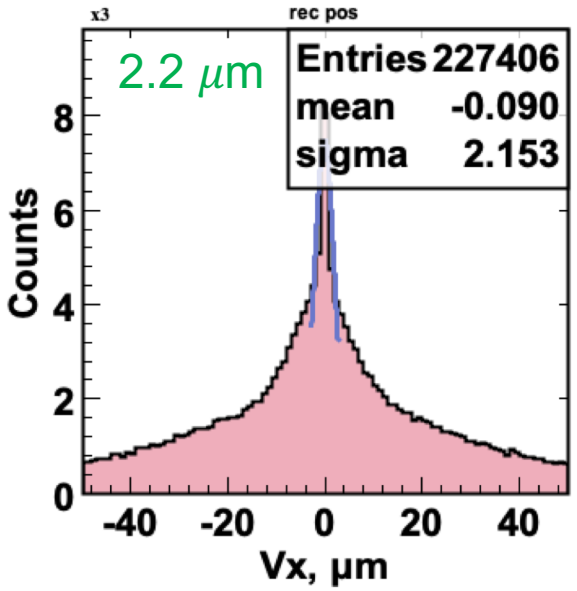


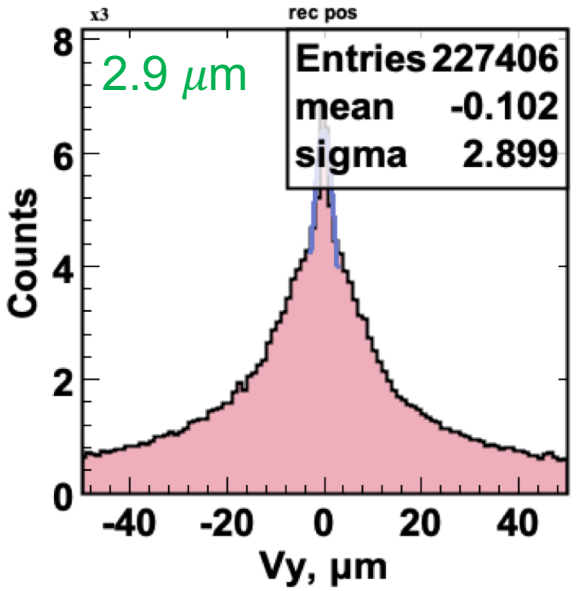


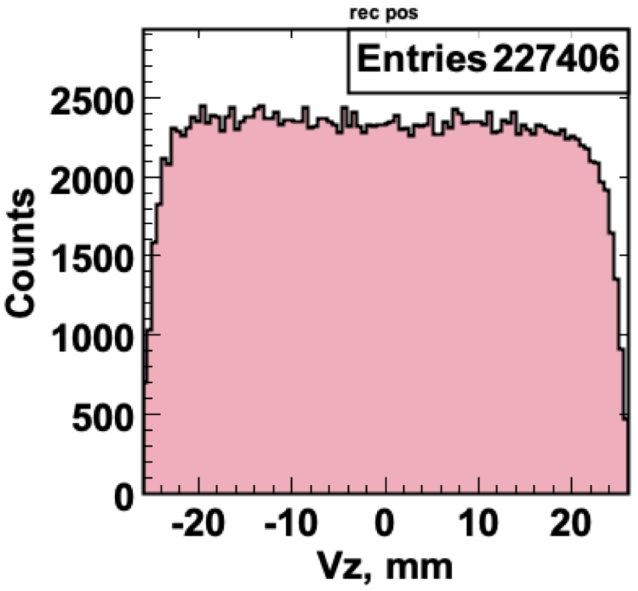


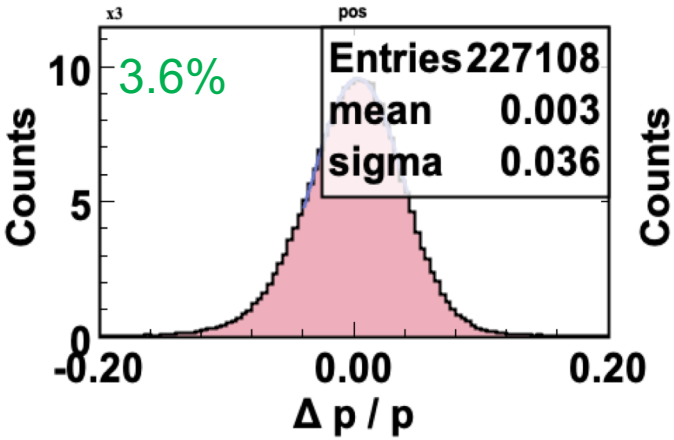


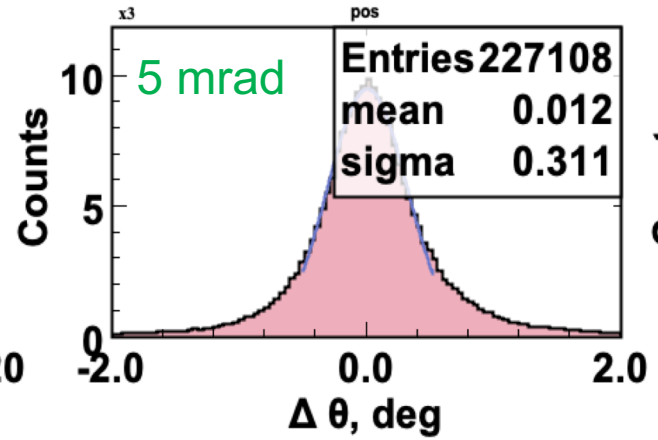
CVT Reconstruction, proton MC

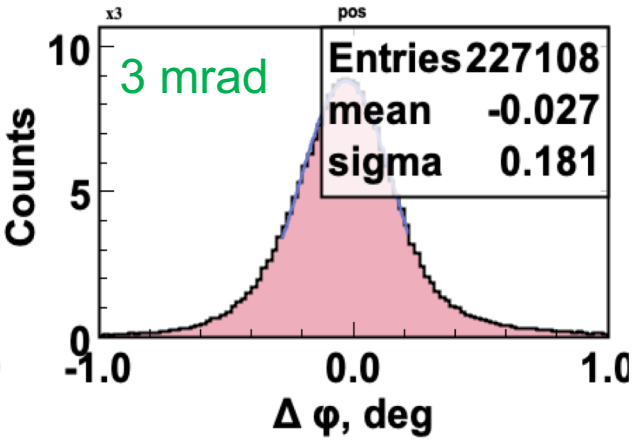


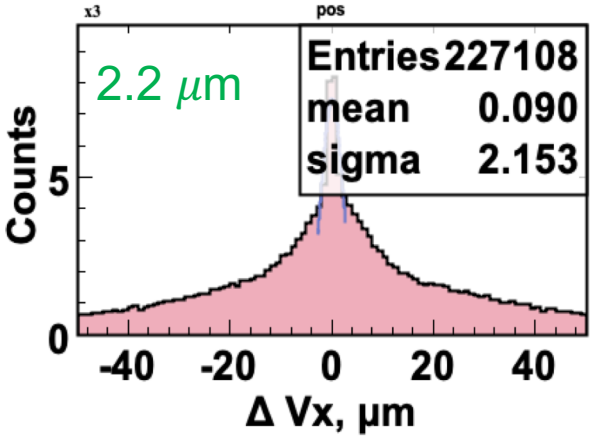


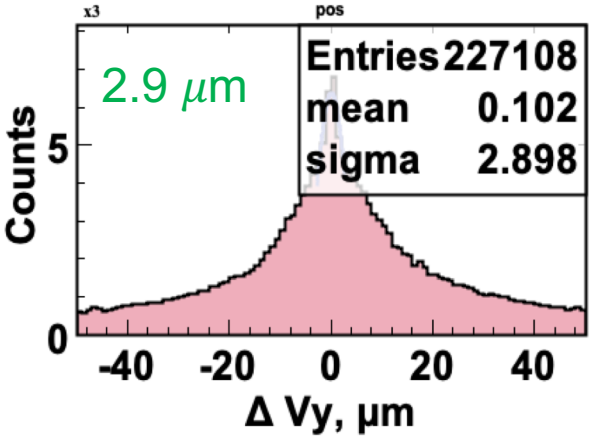


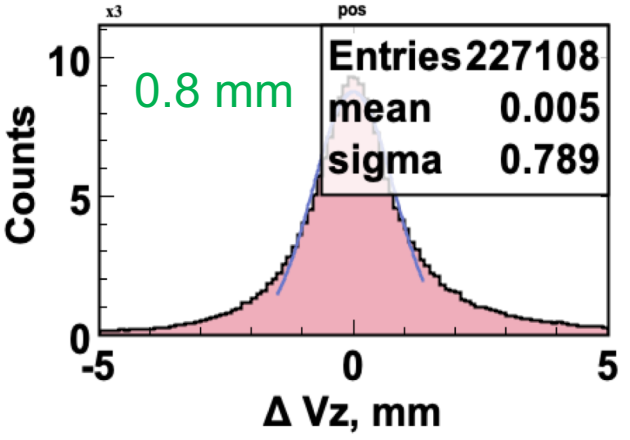




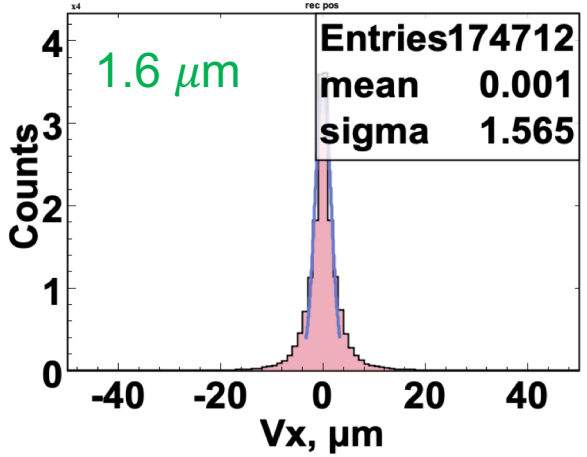


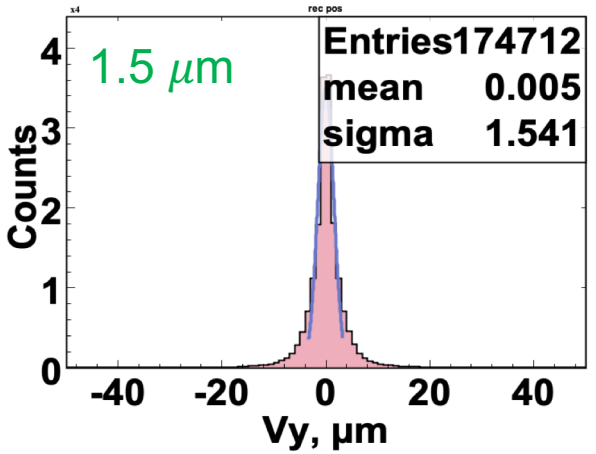


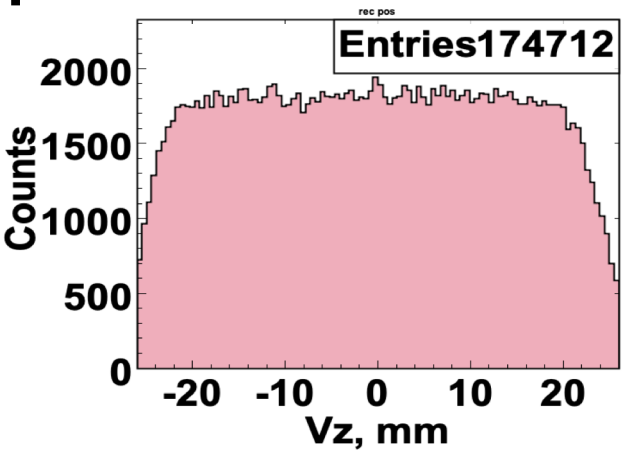


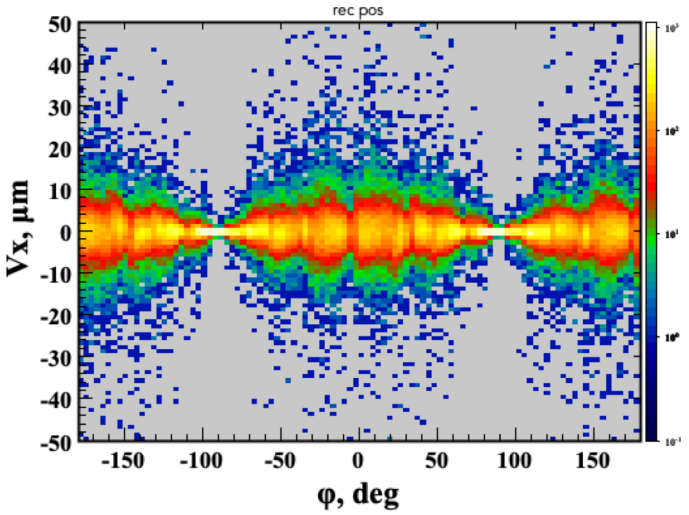


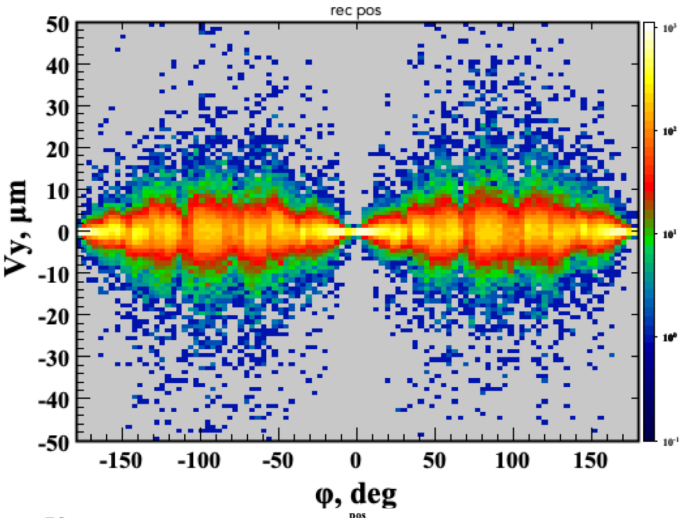
SVT Standalone Reconstruction, proton MC

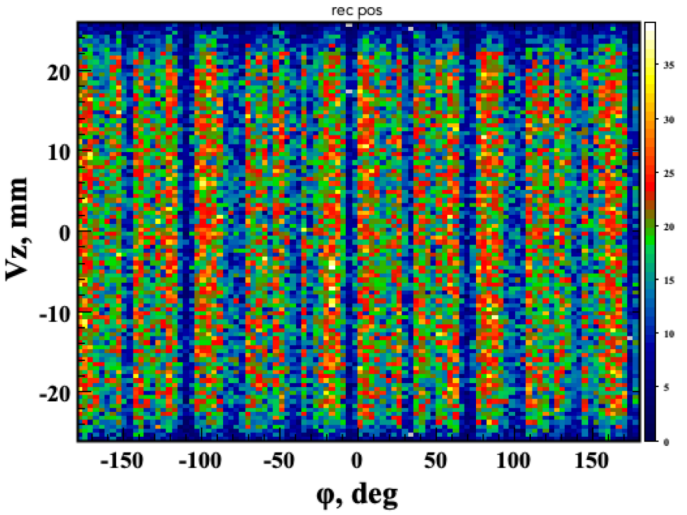


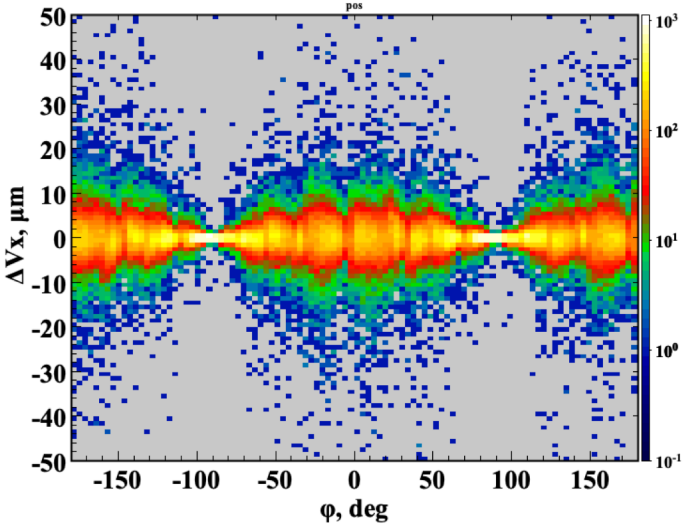


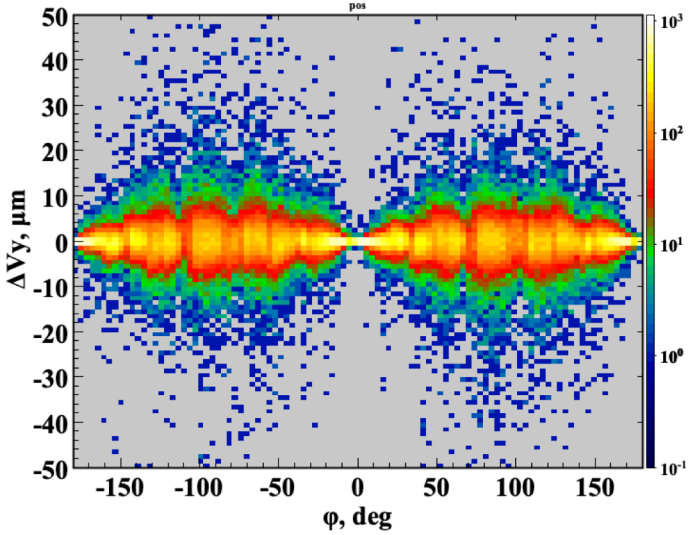


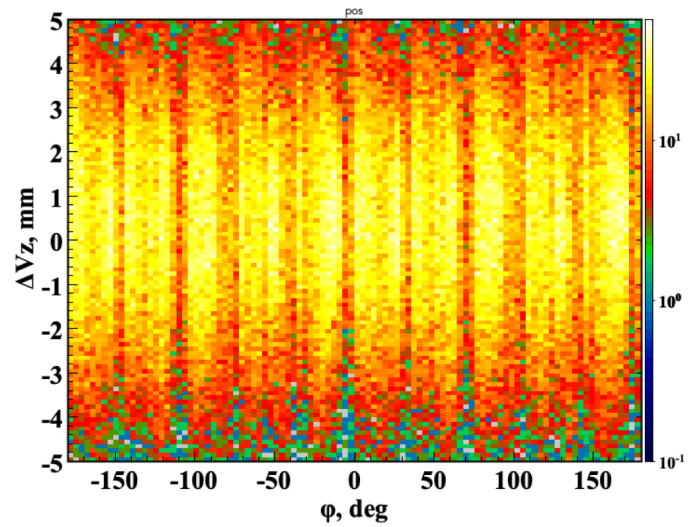




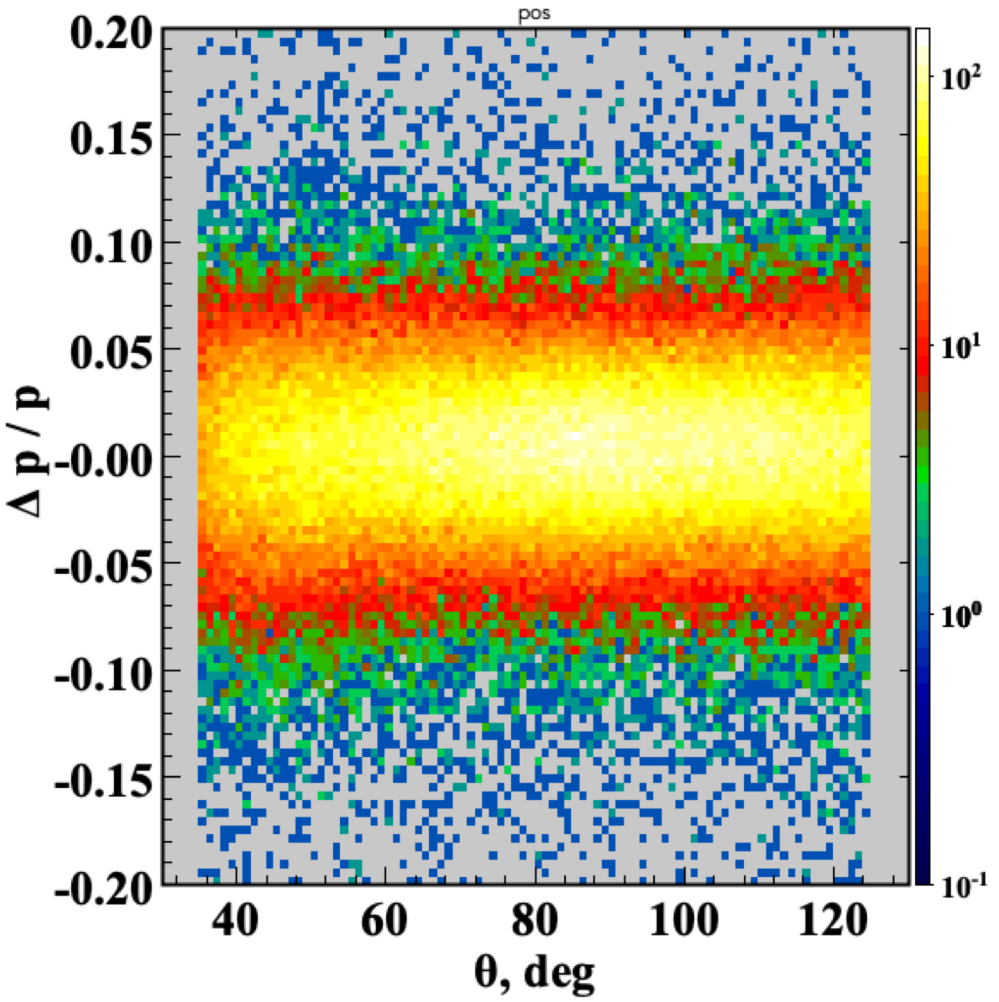




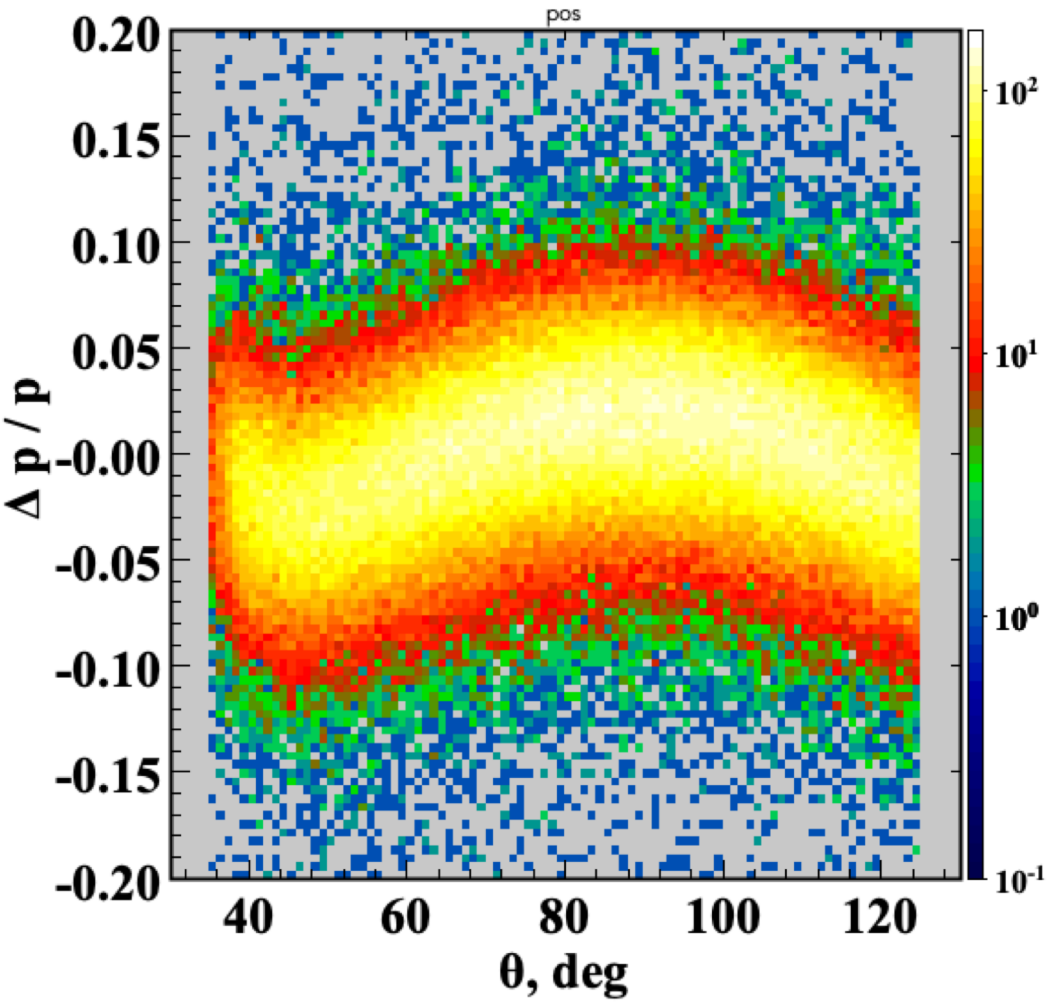




Proton MC



SVT reco



CVT reco

Reduce event reconstruction time

- Reduce track seeding memory footprint, HIGH priority, 3 months, 0.2 FTE
- Study possible improvements of the track swimming algorithm *, HIGH priority, 4 months, 0.3 FTE
- Use profiler to establish current speed. Study trade-offs between execution speed and algorithm efficiency *, MEDIUM priority, 6 months, 0.2 FTE *(with Software task force)*
- Evaluate pattern recognition and reducing combinatorics strategies, develop artificial intelligence algorithms for tracking *, LOW priority, 18 months, 0.4 FTE *(with AI task force)*
- Study feasibility and performance of streaming readout *, LOW priority, 24 months, 0.1 FTE *(with Streaming Readout task force)*

Validate tracking software and implement correction procedures

- Implement kinematic fitting for central tracking *, MEDIUM priority, 6 months, 0.2 FTE *(with Software task force)*
- Develop a common package for momentum corrections *, HIGH priority, 5 months, 1.0 FTE *(with Momentum Corrections task force)*
- Implement/study energy loss corrections in tracking *, HIGH priority, 1 month, 0.5 FTE *(with Software task force)*
- Review current tracking algorithm and assumptions, MEDIUM priority, 3 months, 0.5 FTE
- Implement fiducial cuts, MEDIUM priority, 6 months, 0.5 FTE FTE *(with Analysis Framework task force)*

CVT Reconstruction Tasks in Veronique's Workflow

- **Hit Selection**
  - Timing cuts implementation and study
  - Study of possible background rejection algorithms
- **Cluster Selection**
  - BMT centroid estimate improvement (alternate E-COG)
  - Validate Lorentz angle correction
  - Skipped hits due to status hit linking validation
- **Track Seeding**
  - SVT standalone validation
  - Straight tracks selection
  - More efficient rewrite (large memory footprint)
  - Ghosts identification
- **Geometry**
  - Methods implementation for automatic plugin of new geometry package
  - Debugging of SVT geometry (next slides)
    - SVT stand-alone
- **Track Fitting**
  - Standardization of Helix definition and helix properties (common tracking tools)
  - Standalone KF
    - Geometry plugin for MeasVecs
  - Covariance matrix numeric initialization (as DC)
  - Straight track fitting using KF
- **Trajectory**
  - Swimming speed

CVT Reconstruction Tasks Timelines

Now

- **Track Fitting**
  - Standardize Helix definition and helix properties
  - Standalone KF; Geometry plugin for MeasVecs
  - Covariance matrix numeric initialization (as DC)
  - E loss package
- **Geometry**
  - Debugging of SVT geometry, SVT stand-alone
- **Track Seeding**
  - SVT standalone validation
- **Track Fitting**
  - New KF validation
- **E loss package**
  - Debugging, validation by Very Strangers
- **Geometry**
  - Geometry package development

Jul. 30

- **Track Seeding**
  - Straight tracks selection
- **Track Fitting**
  - Straight track fitting using KF
- **Geometry**
  - Methods implementation for automatic plugin of new geometry package

Aug. 15

Aug. 25

- **Geometry**
  - Switch to new package and validation (all functionality for translations and rotation)
  - Validation

Sep. 15

At this stage the bulk of the development should be done

CVT Reconstruction Tasks Timelines

Sep. 15

- **Track Seeding**
  - More efficient rewrite (large memory footprint)
  - Ghosts identification

Oct. 7

- **Cluster Selection**
  - BMT centroid estimate improvement (alternate E-COG)
  - Skipped hits due to status hit linking

Oct. 21

- **Hit Selection**
  - Timing cuts implementation
  - Study of possible background rejection algorithms

Nov. 7

- **Trajectory**
  - Swimming speed

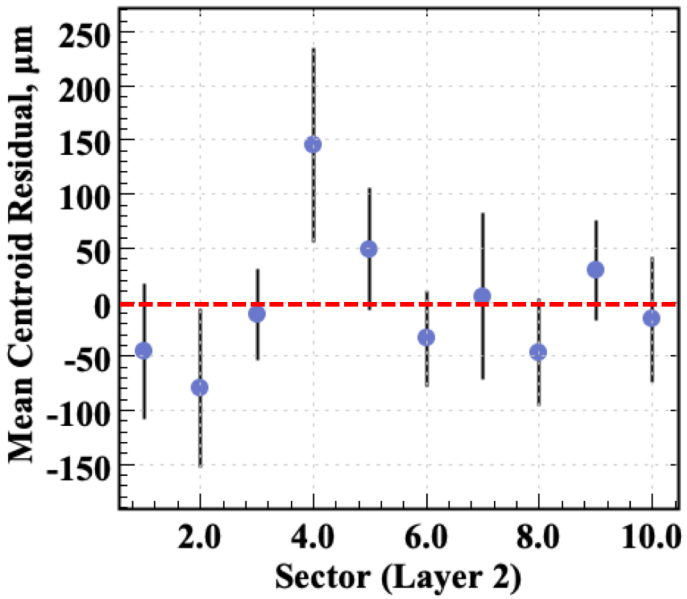
Nov. 15

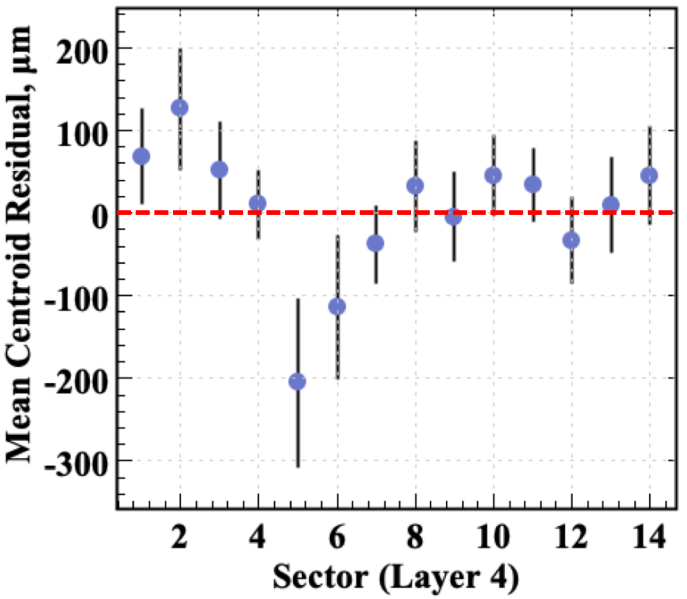
- **Validations**
- Including Lorentz angle correction

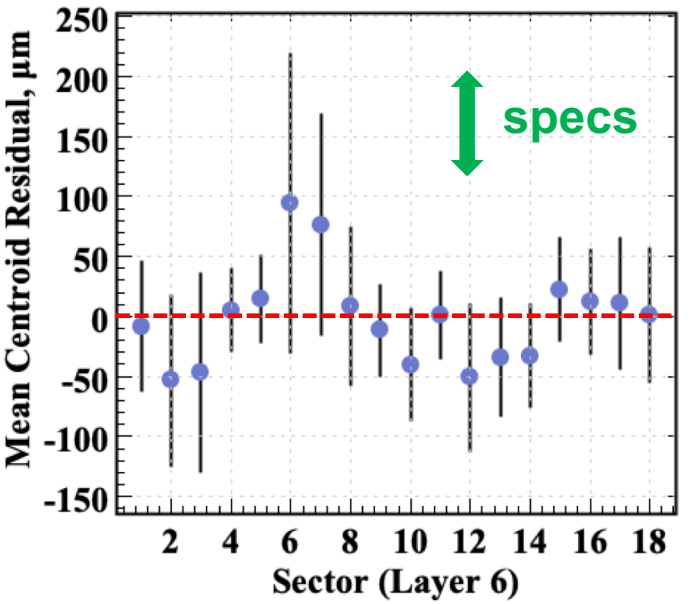
Best estimate of timeline assuming the majority of Veronique's time will be devoted to CVT tracking

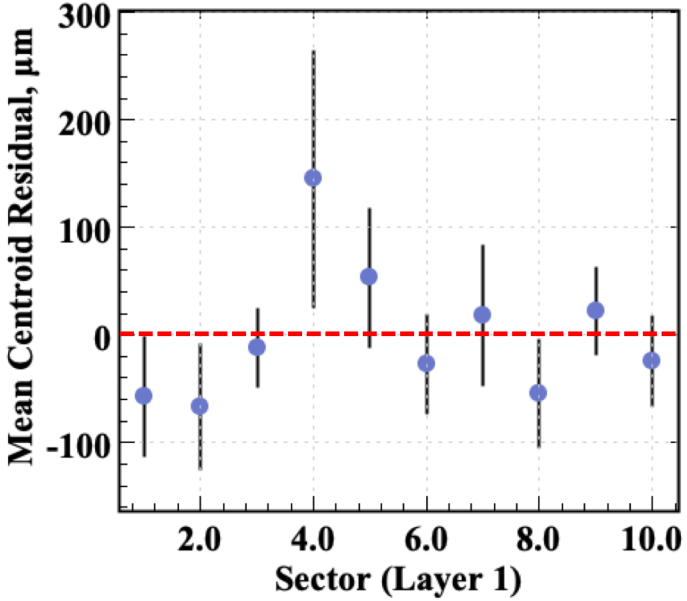
BACKUP

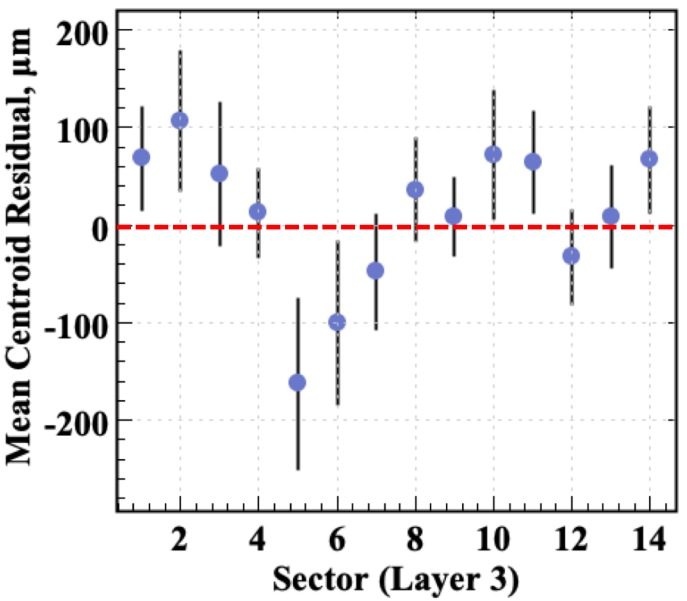
SVT Survey Misalignments, RGA run 4849, 5 nA, inbending

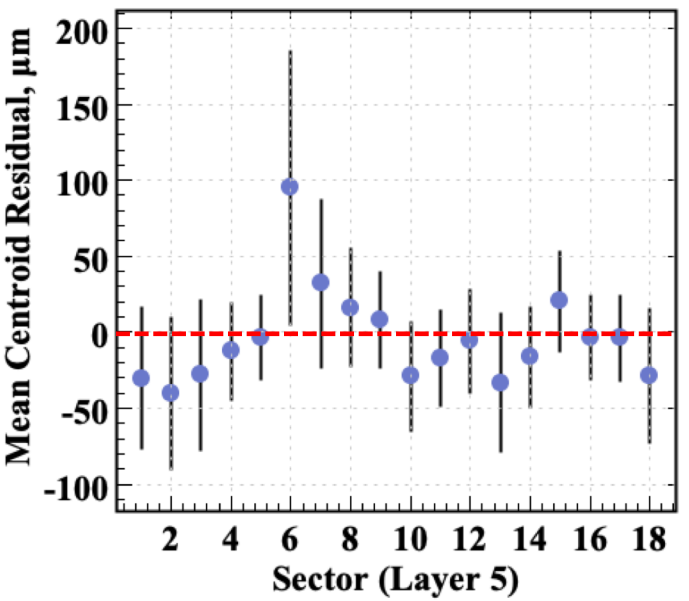






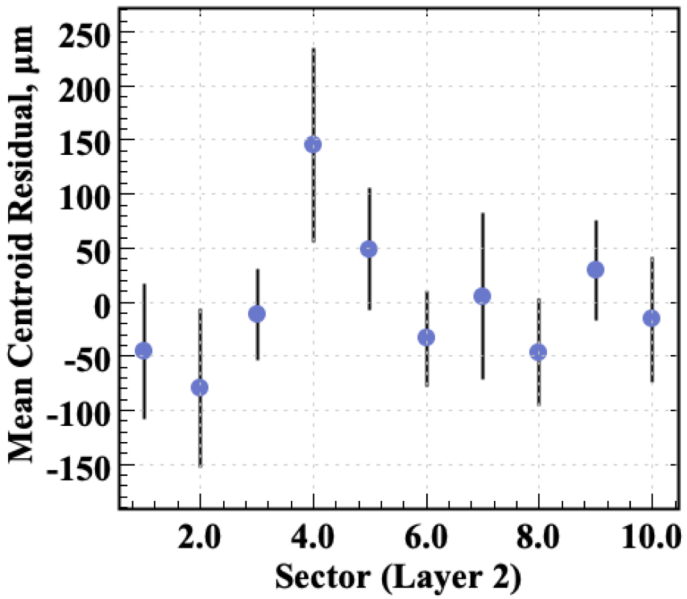


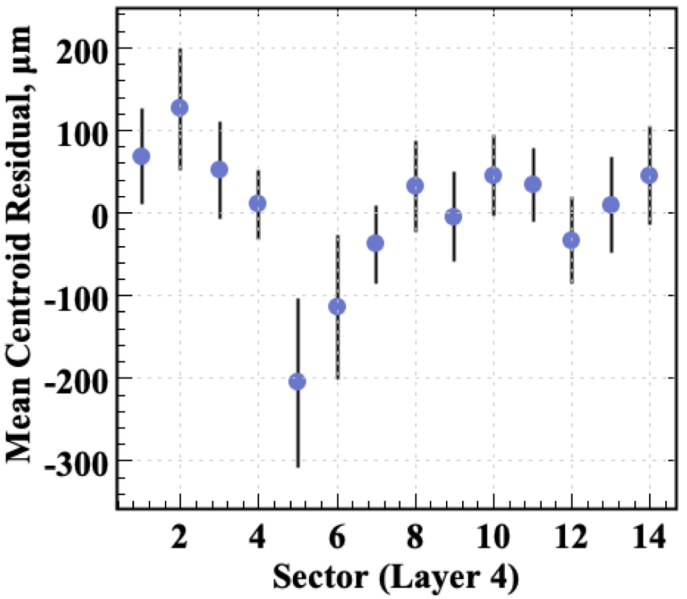


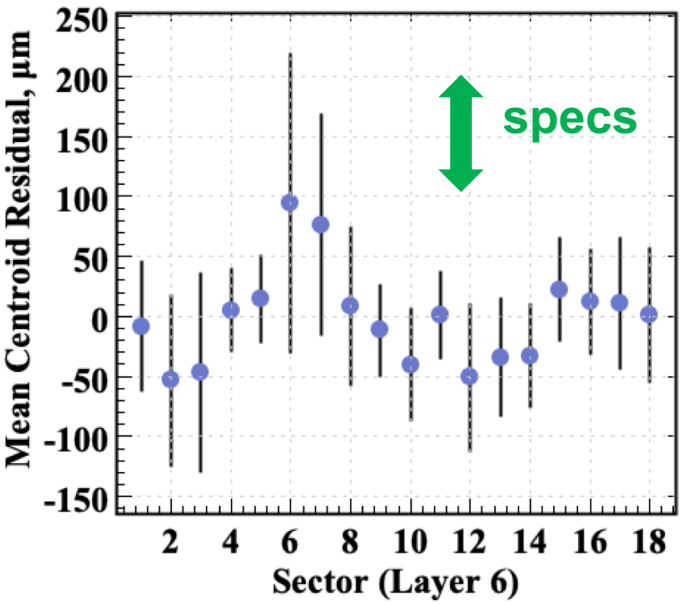


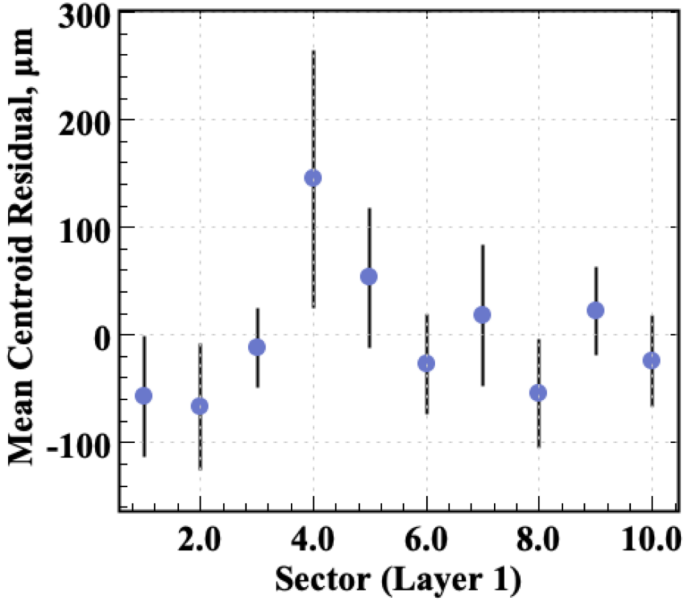
rga_fall2018_svtsurvey

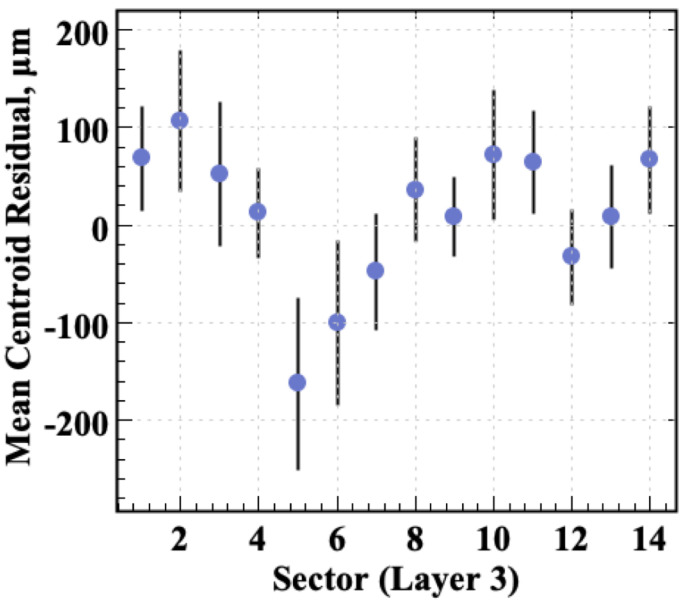
SVT Survey Misalignments, RGB run 11014, 5 nA, outbending

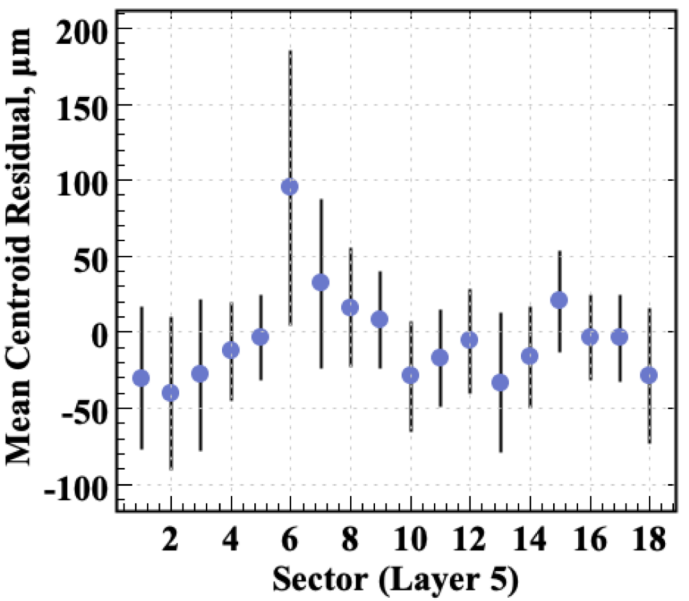




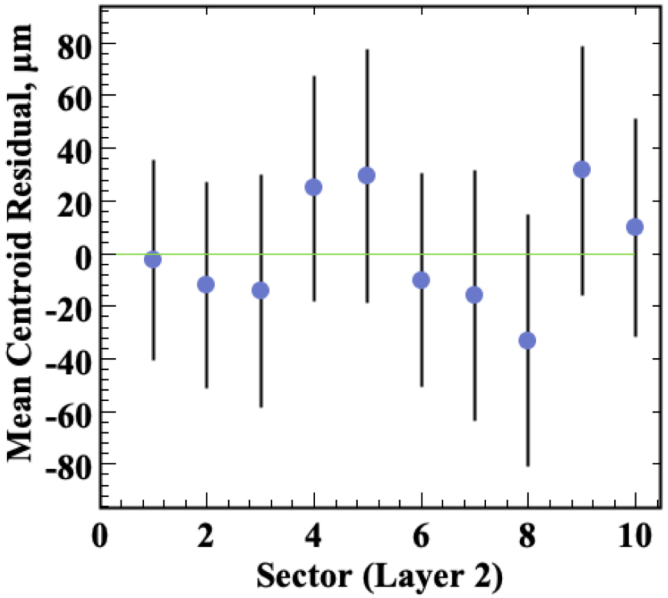


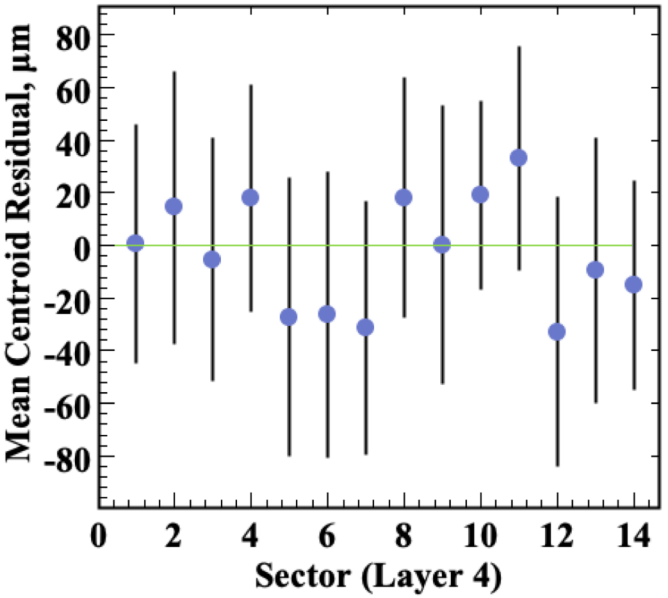


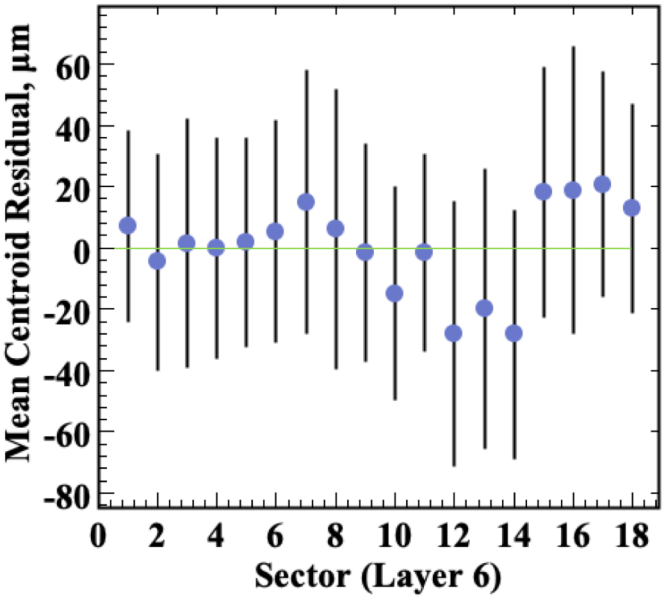


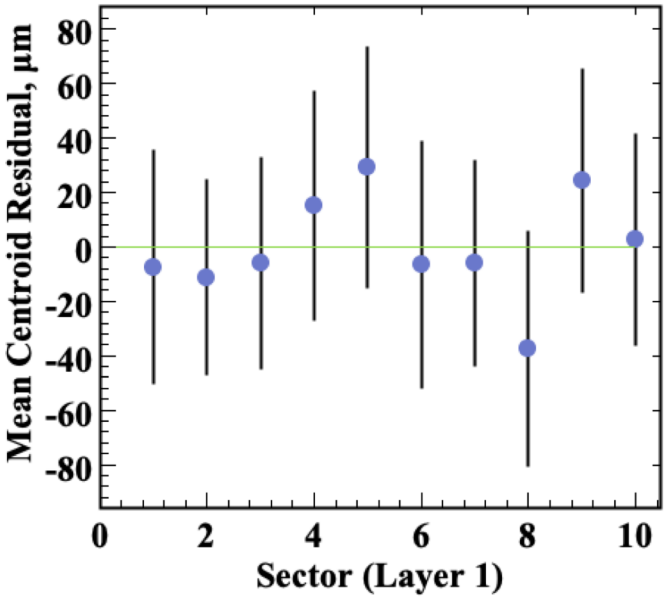


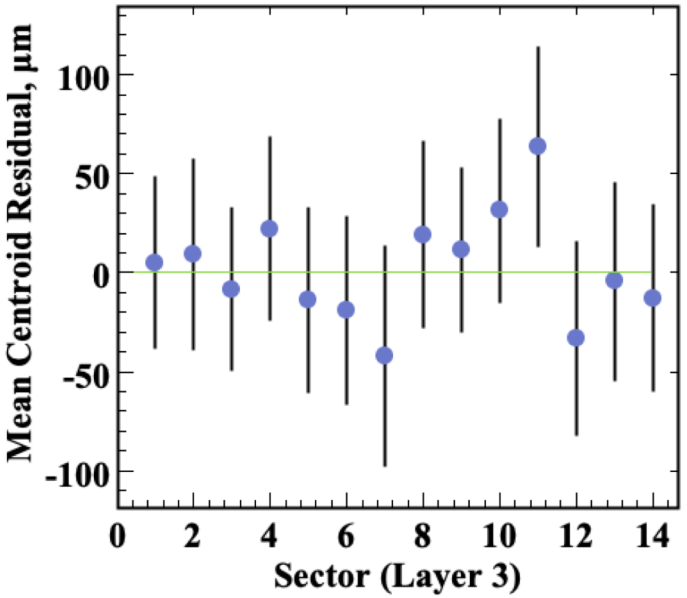
SVT pre-Alignment, RGA run 4849, 5 nA, inbending

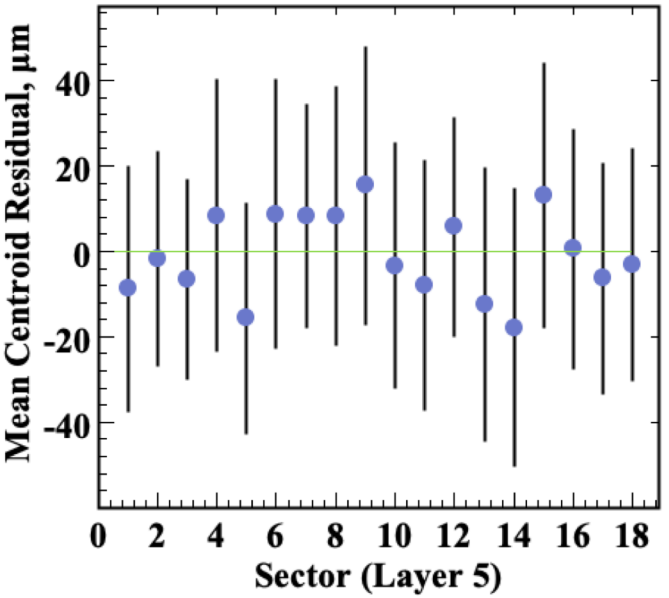












SVT pre-Alignment, RGB run 11014, 5 nA, outbending