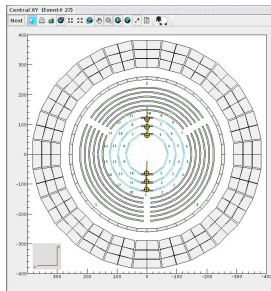


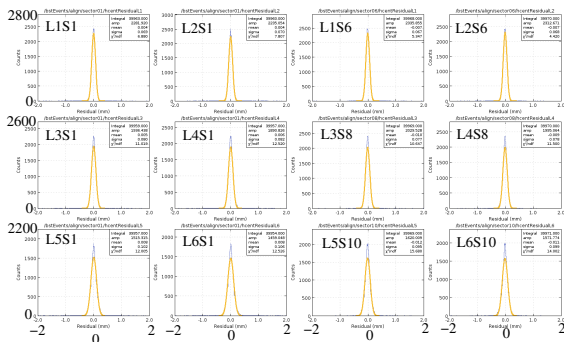
SVT Cosmic-Ray Reconstruction and Alignment

- Use cosmic rays (simulated and measured) to align the SVT.
- Demonstrated for type-1 tracks.
- Using SVT geometry package developed over last two years.
- Provides a single source of SVT geometry for *gemc* and reconstruction.
- Parameters including survey results are stored in *ccdb*.
- Part of Common Tools (*clas-jcsg*).
- Common Tools reconstruction code recently modified to use SVT geometry package.

SVT Cosmic-Ray Reconstruction and Alignment



Type-1 event



Type-1 residuals

Simulated with gmc4a.2.2 and reconstructed with COATJAVA 4a.8.3.

Test SVT Geometry with Line Calculations

Create Line3d object and print out start point for different sets of SVT geometry survey shifts. Survey shift values controlled using local version of database.

Shifts set to zero - results for sectors 1-2 in all layers for origin of line. Units are mm.

Method	Line3d	layer	sector	x	y	z
getPlaneModuleOrigin	labFrameLine:	1	1	-21.02	-65.29	-219.83
getPlaneModuleOrigin	labFrameLine:	2	1	-21.02	-68.77	-219.83
getPlaneModuleOrigin	labFrameLine:	3	1	-21.02	-92.89	-180.38
getPlaneModuleOrigin	labFrameLine:	4	1	-21.02	-96.37	-180.38
getPlaneModuleOrigin	labFrameLine:	5	1	-21.02	-120.32	-141.21
getPlaneModuleOrigin	labFrameLine:	6	1	-21.02	-123.80	-141.21
getPlaneModuleOrigin	labFrameLine:	1	2	-55.38	-40.47	-219.83
getPlaneModuleOrigin	labFrameLine:	2	2	-57.42	-43.28	-219.83
getPlaneModuleOrigin	labFrameLine:	3	2	-59.24	-74.57	-180.38
getPlaneModuleOrigin	labFrameLine:	4	2	-60.75	-77.71	-180.38
getPlaneModuleOrigin	labFrameLine:	5	2	-60.90	-105.88	-141.21
getPlaneModuleOrigin	labFrameLine:	6	2	-62.09	-109.15	-141.21

Shifts on: R1 all zeros, R2 dx = 1.0 sector 1 only, all others zero.

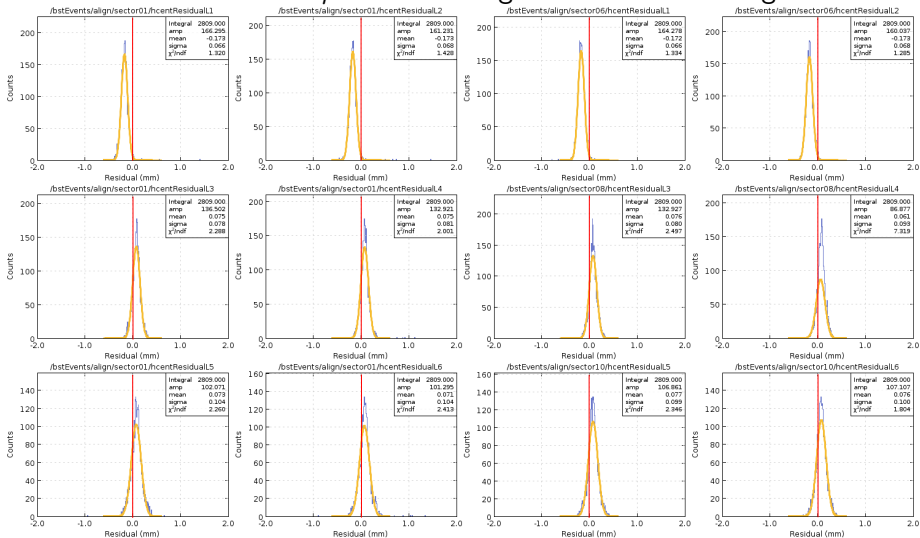
getPlaneModuleOrigin	labFrameLine:	1	1	-21.02	-65.29	-219.83	
getPlaneModuleOrigin	labFrameLine:	2	1	-21.02	-68.77	-219.83	
getPlaneModuleOrigin	labFrameLine:	3	1	-20.02	-92.89	-180.38	<-- shifted by correct amount
getPlaneModuleOrigin	labFrameLine:	4	1	-20.02	-96.37	-180.38	<-- shifted by correct amount
getPlaneModuleOrigin	labFrameLine:	5	1	-21.02	-120.32	-141.21	
getPlaneModuleOrigin	labFrameLine:	6	1	-21.02	-123.80	-141.21	
getPlaneModuleOrigin	labFrameLine:	1	2	-55.38	-40.47	-219.83	no shifts
getPlaneModuleOrigin	labFrameLine:	2	2	-57.42	-43.28	-219.83	
getPlaneModuleOrigin	labFrameLine:	3	2	-59.24	-74.57	-180.38	
getPlaneModuleOrigin	labFrameLine:	4	2	-60.75	-77.71	-180.38	
getPlaneModuleOrigin	labFrameLine:	5	2	-60.90	-105.88	-141.21	
getPlaneModuleOrigin	labFrameLine:	6	2	-62.09	-109.15	-141.21	

Shifts on: R1 all zeros, R2 dx = 0.5 sector 2 only, all others zero.

getPlaneModuleOrigin	labFrameLine:	1	1	-21.02	-65.29	-219.83	no shifts
getPlaneModuleOrigin	labFrameLine:	2	1	-21.02	-68.77	-219.83	
getPlaneModuleOrigin	labFrameLine:	3	1	-21.02	-92.89	-180.38	
getPlaneModuleOrigin	labFrameLine:	4	1	-21.02	-96.37	-180.38	
getPlaneModuleOrigin	labFrameLine:	5	1	-21.02	-120.32	-141.21	
getPlaneModuleOrigin	labFrameLine:	6	1	-21.02	-123.80	-141.21	
getPlaneModuleOrigin	labFrameLine:	1	2	-55.38	-40.47	-219.83	
getPlaneModuleOrigin	labFrameLine:	2	2	-57.42	-43.28	-219.83	
getPlaneModuleOrigin	labFrameLine:	3	2	-58.74	-74.57	-180.38	<-- shifted by correct amount
getPlaneModuleOrigin	labFrameLine:	4	2	-60.25	-77.71	-180.38	<-- shifted by correct amount
getPlaneModuleOrigin	labFrameLine:	5	2	-60.90	-105.88	-141.21	
getPlaneModuleOrigin	labFrameLine:	6	2	-62.09	-109.15	-141.21	

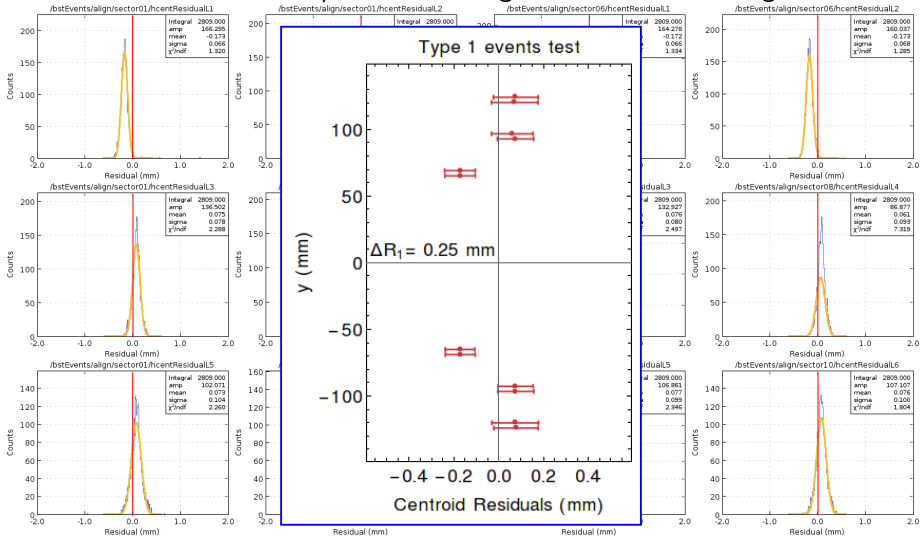
Test SVT Cosmic-Ray Reconstruction

Insert a $\Delta x = 250 \mu\text{m}$ shift in Region 1 of the SVT in gemc.



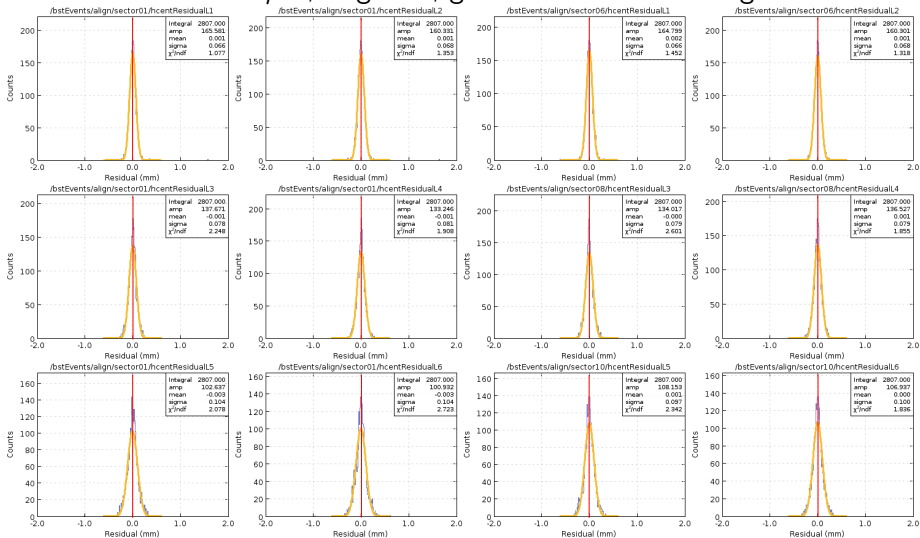
Test SVT Cosmic-Ray Reconstruction

Insert a $\Delta x = 250 \mu\text{m}$ shift in Region 1 of the SVT in gemc.



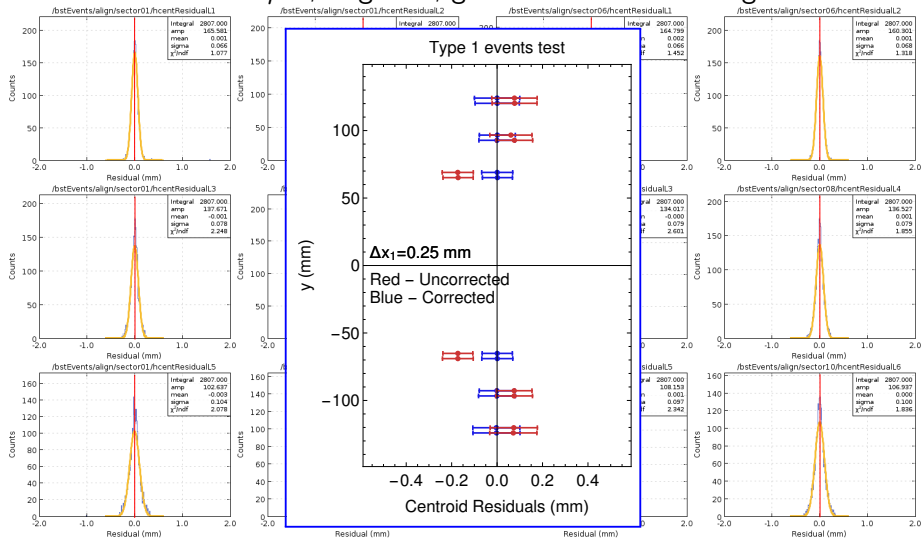
Test SVT Cosmic-Ray Reconstruction and Shifts

Correct $\Delta x = 250 - \mu\text{m}$, Region-1, gemc shift with SVT alignment shifts.



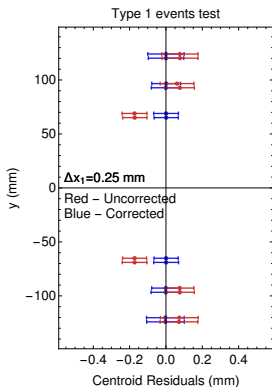
Test SVT Cosmic-Ray Reconstruction and Shifts

Correct $\Delta x = 250 - \mu\text{m}$, Region-1, gemc shift with SVT alignment shifts.

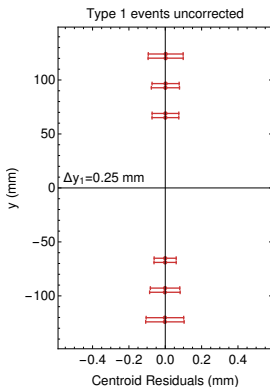


Test SVT Cosmic-Ray Reconstruction and Shifts

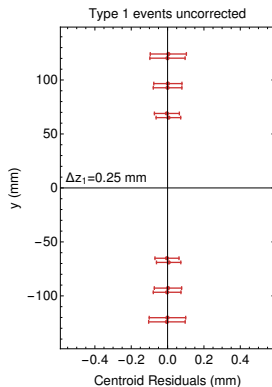
Same size shifts in other directions.



$$\Delta x = 250 \mu\text{m}$$

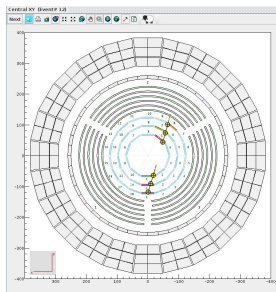


$$\Delta y = 250 \mu\text{m}$$

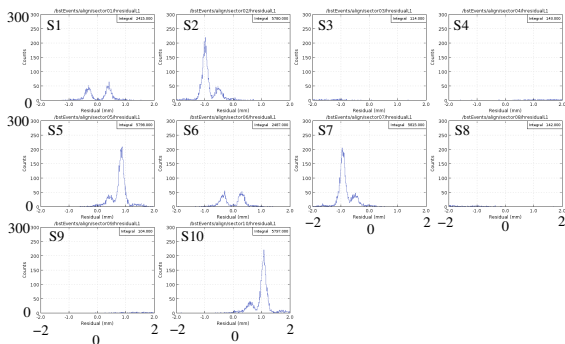


$$\Delta z = 250 \mu\text{m}$$

SVT Cosmic-Ray Reconstruction and Alignment



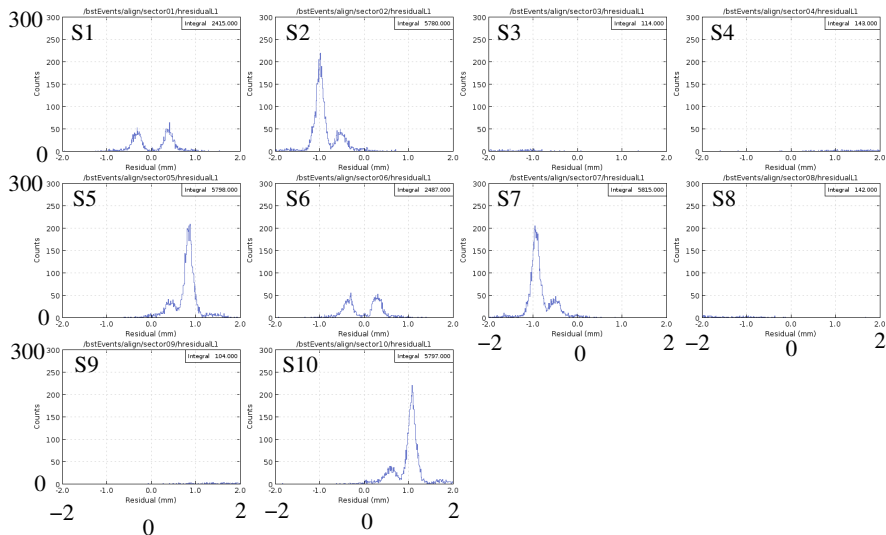
Type-2 event



Type-2, Single-strip, layer-1 residuals

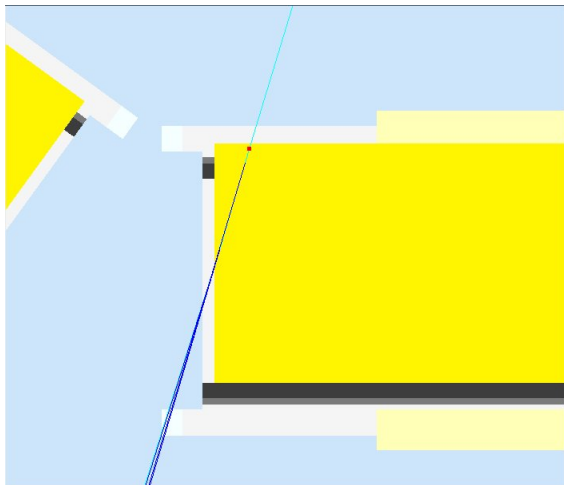
Simulated with gmc4a.2.2 and reconstructed with COATJAVA 4a.8.3.

SVT Cosmic-Ray Reconstruction and Alignment



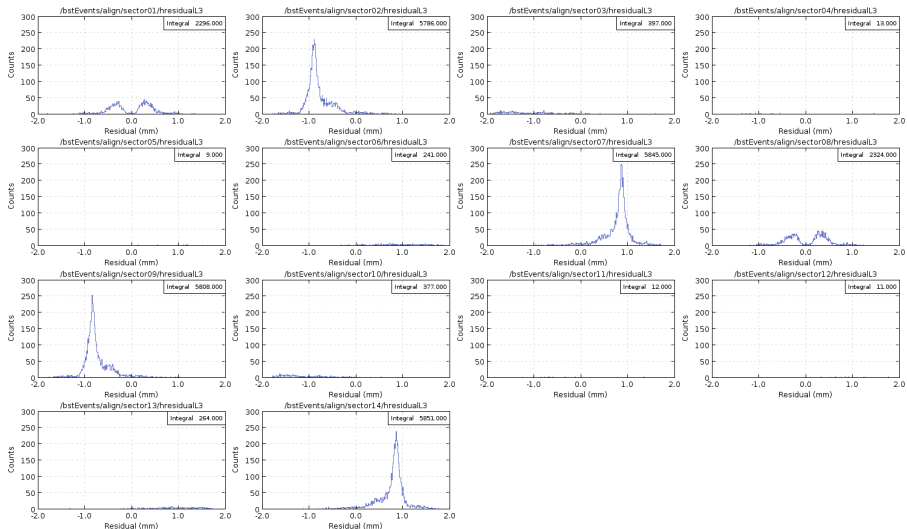
Type-2, Single-strip, layer-1 residuals

Compare Reconstruction and *gemc* geometry



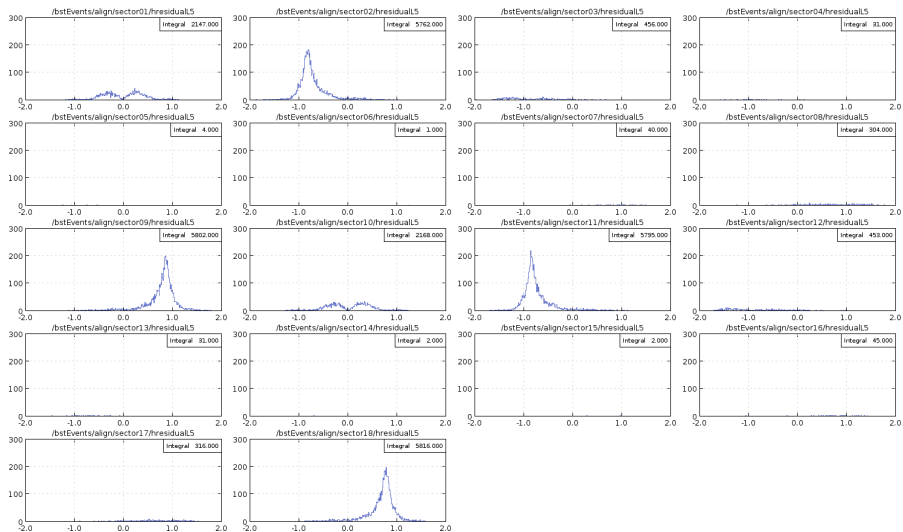
Layer 1, Sector 1, Strip 1 position calculated from reconstruction code and then simulated in *gemc*.

SVT Cosmic-Ray Reconstruction and Alignment



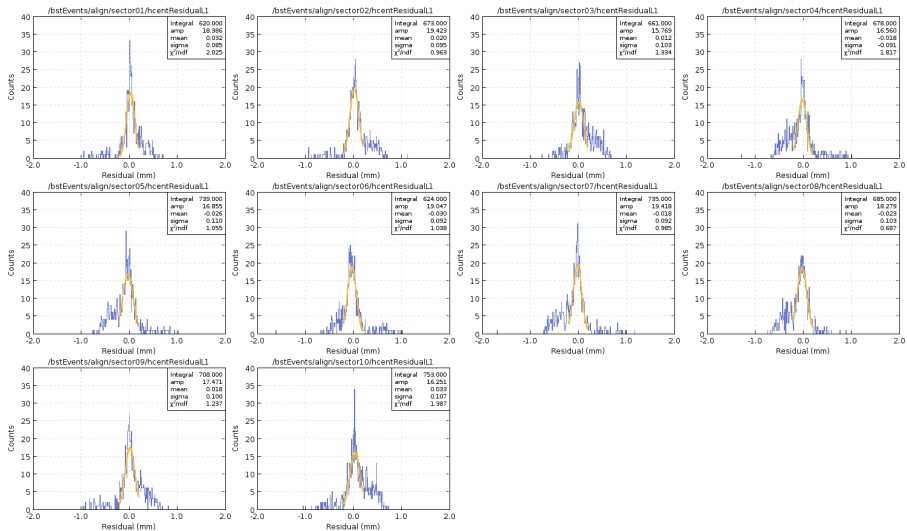
Type-2, Single-strip, layer-3 residuals

SVT Cosmic-Ray Reconstruction and Alignment



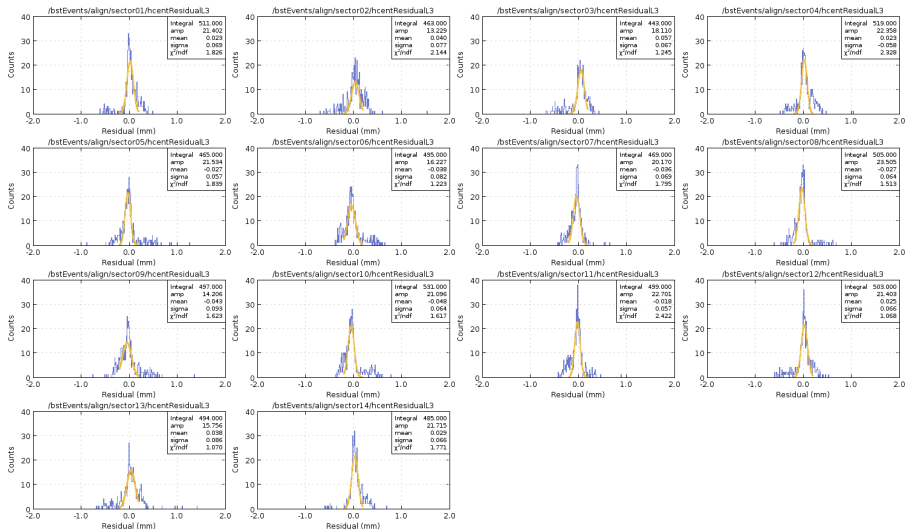
Type-2, Single-strip, layer-5 residuals

SVT Cosmic-Ray Reconstruction and Alignment



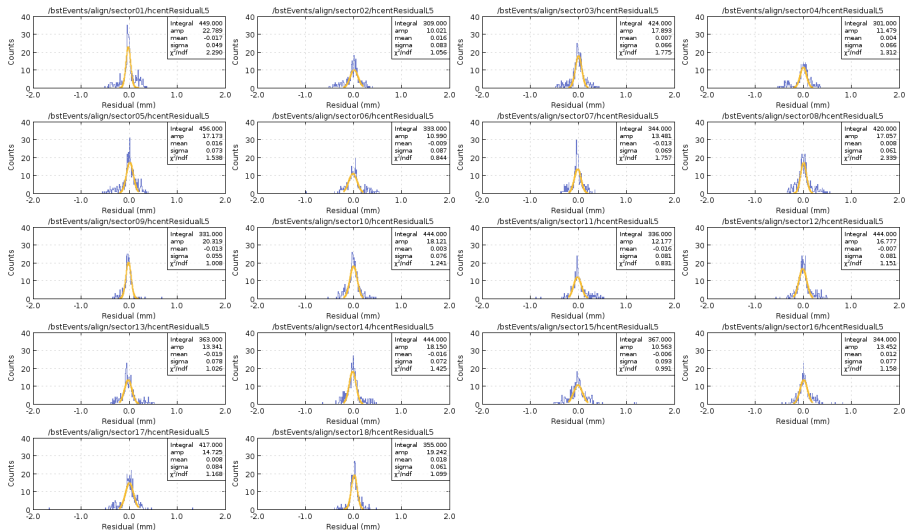
Type-3, Single-strip, layer-1 residuals

SVT Cosmic-Ray Reconstruction and Alignment



Type-3, Single-strip, layer-3 residuals

SVT Cosmic-Ray Reconstruction and Alignment



Type-3, Single-strip, layer-5 residuals