Alignment Update

HFT Alignment studies

- Review – done
- We now have a fully functioning alignment environment, including the PXL, IST and SSD detectors based on older SVT/SSD work
  - a TPC t0-like bug still persists. Geometries used for MC generation and track reconstruction are not consistent
  - Yuri suggested the direct use of root geometry matrices. Eliminate going back/forth to tables step
  - We plan to use the chain for Run-13 alignment
- Need to establish a VMC application for detailed studies/debugging
- Need to change the starting point from ideal to surveyed geometry
  - one of the goals of the engineering run

PXL sectors

PXL Halve 1/2 ALL

IST SSD

Test Results

FIXED ALL+Vertex– MEDIUM STATS

dX mkm	dY mkm	dZ mkm	alpha mrad	beta mrad	gamma mrad	Comment
57.27+-23.28	-1.21+- 1.01	-36.58+-30.43	-0.00+- 0.01	-0.04+- 0.05	0.04+- 0.04	Average for PXL Sector 1
3.83+- 2.65	-1.41+- 1.85	61.27+-28.01	0.06+- 0.04	-0.03+- 0.05	0.01+- 0.04	Average for PXL Sector 2
-1.03+- 0.72	2.31+- 2.20	54.55+-28.16	-0.05+- 0.02	0.02+- 0.01	0.01+- 0.08	Average for PXL Sector 3
3.24+- 0.71	6.10+- 2.96	23.03+-27.66	0.03+- 0.02	0.01+- 0.01	-0.15+- 0.15	Average for PXL Sector 4
-1.39+- 2.31	-2.23+- 1.51	6.69+-26.02	0.00+- 0.02	-0.03+- 0.04	-0.13+- 0.07	Average for PXL Sector 5
1.71+-23.40	-0.07+- 0.92	-12.20+-30.05	-0.00+- 0.01	0.02+- 0.05	-0.08+- 0.04	Average for PXL Sector 6
		22.60+-29.45		0.02+- 0.05	0.04+- 0.04	Average for PXL Sector 7
-0.36+- 0.65	-0.95+- 2.21	52.58+-33.04	0.04+- 0.02	-0.00+- 0.01	0.03+- 0.08	Average for PXL Sector 8
	3.85+- 2.84	6.80+-29.28	0.01+- 0.02	-0.01+- 0.01	-0.02+- 0.15	Average for PXL Sector 9
-0.24+- 2.56			-0.00+- 0.03	0.04+- 0.05	0.07+- 0.08	Average for PXL Sector 10
	-3.70+- 0.84	18.69+-12.02	-0.01+- 0.01	0.01+- 0.01	0.03+- 0.02	Average for PXL - Shell 1
2.56+- 0.56	-1.70+- 0.82	14.95+-12.59	-0.01+- 0.01	-0.00+- 0.01	-0.07+- 0.02	Average for PXL - Shell 2
3.42+- 0.39	-1.94+- 0.53	15.57+- 8.72	-0.01+- 0.00	0.01+- 0.00	-0.03+- 0.01	Average for All PXL
-9.34+- 1.24	6.95+- 1.27	11.47+- 9.85	-0.01+- 0.00	-0.00+- 0.00	-0.00+- 0.01	Average for All Ist
-5.90+- 1.16	5.65+- 1.24	3.47+- 7.88	-0.00+- 0.00	0.00+- 0.00	-0.02+- 0.01	Average for All Ssd

- Statistics matter (up to a point)
- Averages come from several histo fits

Test Results

SHIFTED SSD (some ladders) – MEDIUM STATS

dX mkm	dY mkm	dZ mkm	alpha mrad	beta mrad	gamma mrad	Comment
31.18+-37.04	-0.96+- 1.27	-25.11+-42.73	-0.00+- 0.01	-0.11+- 0.11	-0.04+- 0.06	Average for PXL Sector 1
8.47+- 2.04	-1.49+- 2.97	89.95+-44.84	-0.37+- 0.11	0.26+- 0.11	0.04+- 0.05	Average for PXL Sector 2
-2.81+- 0.92	11.56+- 3.13	114.36+-43.79	-0.14+- 0.03	0.10+- 0.03	-0.10+- 0.11	Average for PXL Sector 3
1.87+- 0.72	7.04+- 3.09	-14.97+-45.15	0.01+- 0.02	-0.12+- 0.03	-0.06+- 0.20	Average for PXL Sector 4
2.95+- 4.01	14.88+- 2.27	-36.74+-39.06	0.03+- 0.06	0.47+- 0.26	-0.06+- 0.10	Average for PXL Sector 5
17.18+-36.09	2.69+- 1.41	10.13+-43.33	0.00+- 0.01	-0.09+- 0.10	-0.05+- 0.07	Average for PXL Sector 6
		65.38+-46.00		0.54+- 0.15	-0.01+- 0.06	Average for PXL Sector 7
-2.08+- 0.96	4.23+- 2.99	-27.47+-46.58	0.03+- 0.03	0.14+- 0.04	-0.11+- 0.13	Average for PXL Sector 8
	7.92+- 3.30	-53.86+-40.89	-0.02+- 0.02	-0.04+- 0.02	-0.06+- 0.17	Average for PXL Sector 9
2.32+- 4.26				-0.29+- 0.21	0.01+- 0.12	Average for PXL Sector 10
	-11.07+- 1.34	11.91+-17.68	-0.10+- 0.01	0.00+- 0.01	-0.06+- 0.04	Average for PXL - Shell 1
1.54+- 0.63	-4.84+- 1.13	24.76+-17.82	-0.03+- 0.01	0.01+- 0.01	-0.02+- 0.04	Average for PXL - Shell 2
-0.63+- 0.53	-9.71+- 0.91	19.02+-12.11	-0.06+- 0.01	0.01+- 0.01	-0.05+- 0.01	Average for All PXL
-4.80+- 1.81	12.82+- 1.72	23.46+-10.86	-0.02+- 0.01	0.00+- 0.01	0.01+- 0.01	Average for All Ist
-4.48+- 1.58	10.67+- 1.54	-619.20+-13.75	-0.01+- 0.00	-0.04+- 0.00	-0.01+- 0.01	Average for All Ssd

- Statistics matter (up to a point)
- Averages come from several histo fits
- Missing points are artifact (see next slides)

Test Results

FIXED – MED STATS

dX mkm	dY mkm	dZ mkm	alpha mrad	beta mrad	gamma mrad	Comment
						../star_institutions_ksu_bouchet_RUNSVT_PXL_PRODPlotsNFP25rCut
0.00+- 0.00	0.00+- 0.00	0.00+- 0.00	0.00+- 0.00	0.00+- 0.00	0.00+-935.77	LSF/Sum Over PXL Shell 2
-5.65+-10.65A				0.01+- 0.02A		dXvsZ_1/dX versus -z => beta for PXL Half 2
	-37.26+-19.03A		-0.09+- 0.01A			dYvsZ_1/dY versus z => alpha for PXL Half 2
		24.76+-17.82A				dZvsZ_1/dZ versus z for PXL Half 2 slope = -1.33+- 0.04
1.49+- 0.64A						dX4dx_1/dX vs -1+jx*vx => dx for PXL Half 2
	-3.07+- 2.41A					dX4dy_1/dX vs jx*vy => dy for PXL Half 2
			-0.18+- 0.06A			dX4da_1/dX vs jx*(-vy*z+vz*y)=> alpha for PXL Half 2
				0.02+- 0.01A		dX4db_1/dX vs -z+jx*(vx*z-vz*x)=> beta for PXL Half 2
			0.11+- 0.02A			dX4dg_1/dX vs y+jx*(-vx*y+vy*x)=> alpha for PXL Half 2
3.06+- 2.96A						dY4dx_1/dY vs jy*vx => dx for PXL Half 2
	-5.19+- 1.29A					dY4dy_1/dY vs -1+jy*vy => dy for PXL Half 2
			-0.05+- 0.02A			dY4da_1/dY vs z+jy*(-vy*z+vz*y)=> alpha for PXL Half 2
				-0.13+- 0.06A		dY4db_1/dY vs jy*(vx*z-vz*x)=> beta for PXL Half 2
					-0.02+- 0.04A	dY4dg_1/dY vs -x+jy*(-vx*y+vy*x)=> gamma for PXL Half 2
			0.19+- 0.06A			dZ4da_1/dZ vs -y+jz*(-vy*z+vz*y)=> alpha for PXL Half 2
				-0.08+- 0.06A		dZ4db_1/dZ vs x+jz*(vx*z-vy*x)=> beta for PXL Half 2
					-0.09+- 0.17A	dZ4dg_1/dZ vs jz*(-vx*y+vy*x)=> gamma for PXL Half 2
1.54+- 0.63	-4.84+- 1.13	24.76+-17.82	-0.03+- 0.01	0.01+- 0.01	-0.02+- 0.04	Average for PXL - Shell 2

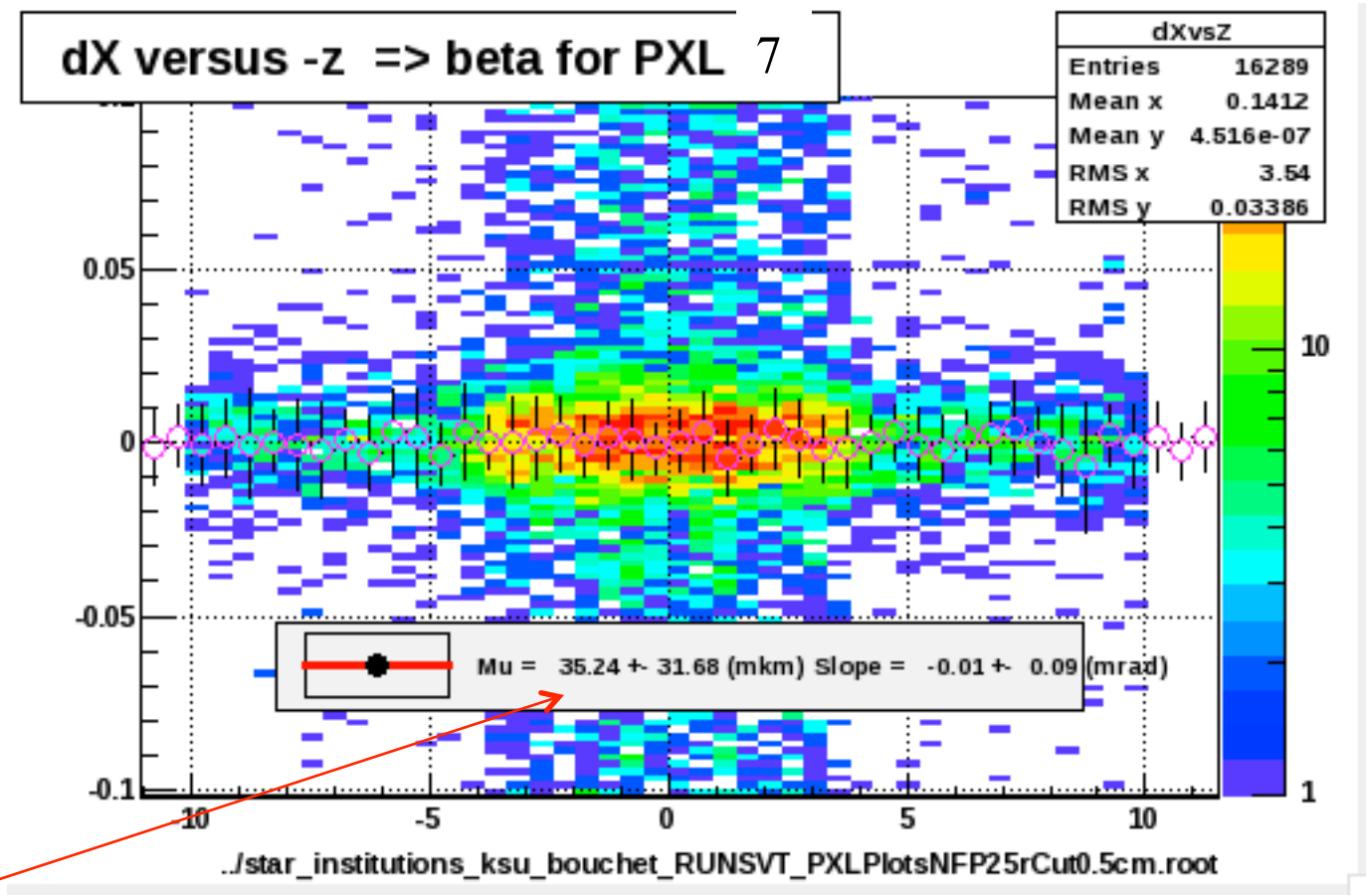
- Averages result from several fits

Test Results

FIXED – MED STATS

dX mkm	dY mkm	dZ mkm	alpha mrad	beta mrad	gamma mrad	Comment
nan+- nan	nan+- nan	nan+- 0.00	nan+- nan	nan+- 0.00	nan+- 0.00	LSF/Matrix and right part for Least Squred Fit
-35.24+-31.68R				-0.01+- 0.09A		dXvsZ_1/dX versus -z => beta for PXL All
	-20.32+-28.96R		0.02+- 0.05R			dYvsZ_1/dY versus z => alpha for PXL All
		22.60+-29.45A				dZvsZ_1/dZ versus z for PXL All| slope = -0
6.90+- 3.27R						dX4dx_1/dX vs -1+jx*vx => dx for PXL
	-16.95+- 4.67R					dX4dy_1/dX vs jx*vy => dy for PXL
			-0.12+- 0.09R			dX4da_1/dX vs jx*(-vy*z+vz*y)=> alpha for P
				0.17+- 0.12A		dX4db_1/dX vs -z+jx*(vx*z-vz*x)=> beta for P
			-0.26+- 0.15R			dX4dg_1/dX vs y+jx*(-vx*y+vy*x)=> alpha for P
-3.17+- 3.47R						dY4dx_1/dY vs jy*vx => dx for PXL
	-1.79+- 2.40R					dY4dy_1/dY vs -1+jy*vy => dy for PXL
			0.01+- 0.05R			dY4da_1/dY vs z+jy*(-vy*z+vz*y)=> alpha for P
				-0.05+- 0.09A		dY4db_1/dY vs jy*(vx*z-vz*x)=> beta for P
					0.04+- 0.04A	dY4dg_1/dY vs -x+jy*(-vx*y+vy*x)=> gamma for P
			-0.22+- 0.20R			dZ4da_1/dZ vs -y+jz*(-vy*z+vz*y)=> alpha for P
				0.08+- 0.12A		dZ4db_1/dZ vs x+jz*(vx*z-vy*x)=> beta for P
					0.13+- 0.70A	dZ4dg_1/dZ vs jz*(-vx*y+vy*x)=> gamma for P
		22.60+-29.45		0.02+- 0.05	0.04+- 0.04	Average for PXL Sector 7

- Averages result from several fits



nan+- nan	nan+- nan	nan+- 0.00	nan+- nan	nan+- 0.00	nan+- 0.00	LSF/Matrix and right part for Least Sq
-35.24+-31.68R				-0.01+- 0.09A		dXvsZ_1/dX versus -z => beta for PXL
	-20.32+-28.96R		0.02+- 0.05R			dYvsZ_1/dY versus z => alpha for PXL
		22.60+-29.45A				dZvsZ_1/dZ versus z for PXL All slop
6.90+- 3.27R						dX4dx_1/dX vs -1+jx*vx => dx
	-16.95+- 4.67R					dX4dy_1/dX vs jx*vy => dy
			-0.12+- 0.09R			dX4da_1/dX vs jx*(-vy*z+vz*y)=> alp
				0.17+- 0.12A		dX4db_1/dX vs -z+jx*(vx*z-vz*x)=> bet
			-0.26+- 0.15R			dX4dg_1/dX vs y+jx*(-vx*y+vy*x)=> alp
-3.17+- 3.47R						dY4dx_1/dY vs jy*vx => dx
	-1.79+- 2.40R					dY4dy_1/dY vs -1+jy*vy => dy
			0.01+- 0.05R			dY4da_1/dY vs z+jy*(-vy*z+vz*y)=> alp
				-0.05+- 0.09A		dY4db_1/dY vs jy*(vx*z-vz*x)=> bet
					0.04+- 0.04A	dY4dg_1/dY vs -x+jy*(-vx*y+vy*x)=> gam
			-0.22+- 0.20R			dZ4da_1/dZ vs -y+jz*(-vy*z+vz*y)=> alp
				0.08+- 0.12A		dZ4db_1/dZ vs x+jz*(vx*z-vy*x)=> bet
					0.13+- 0.70A	dZ4dg_1/dZ vs jz*(-vx*y+vy*x)=> gam
		22.60+-29.45		0.02+- 0.05	0.04+- 0.04	Average for PXL Sector 7