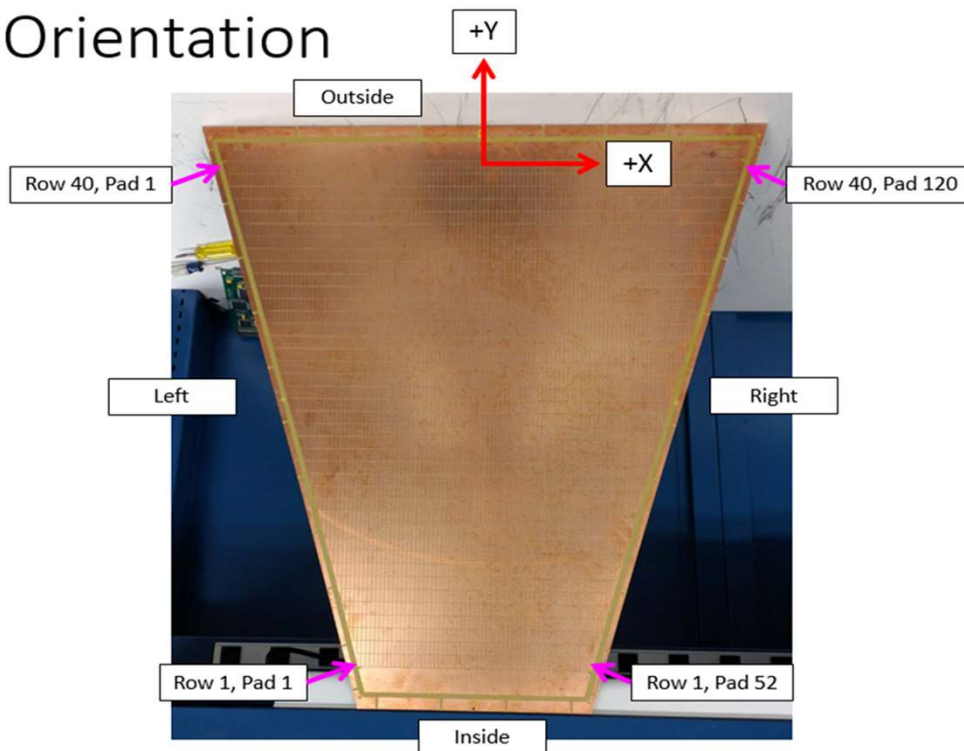


Serial Number	Angle (microRad)	dx (mm)	dy (mm)	ScaleX (mm/mm)	ScaleY (mm/mm)	sumnResid	Var dX (mm)	Var dY (mm)
SN001	-15.5	0.035	0.093	0.000399	0.000196	0.0169	0.012	0.017
SN002	NA	NA	NA	NA	NA	NA	NA	NA
SN003	-12.3	0.020	0.081	0.000384	0.000122	0.0094	0.011	0.011
SN004	NA	NA	NA	NA	NA	NA	NA	NA
SN005	-105.7	0.000	0.089	0.000417	0.000189	0.0114	0.009	0.014
SN006	-47.2	-0.001	0.024	0.000326	0.000109	0.0079	0.008	0.012
SN007	28.4	-0.034	0.057	0.000363	0.000126	0.0047	0.009	0.006
SN008	-91.6	-0.005	0.036	0.000380	0.000166	0.0087	0.010	0.011
SN009	-270.2	0.205	-0.045	0.000303	0.000079	0.0059	0.006	0.011
SN010	-99.6	0.039	0.003	0.000481	0.000187	0.0032	0.006	0.007
SN011	-43.5	-0.007	0.033	0.000375	0.000084	0.0026	0.006	0.005
SN012	-172.1	-0.018	0.065	0.000339	0.000099	0.0027	0.006	0.006
SN013	53.1	-0.024	0.027	0.000362	0.000113	0.0033	0.007	0.006
SN014	-134.3	0.043	-0.019	0.000360	0.000117	0.0067	0.009	0.010
SN015	57.9	-0.035	0.019	0.000331	0.000087	0.0028	0.006	0.006
SN016	-78.0	-0.011	0.007	0.000309	0.000047	0.0056	0.008	0.009
SN017	-95.2	0.040	-0.019	0.000354	0.000085	0.0045	0.007	0.008
SN018	52.9	-0.012	0.111	0.000388	0.000149	0.0031	0.007	0.006
SN019	49.5	0.001	0.018	0.000334	0.000085	0.0053	0.010	0.006
SN020	-18.0	-0.034	0.025	0.000297	0.000047	0.0114	0.011	0.013
SN021	61.6	-0.065	0.049	0.000302	0.000084	0.0073	0.006	0.012
SN022	3.8	0.007	0.098	0.000333	0.000147	0.0434	0.014	0.030
SN023	18.0	-0.014	0.018	0.000309	0.000094	0.0063	0.007	0.011
SN024	-113.0	0.000	0.025	0.000309	0.000075	0.0081	0.010	0.010
SN025	-25.2	-0.011	0.019	0.000335	0.000104	0.0053	0.010	0.006
SN026	-19.5	-0.005	0.042	0.000321	0.000108	0.0095	0.009	0.013
SN027	119.8	-0.012	0.050	0.000333	0.000105	0.0094	0.009	0.013
SN028	NA	NA	NA	NA	NA	NA	NA	NA
SN029	-50.9	0.004	0.011	0.000289	0.000066	0.0088	0.011	0.011
SN030	20.7	-0.036	0.009	0.000298	0.000051	0.0068	0.010	0.009
SN031	-48.3	-0.004	0.043	0.000286	-0.000075	0.0164	0.008	0.019
SN032	-40.8	0.021	0.000	0.000204	-0.000124	0.0196	0.013	0.019
SN033	-41.8	0.032	0.015	0.000194	-0.000103	0.0175	0.012	0.017
SN034	-35.1	0.040	0.025	0.000200	-0.000142	0.0107	0.008	0.014
SN035	-8.7	-0.018	0.031	0.000218	-0.000120	0.0139	0.010	0.016
SN036	-62.5	0.040	0.014	0.000203	-0.000119	0.0093	0.009	0.013

Note: SN006 was installed at STAR in 2018 as Sector 20 Inner. This sector is also known as "Article 3".

Orientation



The Coordinate system uses the center line of the sector to define the Y axis. See photo.

The X axis crosses the Y axis at a point that is slightly above the center of pad row 40 but not as high as the top of pad row 40. To be precise, the origin lies 5.65 mm above the center of pad row 40. Another way to locate the origin is to say it is 1187.65 mm from the beamline; or 668.60 mm above the bottom edge (narrow end) of the sector.

The origin lies directly over the primary tooling ball (on the wide end of the sector) that aligns the sector with the TPC end wheel. There is another tooling ball that is near the narrow end of the sector. It is also on the centerline of the sector. The distance between the primary and secondary tooling balls is 642.11 mm.

The pad plane is displaced from its nominal position by (dX, dY) and rotated by an angle θ .

The angle of rotation is about the origin of the coordinate system. The angle of the padplane (the padrows) is measured with respect to the X axis and a positive rotation is counter-clockwise.

The pad plane is stretched (or shrunk) along the X axis and the Y axis. The amount of stretch (or shrinkage) is given by ScaleX and ScaleY factors. Positive values mean the padplane was stretched during its manufacturing process.

$$\begin{pmatrix} X_{pad} \\ Y_{pad} \end{pmatrix} = \begin{pmatrix} \cos \theta & -\sin \theta \\ \sin \theta & \cos \theta \end{pmatrix} \begin{pmatrix} X * (1 + X_{scale}) \\ Y * (1 + Y_{scale}) \end{pmatrix} + \begin{pmatrix} dX \\ dY \end{pmatrix}$$

Small angle approximations (good to sub-micron level):

$$\begin{aligned} X_{pad} &= X(1 + X_{scale}) + dX - \theta * Y \\ Y_{pad} &= Y(1 + Y_{scale}) + dY + \theta * X \end{aligned}$$

or

$$\begin{aligned} X &= X_{pad}(1 - X_{scale}) - dX + \theta * Y_{pad} \\ Y &= Y_{pad}(1 - Y_{scale}) - dY - \theta * X_{pad} \end{aligned}$$

One more useful thing to know is that the number of Pads per Row (PPR) in the iTPC is:

$$PPR = 2 * \left[Row + 25 - \text{Integer} \left(\frac{Row}{7} \right) \right]$$

Example: Suppose that we observe a "hit" on Pad 114 in Row 38 (see photo for definition of Row Number and Pad Number)

$$\begin{aligned} X_{hit} &= \left(Pad - \frac{PPR}{2} - 1/2 \right) * 5mm * (1 + X_{scale}) + dX \\ &\quad - \theta * [(Row - 40) * 16mm - 5.65mm] \end{aligned}$$

and

$$\begin{aligned} Y_{hit} &= [(Row - 40) * 16mm - 5.65mm] * (1 + Y_{scale}) + dY \\ &\quad + \theta * \left(Pad - \frac{PPR}{2} - 1/2 \right) * 5mm \end{aligned}$$

where Xhit and Yhit are the coordinates of the hit in the STAR global coordinate system (after