SPLAT Baseline Coordinate Definitions

P. Gallardo

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In this document I summarize the coordinate definitions for the three mirrors in the TMA design filename SPLAT_Base _Fwd.zmx, which can be found in `https://github.com/patogallardo/zemax_tools/tree/master/design_analysis/SPLAT_baseline_20210523/SPLAT_Base_Fwd.zmx`. For Step files of this design see folder coordinate_definitions/step_files.

Surfaces covered in this document are: Origin, Primary, Secondary, Tertiary and Image surface. These surfaces can be fully defined with a location vector and a rotation angle. Another way of defining these is by using a location vector and a rotation matrix, which is useful for Grasp studies.

1 Surface definitions and rotation angles

Table 1 shows the surface definitions for this design. Angle α refers to the rotation around the X coordinate in degrees.

2 Rotation matrices

The rotation angle can be expressed more generally by a rotation matrix and an offset, which gives the freedom to represent any 3D rotation in space.

In this formalism a vector in the local coordinate system $\vec{x}_l$ can be expressed as a global vector $\vec{x}_g$ via an offset $\vec{x}_O$ and a rotation matrix R as

$$\vec{x}_g = \vec{x}_O + R\vec{x}_l. \tag{1}$$

surface	X[mm]	Y[mm]	Z[mm]	α [deg]
prime	0.000	0.000	0.000	155.402
second	0.000	5615.000	4898.000	171.165
tert	0.000	8367.000	445.000	-170.883
Image	0.000	9575.762	5024.441	168.927

Table 1: Surface local coordinate system locations and rotations about the X axis for the TMA.

Note that the columns of R contain the orientation vectors of the local x,y,z directions.

Tables 2, 3, 4 and 5 show the rotation matrices for the origins of the mirror coordinate systems.

1.00000	0.00000	0.00000
0.00000	-0.90925	-0.41625
0.00000	0.41625	-0.90925

Table 2: Rotation matrix for the M1 local coordinate system.

1.00000	0.00000	0.00000
0.00000	-0.98813	-0.15360
0.00000	0.15360	-0.98813

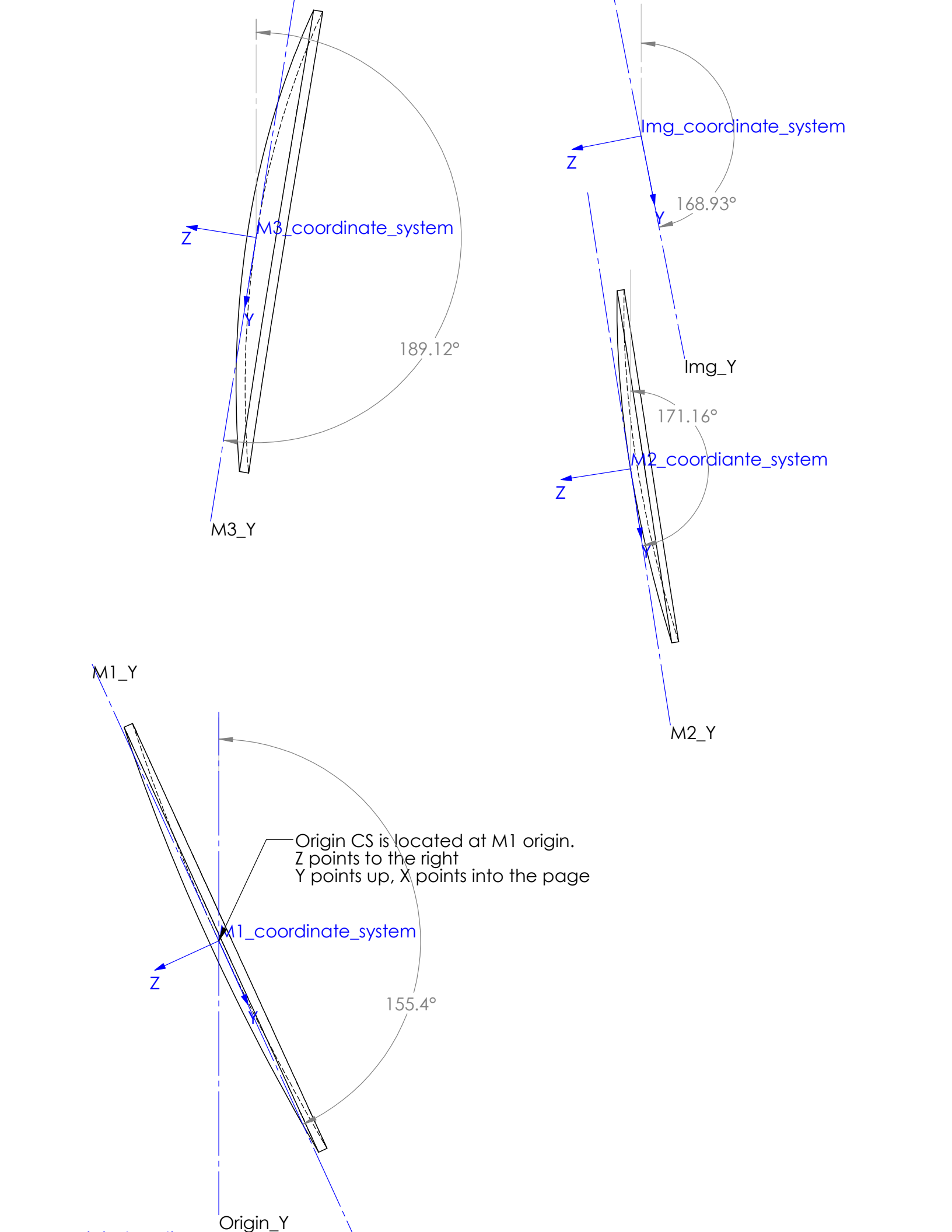
Table 3: Rotation matrix for the M2 local coordinate system.

1.00000	0.00000	0.00000
0.00000	-0.98737	0.15846
0.00000	-0.15846	-0.98737

Table 4: Rotation matrix for the M3 local coordinate system.

1.00000	0.00000	0.00000
0.00000	-0.98138	-0.19207
0.00000	0.19207	-0.98138

Table 5: Rotation matrix for the image surface local coordinate system.


M3_coordinate_system
Z
Y
189.12°
M3_Y
Img_coordinate_system
Z
Y
168.93°
Img_Y
171.16°
M2_coordiante_system
Z
Y
M2_Y
M1_Y
Origin CS is located at M1 origin.
Z points to the right
Y points up, X points into the page
M1_coordinate_system
Z
Y
155.4°
Origin_Y