

# Cobra Rotational Center at Different EL Angle

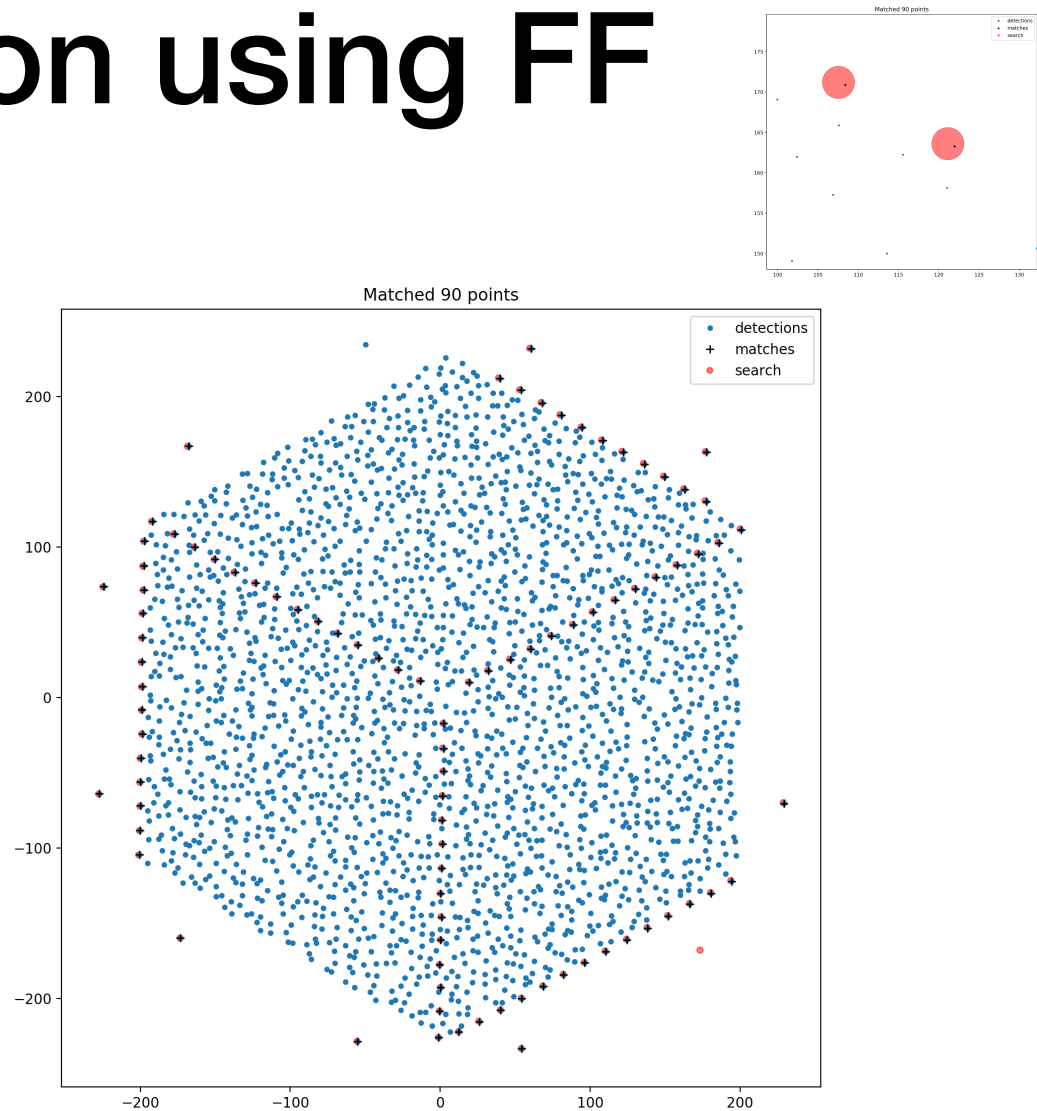
2021/Oct/17

- In September e-run, we carried out a sequence of rotational center measurements at different elevation angles. Starting from EL90, we tilted the telescope to EL75, EL60, EL45, EL30, then come back to EL90.
- At different EL angles, we perform the cobra rotational center measurement by moving theta arm every 250 steps. So that we can compare the differences of rotation centers at different EL angles.

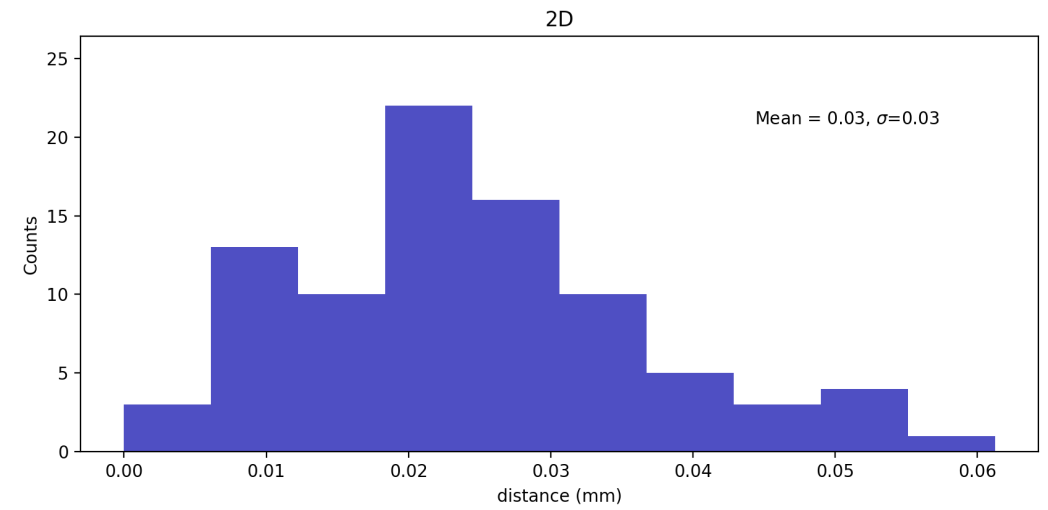
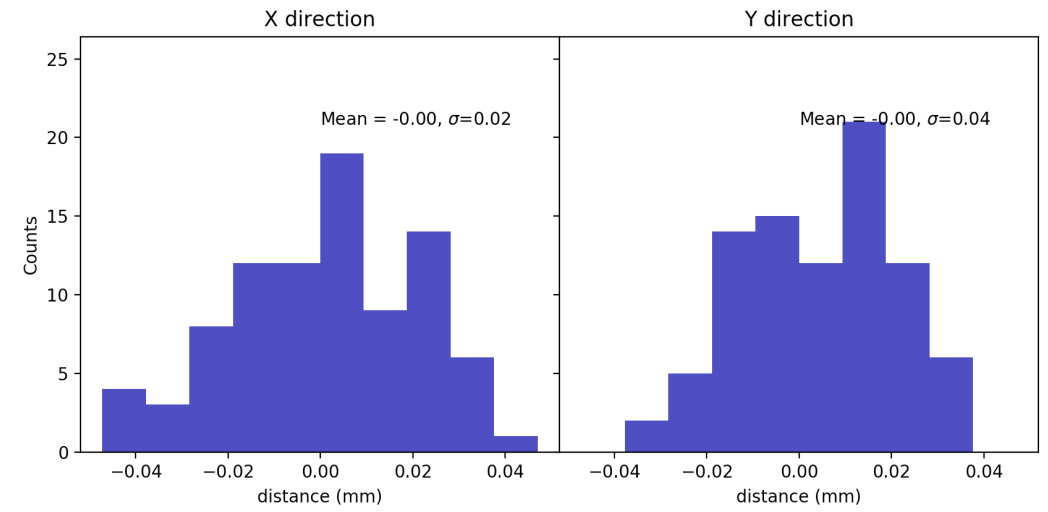
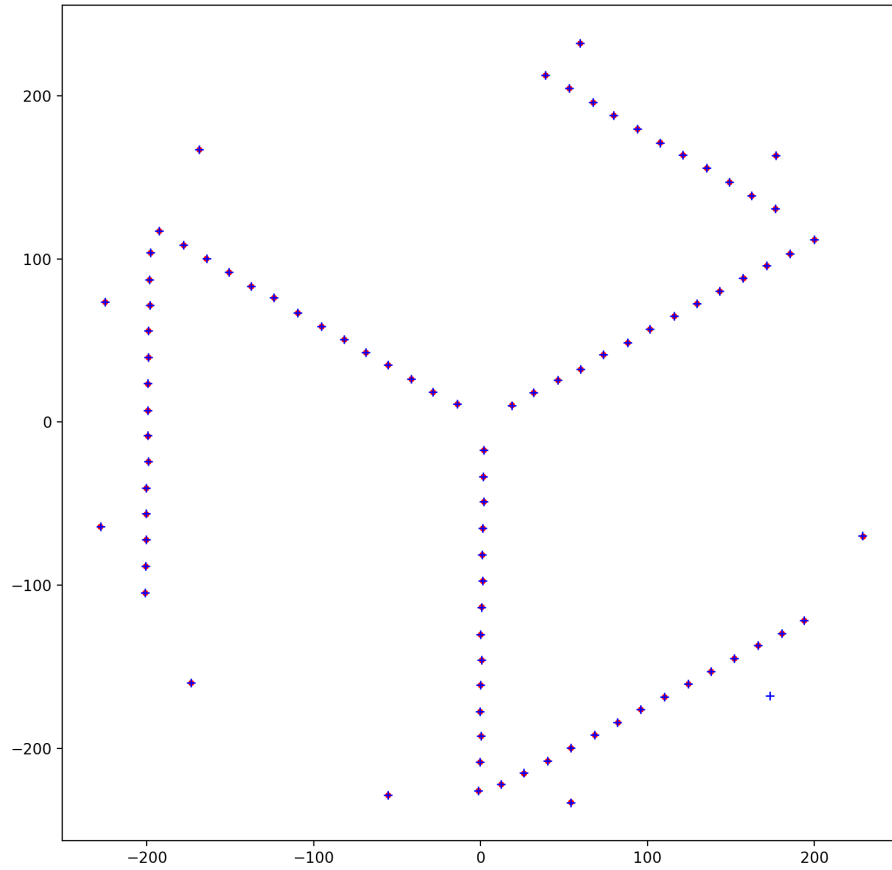
Run ID	Visit ID	EL
20210925_028	68823	90
20210925_029	68828	60
20210925_030	68828	30
20210925_031	68829	45
20210926_000	68833	30
20210926_001	68837	60
20210926_002	68838	75
20210926_003	68841	90
20210926_005	68843	90

# Transformation using FF

- All comparison are made in PFI coordinated, in the unit of mm. Thanks Robert's effort, the transformation is now available in *pfs\_utils*.
- For every MCS exposure, we extract the spot locations with centroid algorithm and send to opDB (mcs\_data).
- Those spots (cobra + FF) are shown as blue dots on the figure. The cross marks are the measured location of FF from Richard.
- Then, the transformation (including distortion correction) can be established since we have all FF locations in MCS and PFI coordinates. We applying this transformation to all detected spots in MCS coordinate.



# Transformation after distortion correction

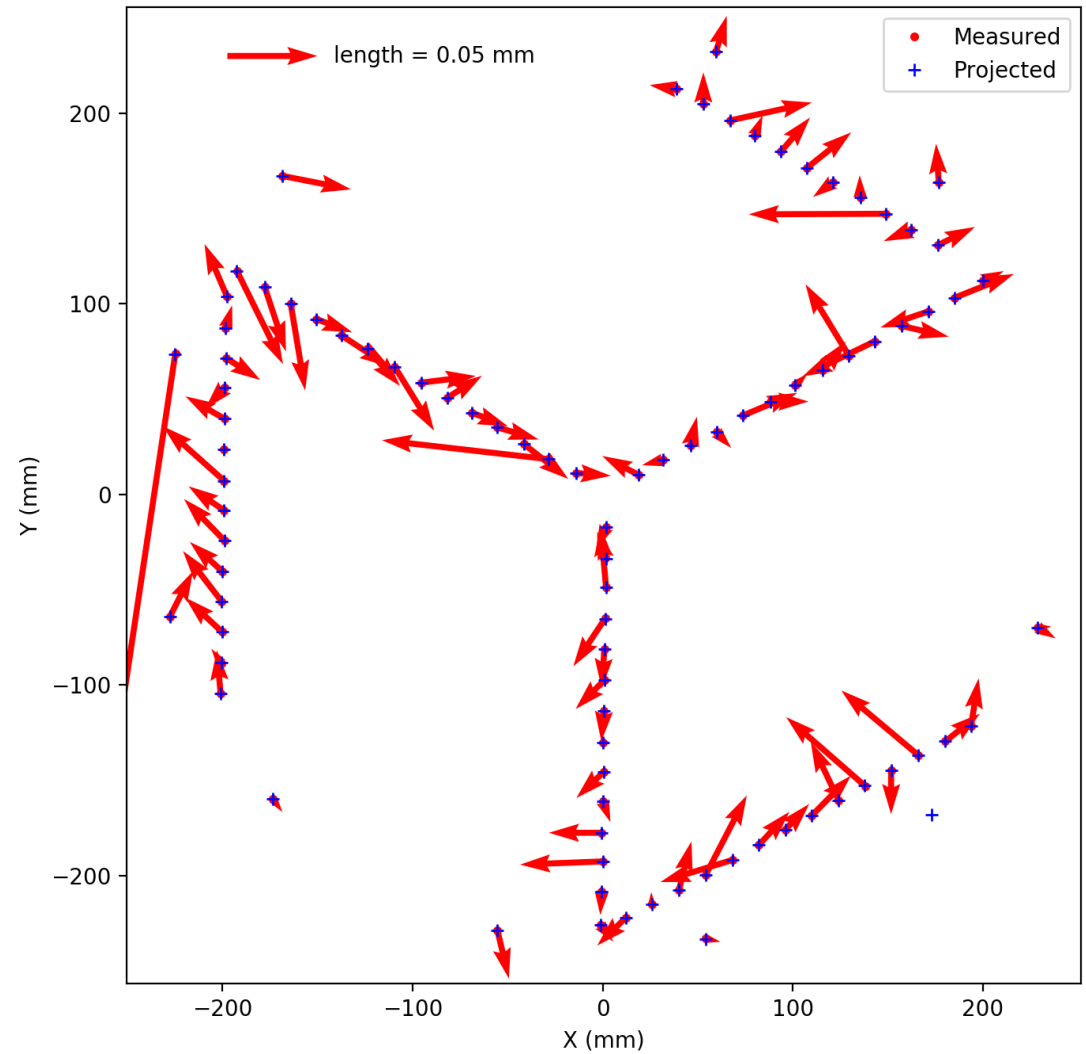
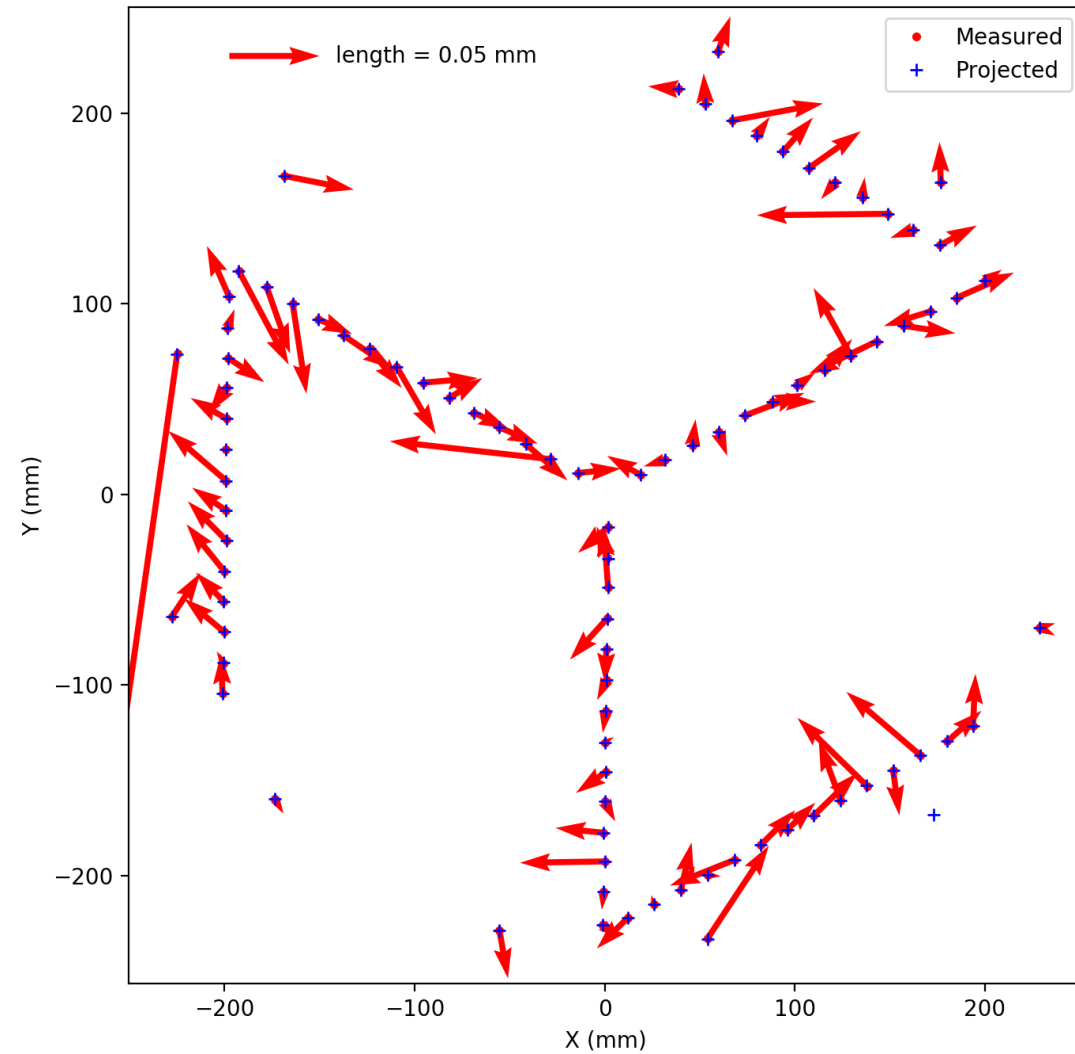




# Vector Plot of Fiducial Fiber Residual (EL90)

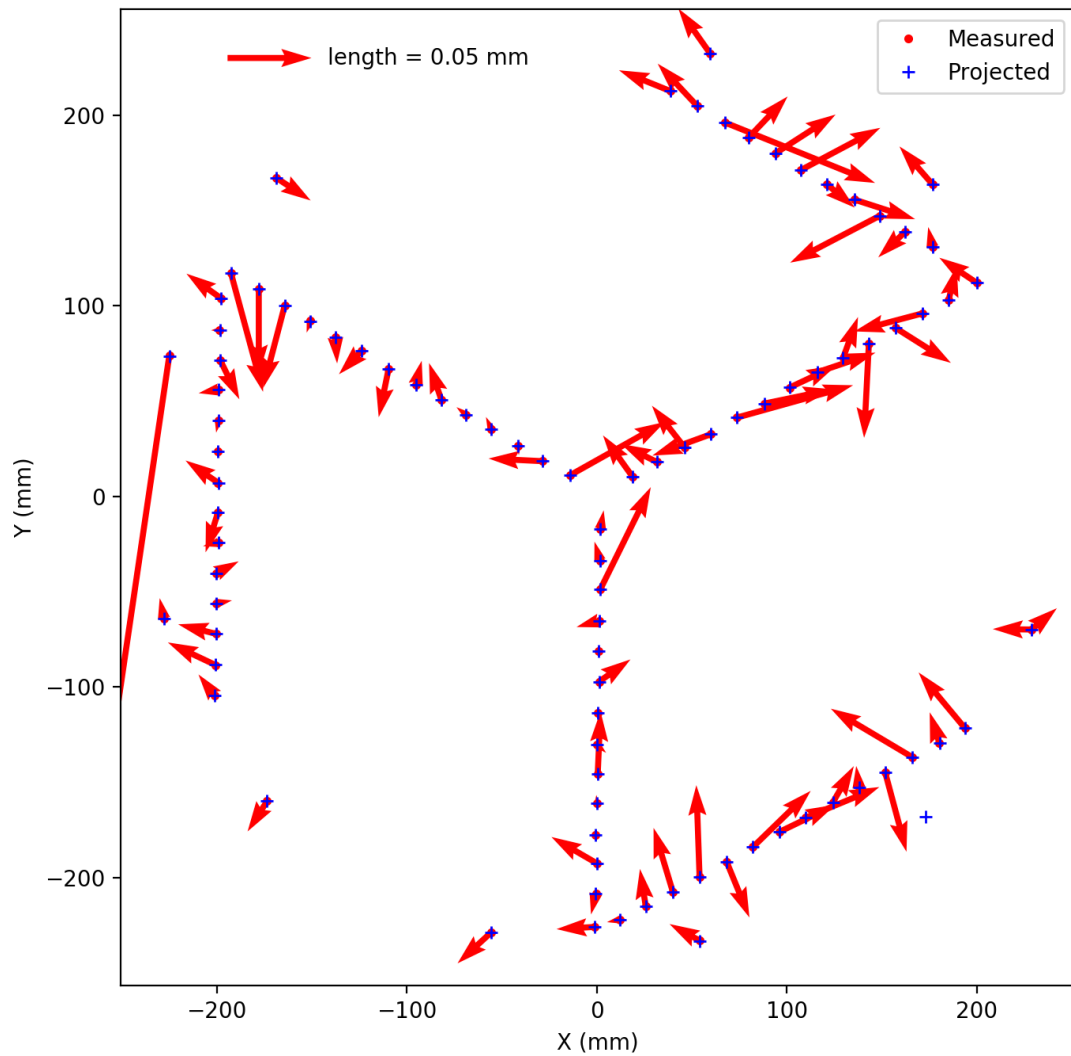
Fiducial Residual Vector Visit=68823 Subid=0

Fiducial Residual Vector Visit=68823 Subid=1

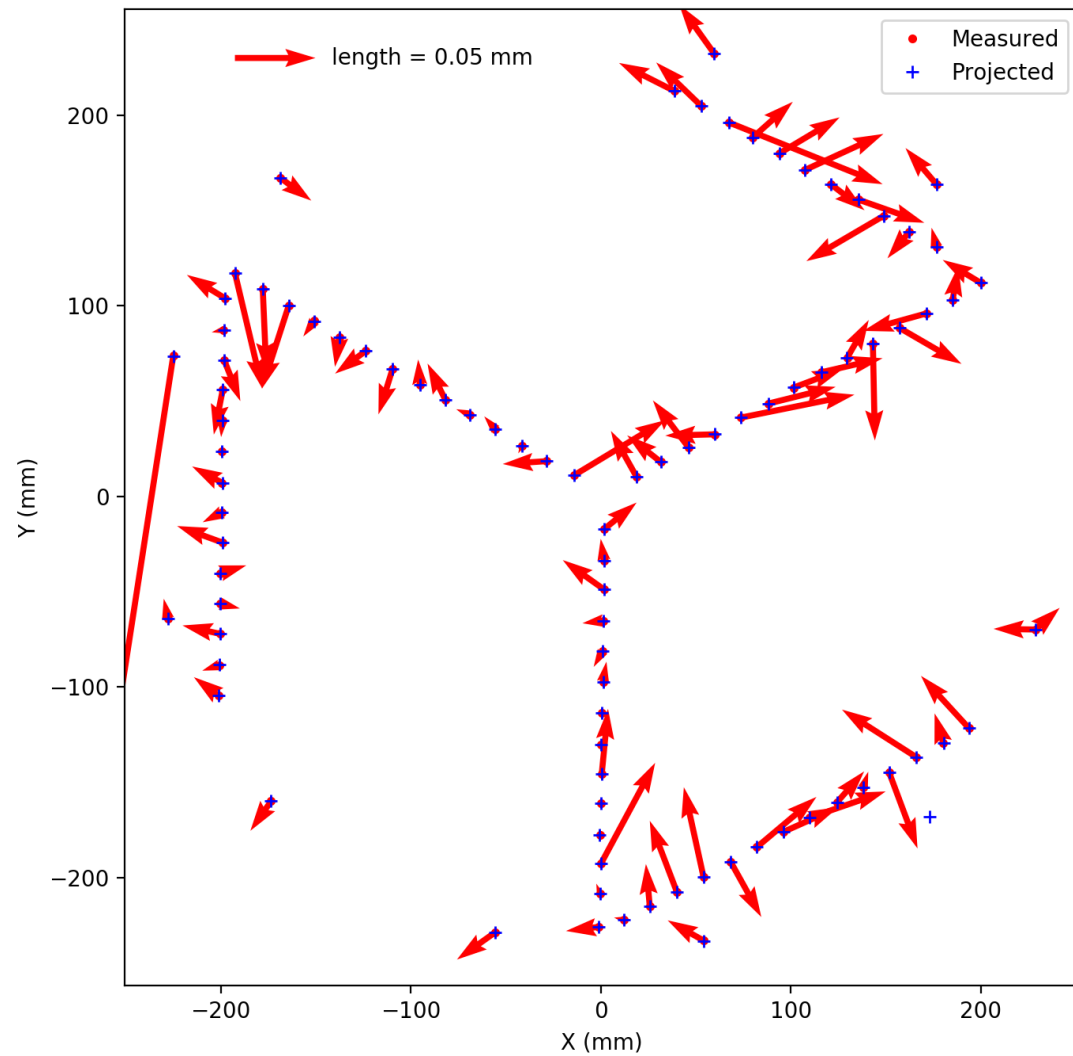


# Vector Plot of Fiducial Fiber Residual (EL60)

Fiducial Residual Vector Visit=68828 Subid=0



Fiducial Residual Vector Visit=68828 Subid=1



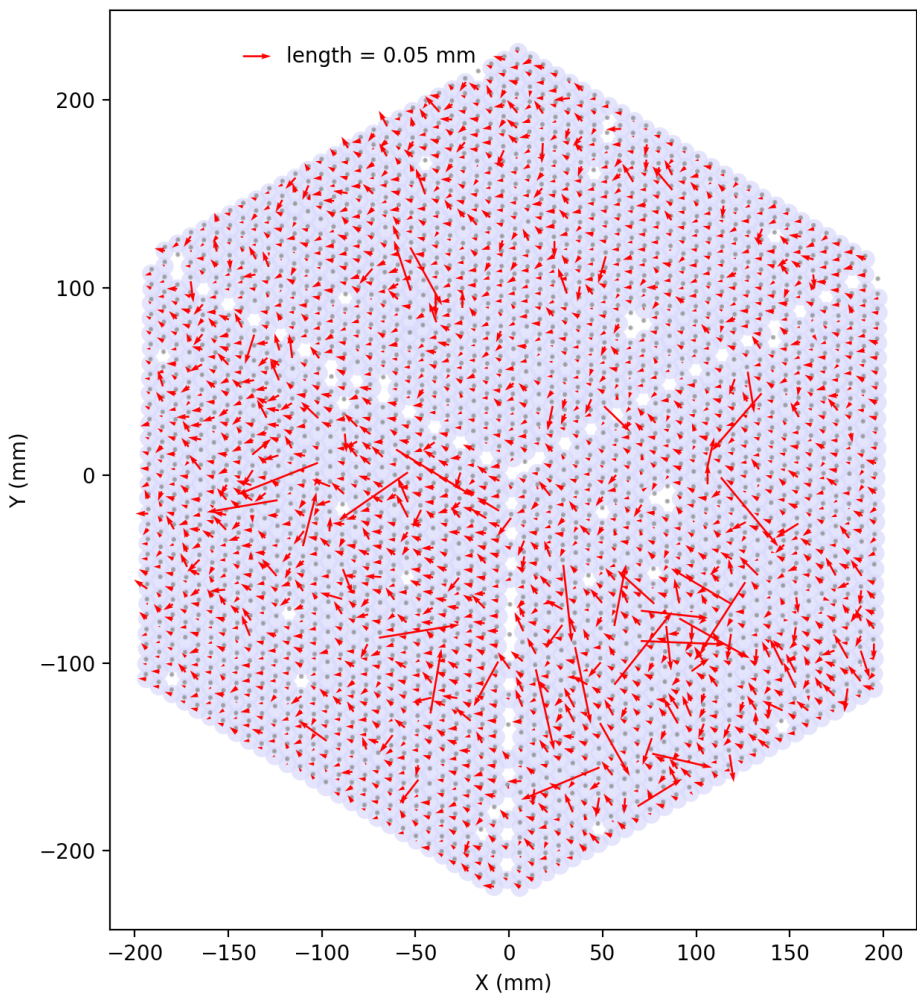
# Compare cobra centers

- We first compare cobra centers repeatability at different EL angle. The, we compare the differences between EL angles. The data sets used for each comparison are listed as followed.

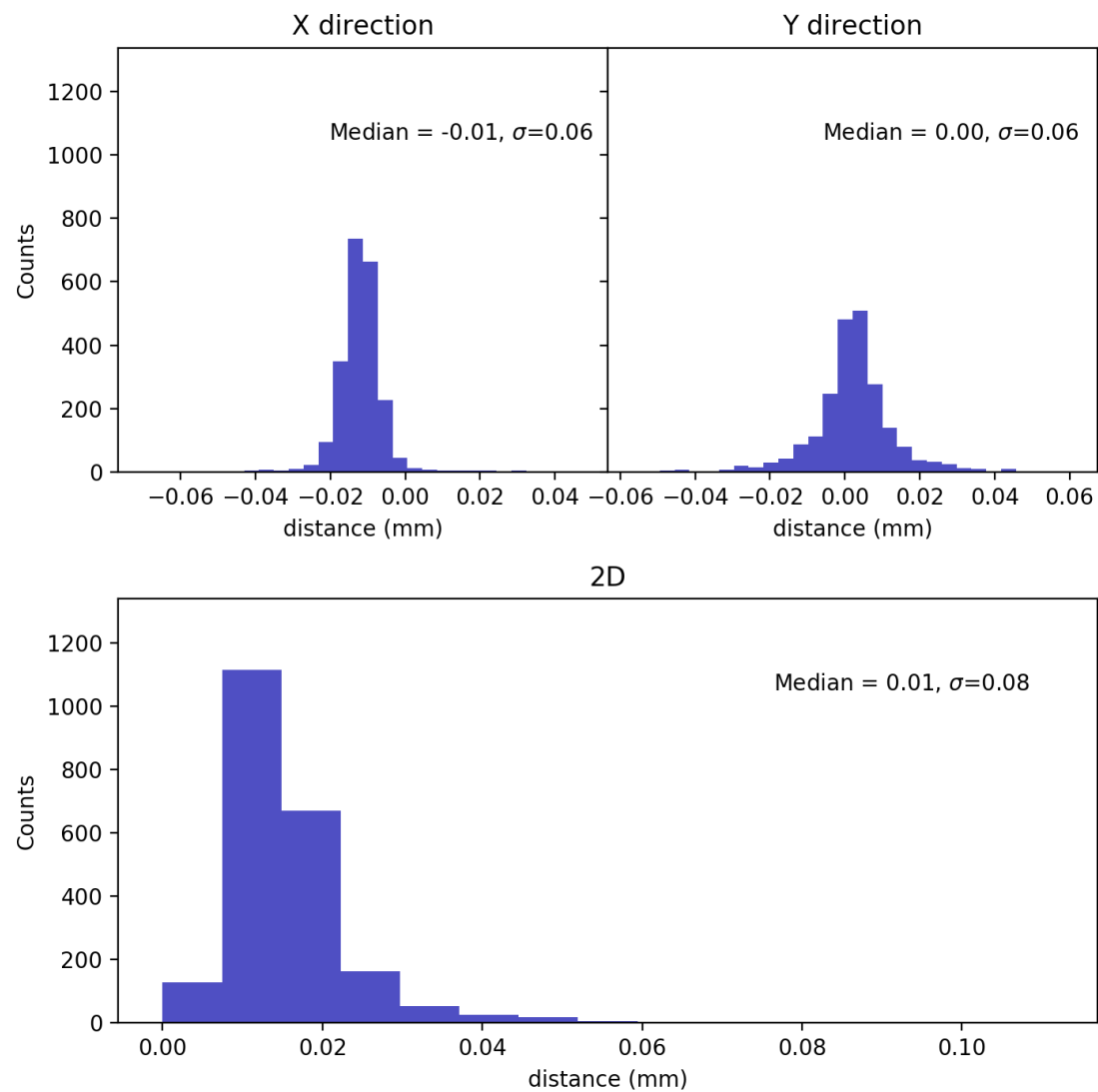
Comparison	Run ID	operator	RunID
Same EL, EL90	20210925_028	-	20210926_003
Same EL, EL60	20210925_029	-	20210926_001
Same EL, EL30	20210925_030	-	20210926_000
EL90-EL60	20210925_028	-	20210925_029
EL90-EL30	20210925_028	-	20210925_030
EL60-EL30	20210925_029	-	20210925_030

# Same EL, EL90

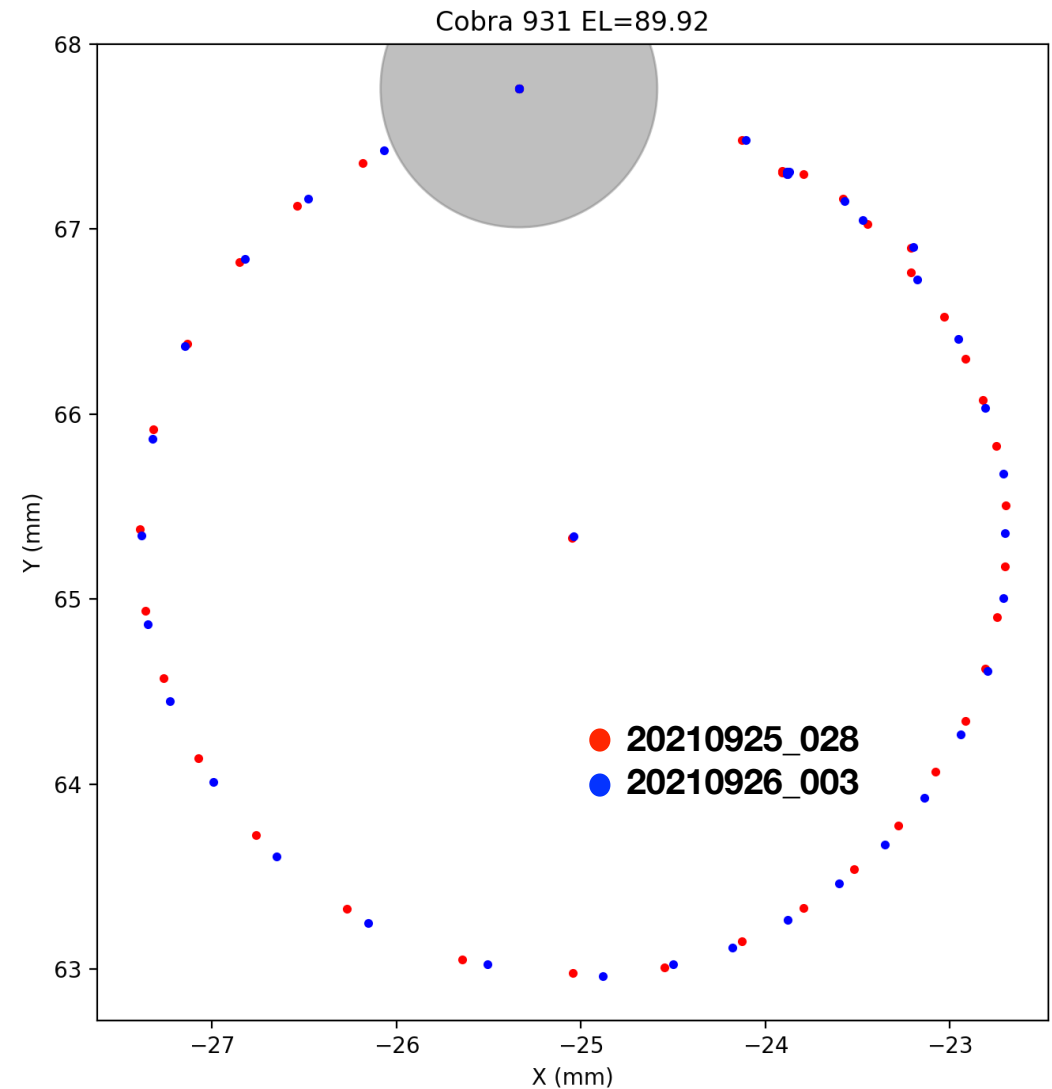
Rotation Center Difference EL=89.92



EL=89.92

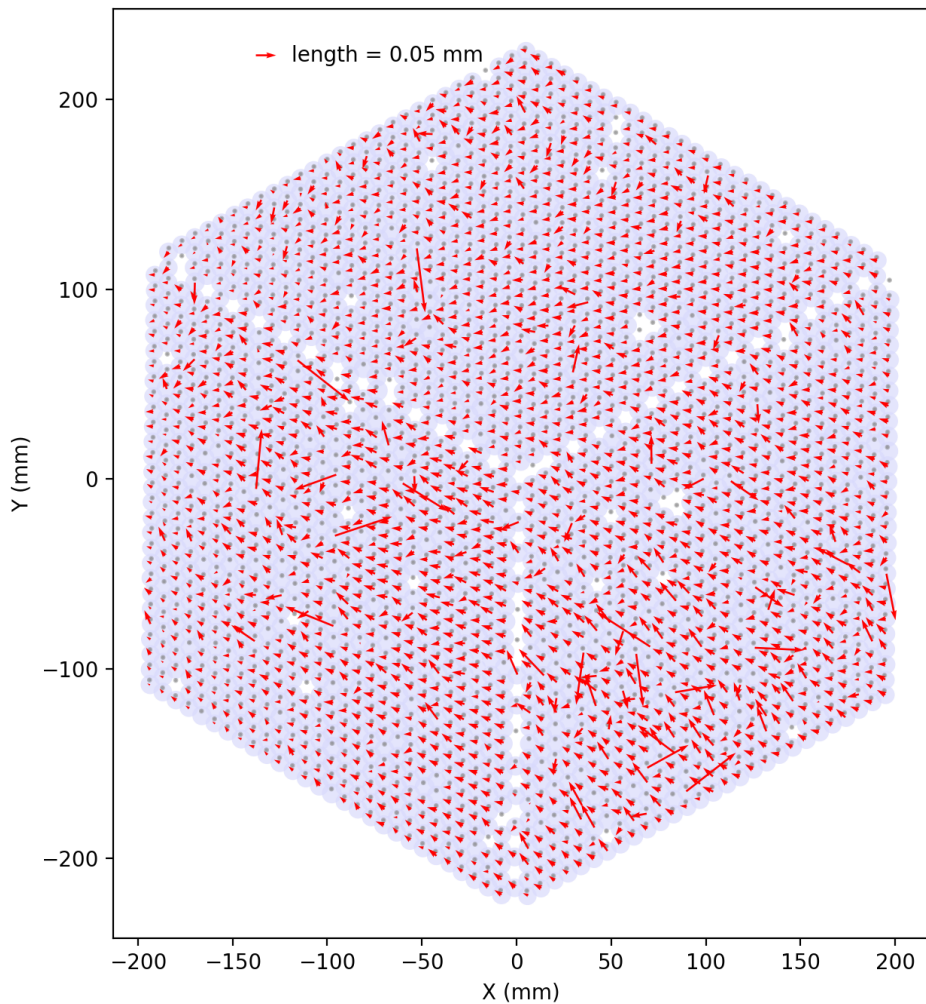


- It is noticed that there are some cobras suffering from high center variations. This is because of the matching algorithm.
- Blue and red spots are cobra locations of two different visitIDs from database. The grey patch is the dot location.
- As seen from the figure, when cobra is in the dot. Algorithm assign the location to be the center of the dot. So, the central fitting algorithm is effected.
- ~5% of the cobra are effected. This need to be fixed before coming e-run.

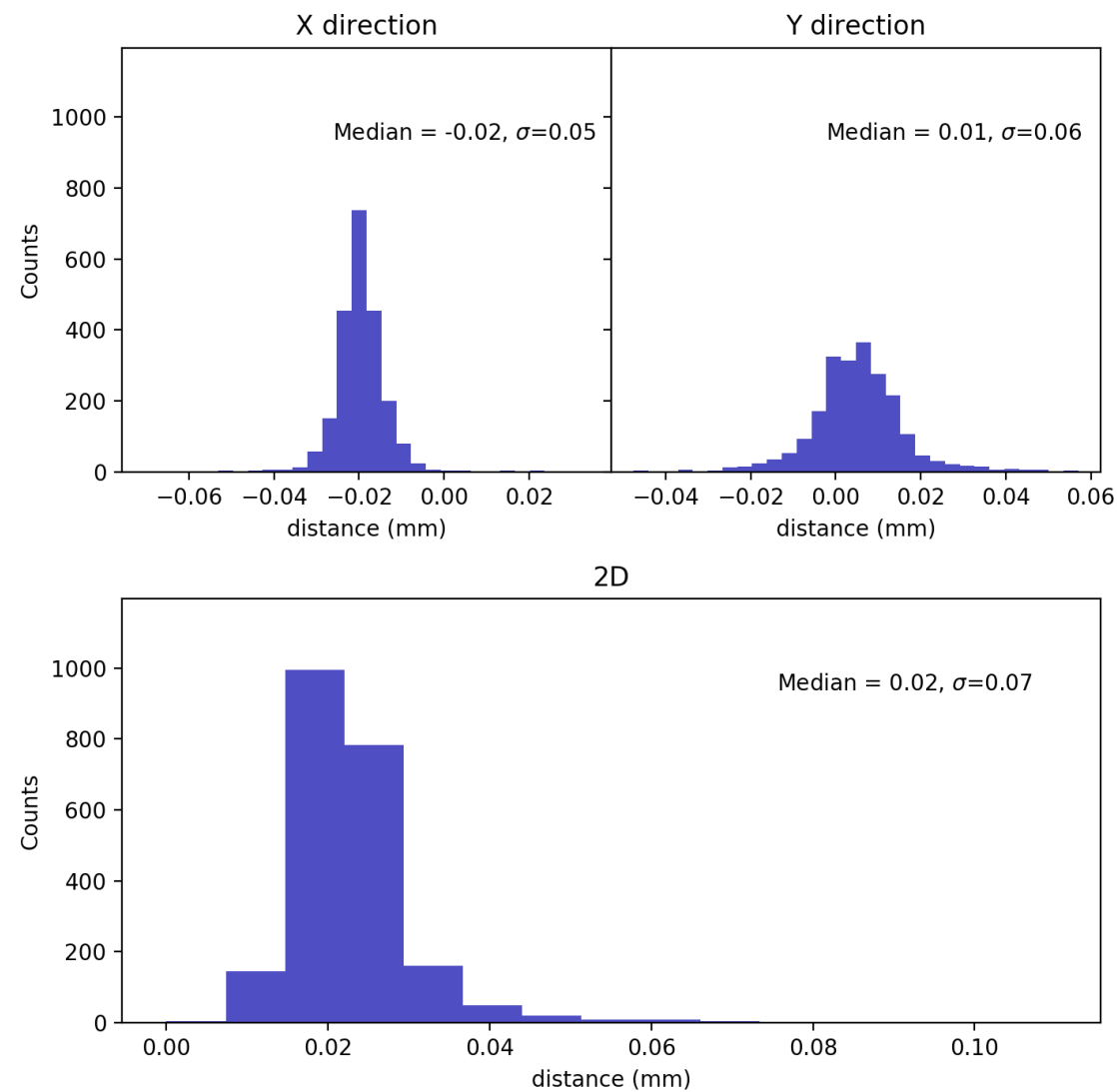


# Same EL, EL60

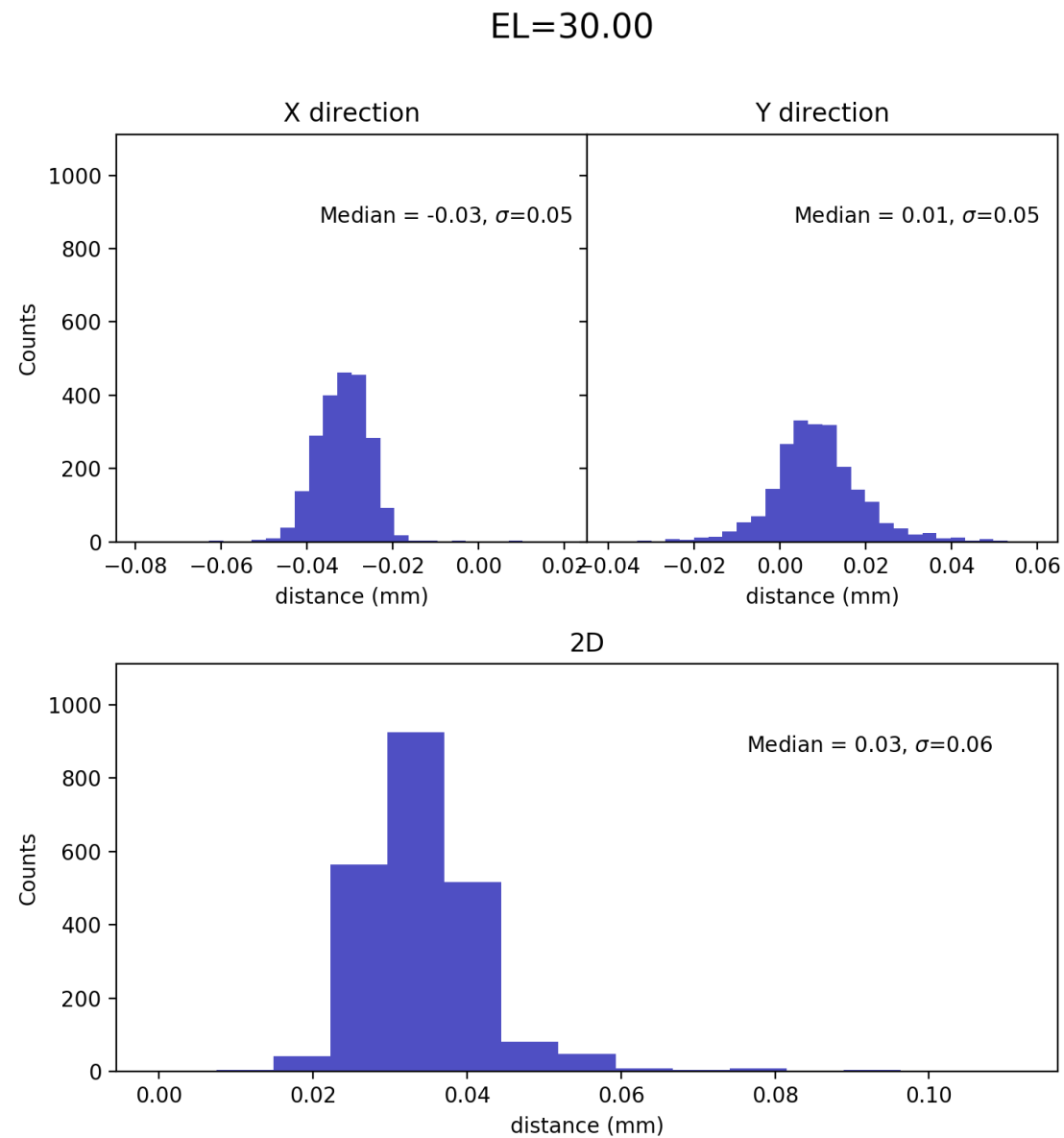
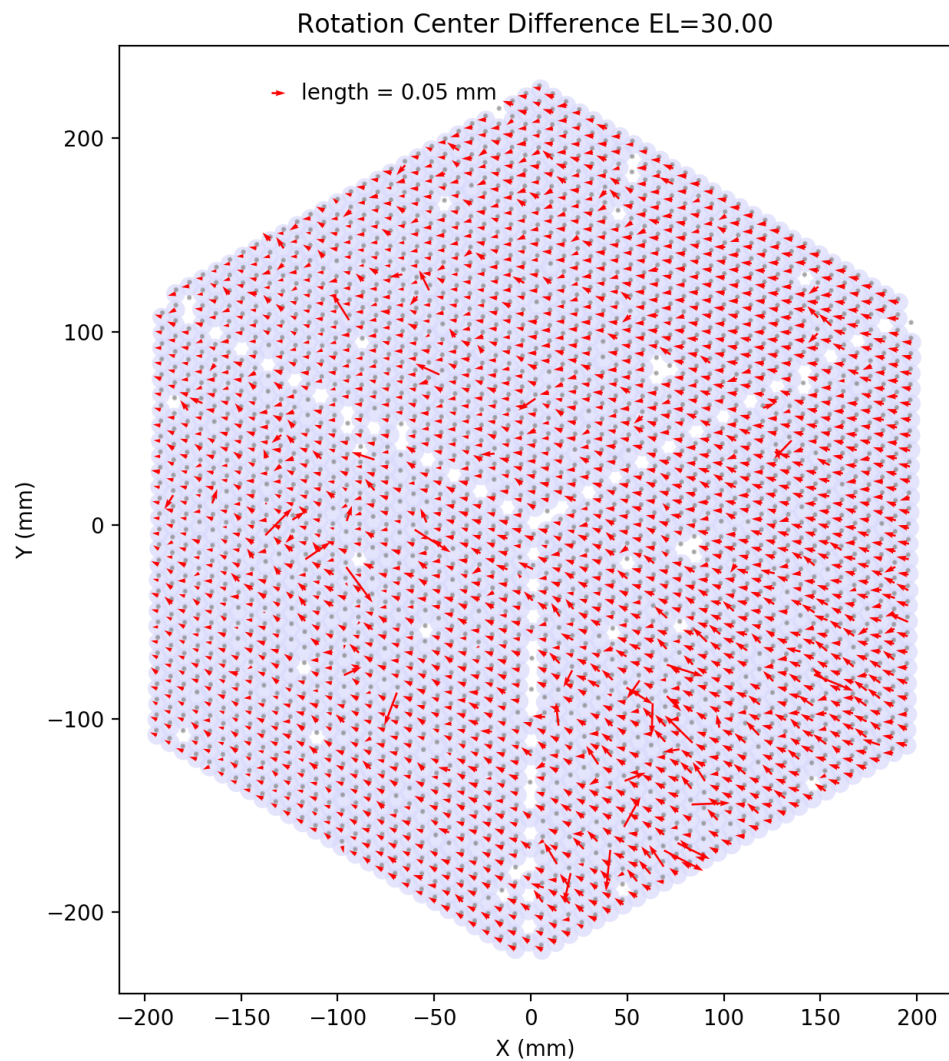
Rotation Center Difference EL=60.00



EL=60.00

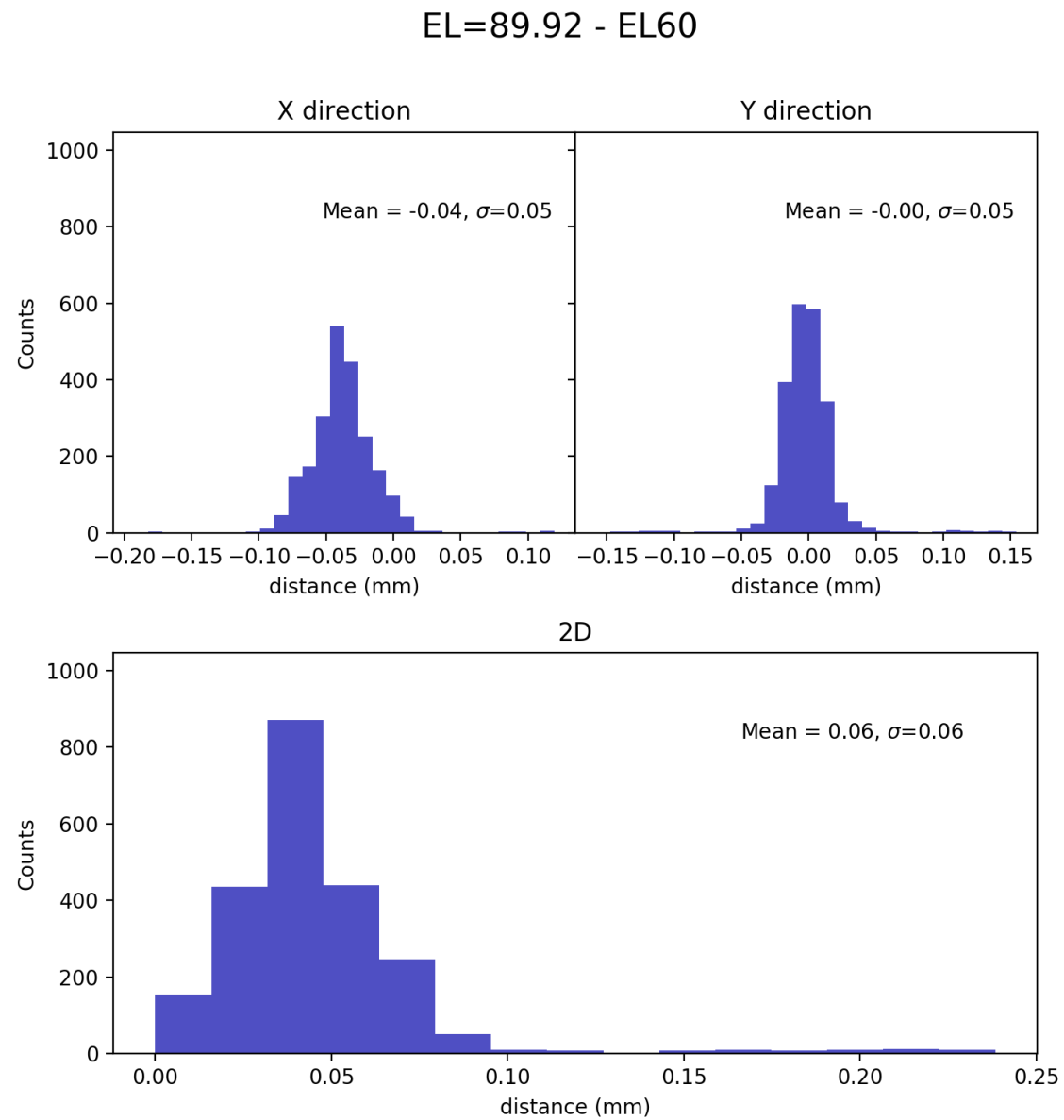
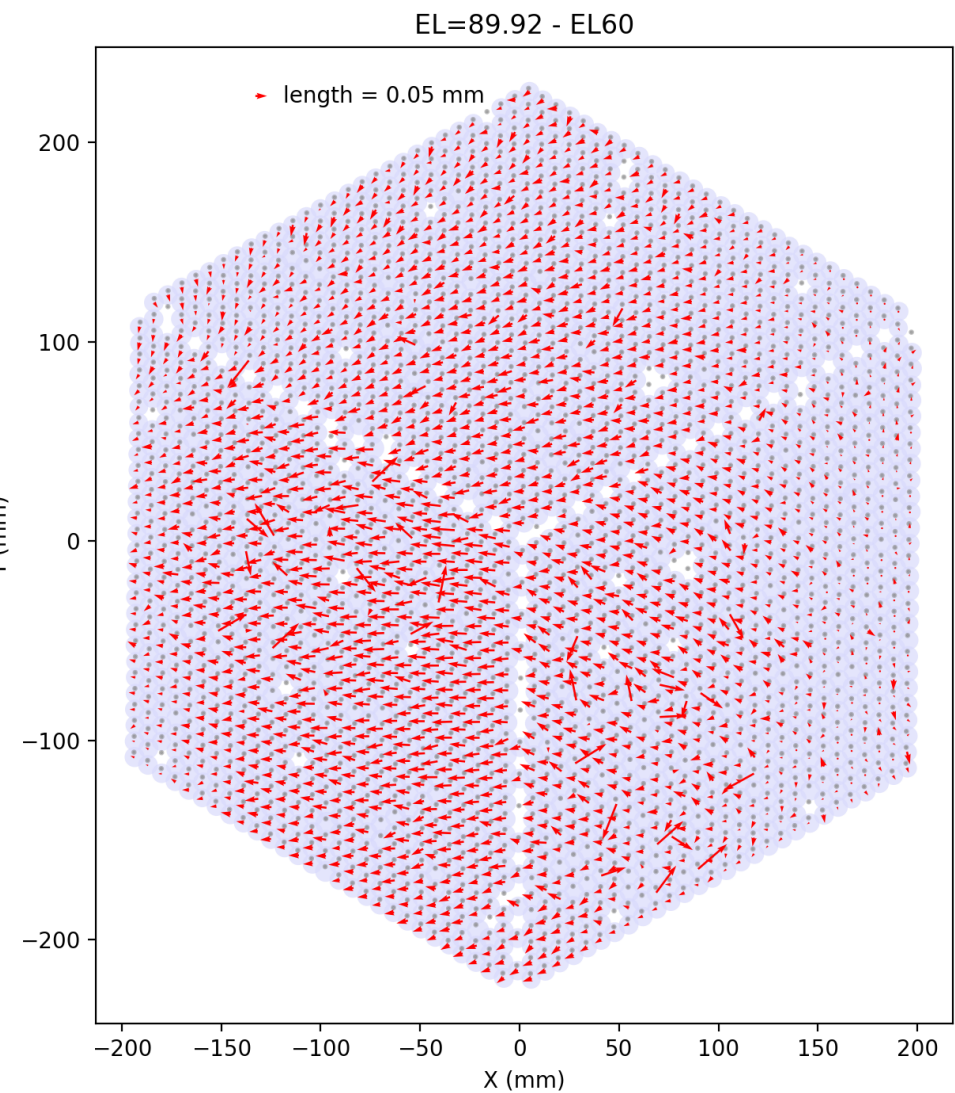


# Same EL, EL30





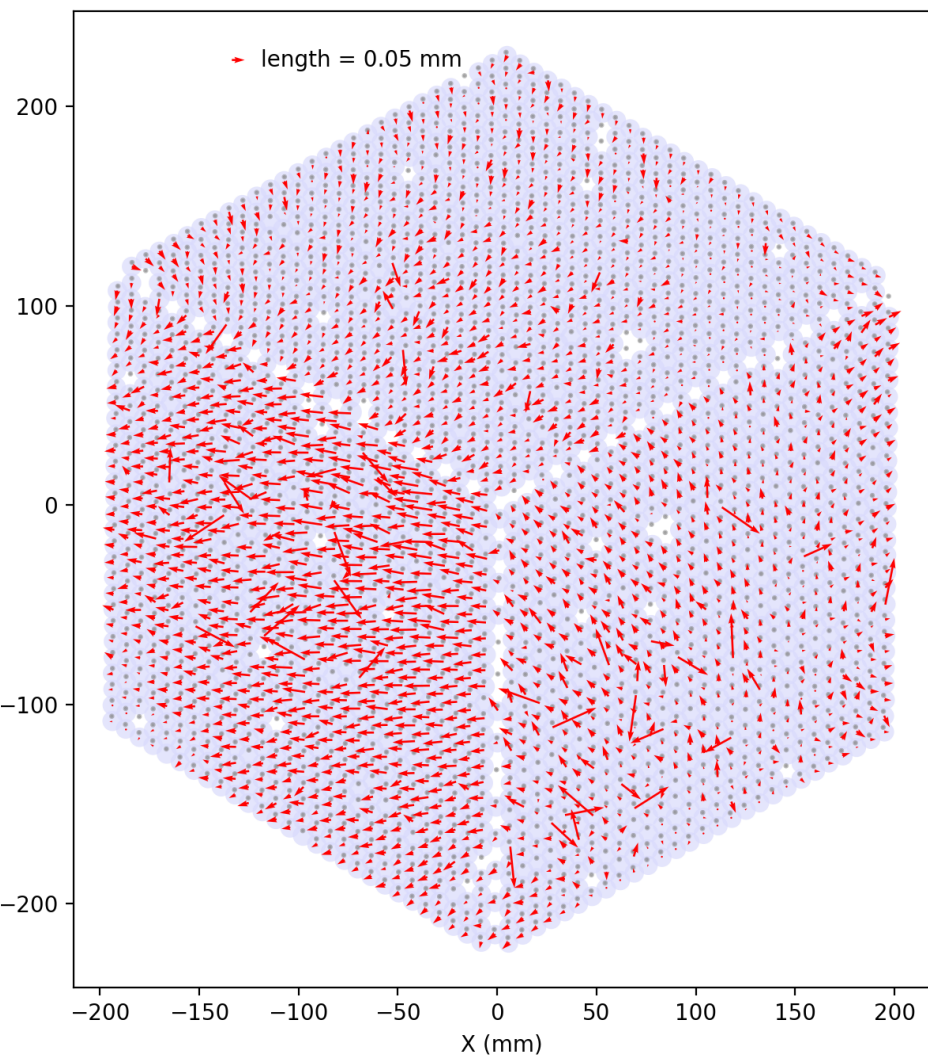
# EL90-EL60





# EL90-EL30

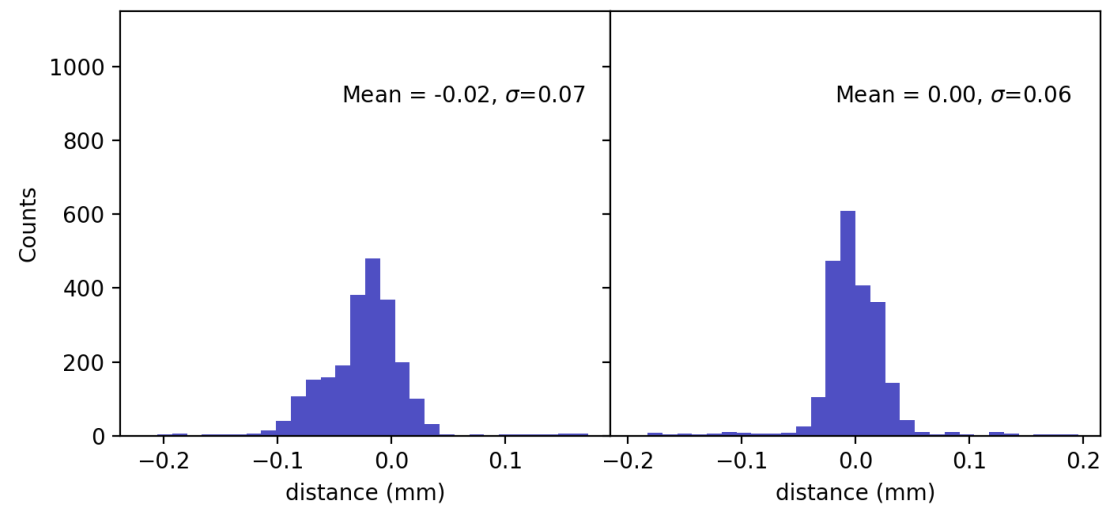
EL=89.92 - EL30



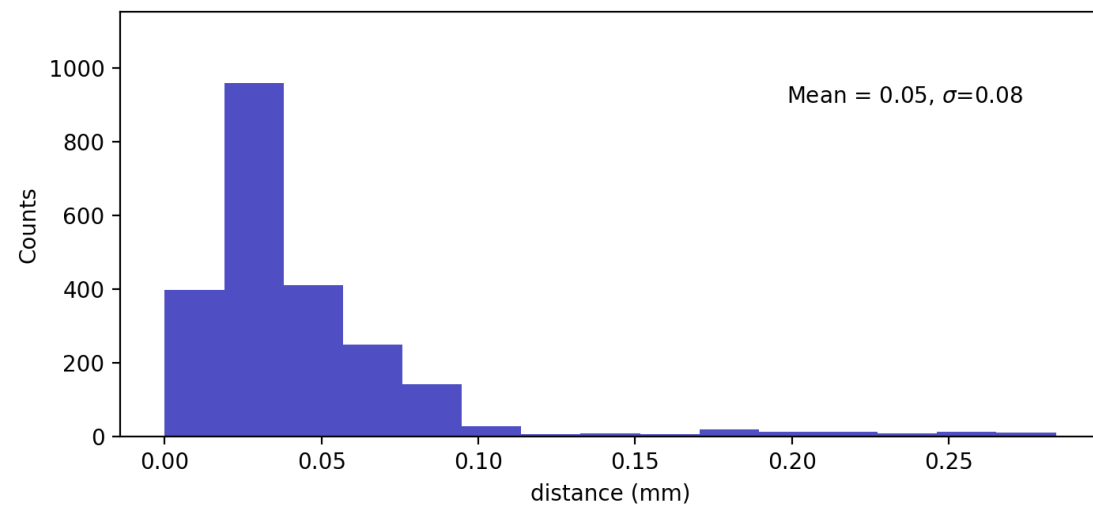
EL=89.92 - EL30

X direction

Y direction

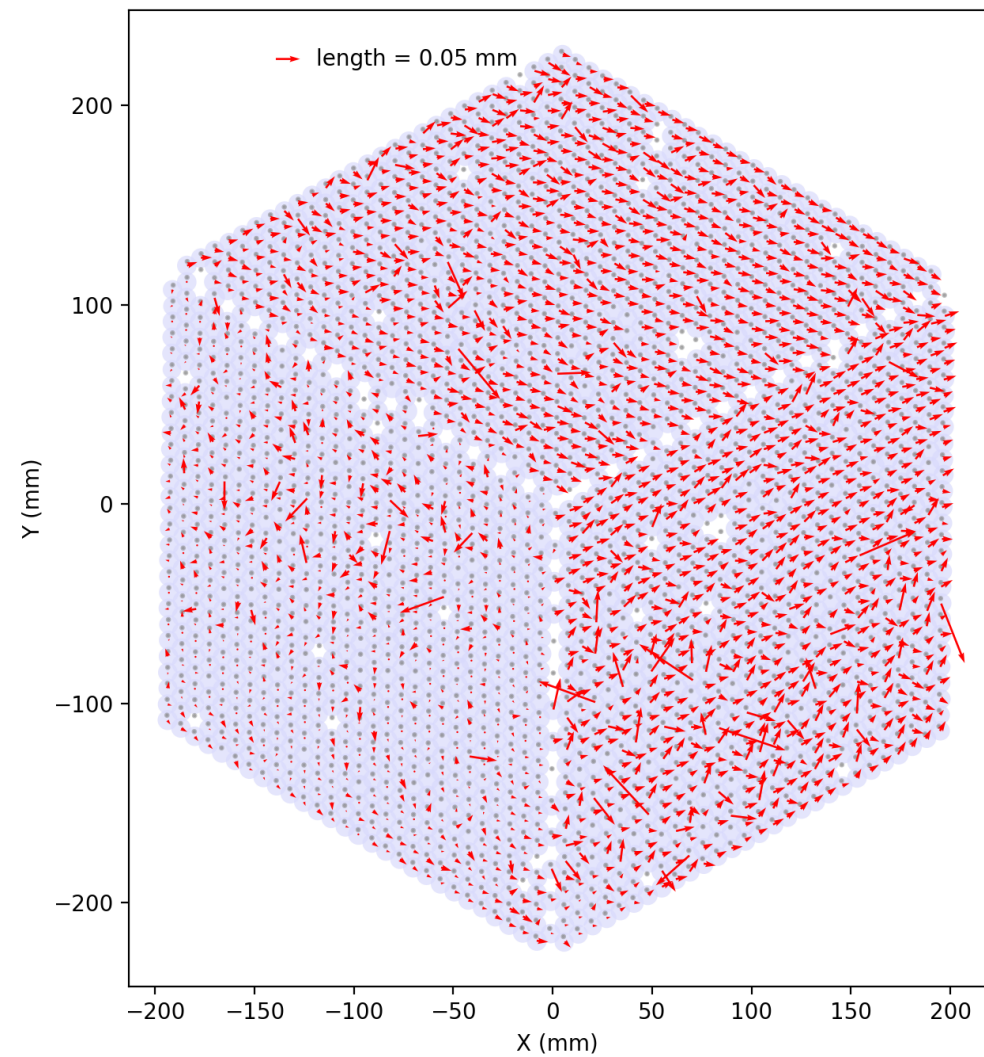


2D



# EL60-EL30

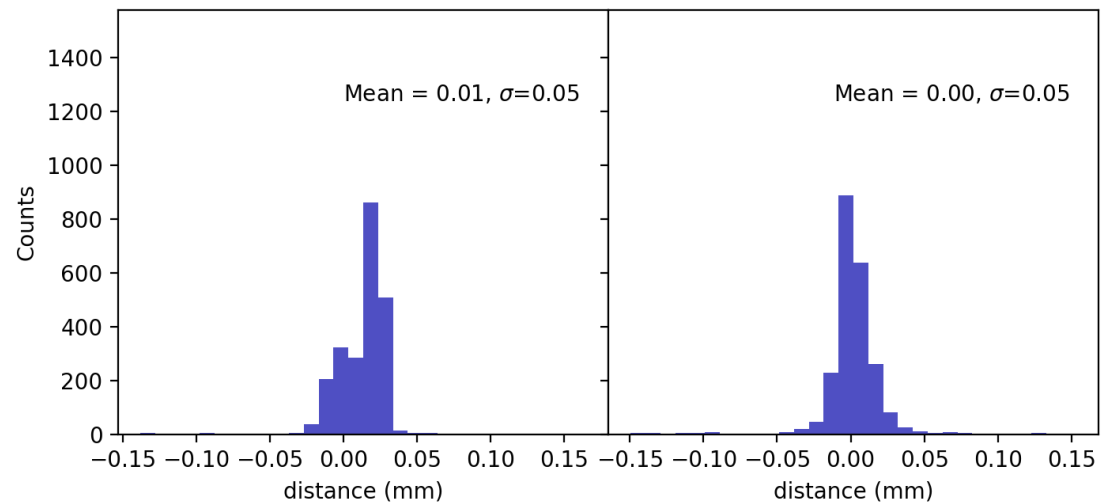
EL=60.00 - EL30



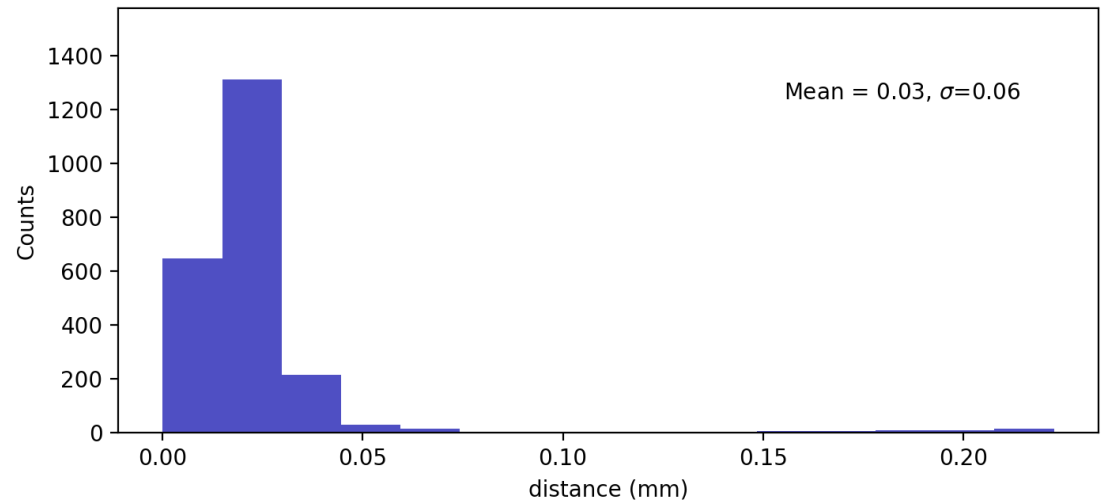
EL=60.00 - EL30

X direction

Y direction



2D



# Measured Rotation Center vs XML Geometry

- We also compared the cobra geometry from XML with measurement data. It is clear that there is a systematic offset between those two measurements.
- The cobra center in XML file needs to be updated.

