

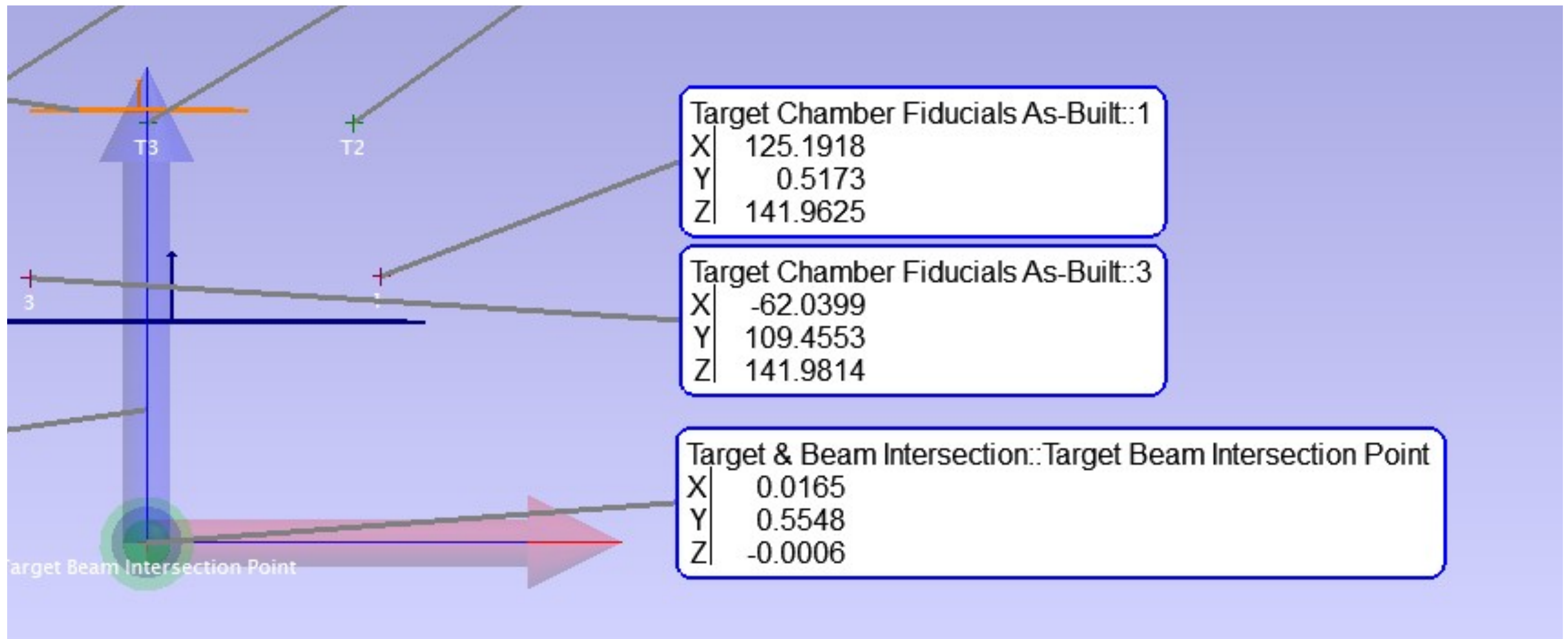
Upgrades for 30 MeV

Douglas Hasell, 19 May, 2026

First - know where you are !

- Survey everything now before you change things
 - so you know how to analyze the data you have

Scattering Chamber and Target Center



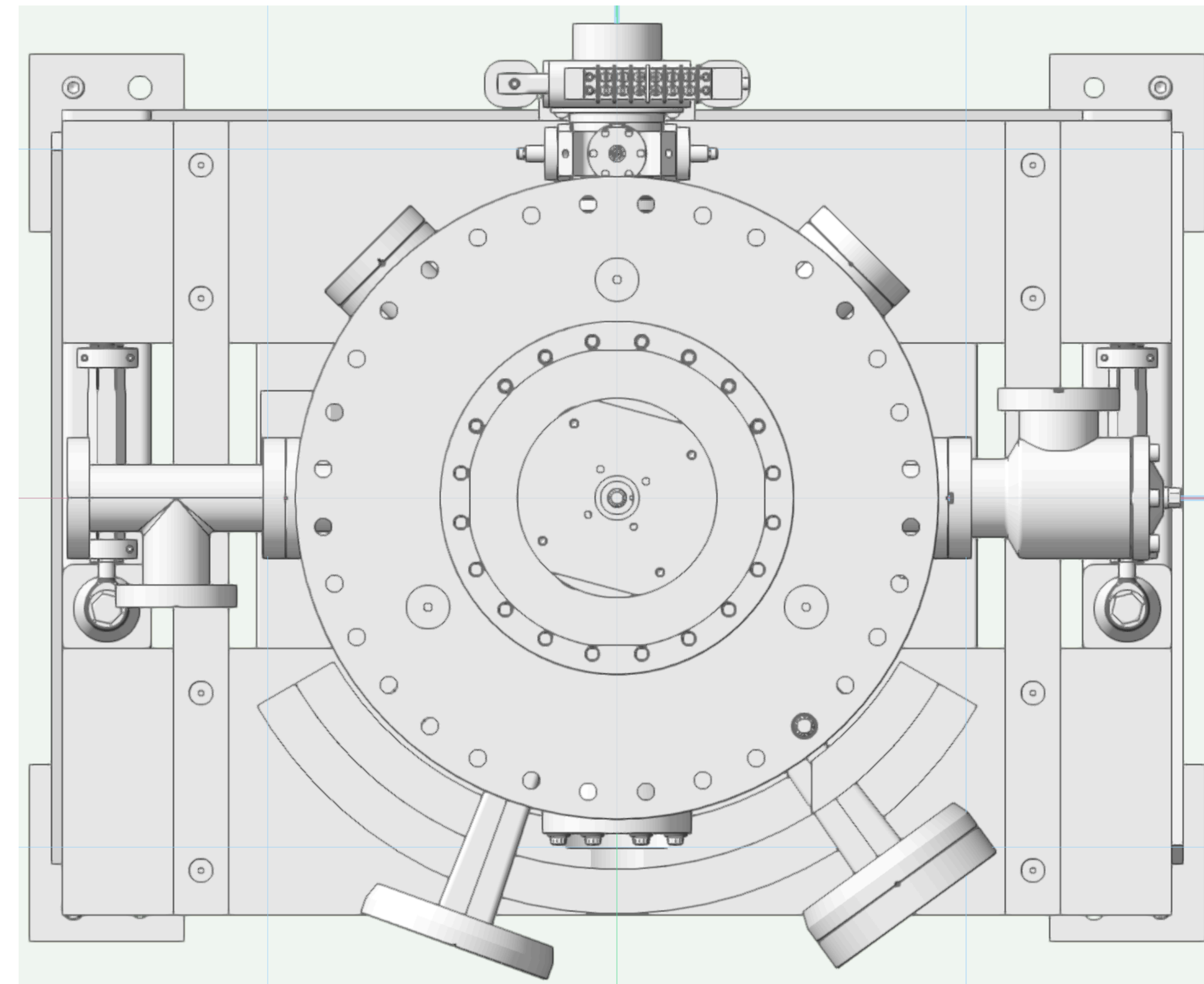
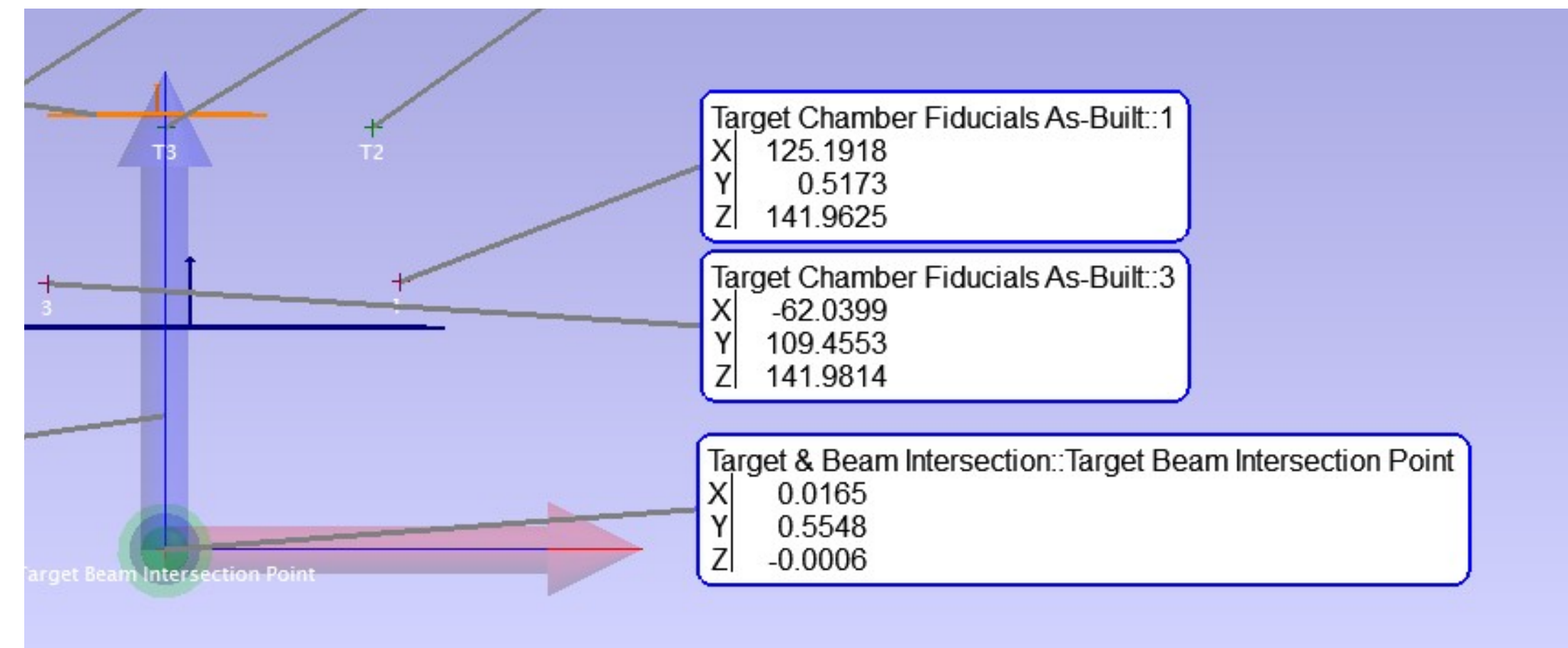
Scattering chamber about 0.55 mm north of nominal

Limited information on rotation

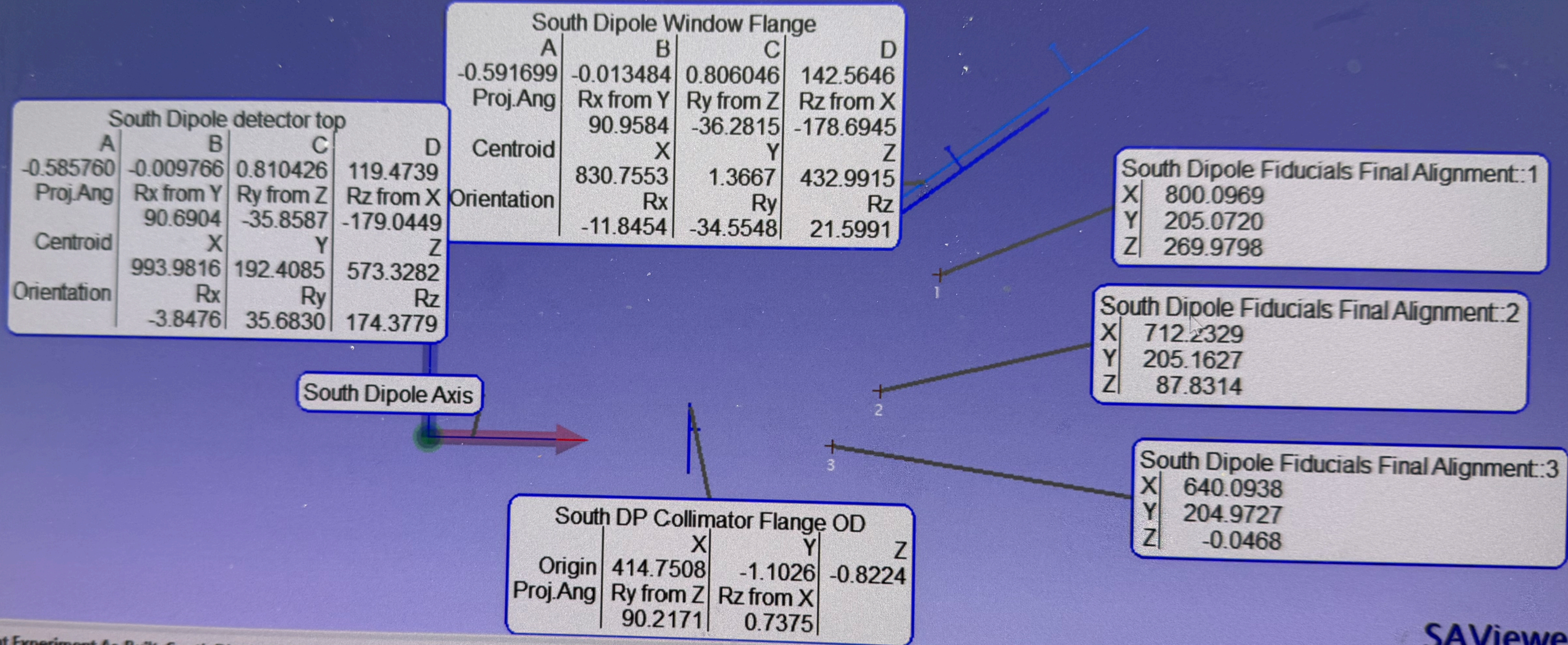
Scattering Chamber

Comparing survey and CAD model

- F1 - 125.19, 0.52, 141.96
- CAD - 125.00, 0.00, 117.00 (25.0 or 25.4)
- F3 - -62.04, 109.46, 141.98
- CAD - -62.00, 108.00, 117.00 (25.0, or 25.4)
- Target - 0.02, 0.55, 0.00
- CAD - 0.00, 0.00, 0.00
- Scattering chamber ~0.55 mm north
- Limited information on rotation 0.02°
- No information on 20° or 36° exit ports
- Measure ?



Visibility
 Controls



Report Bar (WCF: DarkLight Experiment As-Built:South Dipole Axis)

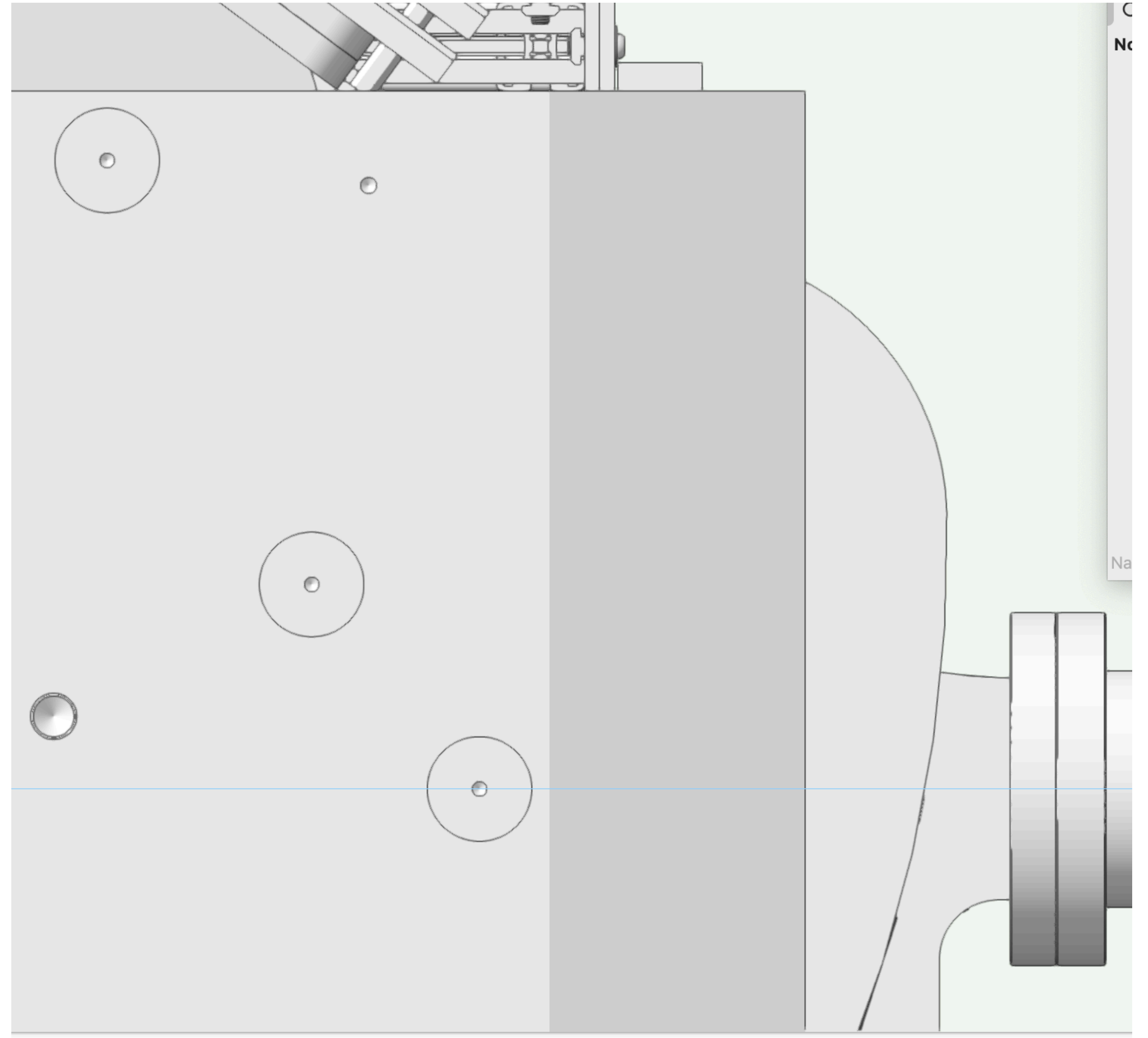
SAViewer

Frames

South Dipole Yoke - electron arm

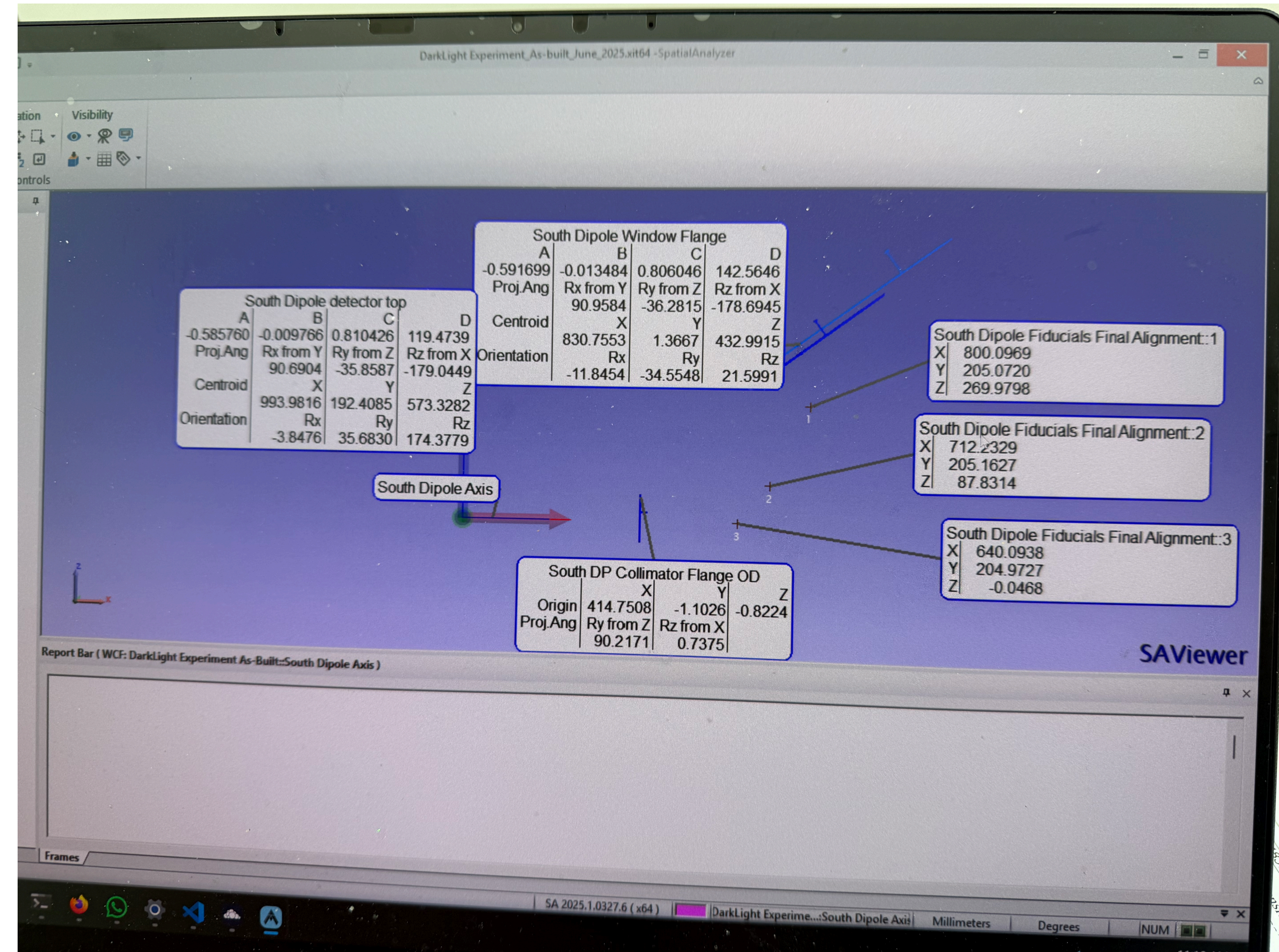
Comparing survey and CAD model

- F1 - 800.10, 205.07, 269.98
- CAD - 800.00, 179.00, 270.00
- F2 - 712.23, 205.16, 87.83
- CAD - 712.00, 179.00, 88.00
- F3 - 640.09, 204.97, -0.05
- CAD - 640.00, 179.00, 0.00
- E - 414.75, -1.10, -0.82
- CAD - 412.00, 0.00, 0.00
- No information on angle 36° ???



South Dipole Exit Flange and GEM

- Exit flange slope 36.28° (36.43°)
- Center at 830.76, 1.37, 432.99
- CAD 822.90, 0.00, 426.20
 - Height of target holder ?
 - Slope of centroid 34.55° (36.43°)
 - But Rx and Rz way off
- Detector top at 35.86° (36.43°)
- Center at 993.96, 192.41, 573.33
 - 192.41 mm shift in Y ?
 - 140 mm above exit flange ?



North Dipole Window Flange			
A	B	C	D
-0.593717	-0.007271	0.804641	140.3392
Proj.Ang	Rx from Y	Ry from Z	Rz from X
	90.5177	-36.4224	-179.2983
Centroid	X	Y	Z
	828.2338	3.5004	436.7450
Orientation	Rx	Ry	Rz
	-24.8097	-27.5689	45.6680

North Dipole Window Edge			
A	B	C	D
-0.596644	0.000697	0.802506	124.5965
Proj.Ang	Rx from Y	Ry from Z	Rz from X
	89.9502	-36.6299	179.9330
Centroid	X	Y	Z
	947.2725	16.3570	549.0004
Orientation	Rx	Ry	Rz
	-35.9986	-7.2822	80.0360

North DP Collimator Flange OD			
	X	Y	Z
Origin	410.1723	0.4095	0.1883
Normal	0.999997	0.002411	0.000026
Proj.Ang	Rx from Y	Ry from Z	Rz from X
	0.6233	89.9985	0.1381
Diameter	151.8401		

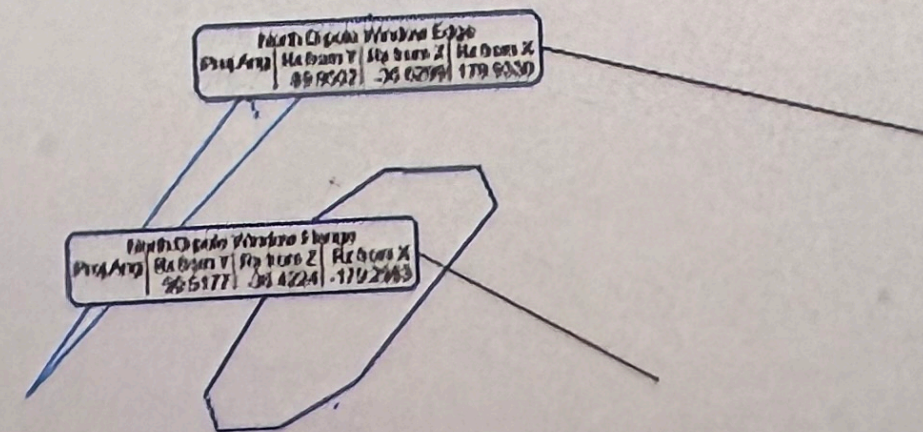
North Dipole Fiducials As-Built:1	
X	799.9593
Y	204.9226
Z	270.0349

North Dipole Fiducials As-Built:2	
X	712.0636
Y	204.8848
Z	87.9179

North Dipole Fiducials As-Built:3	
X	639.9261
Y	204.8912
Z	0.0753

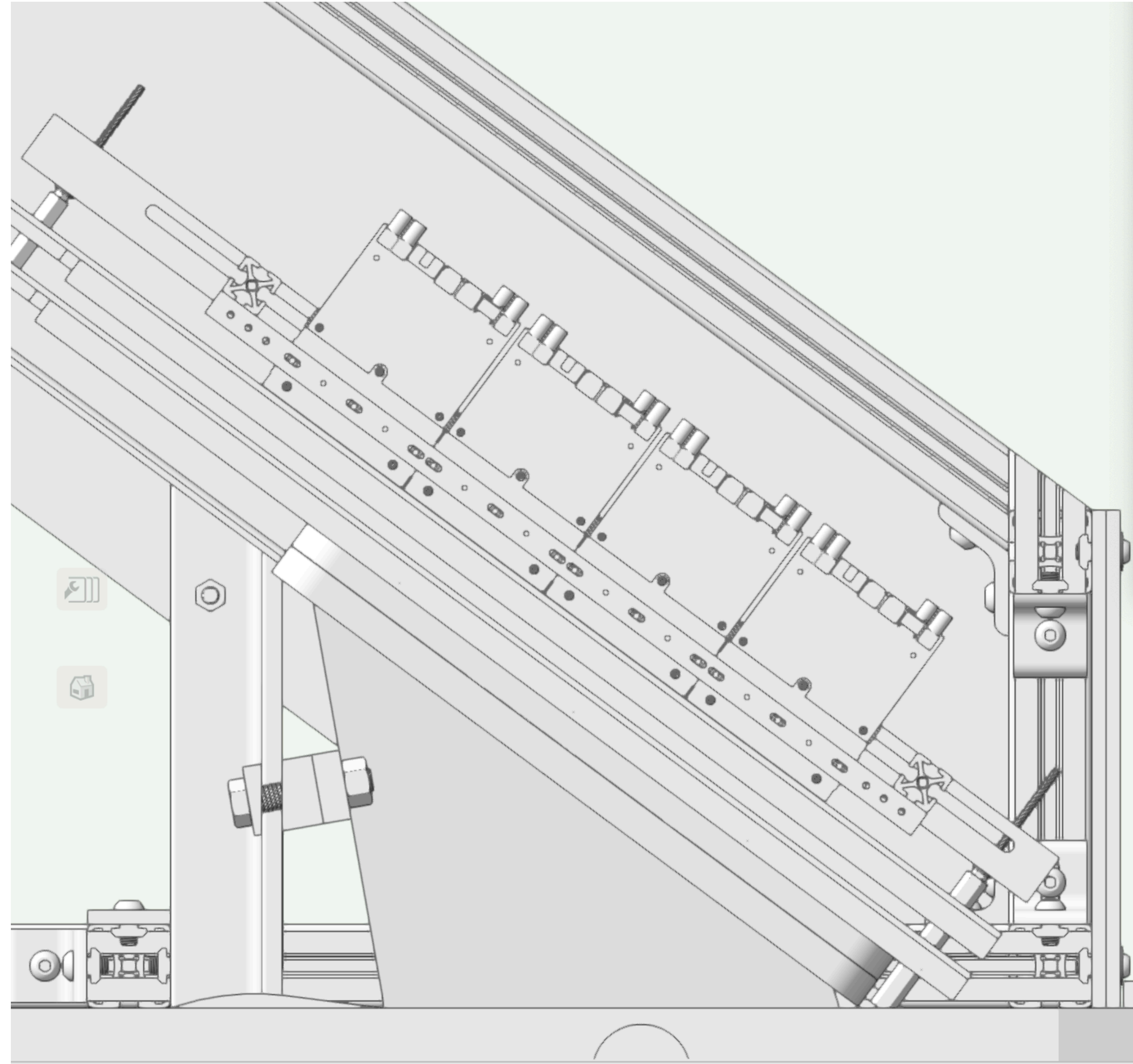
SAViewe

WCF: DarkLight Experiment As-Built::North Dipole Axis)



North Dipole Exit Flange and GEM

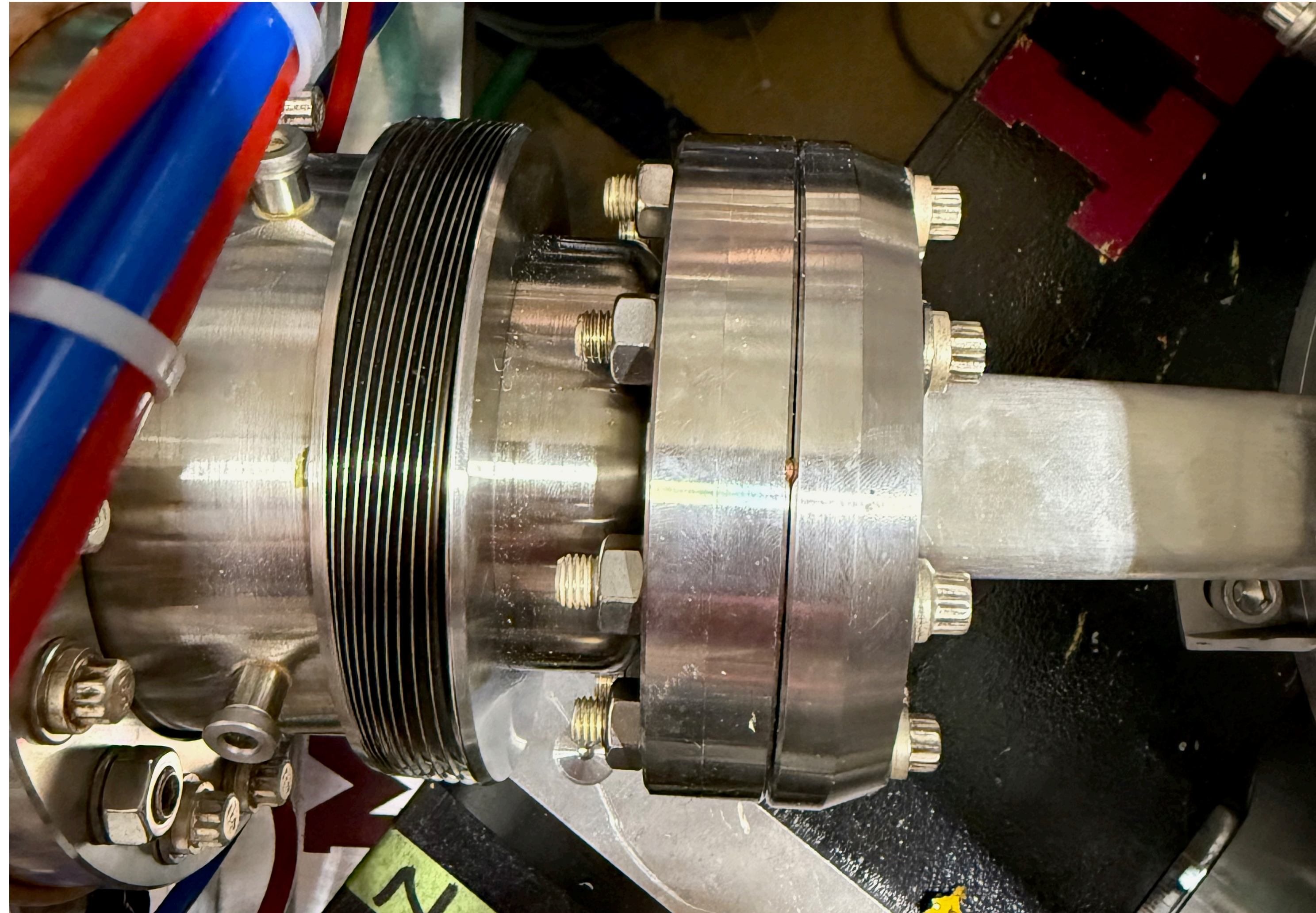
- Yoke and flange okay
 - But no measure of 20° angle
- Exit flange and detector slope okay
 - But centroid angles off
 - Detector 110 mm above exit flange ?
- So not clear where things are?
- Remeasure ?



South Dipole Vacuum Chamber Twisted

Bellows skewed !

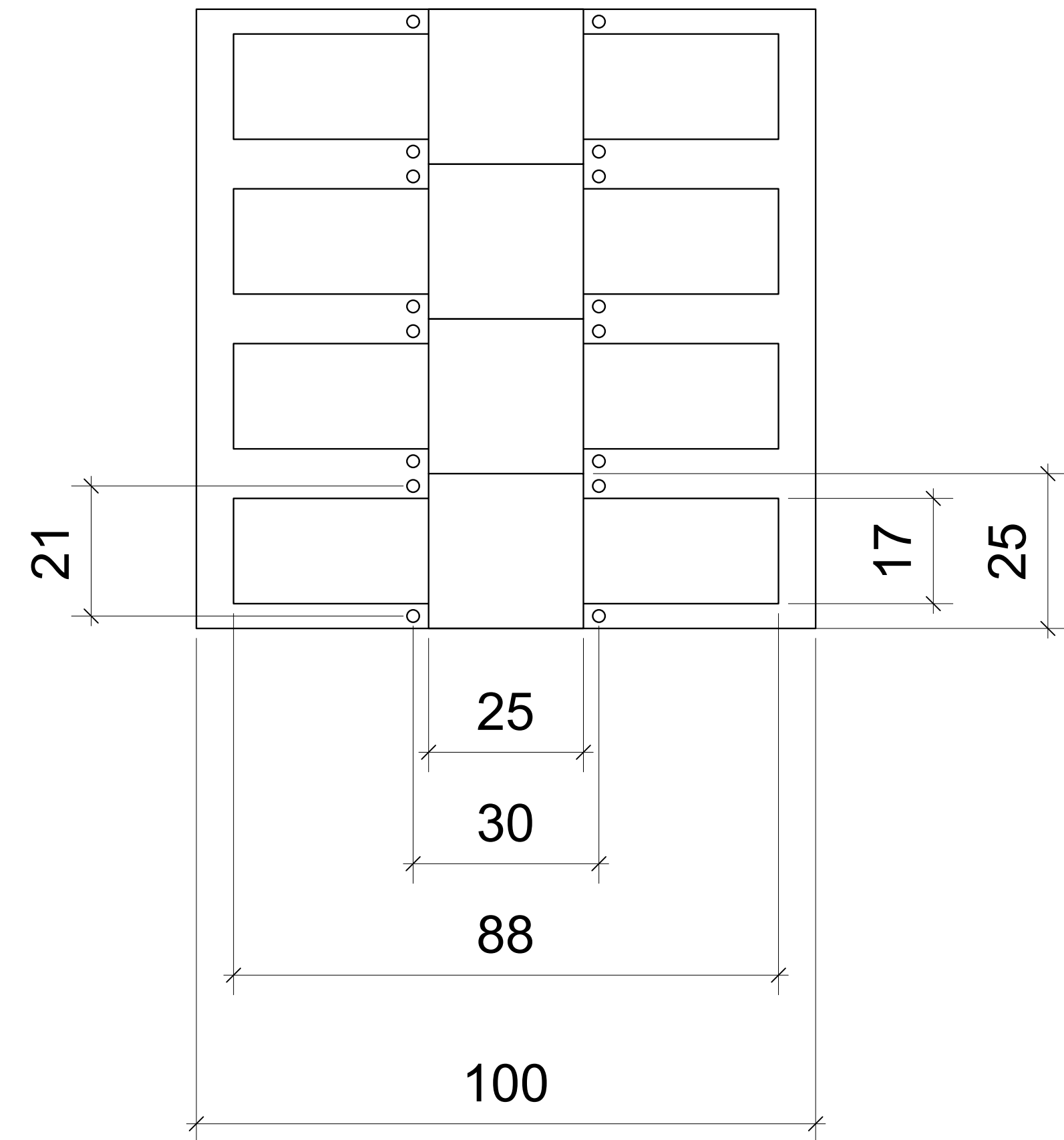
- Believe dipole is at 36°
- Scattering chamber flange may not be at 36° ?
- Suggest measure 0° , 20° , and 36° flanges to cross check.
- Solution means moving dipole to matching angle



Other things for 30 MeV

- Hot filament vacuum gauge lighting up the target
 - Move the gauge, put it in a “tee”
- Beam halo striking target ladder
 - Make target holder bigger
 - Put a tungsten collimator in the beam pipe immediately upstream the target
 - 50 mm long, 50 mm OD, 16 mm aperture

DarkLight
Target Ladder



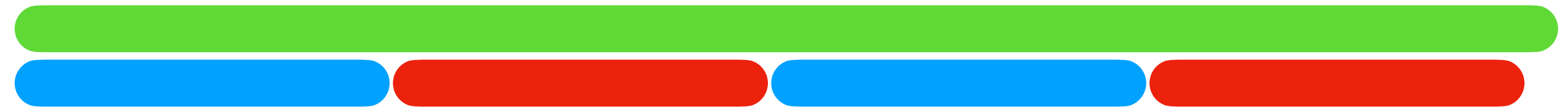
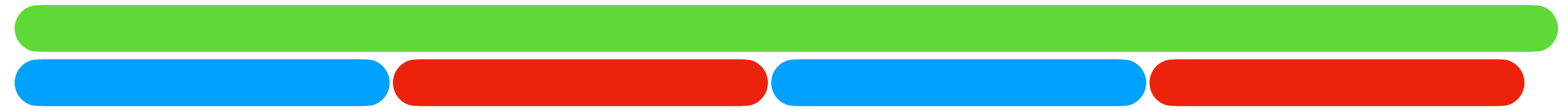
Proposal for alternative tracker

- Goal is to have something working in < 1 year (e.g. early 2027)
- Limit to potential 30 MeV run in 2027
- Not solution for “real experiment” at 50 MeV in future
- Not aiming to have comparable resolutions
 - Something that works reliably, easy to build, operate, and readout
 - Modest cost
 - Appropriately sized for DarkLight

Scintillating strips

4 mm wide, 0.5 mm thick

- 2 XY layers
- 75 strips in dispersive direction
 - 0.53% of nominal momenta
- 30 strips in non-dispersive
 - 0.09° angular coverage
- Couple to 3x3 mm SiPMs
 - Readout one end only cheaper
 - Readout both ends adds complexity but could allow timing, trigger?



0.5 mm thick $0.0012 X_0$

RMS multiple scattering 1.45°

Two planes of XY, 20 mm separation