NGAO OSM

Design Study Update

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08/11/2009
Version 11

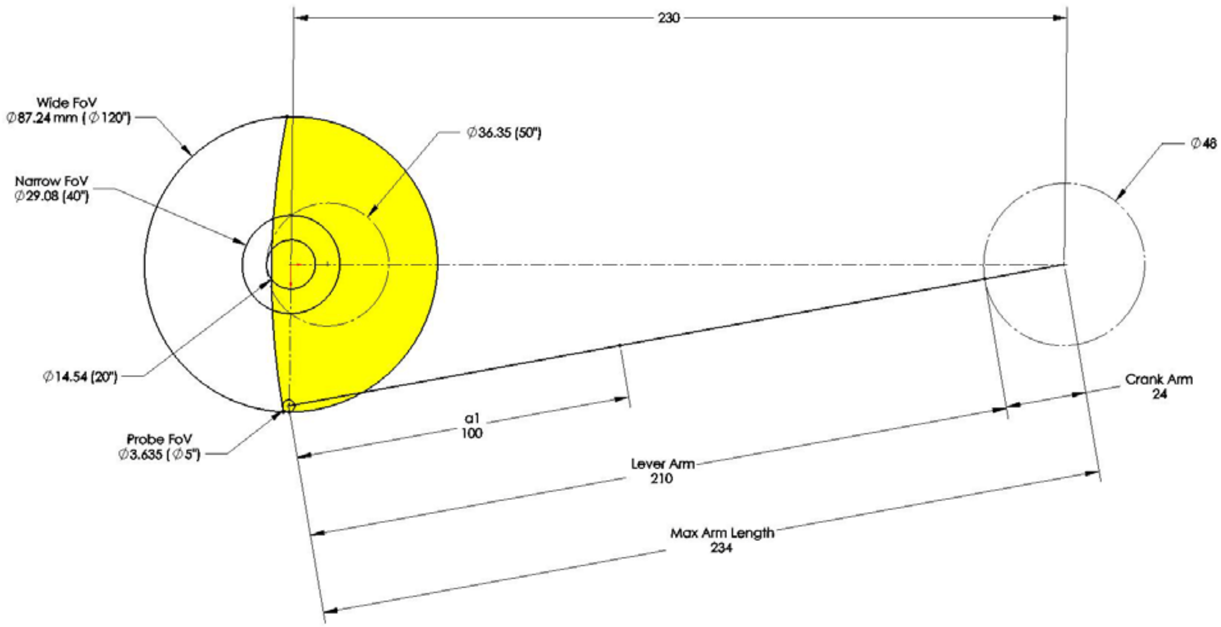
1. Conceptual design and operation

The Ø 5" (3.635 mm) probe covers **half of** the ~~entire~~ Ø 120" (87.24 mm) Field of View.

The 2 degrees of freedom probe arm consists of 2 individual arms: A crank arm and a lever arm, driven by 2 corresponding rotation motors: The crank and lever motors.

Any position in the OSM field of view can be acquired by calculating appropriate values for theta and phi, noting that due to a mirror reflection there could be 2 possible solutions.

The crank motor is secured to the Sensor and rotates the crank arm, precisely about the rotation axis of the crank motor referred to as the theta axis. The lever arm motor provides the necessary second degree of freedom by rotating the lever arm and all associated optics, about the phi axis.



1.1 Basic Design requirements:

Mechanism Type: ϕ/θ

Patrolled Field: Ø 120" (87.24mm)

Probe FoV: Ø 5" (3.635mm)

Acquisition accuracy: 40 mas (30µm)

Stability: 5 mas / 3600s (1 µm)

Position knowledge: < 1 µm (TBC)

Minimum Incremental motion: TBD

Operating Temperature: -10°C +/- 0.3

Note: Separation is a distance determined by the Lever Arm motor envelope to clear the Field of view at any angle of Crank rotation.

1.2 Position Accuracy

Probe Position within the field shall be measured according to the level of desired accuracy: Direct or indirect.

<u>Indirect measurement:</u>

Total Position Accuracy of 30µm at the farthest position across the 144mm field requires a minimum crank rotation accuracy of:

sin α = 30µm / 144 mm ➔ α = 0.012° = .012 π / 180 = .00021 rad = 210 µrad

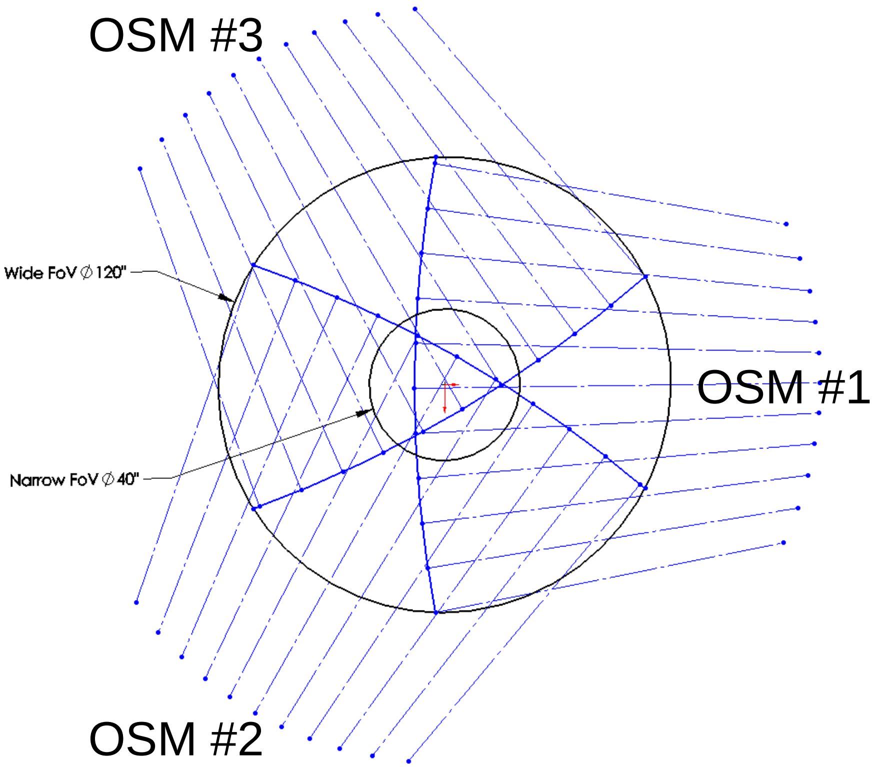
And the 100 mm lever arm motor is 60 % longer than the 40mm Crank arm

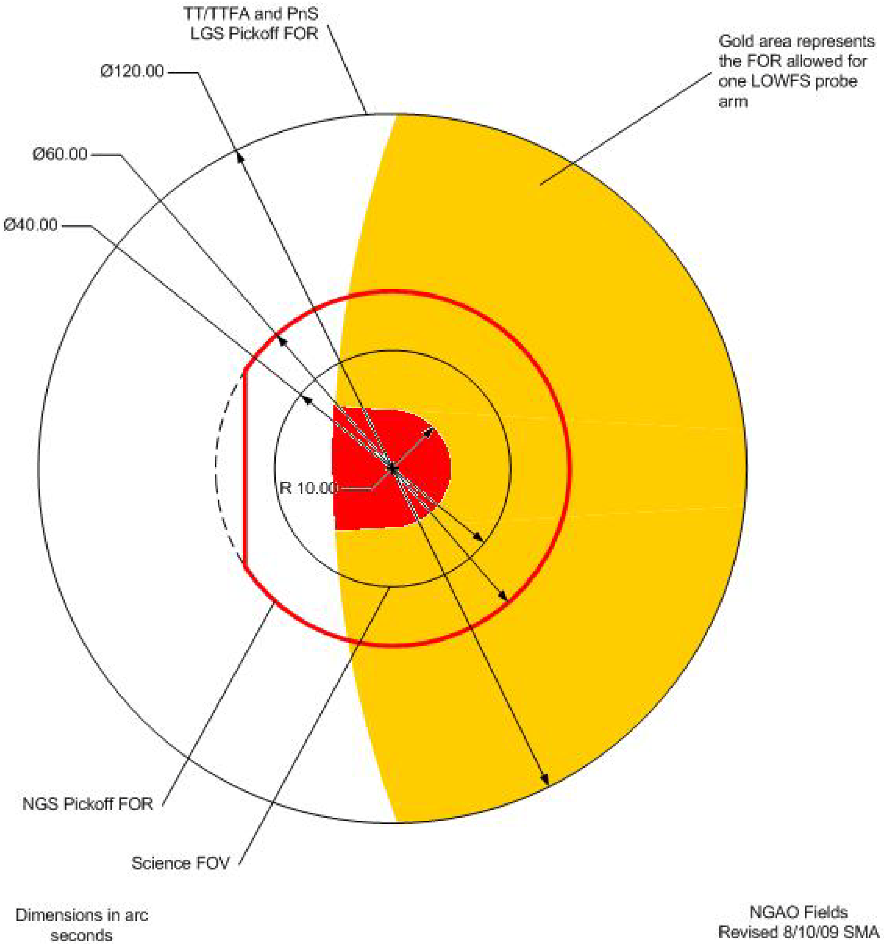
Crank motor rotation accuracy: 210 µrad x 60% = 126 µrad

Lever motor rotation accuracy: 210 µrad x 40% = 84 µrad

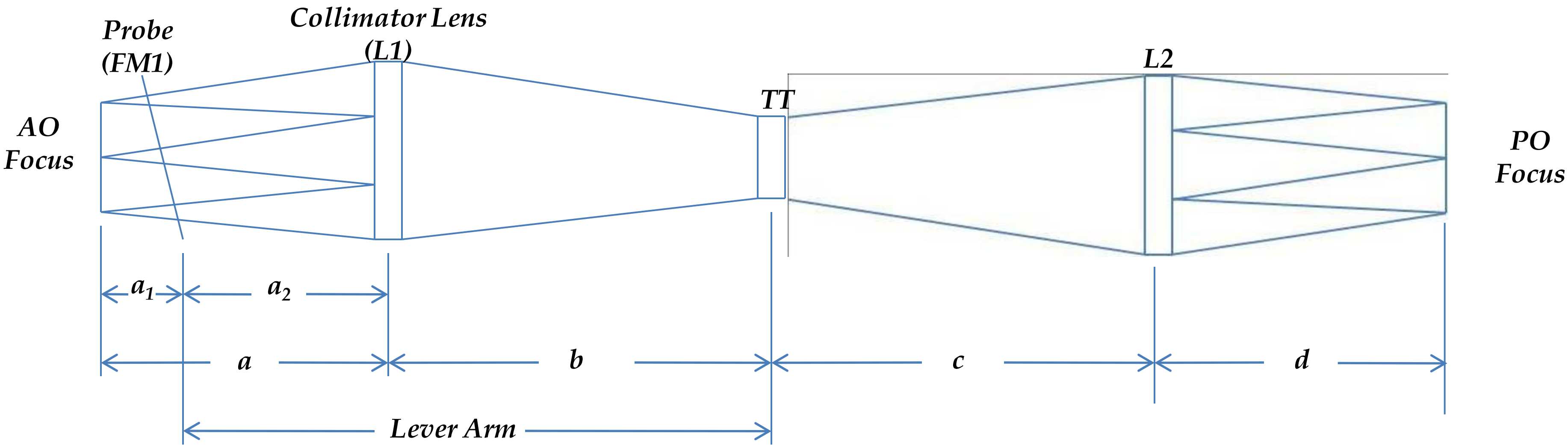
Needs Update

1.1.3 Probe operation





3. Optical Equation



Optical Layout is optimized when the following equations are verified:

3.1) a = b = c = d

3.2) a + b = x (c + d)

Keeping the AO Focus away from the Probe mirror (FM1) gives:

3.3) $a = a_1 + a_2$

Keeping each Lever arms on a different plane to avoid collision between each other gives a different value of a1 for each OSM

The Lever Arm Length previously determined gives:

3.4) Lever Arm length = $b + a_2$

Replacing 3.3 & 3.4 in 3.1 gives: a = b ➔ $a_1 + a_2$ = Lever Arm length - a_2

Solving for a_2 ➔ $2a_2$ = Lever Arm length - a_1 ➔ **a_2 = (Lever Arm length - a_1)/2**

3.5) The Lens Holder size is driving a_2

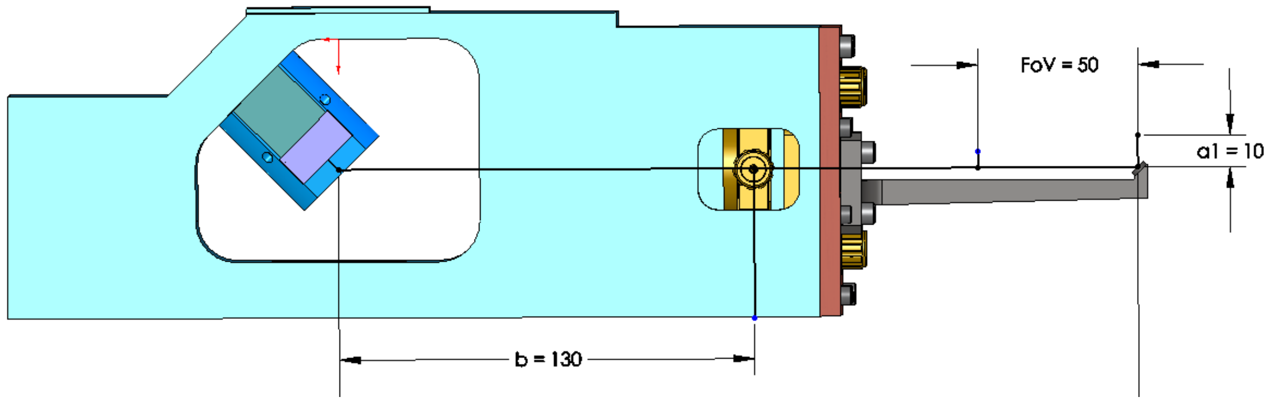
Using a 250mm Lever Arm , would give the following results :

a1 = 10 mm for OSM #1 ➔ 10 + 2 a_2 = 250 ➔ $2a_2$ = 250 - 10 ➔ a_2 = 120
a1 = -5 mm for OSM #2 ➔ -5 + 2 a_2 = 250 ➔ $2a_2$ = 250 + 5 ➔ a_2 = 127.5
a1 = -20 mm for OSM #3 ➔ -20 + $2a_2$ = 250 ➔ $2a_2$ = 250 + 20➔ a_2 = 135

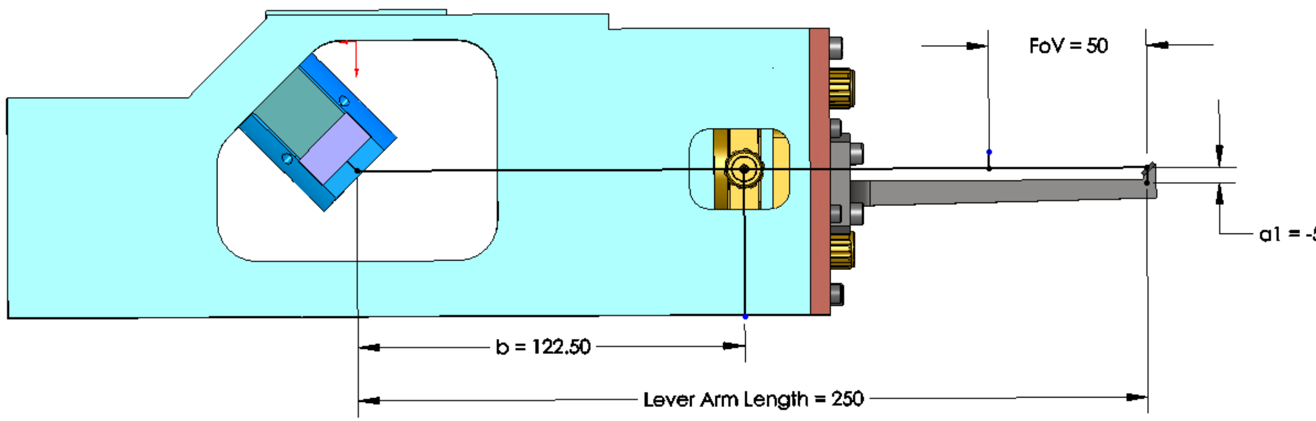
OSM#	a_1	a_2	$a=a_1 + a_2$	a+b
I	10	120	130	260
II	-5	127.5	122.5	245
III	-20	135	115	230

4. Lever Arm Design

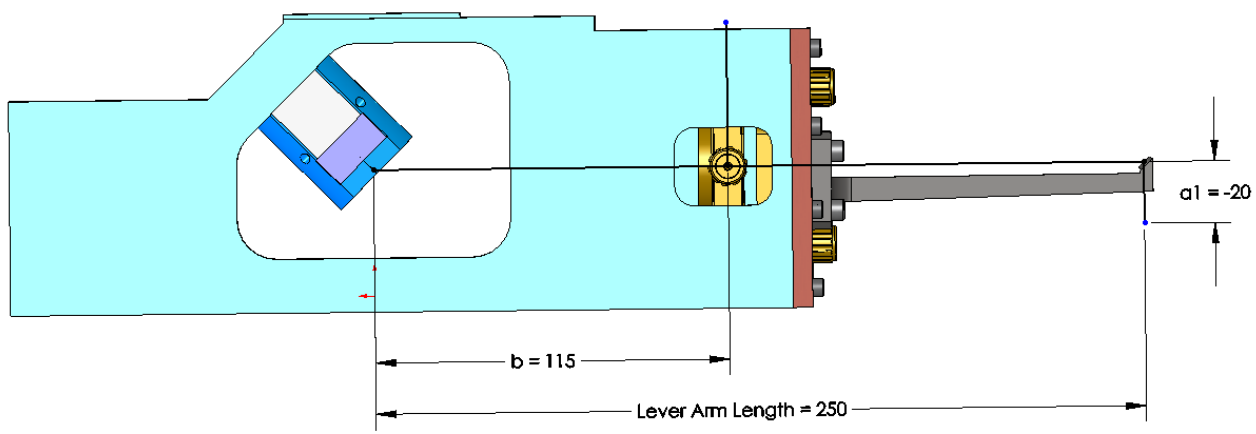
OSM #1
(a1 = 10)



OSM #2
(a1 = -5)



OSM #3
(a1 = -20)



Compact Lens Positioners

NEW

LPV-1

LA1V-XY

- Positions 1.0 in. (25.4) optical elements
- Precision positioning using 100 TPI adjustment screws
- Compact size is ideal for limited-space applications
- English/metric compatibility

The new LA1V-XY and LPV-1 Compact Lens Positioners provide an economical solution for applications requiring two (XY) or five (XYZ $\theta_X\theta_Y$) axes of precision adjustment. Their compact size makes them ideal for OEM applications, or research projects with limited table space. Precise positioning is achieved with the integration of 100 TPI drive screws. Additionally, an integral 5/64 (M2) hex hole in the drive knobs allows for optional Allen key adjustment. Each unit is supplied with two non-marring Delrin retaining rings to safely secure optical elements with a maximum outer diameter of 1.0 in. (25.4mm). Post mounting on the LA1V-XY is achieved by accessing one of the tapped 8-32 or M4 threaded holes in the mount body. The LPV-1 is post mounted via a counterbored hole sized for 8-32 or M4 screws.

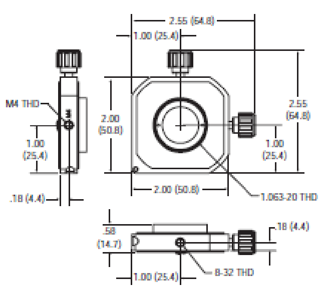
Specifications

	LA1V-XY	LPV-1
Degrees of Freedom	XY	XYZ $\theta_X\theta_Y$
Maximum Optic Diameter [in. (mm)]	1.0 (25.4)	1.0 (25.4)
Optical Axis Height [in. (mm)]	1.0 (25.4)	1.25 (31.8)
Range, XY [in. (mm)]	±0.125 (3.2)	±0.125 (3.2)
Range, Z [in. (mm)]		±0.18 (4.6)
Range, $\theta_X\theta_Y$		±5°
Sensitivity, XY (µm)	0.75	0.75
Sensitivity, Z (µm)		1
Sensitivity, $\theta_X\theta_Y$ (arc sec)		2

Ordering Information

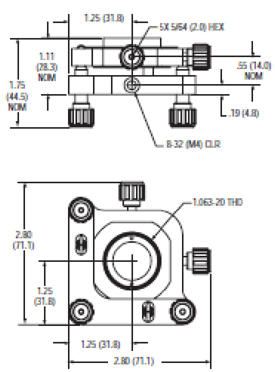
Model	Description
LA1V-XY	XY Lens Positioner
LPV-1	Five-Axis Lens Positioner

Model LA1V-XY



LA1V-XY

Model LPV-1



LPV-1

Rear View of the LPV-1

Related Products

Post mounting options *(see page 705)*

LP Series Precision Multi-Axis Lens Positioners *(see page 679)*

BK 7 Precision Plano-Convex Lenses *(see page 457)*

Precision Achromatic Doublet Lenses *(see page 467)*

CAD *See our website for CAD files*

Newport

LPV-1

Search for: LPV-1

Model: LPV-1 | 5-Axis Compact Lens Positioners, 1-in. Diameter

Opto Mechanics > Lens Holders > Compact Lens Positioners

Available Today

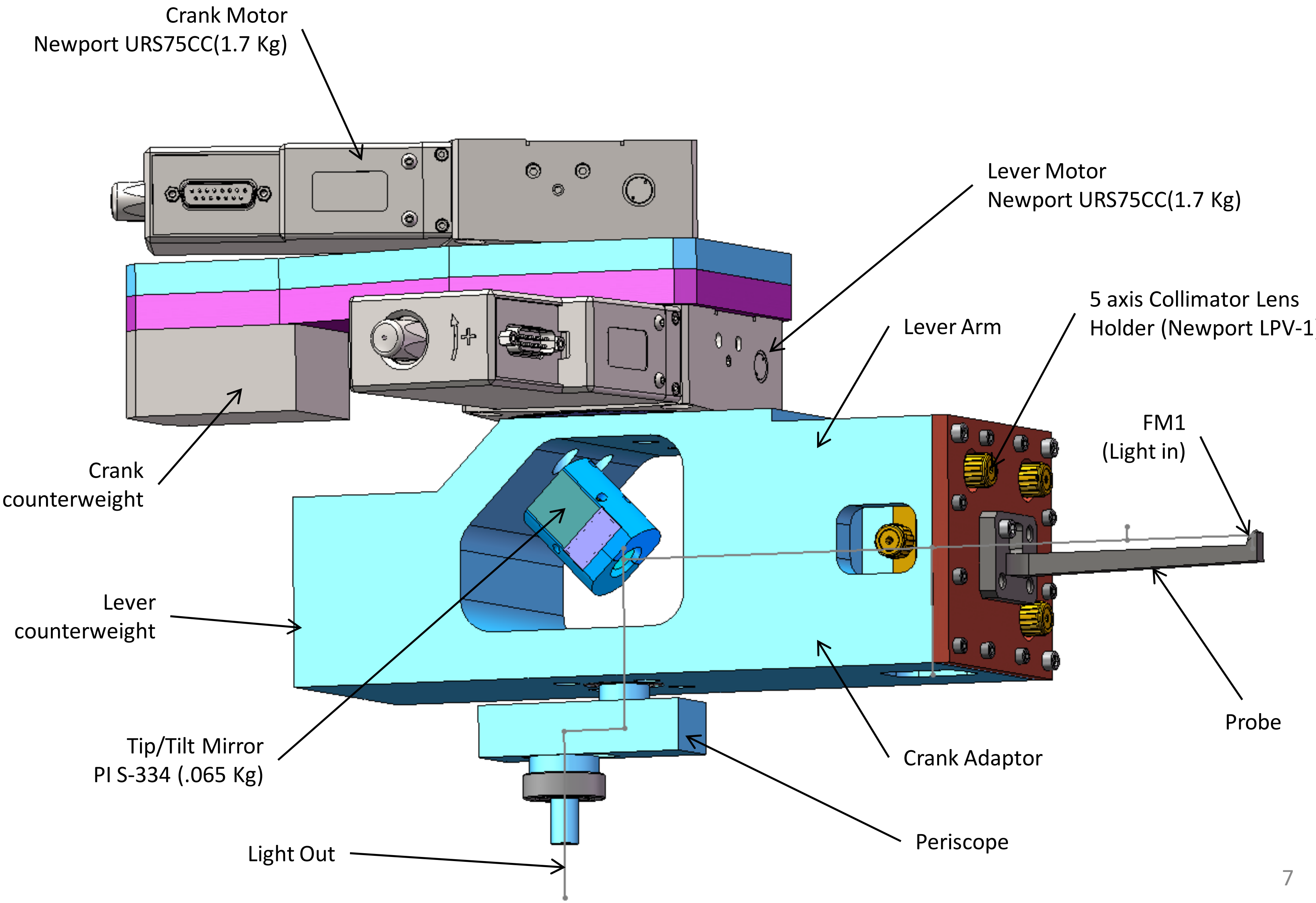
$249.99 1 + Add to cart

- Diameter: 1.0 in. (25.4 mm)
- Adjustments: x, y, z, θx, θy

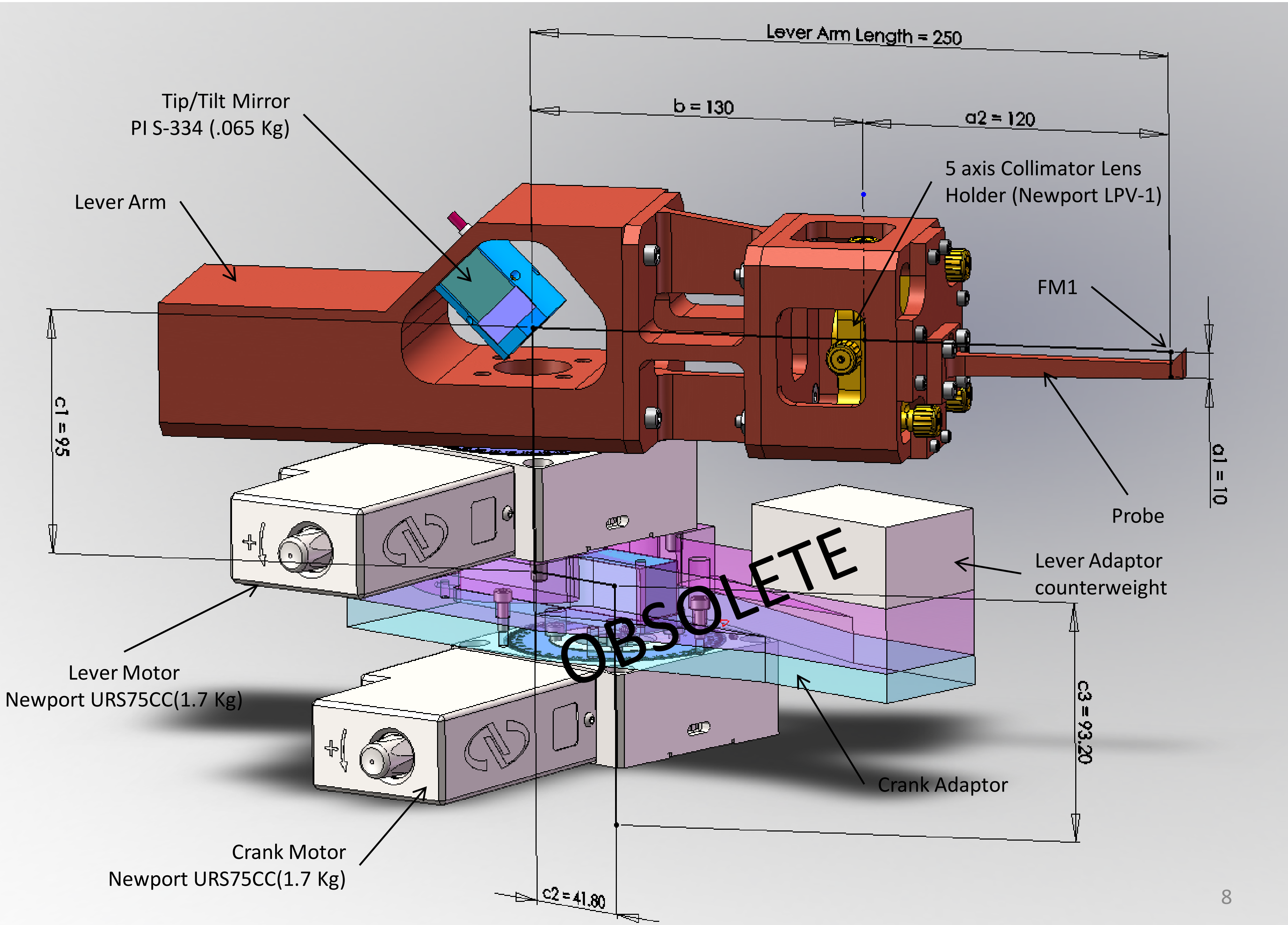
Catalog PDF | 3-D Model | Drawings | Description | Specifications | Product Detail

The new LA1V-XY and LPV-1 Compact Lens Positioners provide an economical solution for applications requiring two (XY) or five (XYZ $\theta_X\theta_Y$) axes of precision adjustment. Their compact size makes them ideal for OEM applications, or research projects with limited table space. Precise positioning is achieved with the integration of 100 TPI drive screws. Additionally, an integral 5/64 (M2) hex hole in the drive knobs allows for optional Allen key adjustment. Each unit is supplied with two non-marring Delrin retaining rings to safely secur optical elements with a maximum outer diameter of 1.0 in. (25.4mm). Post mounting on the LA1V-XY is achieve by accessing one of the tapped 8-32 or M4 threaded holes in the mount body. The LPV-1 is post mounted via a counterbored hole sized for 8-32 or M4 screws.

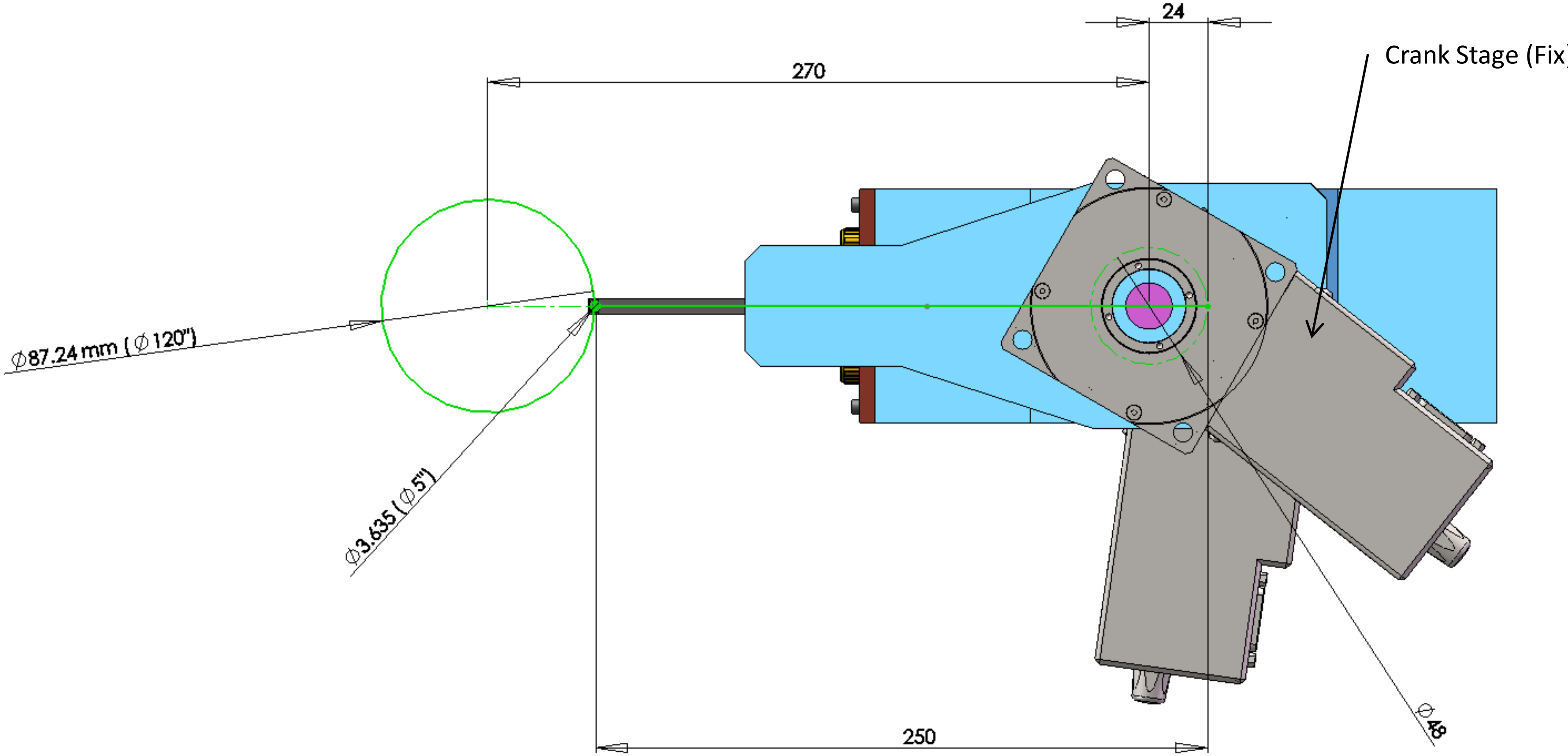
Design With Newport Stages Upstream



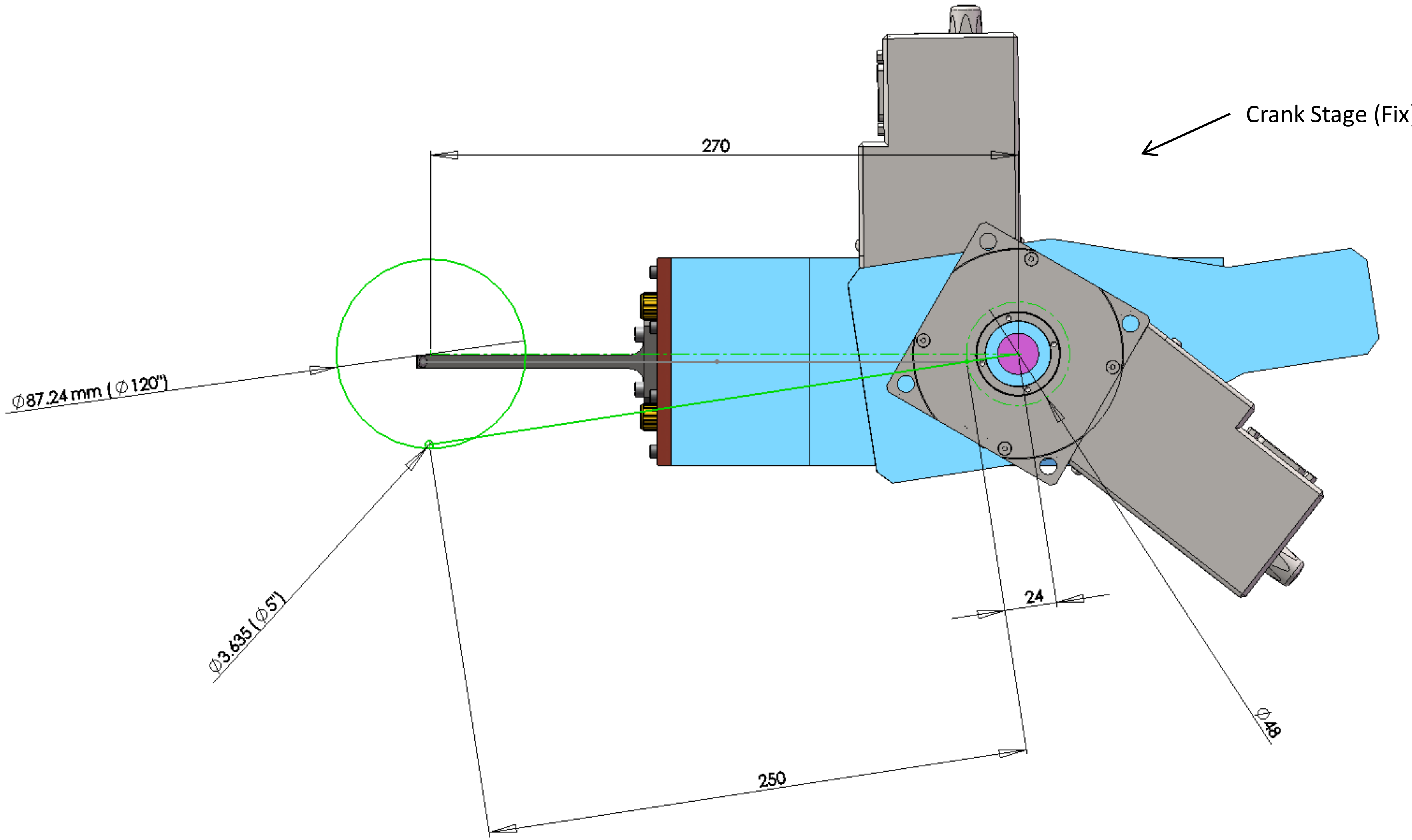
Previous Design With Newport Stages Downstream



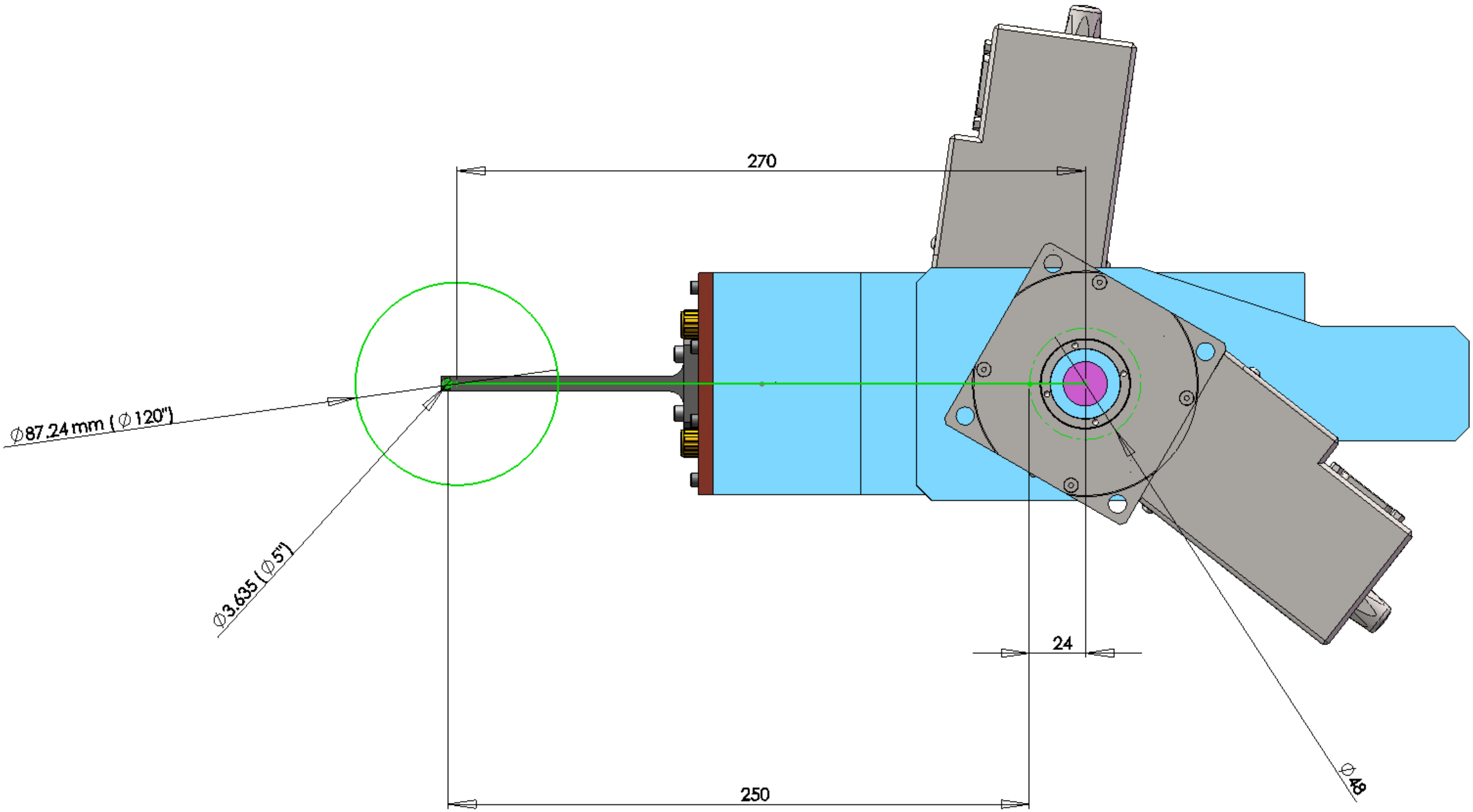
Crank & Lever Motor @ 0° : Probe at 0° (Probe Fully Retracted)



Crank & Lever Fully Extended: Probe at 90° CW

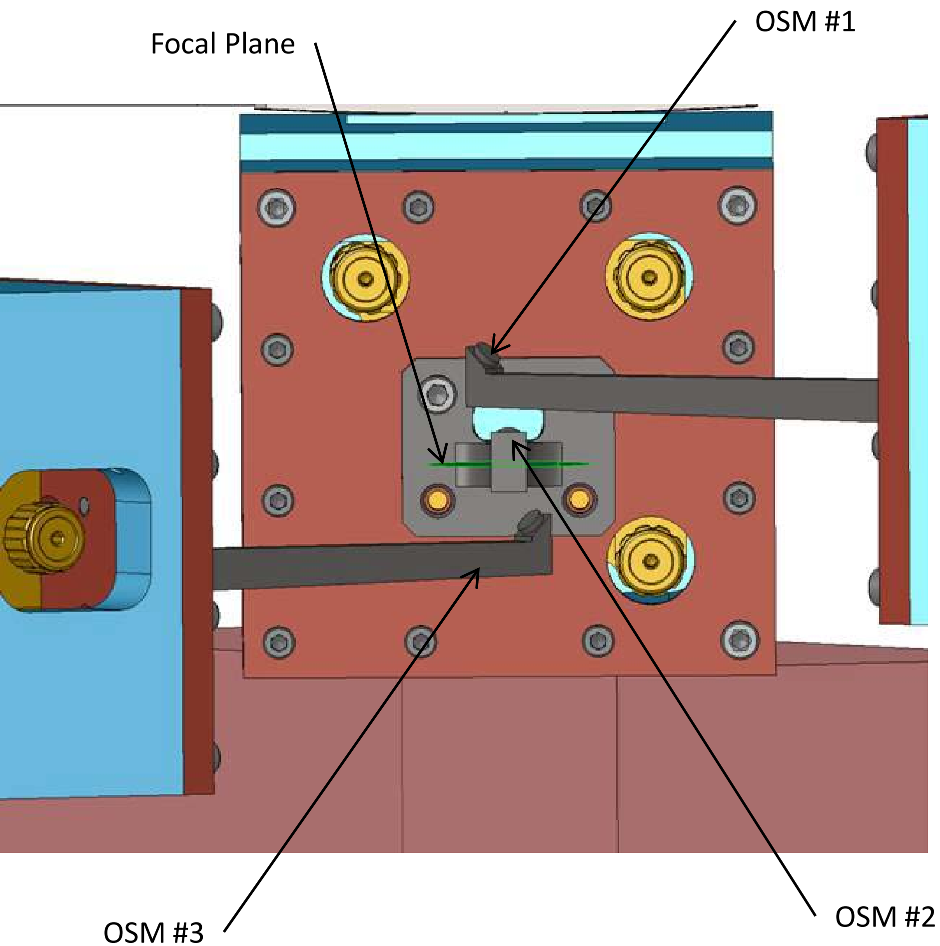


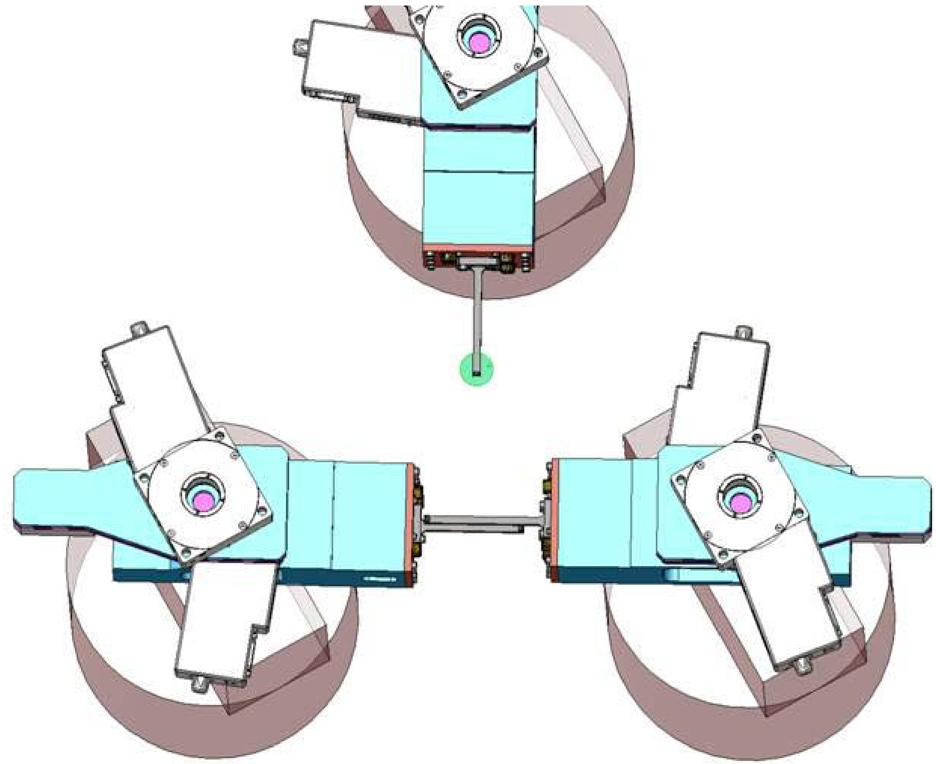
Max Probe extension (In forbidden area)



The whole 120” field can be covered using 180° Rotation for each stages!...

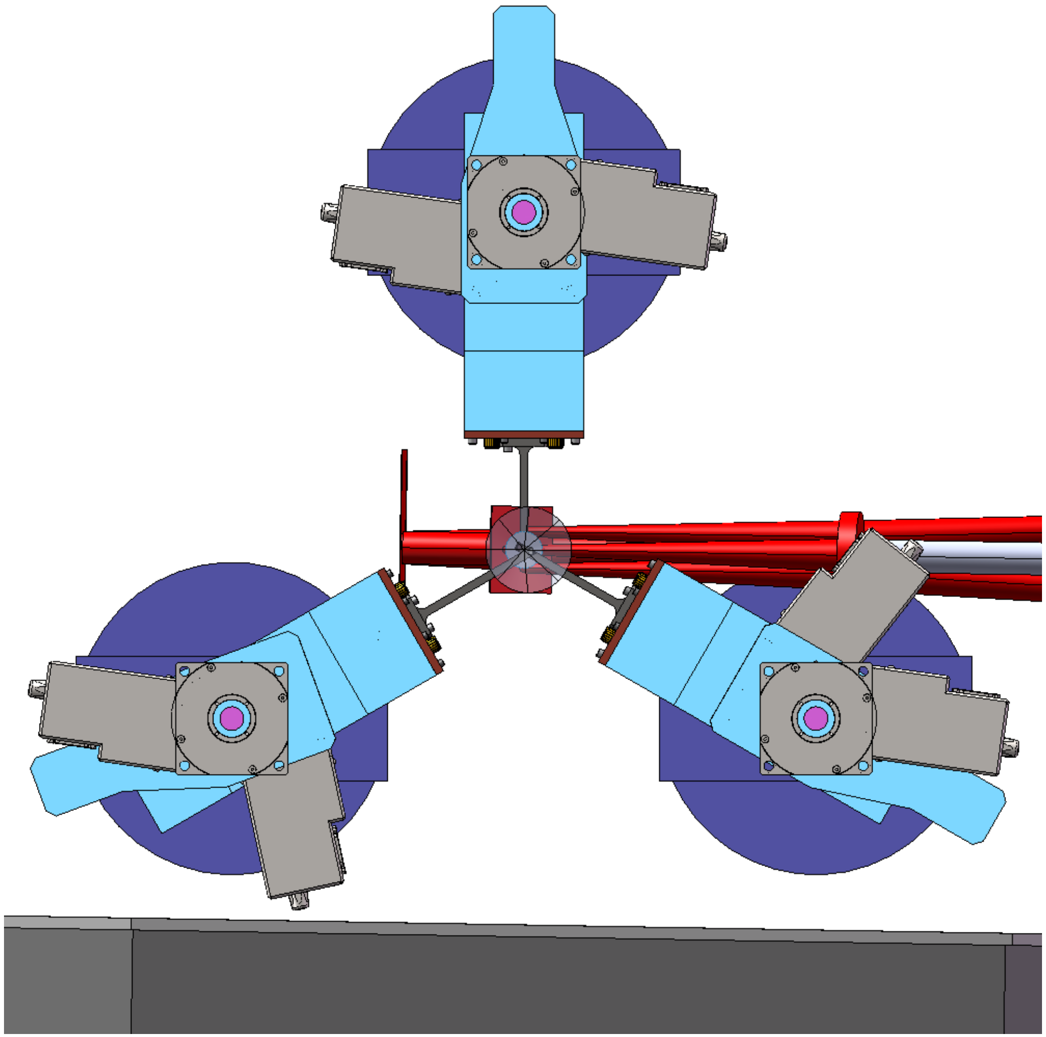
Probes on different level can't collide



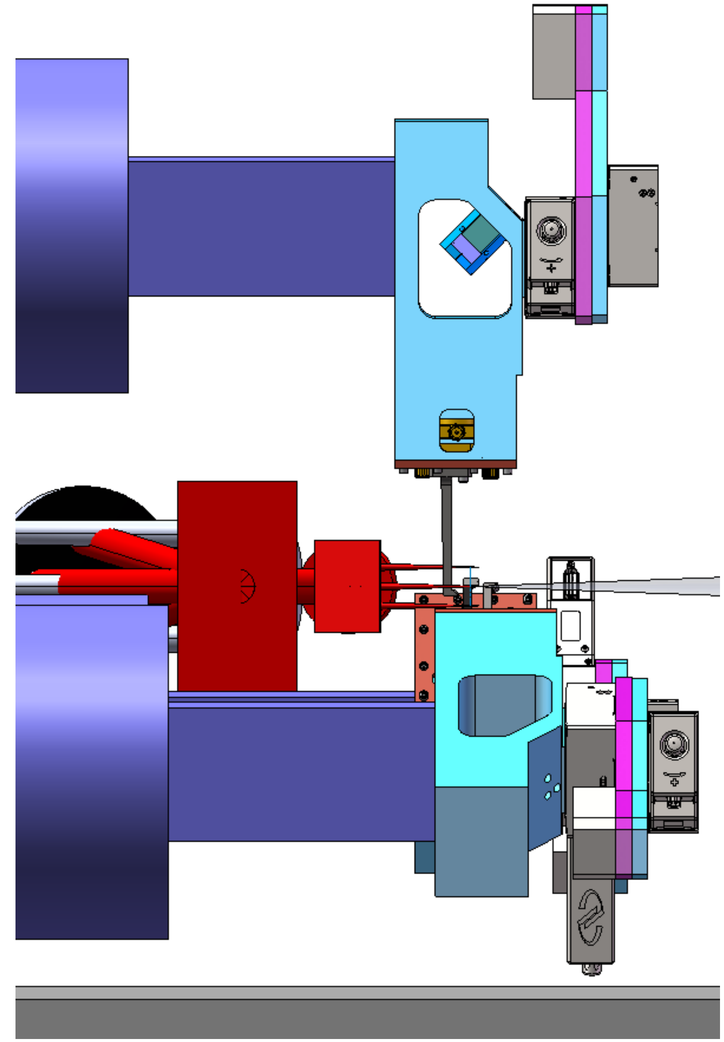


Probes facing each other can't collide

LOWFS OSM Assy shown at various probe position

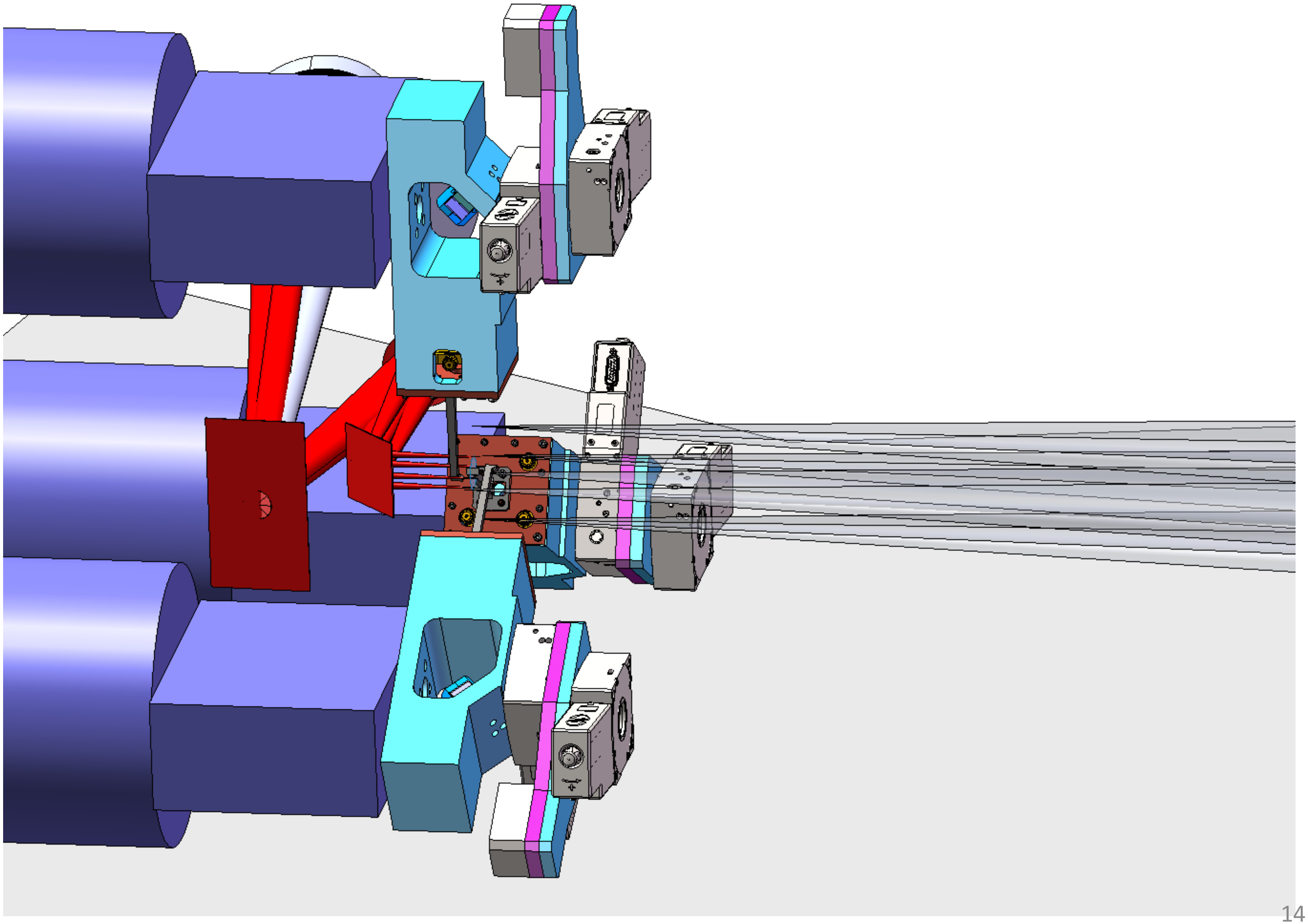


Front View



Side View

LOWFS OSM Assy with stages upstream



Remaining work to be done

-Analyze Tip/Tilt Mirror Vibrations and Impact on Probe stabilization.
- System rigidity Analysis

Questions:

-Probe position Accuracy: 40 (KAON 562) or 70 mas (Contour)
- Minimum Incremental motion ?
- Max Wobble?
- Position Stability (5 mas / 3600 s) TBC
- TT Requirements (Deflection, response, resolution,…)