

NGAO OSM

Design Study Update

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09/29/2009

Version 18

1) Absolute Probe Position Accuracy "on Field" & Cost

- Lever Motor: Newport Stage URS75CC(\$ 3436): $250 \times \tan 0.023 = 0.1 \text{ mm}$

- Crank Motors:

- Newport Stage RVS80PP (\$ 3983) : $290 \times \tan 0.02 = 0.101 \text{ mm}$

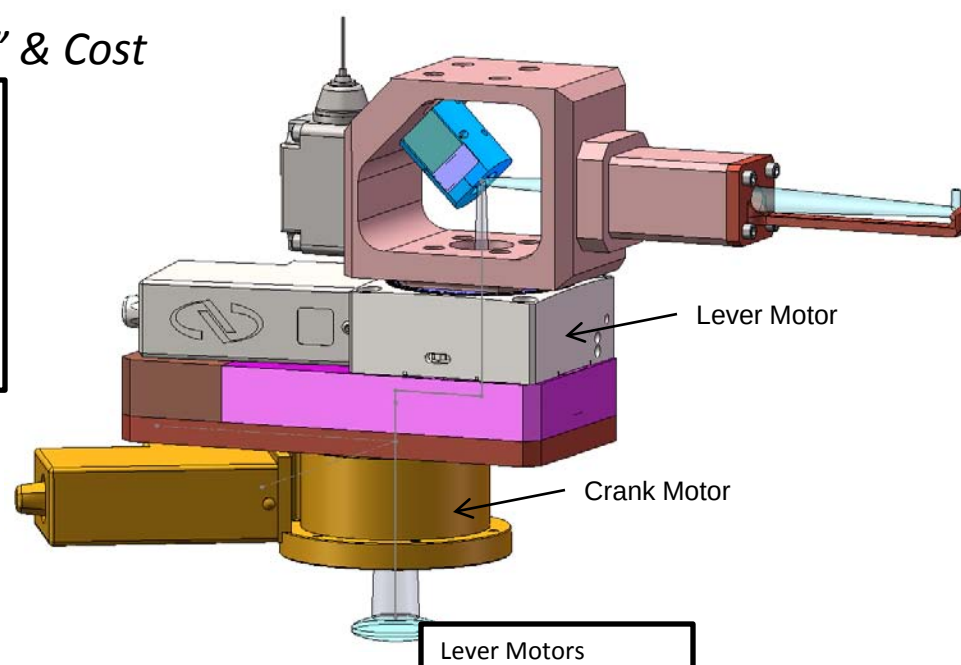
- Newport Stage RVS80CC (\$ 4454) : $290 \times \tan 0.015 = 0.076 \text{ mm}$

- Newport Stage RVS120HAT (\$ 8920) : $290 \times \tan 0.005 = 0.025 \text{ mm}$

Crank Motors

Specifications

Travel Range (°)	360 continuous	With disabled limits, except HAT & HAHLT
	±170	HAT & HAHLT versions
Resolution (°)	0.001	Except RVS80, HAT & HAHLT versions
	0.00025	RVS80CC
	0.0001	RVS80PP, equals 1/100 of a full step
	0.0001	RV120HAT & HAHLT
	0.00075	RV160HAT & HAHLT
	0.0005	RV240HAT & HAHLT
	0.00035	RV350HAT & HAHLT
Minimum Incremental Motion (°)	0.001	Except RVS80, HAT & HAHLT versions
	0.00025	RVS80CC
	0.0002	RVS80PP
	0.0001	HAT & HAHLT versions
Uni-directional Repeatability (°)	0.001 typical, 0.002 guaranteed	Except RVS80CC, HAT & HAHLT versions
	0.001 guaranteed	RVS80CC
	0.002 guaranteed	RVS80PP
	0.00011 typical, 0.0002 guaranteed	HAT & HAHLT versions
Reversal Value (Hysteresis) (°)	0.001 typical, 0.002 guaranteed	Except RVS80PP, HAT & HAHLT versions
	0.005 guaranteed	RVS80PP
	0.0006 typical, 0.001 guaranteed	HAT & HAHLT versions
Absolute Accuracy (°)	0.007 typical, 0.01 guaranteed	Except RVS80, HAT & HAHLT versions
	0.015 guaranteed	RVS80CC
	0.02 guaranteed	RVS80PP
	0.003 typical, 0.005 guaranteed	HAT & HAHLT versions
Maximum Speed (°/s)	80	CC & HAT motor option, except RVS80CC
	40	RVS80CC
	20	PP motor option
	16	CCHL & HAHLT motor option
	2	PE motor option
Wobble (μrad)	40 guaranteed	RVS80
	10 typical, 20 guaranteed	RV120 & RV160
	8 typical, 16 guaranteed	RV 240 & RV350
Eccentricity (μm)	1.4 typical, 4 guaranteed	



Design Details

Base Material	Hardened steel with aluminum body
Bearings	
Drive Mechanism	Ground worm gear with self-compensating preload. Additional 1:2.75 drive belt with URS-CC versions (no belt on URS-PP versions)
Worm Gear Ratio	1:90
Feedback	CC: Worm mounted rotary encoder, 8,000 cts/rev, index pulse. PP: None
Limit Switches	Two independently adjustable optical limit switches
Origin	Optical, fixed at position 0°. Typical 0.0005" repeatability for URS-CC and 0.04" repeatability for URS-PP
Manual Adjustment	Via allen wrench at the end of the worm screw. Allen wrench is included.
Motor	CC: UE34CC DC servo motor PP: UE34PP Two phase stepper motor, 1 full step = 0.02°
Cable	

Specifications

	PP		CC	
	Typical	Guaranteed	Typical	Guaranteed
Travel Range (°)	360 continuous ⁽¹⁾			
Resolution (°)	0.0002 ⁽²⁾		0.0005	
Minimum Incremental Motion (°)	0.0002		0.002	
Uni-directional Repeatability (°)	0.001	0.002	0.001	0.002
Reversal Value (Hysteresis) (°)	0.006	0.01	0.002	0.004
Absolute Accuracy (°)	0.016	0.030	0.012	0.023
Maximum Speed (°/s)	40		80	
Wobble (μrad)	20	50	20	50
Eccentricity (μm)		3		3

1.1 Impact on Design requirements:

- Acquisition accuracy: 40 mas (30 μ m) can not be reached with the current design Acquisition Accuracy of 125 μ m – 201 μ m (172 mas – 276 mas)
- Stability: 5 mas / 3600s (1 μ m) Should be achievable with the current worm gear design
- Position knowledge: < 1 μ m (TBC) is not part of the design yet: **Is it still required?**
- Minimum Incremental motion: TBD
- Operating Temperature: -10°C +/- 0.3 Stages are currently rated for +10°C 35°C

2) OSM Focus Adjustment

Each OSM is individually mobile in translation, installed on Deltron High Precision Roller Slides and actuated with a PI Heavy Duty Precision Linear Actuator.

Deltron Product Specifications

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High Precision Series Crossed Roller Slides (Flange Base)

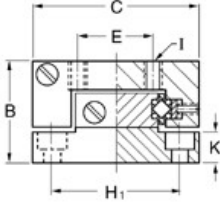
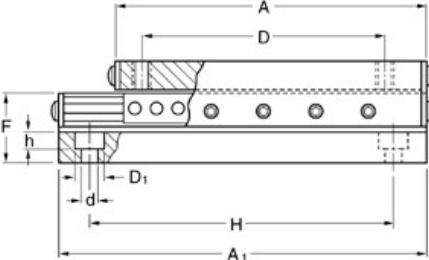
Family: HPRS2-FB

Model: HPRS2-1FB

Price: \$ 252.00

The standard finish is a black anodize carriage and black anodize base. Other finishes are available on request.

Add to cart

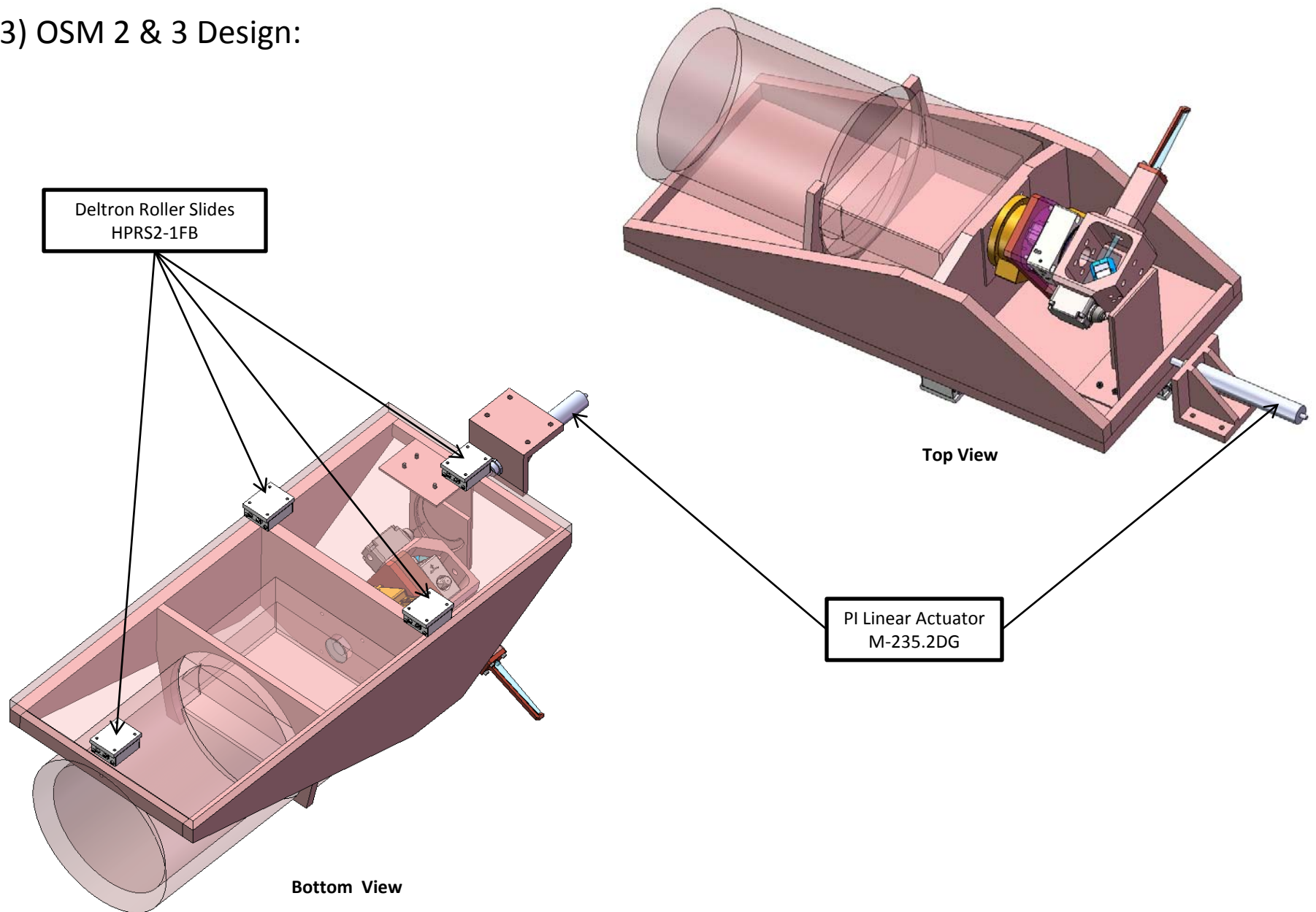
All dimensions in inches unless otherwise specified																		
Model	Price \$	Travel	Load (lbs)	Weight (lbs)	Length A	A1	B	C	D	d	D1	E	F	H1	H	h	I	K
HPRS2-1FB	252.00	1	90	0.38	2.00	2.25	1.031	1.75	1.375	0.157	0.240	0.875	0.68	1.312	1.625	0.145	#6-32	0.28

Roller Slide

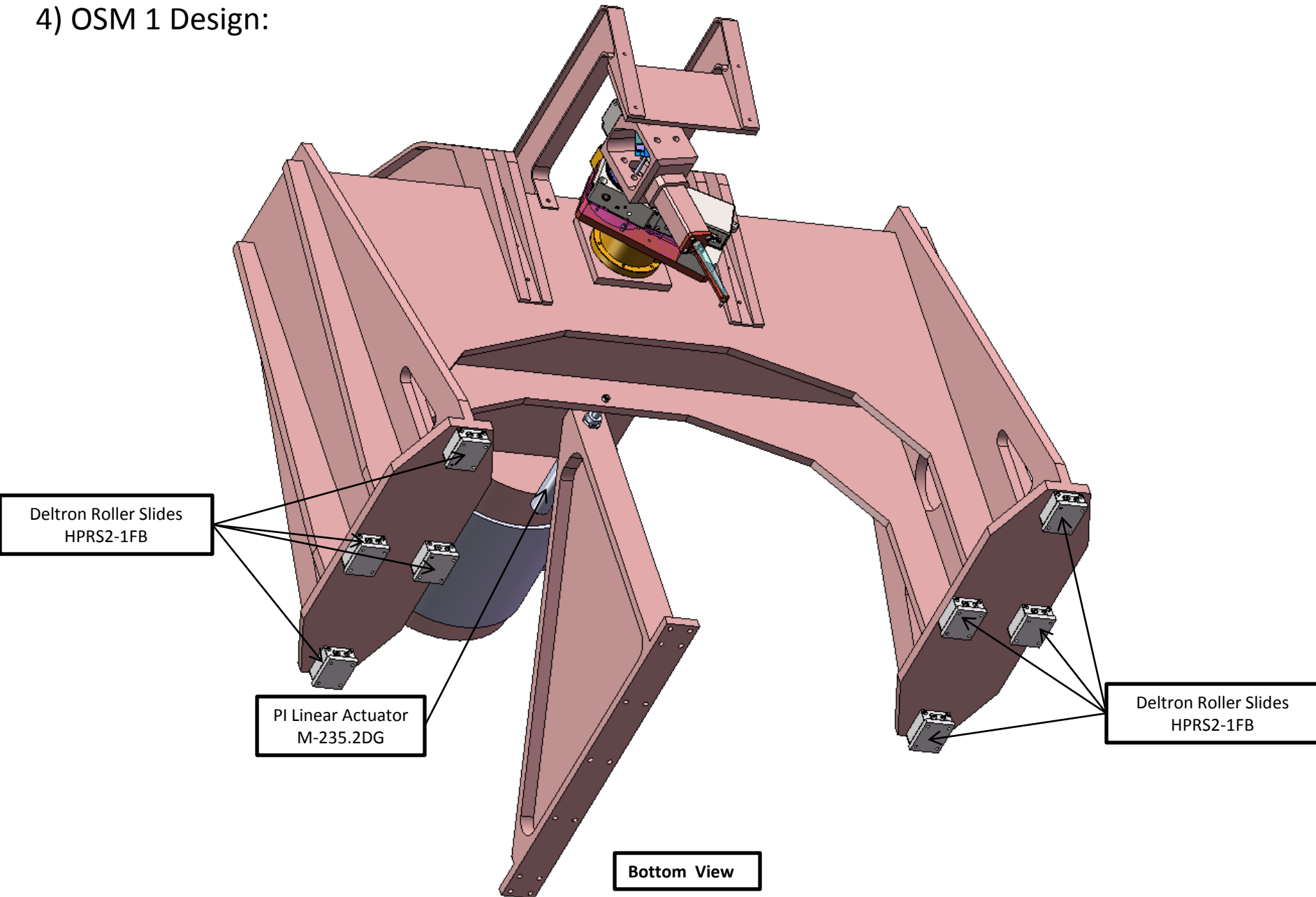
Model	M-235.2DG	Units
Active axes	X	
Motion and positioning		
Travel range	20	mm
Integrated sensor	Rotary encoder	
Sensor resolution	2.048	Cts./rev.
Design resolution	0.016	μ m
Min. incremental motion	0.1	μ m
Unidirectional repeatability	0.1	μ m
Bidirectional repeatability	1	μ m
Max. velocity	2.6	mm/s
Mechanical properties		
Gear ratio	29.6:1	
Motor resolution*		steps/rev.
Max. push/pull force	120	N
Max. lateral force	100	N
Drive properties		
Motor type	DC-motor, gearhead	*
Operating voltage	0 to $\pm$ 12	V
Electrical power	4	W
Limit and reference switches	Hall-effect	
Miscellaneous		
Operating temperature range	-20 to +65	$^{\circ}$ C
Material	Al (anodized), steel	
Mass	0.55	kg
Recommended controller/driver	C-863 single-axis, C-843 PCI board, for up to 4 axes	

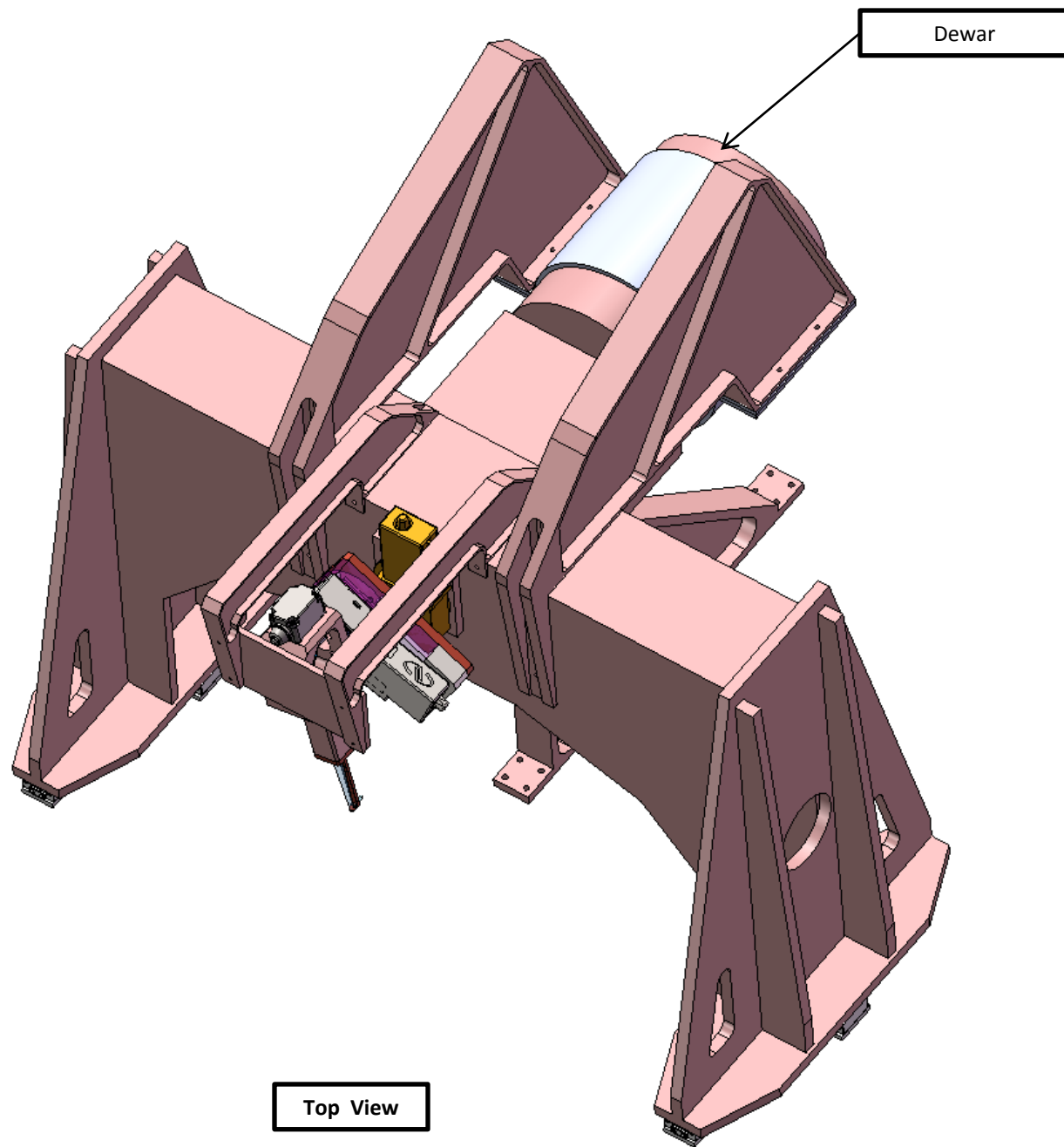
Linear Actuator

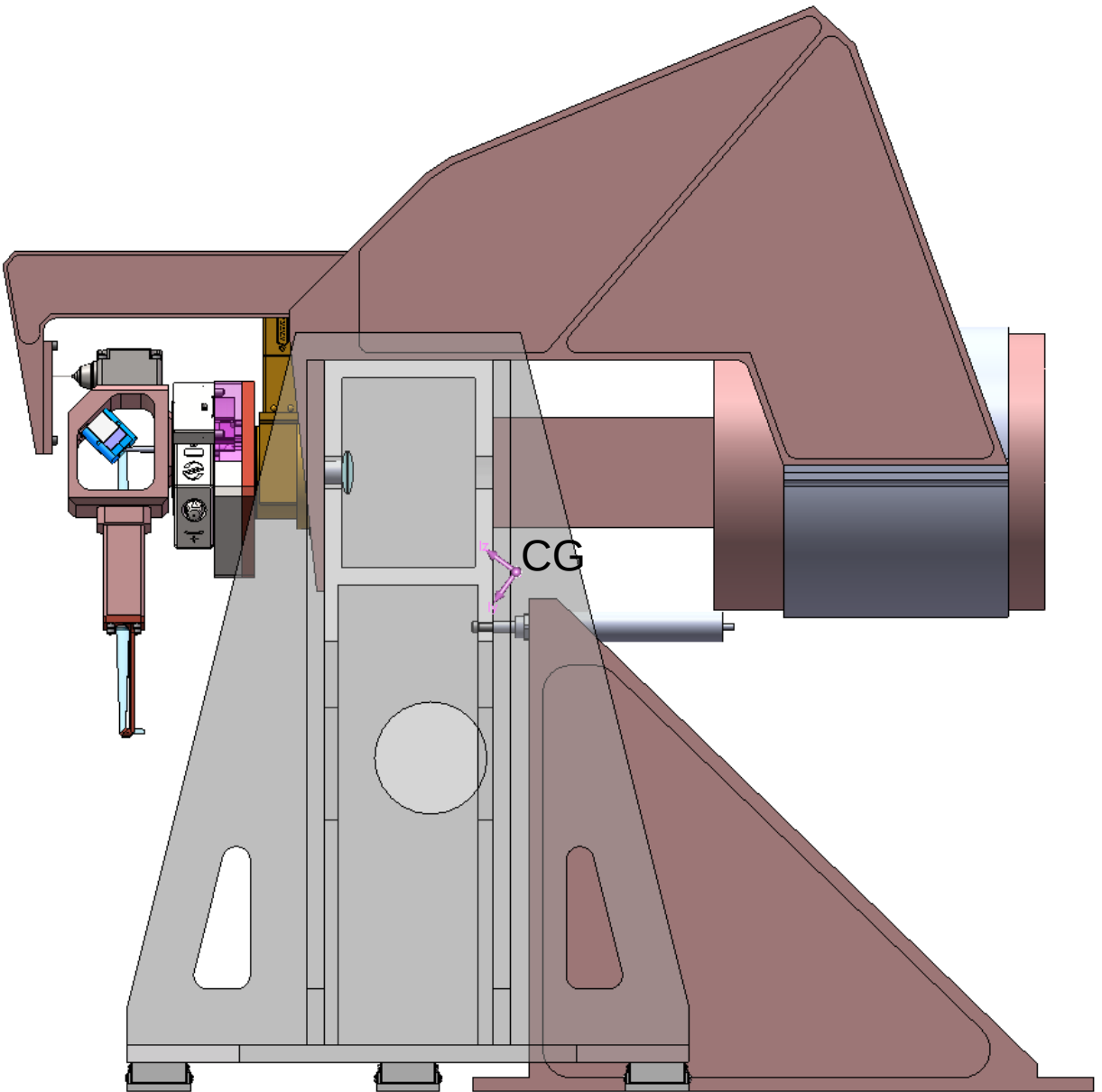
3) OSM 2 & 3 Design:



4) OSM 1 Design:







Side View

Mass Properties

Print... Copy Close Options... Recalculate

Output coordinate system: -- default --

Selected items: OSM 1 Assembly downstream stages a= -20 sm

☒ Include hidden bodies/components

☒ Show output coordinate system in corner of window

☐ Assigned mass properties

Mass properties of OSM 1 Assembly downstream stages a= -20 small lens (Assembly Conf

Output coordinate System: -- default --

Mass = 115.87 kilograms

Volume = 43710387.24 cubic millimeters

Surface area = 6745041.22 millimeters^2

Center of mass: (millimeters)

X = -44.59

Y = 43.16

Z = -202.74

Principal axes of inertia and principal moments of inertia: (kilograms * square millimeters)

Taken at the center of mass.

Ix = (-0.01, 1.00, 0.00)	Px = 10362173.98
Iy = (-0.81, -0.01, 0.59)	Py = 14290429.12
Iz = (0.59, -0.00, 0.81)	Pz = 16160435.93

Moments of inertia: (kilograms * square millimeters)

Taken at the center of mass and aligned with the output coordinate system.

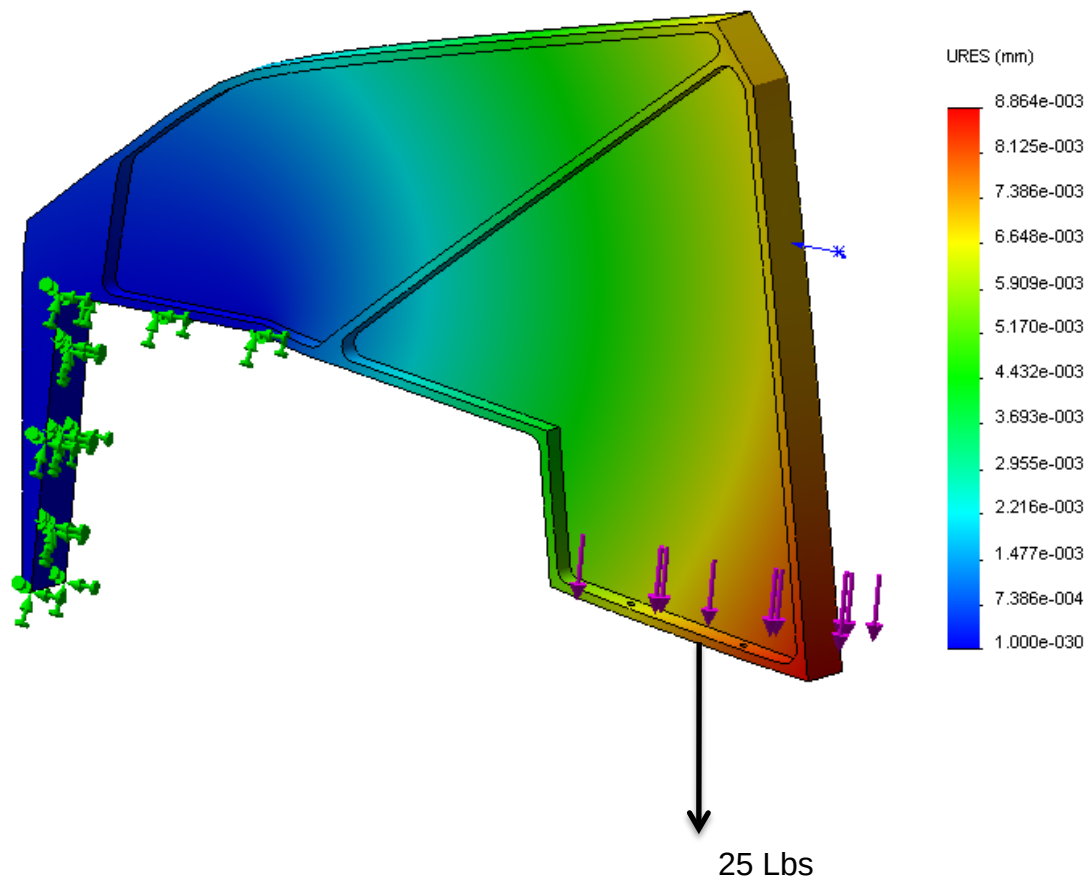
Lxx = 14935220.29	Lxy = -19684.29	Lxz = -888940.77
Lyx = -19684.29	Lyx = 10362344.45	Lyz = 16837.53
Lzx = -888940.77	Lzy = 16837.53	Lzz = 15515474.31

Moments of inertia: (kilograms * square millimeters)

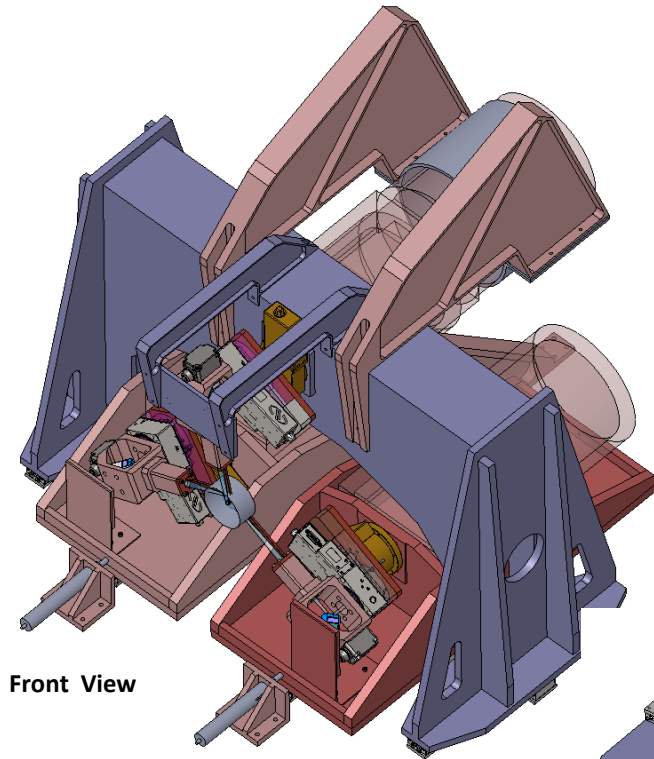
Taken at the output coordinate system.

Ixx = 19913920.62	Ixy = -242653.45	Ixz = 158577.32
Iyx = -242653.45	Iyy = 15355634.46	Iyz = -996969.58
Izx = 158577.32	Izy = -996969.58	Izz = 15961651.22

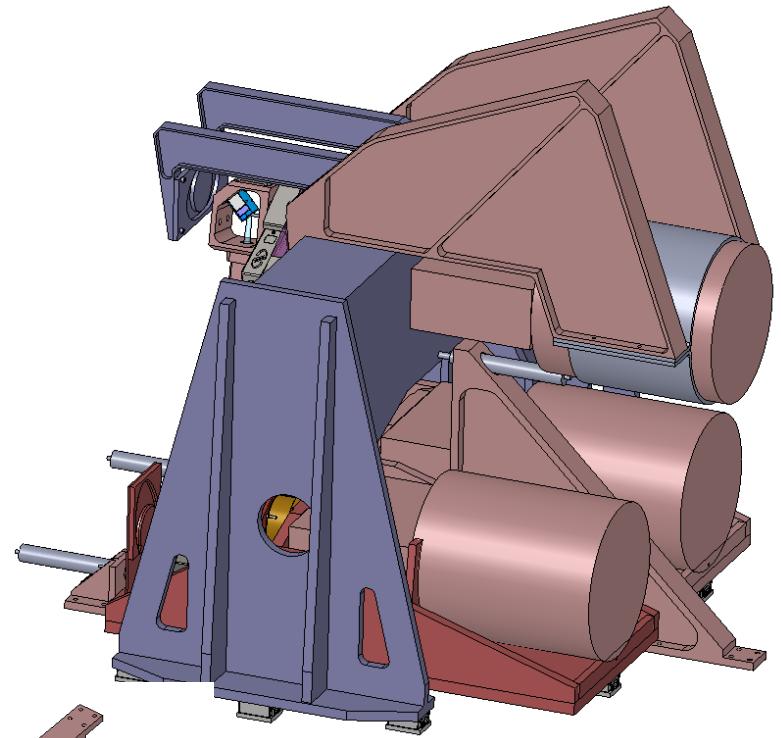
3.1) Dewar Bracket Deformation:



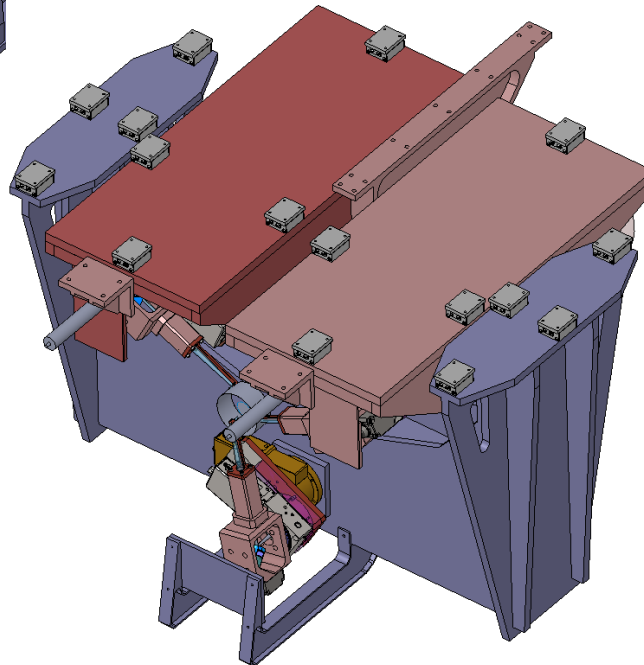
5) LOWFS Design:



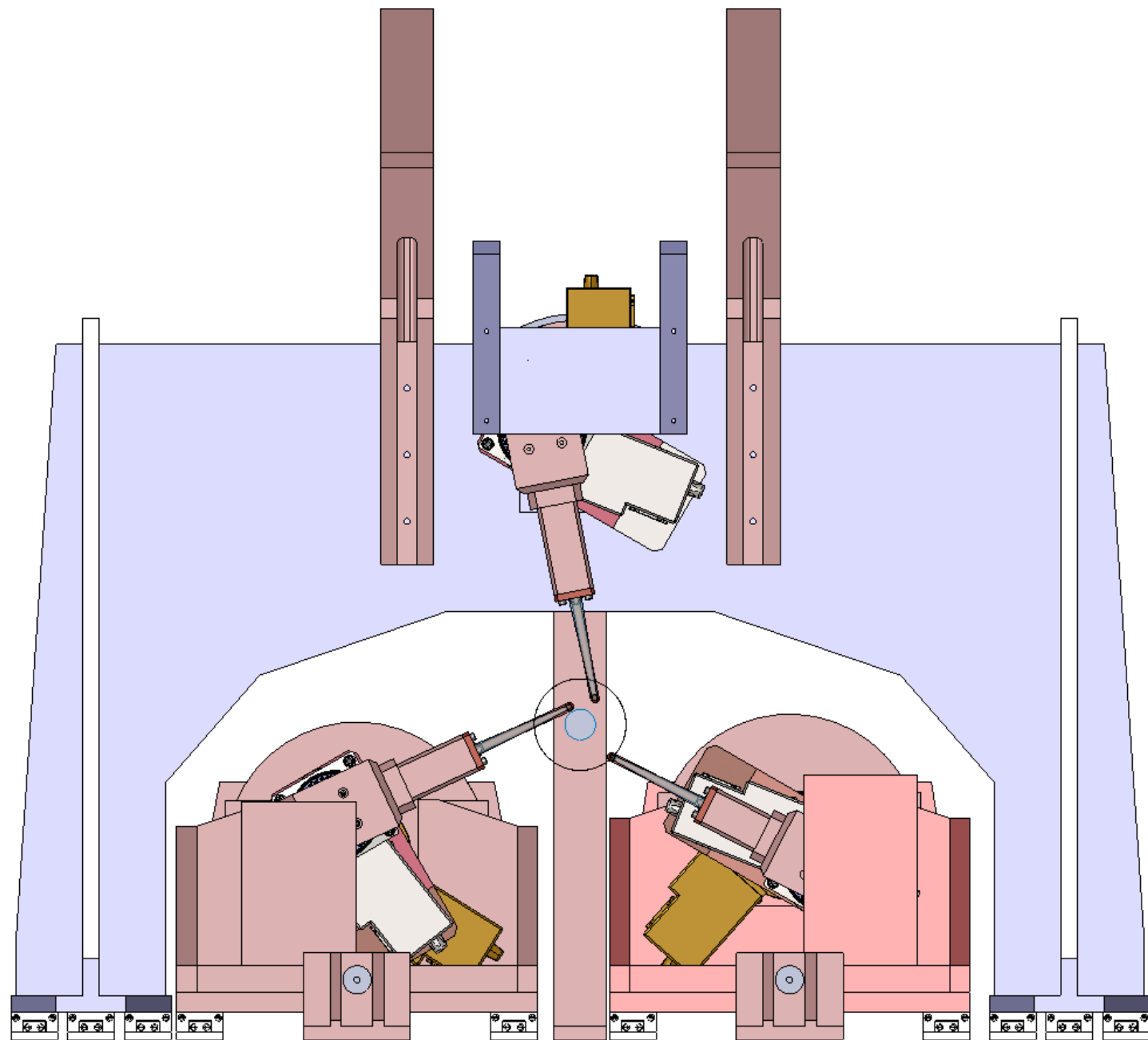
Front View



Back View

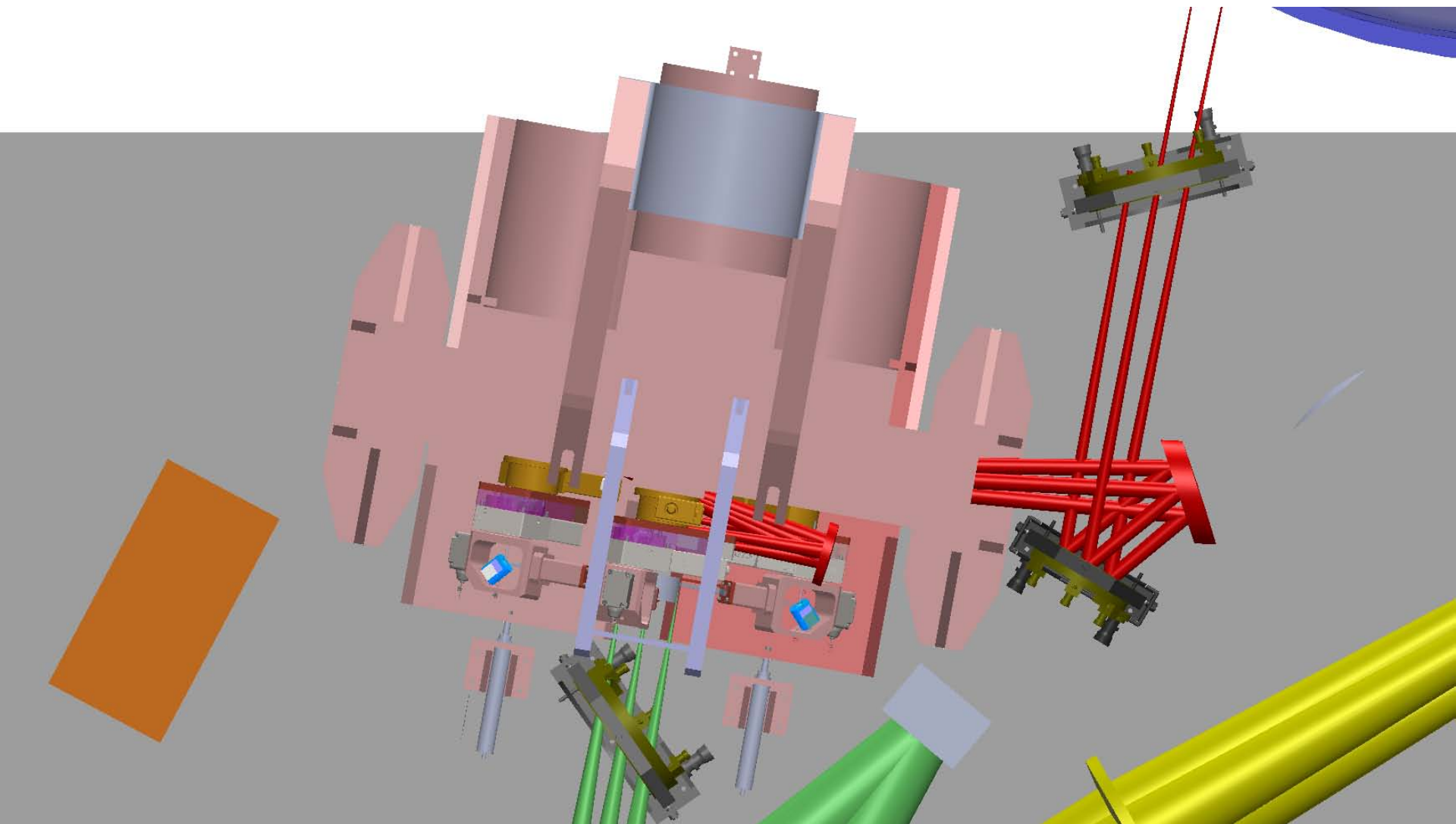


Bottom View

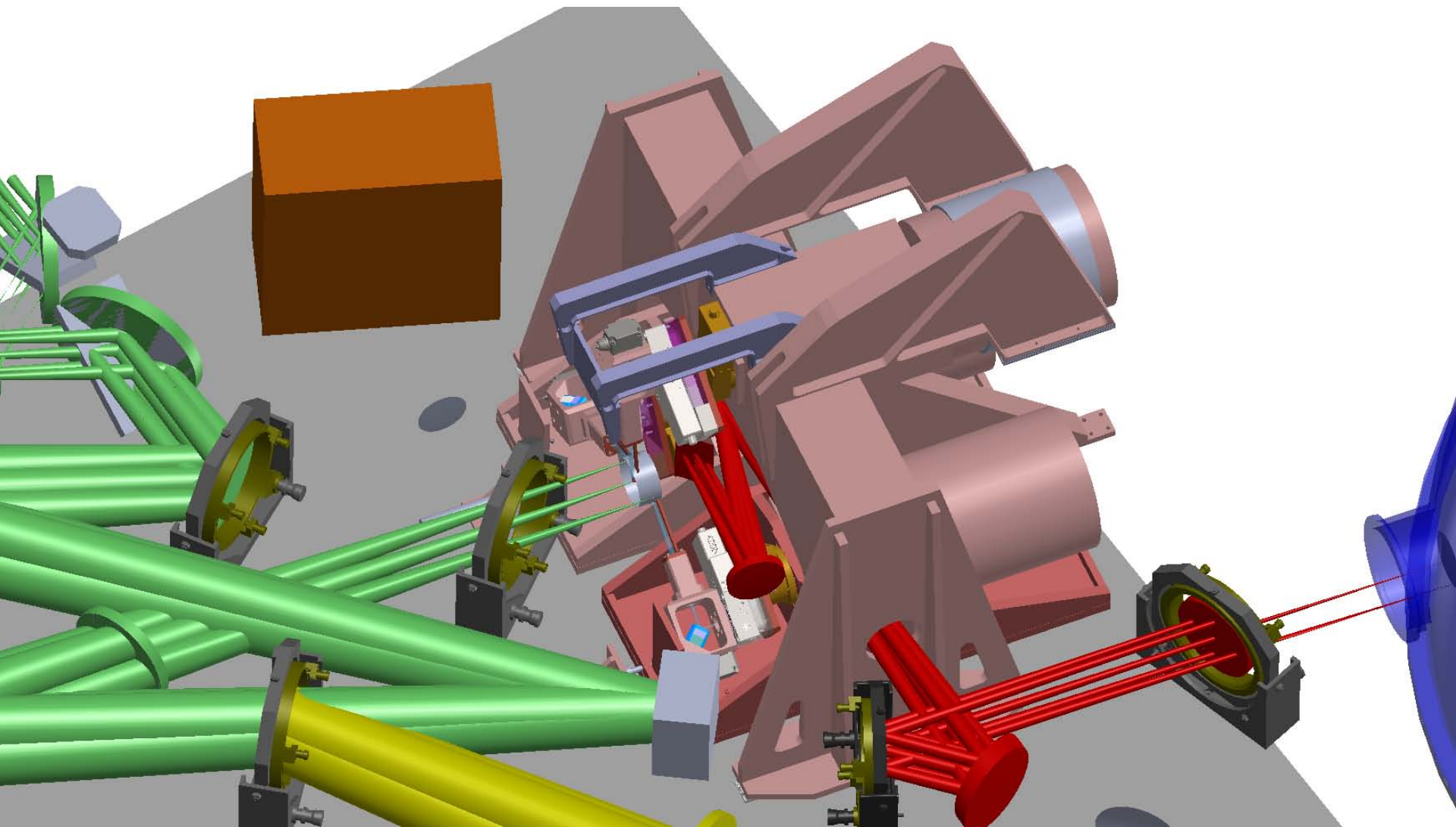


Front View

6) LOWFS in NGAO:



Top View



Isometric View