

NGAO OSM

Design Study Update

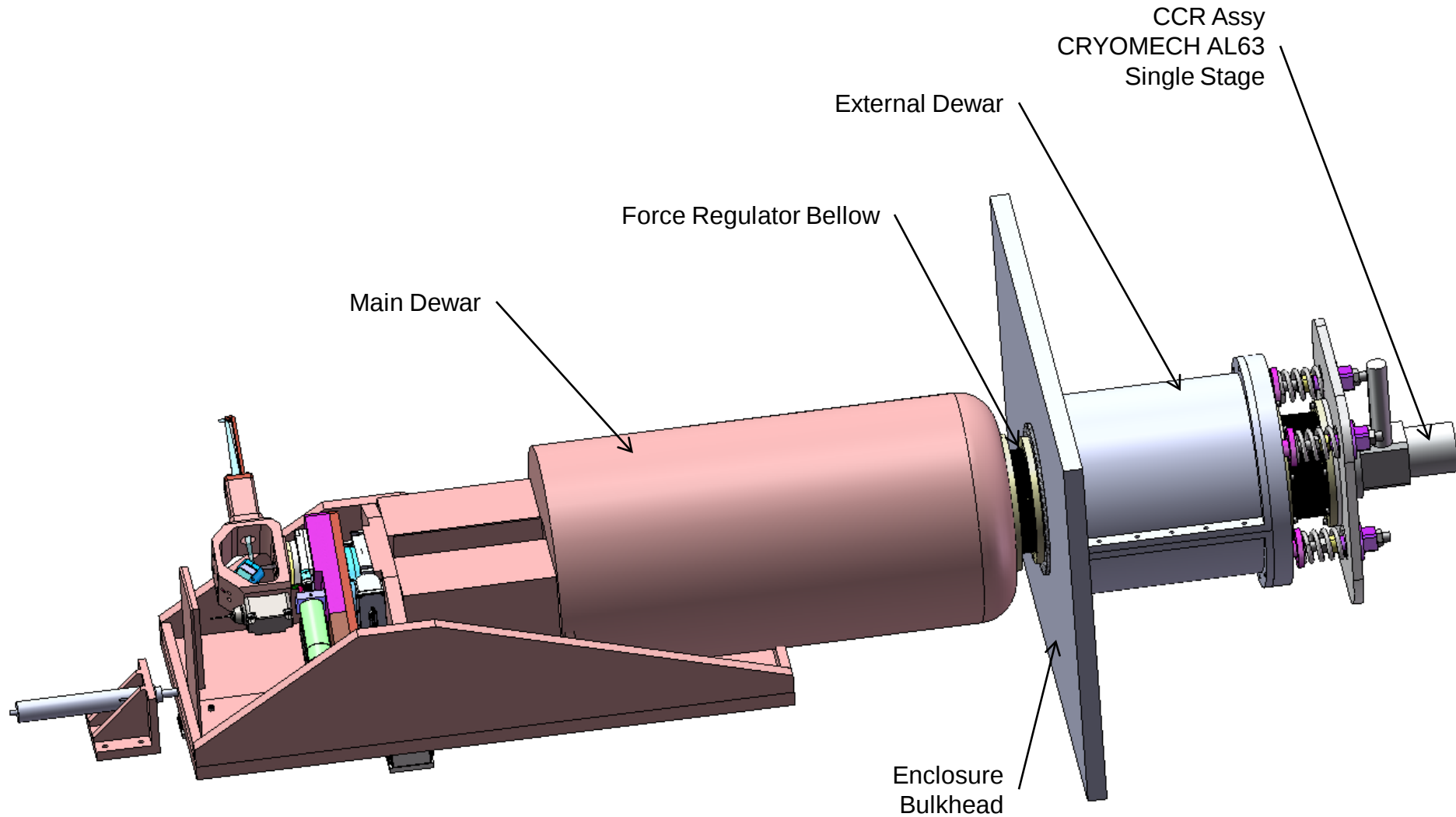
- 1) Cold Head Installation
- 2) Replacing Newport with PI stages

Alex Delacroix

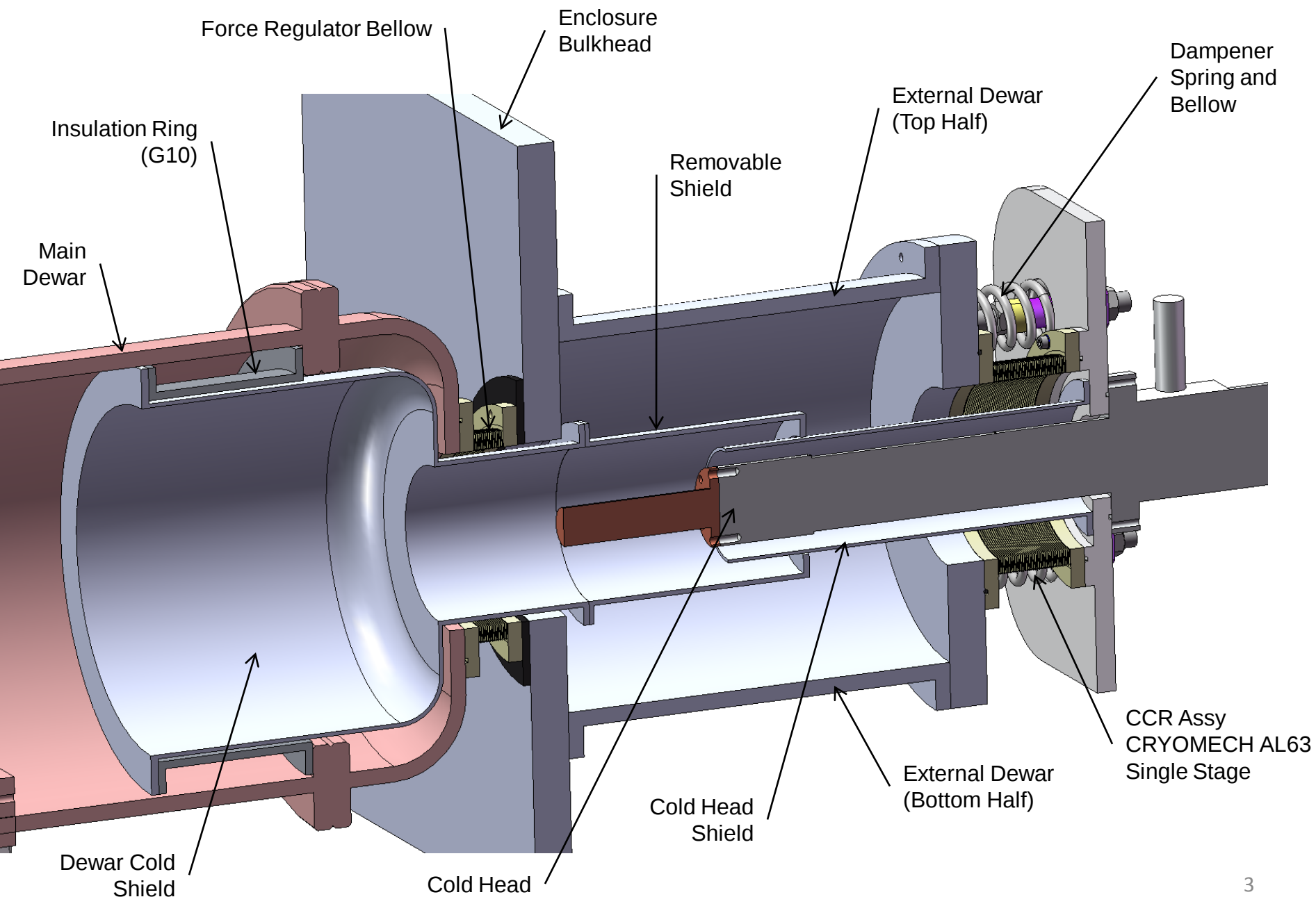
10/06/2009

Version 19

1) COLD HEAD INSTALLATION

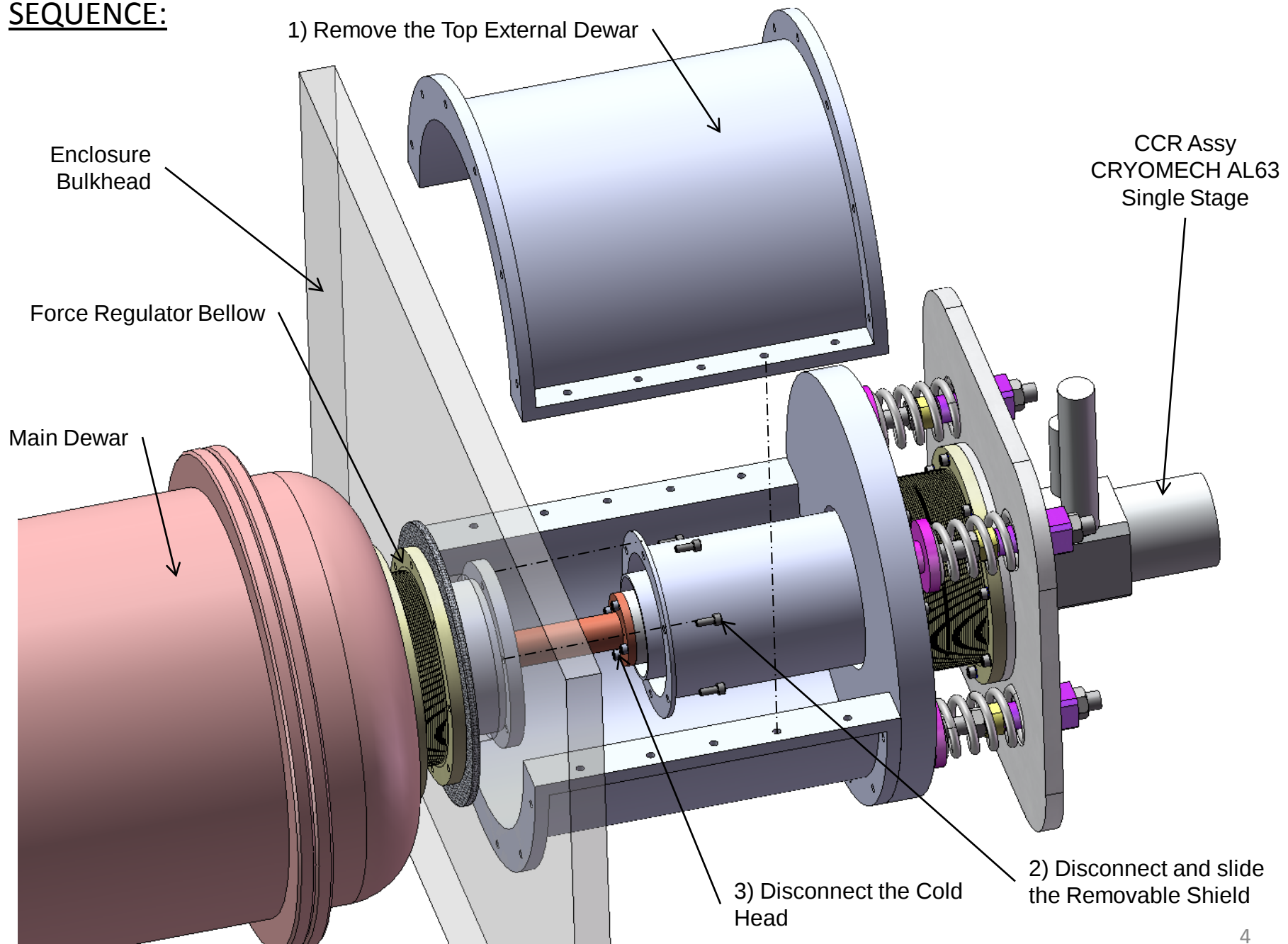


CROSS SECTION:



SEQUENCE:

1) Remove the Top External Dewar



2) Replacing Newport stages with PI stages

Newport Stages are rated +10°C / +35°C Vs PI Stages rated -20°C / +65°C

Field Resolution:

PI	Newport
Lever Stage M-037.DG: 250mm X tan 0.000034° = 0.00015mm	URS75CC: 250mm X tan 0.0005 = 0.0022mm
Crank Stage M-038.DG1: 290mm X tan 0.000035° = 0.00018mm	RVS80PP: 290mm X tan 0.0001 = 0.0005mm
Total = 0.00033mm	Total = 0.0027mm

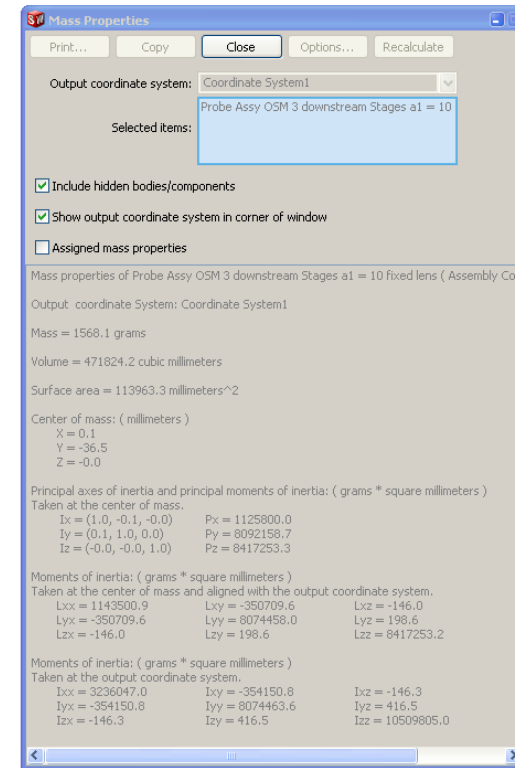
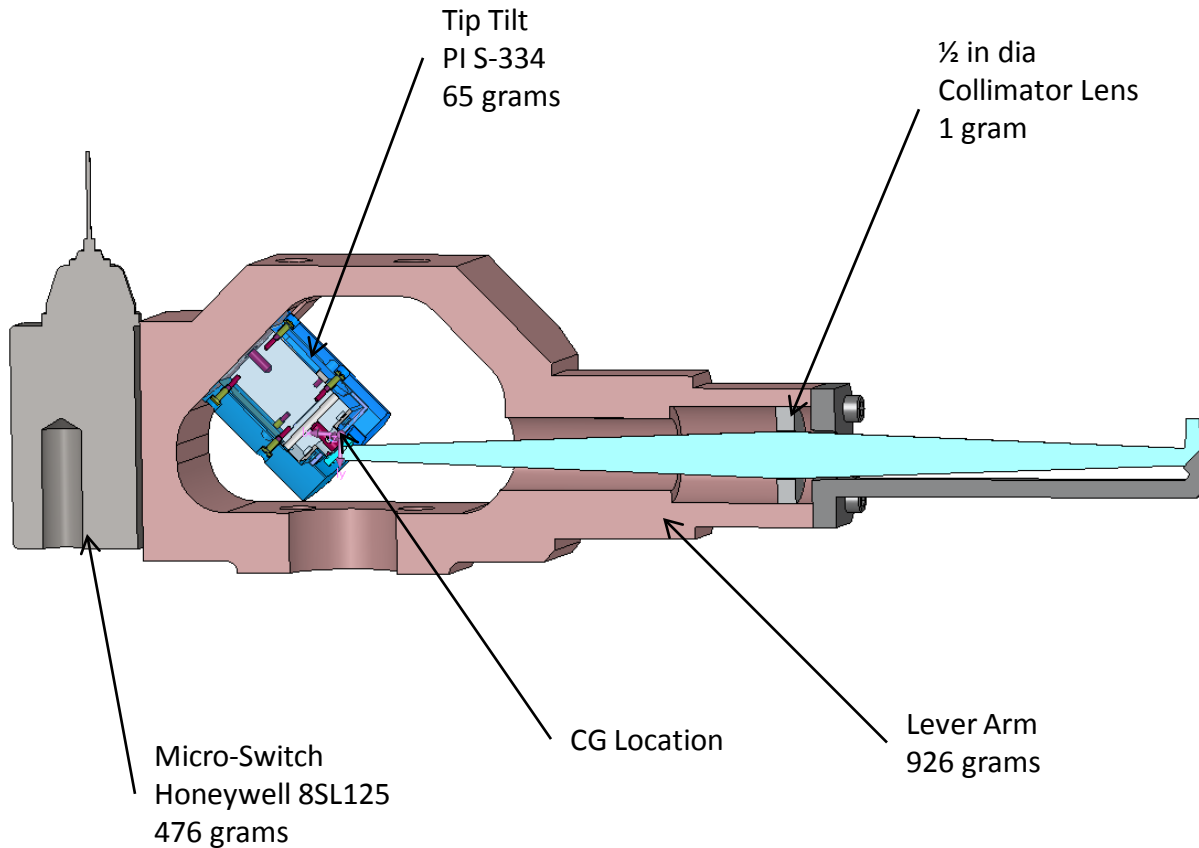
Specifications	Crank RVS80PP		Lever URS75BCC		Lever M-037.DG	Crank M-038.DG1
	Typ.	Guaranteed	Typ.	Guaranteed		
Motor Type	DC		DC servo		DC servo	DC servo
Feedback	Integral Optical encoder		Worm mounted encoder		Shaft mounted encoder	Shaft mounted encoder
Worm Gear Ratio	1:180		1:90		180:1	176:1
Sensor Resolution (cts/rev)	None		8000		2000	2000
Resolution (°)	0.0001		0.0005		0.00003	.000003
Minimum Incremental Motion (°)	0.0002		0.002		.0002	.0002
Uni-directional Repeatability (°)	0.002		0.001	0.002	.0017	.0011
Reversal Value (Hysteresis) (°)	0.005		0.002	0.004	.01	.01
Absolute Accuracy (°)	0.002		0.012	0.023	TBD	TBD
Maximum Speed (°/s)	20		80		6	6
Wobble (μrad)	40		20	50	<150	<75
Eccentricity (μm)	1.4	4	3		TBD	TBD
Max Axial Load (N)	900		200		300	400
Max CW Torque (CCW)	2 (2)		0.5 (0.5)		1 (0.5)	2 (0.8)
Max Cantilever Torque (Nm)	5		5		6	6
Mass (N)	18		17		6.5	12.5
MTBF at 25% load and with a 30% duty cycle	20,000 h		20,000 h		TBD	TBD
Integrated limit switch	Adjustable		Adjustable		No	No
Price	\$3983		\$3436		\$4178	\$4724

1) Mass and CG of the Lever Arm Assembly

Total Mass: 1,570 grams (15.4N)

CG located at the Axis of rotation, 36 mm above the Lever motor Interface.

Torque at the Lever Rotation Stage Interface: $0.036 \times 15.4 = 0.55 \text{ Nm}$



STATIC LOAD ON LEVER MOTOR

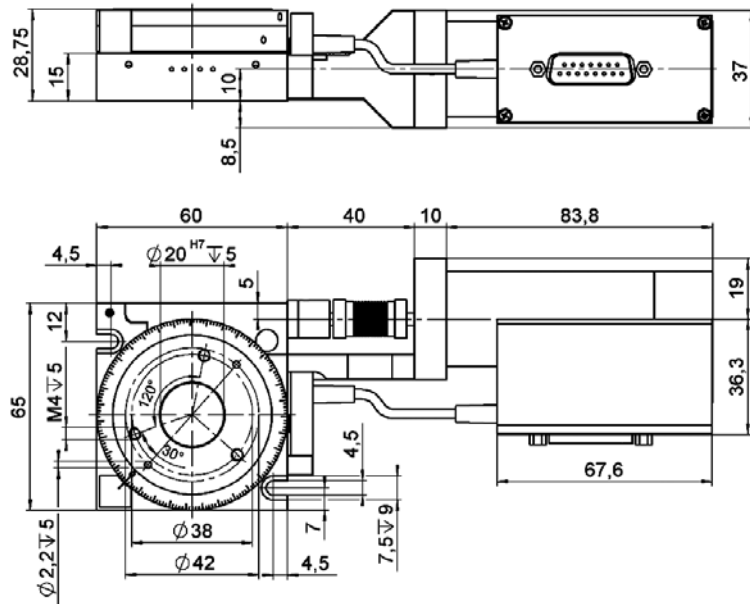
PI M-037.DG Rotation stage

M-037 rotation stages are equipped with ultra-precise worm gear drives allowing unlimited rotation in either direction.

An integrated spring preload eliminates backlash. Double-row ball bearings allow zero backlash, high load capacity and extremely low wobble.

Model M-037.DG is closed-loop DC motors with shaft-mounted position encoders and precision gearheads providing 3.5 μ rad at a design resolution of 0.6 μ rad.

$$\text{Torque FS} = 3/0.55 = 5.5$$



Technical Data

Model	M-037.00	M-037.DG	M-037.PD	M-037.2S
Active axes	Rotation	Rotation	Rotation	Rotation
Motion and positioning				
Rotation range	>360	>360	>360	>360
Integrated sensor	-	Rotary encoder	Rotary encoder	-
Sensor resolution	-	2000	4000	-
Design resolution	-	0.59 (34 x 10 ⁻⁶)	3.75 (0.0005)	5.45* (0.00031)
Min. incremental motion	-	3.5	27	21
Backlash	-	200	200	200
Unidirectional repeatability	-	30	30	30
Wobble	<150	<150	<150	<150
Max. velocity	-	6	45	10
Mechanical properties				
Worm gear ratio	180:1	180:1	180:1	180:1
Gear ratio	-	(28/12)* = 29.6:1	-	-
Motor resolution	-	-	-	6400*
Load capacity/axial force, self-locking	±300	±300	±300	±300
Max. torque (θ ₁ , θ ₂)	±3	±3	±3	±3
Max. torque clockwise (θ ₂)	1	1	1	1
Max. torque counter clockwise (θ ₂)	0.5	0.5	0.5	0.5
Drive properties				
Motor type	-	DC motor, gearhead	ActiveDrive™ DC Motor	2-phase stepper motor*
Operating voltage	-	0 to ±12	24 (PWM)	24
Electrical power	-	3	30	-
Reference switch	-	Hall-effect	Hall-effect	Hall-effect
Miscellaneous				
Operating temperature range	-20 to +65	-20 to +65	20 to +65	-20 to +65
Material	Aluminum	Aluminum	Aluminum	Aluminum
Mass	0.3	0.65	0.62	0.64
Recommended controller/driver	-	C-863 (single-axis) C-843 PCI-Karte (for up to 4 axes)	C-863 (single-axis, p. 4-114) C-843 PCI-Karte (p. 4-120) (for up to 4 axes)	C-663 (single-axis, p. 4-112)

incl. motor cable, 3 m, sub-D connector 15-pin

*2-phase stepper motor, 24 V chopper voltage, max. 0.8 A/phase, 400 full steps/rev., motor resolution with C-663 stepper motor controller



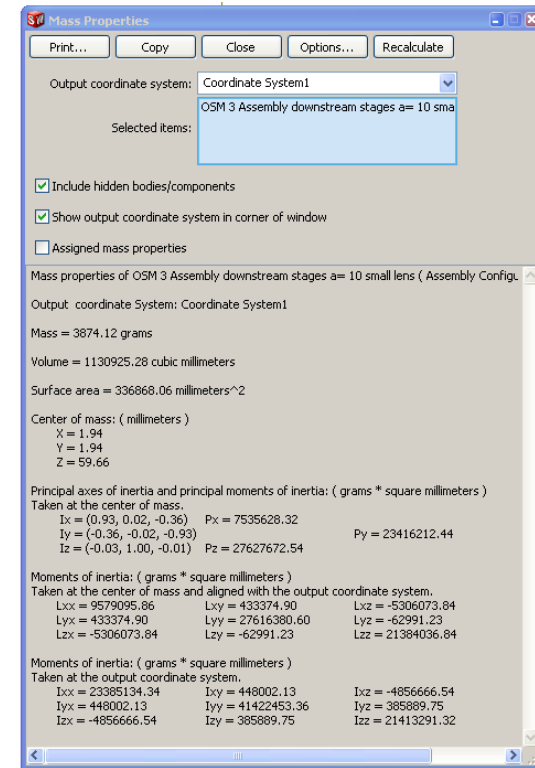
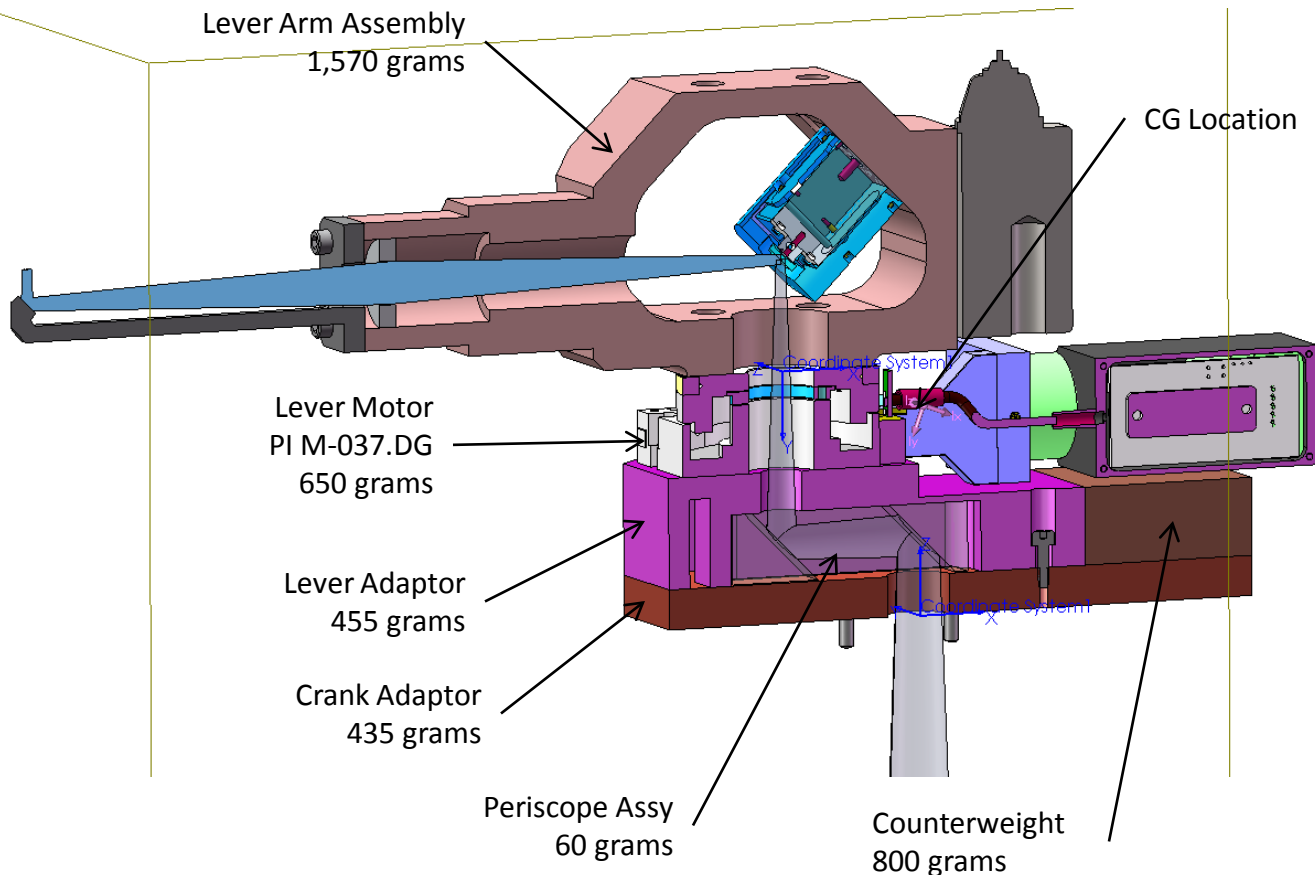
M-037.DG rotation stage with DC Motor and gearhead

2) Mass and CG of the OSM #1 Assembly

Total Mass: 3,874 grams (38N)

CG located at the Crank Axis of rotation, 60 mm above the Lever motor Interface.

Torque at the Crank Rotation Stage Interface: $0.060 \times 38 = 2.3 \text{ Nm}$

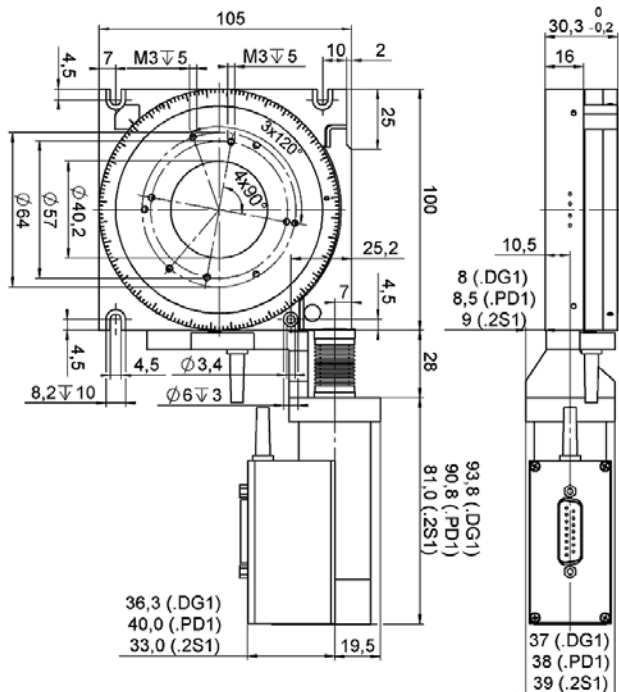


STATIC LOAD ON CRANK MOTOR

PI M-038.DG Rotation stage

Model M-038.DG1 is equipped with a closed-loop DC motor with shaft-mounted position encoder and precision gearhead providing minimum incremental motion of 3.5 μrad at a design resolution of 0.6 μrad .

$$\text{Torque FS} = 6/2.3 = 2.6$$



Technical Data

Model	M-038.001	M-038.DG1	M-038.PD1	M-038.2S1	Units
Active axes	Rotation	Rotation	Rotation	Rotation	
Motion and positioning					
Rotation range	>360°	>360°	>360°	>360°	
Integrated sensor	-	Rotary encoder	Rotary encoder	-	
Sensor resolution	-	2000	4000	-	steps/rev.
Design resolution	-	0.60 (35 x 10 ⁻⁴)	8.95 (0.0005)	5.58* (0.00032)	μrad (°)
Min. incremental motion	-	3.5	27	21	μrad
Backlash	-	200	200	200	μrad
Unidirectional repeatability	-	20	20	20	μrad
Wobble	<75	<75	<75	<75	μrad
Max. velocity	-	6	90	10	°/s
Mechanical properties					
Worm gear ratio	176:1	176:1	176:1	176:1	
Gear ratio	-	2401:81 = 29.6:1	-	-	
Motor resolution	-	-	-	6400*	steps/rev.
Max. load/axial force	± 400	± 400	± 400	± 400	N
Maximum torque (θ_x, θ_y)	± 6	± 6	± 6	± 6	
Maximum torque CW**	2	2	2	2	Nm
Maximum torque CCW**	0.8	0.8	0.8	0.8	Nm
Drive properties					
Motor type	-	DC Motor, gearhead	ActiveDrive™ DC Motor	2-phase stepper motor*	
Electrical power	-	3	30	-	W
Reference switch	-	Hall-effect	Hall-effect	Hall-effect	
Miscellaneous					
Operating voltage	-	12 V differential	24 (PWM)	24	V
Operating temperature range	-20 to +65	-20 to +65	-20 to +65	-20 to +65	°C
Material	Aluminum	Aluminum	Aluminum	Aluminum	
Mass	0.9	1.25	1.35	1.25	kg
Recommended controller/driver		C-863 (single-axis) C-843 PCI board (for up to 4 axes)	C-863 (single-axis, p. 4-114) C-843 PCI board (p. 4-120) (for up to 4 axes)	C-663 (single-axis, p. 4-112)	

*2-phase stepper motor, 24 V chopper voltage, max. 0.8 A/phase, 400 full steps/rev., motor resolution with C-663 stepper motor controller

**CW: clockwise; CCW: counter-clockwise



M-038.PD1 Rotation Stage



Custom M-038 with folded drive