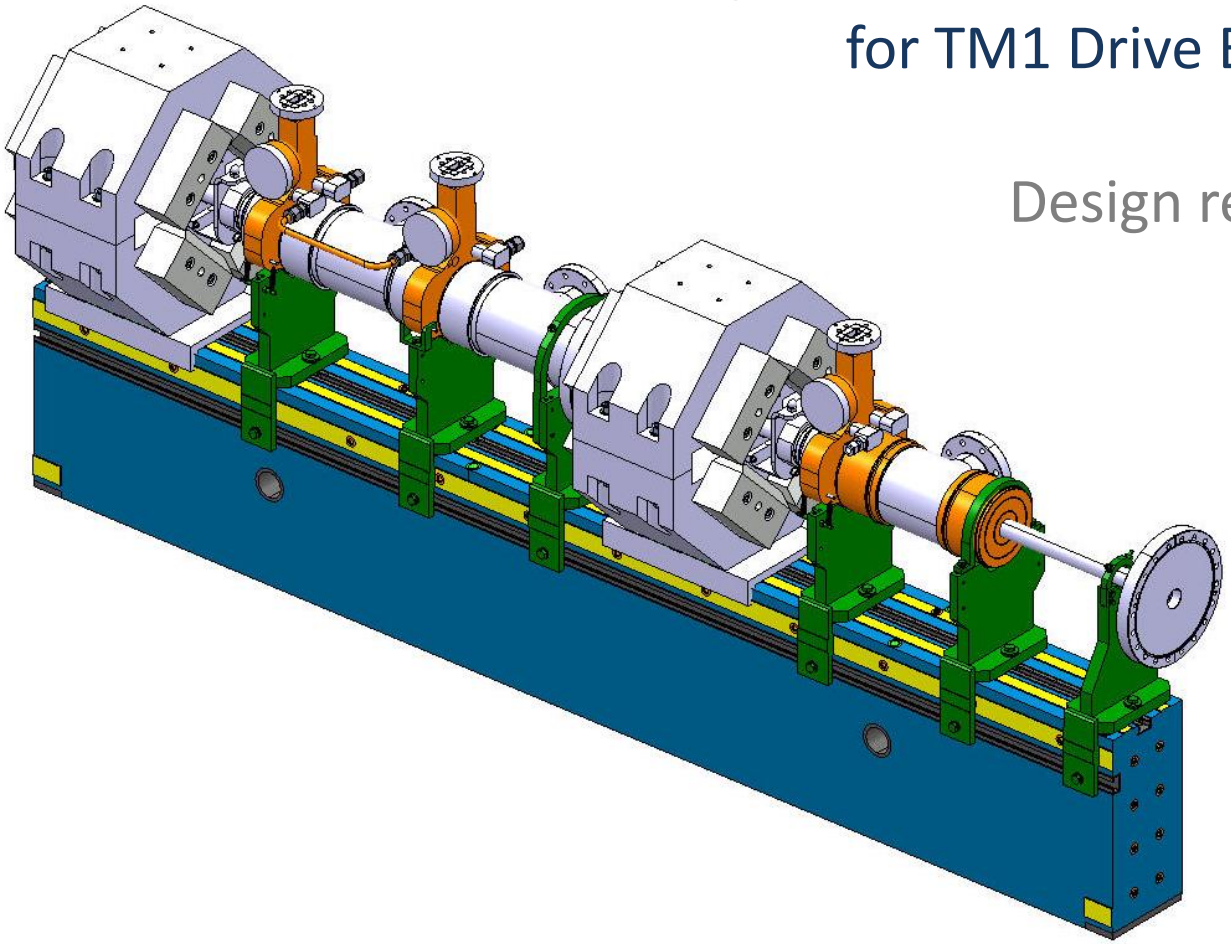
Adjustable V-shaped support

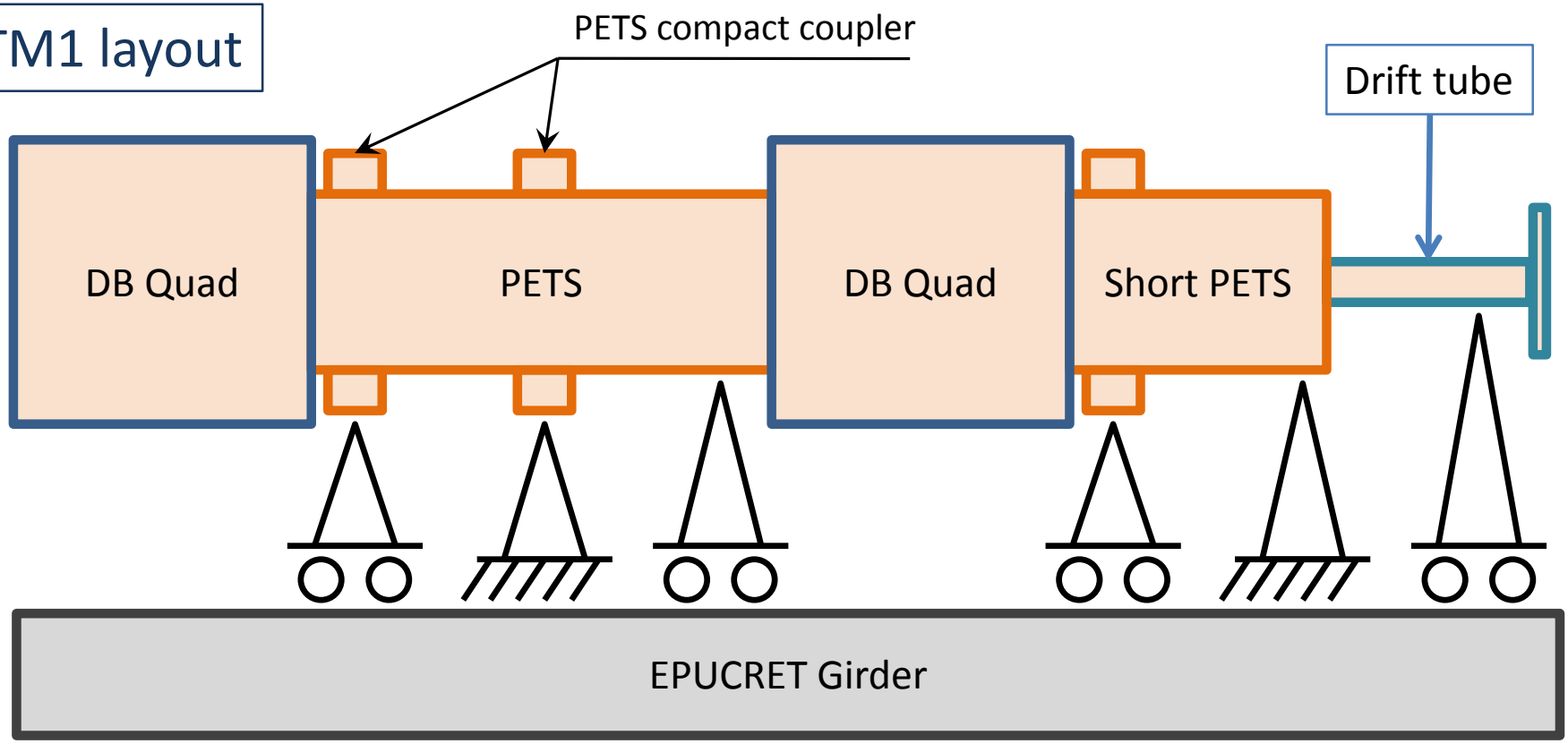
for TM1 Drive Beam girder

Design review



General requirements

TM1 layout

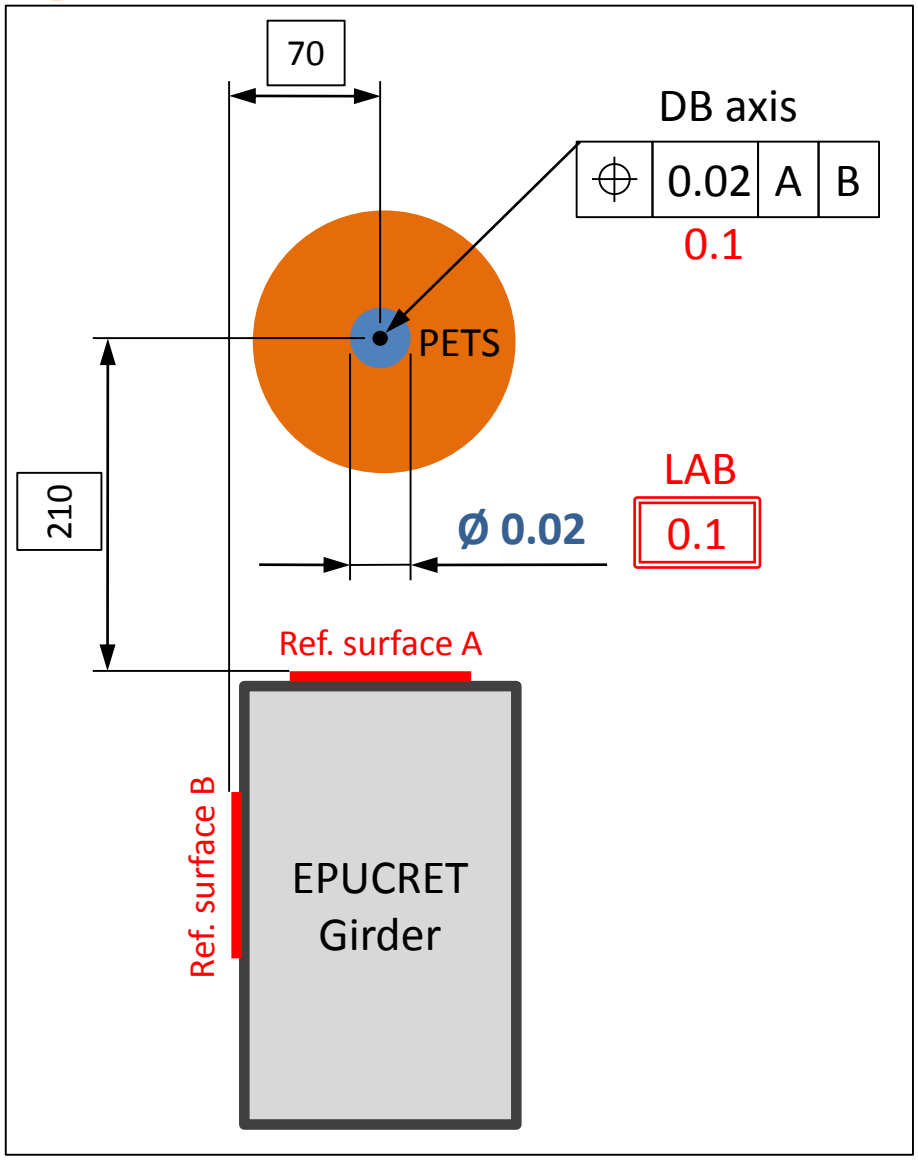


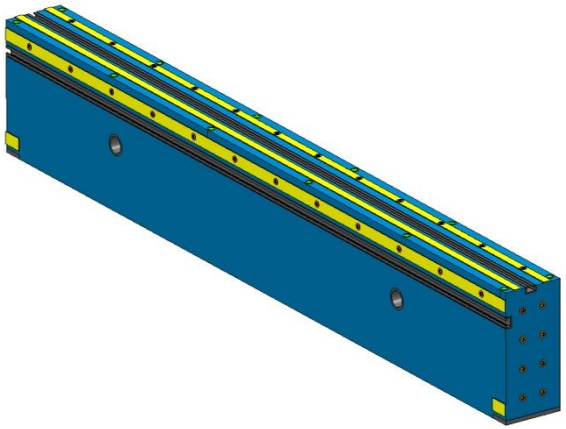
Sliding support

Fixed support

Totally 5 types of clamping:
- 2 different fixed clamps;
- 3 different sliding clamps.

General requirements. Tolerances





Tolerances on the girder

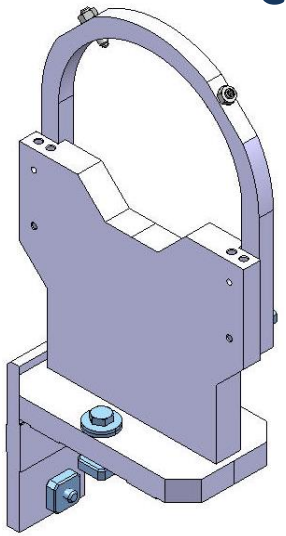
Perpendicularity of surfaces A and B (see picture on the left):
0.02 mm

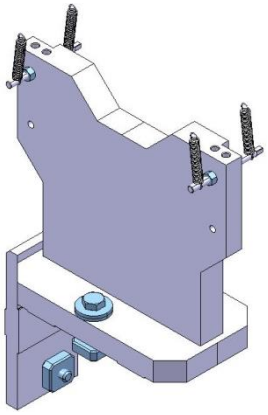
Flatness of the contact surfaces:
0.01 mm

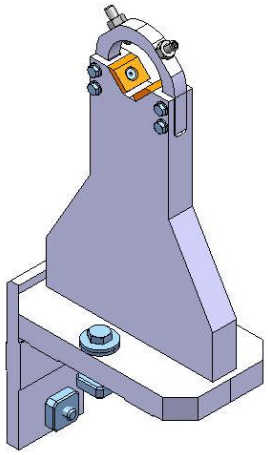
Roughness of the contact surfaces:
0.2 µm

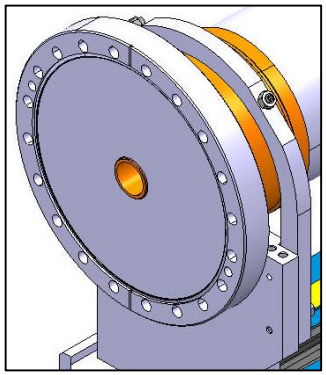
Current solution (non-adjustable)

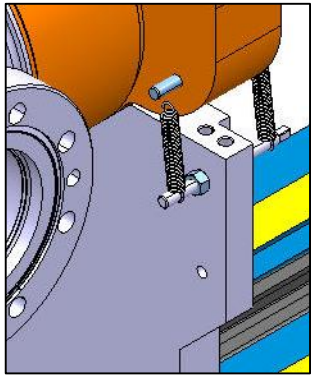
Clamping. Sliding type.

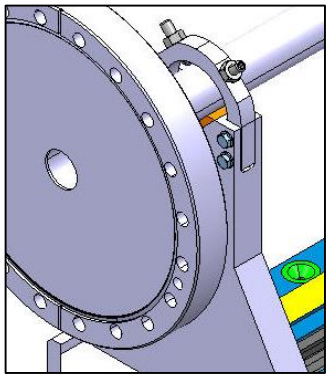










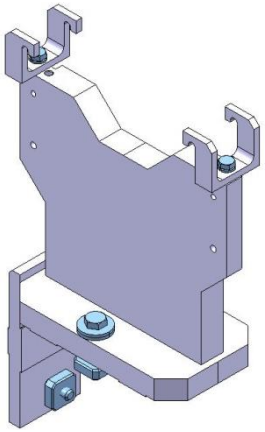


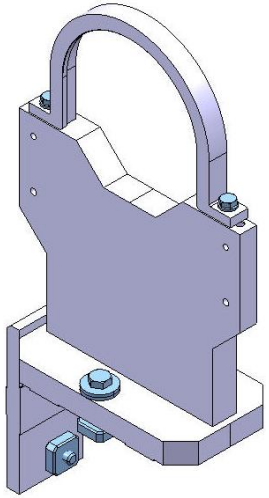
Type A. Strap with ball-head screws

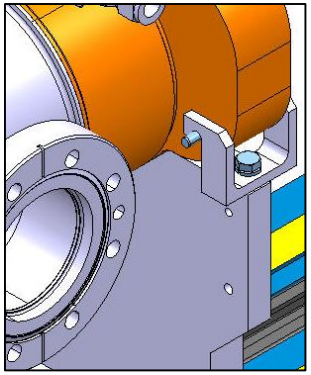
Type B. Spring

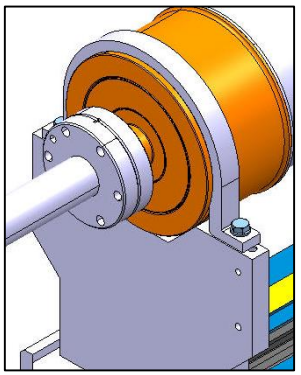
Type C. Strap with ball-head screws

Clamping. Fixed type.







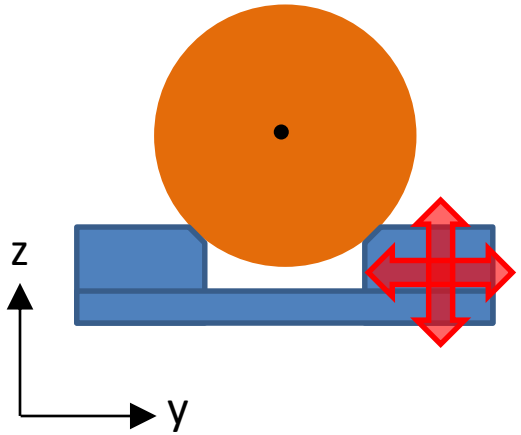


Type D. Bracket

Type E. Strap

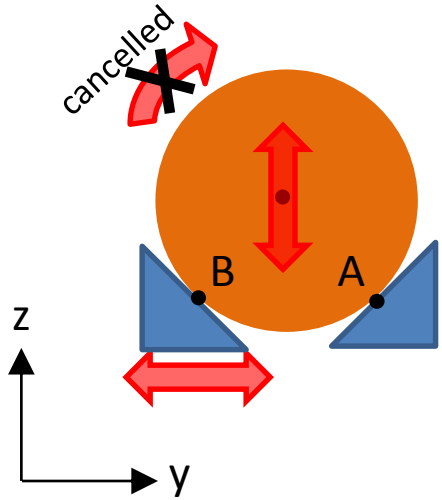
2 ways of adjustment

Simple movement



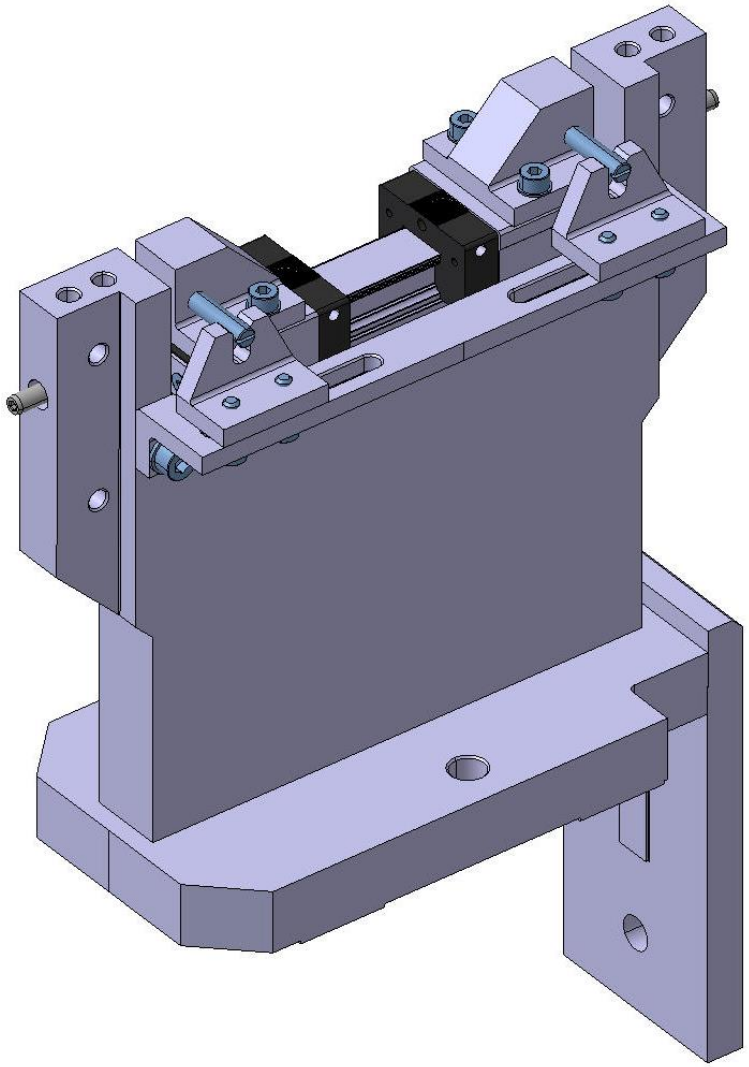
Existing market solutions for lifting the weight of 50 kg range with high precision are too bulky or/and too expensive.

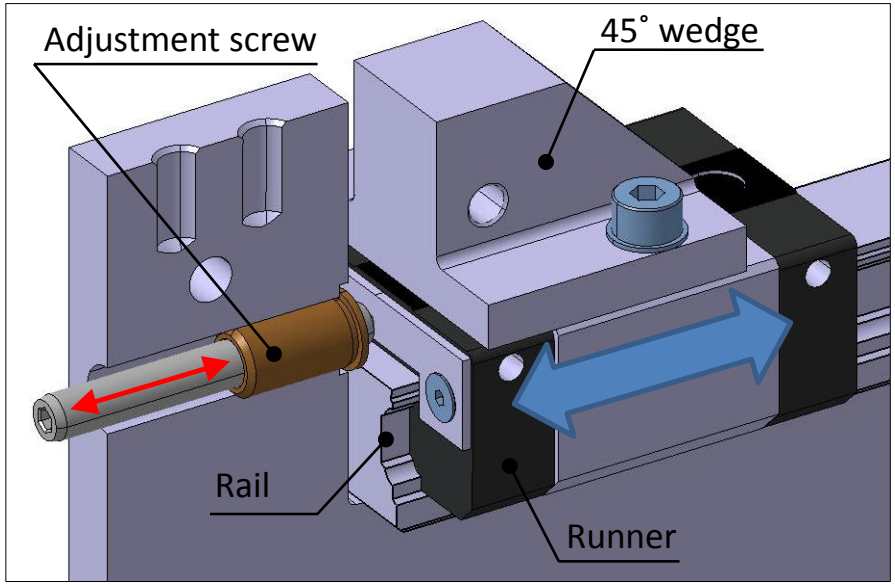
Composite movement

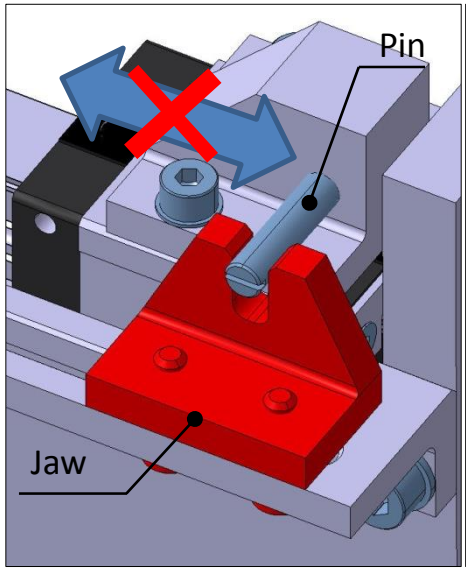


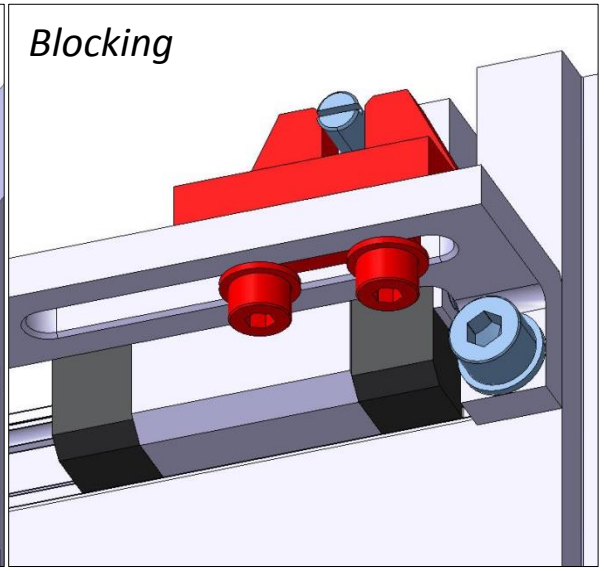
Easier to find on the market adjustment solutions, but there is an issue with the friction in the point B.

Adjustable solutions #1 “Rail”



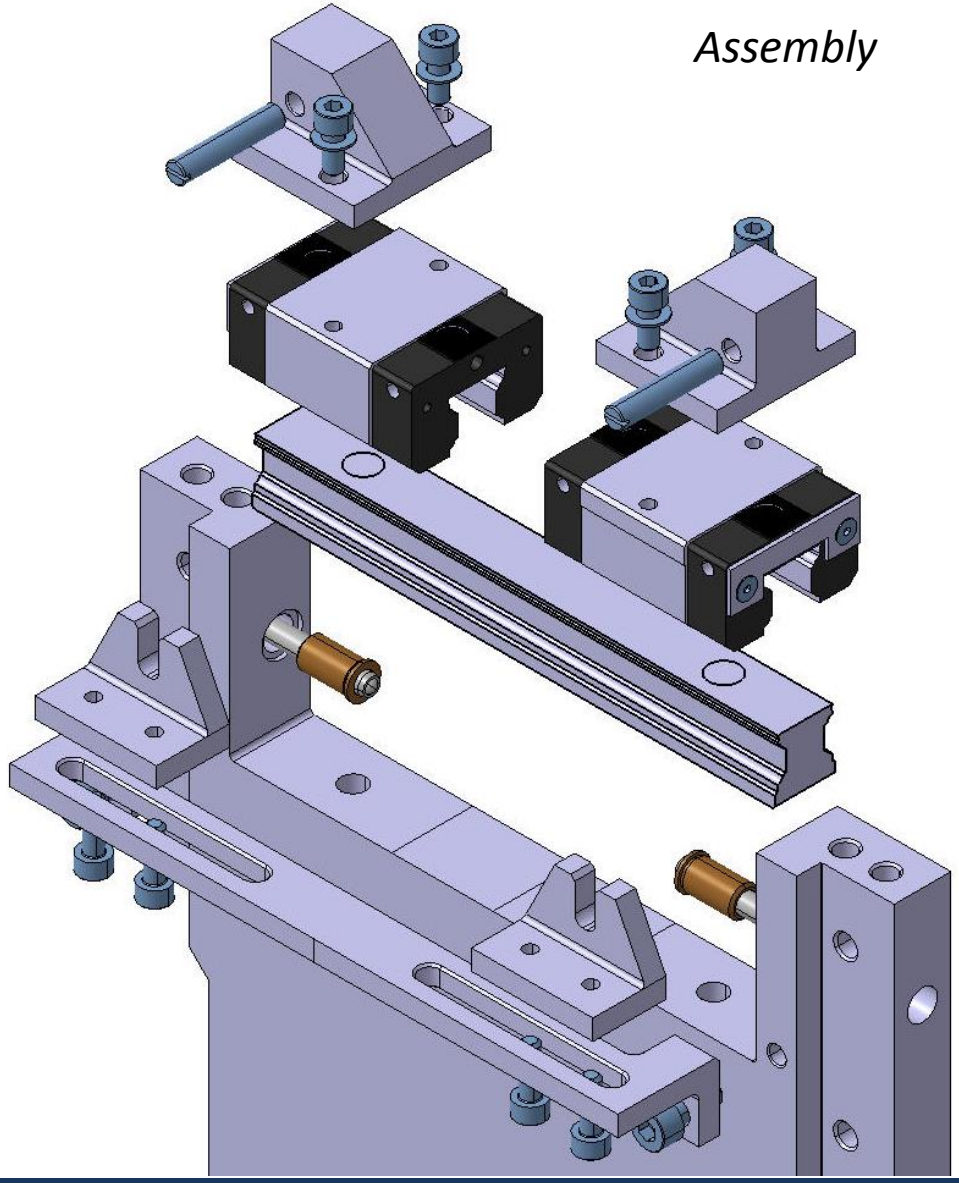






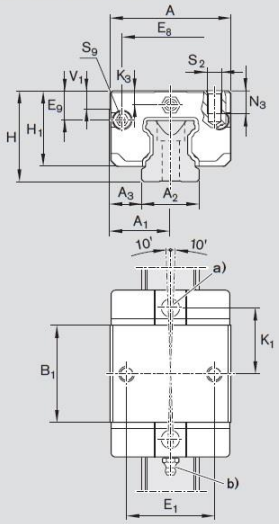
Adjustable solutions #1: Rail

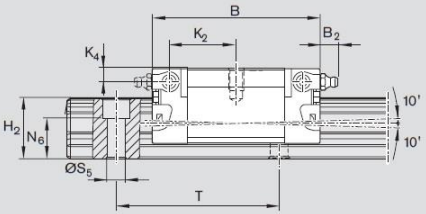
Assembly



About Bosch Rexroth Ball Rail System

Ball Runner Blocks SKS





a) For O-ring
Size 15: Ø 4 · 1.0 (mm)
Size 20 - 35: Ø 5 · 1.0 (mm)
Open lube bore as required (☞ 256).

b) Lube nipple, size 15 - 20:
Funnel-type lube nipple DIN 3405 – A M3x5, B_2 = 1.6 mm
If another lube nipple is used: observe the screw-in depth of 5 mm!
Lube nipple, size 25 - 35:
Hydraulic-type lube nipple DIN 71412 – A M6x8, B_2 = 9.5 mm
If another lube nipple is used: observe the screw-in depth of 8 mm!
Lube nipples are provided (unmounted).
Connection possible at all sides.

Size	Dimensions (mm)																
	A	A_1	A_2	A_3	B	B_1	E_1	E_8	E_9	H	H_1	H_2 1)	H_2 2)	K_1	K_2	K_3	K_4
15	34	17	15	9.5	44.7	25.7	26	24.55	6.70	24	19.90	16.30	16.20	16.25	17.85	3.20	3.20
20	44	22	20	12.0	57.3	31.9	32	32.50	7.30	30	25.35	20.75	20.55	22.95	22.95	3.35	3.35
25	48	24	23	12.5	67.0	38.6	35	38.30	11.50	36	29.90	24.45	24.25	25.35	26.50	5.50	5.50
30	60	30	28	16.0	75.3	45.0	40	48.40	14.60	42	35.35	28.55	28.35	28.80	30.50	6.05	6.05
35	70	35	34	18.0	84.9	51.4	50	58.00	17.35	48	40.40	32.15	31.85	32.70	34.20	6.90	6.90

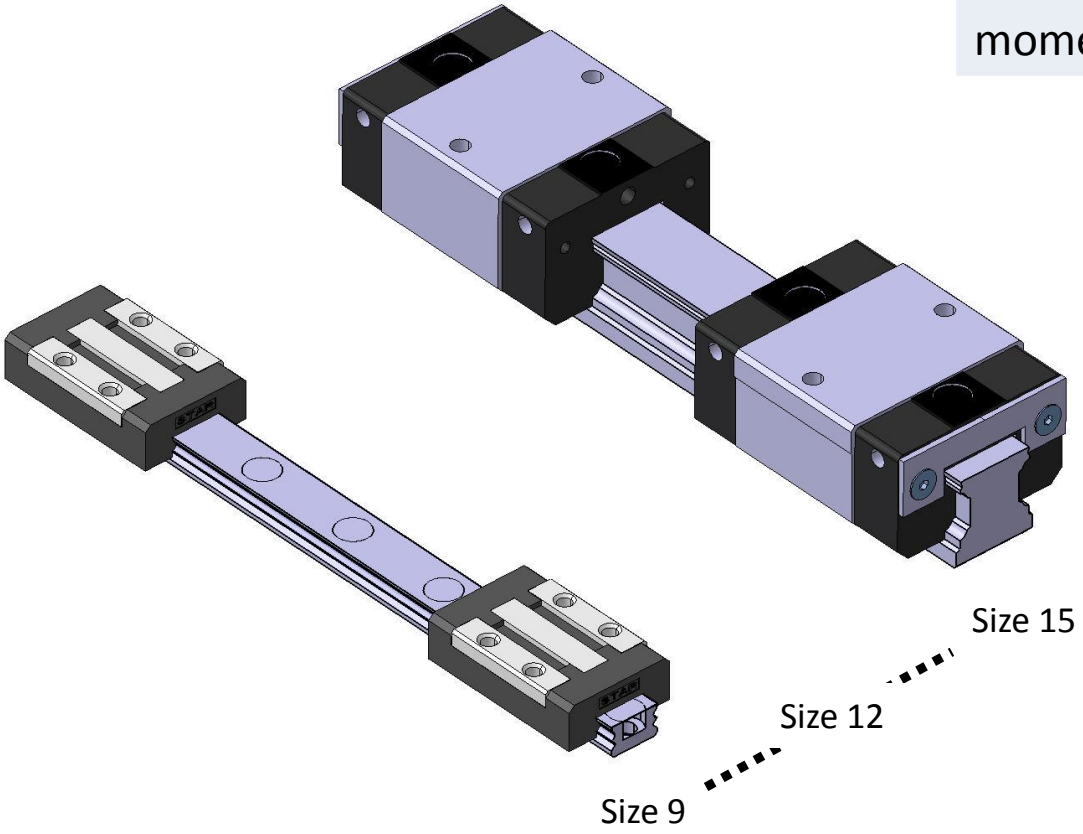
Size	Dimensions (mm)							Weight (kg)	Load capacities 3) (N)	Permissible load (N)	Load moments 3) (Nm)	
	N_3	$N_6^{\pm 0.5}$	S_2	S_5	S_9	T	V_1		C	F_{max}	M_t	$M_{t\,max}$
15	6.0	10.3	M4	4.4	M2.5x3.5	60	5.0	0.10	3 900	1 500	39	15
20	7.5	13.2	M5	6.0	M3x5	60	6.0	0.25	10 100	3 900	130	50
25	9.0	15.2	M6	7.0	M3x5	60	7.5	0.35	11 400	4 400	170	65
30	12.0	17.0	M8	9.0	M3x5	80	7.0	0.60	15 800	6 100	270	105
35	13.0	20.5	M8	9.0	M3x5	80	8.0	0.90	21 100	8 100	450	175

1) Dimension H_2 with cover strip
2) Dimension H_2 without cover strip
3) Load capacities and moments for Ball Runner Block **without** ball chain.
Determination of the dynamic load capacities and moments is based on a travel life of 100,000 m per ISO 14728-1. Often only 50,000 m are actually stipulated. For comparison: Multiply values **C** and M_t from the table by 1.26.

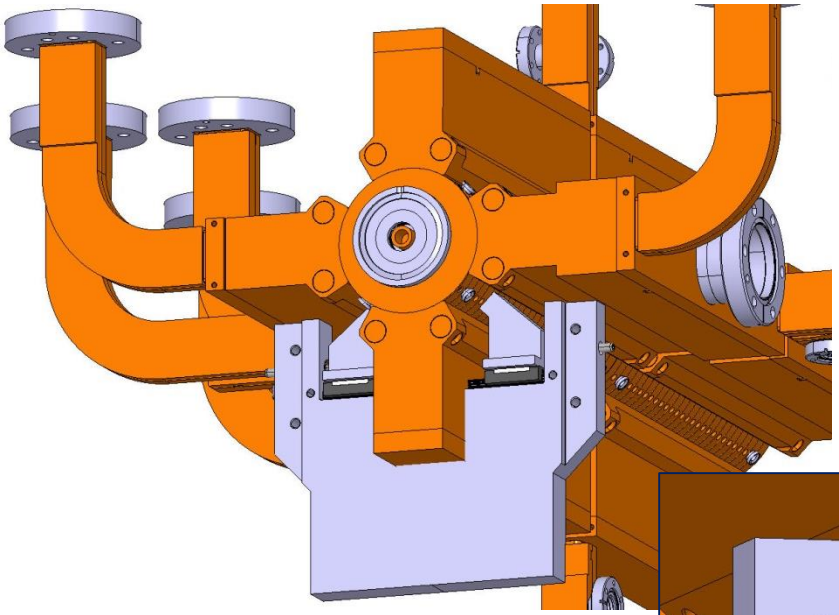
Adjustable solutions #1: Rail

Sizing options

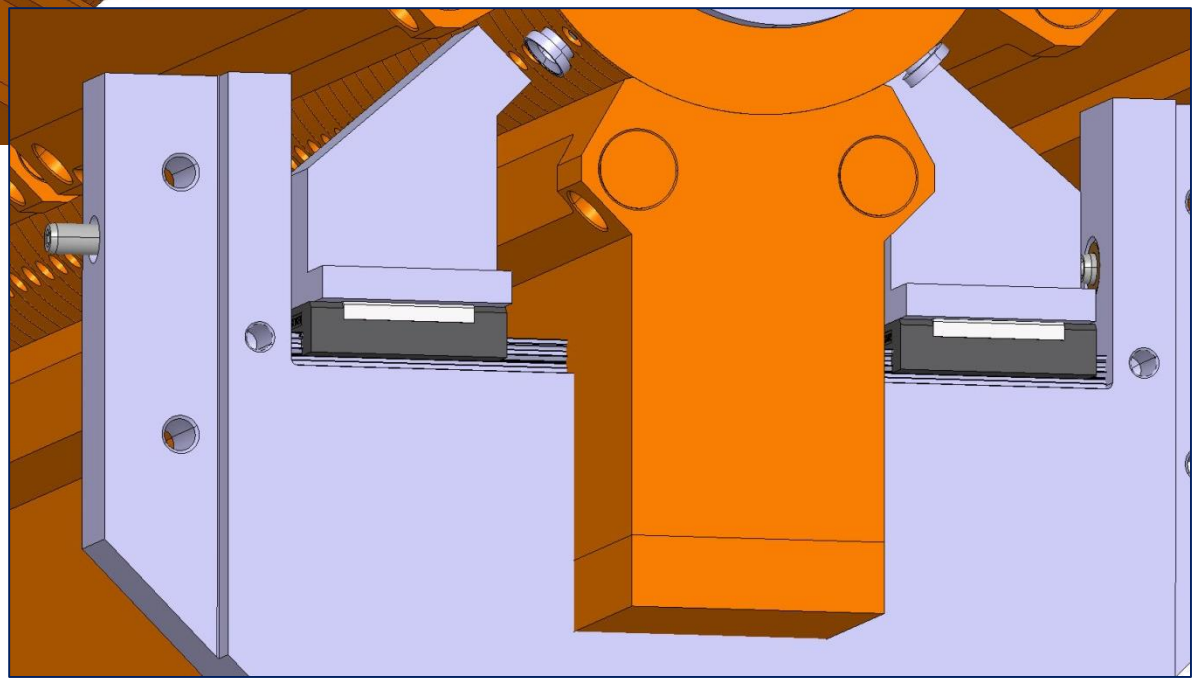
	Size 9	Size 15
Static load capacity	2100 N	3900 N
Stat. torsional moment load	9.6 Nm	39 Nm



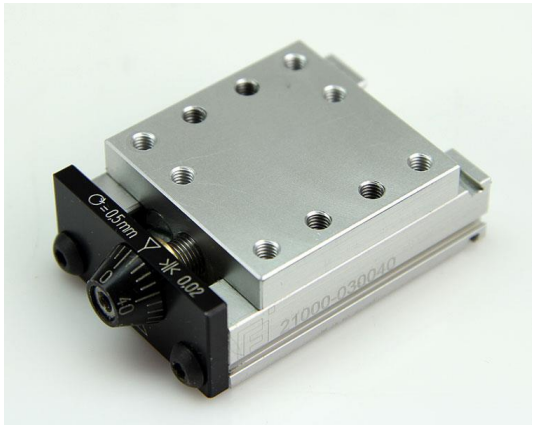
Adjustable solutions #1: Rail

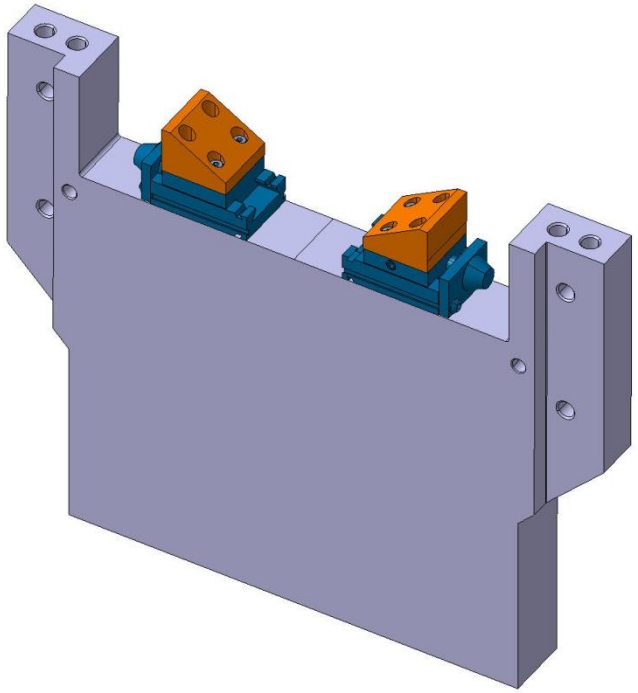


Estimation of using the solution #1 together with SAS

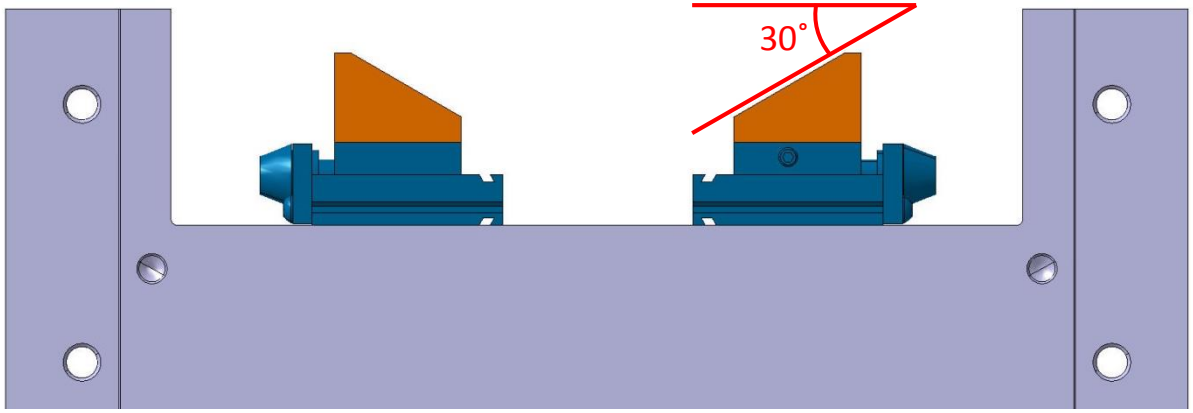


Adjustable solutions #1v2: Slide

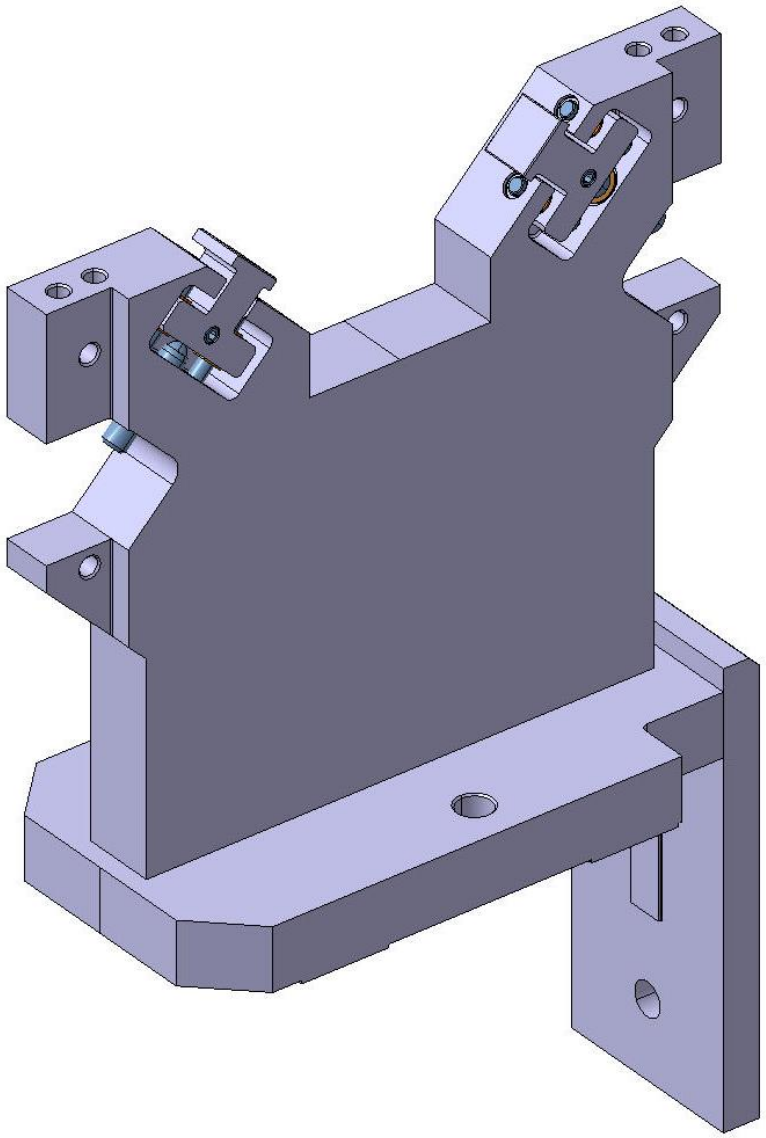


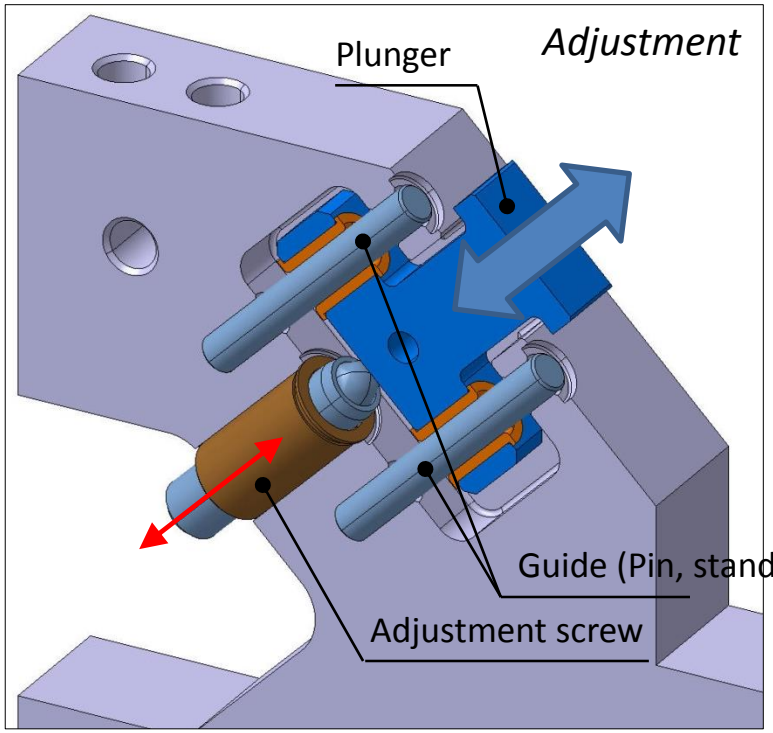


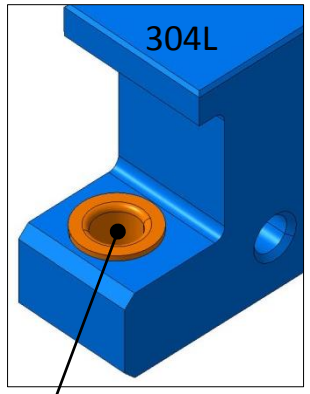
Static load capacity	180 N
Stat. torsional moment load	2 Nm
Stroke	5 mm

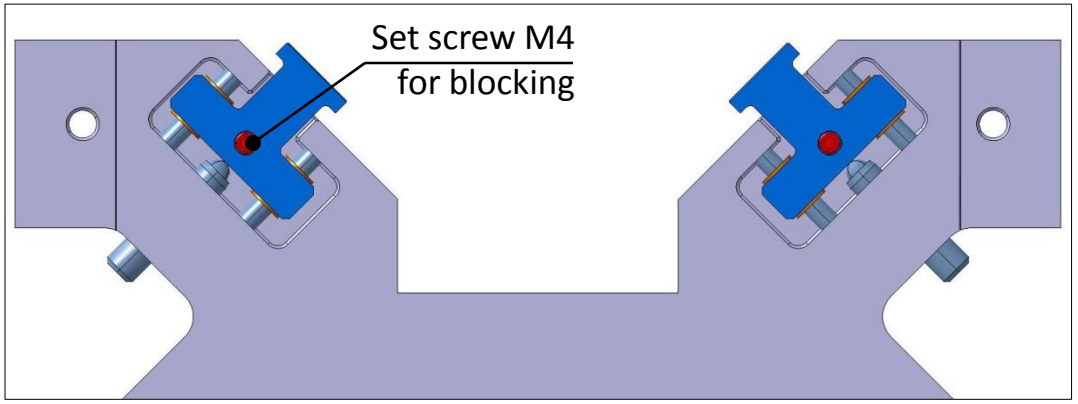


Adjustable solutions #2: “Plunger”



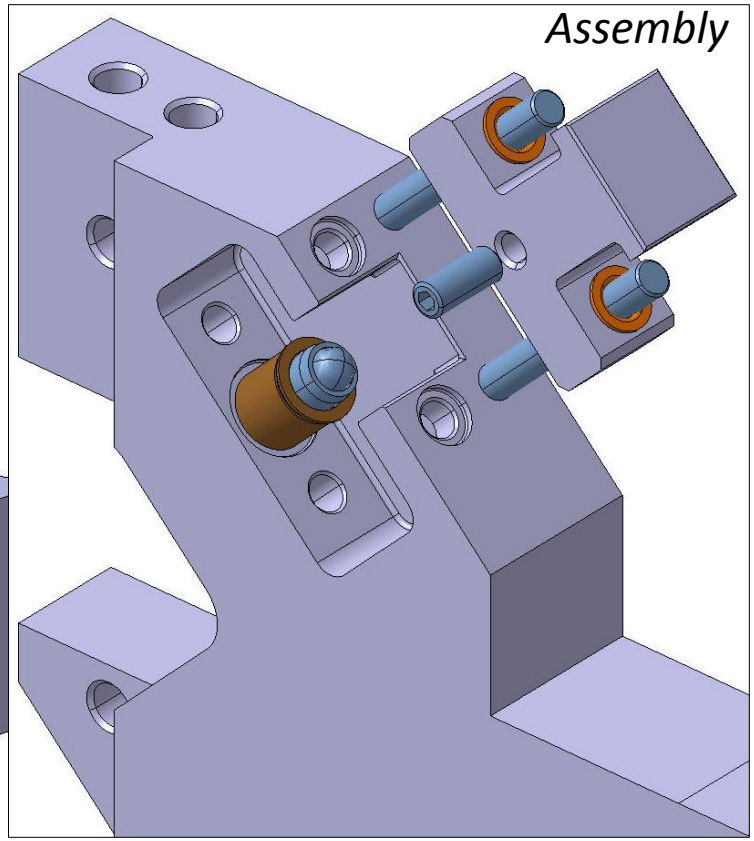




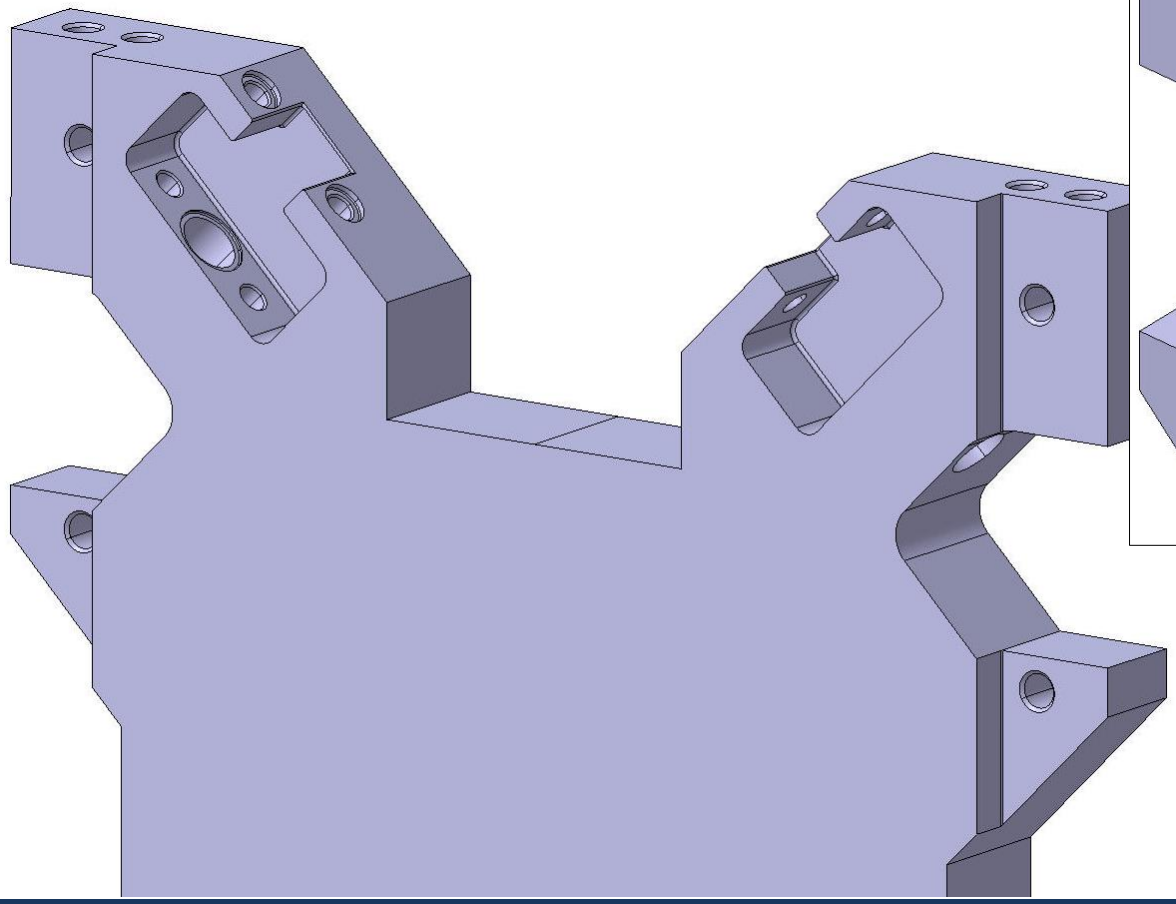


Adjustable solutions #2: “Plunger”

Assembly



Single piece machined support



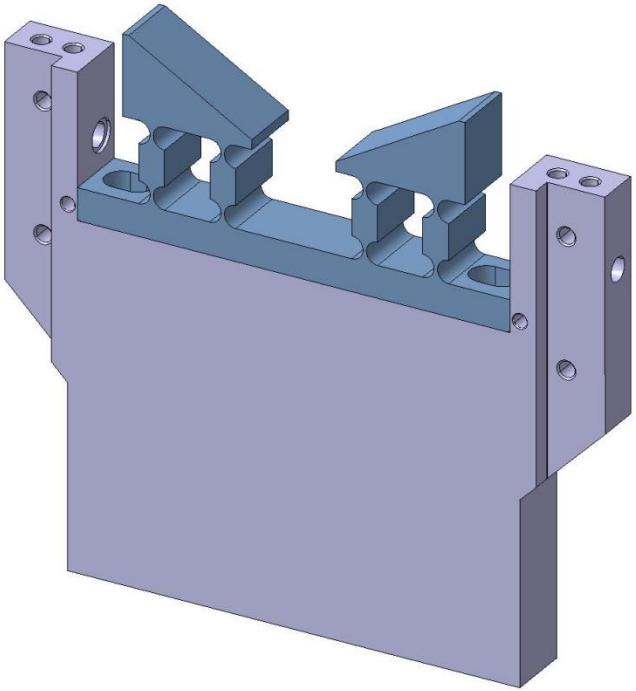
Adjustable solutions #3: Flexture

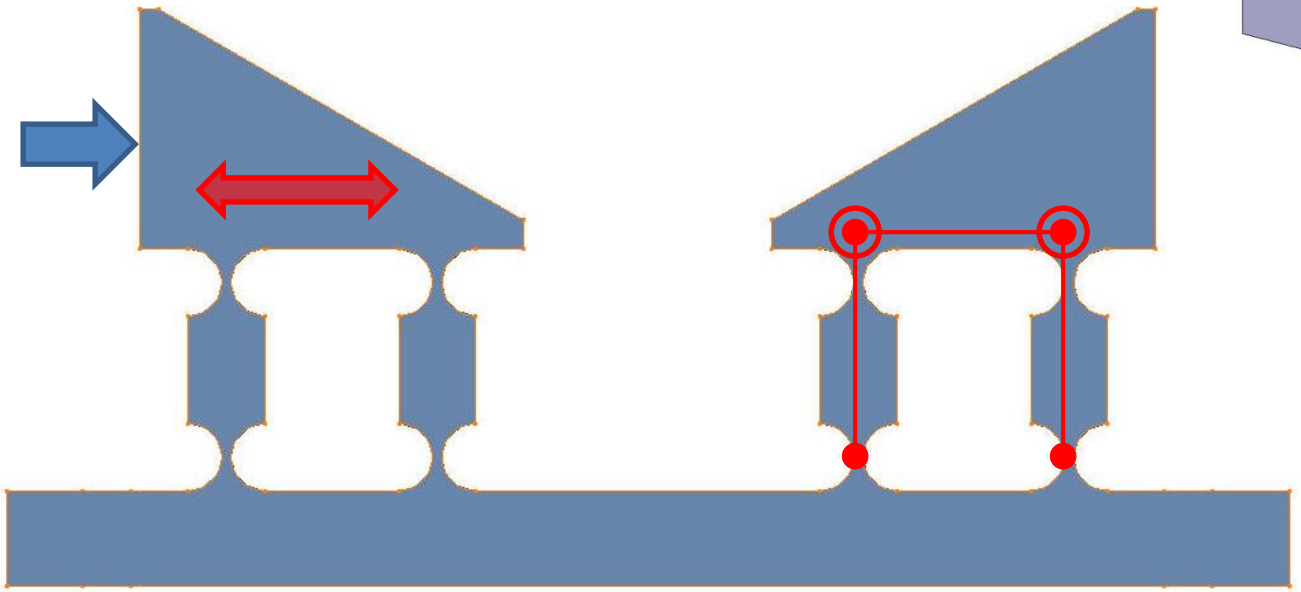
Pros:

- Absolut repeatability
- Very high precision
- No maintenance needed, solid piece

Cons:

- Require EDM (wire cutting) which is expensive and time consuming
- Very short stroke (within the elastic limit)



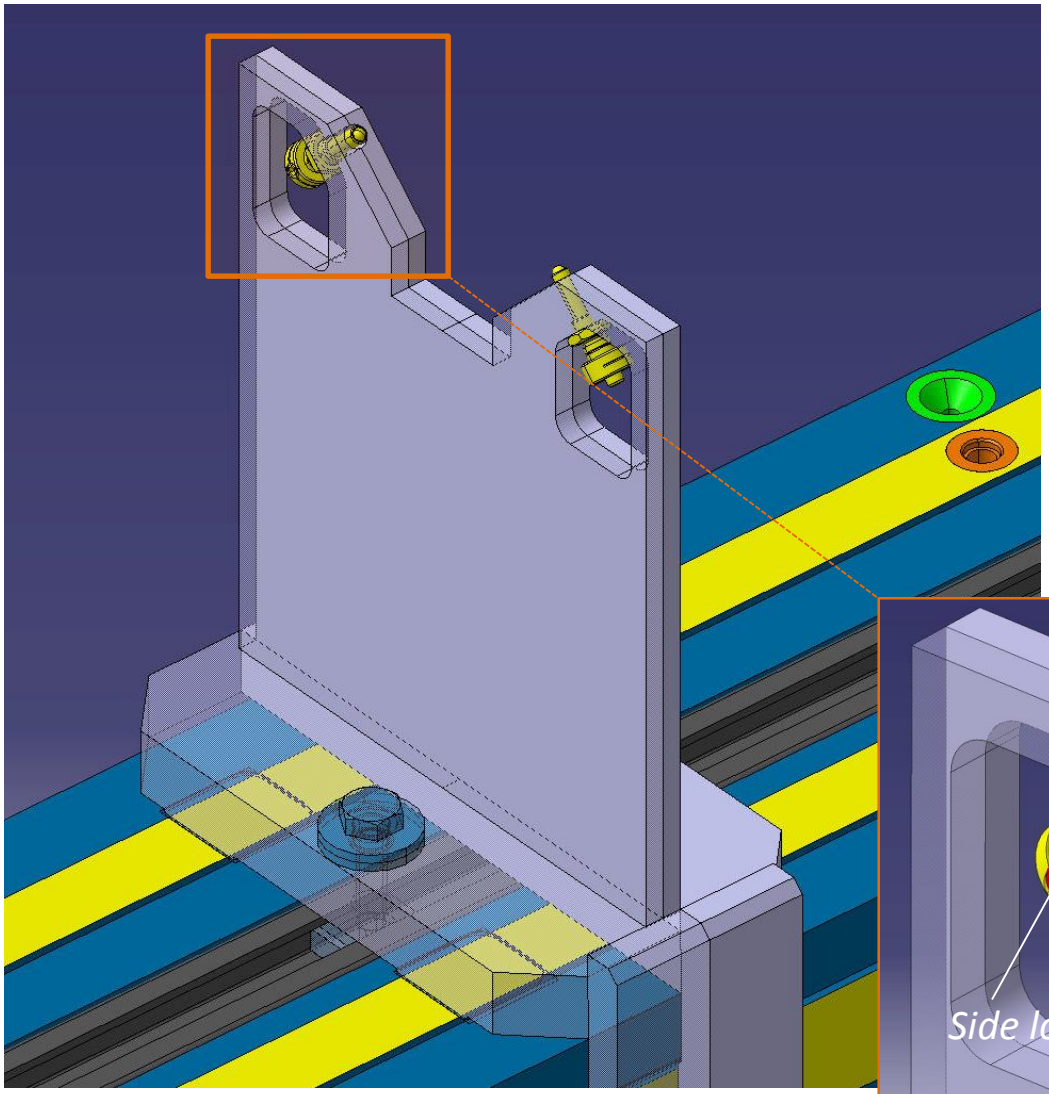


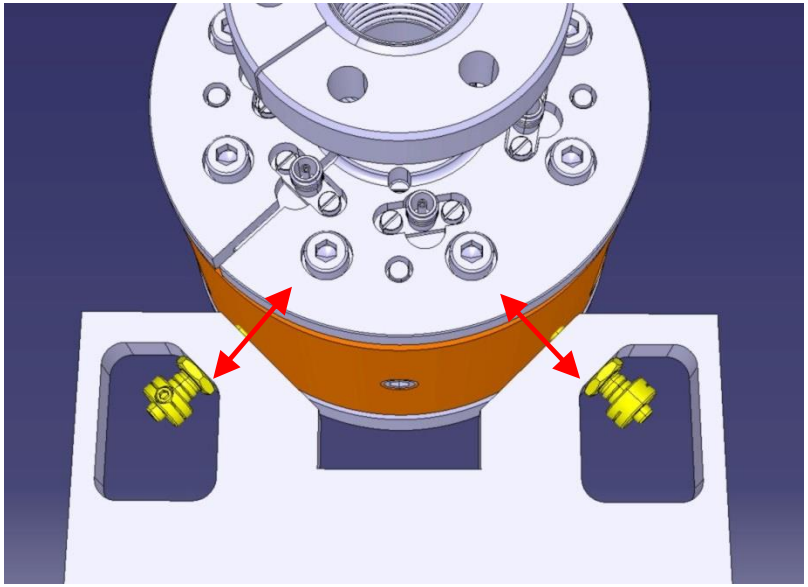
Versions history

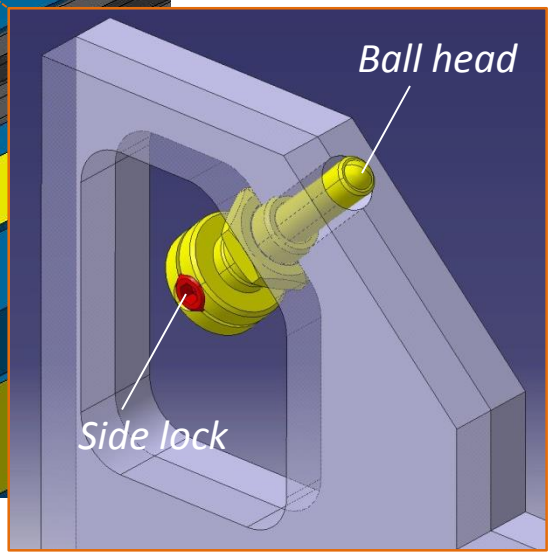
Pros and Cons

#1 Rail	#2 Plunger
The resolution of adjustment is the same (by order of magnitude): 254 µ/rev	
Smooth reliable movement (due to ind. solution)	Comparatively easy assembly, less parts
Heavy duty capability	Need no maintenance
Maintenance (nominal at given conditions)	Almost all the load is taken by the adjustment screw. The load capacity limit is 90 N.
Comparatively complex assembly	Comparatively complex machining

Adjustable V-shaped Support for BPM







Adjustment Screw

AJS8-100-0.5H

Newport Miniature Adjustment Screws

Model	AJS8-100-0.5H	AJS254-0.5H-NL
Adjustment Screw Thread	100 TPI (254 u/rev)	254 TPI (100 u/rev)
Drive Type	Hex	Hex
Travel	0.50 in. (12.7 mm)	0.50 in. (12.7 mm)
Load Capacity	10 lb (45 N)	20 lb (90 N)
Lock	Side Lock	Side Lock