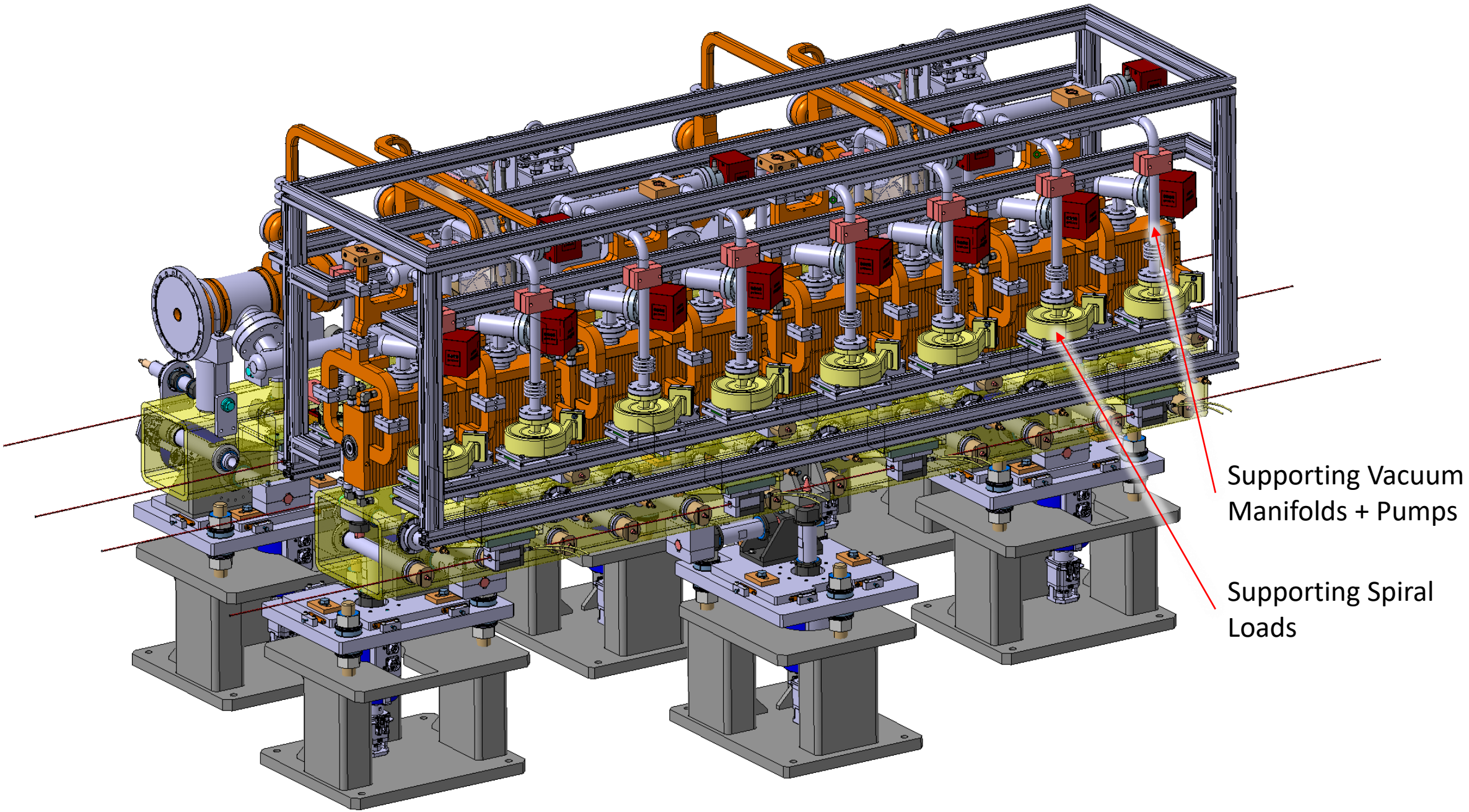
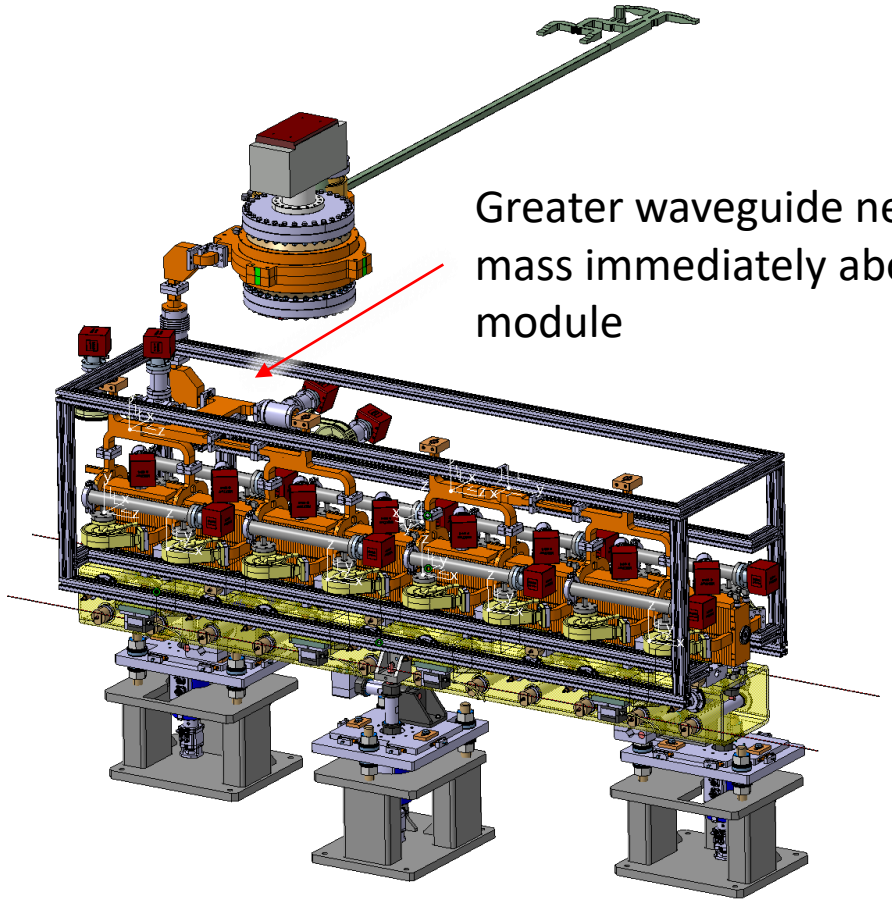
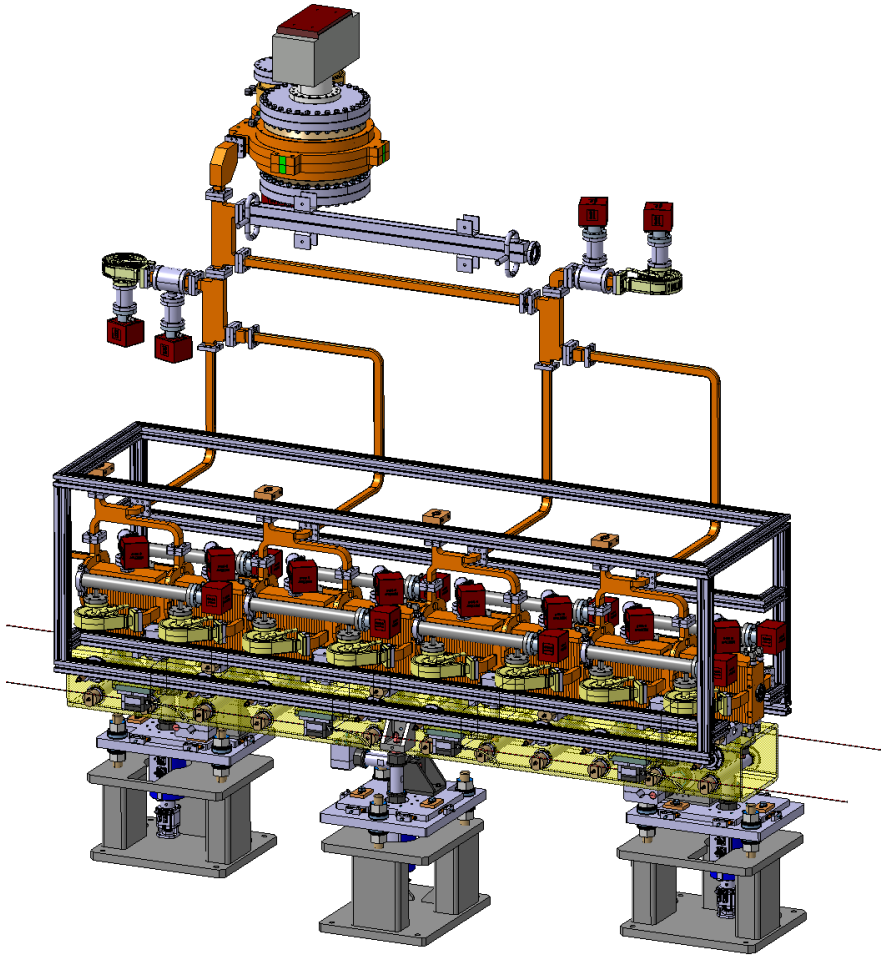
Module Waveguide/Vacuum Support Options

30-08-2023


Supporting Vacuum
Manifolds + Pumps
Supporting Spiral
Loads

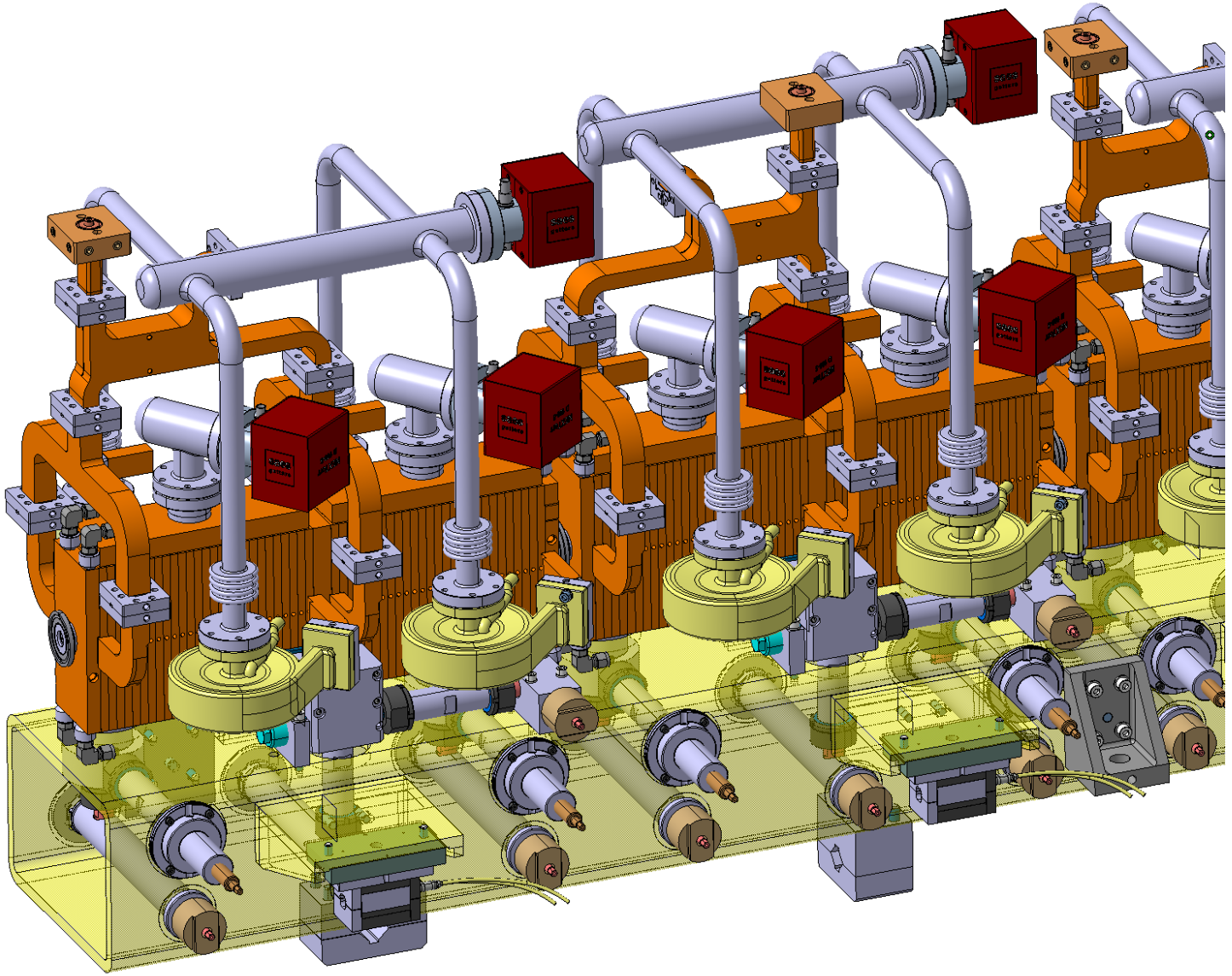
K-Modules





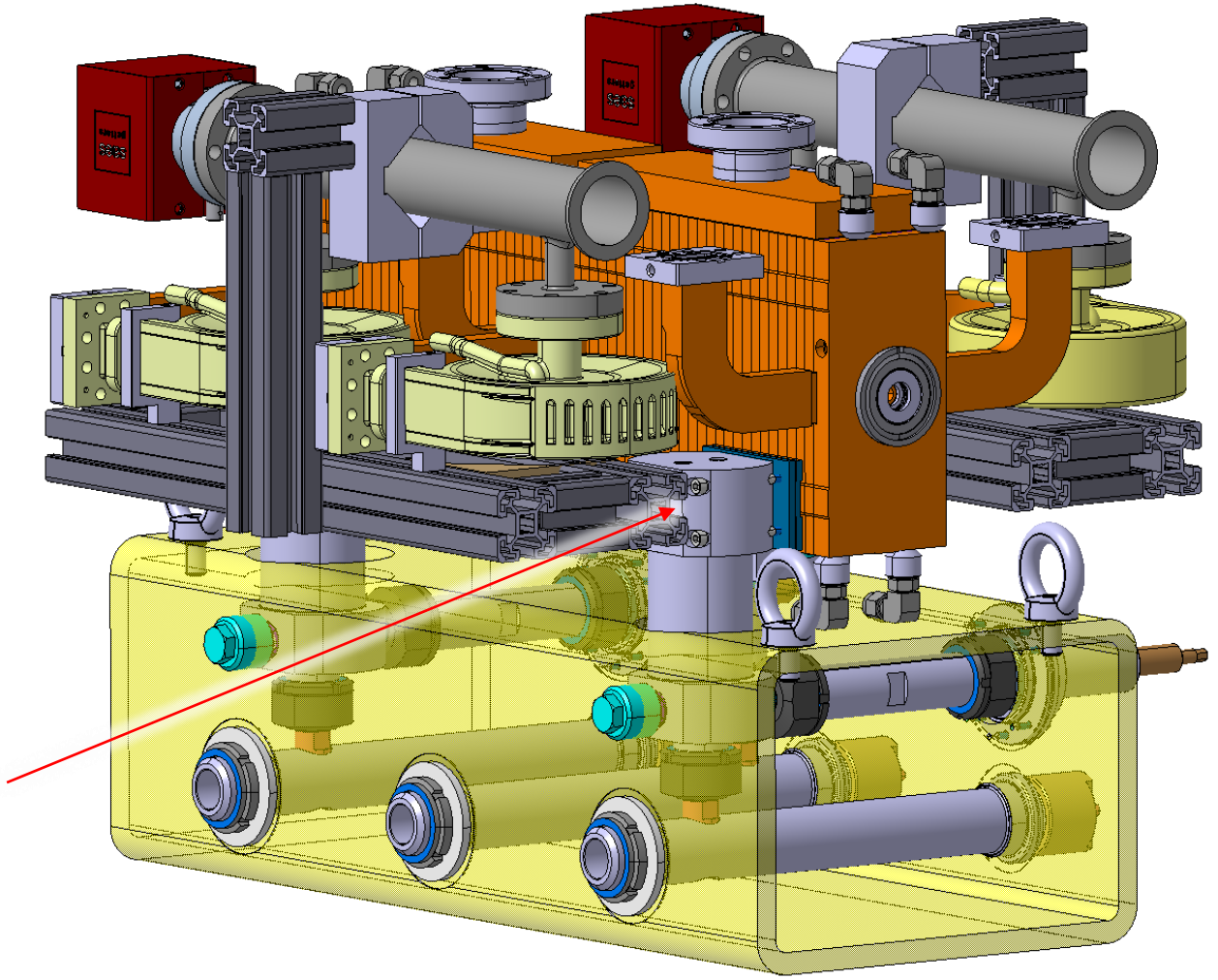
TBM Components

- Spiral loads are mounted off the side of the structures
  - Either vertically or preferably horizontally as shown here
  - The weight hanging directly off the structure is not ideal
  - Weight increased by vacuum pumps and loads
  - Waveguide network is perhaps less significant in terms of the mass, as there is no large hybrid in the TBM.
- Supporting the mass on the Steel girder is an obvious solution, but would constrain the alignment of the structures.



Mounting components to the alignment platform

- Can install a small support frame on either side of the alignment platform for RF-loads and Vacuum Components.
- This maintains the alignment capability of the platform, without increasing the weight on the structure itself
- Slightly increases the mass supported by the platform
  - Could be bad for vibration



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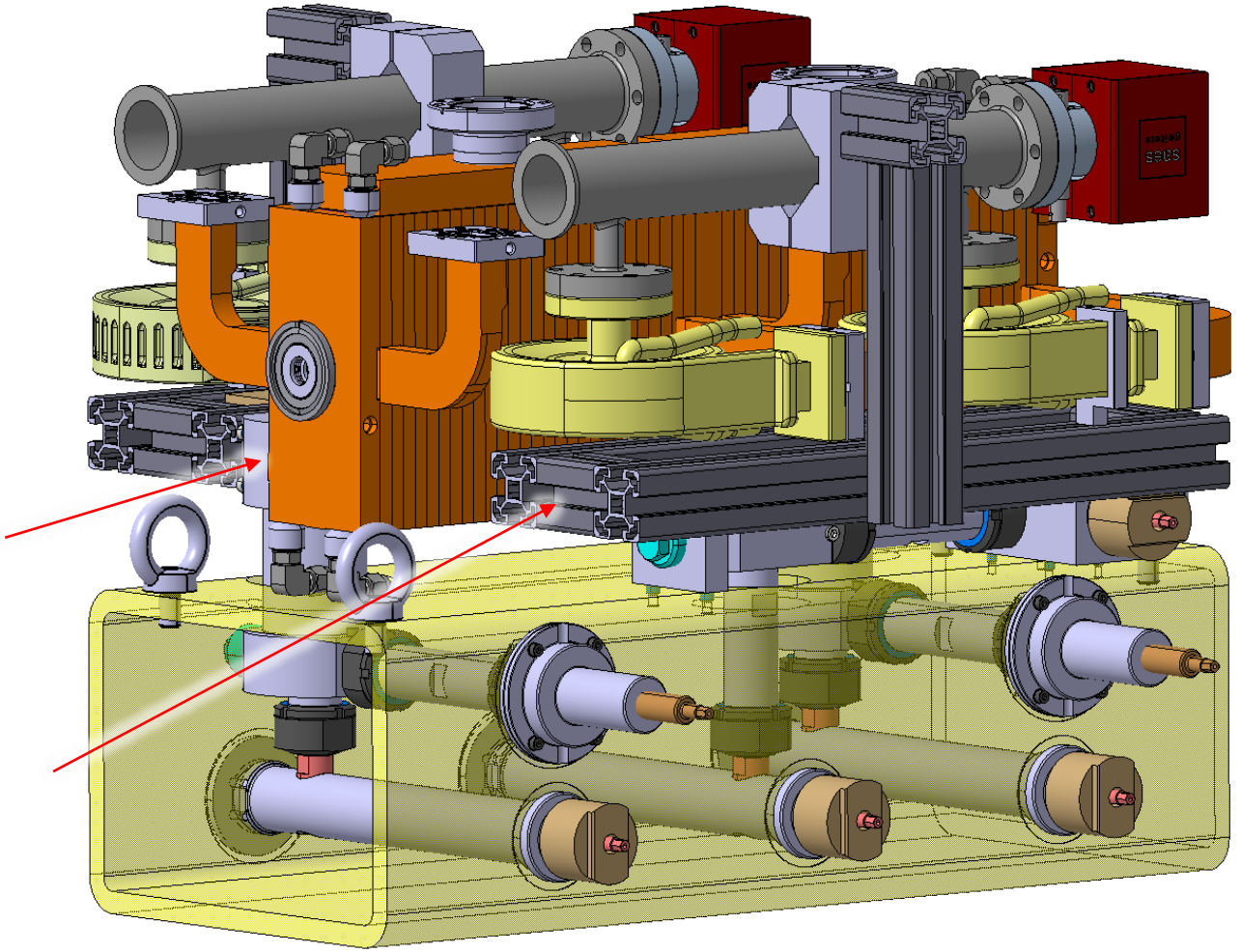
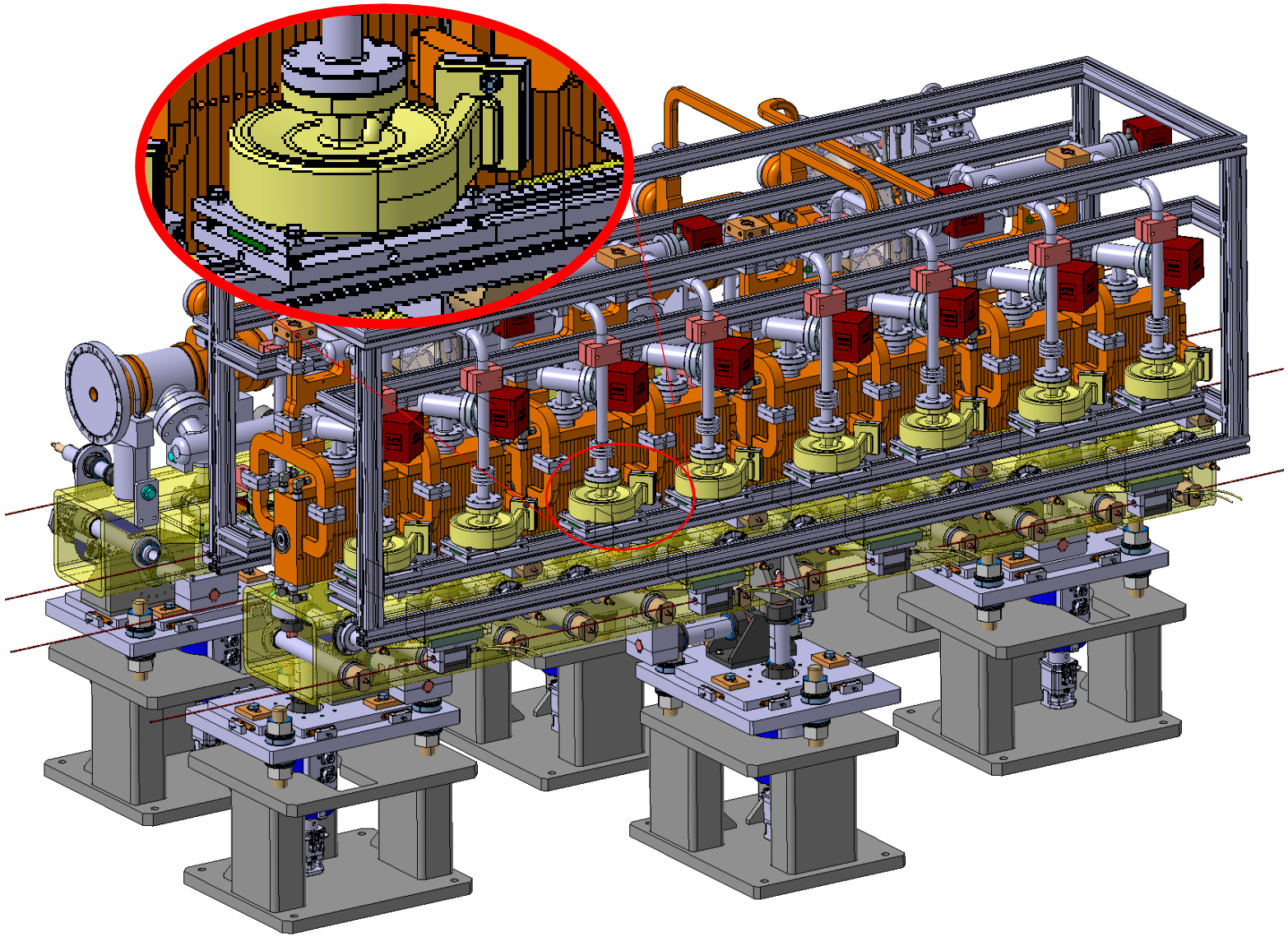


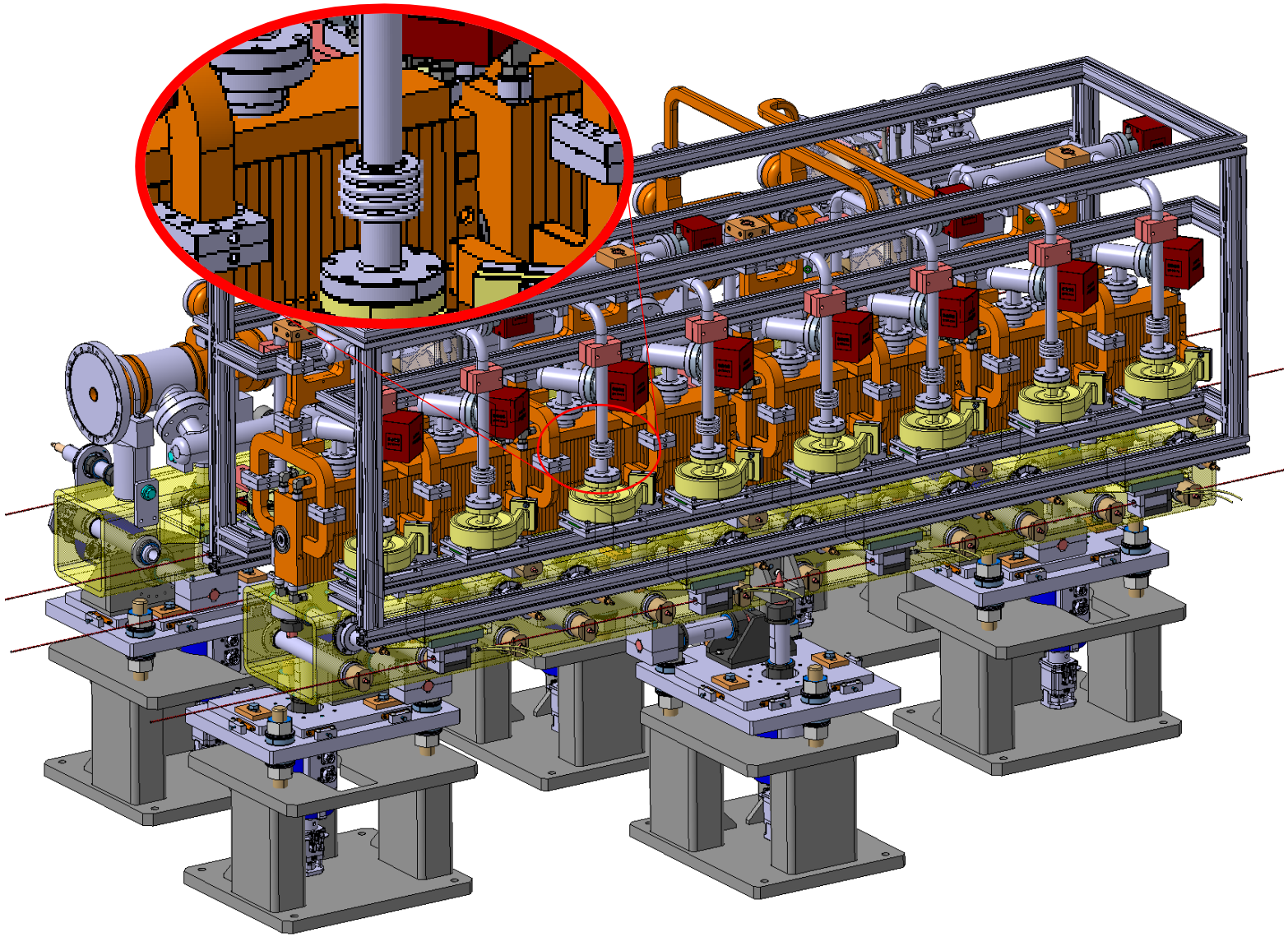
Full support frame

- Could use a full support frame over the whole module.
- The RF loads could be installed after an initial alignment stage (~100µm) and mounted on individual sprung supports
- Take most of the weight without constraining the final alignment



Full support frame

- The vacuum manifold can be hard mounted to the support frame, using bellows before the RF loads.
- Reduces the mass on the Structure Alignment Platform, which improves the vibration performance.



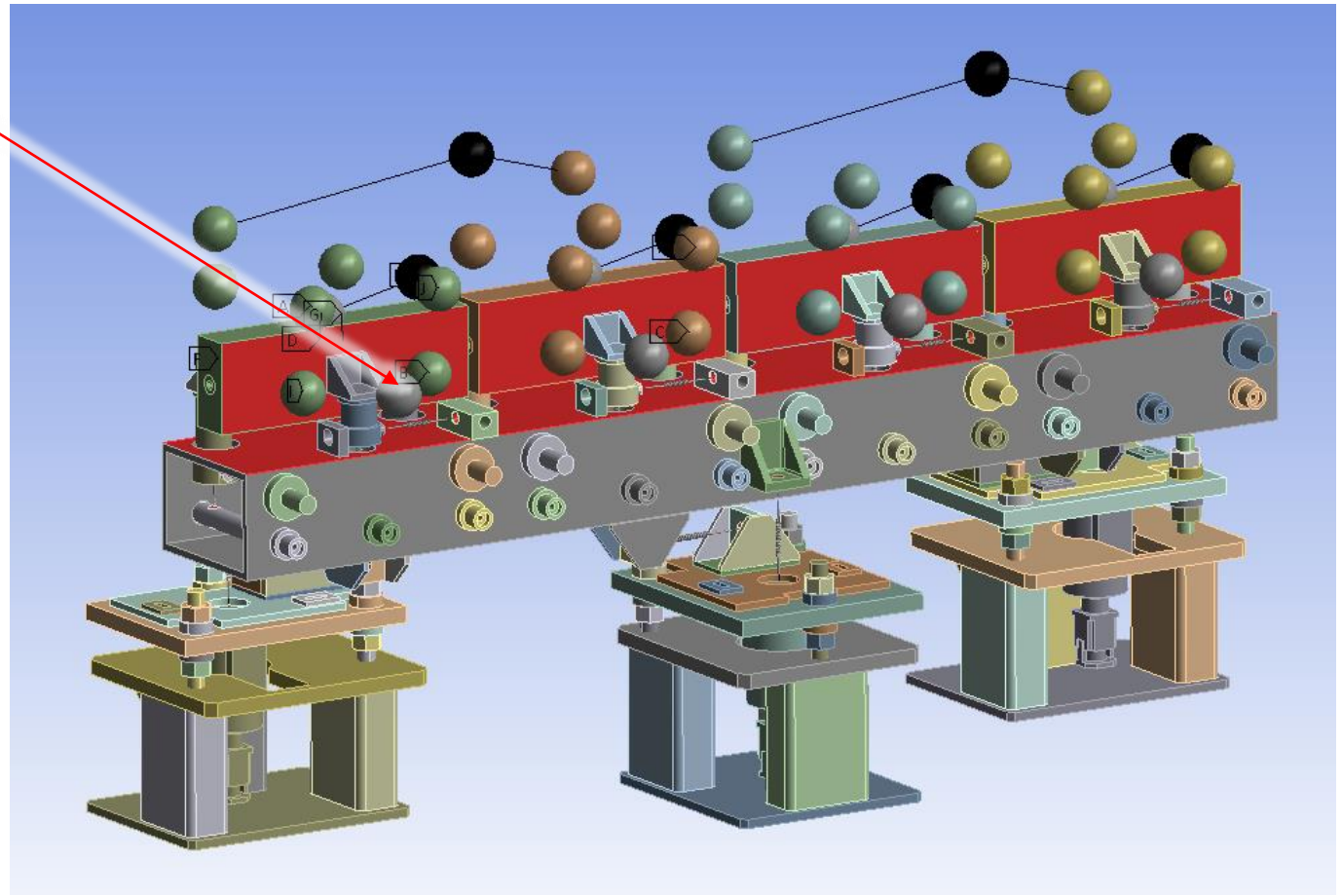
Support Analysis

Vacuum manifold and pump mass attached to the girder rather than the platform

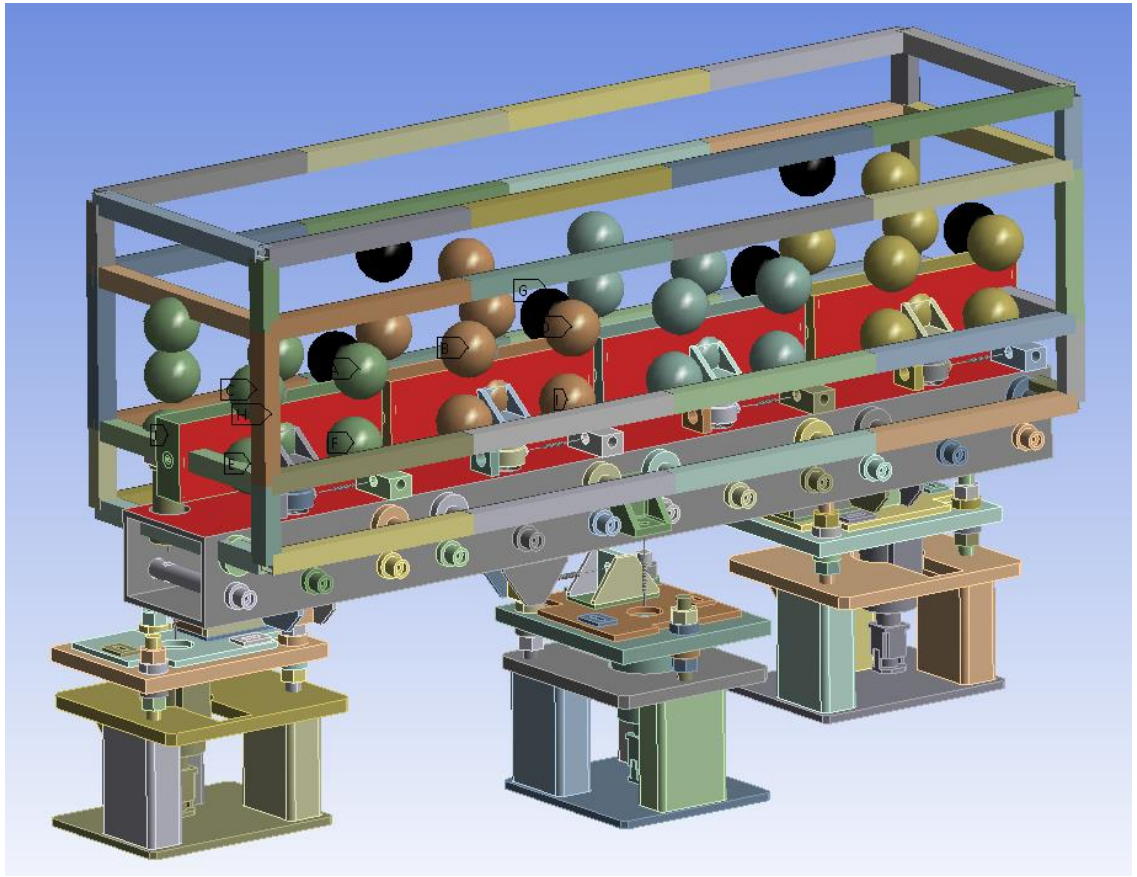
	Mode	Frequency [Hz]
1	1.	58.695
2	2.	60.647
3	3.	79.532
4	4.	100.94
5	5.	125.41
6	6.	130.64

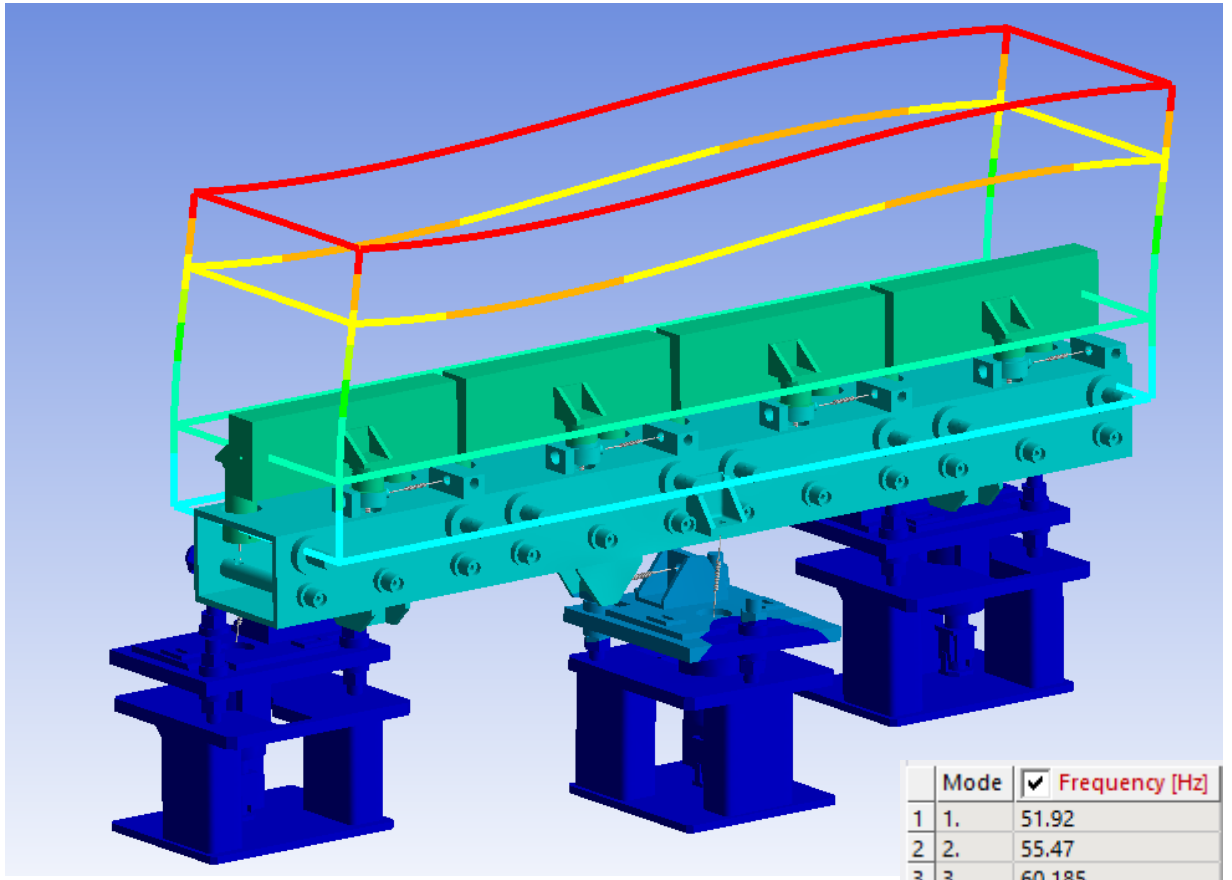
	Mode	Frequency [Hz]
1	1.	63.136
2	2.	65.364
3	3.	107.93
4	4.	134.53
5	5.	141.33
6	6.	144.31

Moderate increase in stiffness



Full Frame Analysis





	Mode	Frequency [Hz]
1	1.	51.92
2	2.	55.47
3	3.	60.185
4	4.	64.04
5	5.	64.347
6	6.	65.192

Very similar vibration behaviour for the same mode

Comparison

TBM

	RF Loads	RF Vacuum Network	Waveguides	Heavy WGs (Large hybrids etc)
Supported on SAS	*Weight on SAS*	*Weight on SAS. Poor vibration behaviour*	*Weight on SAS*	*NA*
Supported on SAS adjustment platform	*Maintains adjustment platform capability*	*Maintains adjustment platform capability. Unnecessary.*	*Maintains adjustment platform capability. Unnecessary*	*NA*
Supported directly off the girder	*Constrains adjustment platform capability*	*Improves vibration behaviour*	*Unlikely to overly constrain the adjustment*	*NA*

Klystron

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Supported on SAS	*Weight on SAS*	*Weight on SAS. Poor vibration behaviour*	*Weight on SAS*	*Weight on SAS. Poor vibration behaviour*
Supported on SAS adjustment platform	*Maintains adjustment platform capability*	*Maintains adjustment platform capability. Unnecessary.*	*Maintains adjustment platform capability. Unnecessary*	*Adjustment platform capability ok. Unnecessary. Poor vibration behaviour*
Supported directly off the girder	*Constrains adjustment platform capability*	*Improves vibration behaviour*	*Unlikely to overly constrain the adjustment*	*Good for adjustment, vibration, and the weight supported on structures.*