An FEA Investigation of the Vibration Response of the BEATS Detector Stage

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Abstract

The Synchrotron-light for Experimental Science and Applications in the Middle East (SESAME) facility is in the process of designing, procuring and installing a new beamline for tomography (BEATS). The BEATS experimental hutch, sample platform and environmental system and detectors, will be located 43m away from the light source. Vibrational noise transferred to the detector can be a source of poor image quality and it is therefore important that the detector stage is analysed for structural rigidity that will attenuate any vibrations. Random vibration analysis for the detector stage is conducted using the measured SESAME floor power spectrum density in order to estimate the instantaneous severity of the vibration in the X, Y and Z direction. In order to validate the random vibration technique, an existing structure (back scattering monochromator on ESRF's beamline ID28) was used to collect experimental data which was compared to simulation for a similarly developed model. The comparison was based on modal frequencies and RMS values.

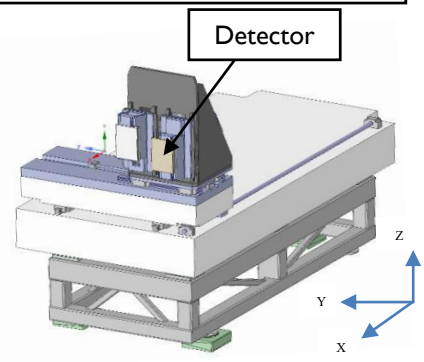
ID28 Model validation

Modal Frequencies

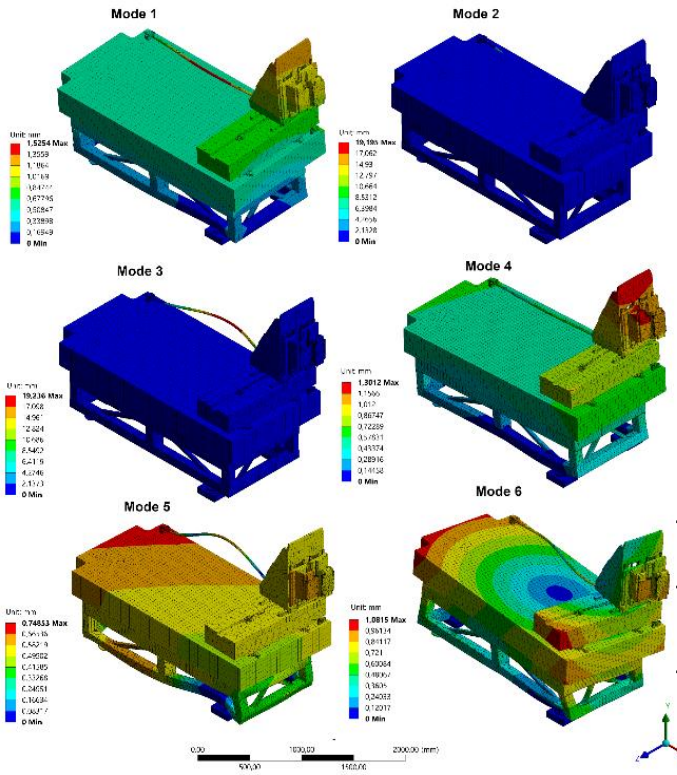
Mode	Experimental Frequency [Hz]	FEA Frequency[Hz]
1	18	17
2	19	18
3	25	26
4	28	27
5	45	46

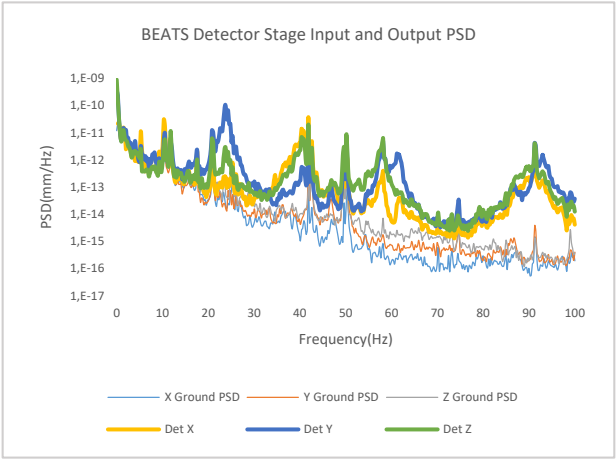
Displacement RMS values

Direction	Measured Ground [nm]	Measured BS Mono [nm]	FEA response [nm]
X(H)	101	117	116
Y(H)	77	96	93
Z(V)	127	137	140



BEATS Detector stage Random Vibration Analysis





Displacement RMS values

Direction	Ground [nm]	Detector [nm]
X(H)	8	10
Y(H)	12	17
Z(V)	14	15

Modal Frequencies

Mode	Frequency [Hz]
1	24
2	35
3	35
4	41
5	62

References

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