

# High Frequency Shock During Random Vibration Testing

**Michael Mastovich**



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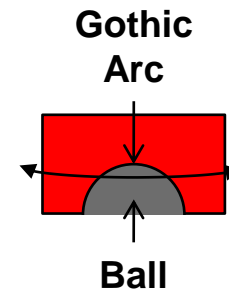
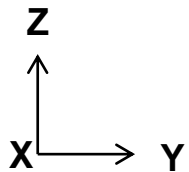
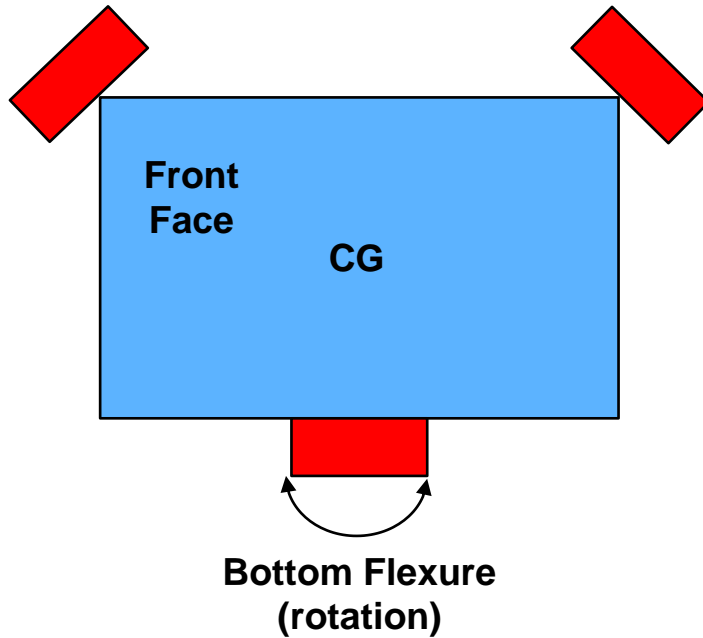


# Overview

- **Experienced high frequency shock during random vibration testing**
- **Geometry is a ball and gothic arch mount**
- **Incorrect stiffness of flexures in finite element model led to much higher reaction forces at interface**
- **What if this was not an audible event? Occurred above 2kHz, therefore outside of normal monitored range**



# Geometry

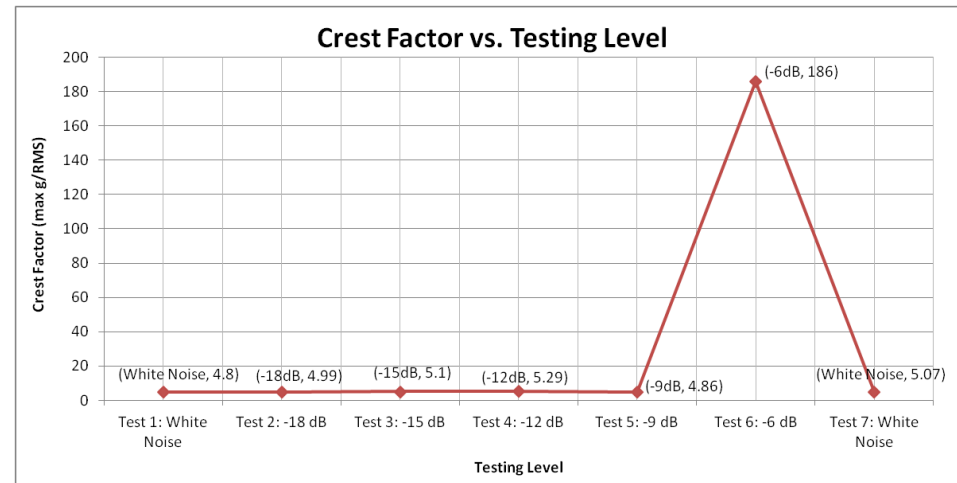
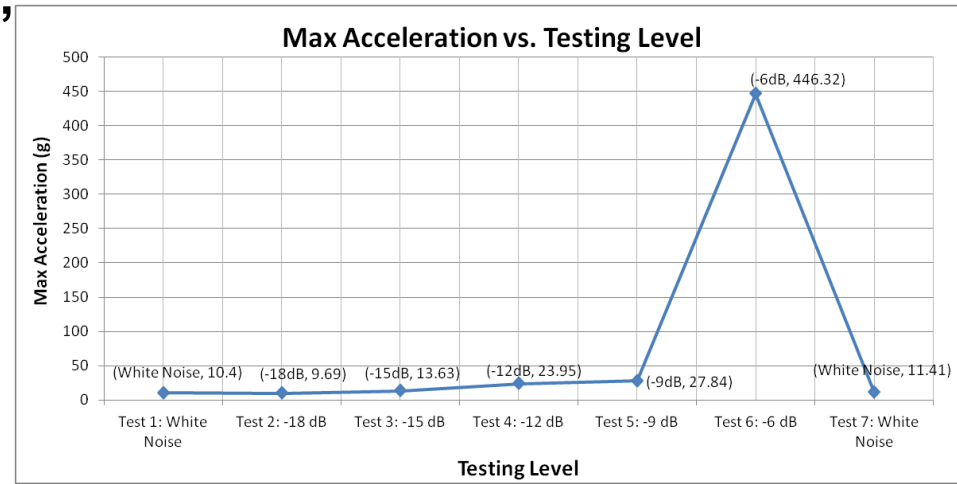




# Y-axis Testing Results

- Testing aborted at -6dB: “peening” sound heard acoustically
- Analysis of data shows a max 446.32g shock event at 13kHz originating from flexure (off-axis)
  - Corresponding natural frequency shift during -6 dB test

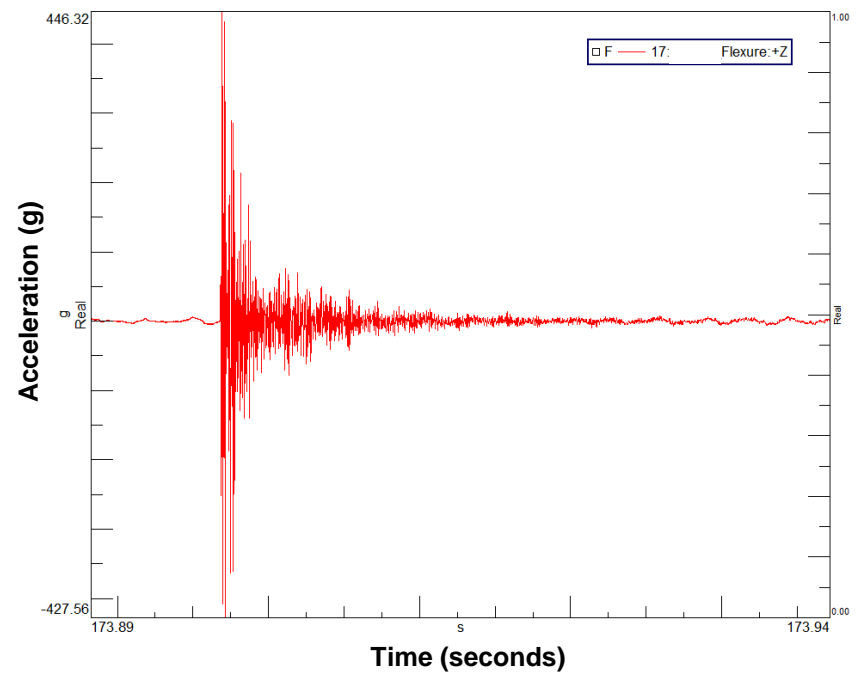
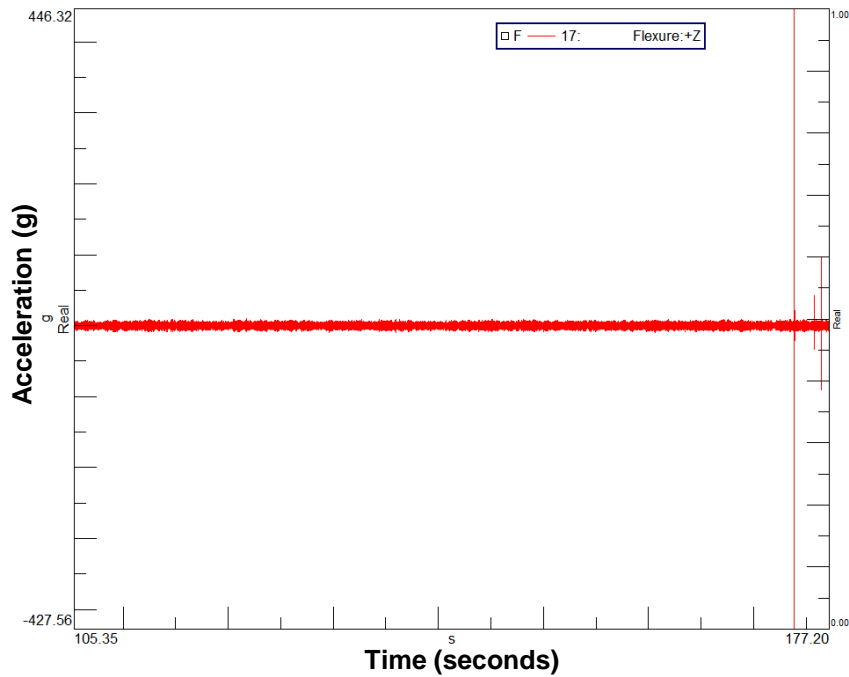
Testing Level	Natural Frequency (Hz) Ch. 17	Q Factor
Test 1: White Noise	192.5	47.97
Test 2: -18 dB	192.5	51.11
Test 3: -15 dB	192.5	50.14
Test 4: -12 dB	192.5	52.55
Test 5: -9 dB	192.5	44.99
Test 6: -6 dB	190	47.22
Test 7: White Noise	192.5	48.78





# Shock Event

- -6dB Random Input
- Shock origination: Bottom Flexure

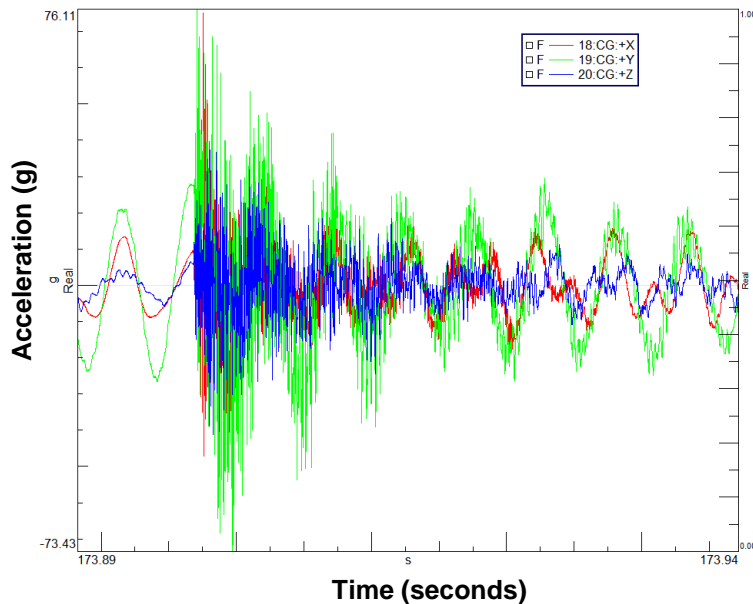




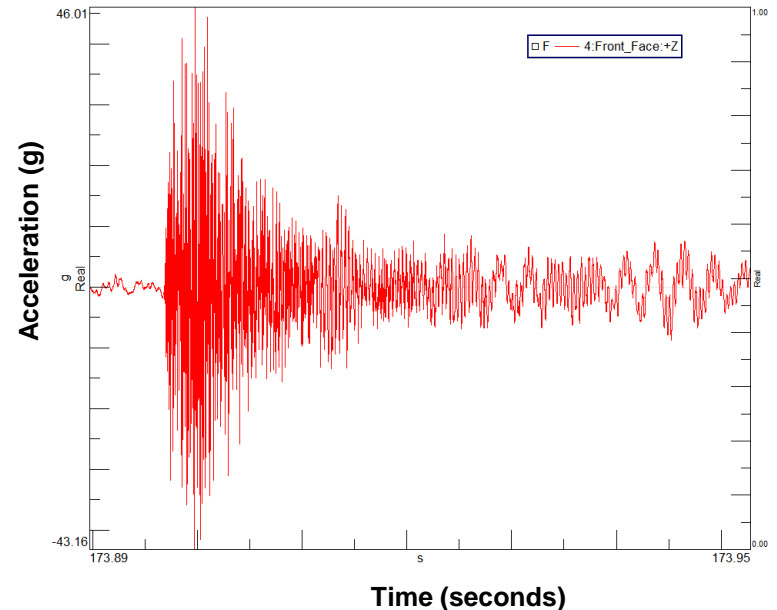
# Shock Event Response at CG and Front Face

- Ydir Input -6dB Random
- Response at CG accelerometer and Front Face accelerometer

CG Accelerometer



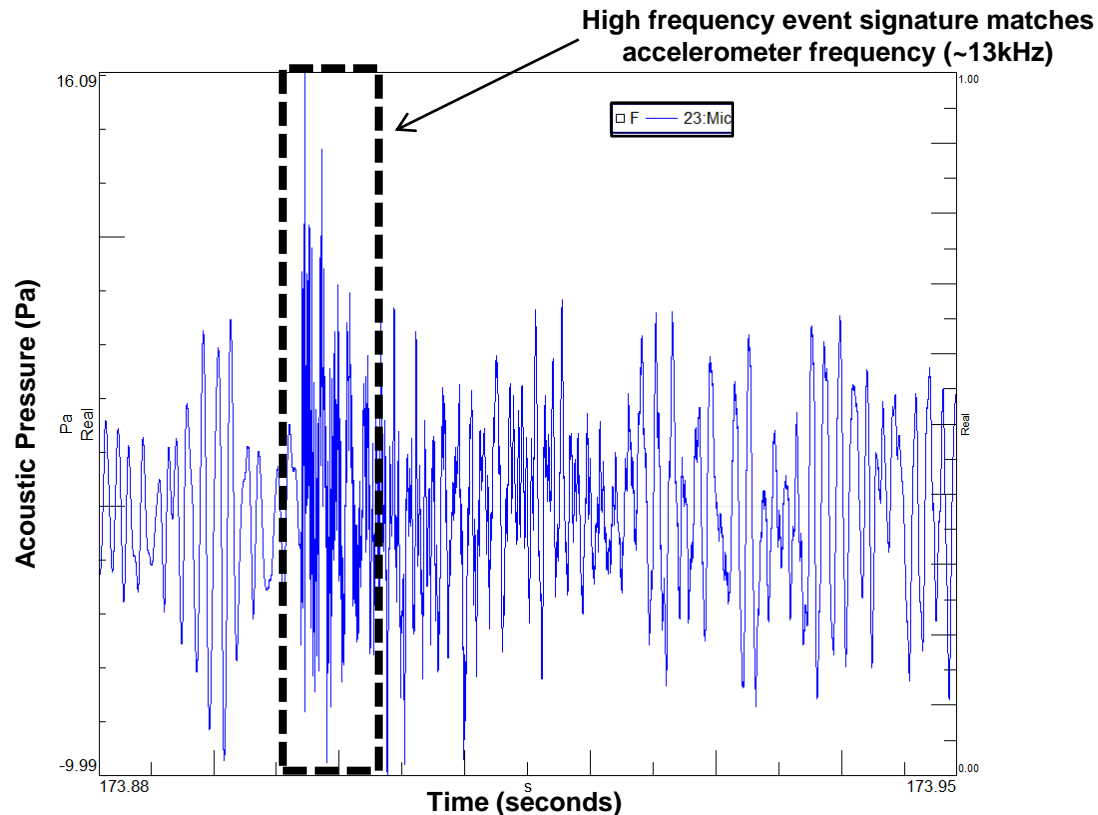
Front Face Accelerometer





# Shock Event Microphone Response

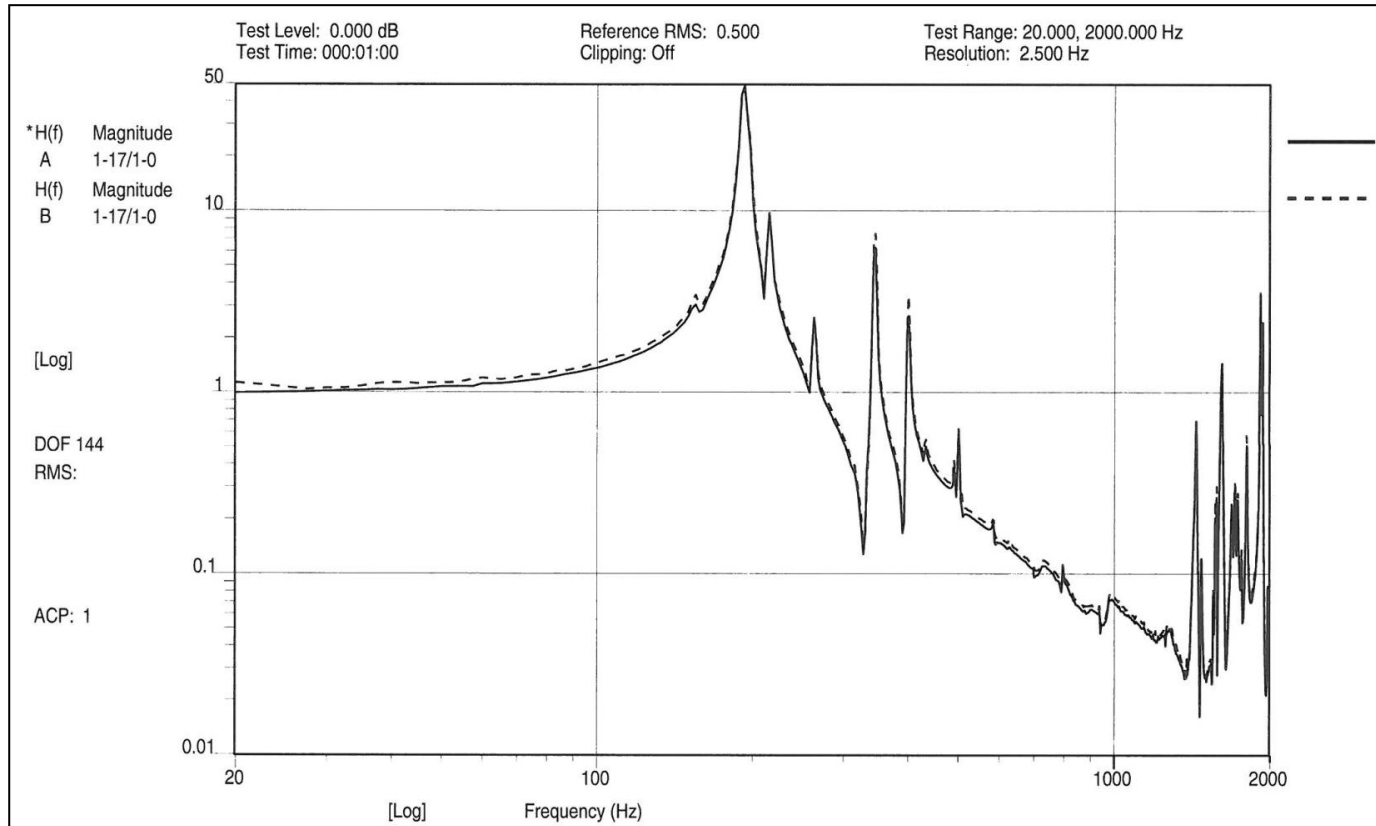
- Input -6dB Random
- Response on microphone normal to bottom flexure (channel 21)





# Pre and Post White Noise Comparison

Resonant frequencies and damping are unchanged after the shock event during vibration at -6dB







# Post Vibration Test Inspection

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- **No decisive macro-level scratching/chipping at interface of tooling balls or flexure**
- **No noticeable fractures on flexure staking**



# Solution

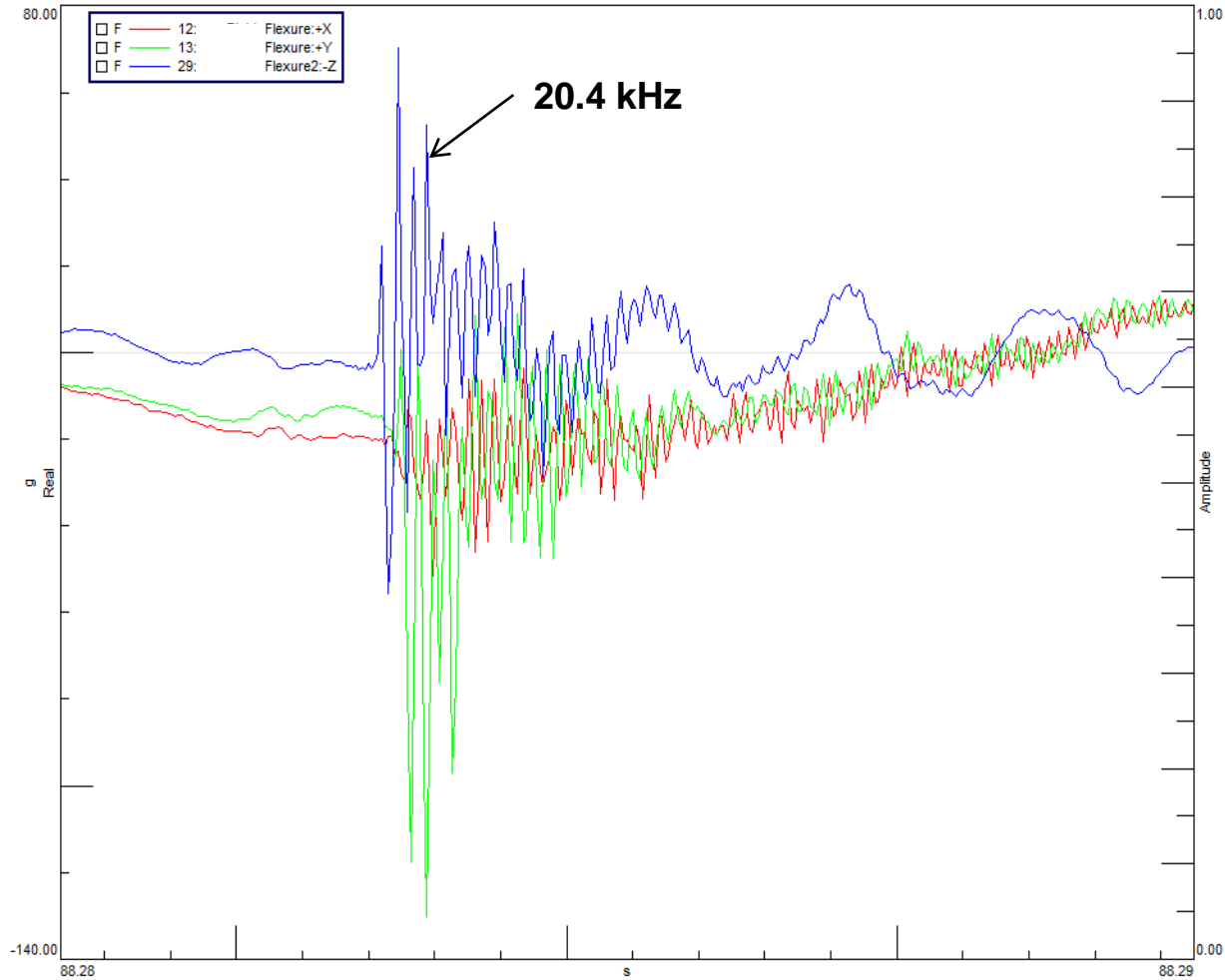
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- **System already in final configuration**
- **Not realistic to replace flexures, but needed to fix rotational stiffness**
- **Reduced shock down to acceptable levels by stiffening flexures using Constrained Damping Layer**



# Shock Event

## Shock on Flexure





# Summary

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- **Need to monitor boundary conditions**
- **Be aware of modeled stiffness vs actual stiffness**
- **Understand possible responses beyond 2kHz**