

SCSI Harbor

Rotational Vibration Test Data

1.0 inch Results

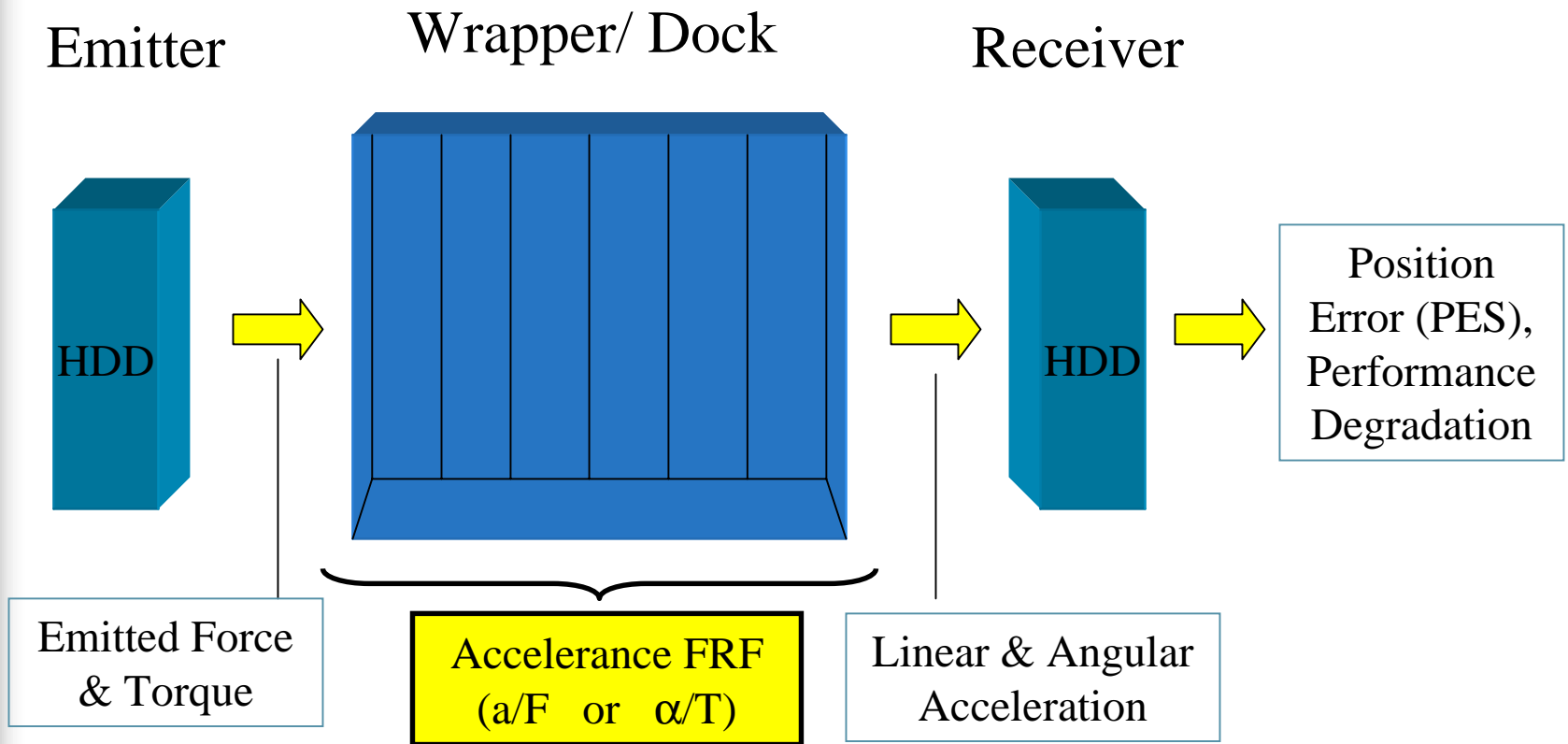


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Structural Transmission





Structural Transmission – Accelerance

- Accelerance is (acceleration/force)

- Linear: $\frac{a(f)}{F(f)}$

- Rotational: $\frac{\alpha(f)}{T(f)}$

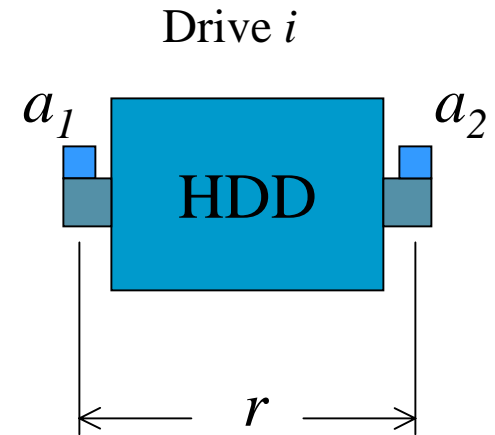
- Measurement

- Frequency Response Functions (FRFs) are measured with respect to I_{vcm}

Accelerance Measurements

■ Setup

- Measure a_1 , a_2 at each receiver
- Measure I_{vcm} at driver



$$\frac{\alpha_{ij}(f)}{I_{vcm_i}(f)} = \frac{1}{r} \cdot \left[\frac{a_{2ij}(f)}{I_{vcm_i}(f)} - \frac{a_{1ij}(f)}{I_{vcm_i}(f)} \right]$$

for receiving drive j
driven by drive i



Making Accelerance Measurements

- Choice between two methods:
 - Method 1: Use Working Drive (seeking)
 - Method 2: Use “Dummy” Drive



Making Accelerance Measurements

Method 1: Use Working Drive (seeking)

- Working under IOMeter
- + It's the real thing
 - + Mass properties and resonances are realistic
- Excitation is high at low frequencies (50-150 Hz), low at high frequencies (>200 Hz)
 - Not enough excitation at high frequencies (>1 kHz)
- Excitation is randomly-spaced bursts
 - Must do lots of averaging to get reliable measurement

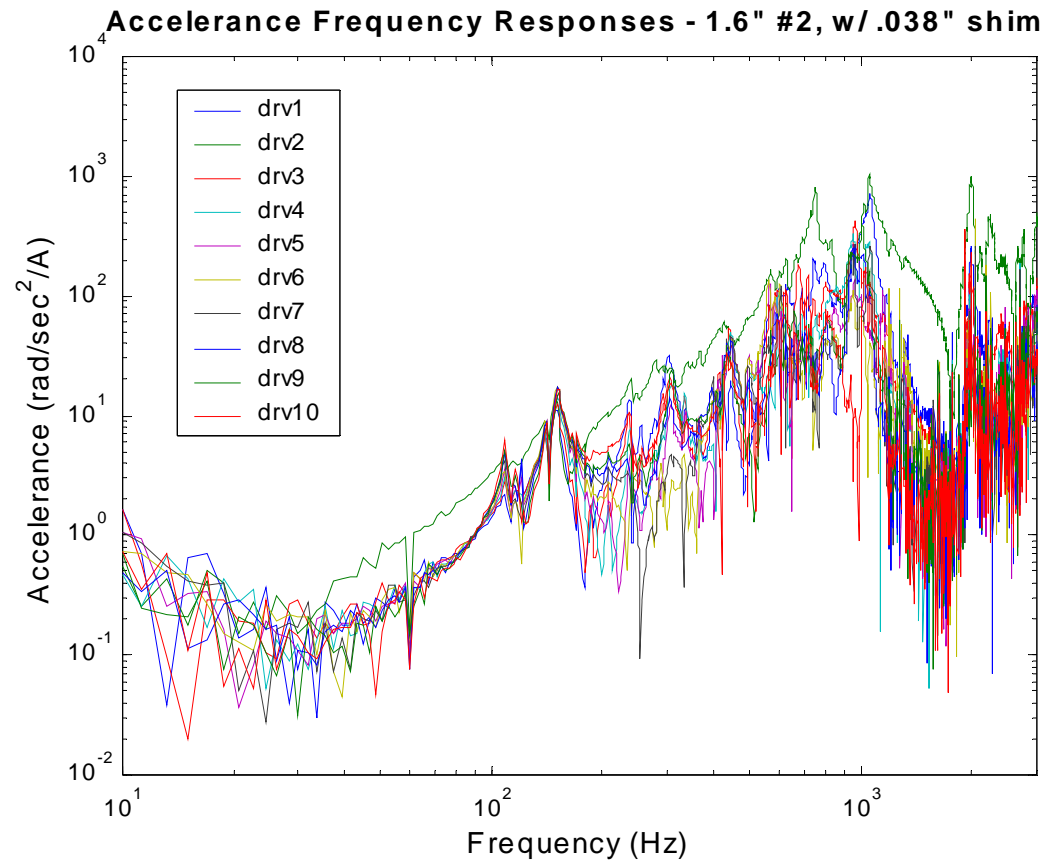


Making Accelerance Measurements (cont.)

■ Method 2: Use “Dummy” Drive

- “Dummy” drive is non-operating, disks not spinning
- VCM current in, actuator motion out
- + Can use swept sine method to improve measurement
 - + Equal input power at all frequencies
- Requires swept sine analyzer
- “Dummy” may not have same mass properties & dynamics as normal working drive

Accelerance Results

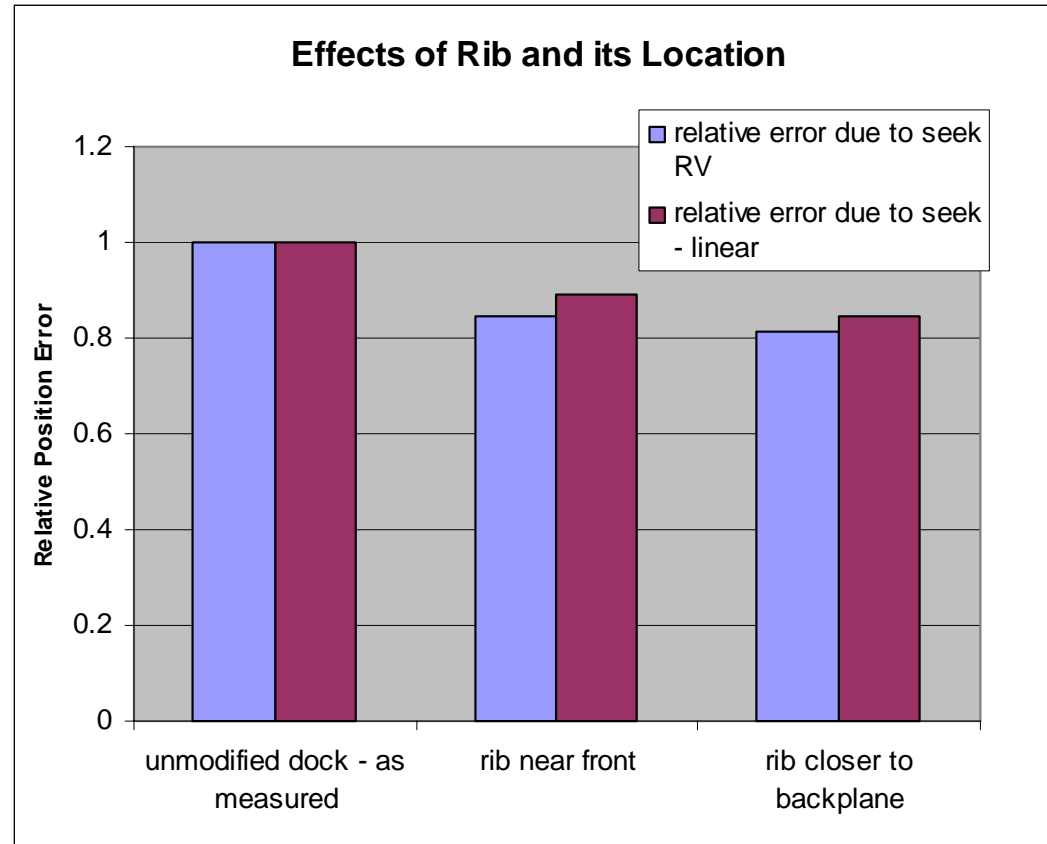




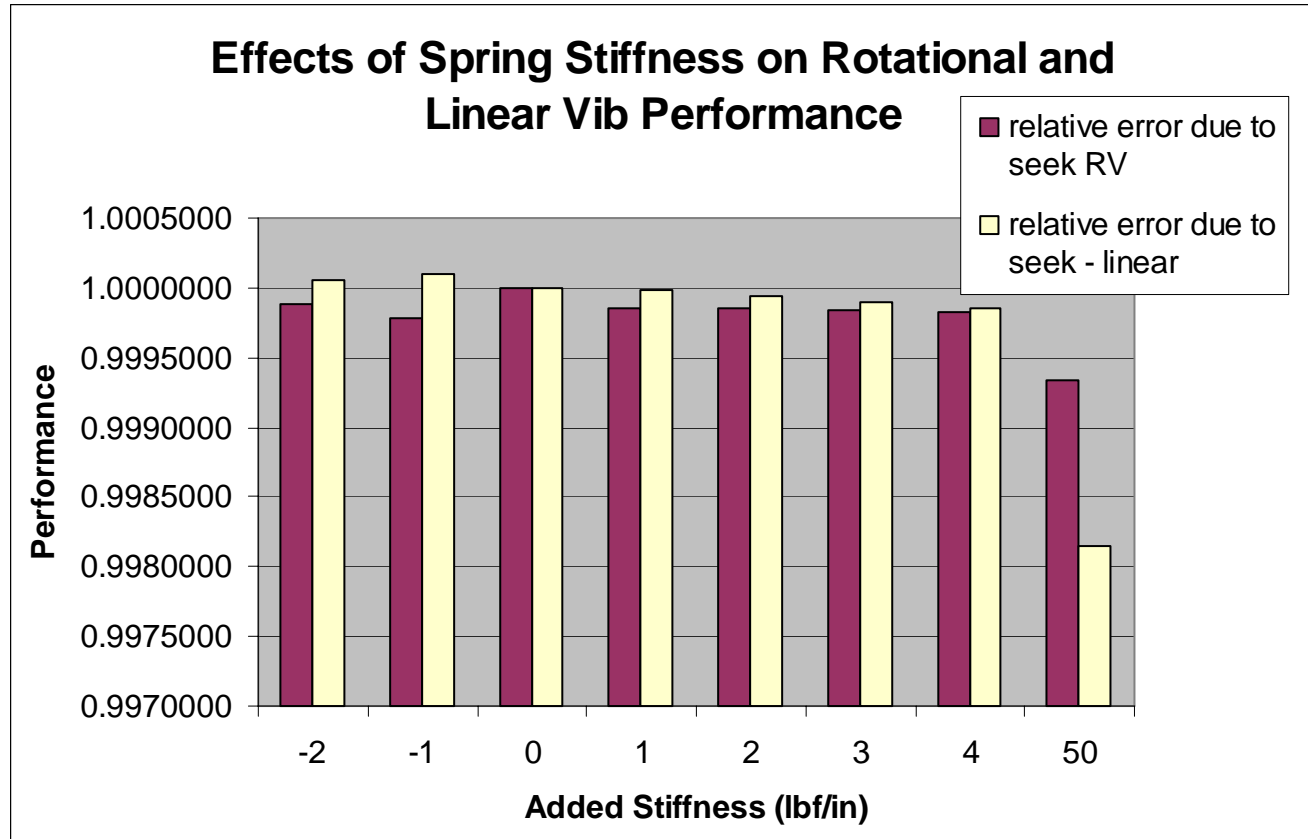
Accelerance Measurements

- Method 2 Trial (Dummy Drive) yielded suspect results
- Conclusion: Stay with Method 1 – use working drive
 - Proven
 - No additional equipment required

Adding a Rib to the Dock



Adding Spring Stiffness to the Dock

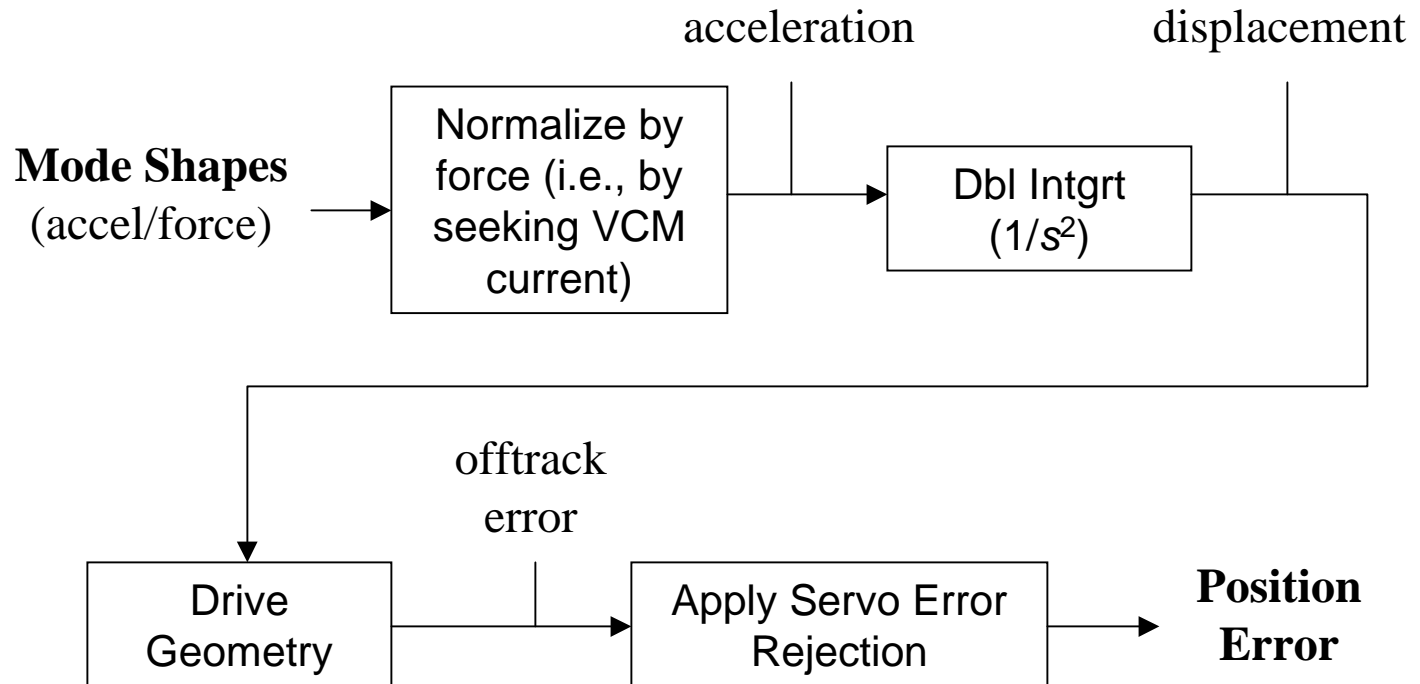




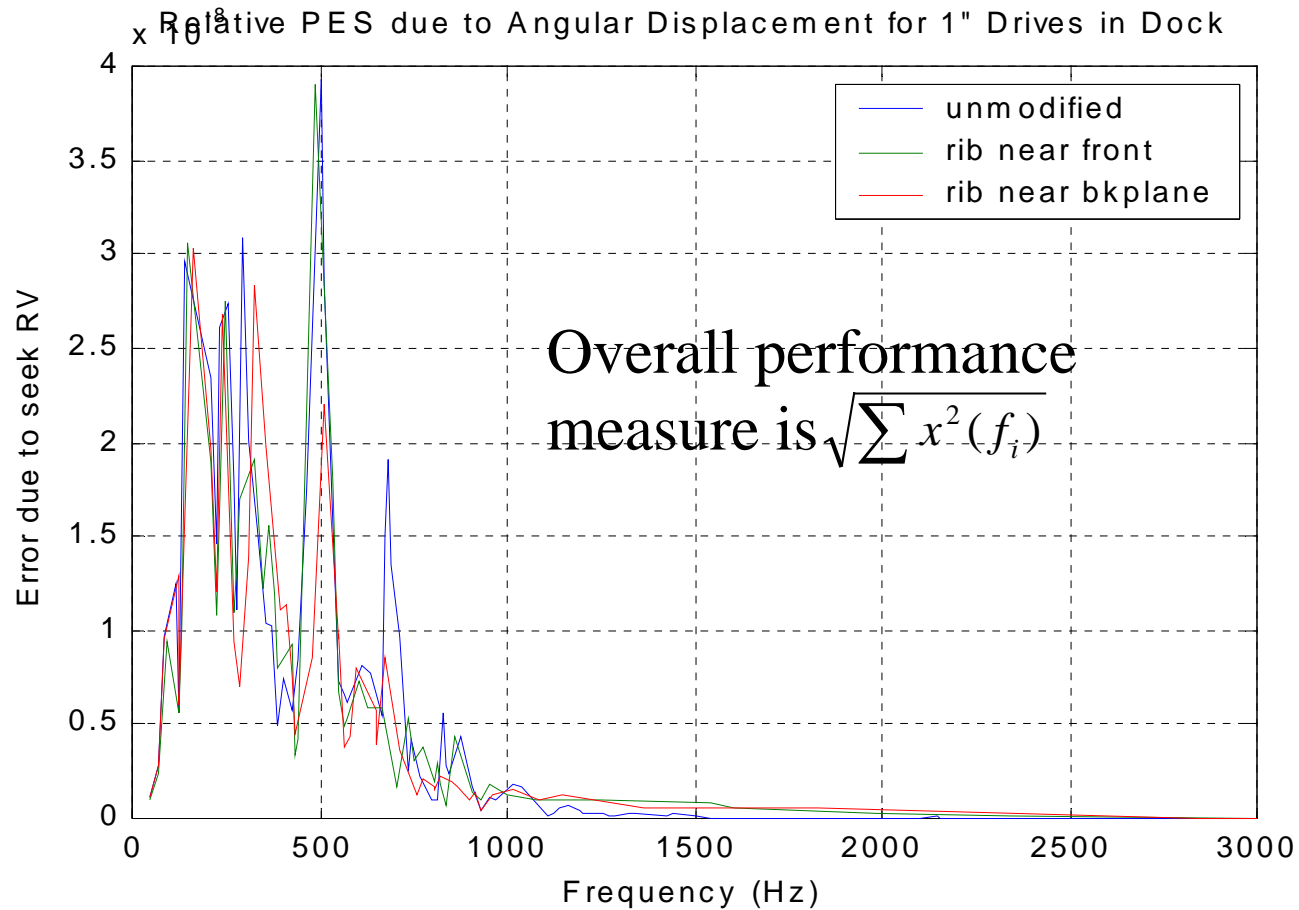
Performance Measure for Dock Design Options

- Use Experimental Modal Analysis database
- Modify “virtual structure” by adding rib, springs
- Evaluate angular and linear deflections of drives in modified structure
- Normalize motion for each mode & point:
 - By the VCM current spectrum (seeking)
 - By r_{hd}/s^2 and by Error Rejection FRF
- Compare sum of all normalized deflections for all modes & points (on drives only)

Performance Measure (cont.)



Performance Measure (cont.)





Measurement of Throughput

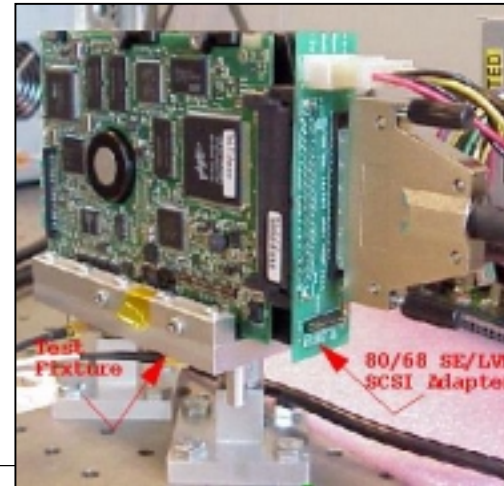
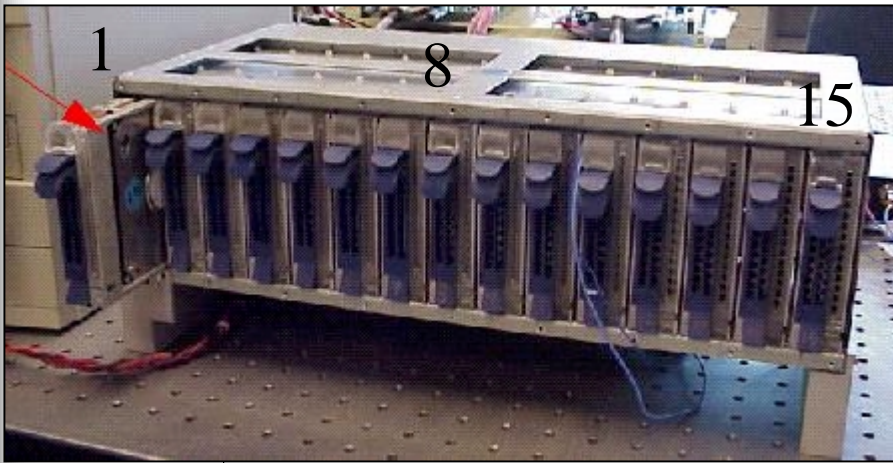
- Measure of overall dock performance
- Measure of individual slot performance
- 2 tests
 - single drive rigidly mounted to table (best case)
 - single drive seeking in dock (self-induced excitation) other drives idling



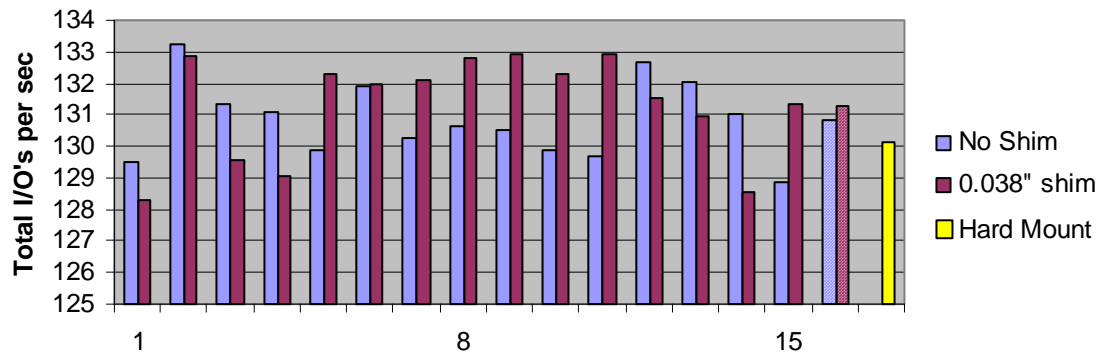
Measurement of Throughput

- Iometer software used to work drives
- 512 byte block xfers, 100% random, 100% write, (Queue depth = 4)
- 5 minute average of Total I/O's per second
- Common drive used for throughput measurements (removes drive to drive variability)
- *To properly compare results need same Iometer loads (same number of working drives)

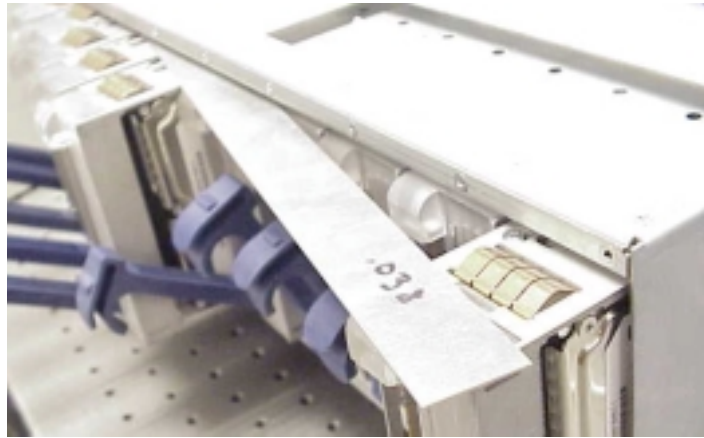
Single Seeking vs Hardmount



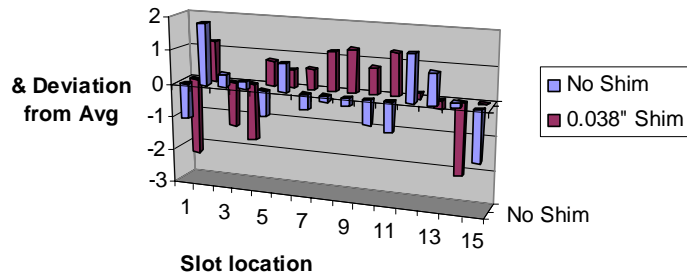
Throughput: Single Seeking vs Hard Mount
No Shim vs 0.038" shim (Stingray)



Shim vs no Shim

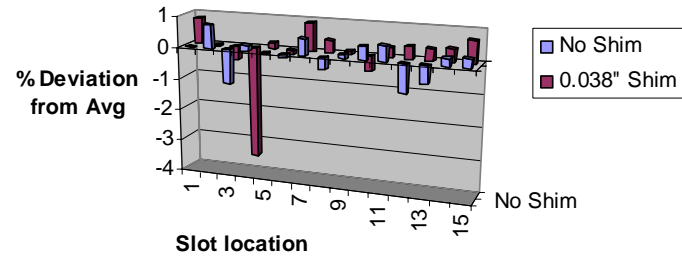


Throughput: Single Drive Seeking With vs Without Shim (Stingray)



	Avg (Total I/O's per sec)	Std Dev.
No Shim	130.84	1.24
0.038" Shim	131.30	1.65

Throughput: Single Drive Seeking With vs Without Shim (DK32AH)



	Avg (Total I/O's per sec)	Std Dev.
No Shim	135.40	0.71
0.038" Shim	135.54	1.42



Measurement of Throughput

- Differences in Hard Mount and Single Seeking throughput varied by less than 1%
- Single Seeking out performed Hard Mount half the time
- On average the Shim increased throughput by just under 1%
- Slot to slot variability (all drives working) as high as 3%, due partially to drive to drive variability
- Minor adjustments to dock can lead to significant changes in throughput