

Microphonics and Dynamic Lorentz Detuning Measurements in Medium Beta Cryomodule (a work in progress as of 25 June 2002)

Jean Delayen

JLab



Summary of main parameters

RF Measurements Summary

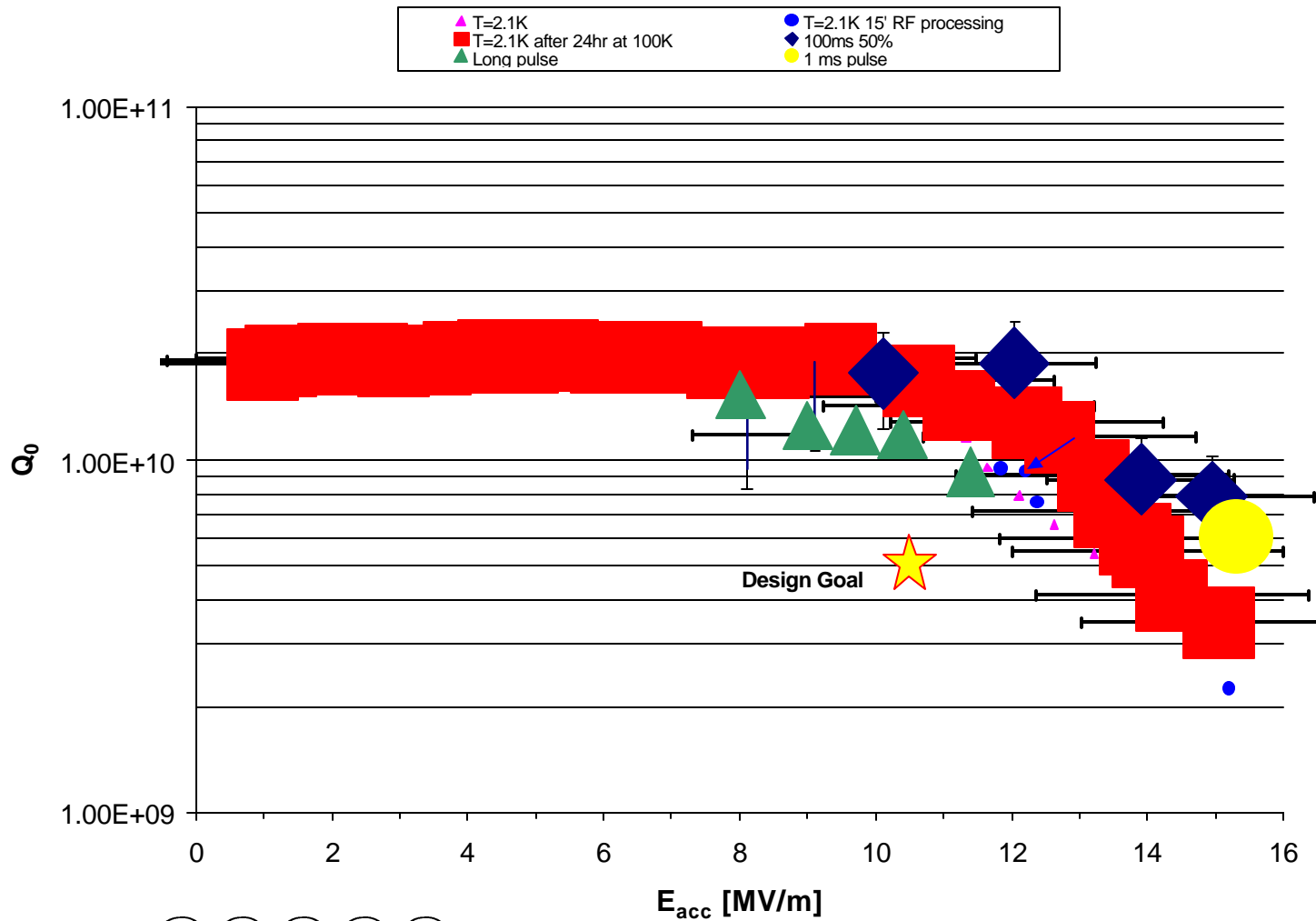
Cavity	E _{max} pulse	Q _o pulse	E _{max} CW	Q _o CW	FPC Q _{ext}	FPC max pulse power (kW)	FPC max average power (kW)	HOM
1	-	-	-	-	4.0E+05	-	-	-
2	15.9	6.0E+09	15	1.5E+10	5.5E+05	3.0E+02	1.2E+02	Damped
3	16	-	-	-	4.0E+05	4.0E+02	-	Damped
Q ext w/Stub tuner		1.0E+07	Stub tuner+iris		2.5E+08			
HOM at 2783MHz			1.4E+06	Dipole or sextupole				
Tuner range 400 kHz								
Tuner resolution 3 Hz								



Cavity #2 performance

061SNS004 with He vessel & Tuner

Q_0 vs. E_{acc}



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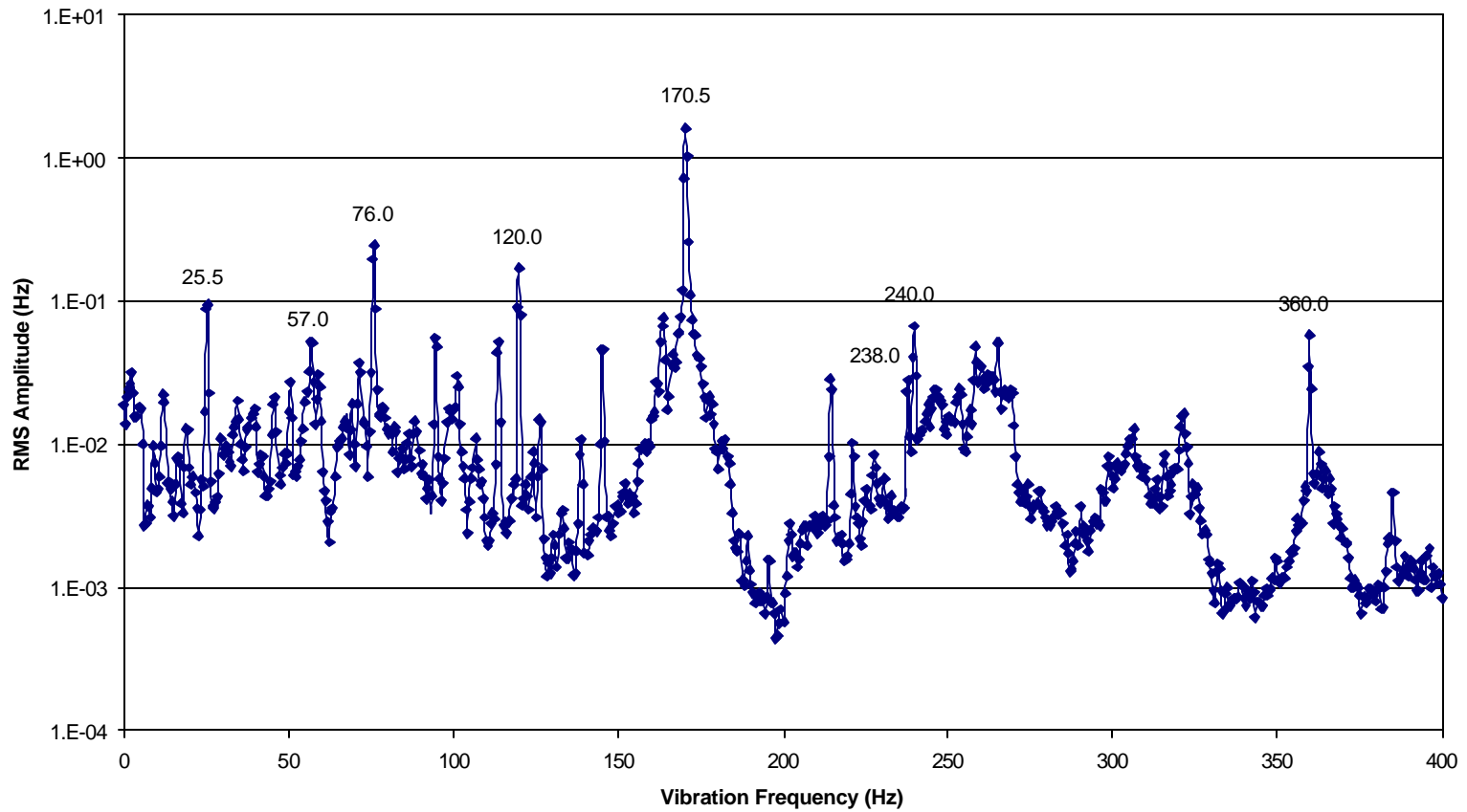
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Cavity Microphonics – Power Spectrum

Background Microphonics, Med B Cryomodule Prototype, Cavity Position 2 @ 1MV/m CW



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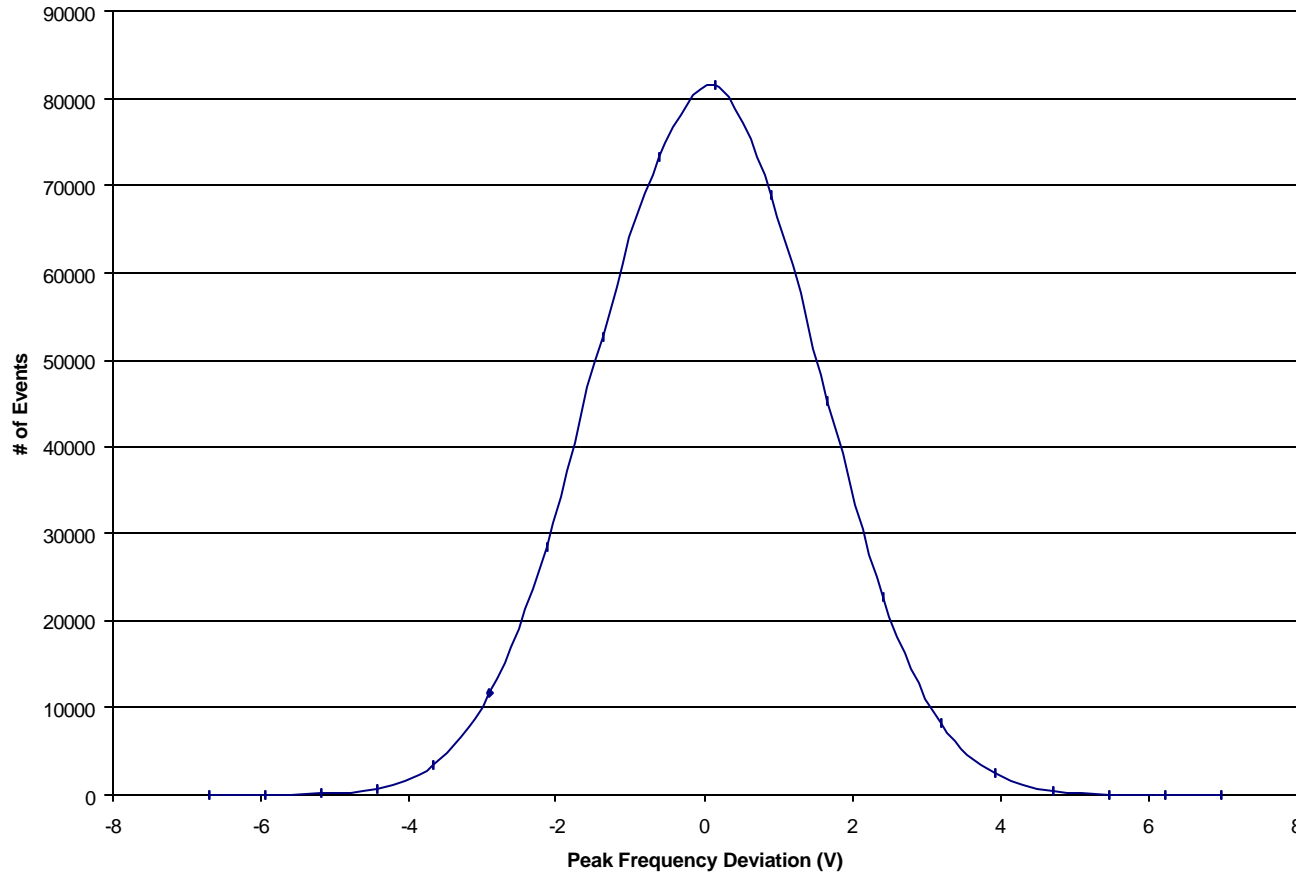
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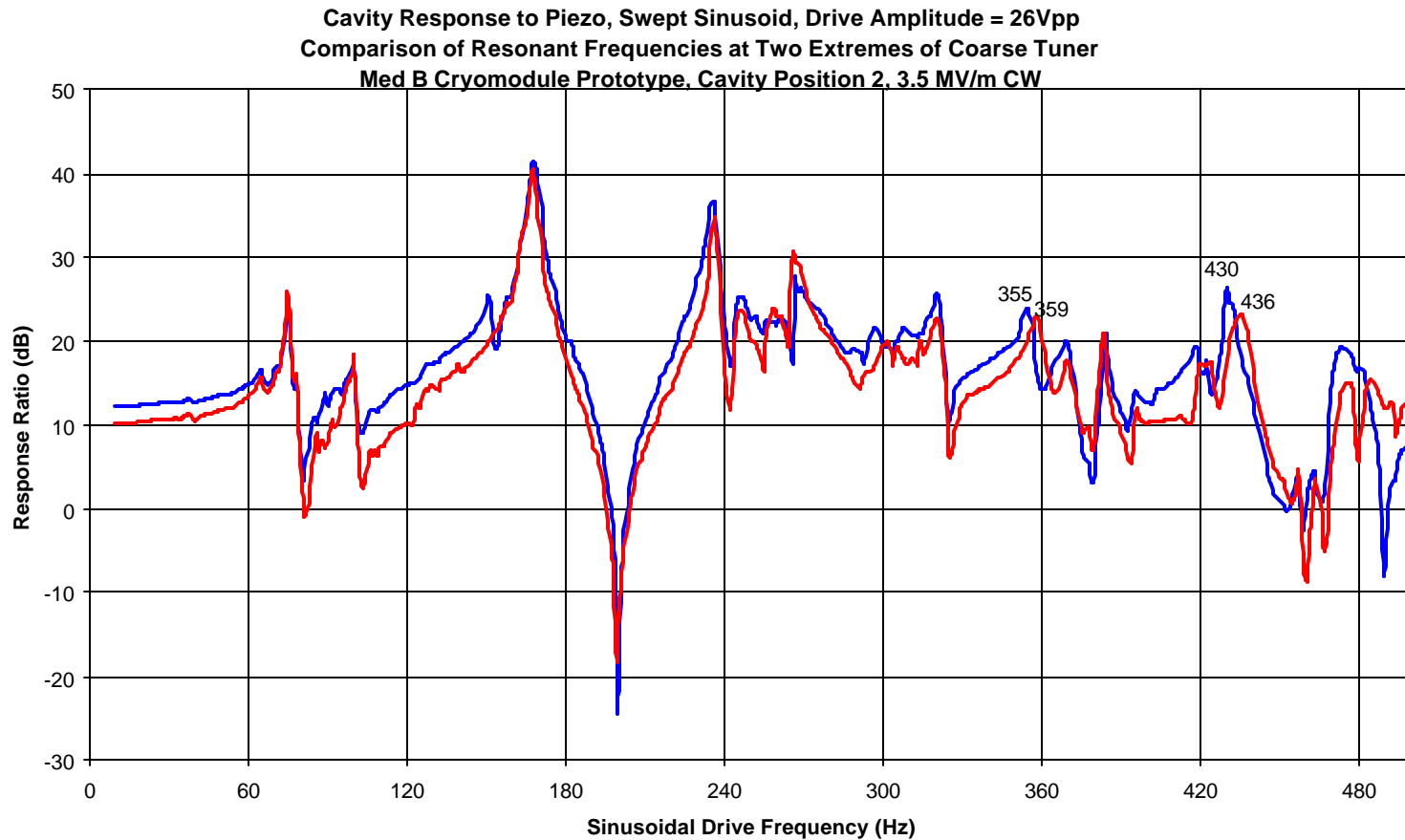
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Cavity Microphonics – Probability Density

Background Microphonics Histogram
Med B CM Prototype, Cavity #2, CW @ 6MV/m



Cavity Response to Piezo, Swept Sinusoid



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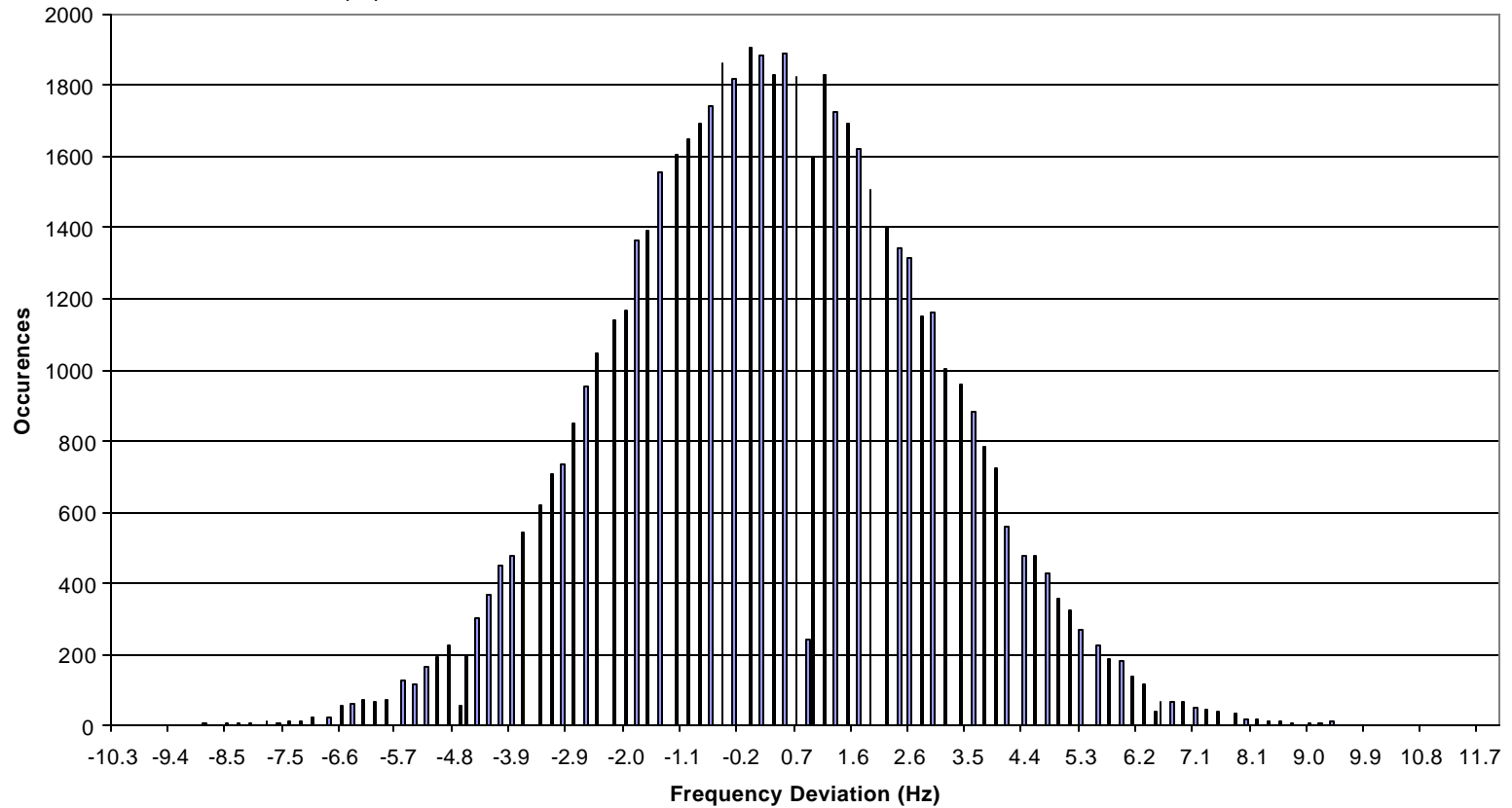
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Cavity Microphonics – Probability Density

Microphonics Histogram; Cavity Position 2; CW Operation; Piezo Energized (static)
120 seconds @ 500Samples/sec

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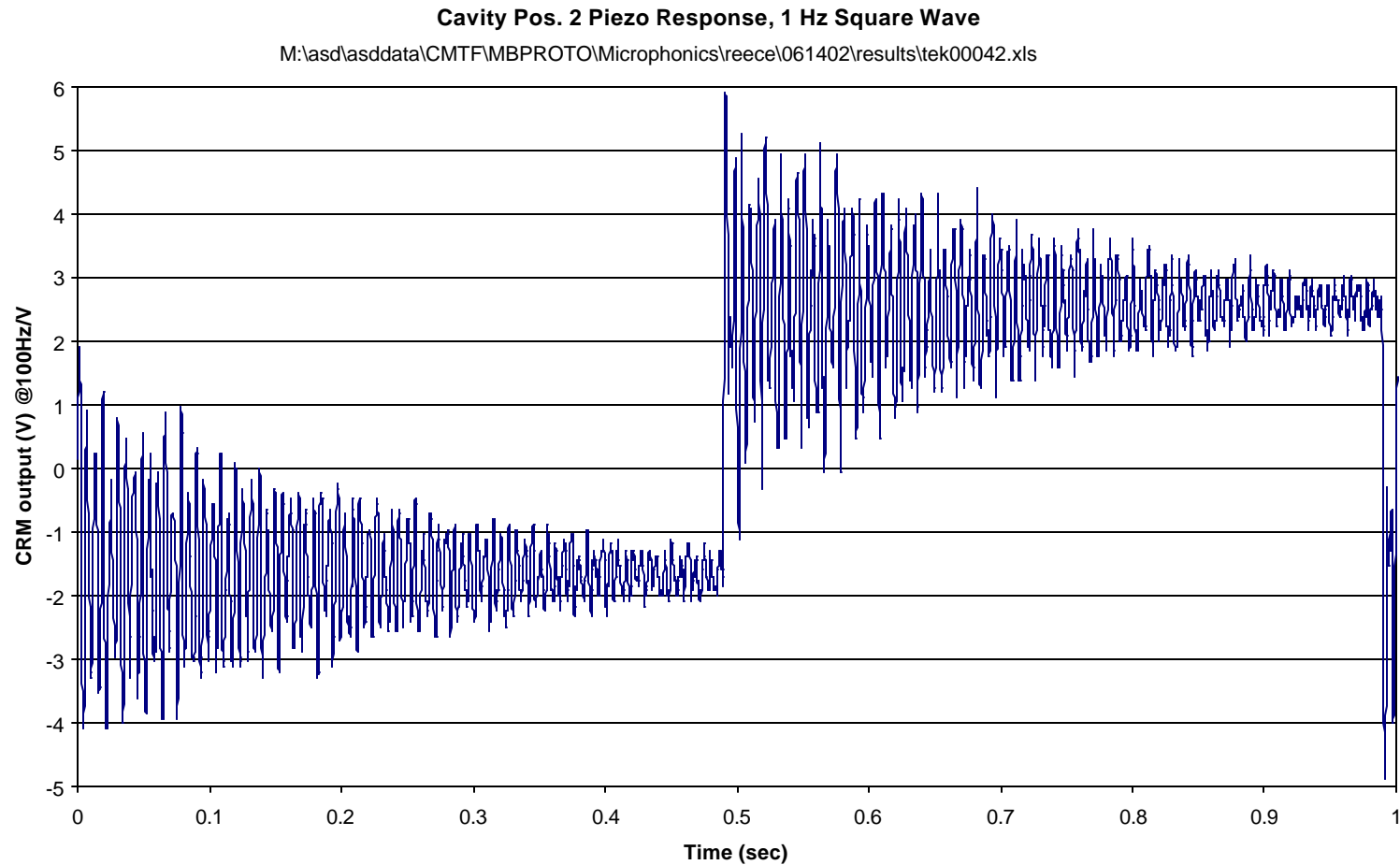
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1 Hz Square Wave Piezo Drive



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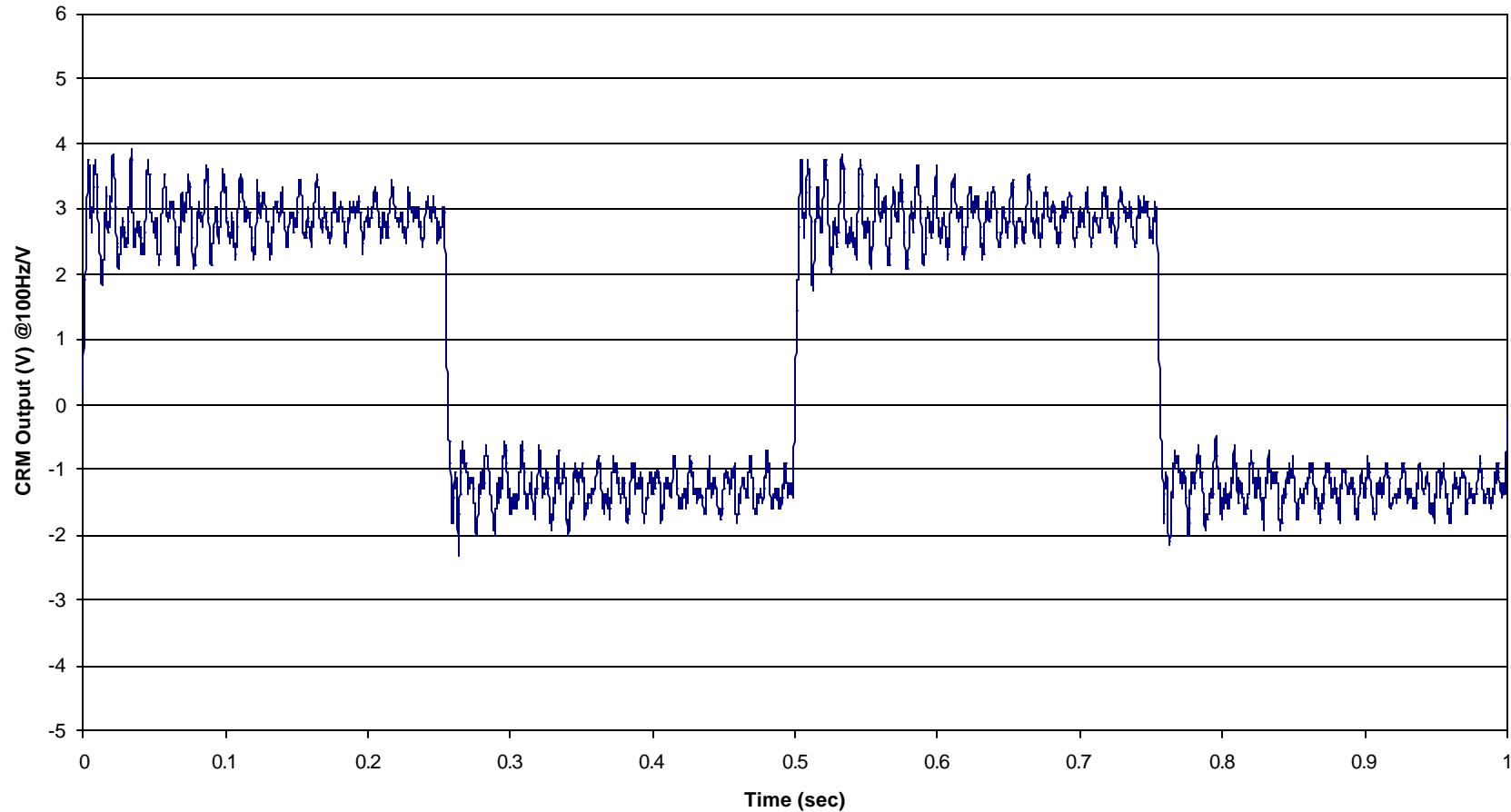
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1 Hz Trapezioidal Wave Piezo Drive

Cavity Pos. 2 Piezo Response @ 5ms rise time; 2 Hz

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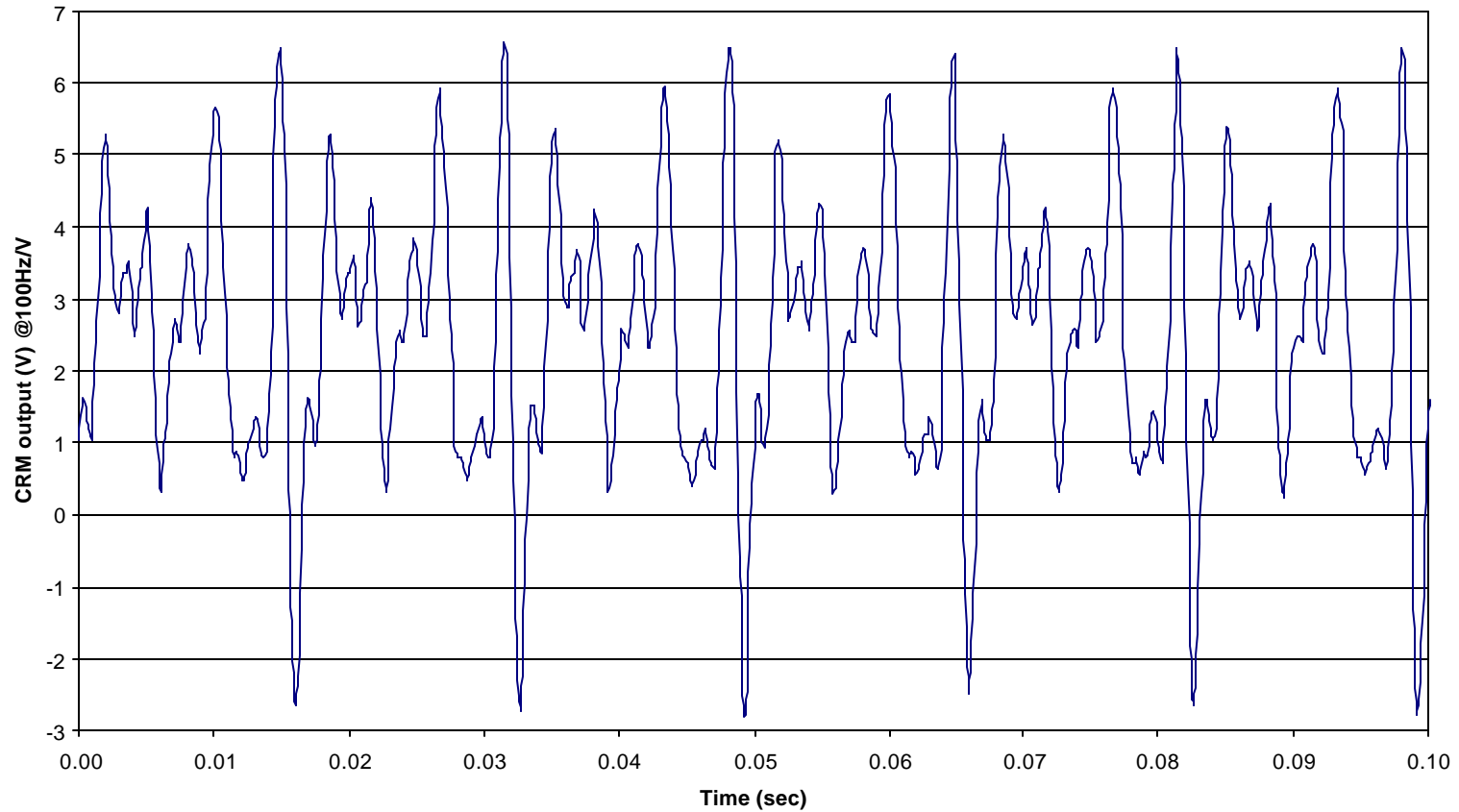
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60 Hz Piezo Drive

Cavity Position 2 Response to Piezo Pulses at 1.28 ms pulse width; 160 usec rise time; 60 Hz

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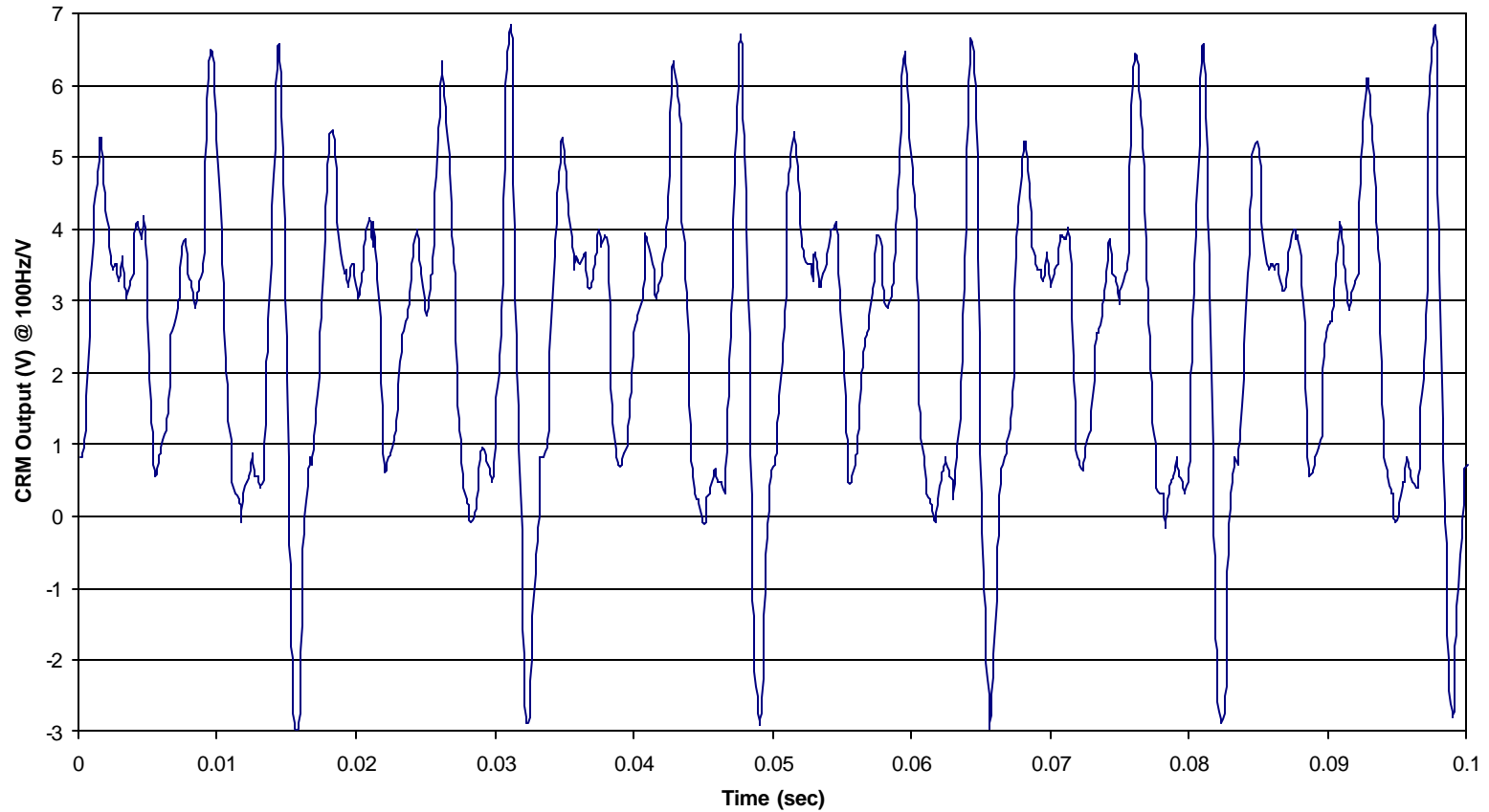
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60 Hz Piezo Drive

Cavity Pos 2 Response at 1.6 ms pulse width; 320 usec rise time; 60 Hz

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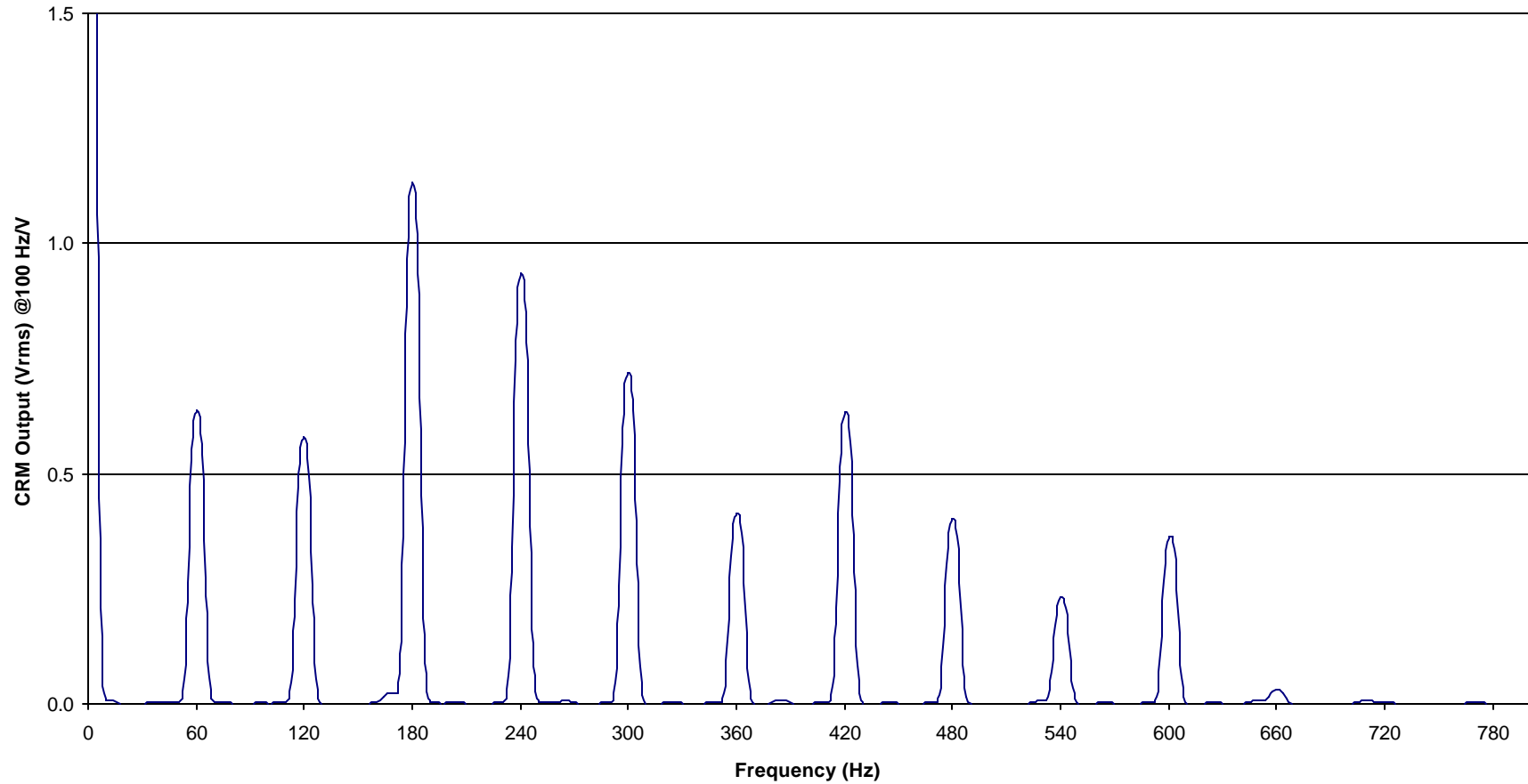
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60 Hz Piezo Drive – Frequency Spectrum

Cavity Pos 2 Response at 1.6ms pulse width; 320usec rise time, 60Hz

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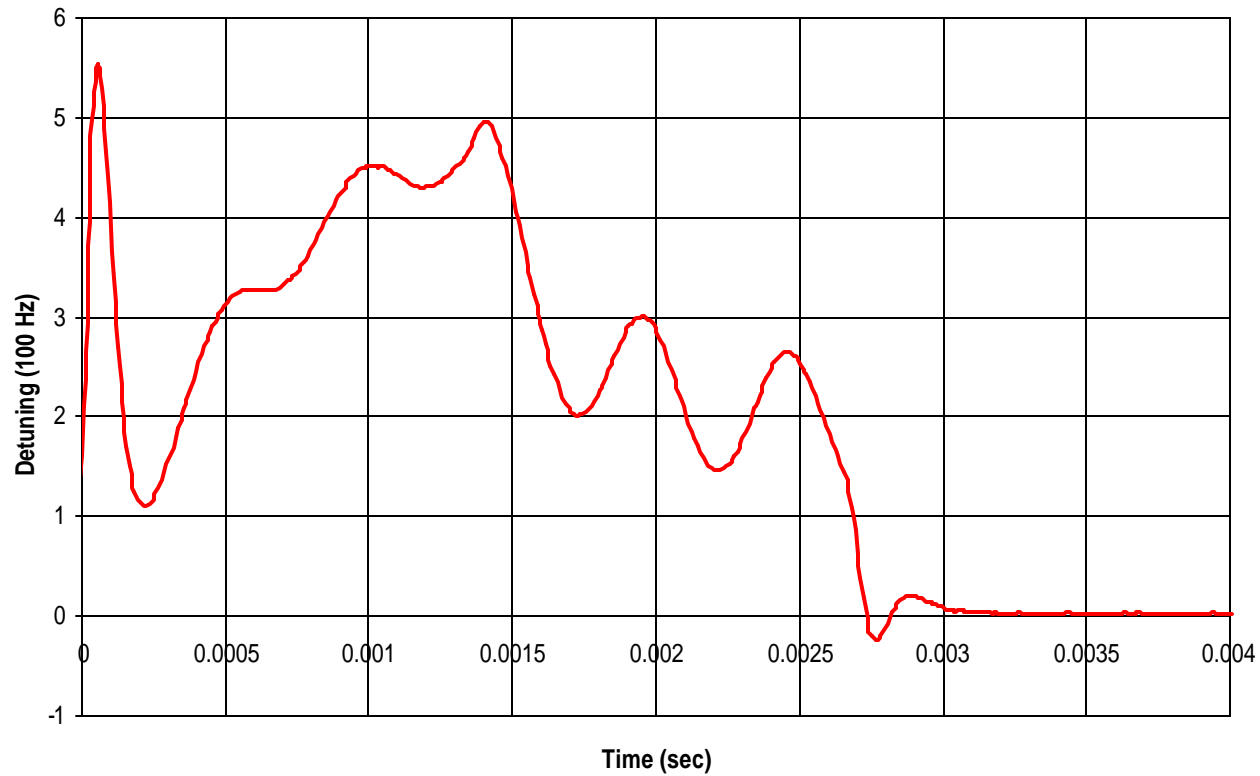
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Cavity Frequency Response to RF Pulse

Dynamic Lorentz Detuning (~11 MV/m)



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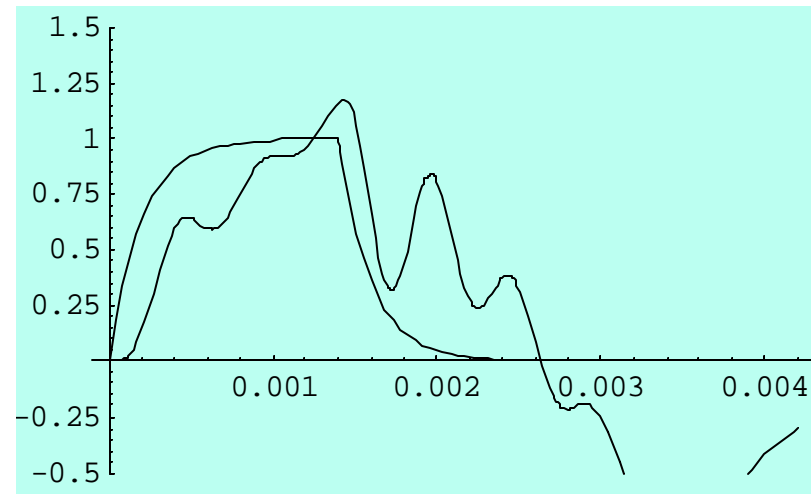
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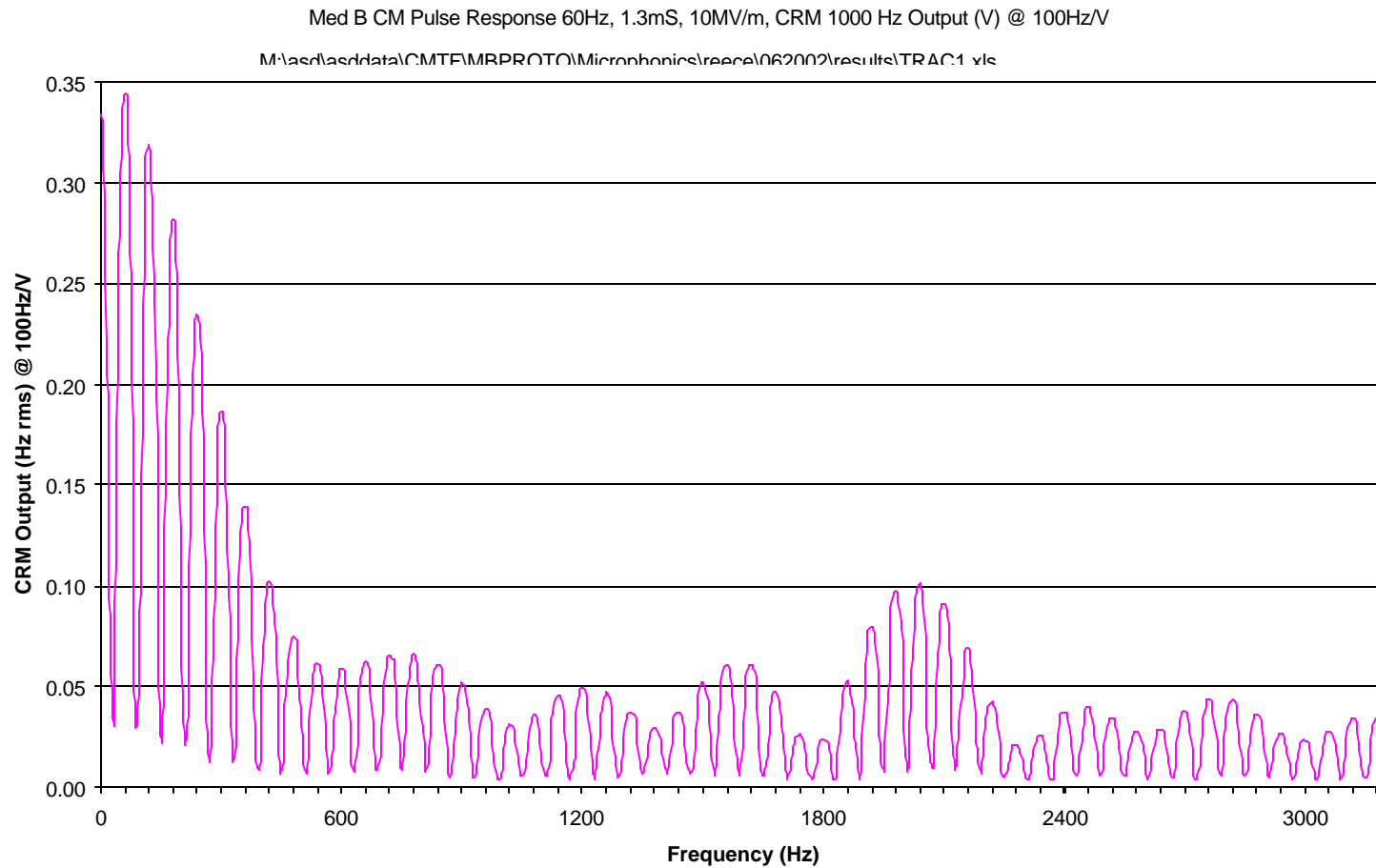
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Modeling of Cavity Response

- Mathematica model with:
- Rf pulse :1.4 msec
- Field rise/decay time: 200 μ sec
- 2 mechanical modes
 - 280 Hz, 300 msec
 - 2000 Hz, 1 msec



Cavity Resonance Monitor Output – Frequency Spectrum



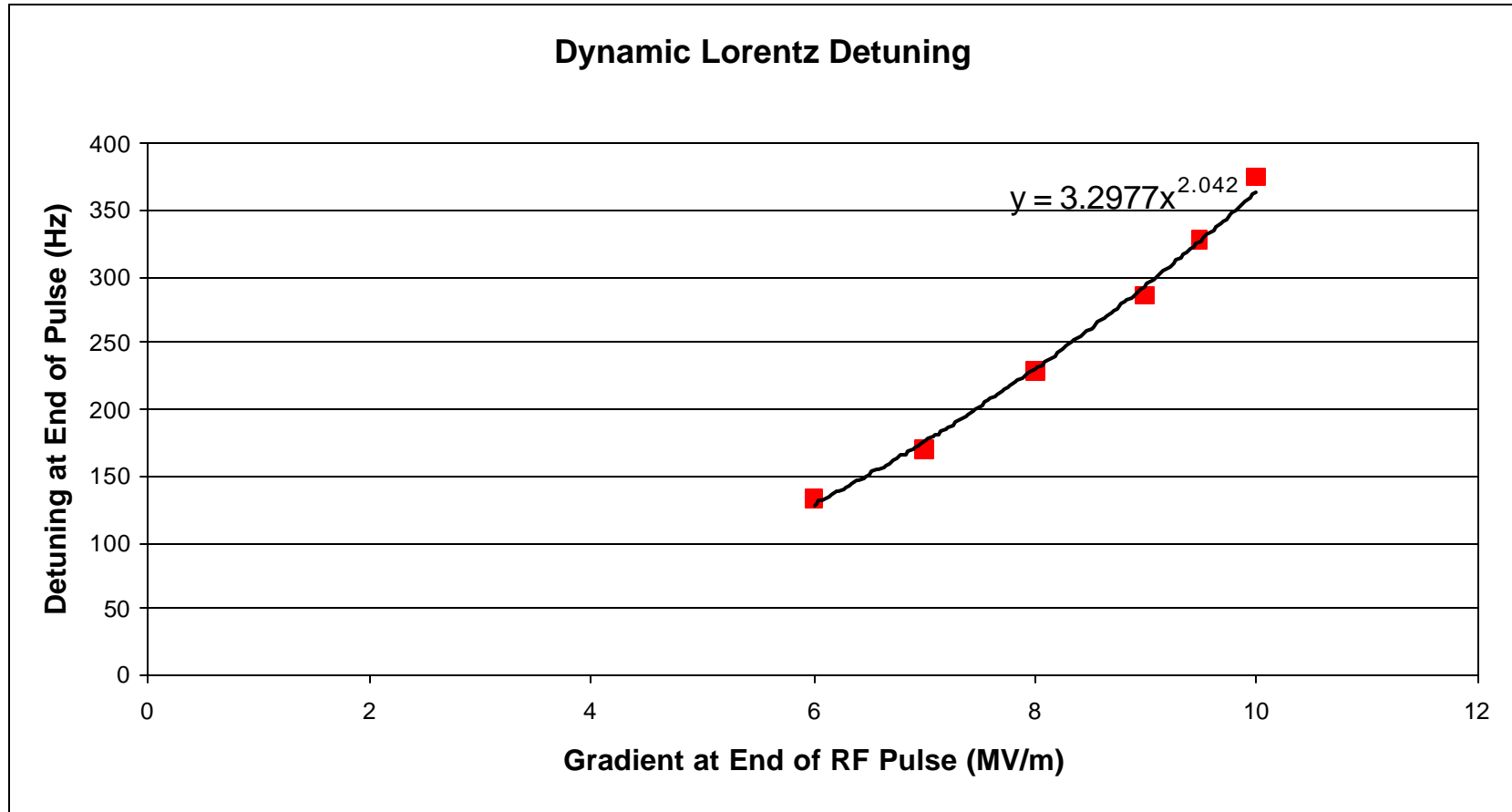
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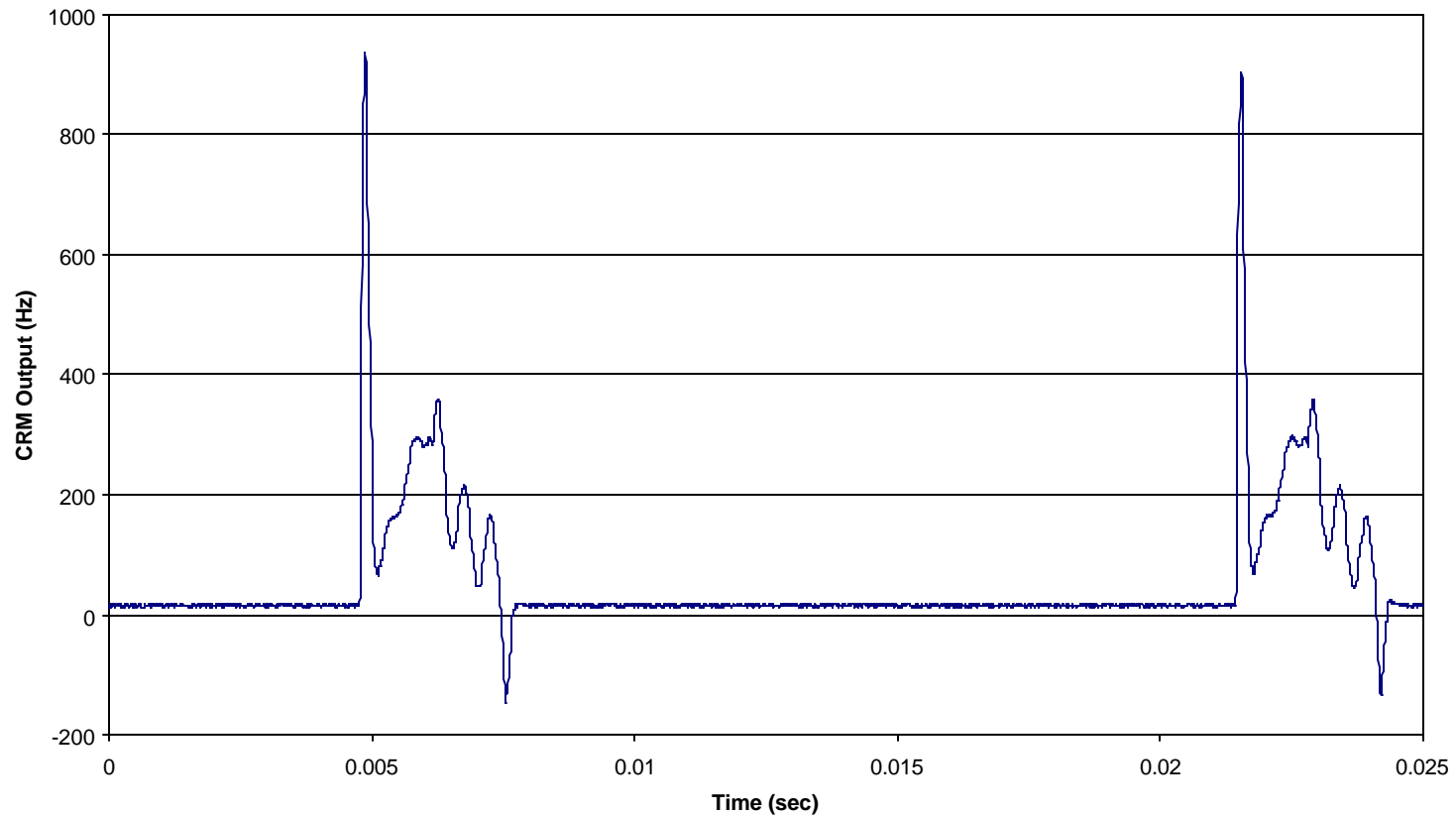
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Dynamic Detuning vs Gradient



60 Hz Cavity Frequency Response

Cavity pos 2 @ 10 MV/m, without piezo compensation



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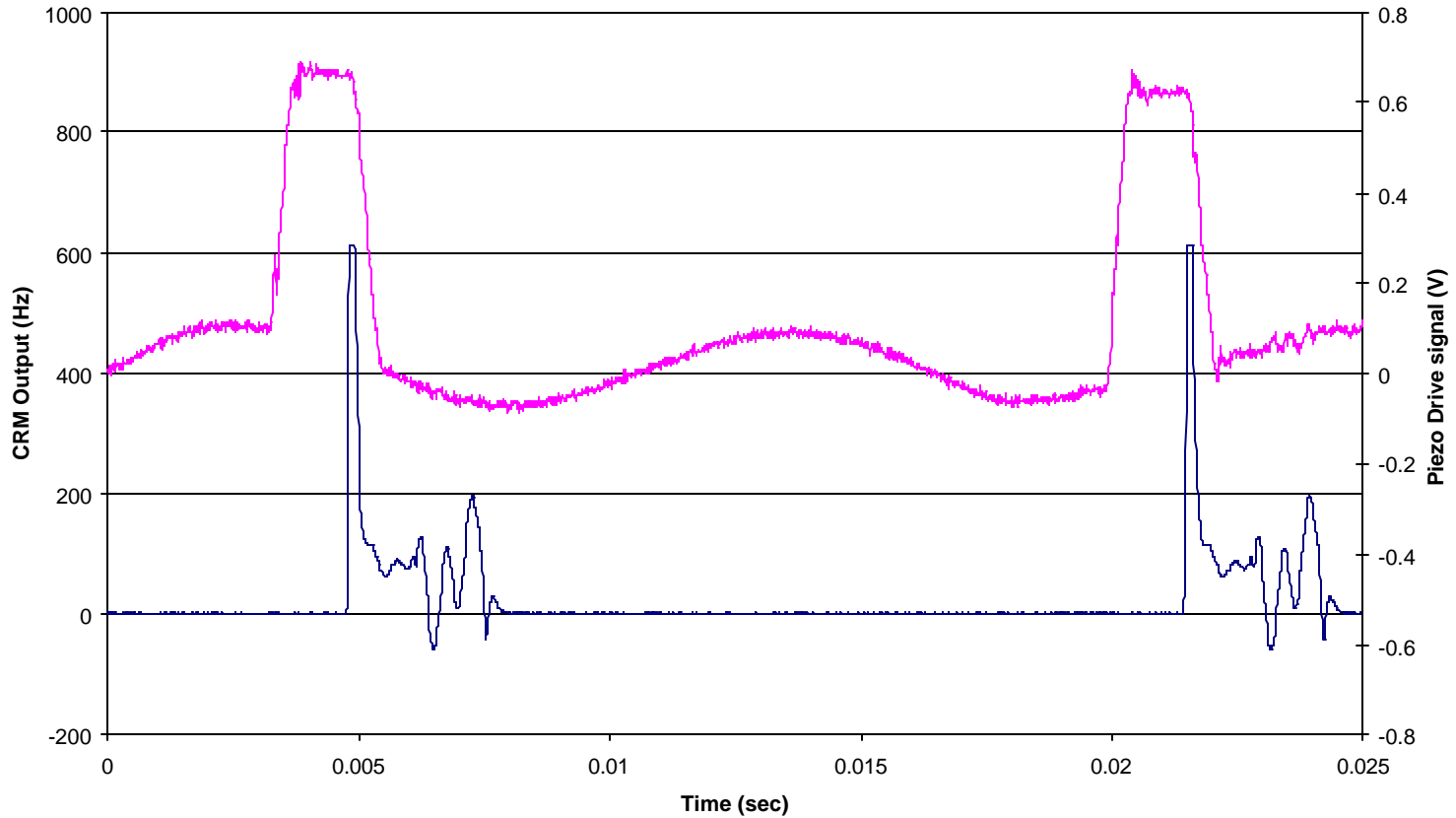
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Response with Piezo Compensation

Cavity pos 2 @ 10 MV/m, using piezo compensation



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