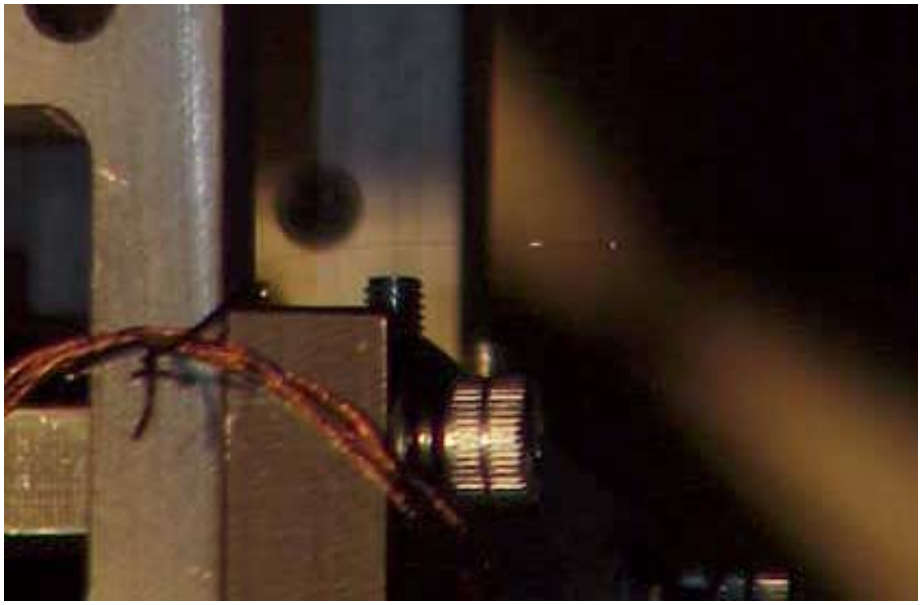
ENVIRONMENTAL DISTURBANCES (INCLUDING S1 - STOPPERS)

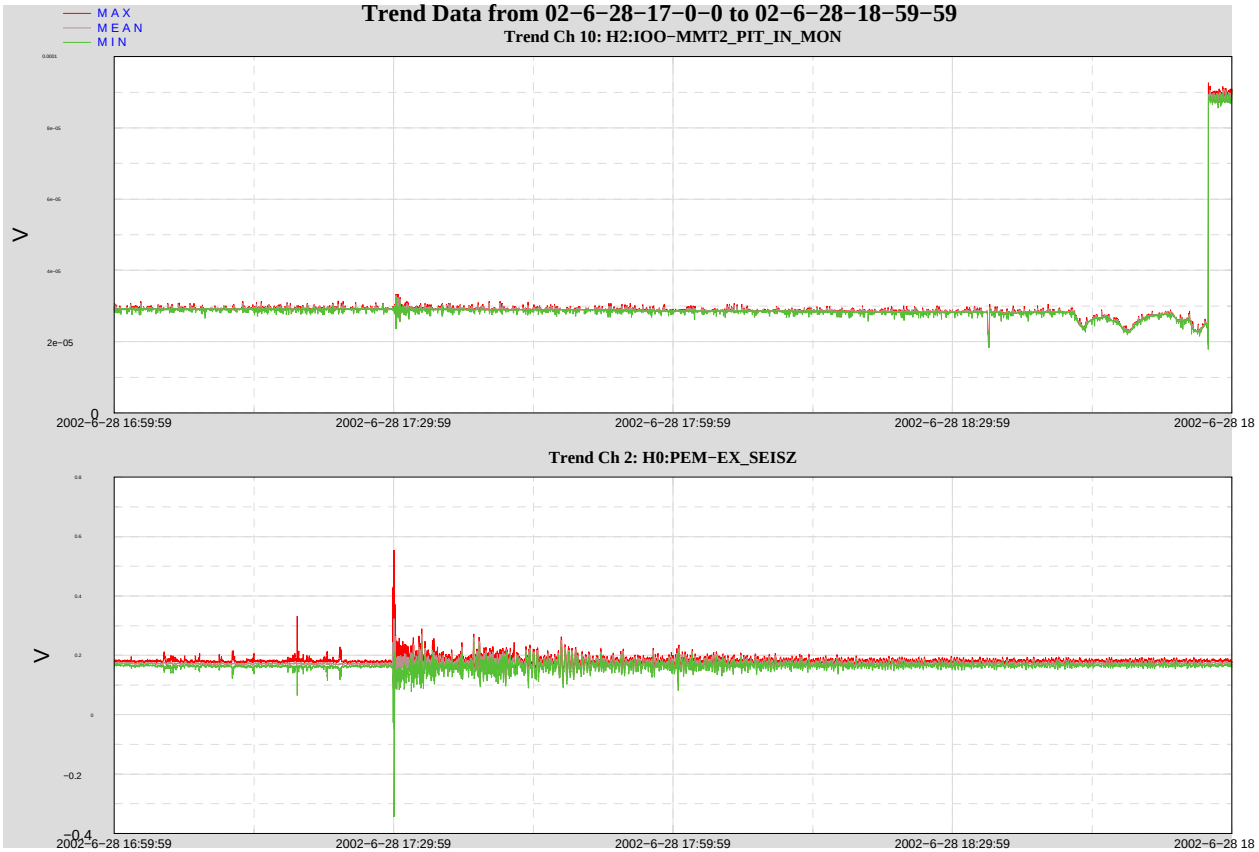


Robert Schofield (Oregon)

E. D'Ambrosio (CIT), D. Cook (LHO), R. Drever (CIT), V. Sannibale (CIT), B. Bland (LHO)

Final Two Hours of MMT2 Suspension

Top: MMT2 Pitch; Bottom: EX seismometer



Quake **Yaw Bias Drift** **Drop**

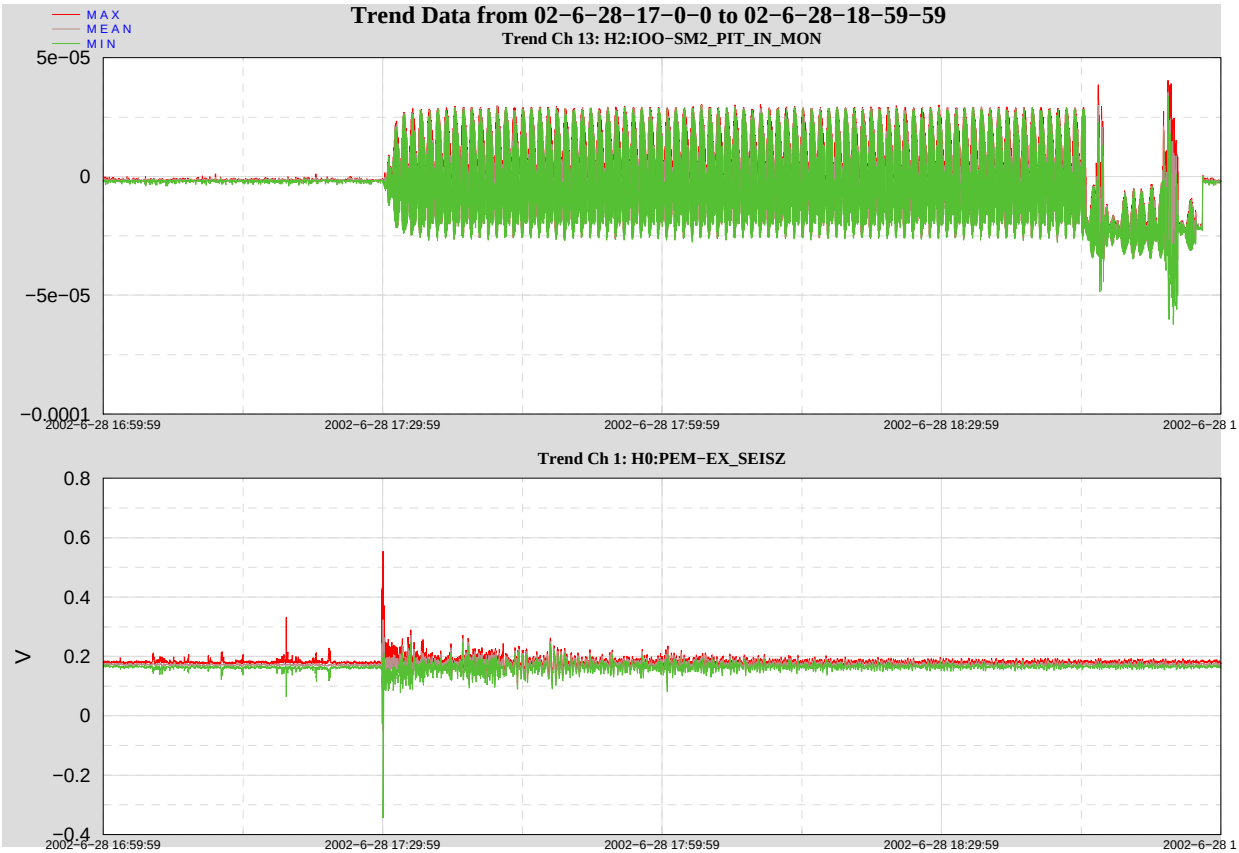
Optic recovered from Russian-Chinese quake.

Also, nearby optic MC2 was steady during final motions of MMT2: any mechanical jolt would shake both

Quake Rings Up SM2

Same time period as shown previously for MMT2 pitch

Top: SM2 pitch; bottom: EX seismometer

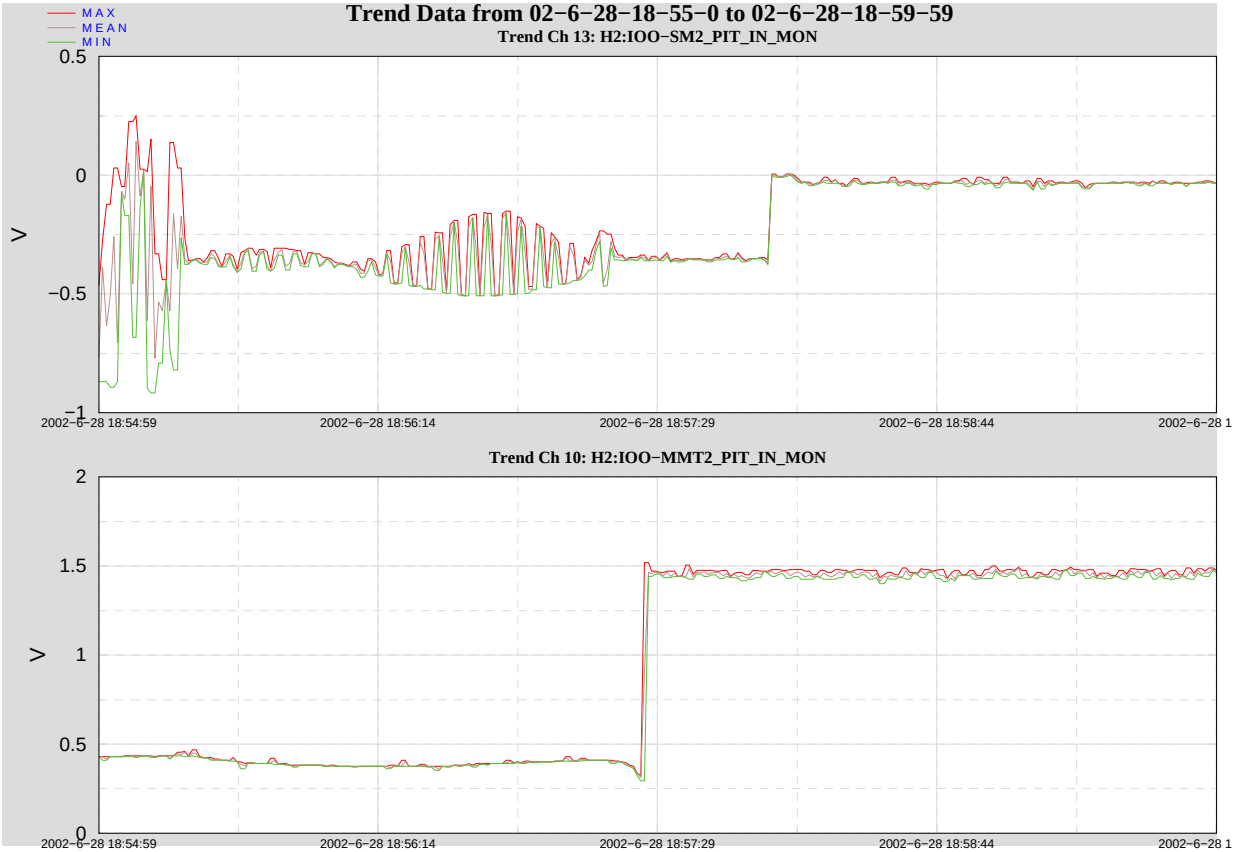


Quake **Josh Quiets**

SM2 Pitch During Final Moments of MMT2

5 minute time span

Top: SM2 pitch; bottom: MMT2 pitch



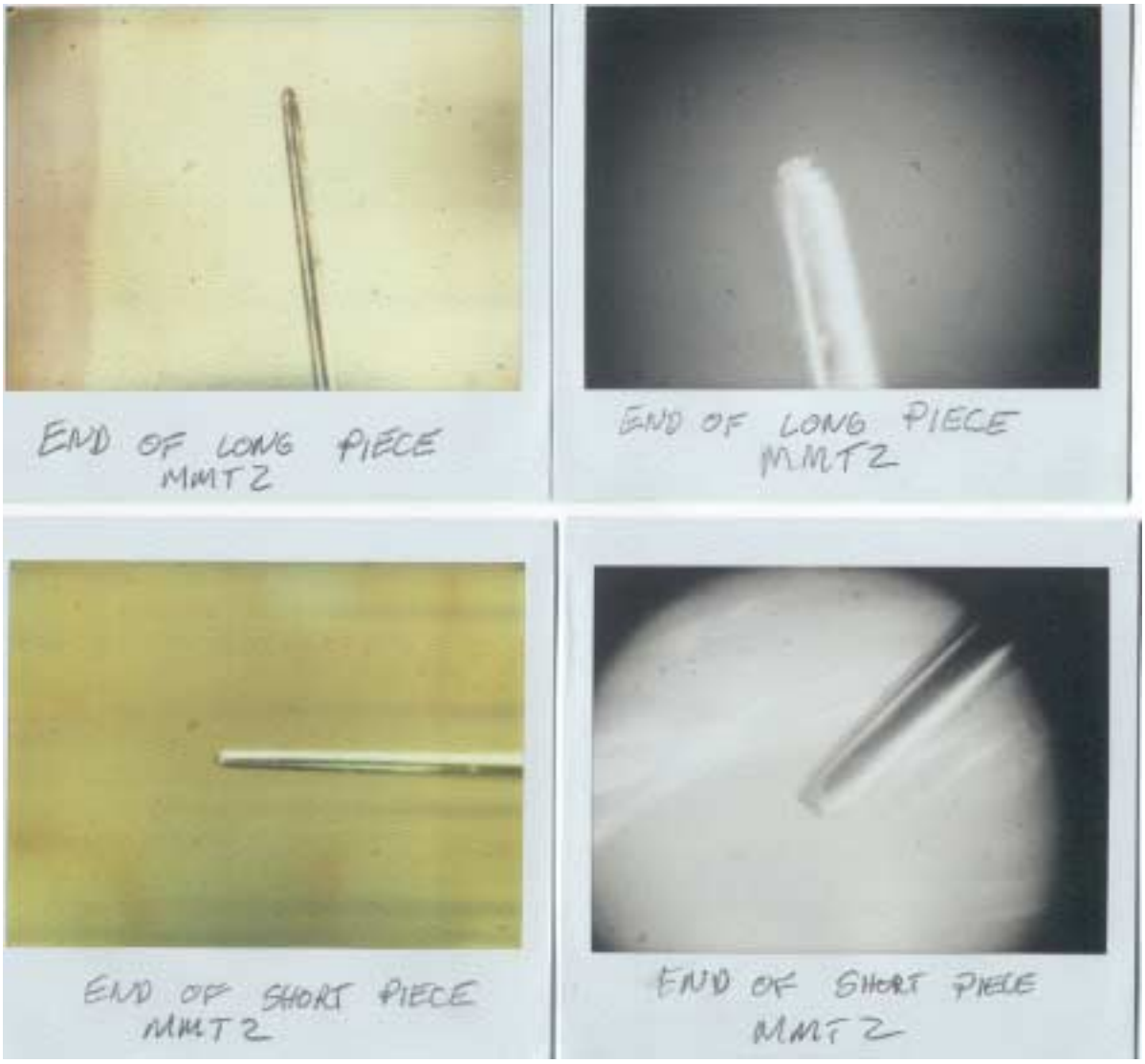
Drop

- **SM2 stabilized about 5 seconds before MMT2 drop**
- **MMT2 pitch-drift accelerates seconds before drop**

Not suggestive of sub-second wire melt.

Ends of Broken MMT2 Wire

Top row: long piece; bottom row: short piece

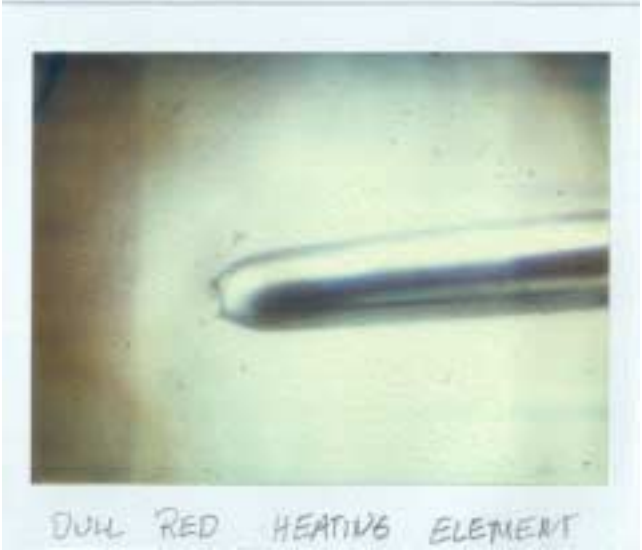


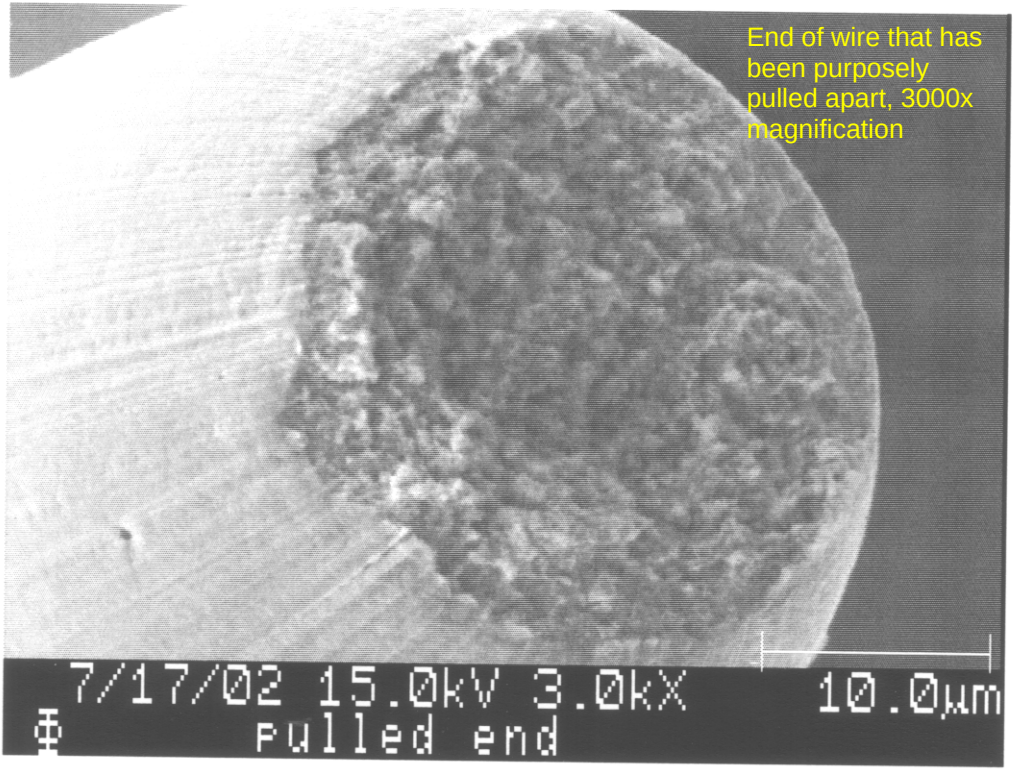
Ends appear rounded; thin film colors near break.

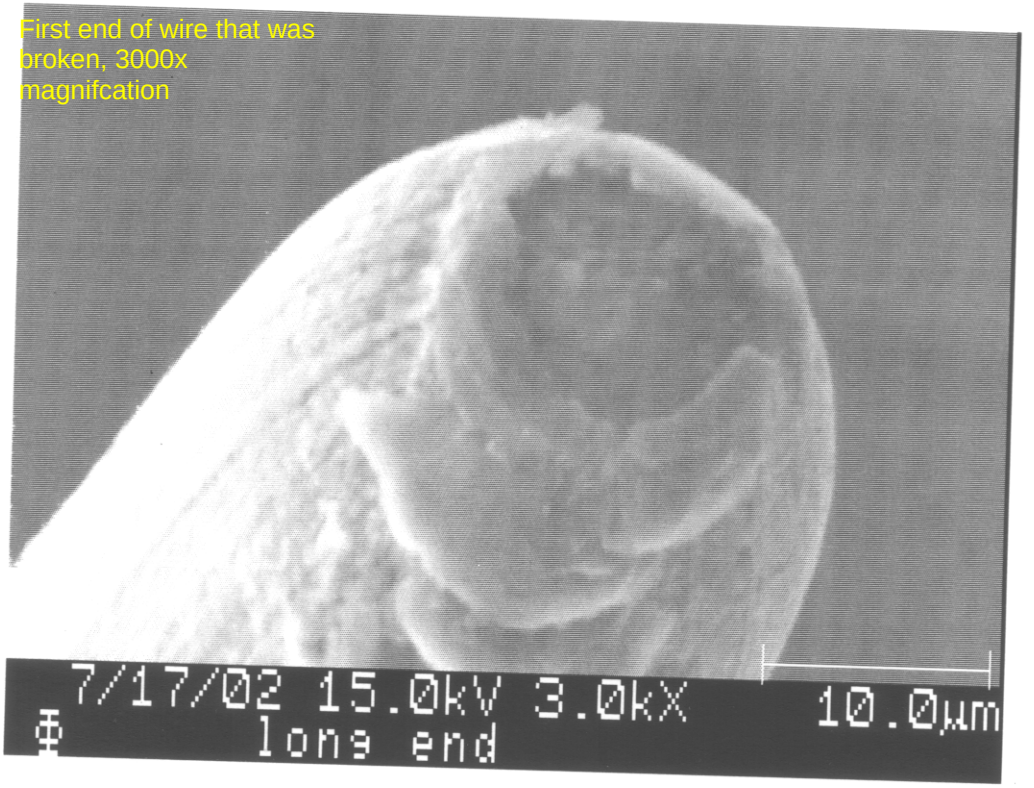
Wires Broken Hot or Cold

Broken at room temperature by increasing tension.

Broken by touching with dull-red stove heating element (170 gms tension)

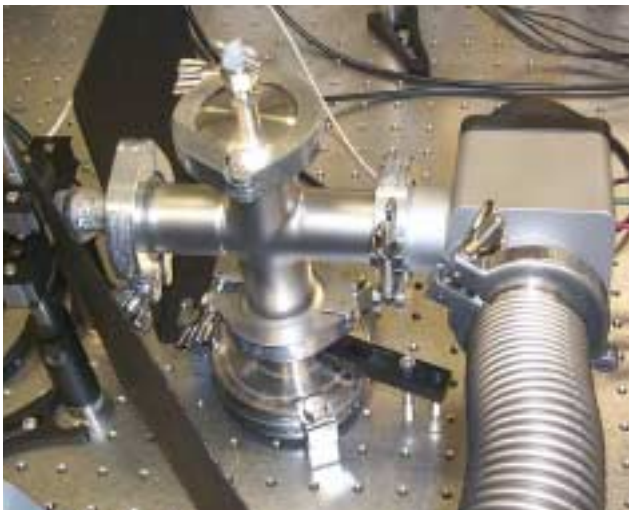


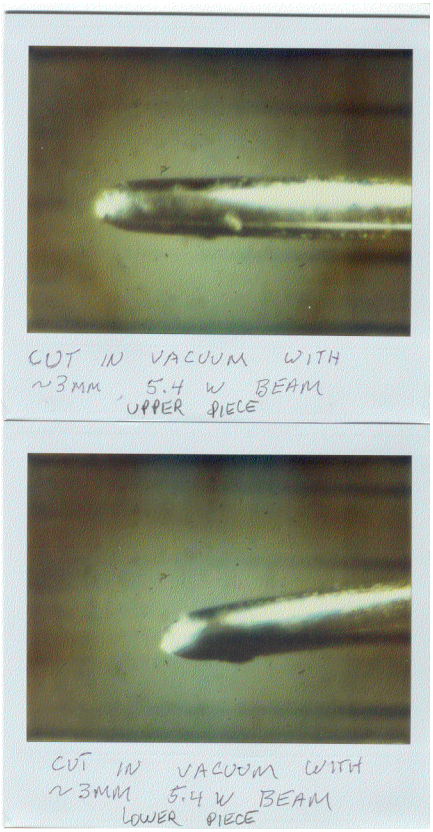

End of wire that has been purposely pulled apart, 3000x magnification
7/17/02 15.0kV 3.0kX
10.0µm
pulled end


First end of wire that was broken, 3000x magnifcation
7/17/02 15.0kV 3.0kX 10.0µm
long end

Laser Cut in Vacuum

150 gm suspended from SOS wire in vacuum chamber with window

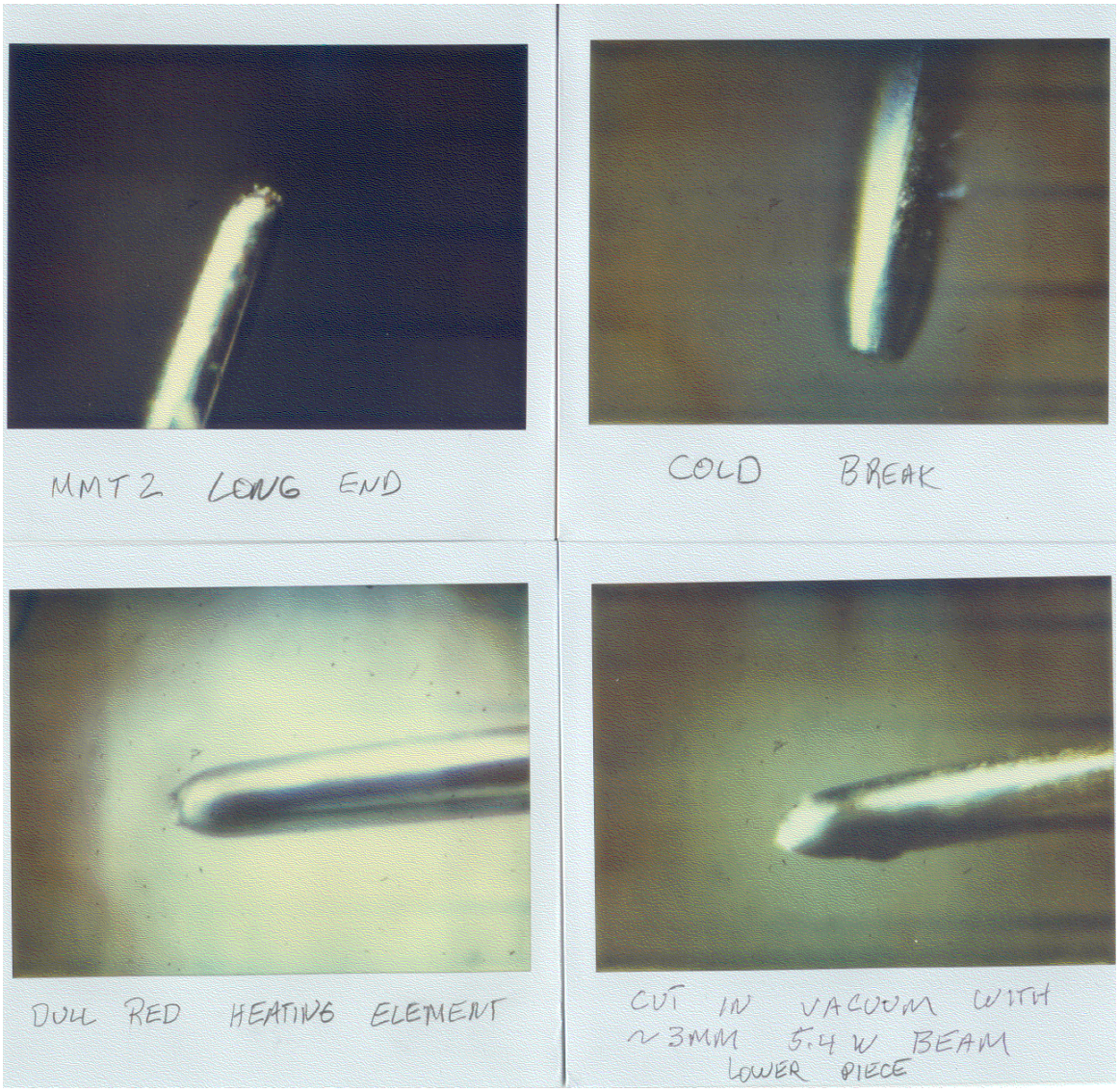




5.4 W 3mm beam scanned across wire at about 1 cm/s

Summary Comparison

MMT2 **Cold**



Heating Element (not melted) **Laser in Vacuum**

MMT2 looks most like the warmed not melted wire, but not conclusive.

Some Lessons Learned

1) Sliders can move beams onto suspension wires: limit sliders.

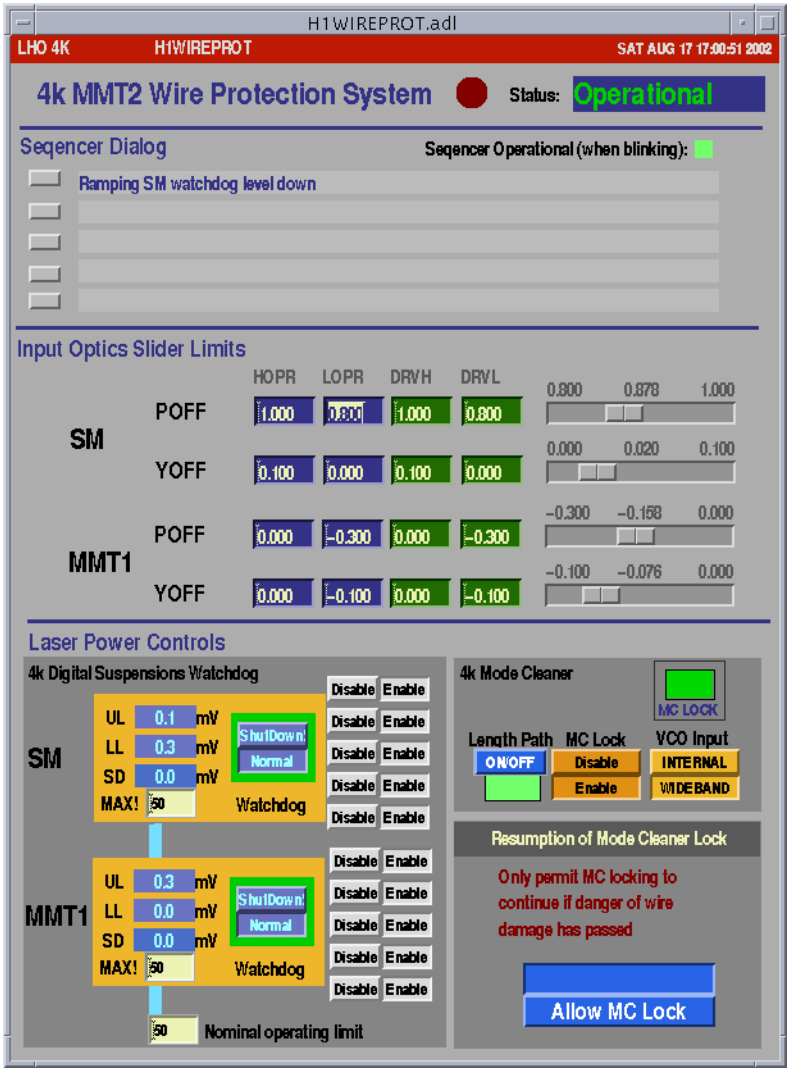
2) Breaking a wire may take a long time: “watchdogs” could be very useful even if there is a delay in blocking the beam.

3) Warming, short of melting, can cause breakage and, short of breaking, may cause alignment drift.

NEW PROTECTION:

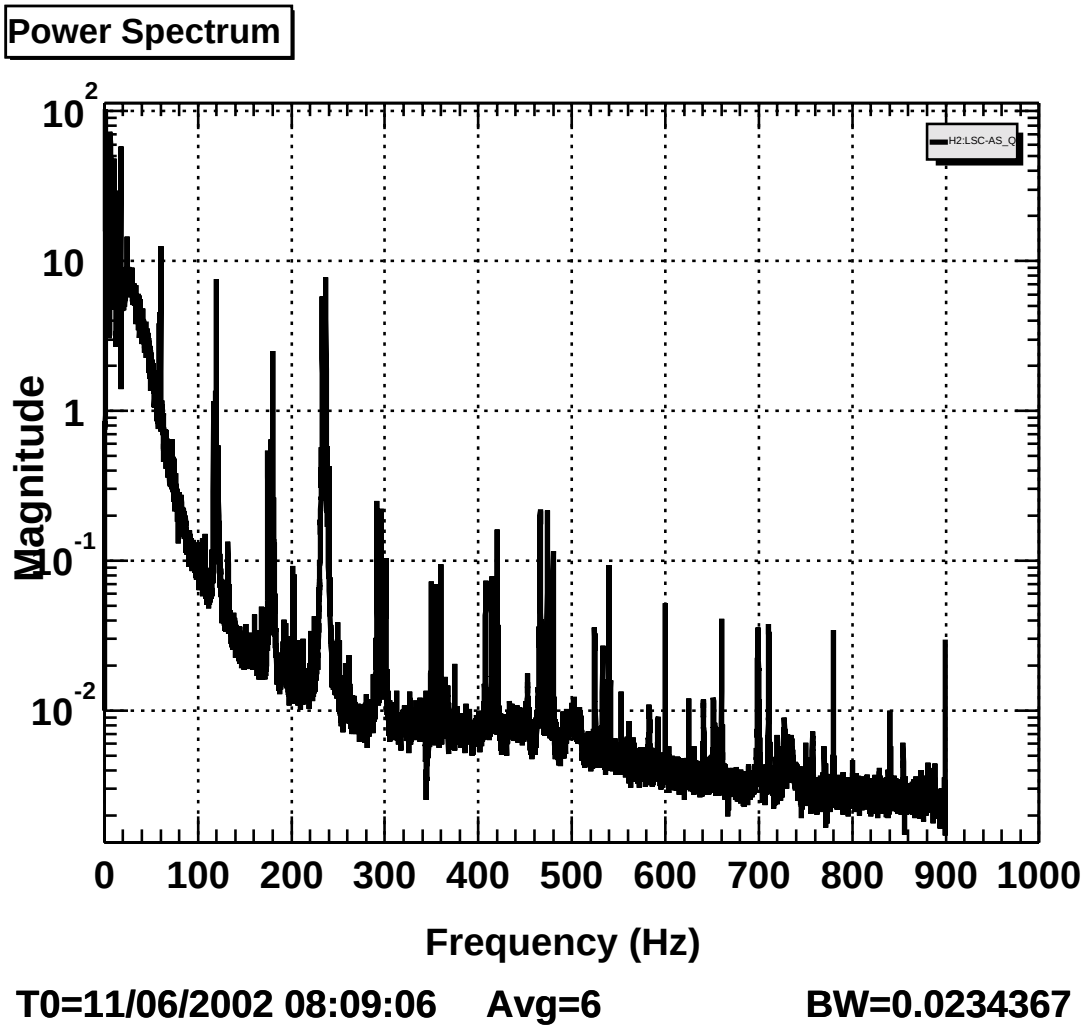
H2: baffles on MC2 and MMT2‘
H1: SM and MMT1 Sliders limited and protected by watchdogs

Dave Barker's Wire Protector



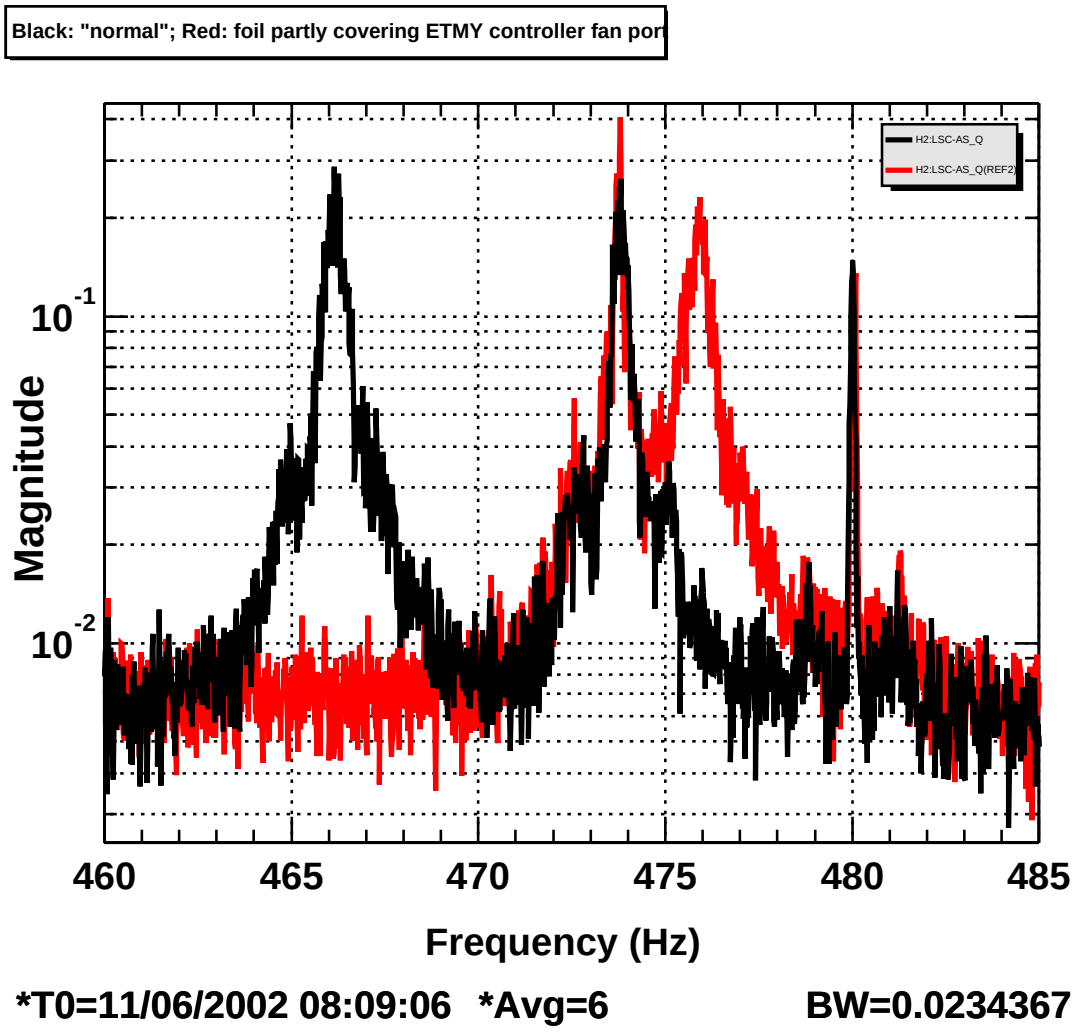
Fans That Show Up on the GW Channel

A Forest of Peaks in AS_Q



Peaks Movable

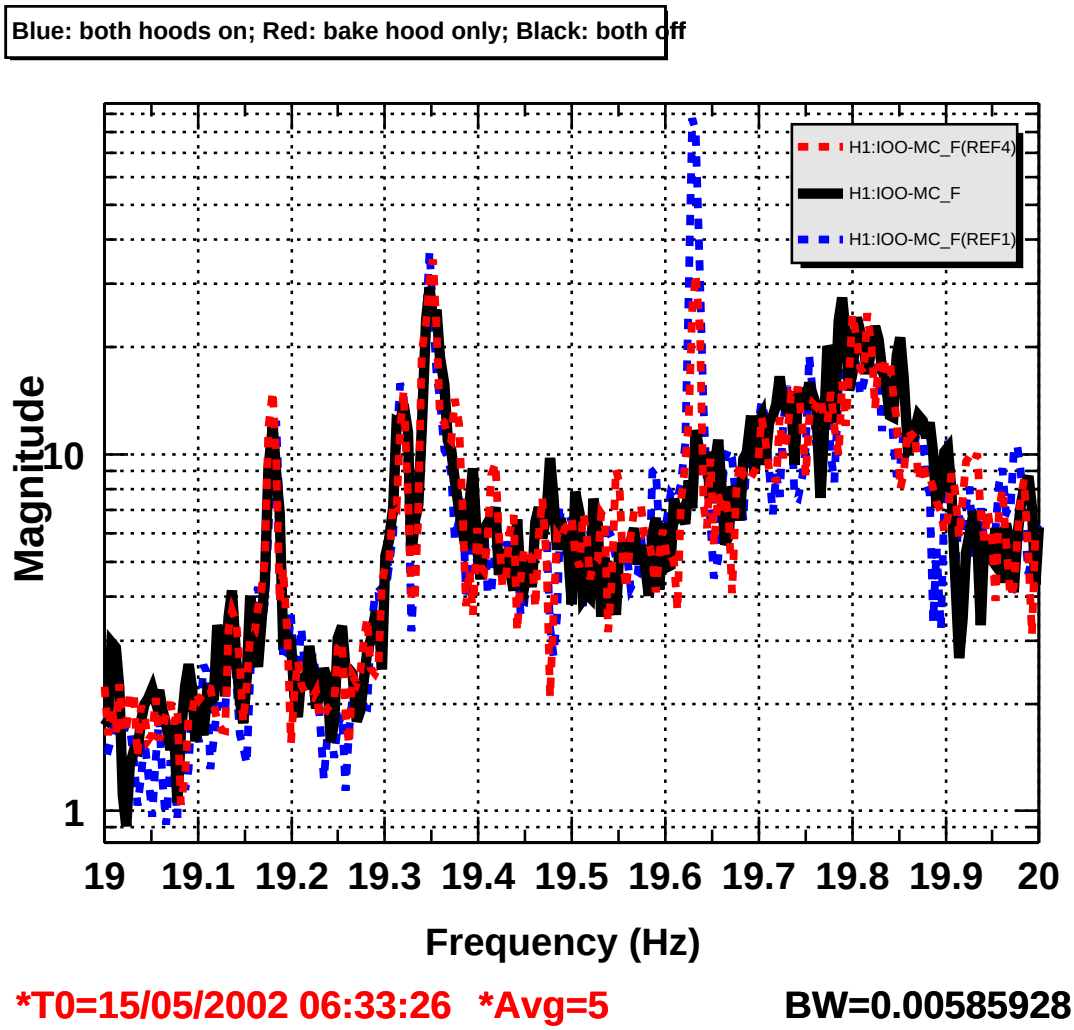
by partially covering fan port of test mass controller with foil



Separate fan power supply removed peaks - fans probably caused power supply ripple

Hood Fans Responsible for 19.6 Hz Peak

“mimicked” small optic bounce mode

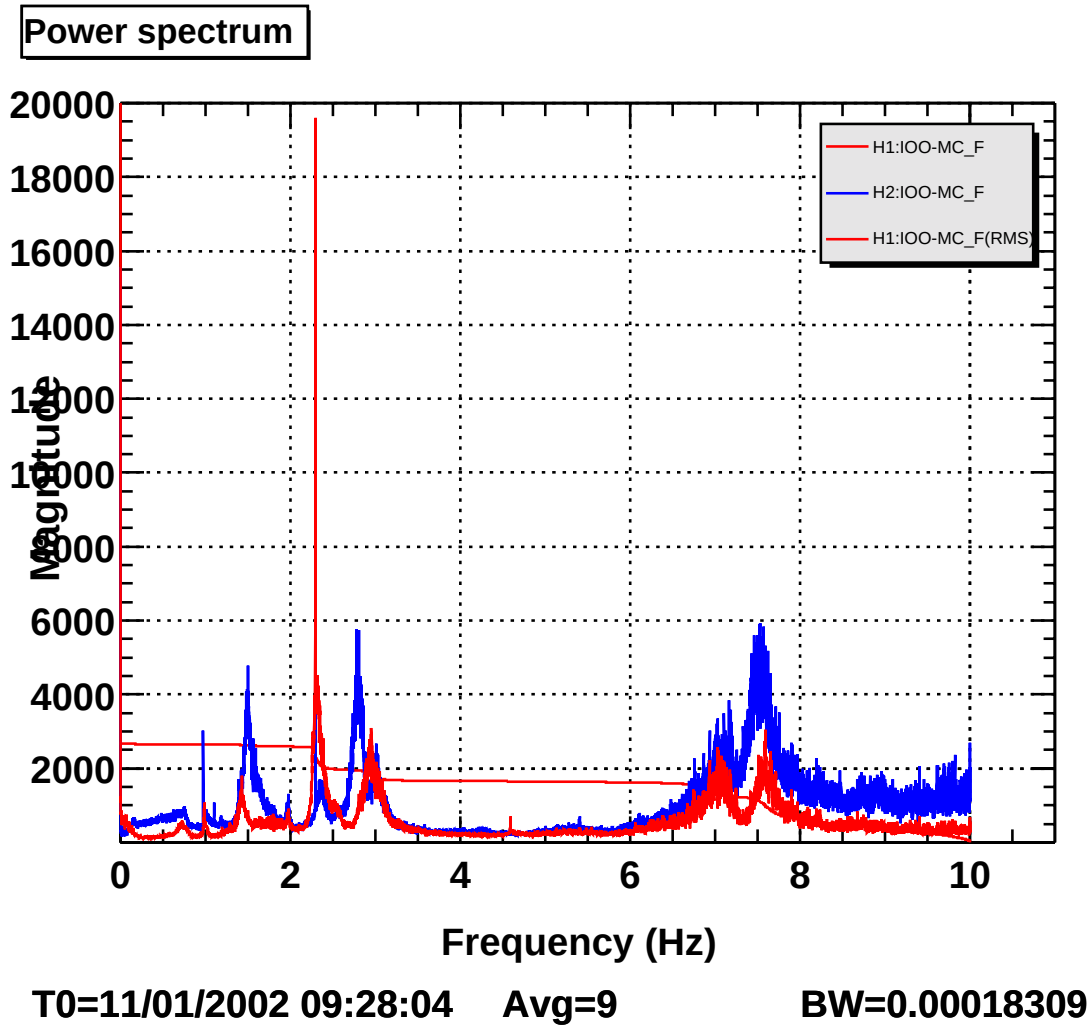


Hood Fans Responsible for 19.6 Hz Peak

One of the two culprits:

The solution:

Peak at 2.295 Hz responsible for about 20% of RMS in 4k mode cleaner control



Effect since reduced by resonant gain stage, but still responsible for several percent of RMS of HAM2 coils.

Cooling Tower Fans at ENW Nuclear Reactor

Mobile seismometer suggested cooling towers.

Motor monitors and gear-teeth ratios allowed calculation of frequency for each of 36 fans: nearly all fell within our peak.

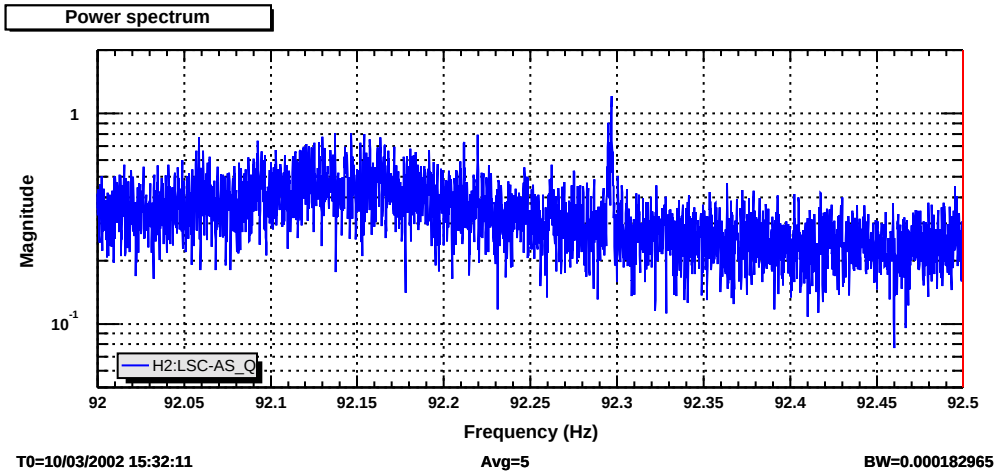
Inside the giant swamp-cooler;

motor shaft, gearbox and 30 ft. diameter blade.

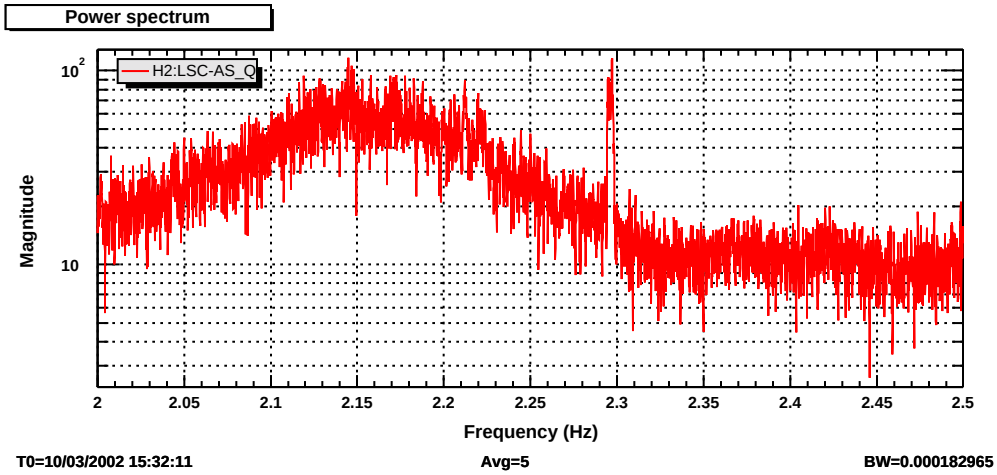
Upconversion of Cooling Tower Fan Peak

sideband on 90 Hz injected peak

The peak at 92.295 Hz



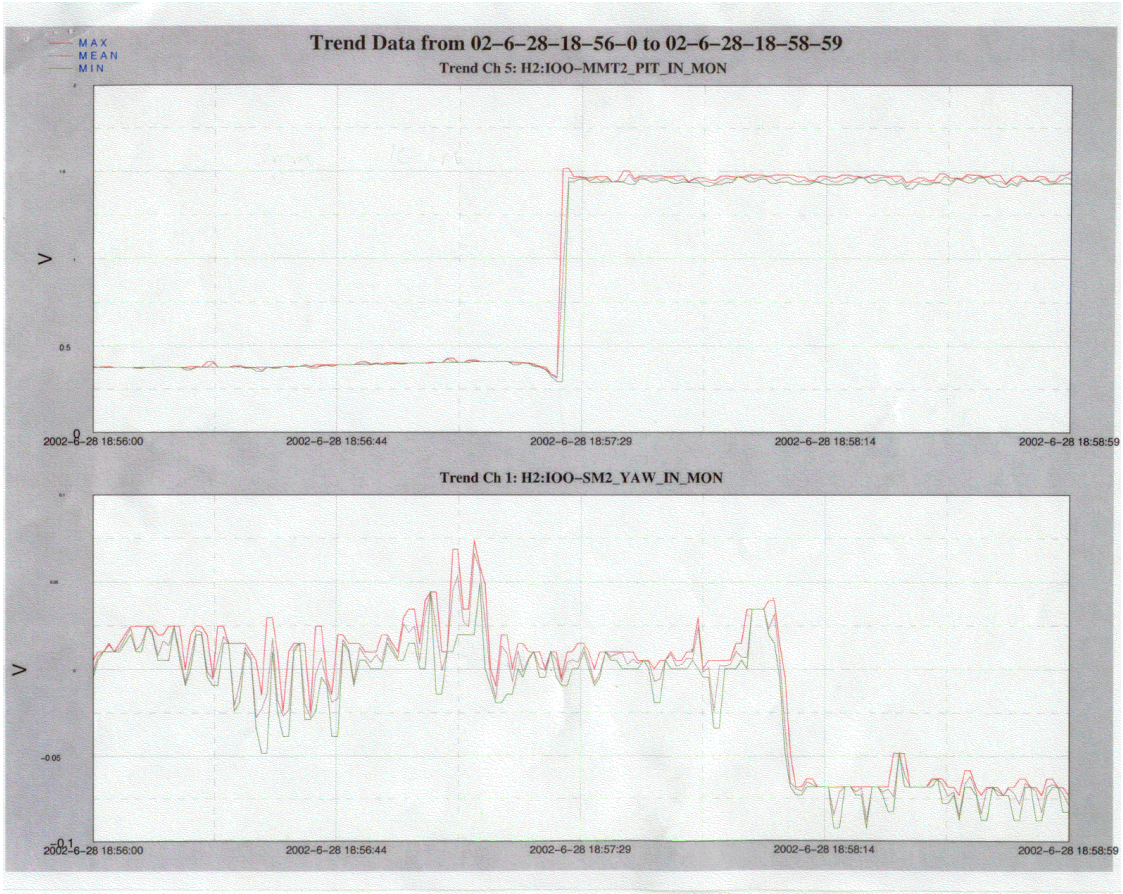
The peak at 2.295 Hz



Bonus slide: SM2 Yaw During Final Moments of MMT2

5 minute time span

Top: MMT2 pitch; bottom: SM2 yaw



Drop

Yaw appears to be offset far enough to put beam on or near wires. Motion just before drop may be a few beam diameters