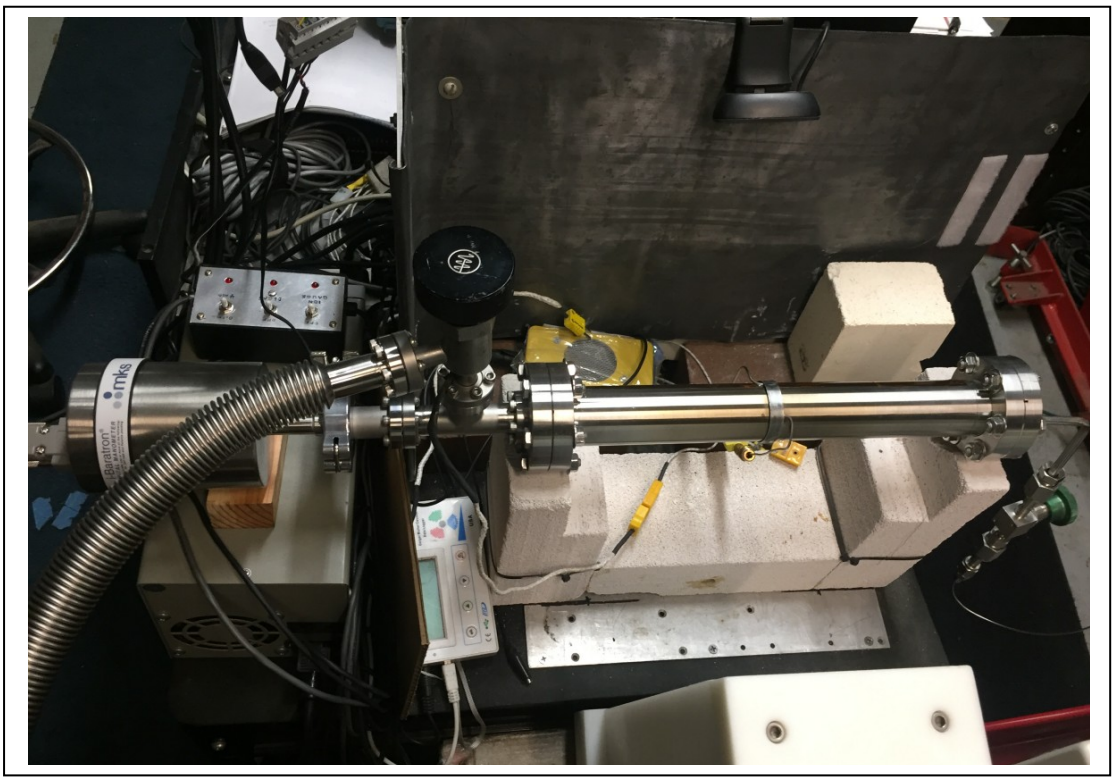
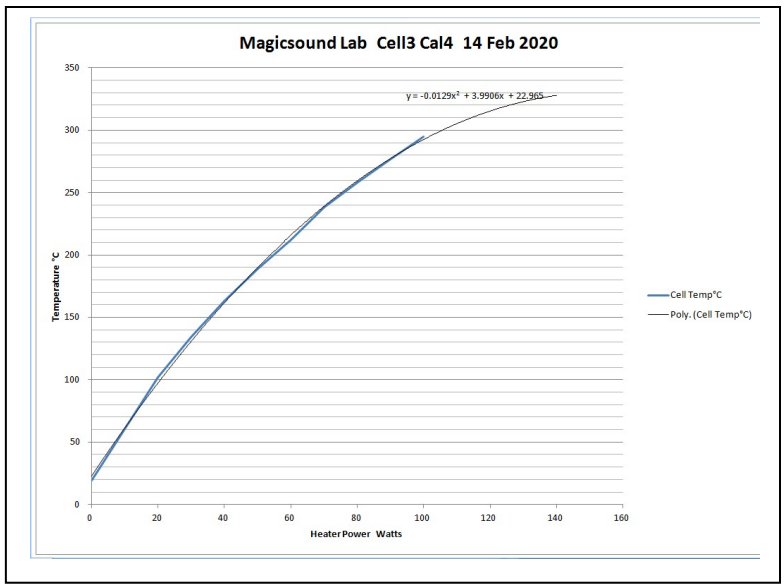
Magicsound Lab - Mizuno replication

Work in process: Last revision 18 February

The cell was re-configured to add a separate isolation valve and a Baratron capacitance pressure gauge. All the fittings are now Conflat, and the system is performing very well. After bake out, a vacuum of 2E-6 is easily reached, with increase of about 2 Pa per day with the valve closed. RGA analysis shows the leakage to be mostly water vapor, possibly from out-gassing despite the bake out. Very little Nitrogen is detected, confirming that air is not getting in.



Initial calibration showed that mounting the thermocouple with Kapton tape and thin wire was not stable over time. It was replaced with two calibrated Omega type K probes, secured with a hose clamp. This is very secure and solid, with good data yielded by the next calibration (with 1030 Pa of H2 in the cell):

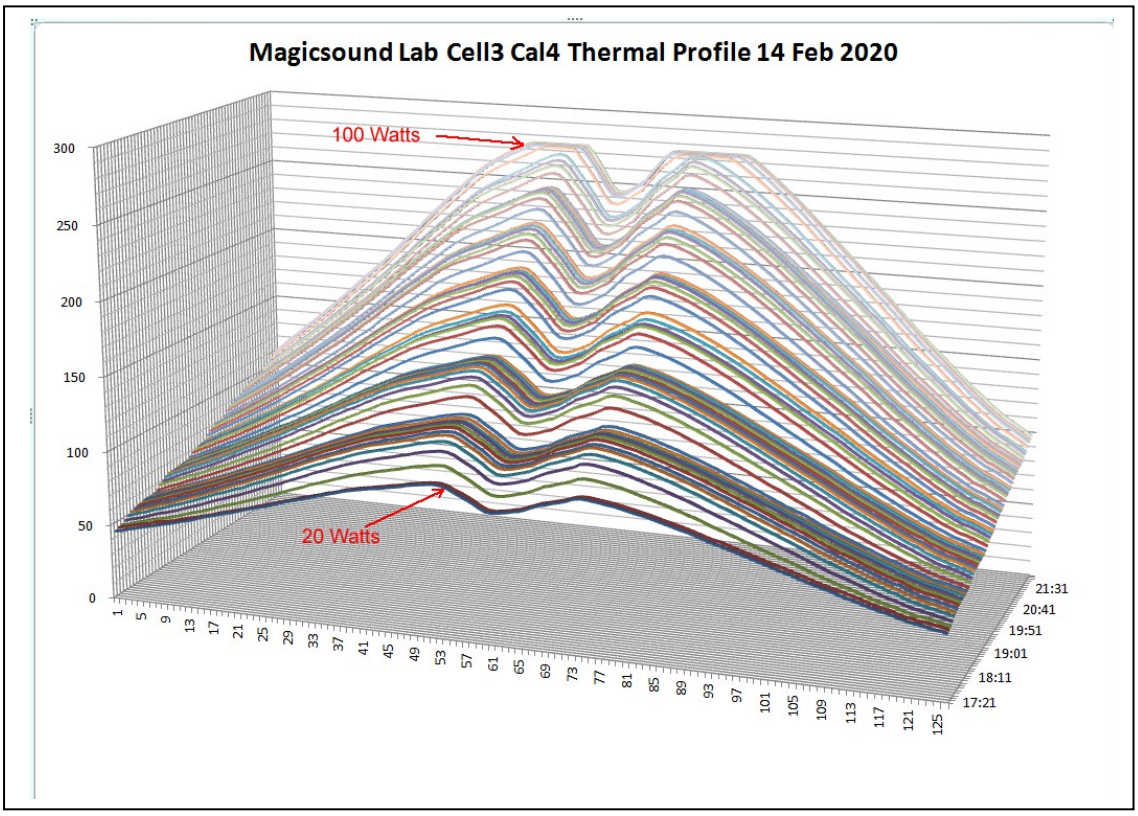


The temperature shown is the hottest spot, at the center of the cell tube where the two thermocouples are mounted. Tracking is very good, within ±1°C over the entire range.

Note that calibration only extended to 100 watts. The heater used is a cartridge 5” x 5/16”, rated at 300 watts in free air. That is degraded by lack of convective cooling to just 150 watts at 350°C.

Since the temperature in the thermo well where the heater lives is sure to be higher than the outside of the cell, the safe continuous operating temperature would probably be exceeded at 150 watts.So a 120 watt limit will be used for now.

Here's a rendering of the cell thermal profile during the entire 5 hour calibration. The data is generated by the Optris camera PIX software, with 125 points along the cell axis sampled every 5 minutes.



The camera was calibrated by adjusting the emissivity so that the highest temperature matched the thermocouples. With ε=0.50, the Optris temperature measurements tracked the thermocouples within ±1°C over the entire range.

The effect of the thermocouple clamp can be clearly seen. While this is not a problem for comparative measurements, it will affect any attempt to estimate thermal power by Stefann-Boltzman calculation. Therefore, the cell will be modified once again to add small welded sockets for the TC probes, followed by another calibration run.