

Target Lab Status and Tests

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Our Task

- Our Main Tasks
 - ✓ Polarization system working
 - Characterize all cells for A1n/d2n
- Man Power
 - Mingyu Chen (UVa), Melanie Rehfuss (Temple), Junhao Chen (W&M)
 - Previous Students: Kai Jin (UVa), Nguyen Ton (UVa)

Current Status Summary

✓ Systems

- ✓ Pumping Optics: Working, still need to test fiber to fiber coupler
- ✓ Field
- ✓ Heating
- ✓ Control System: LabView, need to get EPICs working
 - Interlock

✓ Polarimetry

- ✓ EPR (Melanie): Working, finalize RF coil design, test D2 collection optics
- ✓ Pulse NMR (Mingyu): Working, calibrate with NMR AFP signal
- ✓ NMR AFP: Working, calibrate with water NMR signal

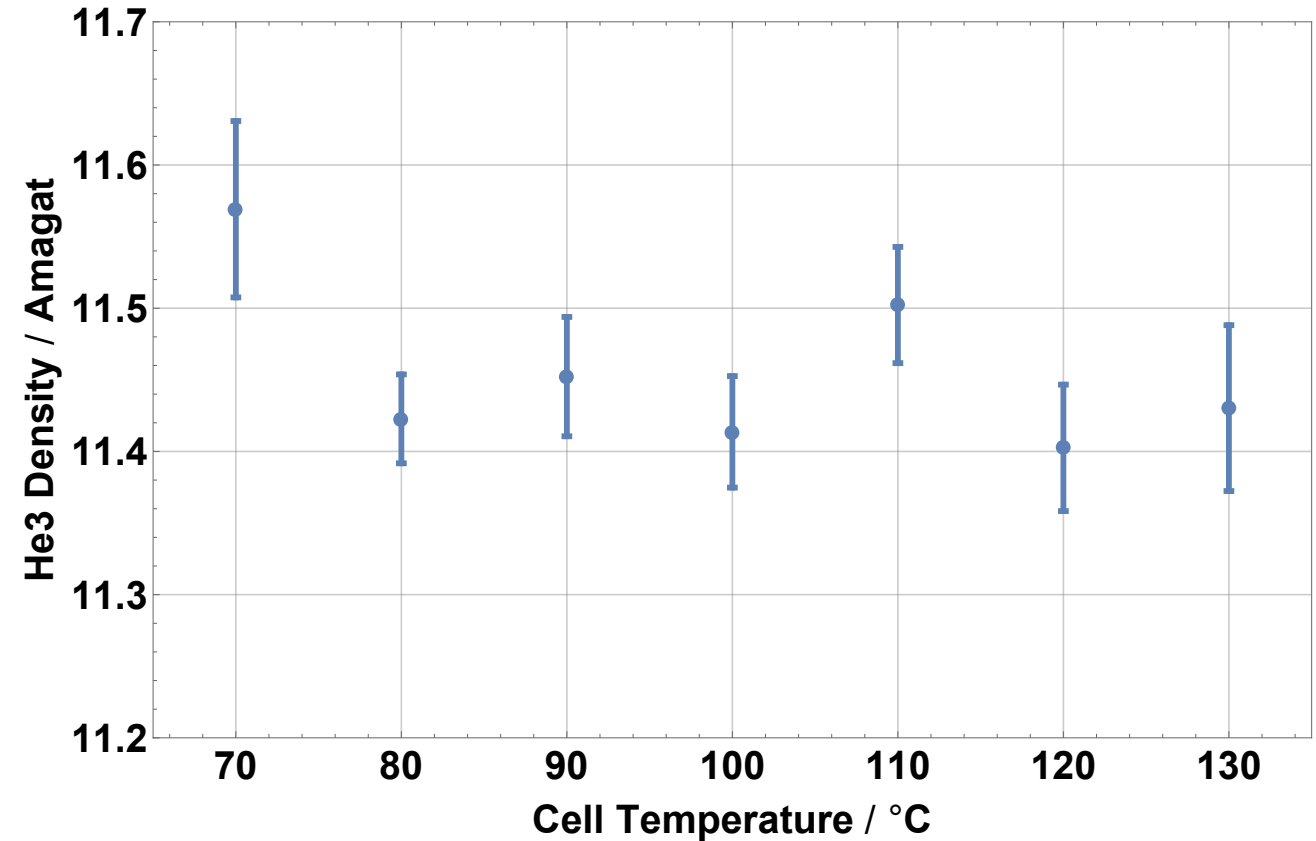
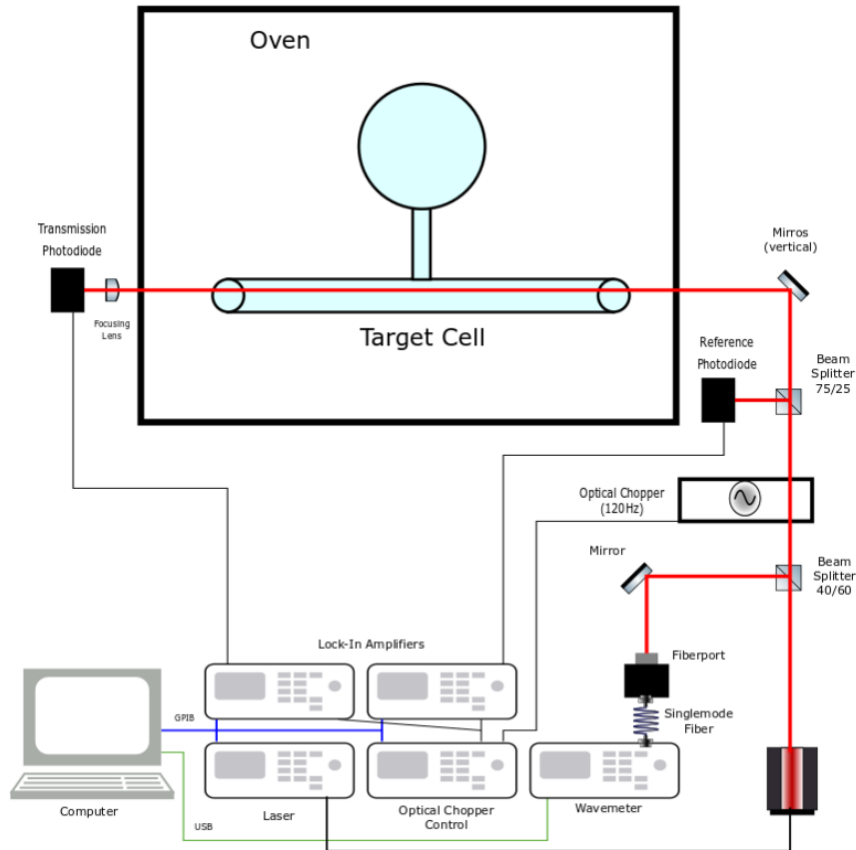
• Characterize

- ✓ Time Constants and AFP loss: Good (Provec-1)
- ✓ Density Measurement Pressure Broadening: Working
- ✓ Ultrasonic Thickness Measurement: Working, systematic error
 - Cell Optimal Condition
 - Pumping Chamber Actual Temperature

Time Constants of Provec-1

Cell Condition		Spin Up / h	Spin Down / h	AFP Loss per Sweep / %
Hot with Convection	P.C.	5.98 ± 0.06	9.36 ± 0.05	0.27 ± 0.01
	T.C.	6.11 ± 0.09	9.44 ± 0.04	0.28 ± 0.01
Cold without Convection	P.C.		19.5 ± 0.4	0.25 ± 0.02
	T.C.		22.6 ± 0.2	0.17 ± 0.01

^3He Density Measurement Pressure Broadening

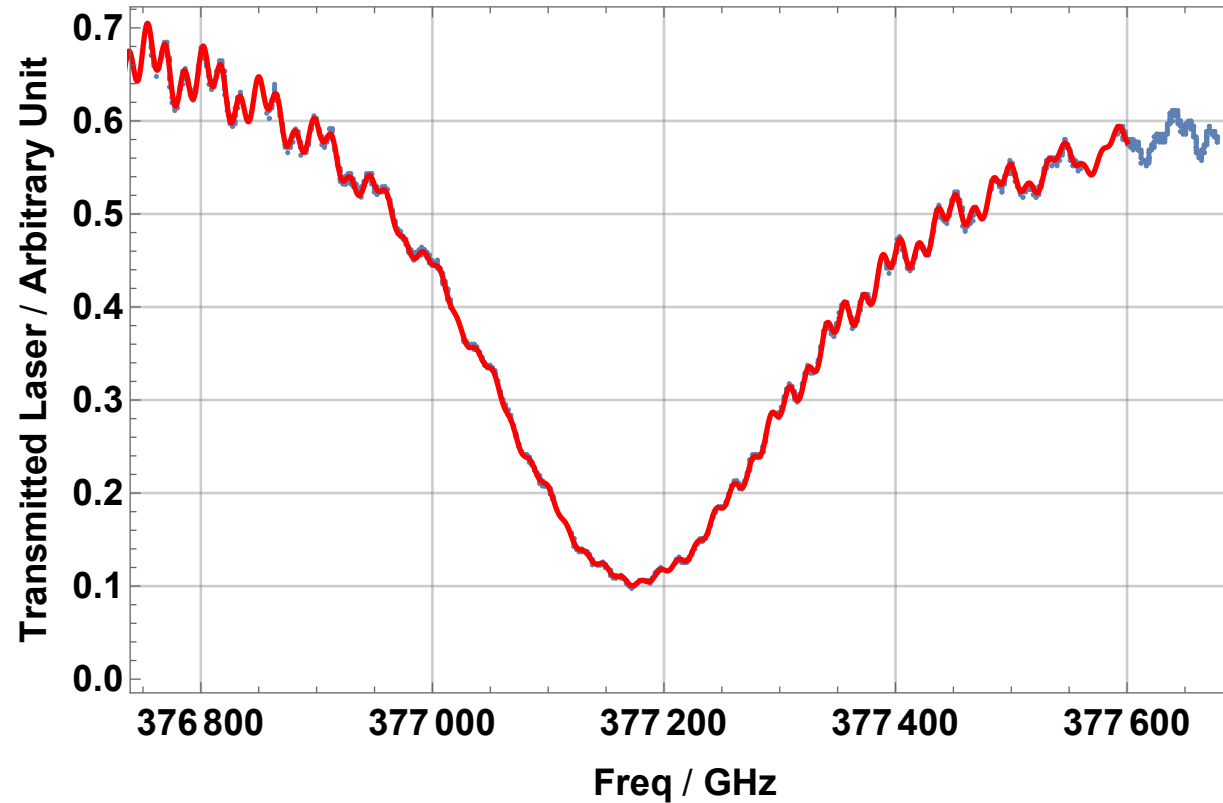


Averaged Density: 11.45 ± 0.02 (Stat.) ± 0.18 (Sys.) amg

Pressure Broadening

Temperature: 100 °C

Cell Archie: 40 cm Target Chamber



$$a (1 + c f) \text{Exp} \left(-b \frac{1 + 0.6642 * 2 \pi \Delta t_d}{\sqrt{(f - f_0)^2 + \left(\frac{\gamma}{2}\right)^2}} \right) (1 + d \text{Sin}(t f + \phi)) + d$$

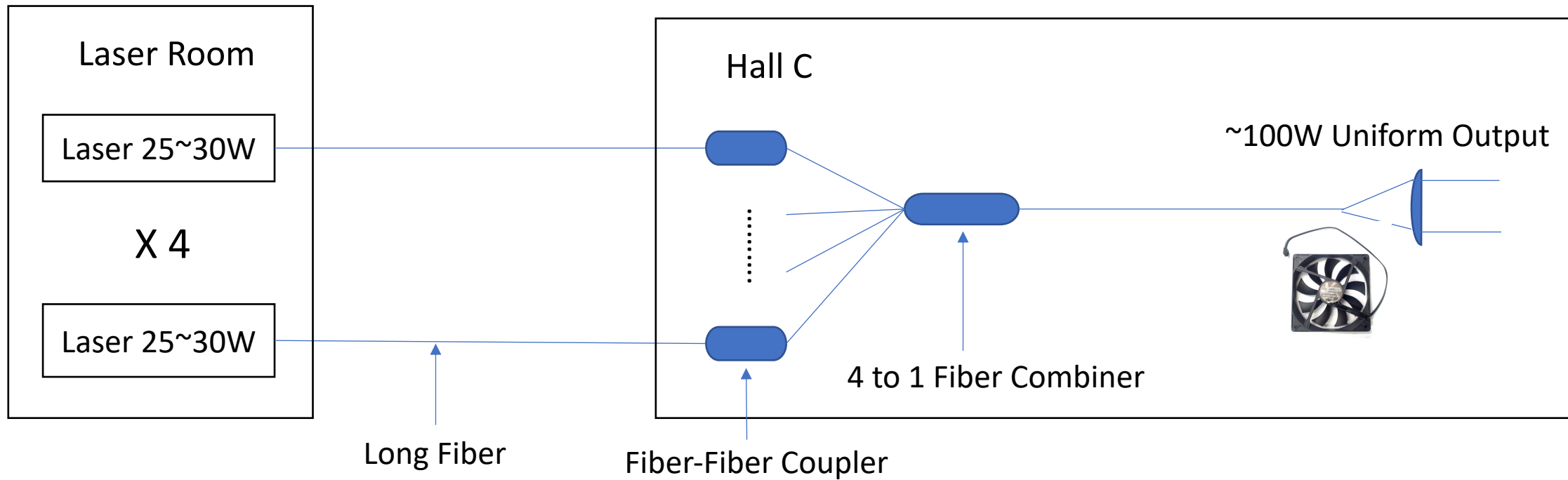
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P.D. response

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Etalon Effect * 3

Laser Power Delivery to Hall



- ✓ Need: 10 long fiber, 8 fiber-fiber coupler, 2 4-1 combiner
- ✓ 4-1 output end need cooling with fans
- ✓ 4-1 tested, steadily works 20 h with 100 W output power
- Still need test: fiber coupler

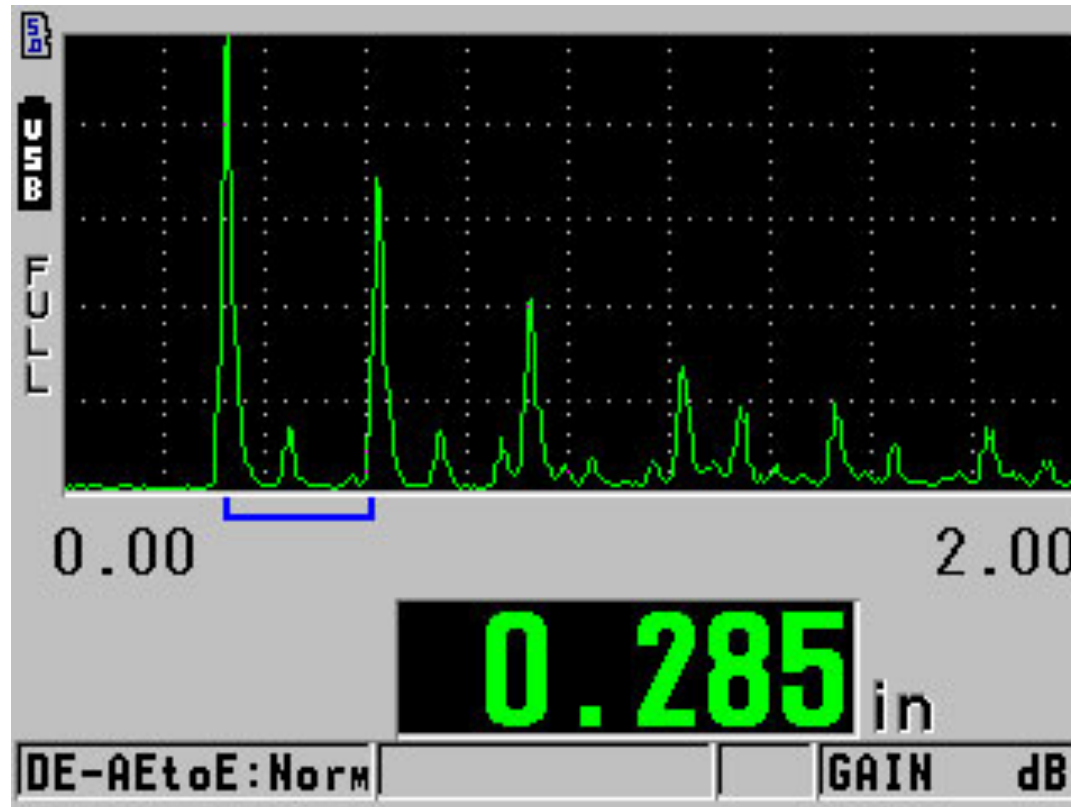
4-1 Specification

Input: 600 μm , 0.22 NA

Output: 1320 μm , 0.22 NA

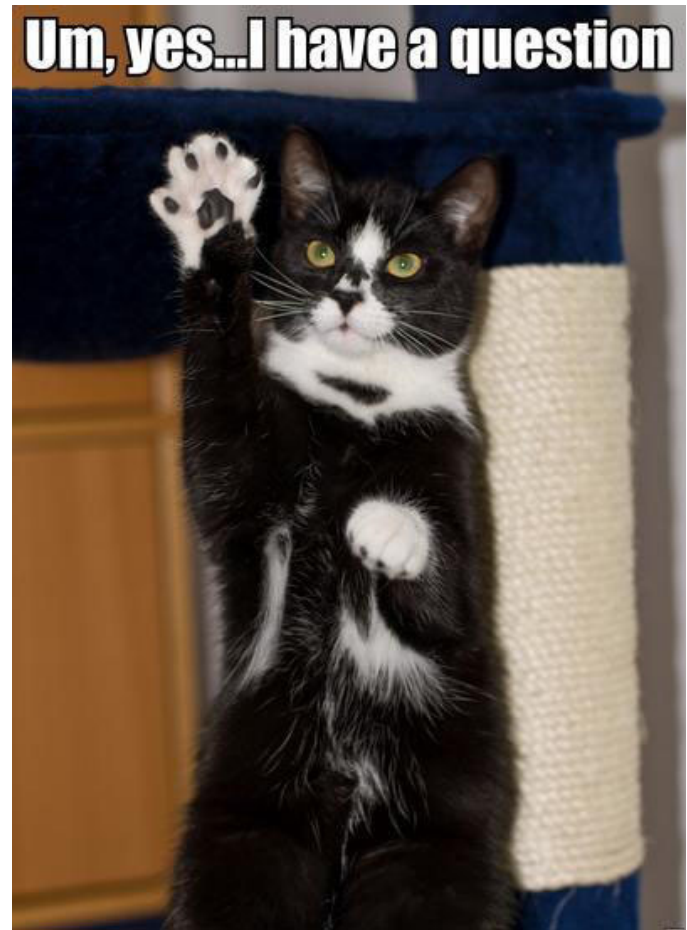
Ultrasonic Thickness Measurement

- ✓ Instruments: 45MG Thickness Gauge, M208 Delay Line Transducer from Olympus
- ✓ How: Time difference between the reflected ultrasonic pulses on material's surfaces
- ✓ Tested on the GE180 Fragments, agrees well with micrometer
- Need to know the systematic error



Plan:

- Near term plans
 - EPR working with D2 light collection optics
 - Calibrate Pulse NMR signal with NMR AFP
 - NMR AFP system ready for water NMR
 - Pumping Chamber Actual Temperature
- Then
 - Water NMR
 - Characterize New Cells
- Help needed from outside
 - EPICs
 - Interlock system
 - Installation

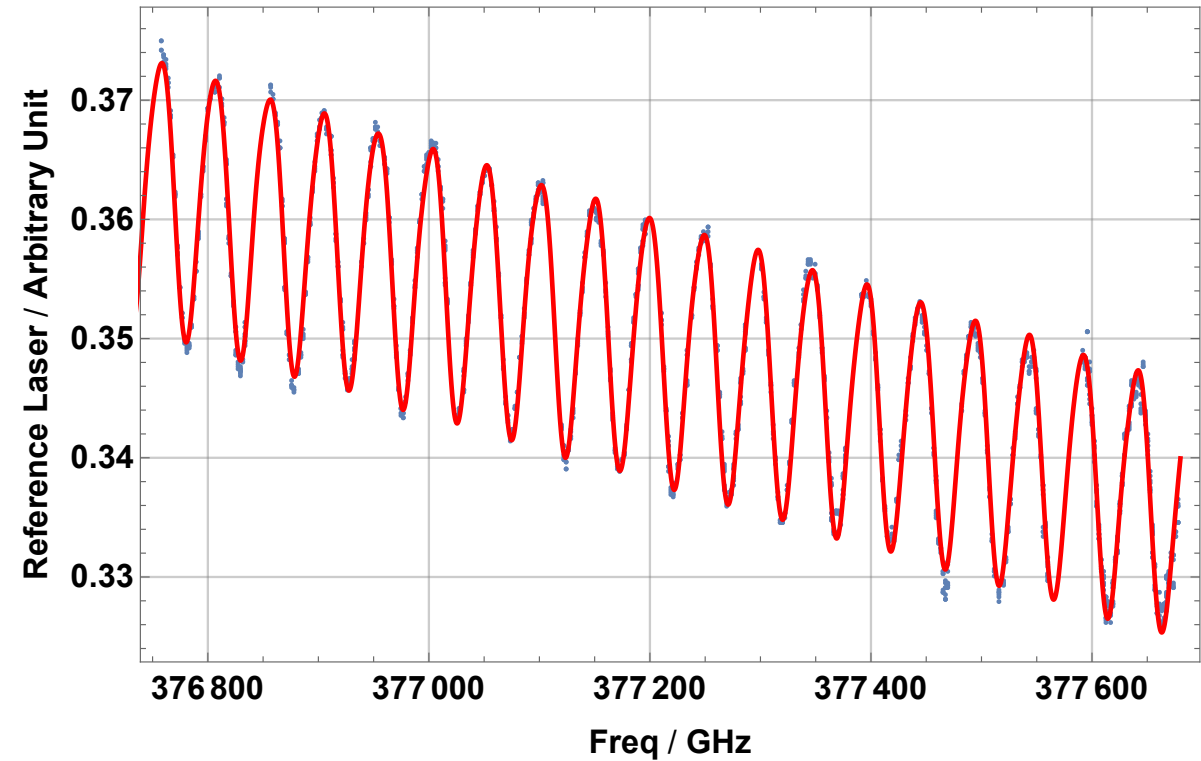
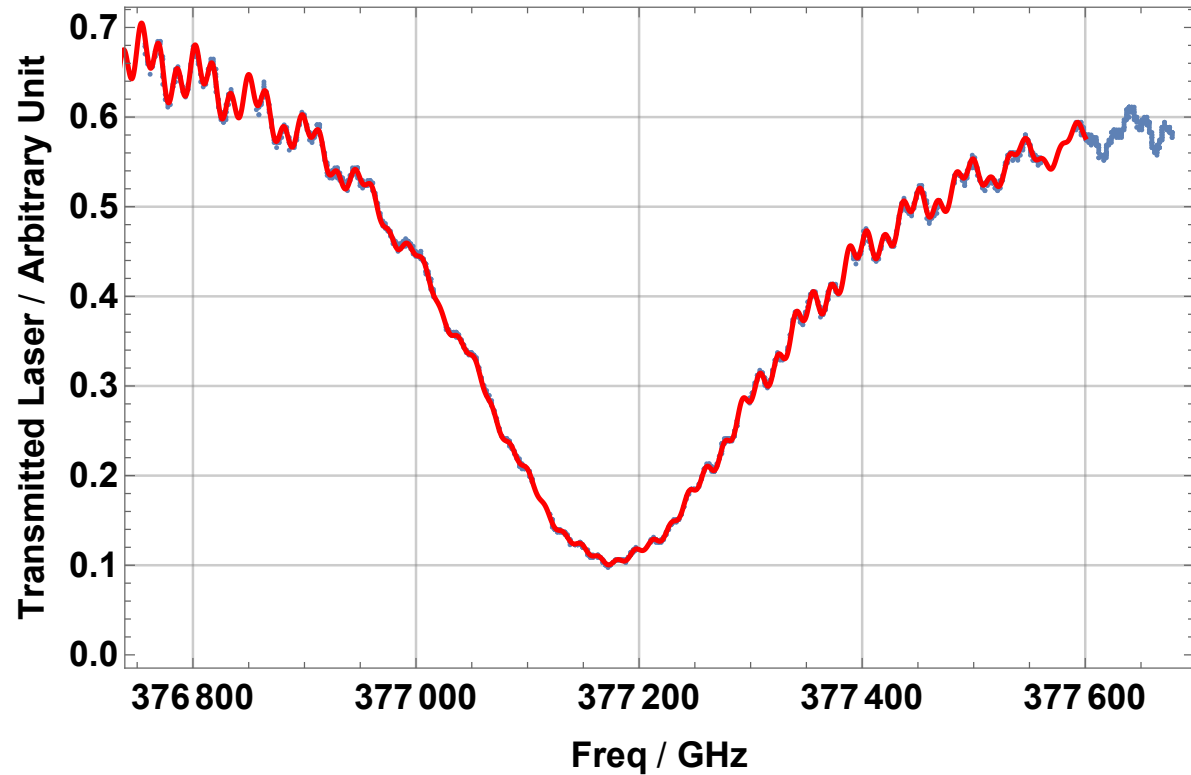


Backup Slides

Pressure Broadening

Temperature: 100 C

Cell Archie: 40 cm Target Chamber



$$a (1 + c f) \text{Exp} \left(-b \frac{1 + 0.6642 * 2 \pi \Delta t_d}{\sqrt{(f - f_0)^2 + \left(\frac{\gamma}{2}\right)^2}} \right) (1 + d1 \text{Sin}(w f + \phi)) + d$$

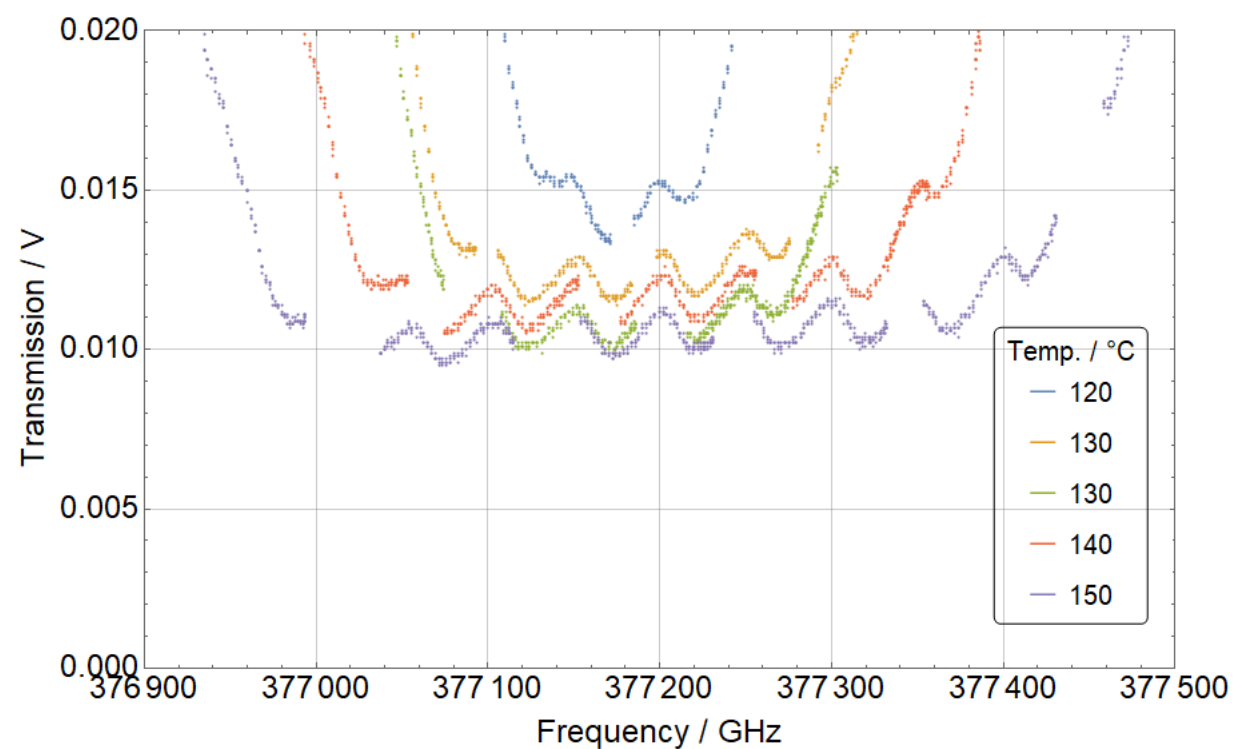
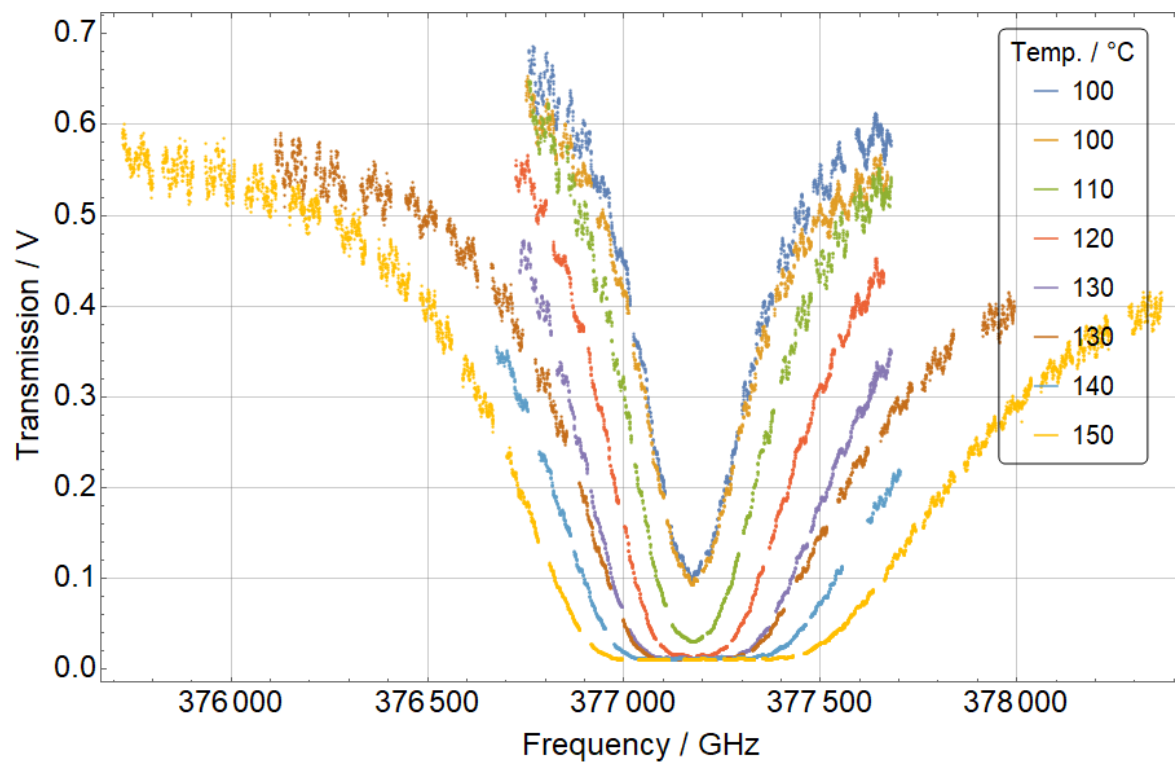
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P.D. response

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Etalon Effect * 3

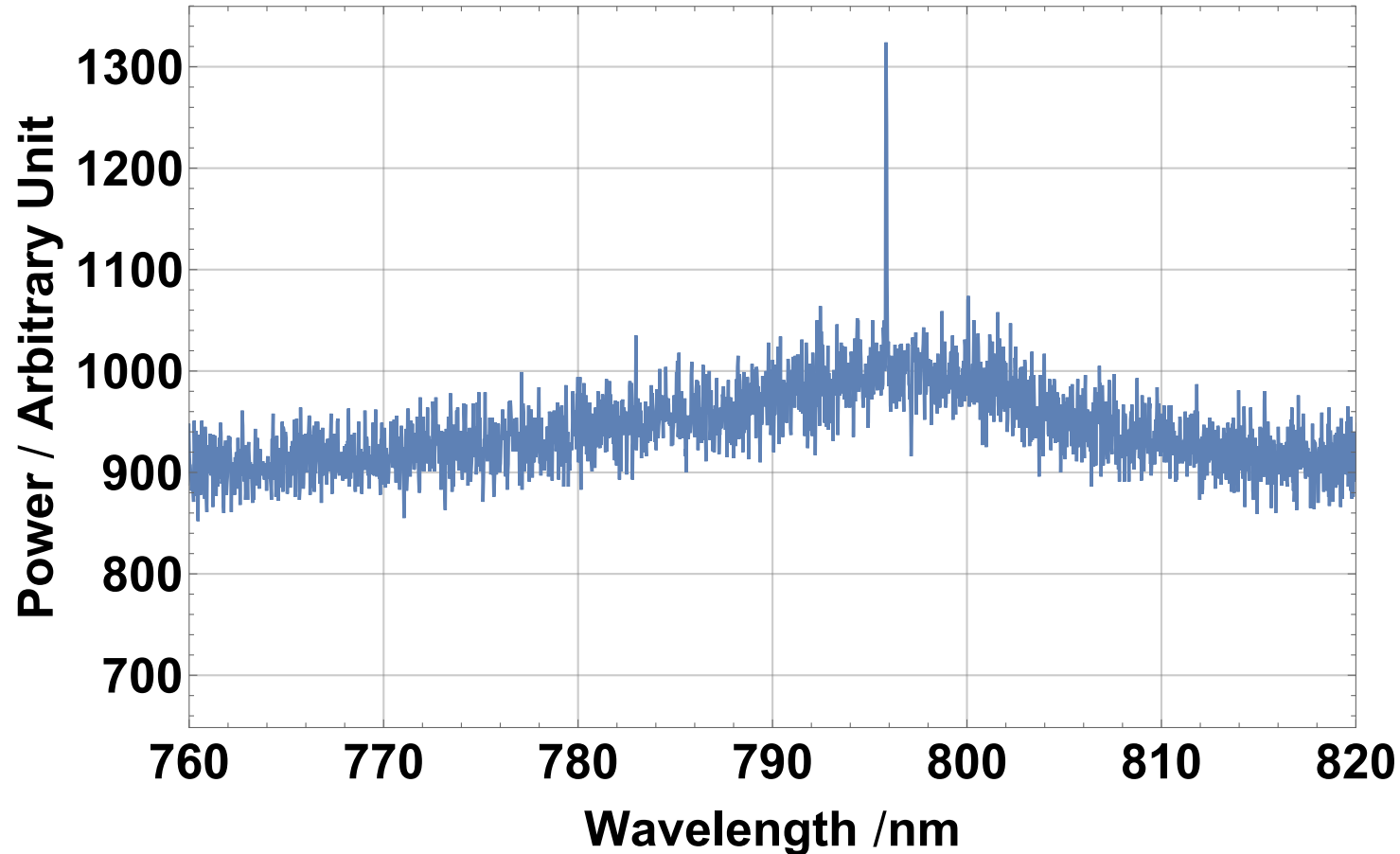
Pressure Broadening Threshold in the Absorption Spectrum



- ✓ Checked ambient light
- ✓ Checked instrument threshold
- The laser might have a broaden background other than its main narrow peak

Pressure Broadening

Probe Laser Spectrum measured with Ocean Optics HR4000

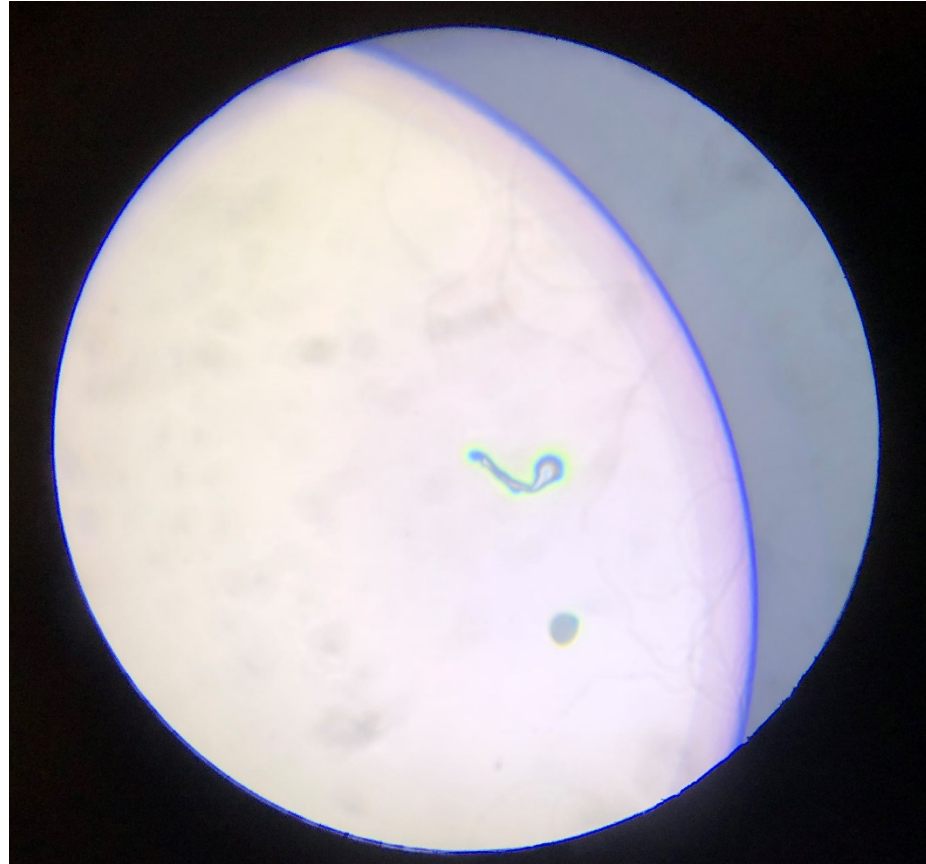


The spectrum may indicate there is background light coming from laser despite the main narrow (<200kHz) peak.

4-1 Power Test

4-1	Total Power	Output end Temperature / °C	Test Time / h
#0	99	40	10
#1	100	30	20
#2	101	26	6
#3	100	25	3
#4	101	30	5

4-1 Surface Check



This 4-1 with worst output end surface condition, stands 20 h of 100 W test, no sign of deterioration