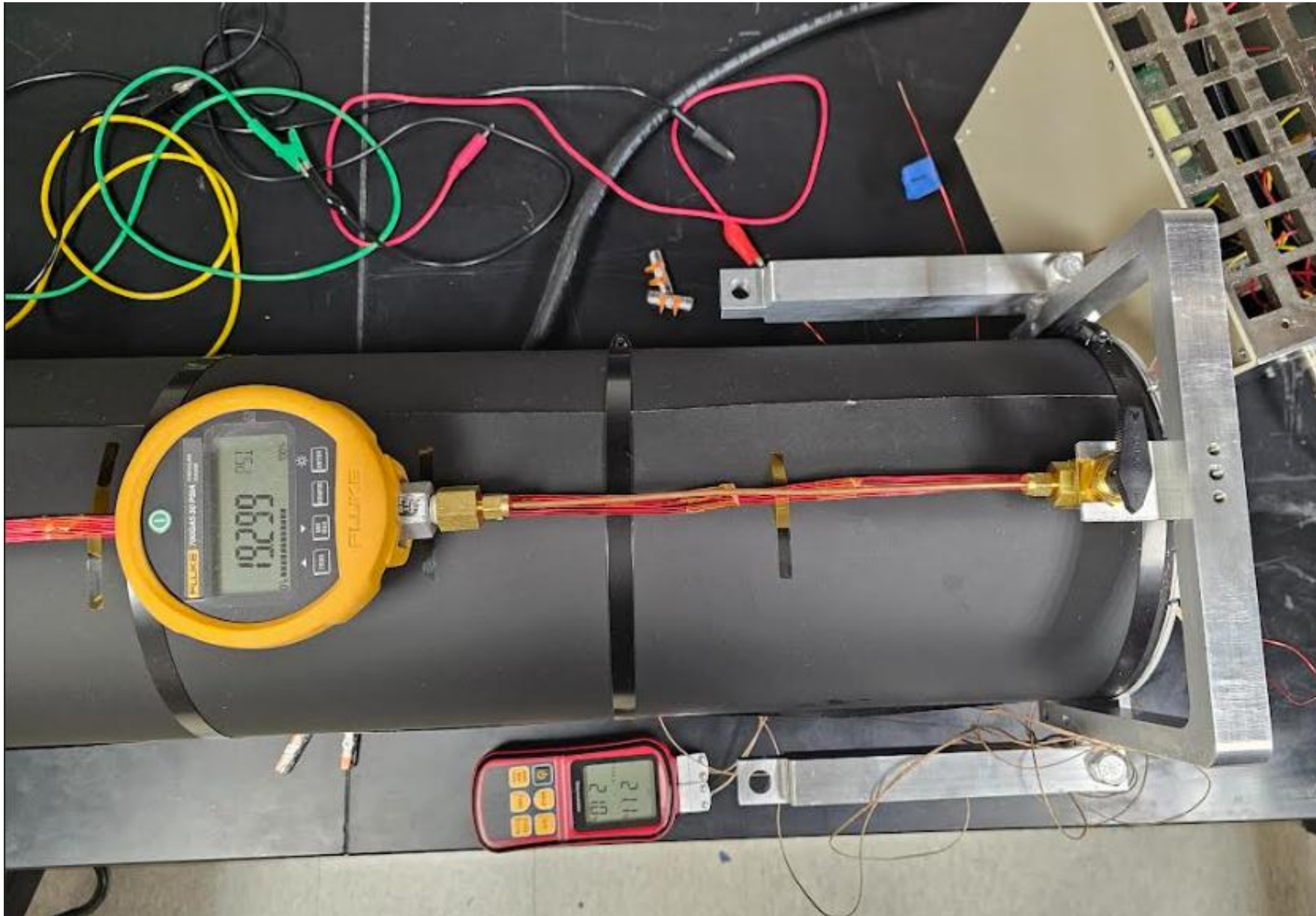


CO₂ Pressure, gas density, measurements scenarios

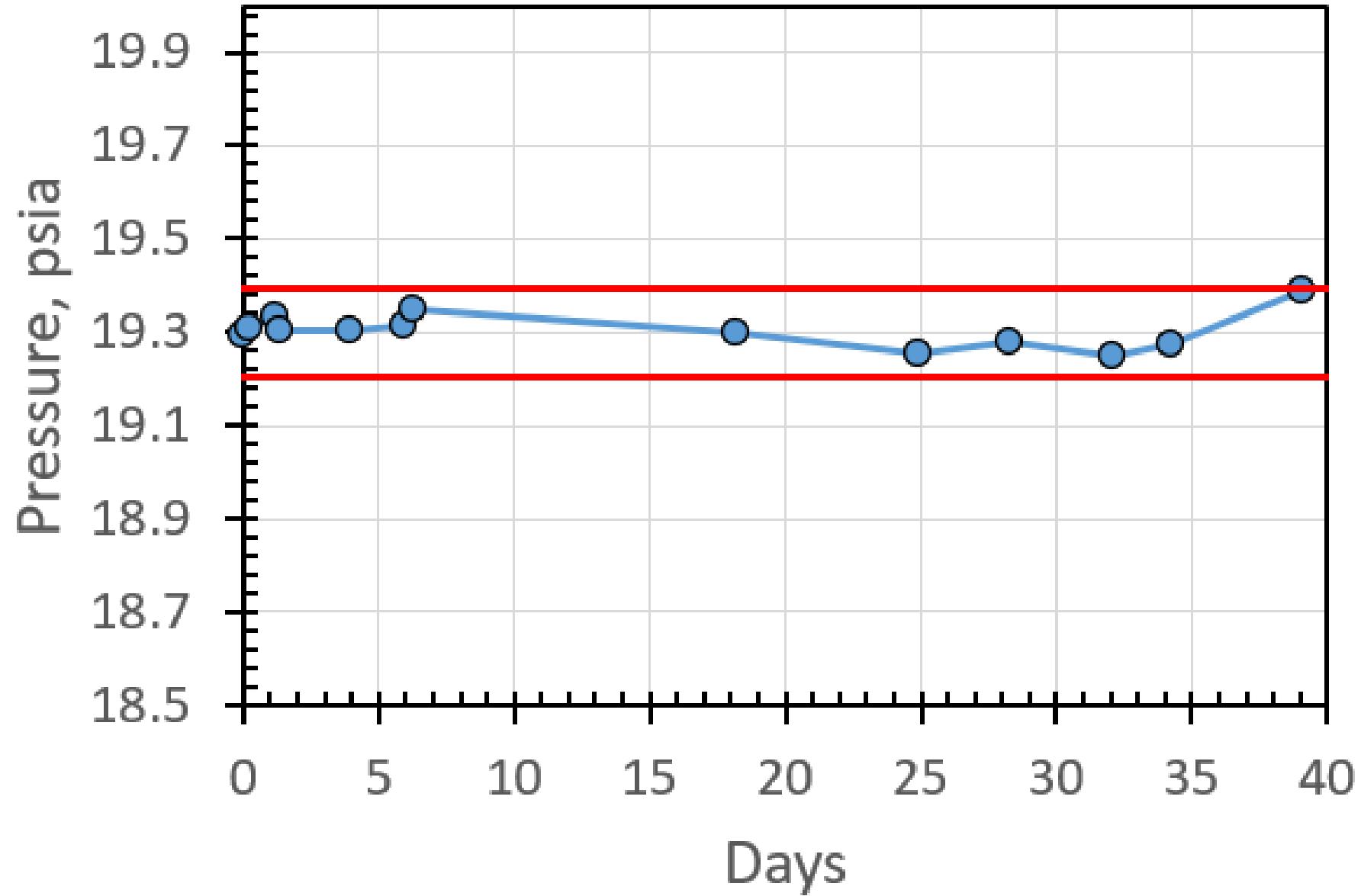
Yu. Kamyshev / UTK

Magnet #2 Leak Test October 24 – November 27, 2024 at UT (Magnet filled with CO₂ to 19.3 psia)

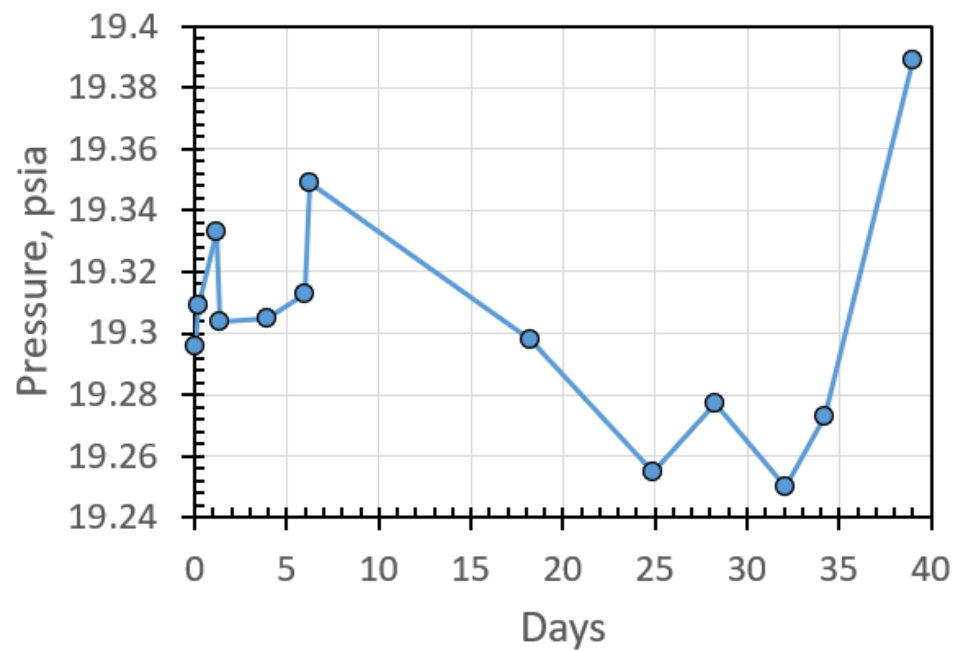


Magnet #2

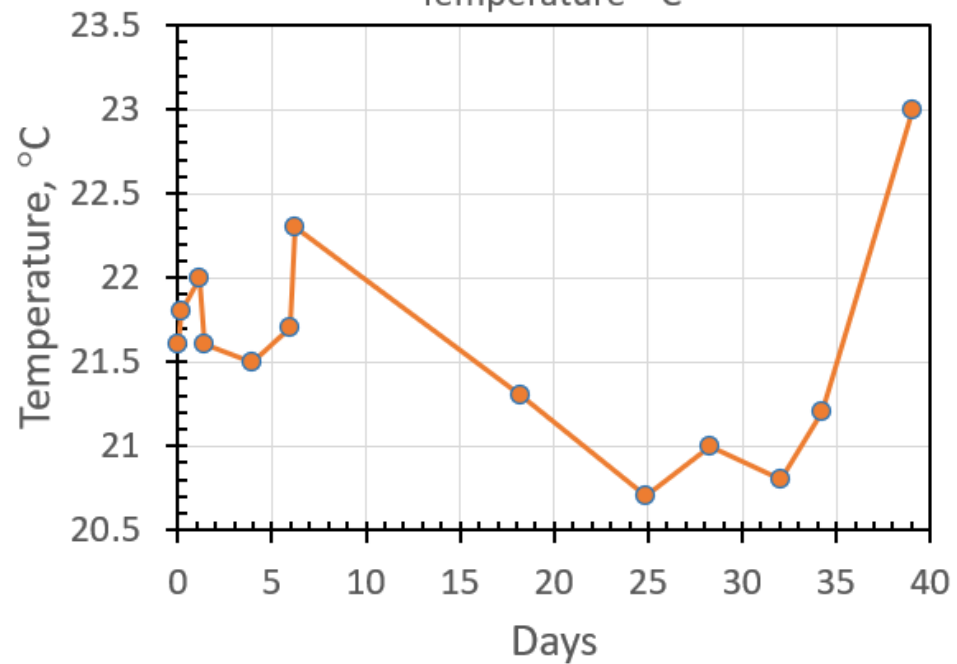
Pressure variation within $\pm 0.5\%$



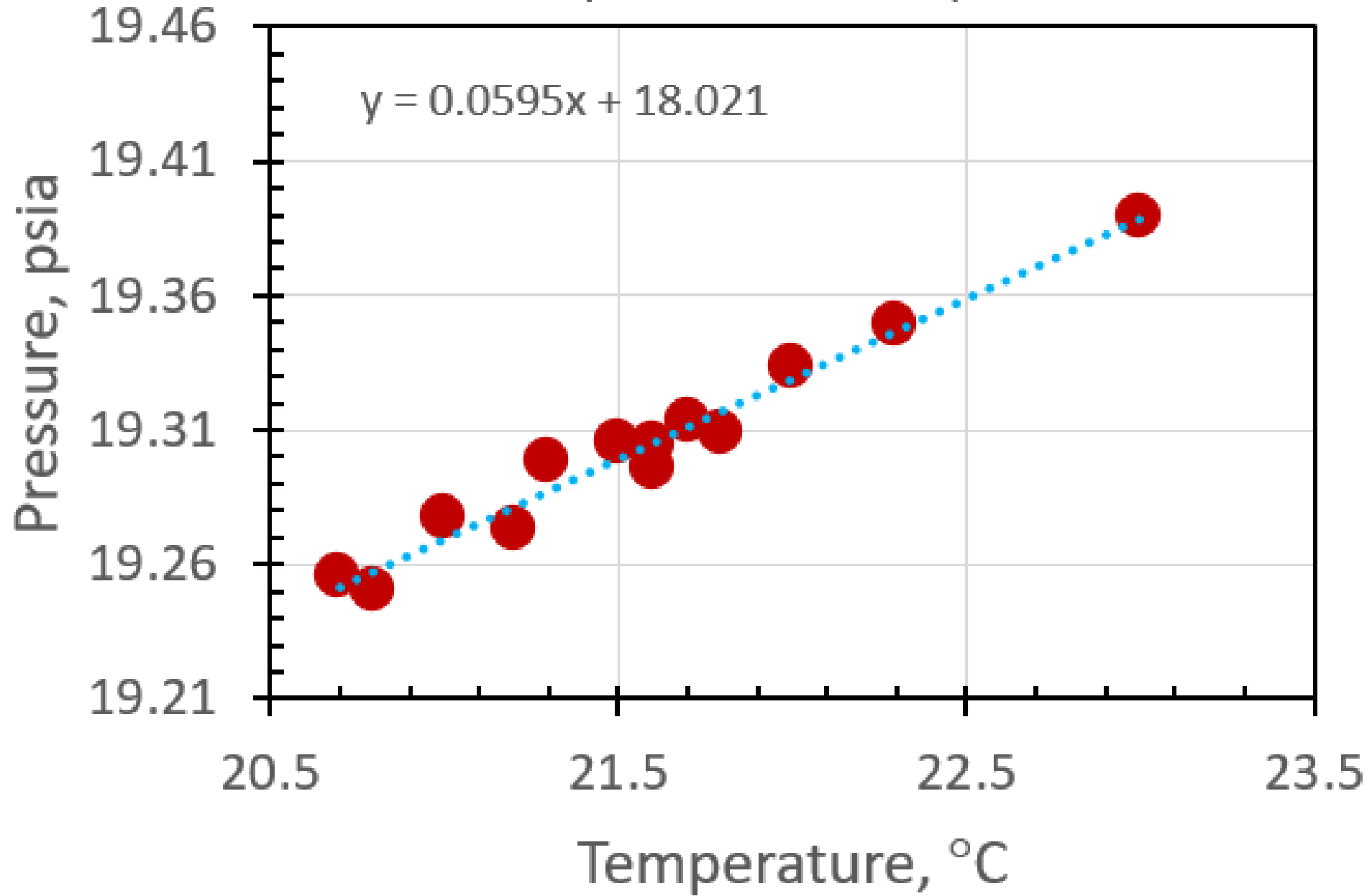
Volume pressure



Temperature °C



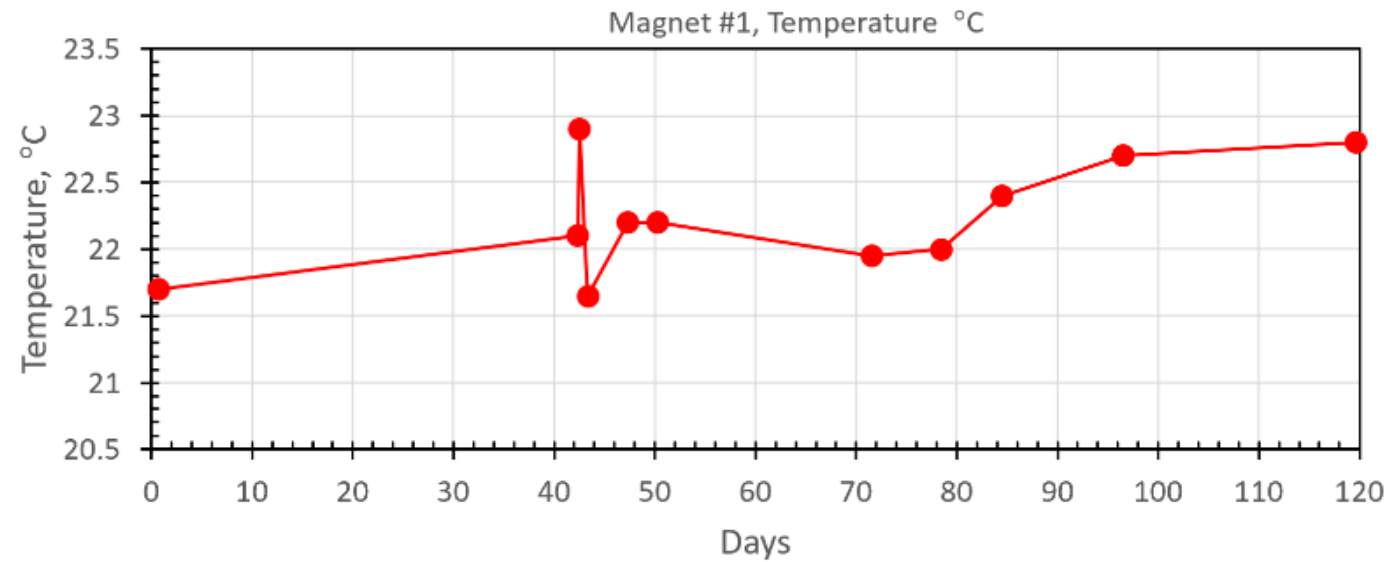
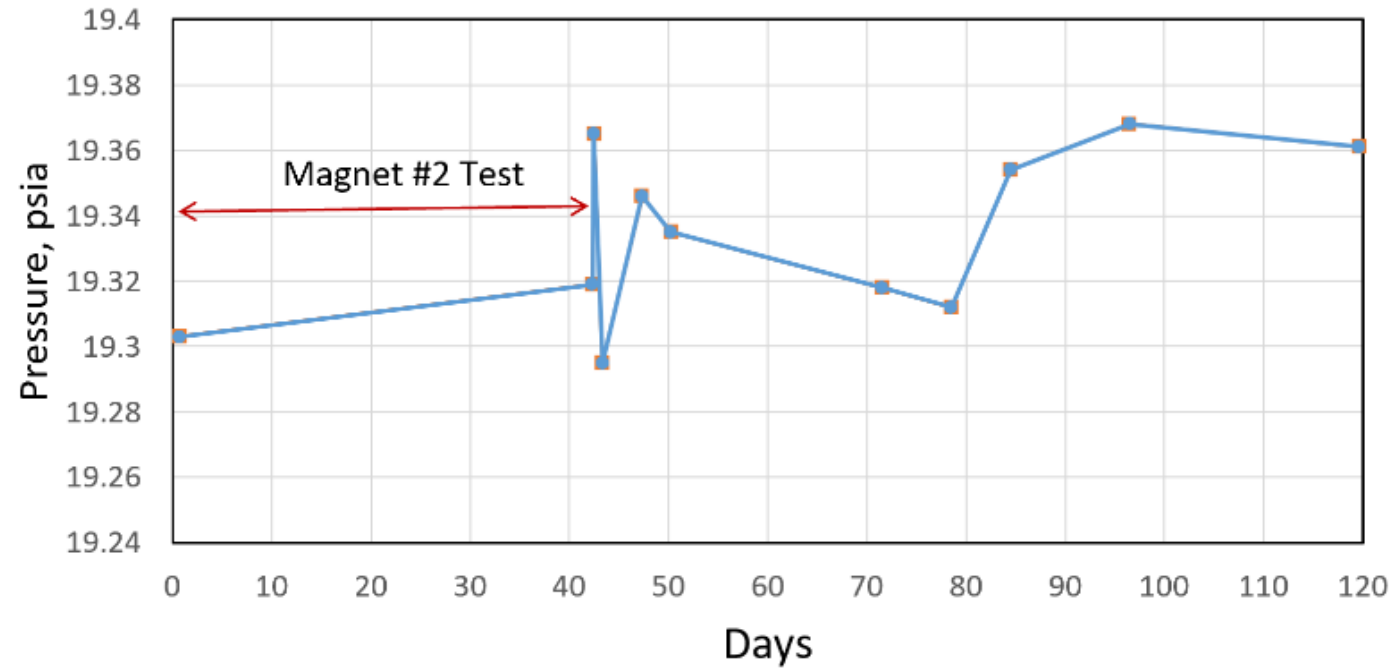
Vessel pressure vs temperature

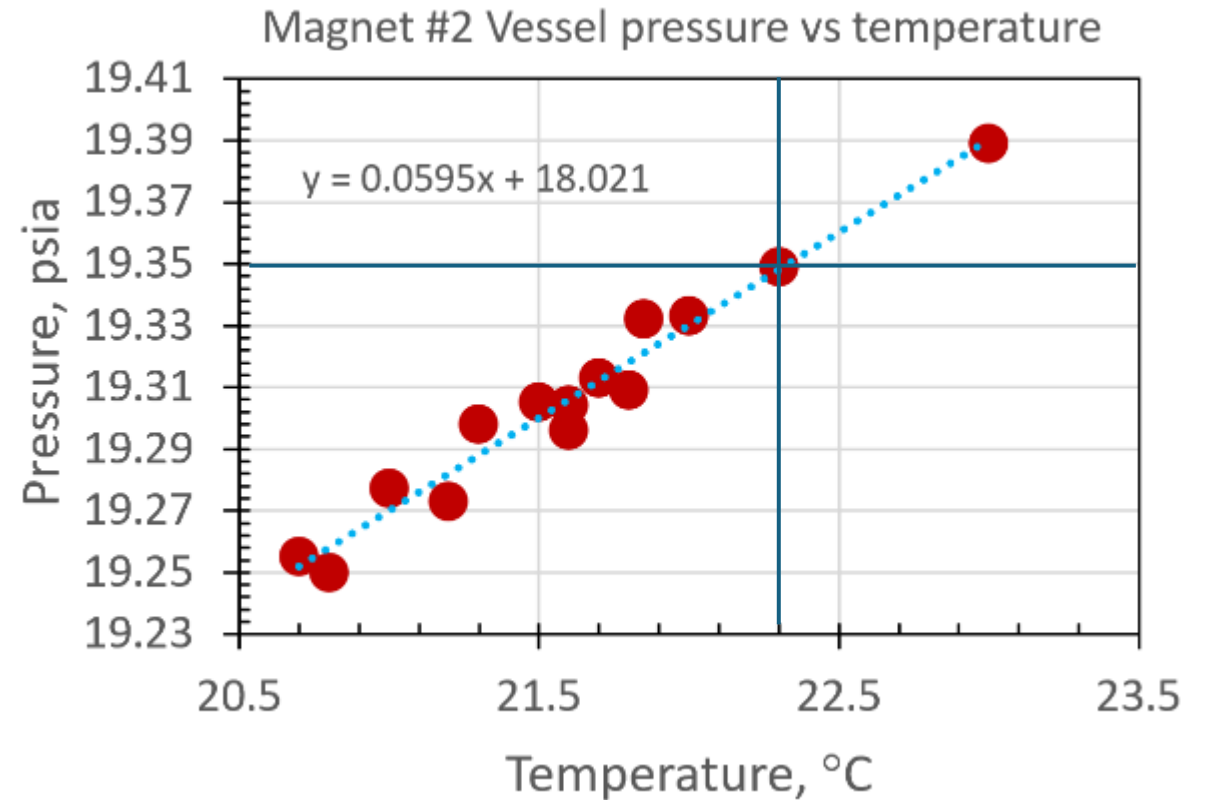
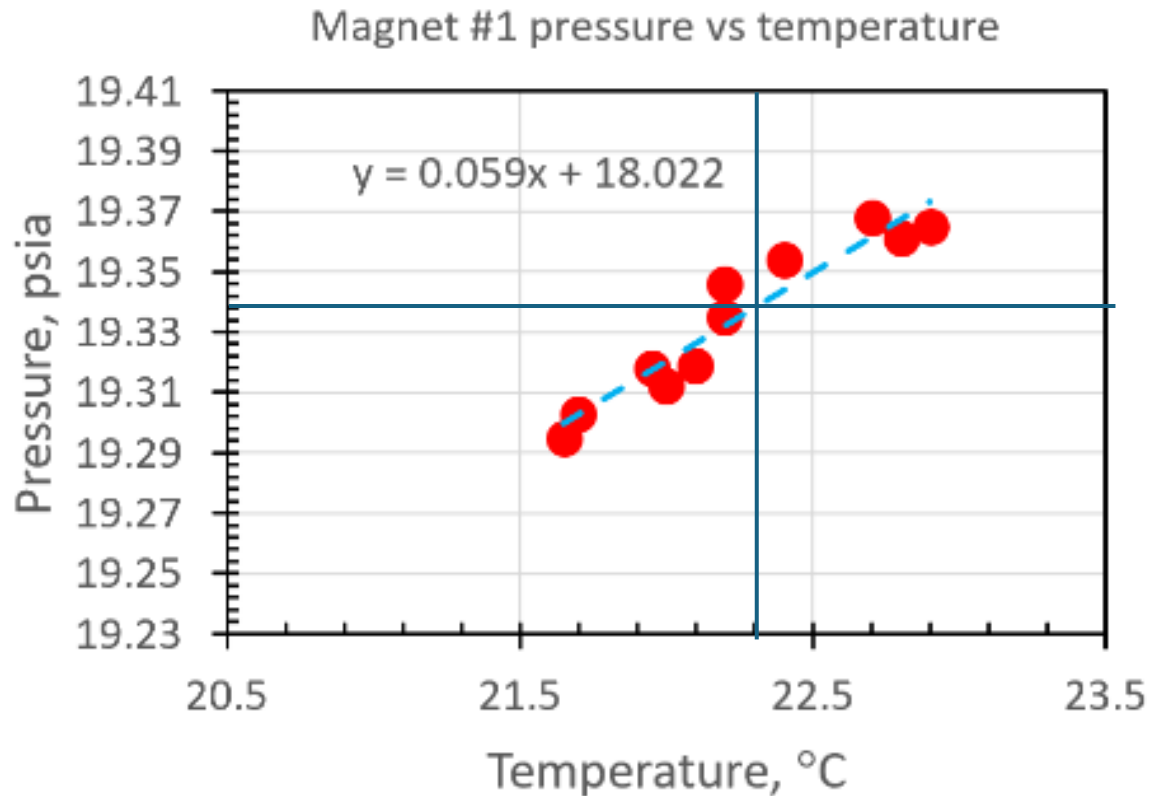


Magnet #1 Leak Test October 24, 2024 – February 19, 2025

(Magnet filled with CO₂ to 19.3 psia)

Magnet #1 Vessel Pressure of CO₂





If the environment temperature is the same (e.g. 22.3°C) – pressure in both volumes is the same:

$$\Delta p = 0.01 \text{ psia, with } \bar{p} = 19.345 \text{ psia (FLUKE), or } \sim 0.05\%$$

Anticipated resonance width ~ 0.15 Gauss; scan step size in measurements 0.03 Gauss, or 0.15%

Average pressure from two fits at 20 °C is 19.2065 psia.

For constant volume density doesn't depend on temperature

density calculator at https://www.peacesoftware.de/einigewerte/co2_e.html

19.345 psia at 22.3°C density of CO2 $\rho = 2.41846 \text{ kg/m}^3$ $V_{\text{opt}} = 1.5732\text{E-}10 \text{ eV}$ $B_{\text{res}} = 26.09 \text{ Gauss}$

19.2065 psia at 20°C density of CO2 $\rho = 2.41988 \text{ kg/m}^3$ $V_{\text{opt}} = 1.5741\text{E-}10 \text{ eV}$ $B_{\text{res}} = 26.10 \text{ Gauss}$

density from https://www.engineeringtoolbox.com/gas-density-d_158.html

19.2065 psia at 20°C density of CO2 $\rho = 2.406692 \text{ kg/m}^3$ $V_{\text{opt}} = 1.5655\text{E-}10 \text{ eV}$ $B_{\text{res}} = 25.96 \text{ Gauss}$

from the calculator at 20°C $\rho = 2.404124 \text{ kg/m}^3$ $V_{\text{opt}} = 1.5638\text{E-}10 \text{ eV}$ $B_{\text{res}} = 25.93 \text{ Gauss}$

Anticipation for measurements: mag. field scan by 1-hour runs
starting from 24.9 Gauss to 27.0 Gauss by 71 points the with step 0.03 Gauss

The question for discussion: whether 1-hour-long runs are statistically justifiable?
Alternative is, say, 1/2 -hour-long runs with express analysis and more detailed scan
around points suspicious for positive signal.