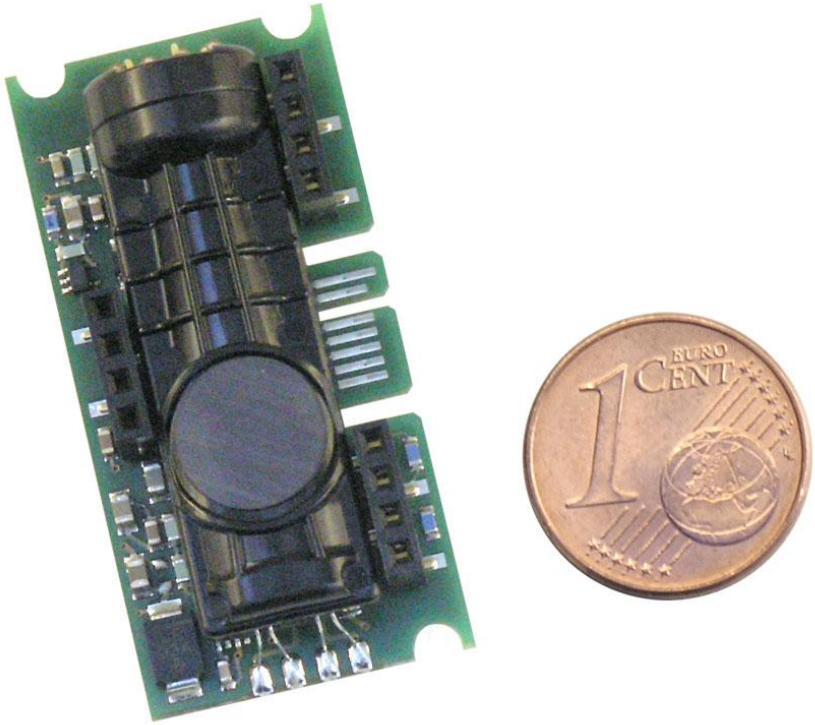
Leak Tests with CO_2 Sensors

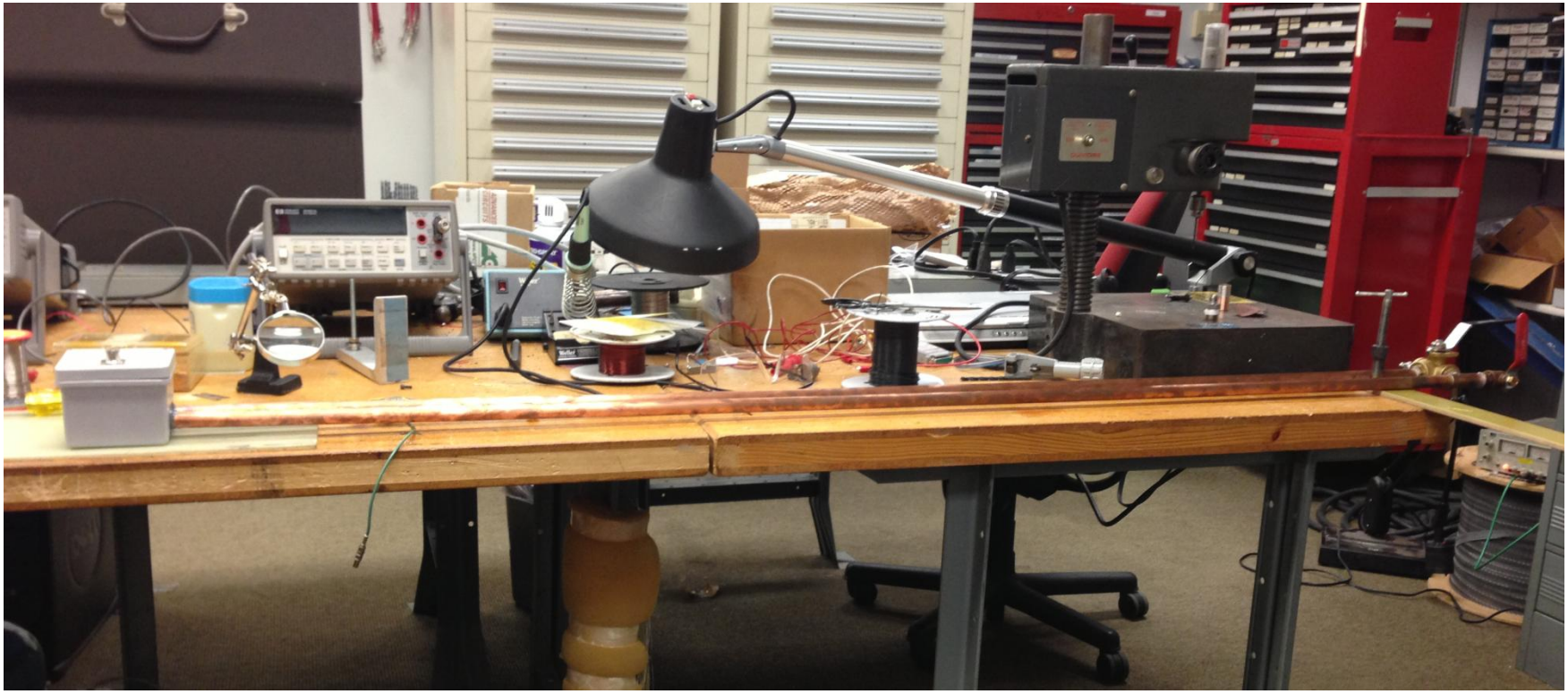
CO_2 Sensors

- EPLUSE G.m.b.H
- NDIR technology
- digital E2 interface (I2C)



Method

- Built an enclosure with approximate volume 733 cc

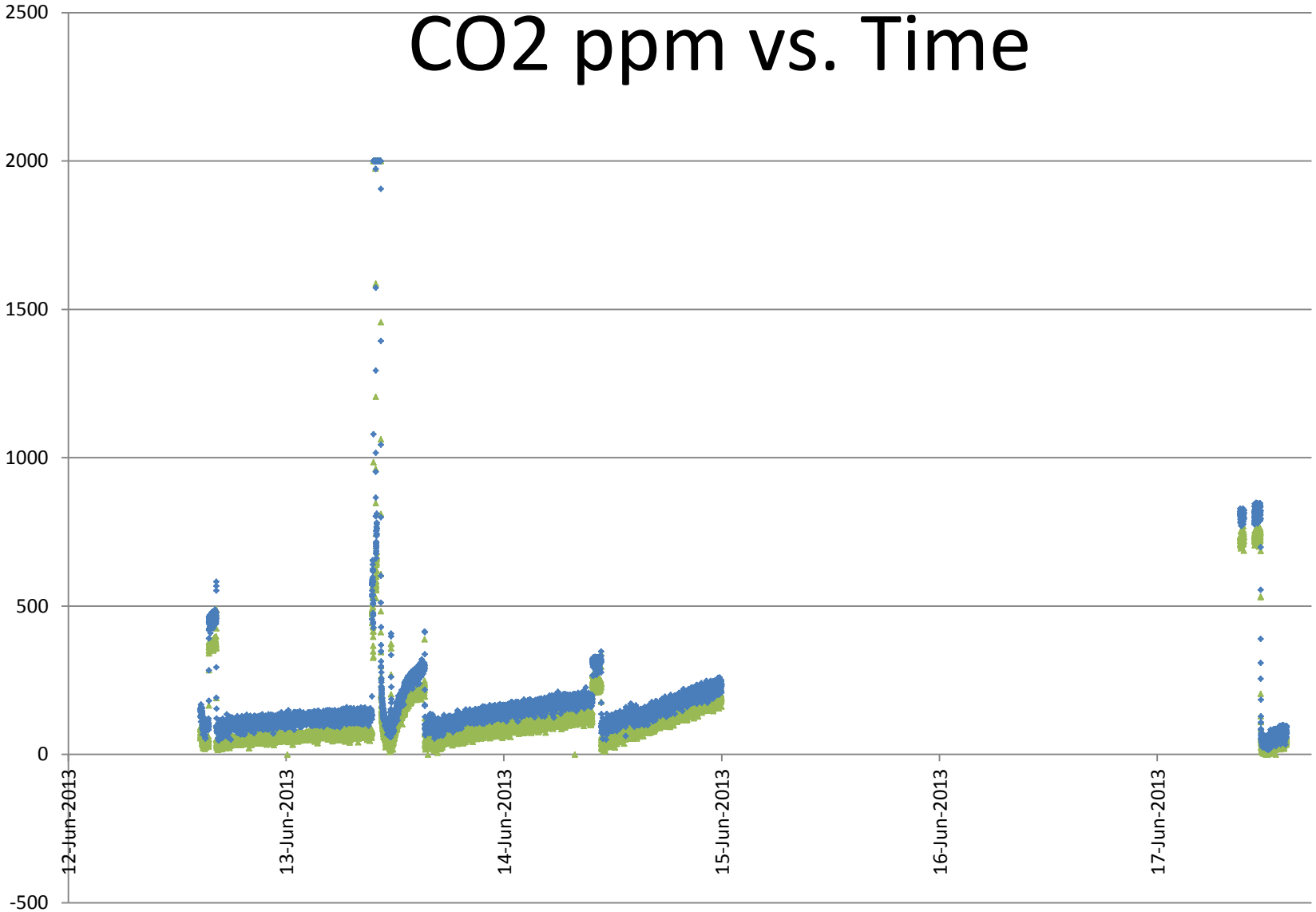


- Place the straw filled with ArCO2
- Purge the interior with Nitrogen
- Measurement of time until CO2 reads value

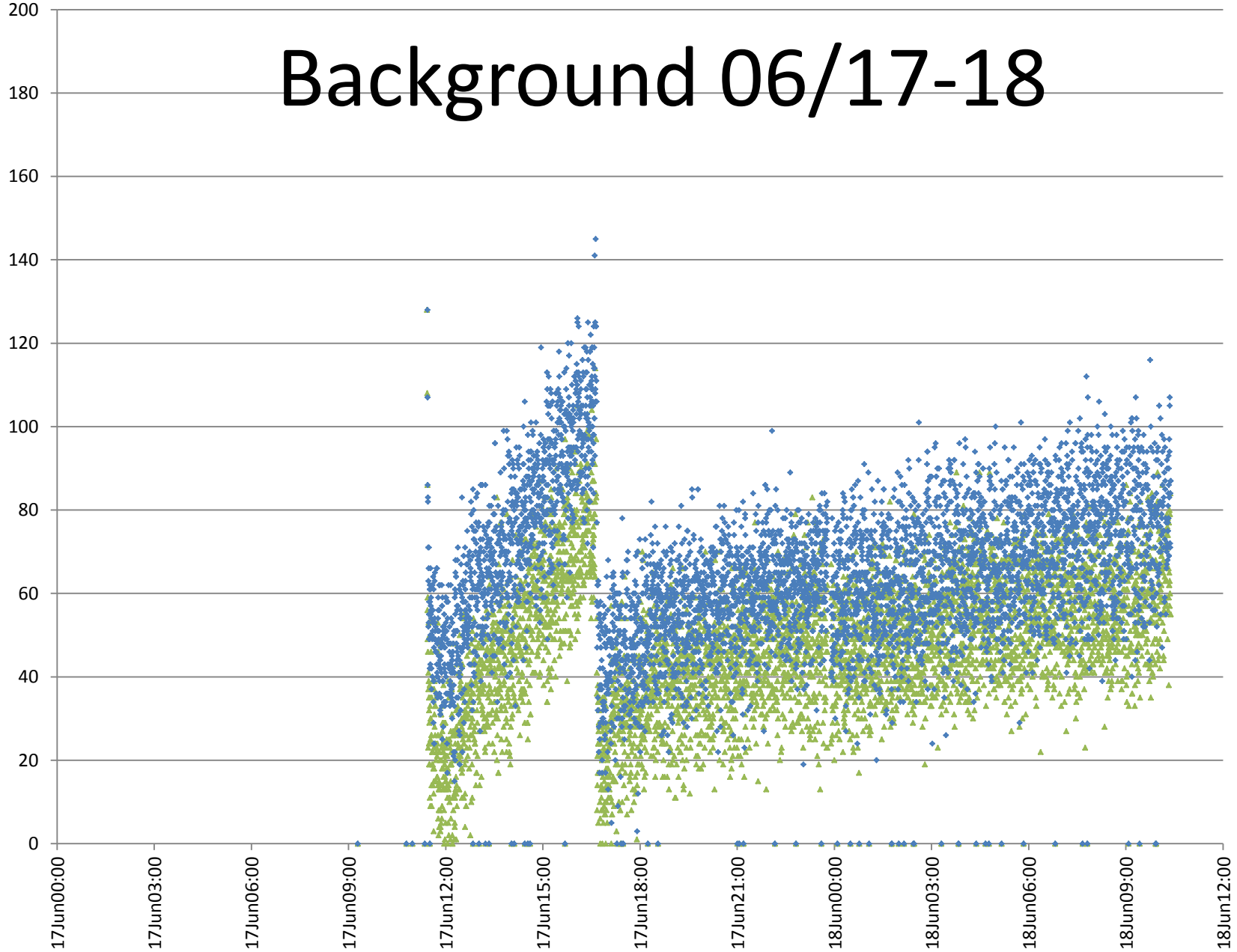
Straws

- Epoxy was used to secure the end pieces to both sides of the straws
- The epoxy was allowed to cure at room temperature for an hour after which they were placed on heating pads at approximately 60 degrees Celsius for about 4 hours
- The straws were confirmed to hold at least 700 grams

CO2 ppm vs. Time



Background 06/17-18



Backgrounds

- Originally attained a background for which the slope of a least squares regression line was $(2.457 \pm 0.031) \times 10^{-5}$ ccm for sensor 1 and $(2.813 \pm 0.043) \times 10^{-5}$ ccm for sensor 2
- The system was purged with ArCO2 beyond the point of the saturation of the sensors. This proved to be a bad idea after which there seems to be residual amounts of CO2 even after 3 nitrogen purges
- One of the plots clearly shows exponential behavior and each subsequent purge yielded backgrounds with slopes higher than noted originally

Calibration

- $ArCO_2$ was run through a .3 mL syringe
- The intake valve was taped over while still closed.
- Injected the contents of the syringe through the tape and the valve was opened
- The intake was taped over again and capped off
- Ideally the .3 mL of 20% CO_2 would increase the readings by ~82 ppm, we noticed ~100
- Assuming maximum leak rate from the straw:
- 1/2500 ccm = 40×10^{-5} ccm it would take only [(1×10^{-4} ppm)*volume]/40×10^{-5} ccm = 0.0733 cc/ 40×10^{-5} ccm = 183.25 min = 3.05 hours per straw to notice an increase such as the one attained in the calibration
- We may want to see if the jump is notable at a lower volume of $ArCO_2$ gas (maybe use .1 mL instead of .3 => ideally 50.1 minutes)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