

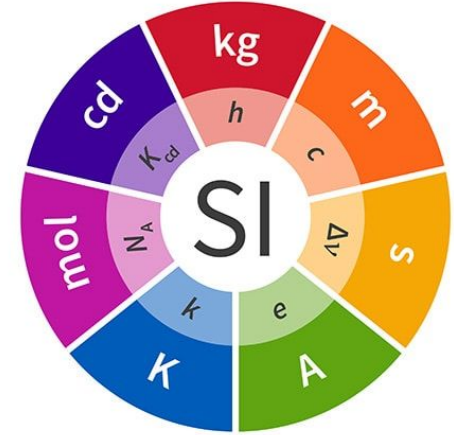
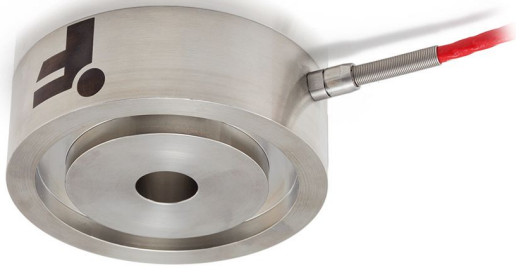


**Don't call the Nobel Committee just yet:  
We forgot to calibrate the instruments  
before the experiment...**

CartoonCollections.com

Calibration  
John R. Leeman  
8/3/21

Calibration ensures we translate the measured parameter into the correct real-world approximation of reality



**“In short, if measurement results matter, calibration matters.”**

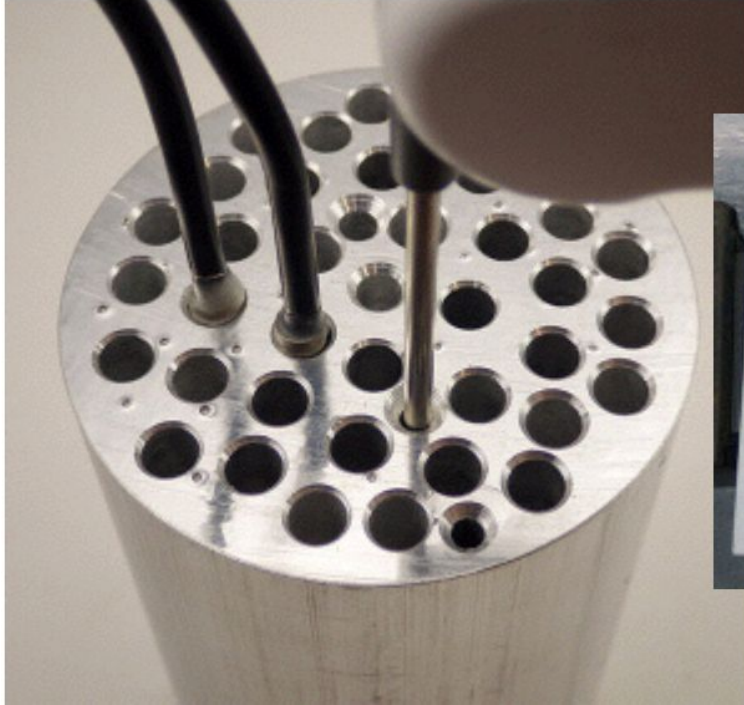
# Calibrations are not forever and should be updated frequently



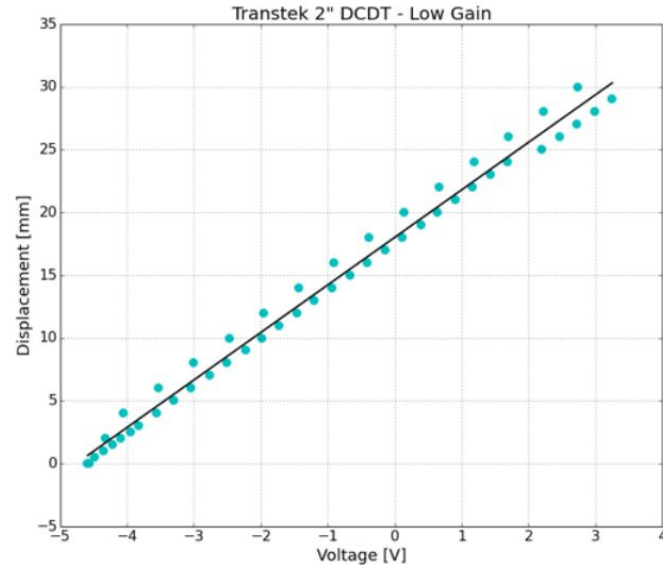
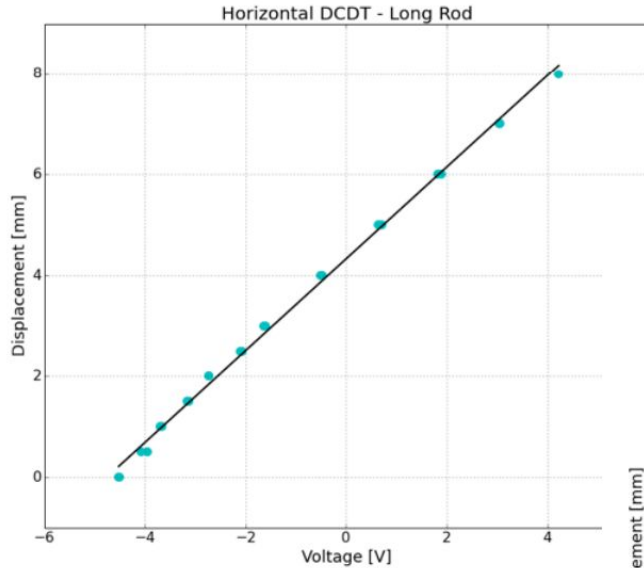
- New sensor
- Repair or modification of apparatus
- Moving apparatus
- After a shock/temperature/load anomaly
- Elapsed time (calibration schedule)
- Elapsed on time (100 hour inspections)
- Before/after critical measurements
- Questionable output
- Output not matching sister instruments
- Requirements (legal or standards)

## Ref. #:1

We take the transducer to known conditions (controlling everything else as best we can) and record the output



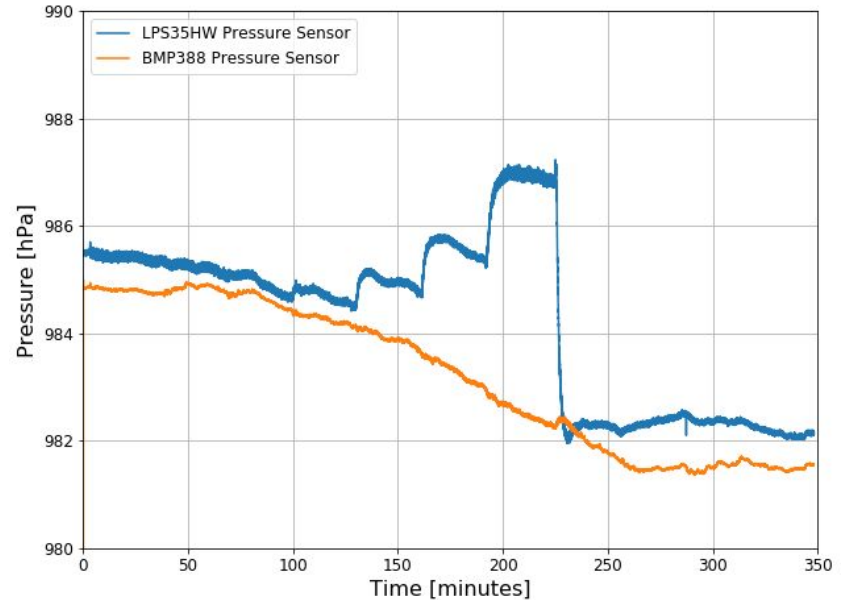
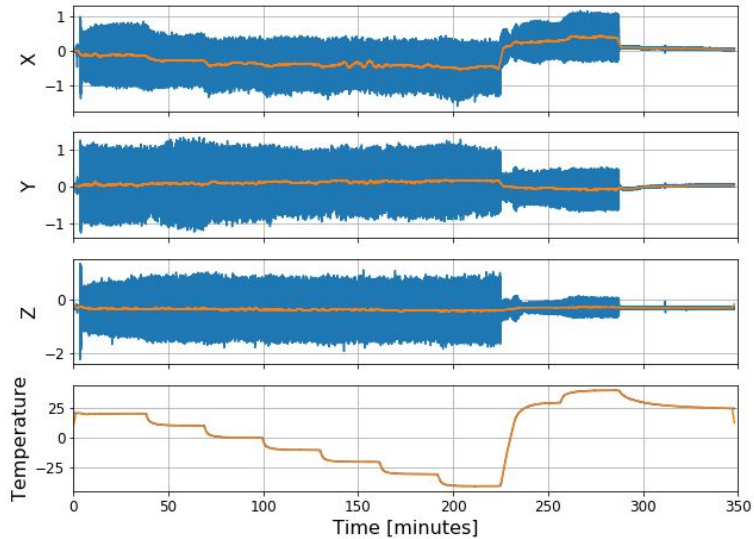
# We can then fit a transfer function and accept or reject the result





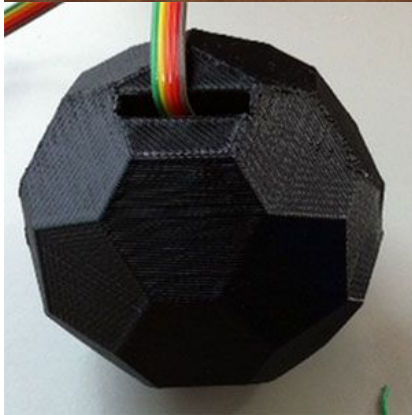
# The biggest thing to remember is cross-sensitivity issues!

BN0055 Accelerometer

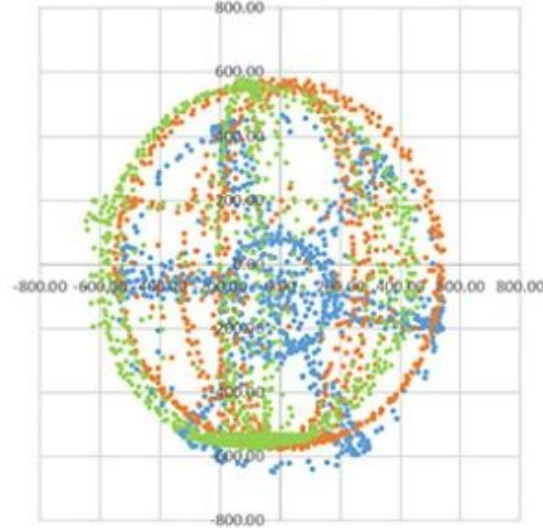


“Everything is a temperature sensor, some things sense other stuff too” - Elecia White

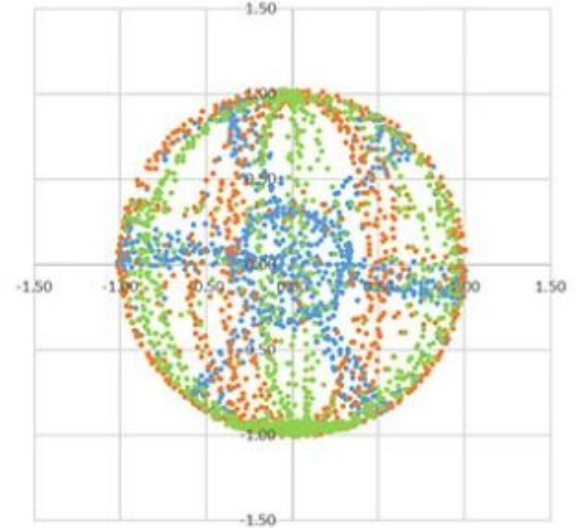
# You can also calibrate things to more natural sources



LM303 Mag Raw (In Housing)  
X/Y (blue), X/Z (orange) Y/Z (green)

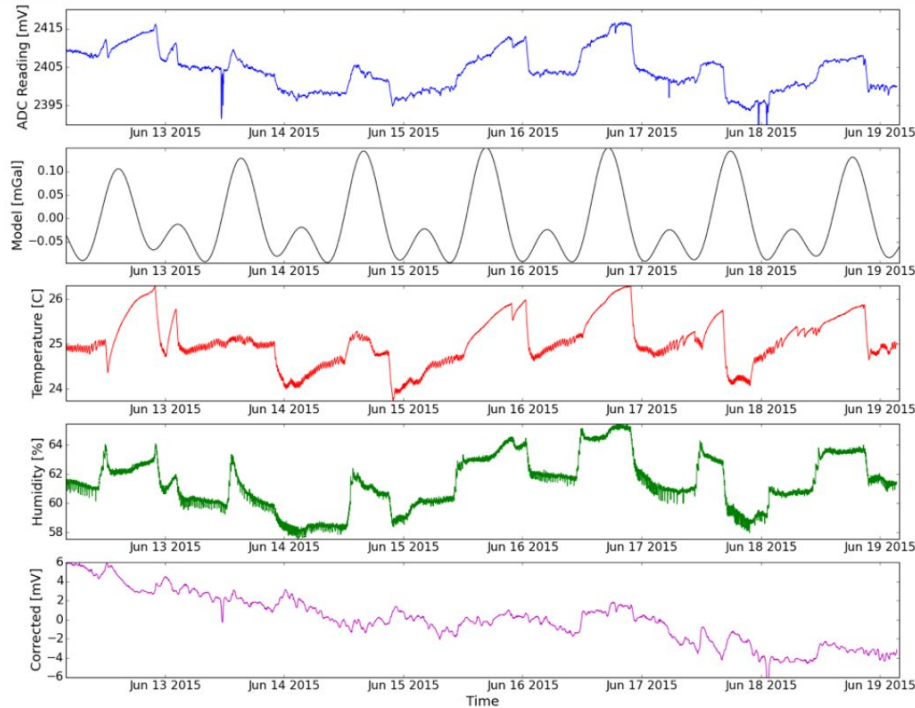


LM303 Mag FreeIMU Calib (In Housing)  
X/Y (blue), X/Z (orange), Y/Z (green)





# Lots of variables to think about/control



- Temperature
- Humidity
- Pressure
- Orientation
- Time of day
- Traffic/Noise Sources
- Tides
- And on and on

# Our recommendations for general equipment

- ASTM if available (just have a procedure recorded)
- Semiannual for first 3 years, annual afterwards
- Before any critical experiment (time vs time cost)
- Against NIST traceable standard (which needs calibrated) or by a lab

# Keep a calibration history log in great detail

44 mm Solid "V"		44mm Solid "H"		62mm "V"		62mm "H"	
10.94 mV/kN	12/10/2009	HG 111.366 mV/kN	3/27/2009	17.82 mV/kN	3/27/2009	HG 173.877 mV/kN	3/27/2009
11.33 mV/kN	1/5/2010	LG 11.58 mV/kN	3/27/2009	18.52 mV/kN	1/5/2010	LG 18.08 mV/kN	3/27/2009
11.15 mV/kN	12/5/2010	HG 110.212 mV/kN	12/10/2009	18.10 mV/kN	1/10/2011	HG 207.152 mV/kN	1/5/2010
10.869606 mV/kN	2/5/2014	LG 11.46 mV/kN	12/10/2009	18.462238 mV/kN	2/5/2014	LG 21.54 mV/kN	1/5/2010
10.829 mV/kN	8/29/2014	HG 114.473 mV/kN	1/7/2011	18.523 mV/kN	8/29/2014	HG 196.333 mV/kN	1/7/2011
10.786349 mV/kN	2/10/2015	LG 11.90 mV/kN	1/7/2011	18.363185 mV/kN	2/10/2015	LG 20.415 mV/kN	1/7/2011
		HG 108.604244	2/5/2014			HG 200.497461 mV/kN	2/5/2014
		LG 11.588748	2/5/2014			LG 20.939407 mV/kN	2/5/2014
		HG 108.71 mV/kN	5/11/2014			HG 208.905 mV/kN	8/29/2014
		LG 11.315 mV/kN	5/11/2014			LG 21.789 mV/kN	8/29/2014
		HG 106.08 mV/kN	8/1/2014			HG 211.236884 mV/kN	2/10/2015
		LG 11.473 mV/kN	8/1/2014			LG 21.393971 mV/kN	2/10/2015
		HG 111.453 mV/kN	8/29/2014			CELL REBUILT	
		LG 11.658 mV/kN	8/29/2014			HG 184.014209 mV/kN	3/6/2015
		HG 119.423363 mV/kN	2/10/2015			LG 18.721994 mV/kN	3/6/2015
		LG 11.742750 mV/kN	2/10/2015				