Things to study:

Accuracy – Difference between measured and the “true” value

* Skewed by bias/precision

Uncertainty analysis

* Error propagation
  + Kline McClintock
  + Sequential perturbation
* Higher order uncertainty
* Uncertainty trees
* Student-t distribution
* When to consider uncertainty
  + Design stage
    - Consider bias
    - Neglect precision

DAQ Setup

* Filtering
* Signal conditioning
* Cold junction
* Data acquisition
* Shunt circuit
* Isolation
* Amplification
* Analog/digital converter
* Buffer

Flow diagram setup

Sources of error

* Noise ratio
  + Put amplifier before wires/close to instrument to reduce wire noise
  + Use shortest wires possible
* Data error

Instruments:

* Flow rate measurements
  + Hot wire anemometer
    - Constant temperature
      * Wheatstone bridge
    - Constant current
    - Equations
  + PIV
  + Doppler anemometry
  + Vane that spins
  + Pitot tube
  + Orifice/sonic nozzle
    - Orifice
    - Venturi meter
    - Flow nozzle
    - Hybrid
  + Rotameter
  + Laminar flow element
  + Electromagnetic flow meter
  + Vortex shedding
  + Turbine flow meter
  + Thermal flow meter
  + Bubble calibrator
  + Coriolis flow meter
* Pressure measurements
  + Barometer
  + Manometer
    - Regular
    - Micro-manometer
    - Inclined tube manometer
  + Dead weight tester
  + Pressure transducer
  + Bourdon
  + Diaphragm
    - Strain gage
    - Capacitance
    - Piezoelectric
* Temperature measurements
  + Thermocouples
  + Thermistors
  + RTD
  + Temperature sensitive paint
  + Thermal expansion meter
  + Thermoelectric temperature measurement
    - Seabeck effect – two dissimilar metals then electromagnetic force
    - Peltier effect
    - Thompson effect
  + Thermochromic liquid crystal (TLC)
* Volume measurements
  + Dry test meter
  + Rotary vane meter
  + Wobblemeter
  + Diaphragm/bellows type
* LAZERS!!! PEW PEW
* Visual techniques
  + CCD
  + CMOS
  + Quantum detector