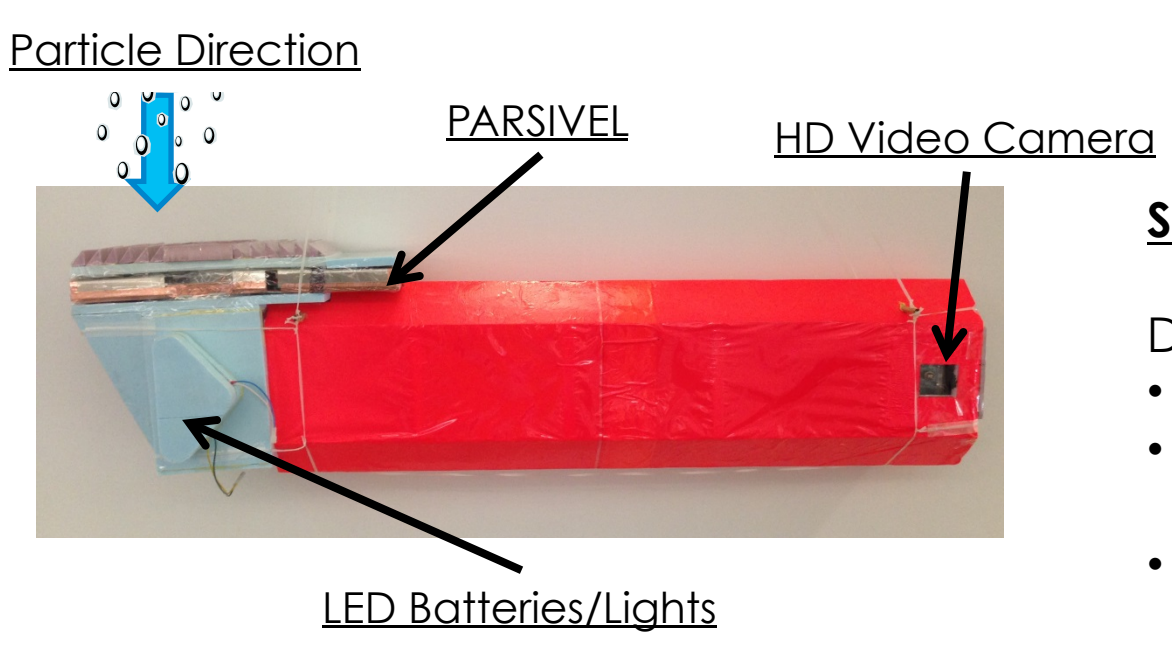
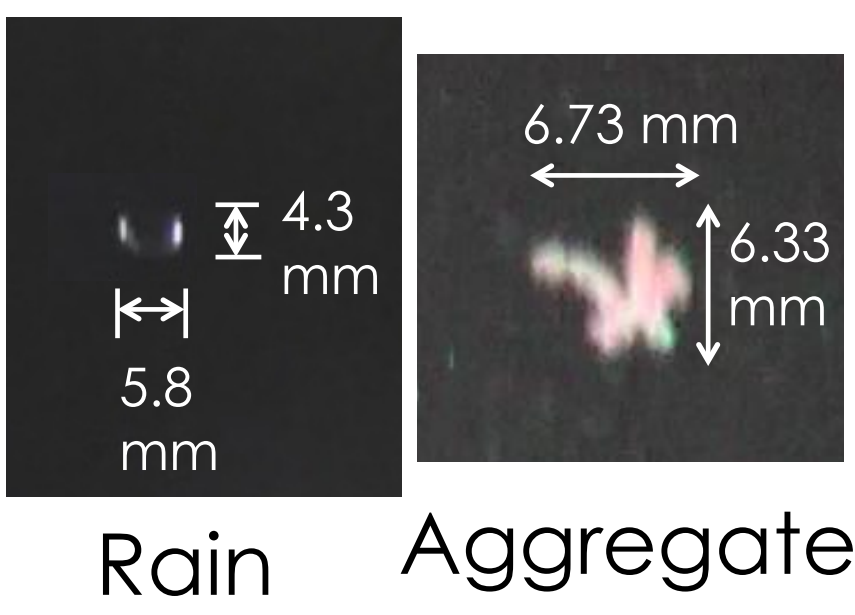


PARTICLE SIZE, IMAGE, and VELOCITY (PASIV) Probe



- Specifications:**
- Dual Instrument System:
 - HD Camera
 - PARSIV Laser Distrometer
 - ~5.5lbs total weight

HD Camera System:
 Model HDC-SD9P
 1920x1080 Resolution
 1/8000 shutter speed
 24 fps
 Equivalent sample of 0.3% of each second



- Of Detected Particles, can provide:
 - Effective radius
 - Eccentricity
 - Thermodynamic profile of particle regions (with radiosonde)
 - Particle Type (i.e. rain, snow, graupel, etc.)
 - Crystal Habit (plates, columns, aggregates, etc.)

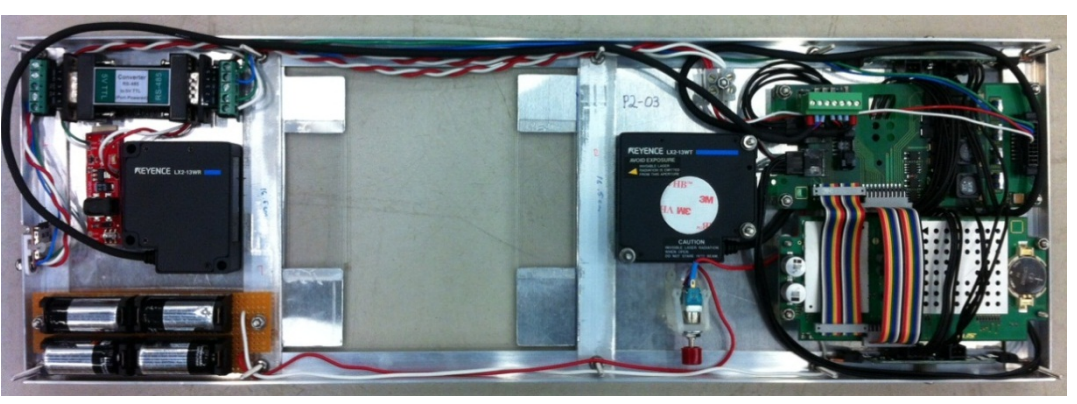
PARSIVEL 2 Laser Distrometer

- Specifications:**
 780 nm Laser
 10 sec data interval
- Available data:
 - Particle Count
 - DSD
 - Velocity Distribution



Above: Unmodified PARSIVEL 2 laser distrometer

Right: Condensed PARSIVEL-2 unit. Data stored locally on micro SD card. Approximately 6 hr battery life.

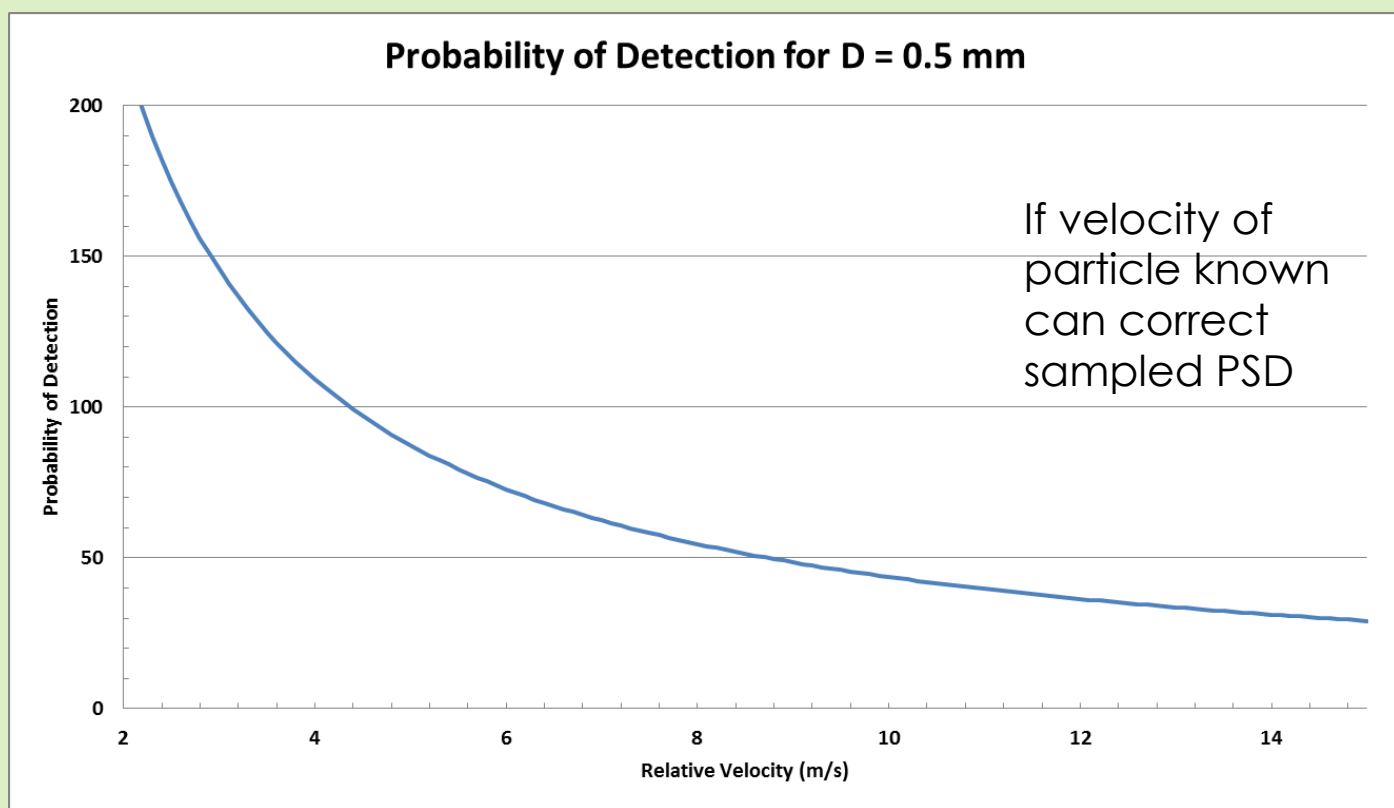
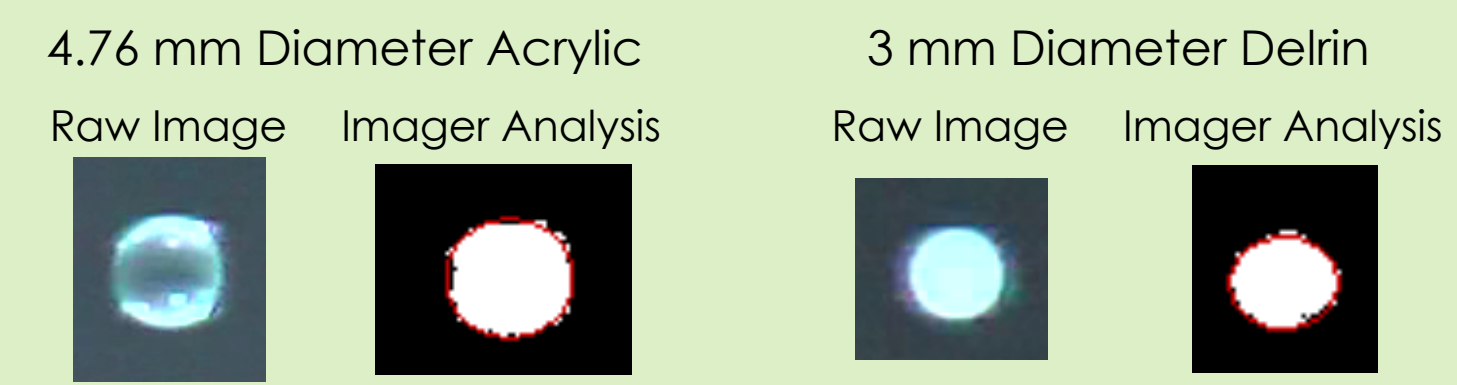
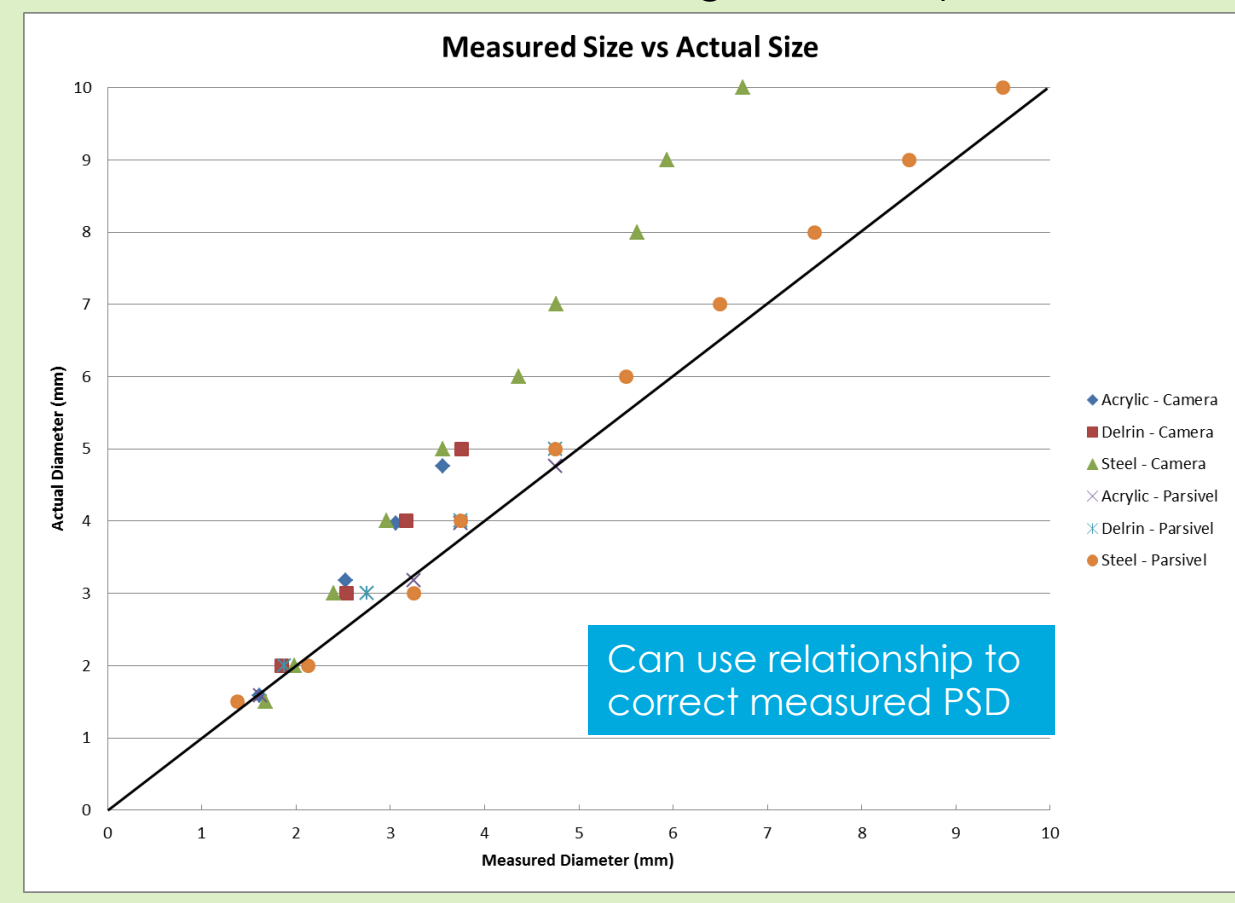


Videosondes

Sean Waugh

Validate sizing accuracy of Camera and Parsivel

Test Objects over diameter range:
 Acrylic Ball Bearing -> "Rain-like"
 Delrin Ball Bearing -> "Graupel-like"



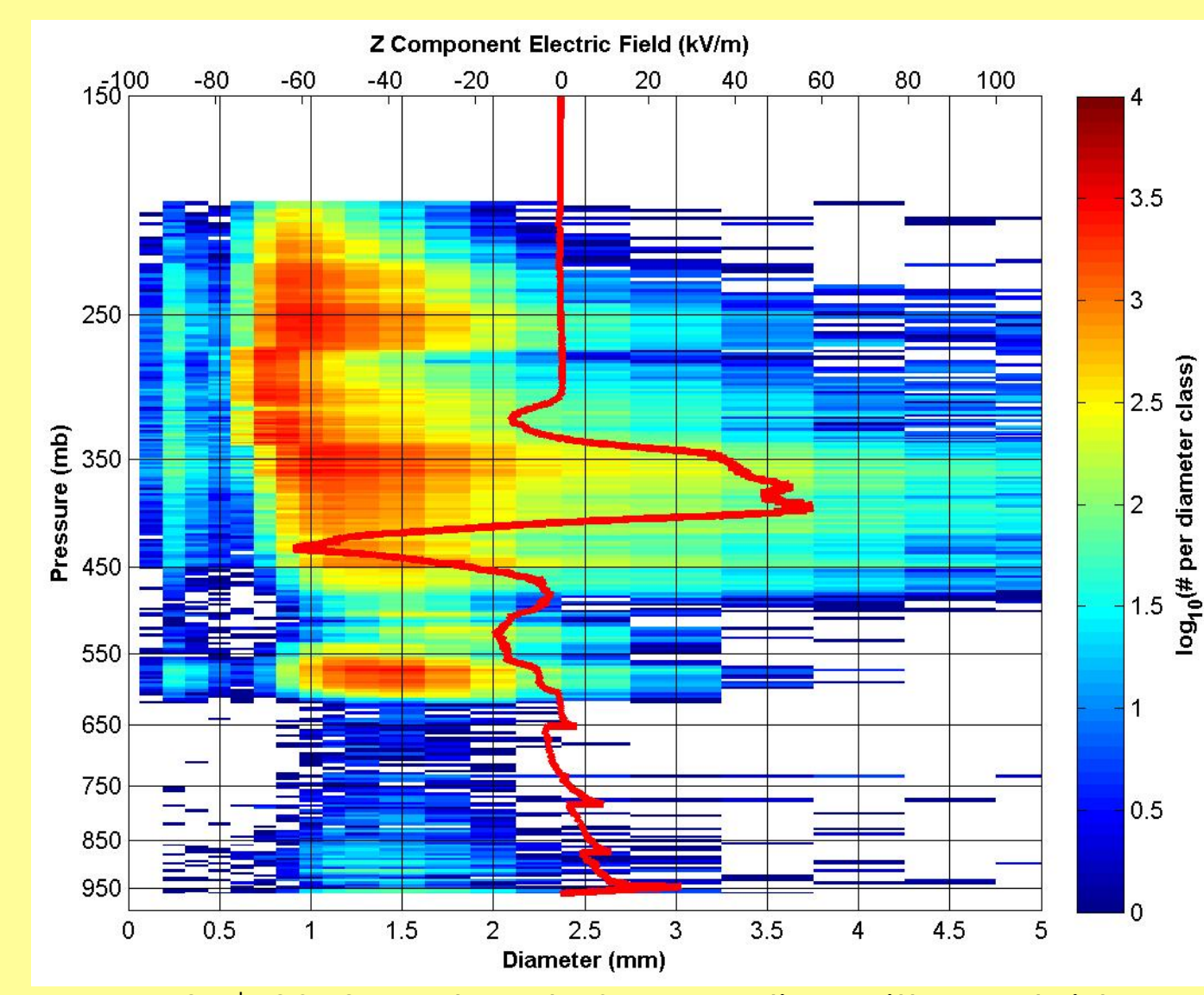
Adapting work of Liu et al., 2013 to PASIV

$$\text{Prob. of Detection} = \left(\frac{\text{Height} - 2D}{\text{Velocity} / \text{Frame Rate}} \right) * 100$$

List of Operation days	
Location	Storm Type
May 29 th , 2012 – C. OK	Supercell
June 21 st , 2012 – C. OK	Multicell
August 15 th , 2013 - FL	Weak single cell
August 16 th , 2013 - FL	Stratiform
Nov 24 th , 2013 – C. OK	Winter Storm
Jul 25 th , 2013 – FL	Single cell
August 8 th , 2014 – FL	Convective Line



Left: PASIV balloon launch on August 1, 2013 in FL during DARPA project.



June 21st, 2012 analyzed PSD sounding with overlaid electric field profile. Comparison indicates correlations between electric field strength and sign with particle distributions.

Above: Video segments from indicated operation days.

Conclusions:

- One-of-a-kind instrument
- In-house design
- Hybrid system for increased confidence and accuracy
- Capable of in situ particle data in under sampled locations of severe weather

Several Applications

- Storm Electrification (when paired with Electric Field data)
- Dual-Pol Radar validation
- Cloud microphysical research

