Instrument and Data Status

CDP = Cloud Droplet Probe

2D-C = Two Dimensional – Cloud

Dave Rogers, NCAR/RAF

Outline:

What the instruments measure

Calibration

Time delays

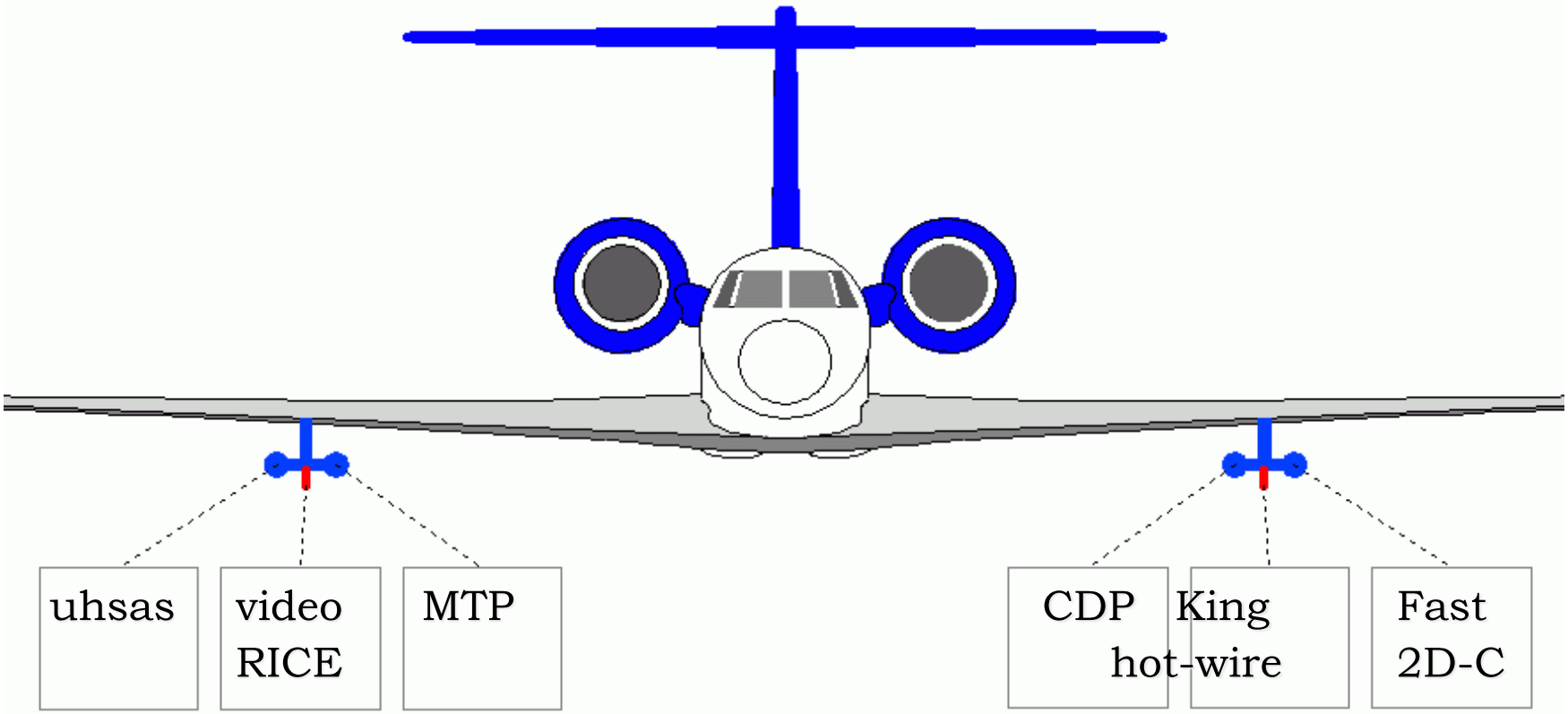
Changes made to the instrument for H4-H5

Data quality

- *Anomalies, errors, artifacts, identification*

Data readiness, re final quality

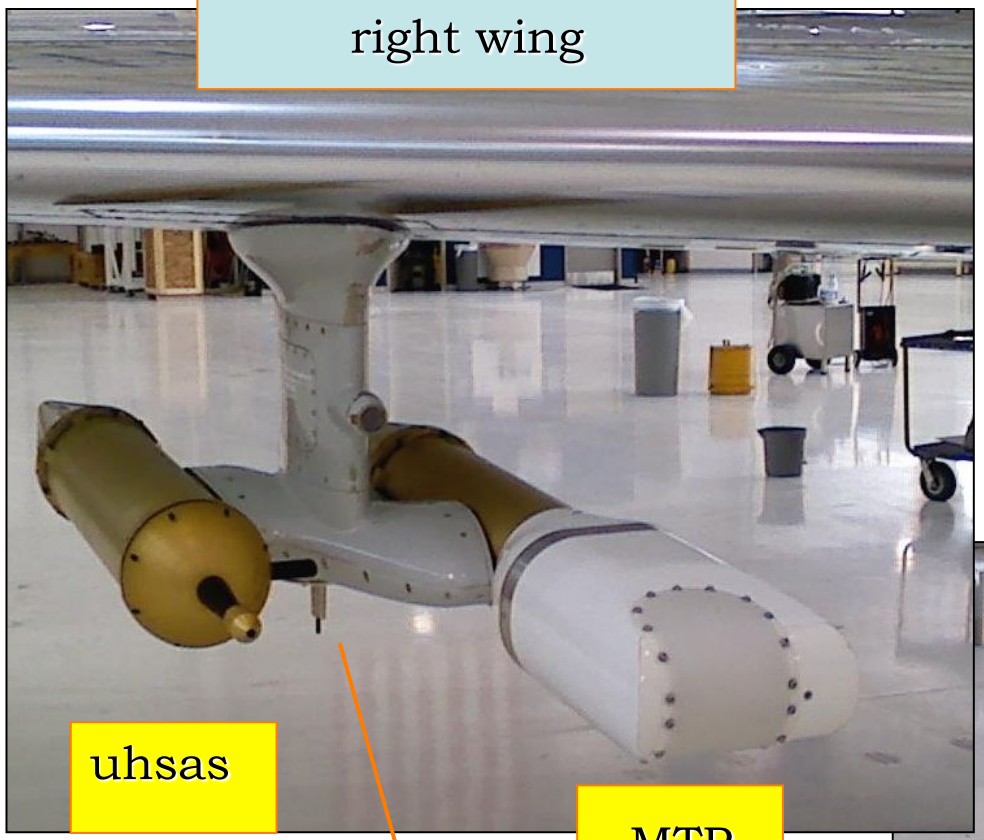
CDP & 2D-C = wing mounted probes



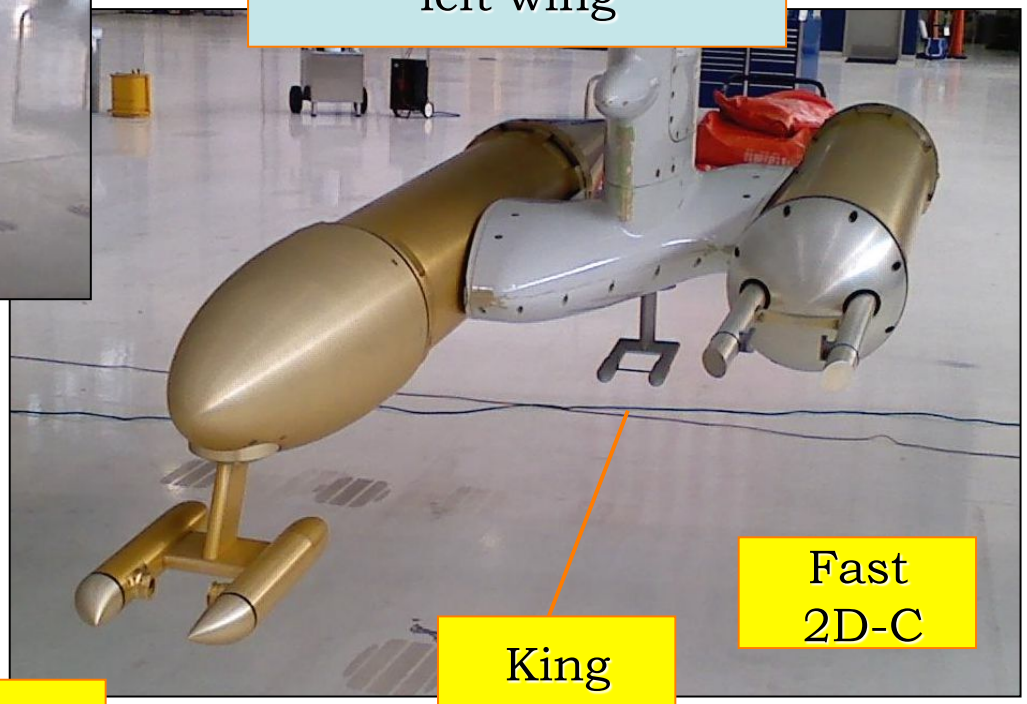
Configuration changed slightly, H1 → H2 → H3

photos

right wing



left wing



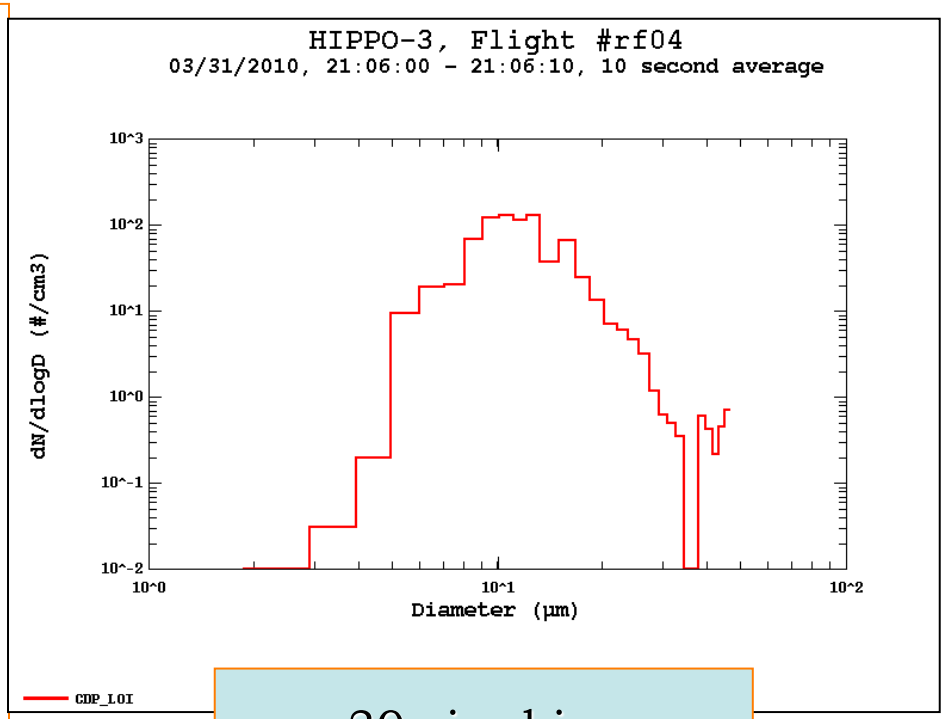
what the instruments measure
CDP

CDP

- *forward light scattering from cloud particles*
- *histogram, 2 – 50 µm diameter*

Data

- *Logging on ADS server*
- *Time delay <0.1 s*
- *Size histograms, 10 Hz*
- *Derived values are in netcdf files*
  - droplet size distribution, concentration, water content, effective radius
- *RAF software for netcdf files*
  - free download, Linux, Mac, Windows
  - time series, x/y, size distribution, flight track, ..
  - extract ASCII

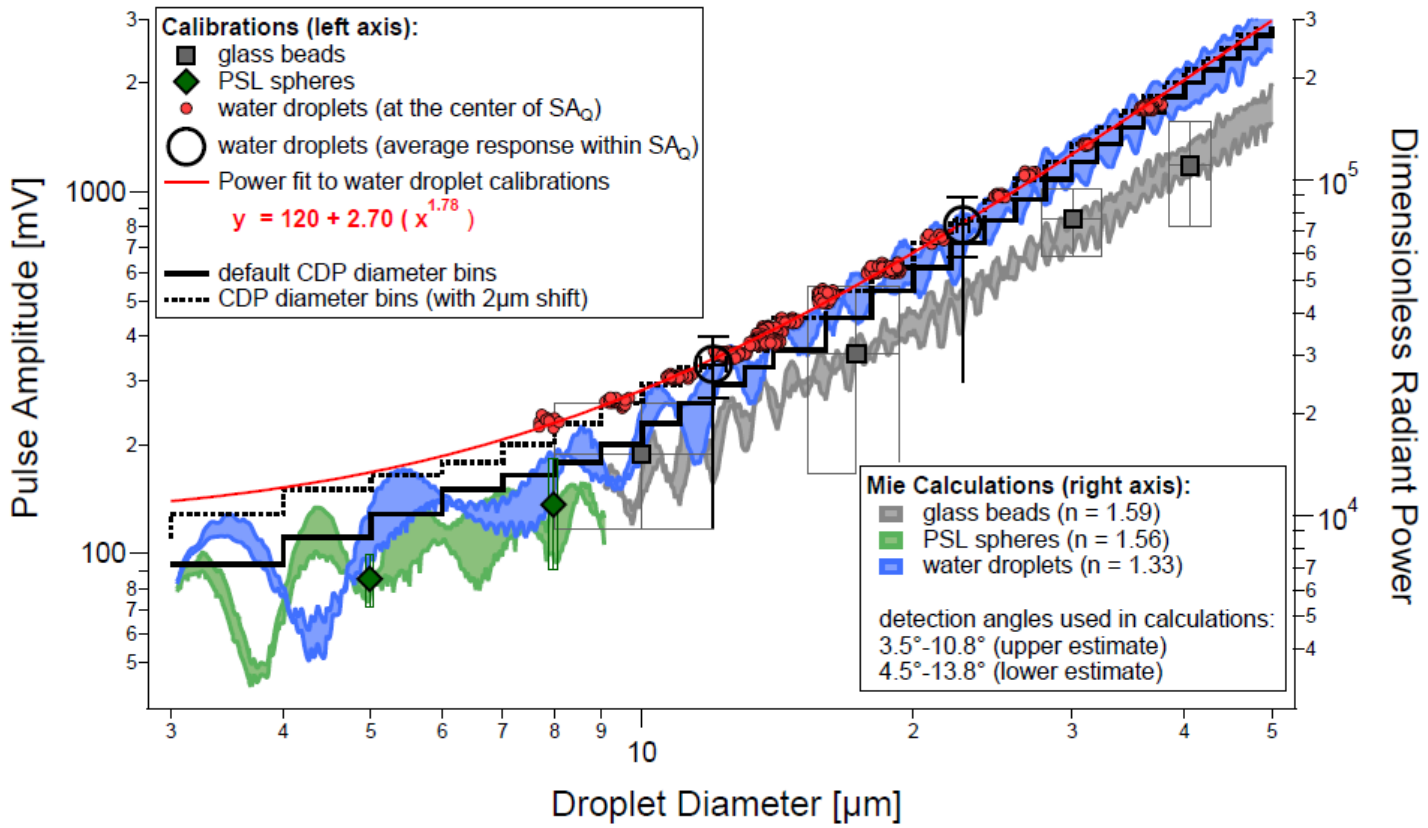


30 size bins

Calibration

CDP = glass beads

S. Lance et al.: Water droplet calibration of the Cloud Droplet Probe (CDP)



Data quality - CDP

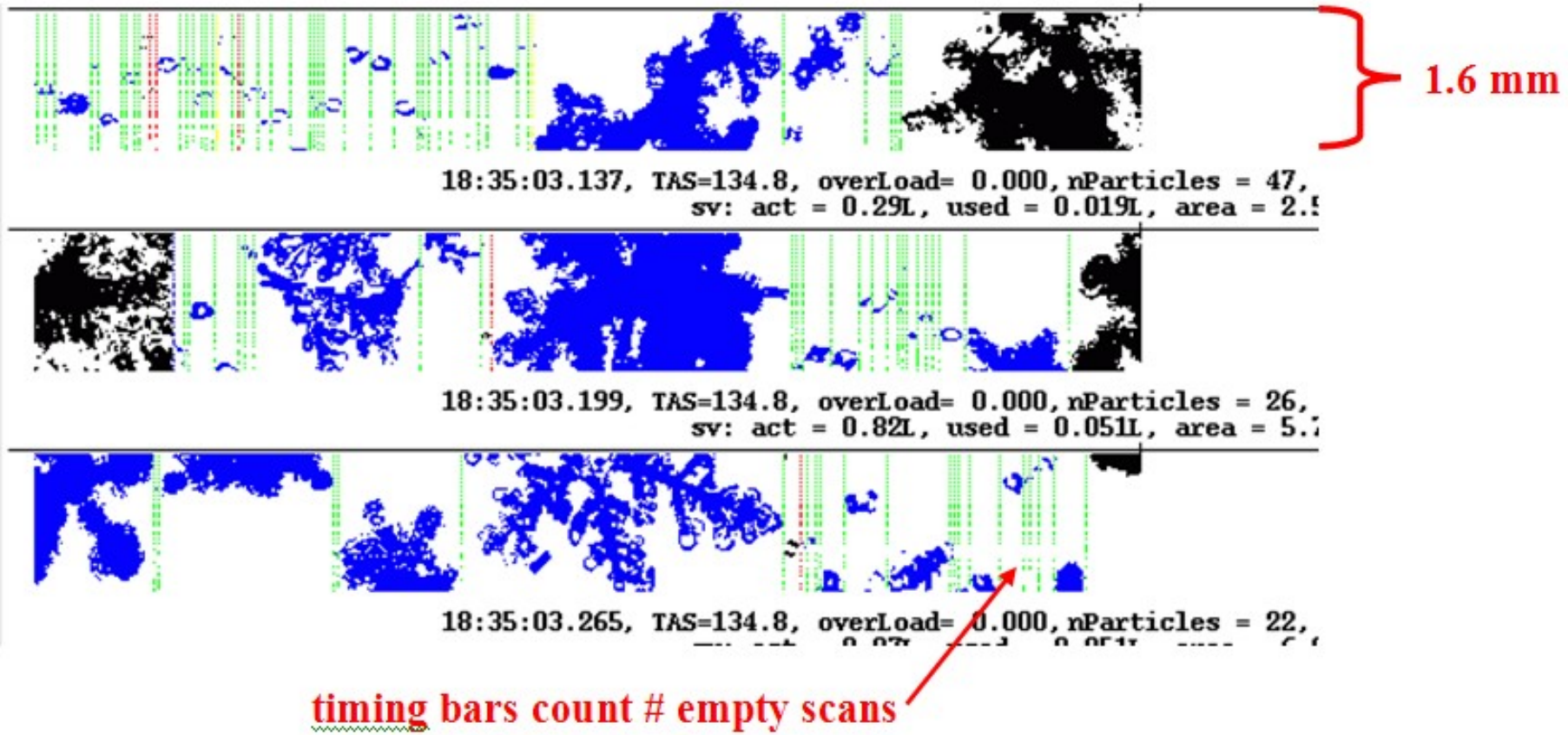
Anomalies, artifacts & errors

- *Coincidence errors:*
  - undercounting when drop conc > ~200 /cc
  - oversizing
- *CDP is designed for spheres but has some response to ice particles*
  - → interpreting CDP data in ice clouds is uncertain
- *Unknown if splash-breakup fragments can bounce into CDP laser beam*
- *Under-sizing ~30% at edge of laser beam*

what the instruments measure
2D-C

optical array shadowing by cloud particles

64 diodes x 25 µm = 1.6 mm



2D-C

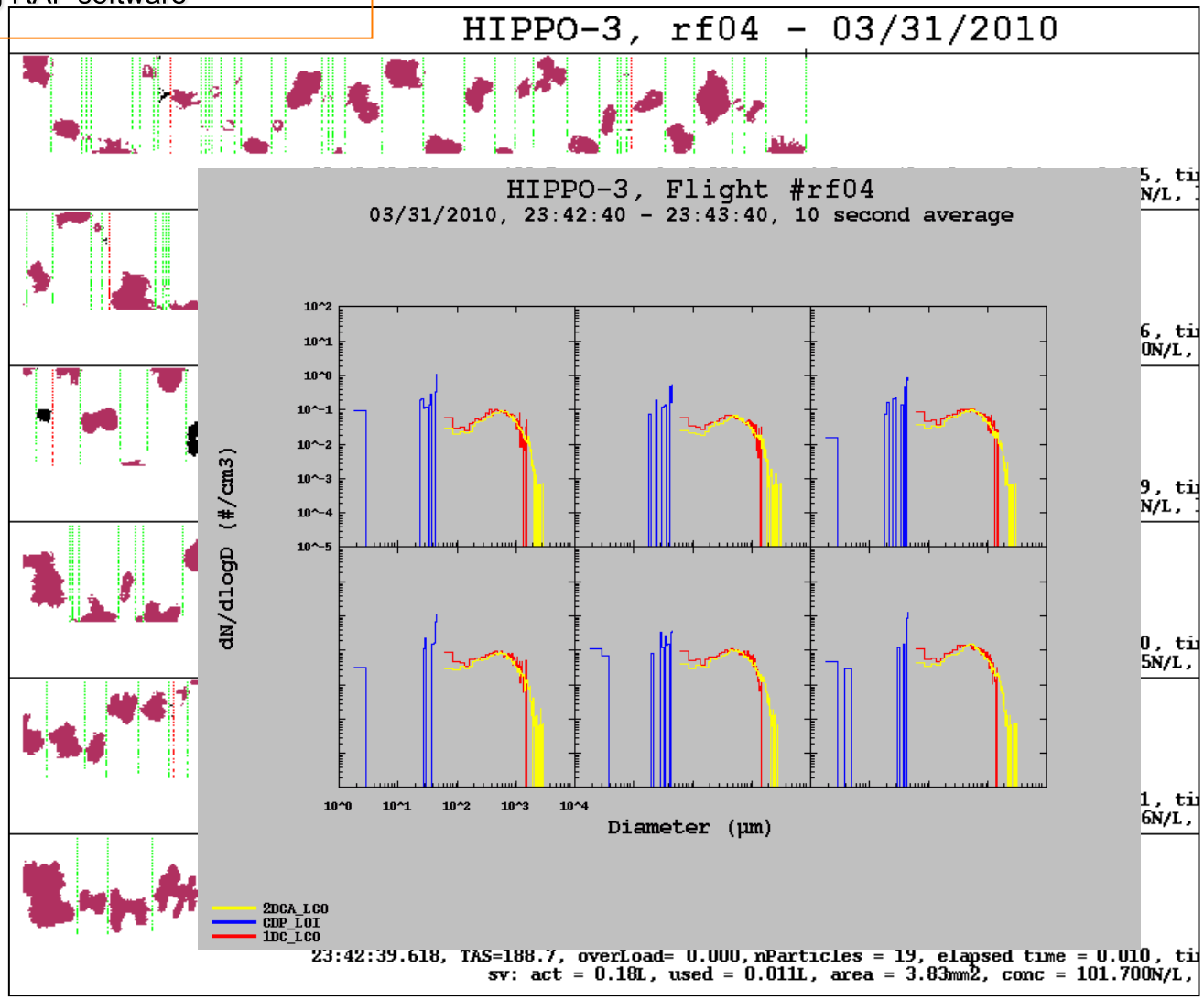
Data

- *Logging on ADS server*
- *Asynchronous → time delay ~µs*
- *derived values in netcdf files*
  - particle size distribution, concentration, water content, …
- *raw 2d image files*
  - image inspection using RAF software

Ice cloud -22°C

~ 10 ms / record

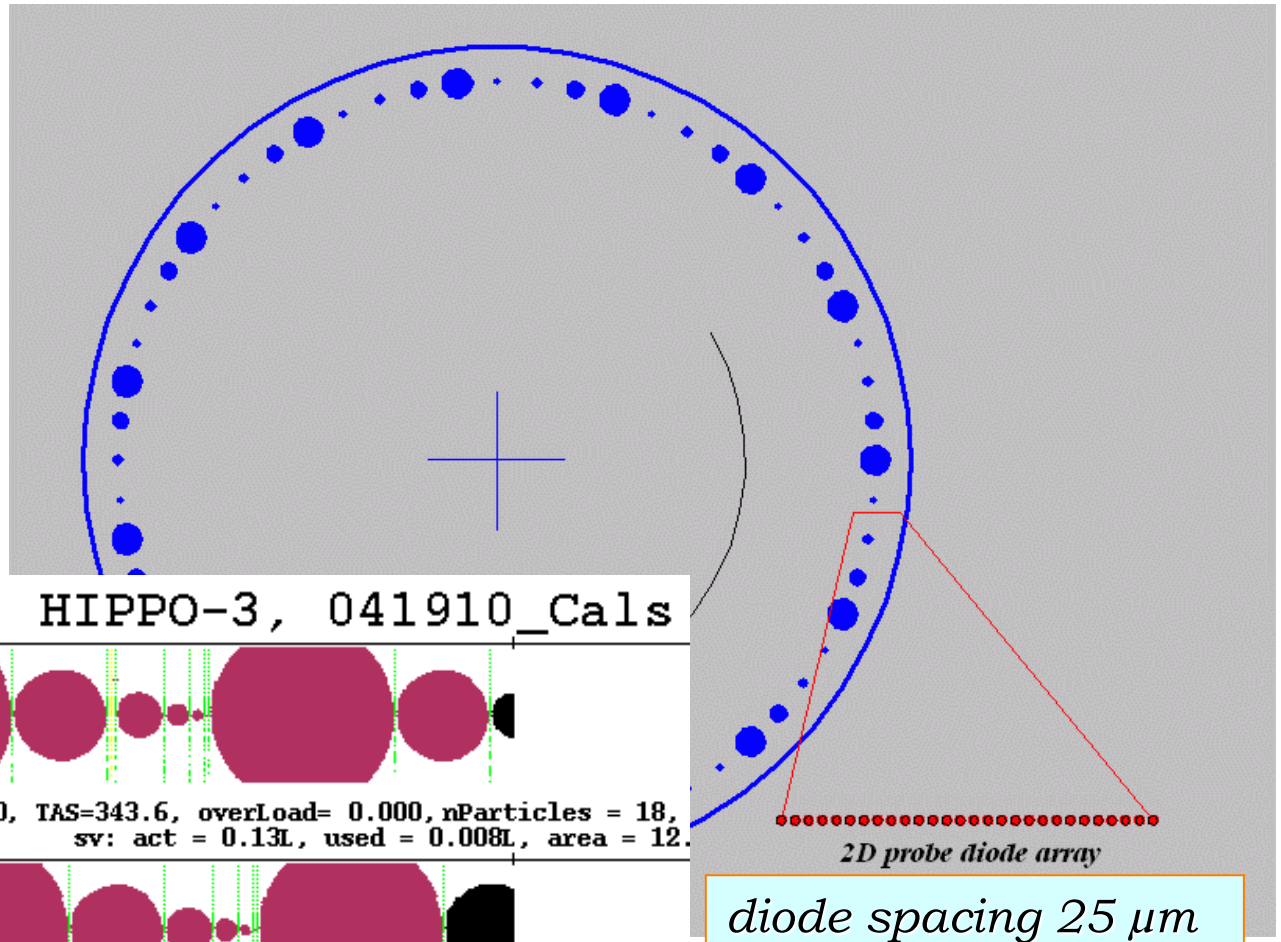
artifact rejection



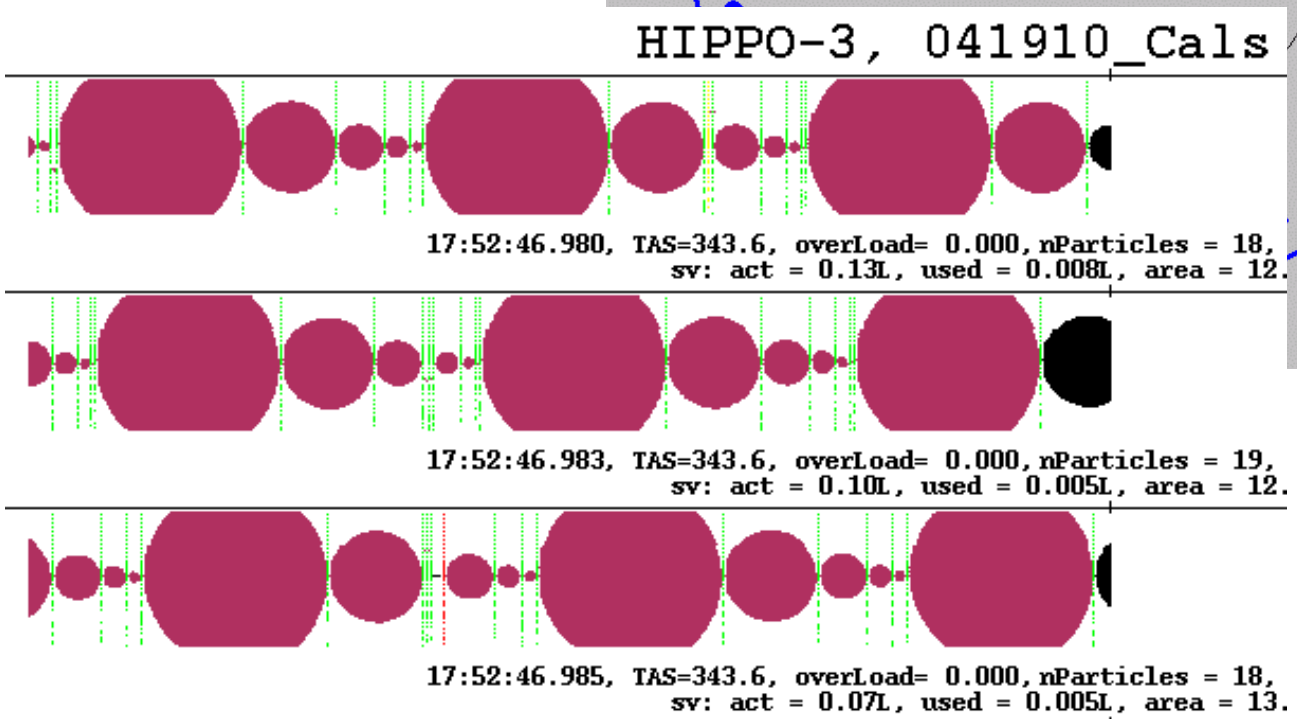
Calibration

2D-C = spinning disk

circle images
50 to 2000 µm



diode spacing 25 µm

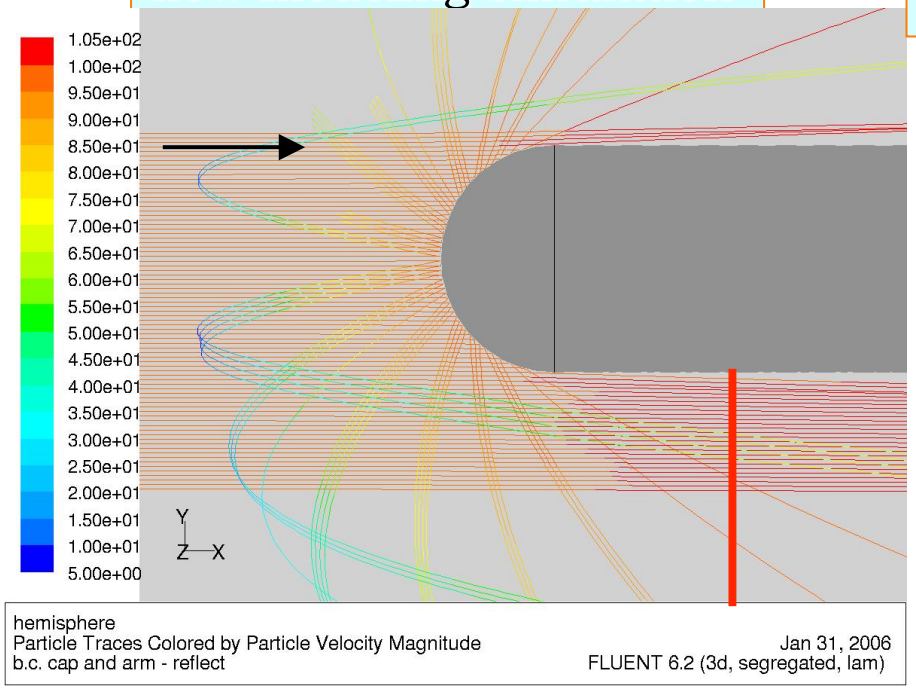


Data quality 2D-C

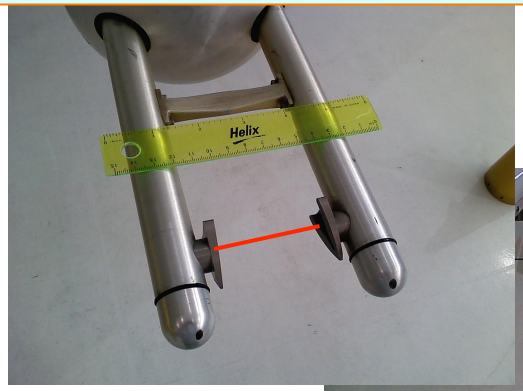
Anomalies, artifacts, errors & identification

- *"streakers" & other goofy images*
  - rejected during image processing
- *preferential alignment of crystals, due to airflow or electric fields*
- *splash-breakup cloud particle fragments can bounce into the laser beam*
  - modify 2D-C tips before H3 to reduce artifacts
  - data processing rejects images with small inter-arrival time

flow modeling simulation



original hemisphere tips



H3 modified tips

changes made to the instruments for H4-H5

CDP – *expect improved performance:*

- *Optics modified with smaller mask to reduce coincidence errors*
  (Sara Lance et al., 2010: Atmos. Meas. Tech., 3, 1–24)
- *Firmware & electronics updated*
  - noise reduction & dynamic baseline

2DC

- *No changes*

Data readiness, re final quality

2011 – developed additional methods for processing 2D image records

- *Time interval between images*
- *Shape classification as ALL or Round*
  - Concentrations for these shapes
- *Some testing with H3 data*

Ice cloud -7°C

needle growth

+ rimed crystals