TORERO upload

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Aerosol size distributions – nucleation to coarse mode

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Aerosols & TORERO science goals

- *Vertical distribution of aerosol particles*
- *Stable layers & stratification*
  - *characterize structures shown by HSRL*
- *Sources, transport & mixing of particles*
  - *especially new formation*
  - *association with trace gas data*
- *Scavenging/removal processes*

Aerosol instruments

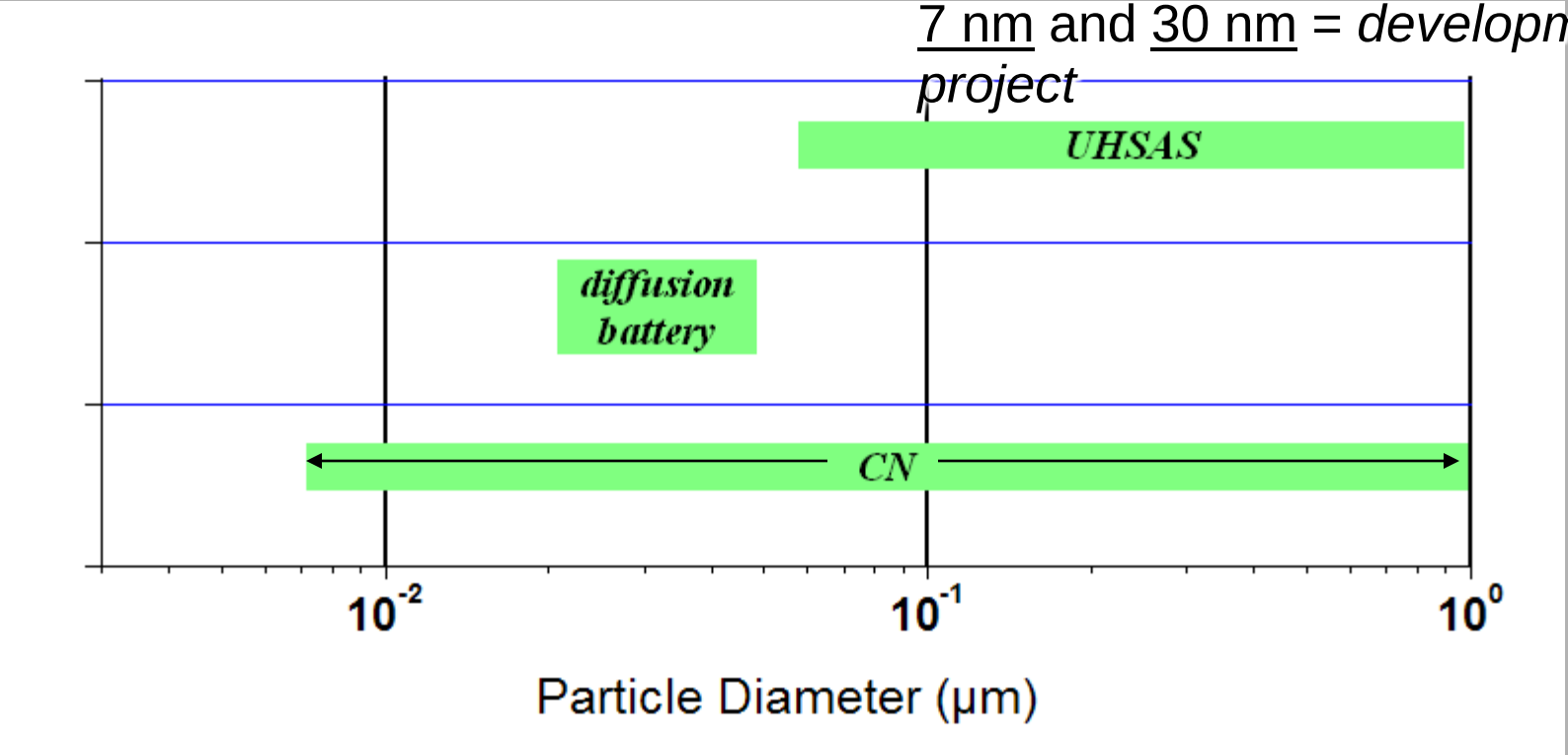
UHSAS – *Ultra-High Sensitivity Aerosol Spectrometer*

- *60 – 1,000 nm in 100 size bins, 10 sps*
- *Size resolution ~1%*

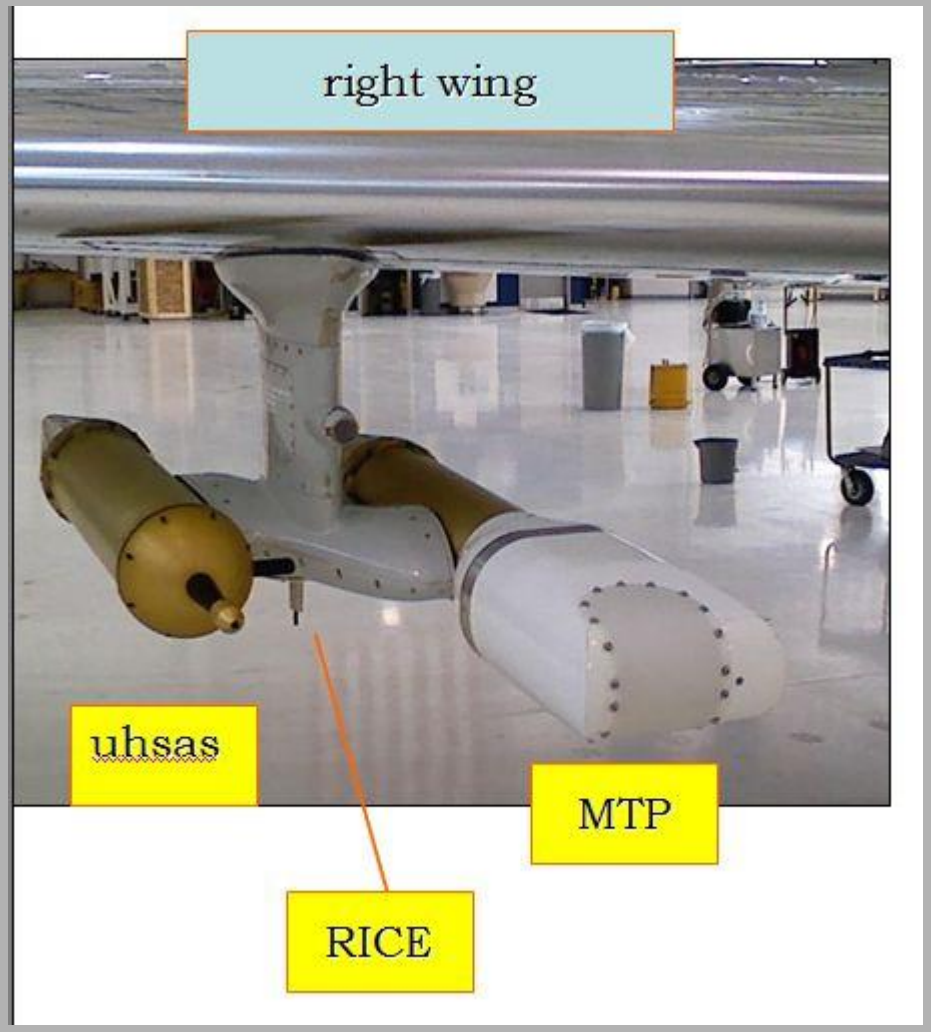
Water-based CN counter (WCN)

- total conc, particles > ~7 nm
- 10 sps
- ~1 sec response
- use 2 WCN with different thresholds

7 nm and 30 nm = *development project*



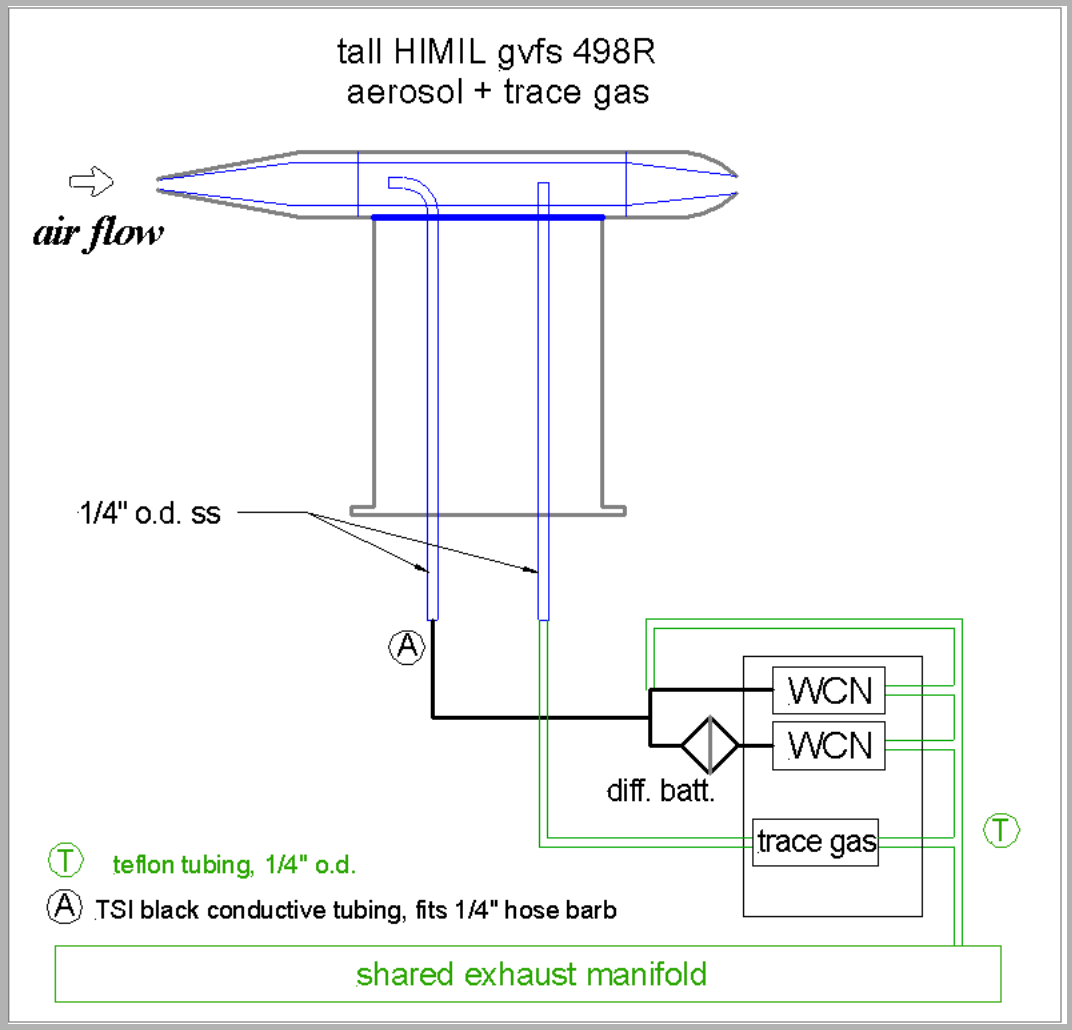
Aerosol instruments

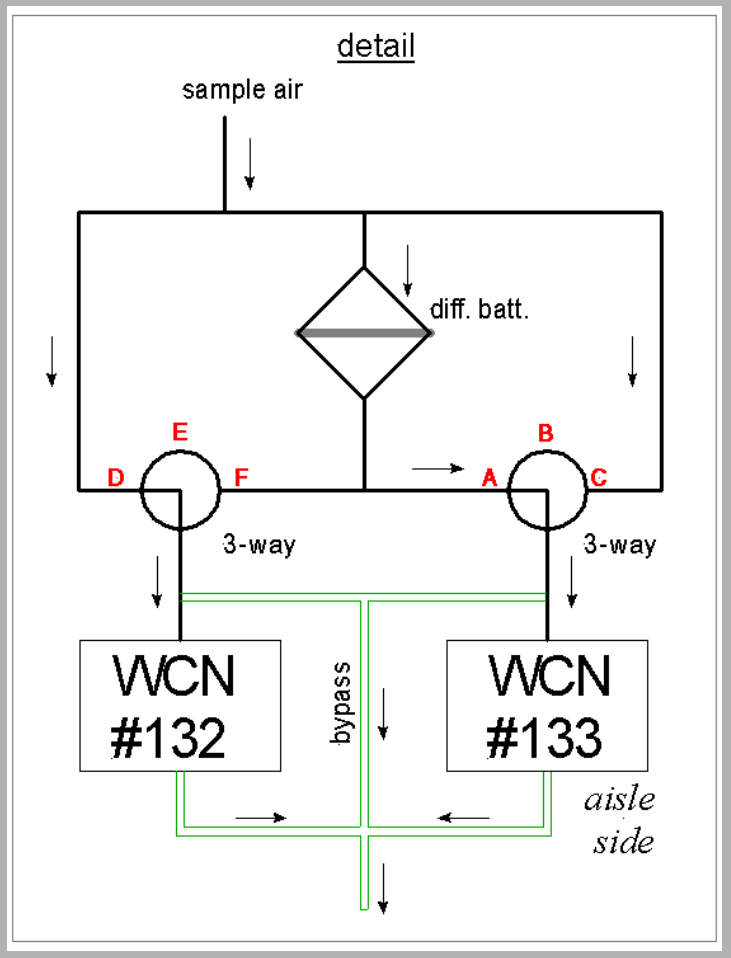


two WCN in cabin

Operator reminder → *Log positions of 3-way valves on chat!*

Typical = AD or CF



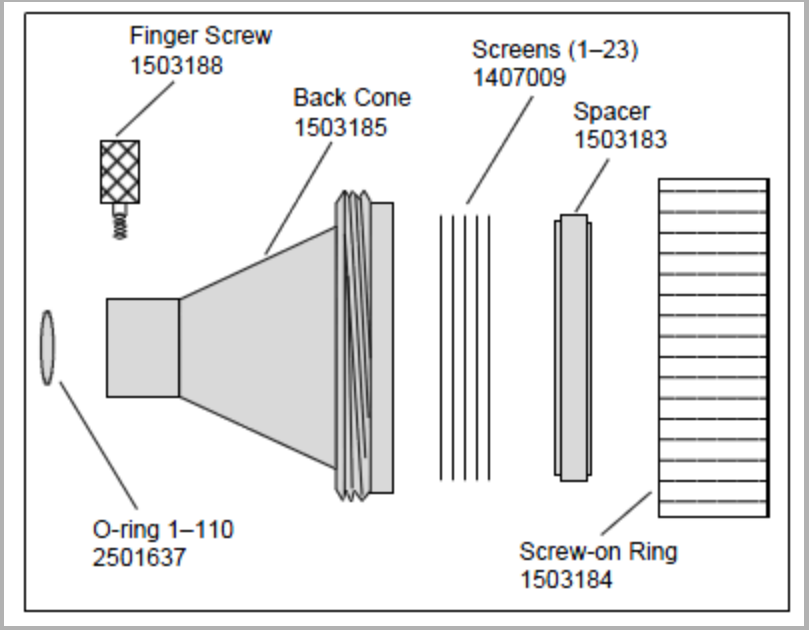


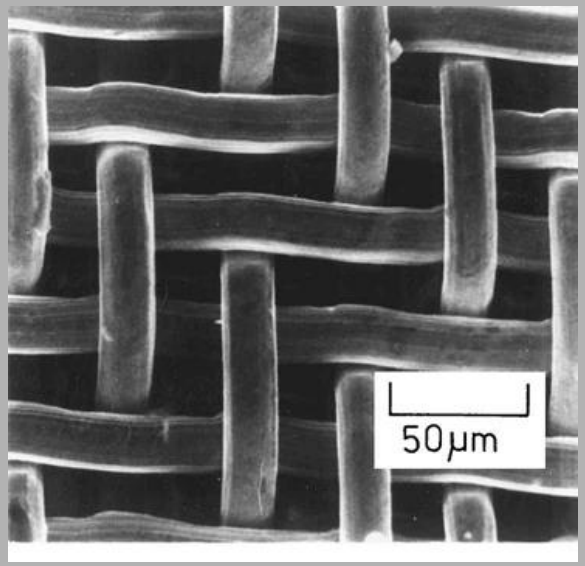
Aerosol diffusion battery

- removes smallest particles
- stack of 8 screens 100 µm mesh

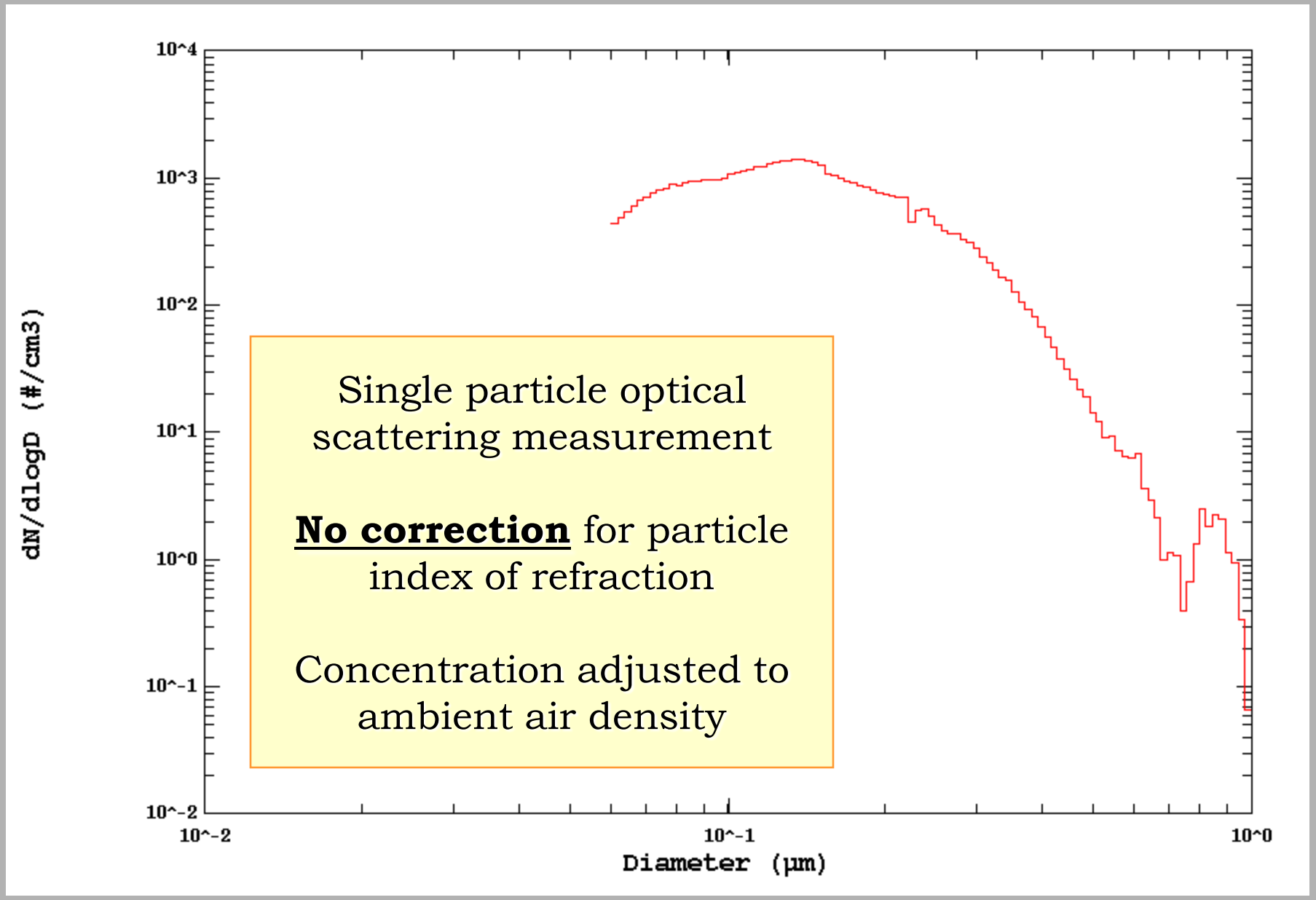
fractional penetration of aerosol through diffusion battery with 8 screens

pressures (mb)	particle diameter (µm) 0.010	0.014	0.020	0.027	0.038	0.054	0.075	0.105
150	0.012	0.058	0.161	0.309	0.470	0.613	0.727	0.812
200	0.026	0.095	0.221	0.379	0.534	0.666	0.767	0.840
300	0.060	0.165	0.314	0.474	0.617	0.731	0.814	0.873
400	0.098	0.225	0.383	0.538	0.669	0.770	0.842	0.891
500	0.135	0.276	0.436	0.585	0.706	0.796	0.860	0.904
600	0.169	0.319	0.478	0.620	0.733	0.815	0.873	0.912
700	0.200	0.355	0.513	0.648	0.754	0.830	0.883	0.919
800	0.229	0.387	0.541	0.671	0.770	0.842	0.891	0.924
900	0.255	0.415	0.566	0.690	0.784	0.851	0.897	0.928
1000	0.280	0.439	0.587	0.707	0.796	0.859	0.902	0.931





UHSAS size distribution measurement – *10 Hz*

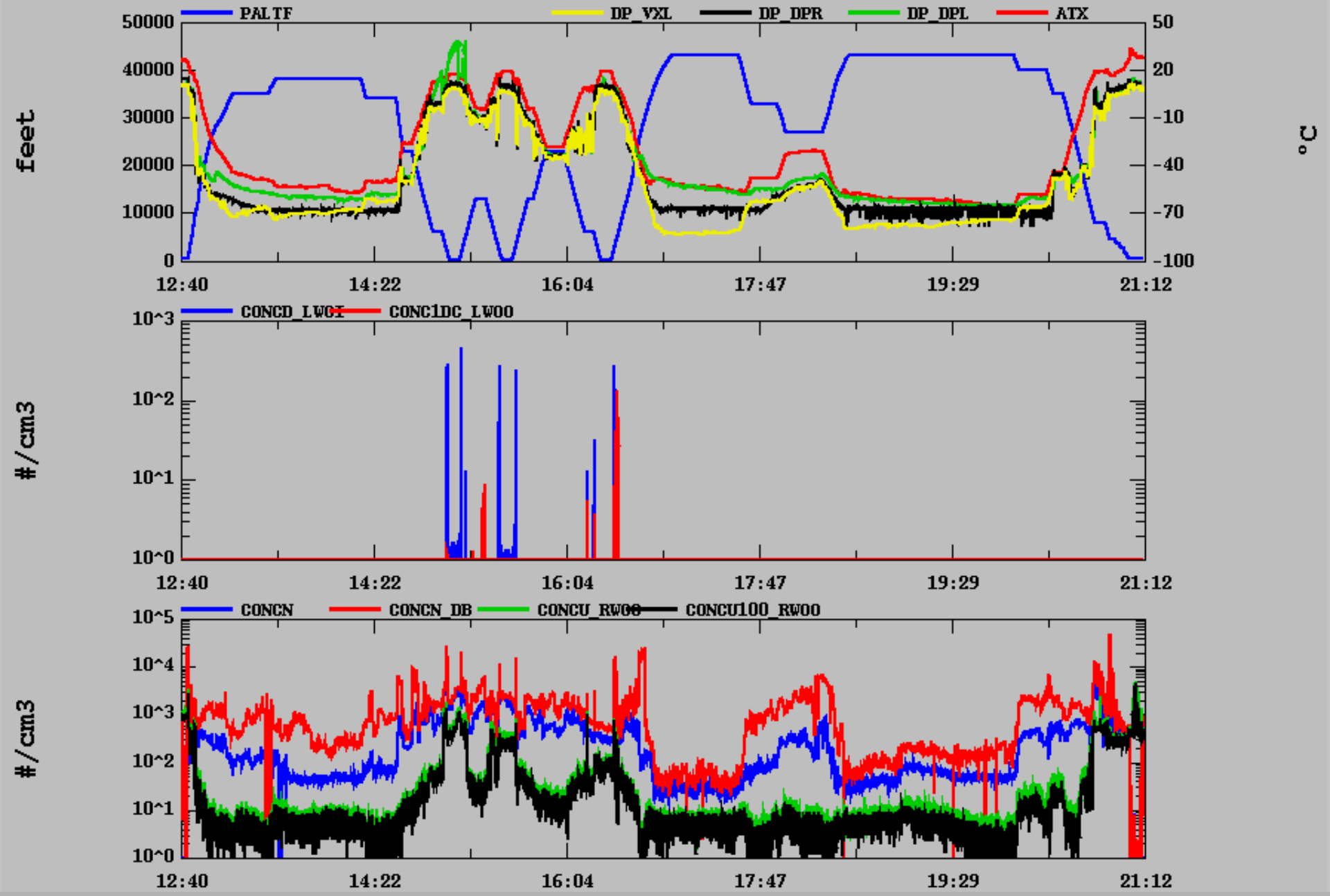


Single particle optical scattering measurement

No correction for particle index of refraction

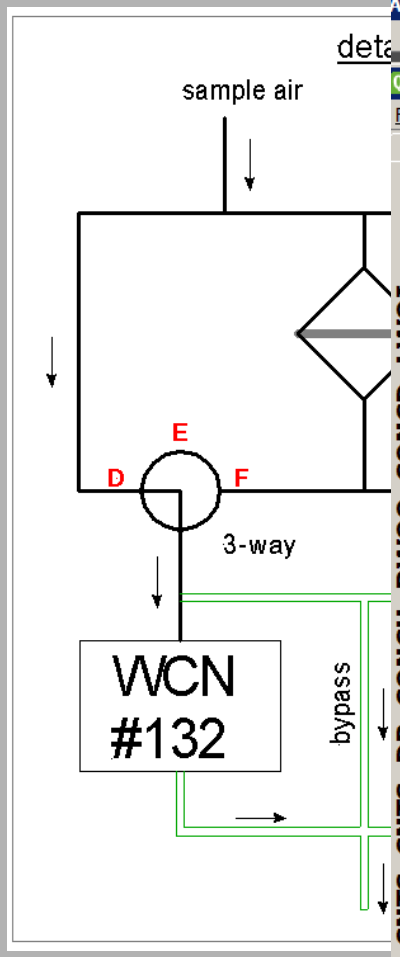
Concentration adjusted to ambient air density

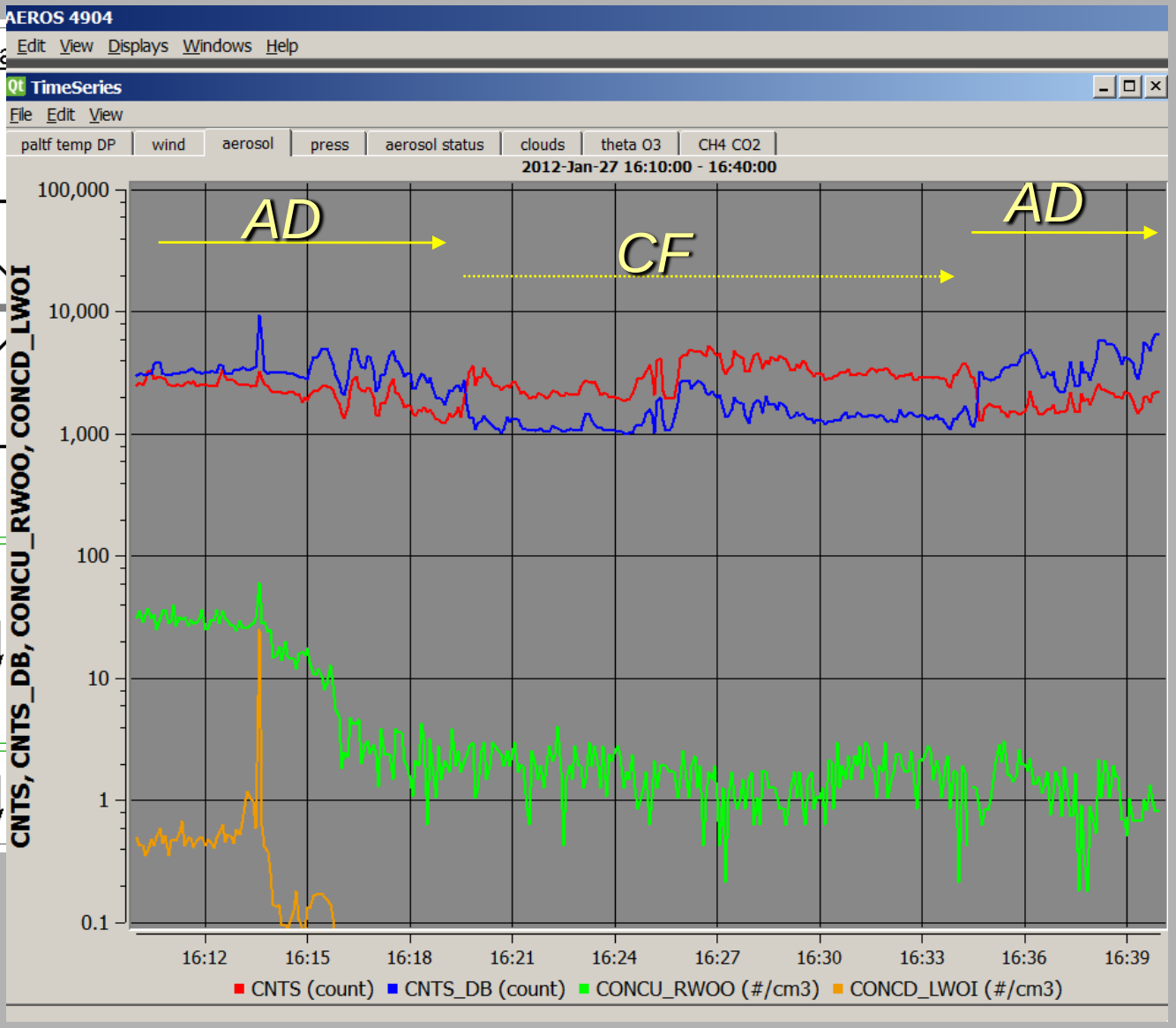
UHSAS tracks WCN's *RF02 – Jan 27*



Question: are WCN equivalent?

change 3-way valves to flip/flop WCN



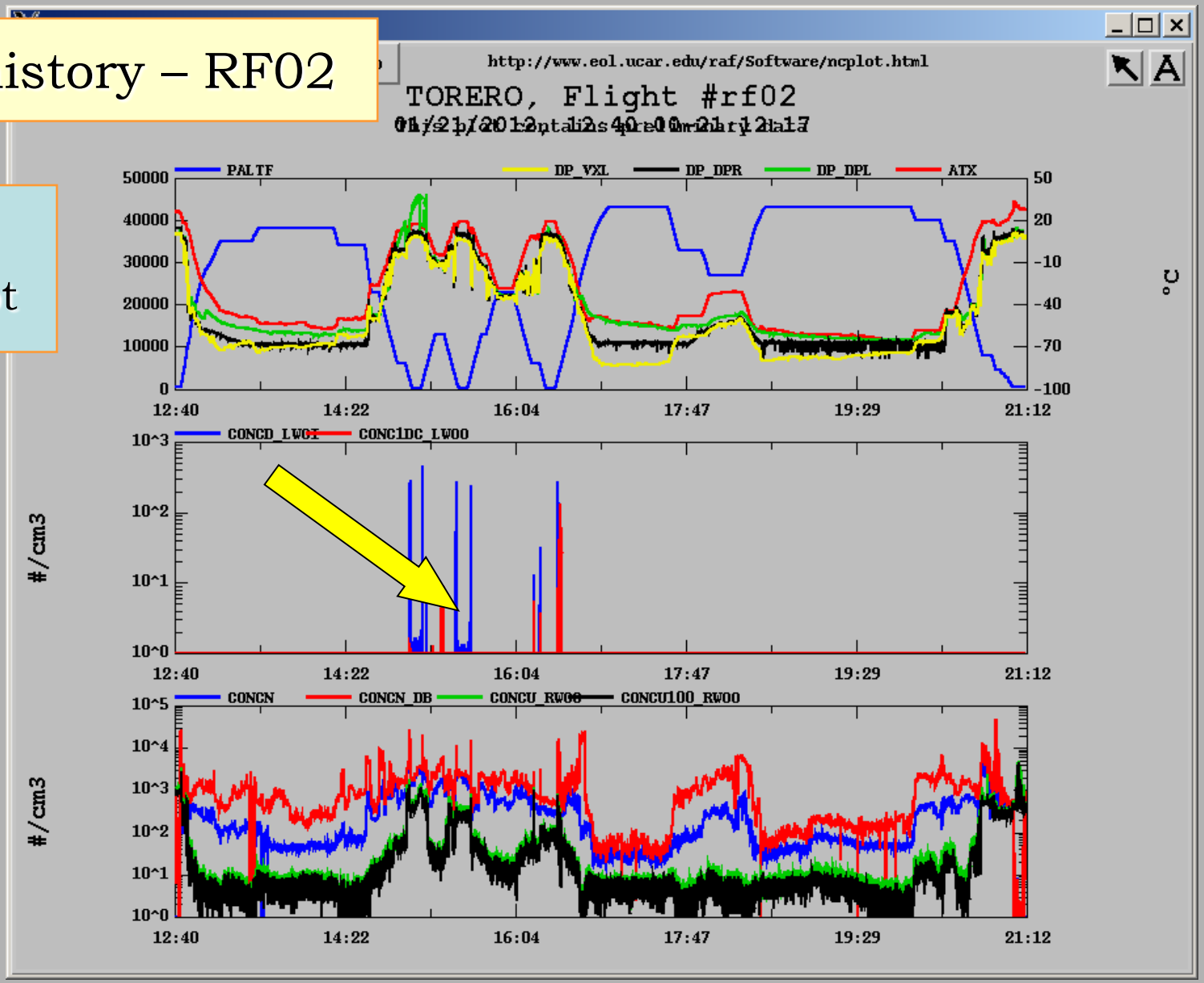


Total history – RF02

Altitude, Temp, dewpt

clouds at MBL inversion

aerosols



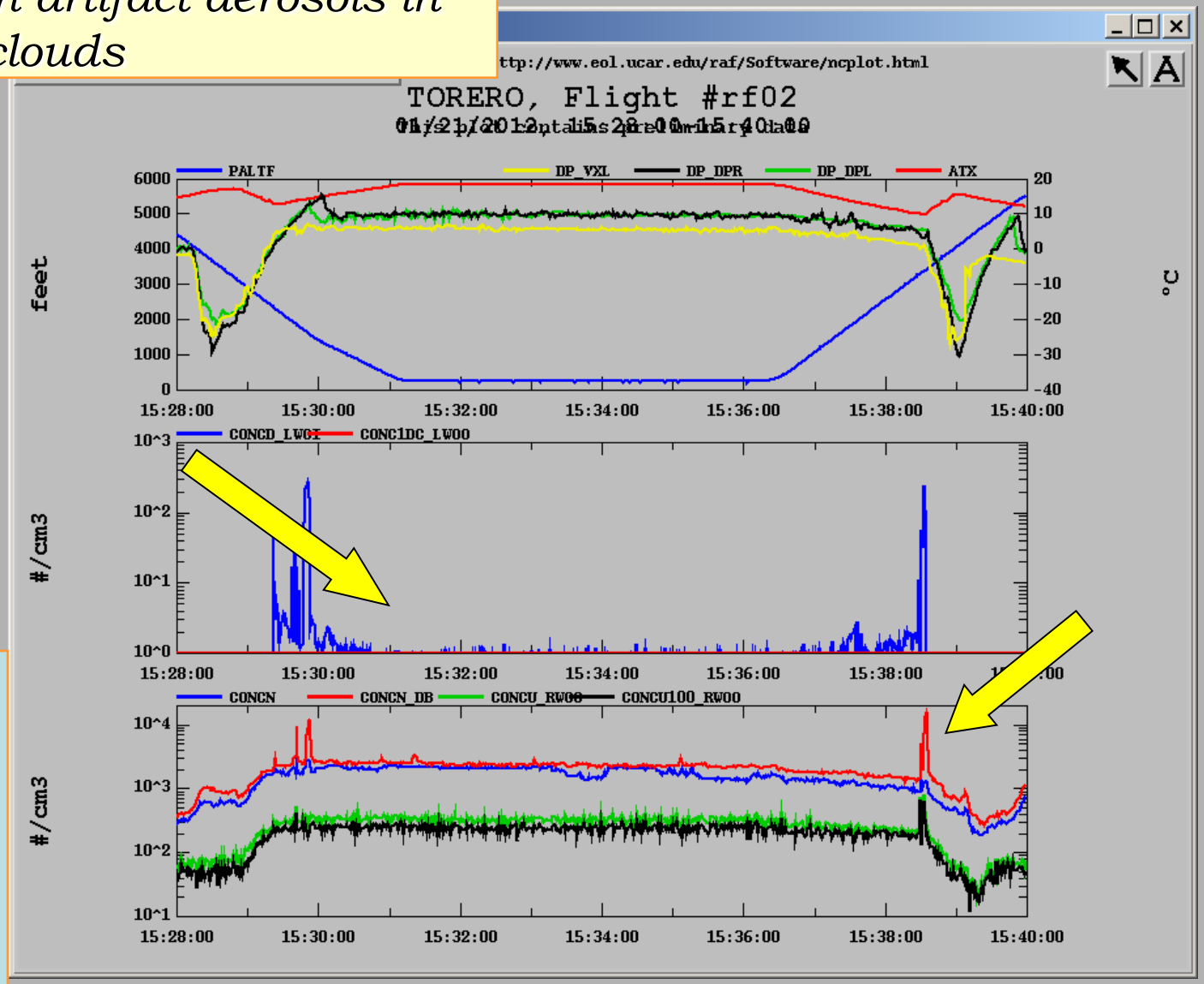
Caution: *splash artifact aerosols in clouds*

altitude, temp, dewpt → *inversion*

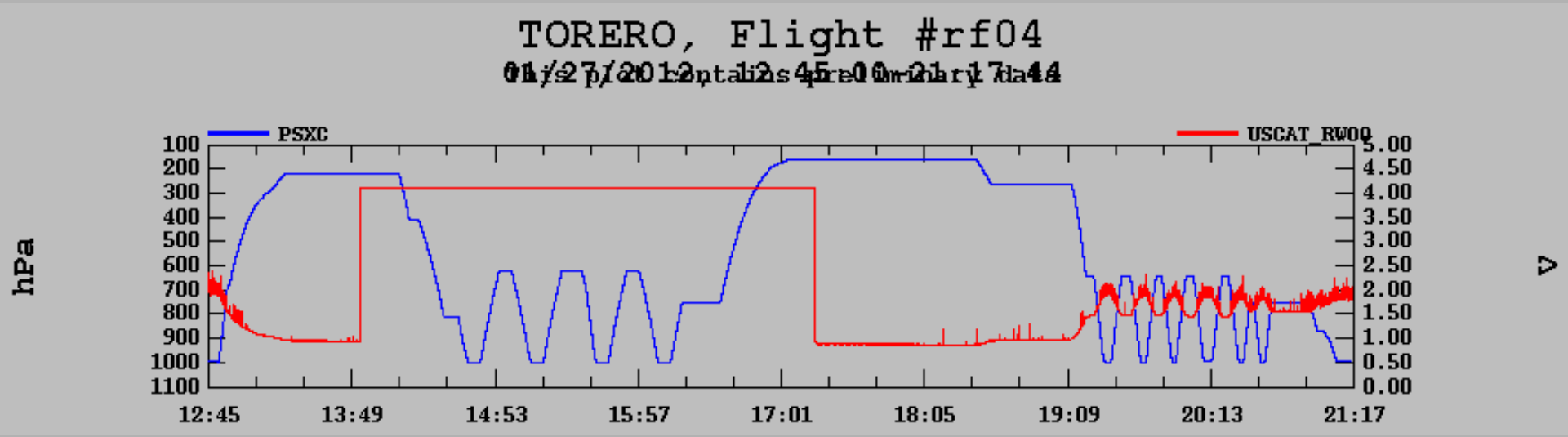
aerosol > 1µm in BL detected by CDP

Aerosol conc greater in BL.

spike in clouds = ***sampling artifact***

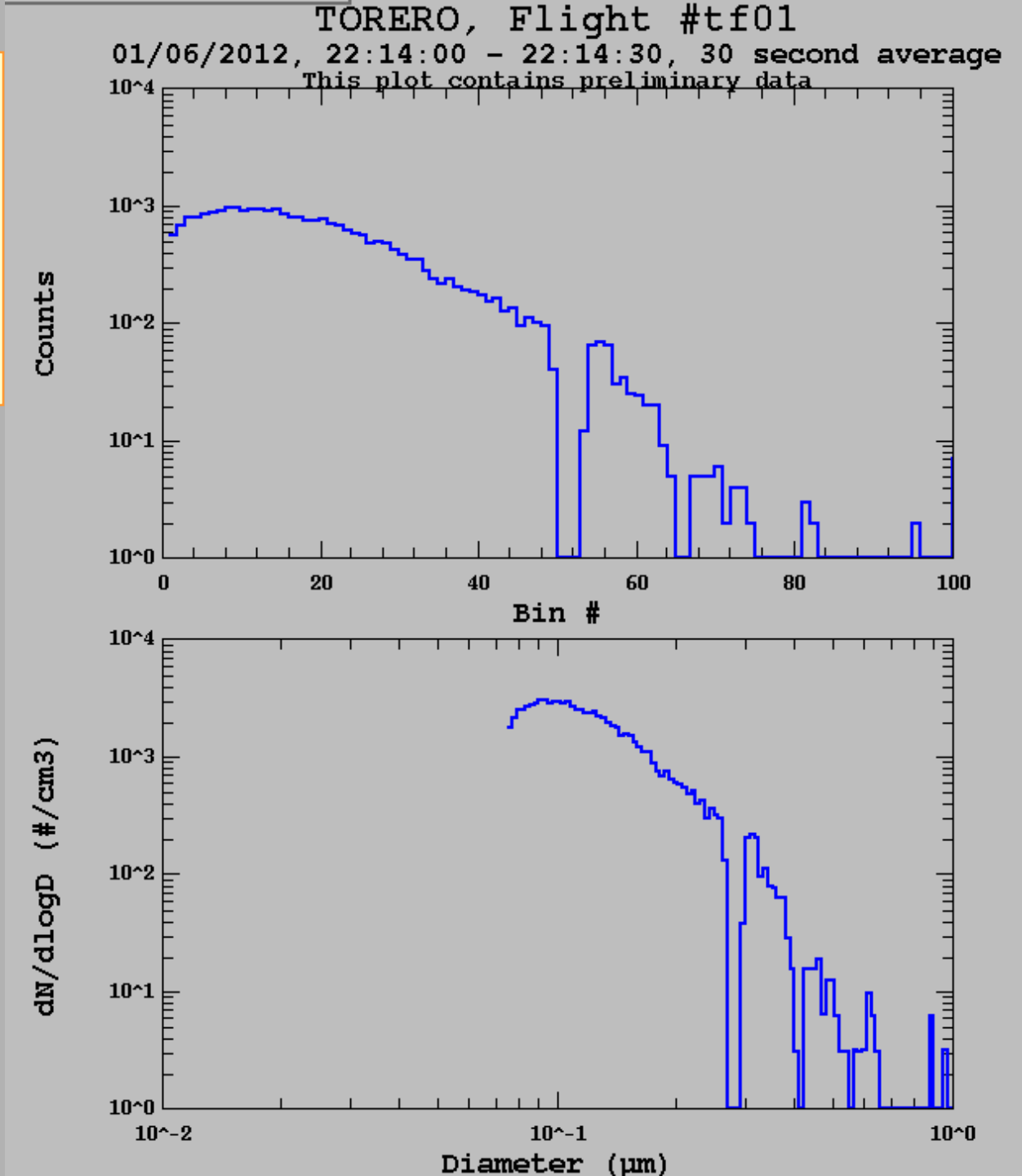


UHSAS – *how to recognize bad data?*
→ ***USCAT*** *saturated 4.1 v*



UHSAS – *how to recognize bad data?*

→ *size distribution unrealistic gaps & bumps*



UHSAS flight measurements

http://www.eol.ucar.edu/~dcrogers/TORERO/uhsas/

date	flight #	UHSAS
19-Jan	RFO1	ok
21-Jan	RFO2	ok
24-Jan	RFO3	ok
27-Jan	RFO4	bad 40%
29-Jan	RFO5	ok
31-Jan	RFO6	ok
3-Feb	RFO7	ok
4-Feb	RFO8	ok
7-Feb	RFO9	ok
10-Feb	RF10	ok
12-Feb	RF11	ok
14-Feb	RF12	ok
17-Feb	RF13	bad 90%
19-Feb	RF14	ok
22-Feb	RF15	ok
24-Feb	RF16	ok
26-Feb	RF17	ok

→ aerosol data in netcdf files

Analysis In Progress

A. Quality assessment for UHSAS & WCN

B. Regions of enhanced/suppressed aerosol concentrations.

Aerosols as tracers

Connections to airmass (thermodynamic markers)

Probing structures revealed by HSRL

Relation to trace gas data & photolytic production

C. Can we identify regions with new particle generation ~7 – 30 nm ?

- *compare WCN's & diff. battery data*
- *position of 3-way valves in log books & chat logs*

D. Effects of clouds on particle removal, scavenging