

# Fast Time-Resolved Aerosol Collector .....Fast TRAC.....

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\*Patent Pending

# Cloud Microstructures $\leq 1$ m

Want to know the aerosols at this resolution

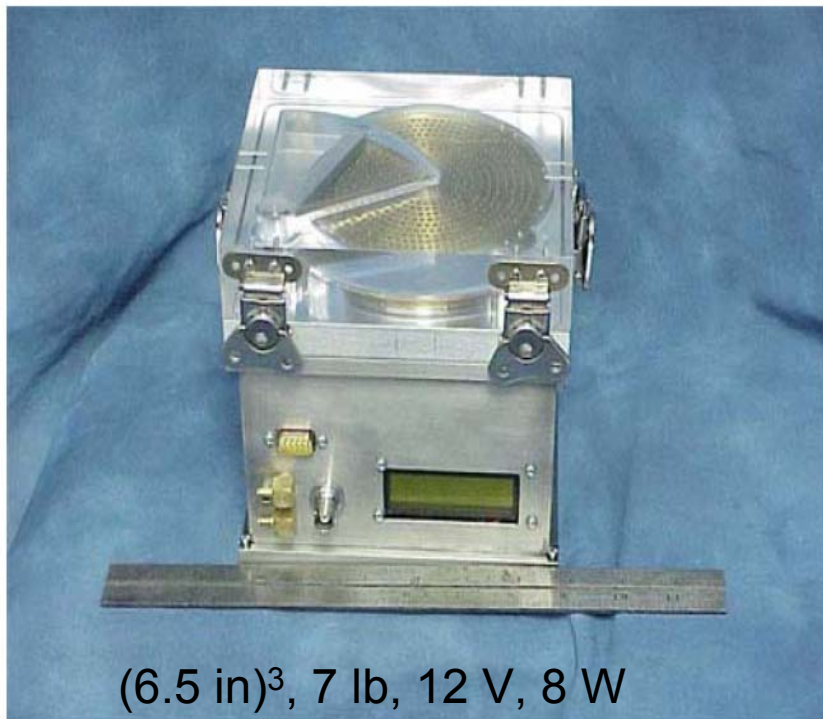


Aircraft flies at 150 m/s

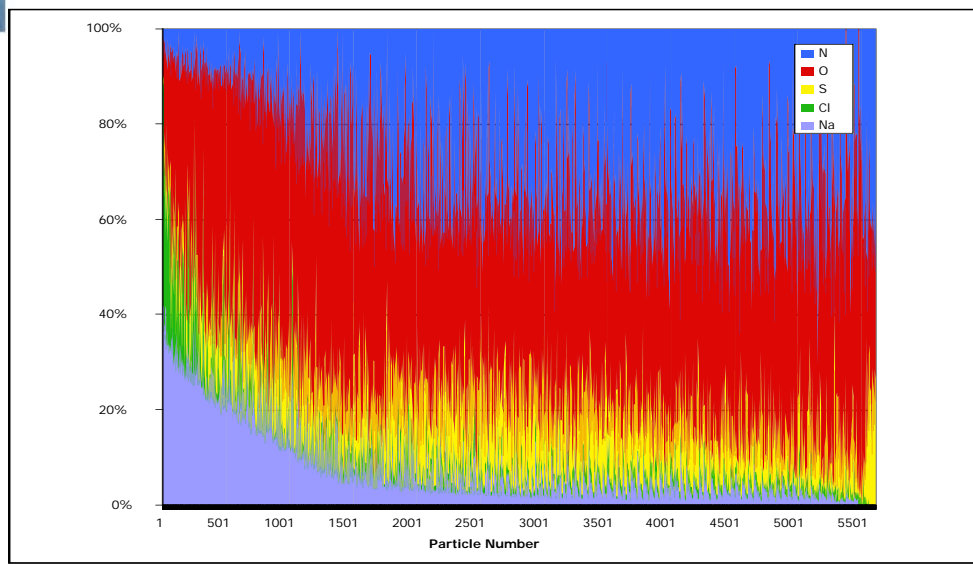
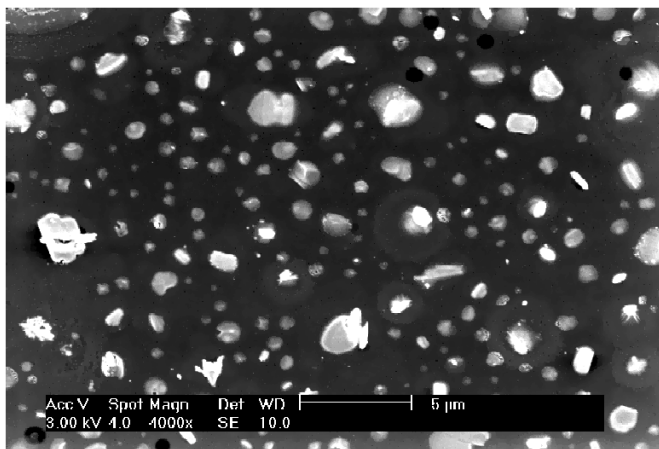
Need time resolution 1 m/150 m/s

= 6 ms (!!!!!)

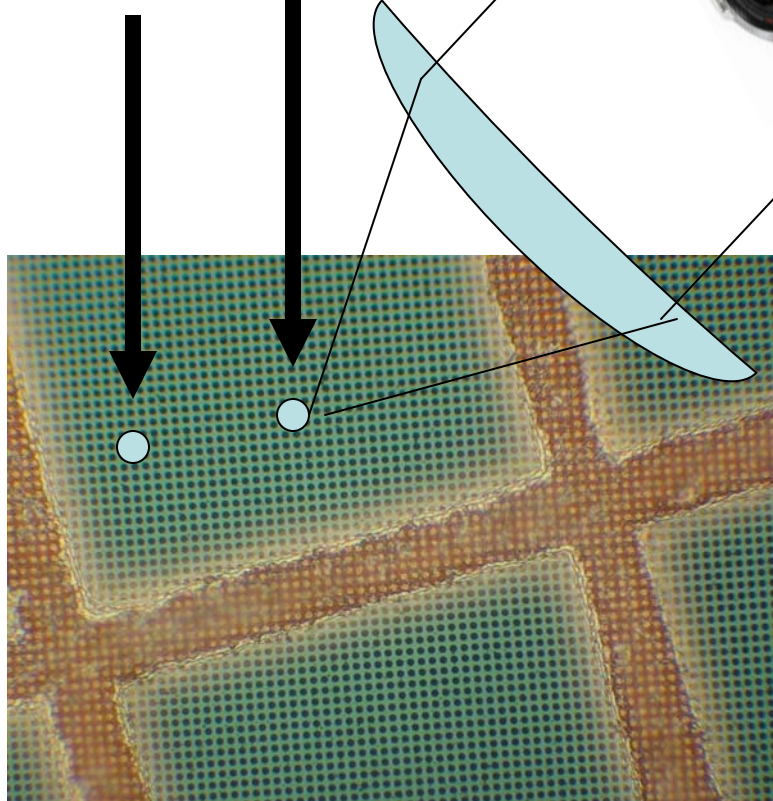
# What is TRAC? - Time-Resolved Aerosol Collector



- Uses an impactor
- ~ 600 TEM samples
- Flow rate: 1 l/min
- Time resolution:  $\geq 1$  min\*
- Applications: Off-line analysis:
  - particle hygroscopicity, morphology, composition..



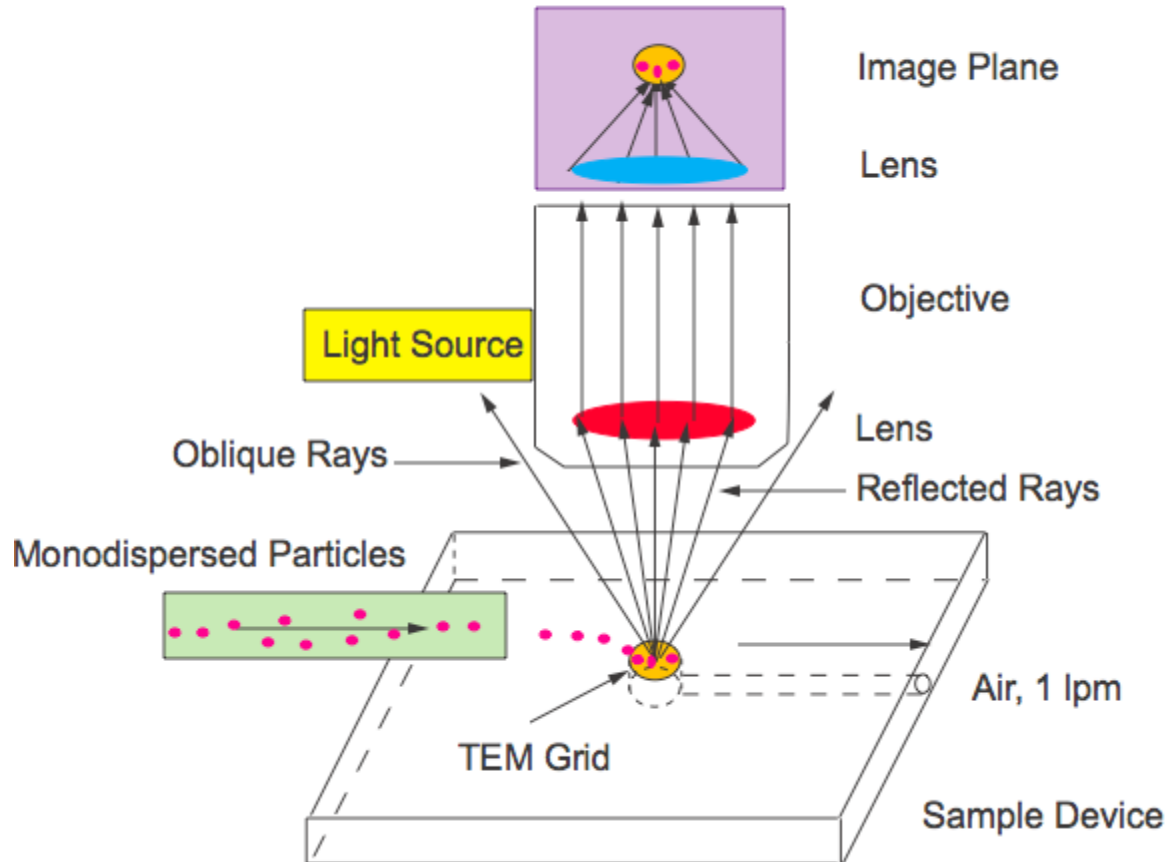
# Fast TRAC Solution



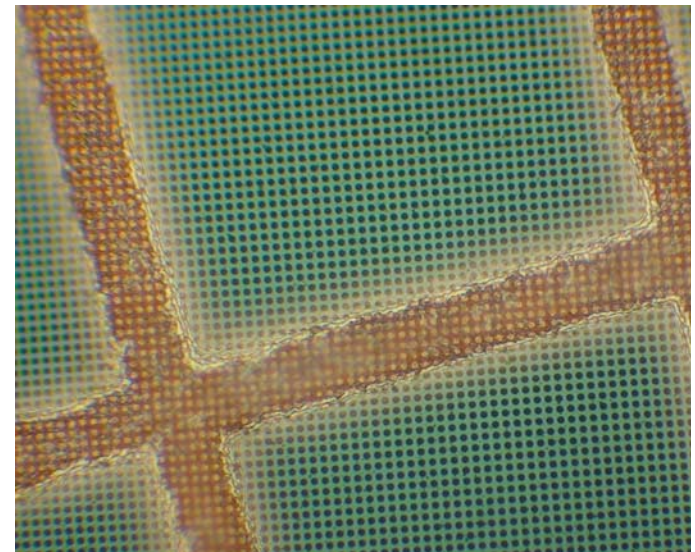
- Observe the particles **DURING** their collection with video microscope
- See  $\geq 100$  nm particles
- $\sim 4$  ms time resolution

# Proof of Concept

SONY High Definition Video Camera



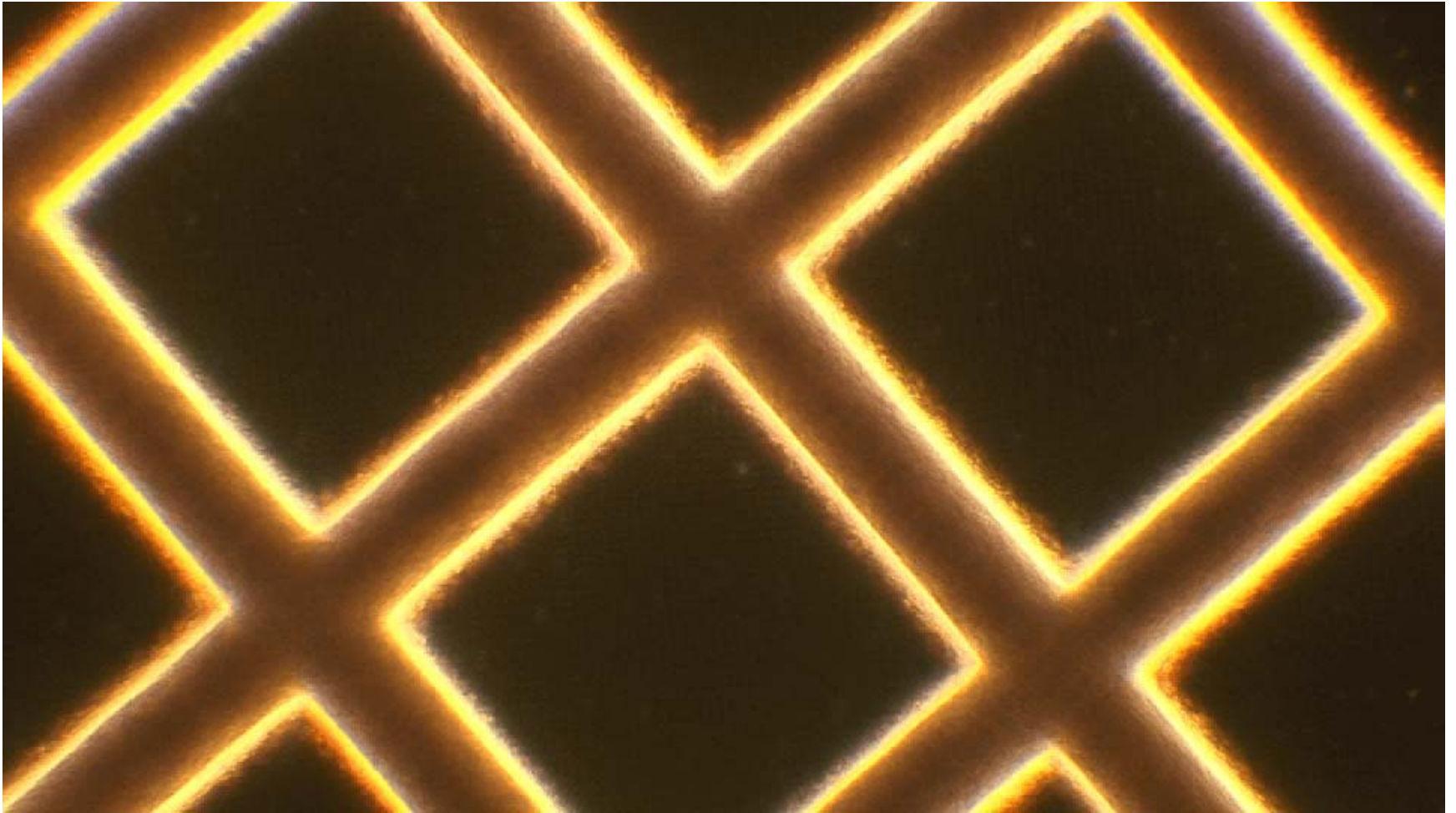
TEM grid Quantifoil 1.2 micron holes on 2.5 micron centers



- Tested several sizes of monodispersed particles  $\geq 100$  nm



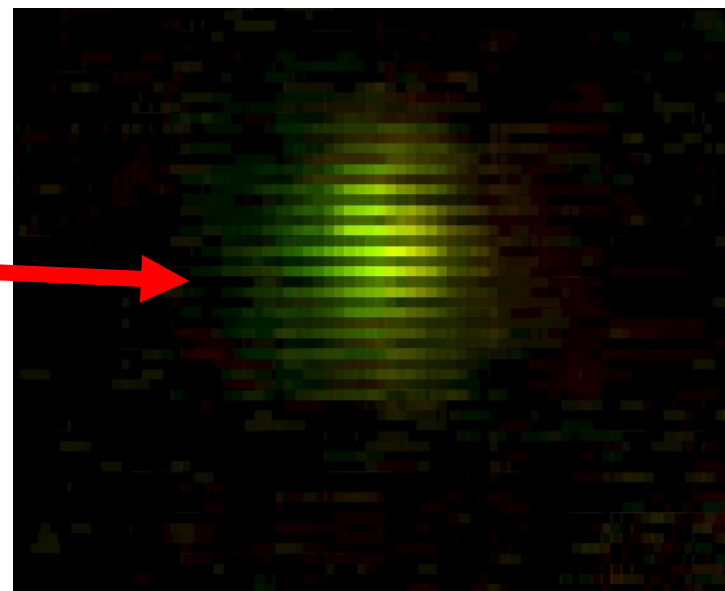
# Results - movies of 200 nm lab particles



Frame 200

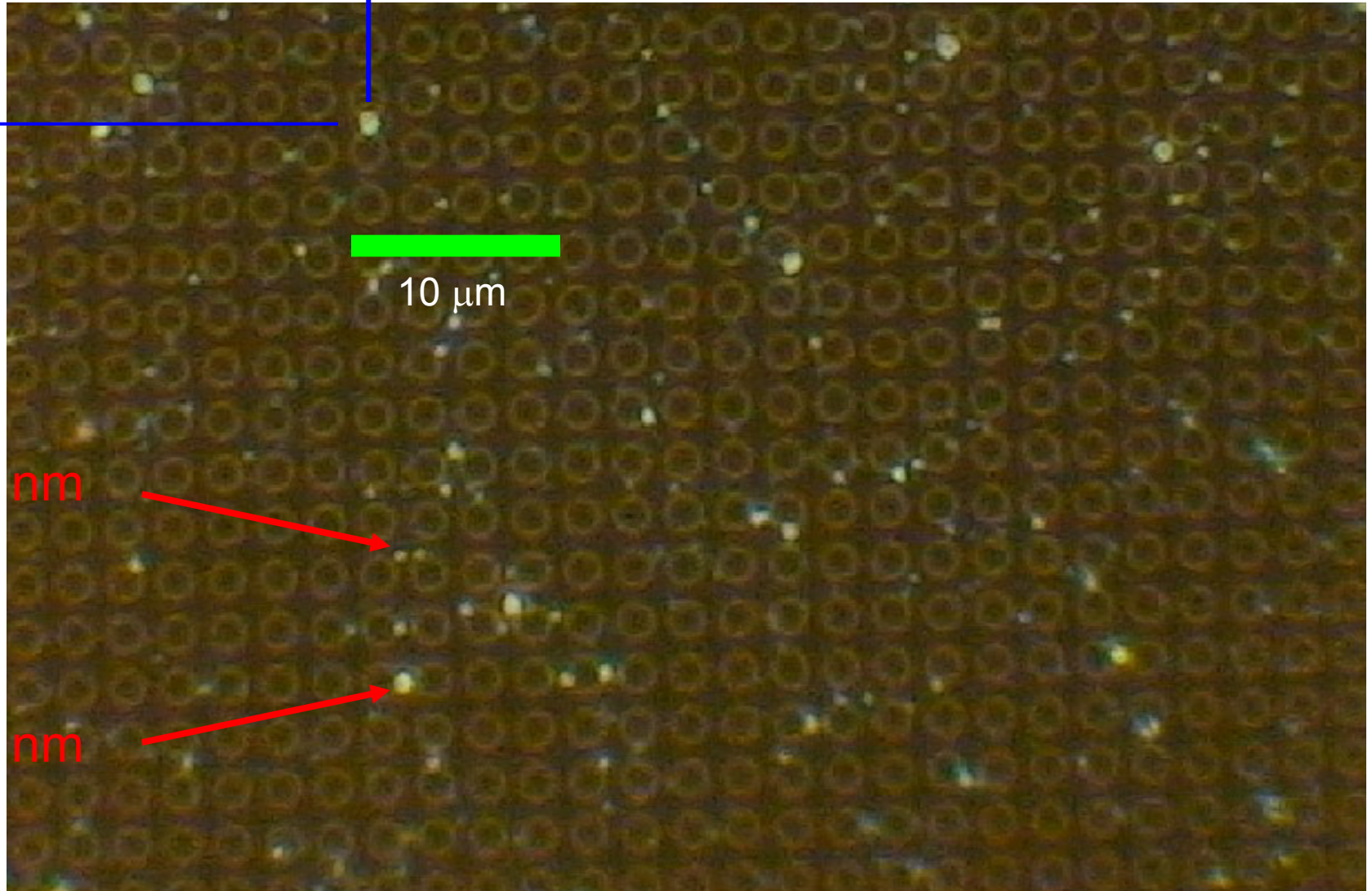
Frame 201

Difference  
photo is black  
except for  
diffraction-limited  
image of 200 nm  
particle





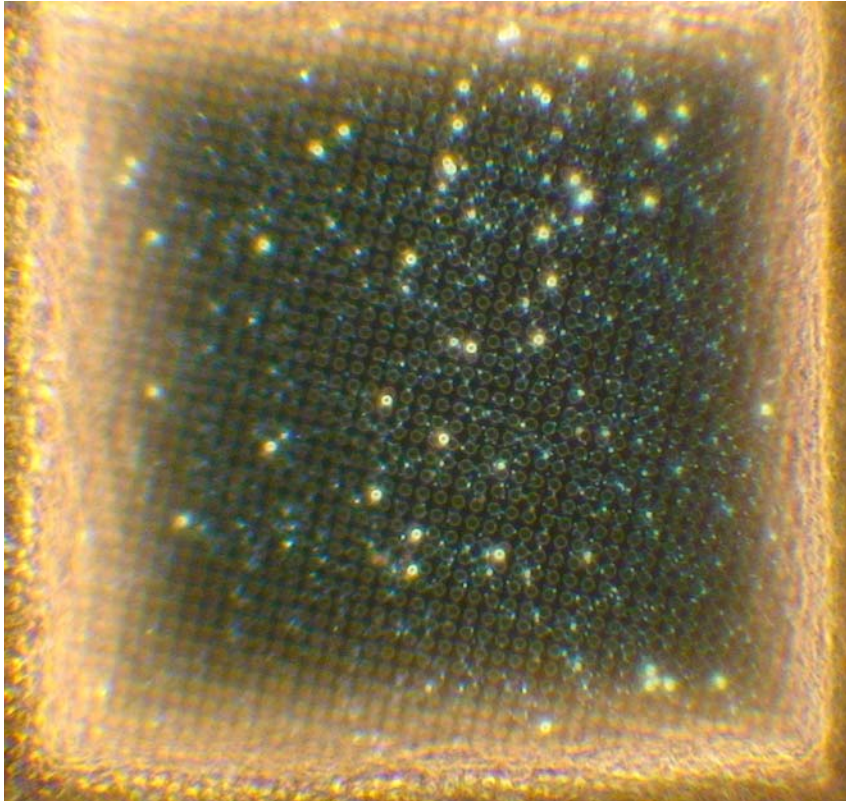
Particle locations to  $\pm 0.1$  micron



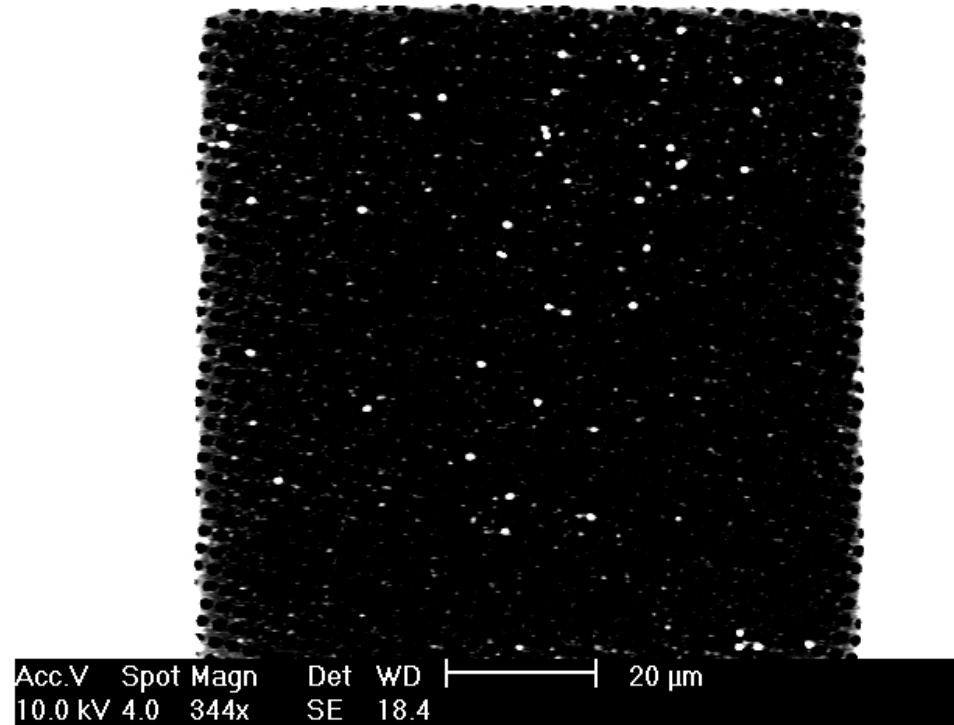
Real-time Optical Sizing !!!!



# Optical and SEM Photos

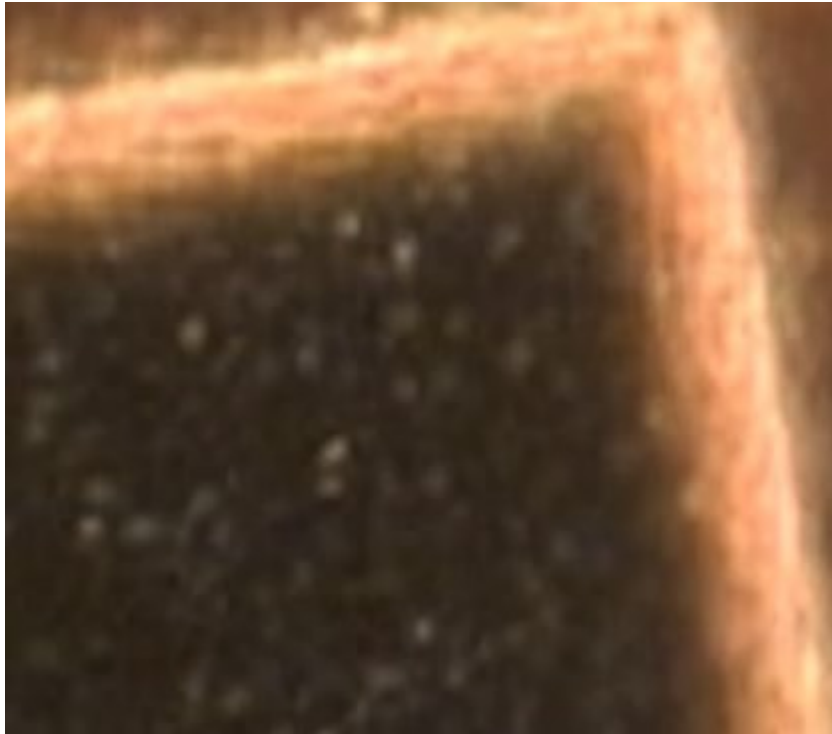


Optical particle map and times

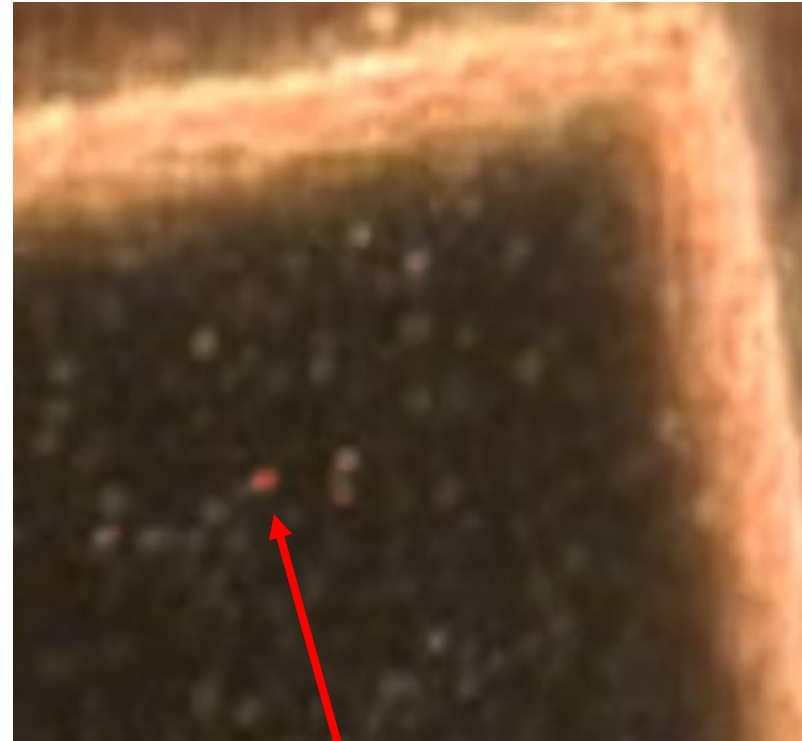


SEM/EDX map and elemental analysis

# Fast Framing



Frame 153



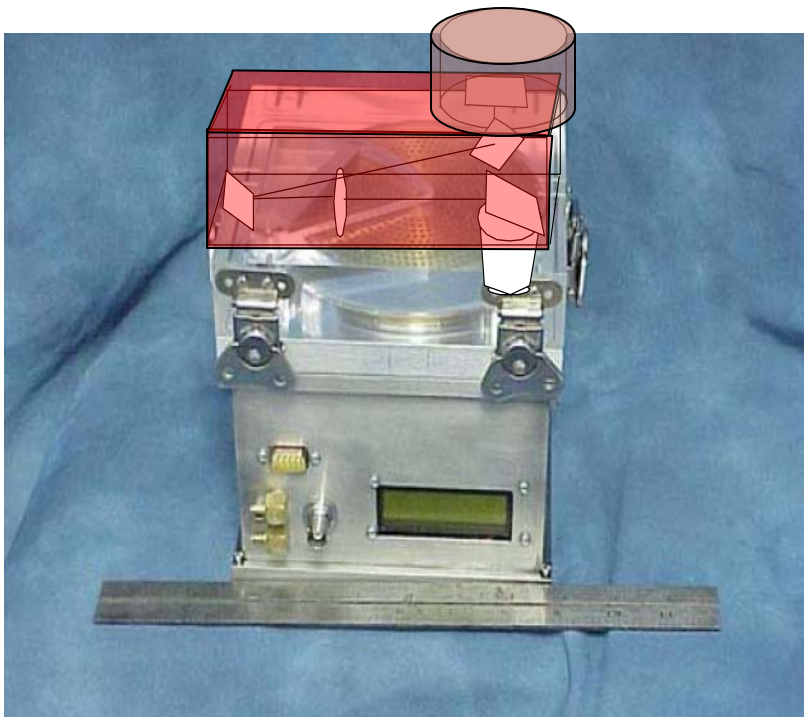
Frame 154

New 100 nm  
Particle Arrives

- 240 frames/sec
- 4 ms per frame
- See  $\geq 100$  nm particles arriving

# Fast TRAC Features

## Size of new Fast-TRAC



- Real-time particle optical sizing
- 4 ms time resolution
- Extensive off-line analyses
- **Good for cloud microstructures**
- **And plumes**



# Future Work

- Make it field-portable
- Deploy Fast TRAC in field campaigns
- Collaborations

**PNNL's Fast TRAC for cloud microstructures and plumes**