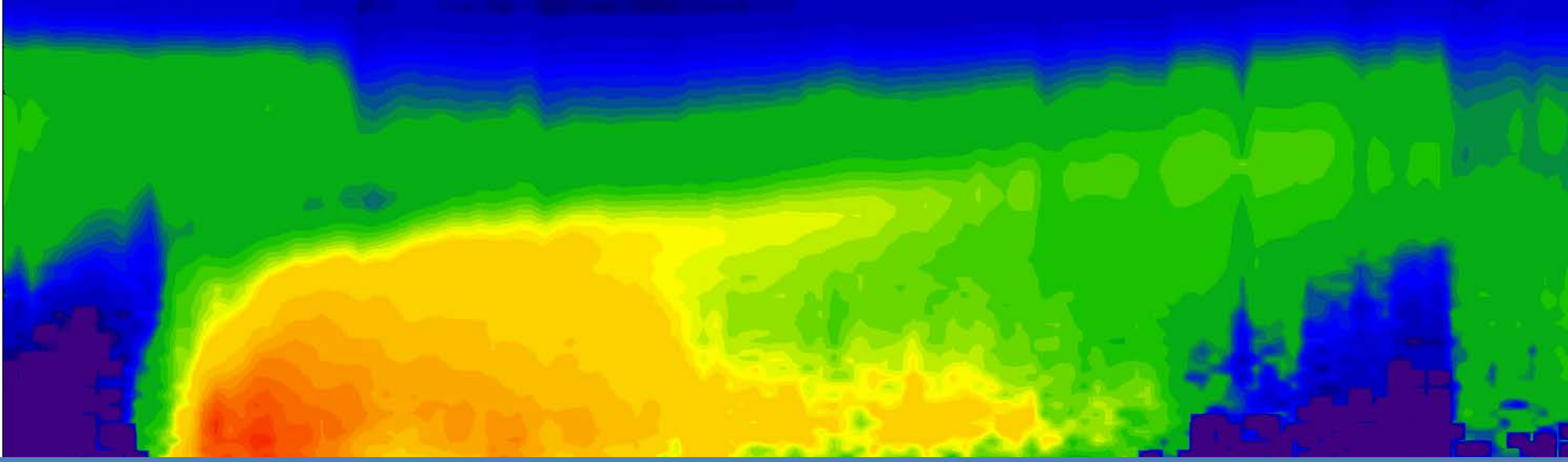
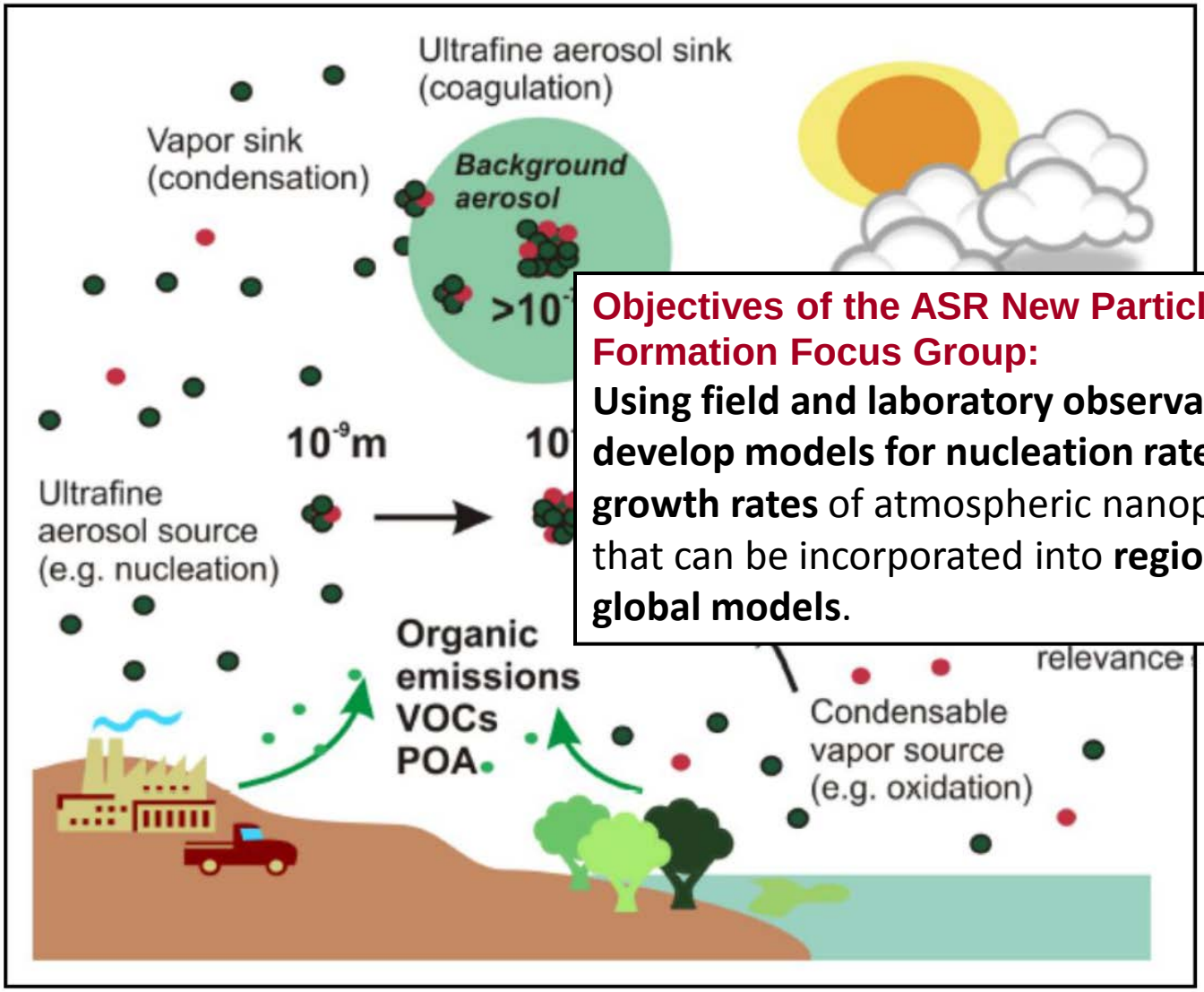


Report on New Particle Formation Focus Group Breakout

Jim Smith, Chongai Kuang,
and the New Particle Formation Focus Group

6 November 2013
DOE ASR Fall Working Group Meeting

Background: New Particle Formation



Objectives of the ASR New Particle Formation Focus Group:

Using field and laboratory observations, develop models for nucleation rates and growth rates of atmospheric nanoparticles that can be incorporated into **regional and global models**.

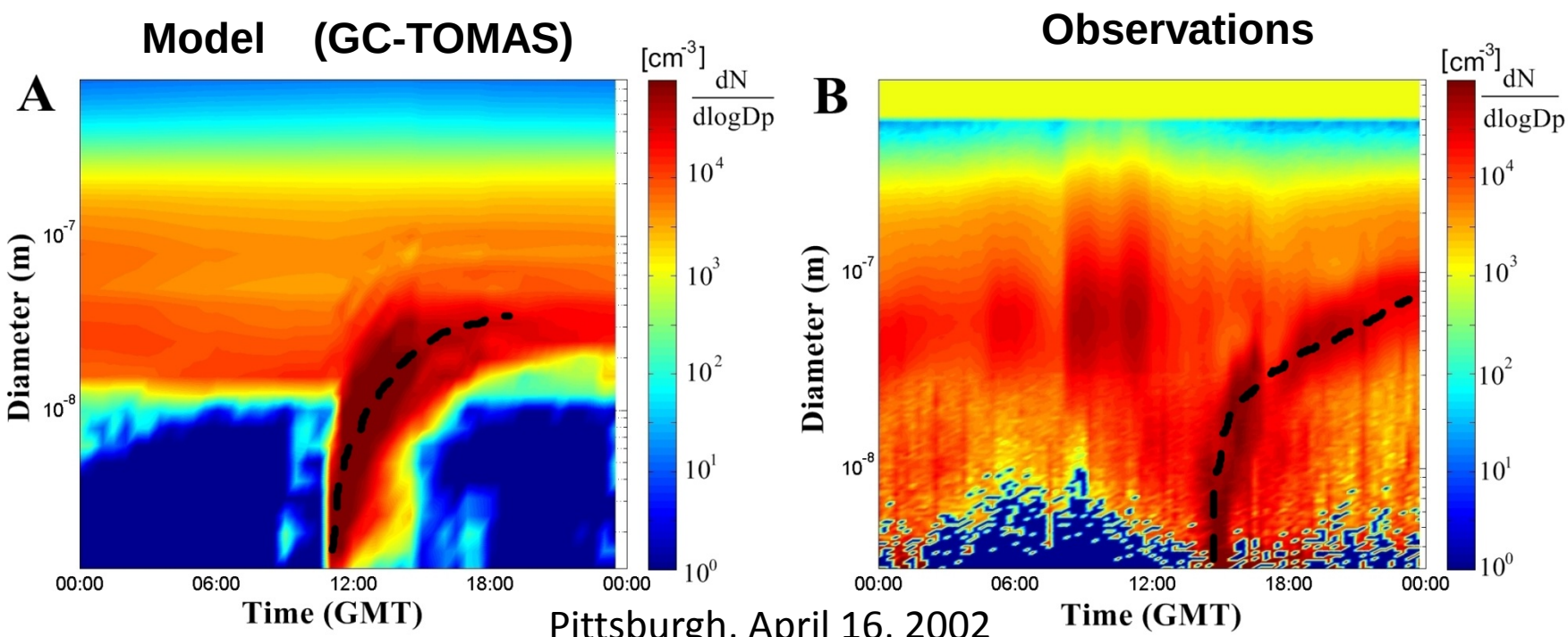
Modeling new particle formation and growth

Several presentations regarding global modeling of new particle formation:

- models (e.g., GEOS-Chem + TOMAS) are ready for mechanisms for nucleation/growth
- currently each model has “shortcuts” in representing growth rates and contribution of organics.
- the rapid time scales for particle formation require changes to models (e.g., MAM + CAM5)

Also progress in process-level modeling of growth:

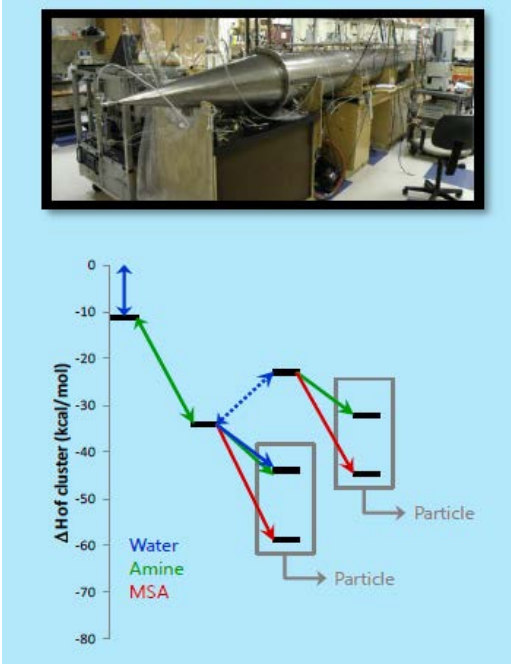
- Initial growth of sub-10 nm particles (which is the most poorly understood process
- growth rates due to reactive and non-reactive uptake and their impacts on observed growth rates.

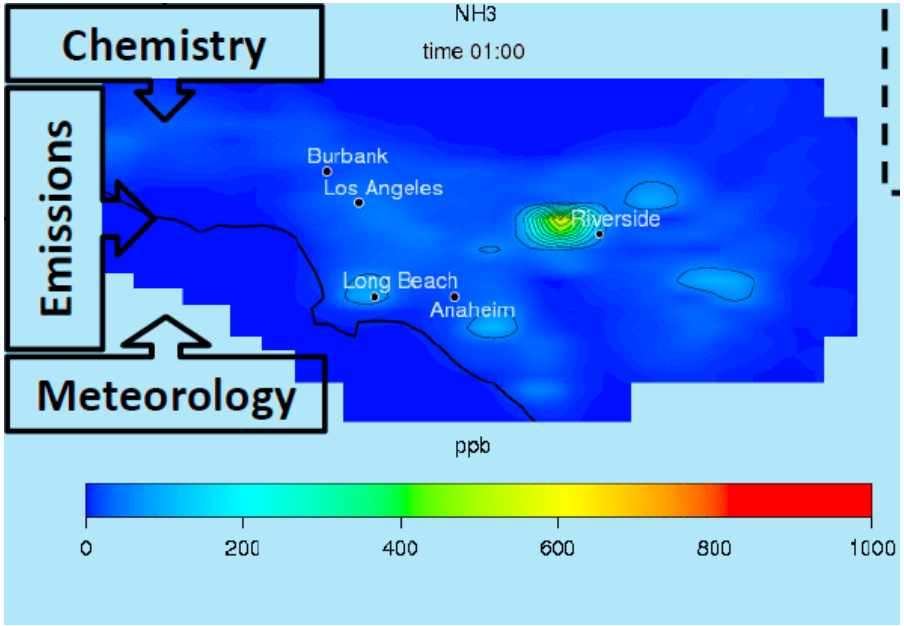


Laboratory studies

The focus of lab studies has been on understanding and modeling nucleation and the first steps in growth (UMN and UC Irvine):

- Recent lab studies include work at UC Irvine to understand and model nucleation in the MSA+amine+H2O system and incorporate into regional model.





lab studies and mechanism … leads to a regional model of the role amines+organosulfates

Alex G. from PNNL, on behalf of the DOE high energy physics community, initiated an extensive discussion about a possible joint Climate-Particle Physics effort to study cloud nucleation at a US-based accelerator facility.

Field Observations

Recent field studies with observations of new particle formation:

- CARES (Central Valley, CA, 2010)
- NPFS (Southern Great Plains, 2013)
- ALC (Aerosol Life Cycle Study (BNL, 2011)

Planned for 2014:

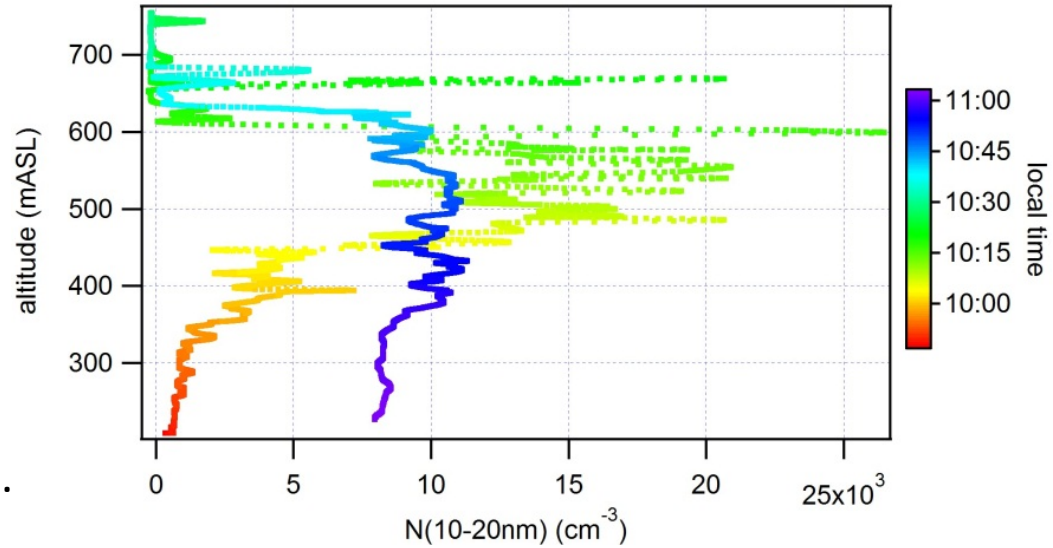
- GoAmazon 2014 IOPs
- BAECC (ARM Mobile Facility deployment, Hyytiälä, Finland Feb – Oct 2014

tethered blimp during NPFS

ARM Long-term observations: Newly procured instrumentation allows extension of existing measurements to quantification of nucleation and growth

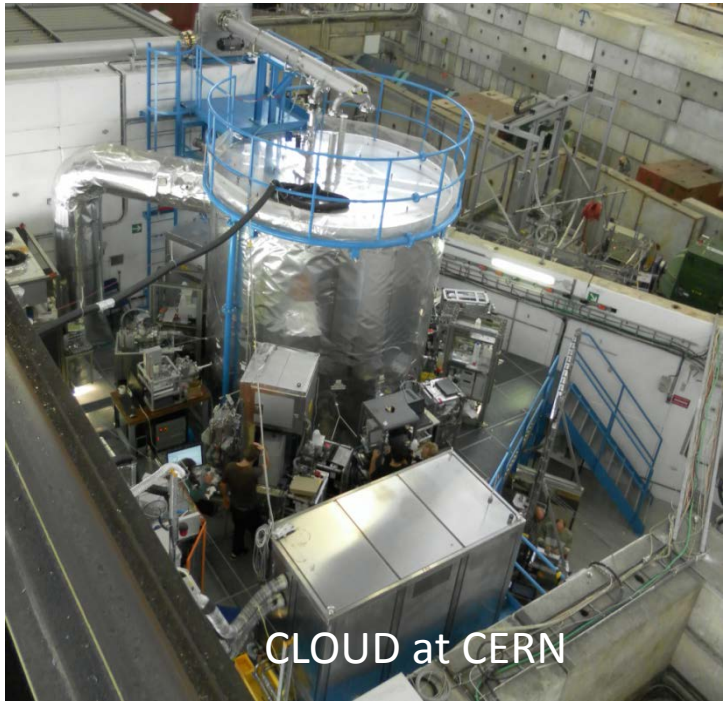
- SGP central facility will receive a trace SO2 analyzer and a nano-Scanning Mobility Particle Sizer.
- This will bring new data products to ARM relating to particle formation.

10-20 nm diameter particle concentration profiles

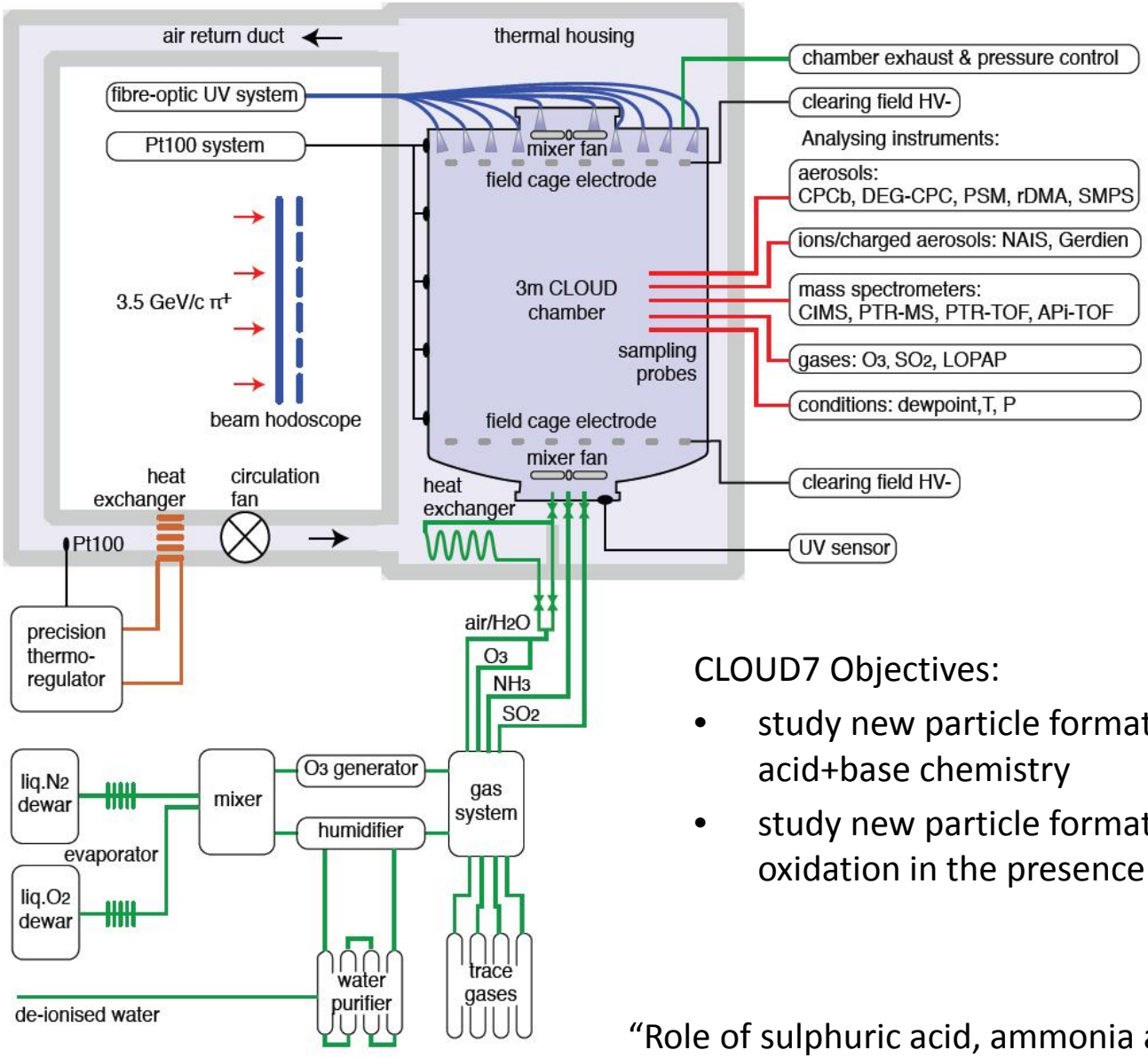


Closing thoughts …

- ASR modeling community is already actively working on incorporating observations of new particle formation into global and regional models.
- ASR laboratory process studies have resulted in the development of 2 successful mechanisms for chemical nucleation.
- Several recent field projects and long-term observations are creating a valuable dataset. Next year 2 important studies in Finland and Brazil will add to this.
- A possible opportunity exists to develop a chamber for research in aerosol formation and growth.



CLOUD: Cosmics Leaving OUtdoor Droplets Experiment



CLOUD7 Objectives:

- study new particle formation from sulfuric acid+base chemistry
- study new particle formation from a-pinene oxidation in the presence of NOx and SO2

"Role of sulphuric acid, ammonia and galactic cosmic rays in atmospheric aerosol nucleation," Kirkby et al., Nature 2011