

Cloud microphysical measurements: Current challenges and emerging technology

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Droplet Measurement Technologies

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All in situ measurements in cloud are susceptible to contamination from ice fragments generated from shattering/rupturing of cloud hydrometeors on aircraft and instrument surfaces.

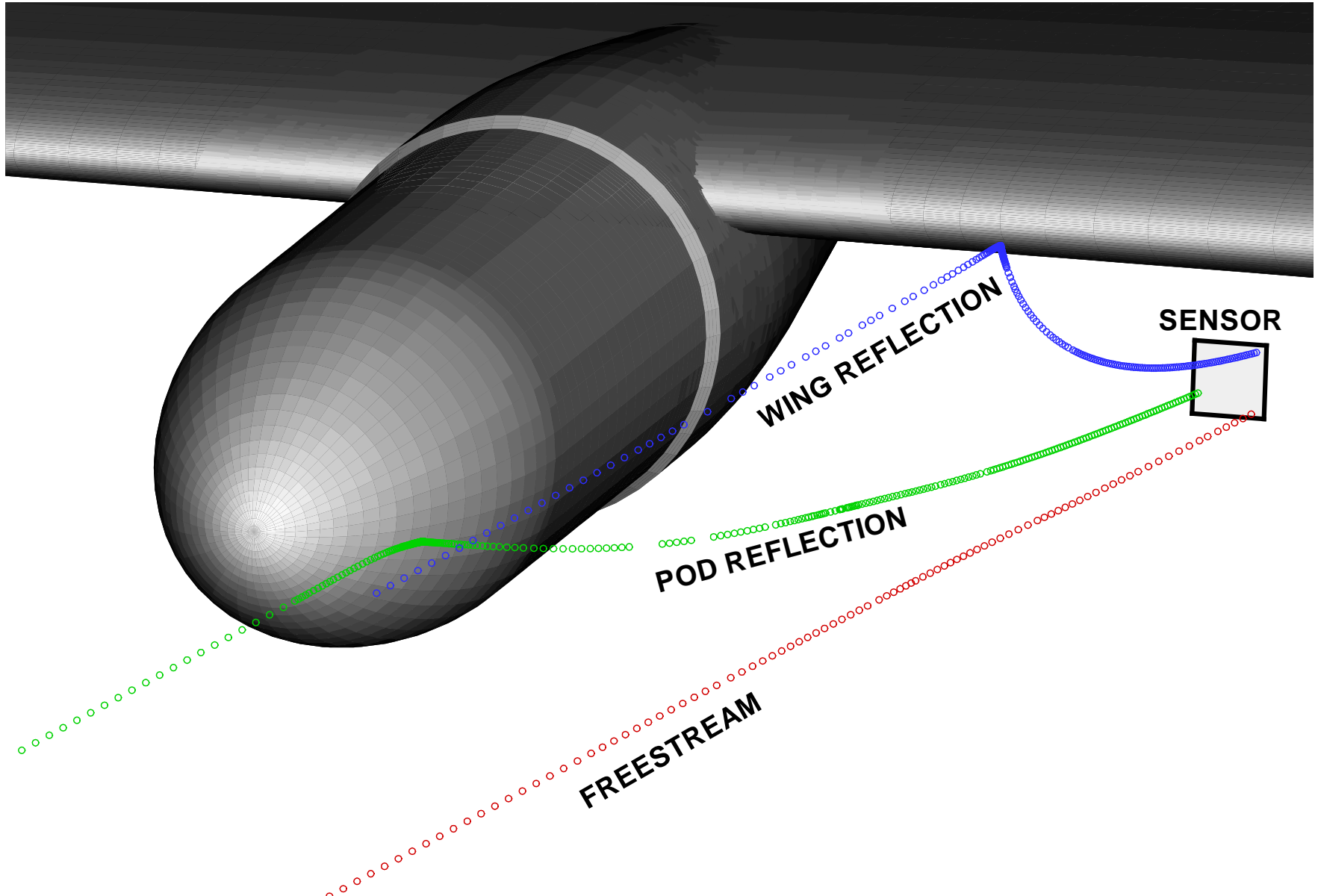
The Challenges:

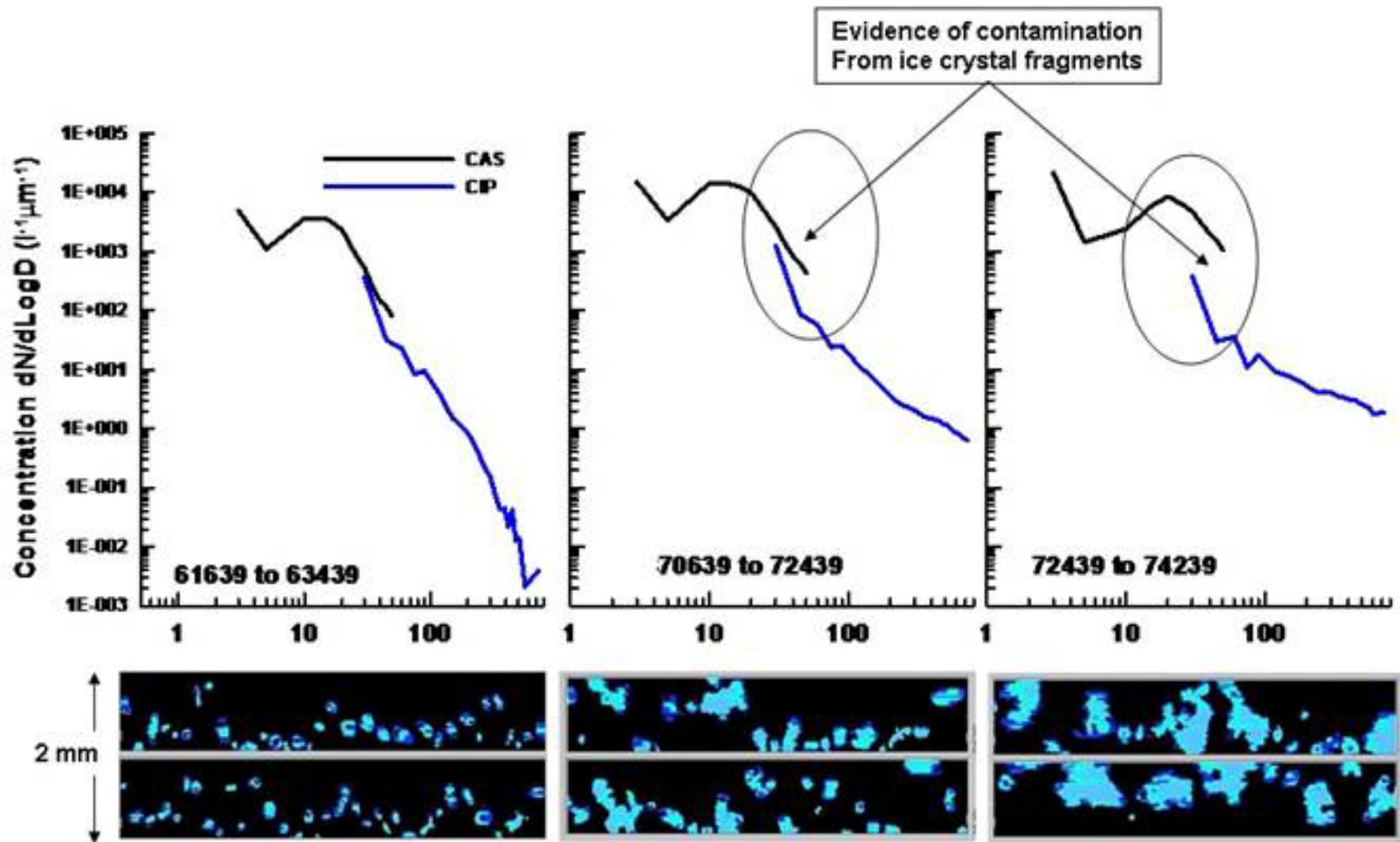
- Detect the presence of spurious particles in measurements.
- Quantify and correct the error.
- Eliminate or minimize the problem.

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Numerical Model of Airflow Induced Particle Enhancement for Instruments Carried by the WB-57F Aircraft

W. A. Engblom and M. N. Ross







CAPS on left pylon of 57F during CRYSTAL and MidCix



CAPS on right wing of 57F during CR-AVE and TC4

Studies at DMT to Correct and Resolve the Problem

In collaboration with NCAR, Environment Canada and Juelich Institute:

Airflow modeling around the FSSP, CAS and CDP

Particle trajectory Calculations

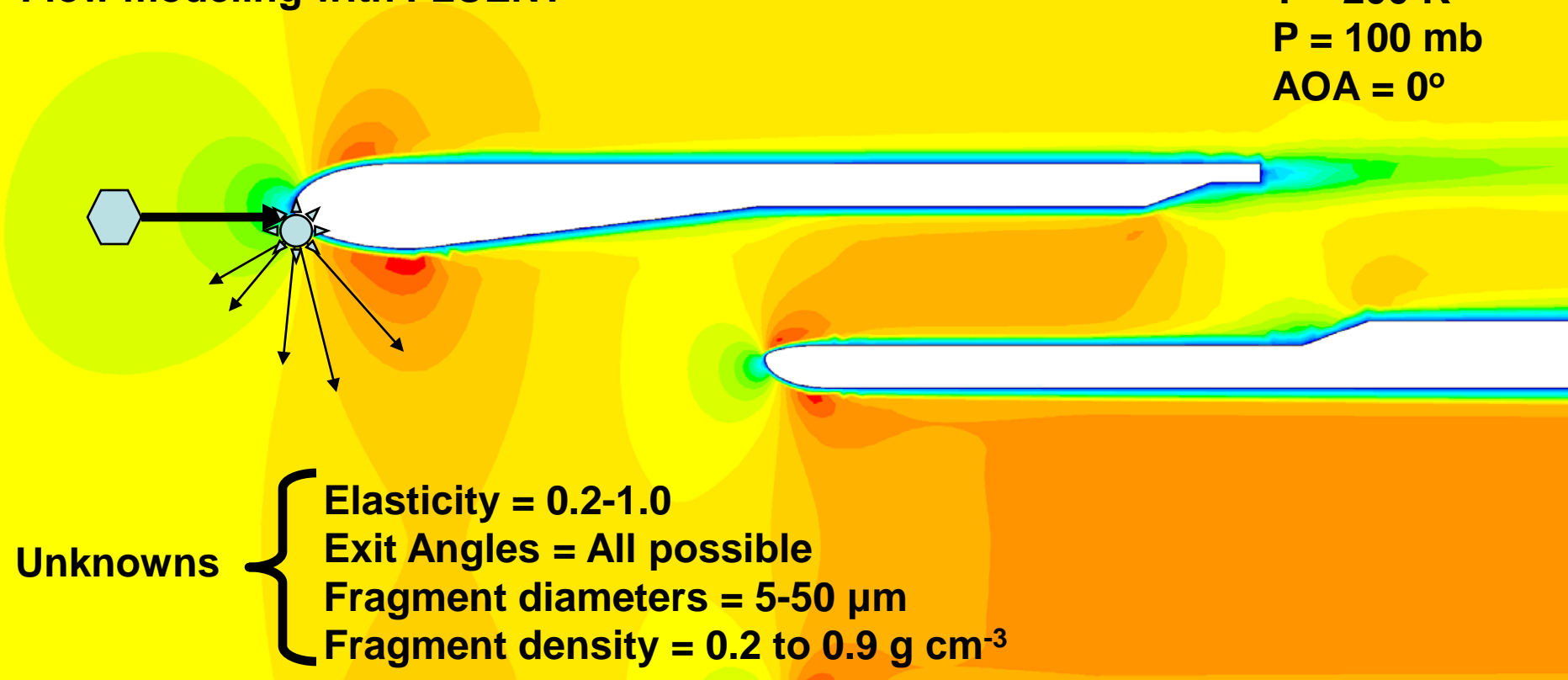
Constrain the unknowns and test the model

Develop corrections when possible.

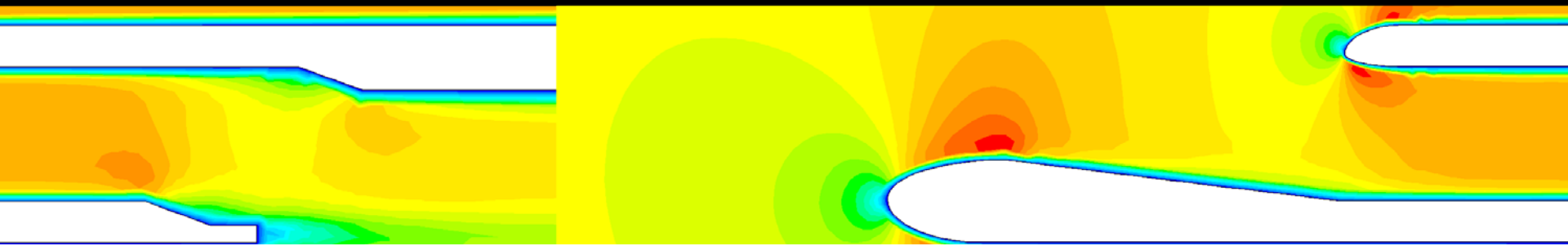
Design a new, inlet-less optical spectrometer

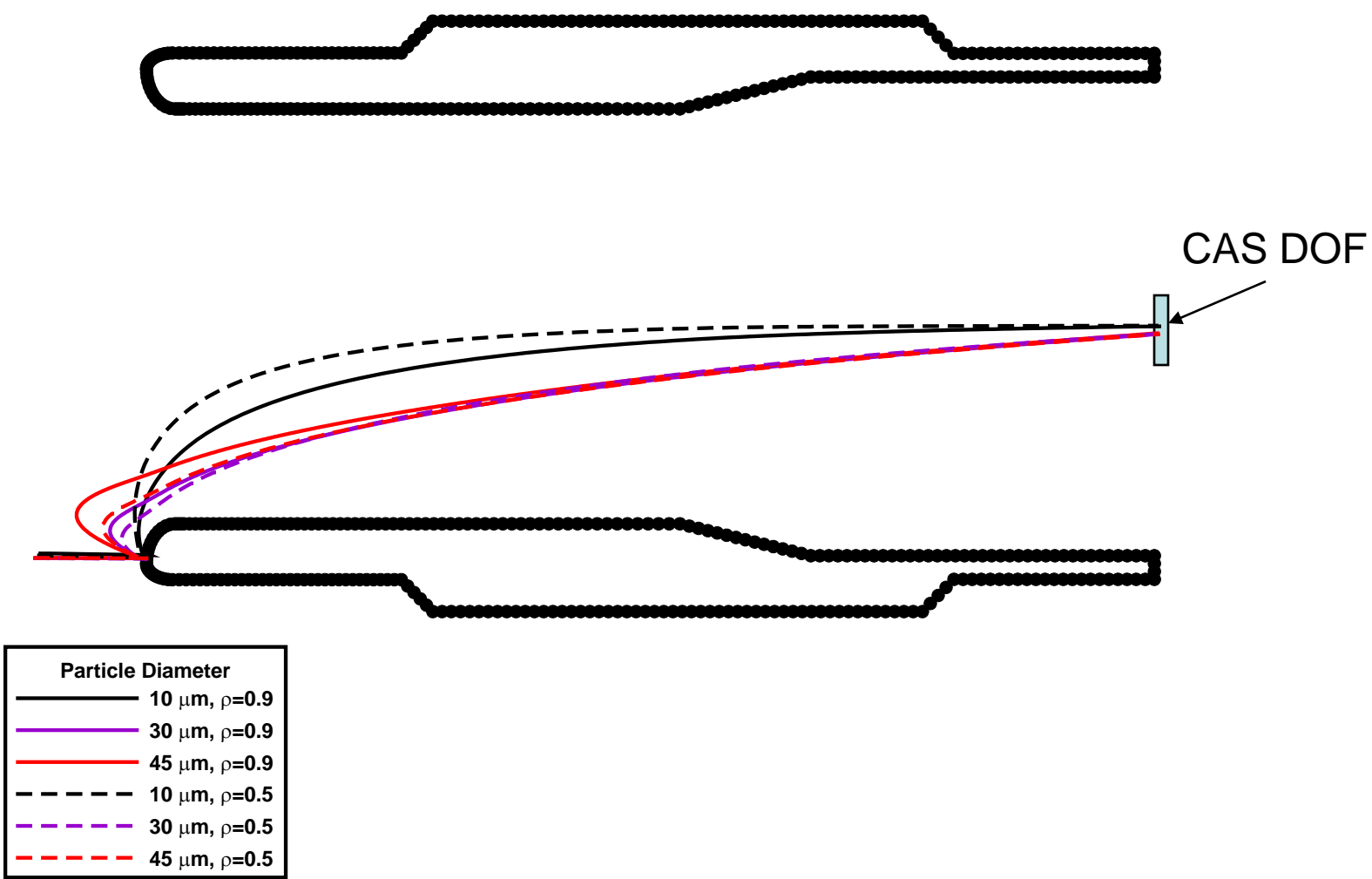
Flow modeling with FLUENT

T = 200 K
P = 100 mb
AOA = 0°



Unknowns {
Elasticity = 0.2-1.0
Exit Angles = All possible
Fragment diameters = 5-50 μm
Fragment density = 0.2 to 0.9 g cm^{-3}





Solutions?

REMOVE THE INLETS



Part for IS-222
Item 1-8-08

Other Solutions?

**Imaging Probes also suffer from Shattering
(A. Korolev's Presentation)**

**In collaboration with A. Korolev and
funding from Juelich Institute, DMT is
developing a new CAPS with an inlet-less
CAS and a CIP with a new form factor.**

New Developments

CAS-Pol

The Cloud Aerosol Spectrometer with bi-directional scattering plus detection of depolarization. Differentiates aspherical particles.

CIP-Gray

The Cloud Imaging Probe with 15 μm resolution and programmable grayscale images. Rejects particles outside the DOF caused by shattering (see A. Korolev presentation) and give much more accurate measurements of sub-100 μm particles.