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Aerosol Cloud Interaction

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Measurement of Ice Nuclei with the FRIDGE Chamber (SFB-641-A2)

FRIDGE - FRankfurt Ice-Nuclei Deposition FreezinG Experiment

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Overview:

1. Working Principle of FRIDGE
2. Filter-Measurements, Results of ICIS 07
3. Electrostatic-Sampling
4. Laboratory-Results, Field-Measurements
5. Conclusions

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1. Working Principle of the FRIDGE- Chamber

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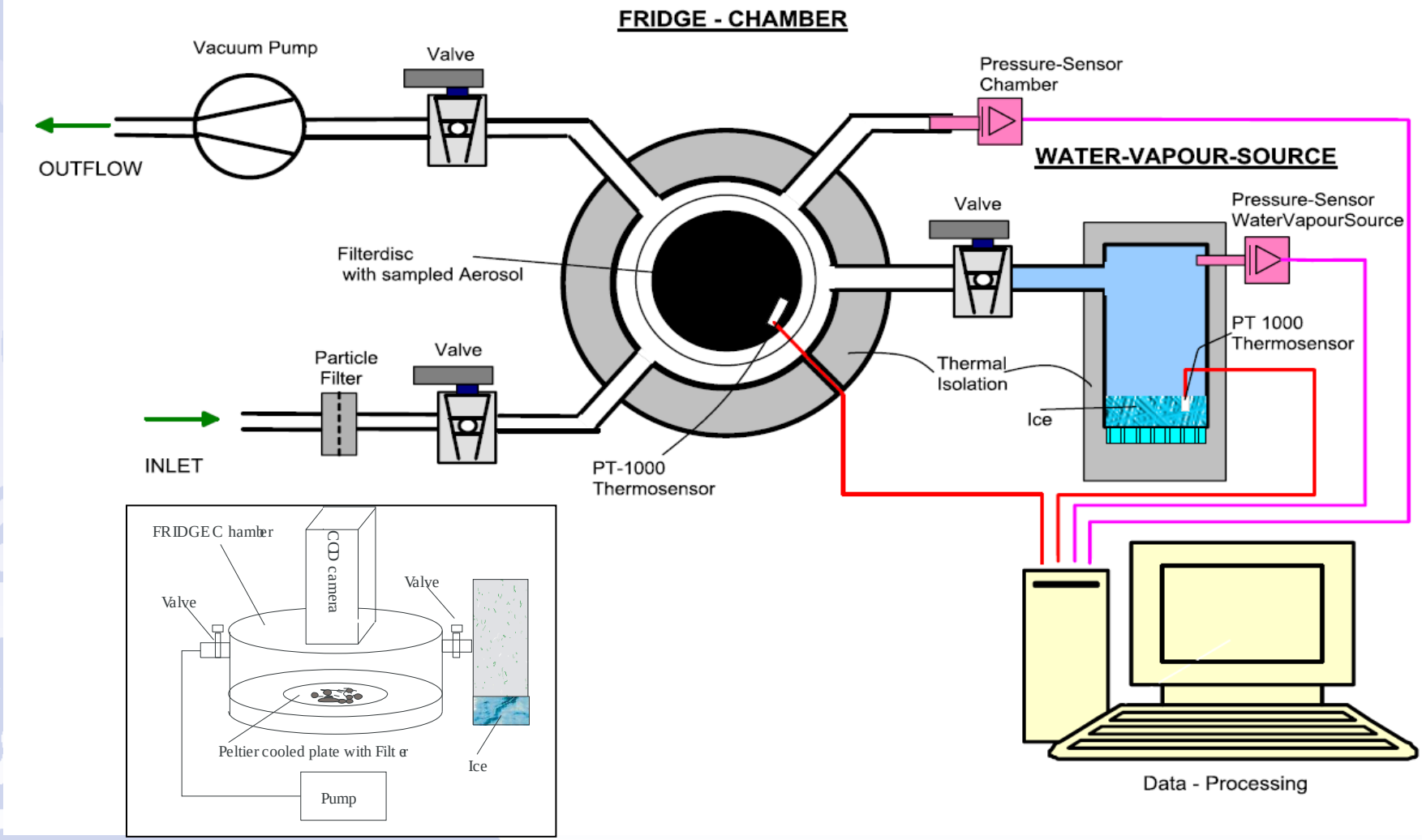
FRIDGE – SCHEME



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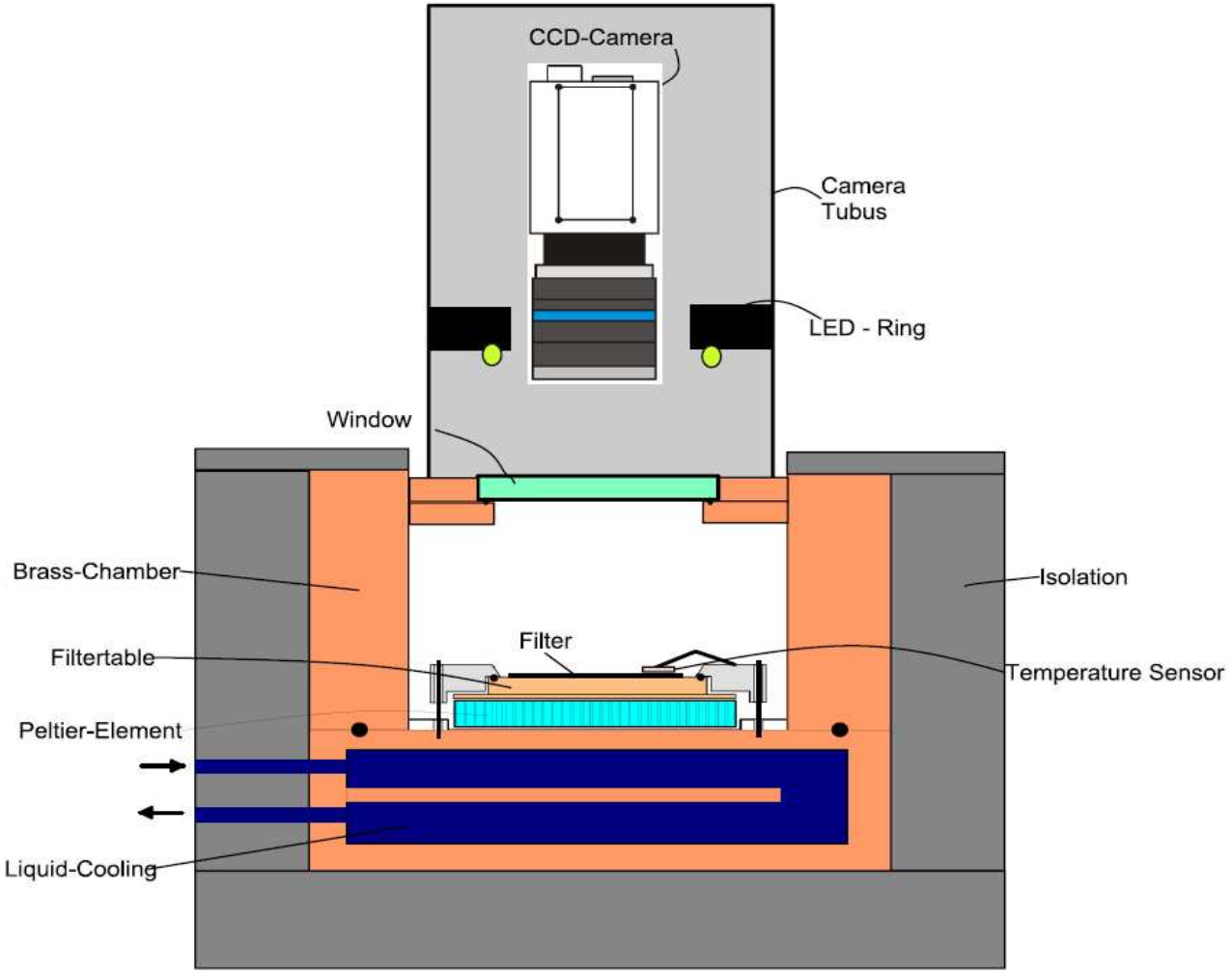
CROSS-SECTION OF FRIDGE CHAMBER



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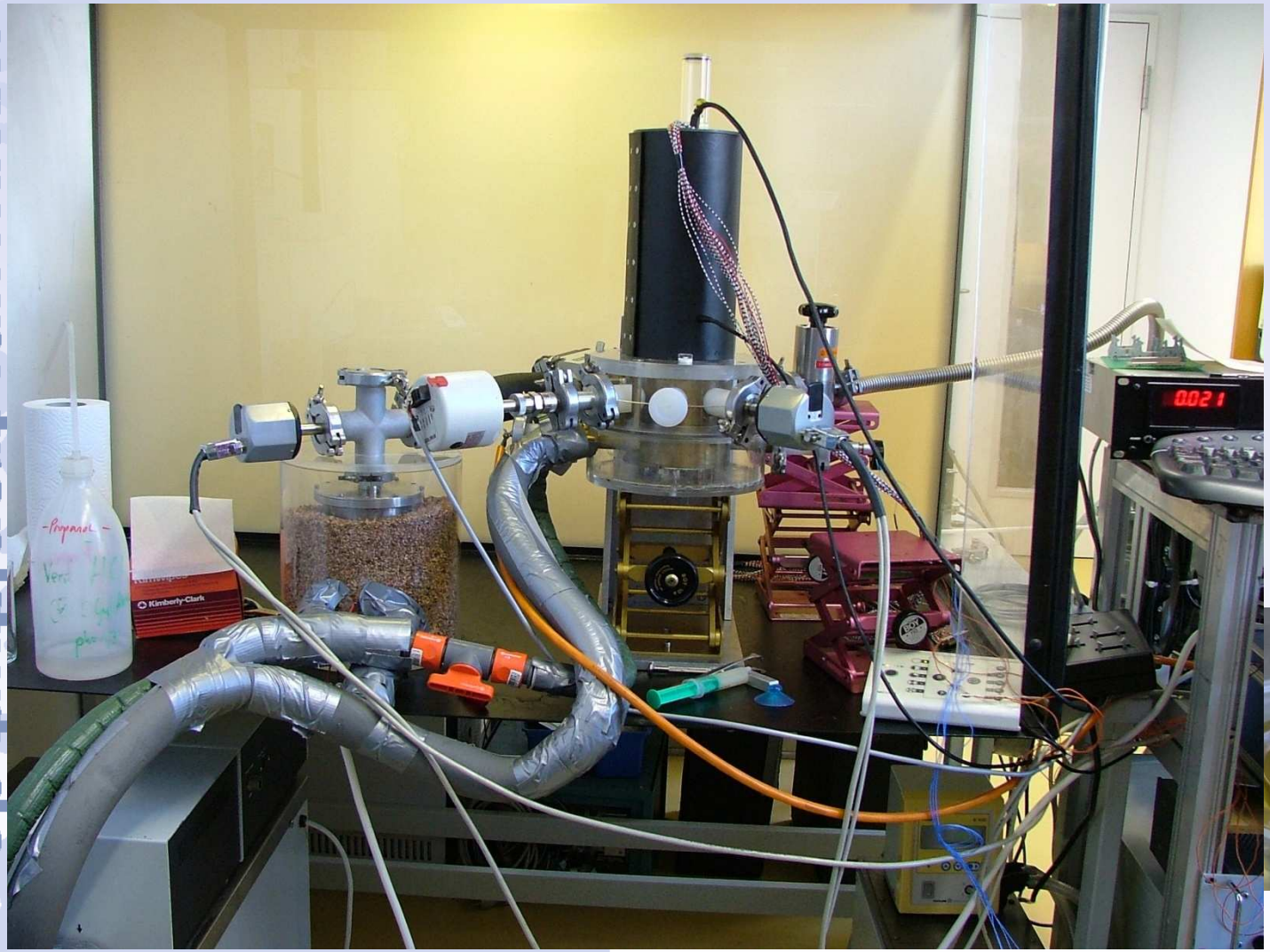
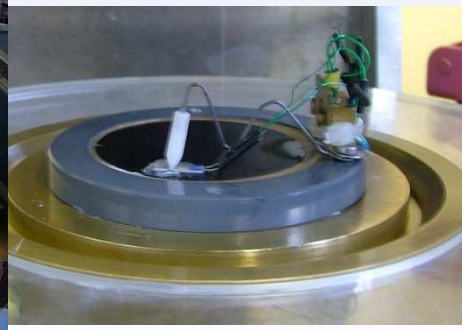
ASSEMBLY OF FRIDGE IN A CLEAN-AIR BOX





AUTOMATED COUNTING OF ICE-PARTICLES (LABVIEW)

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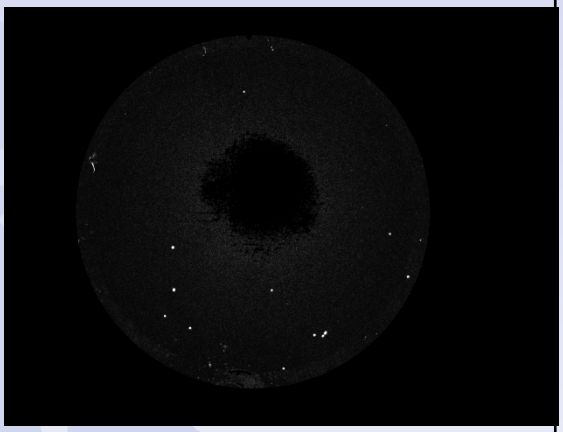
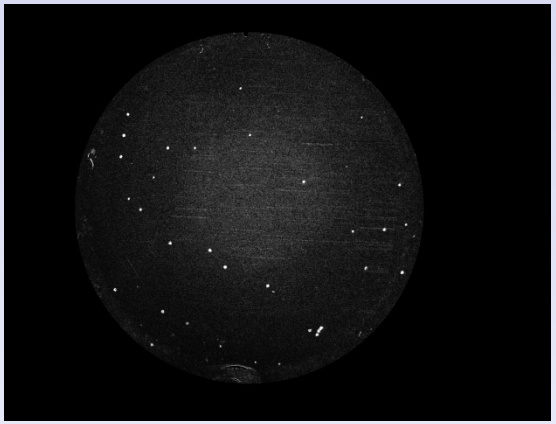
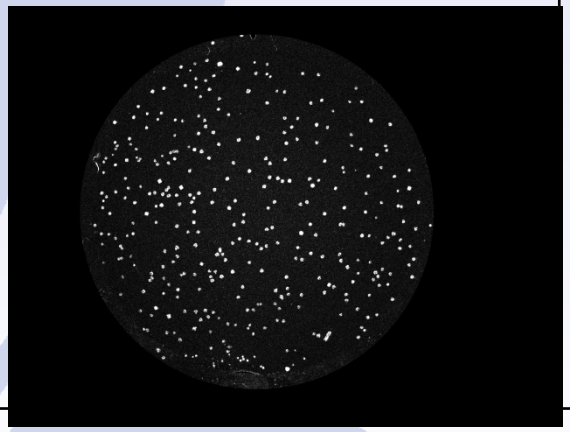
RHi= 111 % ; IN number=19



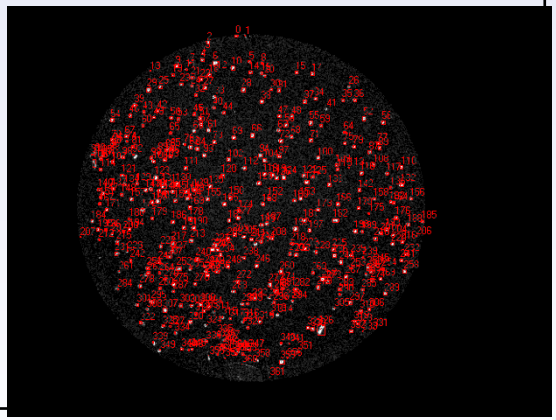
RHi= 113 % ; IN number=49



RHi= 114 % ; IN number=361



analyzed picture at RHi=114%, T=-17°C



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2. Filtersampling, ICIS-07 Workshop

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FILTER-SAMPLING

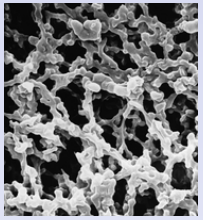
Particle Uptake:

1. Large Particles (>0,3µm) :

Sieving at the filter surface

2. Smaller Particles: **Diffusion** in the pores.

3. Very large particles (>1µm): **Impaction**



Microstructure of the filtermaterial

FILTERS USED:
Millipore – MF-Membrane, black smooth

Diameter: 47 mm

Nitrocellulose

Poresize: 0,45µm

Porosity: 0,79 %

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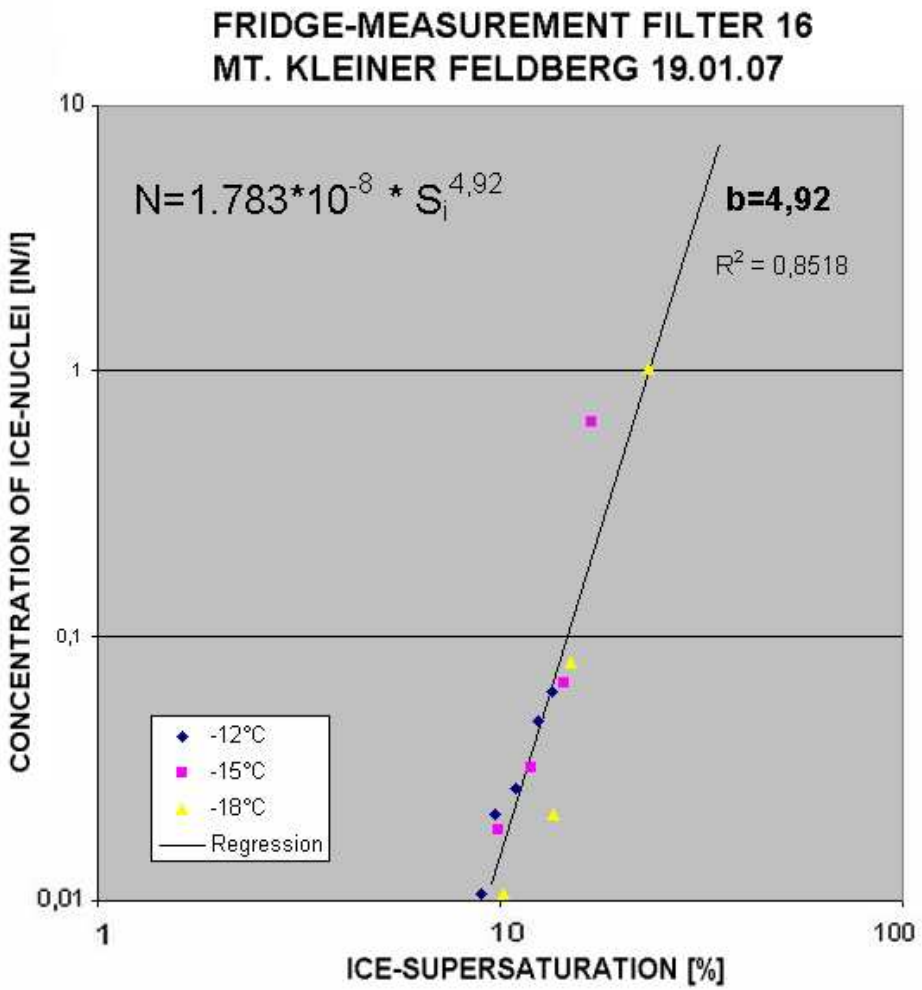
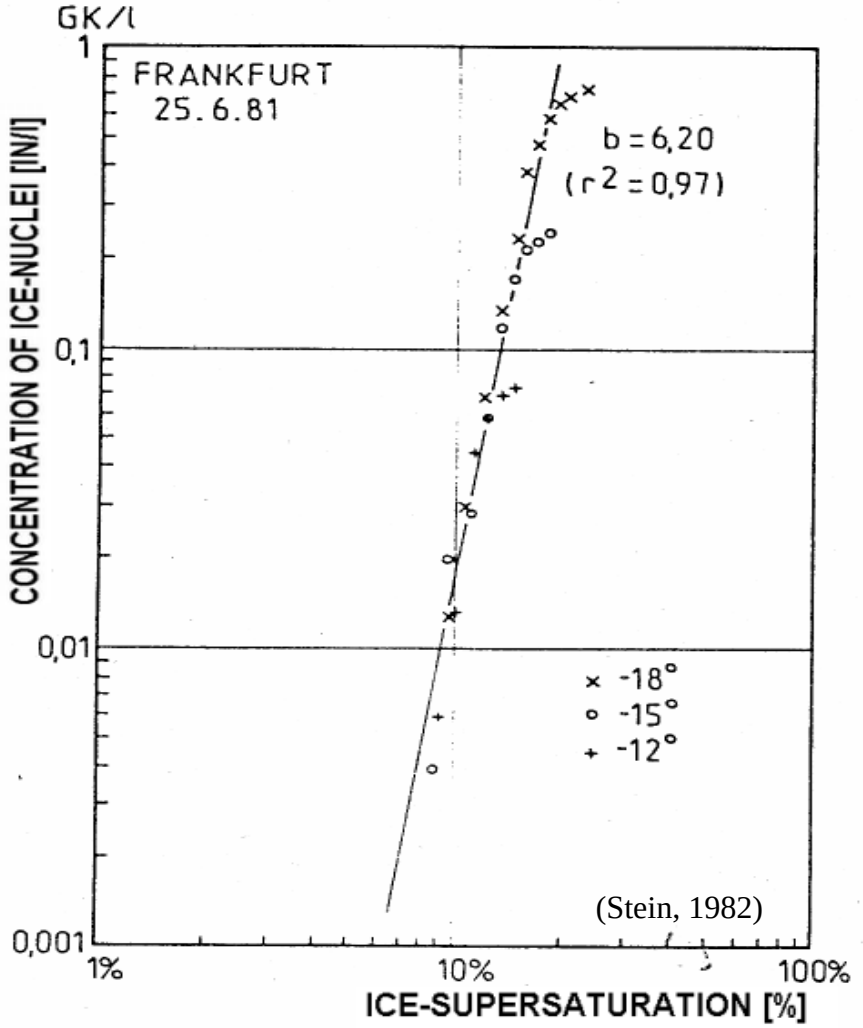
COMPARISON WITH THE EARLY WORKS OF STEIN (1982)





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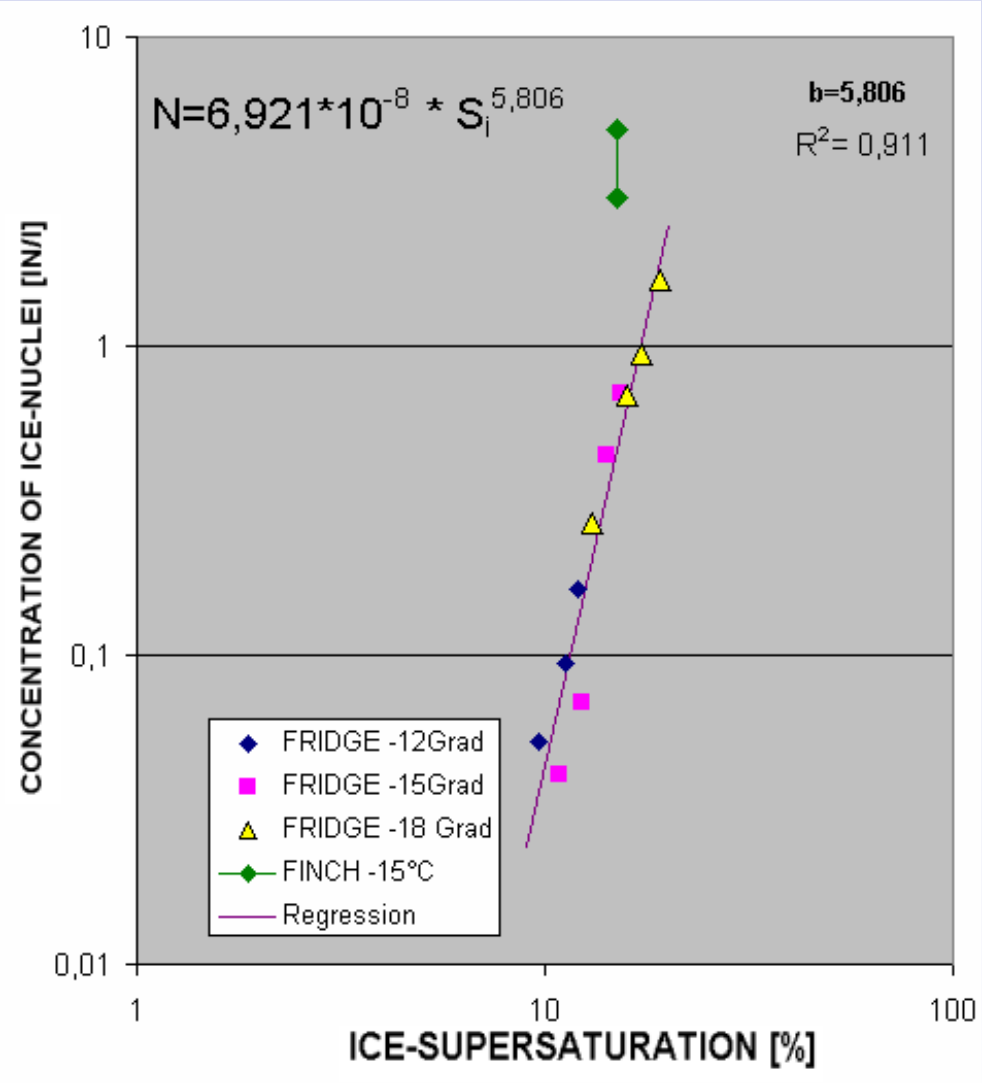
COMPARISON FRIDGE-FINCH

Juli 2007, Taunus Observatorium



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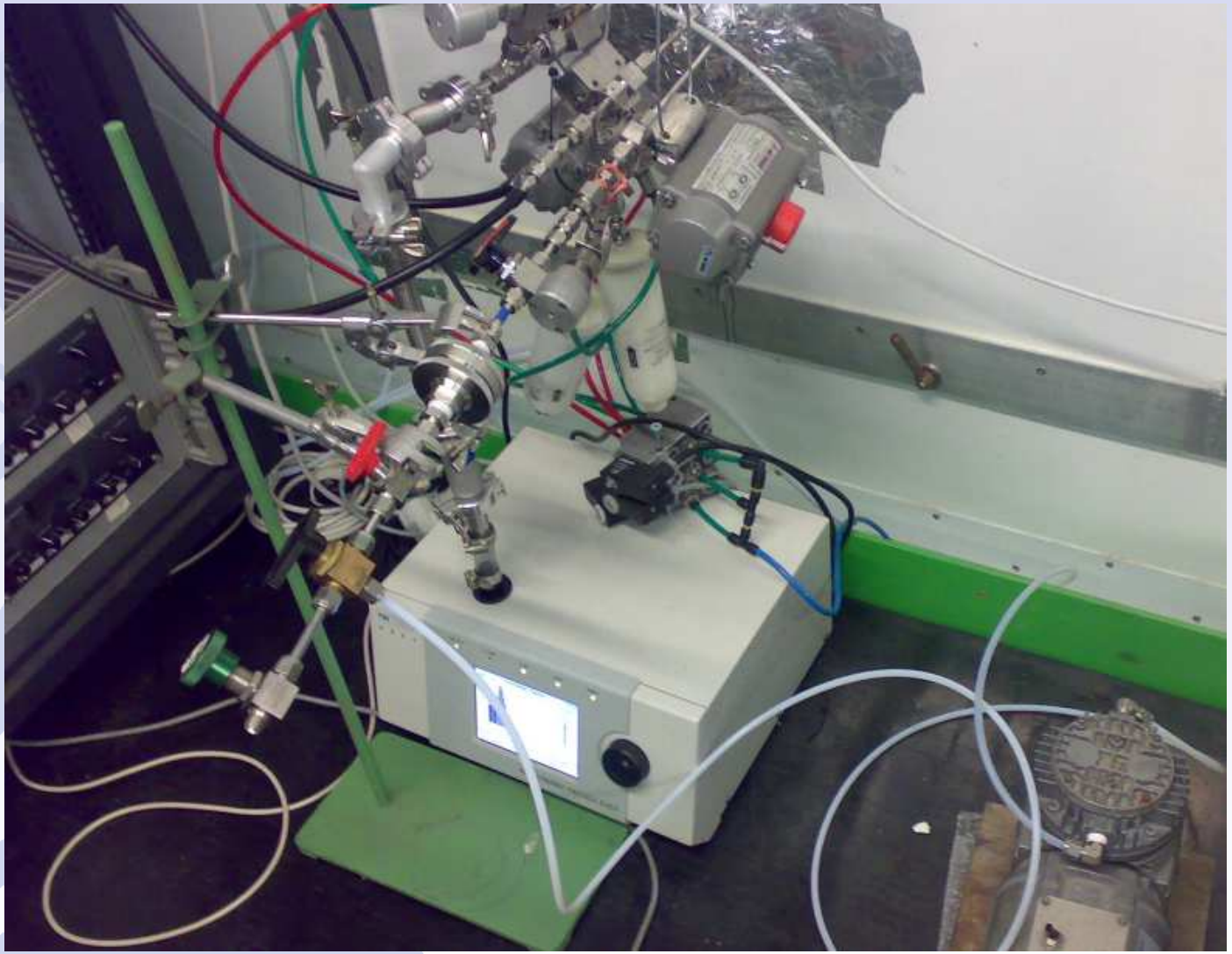
FILTER SAMPLING AT AIDA CHAMBER



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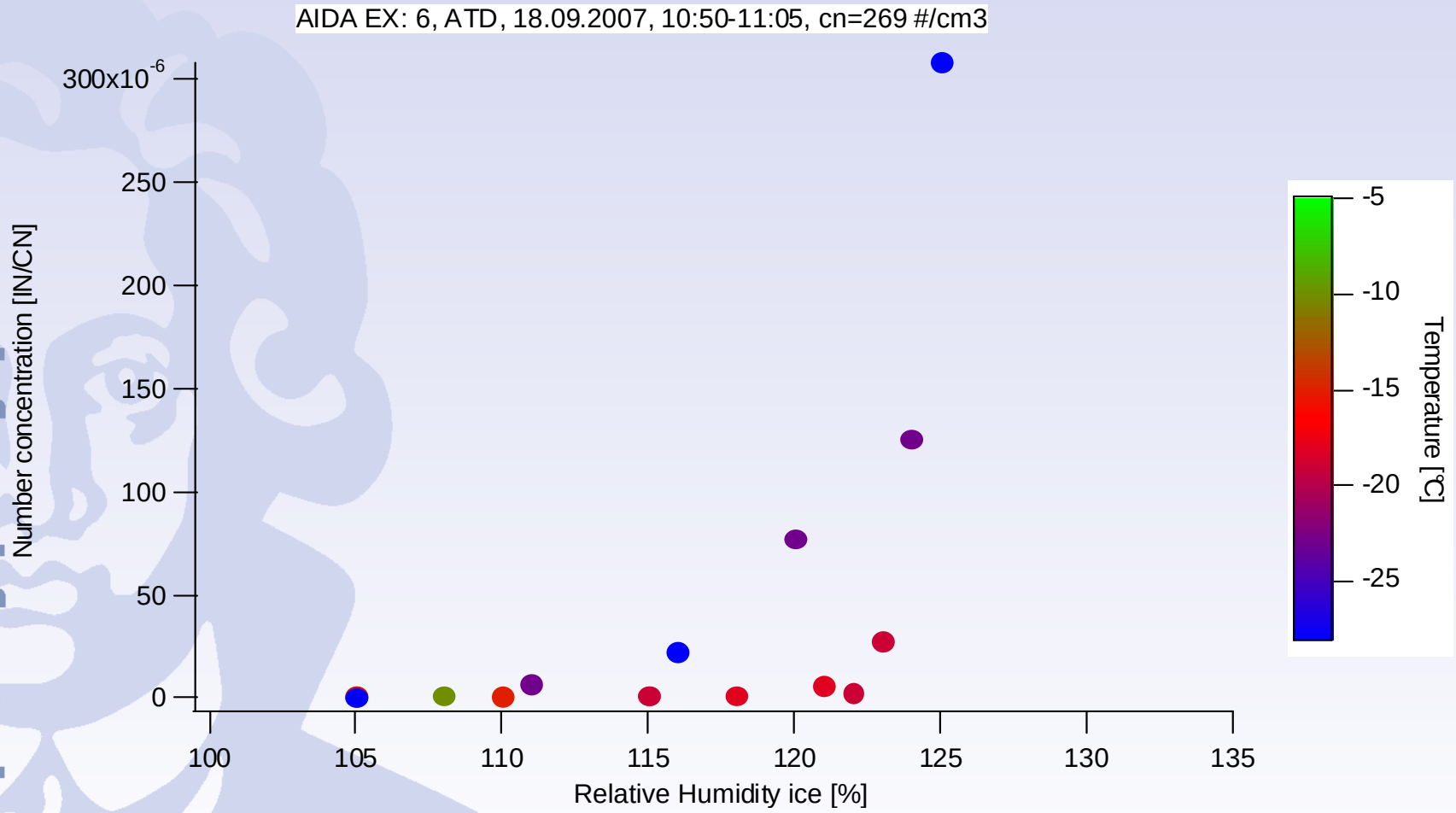
ICIS – AIDA EXPERIMENT 6 ARIZONA TEST DUST

FRIDGE-RESULTS



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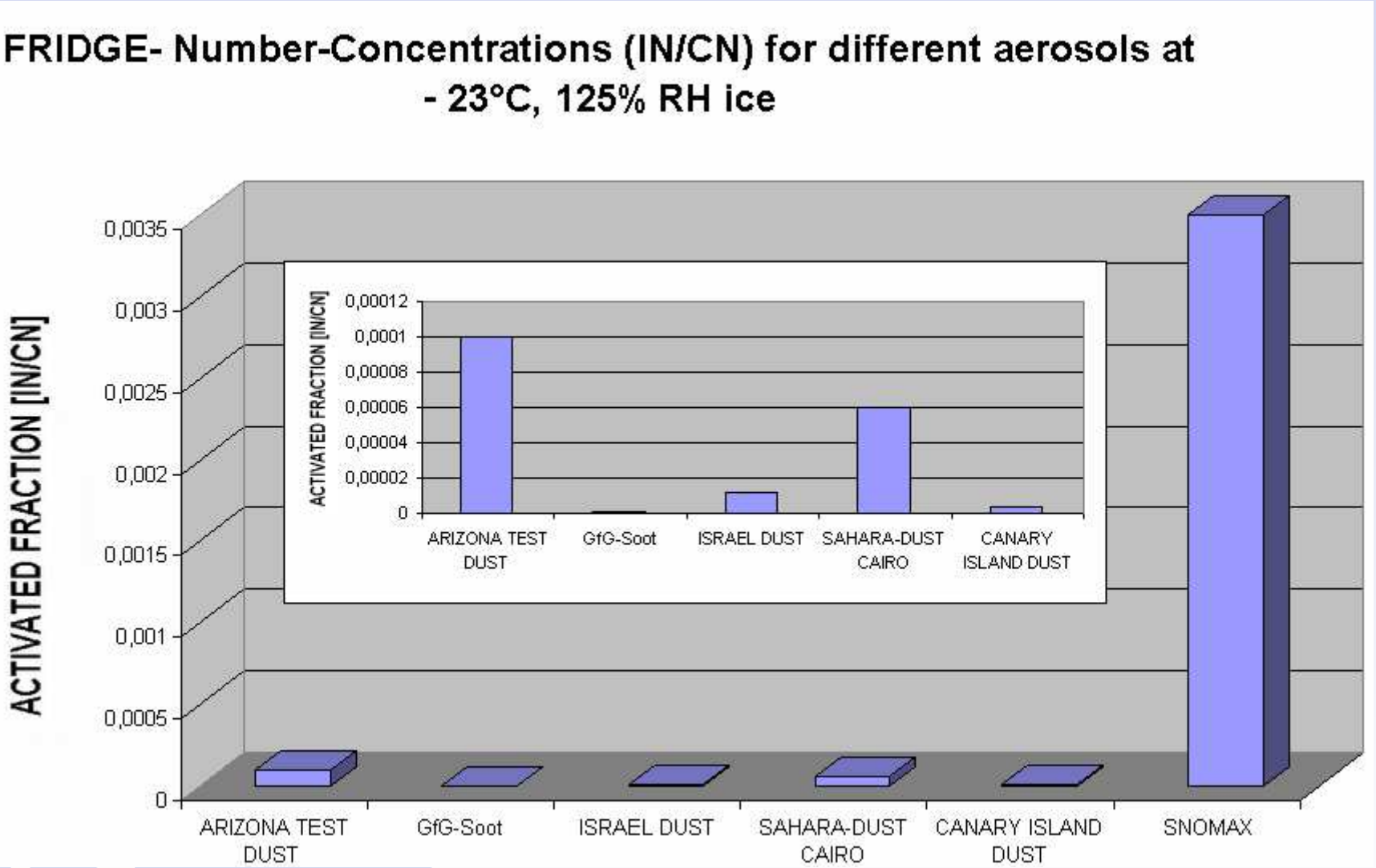
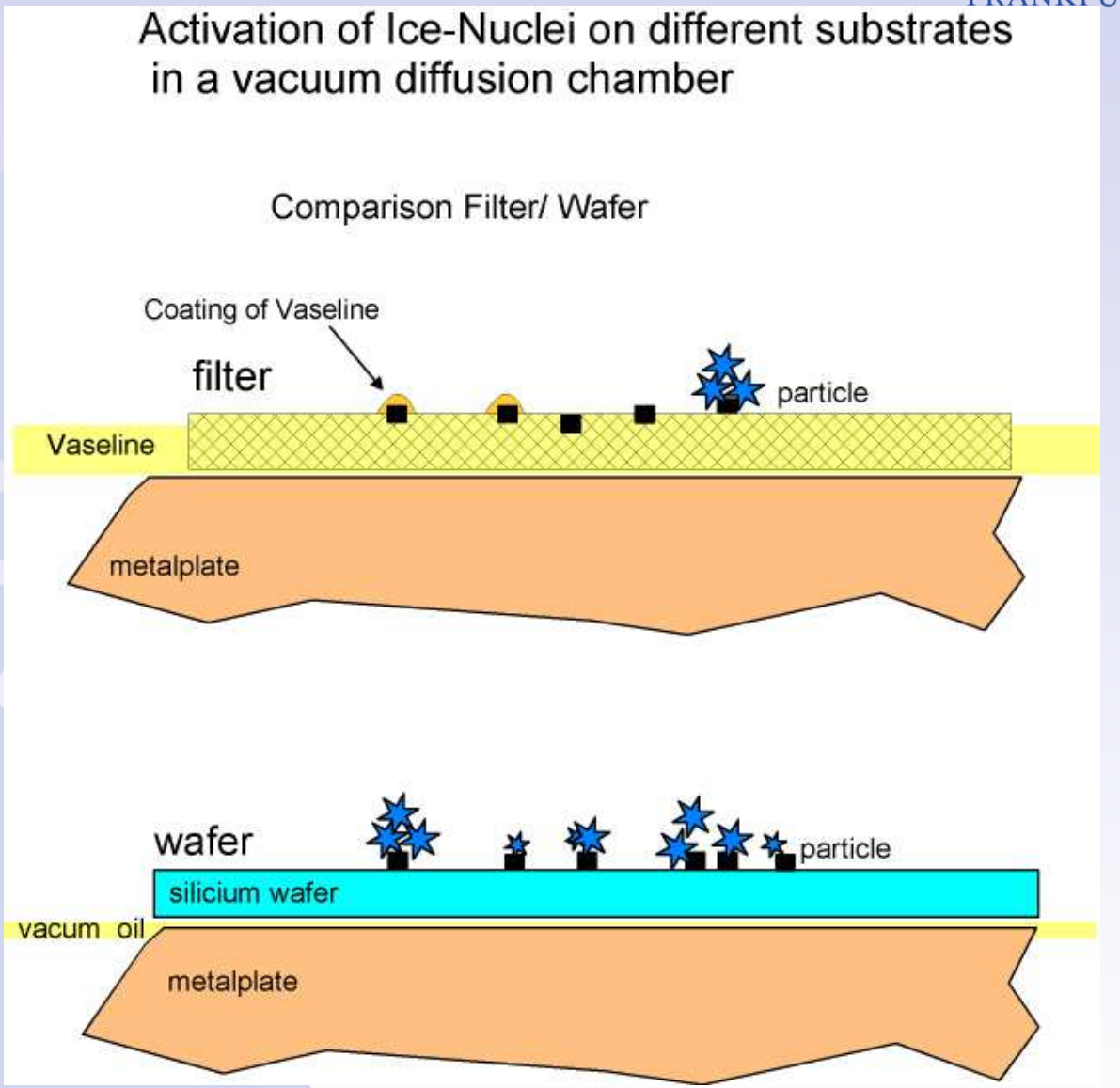
ICIS 07- RESULTS





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3. Electrostatic Sampling

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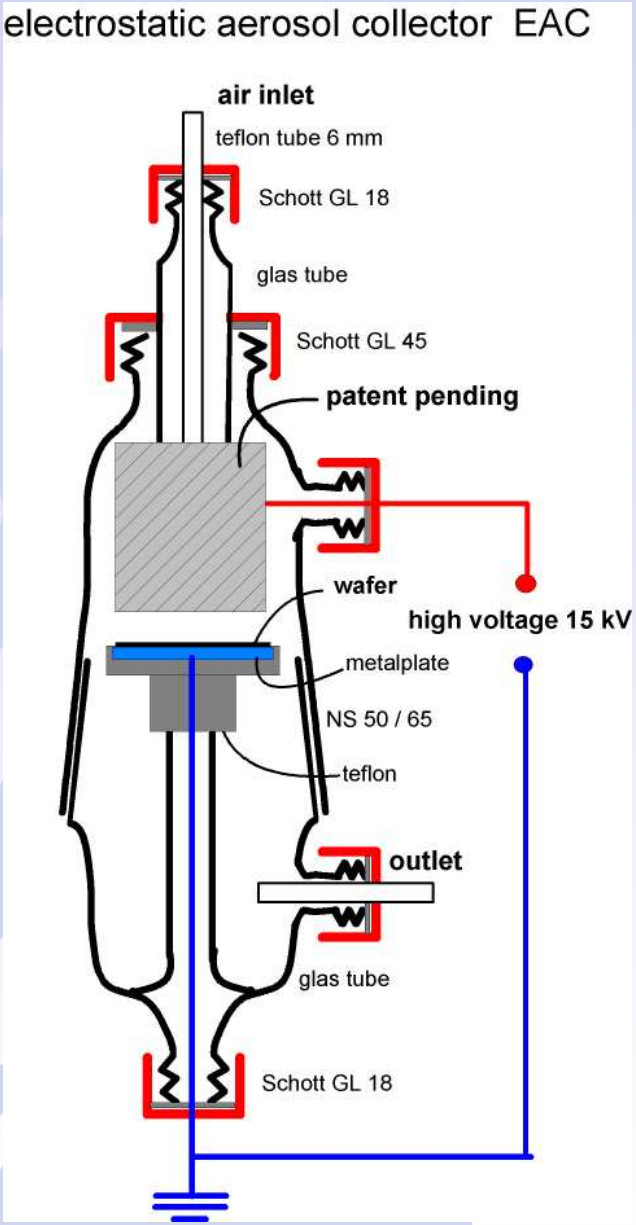

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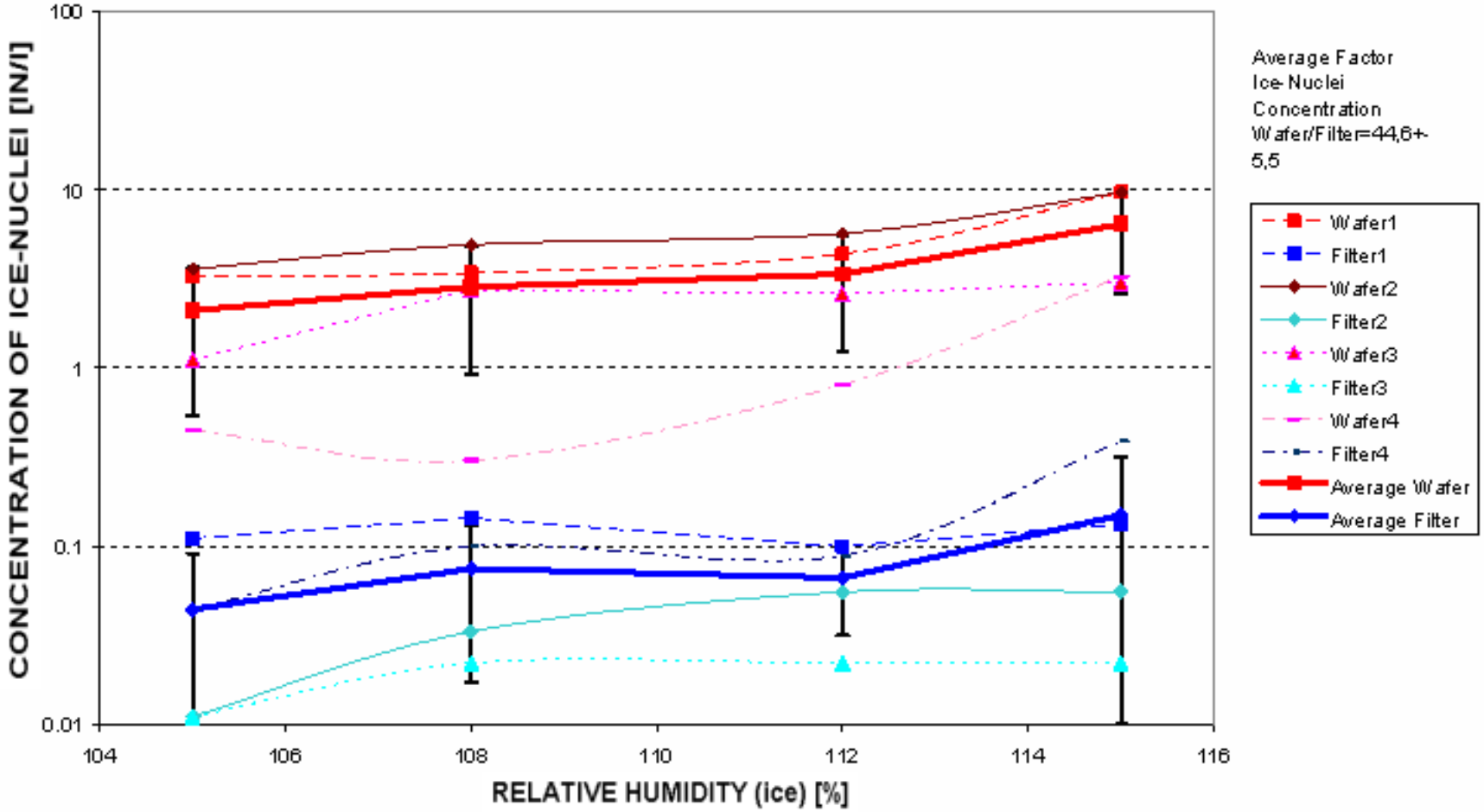
Analysis of Parallel-Sampled Aerosol on Wafer/Filter (30 l) at -14°C



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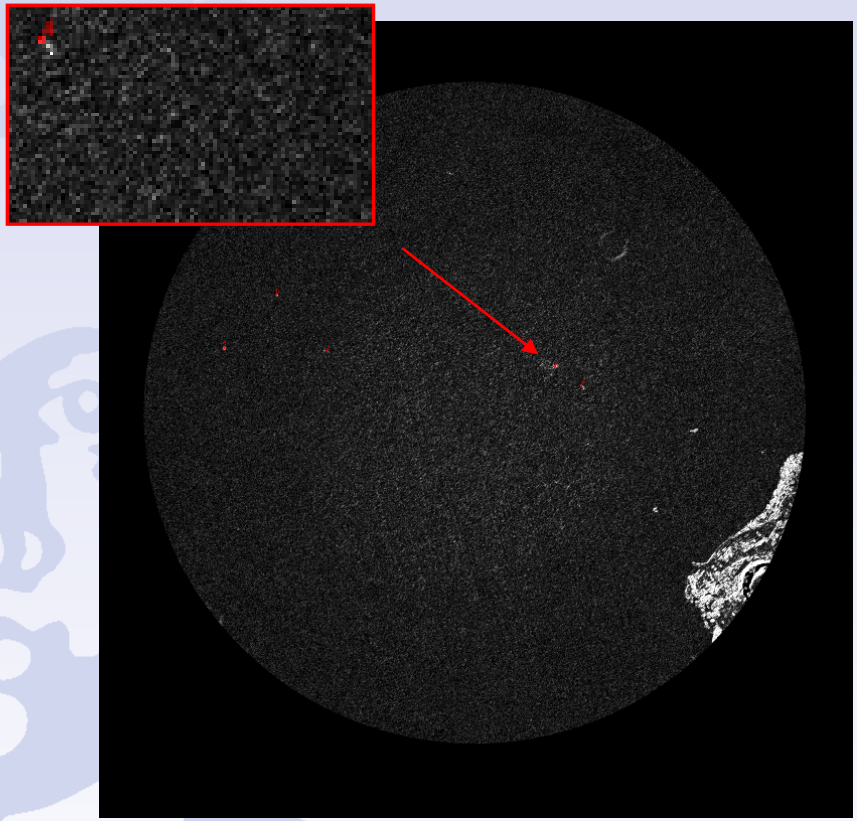
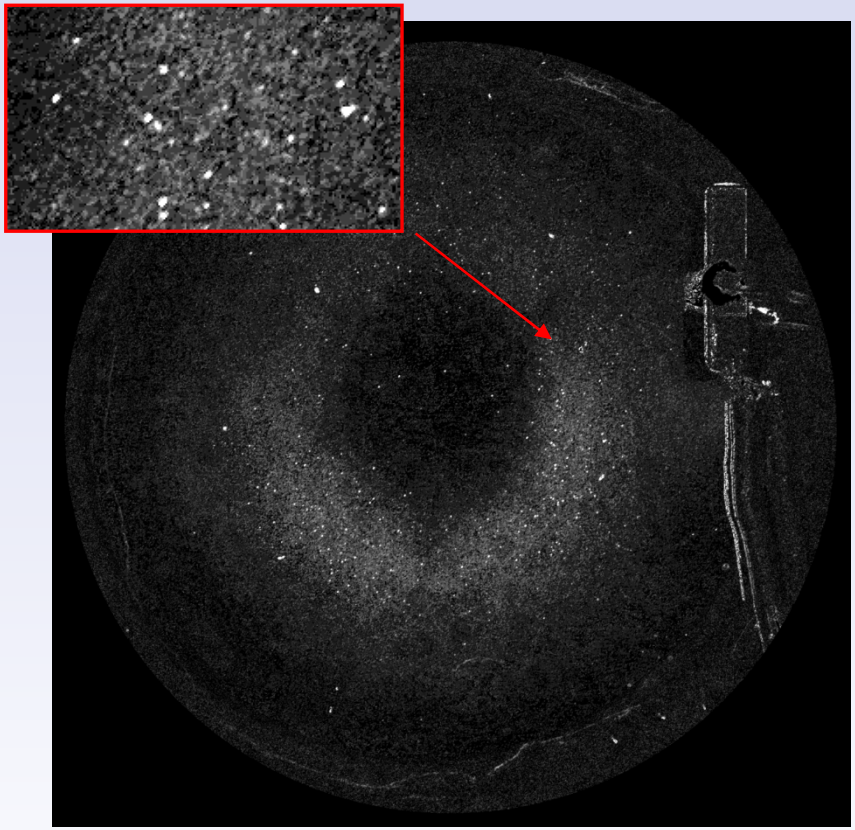
ANALYSIS OF PARALLEL-SAMPLES -14°C, 115% RHice

A) FILTER



B) WAFER



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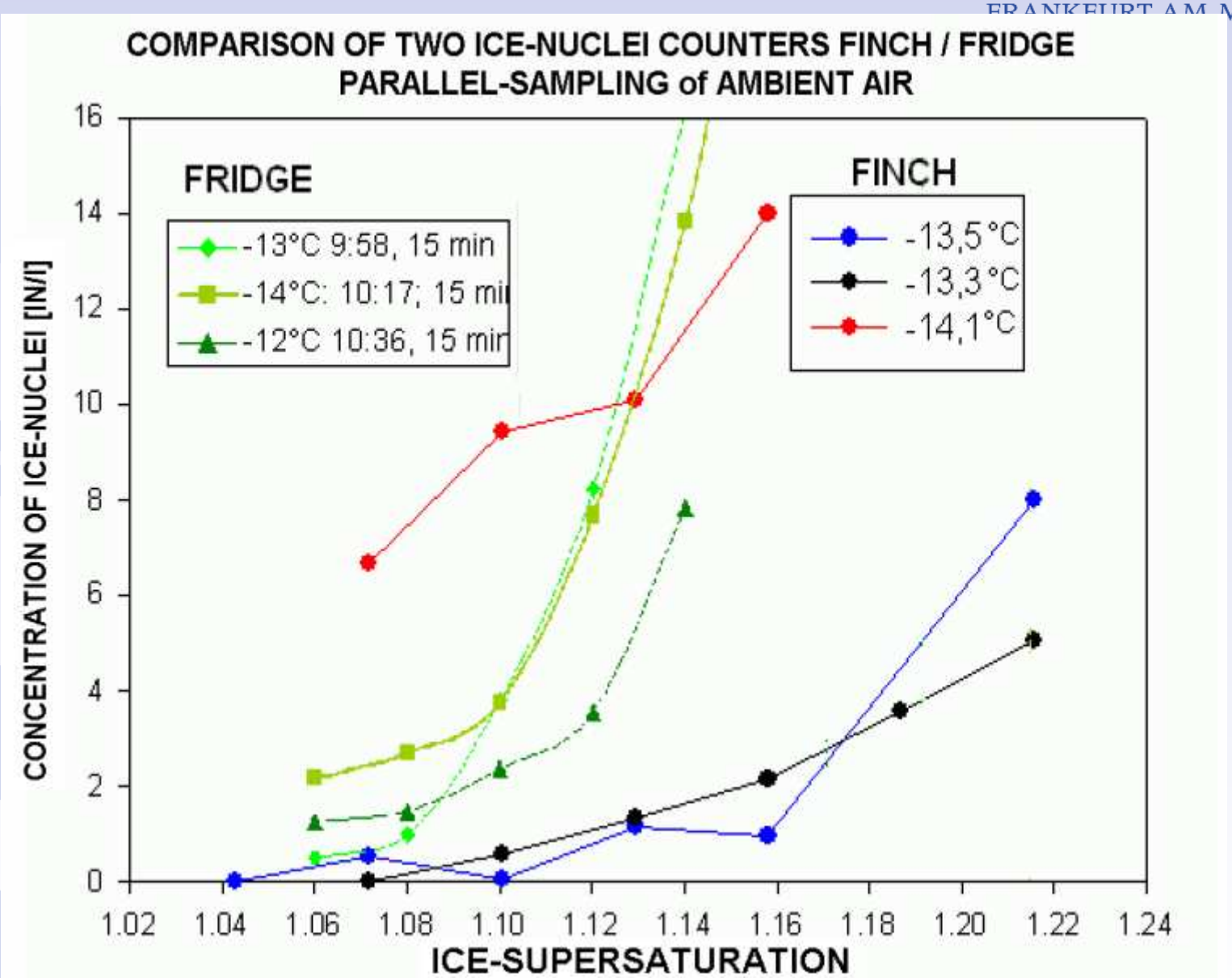
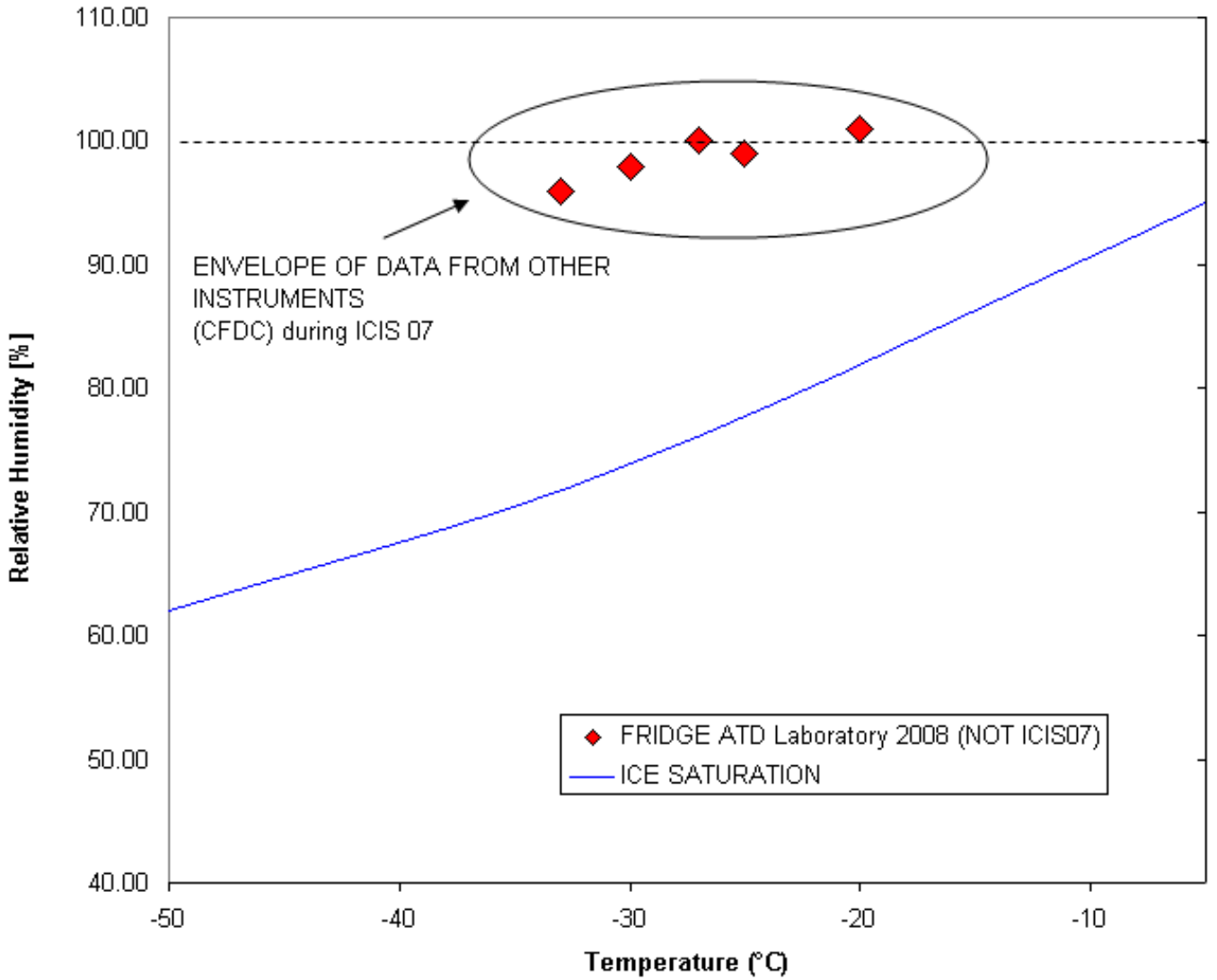
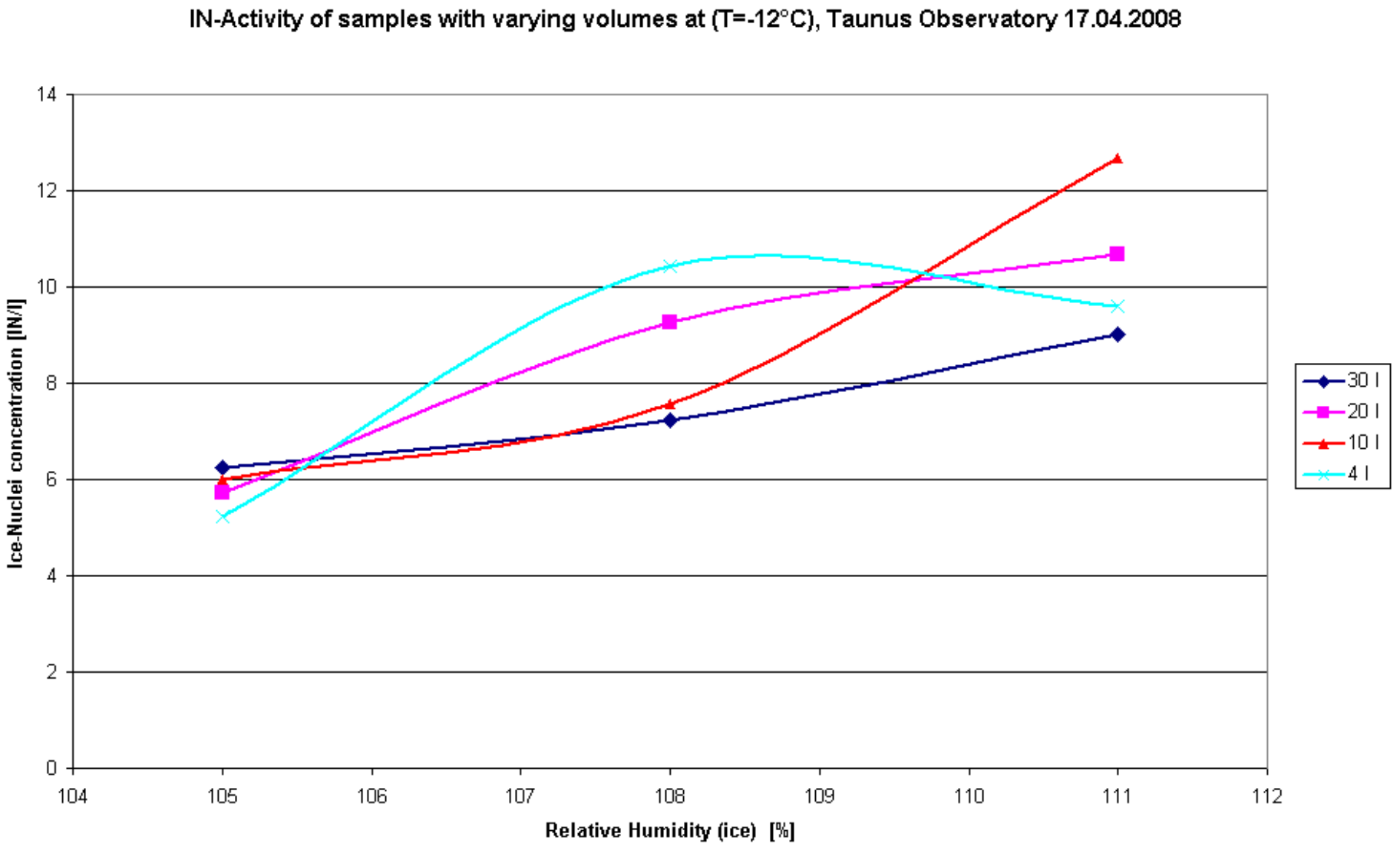
4. Laboratory Results / Field Measurements



Threshhold of 0,1% Ice-Nuclei activated fraction of Arizona Test Dust - Particles from an aerosol-generator collected on Silicon-Wafers. refers to a CN-Counter.





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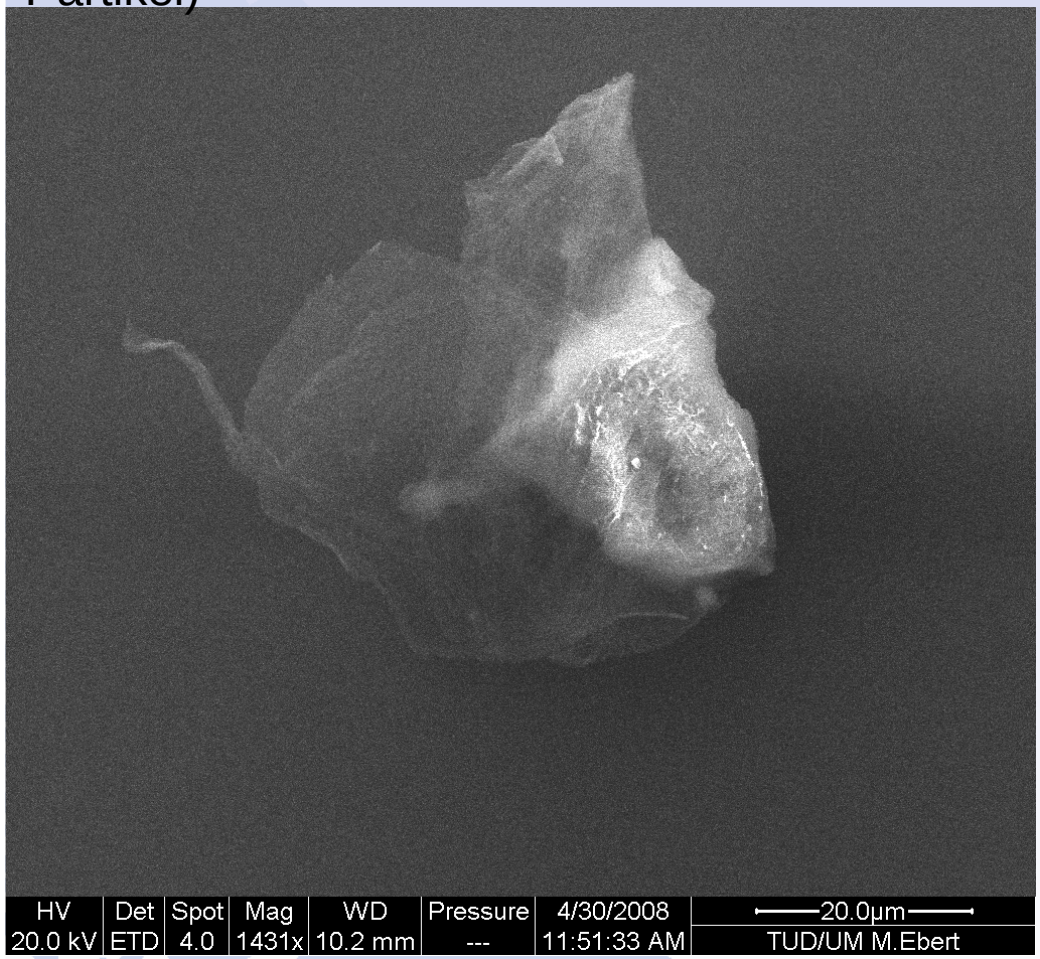
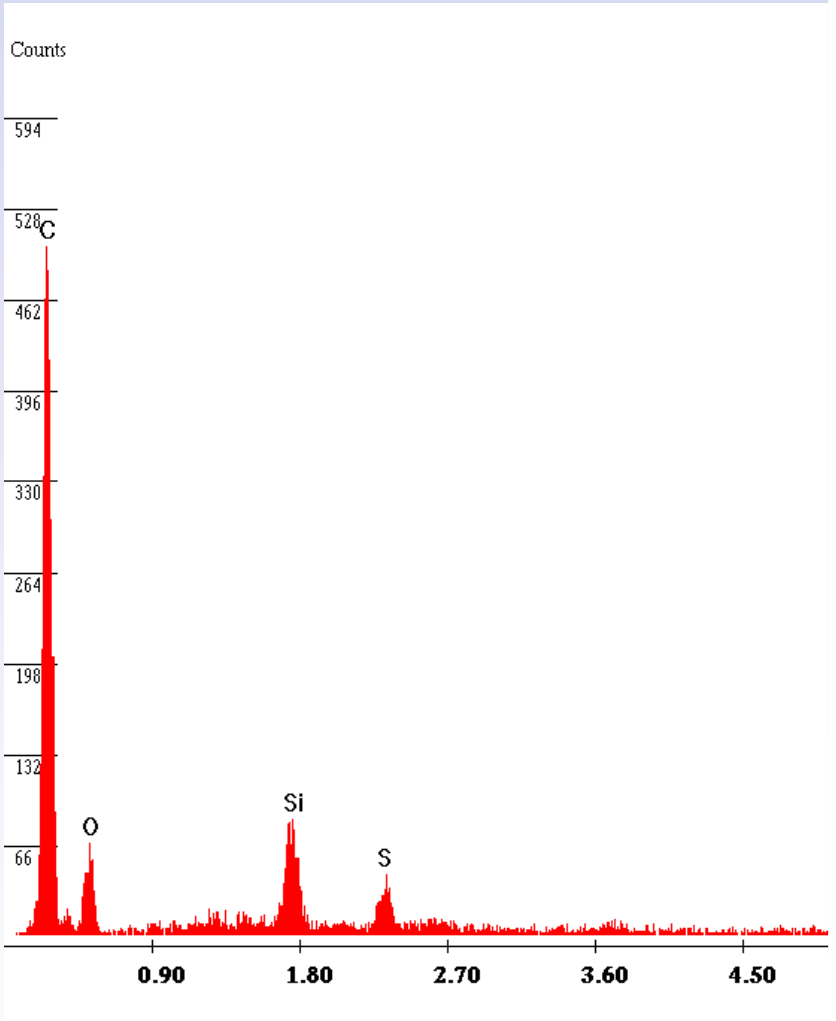
Carbonaceous (wahrscheinlich biologisches Partikel)





(M. Ebert, Institut für Umweltmineralogie
TU-DARMSTADT, pers. Mitteilung 2008)

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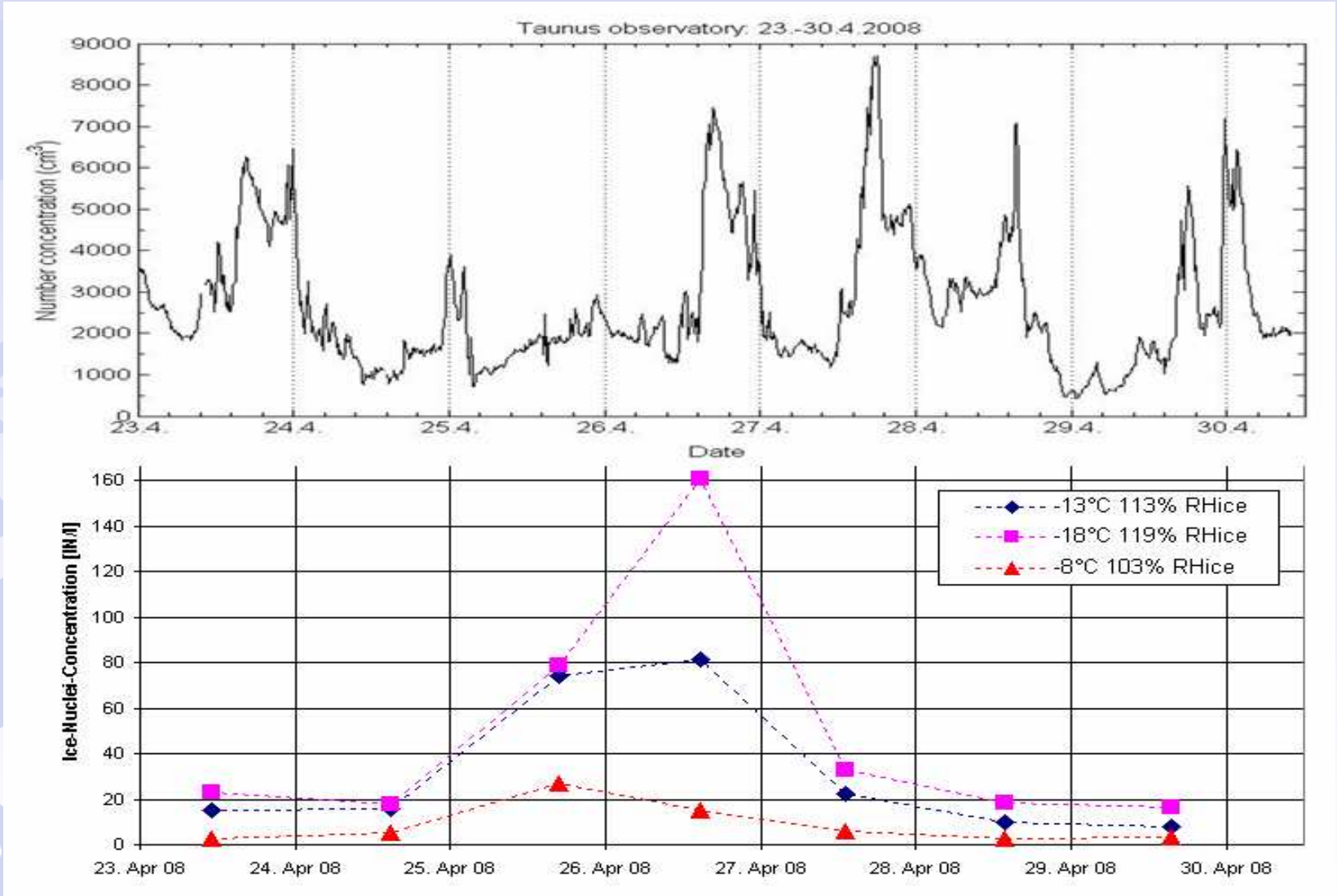
Measurements of Particle-Concentration (upper) and Ice-Nuclei Concentrations (lower part) for a sequence of days at the Taunus Observatory



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Conclusions:

Filter-Analysis of Samples in the Vacuum-Diffusion Chamber shows very low counts of IN compared to Data of CFDC-Chambers

Possible Reason is the use of Vaseline (Petroleum Jelly)

One solution is to deposit the aerosol via electrostatic- precipitation on silicon wafers for analysis in the FRIDGE chamber – without use of vaseline

First Comparison Measurements show a factor of 45 between Filter/Wafer Analysis

Laboratory Tests with ATD show reasonable values for 0,1 % activated fraction.

The first field measurements of the new method show IN Concentration by far higher than what was reported by Stein (1981)

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+

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