

CREATING  
A CIRCULAR  
**FUTURE**

# MATISS1 et 2: Microbial aerosol tethering on innovative surfaces in the international space station



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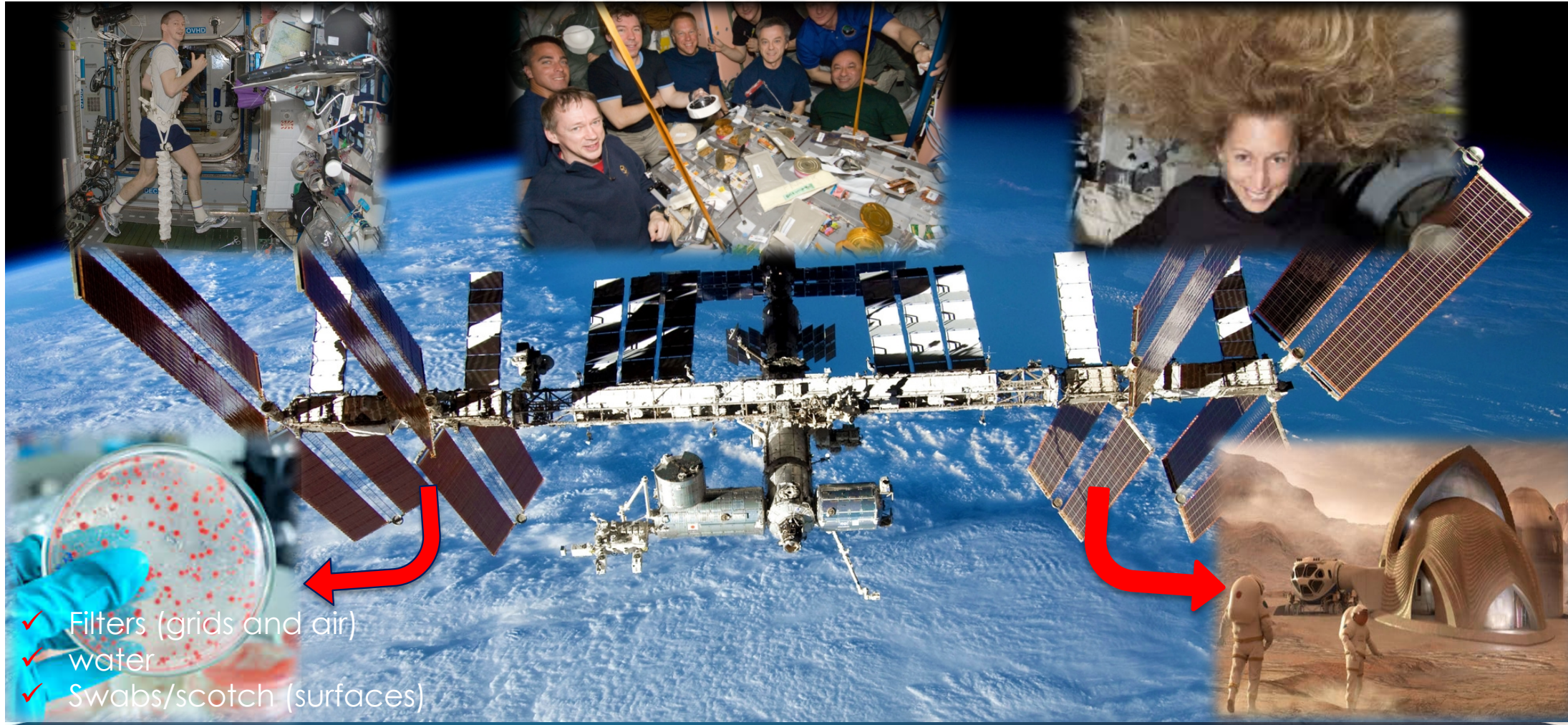
G. Nonglaton, P. R. Marcoux, CEA-Leti

J. Teisseire, E. Garre, Unité mixte de Recherche CNRS/Saint Gobain

C. Thevenot, S. Rouquette, L. Campagnolo, A. Maillet, S. Barde, CADMOS-CNES



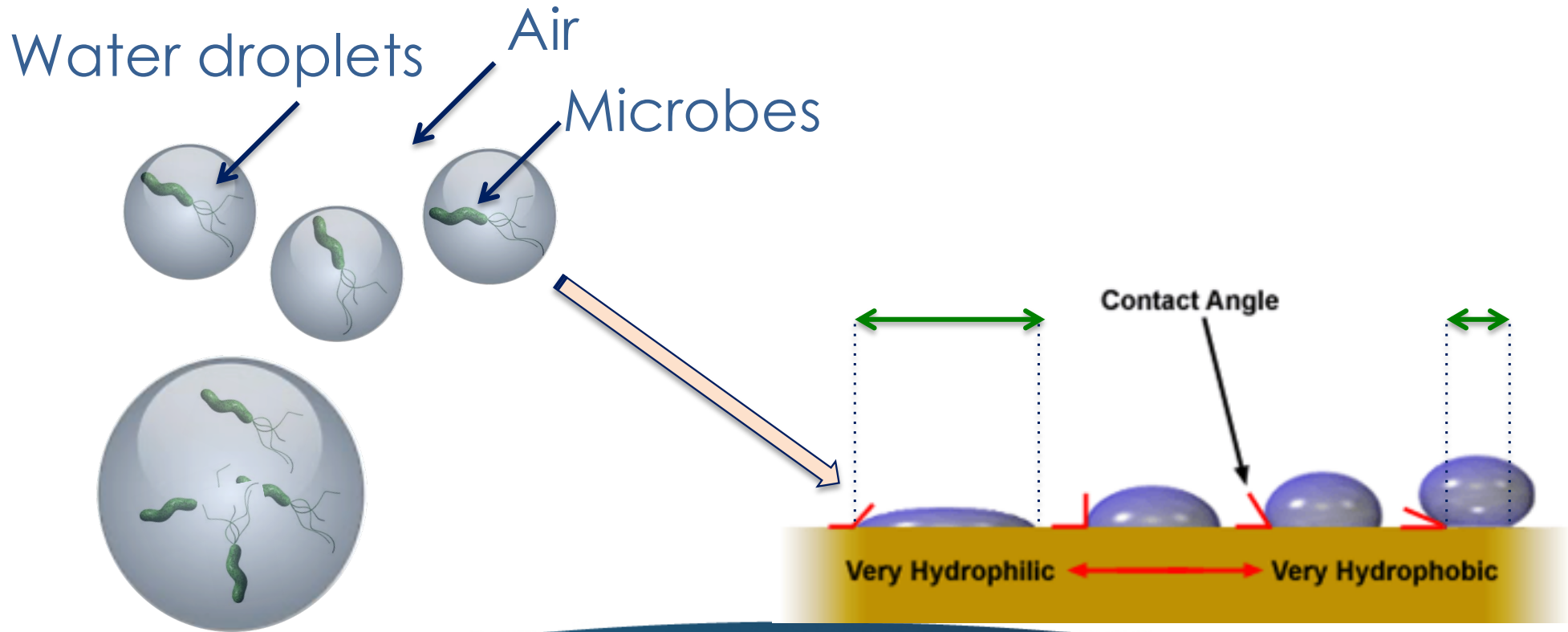
# Surface biocontamination in the ISS



- ✓ Filters (grids and air)
- ✓ water
- ✓ Swabs/scotch (surfaces)



# Hydrophobicity to reduce surface contamination





# Hydrophobic surfaces of silica glass

Uniform and inert nm-thick layers  
Controlled processes in vapor phase

1 nm

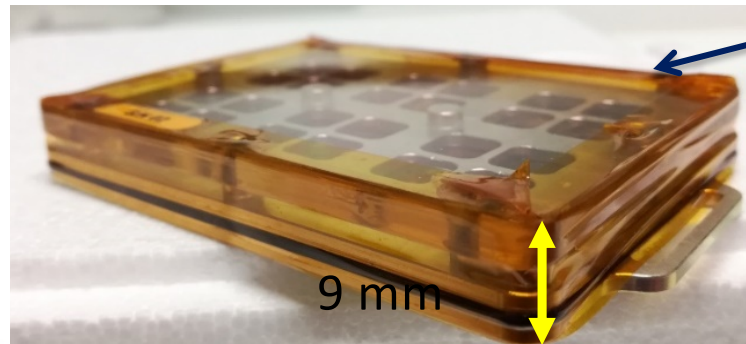
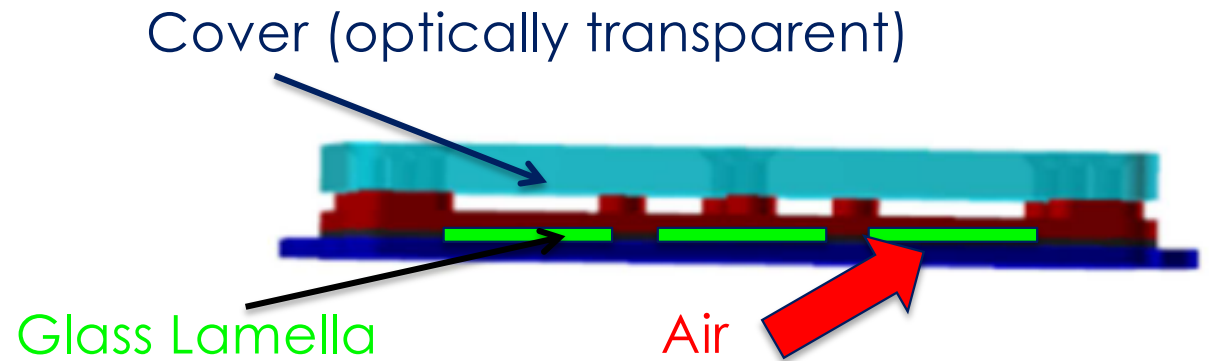
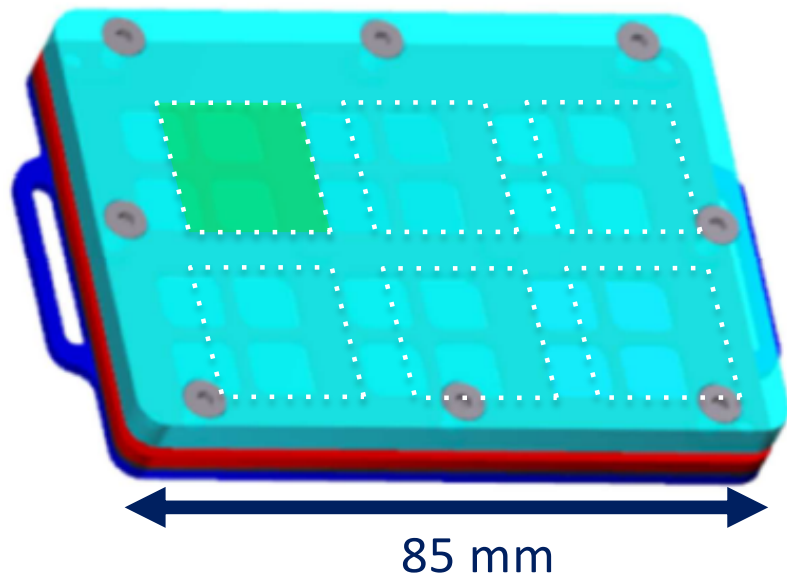
50 to 1000 nm

Patterned hybrid silica layer  
Patterning of

20 μm

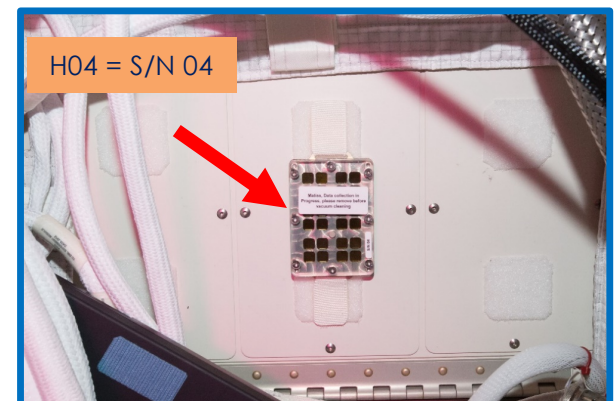
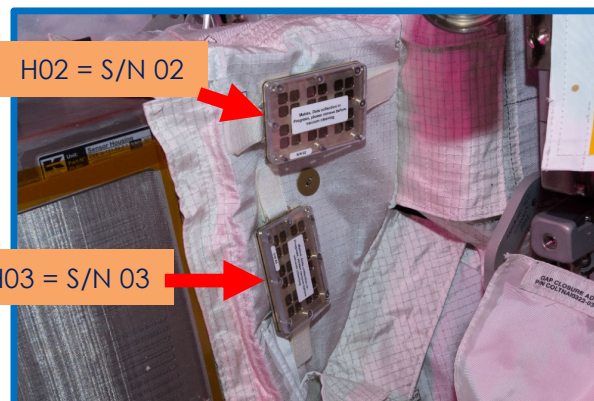
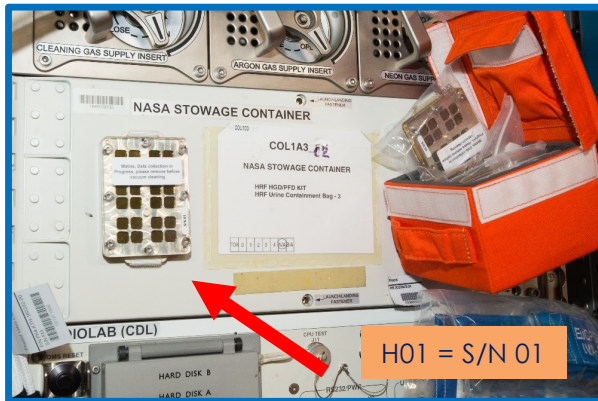


# A safe and long exposure in the ISS





# Matiss 1 – 6 months exposure in Columbus



EPM rack front panel

Return Grid Sensor Housing

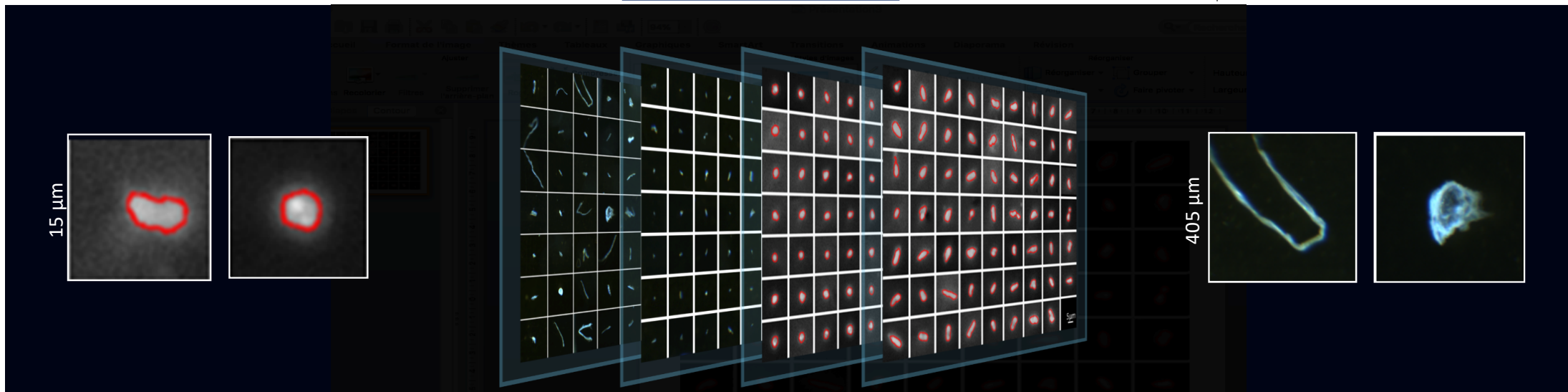
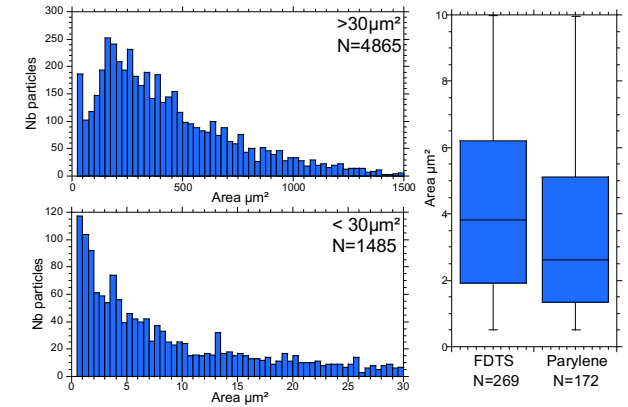
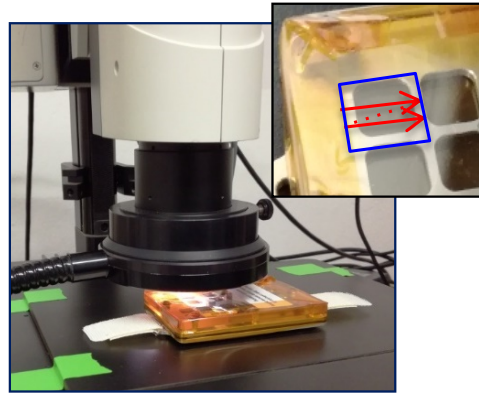
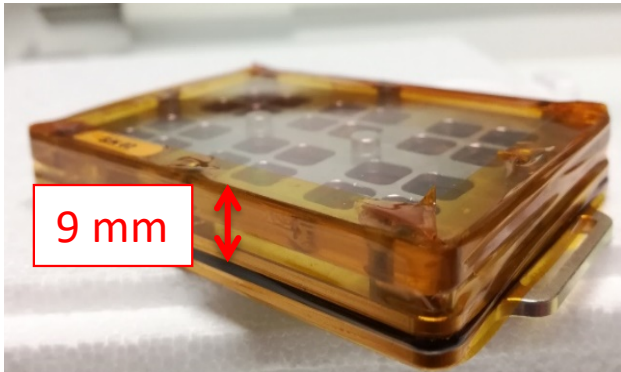
EDR rack front panel

Good air flow areas

Stagnant air containing humidity area

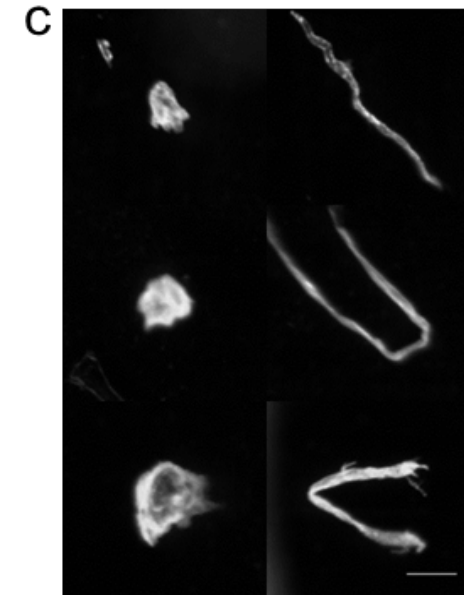
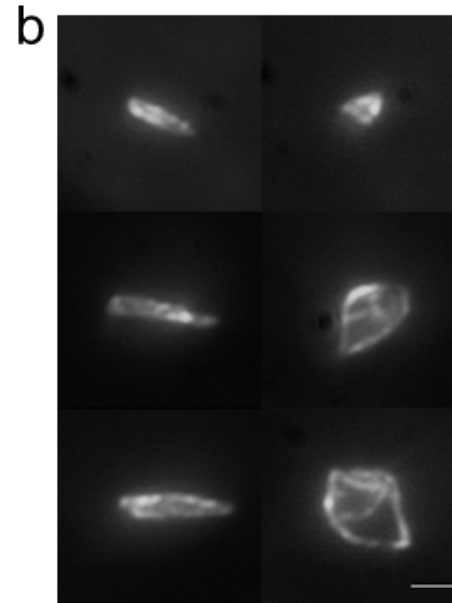
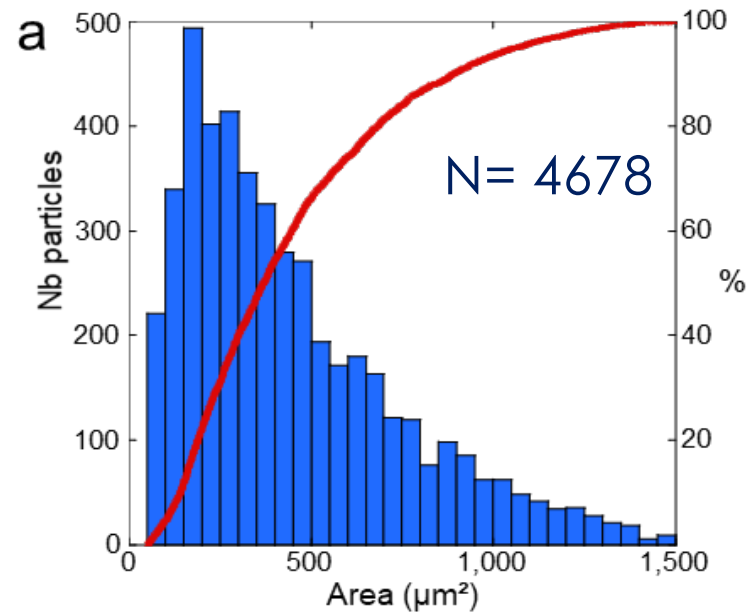


# Laboratory optical microscopy





# Surface contamination by coarse particles

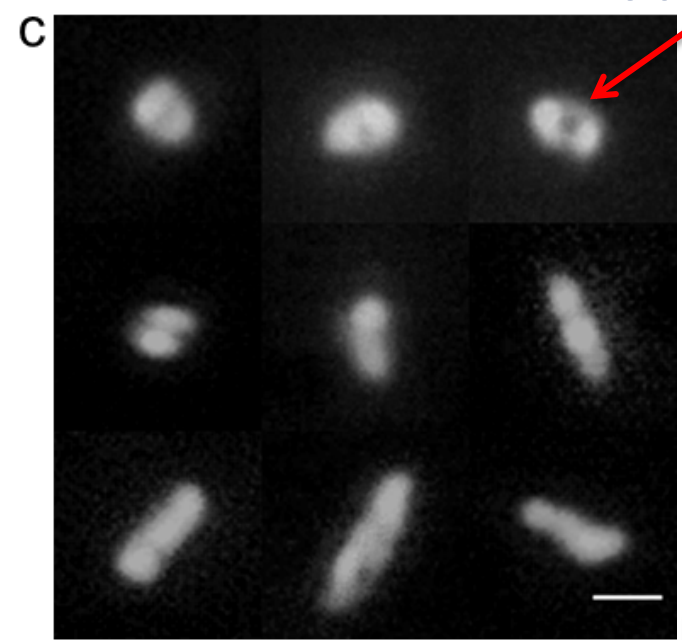
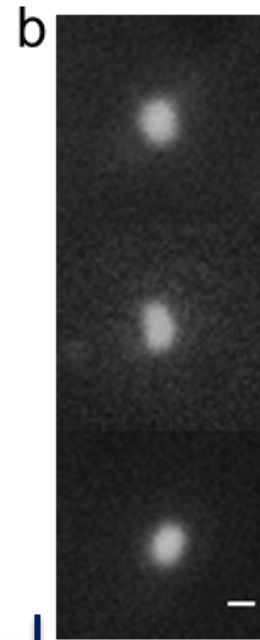
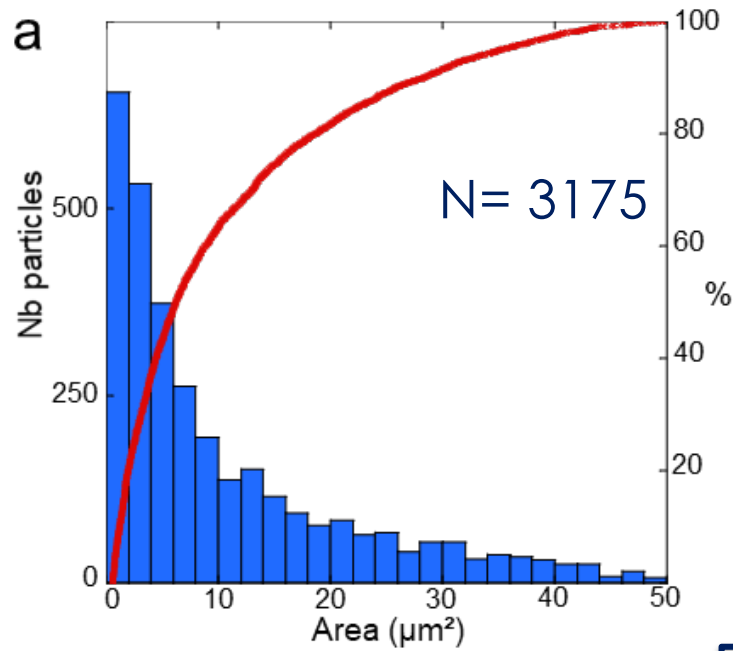


$1.6 \pm 0.2 \text{ particles.mm}^{-2}$





# Surface contamination by fine particles

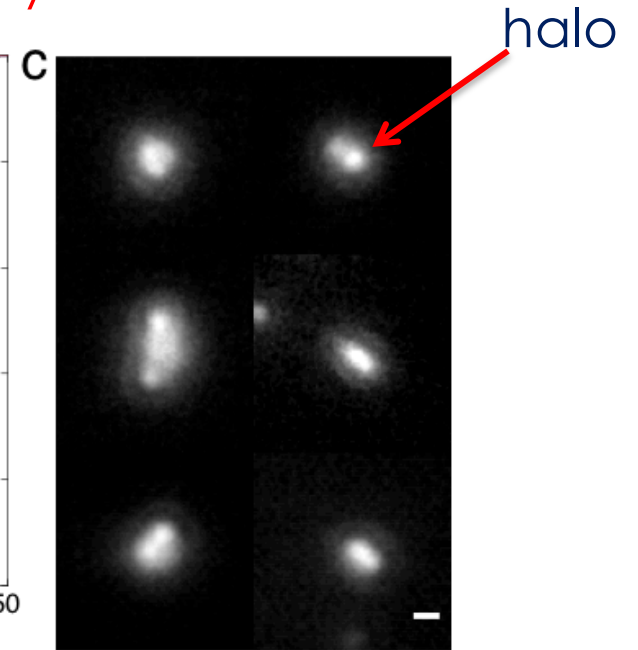
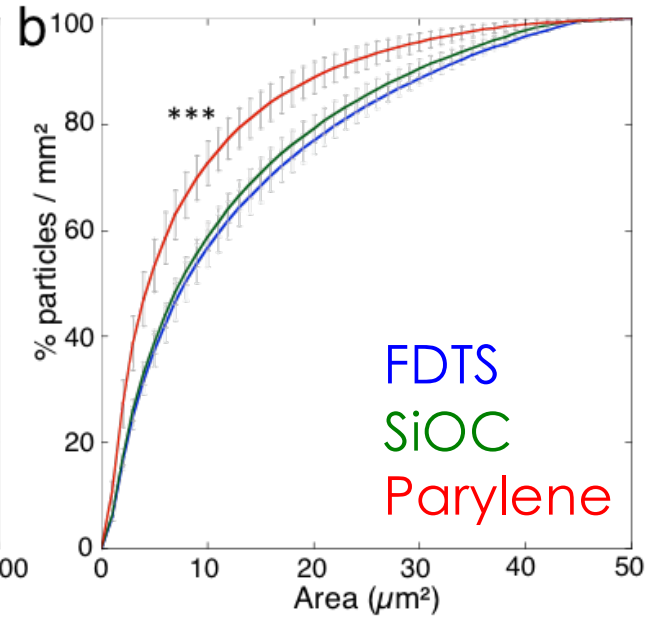
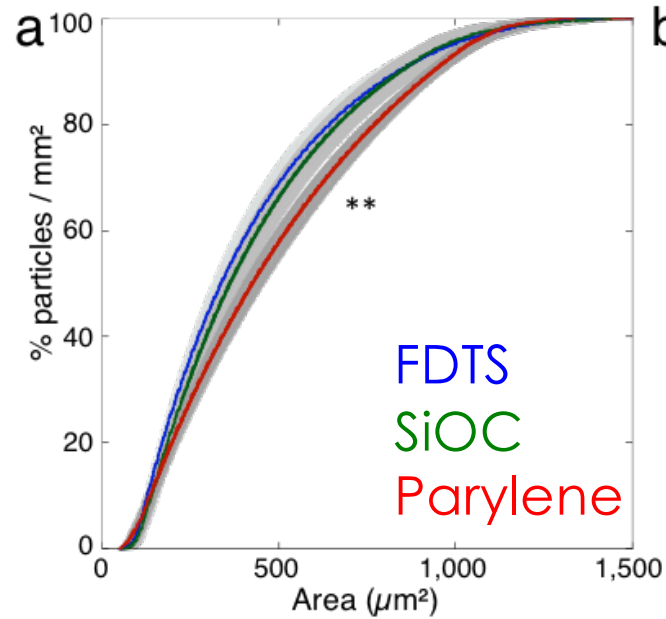


3.3 particles. $\text{mm}^{-2}$



# Surface treatments and biocontamination

Hydrophobicity : **FDTS** >> **SiOC** >> **Parylene**



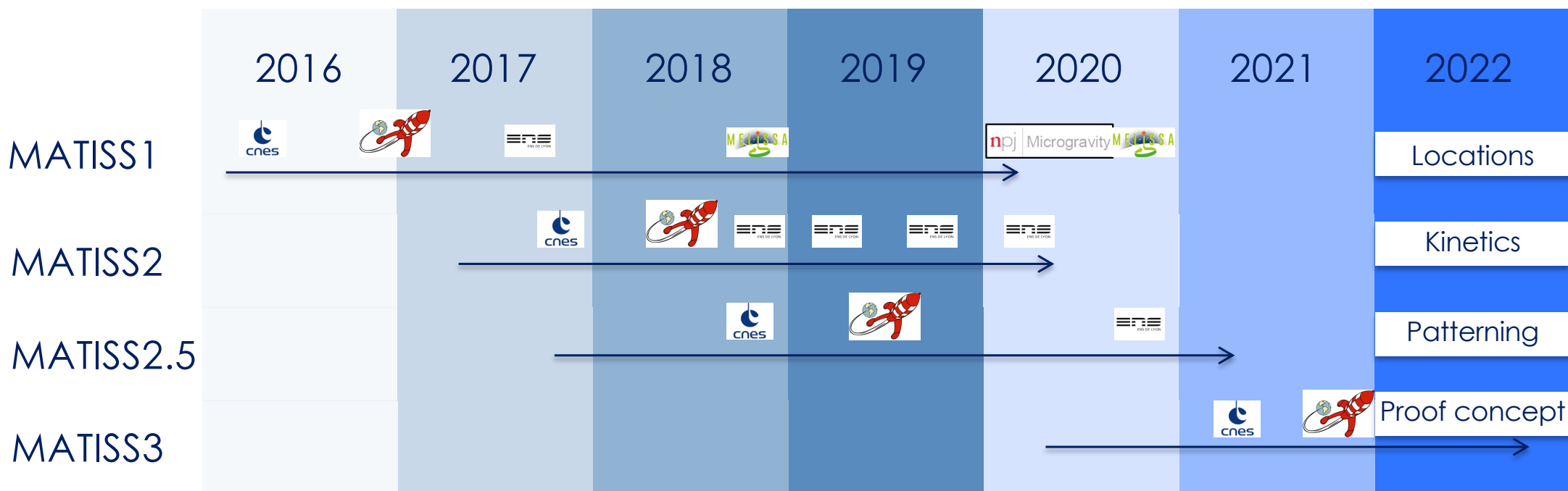


## Summary of MATISS1 results

- Experimental proof-of-concept : MATISS sample holder is adequate for investigating the particulate contamination after long-term exposure
- Relatively clean surfaces and clean environment  
But final coverage of 2.2% in 20 years
- Varied shapes in the coarse (50-1500  $\mu\text{m}^2$ ) and fine (0.5-50  $\mu\text{m}^2$ ) area fractions  
Two biocontamination sources : scale dices (tissue or skin) and microbial cells
- Fraction of the coarse particles appears higher on FDTS than on SiOC, parylene  
the opposite for the fine particles => impact of hydrophobic coatings



# Perspectives



MELISSA



MICRO-ECOLOGICAL  
LIFE SUPPORT SYSTEM  
ALTERNATIVE

**THANK YOU.**

Laurence Lemelle

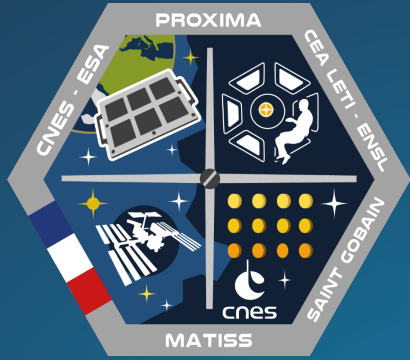
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# PARTNERS

