MATISS

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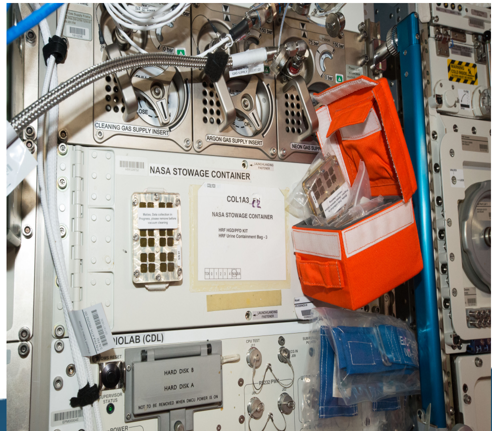
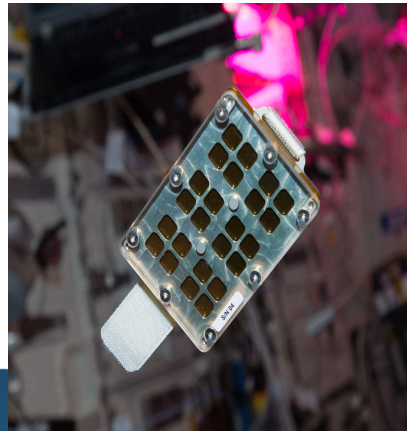
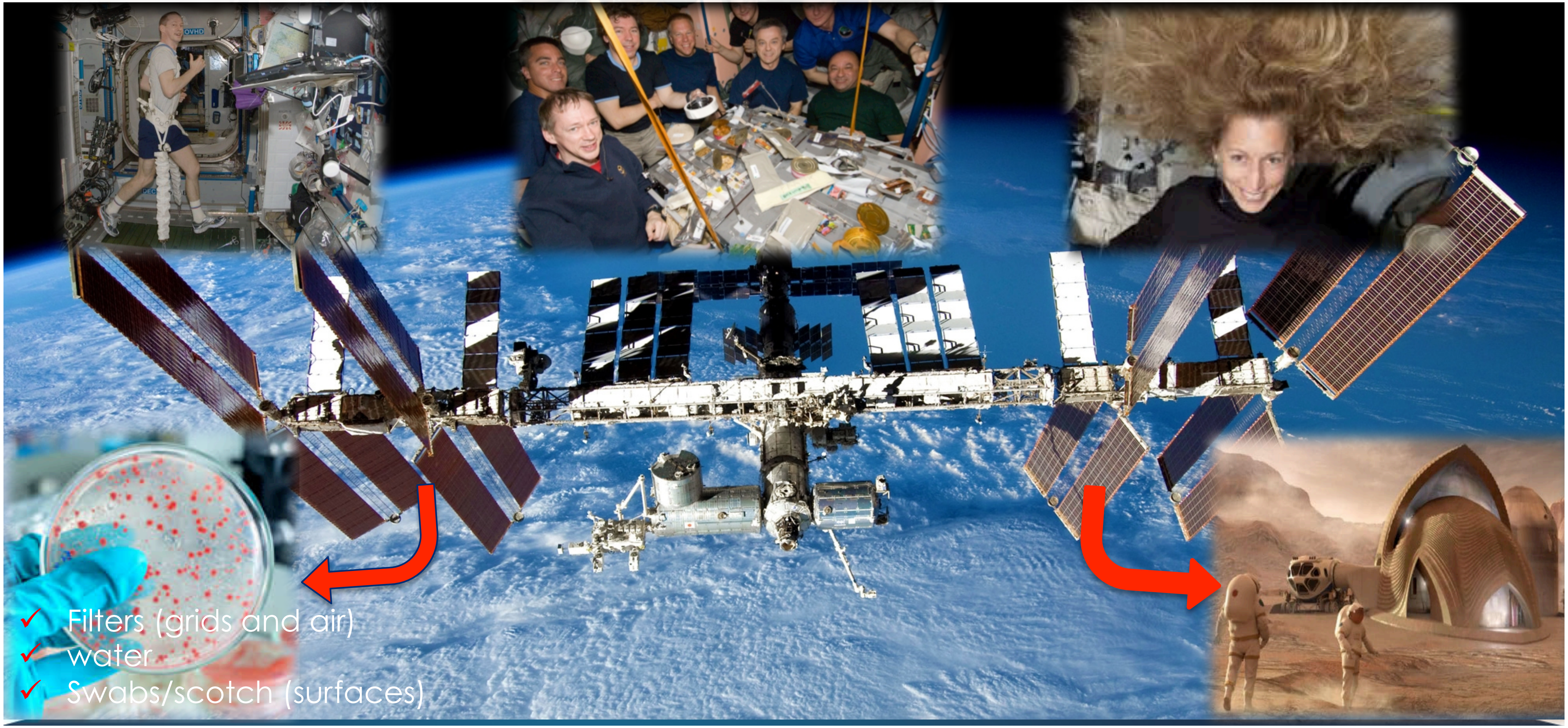
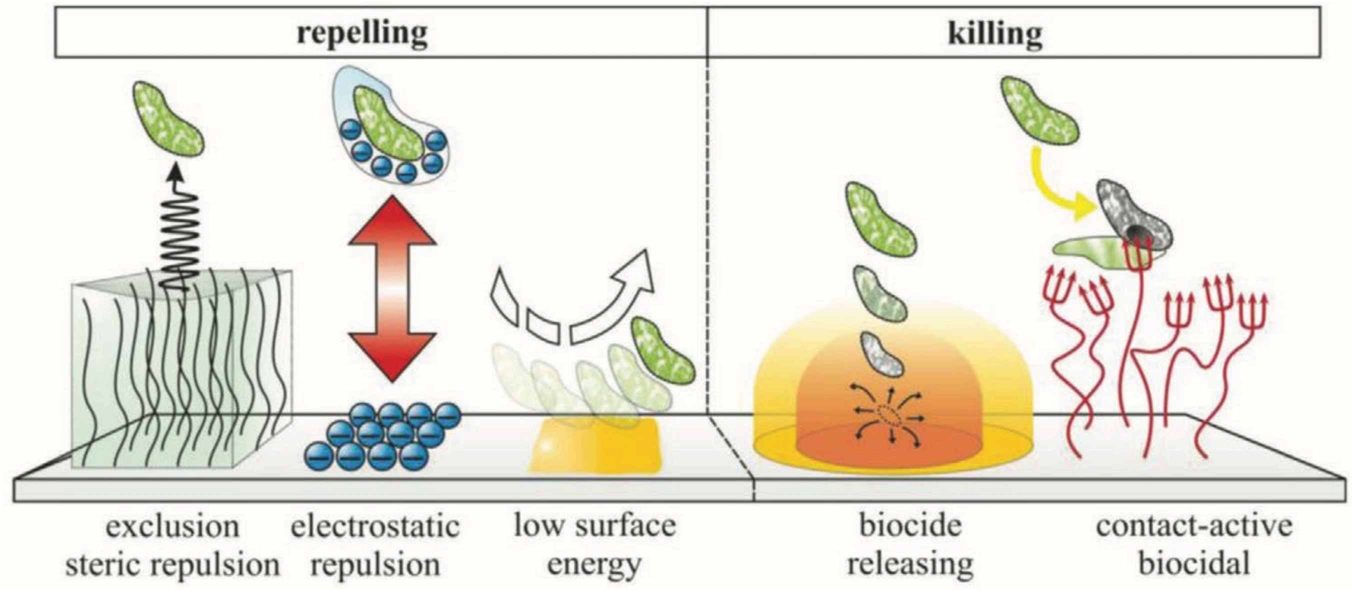




Surface biocontamination in the ISS

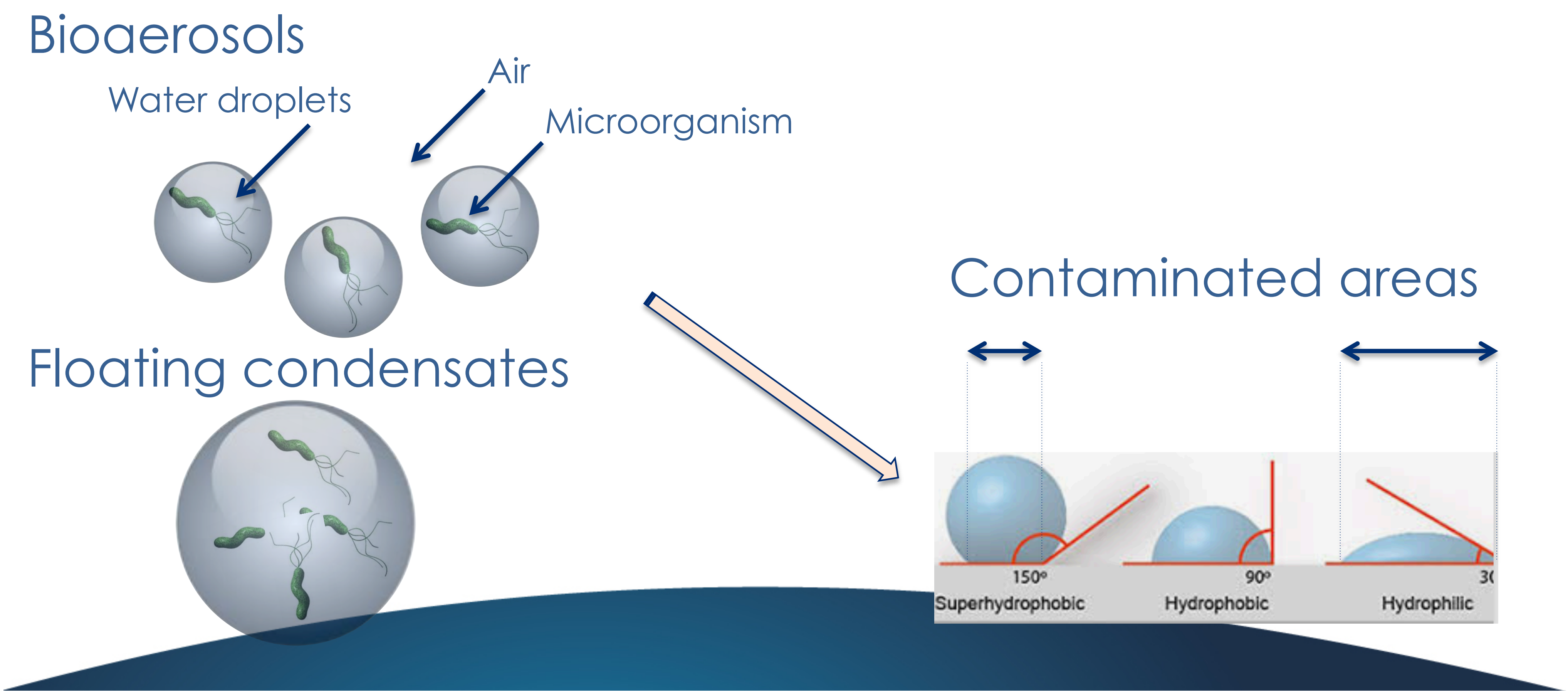


Antimicrobial Surfaces for ISS applications



Wang et al. Adv. Mat. 2022

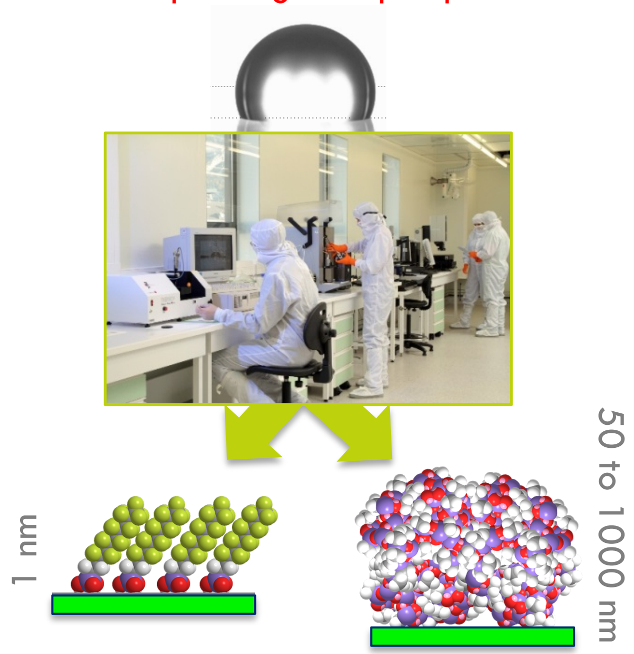
Hydrophobicity to reduce surface contamination



Hydrophobic surfaces of silica glass

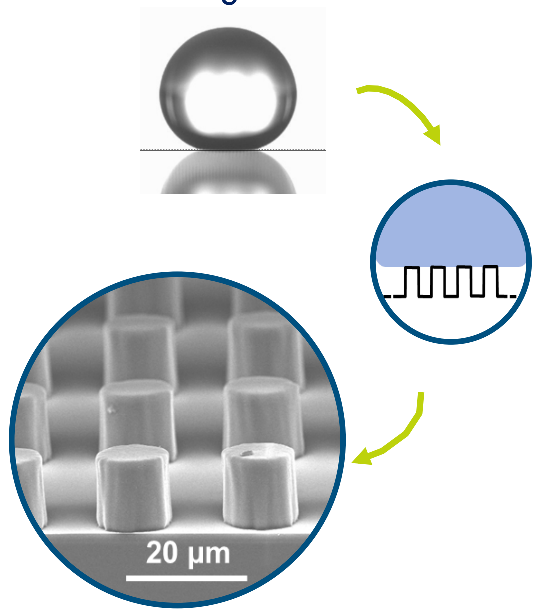
Uniform and inert nm-thick layers

Depositing in vapor phase



Patterned hybrid silica layer

Patterning of surface

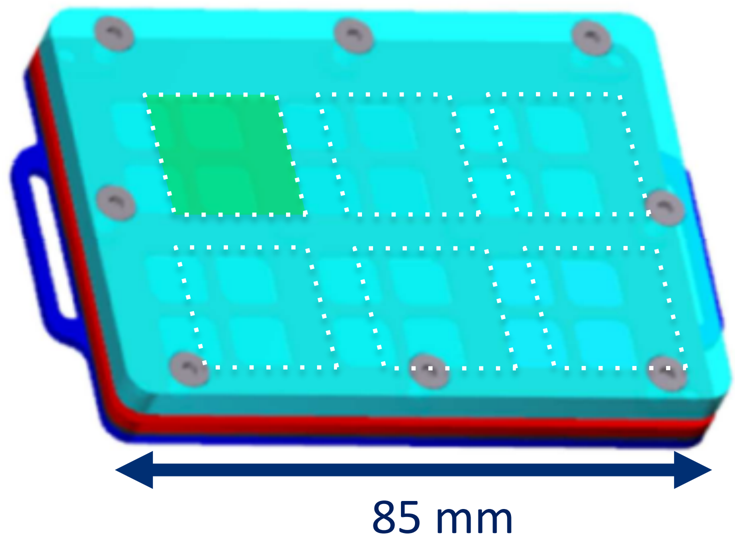


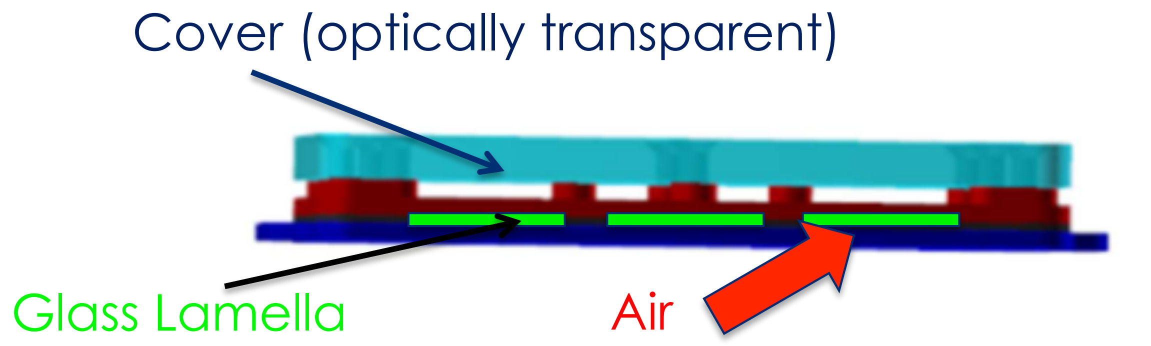
Know how

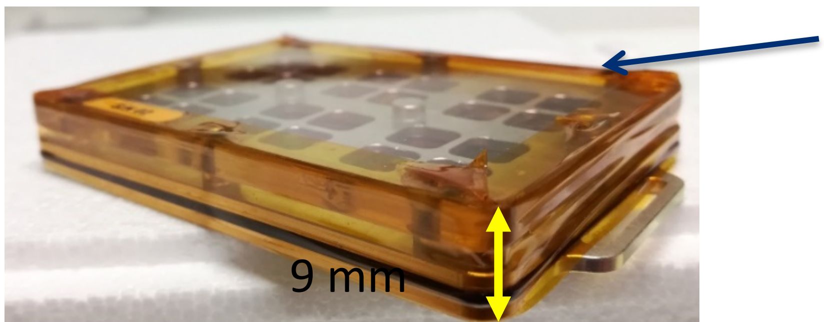
Know how

SURFACE DU VERRE ET INTERFACE
Joint Laboratory

A safe and long exposure in the ISS







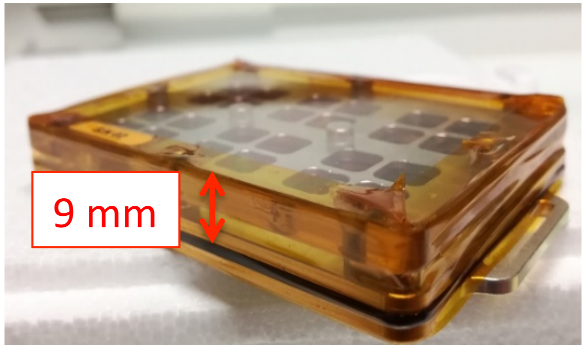
« Confined Lab. state »

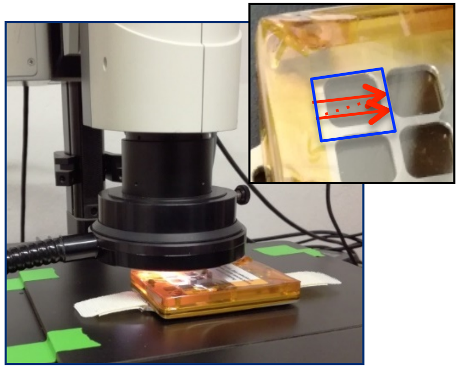
⇕

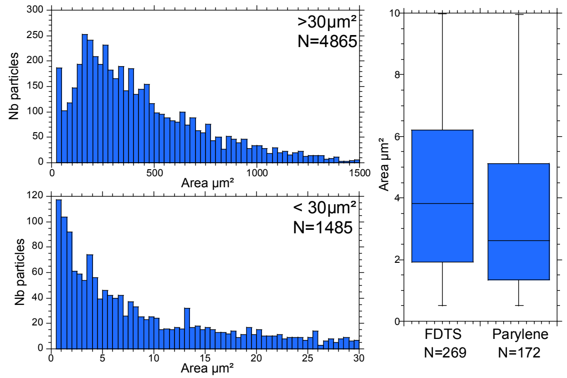
« Exposed ISS state »

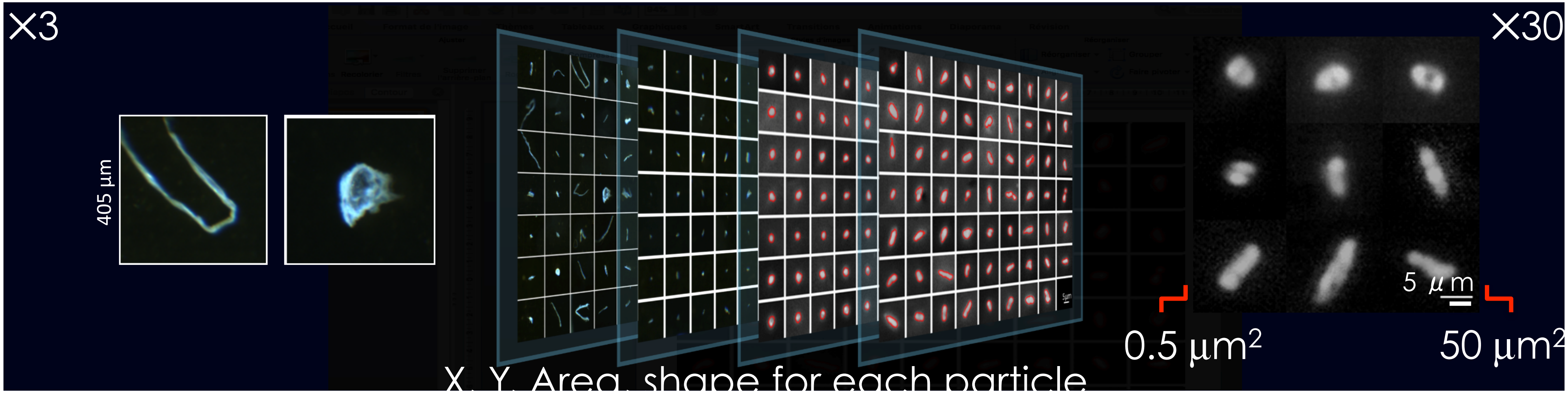
Laboratory optical microscopy

« Confined Lab. state »



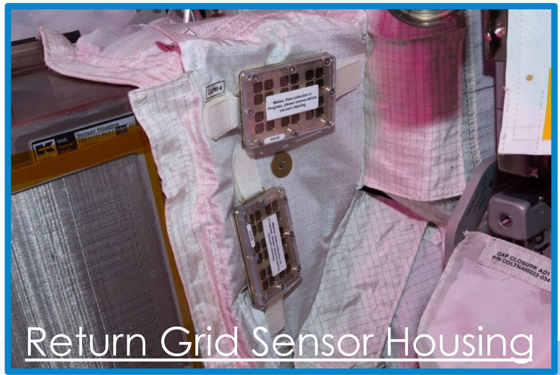


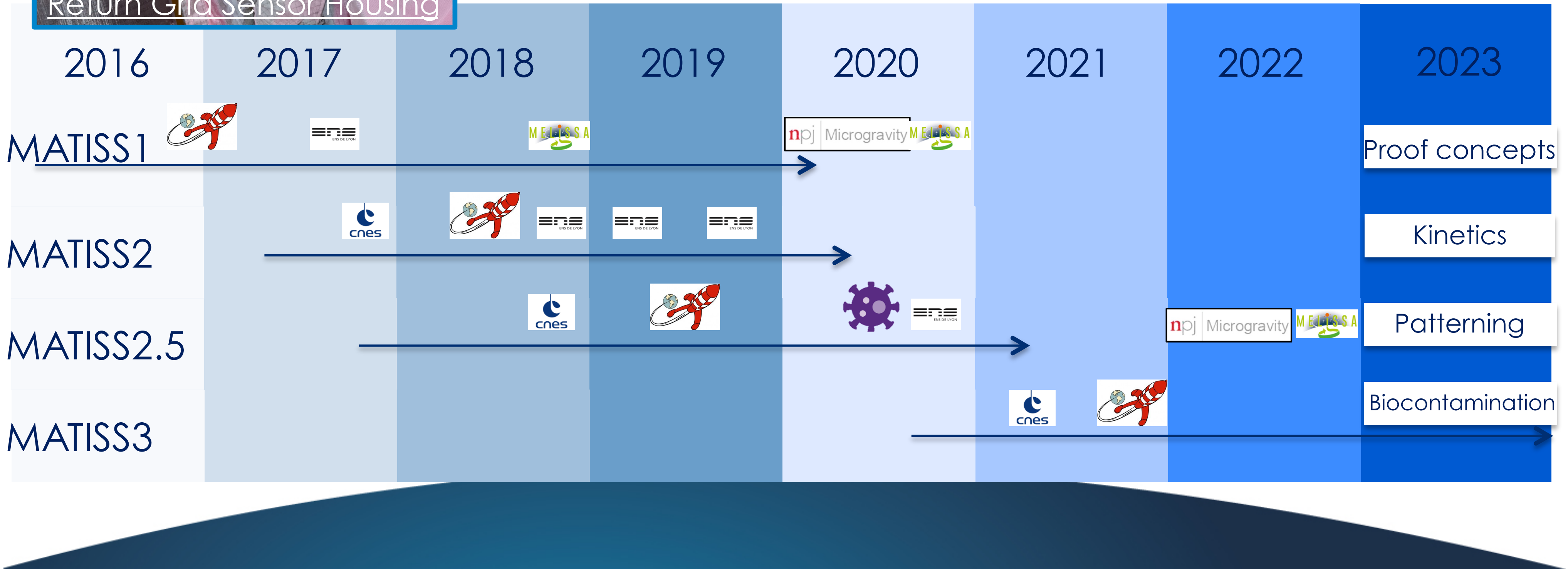




Three campaigns
(8 holders, RGSH, > 6 months)

« Exposed ISS state »





First campaign

Towards a passive limitation of particle surface contamination in the Columbus module (ISS)

Npj microgravity, 6, 29, **2020.** 10.1038/s41526-020-00120-w

- Experimental proof-of-concept MATISS1: **MATISS sample holder** for investigating the particulate contamination after long-term exposure

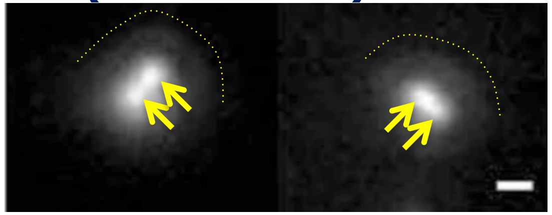
- Relatively clean surfaces and clean environment (**few particles.mm^{-2}**)
  But final coverage of 2.2% in 20 years

First campaign

Towards a passive limitation of particle surface contamination in the Columbus module (ISS)

Npj micrograviity, 6, 29, **2020.** 10.1038/s41526-020-00120-w

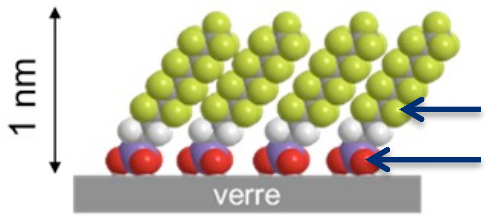
- Varied shapes in the coarse (50-1500 µm^2 , **N=4678**) and fine (0.5-50 µm^2, **N=3175**) fractions => 2 biocontamination sources : scale dices (tissue or skin) and **microbial cells (bioaerosols)**



2 µm

- More coarse/less fine particles on **FDTS than on SiOC and parylene** => impact of hydrophobic coatings ? Focus on FDTS

FDTS fluorinated silane grafting by MVD. Application to the study of surface biocontamination in ISS



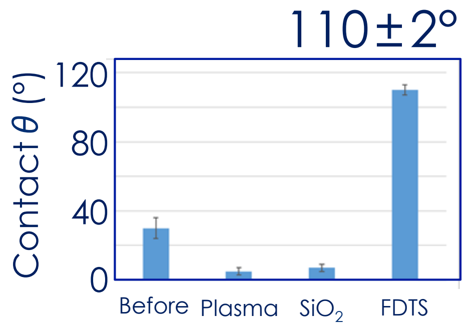
<u>Fluorinated silane monolayers</u>

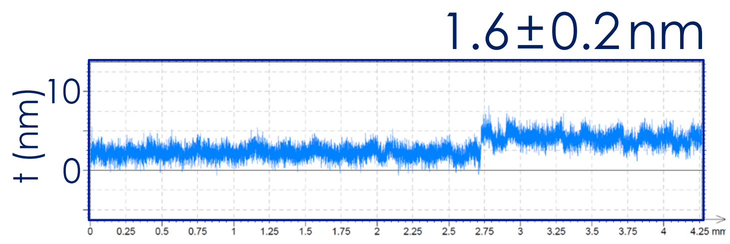
Fluorinated tails toward air interface

Covalent bonds by silanisation on SiO_2-surface

MVD-100 equipment (Applied Microsystem)

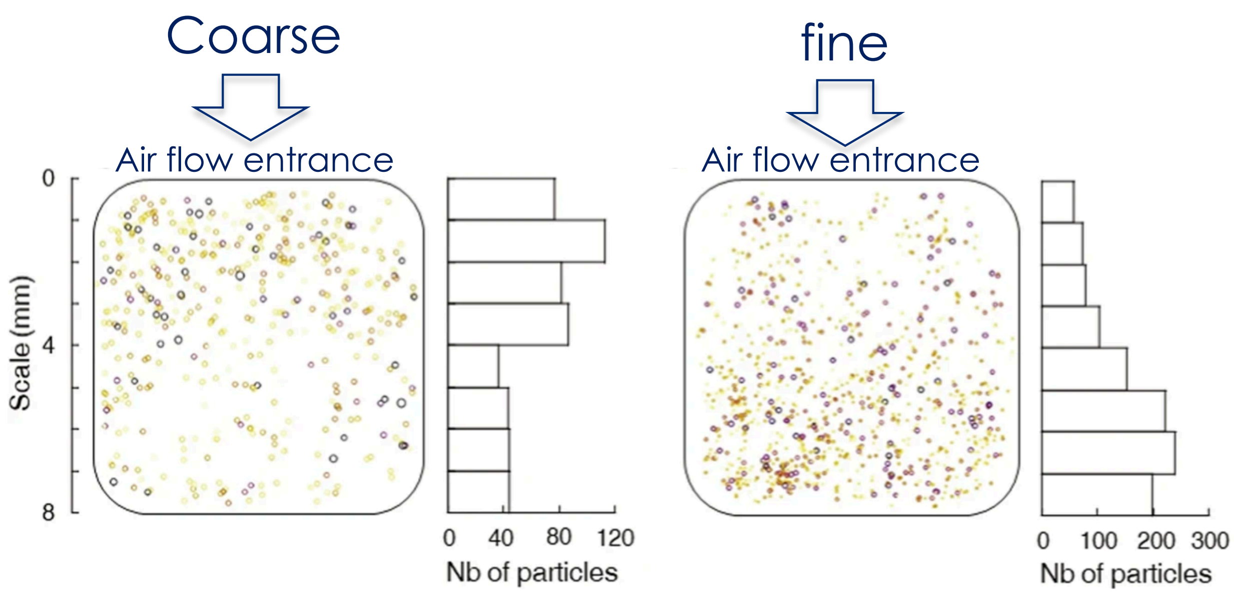
- No solvent
- High diffusivity
- Fast reaction
- Automated processing
- Low temperature processes
- Ultra-thin SAM films
- Outstanding uniformity and conformity





Three campaigns

Impact of an FDTS coating on the contamination



≈ 1 year

~~CTRL~~

- Higher density values of the coarse particles near the flow entry (opposite for fines) Only on FDTS and thus related to hydrophobic interactions

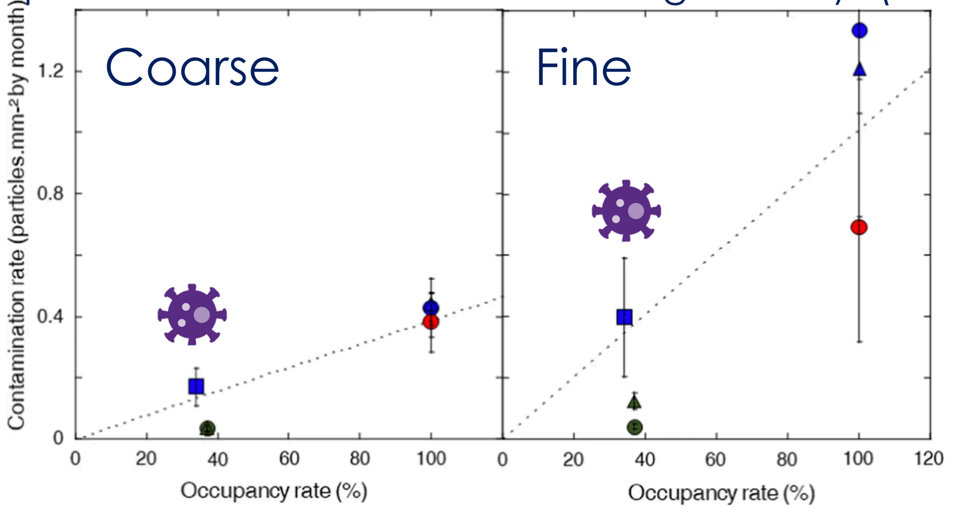
- Perspective : to constrain the action mechanism (chemical nature of the particles)
- New holder to combine optical, Raman and X-rays analyses

Three campaigns

Surface contamination and astronauts' occupancy rates

- **Coarse particles sources vary over monthly periods**

- **FDTS contamination by fine particles (N=2310)**
  4.45±2.66 particles.mm^{-2} for MATISS-1 during 193 days (mid-2017)
  4.68±2.30 particles.mm^{-2} for MATISS-2 during 354 days (2019)
  1.02±0.58 particles.mm^{-2} for MATISS-2.5 during 365 days (2020)

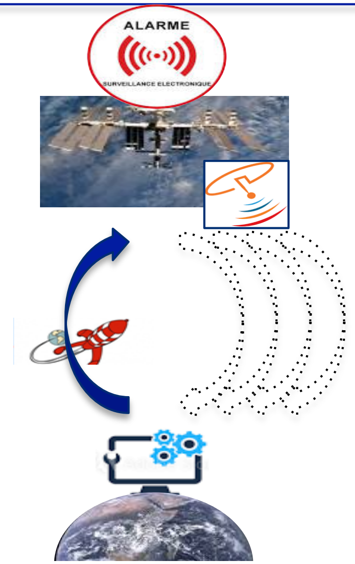


In situ monitoring of surfaces biocontaminations in the ISS

Exp. MATISS

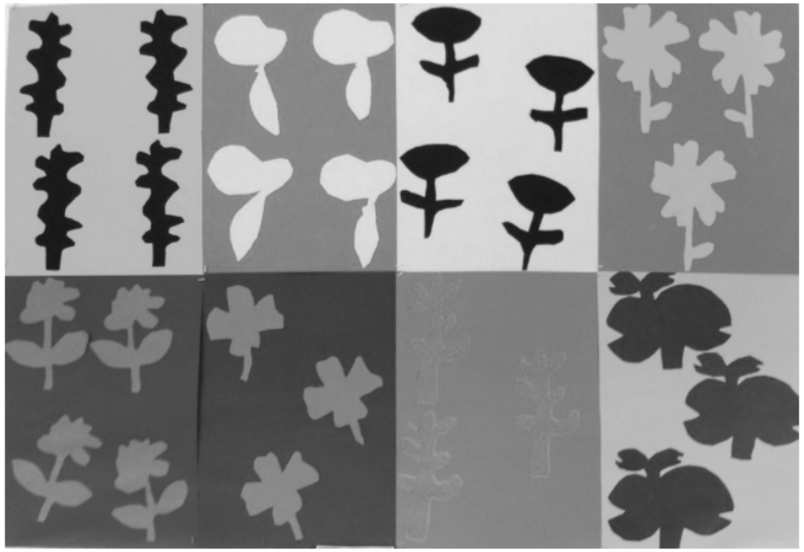
Identify surface coatings that limit biocontamination in the ISS

- Contamination visualization
- Surface effects, kinetic study
- Biocontamination identification



SMART MATISS

In situ and real time sensor of surface contamination

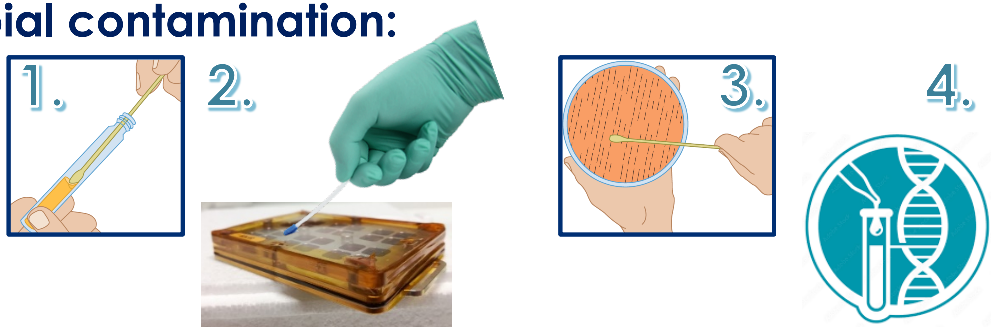
Thank you for your attention.

Three campaigns

Passive limitation of surface contamination by perFluoroDecylTrichloroSilane (FDTS) coatings in the ISS

Npjmicrogravity, 8, 31, **2022**. 10.1038/s41526-022-00218-3

- **Microbial contamination:**



- skin and mucous membranes, of the outer ear and the intestine
- soil and/or water habitats

- **Sources : coarse particles sources vary over monthly periods**