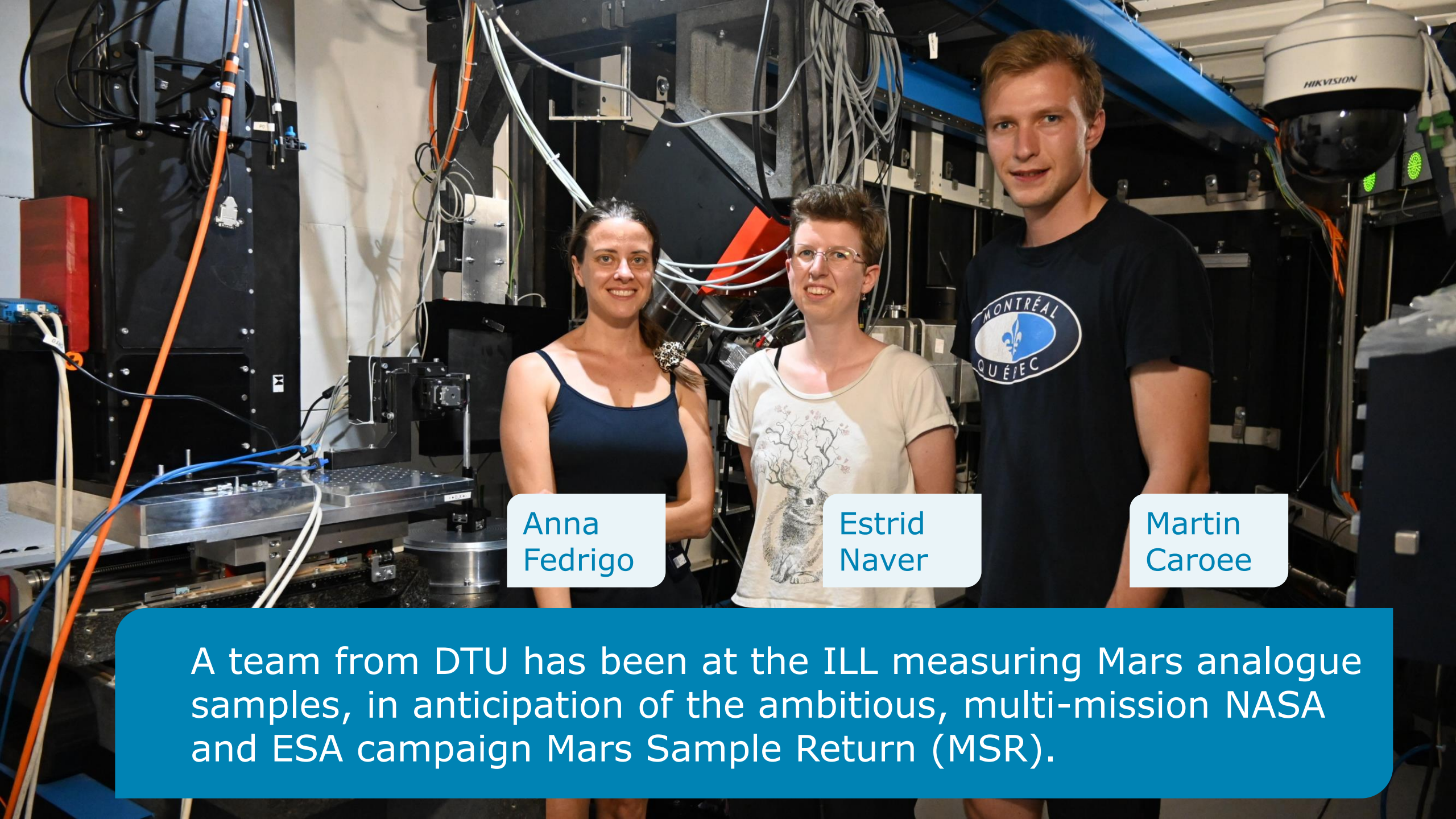


A photograph of three people standing in a laboratory or industrial setting. The background is filled with complex machinery, including a large black frame with various cables (orange, blue, white) hanging from it. On the right, there is a white dome-shaped camera labeled 'HIKVISION'. The three individuals are standing in front of the machinery. The woman on the left is wearing a dark blue tank top. The woman in the middle is wearing a light-colored t-shirt with a graphic of a rabbit. The man on the right is wearing a dark blue t-shirt with a logo that says 'MONTREAL QUEBEC'.

Anna
Fedrigo

Estrid
Naver

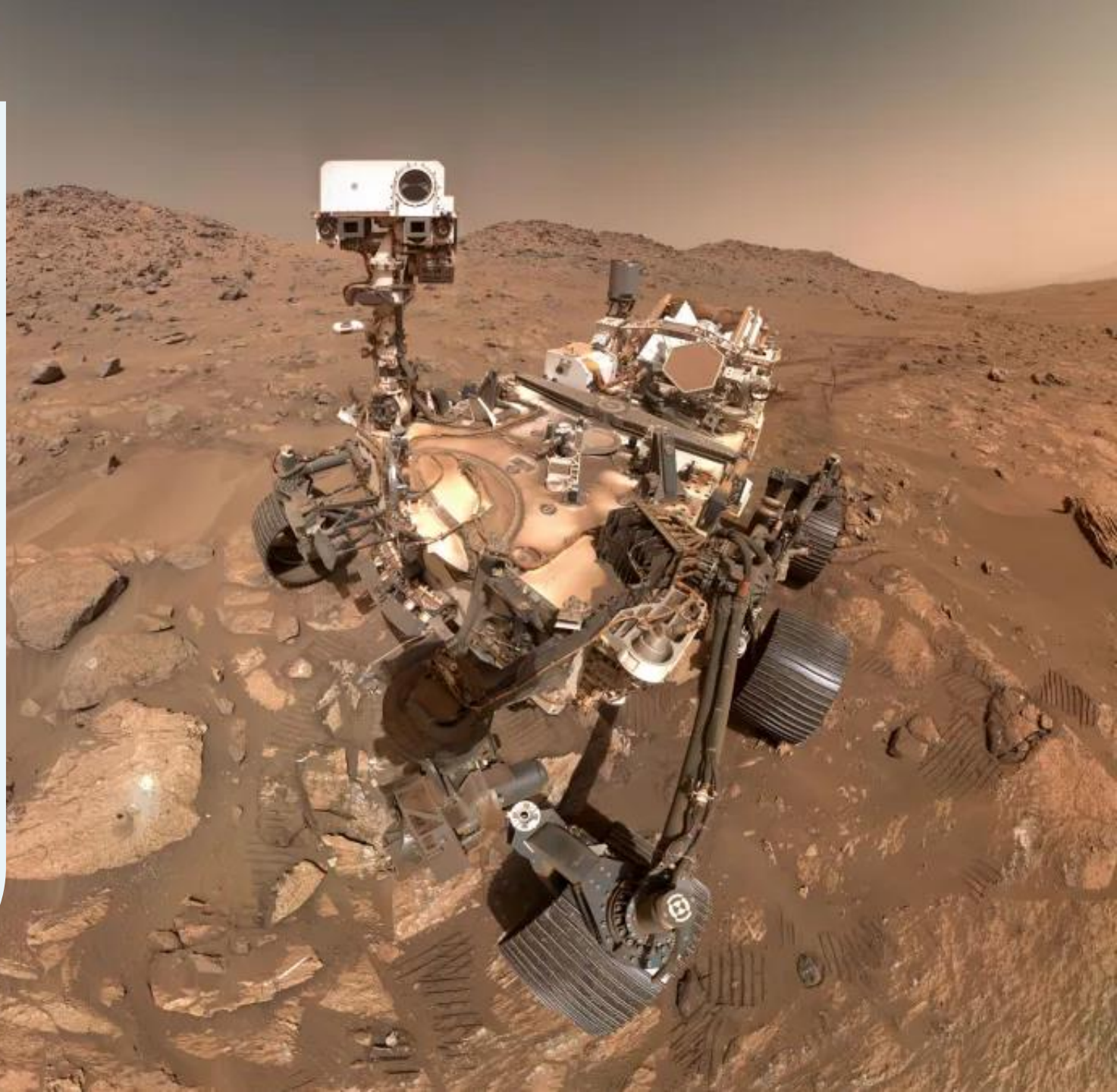
Martin
Caroe

A team from DTU has been at the ILL measuring Mars analogue samples, in anticipation of the ambitious, multi-mission NASA and ESA campaign Mars Sample Return (MSR).

The Perseverance rover is currently building a unique rock collection on Mars.

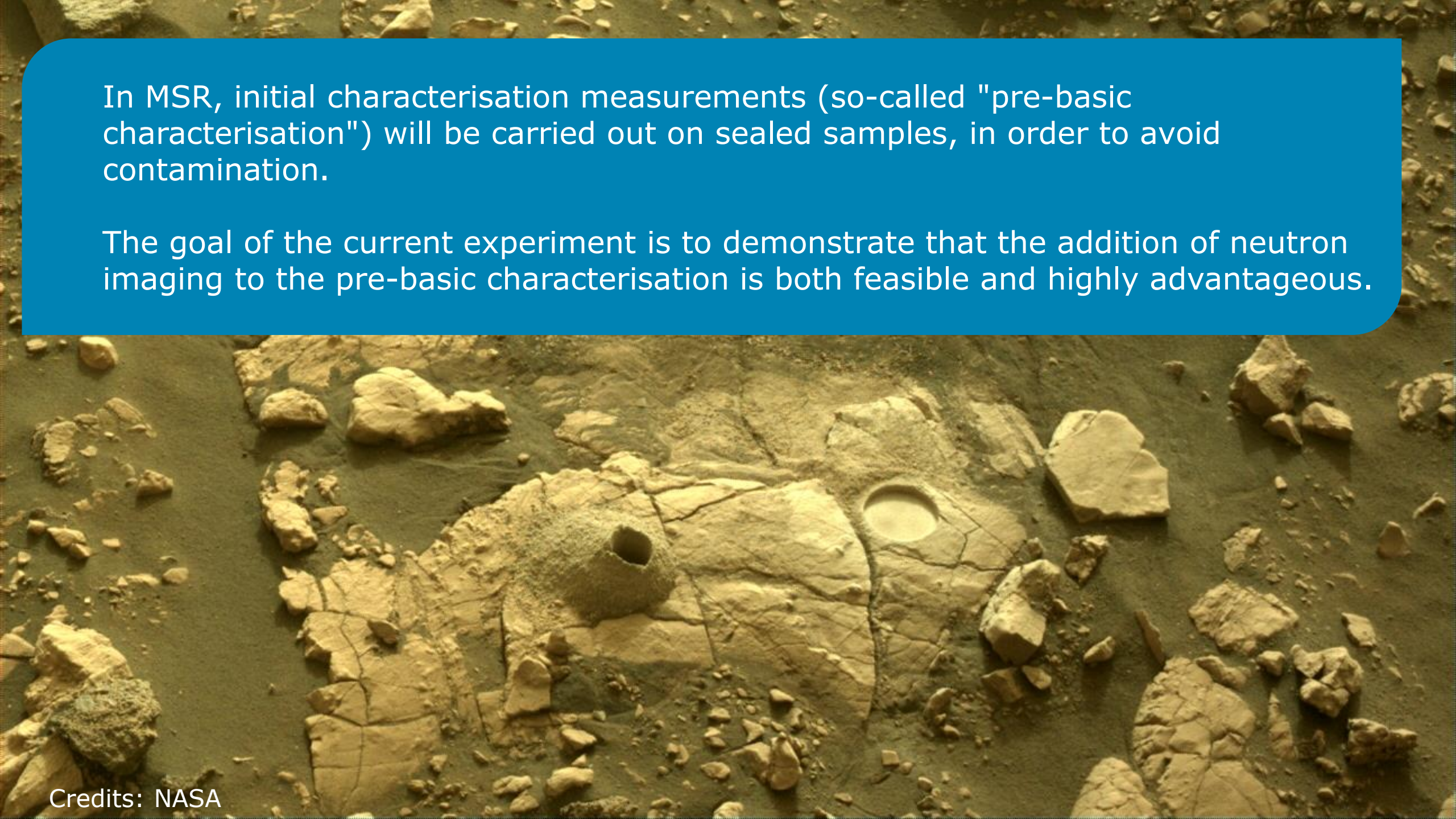
MSR aims to return to Earth 31 Titanium alloy tubes containing diverse geological specimens.

This will provide crucial insights into the planet's environmental, geological, and hydrological evolution – and potentially into its prebiotic chemistry and biology.



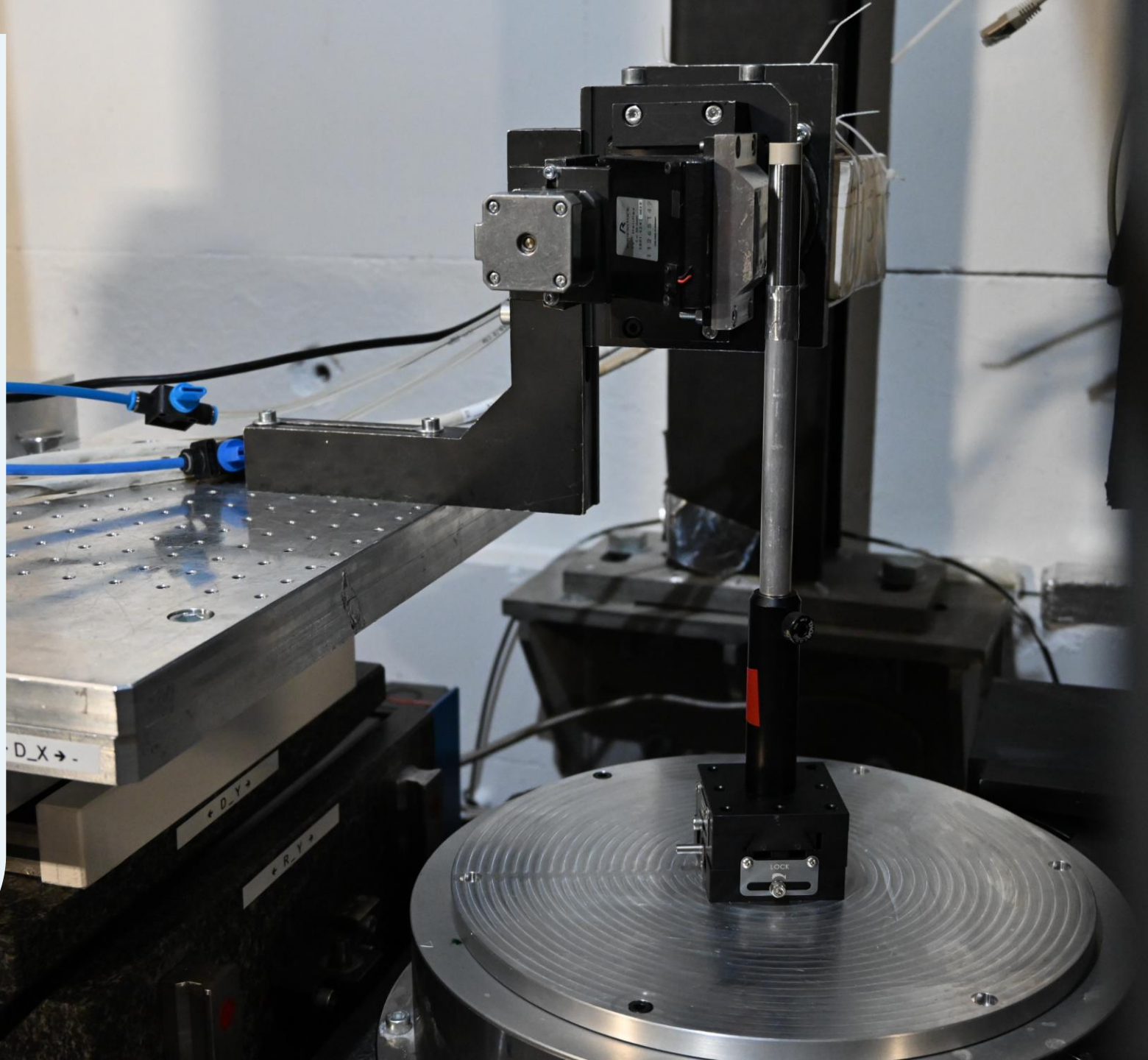
In MSR, initial characterisation measurements (so-called "pre-basic characterisation") will be carried out on sealed samples, in order to avoid contamination.

The goal of the current experiment is to demonstrate that the addition of neutron imaging to the pre-basic characterisation is both feasible and highly advantageous.



At ILL's instrument NeXT, the team performed high-resolution neutron and X-ray scans of Mars analogue samples - chosen for their similarity in composition and variety to the samples collected by the Perseverance rover.

In the photo you see the analogue titanium alloy tube mounted in NeXT. But what's inside?



The sample consists of two parts:

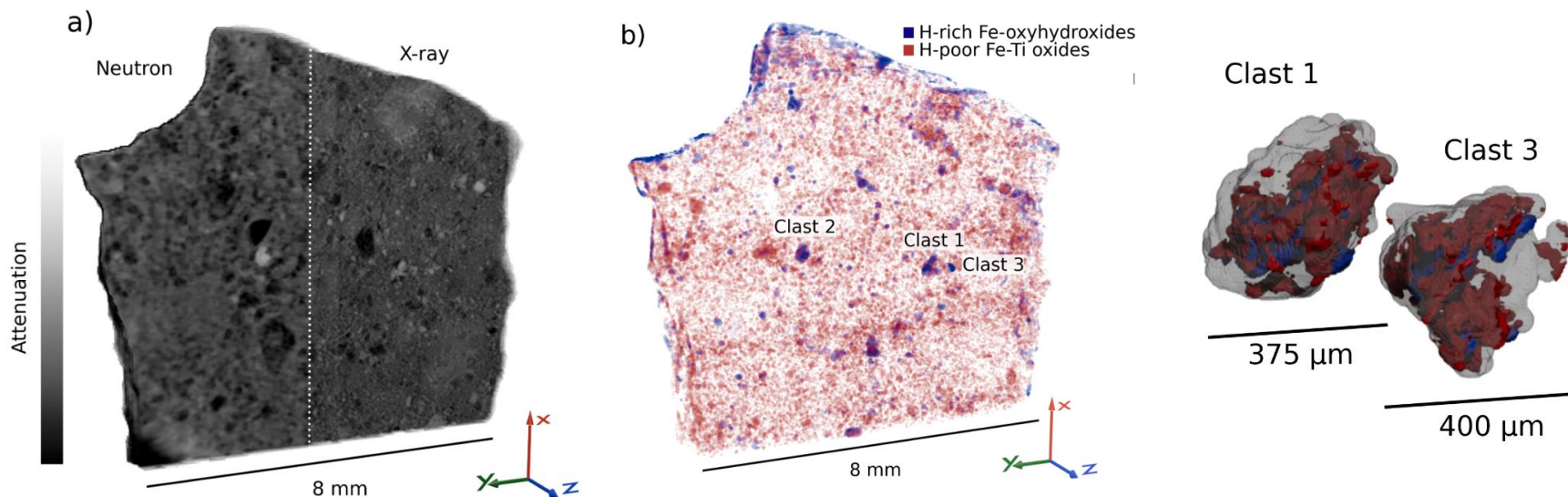


A small slice ($7 \times 7 \times 2 \text{ mm}^3$) of the Martian meteorite nicknamed "Black Beauty" - found in the Morocco desert in 2011 and over 4.45 billion years old...



...lying on some fluvial volcanic sand from Iceland - collected as part of the NASA SAND-E analogue mission.

The study builds on the team's recent work locating and identifying hydrogen rich-phases in the Black Beauty with combined X-ray and neutron tomography.



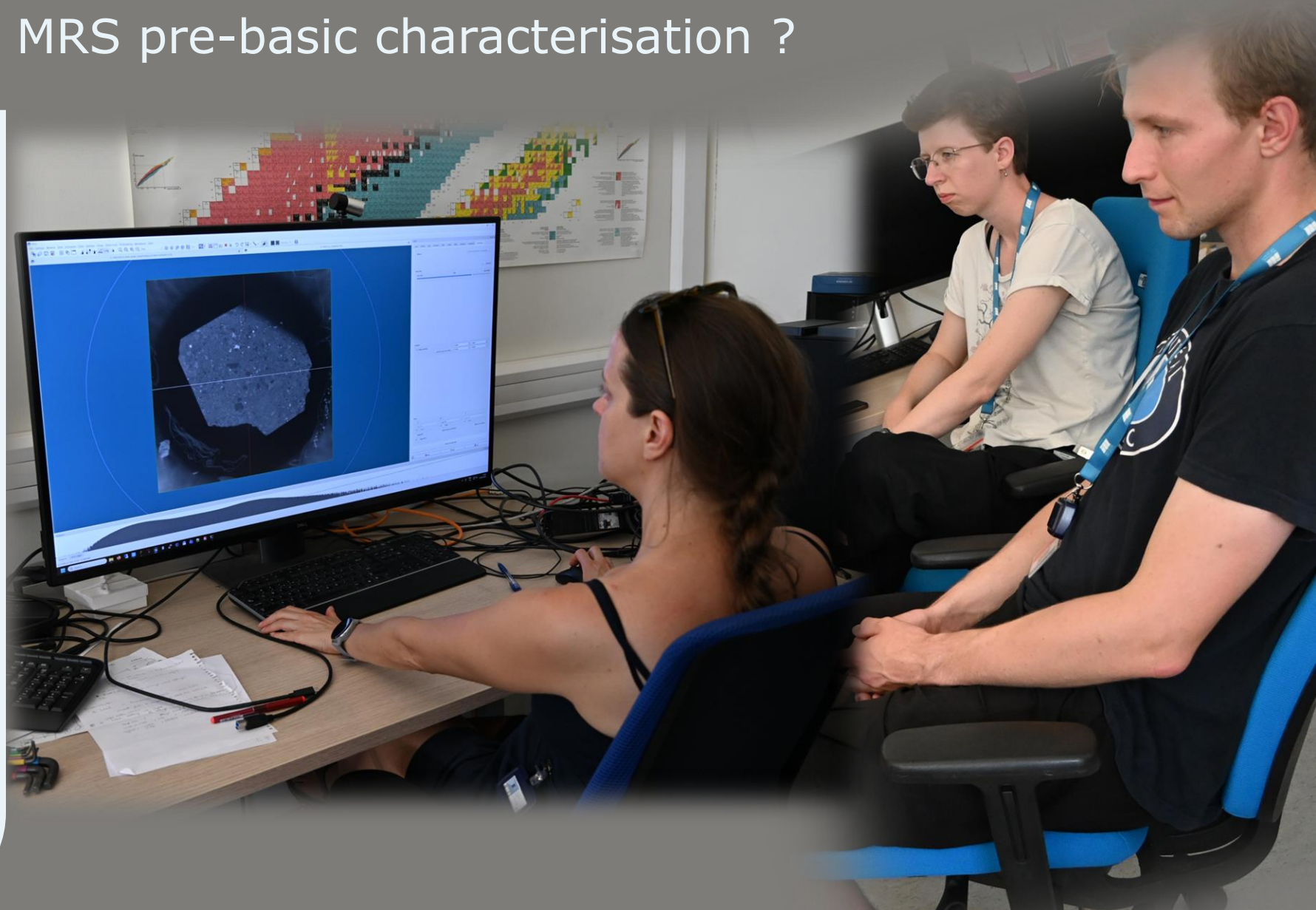
E. B. Naver et al., arXiv, (2601.08390), 2026, <https://doi.org/10.48550/arXiv.2601.08390>

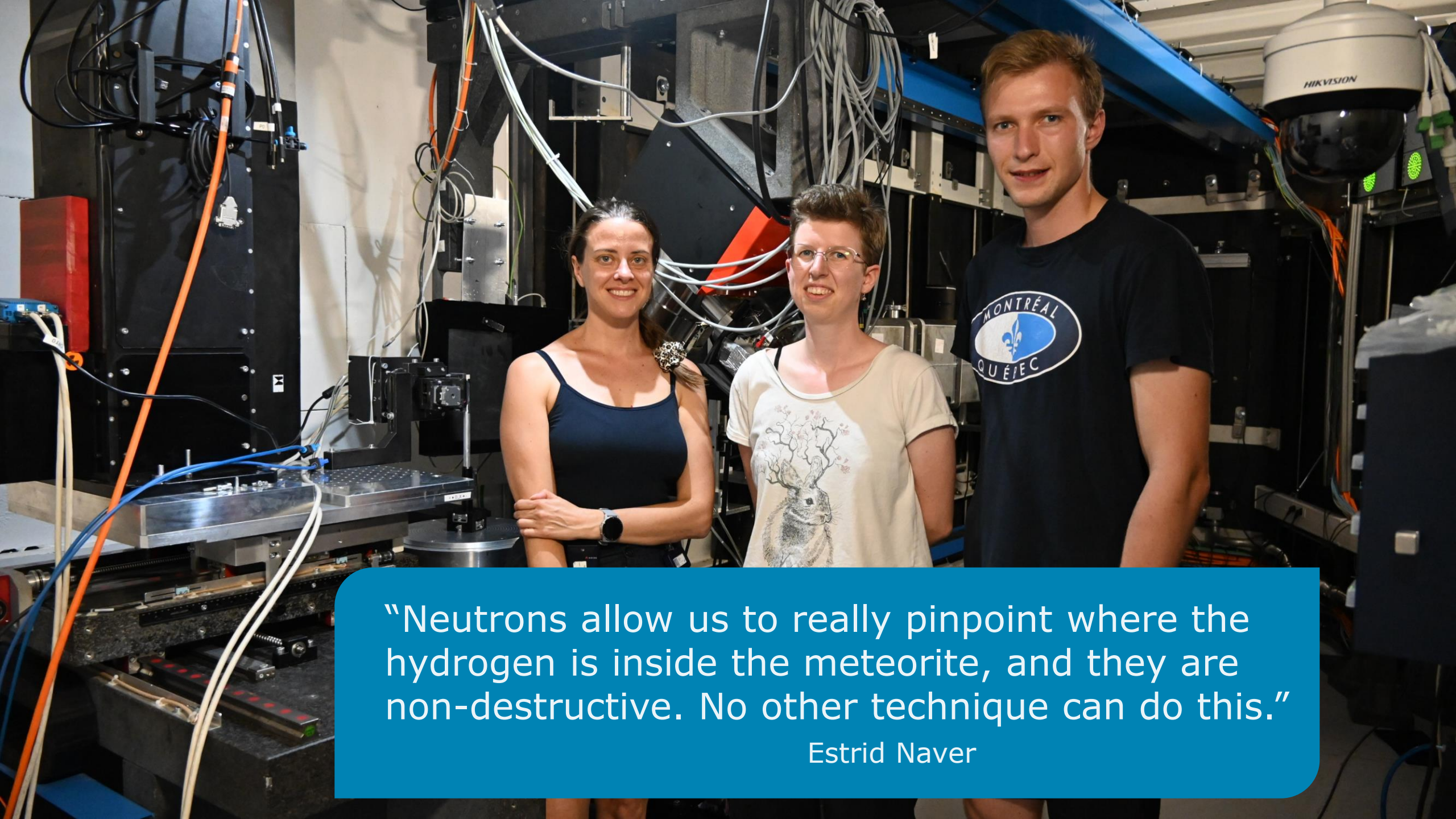
It is part of the PI's postdoctoral project, funded by the Danish centre-of-excellence "ESS Lighthouse SOLID", and of co-proposer Katrine Nikolajsen's ESA-funded PhD thesis.



What can high-resolution neutron imaging bring to MRS pre-basic characterisation ?

- Directly identify hydrous phases and potentially organic material, revealing in which mineral phase they are contained
- Complete the identification of mineral phases and microstructures, leveraging the complementarity between neutrons and X-rays





“Neutrons allow us to really pinpoint where the hydrogen is inside the meteorite, and they are non-destructive. No other technique can do this.”

Estrid Naver