Europlanet TA Report

Please see Annex 1 below

Infrastructure short name	Installation ID	Installation short name
Distributed Planetary Simulation Facility (DPSF)	TA2-4	CSS

PROJECT LEADER – APPLICANT 1

Project number: 17-EPN3-054		
Name: Federico Tosi		
Home Institution full address: INAF-IAPS Via del Fosso del Cavaliere, 100 I-00133 Rome		
Country: Italy		
Legal Status*: RES		
*__UNI__ (University and other higher education organisations) **RES** (Public research organisation (including international research organisation as well as private research organisation controlled by a public authority) **SME** , **PRV** (Other Industrial and/or profit Private organisation) or **OTH**		
Tel: +39 06 45488 700	**Fax:** -	**E-mail:** federico.tosi@iaps.inaf.it
Gender: M	**Year of birth:** 1974	**Group Leader:** Y
New user: N	**Number of visits:** 2	**Nationality:** Italian
Affiliation: INAF-IAPS	**Researcher Status:** EXP	**Activity Domain***: Physics

CO - APPLICANT – if applicable

Name: Simone De Angelis		
Home Institution: INAF-IAPS Via del Fosso del Cavaliere, 100 I-00133 Rome Italy		
Tel: +39 06 45488 384	**Fax:** -	**E-mail:** simone.deangelis@iaps.inaf.it
Gender: M	**Year of birth:** 1982	**Group Leader:** N
New user: N	**Number of visits:** 2	**Nationality:** Italian
Affiliation: INAF-IAPS	**Researcher Status:** PDOC	**Scientific background***: Physics

**Please select the most appropriate description from the list below:*

Physics	Chemistry	Life Sciences & Biotech	Earth Sciences & Environment

Mathematics	Energy	Material Sciences	Engineering & Technology
Social Sciences	Humanities	Information & Communication Technology	

How did you hear about us?

Website	Advertising email	Colleague	
Other: Already applied and selected previously (in 2016).			

HOST (TA Facility) **–** Please be accurate. This information is required for reporting.

Name:	**Host laboratory:**
Cold Surfaces Spectroscopy (CSS)	Institut de Planétologie et d'Astrophysique de Grenoble (IPAG) Bât. OSUG A 414, Rue de la Piscine - Domaine Universitaire 38400 St. Martin d'Hères France
Start Date of visit	23 April 2018
Finish Date of visit:	27 April 2018
No. of days: Please do not include travel days, this is lab/field access only	5
Applicant/Co-applicant reimbursed? Please indicate Yes or No	Yes

VISITORS TO LAB (If different from above applicant and co-applicant) **–**

Name:	**Affiliation:**	**Date**

Project Title – ***Characterization of Hydrated Na-Sulfates at Cold Planetary Conditions***

Scientific Report Summary.

(plain text, no figures, maximum 250 words, to be included in database and published)

Our proposal is focused on a series of laboratory measurements aimed to acquire VIS-NIR spectra of sodium sulfates with different levels of hydration, in three different grain sizes and in a broad range of cryogenic temperatures, representative of real planetary surfaces.

To achieve this goal, we used the setup of *Cold Surfaces Spectroscopy* (CSS) at the *Institut de Planétologie et Astrophysique de Grenoble* (IPAG), to measure sodium sulfates in three

different grain sizes: 36-50 µm, 75-100 µm, and 125-150 µm, and in the overall temperature range 80-275 K.

These measurements are key to correctly interpret spectroscopic data acquired by instruments carried onboard planetary space missions that in the near future will deeply investigate Jupiter's icy Galilean satellites (*JUICE*, *Europa Clipper*) and Mars (*ExoMars 2020*, *Mars 2020*).

Full Scientific Report on the outcome of your TNA visit

First of all, we note that our EuroPlanet proposal: "*Characterization of Na-Sulfates at Cold Planetary Conditions*" explicitly and mandatorily requested 10 working days of laboratory measurements, whereas it was selected granting only 5 working days: in our view, this is a net contradiction, because the scientific objectives set out in the proposals cannot be fully achieved if only half of the needed time is granted.

This unexpected decision forced us to involve a third person, who started the measurements in the week that preceded our TA visit and who was supported with external funds. Therefore, for the future we recommend the boards in charge of selecting this kind of proposals to stick with the time requested by the applicants, especially those people who already know the facility and therefore have a clear idea of potential dead times and the inevitable inconveniences associated to laboratory measurements.

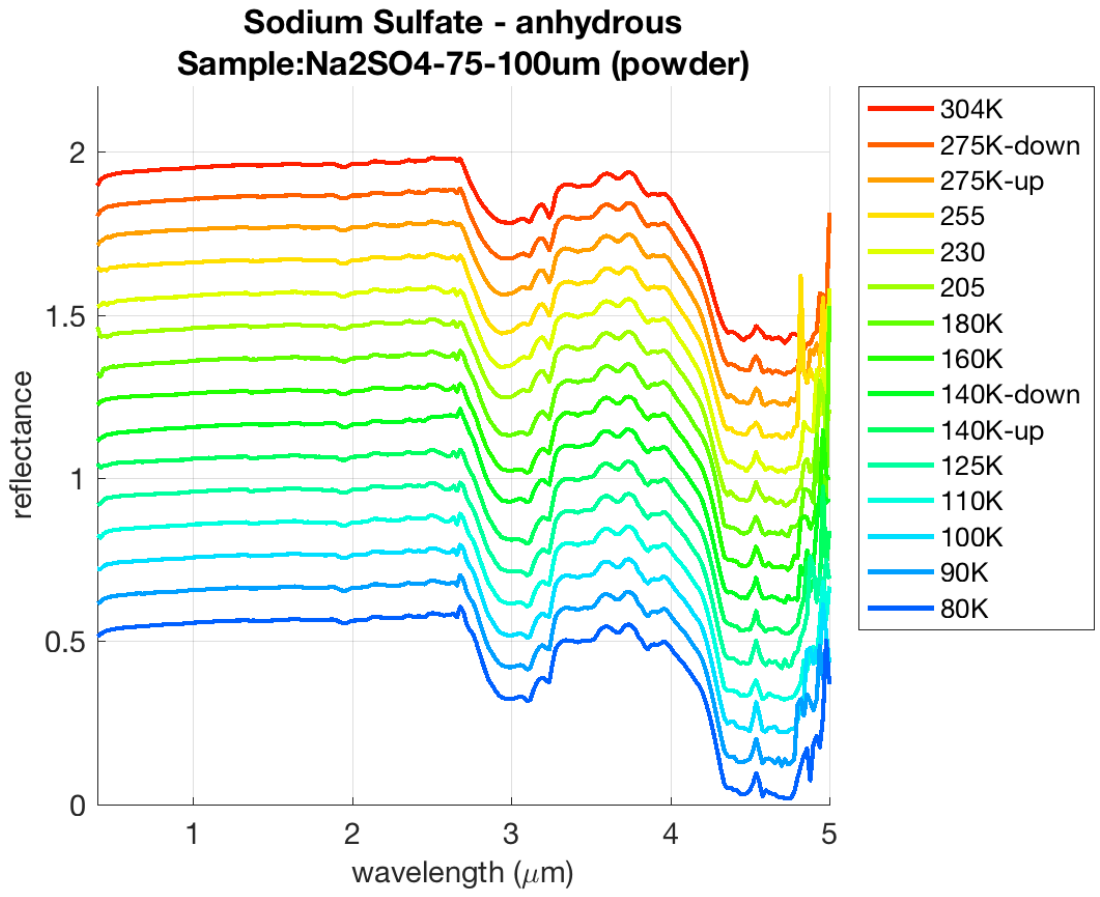
Our visit to IPAG's CSS installation, supported through Europlanet 2020 RI TA, Third Call, took place from 23rd to 27th April 2018 and covered the measurements of only one of the two compounds that had been the subject of our original proposal, namely anhydrous sodium sulfate. The second compound, i.e. sodium sulfate decahydrate, had been measured in the previous week by a third person otherwise supported, for the reasons set out above. Upon our arrival, we met Pierre Beck (staff research scientist and manager of the CSS facility), Olivier Brissaud (staff technician), and Sandra Potin (PhD student), who immediately put us at ease making us available, among other things, a humidity-controlled cabinet and an oven to preserve our samples in optimal conditions prior to the measurement.

One drawback concerned the cooling system of the room where the CSS facility is physically located at IPAG. This issue was discovered one week prior to our arrival and was not readily fixable. Fortunately, this was not a showstopper for our goals, because the cell that contained the sample was anyway maintained at the desired temperature values. However, the room temperature issue requires careful attention as it may facilitate condensation of water vapor on the optical window of the cell if a given sample is extracted and replaced with another sample too quickly.

In the five working days of our TNA visit, multiple reflectance spectra of anhydrous sodium sulfate, for which three separate samples with different grain sizes had been prepared in advance, were acquired in the spectral range 0.5-5.0 µm and in the total temperature range between 80 K and 275 K. Spectra were taken in 12 separate steps from low to high temperatures at intervals varying between 10 K (towards the lowest temperatures) and 25 K (towards the highest temperatures), with the goal of discriminating the fine structure of the main absorption band of sodium sulfate, roughly centered at 4.5 µm. In one case, a spectrum measured at 90 K was found to be corrupted for some reason and the measurement at this temperature had to be repeated later on. In another case, a small

portion of the measured spectrum proved to be unusable (a series of zeros was recorded instead of the expected values), due to a "synchronous detection" problem that the IPAG staff should try to fix in the near future, in order to avoid repeating or discarding measurements. In this regard, a big advantage compared to previous years came from a new automation system implemented for the CSS facility by the IPAG staff. This system enables the automatic acquisition of a sequence of spectra in given temperature ramp. This in fact allows the applicants to take advantage of the entire available time, including night hours, to complete the set of measurements, which in our specific case would otherwise require from 1.5 to 2 days for each sample (particle size).

In the following plot, we show an example of spectral profiles measured for one sample of anhydrous sodium sulfate (grain size 75-100 µm), which nicely confirms the capability of the CSS facility in acquiring reflectance spectra in a sufficiently broad spectral range and cryogenic temperature range, indicative of real planetary surfaces. Our experience is overall positive and CSS, after several years, is still the best facility in Europe where such spectroscopy measurements can be performed.



Please include:

- Publications arising/planned (include conference abstracts etc): 1 conference abstract (European Planetary Science Congress 2018), and 1 peer-reviewed scientific paper to be prepared and submitted to the Icarus journal by spring 2019.

Please add the Europlanet official Acknowledgement to each publication and dissemination activity

"Europlanet 2020 RI has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 654208"

- Host approval

The host is required to approve the report agreeing it is an accurate account of the research performed.

The two managers of the facility, Bernard Schmitt (CNRS/IPAG, Grenoble), and Pierre Beck (UJF/IPAG, Grenoble), approve the report and agree that it is an accurate account of the research performed during the visit of the Cold Surface Spectroscopy facility (DPSF/CSS/TA2-4).

Annex 1

Access provider short name	*Short name of infrastructure*	*Installation*		*Installation Country code*
		ID	*Short name*	
INTA	PFA	TA1-1	Rio Tinto	ES
IRSPS	PFA	TA1-2	Ibn Battuta	IT
Matis	PFA	TA1-3	Iceland	IS
INTA	PFA	TA1-4	Tirez Lake	ES
IRSPS	PFA	TA1-5	Danakil	IT
DLR	DPSF	TA2-1	PEL	DE
MUG	DPSF	TA2-2	IMRF	AT
AU	DPSF	TA2-3	PEF	DK
CNRS	DPSF	TA2-4	CSS	FR
UJF	DPSF	TA2-4(8)	CSS – 3rd party	FR
VUA	DPSF	TA2-5	HPHT	NL
OU	DPSF	TA2-6	LMC	GB
NHM	DPSF	TA2-7	PMCF	GB
VUA	DAFS	TA3-1	GGIF	NL
CNRS	DAFS	TA3-2	HNIF	FR
CNRS	DAFS	TA3-3	SRIF	FR
OU	DAFS	TA3-4	HS50L	GB
OU	DAFS	TA3-5	LFS	GB
OU	DAFS	TA3-6	CSSIA	GB
WWM	DAFS	TA3-7	RNTSI	DE
CNRS	DAFS	TA3-8	IPF	FR