SUPERCAM CALIBRATION TARGET TECHNICAL DEVELOPMENT AND STATUS. F. Rull[1,2], J. A. Manrique[1,2], G. Lopez-Reyes[1,2], J. Medina[1,2], J.M. Madariaga[3], G. Arana[3], J. Laserna[4], V. Garcia[5], R. Wiens[6], S. Maurice[7], A. Cousin[7], M. Madsen[8], C. Castro[9], C. Ortega[9], I. Sard[9], A. Fernández[9], E. Mateo-Martí[10], O. Prieto-Ballesteros[10],
[1]University Valladolid (rull@fmc.uva.es) [2]Unidad Asociada UVA-CSIC through CAB [3]Euskal Herria Unibersitatea [4]University of Malaga [5]Universidad Complutense de Madrid [6]Los Alamos National Laboratory [7]IRAP [8]Niels Bohr Institute [9]AVS [10] Centro de Astrobiología, INTA-CSIC.

Introduction: The instrument SuperCam, onboard next NASA's Mars2020 rover, is a next generation instrument, born as an evolution of Curiosity's ChemCam [1]. As it happened with ChemCam, a high impact is expected from this instrument in Mars2020 operations along with the scientific outcome of the mission. This instrument includes more analytical capabilities in addition to LIBS, such as Time Resolved Raman Spectroscopy, fluorescence and VISIR spectroscopy or the contribution of the Remote MicroImager, RMI, for morphology of the samples. With all these techniques in one instrument, the complexity of SuperCam's Calibration Target, SCCT, has been increased when compared with Chemcam's, as it can be seen in its final design.

Design of the SCCT: The SCCT includes a total of 30 samples divided as follows: twentytwo different sintered mineral samples intended to calibrate the chemometric analyses performed by LIBS and Raman; one organic sample to evaluate the impact of the Martian conditions or organic molecular groups with Raman spectroscopy; five reflectance standards provided by NBI in Denmark consisiting on RGB plus white and dark samples (all of these include a magnetic dust removal system), for RMI and VISIR calibration; a diamond sample to calibrate Raman spectrometer response and Rayleigh position; a titanium plate for wavelength calibration and a geometric target including elements for RMI calibration. All these elements are tied together by an aluminum holder.

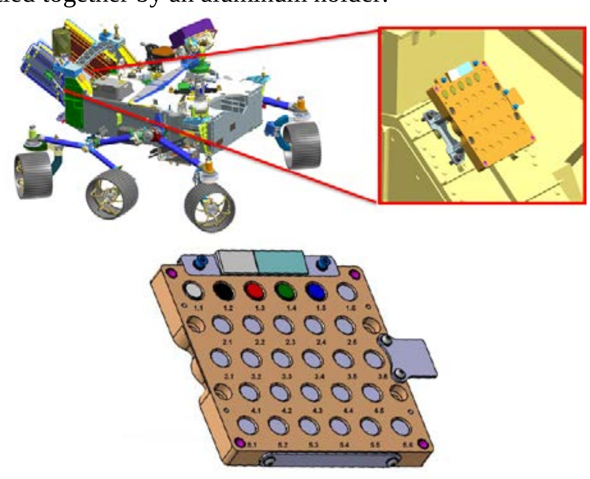

Fig. 1. SCCT design and position in the rover

The design and fabrication of the SCCT is coordinated by our research group at the University of Valladolid, task that involves the collaboration of several institutions in 4 different countries, as LANL in the US, IRAP in France and NBI in Denmark, besides Spain's contribution. The final design of the SCCT includes a total of 30 samples. The fabrication of most of the mineral targets is undertaken mostly in France, with some exceptions as mentioned before. The particularity of the samples makes their characterization specially important, coordinated from Spain, and representing a joint effort fom IRAP [2] in France, and UVA, UPV-EHU [3] and UMA in Spain. The samples are characterized using different techniques to asses their features in terms of homogeneity, either, from the elemental composition point of view, and from the mineral phases point of view. Both features are analyzed carefully since they are affected not only from the original raw material used for the fabrication of the samples, but also by the sinterization process.

Holder mechanical design. the SCCT targets are mounted on a holder that needs to keep them safe from environmental and mechanical threats, also accommodate very different materials with very different thermal and mechanical properties. From the mechanical point of view one the greatest concerns of the design was the survival of the samples to the high level shocks environment during Mars landing. For this means, each sample is mounted in an individual hole with a 8 mm window to be seen by the instrument, and fixed using wavesprings, that can deal with the different tolerances and thermal expansions of the samples while providing a good performance in shocks mitigation. The passive reflectance standards include the same system, adecuated to the higher mass of the magnetic dust removal system. The diamond sample, given its low mass and size, will be mounted on a borehole, glued to the surface of the holder, while the geometric target and the Ti plate will be fastened to the main body, in accordance with geometric requirements for these elements.

Current status of the SCCT: At the moment of this abstract's submission, the EQM model of the SCCT is under construction, with the integration and qualification tests to be done before the conference. The qualification tests include mechanical and thermalvacuum tests to assess the space compatibility, as well as to the cleaning and sterilization processes.

Risk-mitigation shock tests. Given the very high levels of shock and the non-existent heritage on sintered samples, it was decided to run a set of preliminary shock tests in order to asses the mechanical performance on an ETU (Engineering Test Unit) of the holder (Fig. 2). These tests were performed twice with a reduced number of representative samples and a set of dummies.

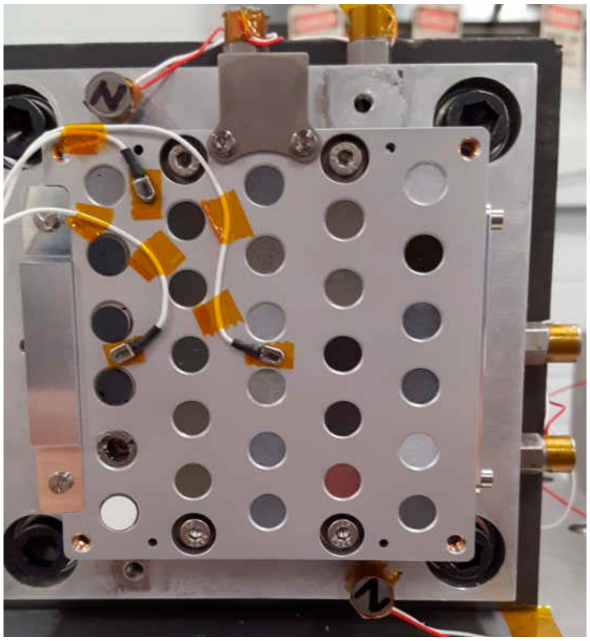

Fig. 2. Shock test configuration on the SCCT ETU

During the first shock test, performed at JPL, several issues were found. One of the sintered samples showed powder coming out of the sample, which resulted in damage of the sample surface and weight. As a result, this sample was discarded from the final set to be included in the SCCT. Another issue was that some clocking on the samples was observed after the shocks, with no other implications. Finally, during this test it was observed that some of the magnet samples (RGB) broke in the sample/magnet interface which is glued. This led to apply mitigation measures in order to avoid this, which included modifying the glue and surface treatment of the samples before gluing, and the addition of a Kapton layer between the sample and the holder, in order to avoid lateral shifts as a result of the shock. With all these mitigation measures implemented, a second shock test was performed at CTA premises in Spain, showing positive results in all aspects (with the only exception of a slightly widened temporal response of the shock, which shall be corrected for the final qualification).

UV radiation tests. A UV radiation test is being performed in the most critical samples (Fig.3) to be included in the SCCT in order to evaluate the effects of the samples when exposed to the martian conditions, especially focused on the optical effects of oxidation due to UV radiation. These tests are being run in a temperature-wise worst-case scenario of ambient temperature, in a Martian representative atmosphere of 7mBar of CO_2. These tests are being performed in the PASC chamber in the CAB (Centro de Astrobiología, Spain) [4].

Fig. 3. Samples under analysis on the PASC chamber, including two options for black samples, an organic epoxy, a piece of PET and the RGB plus white samples

Future work: In addition to the already forseen qualification and verification tests, future tests are being planned to evaluate the influence of the combination of UV and perchlorates in the aging of some of the samples. Also a characterization of the influene of the matrix effect of the sintered targets in LIBS measurements is undergoing.

References: [1] S. Maurice et al. (2015) *LPSC XLVI* Abstract #2818. [2] A. Cousin et al. (2018) *LPSC XLVIII.* [3] J.M. Madariaga et al. (2018) *LPSC XLVIII.* [4] E. Mateo-Martí et al. (2006) Meas. Sci. Technol. 17 (2006) 2274–2280