README for experimental data used in *Lagrangian-based simulations of hypervelocity impact experiments on Mars regolith proxy*

M. Froment[1,2], E. Rougier[2], C. Larmat[2], Z. Lei[2], B. Euser[2], S. Kedar[4], J. E. Richardson[3], T. Kawamura[5], and P. Lognonné[5]

[1]École Normale Supérieure Paris-Saclay, Cachan, France
[2]Earth and Environmental Division, Los Alamos National Laboratory
[3]Planetary Science Institute, Tucson, Arizona, USA
[4]Jet Propulsion Laboratory, California Institute of Technology, Pasadena, California, USA
[5]Université de Paris, Institut de physique du globe de Paris, CNRS, F-75005 Paris, France

Modified June 9, 2020

Contents

Additional files in repository

Sac accelerometer data for AVGR Shot #13.

Summary

This README contains seismic data from the laboratory hypervelocity impact experiment used in the study of Froment et al. [2020]. These data are *.sac* accelerograms recorded on 15 experimental sensors. They are completed with information on the exact sensor coordinates, test bed geometry and known mechanical properties of the impactor and target materials.

These data were recorded in June 2012 during an experimental campaign led by James E. Richardson and Sharon Kedar at the NASA Ames Vertical Gun Range facility (AVGR) [Richardson and Kedar, 2013].

Information on the target material and bolide.

The AVGR is a closed tank with a controlled atmosphere and target bed. The bed is a cylindrical container, 90cm in radius and in depth. It is targeted by a gun able to shoot small beads at a variety of angles between 0 and 90°, and at a speed between 1 and 6 km/s.

The target material used in this experiment is a pumice sand with 0.1-0.2 mm grains. Its porosity is 62% and its bulk density is 880 kg/m^3. The bolide is a spherical pyrex bead with density of 2230 kg/m^3 and diameter of .25" (6.35 mm), for a total mass of .29 g. The tank atmospheric pressure is within a few percents of the Martian atmosphere, at around 600 Pa. The bead is shot at 980 m/s with a vertical incidence. The tests are monitored by 15 accelerometers recording the vertical and/or radial acceleration of the sand in various positions in the tank. Their sampling rate is $1e^{-5}$s.

Graphic of the experimental setup.

A graphic of the experimental setup with accelerometers position and recording channel number is shown on Figure 1.

Table of the coordinates of accelerometers.

Table 1 shows the position of the accelerometers deployed for Shot #13 and indicates the number of the channels used to record the seismic data.

Sac accelerometer data for AVGR Shot #13.

Seismic data of Shot #13 can be found in the present repository. They total 16 waveforms, in the *.sac* format, named with conventions :

Shot_13_yyyymmdd_hhmmss.Channel-number.sac.

For instance: *Shot13_20120618_123244.01.sac* contains the signal of Channel 01. Channel number 16 is a trigger channel used to define the time of impact. To obtain this impact time, a $64{\cdot}10^{-6}$s delay must be added to the time at which the trigger signal window of seismic Channel 16 starts rising.

References

M. Froment, E. Rougier, C. Larmat, Z. Lei, B. Euser, S. Kedar, J. Richardson, T. Kawamura, and P. Lognonné. Lagrangian-based simulations of hypervelocity impact experiments on mars regolith proxy. *Geophysical Research Letters*, 2020. doi: 10.1029/2020GL087393. URL `https://doi.org/10.1029/2020GL087393`.

J. Richardson and S. Kedar. An experimental investigation of the seismic signal produced by hypervelocity impacts. In *Lunar and Planetary Science Conference*, volume 44, page 2863, 2013.

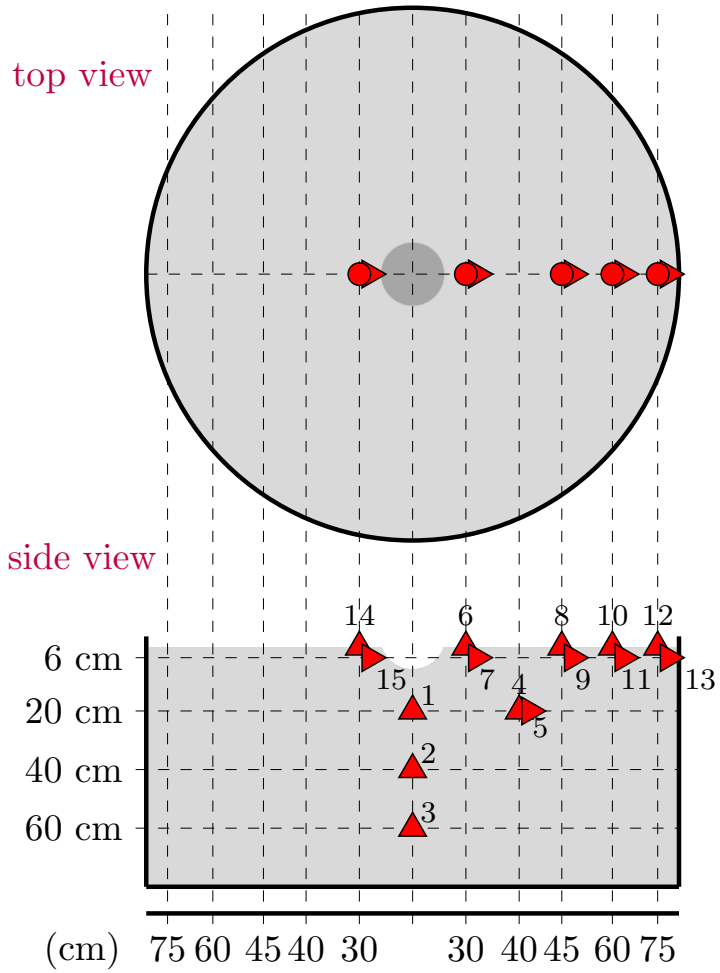

Figure 1: Description of the experimental setup of the AVGR experiments. Accelerometers and the direction of the recorded acceleration are illustrated with red triangles. Sensors are annotated with their channel number.

Table 1: Positions of the accelerometers in the pumice sand tank

Channel Group	Radial distance from center of tank (cm)	Vertical distance from surface of tank (cm)
1	0	21.8
2	0	42.1
3	0	59.3
4,5	43	22.3
6,7	29.3	6.7
8,9	44.5	6.9
10,11	59.5	5.8
12,13	74.5	5.8
14,15	28.5	6.6