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Combined experimental and numerical approach to evaluate impact scaling relations and reproducibility of craters produced at the Experimental Projectile Impact Chamber (E.P.I.C., Centro de Astrobiología, Spain.)

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The Experimental Projectile Impact Chamber at Centro de Astrobiología, Spain, consists of a 7m wide, funnel-shaped test bed, and a 20.5mm caliber compressed N2 gas gun. The test bed can be filled with any type of target material, but is especially designed for wet target experiments. The shape and size aim to decrease disturbance from reflected surface waves in wet target experiments. Experiments are done under 1Atm pressure. The gas gun can launch projectiles of any material and dimensions <20mm (smaller diameters using sabots), and at any angle from vertical to near horizontal. The projectile velocities are of the order of a few hundreds of meters per second depending mainly on the gas pressure, as well as projectile diameter and density. When using a dry sand target a transient crater about 30cm wide is produced. Wet target experiments have not yet been performed in this newly installed test chamber, but transient cavities in water are expected to be in the order of 50-70cm wide. The large scale allows for detailed study of the dynamics of cratering motions during the stages of crater growth and subsequent collapse, especially in wet targets. These observations provide valuable benchmark data for numerical simulations and for comparison with field studies.

Here we describe the results of ten impact experiments using three different gas pressures (100bar, 180bar, 200bar), two projectile compositions (20mm, 5.7g delrin; 20mm, 16.3g $Al2O_3$), and two different impact angles (90° and 53° over the horizontal plane). Nine of the experiments were done in a quarter-space geometry using a specially designed camera tank with a 45mm thick glass window. One experiment was done in half-space geometry as reference. The experiments were recorded with a high-speed digital video camera, and the resulting craters were documented with a digital still frame camera. Projectile velocities are estimated with a combination of tracking software and a Shooting Chrony Alpha M-1 chronograph to be about 330m/s for delrin (100bar), 220m/s for $Al2O_3$ (100bar), 400m/s for delrin (200bar), and 275m/s for $Al2O_3$ (200bar). The velocities for the lighter delrin projectile and at the higher pressure are above the speed of sound in dry silica sand (243 m/s; Sandia report SAND2007-3524).

The experimental set up (i.e. target material, projectile density and velocity, impact angle), as well as the dimensions of the resulting craters, are used as inputs in numerical simulation using the iSALE computational code. Results from these simulations will be presented and compared with the experiments.