Introduction: We present results of hydrocode calculations of the LCROSS impact. Using our Smooth Particle Hydrodynamic (SPH) impact code, we investigate the crater formation, crater morphology, velocity distribution of ejecta etc. for different target material (regolith) properties including strength and porosity.

Numerical method: Our numerical tool is based on the Smooth Particle Hydrodynamic (SPH) method. In order to simulate solids, standard SPH was extended to include a strength and a fracture model [1]. Therefore, our SPH impact code can be used to model impacts and collisions involving solid bodies in the strength- and gravity-dominated regime. This method was already successfully tested at different scales.

At small scales, the method was validated by simulating laboratory impacts. Our model predicts shapes, locations and velocities of the largest fragment with high accuracy [1].

A natural laboratory for studying collision physics at larger scales is provided by the twenty or more asteroid families identified in the asteroid belt. By simulating classes of collisions, our model was able to reproduce the main characteristics of such families [2].

Simulations with porosity. Recently, our SPH impact code was extended to include a porosity model. The model is based on the so called P-\alpha model [3] which was adapted for implementation in our SPH code [4]. We are now capable of performing SPH simulations including fracture and porosity.

Impact simulations: Using our 3D SPH impact code, we perform several simulations of the LCROSS impact, considering different properties of the target material.

As an example we show the outcome of a simulation after 0.4 seconds. In this simulation, the impactor is modelled as an underdense (\(\rho=0.03\text{g/cm}^3\)) 3\times10m aluminium cylinder with a mass of 2020kg and an impact velocity of 2.5km/s. For the target we use predamaged (strengthless) basalt with a density of \(\rho=1.8\text{g/cm}^3\). In this simulation, the Tillotson equation of state is used.

Figure 1 shows a 2D slice of the 3D distribution of SPH particles for this simulation. The colors label the z-component of the velocity, positive values indicate ejection. For the same simulation, the ejected mass with a vertical velocity higher than a certain velocity is plotted as a function of velocity (see figure 2).

Results of further simulations including different types of target material, target porosity, and EOS will be presented.