D2.5 / Summary of the deliverable: "Measurements of wall pressure and material loss for different fluids and target materials "

provided by ESR 6, Ms Iris Koukouvini under the guidance of Dr Ioannis Karathanassis and Prof Manolis Gavaises, CITY, University of London, November 2018

The main goal of the study was to investigate the influence of cavitation structures and their collapse on erosion through experimental setups of enlarged fuel-injector replicas. The experiments comprise two parts, namely shadowgraphy visualisation and mCT measurements.

On the first part of the experimental process, the development of a highly transient two phase flow was studied, in a nozzle orifice of an enlarged diesel injector model with length of 5mm and diameter of 1.5mm, for different operating conditions (Cavitation/Reynolds numbers and needle lift), in closed hydraulic circuit under steady flow conditions. The dataset was acquired using a high-speed camera at 50000 fps. Through the post processing the probability of vapour presence and its standard deviation were calculated, depicting also the transient behaviour of the relevant phenomena.

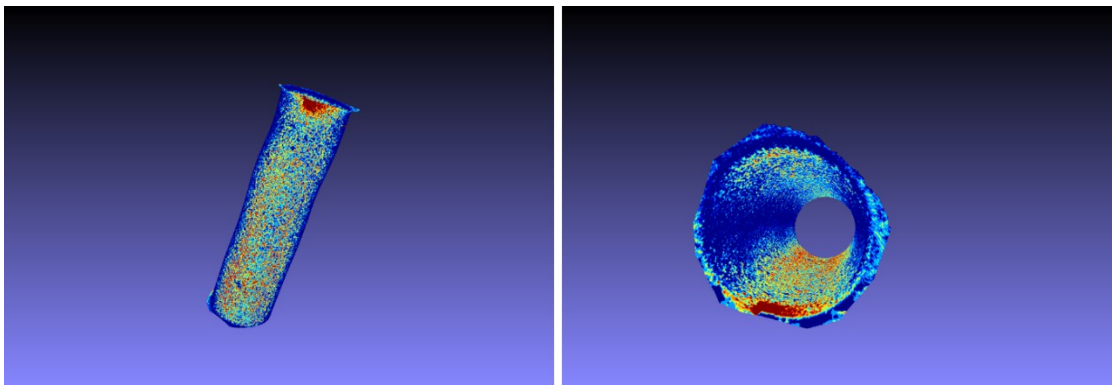

Figure: Alteration at the orifice wall surface after 24 hours exposure to cavitating flow at CN~6, Re=35500. (Left panel) Bottom view. Flow is from top to bottom. (Right Panel) Cross-sectional view with orifice entrance being at the foreground. (Range 6 (blue)-24 (red) μm).

Finally, on the second part covering the erosion test, a closed hydraulic circuit similar to that used for the shadowgraphy setup, was employed. At time intervals of 4 hours and up to 24 hours, each model under investigation was scanned using the Micro X-ray Tomography facility at the University of Bergamo, to extract the geometrical changes caused by cavitation-induced erosion. Through the acquired results, the 3D reconstruction of the geometries was computed based on logarithmization and filtered back projection.

Consequently, the geometrical change of the orifice surface structure due to the erosion was captured and was properly quantified, compared to a reference scan of orifice prior to being exposed to cavitating flow.