

Abstract

The aim to acquire reusable launchers is to perform non-destructive tests of used stages and its components within a short period of time, and to confirm their ability for the next flight.

OH B DC, together with the Fraunhofer Development Center for X-ray Technology, developed and built a large scale 3D-Rayon X device named XXL-CT that has the ability to scan large scale structures.

This high energy X-Ray device has the power to penetrate even high absorbing materials of large components, and receive high resolution images with submillimeter accuracy.

Additionally, a specialized mechanical structure allows the scanner and the object to move in different positions, providing a complete and accurate 3D insight.

A 3D scanner such as this one can scan each part of a complex machine without requiring disassembly, and provides physical measurement data that can be compare with the theoretical engineering 3D data.

This technology is currently used to measure and analyze prototype cars after crash tests without to have to disassemble them. It allows easily and in an unprecedented short time to validate the physical deformation of the crash with its digital twin generated by FEM simulation. It is also used to examine the wear and tear of complex machines, such as sports car engines and their transmission units or EV battery modules.

Just as this 3D scanner is used for large scale components, this technology is also suited to scan rockets engines or entire rocket stages.

A second generation of scale 3D X-Ray Scanners are currently being developed for the University of Kaiserslautern in Germany.

This 3D X-Ray Scanner not only analyzes large concrete pillars and its components in a resolution detail well below 100 microns, it also allows the user to study wear mechanisms like crack propagation inside the investigated objects under defined mechanical stresses like tension, torsion and bending at quasi-static states and even in real time with up to 300Hz framerate.

This presentation will provide an overview of the state-of-the-art 3D Rayon X large-scale system and its potential and suitability for detailed examination and wear testing of reusable launcher stages.

Using this scanner would not only reduce the time of the overhauling after a launch, but will also increase its reliability and traceability.