Materials challenges abound and touch our lives in nearly every way. To understand how different materials and devices perform, we must understand and characterise how they are formed or fail. Dynamic micro-CT is a non-destructive imaging technique that provides unique insights into these challenges by uncovering 3D microstructure in real-world in situ environments. Dynamic micro-CT is a powerful analytical technique with high spatial nanometer resolution for failure analysis and control quality of automotive components that can be up to tens of centimeters in size.