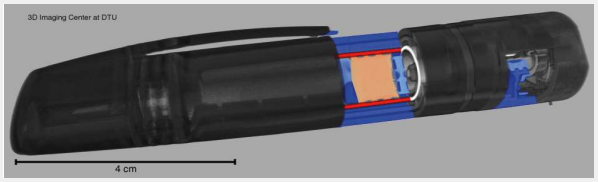
Superman vision

If Superman was looking for a new job, who in this world wouldn't immediately hire him as a Quality Inspector? The ability with laser precision to see moving parts operate in real time, to slow it down, to enlarge and to probe in 3D with his X-ray vision? Consider the LINX project called "4D Scanning Under Operations", where the forth "D" denotes time. The ambition is to be able to make high resolution 3D X-ray movies of select manufacturing processes, as they happen: Superman vision.

Employing X-ray technology for quality inspection and R&D is nothing new. The project's two industry partners, Danish insulin leader Novo Nordisk and Swedish packaging giant Tetra Pak already use it. However, available technologies are still lacking in the resolution and speed they can provide. There are severe limitations on the size of the object that can be inspected, and taking samples from the manufacturing line back to the lab is often necessary. None of this is ideal.



The Novo insulin pen has several moving parts and is injection moulded with extreme precision to comply with regulatory requirements. There is no tolerance for error. The company's quality inspection tools must reflect this.

Mette Poulsen, Senior Research Scientist, Novo Nordisk: *I am impressed by the speed at which LINX and the Danish universities were able to address my specific questions.*

The packaging material in a beverage carton is a six layered laminate. The layers together ensure the integrity of the packaging. Understanding and controlling how they behave when folded at high speed is of paramount importance.

The issue

Time resolved X-ray tomography (4D Superman vision) is expanding for scientific applications where it holds great promise. However, the industrial application of these technologies still lacks behind. The speed at which 3D images are generated needs to increase, and the scale limitation which is currently just a few millimeters must be lifted. The size and operability of the inspection equipment itself must be adapted for industry's purpose.

What we did

Through LINX, a project collaboration was set up between Novo Nordisk, Tetra Pak and Technical University of Denmark (DTU). DTU has extensive knowhow of advanced micro-meter scale X-ray and neutron technologies applied for non-destructive testing and inspection.

The Partners first set out to investigate how far existing technologies could take them. This included experiments at large scale synchrotron facilities and the facilities already present at the universities and at Novo Nordisk and Tetra Pak.

The Project's long-term objective is twofold:

1. Create 3D X-ray (or neutron) movies of the objects provided by the industrial partners.

2. Propose ways this can be done using in-house industrial equipment.

What's next?

The Project is currently focused on performing the first static 3D measurements of sample fractions. As part of this process it is investigated how current large-scale synchrotron beams may be "widened" to enable the measuring of larger objects.

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