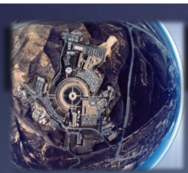

Use of Dragonfly Software for HDC Drill Hole Analysis

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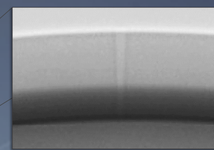
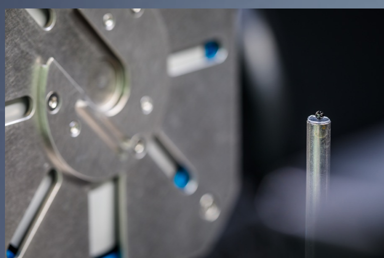
Data Requirements

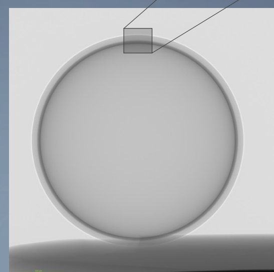
X-Ray tomographs of high-density carbon (HDC) capsules is a primary metrology technique used to gain important information on the inside of capsules. One use of this information is for drill hole analysis. This data provides thousands of 2D slices throughout the capsule that give you a whole picture of the inside of the capsule and its walls. Utilizing a 3D tomography analysis software called Dragonfly allows us to generate a 3D representation of the whole capsule.



Drill Hole



A close-up of a capsule about to be radiographed for tomography

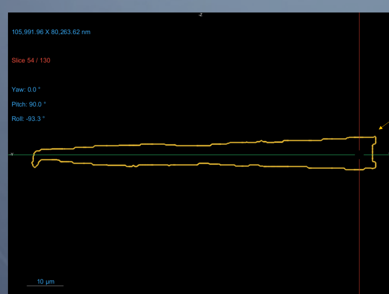


A 2D cross-section image from a tomography

How is this an Upgrade

Before Dragonfly, only two 2D slices were used to generate an estimate of the hole diameter at any given depth.

Dragonfly gives us the entire asymmetrical picture that leads to a more accurate hole diameter at any given depth as well as the overall drill hole volume.

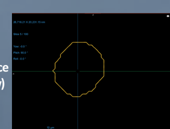


2 Cross sections such as this were used to get an estimate of the hole diameter at any given depth.

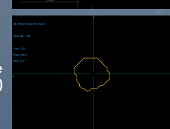
This process did not account for asymmetry, thus giving only a rough estimate of the actual drill hole size

	Labview	Dragonfly
Projections	2	2000
Data Type	2D	3D

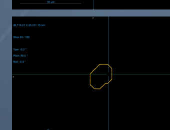
Drill Hole Entrance (Top-Down View)



Drill Hole Middle (Top-Down View)



Drill Hole Exit (Top-Down View)

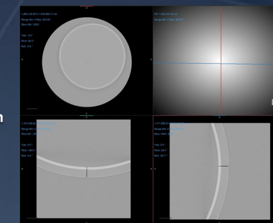


Data Process Flow

1.

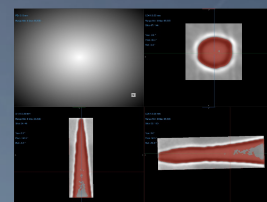
1. After acquiring the radiographs, the file is reconstructed into its three-dimensional representation.

2. The reconstructed data is then imported into the Dragonfly software.



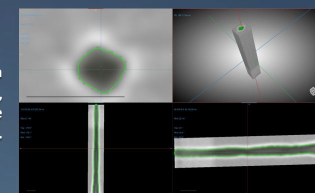
2.

3. A "boundary box" is made to focus only on the drill hole portion of the representation.



3.

4. The drill hole is "filled", and an accurate outline is created. Thus, isolating the 3D drill hole from the rest of the data.



4.

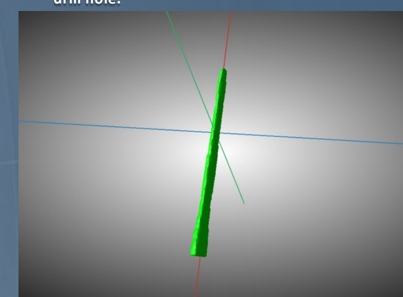
5.a The quantitative data is then processed through proprietary code to give final drill hole analysis dimensions.

Depth (um)	Area	Max Diameter	Min Diameter
0	32.743	7.112	5.878
2	32.873	7.149	5.796
4	31.492	7.008	5.503

Drift range (um)	0.5
Global Avg. Diameter (um)	4.7
Global Stdev Diameter (um)	0.8
Average Area (um^2)	18.1
Volume (um^3)	1689.6

5.a Example of drill hole analysis data output

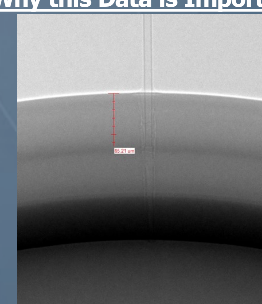
5.b The qualitative data is then output as a 3D representation of the drill hole.



5.b Isolated 3D representation of the drill hole

Why this Data is Important

When building HDC capsules into a capsule fill tube assembly (CFTA), having accurate hole diameters at every depth assists in verifying the correct fill tube size can be used, and if any potential debris will inhibit insertion.



Radiograph of a fill-tube inside of a capsule drill hole

Experimentally, knowing an accurate drill hole mass deficit can assist with making better simulations for high yield fusion shots at NIF (National Ignition Facility).

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