

Is edge monitoring sufficient for DCB measurements of composites? X-ray computed tomography tackles the question

T. Chatziathanasiou, J. Soete, J. Vanhulst, L. Gorbatikh, M. Mehdikhani

Online Workshop: “Mode I interlaminar fracture toughness and the factors influencing it”
14th May 2024

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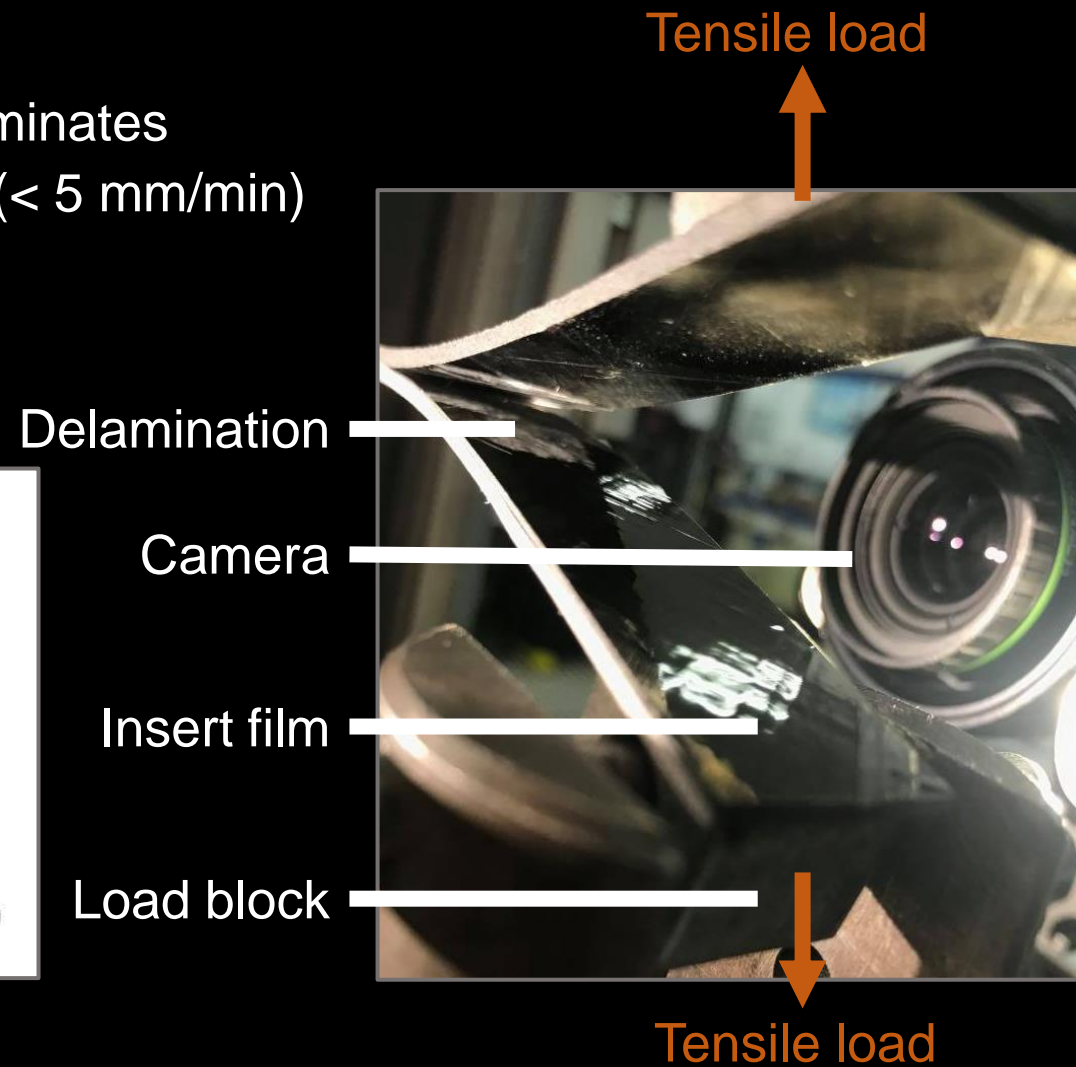
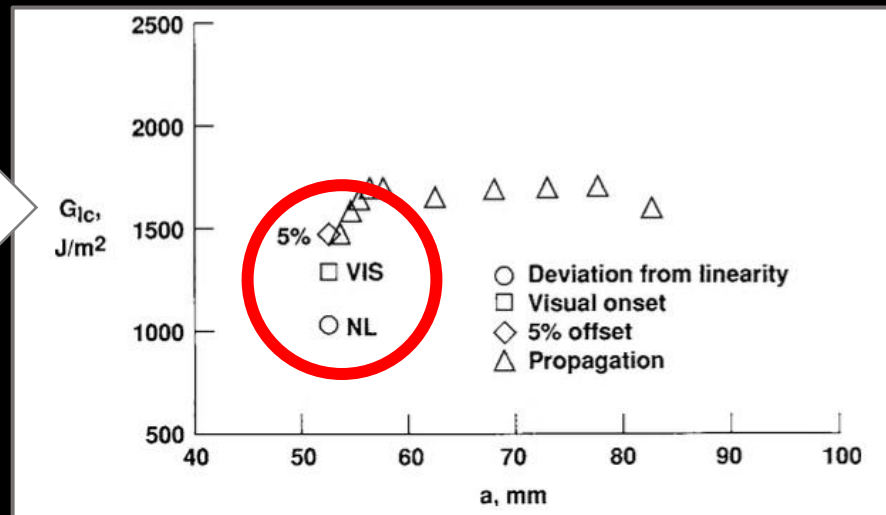
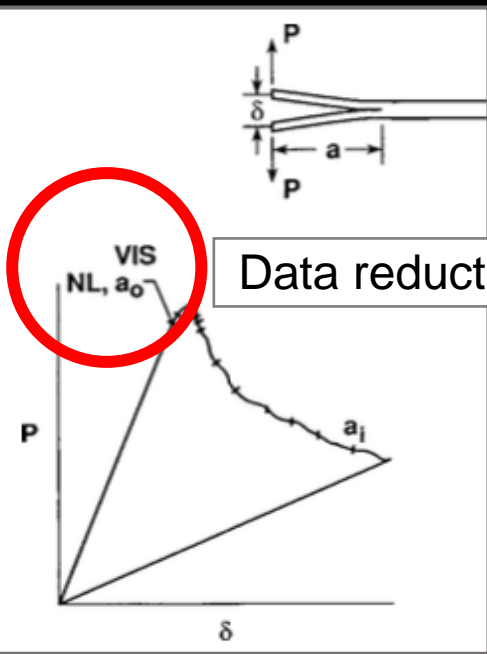
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Double Cantilever Beam (DCB) test

Standard test method (ASTM D 5528)

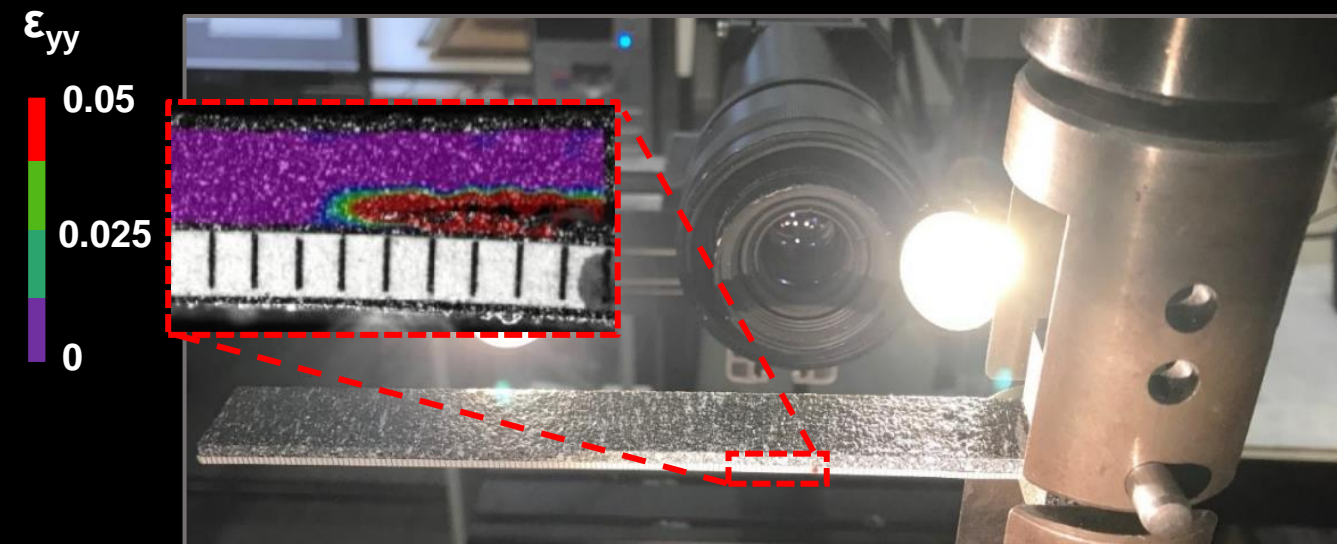
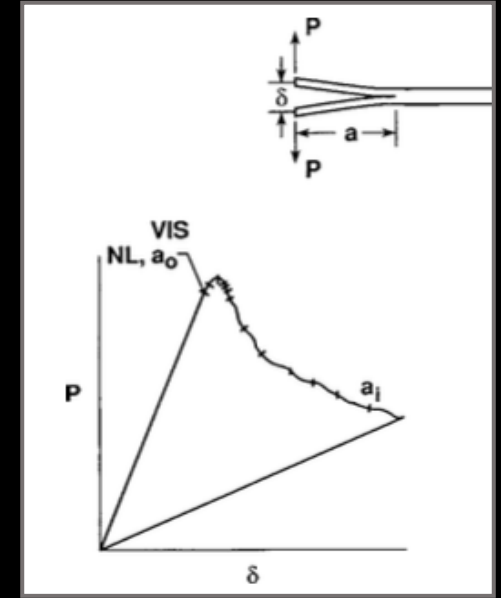
- Limited to UD carbon fibre and glass fibre tape laminates
- Limited to quasi-static cross-head displacements (< 5 mm/min)
- Load – Opening displacement – Crack length



Crack initiation detection

Ways to “detect” initiation

- Non-linearity point in load-displacement curve
- Visual detection (operator, digital image correlation, etc.)
- 5% increase in compliance
- In-situ or ex-situ non-destructive testing techniques e.g. AE, XCT



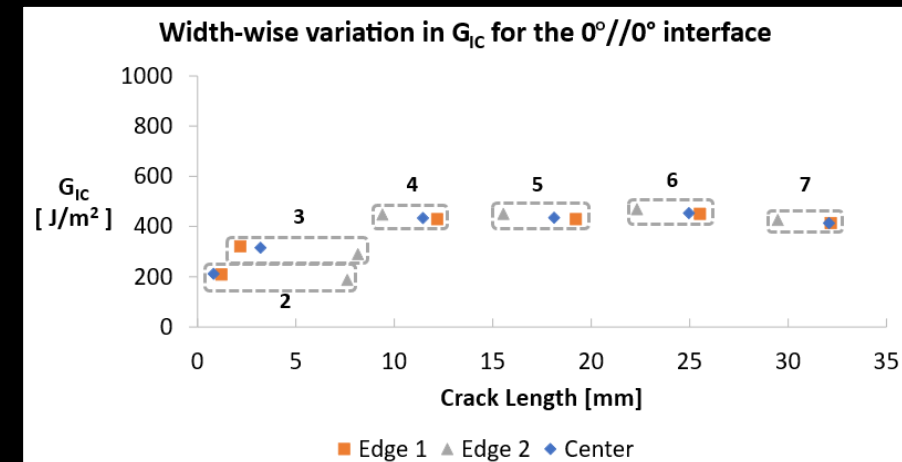
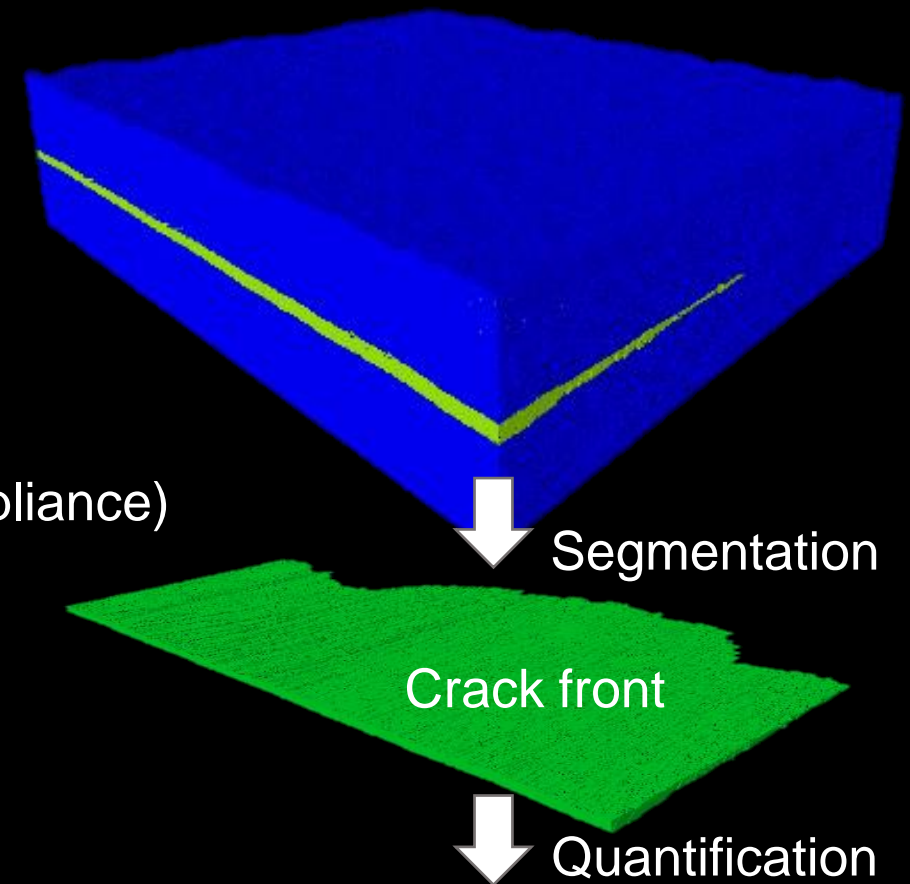
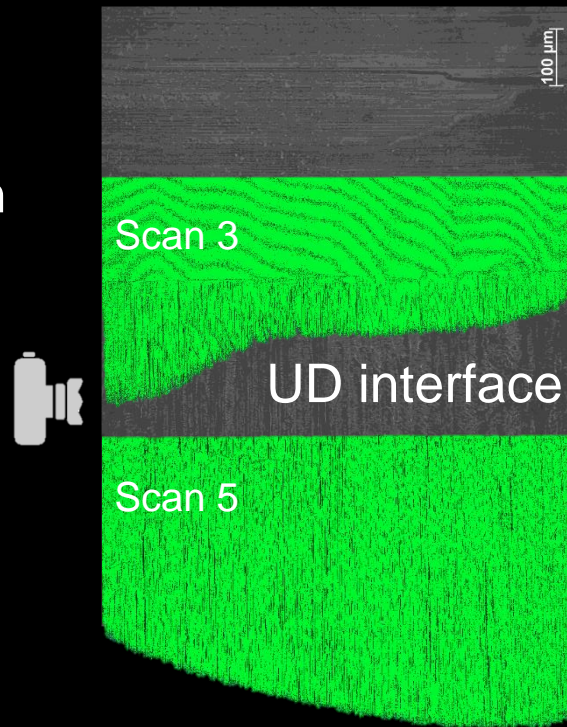
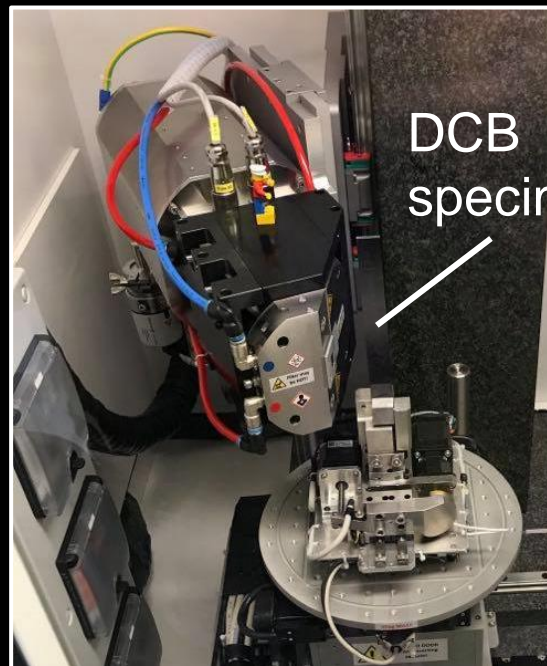
Issues in edge monitoring techniques

- 2D edge crack detection
- 3D dissipation mechanisms
- Assumptions in data reduction

In-situ X-ray computed tomography

X-ray computed tomography

- 3D volume - crack detection (R-curves)
- No assumptions or approximations (edge/ NL / 5% compliance)
- In-situ visualisation of dissipation mechanisms



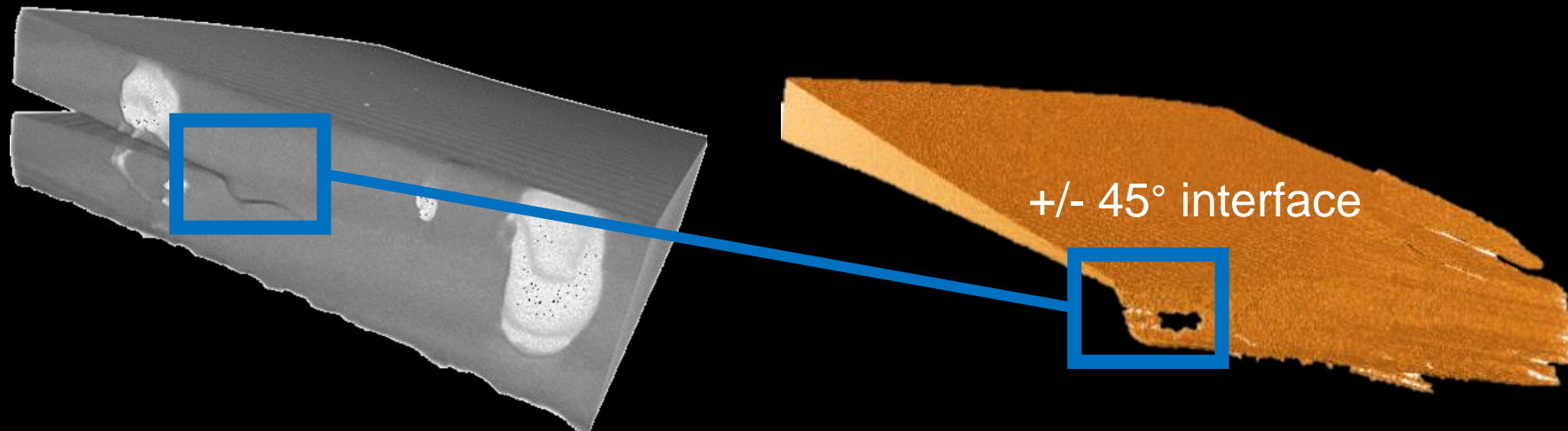
Is edge monitoring sufficient?

Not if we want to expand the applicability of the current standards

- Towards different interfaces – fibre types – strain rates

BUT

- Different mechanisms (micro – meso relationship)?
- What are we characterising then? Is it still mode I?



What about initiation detection?

- Should there be a minimum crack length for a delamination to be considered as initiation?

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