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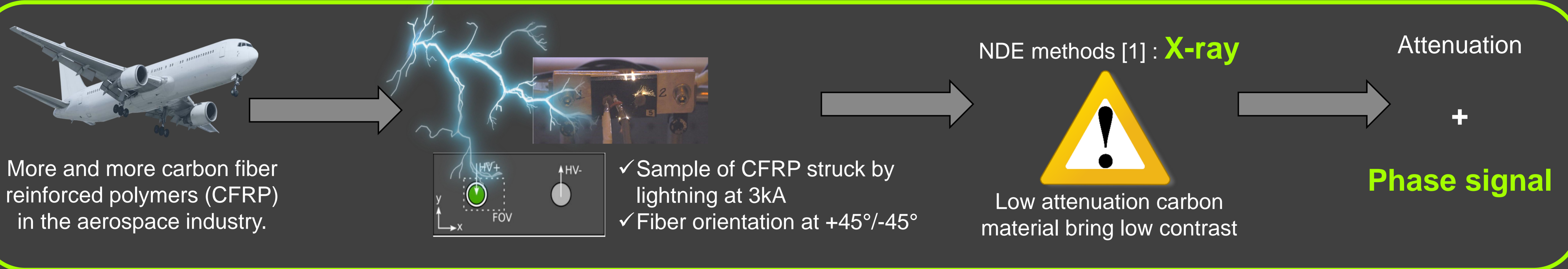
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TWO PHASE CONTRAST METHODS TO STUDY CFRP STRICKEN BY LIGHTNING

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Laboratory Bench

Multi-Lateral Shearing Interferometer (MLSI)

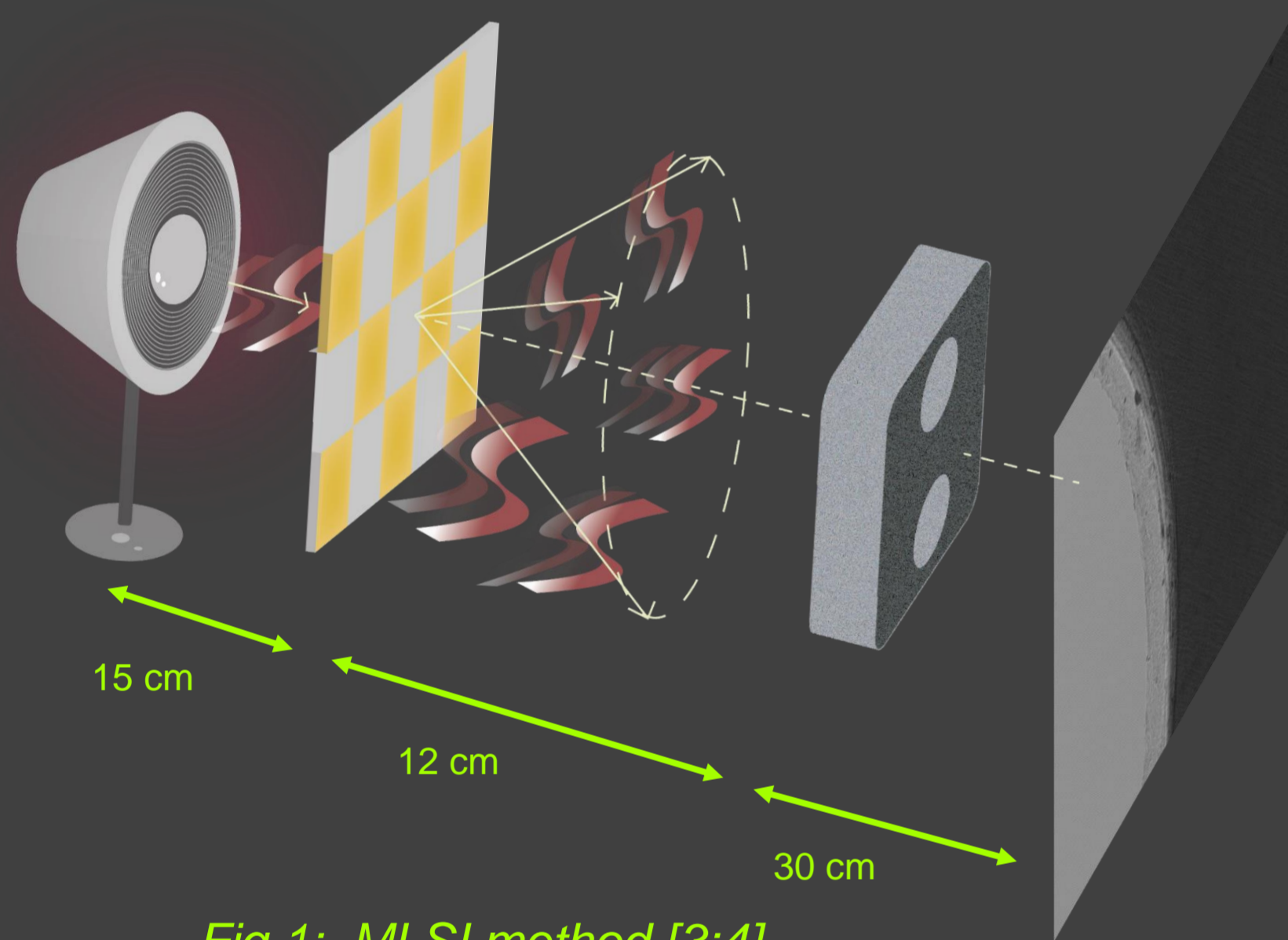


Fig 1: MLSI method [3;4]

- Polychromatic source ; divergent wave
- Detector pixel size = 6,5µm ; fov = 13,3 × 13,3 mm²
- Magnification = 3,2 ; Effective pixel size = 2,05 µm

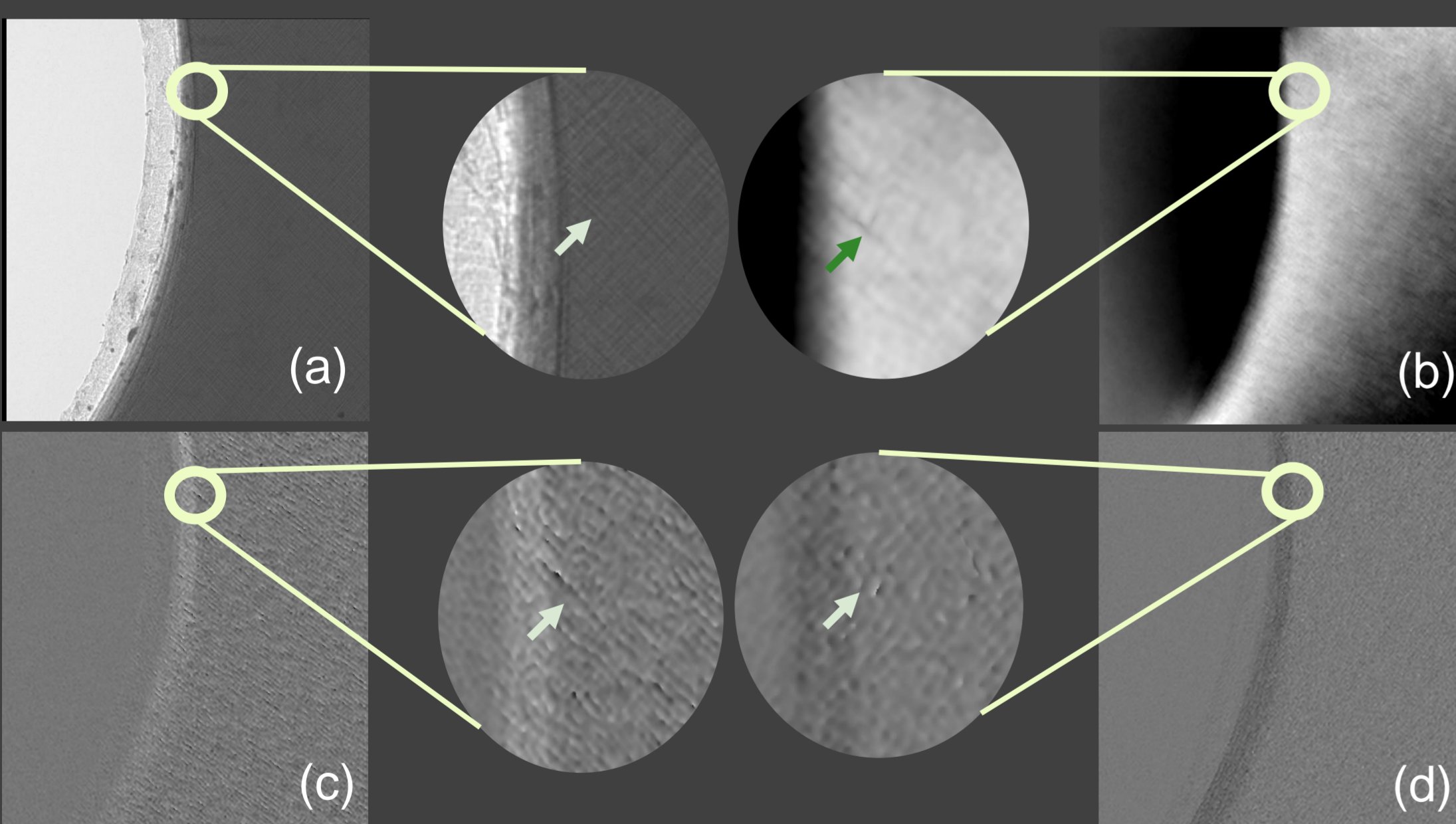
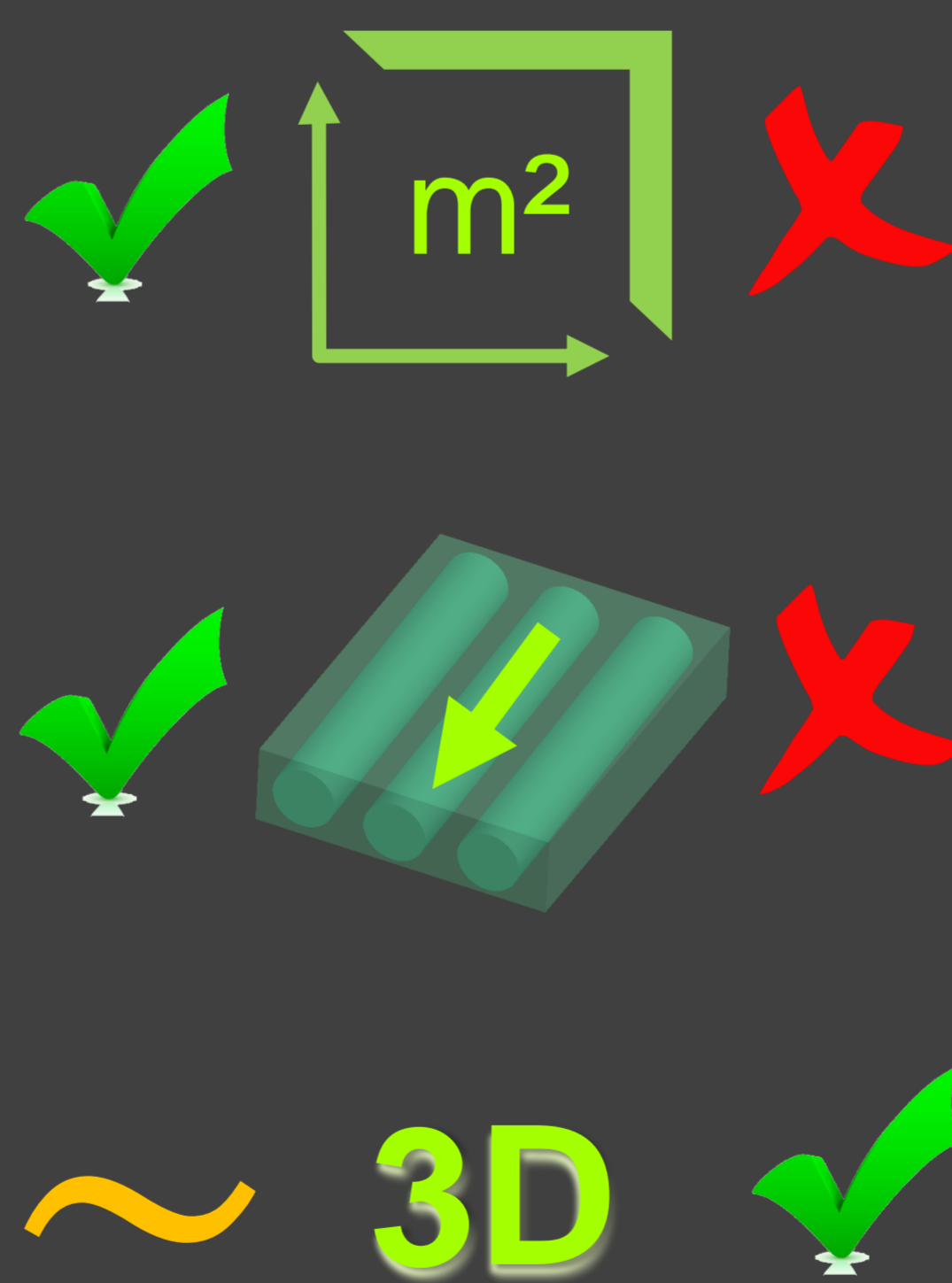


Fig 2: CFRP image with MLSI method: Image of attenuation (a), phase image (b), phase gradient images in two axis directions (-x+y and x+y) (c)(d) [6]

X-RAY



Synchrotron

Free Propagation

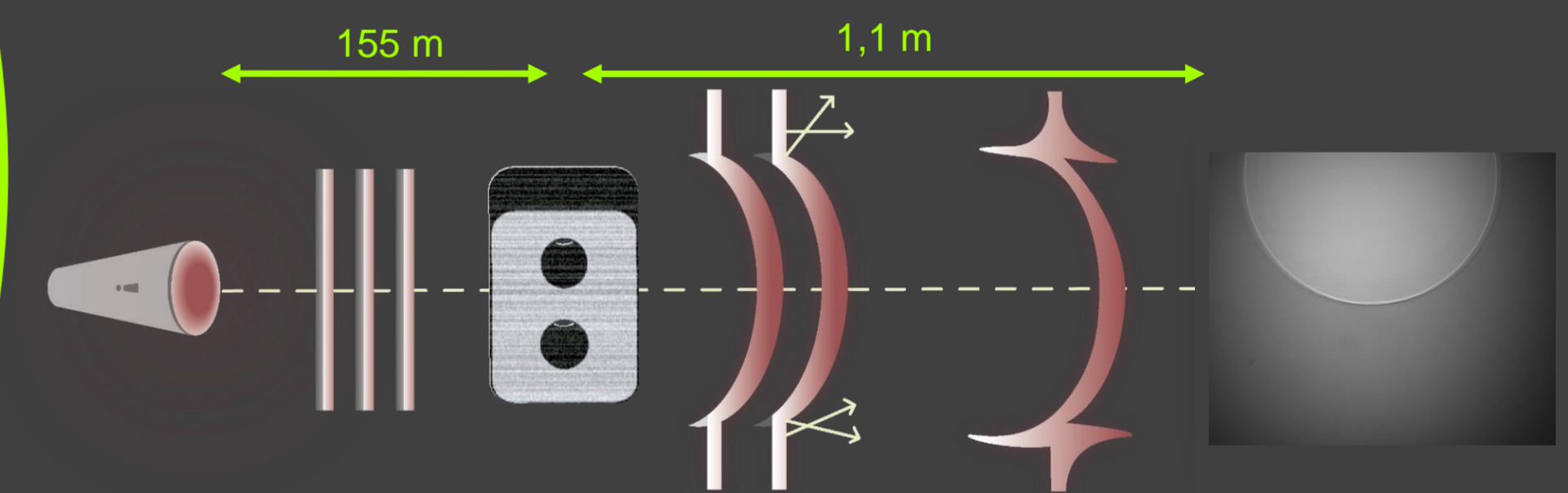


Fig 2: free propagation phase contrast method [2]

- Tomographie measurement
- Polychromatic source ; plane wave
- Detector pixel size = 6,5µm ; fov = 16.6 × 10.7 mm²
- Magnification = 1 ; Effective pixel size = 6,5µm

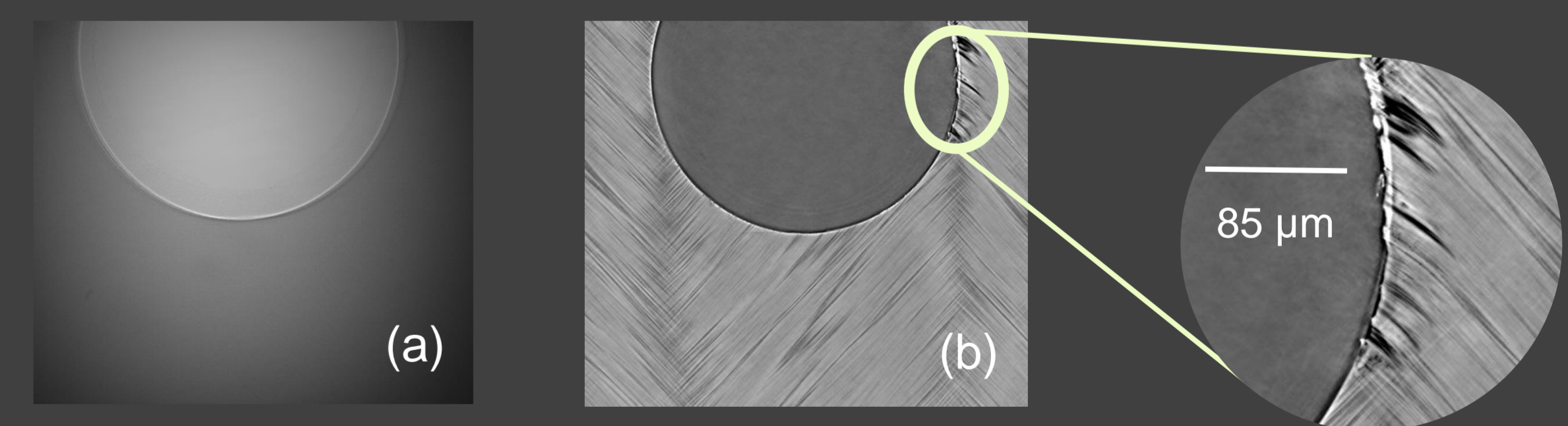


Fig 4: CFRP image with free propagation method : 2D projection (a) ; slice from the 3D reconstruction (b) [5;7]

- The ID19 setup gives us a larger inspection area
- More sensitive to strong optical index variation

On the one hand, 2D and **3D synchrotron** measurements offer a **large inspection area**, and **sensitivity to strong optical index variation** which is interesting to detect lightning damage especially at the interface screw/CFRP.

On the other hand, the **laboratory bench**, with MLSI method, is more **convenient** to use. It allows to extract the phase, thus **attenuation and phase image** offer complementary information. As a result, 2D projection is able to evidence a lightning damage. Furthermore, the carbon fiber orientation appears clearly on 2D projection thanks to Fourier demodulation. Thus, the future work will be to **adapt the laboratory bench to tomography measurement**, taking advantage of both higher sensitivity to fiber orientation and accessibility.