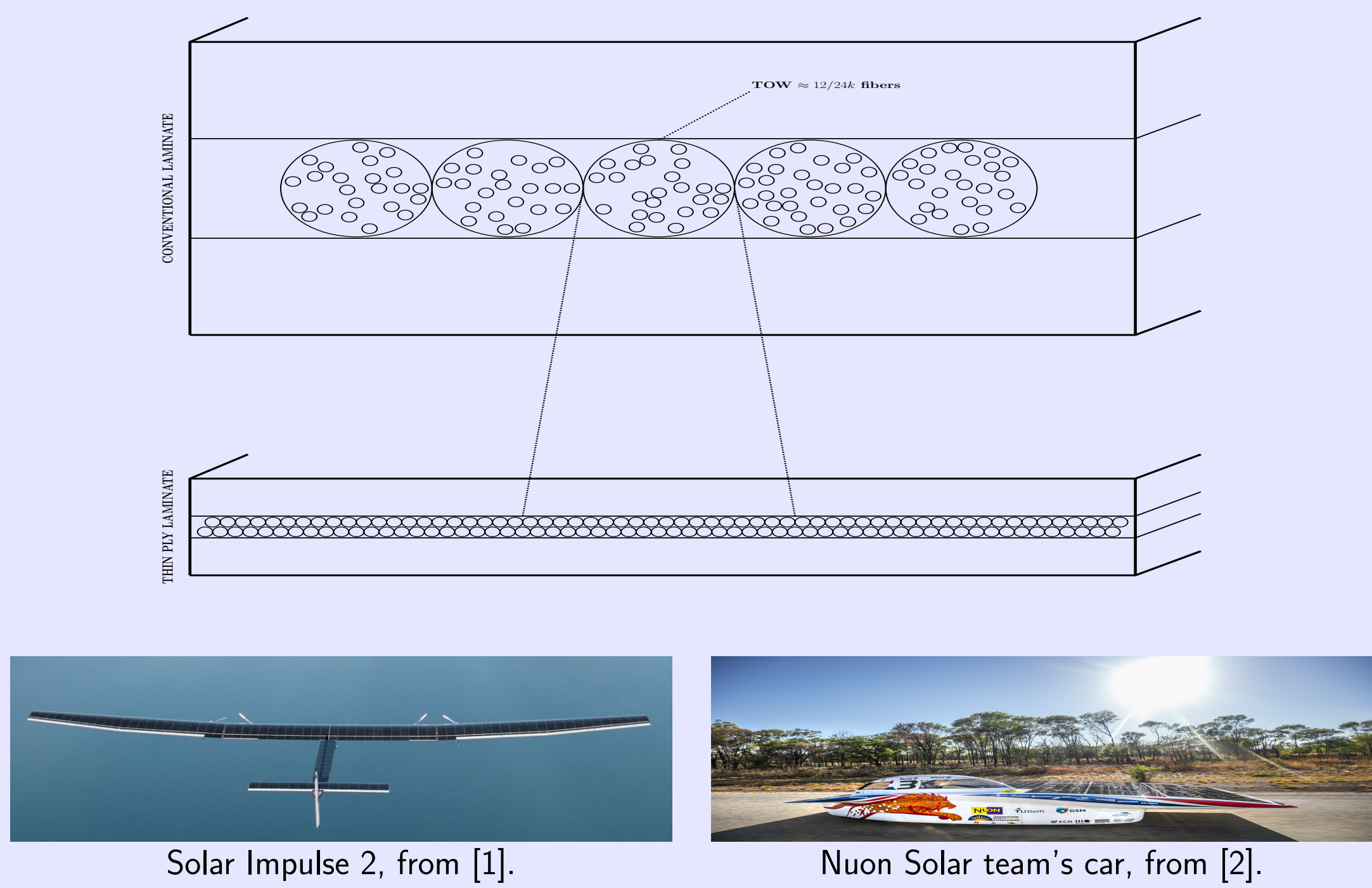


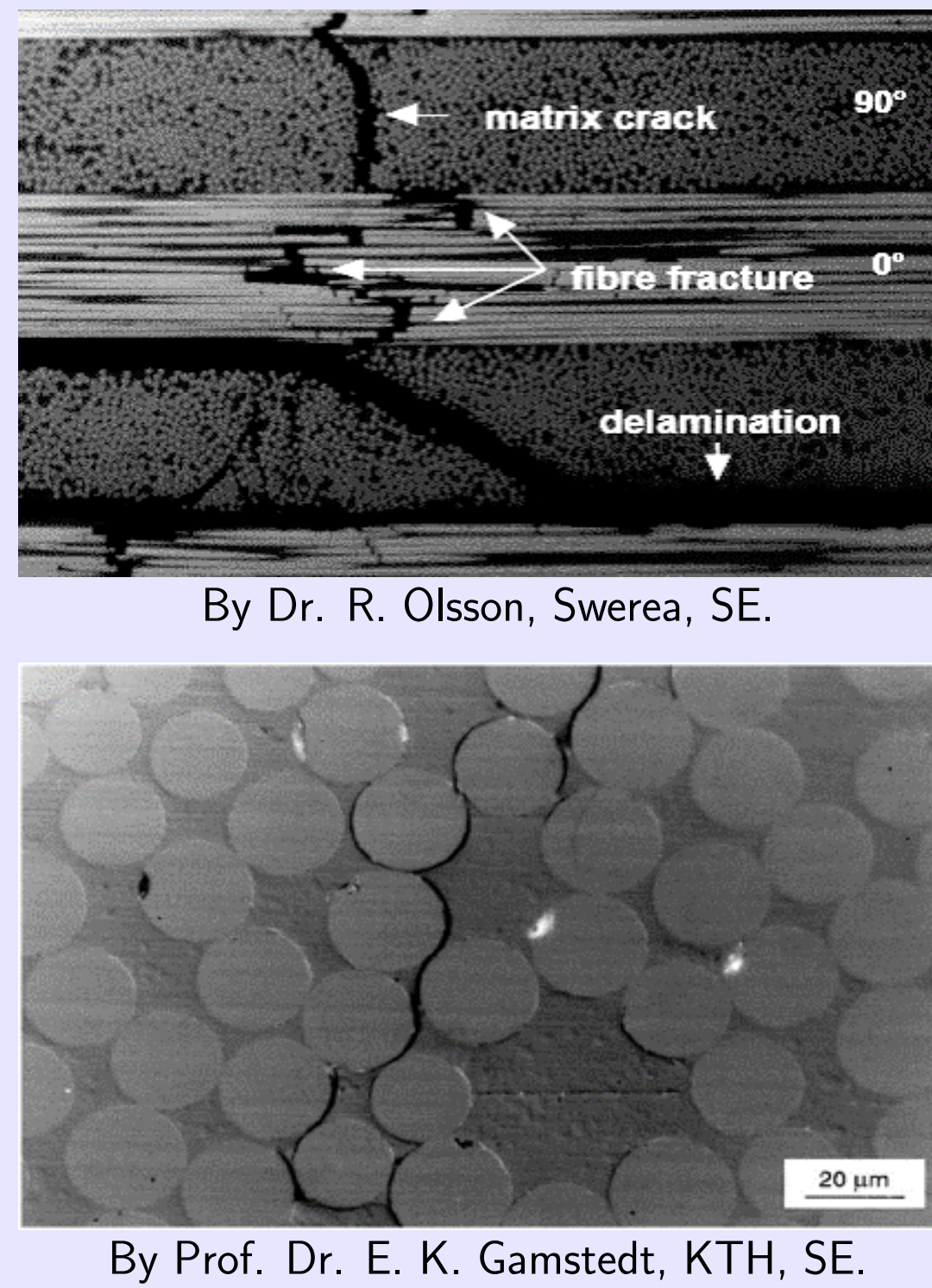
Micromechanical Models of Transverse Cracking in Ultra-thin Fiber-Reinforced Composite Laminates

Ultra-thin Fiber Reinforced Polymer Composite (FRPC) Laminates: an Introduction

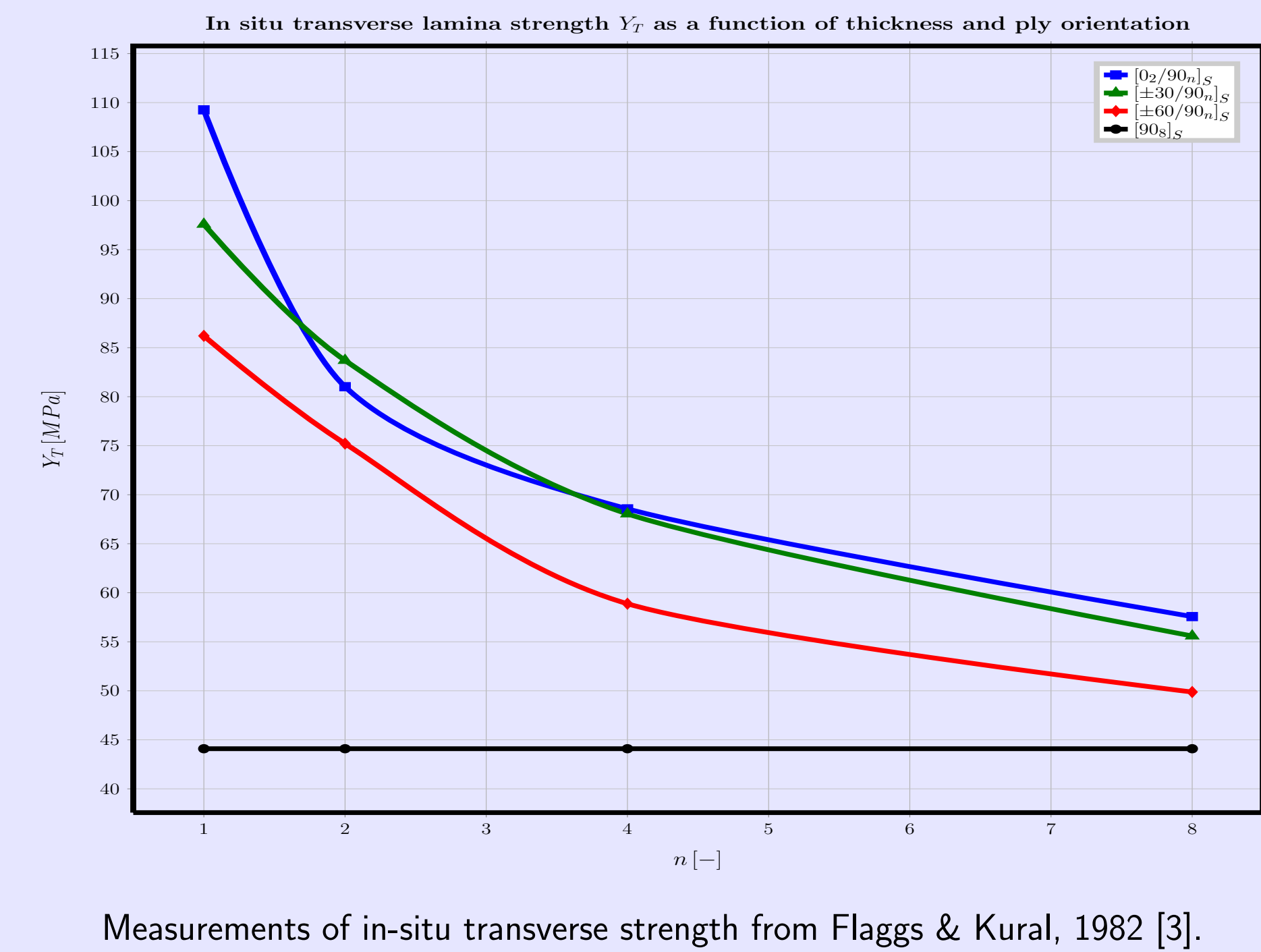
Technological origins and applications



Damage in FRPCs: a visual introduction



The thin ply effect



Objectives & Approach

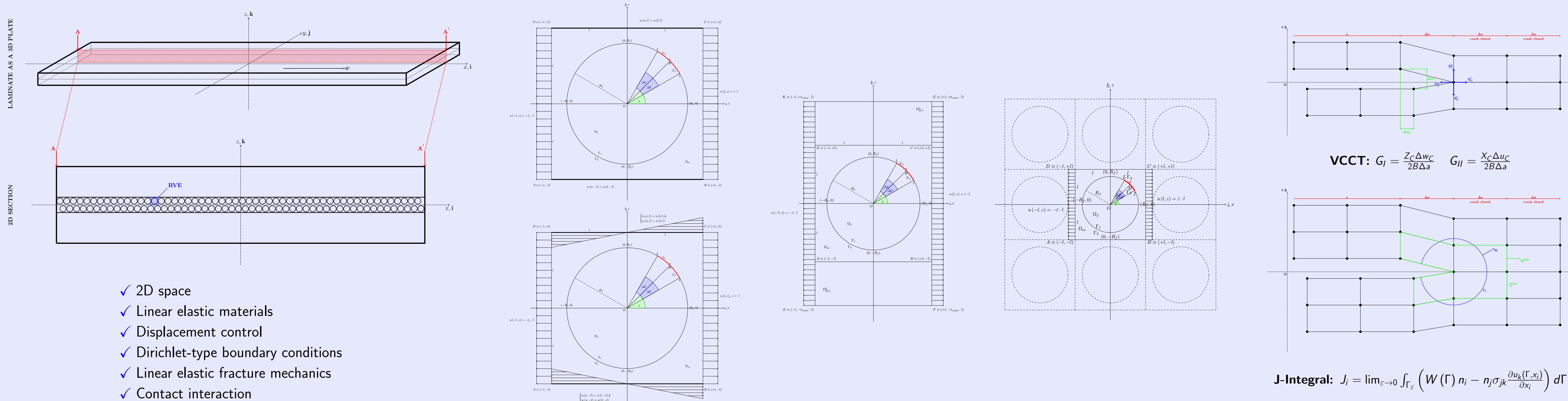
What do we want to achieve?

- Investigate the influence of volume fraction, material properties, thin ply thickness and bounding plies' thicknesses on crack initiation
- $G_{*c} = G_{*c}(\theta_{debond}, \Delta\theta_{debond}, E(\cdot), \nu(\cdot), G(), VF_f, t_{ply}, \frac{t_{ply}}{t_{bounding\ plies}})$

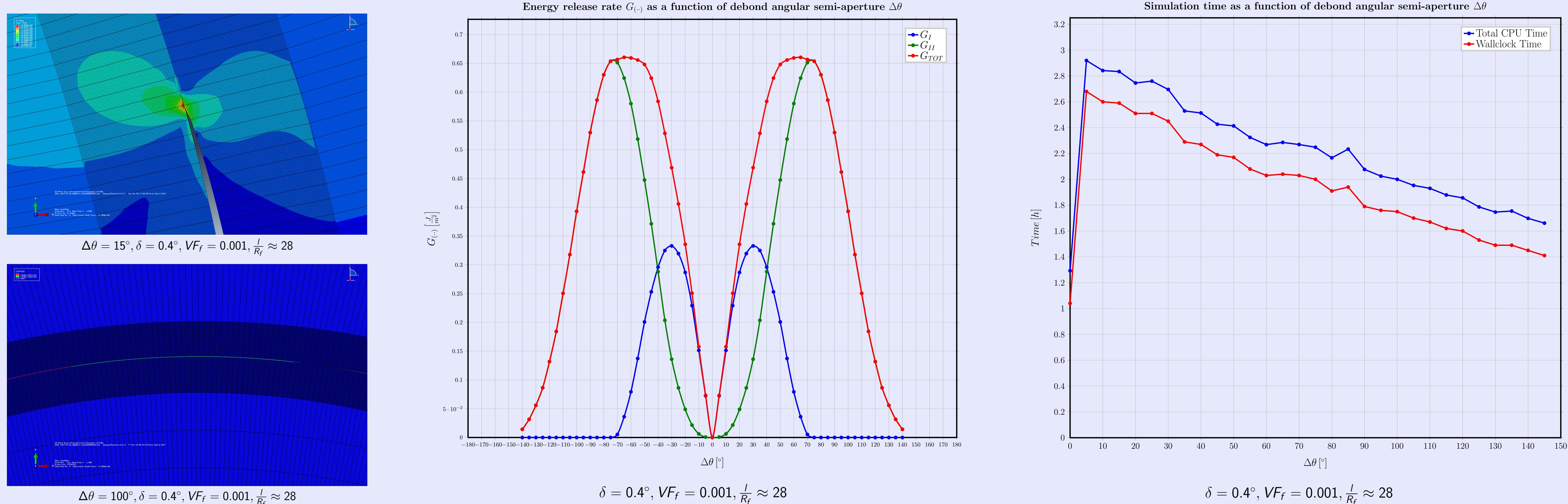
How do we want to achieve it?

- Design and categorization of several Representative Volume Elements (RVEs)
- Automated generation of RVEs geometry and FEM model
- Finite Element Simulations (in Abaqus)

Design & Analysis of Representative Volume Elements (RVEs)



Preliminary Results & Validation



Conclusions & Perspectives

What has been accomplished?

- 2D micromechanical models have been developed to investigate crack initiation in thin ply laminates
- A numerical procedure has been devised and implemented to automatize the creation of FEM models
- Validation for $VF_f \rightarrow 0$ (matrix dominated RVE) with respect to previous literature [4, 5]

What's next?

- Investigate the dependence on VF_f , t_{ply} , $t_{ply}/t_{bounding\ plies}$ and different material systems
- Study numerical performances with respect to model's parameters
- Repeat for different RVEs and compare

Acknowledgements

The support of the European Commission through the Erasmus Mundus Programme is thankfully acknowledged.

References

- NTPT makes world's thinnest prepreg even thinner. (2017, February 10). Retrieved from <http://www.thinplytechnology.com/news-159-ntpta-makes-world-s-thinnest-prepreg-even-thinner>
- oXeon TECHNOLOGIES. (2017, February 10). Retrieved from <http://oxeon.se/technologies/>
- Donald L. Flagg, Murat H. Kural: Experimental Determination of the In Situ Transverse Lamina Strength in Graphite/Epoxy Laminates. *Journal of Composite Materials*, 1982; 16(2).
- Toya, M.; A crack along the interface of a circular inclusion embedded in an infinite solid. *Journal of the Mechanics and Physics of Solids*, 1974; 22(5), pp. 325-348.
- Paris, F., Cano, J., and Varna, J.; The fiber-matrix interface crack - a numerical analysis using boundary elements. *Int. J. Fract.*, 1990; 82(1), pp. 11-29.