3D X-Ray Machine Vision for Better Catalysts

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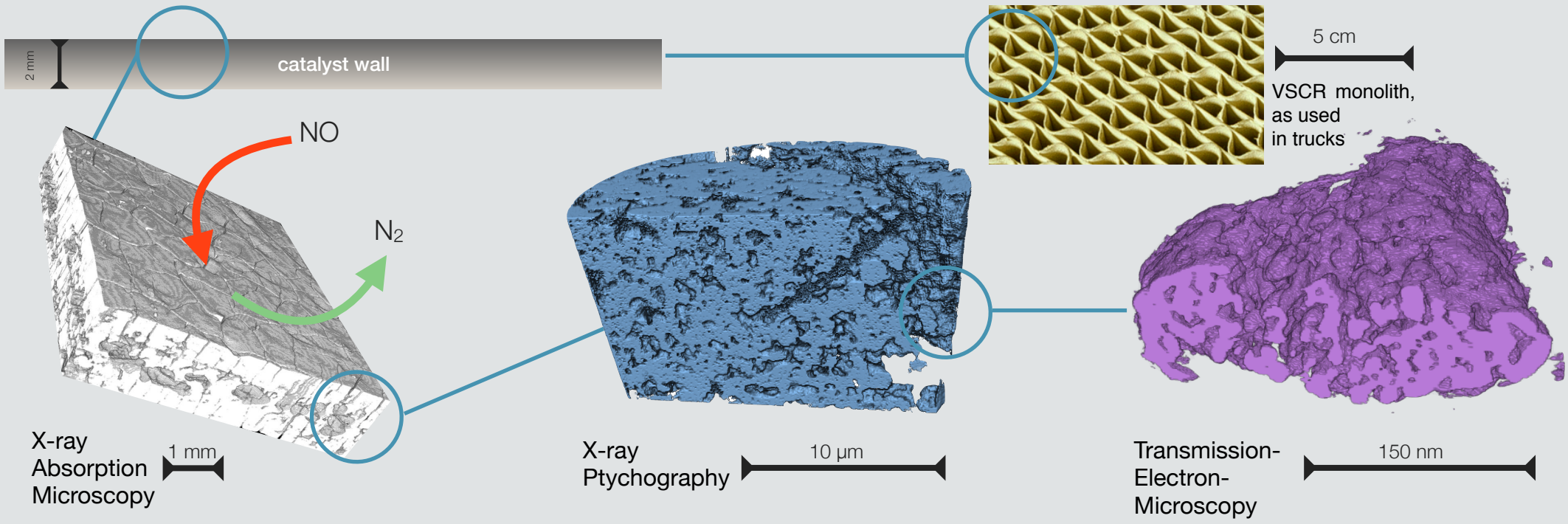
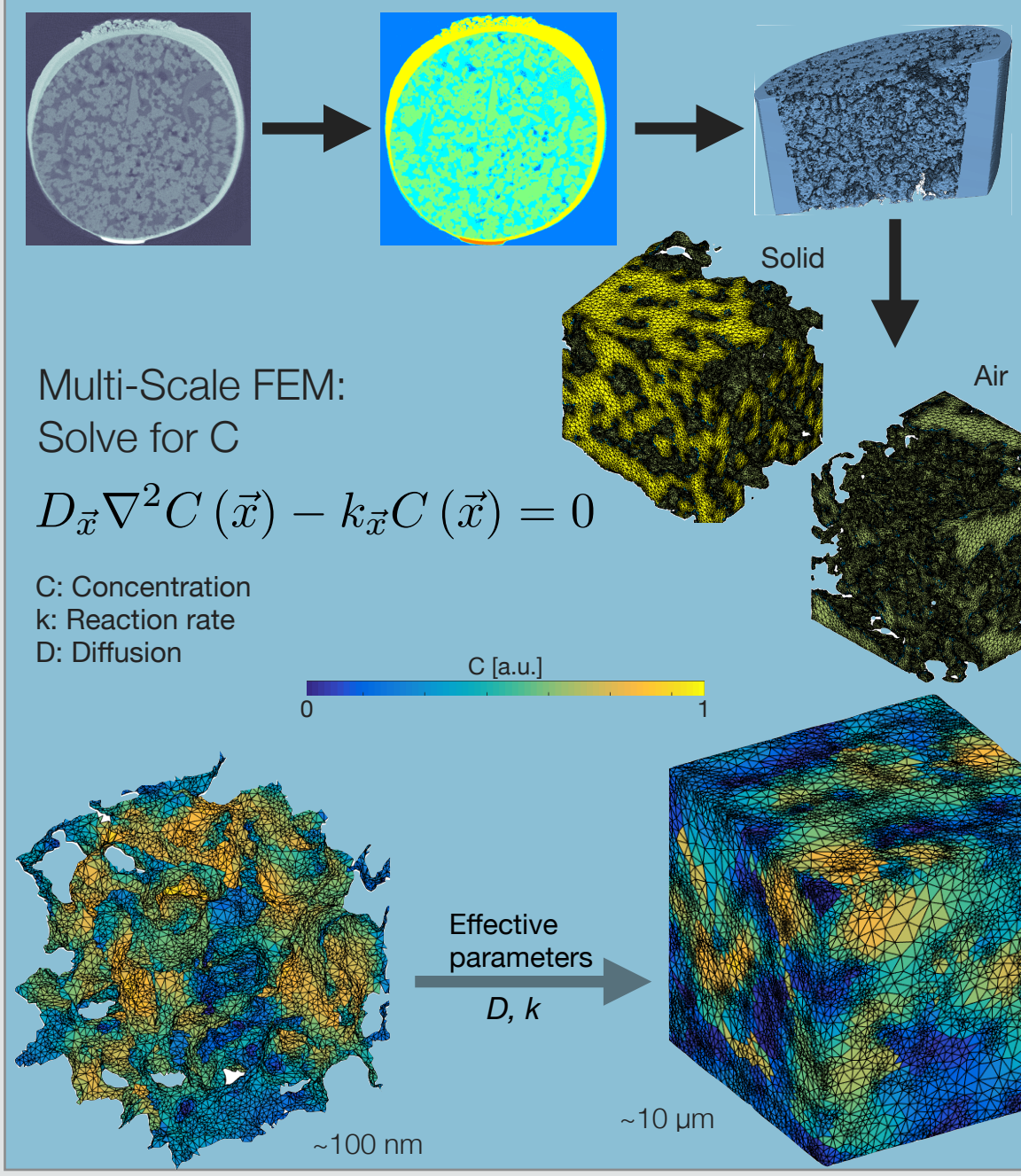
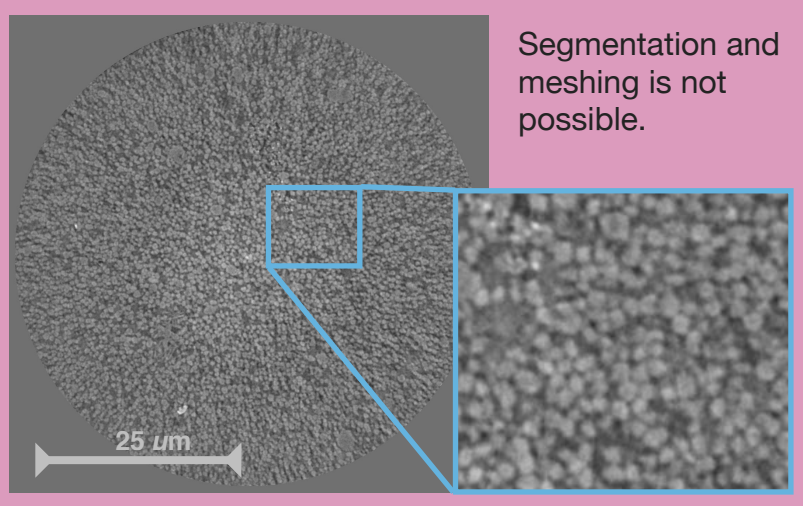
In Heterogenous Catalysis, the catalyst is typically a solid which enhances the reactions of fluids or gases. Since this is a surface reaction, one tries to increase the surface area by dispersing the catalyst over a very porous material or choosing a catalyst which naturally has this property. Along with the pure chemical reaction speed, the structure of the pores has a major influence on the the activity. For instance, very small pores enhance the surface area per volume, but may create serious diffusion barriers. Bad connectivity can limit the access to large parts of the catalyst. Many of those phenomena are intrinsically 3D, which means a full understanding requires 3D characterisation techniques, such as X-ray or electron-tomography. We develop characterisation and simulation techniques to enable rational design and rapid prototyping of future catalyst materials.



Imaging - Segmentation - Meshing - Simulation [1]

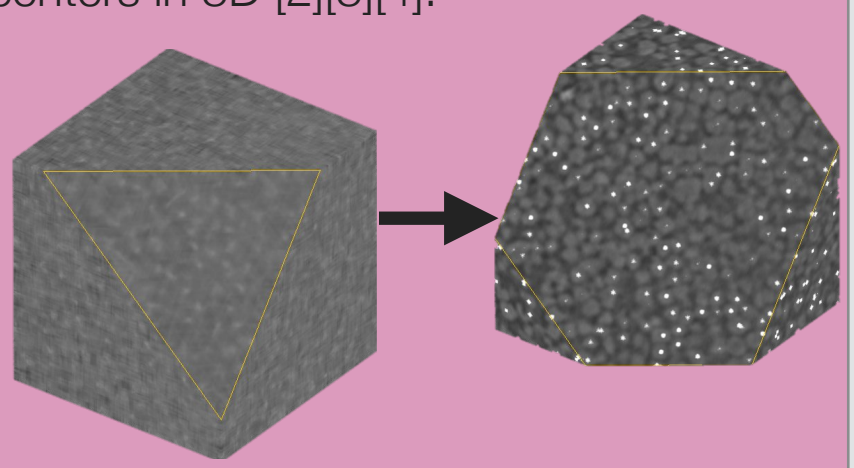


Characterisation with low resolution



Segmentation and meshing is not possible.

Use Supervised Learning based on a dictionary method to find the particle centers in 3D [2][3][4]:



Analyse spacing statistics, build discrete element model…

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Funding:
Innovation Fund Denmark
Haldor Topsoe A/S
Niels Bohr Institute

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