Soft Matter & Polymers: Grand Challenges

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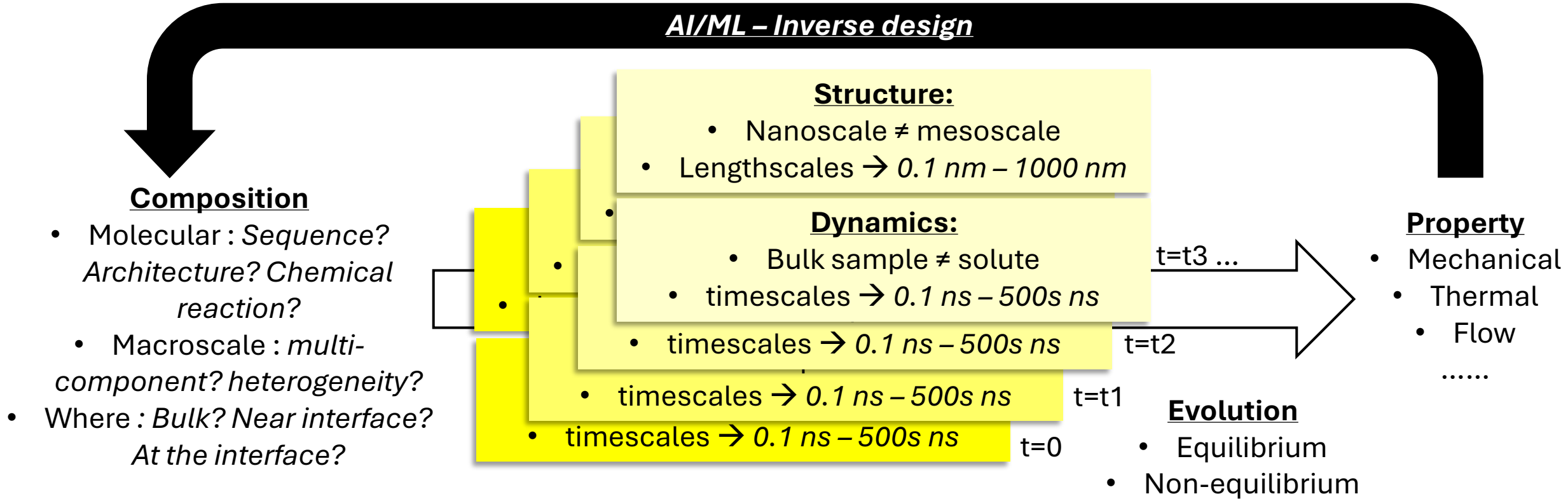
“Decoding complexity in bulk, boundaries & beyond to make next generation sustainable and multifunctional materials”

Big picture - Why complexity?



Why STS?
- High flux – smaller samples!
- HTS/ Rastering?
- H/D contrast

Why STS?
- Cold neutrons – larger Q-range!
- Cold neutrons – larger dynamical range!
- Time-of-flight – event mode data acquisition

Why STS?
- *Flexible sample environments*
- *In-operando measurements*
- *Simultaneous measurements?*

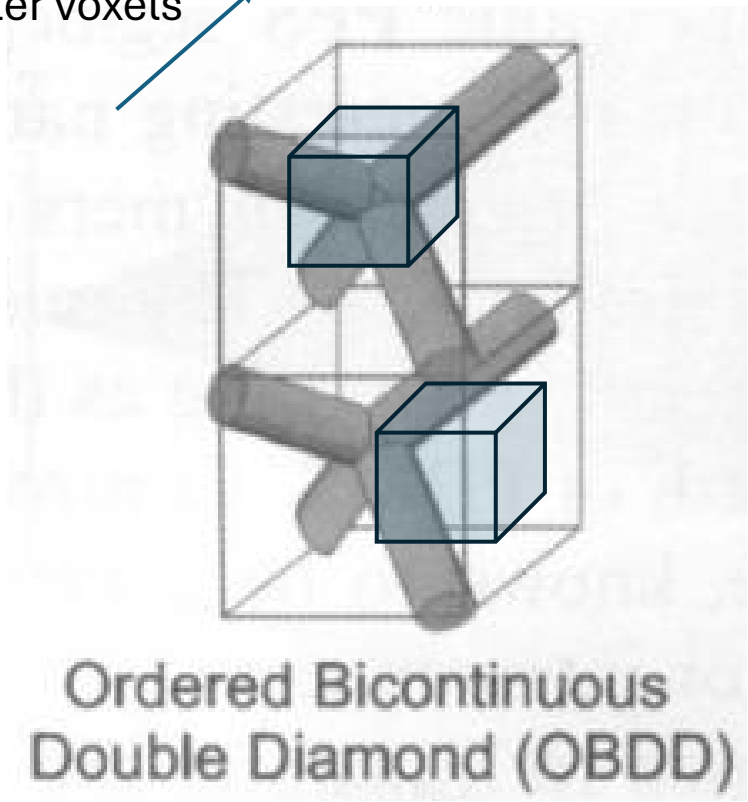
Soft Matter & Polymers: Grand challenges

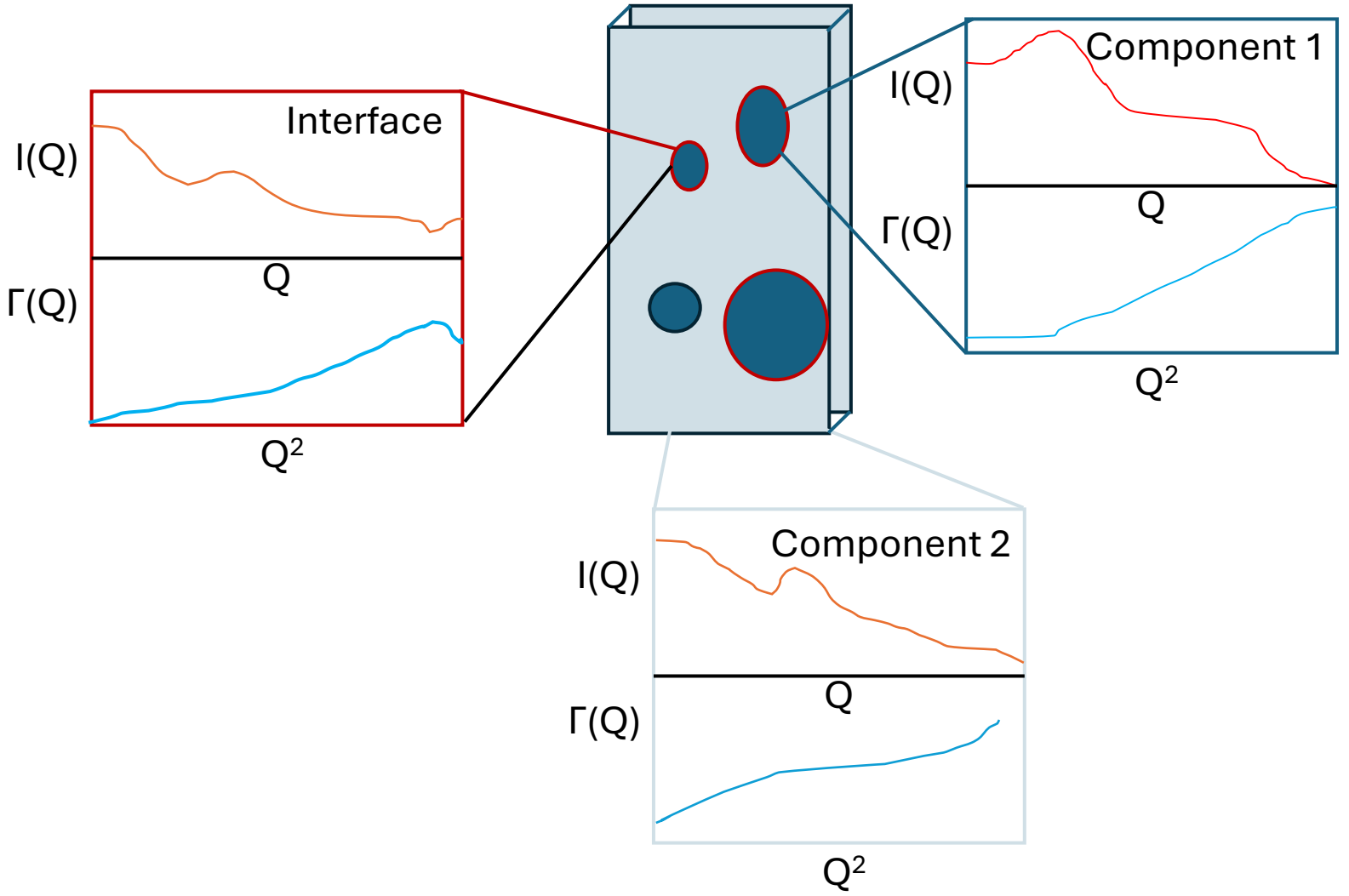
	Challenge statement	Goal	Why uniquely STS?	Product
Sustainable materials	*"Build ecosystems where all materials involved are green, recyclable, and/or compostable for a healthy environment."*	Circular economy	Wider Q-range with greater sensitivity at low frequencies	Reconfigurable materials
Multifunctional materials	*"Process-dependent material properties (kinetics) understood across time and length-scales (structure & dynamics)"*	Additive manufacturing of multi-functional materials	Multi-modal and in-operando measurements	Soft robotics
Evolution theory	*"Learn and predict soft matter evolution using neutron-validated datasets"*	Water in biological and technological contexts	Small beam sizes, high flux, rapid data collection	Hydrogen economy

Inverse design of artificial enzymes, recyclable reconfigurable polymers and nanocomposites, and designer membranes

Game changing experiments

Raster voxels





Simultaneous SANS/NSE tomography ? Leverage polarization of neutrons for both static and dynamic measurements?