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The Exposome of Structures

Living to the limits; ageing well

Neil Bourne

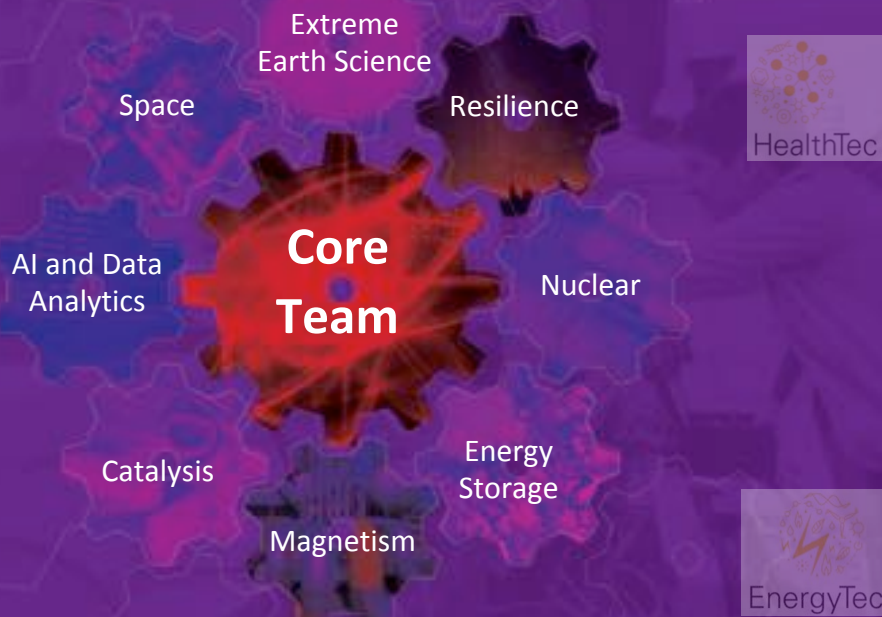
Director

*The University of Manchester at Harwell & The Thomas Ashton Institute
Harwell Campus, Didcot, Oxfordshire, OX11 0DE, UK.*

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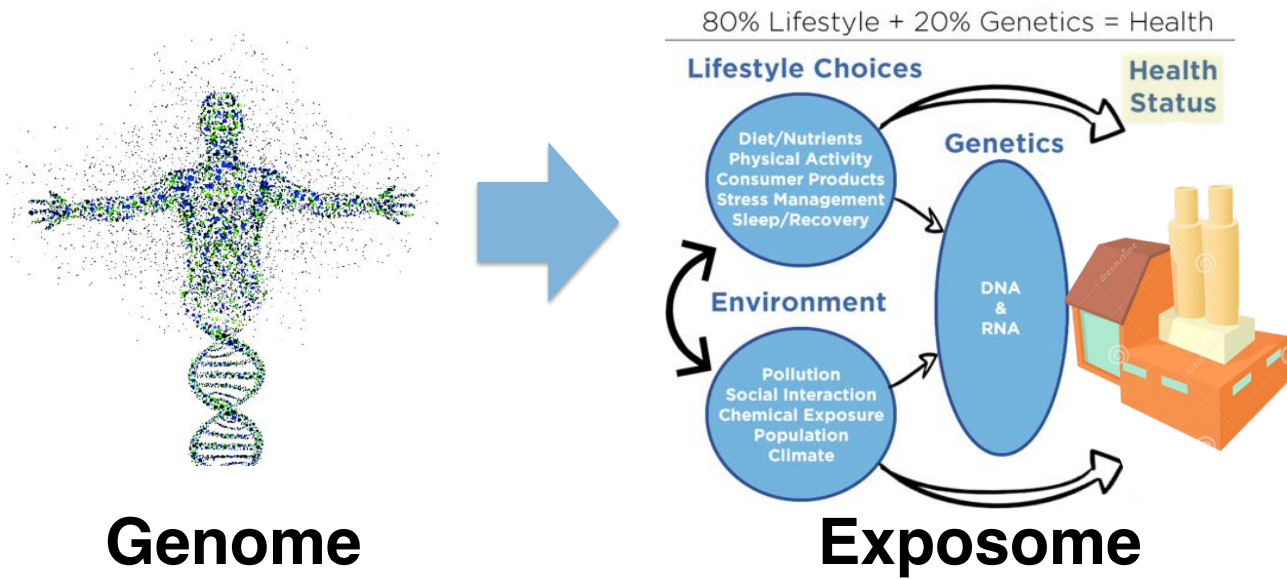






The exposome of structures

Wild, CP (2005) *Cancer Epid.*



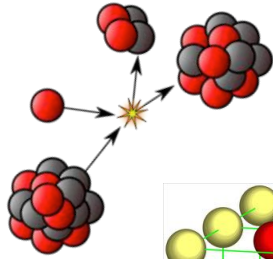


The exposome of structures

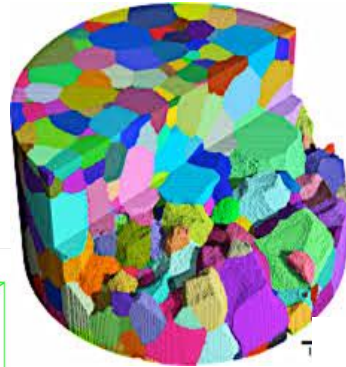
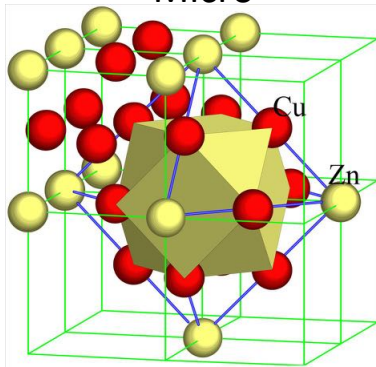
- Quantum of behaviour
Defining the genome of the mesostructure
- Defining the problem
Applying the right exposome
- Using the tools
A new path to assurance?
- Closure

Representative structures

Nuclear

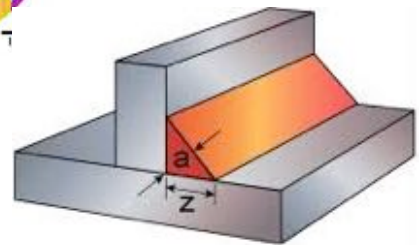


Micro



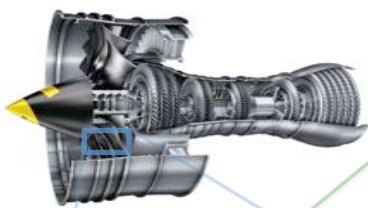
Meso

Macro

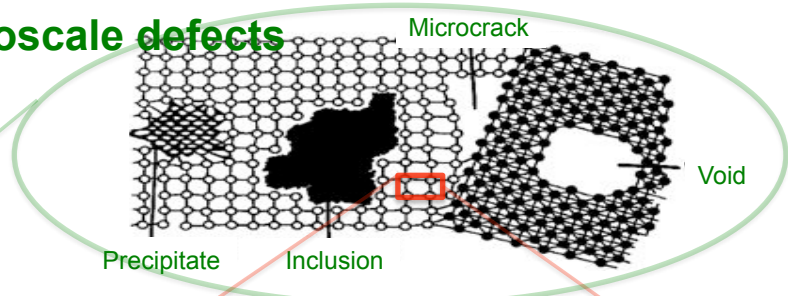


Defects in components

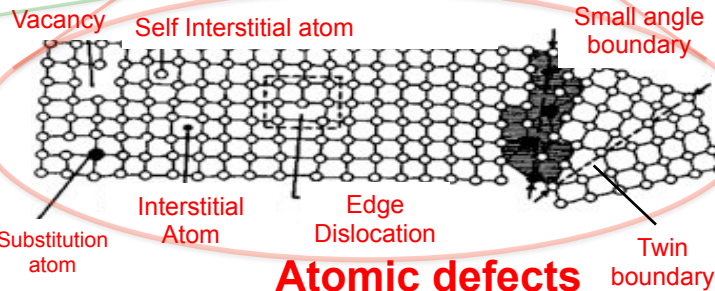
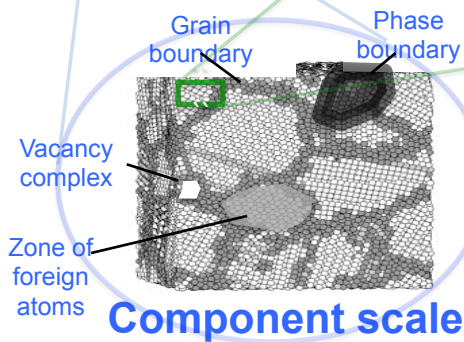
Macroscale



Mesoscale defects

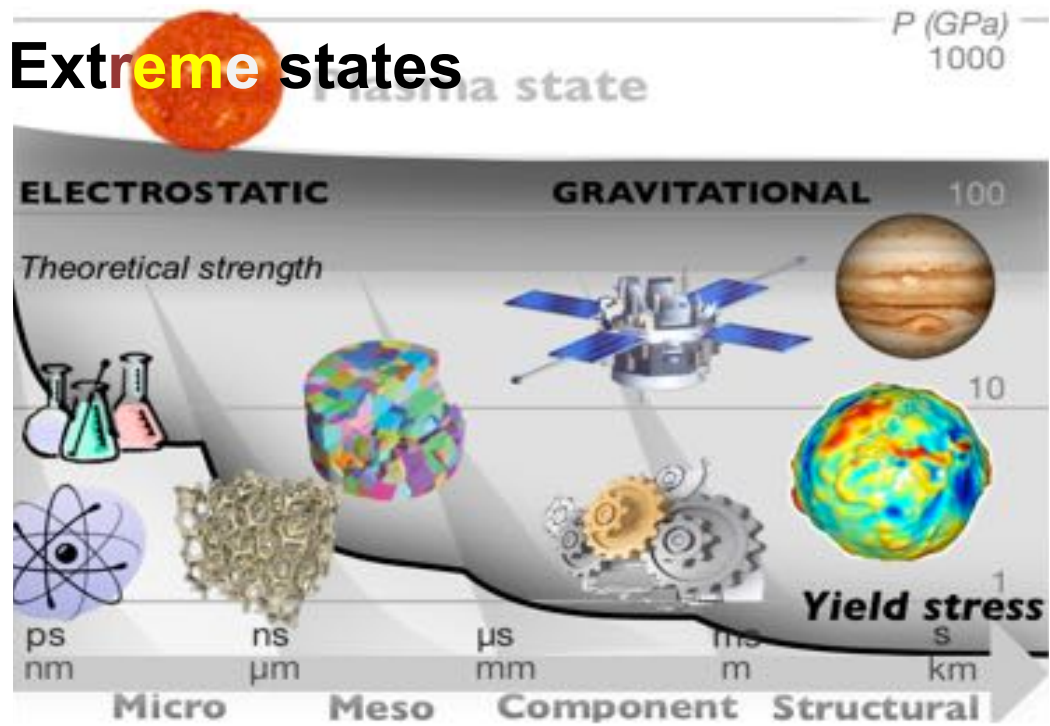
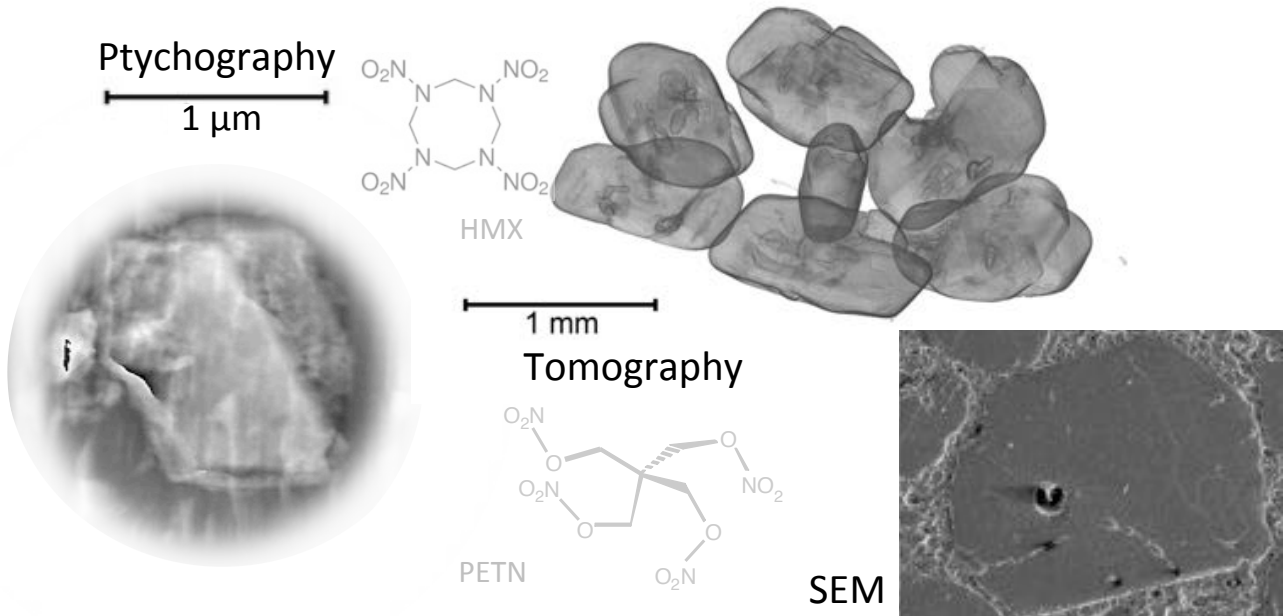


Component scale

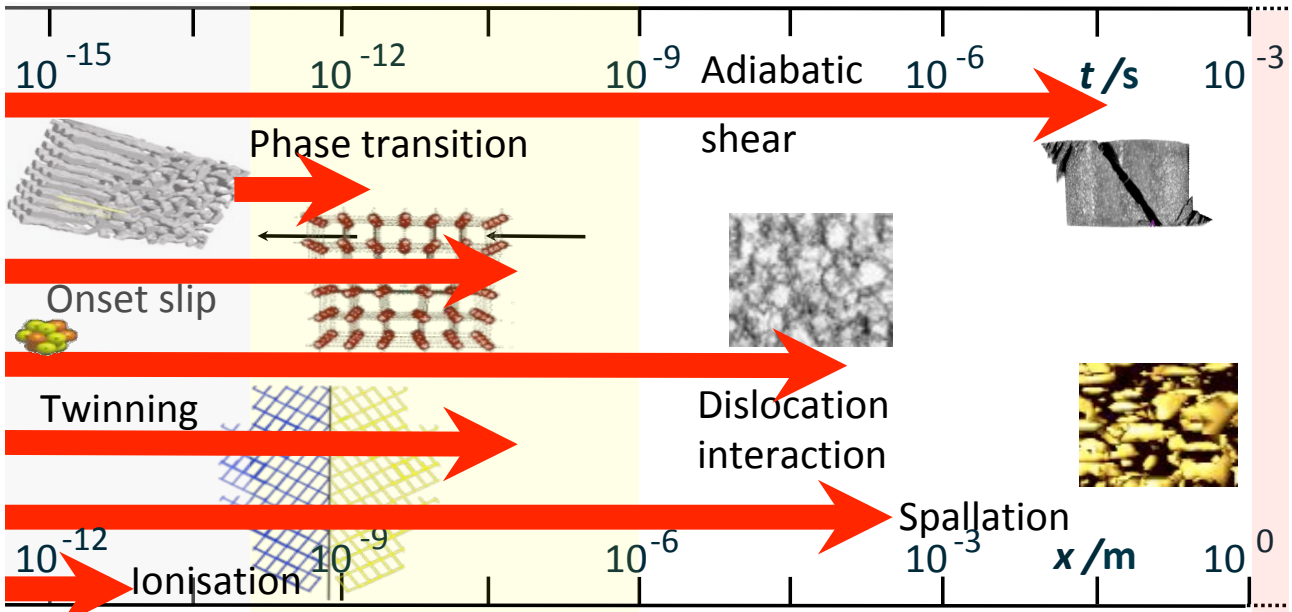


Atomic defects

Imaging defects in HMX

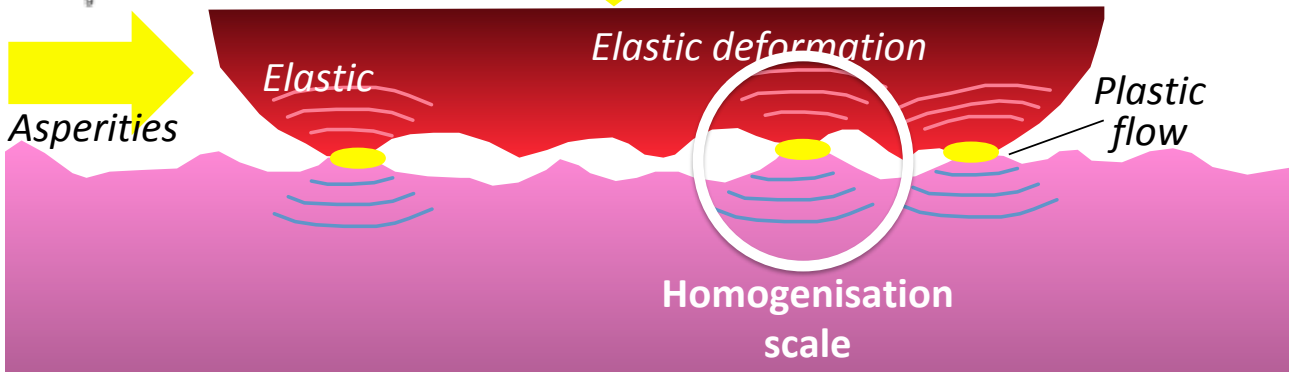
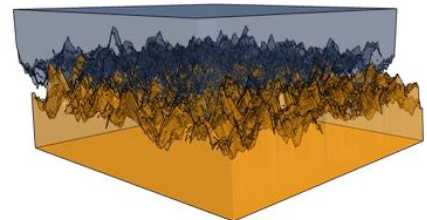
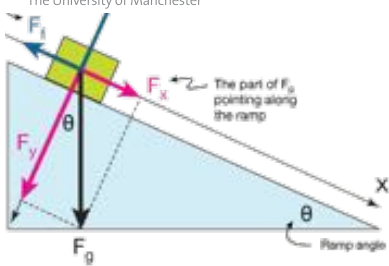


Deformation mechanisms



Friction mechanisms

$$F = \mu R$$



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RVE Meta-Imaging across the states

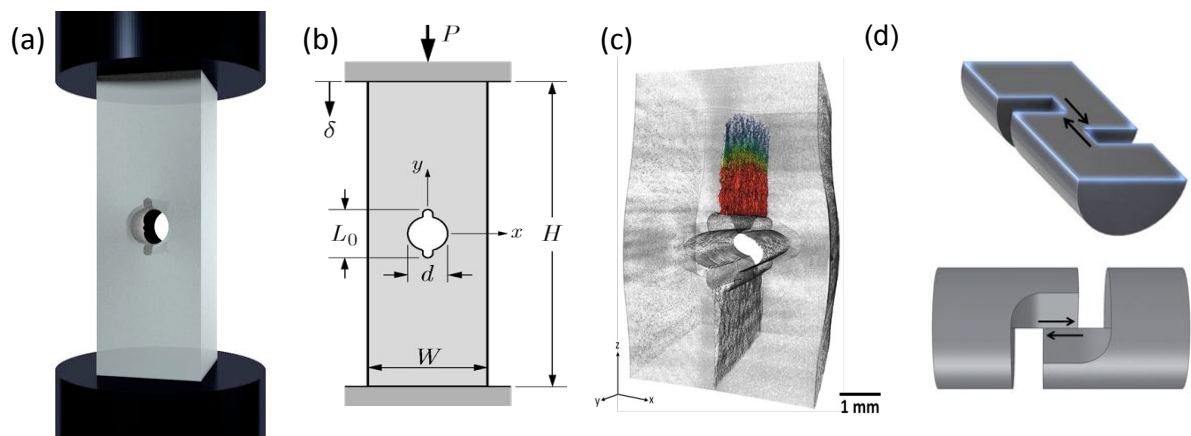
- $\Sigma(\mathbf{r}, P, T, e, l, m, t, t)$
- Matter
- States
- Defects

Micro \Rightarrow Macro

$\Sigma(\mathbf{r}, P, T, e, l, m, t, t)$

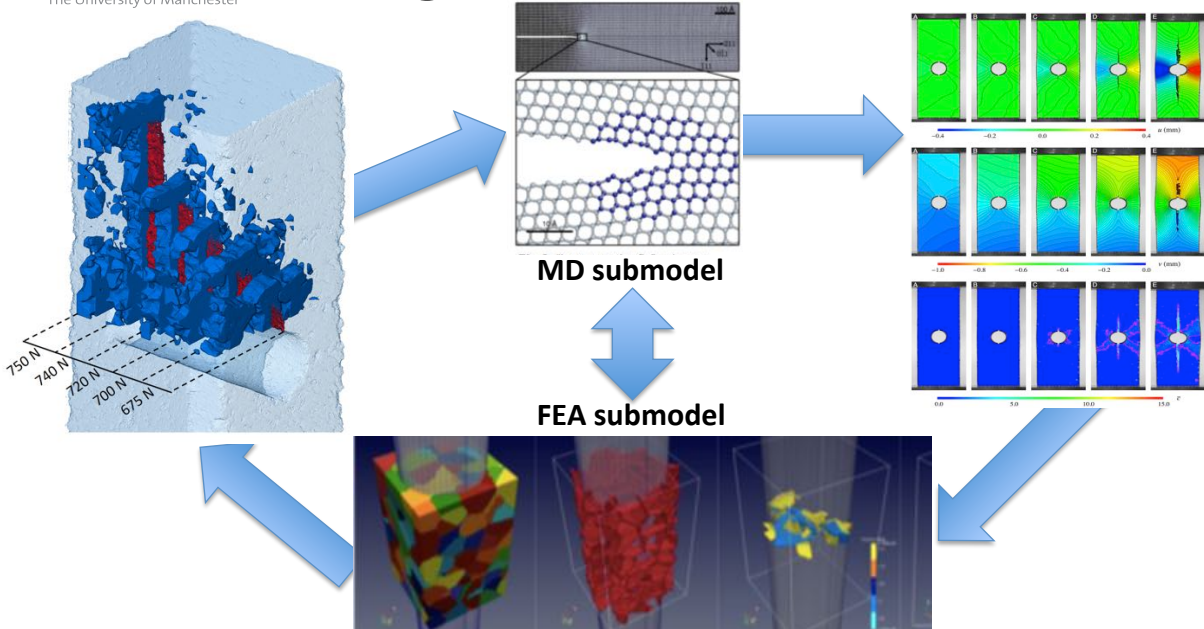
Combine sources, techniques and analysis to reveal chemical, mechanical, biological states to map the *genome of structures*

Mesoscale failure mapping tools

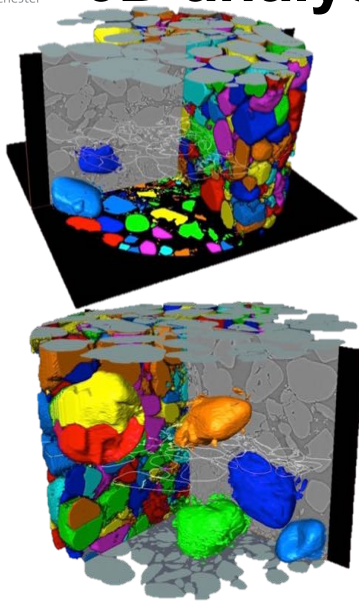


- Sammis & Ashby (1986)
- Gray, Vecchio, Livescu (2016)

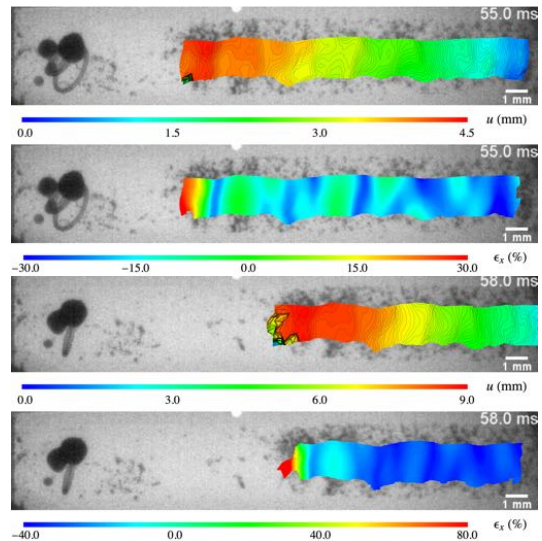
Designing for fracture



6D analysis: XCT+ DIC + sensors

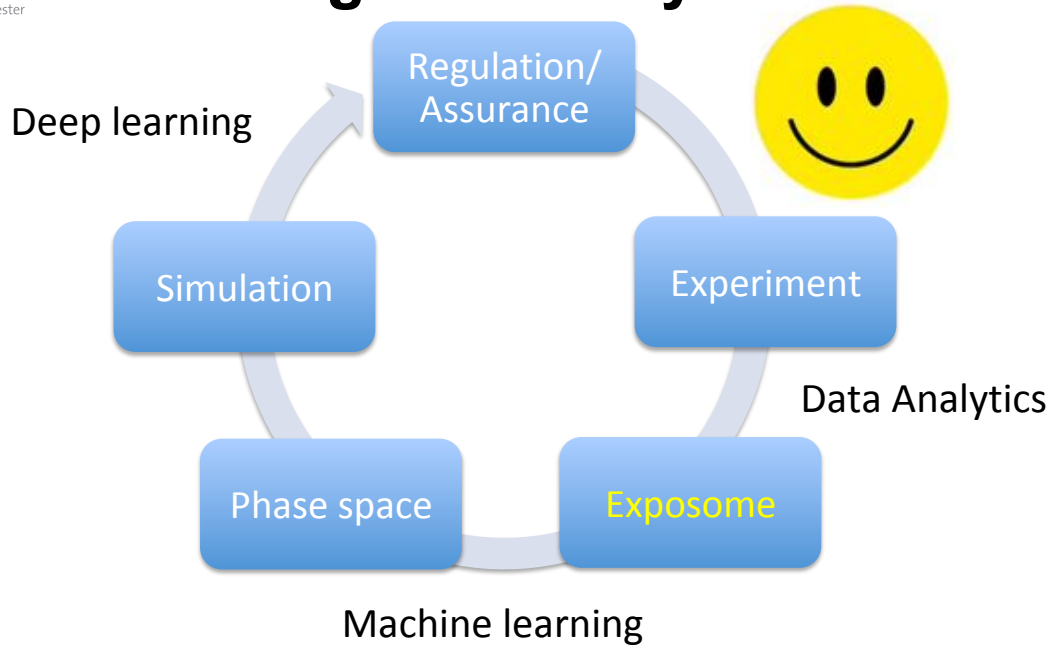


Defining the structure



Defining the response

Delivering *all* healthy structures



Closure

- **Quantum of behaviour**
Representative RVE to capture failure
Idealised experiments span relevant mechanisms in limits of scale/load
- **Creating the exposome**
Automated probe for the phase space
Scales span force fields and academic disciplines
*Applying the **exposome***
- **Use the tools to reach safe structures**
A new path to assurance?

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Colloquium: *Living to the limits; ageing well*



Starts: 15:00 **27th September 2019**

Ends: 17:00 27 Sep 2019

What is it: Lecture

Organiser: The University of Manchester at Harwell

Who is it for: University staff, External researchers, Adults, Alumni, Current University students

www.harwell.manchester.ac.uk

Remote Monitoring in Extreme or Hazardous Environments

Managing Risks from Ageing Infrastructure.

UoM, UK Hazard Forum, SARS, TWI, Oil & Gas Technology Centre, HSE (& partners)

Wednesday 29th January 2020

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