Planning the Chemical and Energy Sciences Community at the NSLS-II

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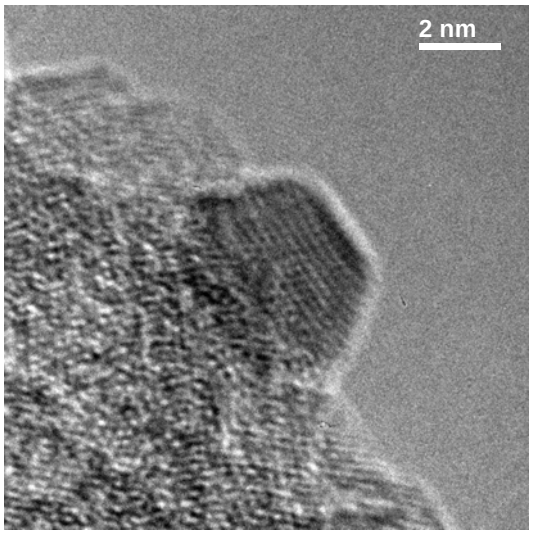
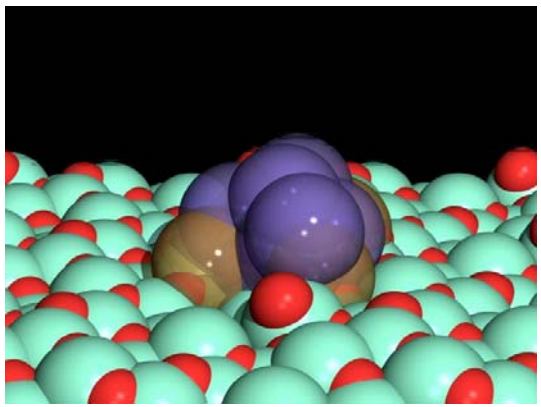
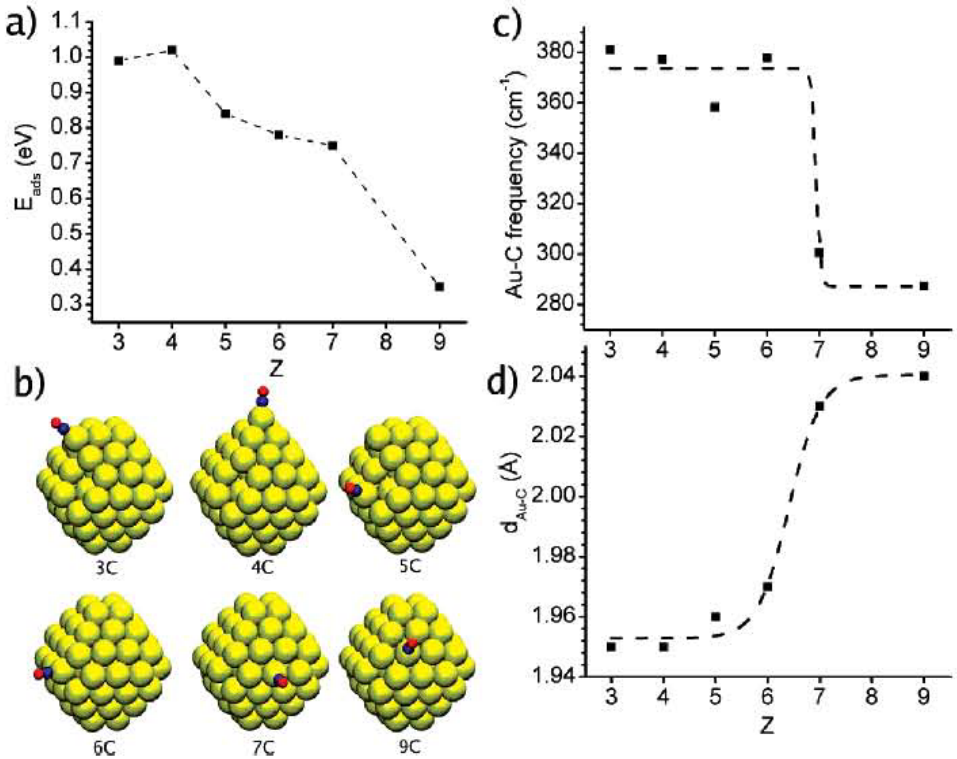
Improvements of spatial and temporal resolution of x-ray probe are needed, combined with conditions for in situ and operando experiments with real samples





Dynamic structure of supported Pt nanoparticles (R. Nuzzo, AIF, J. Rehr, et al)



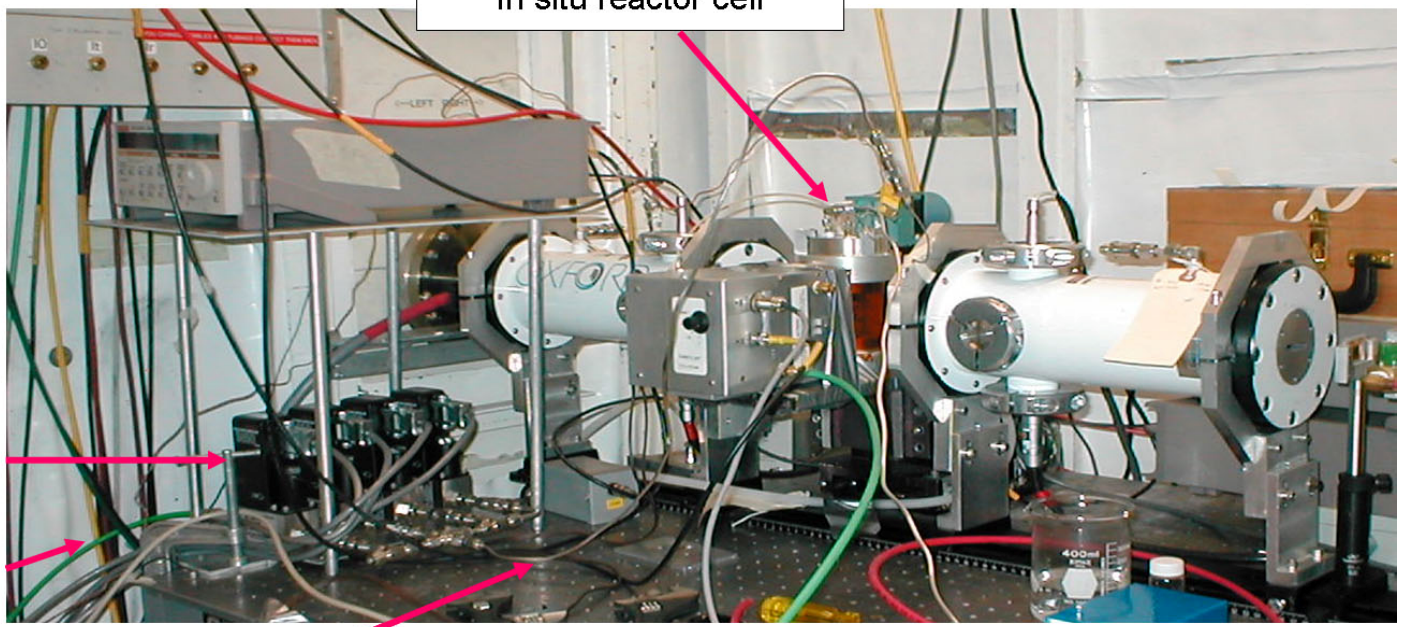
Dynamic shape change of Au nanoparticles by CO adsorption (K. McKenna and A. Shluger)

SCC beamlines (X18B/X19A):

Flow control electronics, gas cylinders (outside the hutch)

Flow controllers

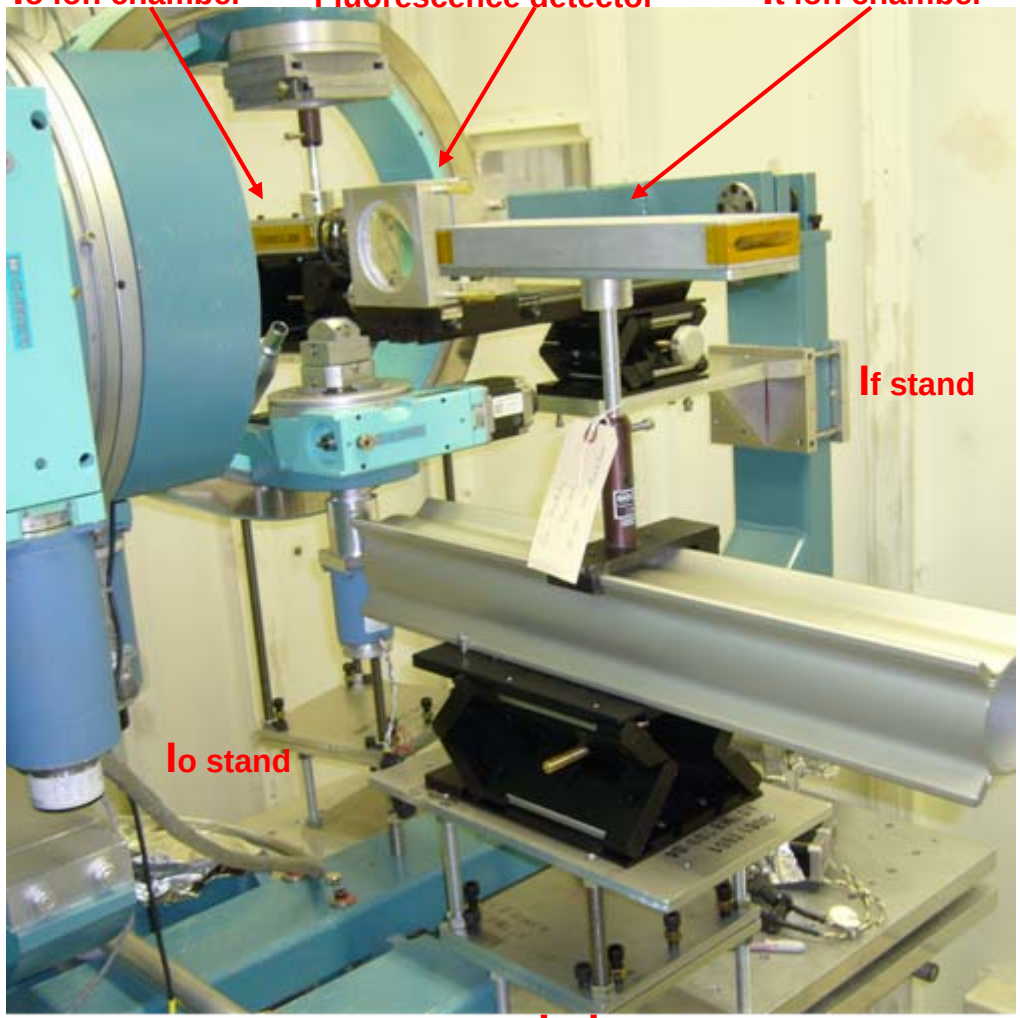
Gas inputs



Mixed gas output

RGA (MS and GC): Inside the hutch

A recent addition:
Quick, Combined,
XAFS/XRD on X18A
beamline



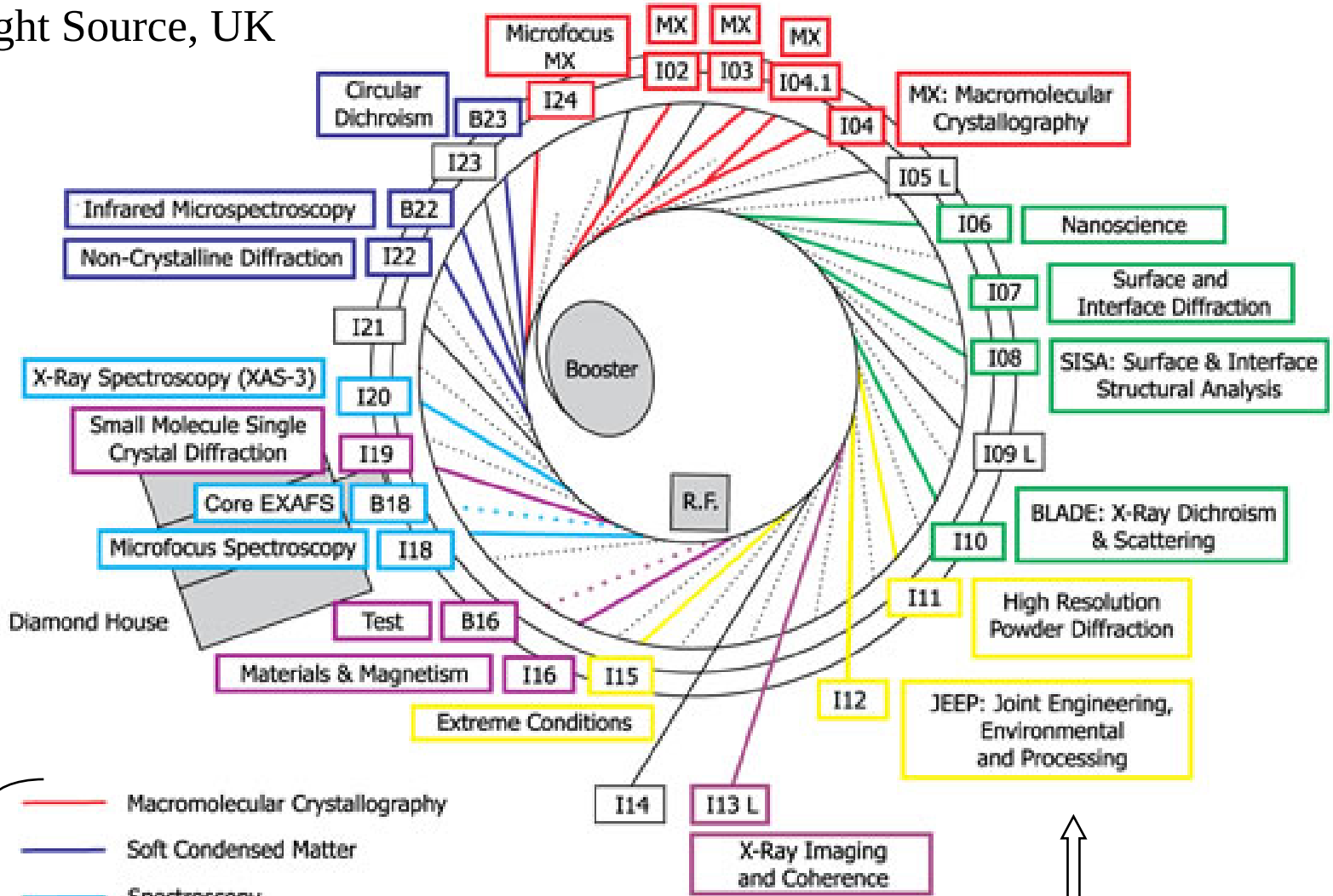
Diamond Light Source, UK

Grand Challenges:

"What science can be done with 10nm focal spots and 1 meV energy resolutions?"

- Imaging and spectroscopy of individual nanoparticles (among other examples)

Diamond Light Source, UK



Science & technique ("villages")

Techniques and instruments

Proposed approach:

I. **Highly specialized** beamlines, optimized for best performance in a range of parameters.

Chemical & Energy Sciences Consortium (SCC-II)

User support, infrastructure for in situ and operando experiments (e.g., reactors, gas handling, RGA)

"Fast" kinetics	Complex spatial metrics	Dilute concentrations	Bimetallic nanoalloys	Single nanopartilce spectroscopy	In situ surface structure & reactivity:	?
quick-scanning mono (0.1s or better) + high flux	high energy, +high flux	high flux	high flux, large energy range	nm focal spot size, high flux + energy scanning	XPS analyzer, high flux	
⇩	⇩	⇩		⇩	⇩	
Quick, combined XAFS/XRD/DAFS on a 3-pole wiggler	XRD/PDF Project powder diffraction beamline on an undulator	Project XAS beamline on a damping wiggler		Project Nanoprobe beamline on an undulator	Time-resolved (ms) experiments using high pressure (<10 Torr) XPS/NEXAFS analyzer on a soft x-ray undulator	
(dedicated)	(shared)	(shared)		(shared)	**(dedicated)**	

Proposed approach (cont'd):
II. **Other** beamlines needed for CES research.

Chemical & Energy Sciences Consortium (SCC-II)

User support, infrastructure for in situ and operando experiments (e.g., reactors, gas handling, RGA)

Time-resolved kinetics
(> 1s)

Concentrated samples

Spectroscopy in tender (1-3 keV) x-ray region

?

XAS beamline on a 3-pole wiggler

(shared)

XAS beamline on soft bend (0.4 T) bending magnet

(shared)