



Energy Technology At ALBA II: New Opportunities

Presented By:

Francois Fauth

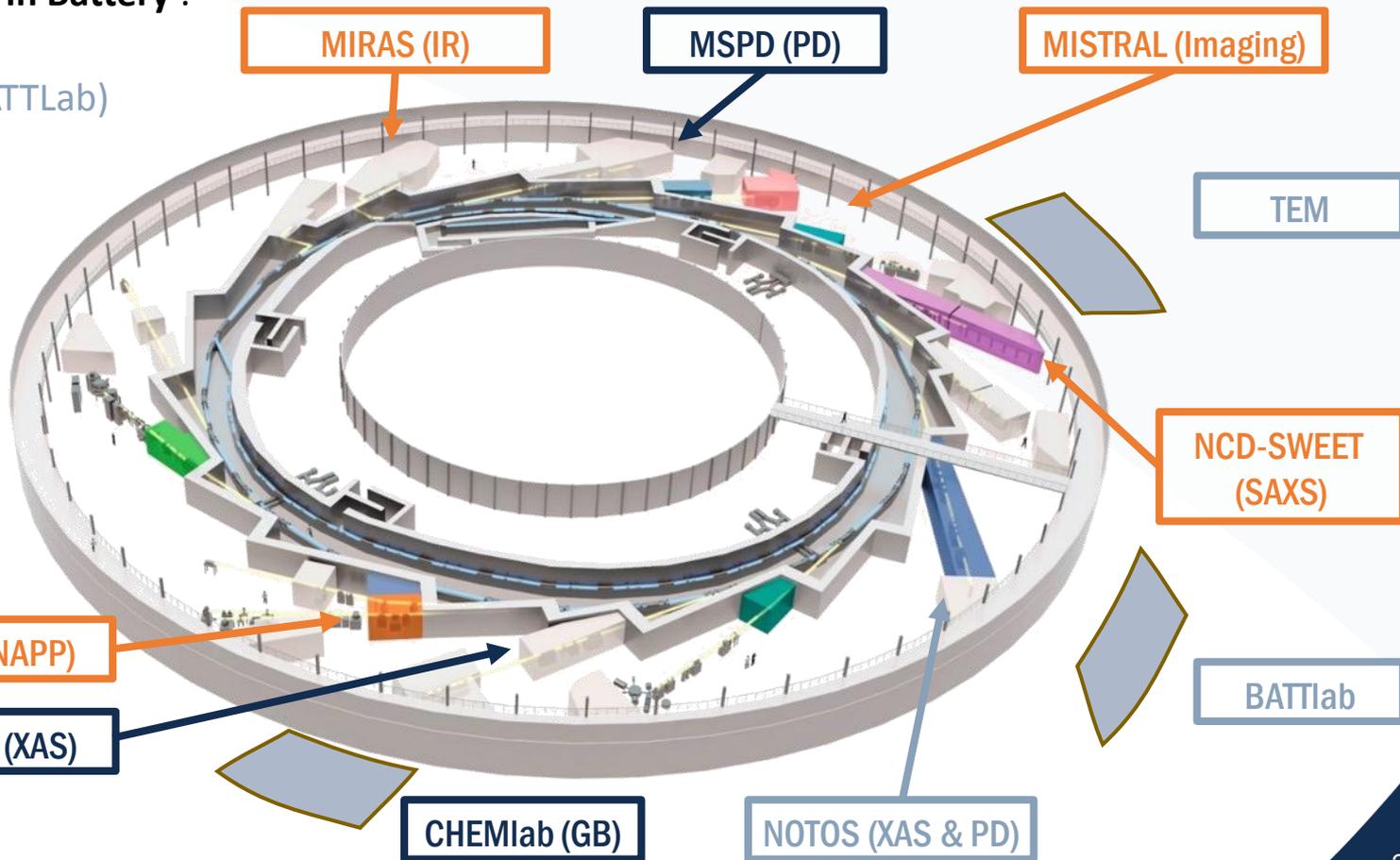
(Section Head)

Existing tools Energy Technology at ALBA

Current facilities in Battery :

2+3.5+2 BLs

- CHEMlab (BATTLab)
- TEM



Fully dedicated

Partially dedicated

In construction or discussion

FAXTOR (Tomography)

CIRCE (NAPP)

CLAESS (XAS)

CHEMlab (GB)

NOTOS (XAS & PD)

MIRAS (IR)

MSPD (PD)

MISTRAL (Imaging)

TEM

NCD-SWEET (SAXS)

BATTlab

Existing tools Energy Technology at ALBA

Current facilities in Catalysis :

2.5+3+1 BLs

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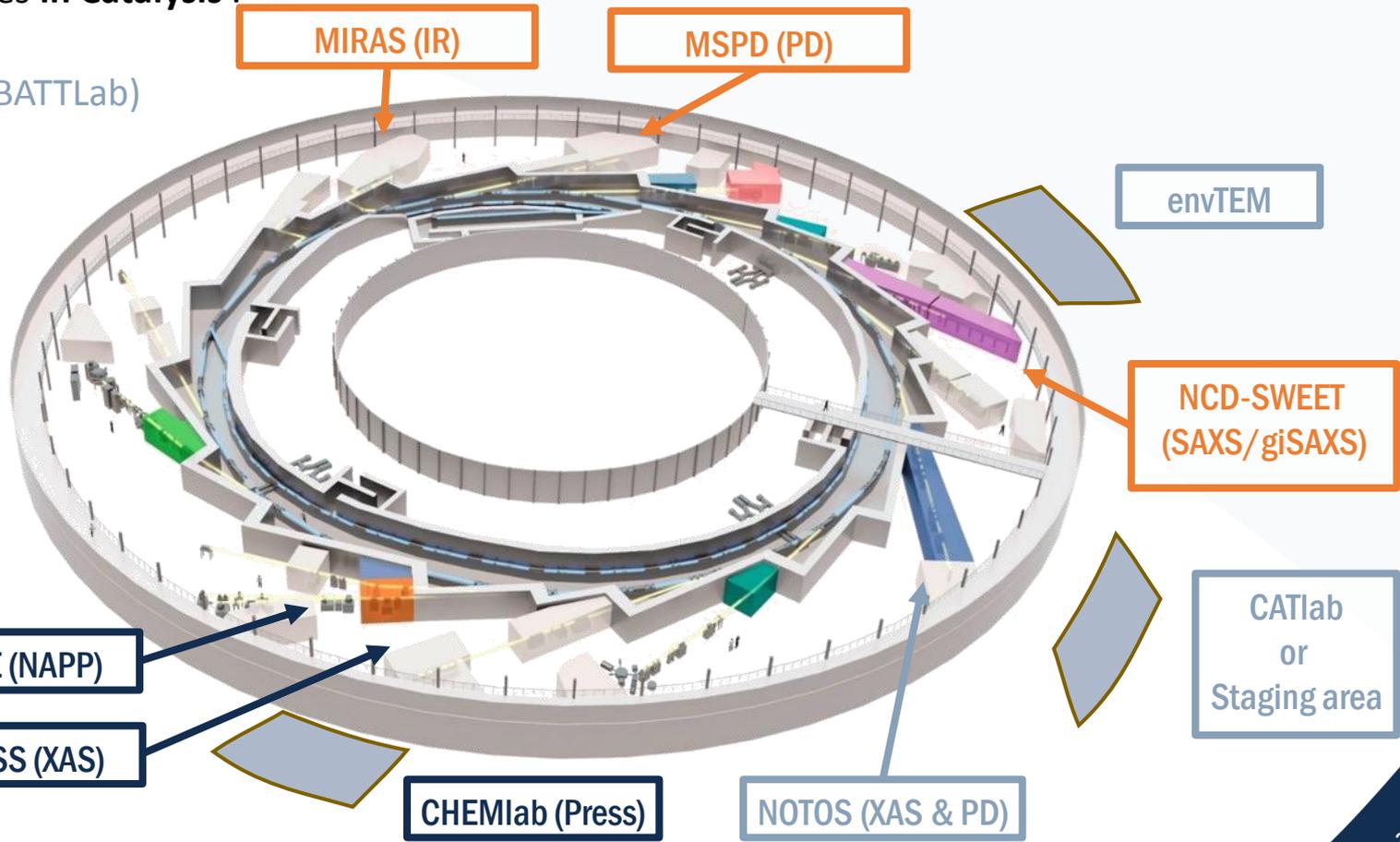
envTEM

NCD-SWEET
(SAXS/giSAXS)

CATlab
or
Staging area

CHEMlab (Press)

NOTOS (XAS & PD)



Prospecting facilities in Chemistry and Material Sciences



Material synthesis facility
Material Pre-treatment
(reduction/oxidation/calcination)

Complementary techniques
facilities (Raman, NMR, IR, XPS, EDX, UVvis...)
Offline or with Inline integration

Full field nm range imaging

Nano probe
(high energy, long beamline)

Use of coherence
(imaging, speckles)

Inelastic scattering
(medium, high ? energy)

Micro fluorescence

Tender X-ray NAPP

High energy diffraction/scattering
(PDF, HP)

Tuning Electronic and Chemical Properties by Controlling Atomic Structure of Functional Materials.

using a suite of techniques and services enabling the catalytic role of ALBA

Focused on scientific fields:

- Energy storage.
- Hydrogen circular economy.
- Gas (Carbon) sequestration.

Techniques

- High throughput ensemble averaging probes including IR, XAFS, and diffraction.
- X-ray microscopy in scanning and full field mode with absorption and phase contrast.
- TEM.
- Multi-modal approach combination of ex-situ, in-situ, and operando experiments.

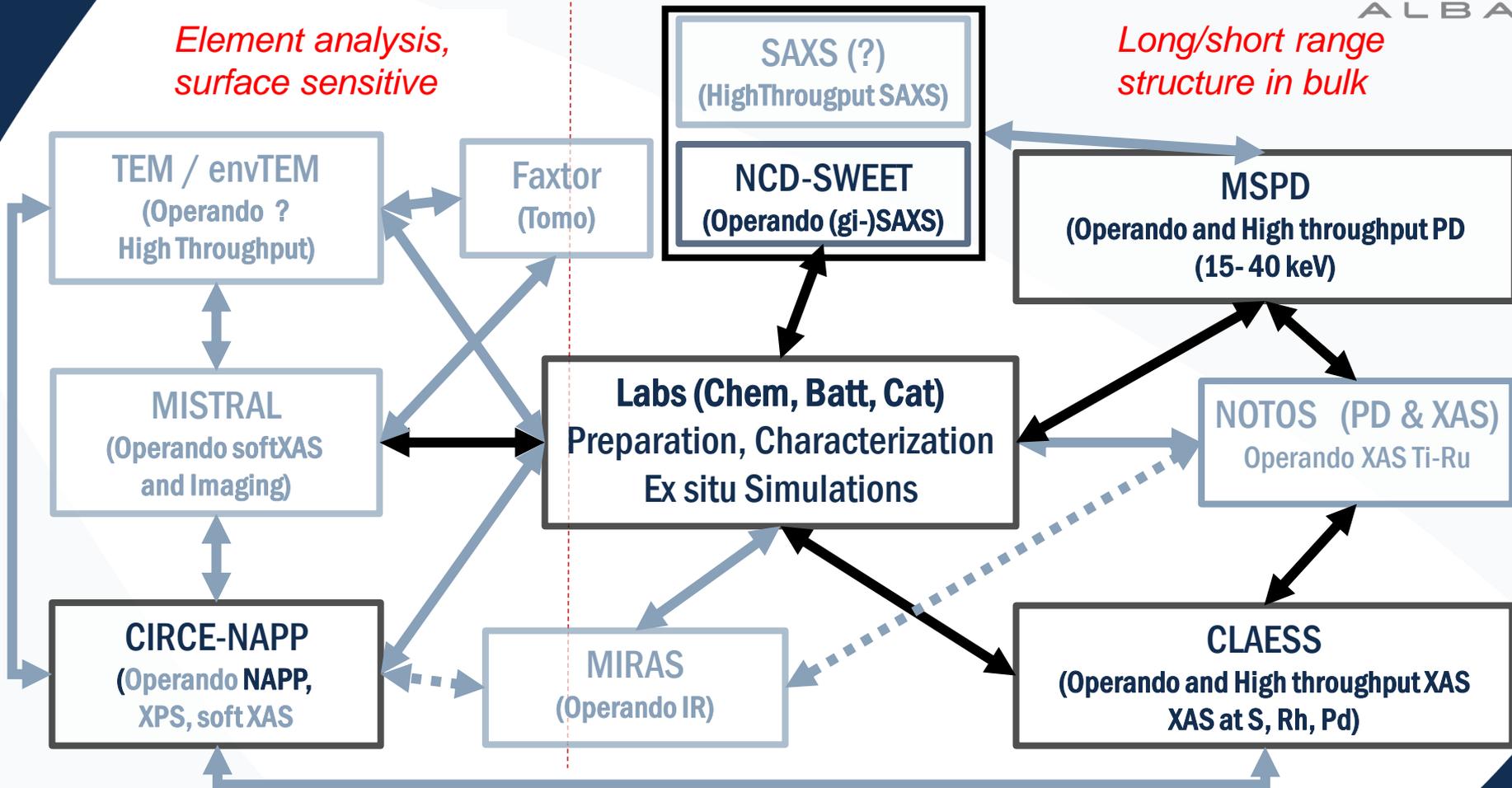
Services

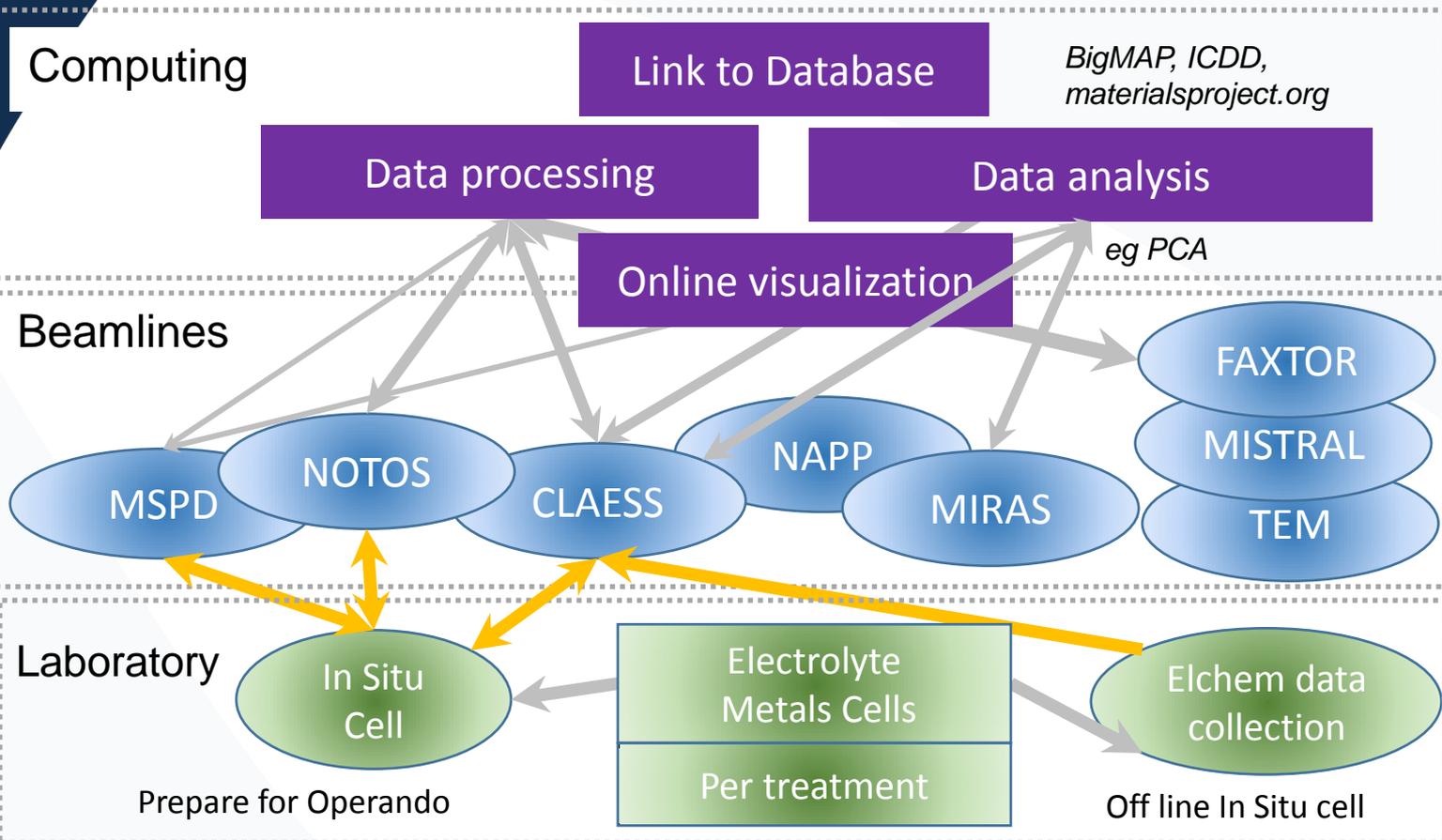
- Sample preparation tools allowing remote combinatorial approaches.
- multi-modal pipelines and access modes for providing solutions for main focus area applications.
- Big data gateway for data mining community.
- data analytics tools to identify structure-function correlations in multi-modal experiments.

Correlation between soon-to-come program tools

*Element analysis,
surface sensitive*

*Long/short range
structure in bulk*





Users

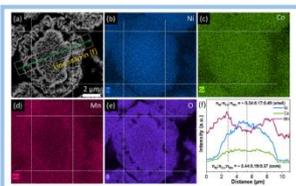


@ALBA

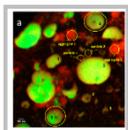
Our Goal at a Glance : Battery case

Imaging, Tomography

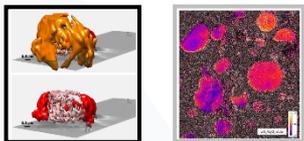
SEM and EDX



TEM

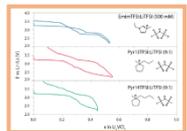


MISTRAL



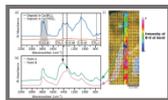
Spectroscopy (molecule)

MIRAS



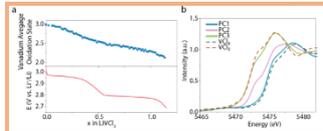
Electrolyte bulk

SEI

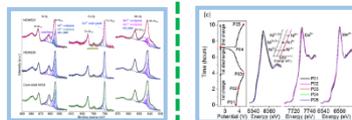


Spectroscopy (electronic configuration)

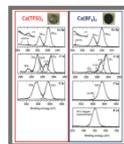
CLAESS, NOTOS-XAS



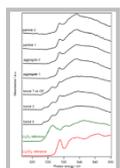
Computing



XPS

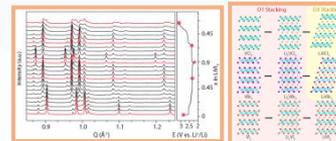


CIRCE-NAPP

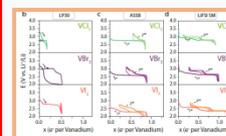


Diffraction (crystal structure)

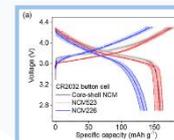
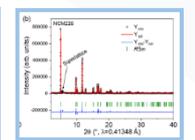
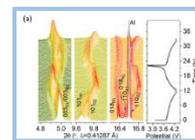
MSPD, NOTOS-PD



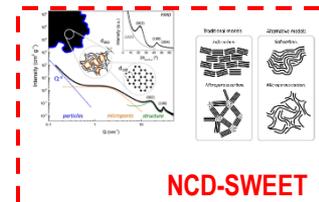
Laboratory (performance, discovery)



Dubouis et al Nat Mat, accepted



Wua et al Nat Mat, Nano Energy 78 (2020)



NCD-SWEET

Saurel et al Nat Mat, Energy Storage Materials 21 (2019)

Our Goal at a Glance : a Catalysis example

XAS

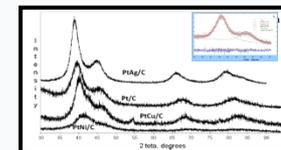
Local structure around selected element
Chemical/electronic state

Synthesis of bimetallic particles
for optimized catalytic reactions
(H₂, O₂) conversion

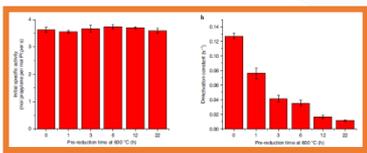
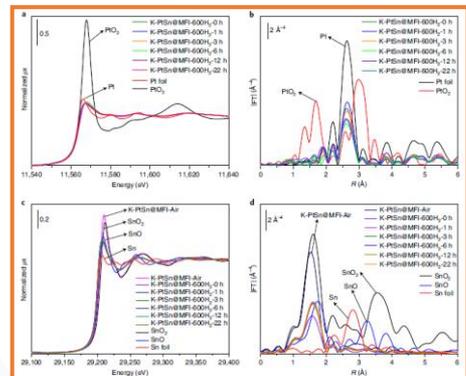
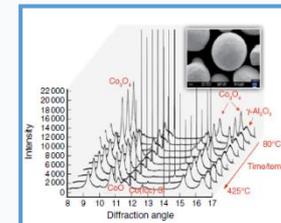
Diffraction

Long/short range structure

Nano size



InSitu XRD
under 5% H₂ flow



Laboratory

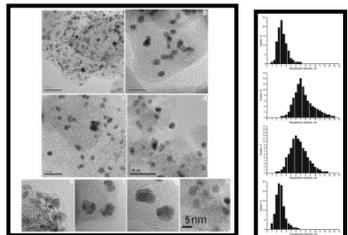
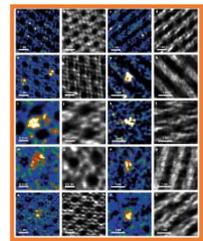
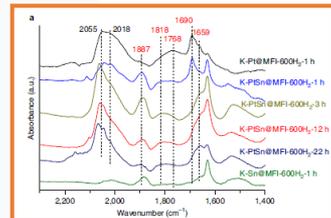
Synthesis, calcination, pre treatment (oxidation/reduction)
Sample environment

TEM / STEM

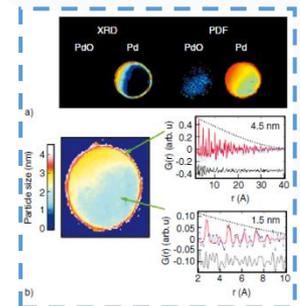
Localisation of atoms arrangement
Nanoparticle size distribution

IR (CO Probe)

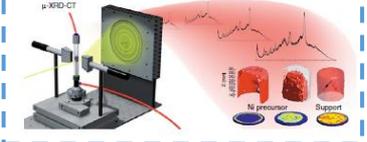
Interaction with molecule



XRD-CT PDF-CT



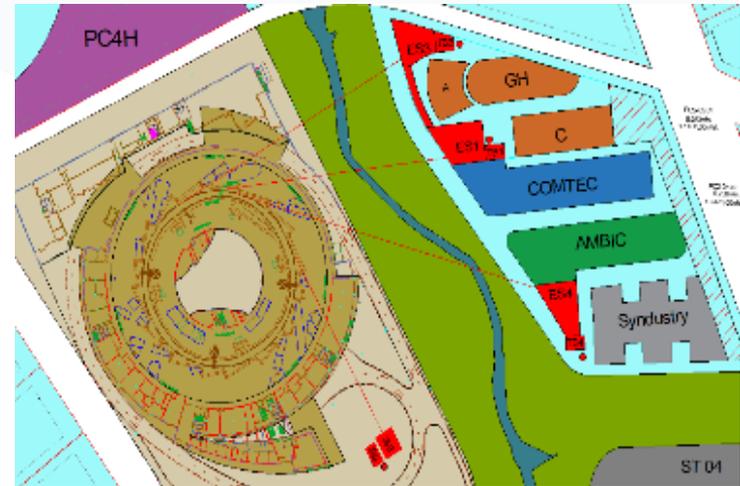
Computed Tomography XRD, PDF



ASTIP: Examples for Strategic Partnerships (in Pre-Proposal Stage)

Large partnership with local institutions and opening to other national institutions to form a hub of 4 pillars, being ALBA II in the center. The other three pillars will be:

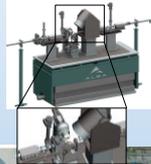
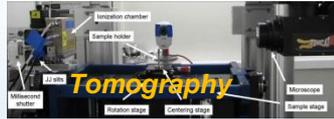
- AMBIC (life sciences)
 - COMTEC (material sciences)
 - SYNDUSTRY (Innovation hub for industry)
- The material sciences center COMTEC could focus around:
 - Material synthesis
 - Battery preparation and characterization
 - Catalysis reaction
 - Sample Environment design, production and offline commissioning
 - COMTEC provides full service building on the strength and expertise of local groups and provides them the full network.
 - ASTIP is in the preproposal stage



ALBA II A Fourth Generation Source



New BLs proposals



ALBA Core-Business

The Labs



- **ALBA II will provide complete characterization solutions for the branding areas Battery and Catalysis :**
 1. Enhanced multi techniques approach
 2. Optimized high throughput and operando instrumentation (methodology, data processing and pre-analysis, sample environments)
 3. ALBA II will form strategic partnerships and will be embedded into research supporting infrastructure which provides all non X-ray support to the users (example of the ASTIP proposal).
- **ALBA II will still provide all current services to all (Spanish) other users**

NOTOS BEAMLINE SEES ITS FIRST LIGHT

Questions welcome

