Report on the ongoing activity of the "Characterization Cluster" - strategies on how to link the two activities

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THE CHARACTERIZATION CLUSTER

- A cluster of project has been launched with a kikc-off meeting in Brussels on the **27th November**

- **Main aim is** permitting closer cooperation between projects working on research and development in the area of nano-scale characterisation.

- Three experts, already working with several of the projects, have been assigned to act as daily secretary and contacts and form **sub-clusters**:
  - "**Sensors**" Rudolf Frycek
  - "**Characterisation Tools**" Costas Charitidis
  - "**Characterisation for Model Validation**" Gerhard Goldbeck
  - "**Metrology – Standardisation**"

Main scope of the cluster

- Identify and **group projects** according to application areas and technologies;
- Identify **common interests** (scientific, technical and commercialization wise) of on-going research and development;
- Identify **methods** to support and strengthen common dissemination activities of the projects;
- Agree with projects on how to **support** their individual and common innovation and exploitation activities;
- Identify **subjects** and formulate **recommendations** for new research, innovation and business development policies;
- Contribute to implement the **priorities** envisaged for the **2016-2017 work programme** of the NMBP Programme.

MAIN OUTPUT OF THE KICK-OFF MEETING

- The **structure** of the sub-clusters have been agreed and specific responsibilities are assigned;
- The three discussion papers for sub-clusters have been prepared and can be shared with EMMC;
- **Objectives**:
  - maximize the **cooperation** between projects
  - identify **common interests** in on-going research and development
  - establish the formation of **standard methodologies** on nanocharacterization in Europe
  - promote the **connection** with external bodies
  - avoid duplicating work and improve **efficiency**
  - provide a **forum** for discussion
  - disseminate the nanocharacterization issues to industrial stakeholders and general public

NEW CHARACTERISATION TOOLS: THE KEY-WORDS

- High resolution characterization/calculation tools are already available in the scientific community;
- Some of them are ready for down-scaling to industry

- **Key words** for their effective application into nanomaterials development are:
  - **Development of PORTABLE new characterization tools**
  - Exploitation into **Best practice guides and standards**
  - ***TRIPOD* structure** of the EU projects on characterization;
  - Establishment of **Materials Databases**
  - **Smart sharing of raw data**
  - **Synergic Interaction with modelers** (through ***EMMC*** and its Validation WG)

CHARACTERISATION-TOOLS SUB-CLUSTER

- Main required horizontal actions:
  - **Validation** of measurement procedures
  - New **standard** reference materials
  - **Metrological traceability** (ensures measurement results made at different times and different locations)
  - Legislation (guidelines for proper standardization)

- Establishment infrastructure for effective exchange of information between clusters (Nano-KTN, NanoSafety Cluster, EMPIRA, ISO, OECD initiatives)

CHARACTERISATION-TOOLS SUB-CLUSTER

- Potential future actions

  - Finalise the working groups and participants
  - Establish a mechanism or infrastructure on how this cluster can link interact with other clusters/ programs to provide synergy but not duplication
  - Each WG to use the infrastructure to extract information from different clusters/programmes
  - Each WG to write priority areas
  - Cluster should to present and discuss priority areas across the different WG.
  - Give a report to EC on the basis of this finding.
  - **Write a call**, wherever possible include priorities from different WGs.

"Characterization Tools" Sub-Cluster

WG1
Metrology Instrumentation

- Principles/Theory
- Methodology
- Technical Issues
- Nanometrology
- New topics/techniques

WG2
Standardization

- Standardization of analytical methods and SOPs.
- Validation of measurement techniques
- Development of new reference materials
- Development of 3D calibration standards
- Contact with standardization/regulation bodies

WG3
SMEs & Industrial needs

- Commercialization
- Implementing high-risk and high-potential innovation ideas
- Entrepreneurship
- Internationalisation
- High returns of investment

WG4
Networking activities

- Contact with other EU & international bodies and metrology institutes
- Establish Communities of Research (CoRs)
- Open Research Data
- Common Platforms
- Exchange of experience between national innovation agencies

WG5
Dissemination

- Industrial application
- Associations
- Standardization
- Legislation
- Workshops/Conferences
- Website

"Characterization Tools" Sub-Cluster

WG1
Metrology Instrumentation

Contact person:
Tofail Syed

Contributors:
Jordi Fraxedas
Stefan Weigel
Olga Kazakova
Marco Sebastiani
Michela Sega
Philip Martin

WG2
Standardization

Contact persons:
Adriele Prina-Mello
Ratna Tandra

Contributors:
Andrea Fornana

WG3
SMEs & Industrial needs

Contact persons:
Zora Strelcova
Antonio Nigro

Conrtibutors:
Marielle Wouters
Denis Stoiakine
Christof Hubner

WG4
Networking activities

Contact person:
Lars Mattsson

Contributors:
Ratna Tandra
Marco Sebastiani

WG5
Dissemination

Contributors: NTUA, FORTH/ICE-HT

Characterisation for Model Validation

- The key areas of characterisation for model validation the sub-cluster:

  - **Support** model development.
  - Characterisation to determine **model input parameters**
  - Characterisation to **validate** the output of simulations
  - Characterisation of materials and systems on an **industrial product scale**
  - **Certification** of models and methodologies

Characterisation for Model Validation

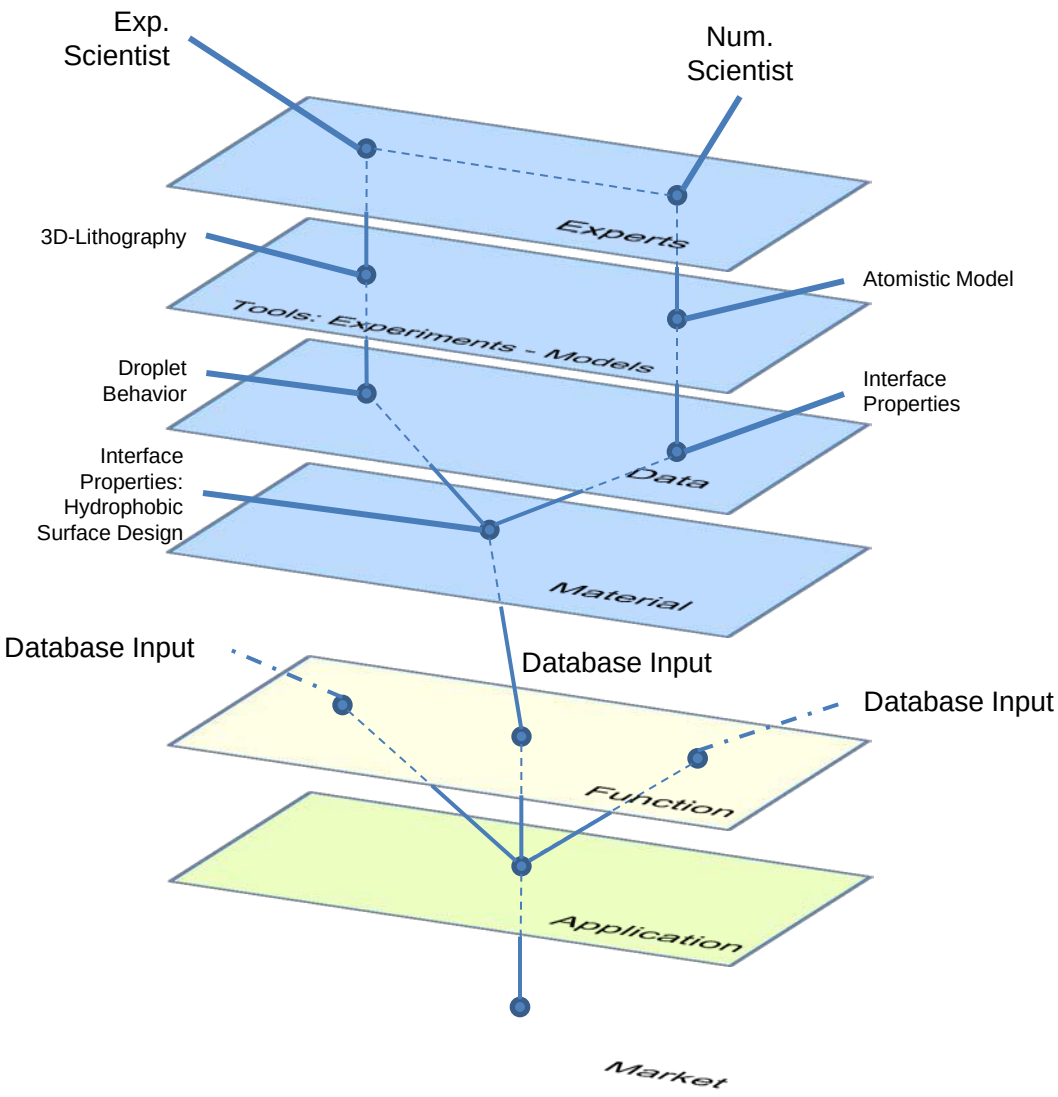
- In order to deliver on industry's need for well validated models (e.g. structure-property relations) there is a need for **much more comprehensive data including:**

  - Reliable (open) data sets
  - **Local**/nano-scale material characterization in terms of property determination for material constitutive laws. New nanoscale measurement techniques required to validate and to calibrate models e.g. of microelectronic devices and systems.
  - Multi-scale characterisation
  - Keeping raw data as much as possible
  - Including the effects of processing, including process parameters
  - Extending from materials to device and systems data and models.

Characterisation for Model Validation

- The key objectives are to:
  - **Improve the links between characterisation and modelling.**
  - Overcome the lack of data issue, including
    - access to existing data
    - comprehensive storage of new data
  - Procedures to provide (multi-scale) materials data that allow to validate (and to calibrate) models, see for example the slide from the microelectronics field.

A NEW CONCEPT FOR MATERIALS DATABASES

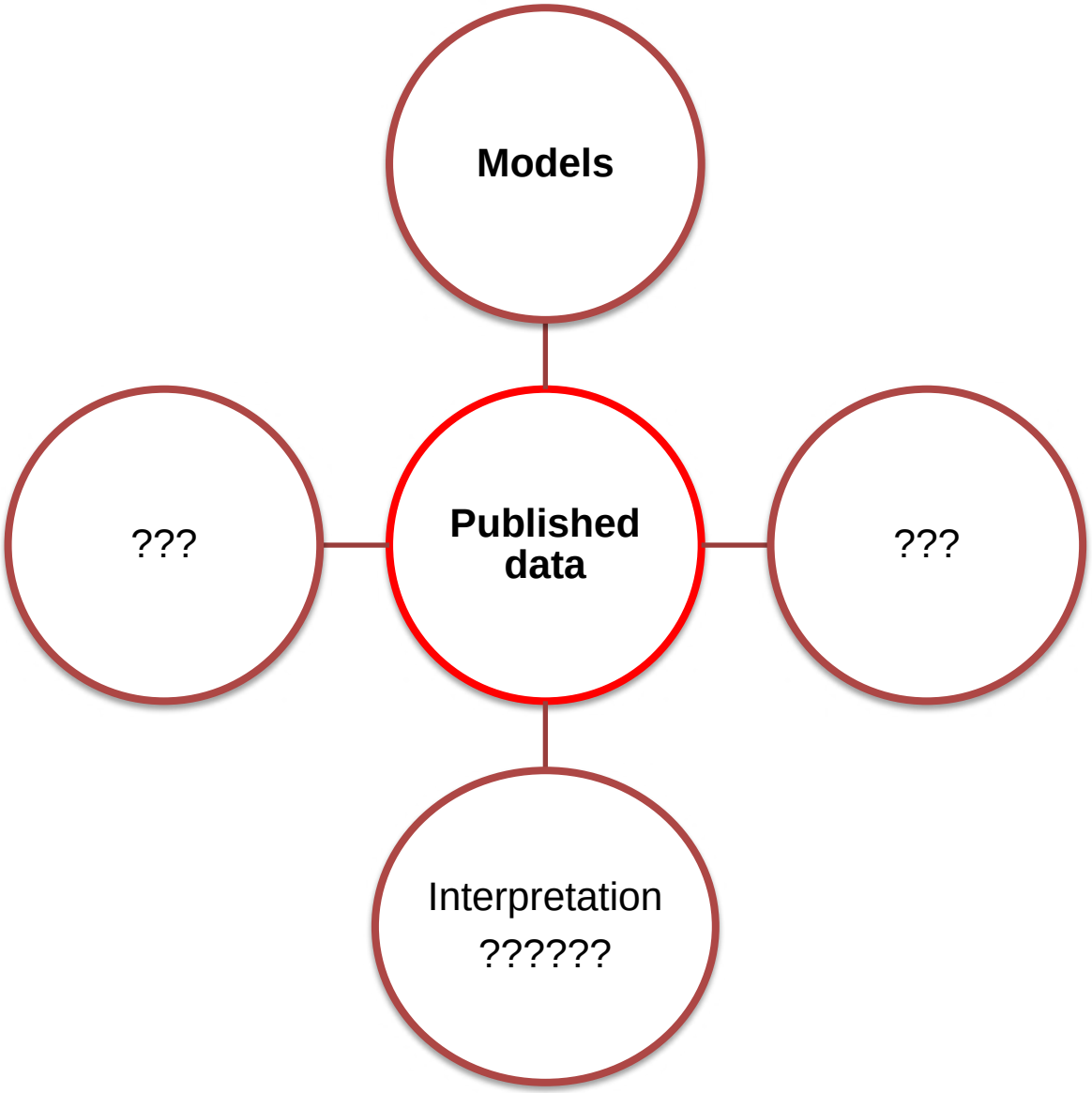


Linking Materials, Tools, and Experts through the Database to the Market

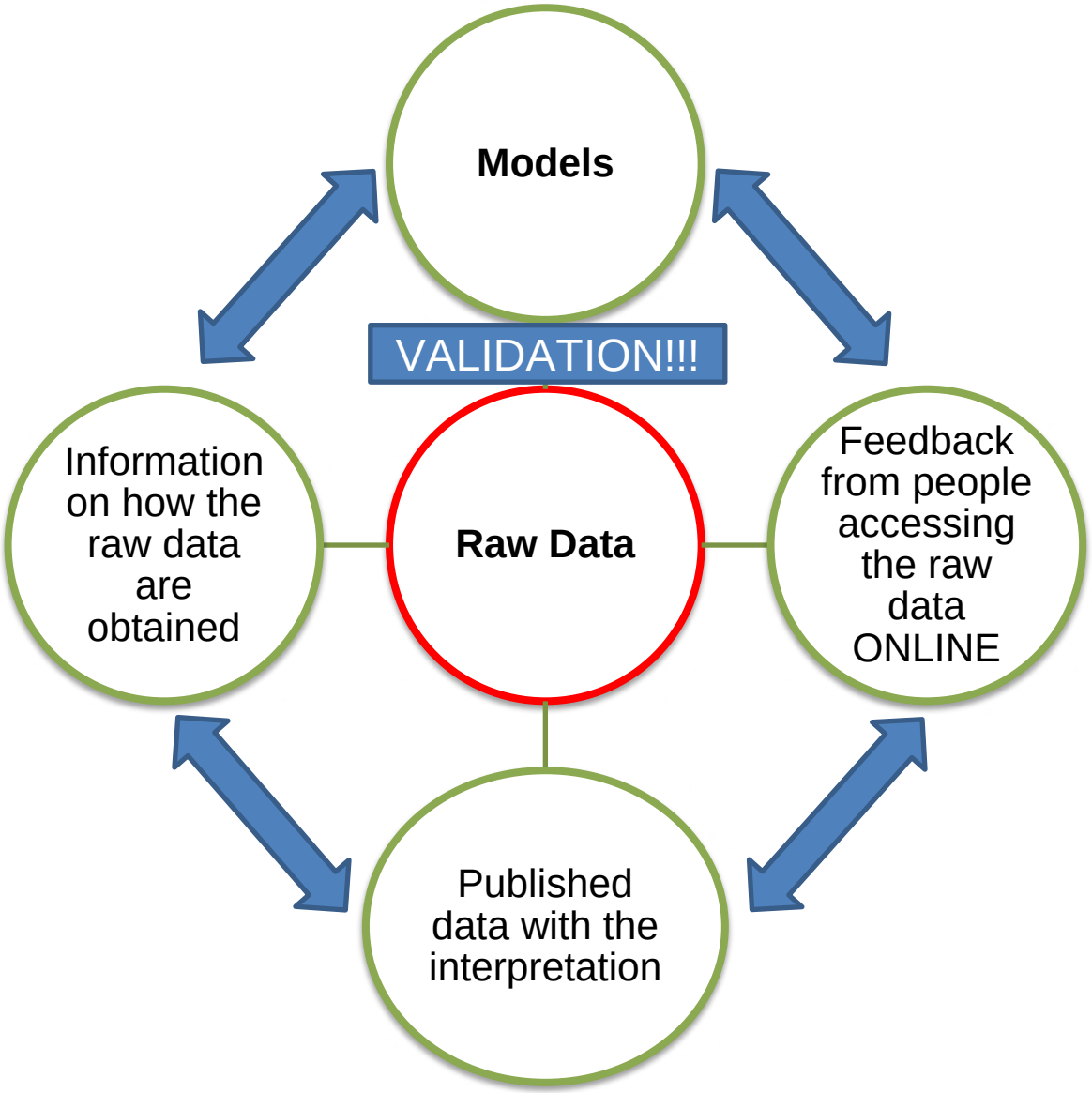
EMMC

Market players use the database for novel applications

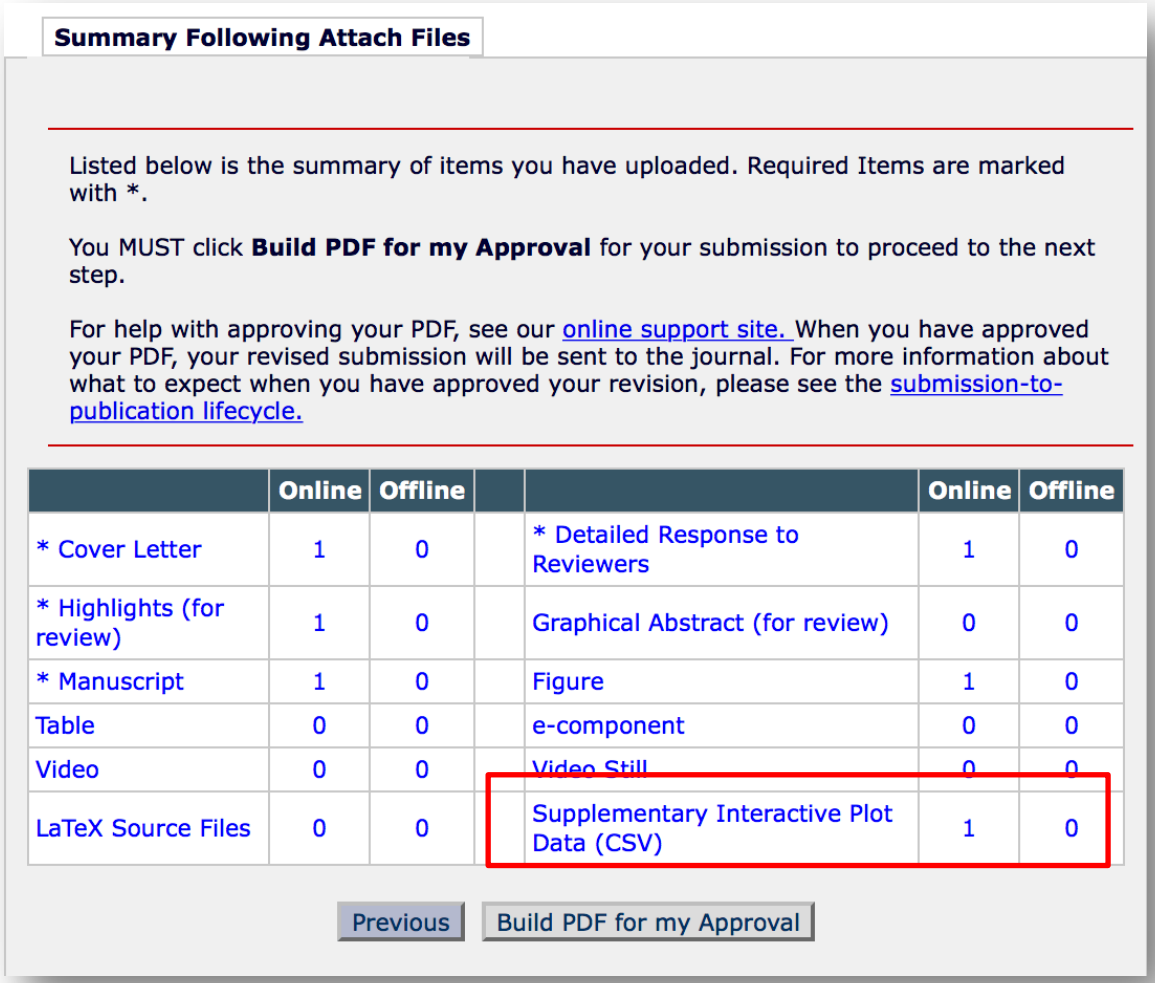
Experimental data handling - Today



Experimental data handling - Tomorrow



TOOLS ARE ALREADY AVAIBALE



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- Involvement of scientific publishers is very important!!

CHARACTERISATION FOR MODEL VALIDATION - **ACTIONS**

- Support and work closely with the **EMMC** on a **sharing database system** for data and the Materials Modelling Market Place.
- Identify existing research data(-bases) to provide more information about a first (still unconnected) set of databases.
- Establish information databases
  - of actors including characterisation laboratories.
  - of methods and types of data they can provide.
- Identification of gaps in data as well as characterisation capabilities (methodologies and tools).
- Establish a stronger collaboration between institutes and tool suppliers (R&D&I).

EMMC/CHAR. CLUSTER **STRATEGIES**

- **New requirements** are continuously coming from numerous different industry sectors;
- We do not necessarily need “new materials”, we do need **“innovation in materials to face the new requirements”**
- **Combination** between adv. Modelling and characterisation tools can help models to give Better/faster answers to new industry requirements;
- The key points is developing a structured/robust **interface** to promote **communication** between the two worlds.

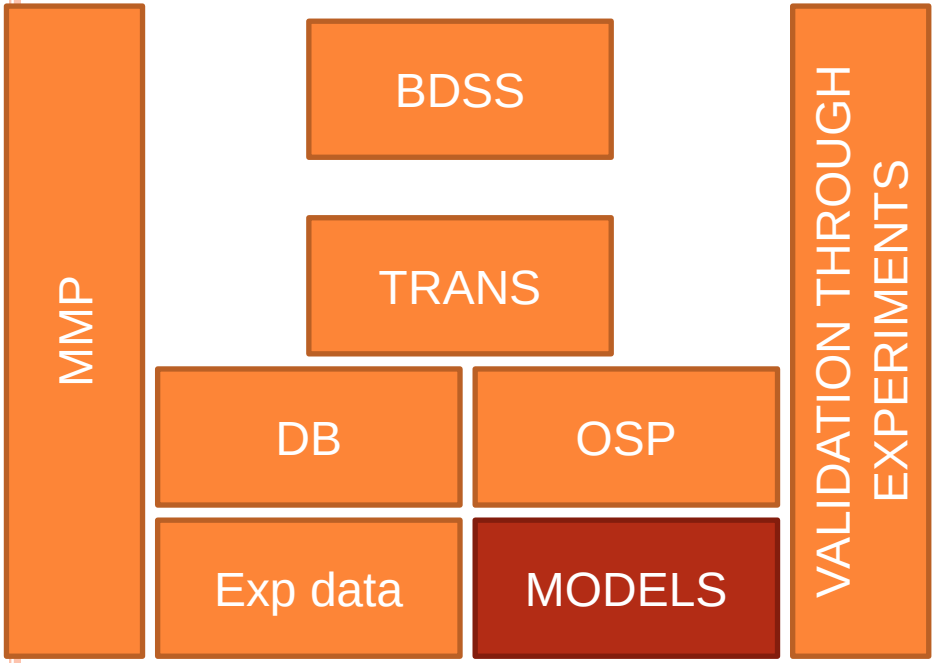
EMMC/CHAR. CLUSTER **STRATEGIES**

- In our case, the “bridges” are :
  - the VALIDATION WG at EMMC (C. Eberl, M. Sebastiani)
  - the Characterisation for Model Validation sub-cluster (Gerhard Goldbeck)

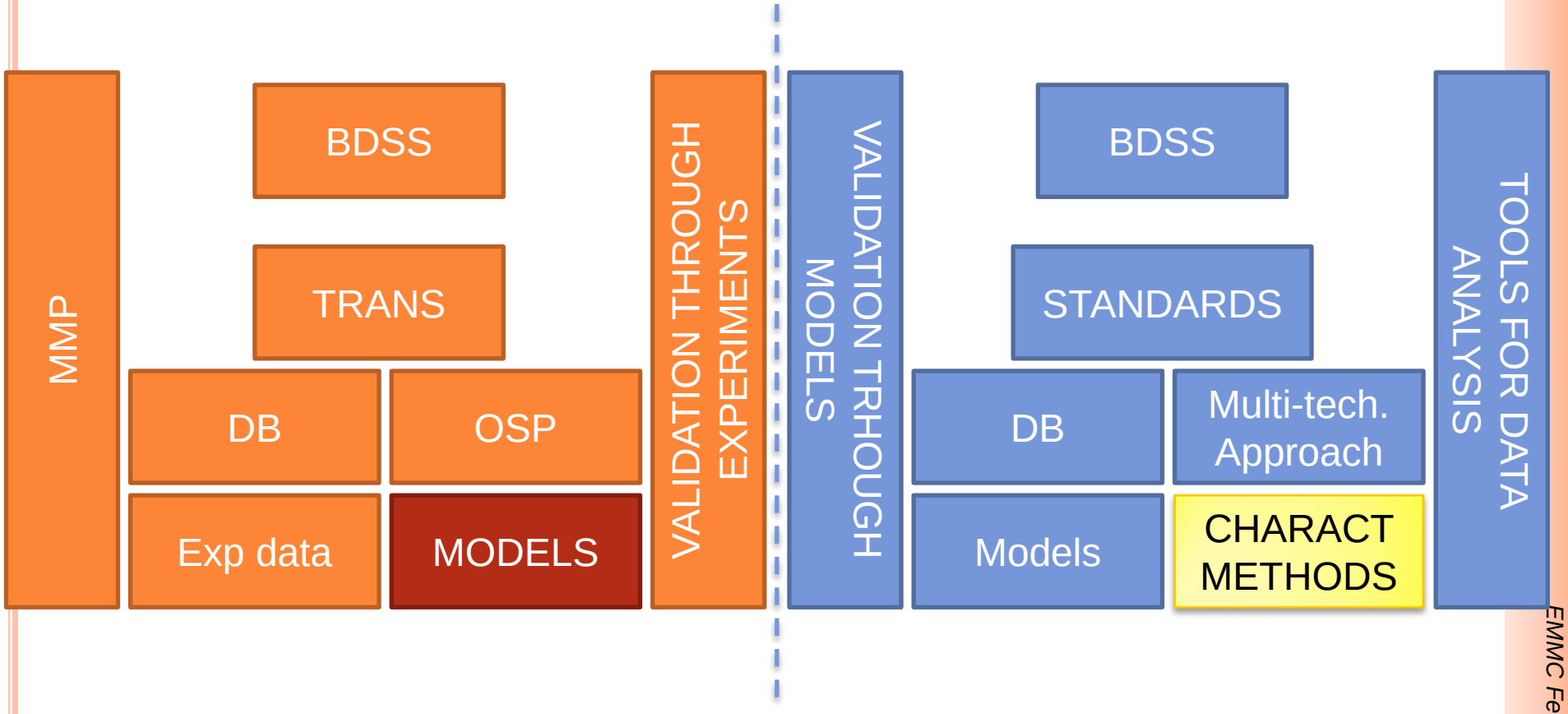
- The MAIN overlapping topic is establishment of new concepts for **materials data handling/sharing**

- The two activities should define a common task on this, by:
  - Identifying people from both communities working on it
  - JOINTLY proposing a new NMP topic on next-generation modelling/experimental database development and data sharing

EMMC/CHAR. CLUSTER **STRATEGIES**



EMMC/CHAR. CLUSTER **STRATEGIES**



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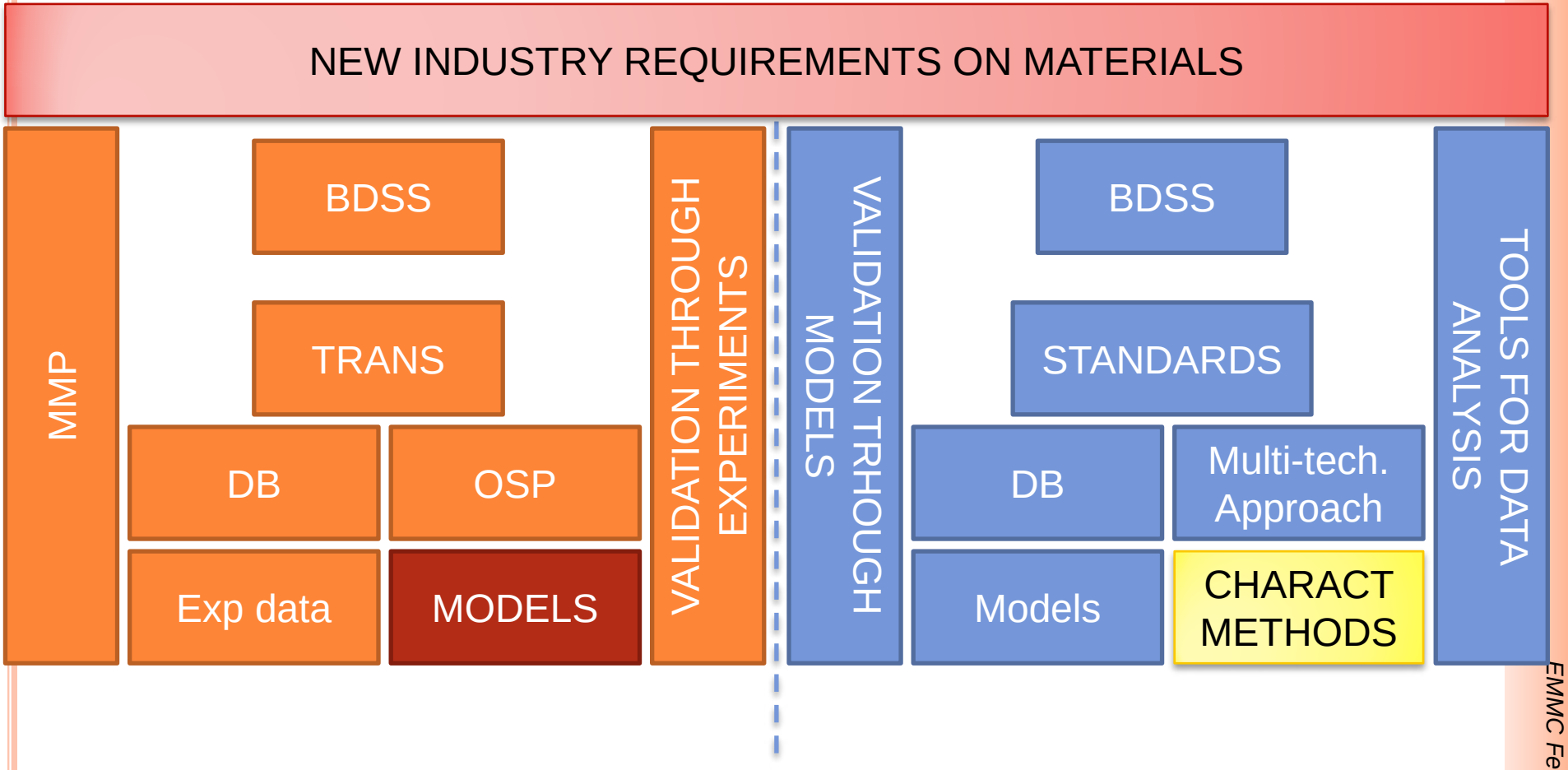

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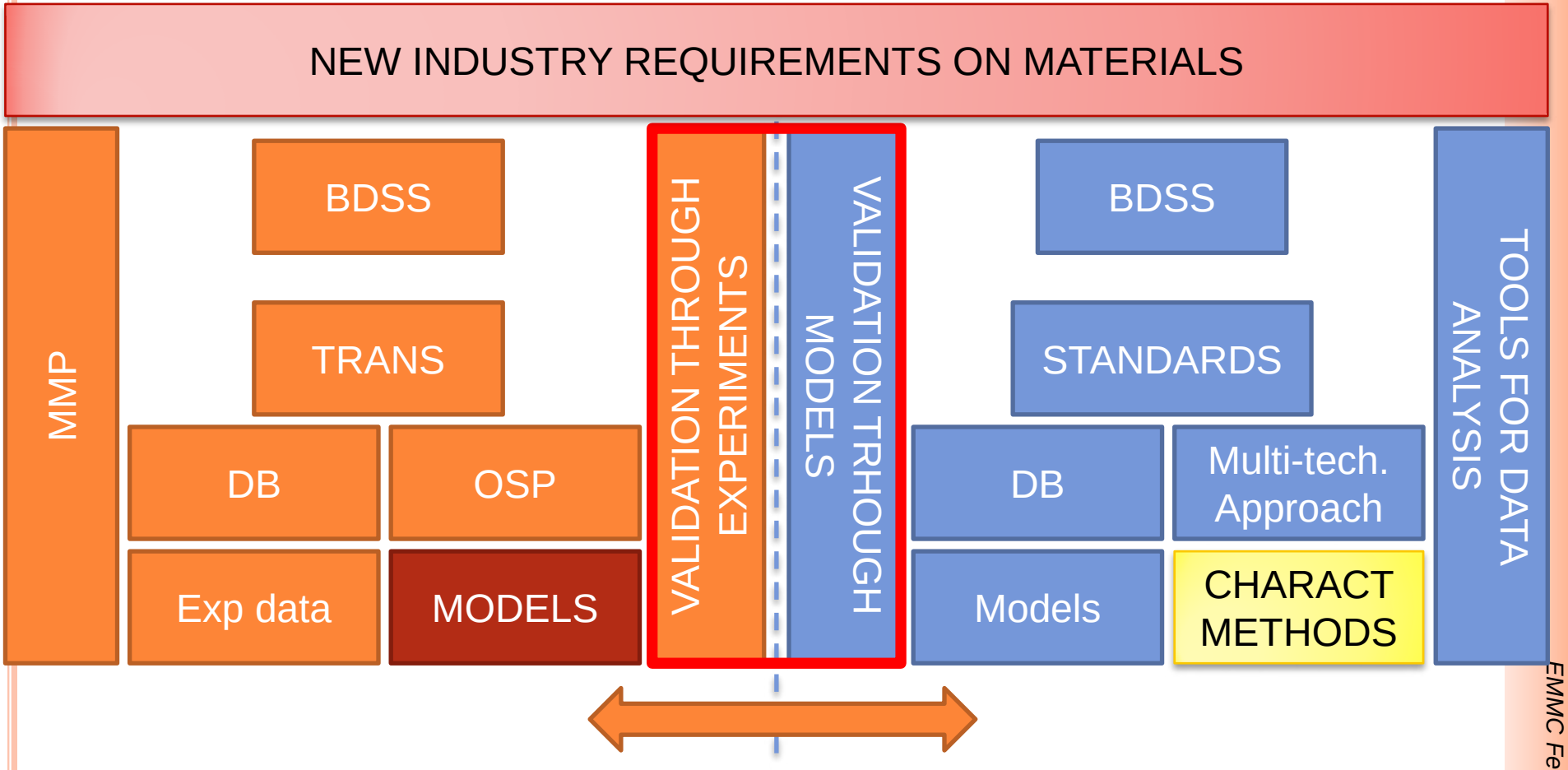

- EMMC – Chract. Cluster through NEW RAW-DATA Handling/sharing projects

Thank you for your attention

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