




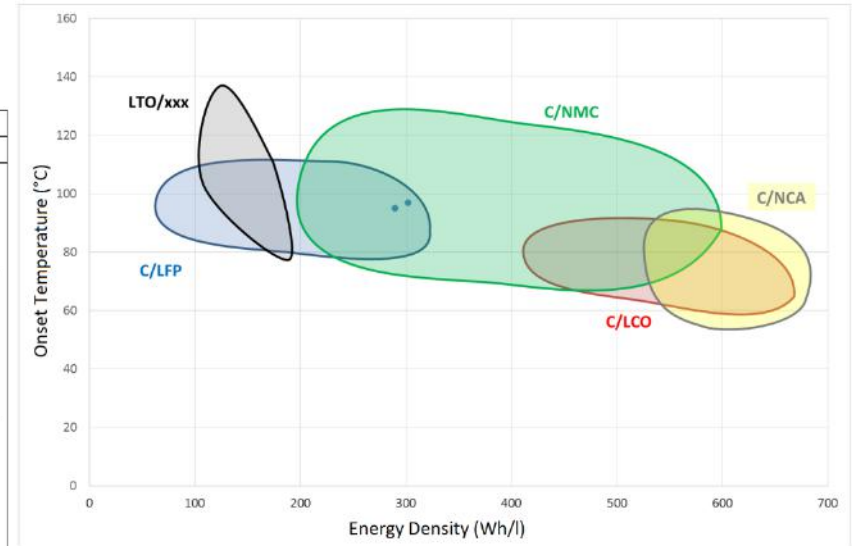




Energy Object					
Energy Storage				Energy Converter	
Battery		Hydrogen Storage		Flywheel	Fuel Cell Stack
 Battery Cell	 Battery Pack	 Hydrogen Tank	 Hydride Storage Module		
 Supercapacitor Cell					

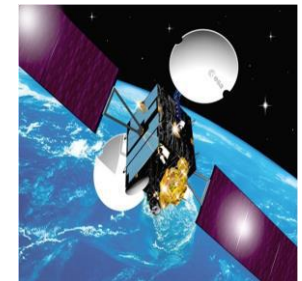


# ESTOR : A DATABASE FOR ENERGY STORAGE AND CONVERSION

Fabien Perdu

## Need for energy storage systems for various applications

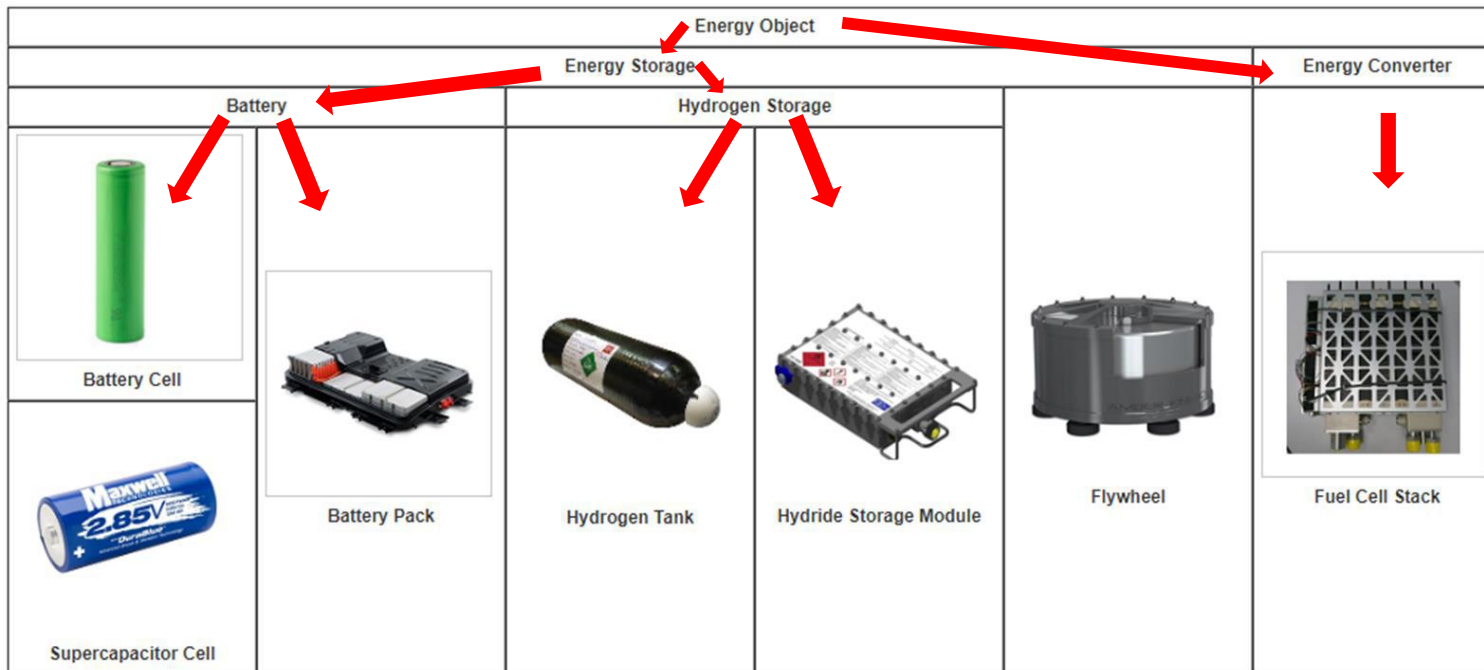
- Transports
- Network services
- ...



- **Tradeoffs are to be found between various criteria**
  - Energy density
  - Power density
  - Energy efficiency
  - Lifetime
  - Operating temperatures
  - Safety
  - Cost
  - Environmental impact
- ...
- **No existing database with detailed technical data on various technologies**

- **CEA launched ESTOR database project to**
  - capitalize and validate existing information and test data
  - enhance communication between services testing, simulation, system integration,  
⇒ **need for detailed technical data on a given type of specific objects**
  - allow unbiased comparison of technologies for a given application  
⇒ **need for generic data on many types of objects**
  - allow collaboration and sharing with partners of different domains towards a shared european database  
⇒ **need for fine access control management**

- Hierarchy of object classes inside the Technologies table.



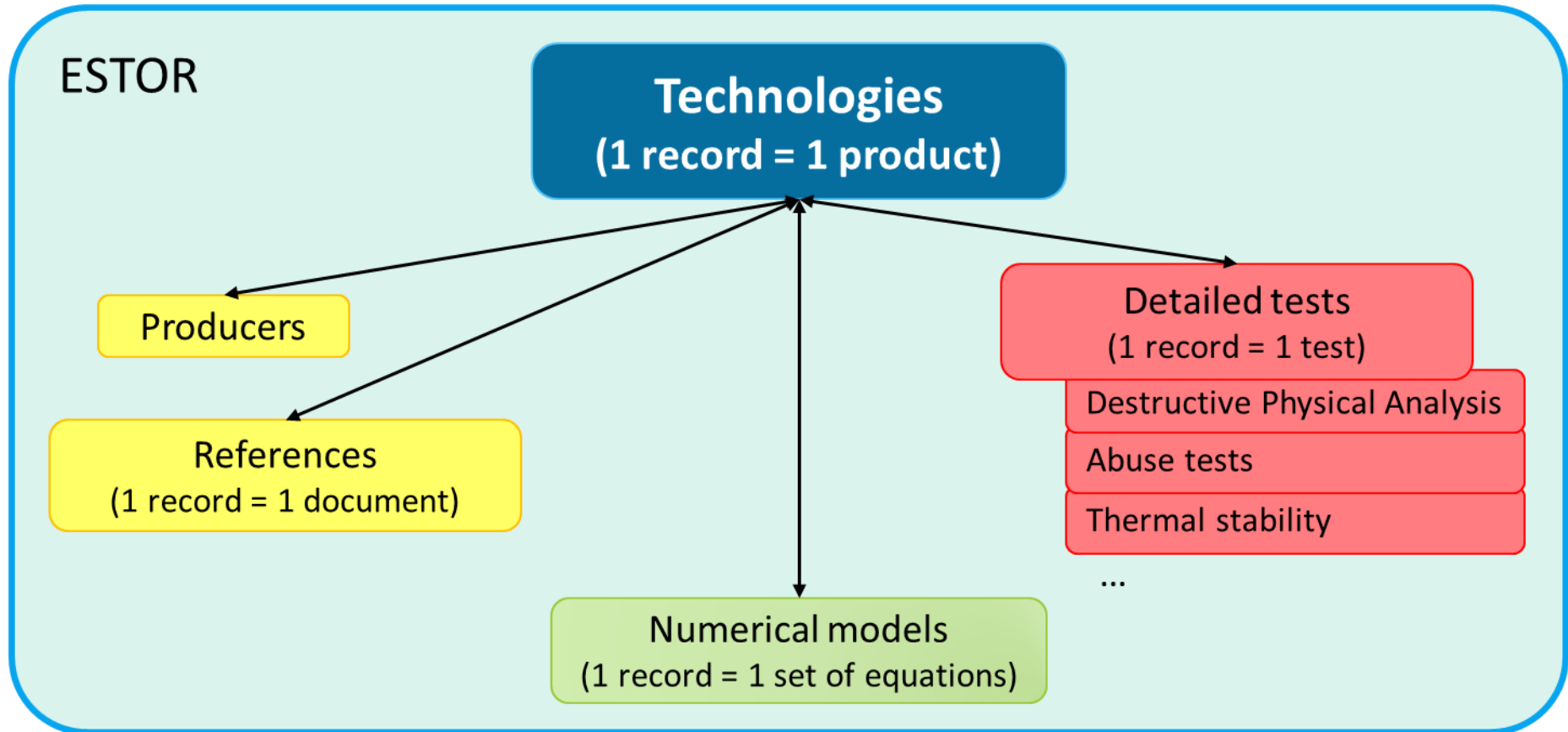
Generic  
(e.g. mass, power)



Specific  
(e.g. capacity, flowrate)

## Selecting a class selects

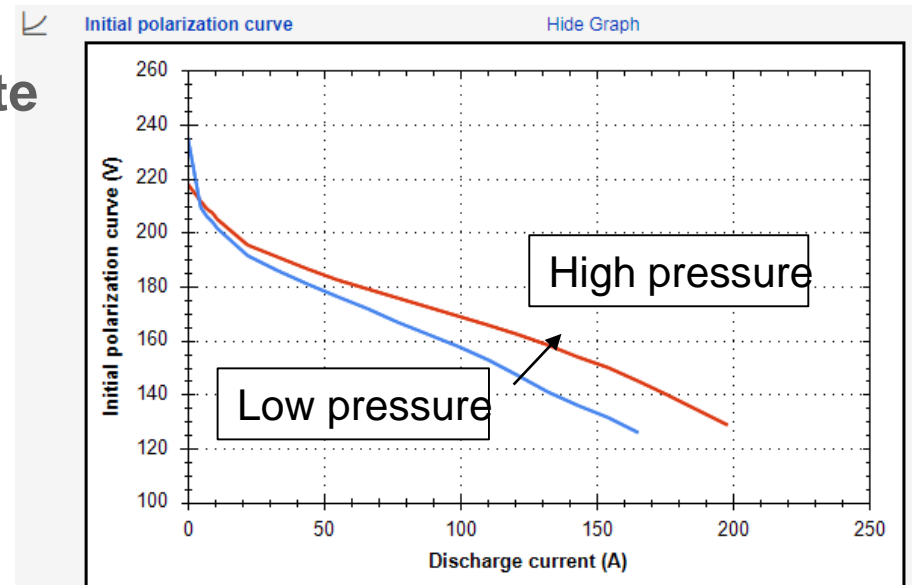
- a subset of objects of the relevant type
- the relevant attributes for these objects to display



Hundreds of attributes are defined  
and hundreds of records are filled

- Each technology record bears
  - Traceability attributes (date, source of data,...)
  - Nominal performance
  - Performance in specific conditions
  - Ageing
  - Cost and environmental impact

- Example of performance attribute  
polarization curve of a PEM fuel cell



- Example of specific test data

▼ POSITIVE ELECTRODE

(+) Double-side electrode thickness	137	µm
(+) Electrode length	1700	mm
(+) Electrode width	55	mm
(+) Electrode loading	26.7	mg/cm <sup>2</sup>

Pictures of core (+) electrode

[Hide table](#)



(+) Optical microscopy pictures

[Hide table](#)

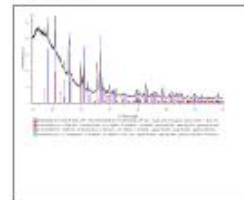


(+) Active material composition

LFP

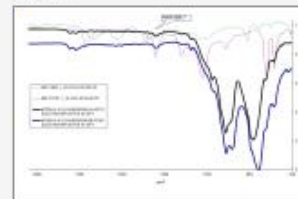
(+) XRD

[Hide table](#)




(+) IR

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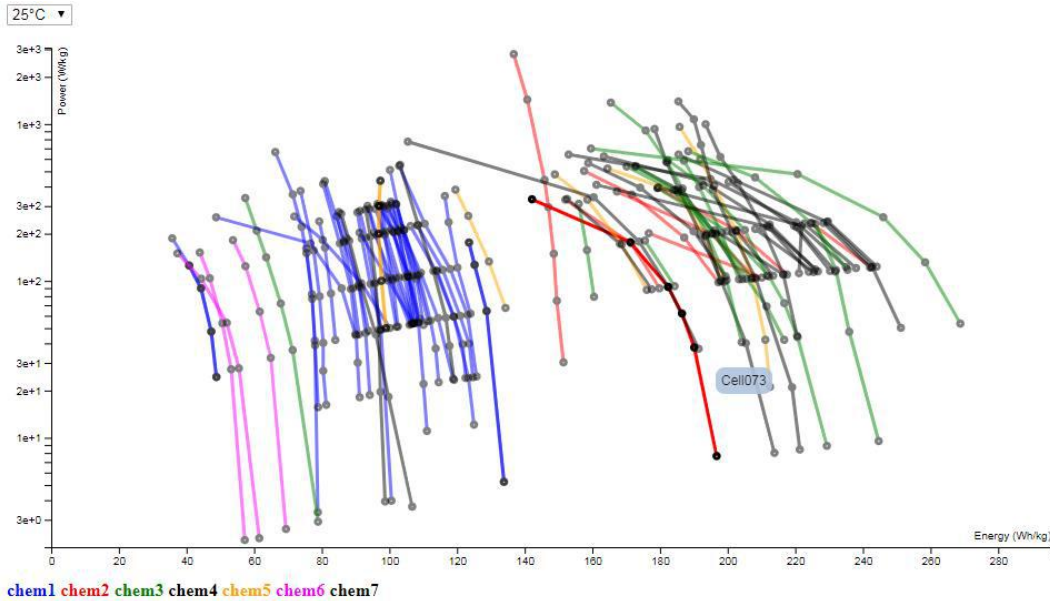




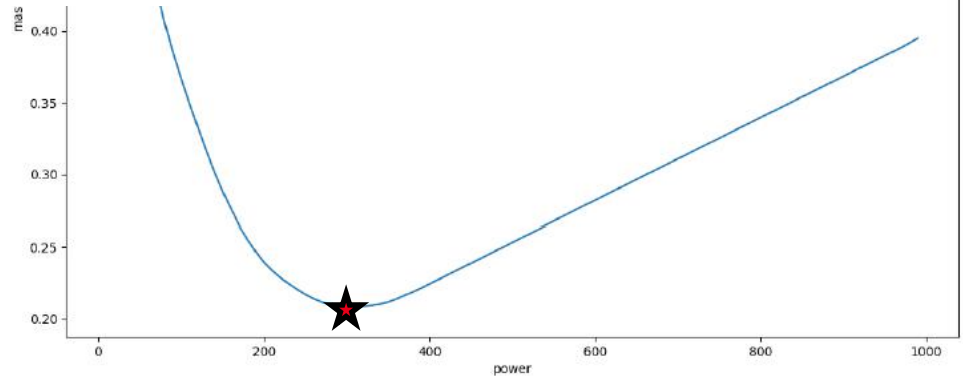
- **Example of scripting :**  
automatic checks and completion

Length	227	mm
Width	160	mm
Height	7.25	mm
 Volume	0.263	l
<i>Script status</i>		Checked by script : OK

- Allows new exploration tools



and coupling with  
simulation software



- **Uses Granta MI software**
  - Very versatile structure
  - Fine tuning of access rights
  - Easy access through web application
  - Advanced usage through Python API

- **European project great opportunity to build upon ESTOR**
  - Shared access to various European partners
  - Large number of characterization techniques for batteries  
=> need to extend the existing structure

## FUTURE WORK

- Objects (1 table = Technologies):  
Cell INR18650VTC6 from Sony  
NMC MX6 from Umicore,...

Store description and aggregated results of various tests on various samples  
Allows for 'material datasheets'

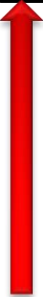


- Sample (1 table):  
An individual cell or material or...  
(instance of object)

Store sample history :  
Which tests, when, in which order  
Allow splitting a sample into several or creating a sample from several

- Technique:  
Method for preprocessing,  
testing, post processing

Store the description of the technique  
(characterization or model)



- Test:  
Application of a technique  
to a sample

Store test conditions  
+ post-processed test results  
+ pointer to raw test results  
(which remain at SP)

