

Definition and presentation of a data base prototype about secondary emission material characteristic

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SPINE meeting

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(1) Artenum Toulouse

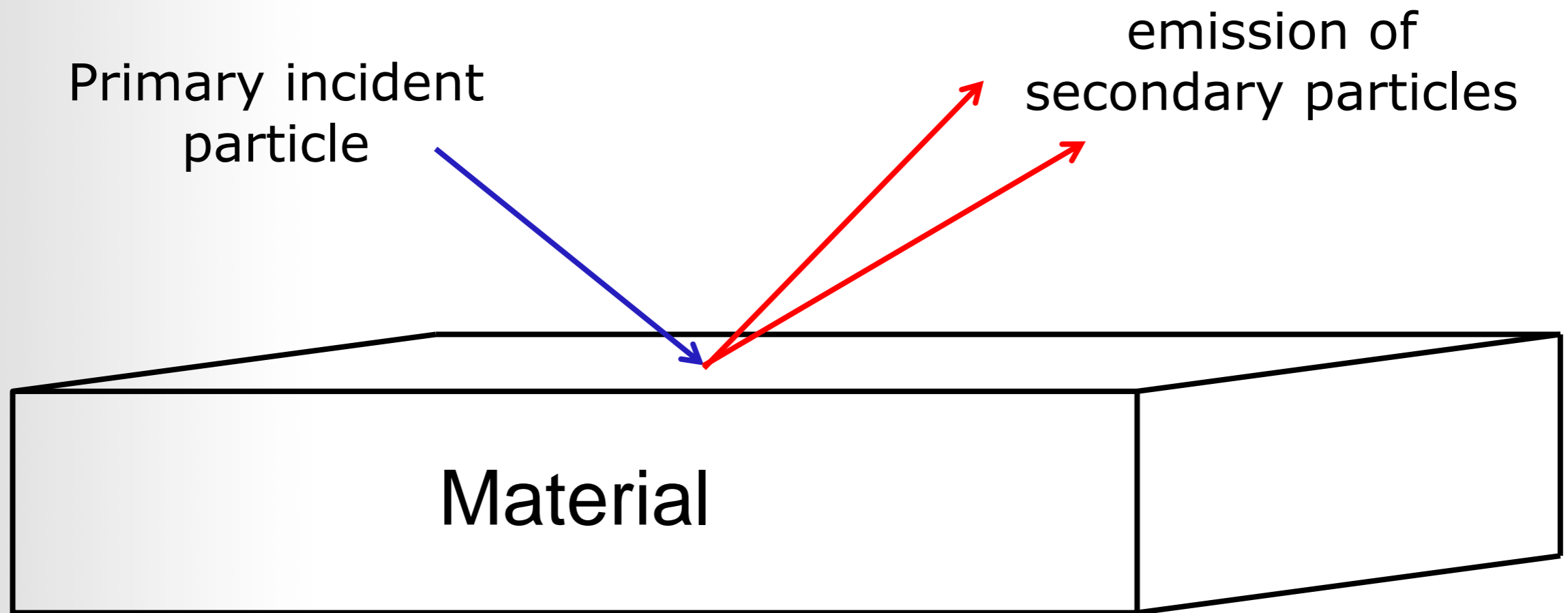
(2) CNES/Toulouse

(3) Artenum Paris/Lyon

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Meeting – October 2017

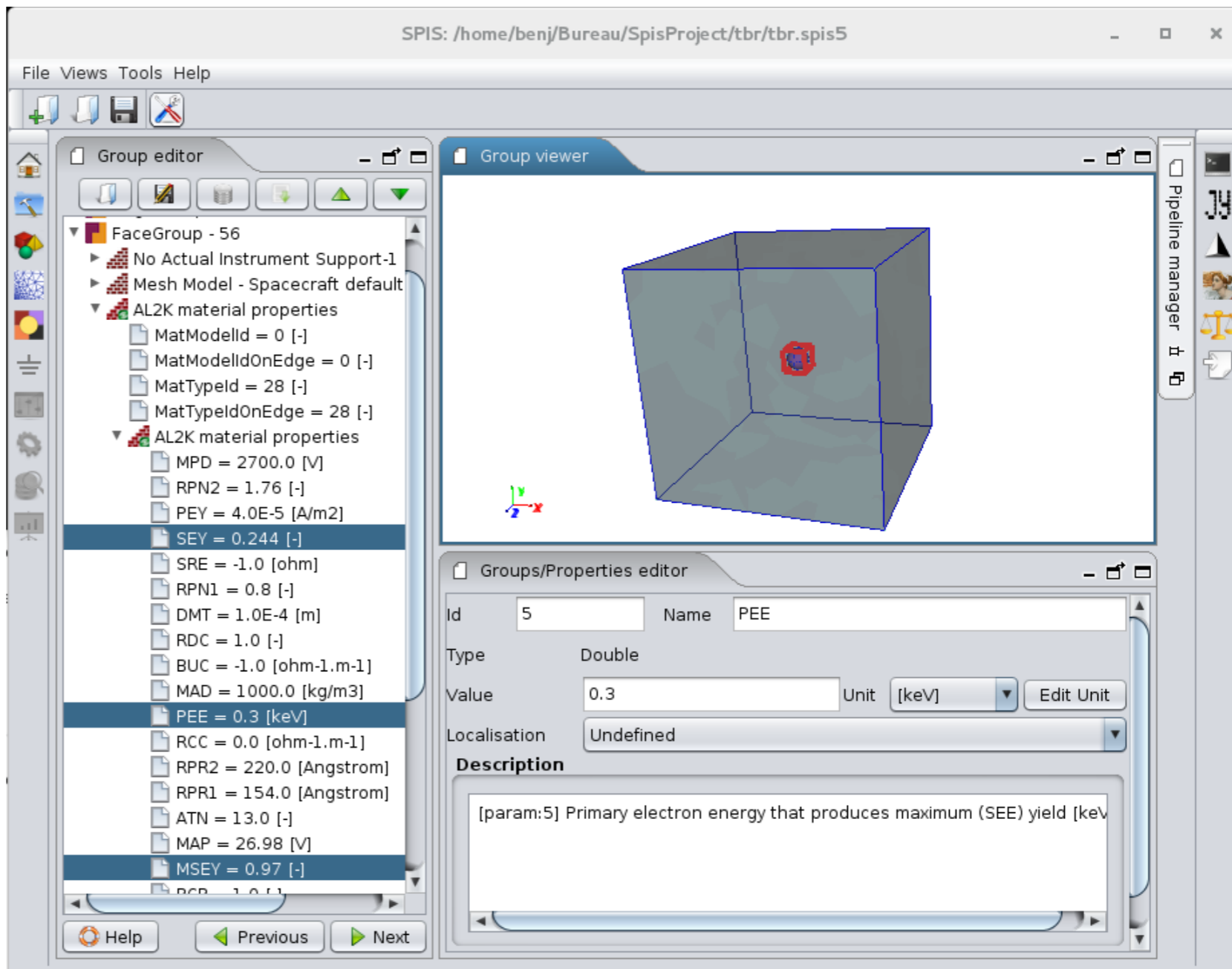
Secondary emission is when a primary incident particle hits a surface and induces the emission of secondary particles



Important during the modelling process of the effect of the space environment for different communities

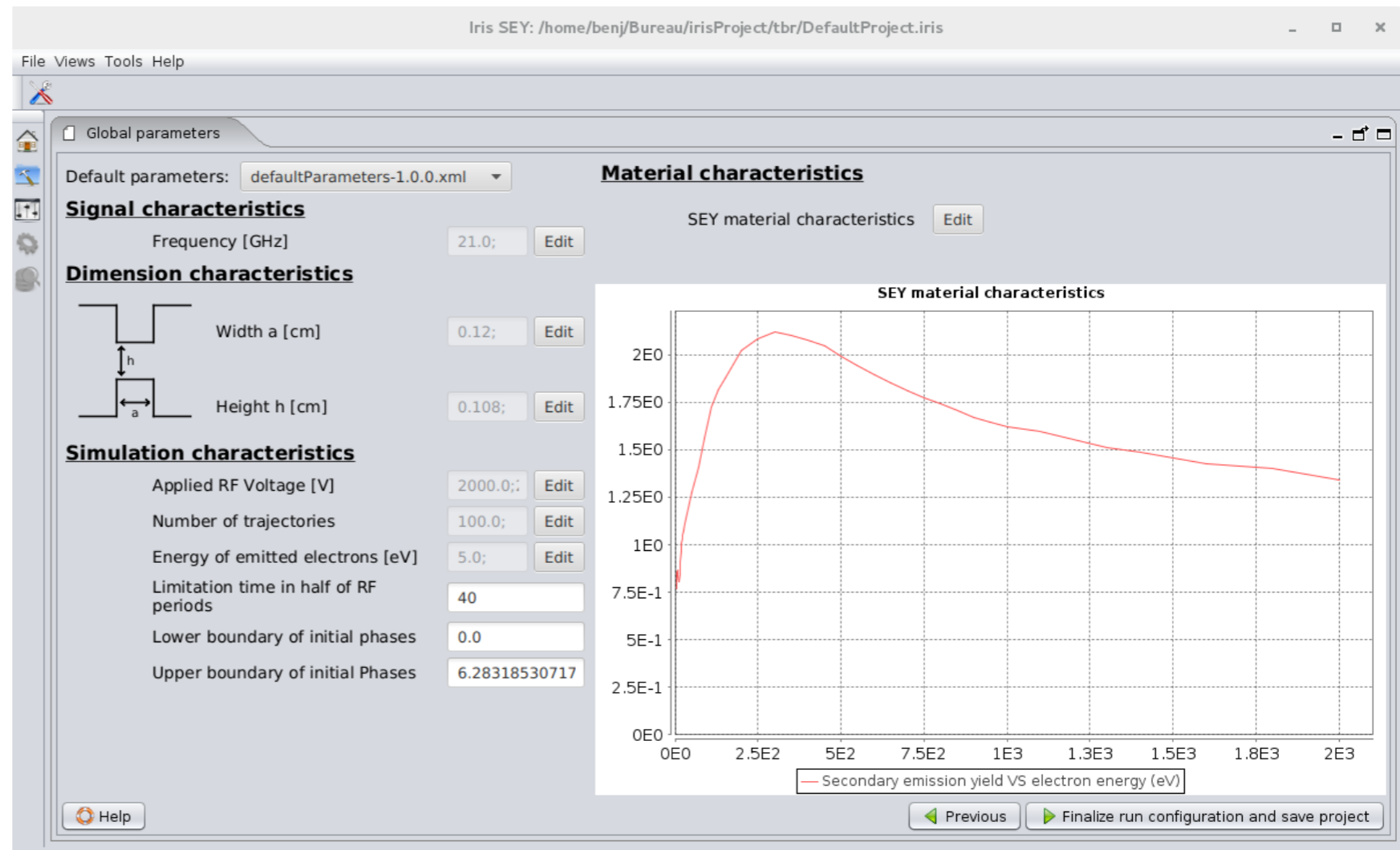
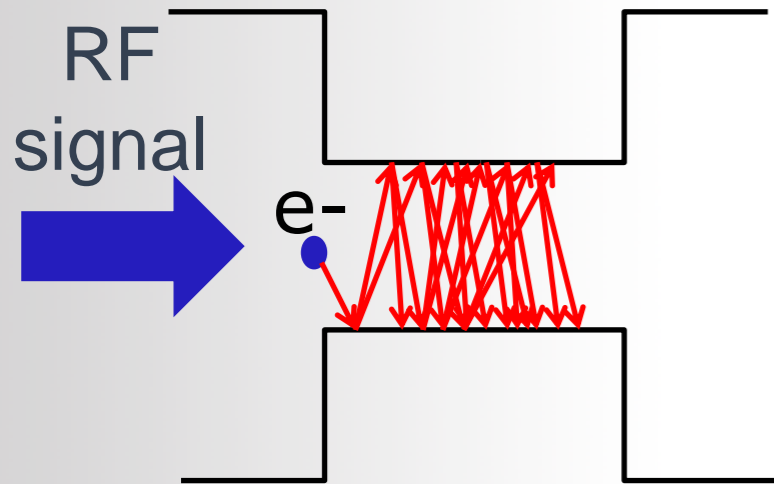
- modelling of the spacecraft charging:
 - for example in SPIS

SEY characteristic
 PEE characteristic
 MSEY characteristic
 IPE characteristic



Important during the modelling process of the effect of the space environment for different communities

- modelling of the multipactor effect:
 - for example in Iris SEY where the secondary emission yield characteristics is needed to run a simulation



The secondary emission depends on the material SEY characteristics

At least two different possibilities to define it:

- thanks to the experimental campaigns
- thanks to the analytical models

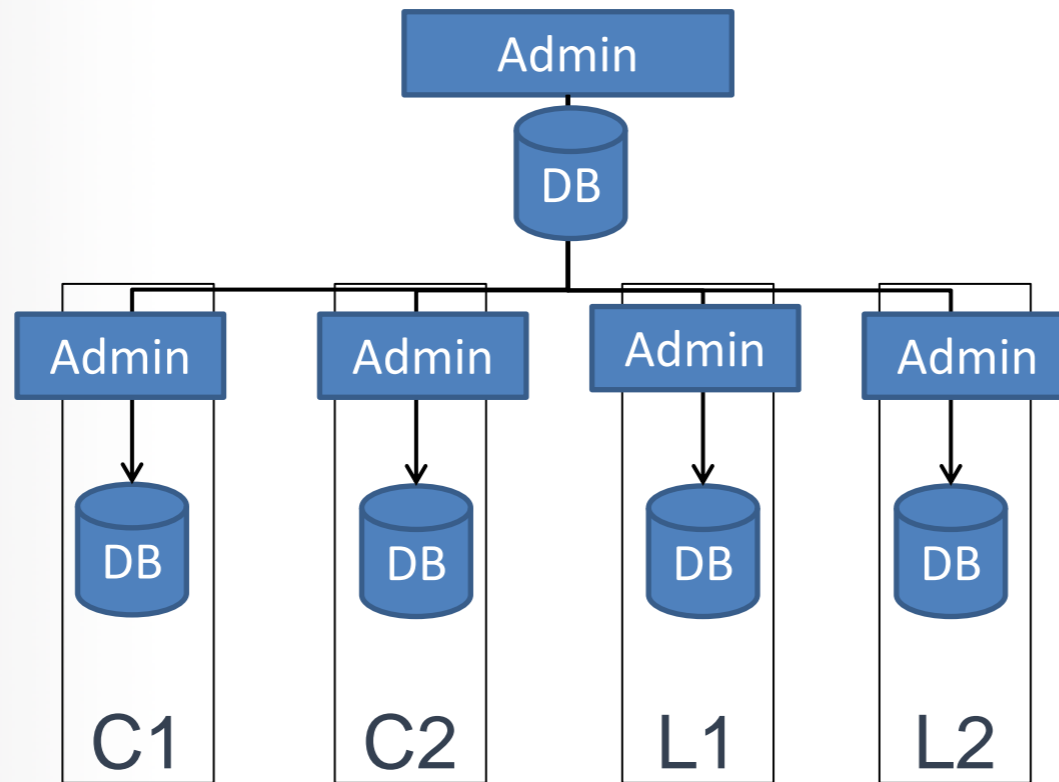
The purpose of the current presentation is to propose how it is possible to store these information thanks to the CNES contract: DA N°10121224 /DSO/RF/HNO-2017.0005952

User requirements done from interviews with CNES (Jérôme Puech), with ONERA (Mohamed Belhaj, Christophe Inguimbert and Sarah Dadouch) and Artenum teams

- General objective of the data base
- Presentation of the developed data base prototype
- Presentation of the features to develop in a realistic data base
- Discussion

- **General objective of the data base**
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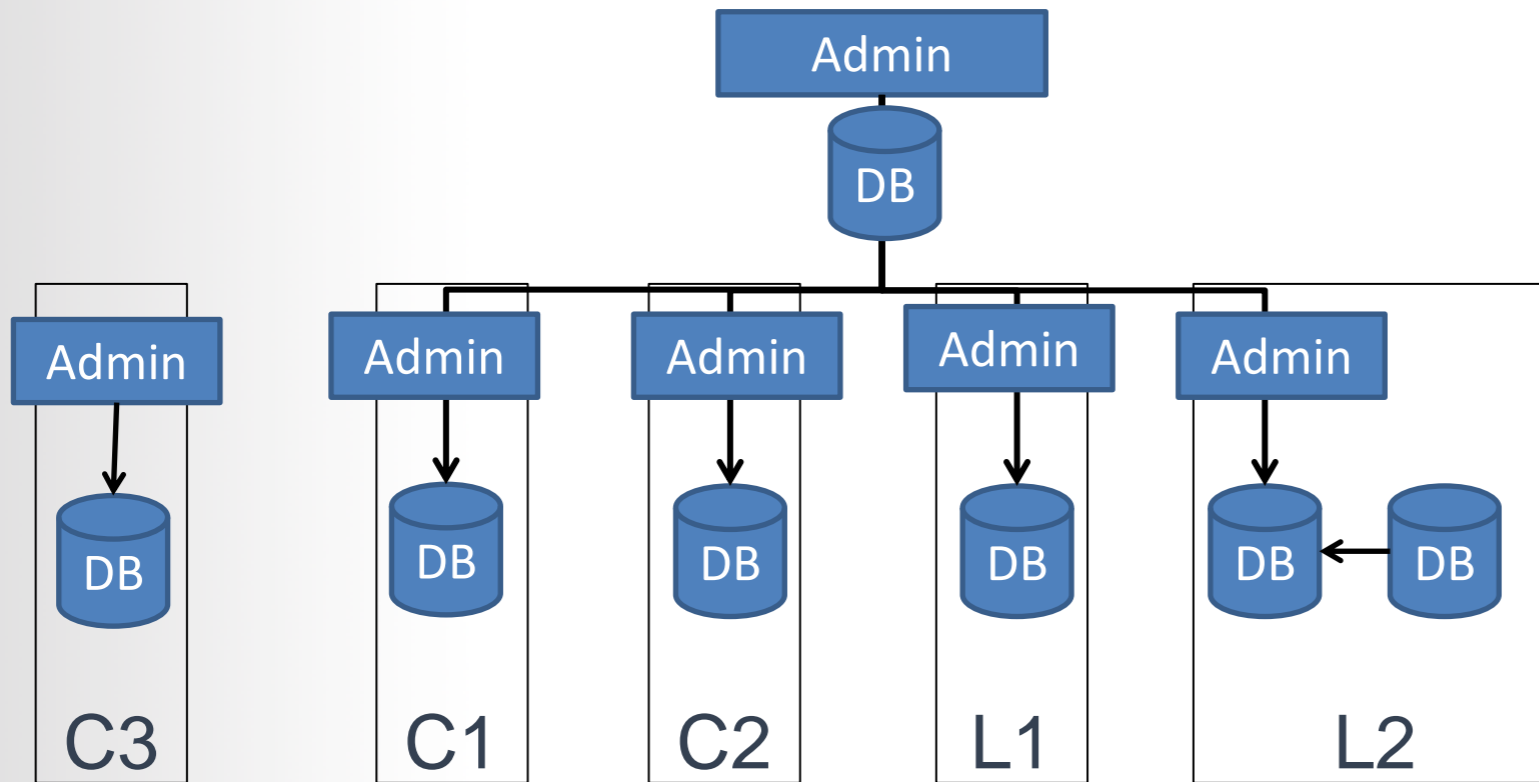
General objective of the data base



**Several data bases
linked and managed by
an administrator**

- C1= company 1
- C2= company 2
- L1= laboratory 1
- L2= laboratory 2

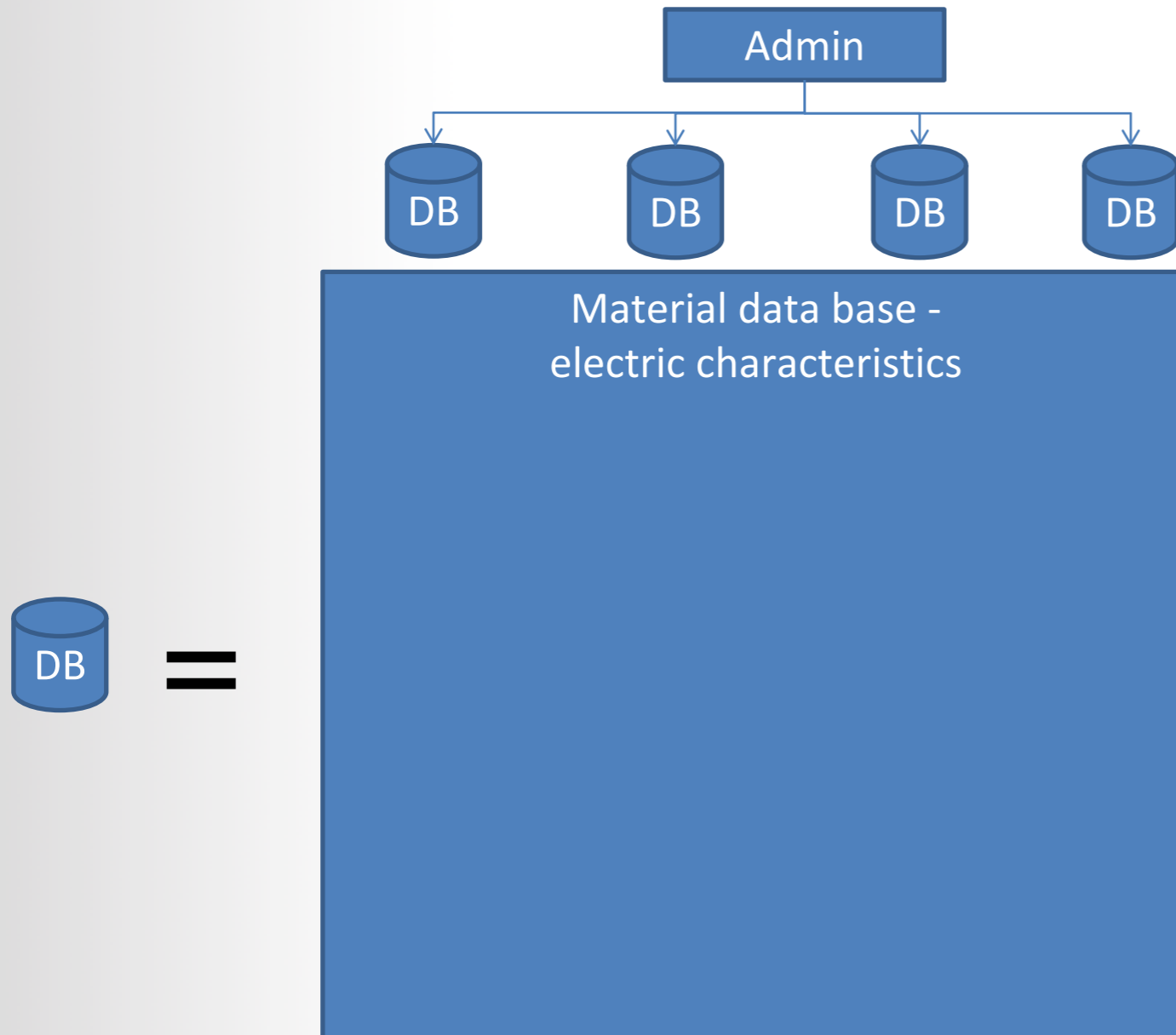
General objective of the data base

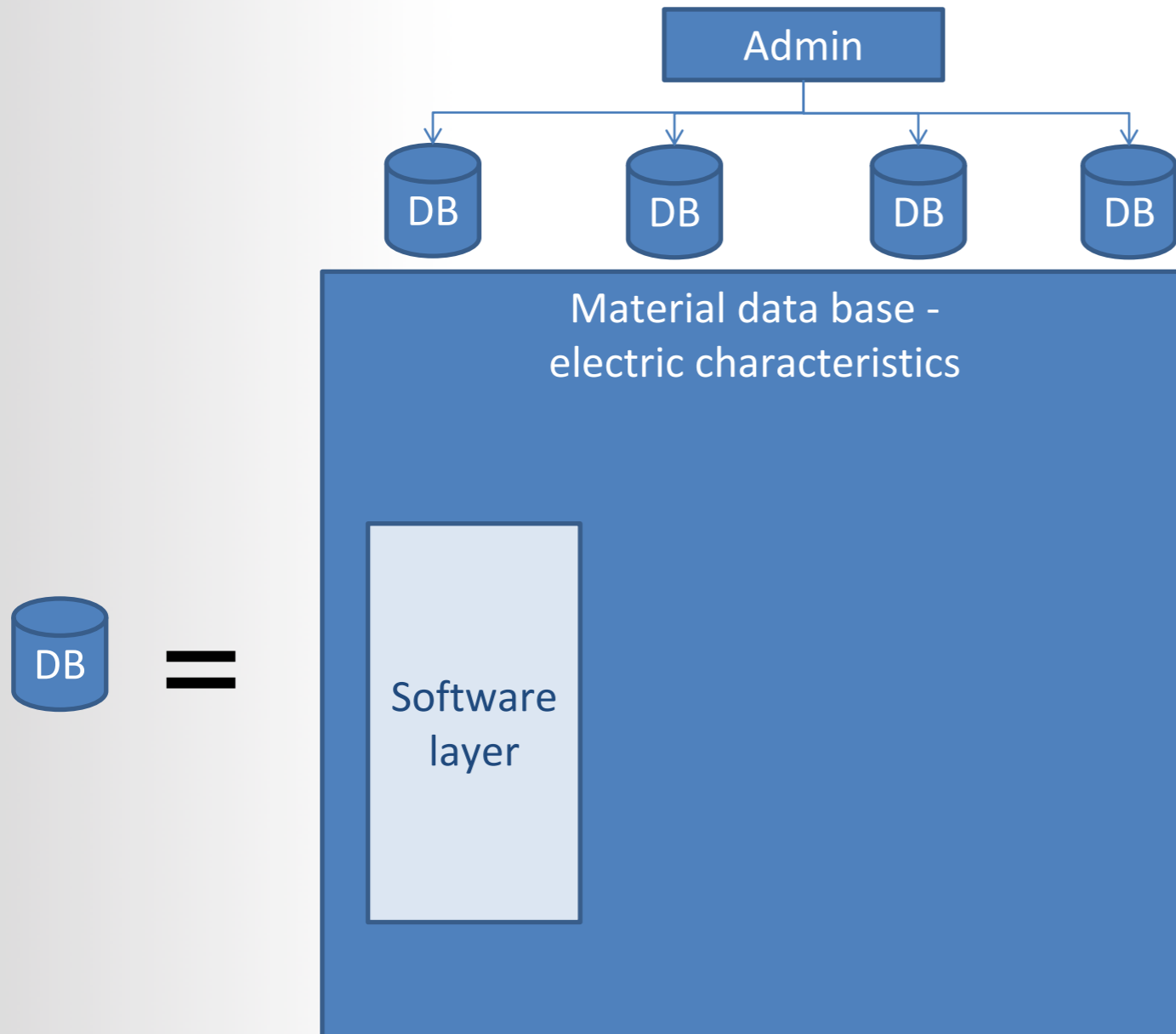


Private data base can be visible only by a few company/labs and/or used independently

- C1= company 1
- C2= company 2
- L1= laboratory 1
- L2= laboratory 2

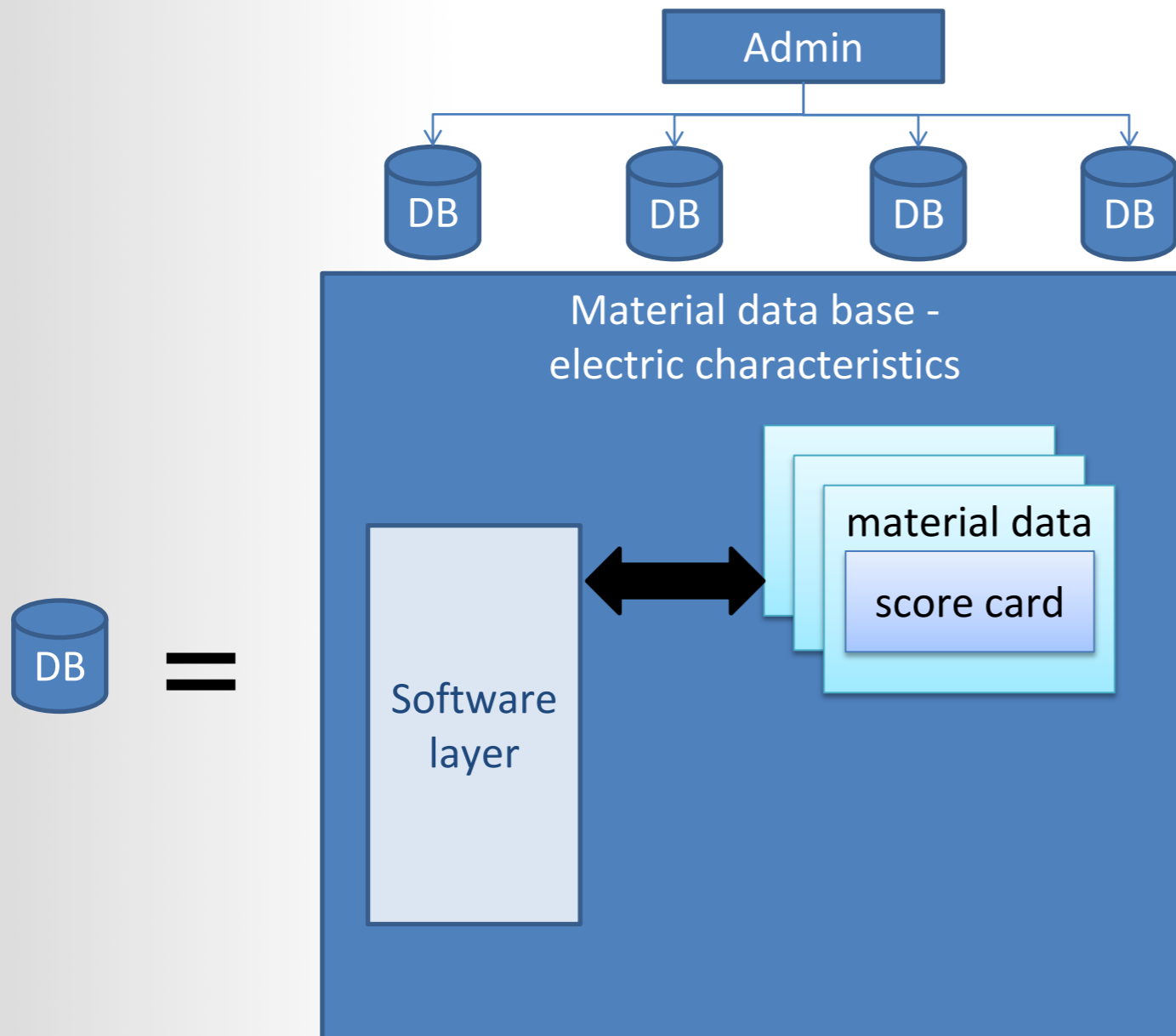
Data base definition





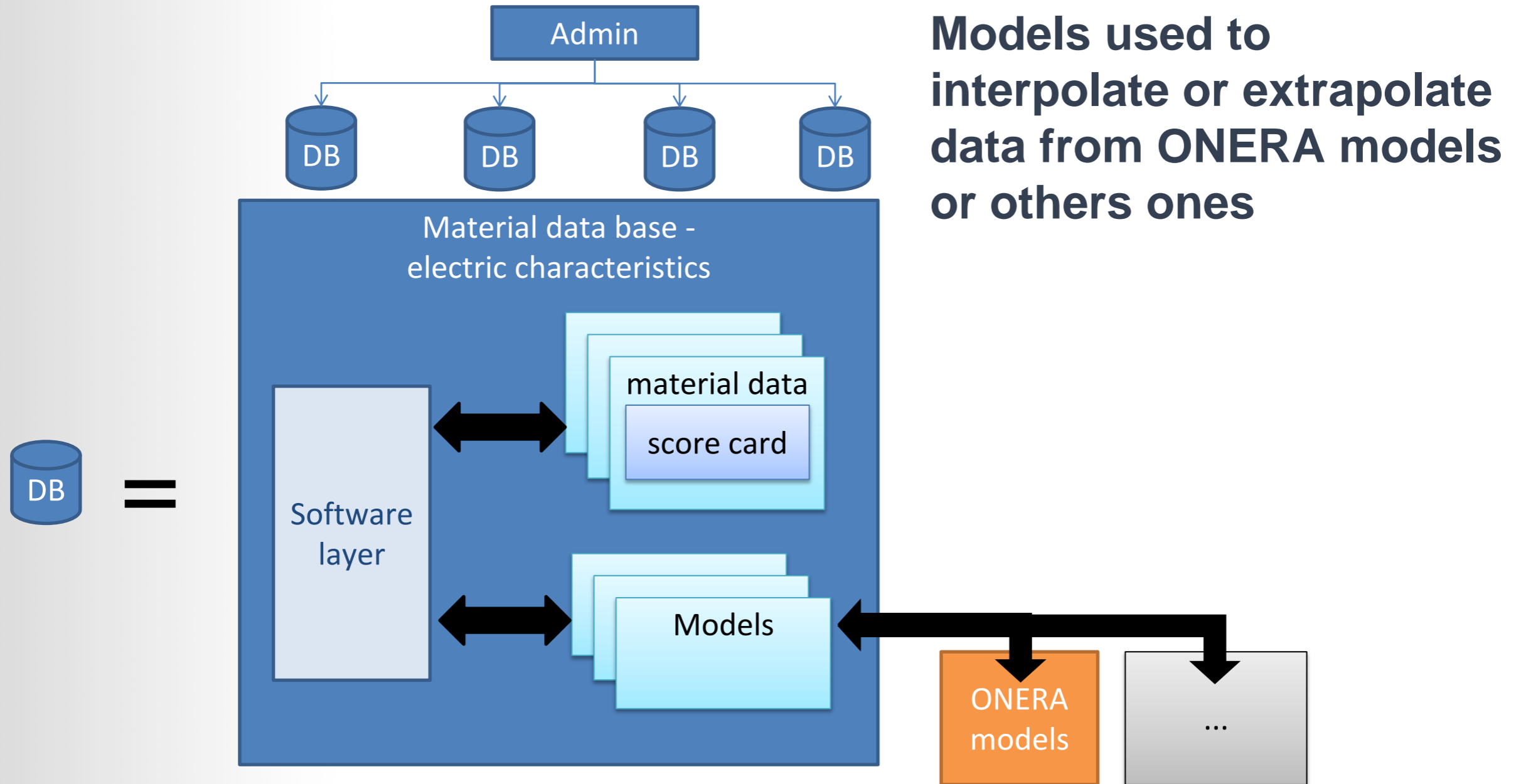
Software layer used to

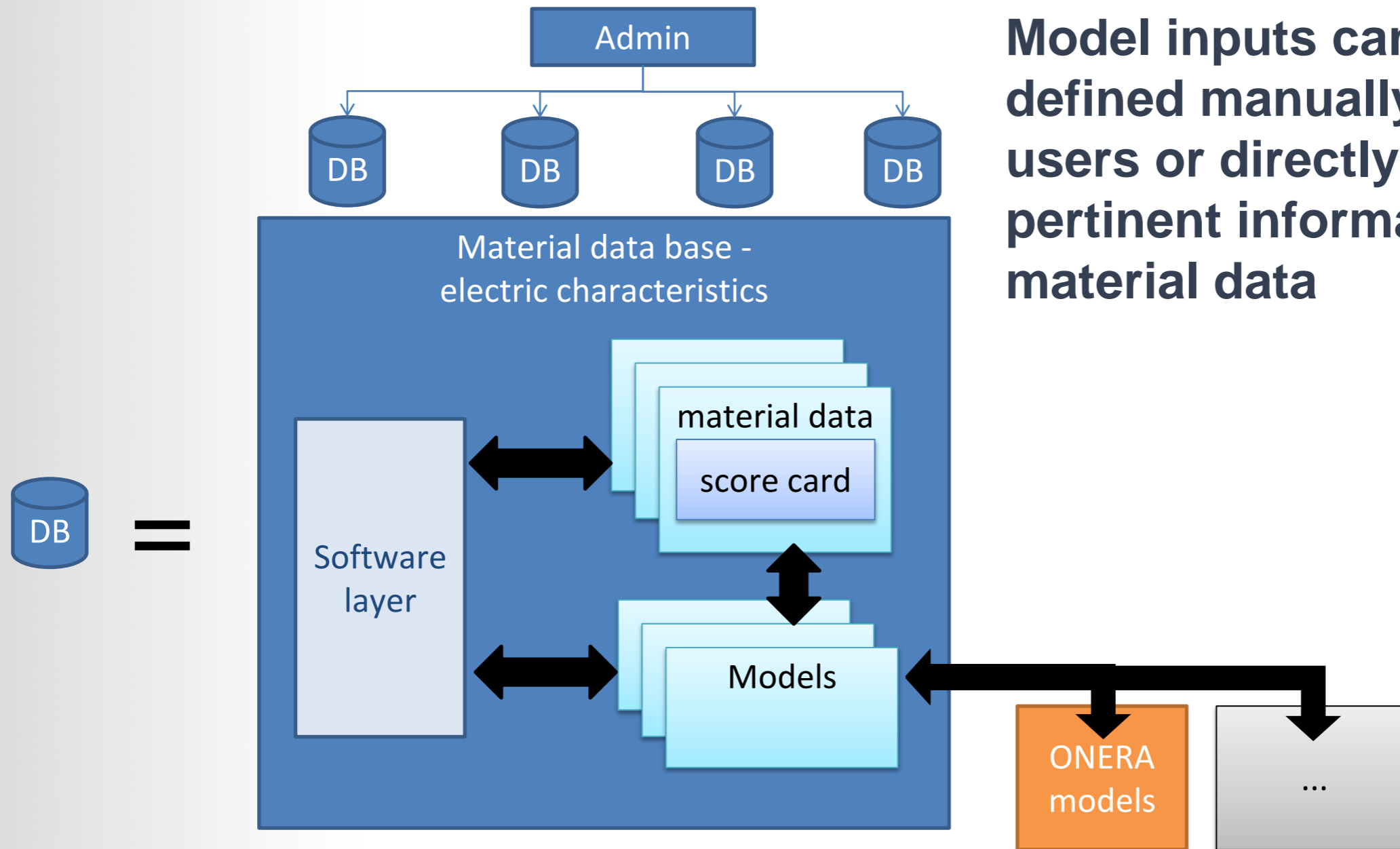
- Display UI
- Main controller
- Central data model
- ...



Store and sort secondary emission characteristics of material with score card from

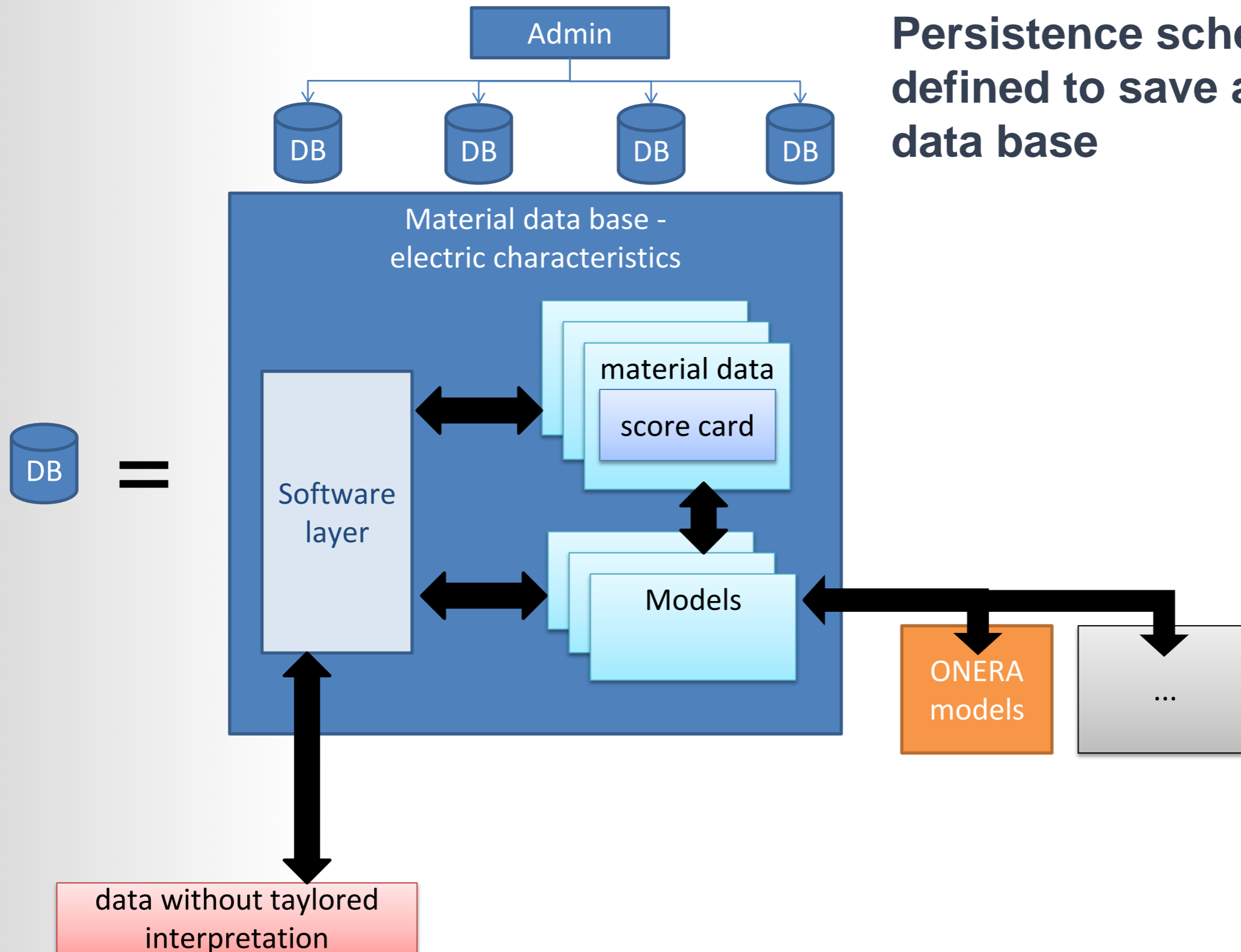
- Experimental campaigns
- Scientific publications
- ...



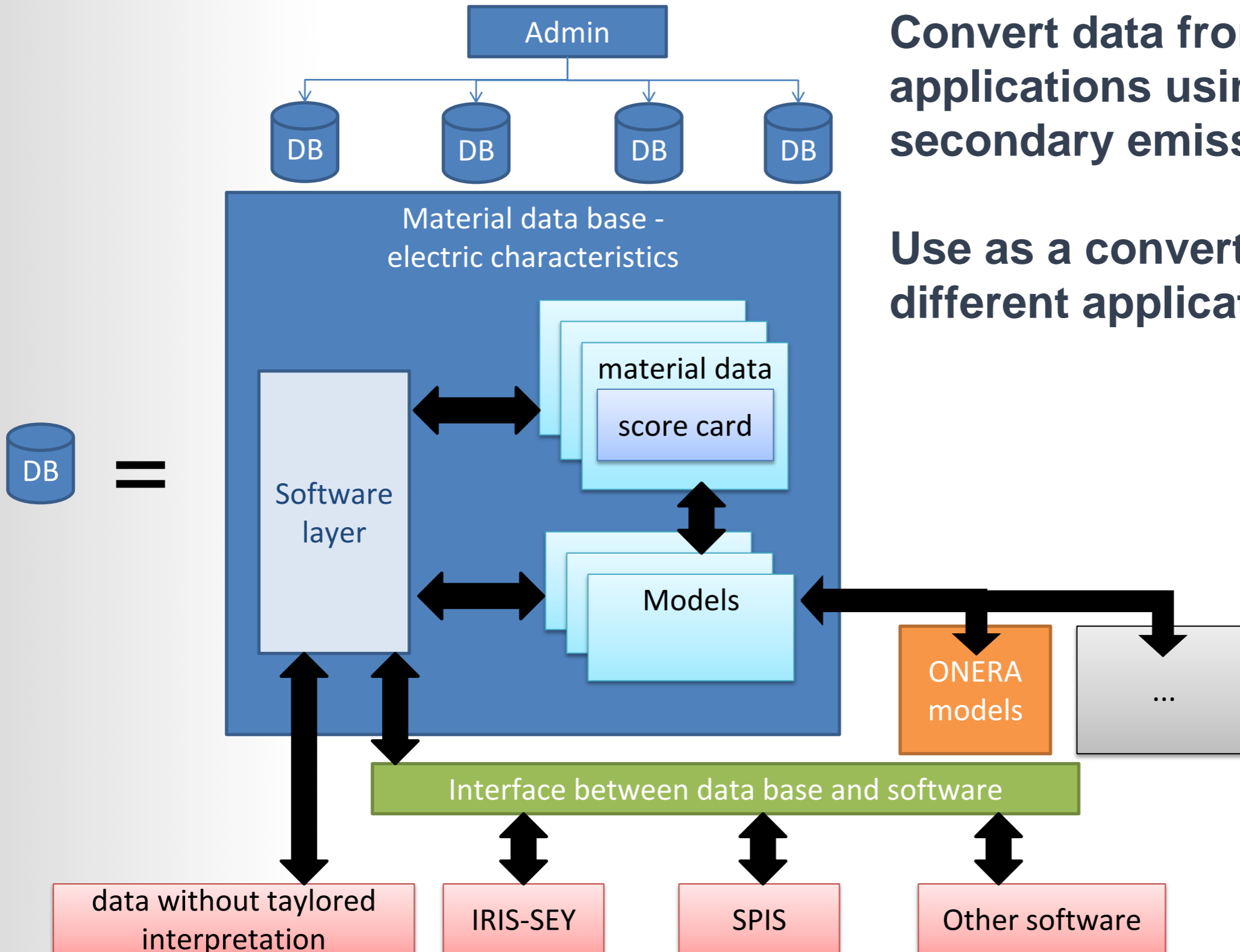


Model inputs can be defined manually by the users or directly extract the pertinent information from material data

Persistence scheme must be defined to save and load the data base



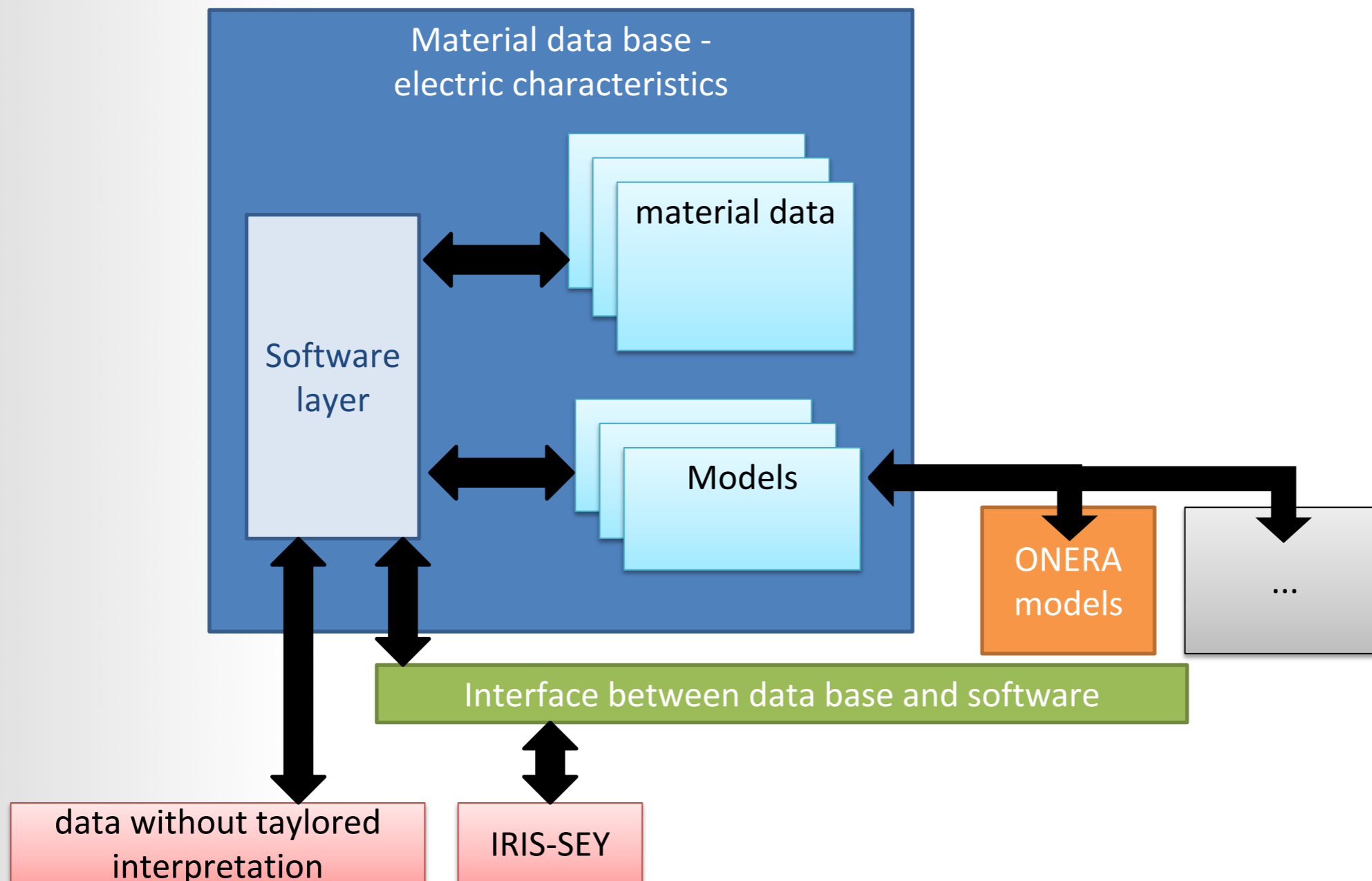
General objective of the data base



Convert data from/to tailored applications using secondary emission

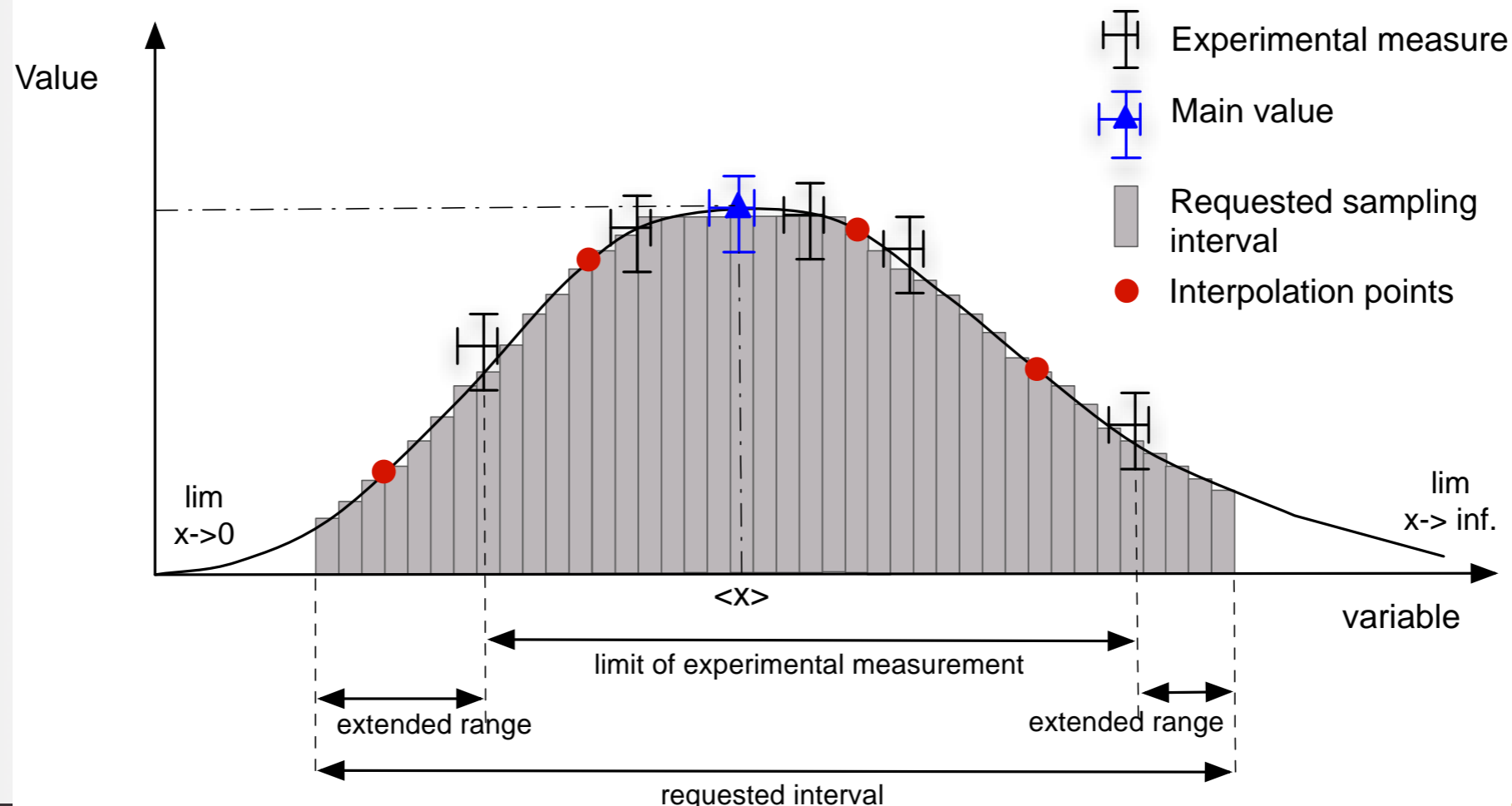
Use as a converter between different applications

Scope of the developed data base prototype



Scope of the developed data base prototype

- Three main objectives have been identified after the user requirements interviews to define a data base:
 - Store material data from experiments, scientific literature, ...
 - Store analytical model definition and run them to interpolate or extrapolate data
 - Convert file format from dedicated tools to another ones

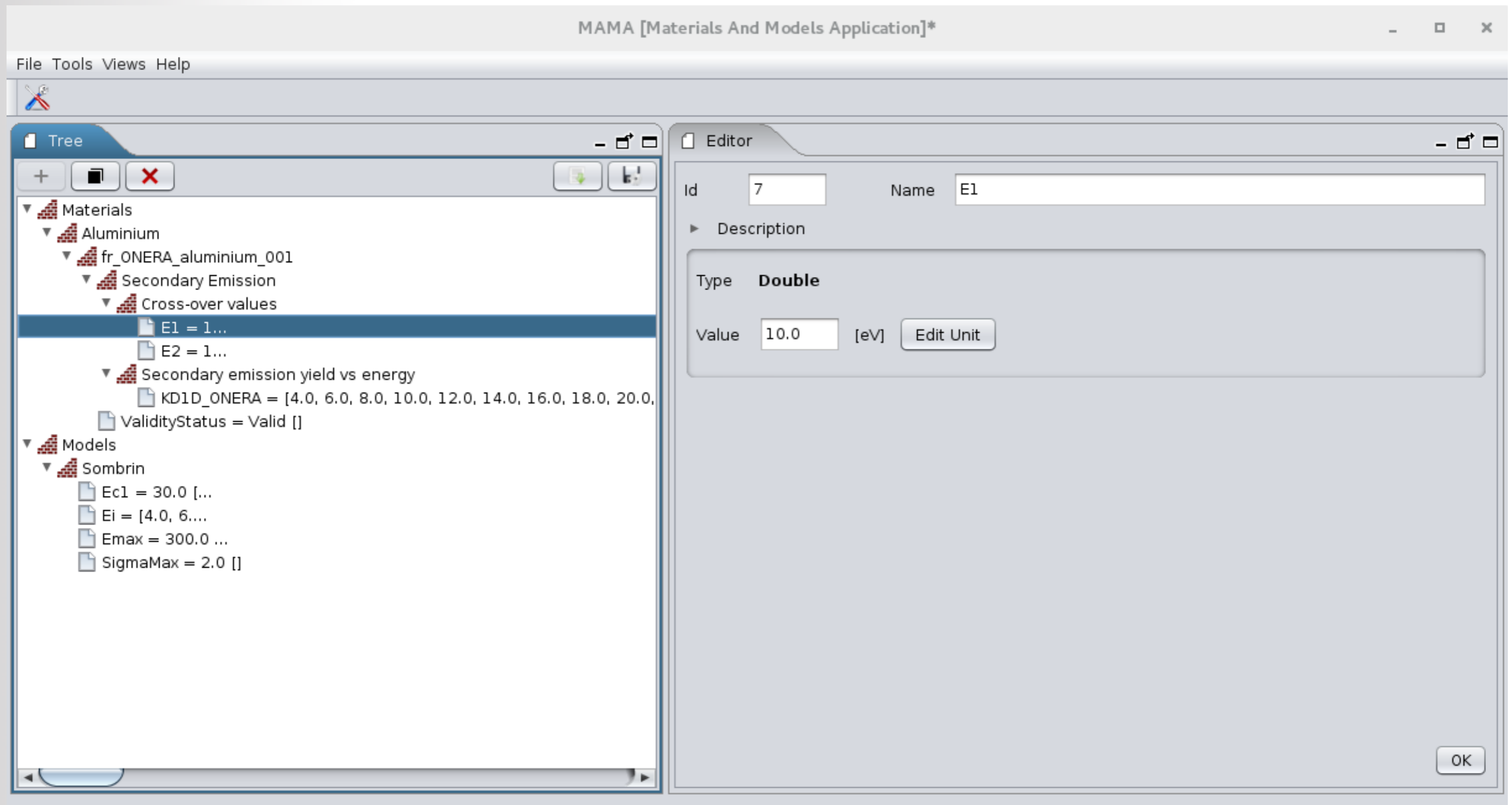


- General objective of the data base
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MAMA for Materials And Models Application:

- Based on Keridwen and Frida third parties
- Store secondary emission material properties and characteristics
- Create/duplicate/remove material properties defined by
 - Unique name
 - Unique Id
 - Description
 - Sub-properties same definition as a property
 - Can store several or any characteristics
- Create/duplicate/remove material characteristics
 - Value (scalar, boolean, matrix, multi-series, tuple, string)
 - Visualize and edit the value
 - Unit
 - Unique name
 - Unique Id
- Flex structure allowing hierarchy
- Predefined structure to help users

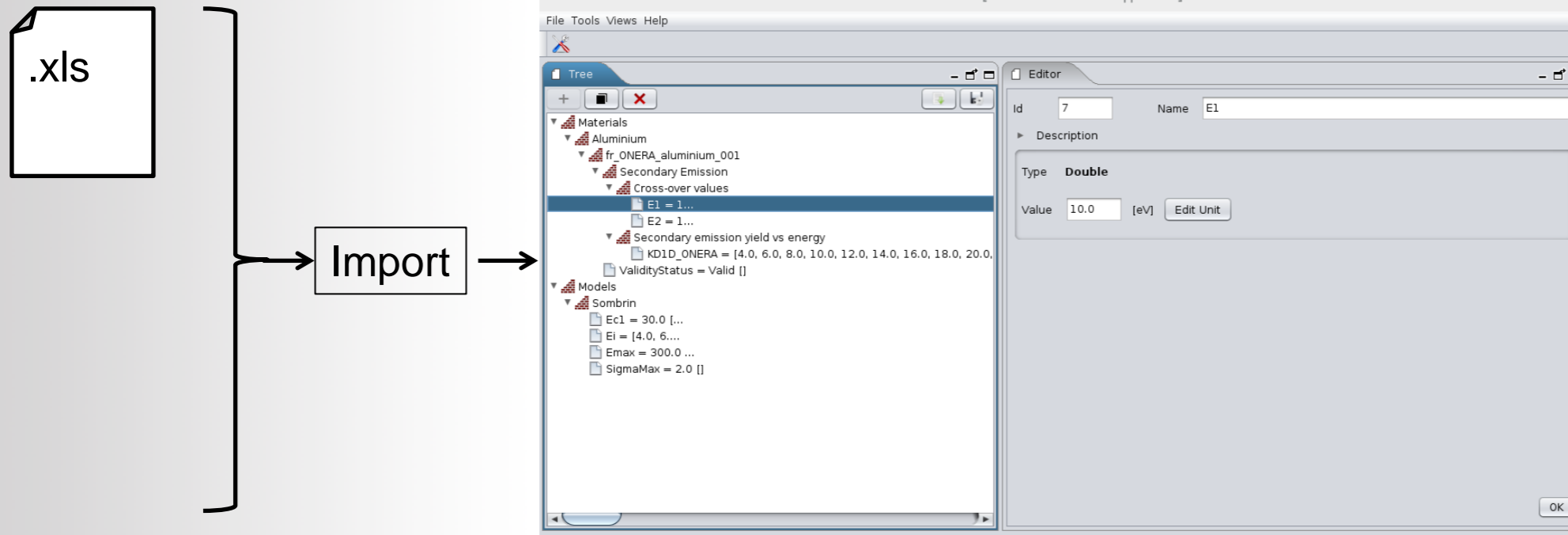
MAMA for Materials And Models Application:



Properties and characteristics edition

Import and Export material characteristics and properties:

- Plugins: if the java file is present in the application, the associated import or export developed in the plugin is available

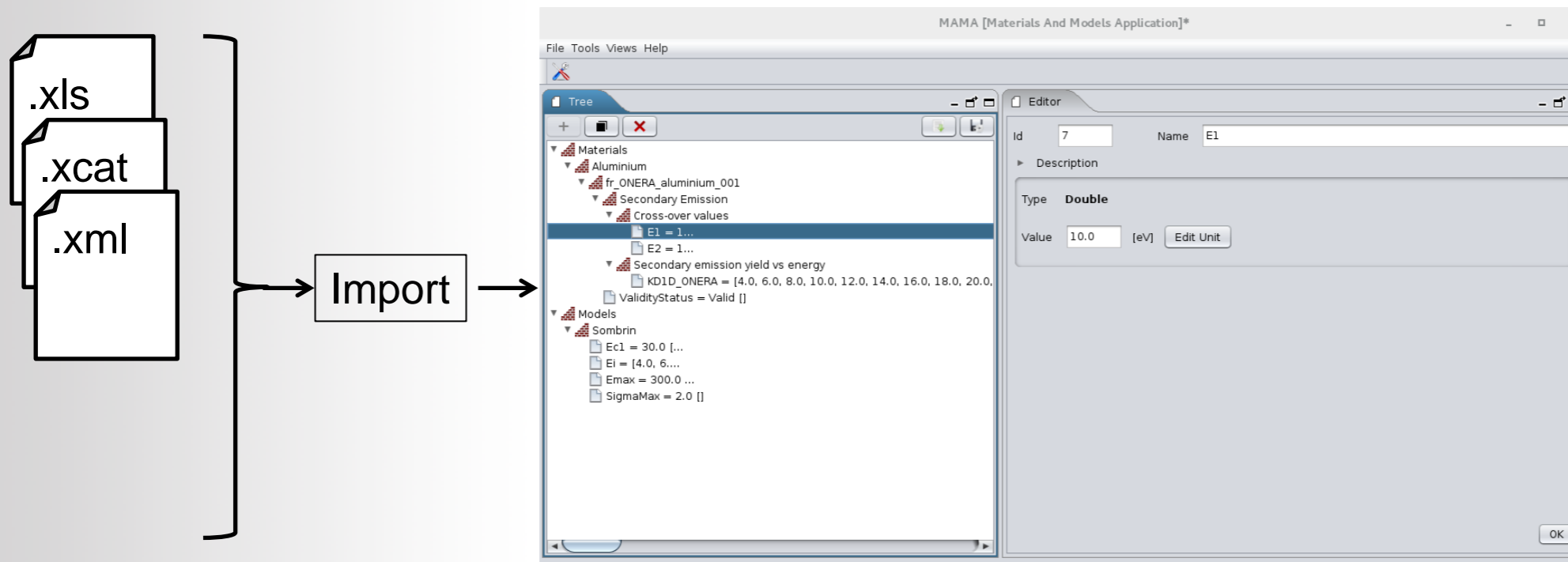


MAMA

Excel files storing experimental data material performed by ONERA and consistent with the format defined by the ONERA

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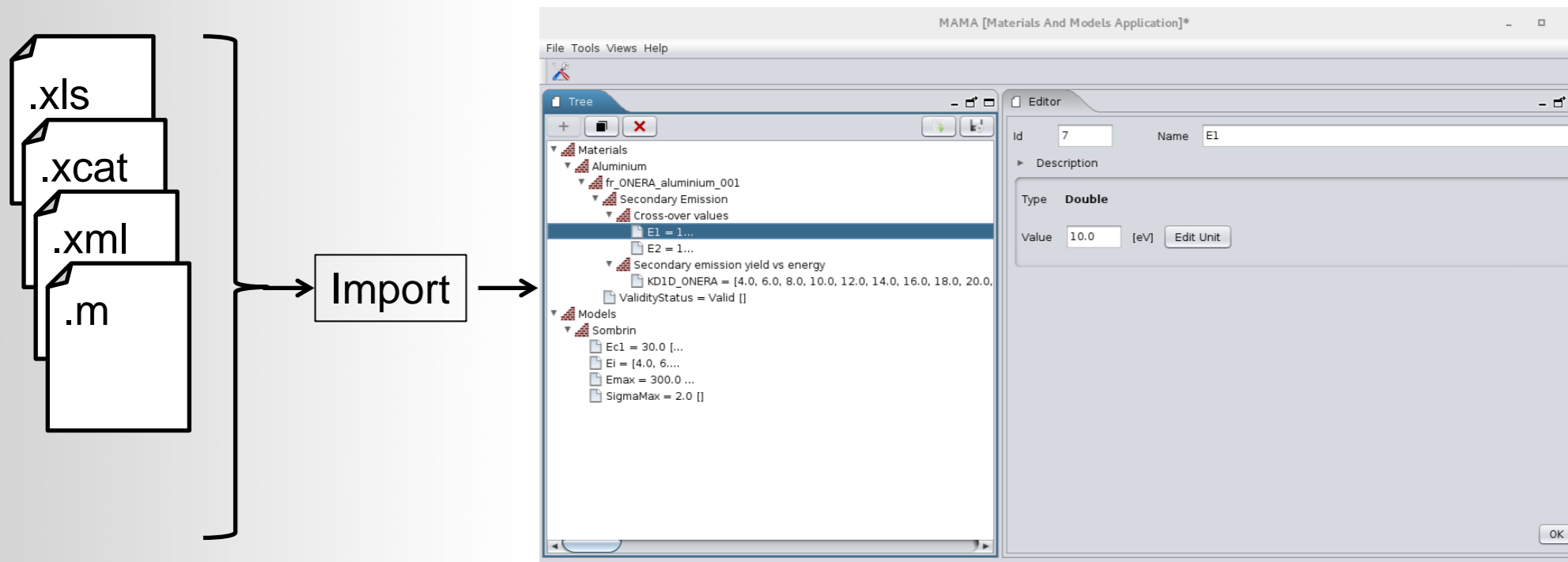
MAMA

Frida catalogue and Frida xml files used for:

- The persistence scheme
- Same format in SPIS software

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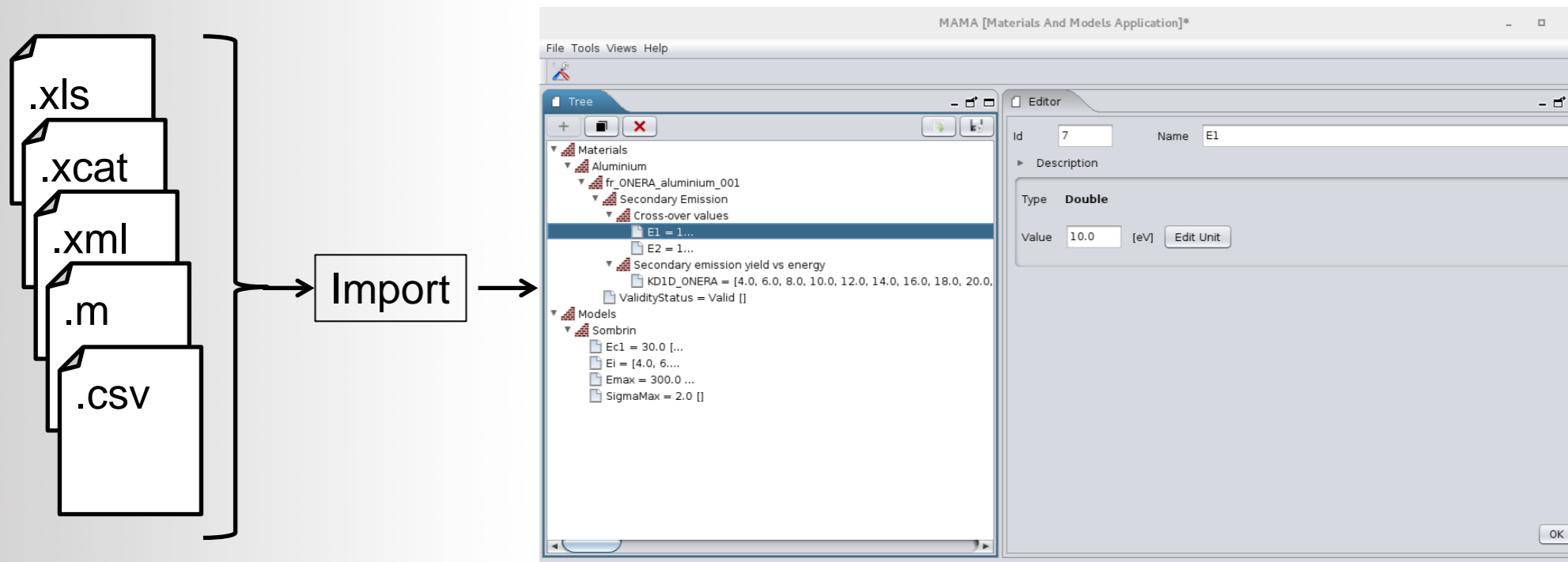


MAMA

.m file which is an ascii file consistent with lots of commercial or non commercial software modelling multipactor effect (tabulated function separated by tab character)

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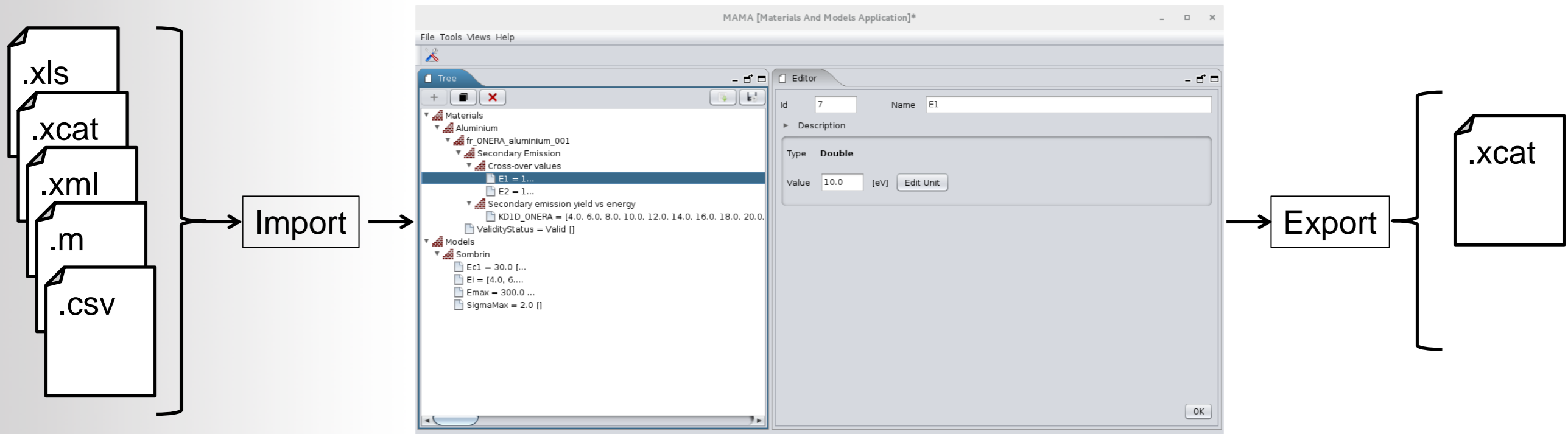


MAMA

.csv file exported from the Matrex data base without taylorred interpretation

Import and Export material characteristics and properties:

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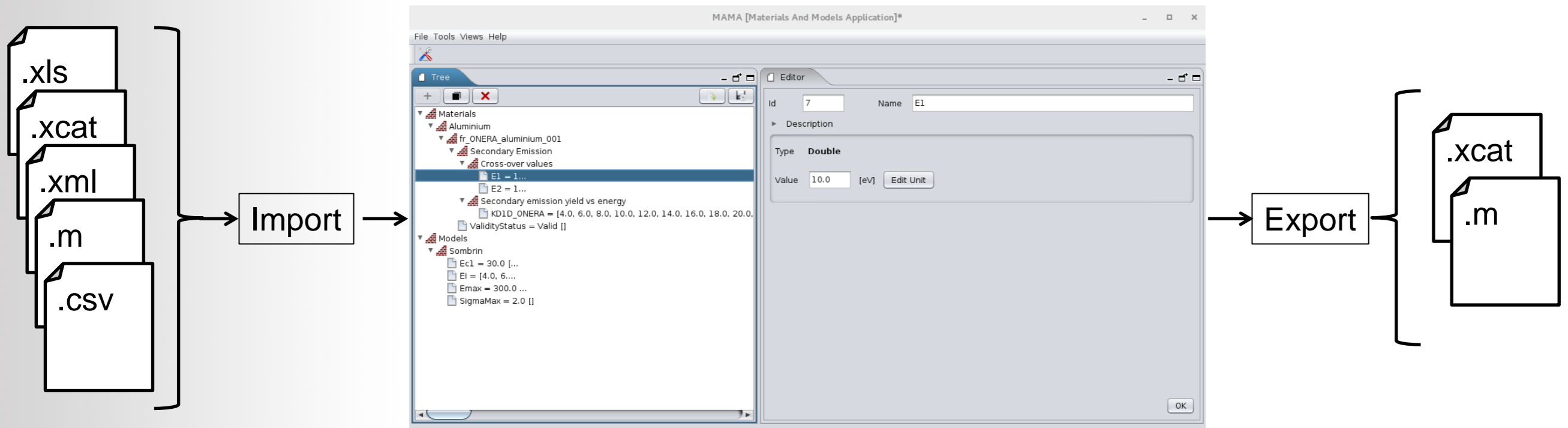
MAMA

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MAMA

.m file which is an ascii file consistent with lots of software modelling multipactor effect (tabulated function separated by tab character)

Models:

- Defined by input characteristics set manually
- Run the model to compute the material characteristics to model
- Export the result in a dedicated file loadable by MAMA
- Plugins: if the java file is present in the application, the associated model is available, if not it is not available

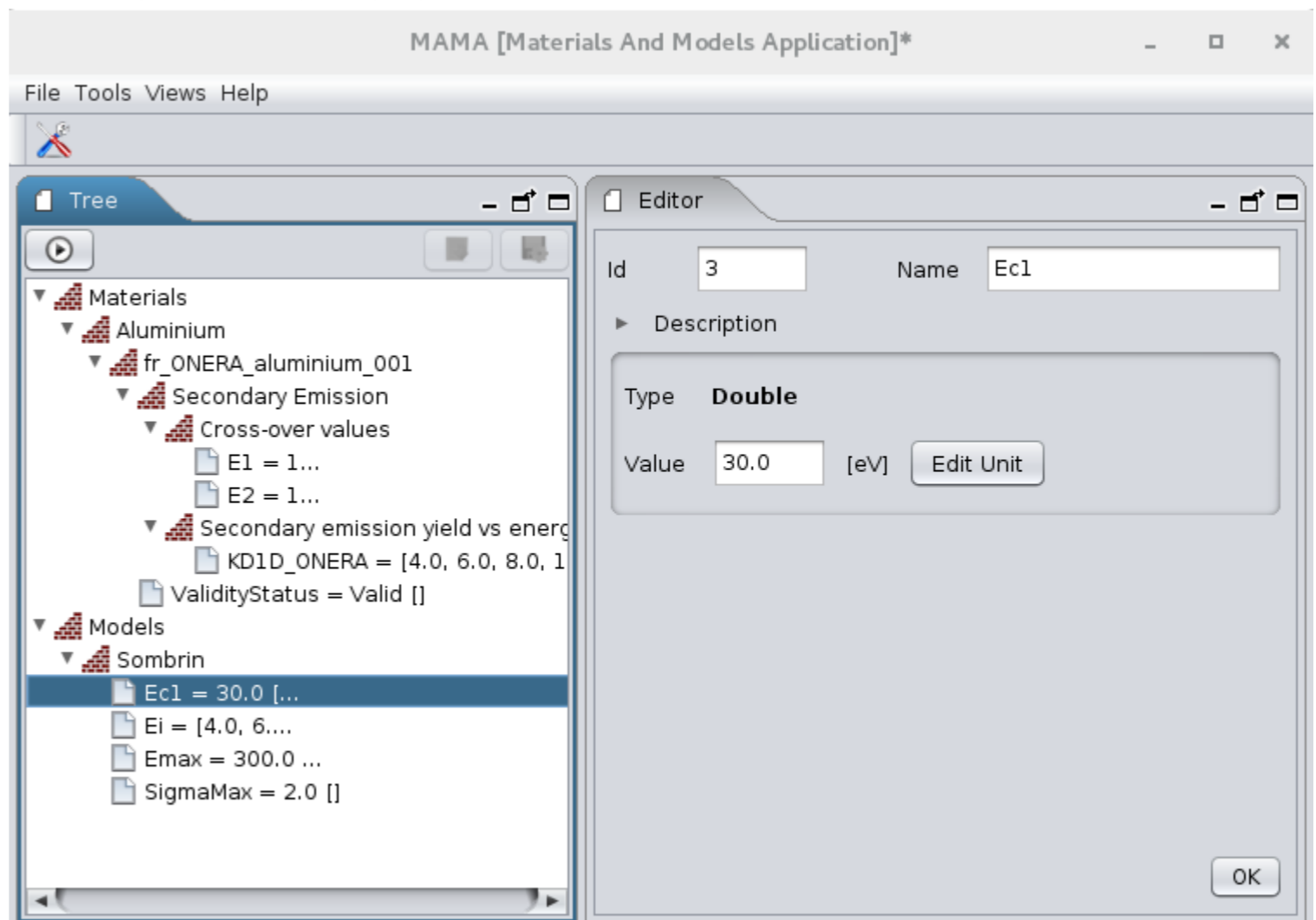
Today only the Sombrin model has been implemented in the data base prototype based on

Multipactor threshold sensitivity to Total Electron Emission Yield in parallel-plate waveguide and TEEY models accuracy. N. Fil (1), M. Belhaj (2), J. Hillairet (1), J. Puech (3)

(1) CEA, the French Alternative Energies and Atomic Energy Commission, DRF//IFRM/SI2P/GSCP, CEA Cadarache, 13108 Saint Paul-Lez-Durance, France

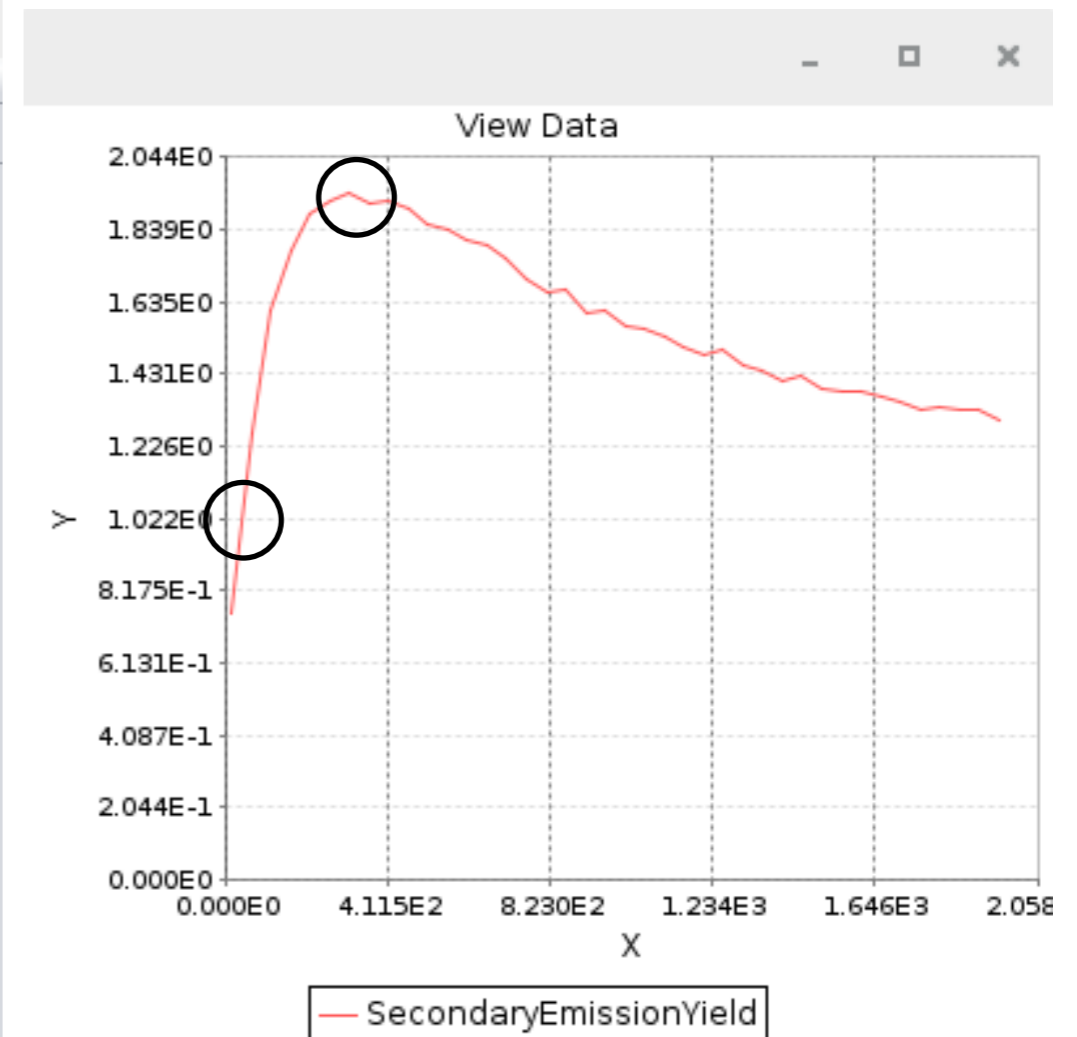
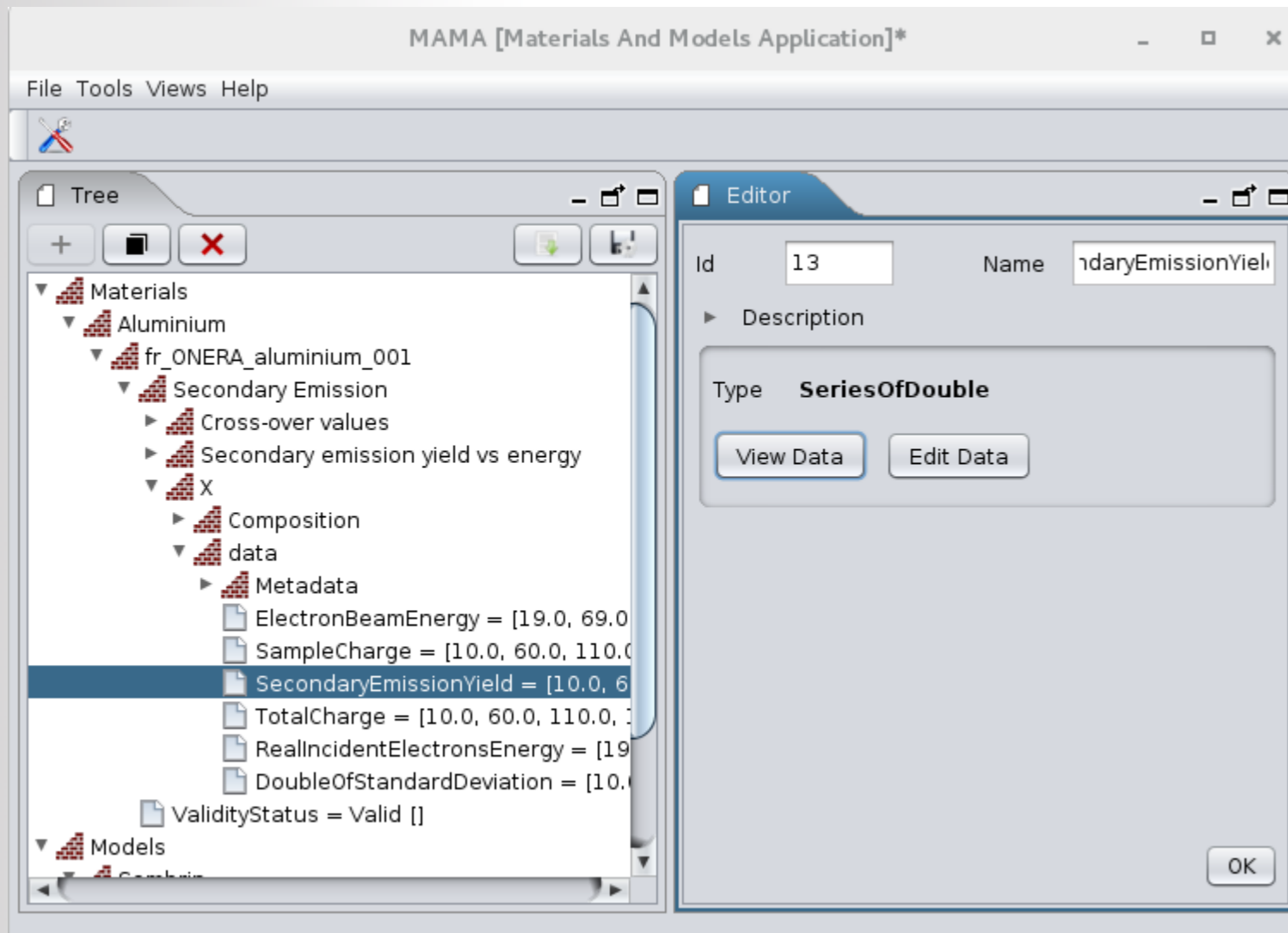
(2) ONERA, the French Aerospace Laboratory, DESP, 31000 Toulouse, France

(3) CNES, the French National Centre for Space Studies, DCT/RF/HT, 31000 Toulouse, France



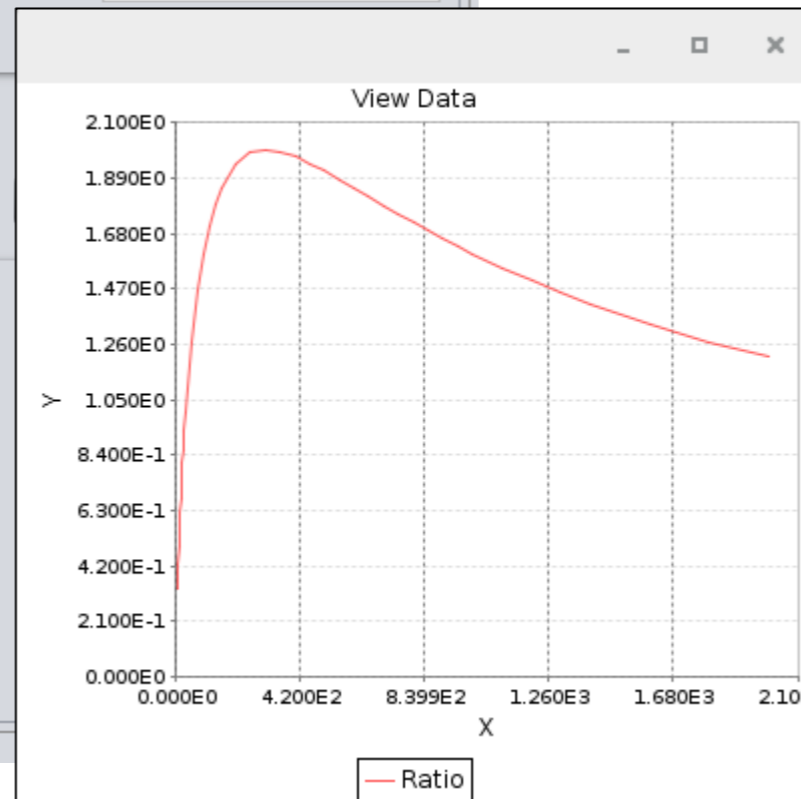
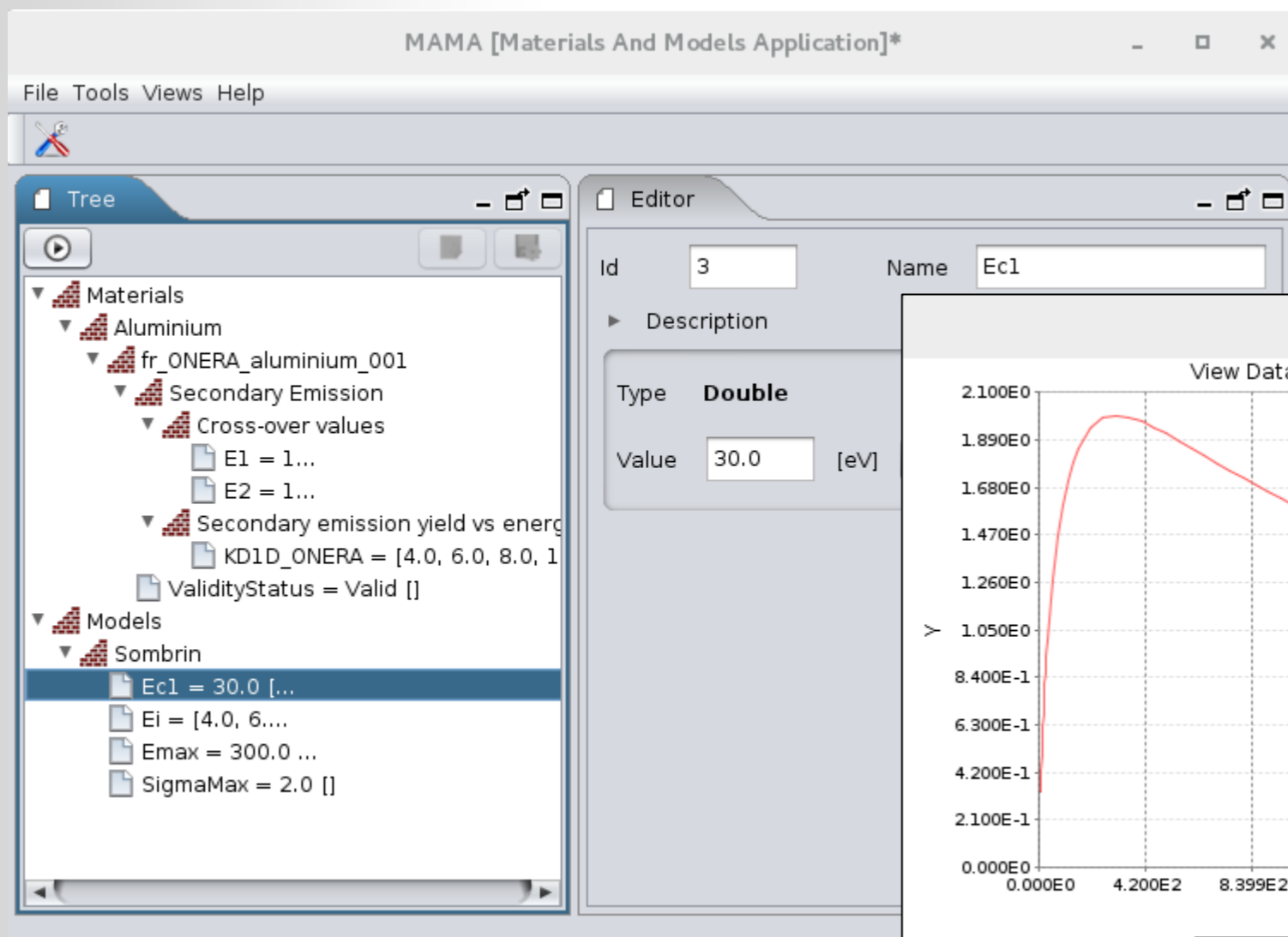
application case:

- Import excel file storing data material from ONERA

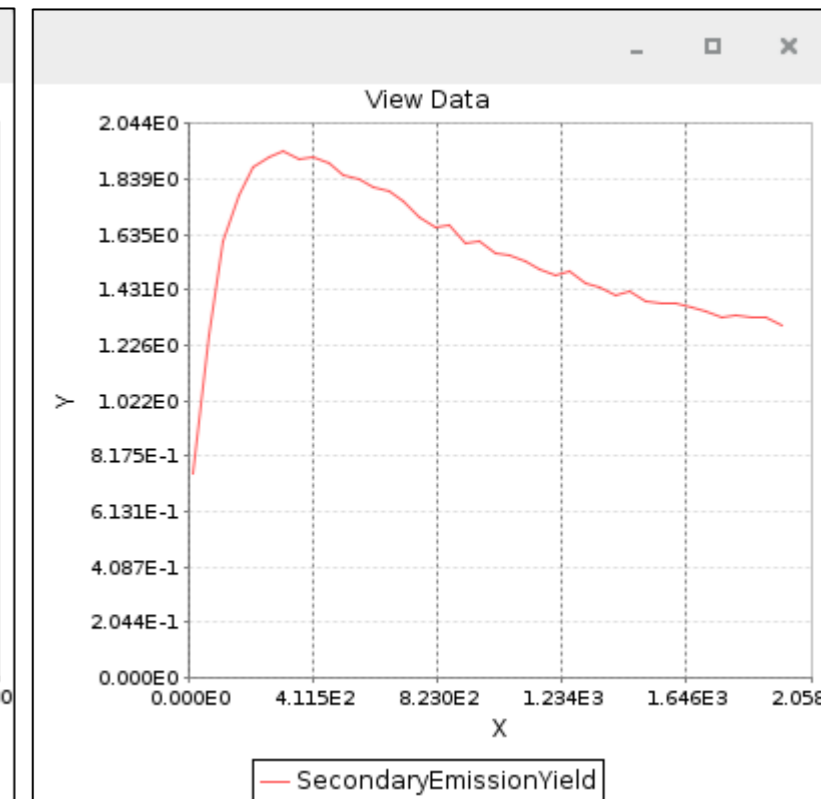


application case:

Apply Sombrin model from the excel file values and load the model result in the data base



model result



experimental result

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Lots of features defined in the URD_Multipactor_Rev1.0 document are not implemented in the prototype and must be considered for a realistic data base:

- Data base request/search features
- Versioning of the data base
- Backwards compatibility
- Access right
- Users identification
- Roles identification
- Traceablility
- Scripting
- Move properties and characteristics
- New import/export formats
- New analytical models
- ...

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Cross validation about the identified user requirements

In the CNES contract: DA N°10121224 / DSO/RF/HNO-2017.0005952:

- User requirements about a tool able to store data material about secondary emission has been identified and detailed in the URD_Multipactor_Rev1.0 document
- A data base prototype from these requirements has been developed and is/will be used as a basis of discussion to cross validate the identified user requirements

Questions?

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