

DE LA RECHERCHE À L'INDUSTRIE



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Working Party on Nuclear Criticality Safety

1st Meeting on Subgroup 2

BLIND BENCHMARK ON MOX DAMP POWDERS

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Monitors :

B. Rearden (ORNL, USA) ; **A. Santamarina** (CEA, France)

Participants :

C. Perfectti (ORNL, USA), **Y. Golovko** (IPPE, Russia),

A. Jinaphanh / N. Leclaire (IRSN, France),

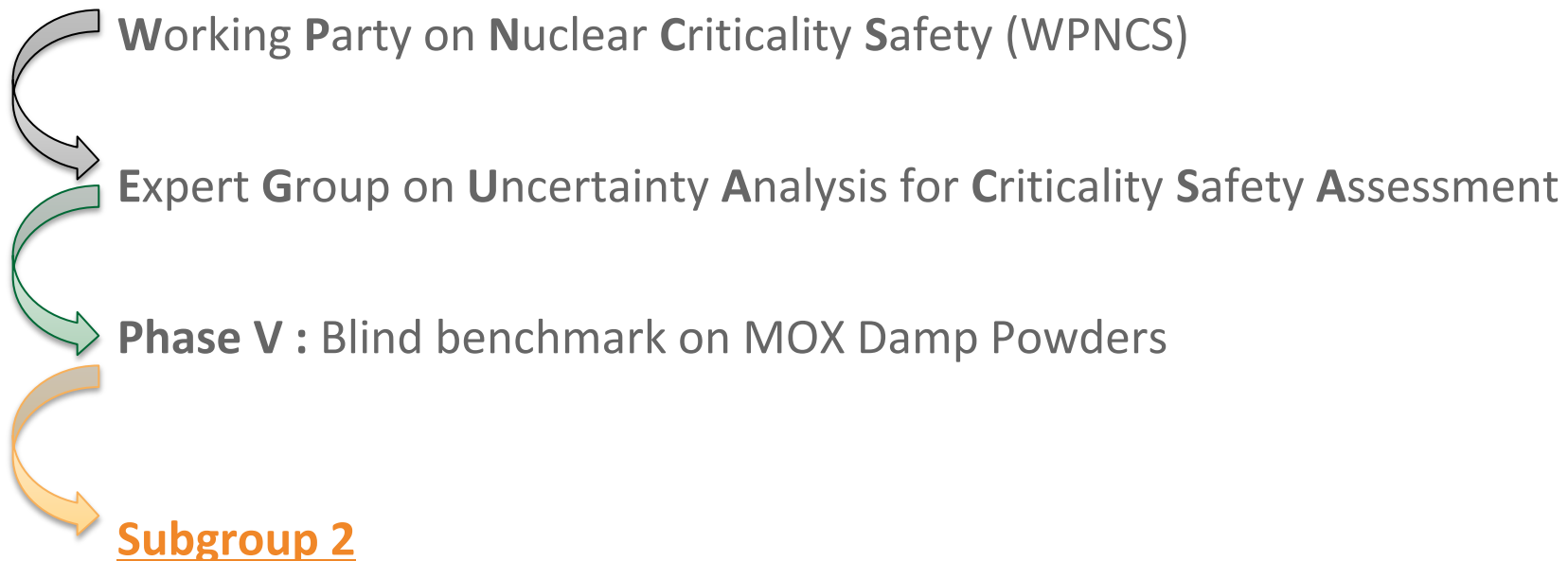
D. Mennerdahl (EMS, Sweden)



WPNCSS-2018 Meetings, 92100 Boulogne-Billancourt, France

JULY 5, 2018

SUBGROUP 2 BACKGROUND



Co-ordinator : C. Carmouze (CEA, France)

Monitors : B. Rearden (ORNL, USA)
A. Santamarina (CEA, France)

■ Objective and Scope

■ Expected results

OBJECTIVE AND SCOPE (1/4)

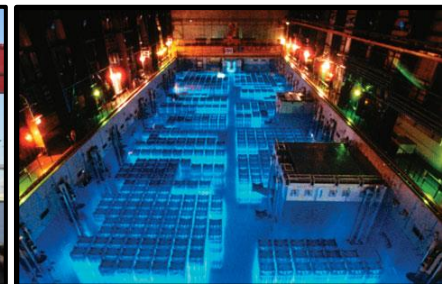
Criticality calculations sources of uncertainties

- ✓ Manufacturing and operational data
- ✓ Experimental data & benchmark models
- ✓ Calculation codes: models and assumptions,
nuclear data → Main source / To be minimized

OECD / NEA – WPNCS Expert Group on **U**ncertainty
Analysis for **C**riticality-**S**afety **A**ssessment (**UACSA**)

- ❖ Address issues related to **sensitivity and uncertainty studies** for criticality calculations;
- ❖ Conduct the comparison and testing of methods and computing tools for **uncertainty analysis** ;

WPNCS BENCHMARK ON DAMP MOx POWDERS



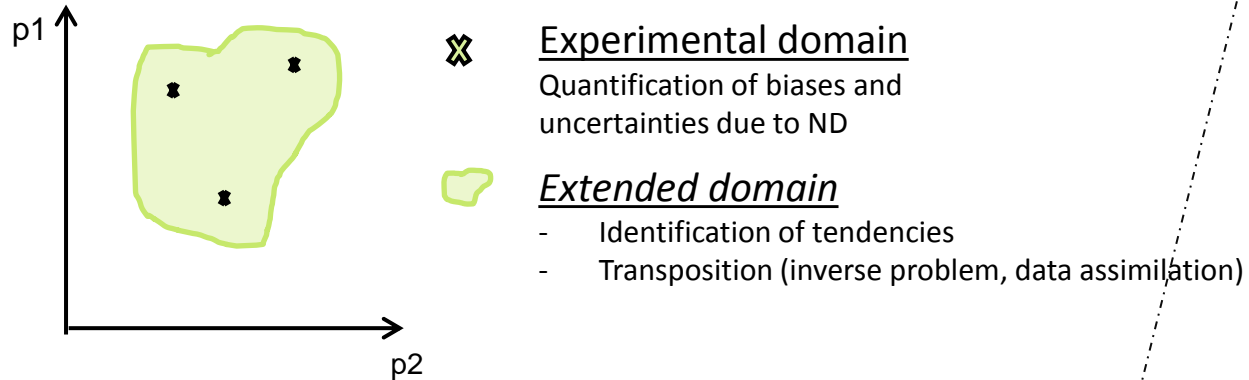
OBJECTIVE AND SCOPE (2/4)

Why ?

- To **compare Validation Methods used in Criticality-Safety Calculations** of Industrial Applications

↔ Methods for **predicting k_{eff} computational bias and uncertainty**

Especially when the experimental domain is restricted



How ?

- By defining a system for which:
 - **limited applicable benchmark experiments** are available
 - **nuclear data uncertainties** (cross sections) are substantial

↔ highlighting the **reliance** of computational methods

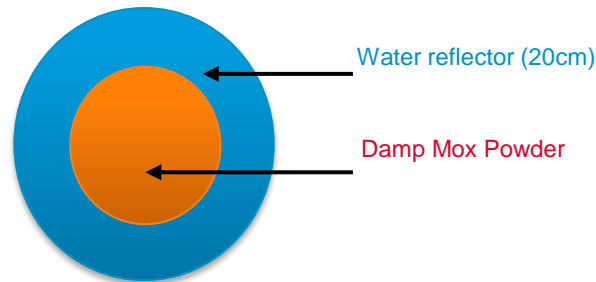
WPNCs - SubGroup 2 : A **benchmark on damp MOX powders**

OBJECTIVE AND SCOPE (3/4)

- The CEA has shared the final benchmark specifications in **September 2015**

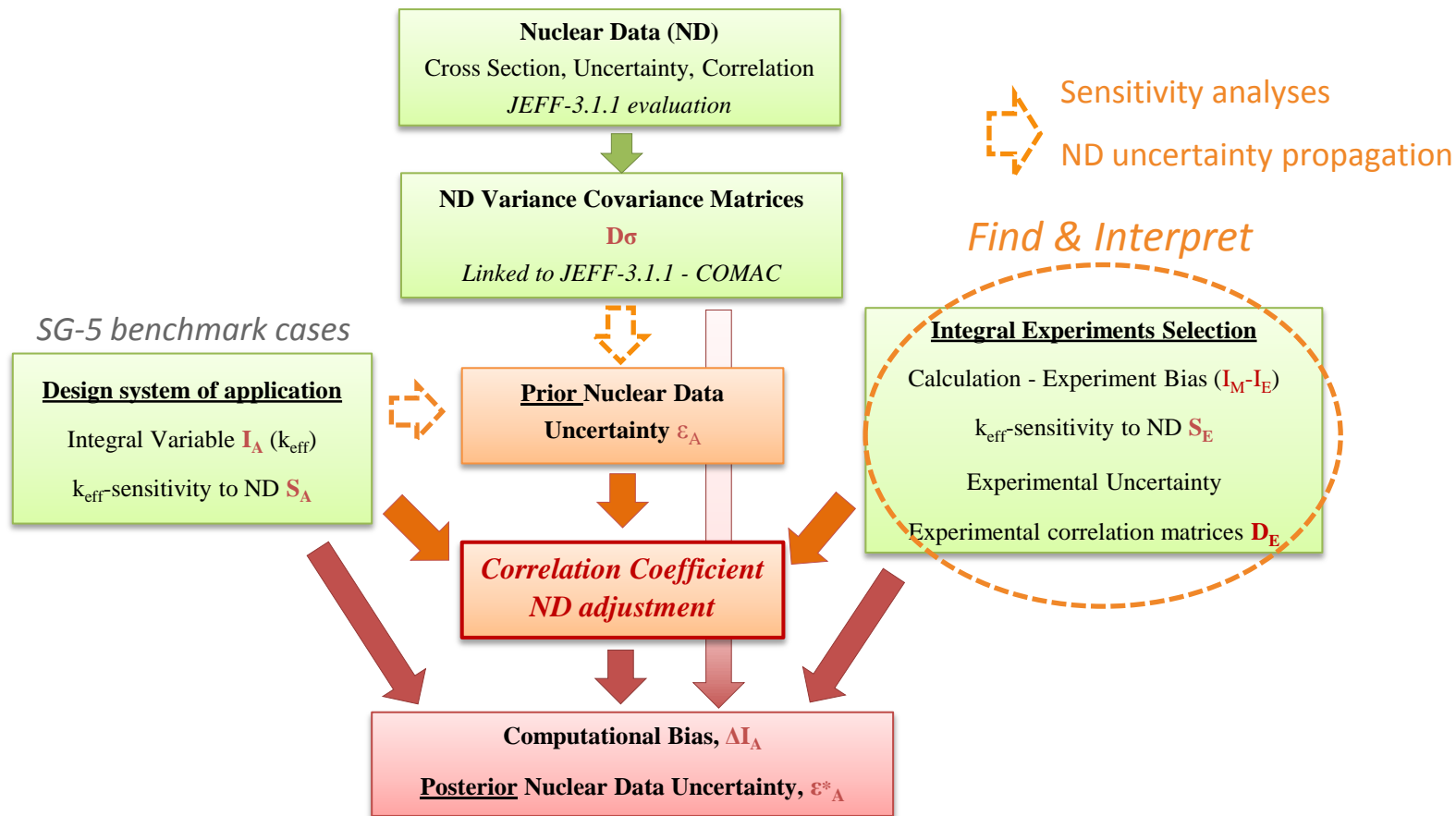
- **Benchmark Specifications:**

- ✓ Basic Geometry → **sphere of MOx powder surrounded by 20 cm of water**
- ✓ **3 PuO₂ contents** : 100, 30 and 12.5% (representative of GEN-IV and GEN-II / III)
- ✓ **3 Pu isotopic vectors**: (71/17/11/20% ; 64/23/10/3% ; 96/4/0/0%)
- ✓ **3 Powder Moisture Rate**: 5, 3 (basic value) and 1% wt H₂O



OBJECTIVE AND SCOPE (4/4)

The **goal of** is to **involve studies** on the bias and uncertainty quantification
of the k_{eff} of **damp MOx powders**



■ Objective and Scope

■ **Expected results**

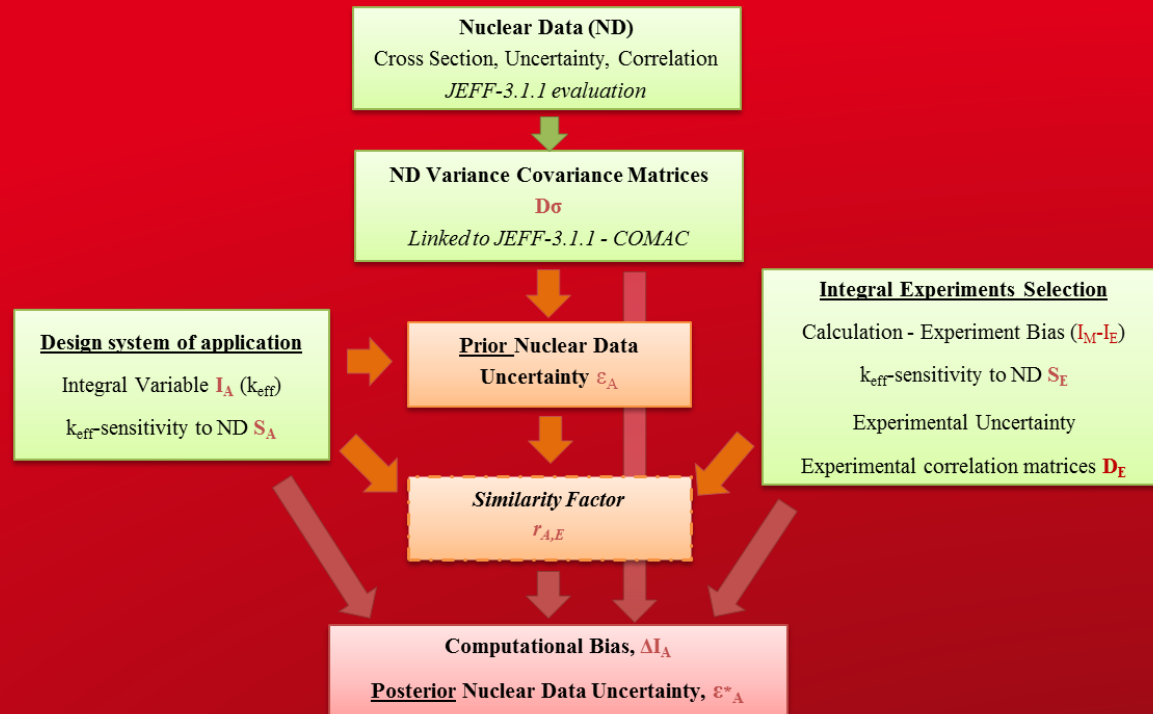
- ✓ Brief description of **codes and Nuclear Data library**
- ✓ k_{eff} calculated value for the 15 cases
- ✓ **Prior uncertainty** $\sigma_{k_{\text{eff}}}$ due to nuclear data
 - ➔ Description of **covariance matrices** and k_{eff} -sensitivity profiles
- ✓ ICSBEP identification of **selected experiments**
 - ➔ Description of the **method used to select experiments and quantify similarities** between exp. and benchmark cases
- ✓ **Projected k_{eff} value** obtained by using representative experiments information
 - ➔ Description of the **Method used to predict the computational bias on the benchmark cases**
- ✓ **Posterior ND uncertainty** $\sigma_{k_{\text{eff}}}^{\text{post}}$ associated with the computational bias



Blind Bench. ➔ The CEA will collect all the results

➔ The CEA will summarize the participants' results ➔ discussion open between participants

Thank you for listening !



The authors are indebted to Orano & EDF for financial support