

MUSA – Management and Uncertainties of Severe Accidents

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MUSA



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2nd RCM on Advancing the State of Practice in Uncertainty and Sensitivity Methodologies for SA Analysis in WCRs
20-22 October 2020

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Background

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Project Description

- ▶ MUSA was founded in Horizon 2020 EURATOM NFRP-2018 call on **“Safety assessments to improve accident management strategies for generation II and III reactors”**. MUSA GA 847441.
- ▶ The MUSA project aims to establish **a harmonised approach for the analysis of uncertainties and sensitivities associated with severe accident (SA) analysis** among EU and non-EU entities.



MUSA kick-off meeting in Madrid, Spain
July 10-12, 2019

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Project Description



- ▶ The project was launched in June 2019.
- ▶ The MUSA project is coordinated by **Centro de Investigaciones Energéticas, Medioambientales y Tecnológicas (CIEMAT)** in Madrid, Spain.



- ▶ MUSA has the **NUGENIA label** that recognises the excellence of the project proposal (obtained on 7 July 2018)

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MUSA in Numbers



▶ 48 months



▶ Budget of € 5,768,452.50



▶ 28 partners*



▶ 16 countries

- ▶ *The MUSA project includes partnerships with non-European institutions (Canada, China, Japan, South Korea and USA).

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MUSA Consortium Members



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Objectives & Scope

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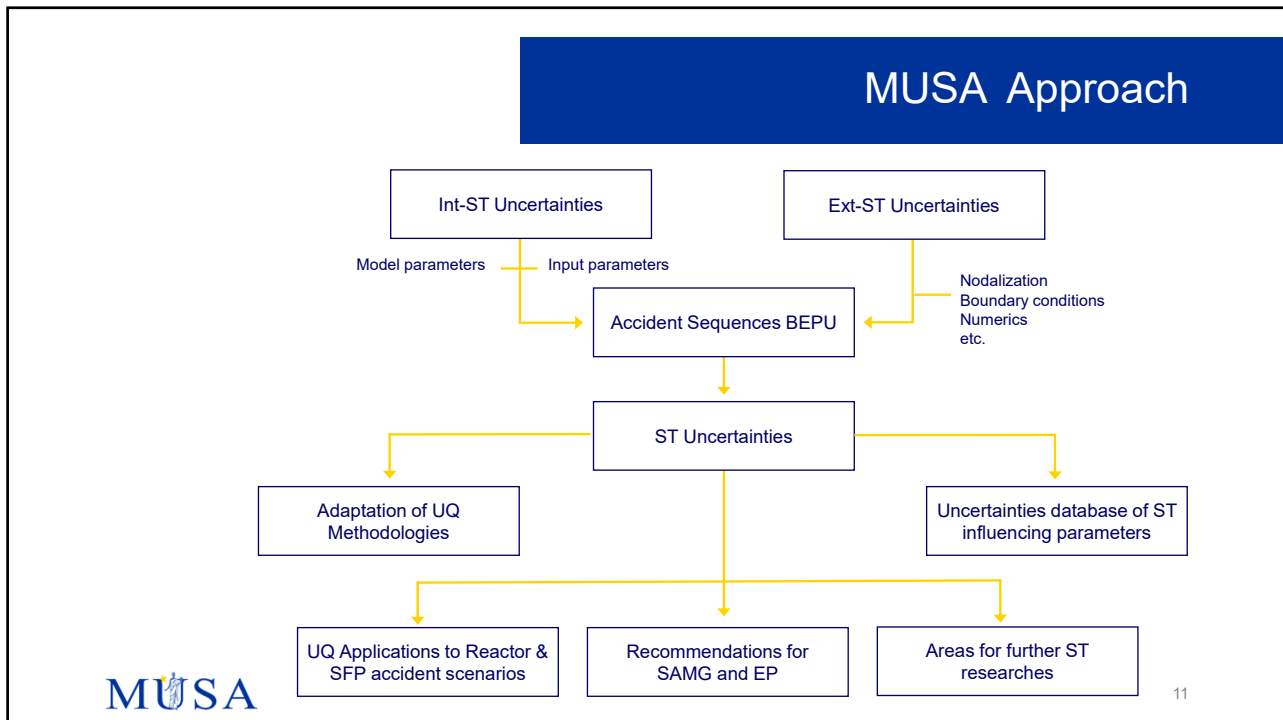
► **Objectives:** To **assess the capability of SA codes** when modelling accident scenarios

- Identification and characterization of input & models uncertainties.
- Assessment of available UASA methodologies.
- Adaptation of available UASA methodologies.
- Application to postulated NPP scenarios

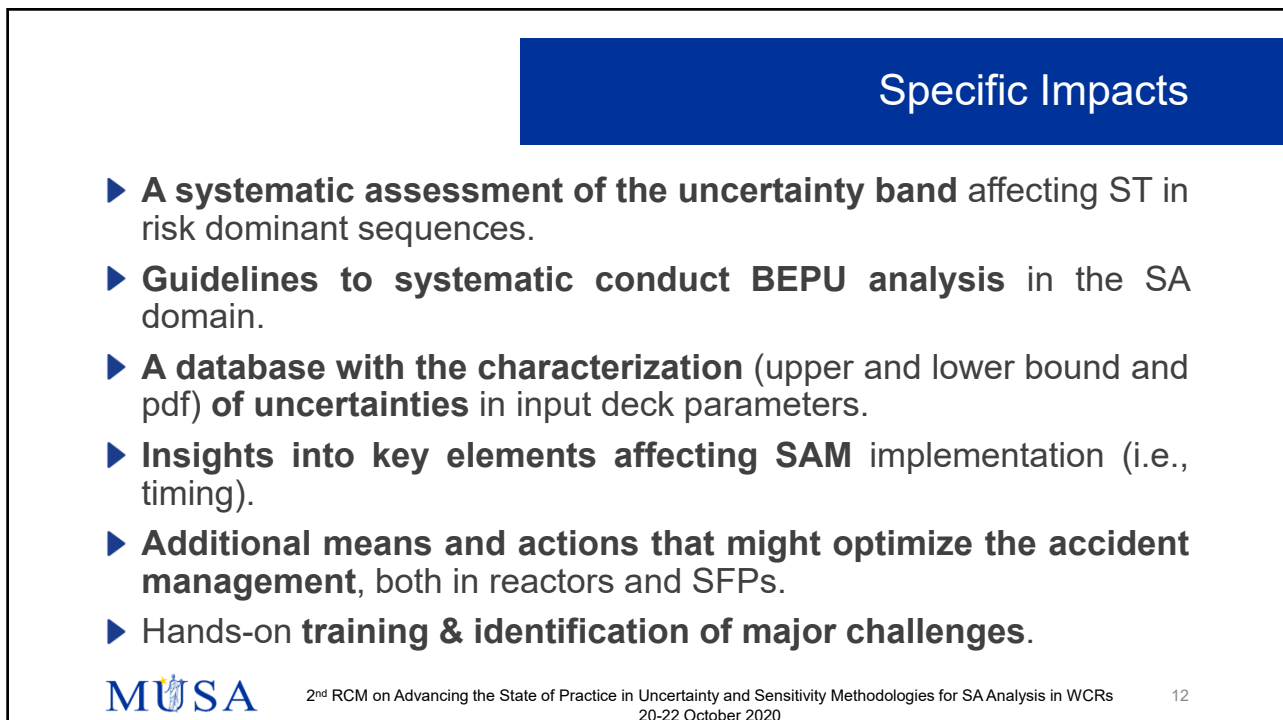
► **Scope:**

- Gen II, Gen III & Gen III+
- Reactor & SFP.
- Focused on Source Term.
- SA measures (existing & innovative)

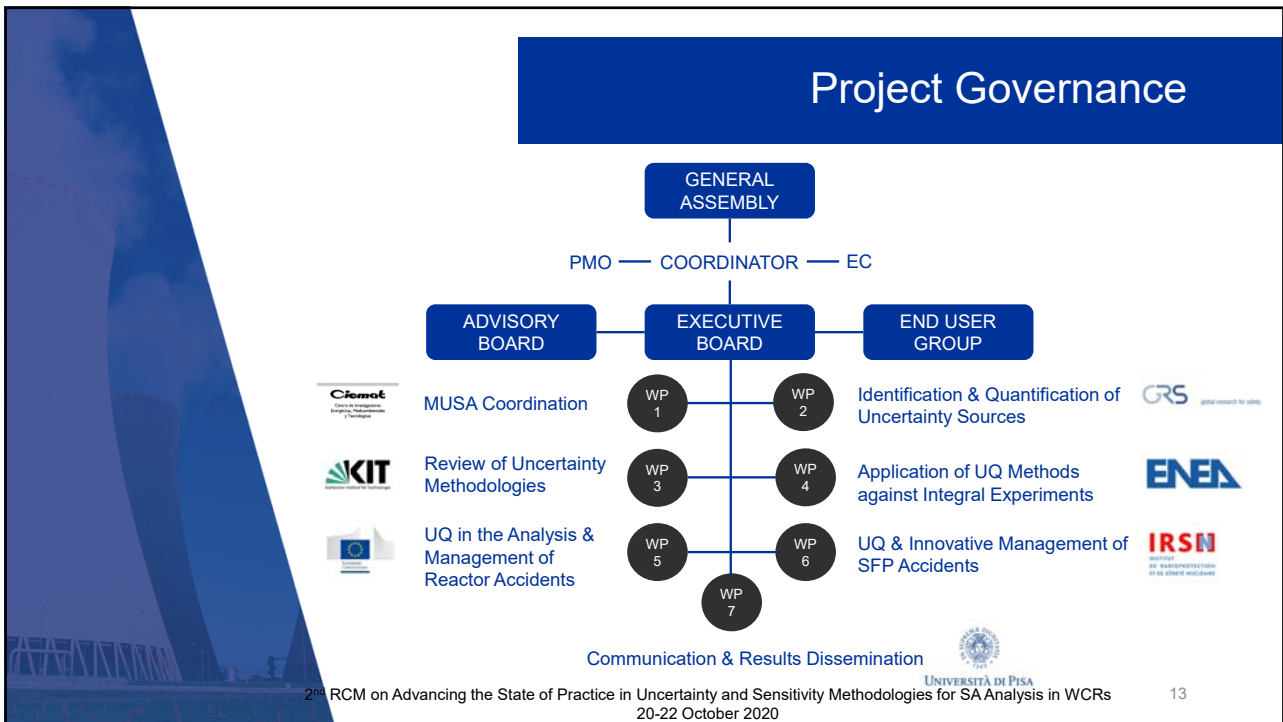
Structure & Global Features



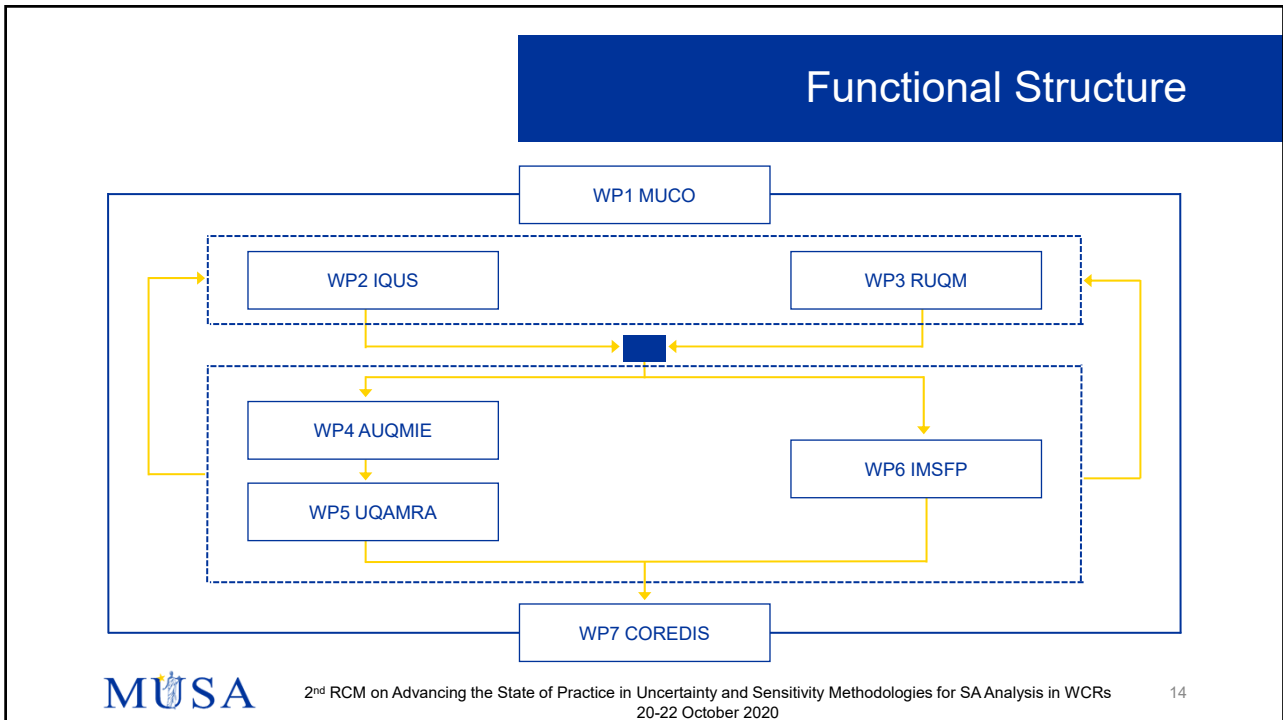
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Generic Expected Outcomes


- ▶ **Close-out open issues in the SA area:** uncertainties governing the Source Term (ST) estimates will be identified so that future research can reduce ST predictions uncertainties.
- ▶ **Increase safety margins** of power plants under operation (support to NPP assessments).
- ▶ **Improve emergency response** measures and SAM strategies.
- ▶ **Enhance nuclear safety** while boosting the EU safety requirements' implementation.

Knowledge Dissemination

- ▶ MUSA education and training activities target Masters and PhD students, as well as young researchers in the ST field.
 - **Public learning modules** on MUSA major outcomes.
 - **Mobility exchange programme** under which university students and young researchers go to internship programmes.
 - **Production of a lecture on “Uncertainty Quantification in Severe Accident Analyses”** for the different international courses that might be given on Severe Accidents and/or on “uncertainties”.



First-year Progress



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Gantt Chart

- Duration (Planned)
- Duration (Real)
- % Completed
- Real Duration (beyond planned)
- % Completed (beyond planned)

Activity	PERIODS							
	2019	2020		2021		2022		2023
	2 nd Semester	1 st Semester	2 nd Semester	1 st Semester	2 nd Semester	1 st Semester	2 nd Semester	1 st Semester
WP1 MUCCO								
WP1.1 Project coordination								
WP1.2 Management of external supporting groups								
WP2 IQUS								
WP2.1 Gen III/III+ PWR and VVER								
WP2.2 Gen III/III+ BWR								
WP2.3 SFP								
WP3 RUQM								
WP3.1 Review of uncertainty methodologies and tools								
WP3.2 Elaboration of guidelines for the use of UsSA codes/methods								
WP3.3 Feedback integration from application of uncertainty tools								
WP4 AUQMIE								
WP4.1 Benchmark specifications								
WP4.2 Benchmark calculations								
WP4.3 Analyses of results								
WP5 UQAMRA								
WP5.1 Gen III/III+ PWR and VVER								
WP5.2 Gen III/III+ BWRs								
WP6 IMSFP								
WP6.1 UQ on a postulated catastrophic situation in a SFP								
WP6.2 Review of existing and innovative AM measures								
WP6.3 Assessment of potential RC reduction from innovative AM measures and systems								
WP7 COREDIS								
WP7.1 MUSA Public Communication								
WP7.2 MUSA Internal Dissemination								
WP7.3 MUSA External Dissemination								
WP7.4 Education and Training Activities								



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WP1: MUCO

- ▶ The project GA, NDA (AB, EUG), CA (Consortium) and CoopAg (CIEMAT-USNRC) already signed.
- ▶ Six ExB visio meetings held; 7th to be held on 14th Sept.
- ▶ An assessment of COVID impact done and ongoing (i.e. WP5, Task 6.1 & 7.4 delayed; Remote annual plenary meeting).
- ▶ OWorkspace, QPlan & DataMgmt settled.
- ▶ Feedback from AB & EUG reported in D1.4 and D1.5

WP2: IQUS

- ▶ First PMtg held on 20-22nd Jan, 2020; 2nd PM to be held in Sept..
- ▶ FOMs identified and agreed for WP5 (WP4) & WP6.
 - Primary FoM (Source Term related)
 - SAM specific FoM
 - Additional variables (reactor & SFP)
- ▶ Individual areas of contribution (Phenomena) under discussion.
 - Source Term phenomena (release, transport & chem. In RCS and RCB; etc.)
 - Other phenomena affecting ST (core degradation; corium transfer to cavity; etc)
 - Accident scenario features affecting ST (Reactor; RPV failure mode; setpoints;...)
 - Accident management actions affecting ST
- ▶ Parameter uncertainty characterization planned by the end of Nov. 2020.

WP3: RUQM

- ▶ The critical review of UQ methodologes is ongoing (due date end of Nov. 2020)
- ▶ Guidelines for UQ methodologies application in SA analysis started.

WP4: AUQMIE

- ▶ Calculation phase launched on July 2020.
- ▶ Based on the FPT1 scenario (no benchmarking!).
- ▶ All necessary input from IRSN for BE input deck build, available.
- ▶ First PMtg to be held this Fall or early next year.

WP5: UQAMRA

- ▶ Closely linked to WP2.1 & WP2.2.
- ▶ Launched on 8th Sept.
- ▶ Main present discussions: scenarios to be dealt with.
- ▶ Grouping of partners according to reactor technology (VVER; PWR; CANDU).
- ▶ The structure of the database to be built, under discussion by ExB.

WP6: IMSFP

- ▶ Closely connected to WP2.3
- ▶ Recently launched in September.
- ▶ Individual contributions presently under consideration.
- ▶ Scenarios with large fuel damage out of scope.
- ▶ Ongoing reporting on SAM actions concerning SFPs in partners' countries.

WP7: COREDIS

- ▶ The dissemination and communication strategy built and agreed.
- ▶ Mobility grants policy already agreed; launching halted by COVID.
- ▶ The MUSA public website open since Oct. 2019.
- ▶ Instruments for MUSA communication (templates; slides; flyer) in the sharepoint.
- ▶ The first internal NL already released.

Summary

- ▶ MUSA was approved by EC and launched on 1st June 2019.
- ▶ All legal consortium docs. settled.
- ▶ The COVID crisis has notably impacted the project, despite the ExB monitoring.
- ▶ WPs on Identification and quantification of input uncertainties (WP2) and on UQ methodologies (WP3) working at full power.
- ▶ Training with UQ methodologies on FPT1 has just started (BE calculation).
- ▶ Application packages (WP5 & WP6) launched in Sept. 2020.
- ▶ The COVID has slowed down the Communication and Dissemination activities (WP7).

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Thank you for your attention!



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