

MUSA – Management and Uncertainties of Severe Accidents

L.E. Herranz, CIEMAT

S. Beck, GRS; V.H. Sanchez, KIT; F. Mascari, ENEA; S. Brumm, JRC;
O. Coindreau, IRSN; S. Paci, UNIPI

 MUSA



MUSA has received funding from the Euratom research and training programme 2014-2018 under grant agreement No 847441.

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Background

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

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)

MUSA in Numbers



▶ 48 months



▶ Budget of € 5,768,452.50



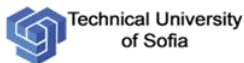
▶ 28 partners*



▶ 16 countries

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

MUSA Consortium Members



Objectives & Scope



► **Objectives:**

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

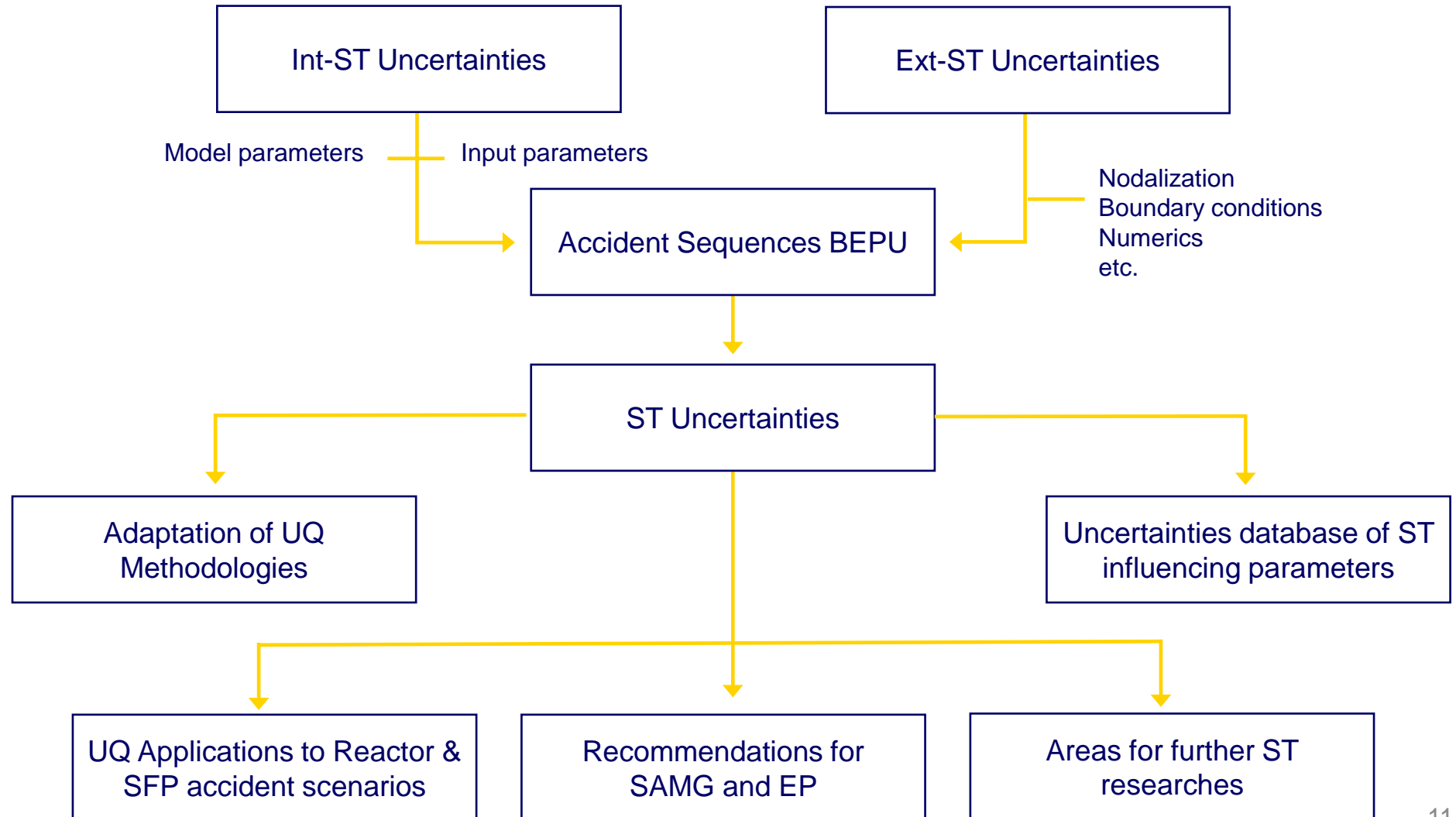
- Identification and characterization of input & models uncertainties.
- Assessment of available UASA methodologies.
- Adaptation of available UASA methodologies.
- Application to postulated NPP scenarios

► **Scope:**

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

Structure & Global Features

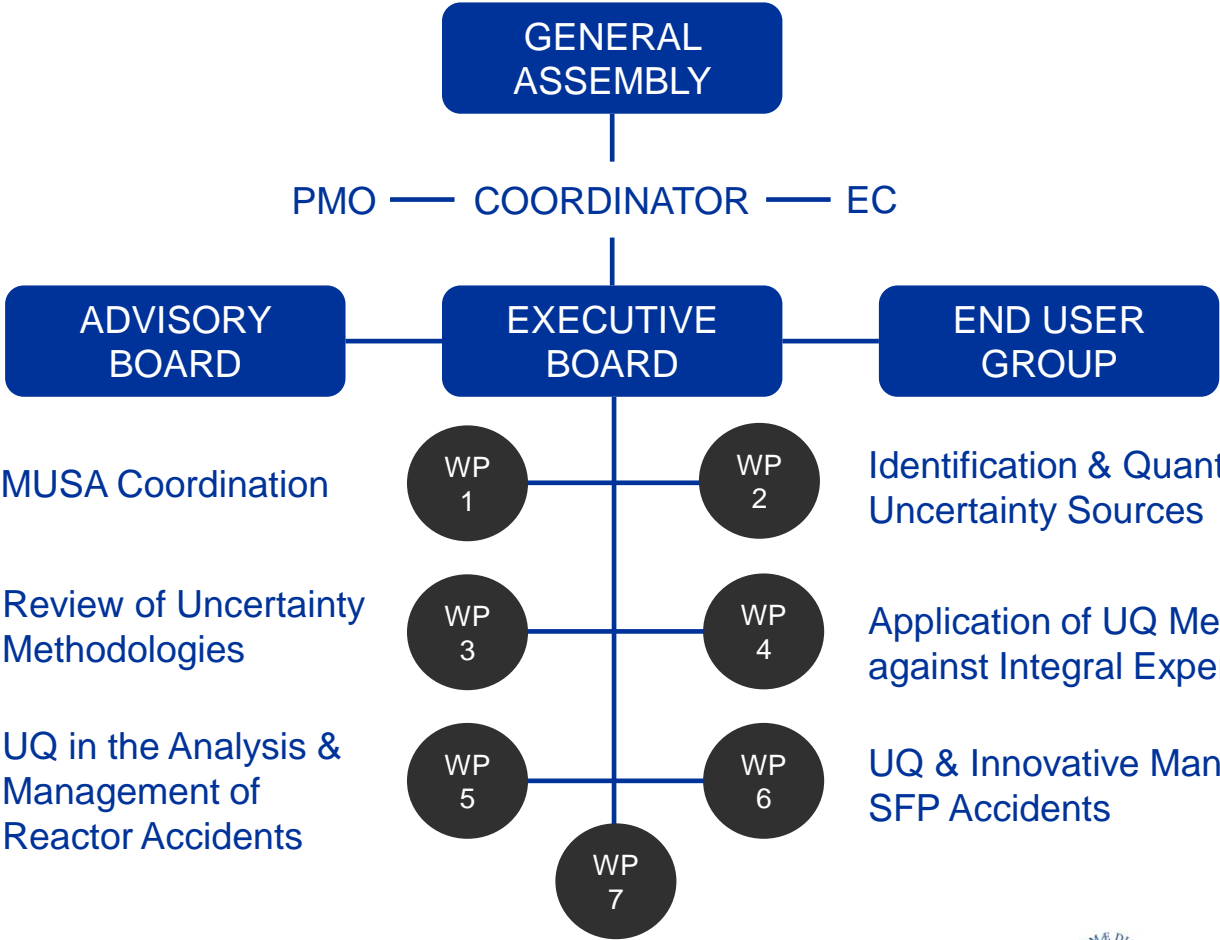
MUSA Approach



Specific Impacts

- ▶ **A systematic assessment of the uncertainty band** affecting ST in risk dominant sequences.
- ▶ **Guidelines to systematic conduct BEPU analysis** in the SA domain.
- ▶ **A database with the characterization** (upper and lower bound and pdf) **of uncertainties** in input deck parameters.
- ▶ **Insights into key elements affecting SAM** implementation (i.e., timing).
- ▶ **Additional means and actions that might optimize the accident management**, both in reactors and SFPs.
- ▶ **Hands-on training & identification of major challenges.**

Project Governance

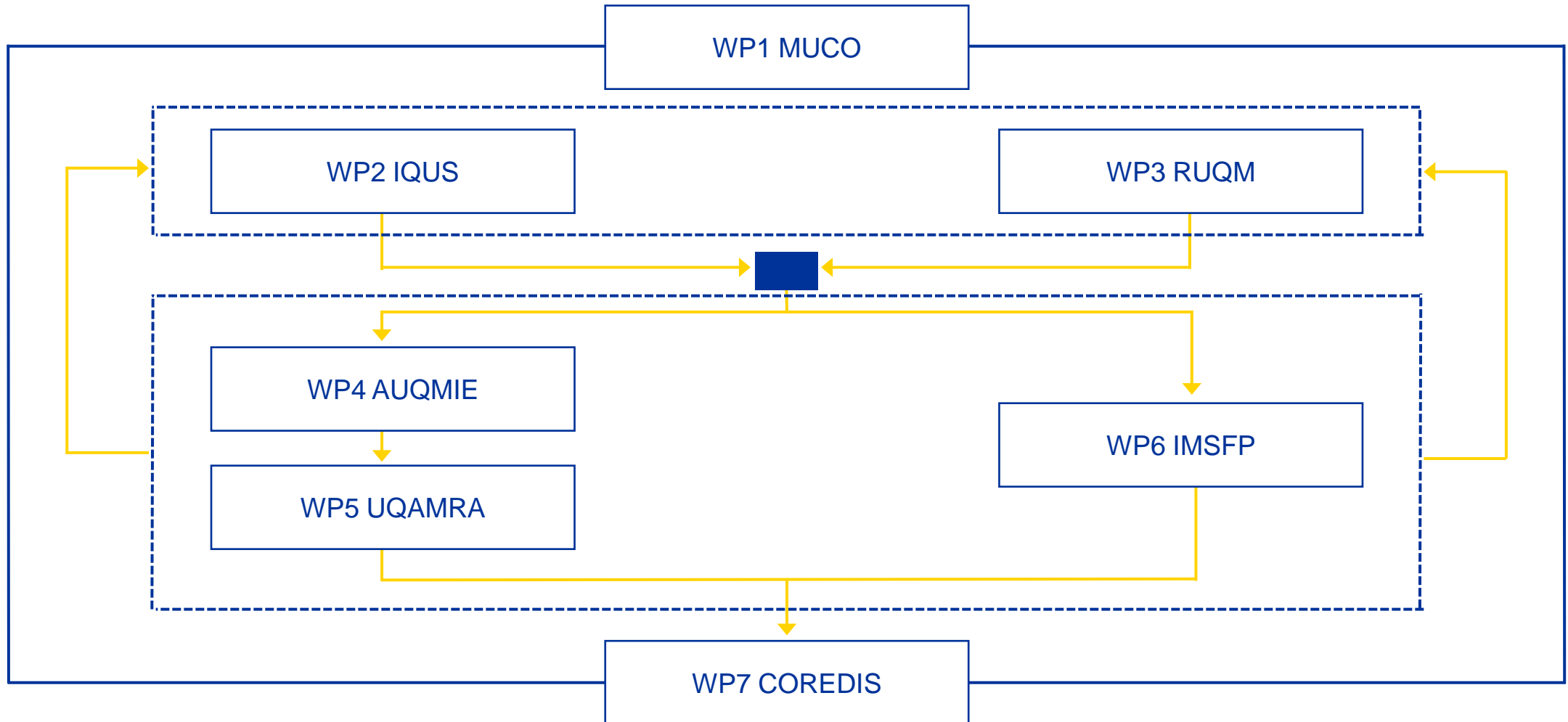


Communication & Results Dissemination

CSARP/MCAP Meeting
August 31 - September 4, 2020

UNIVERSITÀ DI PISA

Functional Structure



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

Gantt Chart

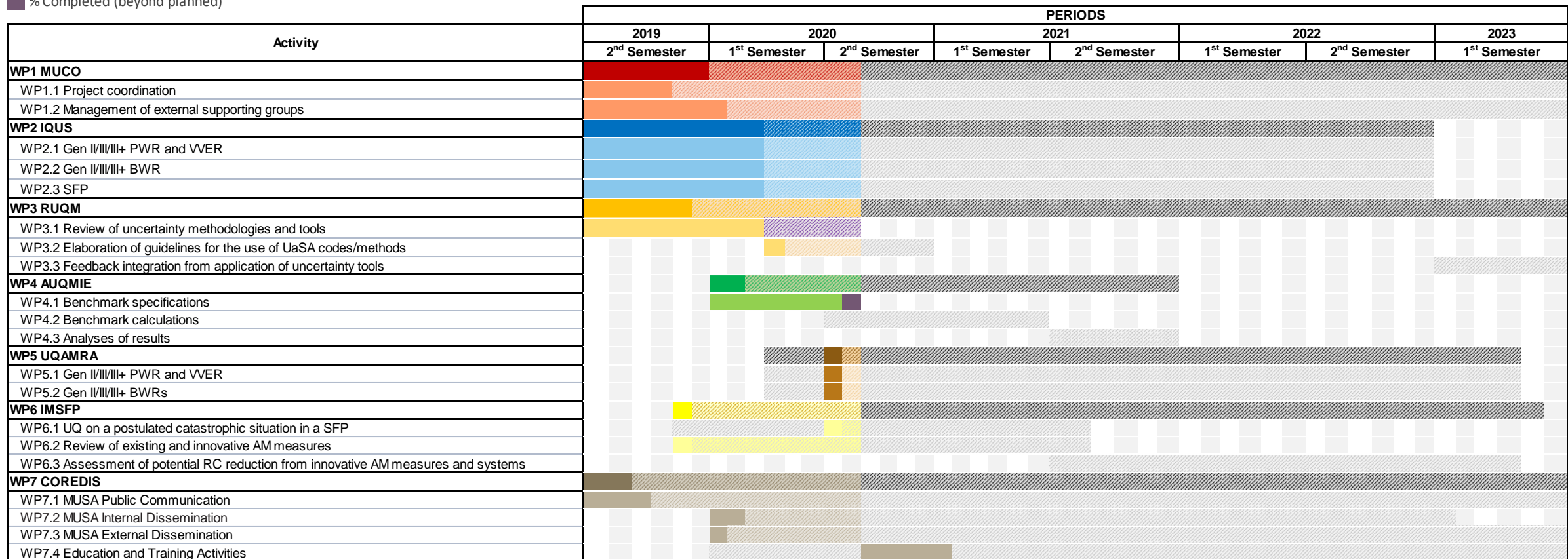
Duration (Planned)

Duration (Real)

% Completed

Real Duration (beyond planned)

% Completed (beyond planned)



- ▶ 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

- ▶ 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

- ▶ The critical review of UQ methodologes is ongoing.
- ▶ Guidelines for UQ methodologies application in SA analysis started.

- ▶ 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 next Fall.

- ▶ Closely linked to WP2.1 & WP2.2.
- ▶ To be launched on 8th Sept.
- ▶ Main aim of the meeting: converging on scenarios to be dealt with.
- ▶ The structure of the database to be built, under discussion by ExB.

- ▶ Closely connected to WP2.3
- ▶ To be launched in Sept.
- ▶ Individual contributions presently under consideration.
- ▶ Scenarios with large fuel damage out of scope.

- ▶ 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) will be launched in Sept. 2020.
- ▶ The COVID has slowed down the Communication and Dissemination activities (WP7).

Thank you for your attention!



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