



**OECD/NEA Deterministic Time-Dependent Neutron
Transport Benchmark without Spatial Homogenization
(C5G7-TD) – Eight Workshop (C5G7-TD-8)**

**Bologna, Italy
May 25, 2023 (Track 1 Morning)**

Hosted by ENEA, Italy

Announcement and Proposed Program

Sponsorship

The 8th workshop for the OECD/NEA Deterministic Time-Dependent Neutron Transport Benchmark without Spatial Homogenization (C5G7-TD) benchmark – C5G7-TD-8 - will be held on May 25, 2023 (track 1 morning), in Bologna, Italy in conjunction with fourteen other meetings including OECD/Nuclear Energy Agency (NEA), Nuclear Science Committee (NSC) Working Party on scientific issues and uncertainty of Reactor Systems (WPRS) Workshops and International School as well as CTF User Group meeting and training, in order to facilitate co-ordination and share work, to combine efforts in common areas such as neutronics, thermal-hydraulics, multi-physics modelling and uncertainty analysis, and to make the participation more efficient. The meetings/workshops concerned are:

- May 22, 2023 (track 2 morning) – Ninth COBRA-TF (CTF) User’s Group (UG) Meeting (CTF-9) followed by a hands-on CTF training sessions which will be conducted on Monday afternoon, May 22, 2023 and Tuesday morning, May 23, 2023 (track 2);
- May 22, 2023 (track 1 afternoon) – First Burst-Fission-Gas Release Benchmark (BFGR-1) workshop;
- May 23, 2023 (track 1) - Sixteen OECD/NEA Light Water Reactor (LWR) Uncertainty Analysis in Modelling (UAM) Benchmark (LWR-UAM-16) workshop;
- May 23, 2023 (track 2) – OECD/NEA HTGR-TH Benchmark introductory presentation and discussions;
- May 22-23 (track 3), 2023 – OECD/NEA International School on Simulation of Nuclear Reactor Systems (SINUS);
- May 24, 2023 (track 1 morning) - OECD/NEA Task Force on Doppler Effective Fuel Temperature meeting;
- May 24, 2023 (track 2 morning) – Fourth OECD/NEA McMaster Core Thermal-Hydraulics (CTH) Benchmark (CTH-4) workshop;
- May 24, 2023 (track 1 afternoon) – OECD/NEA Task Force Artificial Intelligence & Machine Learning meeting;
- May 24, 2023 (track 2 afternoon – LFR neutronics) – May 25, 2023 (track 2 morning – LFR Thermal-hydraulics) – Second OECD/NEA Lead Fast Reactor (LFR) Benchmark (LFR-2) workshop;
- May 24, 2023 (track 1 afternoon) – May 25, 2023 (track 1 morning) - Eight OECD/NEA Time-Dependent Neutron Transport (C5G7-TD) Benchmark (C5G7-TD-8) workshop;
- May 25, 2023 (track 2 afternoon) – Second Liquid Metal Fast Reactor (LMFR) Thermal-Hydraulics (T/H) Benchmark workshop (LMFR T/H-2);
- May 25, 2023 (track 1 afternoon) – May 26, 2023 (track 1 morning) - Third meeting on OECD/NEA TVA Watts Bar 1 (WB1) Multi-Physics Multi-Cycle Depletion Benchmark (TVA-WB1-3) workshop.
- May 26, 2023 (track 2) - Eight OECD/NEA Sodium Fast Reactor (SFR) UAM Benchmark workshop and First Liquid Metal Fast Reactor (LMFR) Thermal-Hydraulics (T/H) Benchmark workshop (SFR-UAM-8);

- May 26, 2023 (track 1 afternoon) – Fifth benchmark meeting on Rostov-2 VVER-1000 Multi-physics transient benchmark (Rostov2-5).

Background and Purpose of the Benchmark Workshop

The objective of the workshop is to define, refine, conduct, and summarize the OECD/NEA Time-Dependent Neutron Transport Benchmark without Spatial Homogenization – C5G7-TD. This benchmark was proposed to the Expert Group on Radiation Transport and Shielding (EGRTS) and has been approved by the NSC WPRS in the meeting in February 2015. The benchmark team lead by NCSU is reporting the progress on benchmark activities to the Expert Group on Physics of Reactor Systems (EGPRS), Expert Group on reactor core Thermal-Hydraulics and Mechanics (EGTHM), and the Expert Group on Multi-Physics of reactor systems (EGMUP) of WPRS, NSC.

The C5G7-TD benchmark was established to develop a series of well-defined exercises to test and verify the standalone neutron transport and coupled multi-physics simulation capabilities for light water reactor (LWR) applications. The targeted solution methods in this benchmark do not utilize spatial homogenization above the fuel pin level, i.e., pin-averaged or pin-resolved methods in reactor physics and sub-channel-based methods thermal-hydraulics simulation. There are three phases planned for this benchmark:

- Phase I (Kinetics Phase): verification of methods and codes for heterogeneous time-dependent neutron transport calculations without feedback
 - Part A: Cartesian geometry exercises
 - Part B: Neutron noise analysis
 - Part C: Hexagonal geometry exercises
- Phase II (Dynamics Phase): verification of methods and codes for heterogeneous time-dependent neutron transport calculations with feedback
 - Part II-1: Prompt feedback
 - Part II-2: Complete feedback
- Phase III (High-fidelity Phase): uncertainty propagation in high-fidelity multi-physics calculations

In Phase I, both Part A and B are based on the well-established steady-state C5G7 benchmark problem in the Cartesian geometry, while Part C is designed to address the hexagonal core configuration. The specifications of Part A and B have been finalized, and that for Part C has been developed and will be discussed at the workshop. Several versions of the summary report of Part A has been prepared and shared with the participants. The final version is posted on the benchmark SharePoint.

The cases in Phase II-1 have been defined and are currently being refined according to the feedback from participants. Specifications for Phase II-1 have been updated on the benchmark SharePoint. Results have been submitted by the participants and are being analyzed. Phase II-2 specification (complete feedback) is being developed and will be finalized after this workshop.

Scoping studies are being carried out by NCSU to obtain preliminary results and develop the specification for cases in Phase III. Discussions at the workshop will focus on making a work plan to conduct Phase III.

More information and supporting documents are available at:

https://www.oecd-nea.org/jcms/pl_32145/deterministic-time-dependent-neutron-transport-benchmark-without-spatial-homogenisation-c5g7-td

Scope and Technical Content of the Meeting

The topics to be addressed at the workshop include:

- Conclusion of Phase I-A and finalization of the summary report;
- Comparative analysis of submitted results for Phase I-B;
- Discussion on the final benchmark specifications for Phase I-C, as well as received comments, suggestions, and corrections;
- Corrections to Phase II-1 specifications;
- Finalization of draft the specification of Phase II-2, including new data libraries and functions prepared for it;
- Discussion of reference results for benchmark cases for Phase II;
- Discussion of final templates and methods for submission of participants' results for Phase II;
- Comparative analysis of submitted results for Phase II;
- Discussion of Phase III exercises and preliminary results;
- Presentations on participants' experience and expertise in time-dependent neutron transport calculations;
- Presentations on participants' experience and expertise in high-fidelity dynamics calculations;
- Defining a work plan and schedule outlining actions to progress on the benchmark activities.

The proposed meeting program is attached as Annex 1.

Organization of the Meeting

The meeting is organized around the discussion in depth of the benchmark specifications, templates for submission of participants' results, reference solutions, and proposed work plan and time schedule for the OECD/NEA C5G7-TD benchmark activities. The participants are requested to present their modelling and results as well as their experience and expertise in time-dependent neutron transport analysis.

Participation in the Meeting

Participation is restricted to individuals from OECD/NEA member country institutions who agree to the benchmark non-disclosure agreement (NDA). Participants are asked to sign and send the corresponding NDA form to wprs@oecd-nea.org. The benchmark NDA form can be found at:

https://www.oecd-nea.org/jcms/pl_32145/deterministic-time-dependent-neutron-transport-benchmark-without-spatial-homogenisation-c5g7-td

Organization and Program Committee of the Meeting

An Organization and Program Committee has been nominated to make necessary arrangements for the 8th Benchmark Workshop and to organize the Sessions, draw up the final program, appoint Session Chairmen, etc. The members of the Program Committee are:

Giacomo Grasso – *Co-Chair, and Local Host*
ENEA, Italy

Jason Hou - *Co-Chair and Coordinator*
North Carolina State University, USA

Pascal Rouxelin
North Carolina State University, USA

Secretariat: **Oliver Buss**
OECD/Nuclear Energy Agency, France

Proposed Program of the Meeting

The proposed program was drawn up by the Program Committee and is enclosed as Annex 1.

Language of the Benchmark Workshop

The official language of this workshop is English.

Proceedings of the Meeting

A summary of the workshop will be published by the OECD/NEA after the meeting. The summary will be distributed free of charge to the benchmark participants and to Delegates of the EGPRS, EGTHM, EGMUP, WPRS, and NSC. The program committee and the session Chairmen will prepare a summary report on the main results of the meeting for presentation to the EGPRS, EGTHM, EGMUP, WPRS, and NSC. Presentations will be available free of charge to the benchmark participants to download from participants' restricted area of the benchmark website after the workshop.

Contacts and Registrations

The annual benchmark workshops/meetings of the [Working Party on Scientific Issues and Uncertainty Analysis of Reactor Systems \(WPRS\)](#) and OECD/NEA EGMUP Task Force on Doppler Effective Fuel Temperature Meeting will be hosted by ENEA in Bologna (Italy). The meetings will take place in two tracks in parallel during the week of 22 May to 26 May 2023 to exchange results and lessons learned for the different WPRS benchmark activities and to discuss future activities.

The link to registration page for the WPRS-related workshops/meetings, overall program, and local information for transportation and hotels is:

https://www.oecd-nea.org/jcms/pl_71612/wprs-benchmarks-workshop-2023

The link to registration page for the CTF-9 UG Meeting and Training is:

<https://www.ne.ncsu.edu/rdfmg/cobra-tf/ninth-ctf-user-group-ug-meeting-and-training/>

Workshops' Location

The meeting place for all the meetings/workshops during the week of May 22 – 26, 2023, in three tracks is at the Zanol Hotel Europa, Bologna, Italy (in-person meeting). As mentioned above the local information for transportation and hotels is given at:

https://www.oecd-nea.org/jcms/pl_71612/wprs-benchmarks-workshop-2023

The program and schedule of the meetings is shown below:

	Track 1	Track 2	Track 3
Monday, May 22	Morning: MPCMIV Afternoon: Burst Fission Gas Release	Morning: CTF UG Afternoon: CTF Training	Morning: SINUS Afternoon: SINUS
Tuesday, May 23	Morning: LWR UAM Afternoon: LWR UAM	Morning: HTGR-TH Afternoon: HTGR-TH	Morning: SINUS Afternoon: CTF Training
Wednesday, May 24	Morning: Task Force on Doppler Effective Fuel Temperature Afternoon: Task Force on AI & ML	Morning: McMaster CTH Afternoon: LFR Neutronics	
Thursday, May 25	Morning: C5G7-TD Afternoon: TVA-WB1	Morning: LFR TH Afternoon: LMFR TH	
Friday, May 26	Morning: TVA-WB1 Afternoon: Rostov-2	Morning: SFR-UAM Afternoon: SFR-UAM	

ANNEX 1

8th workshop for the OECD/NEA Deterministic Time-Dependent Neutron Transport Benchmark without Spatial Homogenization (C5G7-TD) – C5G7-TD-8

Hosted by ENEA
Bologna, Italy

May 25, 2023 (track 1 morning)

PROPOSED PROGRAM

C01-14: Session code

C01. Introduction and opening remarks

C02. Overview of benchmark activities

C03. Presentations on related activities

C04. Overview and discussion of Phase I-A summary report

C05. Discussion of Phase I-B results

C06. Discussion of Phase I-C specification and cross section data

C07. Discussion of the final Specifications for Phase II-1

C08. Participants' presentations on their modelling and results for time-dependent neutron transport calculations

C09. Discussion of the draft Specifications for Phase II-2

C10. Discussion of the selected dynamics test problems and requested output for Phase II-2

C11. Participants' presentations on their expertise and experience in high-fidelity dynamics modelling and results

C12. Planning of Phase III strategies

C13. Action items and schedule of benchmark activities - next workshop (C5G7-TD-9) and plans

C14. Conclusions and closing remarks