3D S.U.N COP 2008: 9th Seminar

Final

Petten - Amsterdam, The Netherlands
October 13 – October 31, 2008

SEMINAR AND TRAINING ON
SCALING, UNCERTAINTY AND
3D COUPLED CODE CALCULATIONS
IN NUCLEAR TECHNOLOGY

To be held at
European Commission, Joint Research Center, Institute for Energy (EC-JRC-IE)
Petten, The Netherlands

http://dimnp.ing.unipi.it/3dsuncop/
Lecturers

A. Abdul-Razzak  Atomic Energy of Canada Limited (AECL), Canada
N. Aksan  Switzerland
T. Bajs  Faculty of Electrical Engineering and Computing (FER), Croatia
D. Baraldi  Joint Research Center (JRC), European Commission (EC)
D. Bestion  Commissariat a l’Energie Atomique (CEA), France
M. Bykov  OKB Gidropress (OKB-GP), Russia
R. Bolado Lavin  Institute for Energy (IE), JRC, EC
C. Boyd  United States Nuclear Regulatory Commission (US NRC), USA
G. Bruna  Institut de Radioprotection et de Sûreté Nucléaire (IRSN), France
A. Bucalossi  JRC-IE, EC
F. D’Auria  University of Pisa (UNIPI), Italy
A. Del Nevo  UNIPI, Italy
P. Dufour  CEA, France
M. Dzodzo  Westinghouse Electric Co. (Westinghouse), USA
C. Frepoli  Westinghouse Electric Co., USA
R. Galetti  Comissão Nacional de Energia Nuclear (CNEN), Brazil
H. Glaeser  Gesellschaft für Anlagen- und Reaktorsicherheit (GRS), Germany
D. Gregi  FER, Croatia
Y. Hassan  Texas A&M University (Texas A&M), USA
C. L. Heck  General Electric Energy Nuclear (GE), USA
R. Martin  Framatome ANP/AREVA, USA
J. Mišák  Nuclear Research Institute (NRI), Czech Republic
F. Moretti  UNIPI, Italy
D. Novog  McMaster University (McMaster), Canada
C. Parisi  UNIPI, Italy
A. Petruzzi  UNIPI, Italy
N. Popov  Atomic Energy of Canada Limited (AECL), Canada
V. Rangelová  JRC-IE, EC
J. Rempe  Idaho National Laboratory (INL), USA
F. Reventos  School of Industrial Engineering of Barcelona (ETSEIB), Spain
L. Sabotinov  IRSN, France
B. R. Sehgal  Royal Institute of Technology (KTH), Sweden
H. Tsige-Tamirat  JRC, EC
T. Van Der Hagen  Delft University (TU-Delft), The Netherlands
G. Vayssier  Nuclear Safety Consultancy (NSC), The Netherlands
C. Vitanza  Organisation for Economic Co-operation and Development (OECD)

Code Instructors

C. Allison  Innovative Software System (ISS), USA
W. Ambrosini  UNIPI, Italy
H. Austregesilo  GRS, Germany
E. Baglietto  CD-adapco, USA
T. Downar  Purdue University (PURDUE), USA
T. Kozlowski  KTH, Sweden
G. Laviale  CEA, France
R. Macian  Technical University of Munich (TUM), Germany
M. Naitoh  Nuclear Power Engineering Corporation (NUPEC), Japan
A. Petruzzi  UNIPI, Italy
N. Popov  AECL, Canada
First Week: Fundamental Theoretical Aspects Sessions

A total of 40 hours teaching will be delivered.
A minimum of 15 participants is required to provide the first week training.

Session I

Welcome and Objectives of the Seminar
Representatives of Local Institution

Presentation of the Activities and Introduction to the Seminar
F. D’Auria (UNIPI), A. Petruzzi (UNIPI)
L. De Barberis (JRC-IE), A. Bucalossi (JRC-IE)

• Lecture 0A: Presentation of the Topics of the Seminar
  A. Petruzzi (UNIPI, Italy)

Session II

System Codes: Evaluation, Application, Modelling and Scaling

• Lecture 1A: Role of System Codes in Nuclear Reactor Safety
  F. D’Auria (UNIPI, Italy)

• Lecture 2A: Features of Thermal-hydraulic System Codes
  F. D’Auria (UNIPI, Italy)

• Lecture 3A: Scaling of Thermal-hydraulic Phenomena: Addressing the Scaling Issue
  F. D’Auria (UNIPI, Italy)

• Lecture 4A: Overview of CSNI Separate Effects Test Facility Matrices for Validation of Best Estimate Thermal-Hydraulic Computer Codes
  N. Aksan (Switzerland)

• Lecture 5A: Overview of CSNI Integral Effects Test Facility Matrices for Validation of Best Estimate Thermal-Hydraulic Computer Codes
  N. Aksan (Switzerland)

• Lecture 6A: EMDAP Method for Scaling Analysis
  M. Dzodzo (Westinghouse, USA)

• Lecture 7A: Scaled Calculations for 3 Loop PWR
  F. Reventos (ETSEIB, Spain)
International Standard Problems (ISP)

- **Lecture 8A:** Lesson Learned from OECD/CSNI International Standard Problems  
  *N. Aksan (Switzerland)*

- **Lecture 9A:** Characterization and Results from ISP-42 PANDA Test  
  *N. Aksan (Switzerland)*

- **Lecture 10A:** Characterization and Results from ISP-26 ROSA IV LSTFT Cold Leg Small Break LOCA Experiment  
  *N. Aksan (Switzerland)*

Best Estimate in System Code Applications and Uncertainty Evaluation

- **Lecture 11A:** Evaluation of Safety Margins of Operating Reactors Using “Best Estimate” Methods Including Uncertainty Analysis  
  *H. Glaeser (GRS, Germany)*

- **Lecture 12A:** Current issues in deterministic safety analysis for licensing  
  *J. Mišák (NRI, Czech Republic)*

- **Lecture 13A:** TH Analysis for Control and Operation Support  
  *F. Reventos (ETSEIB, Spain)*

- **Lecture 14A:** User Effect on Code Application and Qualification Needs  
  *F. D’Auria (UNIPI, Italy)*

- **Lecture 15A:** Results from the Application of Uncertainty Methods in the CSNI Uncertainty Methods Study (UMS)  
  *A. Petruzzi (UNIPI, Italy)*

- **Lecture 16A:** Major Results of the BEMUSE Programme (Best Estimate – Uncertainty and Sensitivity Evaluation)  
  *A. Petruzzi (UNIPI, Italy)*

- **Lecture 17A:** The Origin of Uncertainties  
  *A. Petruzzi (UNIPI, Italy)*

- **Lecture 18A:** Approaches to Calculating Uncertainty and Topics Relevant for Uncertainty Evaluation (TRUE)  
  *F. D’Auria (UNIPI, Italy), A. Petruzzi (UNIPI, Italy)*
Qualification Procedures

- **Lecture 19A**: The Features of the UMAE Methodology  
  *F. D’Auria, A. Petruzzi (UNIPI, Italy)*

- **Lecture 20A**: Qualifying, Validating and Documenting a TH Input Deck  
  *F. Reventos (ETSEIB, Spain)*

- **Lecture 21A**: Procedures for Nodalization Qualification (at Steady State and at Transient Level)  
  *A. Petruzzi (UNIPI, Italy)*

- **Lecture 22A**: The FFTBM for Accuracy Evaluation: A Supporting Method for Uncertainty Tools  
  *A. Petruzzi (UNIPI, Italy)*

Methods for Sensitivity and Uncertainty Analysis

- **Lecture 23A**: Sensitivity and Uncertainty Analyses: Basic Concepts  
  *To be contacted*

- **Lecture 24A**: The Ideas at the Basis of CIAU (Code with the capability of Internal Assessment of Uncertainty)  
  *F. D’Auria, A. Petruzzi (UNIPI, Italy)*

- **Lecture 25A**: GRS Method for Uncertainty and Sensitivity Evaluation of Code Results and Applications  
  *H. Glaeser (GRS, Germany)*

- **Lecture 26A**: Demonstration of the Software System for Uncertainty and Sensitivity Analyses (SUSA)  
  *H. Glaeser (GRS, Germany)*

- **Lecture 27A**: Overview of Uncertainty Methods and Comparison with CSAU Methodology  
  *F. D’Auria, A. Petruzzi (UNIPI, Italy)*

- **Lecture 28A**: Uncertainty and Sensitivity Analysis: Applications to advanced reactors  
  *R. Bolado Lavin (JRC-IE, EC)*
Session VII

Relevant Topics in Best Estimate Licensing Approach

- **Lecture 29A:** Approaches to Best Estimate Analysis for Licensing of NPPs according to IAEA Safety Standards
  
  *J. Mišák (NRI, Czech Republic)*

- **Lecture 30A:** Risk Informed Regulation
  
  *G. Vayssier (NSC, The Netherlands)*

- **Lecture 31A:** Best Estimate Approach in German Licensing
  
  *H. Glaeser (GRS, Germany)*

- **Lecture 32A:** EUR Prescriptions and WENRA position
  
  *J. Mišák (NRI, Czech Republic)*

- **Lecture 33A:** Licensing Experience with BEPU LBLOCA Methodologies for Siemens and Westinghouse NPP
  
  *R. Galetti (CNEN, Brazil)*

Session VIII

The CIAU/UMAE Methodology: Development

- **Lecture 34A:** CIAU Method for Uncertainty Evaluation of Code Results
  
  *A. Petruzzi (UNIPI, Italy)*

- **Lecture 35A:** Key Applications of CIAU Methodology
  
  *F. D’Auria (UNIPI, Italy)*

- **Lecture 36A:** Bifurcation Study with CIAU
  
  *A. Petruzzi (UNIPI, Italy)*

- **Lecture 37A:** Extension of the CIAU Methodology to 3D Neutron Kinetics/Thermal-hydraulics Coupled Codes: CIAU-TN
  
  *A. Petruzzi (UNIPI, Italy)*
Session IX

The CIAU/UMAE Methodology: Applications

- **Lecture 38A**: CIAU Software  
  *A. Petruzzi (UNIPI, Italy)*

- **Lecture 39A**: Consistent Code Qualification Process and Applications to Experimental Tests performed in PKL Facility  
  *A. Del Nevo (UNIPI, Italy)*

- **Lecture 40A**: Scaling Issue: Counterpart Test in the area of VVER-1000 Technology (PSB facility)  
  *F. D’Auria (UNIPI, Italy)*

- **Lecture 41A**: UMAE/CIAU Application to Mochovce NPP  
  *B. Kvizda (VÚJE, Slovakia), A. Petruzzi (UPI, Italy)*

- **Lecture 42A**: CIAU Database for CATHARE Thermal-Hydraulic System Code  
  *A. Del Nevo (UNIPI, Italy)*
SECOND WEEK:
INDUSTRIAL APPLICATIONS, COUPLING METHODOLOGIES AND
HANDS-ON TRAINING SESSIONS

A total of 20 hours teaching will be delivered during the morning sessions
A minimum of 20 participants is required to provide the second week training.

Session I
Mornings

Industrial Applications of Best Estimate + Uncertainty Methodologies

- **Lecture 1B:** Westinghouse Realistic Large Break LOCA Methodologies: Evolution from Response Surface Methods to Statistical Sampling Technique
  C. Frepoli (Westinghouse, USA)

- **Lecture 2B:** AREVA NP’s Realistic Large Break LOCA Methodology
  R. Martin (AREVA, USA)

- **Lecture 3B:** Best Estimate and Uncertainty Analysis for CANDU Reactors
  N. Popov (AECL, Canada)

- **Lecture 4B:** GE Techniques for Establishing andConfirming Uncertainties for Transient and Accident Applications
  C. L. Heck (GE, USA)

- **Lecture 5B:** The Angra-2 DEGB Licensing Calculation by the UMAE/CIAU Method
  R. Galetti (CNEN, Brazil), F. D’Auria (UNIPI, Italy)

- **Lecture 6B:** Best Estimate Analysis in WWER-1000 NPP
  M. Bykov (OKB-GP, Russia)

Session II
Mornings

3D Neutron-Kinetics/Thermal-Hydraulics (NK-TH) Coupling

- **Lecture 7B:** Procedures and Codes for XS Generation
  D. Grgić (FER, Croatia)

- **Lecture 8B:** Introduction to Cross-Section Sensitivity and Uncertainty Analysis
  H. Tsige-Tamirat (JRC, EC)
• Lecture 9B: Basis for Coupling 3D Neutron-Kinetics/Thermal-Hydraulics Codes  
  D. Grgić (FER, Croatia)

• Lecture 10B: PWR/WWER 3D NK-TH Coupled Analysis  
  D. Grgić (FER, Croatia)

• Lecture 11B: 3D NK-TH Coupled Analysis with RELAP5/PARCS and RELAP5-3D©-NESTLE  
  C. Parisi (UNIPI, Italy)

Interactions of Thermal-Hydraulics with Fuel behaviour, Structural Mechanics and Computational Fluid Dynamics

• Lecture 12B: Modelling Fuel Behaviour and its Interaction with Thermal-hydraulics  
  C. Vitanza (OECD)

• Lecture 13B: Safety Limits, with Particular Reference to High Burn-Up  
  C. Vitanza (OECD)

• Lecture 14B: Mox Fuel and related Safety Issues  
  G. Bruna (IRSN, France)

• Lecture 15B: Pressurised Thermal Shock  
  C. Boyd (USNRC, USA)

• Lecture 16B: The BWR Stability Issue  
  T. Van Der Hagen (TU-Delft, The Netherlands)

• Lecture 17B: Role of CFD Codes and Bases for their Use in Nuclear Reactor Technology  
  Y. Hassan (Texas A&M, USA)

International Programs relevant for Safety Analysis in NPP

• Lecture 18B: Overview of TH Code-related Activities in the EC TACIS/PHARE framework  
  A. Bucalossi (JRC-IE, EC)

• Lecture 19B: NEA Benchmarks (including Reactivity Initiated Accidents)  
  F. D'Auria (UNIPI, Italy), E. Sartori (OECD)

• Lecture 20B: Two-phase CFD activities in CSNI-GAMA-WG3 and in the NURESIM project  
  D. Bestion (CEA, France)
Invited Code Specific Lectures and Hands-on Training (20 hrs each)
A minimum of five participants per code is required to provide the respective training.

**Thermal-hydraulic System Codes**

- **Parallel Training PA1:** ATHLET  
  H. Austregesilo (GRS, Germany)
- **Parallel Training PA2:** CATHARE  
  G. Lavialle (CEA, France)
- **Parallel Training PA3:** CATHENA  
  N. Popov (AECL, Canada)
- **Parallel Training PA4:** RELAP5  
  W. Ambrosini, A. Petruzzi (UNIPI, Italy)
- **Parallel Training PA5:** TRACE  
  R. Macian (TUM, Germany)

**Neutron-Kinetics Codes and 3D NK-TH Coupling**

- **Parallel Training PA6:** PARCS  
  T. Downar (PURDUE, USA)  
  T. Kozlowski (KTH, Sweden)

**Thermal-Hydraulic and Severe Accident Codes**

- **Parallel Training PA7:** IMPACT  
  M. Naitoh (NUPEC, Japan)
- **Parallel Training PA8:** RELAP/SCDAPSIM  
  C. Allison (ISS, USA)
Special Sessions (20 hrs each)

A minimum of ten participants per session is required to provide the respective lectures/hands-on training.

- **Parallel Training PB1: Computational Fluid Dynamics**
  - Lecture PB1-1: Models and Capabilities of CFD Codes
    - Y. Hassan (Texas A&M, USA)
  - Lecture PB1-2: Validation Activities for CFD Codes
    - Y. Hassan (Texas A&M, USA)
  - Lecture PB1-3: Two-phase CFD application to boiling flows and CHF investigations
    - D. Bestion (CEA, France)
  - Lecture PB1-4: Two-phase CFD application to stratified flow, DCC and PTS
    - D. Bestion (CEA, France)
  - Lecture PB1-5: Validation and application of CFD codes to the hydrogen issue in the containment
    - D. Baraldi, H Wilkening, M Heitsch (JRC-EC)
  - Lecture PB1-6: Prediction of Boron Mixing with CFD Codes
    - F. D’Aurin, F. Moretti (UNIPI, Italy)
  - Hands-on Training: STAR-CD
    - E. Baglietto (CD-adapco, USA)

- **Parallel Training PB2: Severe Accident Analysis**
  - Lecture PB2-1: Severe Accident Phenomenology
    - J. Rempe (INL, USA)
  - Lecture PB2-2: Severe Accident Analysis Codes
    - J. Rempe (INL, USA)
  - Lecture PB2-3: AREVA NP’s Severe Accident Safety Issue Resolution Methodology
    - R. Martin (AREVA NP, USA)
  - Lecture PB2-4: Severe Accident Analysis and Applications
    - B.R. Sehgal (KTH, Sweden)
  - Hands-on Training: RELAP/SCDAPSIM
    - C. Allison (ISS, USA)
• **Parallel Training PB3:** WWER Technology: Thermal-Hydraulics, Safety Design and Computer Codes

  o **Lecture PB3-1:** WWER Thermal-Hydraulics Design  
    *M. Bykov (OKB-GP, Russia)*

  o **Lecture PB3-2:** WWER Thermal-Hydraulics Phenomena  
    *M. Bykov (OKB-GP, Russia)*

  o **Lecture PB3-3:** WWER Safety and Safety Systems  
    *M. Bykov (OKB-GP, Russia)*

  o **Lecture PB3-4:** The WWER Validation Matrix  
    *M. Bykov (OKB-GP, Russia)*

  o **Lecture PB3-5:** WWER Computer Code V&V  
    *M. Bykov (OKB-GP, Russia)*

  o **Lecture PB3-6:** WWER Best Estimate and Uncertainty Analysis  
    *M. Bykov (OKB-GP, Russia)*

  o **Lecture PB3-7:** CATHARE Validation and Assessment of WWER experimental facilities.  
    *L. Sabotinov (IRSN, France)*

  o **Lecture PB3-8:** Accident Analysis of WWER NPP by CATHARE code  
    *L. Sabotinov (IRSN, France)*

  o **Lecture PB3-9:** WWER Transient Analysis Applications  
    *Contributions from: A. Bucalossi, V. Rangelova (JRC-IE, EC), F. D’Auria (UNIPI, Italy)*

• **Parallel Training PB4:** CANDU Technology: Thermal-Hydraulics, Safety Designs, Computer Codes

  o **Lecture PB4-1:** CANDU Thermal-Hydraulics Design  
    *N. Popov (AECL, Canada)*

  o **Lecture PB4-2:** CANDU Thermal-Hydraulics Phenomena  
    *D. Novog (McMaster University, Canada)*

  o **Lecture PB4-3:** CANDU Safety and Safety Systems  
    *N. Popov (AECL, Canada)*

  o **Lecture PB4-4:** CANDU Computer Code V&V  
    *N. Popov (AECL, Canada)*

  o **Lecture PB4-5:** CANDU PIRTs  
    *N. Popov (AECL, Canada)*
**DRAFT PROGRAMME OUTLINE**

- **Lecture PB4-6:** CANDU BEAU (Best Estimate And Uncertainty)  
  *A. Abdul-Razzak (AECL, Canada)*

- **Lecture PB4-7:** CANDU BEAU Sample  
  *A. Abdul-Razzak (AECL, Canada)*

- **Lecture PB4-8:** CANDU Transient Analysis Applications  
  *D. Novog (McMaster University, Canada)*

- **Parallel Training PB5:** GEN-IV Technology: Thermal-Hydraulics, Safety Designs, Computer Codes

**INTRODUCTION**

- **Lecture PB5-1:** Generation IV Nuclear Reactors: Preliminary Safety Considerations  
  *G. Bruna (IRSN, France)*

- **Lecture PB5-2:** Overview of the main features of the GEN-IV reactor concepts  
  *G. Bruna (IRSN, France)*

- **Lecture PB5-3:** Overview on some Aspects of Safety Requirements and Considerations for GEN-IV Water Cooled Nuclear Reactors  
  *N. Aksan (Switzerland)*

**THE GEN-IV SODIUM FAST REACTOR**

- **Lecture PB5-4:** Fast Reactor Physic, Core and Assembly Design, Codes for Neutronics and Core Thermal-hydraulics  
  *P. Dufour (CEA, France)*

- **Lecture PB5-5:** Reactor Design, Safety System Design, Associated Codes  
  *P. Dufour (CEA, France)*

- **Lecture PB5-6:** Conceptual Design Studies and Research Programs  
  *P. Dufour (CEA, France)*

**THE GEN-IV SUPER CRITICAL WATER REACTORS**

- **Lecture PB5-7:** European Super Critical Water Reactor (SCWR) "High Performance Light Water Reactor (HPLWR)" Safety and Thermal-Hydraulics  
  *N. Aksan (Switzerland)*
Lecture PB5-8: General Application of some Safety Requirements of European Utility Requirements (EUR) to High Performance Light Water Reactor (HPLWR)
N. Aksan (Switzerland)

THE GEN-IV CANDU SUPER CRITICAL WATER REACTORS

Lecture PB5-9: CANDU Super Critical Water Reactors: Conceptual design
D. Novog (McMaster, Canada)

Lecture PB5-10: CANDU Super Critical Water Reactors: Thermalhydraulics R&D
D. Novog (McMaster, Canada)

Lecture PB5-11: CANDU Super Critical Water Reactors: Reactor Physics R&D
D. Novog (McMaster, Canada)

Lecture PB5-12: CANDU Super Critical Water Reactors: Materials R&D
D. Novog (McMaster, Canada)

THE GEN-IV VERY HIGH TEMPERATURE REACTORS

Lecture PB5-13: VHTR: Conceptual Design Studies and Research Programs
To be confirmed

Lecture PB5-14: VHTR: Reactor Core and Assembly Design
To be confirmed

Lecture PB5-15: VHTR: Thermal-hydraulics and Advanced Codes
To be confirmed

Lecture PB5-16: VHTR: System analyses and code applications
To be confirmed
A total of 40 hours of hands-on training will be delivered. A minimum of ten participants is required to provide the third week.

Session I

**BETHSY ITF**

- **Lecture 1D:** Description of the BETHSY Facility  
  T. Bajs (FER, Croatia)
- **Lecture 2D:** Description of BETHSY RELAP5 Nodalization  
  T. Bajs (FER, Croatia)
- **Exercise 1:** Nodalization Development - Tools: RELAP5  
  T. Bajs (FER, Croatia)
- **Exercise 2:** Application of the Proposed Methodology at Steady State Level  
  T. Bajs (FER, Croatia)
- **Lecture 3D:** Description of the BETHSY Test 9.1.b (ISP27)  
  T. Bajs (FER, Croatia)
- **Exercise 3:** Application of the Proposed Methodology at Transient Level - Tools: RELAP5, FFTBM  
  T. Bajs (FER, Croatia)
- **Exercise 4:** Application of the Proposed Methodology for Uncertainty Evaluation - Tools: CIAU  
  A. Petruzzi (UNIPI, Italy)
- **Exercise 5:** Detection of ‘Simple’ Input Error - Tools: RELAP5  
  T. Bajs (FER, Croatia), A. Petruzzi (UNIPI, Italy)

Session II

**LOFT (or PMK) ITF**

- **Lecture 4D:** Description of the ITF Facility  
  A. Petruzzi (UNIPI, Italy)
- **Lecture 5D:** Description of ITF RELAP5 Nodalization  
  A. Petruzzi (UNIPI, Italy)
- **Exercise 6:** Nodalization Development - Tools: RELAP5  
  A. Petruzzi (UNIPI, Italy)
Exercise 7: Application of the Proposed Methodology at Steady State Level
A. Petruzzi (UNIPI, Italy)

Lecture 6D: Description of the ITF Transient Test
A. Petruzzi (UNIPI, Italy)

Exercise 8: Application of the Proposed Methodology at Transient Level - Tools: RELAP5, FFTBM
A. Petruzzi (UNIPI, Italy)

A. Petruzzi (UNIPI, Italy)

VISIT TO THE HIGH FLUX REACTOR (HFR)

- Presentation of the JRC and the Main HFR Activities
- Entrance in the Vital HFR Area
- Entrance in the HFR Control Room

EVALUATION SESSION

Learning Examination on Training Programme

- Written Evaluation on Specific Training Topics
- Resolution of Calculation Errors in Input Decks (RELAP5)
- Final Discussion on Learning Examination Topics

Closing Ceremony

- Evaluation of the Seminar from the Participants
- Presentation of the Participation Certificate
## TIME SCHEDULE

### I WEEK

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<th>13/10/2008</th>
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<td>Lectures A: Sessions I to IX</td>
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### II WEEK

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<td>Parallel Sessions A: PA1 – PA8</td>
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<tr>
<td>16:30 – 18.30</td>
<td>Parallel Sessions B: PB1 – PB5</td>
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<tr>
<td>20:00 – 23.00</td>
<td>Official Dinner</td>
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</table>

### III WEEK *

<table>
<thead>
<tr>
<th>Date</th>
<th>27/10/2008</th>
<th>28/10/2008</th>
<th>29/10/2008</th>
<th>30/10/2008</th>
<th>31/10/2008</th>
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<tbody>
<tr>
<td>8:30 – 10.30</td>
<td>Lectures D and Exercises: Sessions I to II</td>
<td>Lectures D and Exercises: Sessions IV</td>
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<tr>
<td>10:30 – 11.00</td>
<td>Coffee Breaks</td>
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<tr>
<td>11:00 – 13.00</td>
<td>Lectures D and Exercises: Sessions I to II</td>
<td>Visit to the HFR</td>
<td>Lectures D and Exercises: Sessions III</td>
<td>Lectures D and Exercises: Sessions IV</td>
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<tr>
<td>13:00 – 14.00</td>
<td>Lunches</td>
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<tr>
<td>14:00 – 16.00</td>
<td>Lectures D and Exercises: Sessions I to II</td>
<td>Lectures D and Exercises: Sessions IV</td>
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<tr>
<td>16:00 – 16.30</td>
<td>Coffee Breaks</td>
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<td>Closing Ceremony</td>
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<tr>
<td>16:30 – 18.30</td>
<td>Lectures D and Exercises: Sessions I to II</td>
<td>Lectures D and Exercises: Sessions IV</td>
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<tr>
<td>20:00 – 23.00</td>
<td>Official Dinner</td>
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*At the moment it is foreseen to use the RELAP5 code (the use of other codes may also be considered, depending on the number of requests received).*
The 3D S.U.N.COP 2008 at the Institute for Energy (IE), Joint Research Center (JRC) of European Commission will be the ninth seminar of its kind organized in five years. The previous eight seminars were successfully held at:

- The University of Pisa (Pisa, Italy), 5 – 9 January 2004 (6 participants) and 14 – 18 June 2004 (11 participants);
- The Pennsylvania State University (University Park, PA, USA), 24 – 28 May 2004 (15 participants);
- The University of Zagreb (Zagreb, Croatia), 20 June – 8 July 2005 (19 participants);
- The Polytechnic University of Catalonia (Barcelona, Spain), 23 January – 10 February 2006 (33 participants);
- The Autoridad Regulatoria Nuclear (ARN), the Comisión Nacional de Energía Atómica (CNEA), the Nucleoelectrica Argentina S.A (NA-SA) and the Universidad Argentina De la Empresa (Buenos Aires, Argentina), 2 October – 14 October 2006 (37 participants);
- The Texas A&M University (College Station, Texas, USA), 22 January – 9 February 2007 (26 participants);
- The McMaster University, the Atomic Energy of Canada Limited (AECL), the Canadian Nuclear Society (CNS), the Canadian Nuclear Safety Commission (CNSC), 8 October – 26 October 2007 (33 participants).

The University of Pisa (UNIPI), the Institute for Energy (IE) of JRC, the Faculty of Electrical Engineering and Computing (FER) of Zagreb and the School of Industrial Engineering of Barcelona (ETSEIB) are jointly organizing a Seminar and Training to transfer competence, knowledge and experience in the area of Scaling, Uncertainty and 3D Coupled Code Calculations.

The seminar will take place in Petten, close to Amsterdam (The Netherlands) from October 13th to October 31st, 2008 at the Institute for Energy (IE) of EC JRC. It will be held in the modern classrooms which are equipped with data projectors and networked PCs suitable for running advanced best estimate thermal-hydraulic codes (e.g. RELAP5).

The seminar is open to universities, vendors, national laboratories and regulatory bodies. At least two years’ experience in the use of a thermal-hydraulic system code is needed to participate in the course. A minimum of twenty participants is required to organize the seminar. A maximum of 40 persons will be accepted.

The seminar is subdivided into three parts and participants may choose to attend a one-, two- or three-week course. The first week is dedicated to lectures describing the concepts of the proposed methodologies; the second week is devoted to training and to the applied part while the third week will be dedicated to user qualification, including a learning examination on the topics of the seminar. The participants will be divided into groups of threes or fours and each group will be accompanied by an expert during the entire training activity. The application of the proposed methodology will be illustrated through tests in the BETHSY, LOFT and/or in the PMK facility. A visit to the High Flux Reactor (HFR) will be organized during the third week of the course.

Further information about participation and registration as well as useful practical information can be obtained from Alessandro Petruzzi at the following email address: a.petruzzi@ing.unipi.it. Special accommodation will be offered on a separate sheet. An internet website with the latest news is also available at: http://dimnp.ing.unipi.it/3dsuncop/

Objective of the Seminar/Training

To transfer to the participants competence and experience in uncertainty methodologies and 3D coupled code calculations from activities carried out over the last two decades by a group of experts from different organizations (university professors, researchers and industrial experts) through participation in benchmarks, International Standard Problems and international cooperation. The University of Pisa will be the leader of the planned activities. Managers and research strategists would also benefit from attending the Seminar.

Expected Products

The Seminar will provide a transfer of experience and know-how from recognized experts in the respective fields. It will thus contribute to maintaining and increasing technical competence and to ensuring the sustainable development of nuclear technology. CDs containing all lectures will be distributed to the participants.

Organizing Committee

A. Petruzzi (UNIPI)
A. Bucalossi (JRC-IE)
P. Pla (UNIPI)
T. Bajs (FER)

Scientific Committee

F. D’Auria (UNIPI)
L. De Barberis (JRC-IE)
D. Grgić (FER)
F. Reventos (ETSEIB)
N. Aksan (Switzerland)
Y. Hassan (Texas A&M)
E. Sartori (OECD)
REGISTRATION FORM
To be returned by 11 July 2008

Last name: ............................................................ First name: ............................................................................................
Title: .................................................................................... Organization: ....................................................................................
Address: ..............................................................................................................................................................................................
City: .............................................  State: .......................................  Zip Code: ..……..……….  Country ……..……………….....
Phone: ……………………..  Fax: ………… ………………  Email: ……………………..………………………………...
(Please type all information as you wish it to appear on your name badge)

On entering the Petten site, which is a secured area, you need to present your passport or identity card
Nationality: ....................................................................................... Date of Birth: ............................................................
Passport or ID Number: ..................................................................... Date of Issue: ......................... Expiry Date: .........................
Private Address: ................................................................................ City: ....................................... Country: ................................

TO BE COMPLETED ONLY BY PARTICIPANTS IN THE SECOND WEEK
Please select the parallel session in which you are interested:
(ONE topic only, EITHER from Session A or B, may be chosen)

Parallel Sessions A: PA1 – PA8
PA1-ATHLET  □  PA2-CATHARE  □  PA3-CATHENA  □
PA4-RELAP5  □  PA5-TRACE  □  PA6-PARCS  □
PA7-IMPACT  □  PA8-RELAP/SCDAP  □

Parallel Session B: PB1-PB5
PB1-COMPUTATIONAL FLUID DYNAMICS  □
PB2-SEVERE ACCIDENT ANALYSIS  □
PB3-WWER TECHNOLOGY  □
PB4-CANDU TECHNOLOGY  □
PB5-GEN-IV TECHNOLOGY  □

Please indicate your level of expertise in using the selected code in Parallel Session A
□ Never used
□ Beginner (very few calculations performed)
□ Intermediate (developed at least one full nodalization)
□ Advanced (developed more than one full nodalization)
□ Expert (more than five years of experience)

Registration Fees
Include the proceedings, lunches, coffee breaks and the official dinners (one per week):
20 October – 24 October 2008  – 3D S. UN. COP: 9th Seminar (second week) ……………………………………. □ € 2500
13 October – 24 October 2008  – 3D S. UN. COP: 9th Seminar (first and second week) ……………………………………. □ € 3500
20 October – 31 October 2008  – 3D S. UN. COP: 9th Seminar (second and third week) ……………………………………. □ € 3500
13 October – 31 October 2008  – 3D S. UN. COP: 9th Seminar (all three weeks) ……………………………………. □ € 4000

* Bank charges to be added to registration fees
Payment by 31 July 2008

□ Information will be provided after July 11th, 2008.

The Registration Form should be sent to:
Alessandro Petruzzi :  FAX #:  0039 050 2210384           email: a.petruzzi@ing.unipi.it