Budapest Univ. of Technology and Economics

Slovak Technical University, Bratislava

Atominstitut der Österreichischen Universitäten

Czech Technical University, Prague

The „Eugene Wigner Course", an example of international cooperation in nuclear education

Prepared and presented by
Dr. Csaba Sükösd, Budapest

enen european nuclear education network

- A.) History, background
- B.) General organisation
- C.) Group work
- D.) Time schedule
- E.) Contents
- F.) Assessment, evolution
- G.) Finances
- H.) The „Wigner Course" in 2006

A.) HISTORY, BACKGROUND

1) Nuclear Education and Training: Cause for Concern? (OECD / Nuclear Energy Agency)

*"Although the number of nuclear scientists and technologists may appear to be sufficient today in some countries, there are indicators that **future expertise is at risk**. In most countries, there are now fewer comprehensive, high quality nuclear technology programmes at universities than before. The ability of universities to attract top quality students, meet future staffing requirements of the nuclear industry, and conduct leading-edge research is becoming **seriously compromised**".*

Decreasing number of students dissolved nuclear depts. → **Even these few students cannot get high quality nuclear education!**

A.) HISTORY, BACKGROUND (continued)

2) ENEN project in the 5th Framework program of the EU

Workprogram 10/a: „**Experimental pilot sessions**"

Objectives:

- study the **feasibility** of creating international courses
- **organise** such a pilot course if possible
- the course should be financially „**self-supporting**" and „**zero-balanced**"

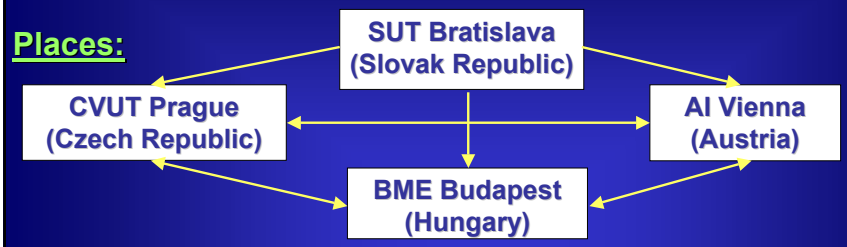
Results:

- Definition of the „*Eugene Wigner" Course for Reactor Physics Experiments*
- Performing it for the first time in April 2003.

NOTE: It is a newly created course, *NOT* an already existing one just opened for a larger target community !

B.) GENERAL ORGANISATION of the WIGNER COURSES

Places:



Purpose of the course: experimental (and theoretical) training of students and young professionals in reactor physics by support of practical exercises at three different research reactors (unique opportunity!!)

Evaluation: group reports of the experiments

Value: 6 ECTS (credits) recommended by *ENEN*

C.) GROUP WORK

- the participants work in groups: A, B, C, D
- each group contains 4-5 students

Special care is taken to „mix" students according to nationality and gender in the different groups.
This way the „international" character of the course can be emphasised

D.) TIME SCHEDULE (Example: Wigner Course 2004)

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
SUT Bratislava	A,B,C,D																	
BME Budapest						A,B							C,D					
AI Vienna						C			D				A			B		ABCD
CVUT Praha						D			C				B			A		

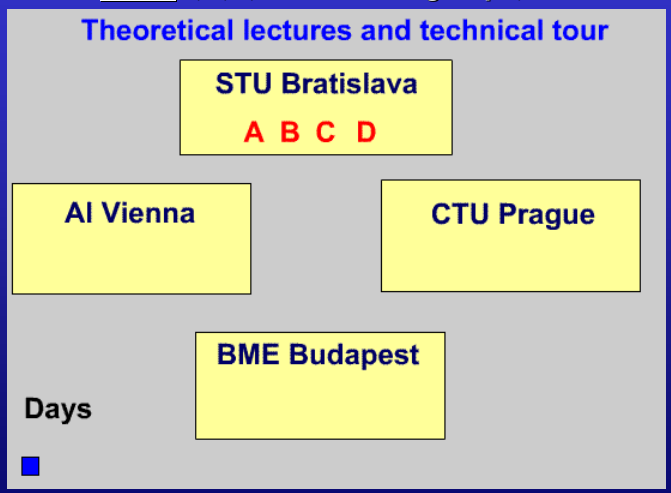
Notes:
A,B,C,D denote the groups;

The meaning of the colors:

- Theoretical lectures & technical visit of a NPP
- Reactor experiments
- Final evaluation
- Travel & free time

D.) TIME SCHEDULE (Logistic)

Note: A,B,C,D denote the groups;



E.) CONTENTS (1) List of theoretical courses (2004)

LECTURES

Nuclear Safety
Prof., Vladimir Slugen, STU (Bratislava)

Survey of research reactors and associated systems
Prof. Mario Villa, Atominstitut (Vienna)

Data evaluation techniques related to the practical exercises
Prof. Zoltán Szatmáry, BME (Budapest)

Radiation protection and dosimetry
Dr. Peter Zagyvai, BME (Budapest)

Detectors of Radiation
Prof. Marcel Miglierini, STU (Bratislava)

Instrumentation for Nuclear Measurements
Dr. Szabolcs Czifrus, BME (Budapest)

Nuclear Measuring Methods
Dr. Szabolcs Czifrus, BME (Budapest)

TECHNICAL VISIT to Jaslovske Bohunice Nuclear Power Plant
Prof. Jan Hasčik, STU (Bratislava)

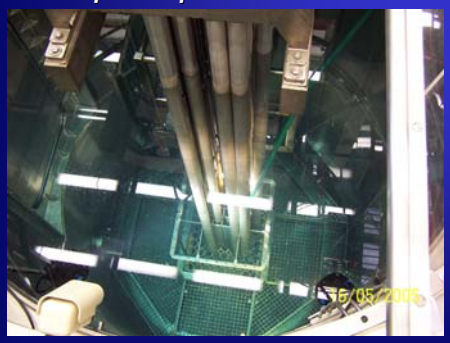
E.) CONTENTS (cont.) Experiments at the BME Budapest

- *Reactor Operation Exercise*
- *Determination of delayed neutron parameters and uranium content of a sample*
- *Measurement of thermal neutron diffusion length in graphite*
- *Reactivity worth of neutron absorbers*
- *Neutron activation analysis*

E.) CONTENTS (cont.)

Experiments at the CTU Prague

- *Properties of neutron detectors for nuclear reactor control*
- *Measurements of reactivity by various methods*
- *Calibration of control rods*
- *Study of nuclear reactor dynamics*
- *Digital control and safety system of research reactors*
- *Start-up and operation of the VR-1 reactor*



E.) CONTENTS (cont.)

Experiments at the AI Vienna

- *Measurement of the thermal neutron flux density in the reactor core*
- *Determination of the neutron absorption cross section*
- *Determination of the reactivity value of uranium fuel and graphite elements in different reactor positions*
- *Critical experiment*
- *Determination of the importance function and the void coefficient*
- *Reactor power calibration and determination of the reactivity temperature coefficient*
- *Demonstration of reactor pulses with different reactivity insertion*

E.) CONTENTS (cont.)

The lecturers / experiment supervisors have to fulfil the following requirements:

- should be regular university professors or associate professors
- have at least PhD scientific degree
- have at least 5 years of teaching experience in the field
- internationally recognised experts

E.) CONTENTS (cont.) Assessment of students' work

- During the experiments
  - Groups have to write laboratory reports, where
    - the measurement is described,
    - the raw measured data are indicated,
    - the data evaluation method is outlined
    - the results are presented and
    - discussed.
  - The written laboratory report is assessed („graded") by the experiment's supervisor

- Final evaluation session (last day)
  - Each group chooses one experiment for oral presentation
  - every student of the group is involved, he/she has to present some part of the subject
  - each presentation is followed by a discussion where every participant and the members of the jury take part
  - An international jury composed from selected professors of the Organising Committee assesses the presentations

F.) ASSESSEMENT & EVOLUTION OF THE COURSE

-Assessment is twofold:
- the Organising Committee assesses it after the course
- the participants are asked to write anonym „feedback-reports"

-Special care is taken to harmonise
- the content of the theoretical courses and the experiments
- the content of the experiments in different laboratories

Result: Evolution of the curriculum and of the logistic

Wigner Course 2003 (first try)
- ❖ Larger number of theory lectures (21 days course)
- ❖ In a few cases not very strong relevance for the experiments
- ❖ 3 similar experiments in different laboratories

Wigner Course 2004
- ❖ Fewer theoretical lectures (18 days course)
- ❖ Only relevant topics kept (new relevant topics included)
- ❖ No similar experiments

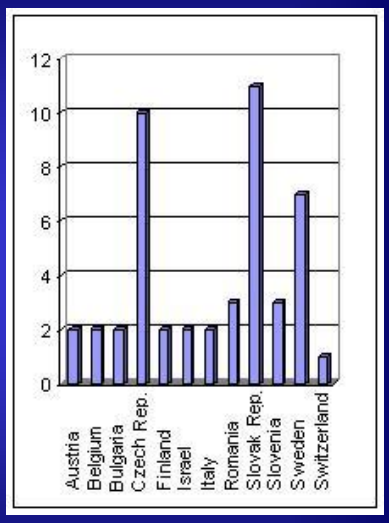
Wigner Course 2005
- ❖ structure as in 2004 (unchanged)
- ❖ only two groups (A,B)
- ❖ opened also for young professionals

F.) EVOLUTION OF THE COURSE (continued)

Participation in the Wigner Courses in the past 3 years:

47 participants of
12 countries.

Distribution according to degrees:
35 MSc students
7 PhD students
5 young professionals



Distribution of participants

G.) FINANCES

„The course should be self-supporting and zero-balanced"

Costs fall in two categories:

- Students cost (proportional to the number of students)
  - Accommodation
  - Travel costs (between the 4 cities during the course)
  - Course material (textbooks printing etc)
- Fix costs (independent from the number of students)
  - Reactor operation: (2 weeks, 3 reactors = 30 reactordays)
  - Lecturers honorary (32 hours)
  - Other costs (mail, phone, lecture room rental, opening and closing ceremony, overheads at 4 places)

G.) FINANCES (continued)

Participation fee

(supposed to be paid by the student, or by the sending institution)

2003	2100 €	18 students 2 professionals
2004	1900 €	16 students 1 professional
2005	700 +1200 € (ENEN) 3500 +1200 €	8 students 2 professionals

(Fix + students cost)

The IAEA assisted financially (many thanks!!!)

- Covered the costs (sometimes only partly) for a number of participants
- Contributed to the fix costs with a „lump sum"

Without the IAEA assistance the courses could not have been performed

H.) THE „WIGNER COURSE" IN 2006

The Organising Committee made the following decisions:

- Date of the course: 4 – 22 September 2006
- Only 10 participants (groups A and B)
- Participation fees as in 2005: 700+1200 € (for ENEN), and 3500+1200 €.
- All participants travel together (no exchange in the middle of the week)
  - 2 days theoretical lectures in Bratislava
  - 1 day technical tour in NPP
  - 3 days reactor experiments in Prague
  - 3 days reactor experiments in Vienna
  - 3 days reactor experiments in Budapest
  - 1 day final evaluation in Budapest.

Application should be sent to:
Dr. Csaba Sükösd BME Dept. of Nuclear Techniques
H-1521 Budapest Hungary

Further information:

The Web-site of the „Wigner Course" is:

http://www.reak.bme.hu/nti/Education/Wigner_Course

the detailed information for the Wigner Course 2006 will be published in September 2005

THANK YOU FOR YOUR ATTENTION !!