

IAEA Activities in the Area of Partitioning and Transmutation

Alexander Stanculescu
Nuclear Energy Department
Nuclear Power Technology Development Section



IAEA

International Atomic Energy Agency

IAEA Activities

□ Implemented in collaboration by IAEA's *Nuclear Power Technology Development* and *Nuclear Fuel Cycle and Materials* Sections

□ Framework given by the *Technical Working Groups on Fast Reactors (TWG-FR)* and on *Nuclear Fuel Cycle Options (TWG-NFCO)*

Technical Working Group on Fast Reactors (TWG-FR)

□ TWG-FR **working tool** to

- Promote **exchange of information** on national and multi-national fast reactor and hybrid systems programs (e.g. ADS)
- Stimulate and facilitate **collaborative research and development** (Coordinated Research Projects, CRPs)
- Coordinate activities with other Agency projects (e.g. in Safety), and international organizations (EC, ISTC, and OECD/NEA)

Membership of the TWG-FR

Belarus, Brazil, China, France, Germany, India, Italy, Japan, Kazakhstan, Republic of Korea, Russia, Switzerland, United Kingdom, and United States of America, as well as the EU (EC), ISTC, and OECD/NEA

Observers: Belgium, Sweden

Recent and Ongoing Activities

□ ***School on Physics, Technology and Applications of Accelerator Driven Systems (ADS)***, in collaboration with ICTP, 19 – 30 Nov 2007, Trieste, Italy

➤ **Lecture notes on**
http://cdsagenda5.ictp.trieste.it/full_display.php?email=0&ida=a06213

Recent and Ongoing Activities, cont'd

- ***Advanced Workshop on Model Codes for Spallation Reactions***, in collaboration with ICTP, 4 – 8 Feb 2008, Trieste, Italy
 - **International Nuclear Data Committee Report, INDC(NDS)-0530**

Recent and Ongoing Activities, cont'd

□ ***Workshop on Nuclear Reaction Data for Advanced Reactor Technologies***, in collaboration with ICTP, 19 – 30 May 2008, Trieste, Italy

➤ Lecture notes on http://cdsagenda5.ictp.trieste.it/full_display.php?smr=0&ida=a07153

Recent and Ongoing Activities, cont'd

□ Coordinated Research Project (CRP) on *Studies of Innovative Reactor Technology Options for Effective Incineration of Radioactive Waste*

- 17 institutions in 13 Member States & EC (JRC)
- Transient behaviour of advanced transmutation systems, both critical and sub-critical
- Papers at PHYSOR 2006, ICENES 2007, and GLOBAL 2007
- Final CRP report to be published by end 2008

Recent and Ongoing Activities, cont'd

- **Coordinated Research Project (CRP) on *Analytical and Experimental Benchmark Analyses of Accelerator Driven Systems***
 - **Participation from 27 institutions in 18 IAEA Member States**
 - **Papers at AccApp2007, and PHYSOR2008**

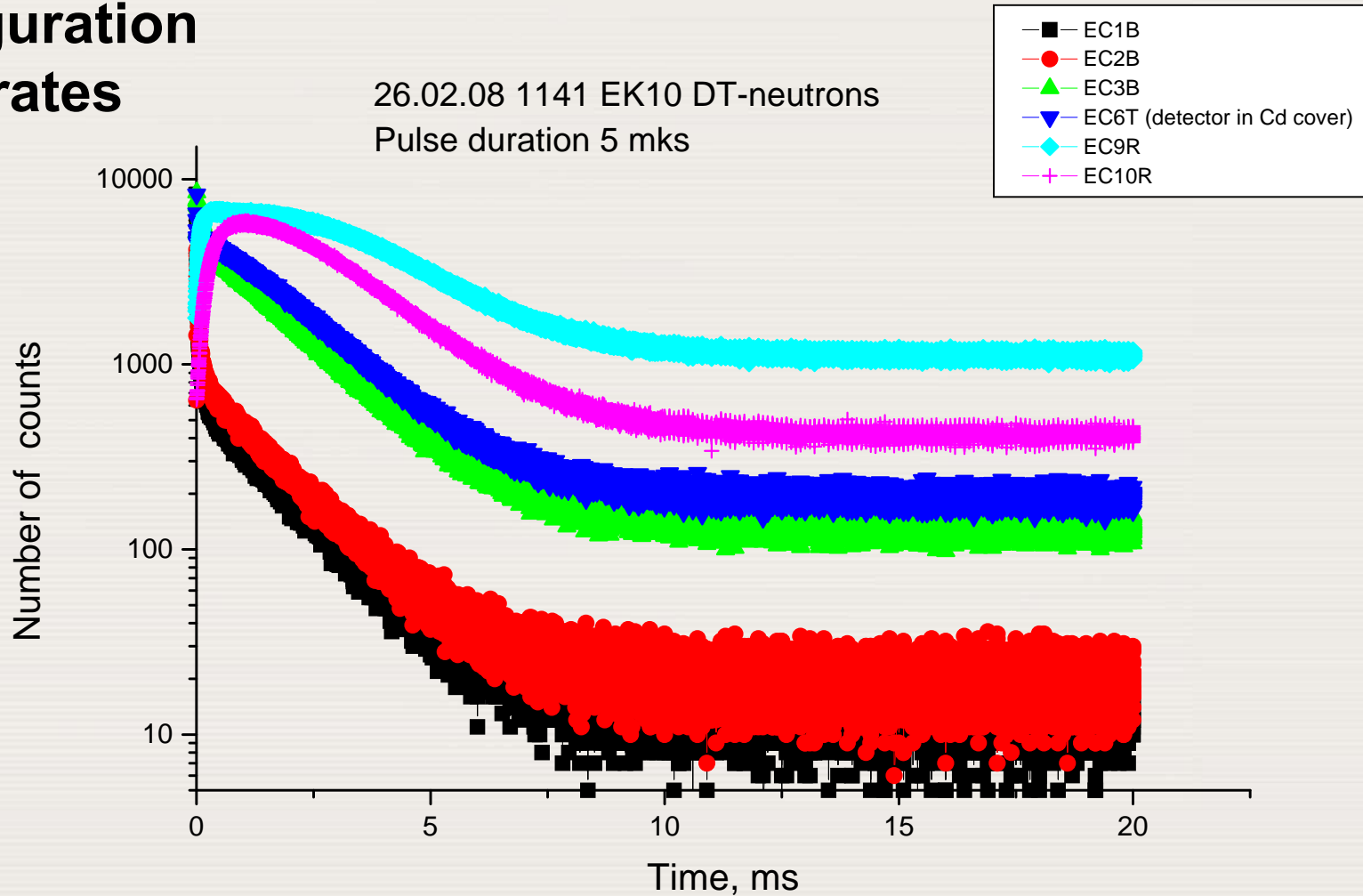
Recent and Ongoing Activities, cont'd

➤ Scope of the CRP

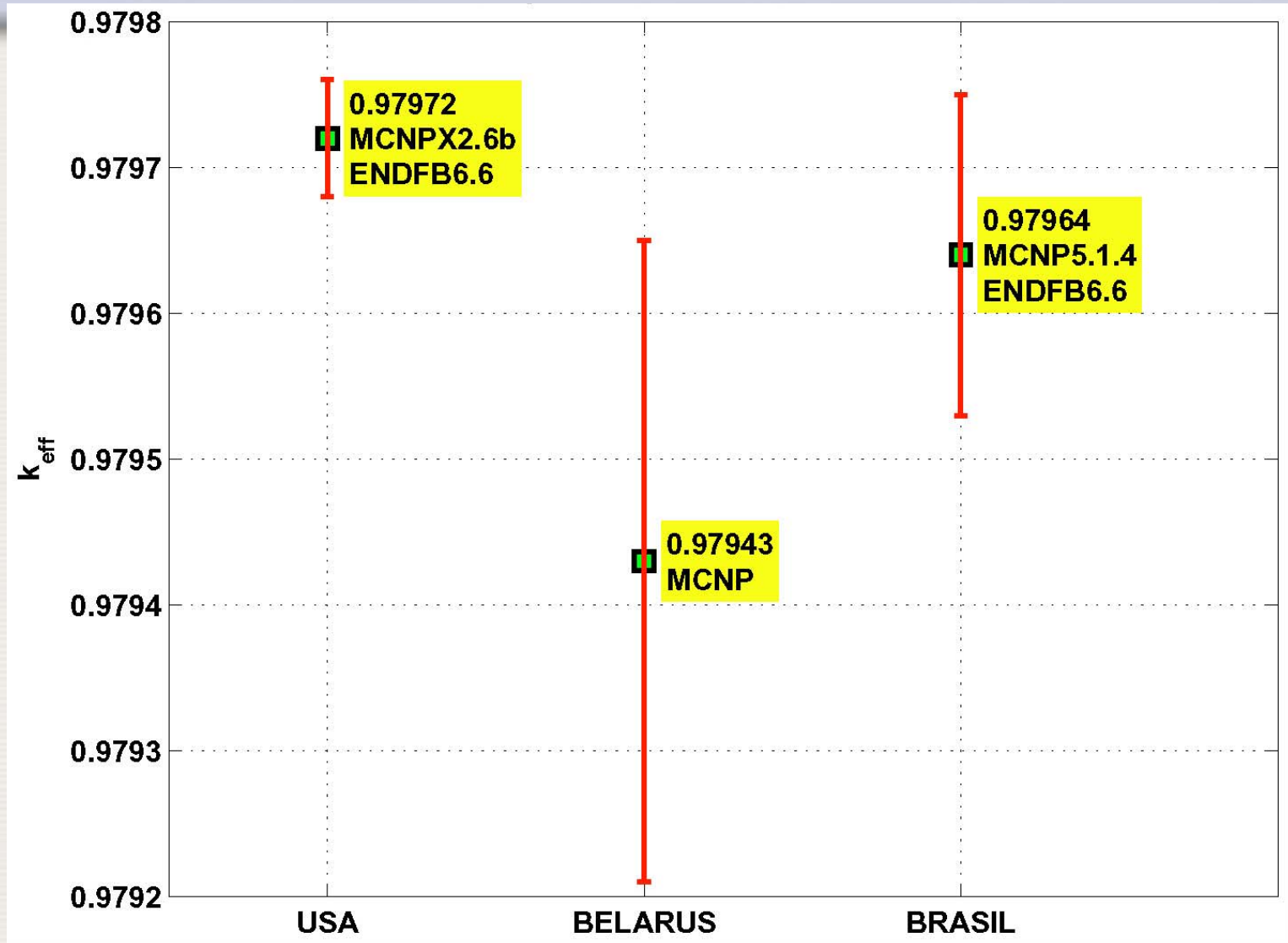
- Computational and experimental benchmarking
- ADS and non-spallation neutron source driven sub-critical systems
- Work domains in the first stage
 - ✓ YALINA Booster
 - ✓ Kyoto University Critical Assembly (KUCA)
 - ✓ Pre-TRADE
 - ✓ FEAT and TARC
 - ✓ ADS kinetics analytical benchmarks
 - ✓ Actinides cross sections
 - ✓ Spallation targets
 - ✓ ADS performance

YALINA Booster

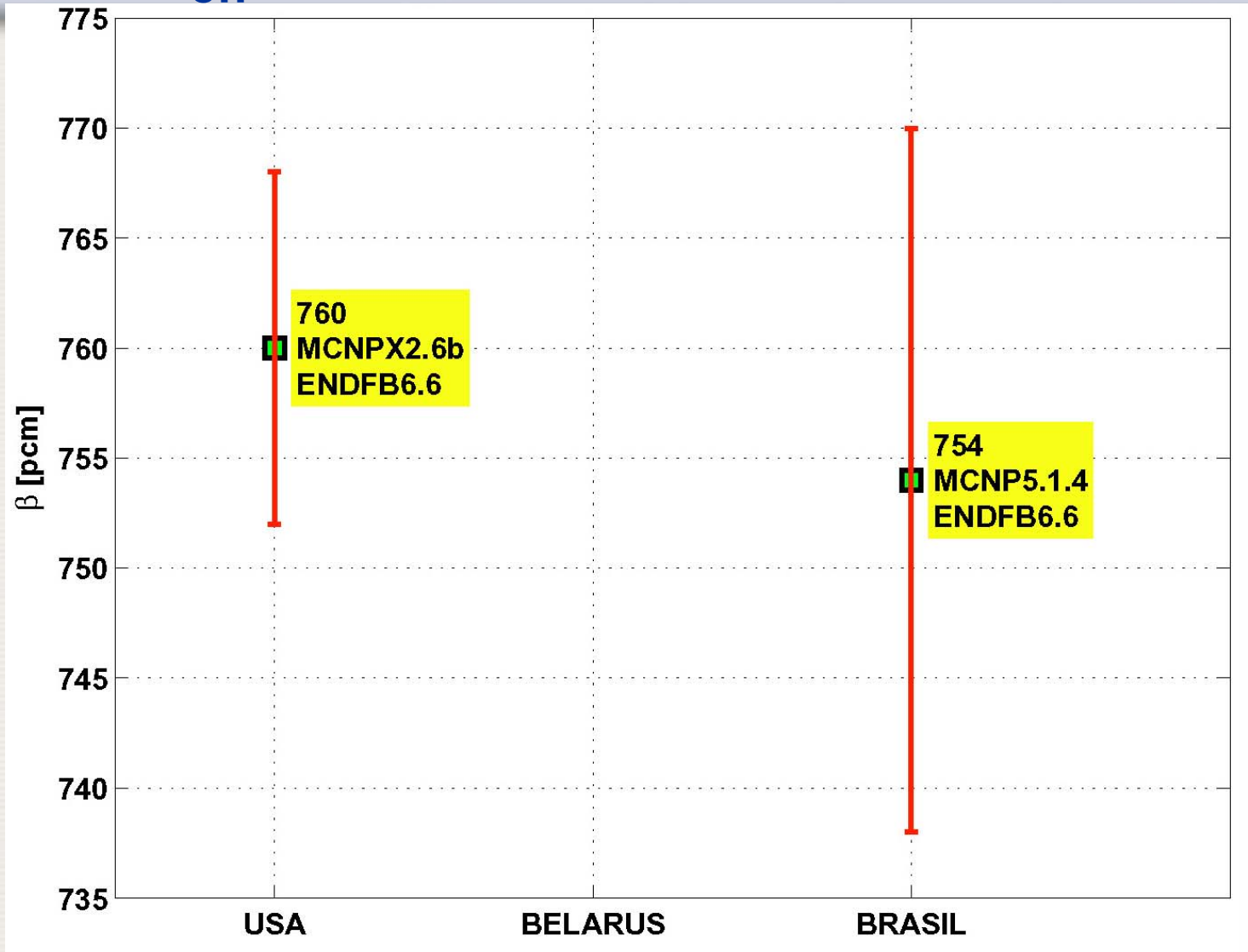
- Ref. configuration
- ^3He count rates



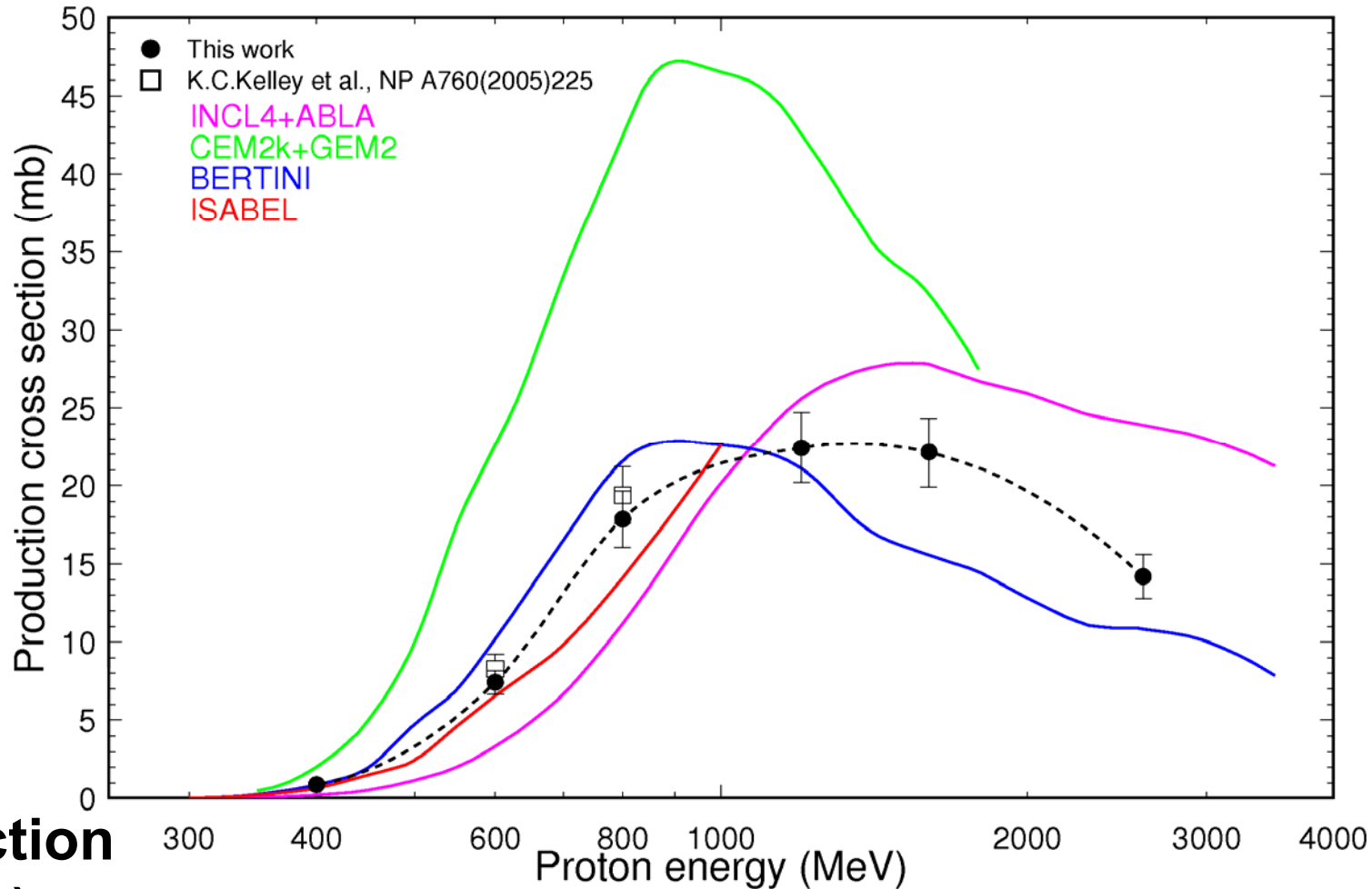
YALINA Booster Reference Configuration, Preliminary k_{eff} Intercomparisons



YALINA Booster Reference Configuration, Preliminary β_{eff} Intercomparisons



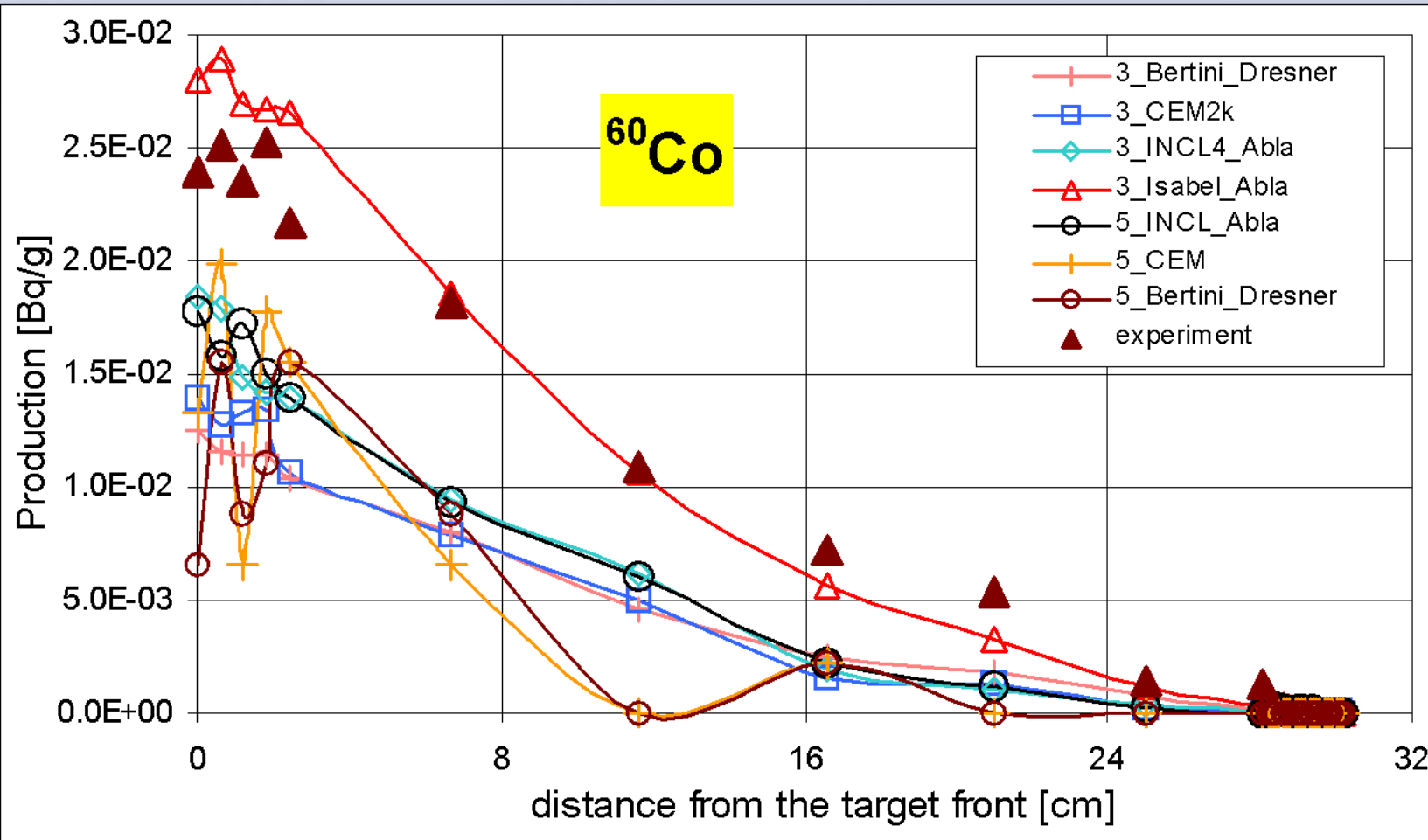
Spallation Targets, ITEP Benchmarks



^{148}Gd production from $^{\text{nat}}\text{W}(p,x)$

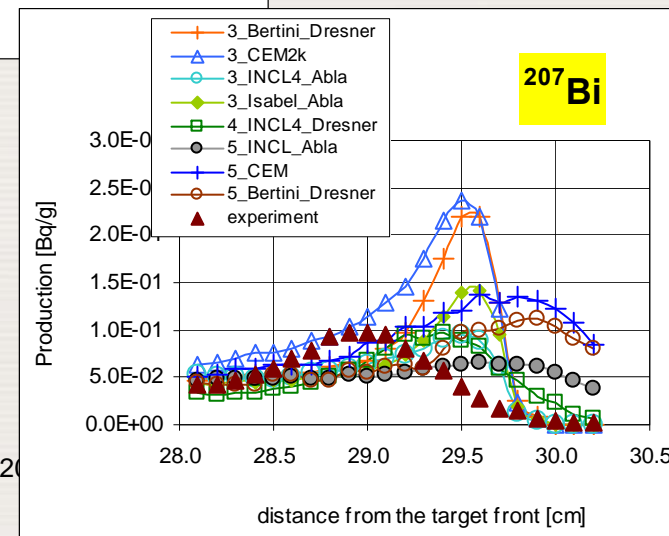
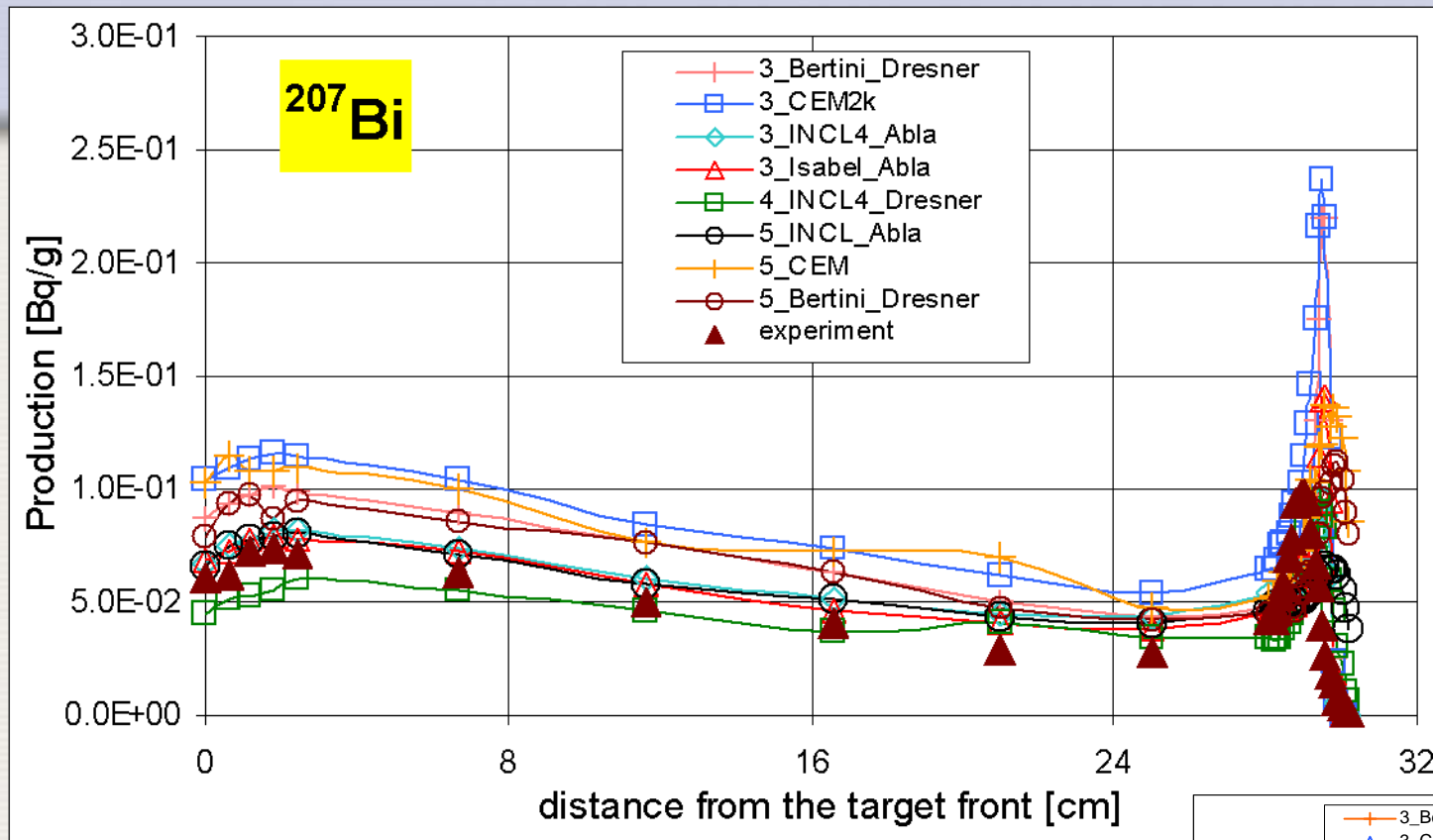
- Satisfactory agreement of exp. results with previous measurements at 0.6 and 0.8 GeV
- Theoretical predictions only qualitative

Spallation Targets, JINR Benchmarks



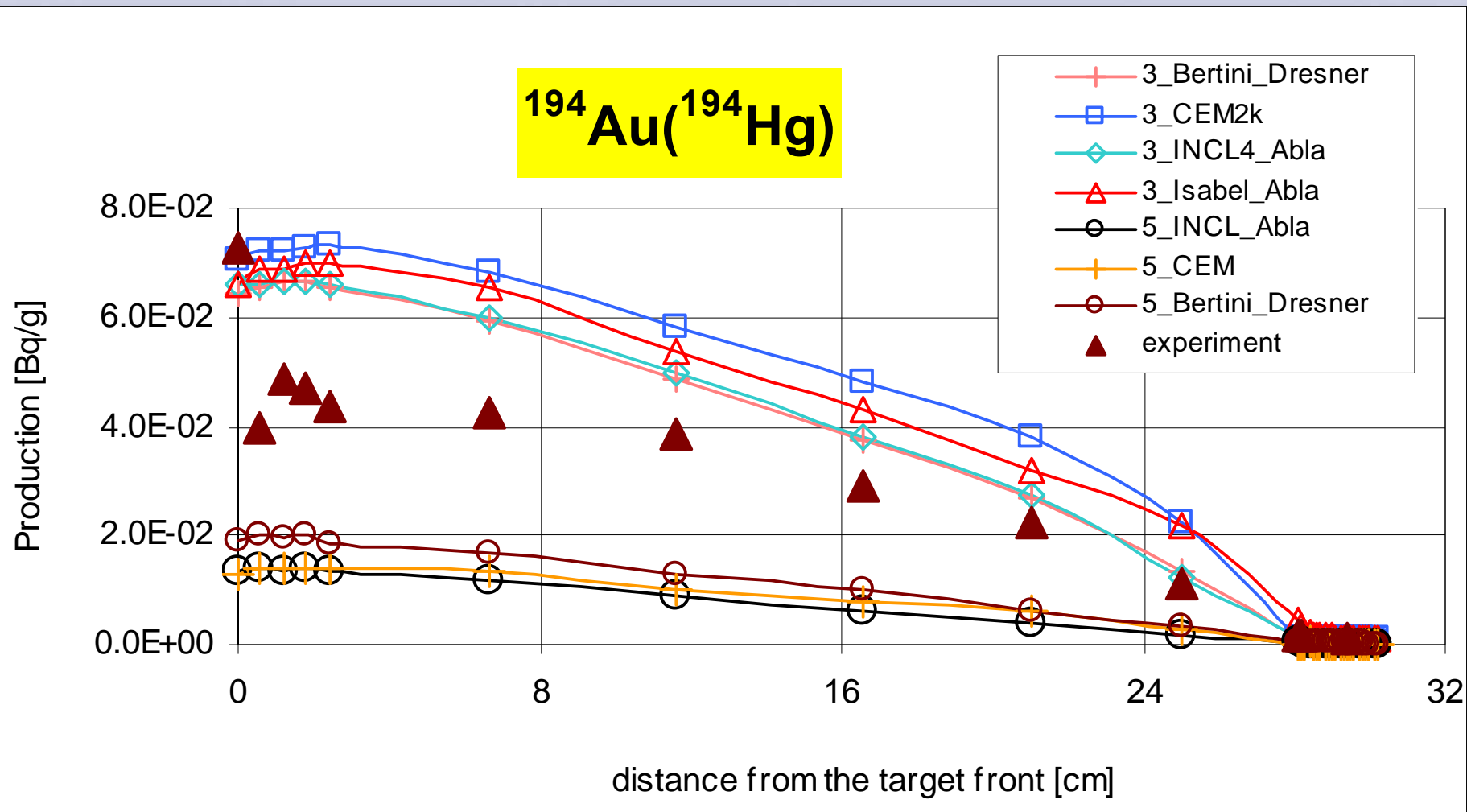
- Axial distribution of long-lived residual isotopes production rates in Pb samples
- Preliminary results show large discrepancies

Spallation Targets, JINR Benchmarks



- Discrepancies position dependent
- Larger farther away from the target

Spallation Targets, JINR Benchmarks



•Somewhat better agreement for heavier residues

Recent and Ongoing Activities, cont'd

- **Conclusions on current status of the CRP on *Analytical and Experimental Benchmark Analyses for Accelerator Driven Systems***
 - Progress not uniform for all benchmarks
 - In some cases, intermediate results reveal high discrepancies, requiring further in-depth analyses

Planned Activities

School on *Physics, Technology and Applications of Innovative Fast Neutron Systems*

➤ Organized by IAEA's Department of Nuclear Energy, Department of Nuclear Sciences and Applications, in collaboration with ICTP, 9 – 20 November 2009, Trieste, Italy

➤ Syllabus

- Physics and Design Studies
- General Concept Studies
- Sub-system Studies
- Nuclear Data
- Fuel Development
- Fuel Recycling
- Fuel Cycle Studies
- Impact of Transmutation Scenarios on High-level Waste Repositories
- ...

Planned Activities, cont'd

□ Large IAEA International Conferences

➤ *International Topical Meeting on Nuclear Research Applications and Utilization of Accelerators, Vienna, 4 – 8 May 2009*

- Organized by IAEA's Department of Nuclear Energy, Department of Nuclear Sciences and Applications, in collaboration with ANS
- Announcement and online registration <http://www-pub.iaea.org/MTCD/Meetings/Announcements.asp?ConfID=173>

Planned Activities, cont'd

- ***Fast Reactors and Associated Fuel Cycle – Challenges and Opportunities, 7 – 11 Dec 2009, Kyoto, Japan***
 - **Organized by IAEA's Department of Nuclear Energy**
 - **First meeting of the International Advisory Committee
3 – 4 Nov 2008**
 - **Announcement before the end of 2008**

Publications Under Preparation

- Accelerator Driven Systems: Energy Generation and Transmutation of Nuclear Waste; Status Report**
- Status Report on Lead and Lead-Bismuth Cooled Fast Reactors**

Databases

ADS Research and Development Database

- ADS related R&D programs: experimental facilities (existing and planned) and programs, methods and data development, design studies, ...
- Web based, operational

<http://www-adsdb.iaea.org/index.cfm>

Looking Ahead

- ❑ Renewed interest in nuclear energy
- ❑ Sustainability ⇒ spent fuel utilization & breeding returning to centre stage ⇒ fast reactor necessary linchpin
- ❑ Fast reactor deployment likely to be accelerated
- ❑ Necessary condition for successful deployment ⇒ **understanding & assessment of technological and design options (based on past knowledge and experience, as well as on research and technology development efforts)**
- ❑ IAEA assists Member State fast reactor deployment activities by providing an umbrella for **knowledge preservation, information exchange and collaborative R&D to pool resources and expertise ⇒ new project on TECHNOLOGY SUPPORT FOR FAST REACTOR MID TERM DEPLOYMENT**

Looking Ahead, cont'd

- Achieving the **full potential of fast neutron system and closed fuel cycle technologies** with regard to **both efficient utilization of the fissile resources and waste management** requires continued advances in research and technology development to ensure improved economics and maintain high safety levels with increased simplification of fast reactors
- Areas of collaboration identified by Member States through participation in the IAEA Nuclear Energy Department's Technical Working Group on Fast Reactors (TWG-FR)
- New project on **INNOVATIVE FAST NEUTRON SYSTEMS TECHNOLOGY OPTIONS**

For more information, please visit
<http://www.iaea.org/inisnkm/nkm/aws/fnss/index.html>

Thank You !

