IAEA NKM Programme

IAEA
International Atomic Energy Agency
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International Fast Reactor Knowledge Organization System

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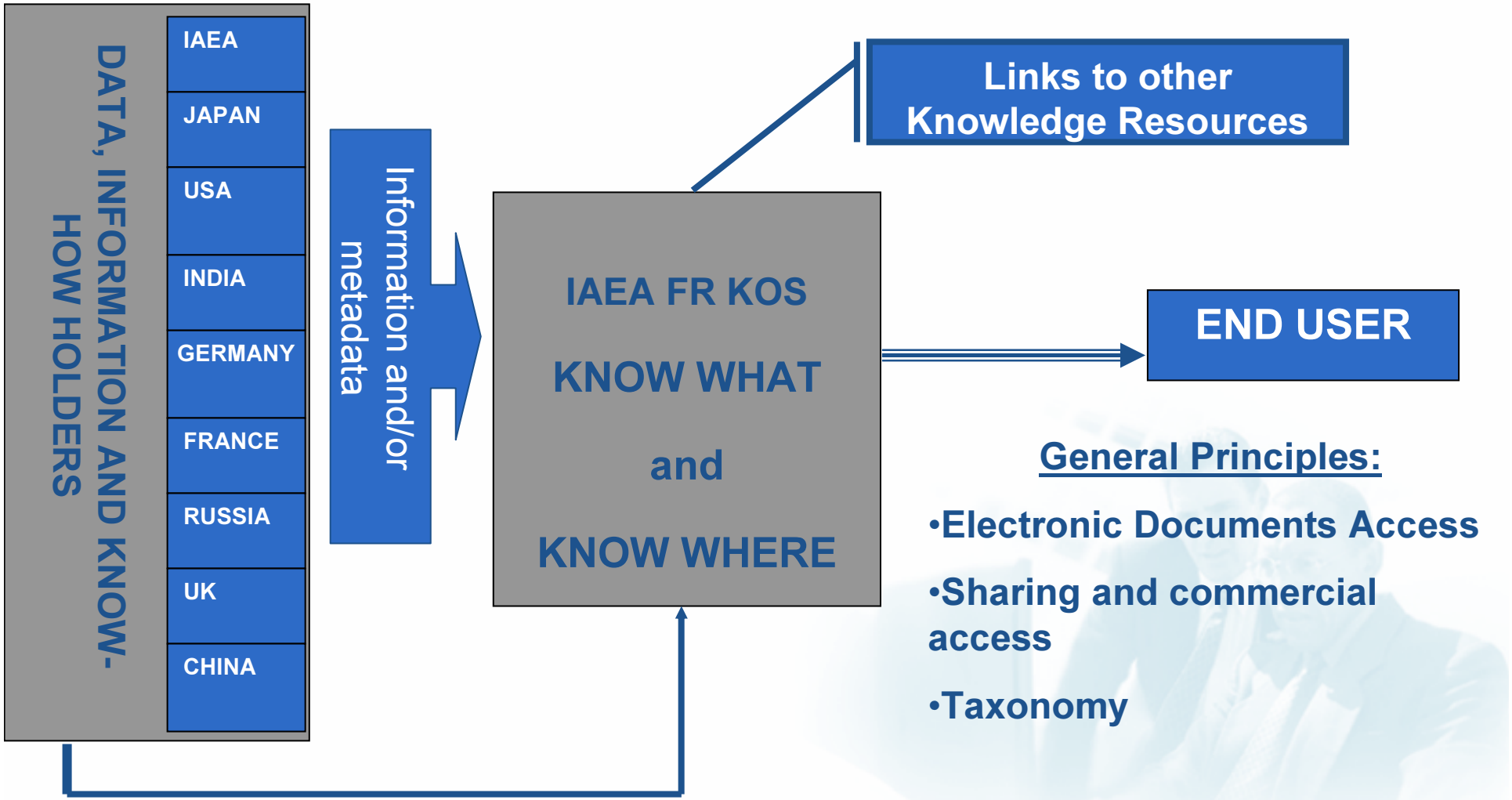
International Conference on Fast Reactors and Related Fuel Cycles (FR09): Challenges and Opportunities
7-11 December 2009, Kyoto, Japan

Fast Reactor Knowledge Preservation Initiative

- **To capture, preserve, maintain and share with interested Member States knowledge on Fast Reactors which exists on national level and complement current and future Member States' nuclear knowledge capacity.**

Fast Reactor Knowledge Partnership



General Principles:

- Electronic Documents Access
- Sharing and commercial access
- Taxonomy

FR KOS Project Objective

- To develop a Knowledge Organization System into which existing national knowledge and information systems will fit, and which will complement and integrate current and future Member States' efforts to preserve fast reactor data and knowledge.

FR KOS Motivation factors

- Continuing knowledge loss over decades
- Research and Development
- Nuclear Education, scientists and students
- From Nuclear Renaissance
  to Fast Reactors Innovative Renaissance, FR09
- Developed countries, Developing countries, Nuclear Newcommers

FR Knowledge Preservation Initiative

- **Contributors:**
  - **Participating Member States: China, France, Germany, Japan, Russia, UK, USA, India**
  - **Role of the IAEA**
  - **New members are welcome**
- **Common approach:**
  - **System requirements and implementation**
  - **FR Knowledge Domain**

Fast Reactors Knowledge

Technology development → Technology utilization

R& D
- Reactor Physics
- Fuel and Materials
- Heat Transfer System Testing
- Pipe Integrity Testing
- Seismic Design
- Accident analysis
- Sodium Fire Testing
- Beyond design Basis Events

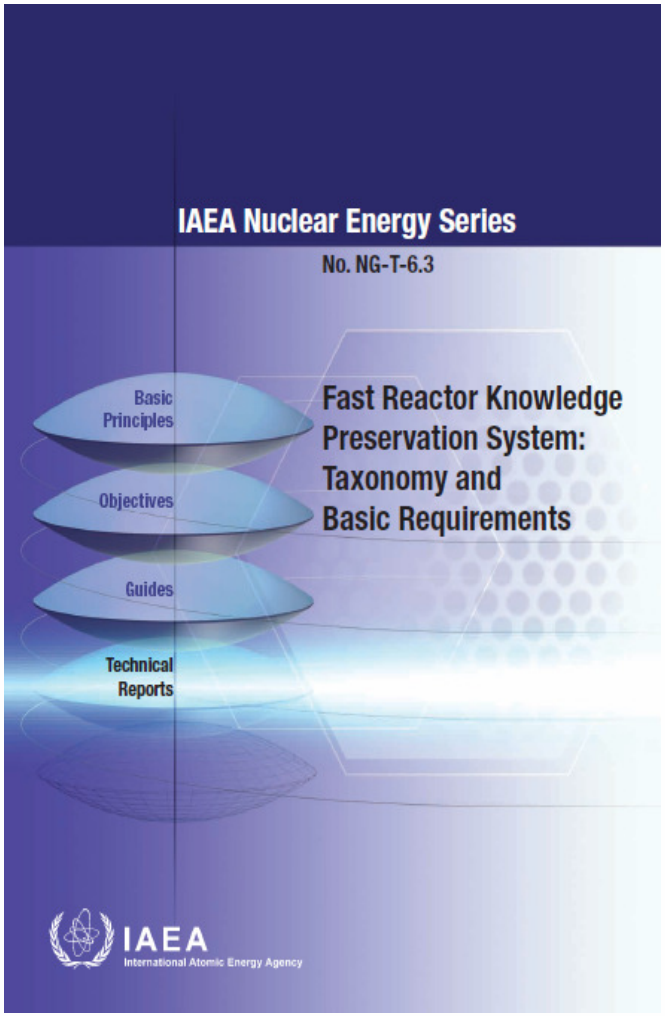
Design & Licensing
- General System Criteria
- Standards
- Core design
- Dynamic Analysis
- System design Description
- Demonstration of Safety
- Project Cost analysis

Manufacturing & Construction
- Site Development
- Plant Assembly
- Components Manufacturing
- Balance of plant

Operation
- Cold Start up
- Low power commissioning
- Fuel power operations
- Maintenance
- Off-normal and emergency operation

Decommissioning
- Planning
- Experience

Project milestones



NE Series Report NG-T-6.3 defines

- Taxonomy
- Basic Requirements

for

Fast Reactor
Knowledge Organization System

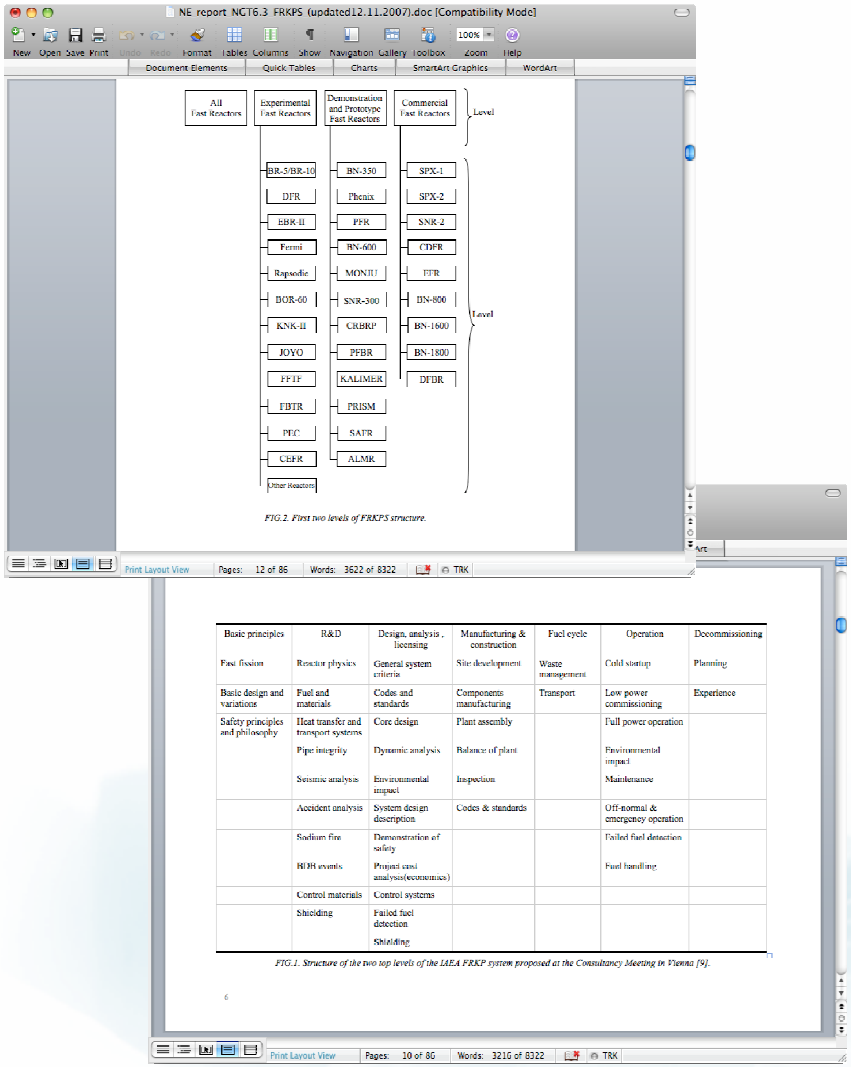
Fast Reactor Taxonomy

- Fast Reactor Taxonomy is
  - a hierarchical model
  - of knowledge domain
  - in the field of Fast Reactor Science and Technology

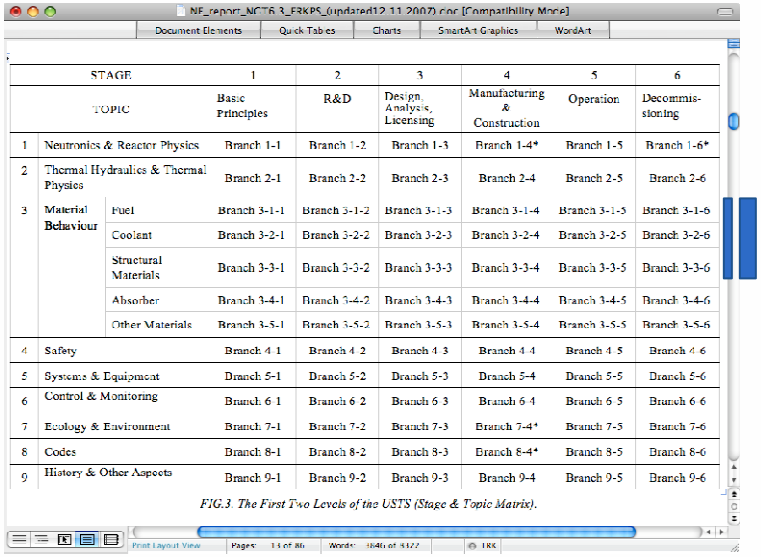
Fast Reactor Taxonomy

- Covers
  - all possible types of fast reactors
  - all aspects of fast reactors
  - all stages of implementation of fast reactor technology

- Based on 2 dimensional matrix (2 top levels):
  - stages of implementation
  - technology elements

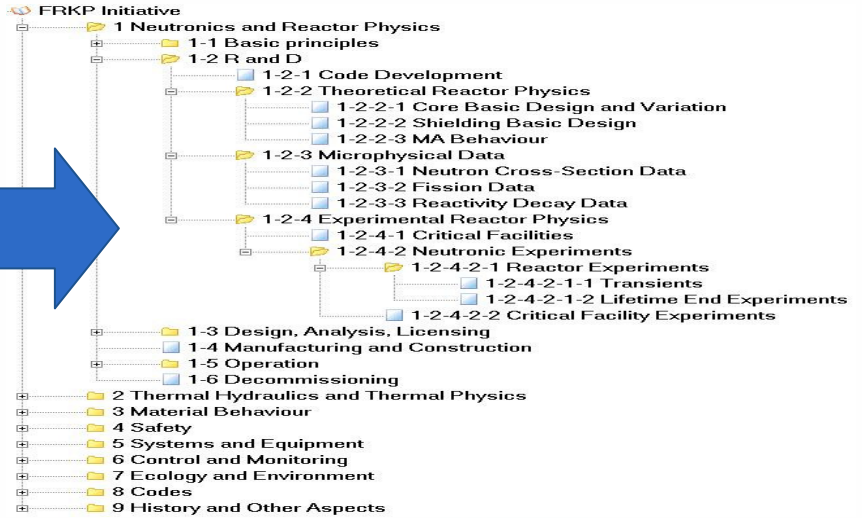


Fast Reactor Taxonomy - Topic Trees



	STAGE		1	2	3	4	5	6
	TOPIC		Basic Principles	R&D	Design, Analysis, Licensing	Manufacturing & Construction	Operation	Decommissioning
1	Neutronics & Reactor Physics		Branch 1-1	Branch 1-2	Branch 1-3	Branch 1-4*	Branch 1-5	Branch 1-6*
2	Thermal Hydraulics & Thermal Physics		Branch 2-1	Branch 2-2	Branch 2-3	Branch 2-4	Branch 2-5	Branch 2-6
3	Material Behaviour	Fuel	Branch 3-1-1	Branch 3-1-2	Branch 3-1-3	Branch 3-1-4	Branch 3-1-5	Branch 3-1-6
		Coolant	Branch 3-2-1	Branch 3-2-2	Branch 3-2-3	Branch 3-2-4	Branch 3-2-5	Branch 3-2-6
		Structural Materials	Branch 3-3-1	Branch 3-3-2	Branch 3-3-3	Branch 3-3-4	Branch 3-3-5	Branch 3-3-6
		Absorber	Branch 3-4-1	Branch 3-4-2	Branch 3-4-3	Branch 3-4-4	Branch 3-4-5	Branch 3-4-6
		Other Materials	Branch 3-5-1	Branch 3-5-2	Branch 3-5-3	Branch 3-5-4	Branch 3-5-5	Branch 3-5-6
4	Safety		Branch 4-1	Branch 4-2	Branch 4-3	Branch 4-4	Branch 4-5	Branch 4-6
5	Systems & Equipment		Branch 5-1	Branch 5-2	Branch 5-3	Branch 5-4	Branch 5-5	Branch 5-6
6	Control & Monitoring		Branch 6-1	Branch 6-2	Branch 6-3	Branch 6-4	Branch 6-5	Branch 6-6
7	Ecology & Environment		Branch 7-1	Branch 7-2	Branch 7-3	Branch 7-4*	Branch 7-5	Branch 7-6
8	Codes		Branch 8-1	Branch 8-2	Branch 8-3	Branch 8-4*	Branch 8-5	Branch 8-6
9	History & Other Aspects		Branch 9-1	Branch 9-2	Branch 9-3	Branch 9-4	Branch 9-5	Branch 9-6

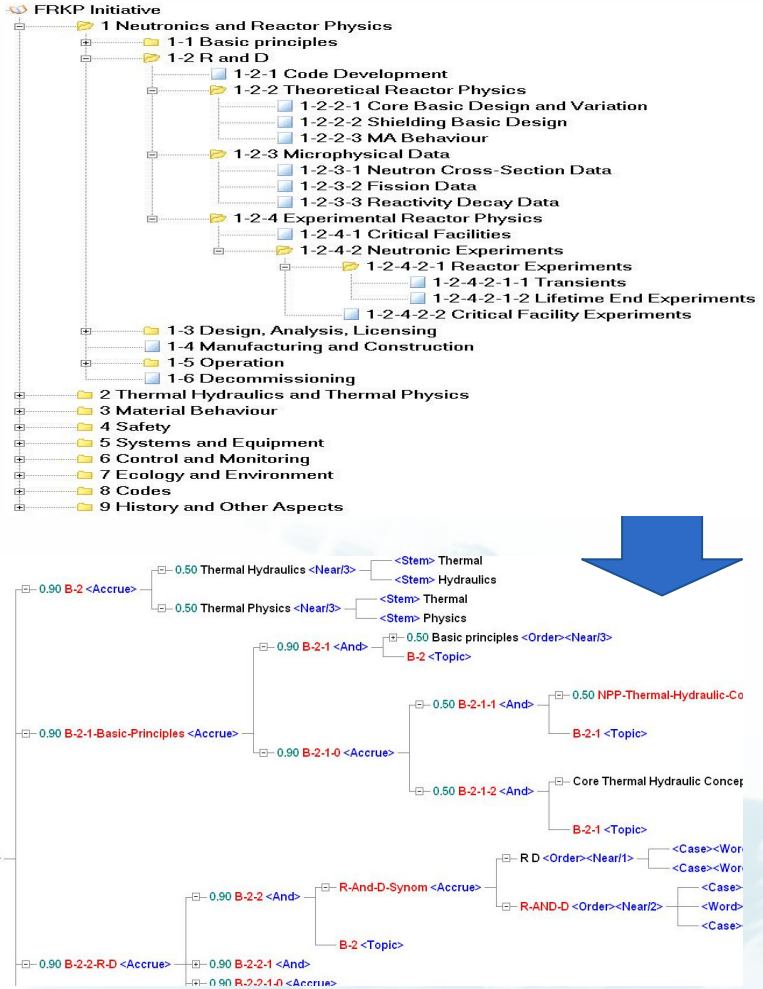
FIG.3. The First Two Levels of the USTS (Stage & Topic Matrix).



- Fast Reactor Topic Trees are digital implementation (in knowledge organization system) of Fast Reactor Taxonomy

Fast Reactor Topic Trees

- Topic trees
  - are predefined queries
  - organized in tree-like form
  - with the purpose of searching on Fast Reactor (FR) Knowledge Base (KB)
  - are available to end users as a shared resources
  - encapsulate a hierarchical structure the expert's knowledge



Fast Reactors Knowledge – Where to get?

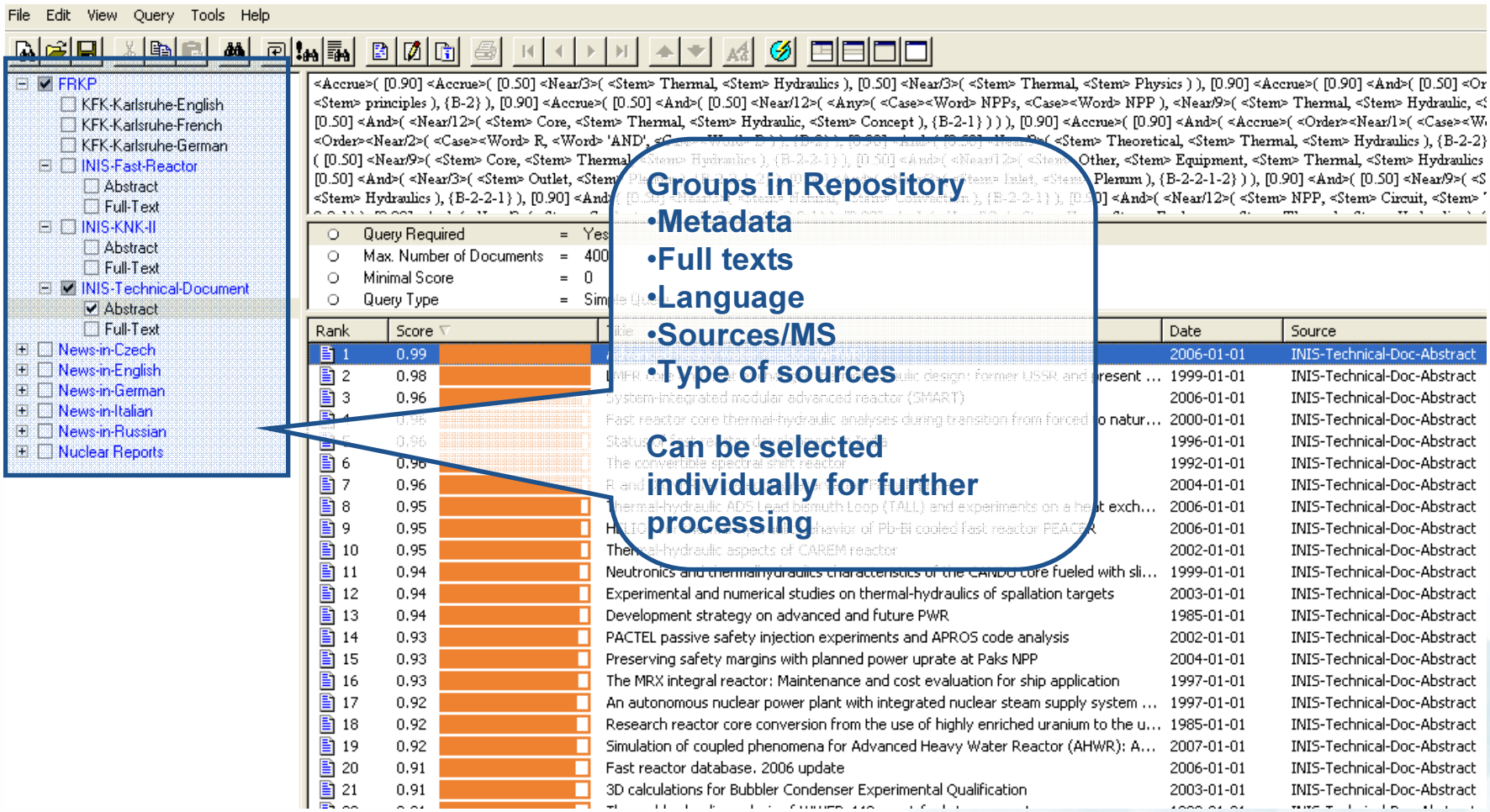
- WHAT?
  - we know what we want to find
    (Topic Trees)
- WHERE ?
  - where can we search for that knowledge?
    (KR)

Fast Reactor Knowledge Repository

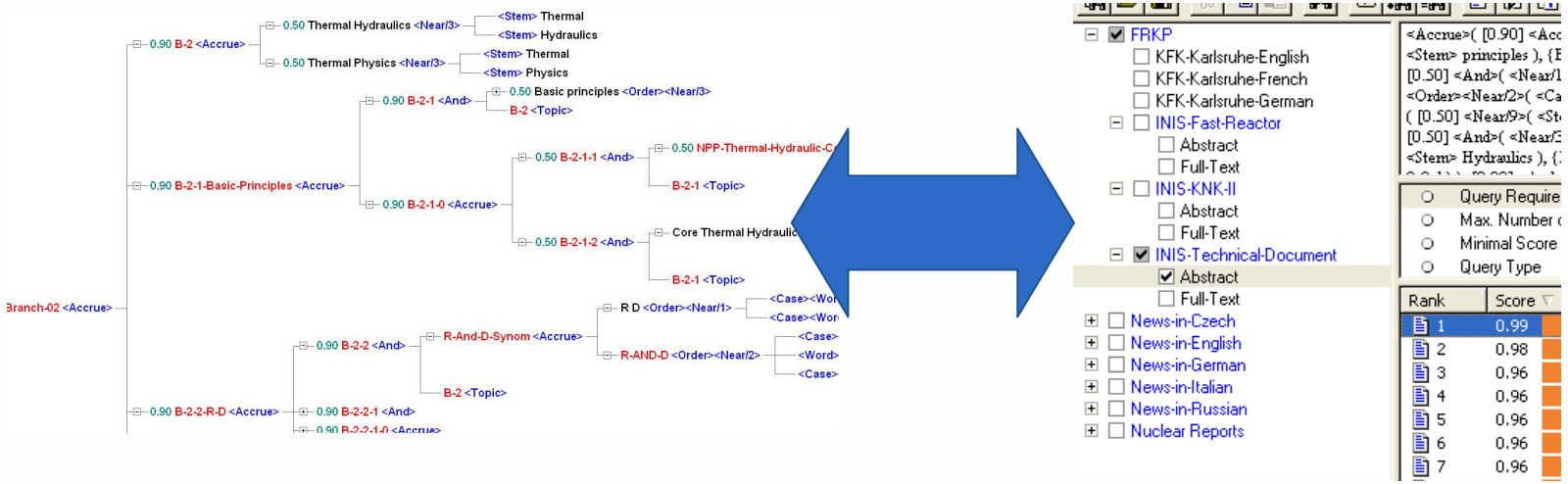
- Sources of the FR Knowledge
  - Member States
  - INIS and other Information and Knowledge Systems
  - Topical events
  - Internet
  - NuArch (future prospective)

- Information types
  - Limited to Metadata
  - Full texts or availability in metadata

Fast Reactor Knowledge Repository

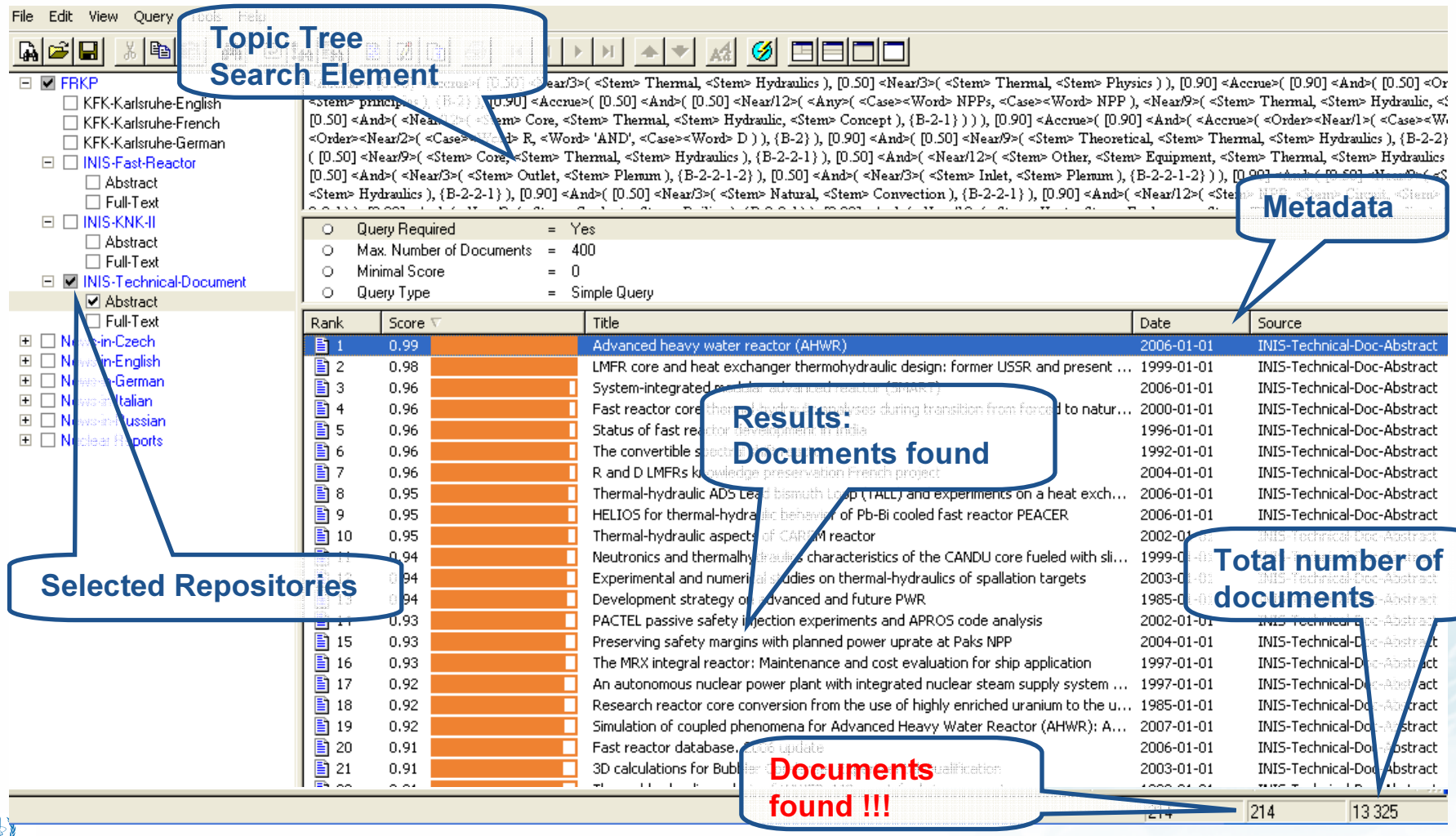


Topic Trees and Document Collections



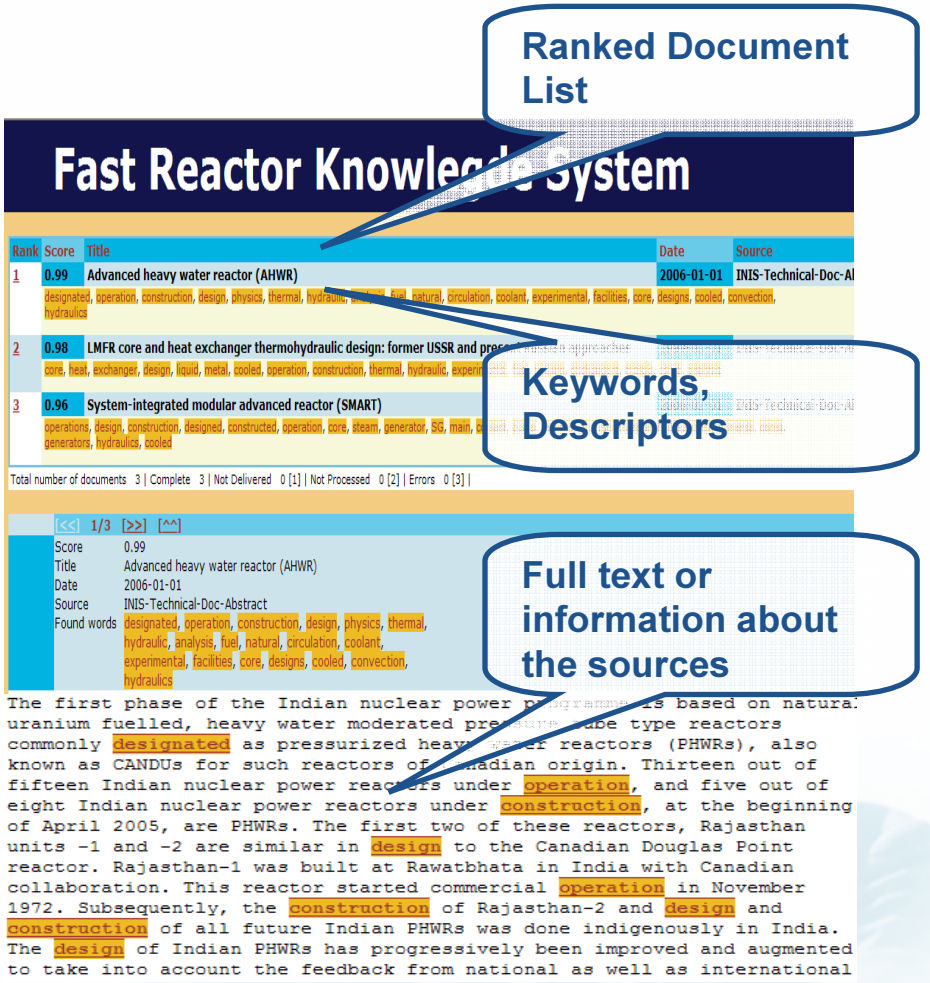
- Topic trees include intellectual rules how to filter documents based on the selected
  - Topic Tree
  - Document repositories

Document Search – How it works?

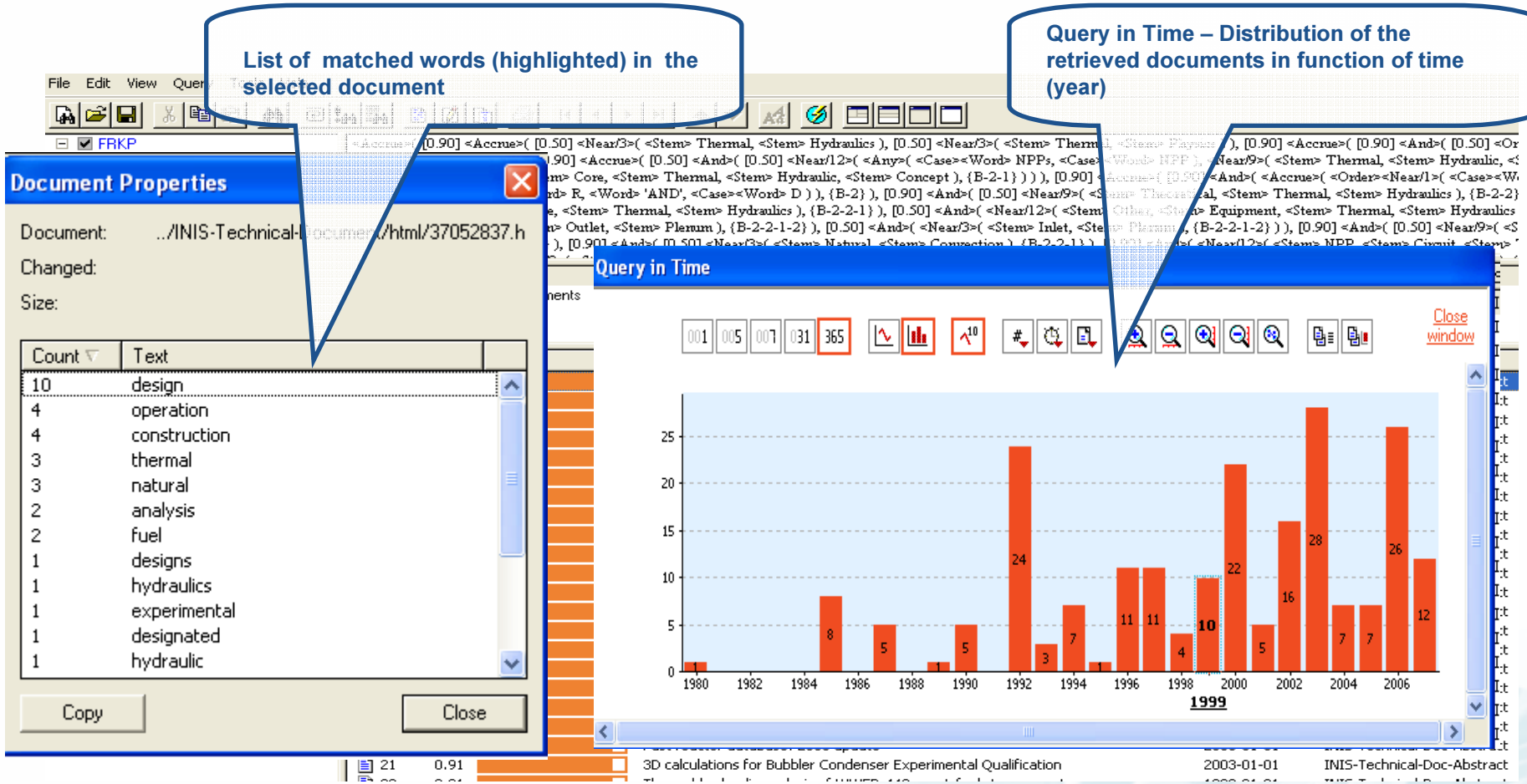


Outputs of Fast Reactor Knowledge Organization System

- Documents from the result list can be
  - exported in different format (XML HTML, text) which can be analysed further
  - made available for Member States
  - used by subject matter experts (SME)

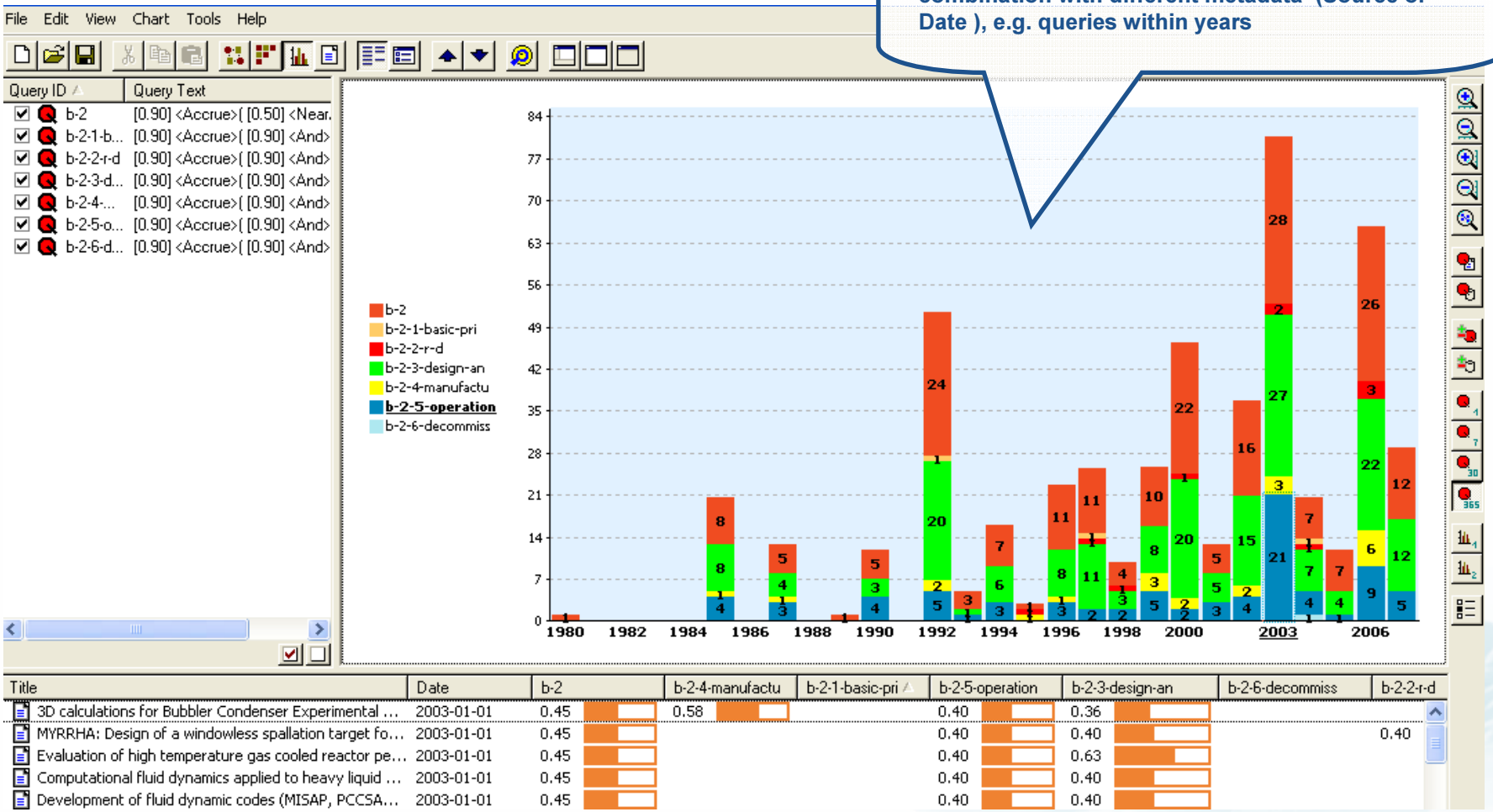


FR KOS – Knowledge Mining and Analytics

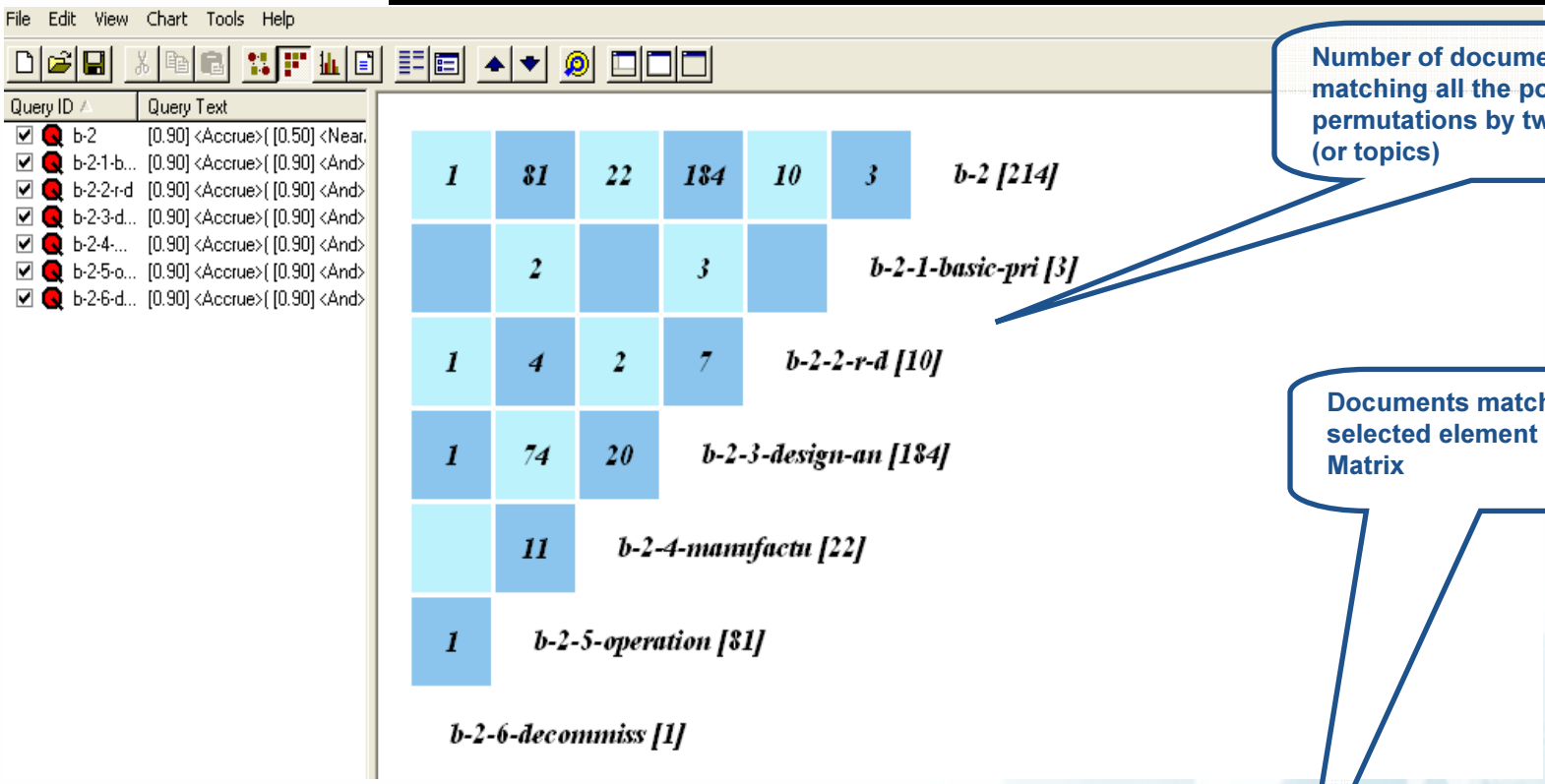


FR KOS – Summary Graph

Visualisation of the results of the queries in combination with different metadata (Source or Date), e.g. queries within years



FR KOS – Cross Matrix

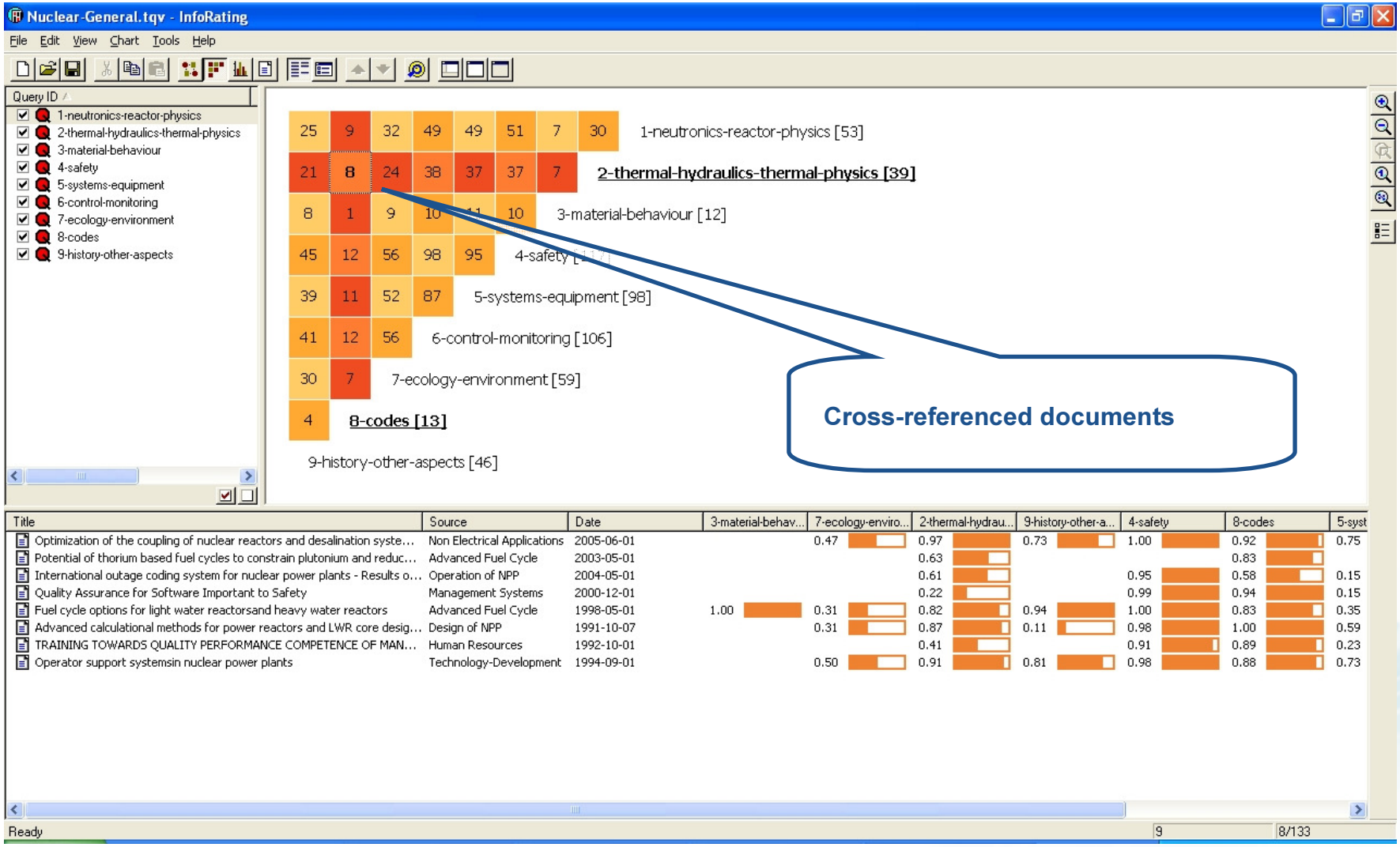


Number of documents matching all the possible permutations by two queries (or topics)

Documents matching the selected element of the Cross Matrix

Title	Date	b-2	b-2-4-manufactu	b-2-1-basic-pri	b-2-5-operation	b-2-3-design-an	b-2-6-decommiss	b-2-2-r-d
RITME: A fast and simple computing code for PWR co...	1992-01-01	0.44		0.40		0.36		
Preserving safety margins with planned power uprat...	2004-01-01	0.45		0.40	0.40	0.63		
An autonomous nuclear power plant with integrated ...	1997-01-01	0.45		0.40	0.63	0.36		
System-integrated modular advanced reactor (SMART)	2006-01-01	0.45	0.80		0.40	0.40		
LMFR core and heat exchanger thermohydraulic desi...	1999-01-01	0.45	0.77		0.40	0.75		
Fast reactor core thermal-hydraulic analyses during t...	2000-01-01	0.45	0.76			0.71		
A review on the Indian fast reactor programme. April...	1995-01-01	0.45	0.70					0.40
Experimental and numerical studies on thermal-hydra...	2003-01-01	0.45	0.70			0.40		0.40
Advanced heavy water reactor (AHWR)	2006-01-01	0.67	0.70		0.61	0.76		

FR KOS – Knowledge Mining and Analytics



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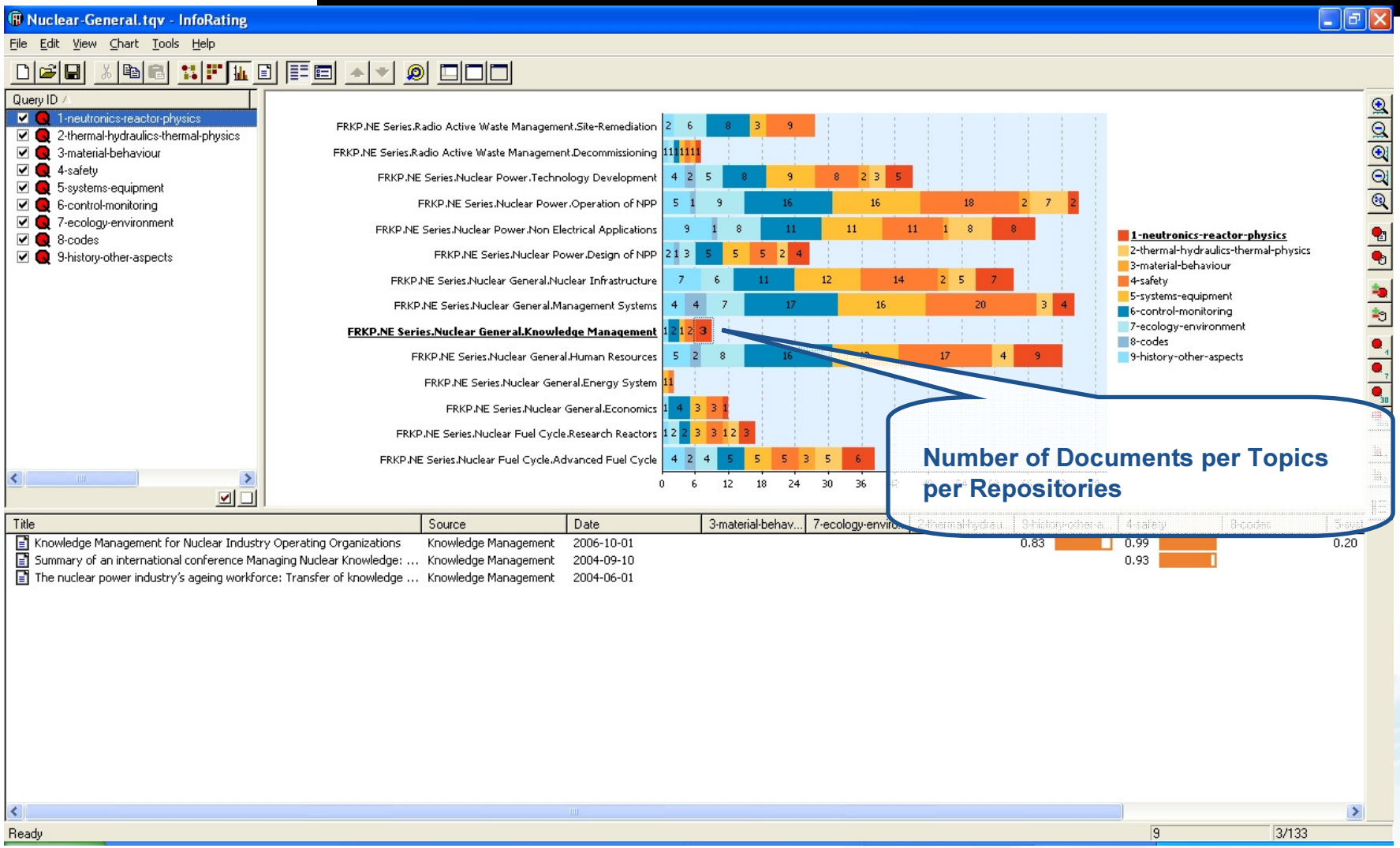

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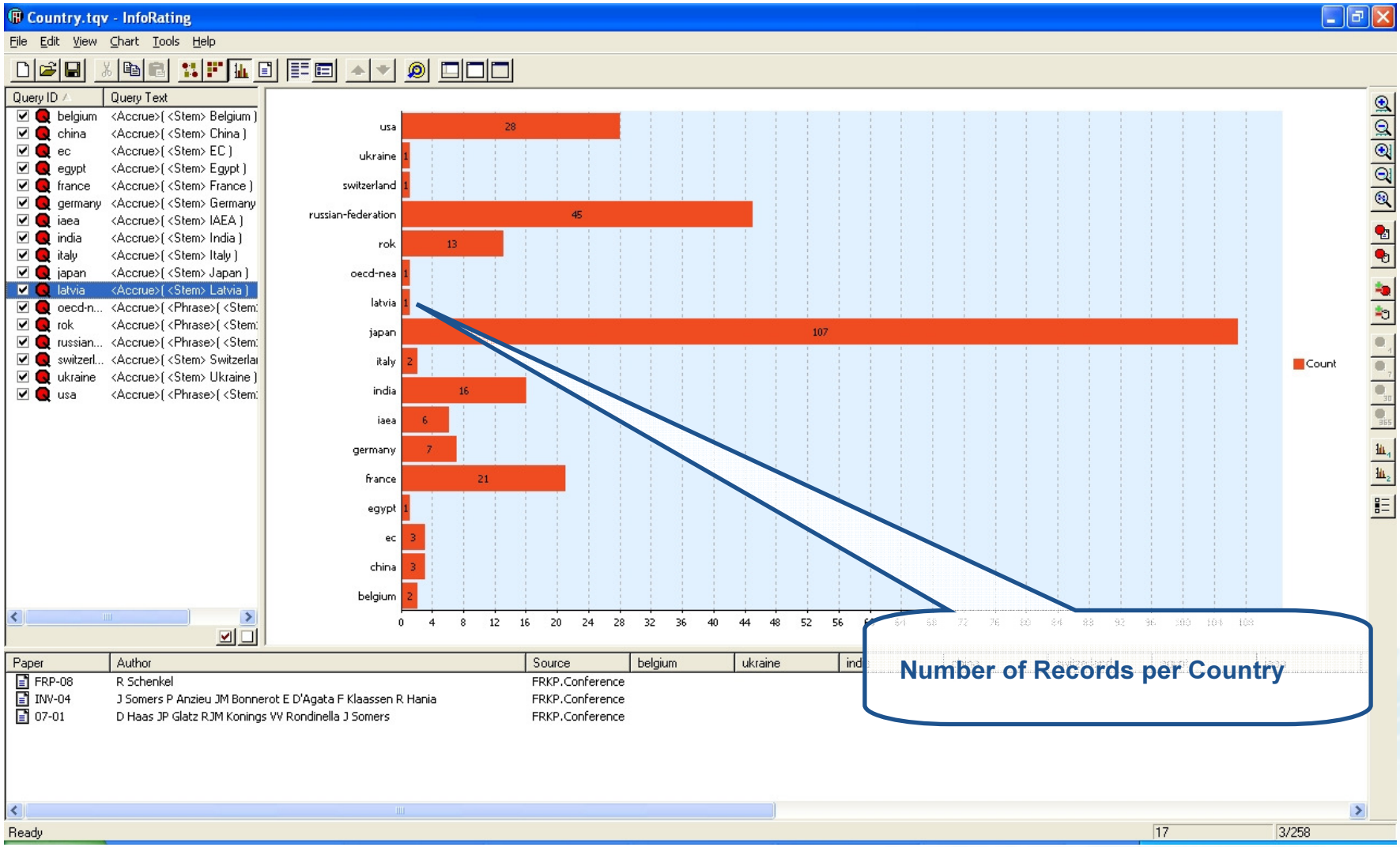

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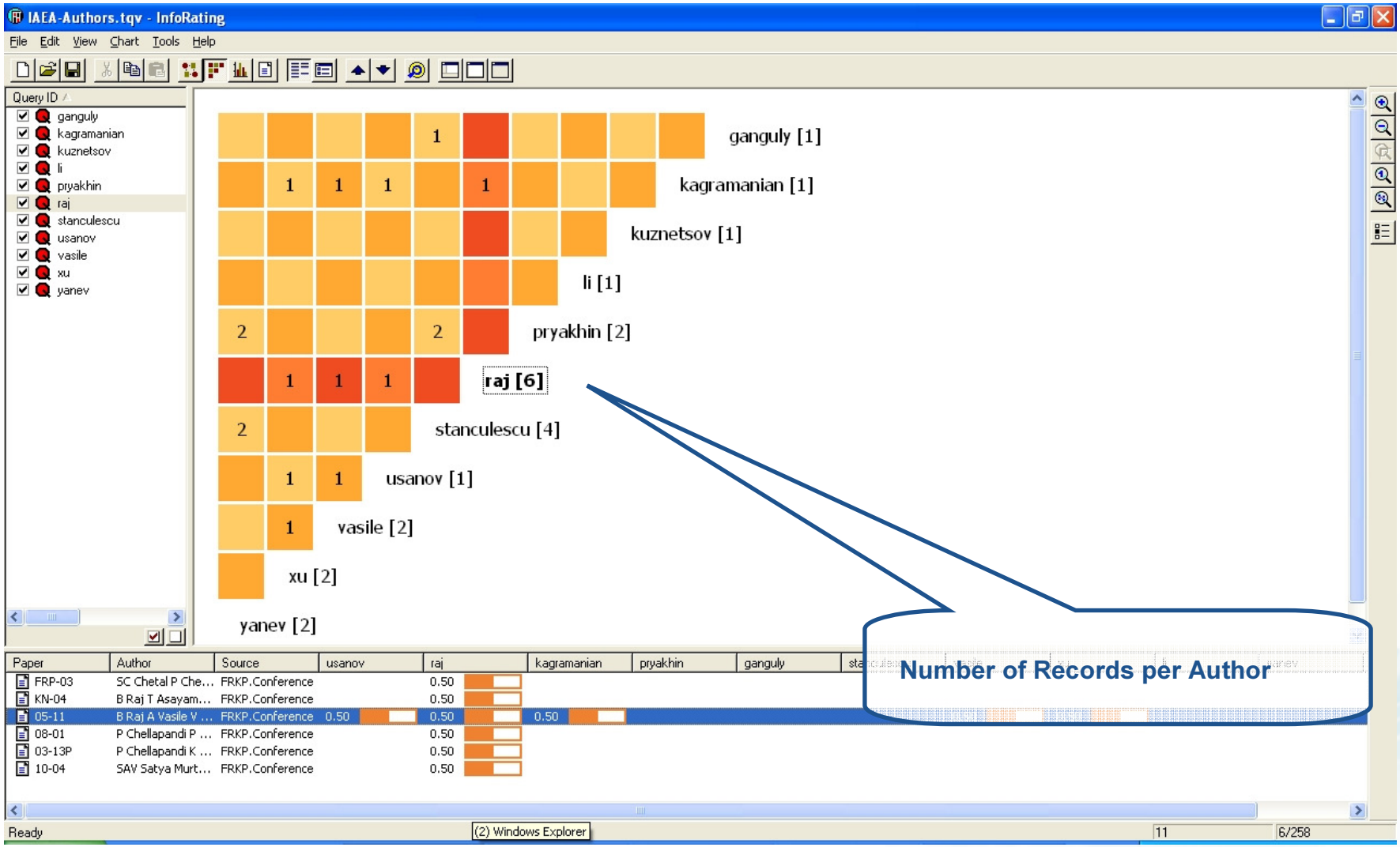

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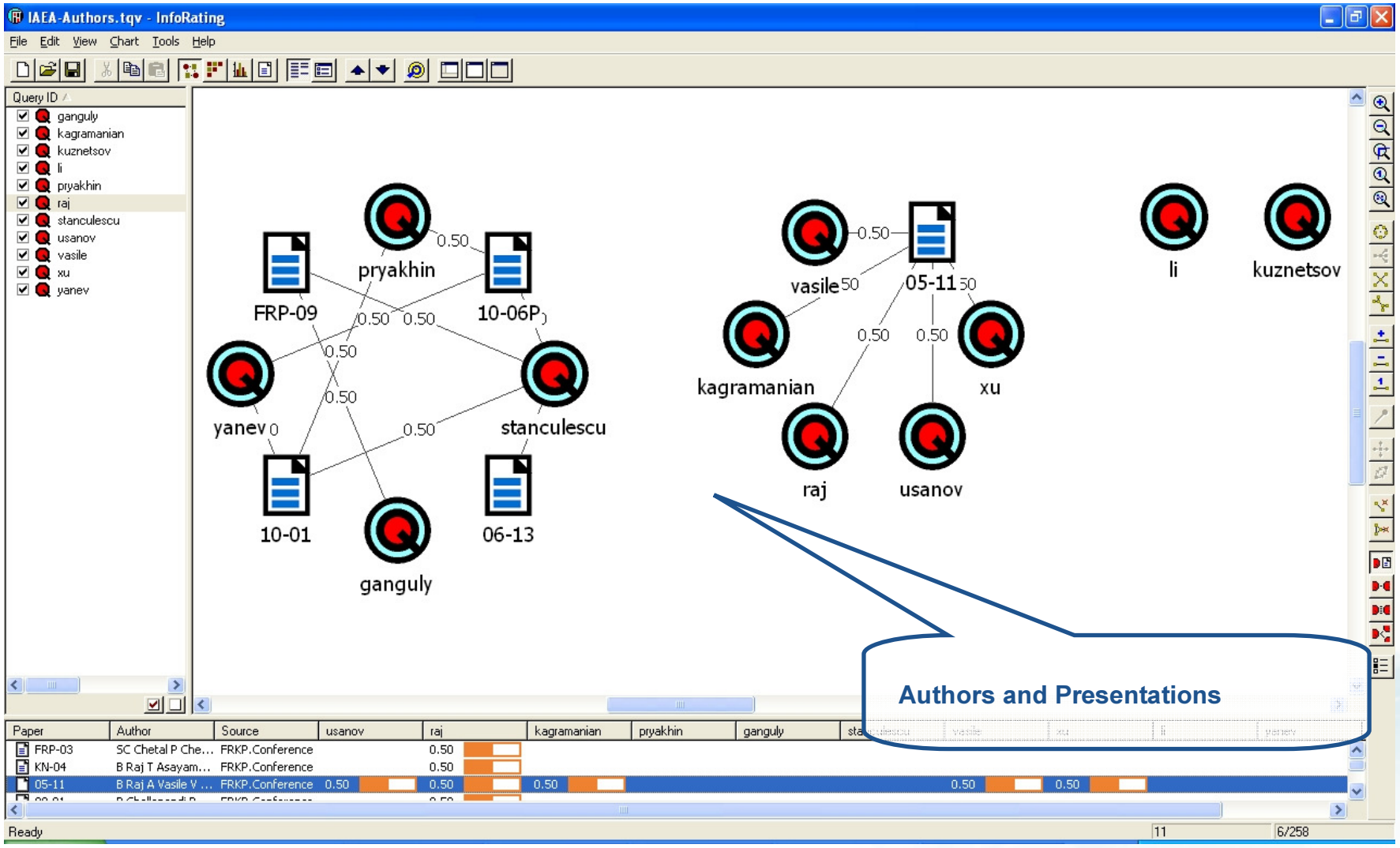


Contributions to FR KOS (Content)

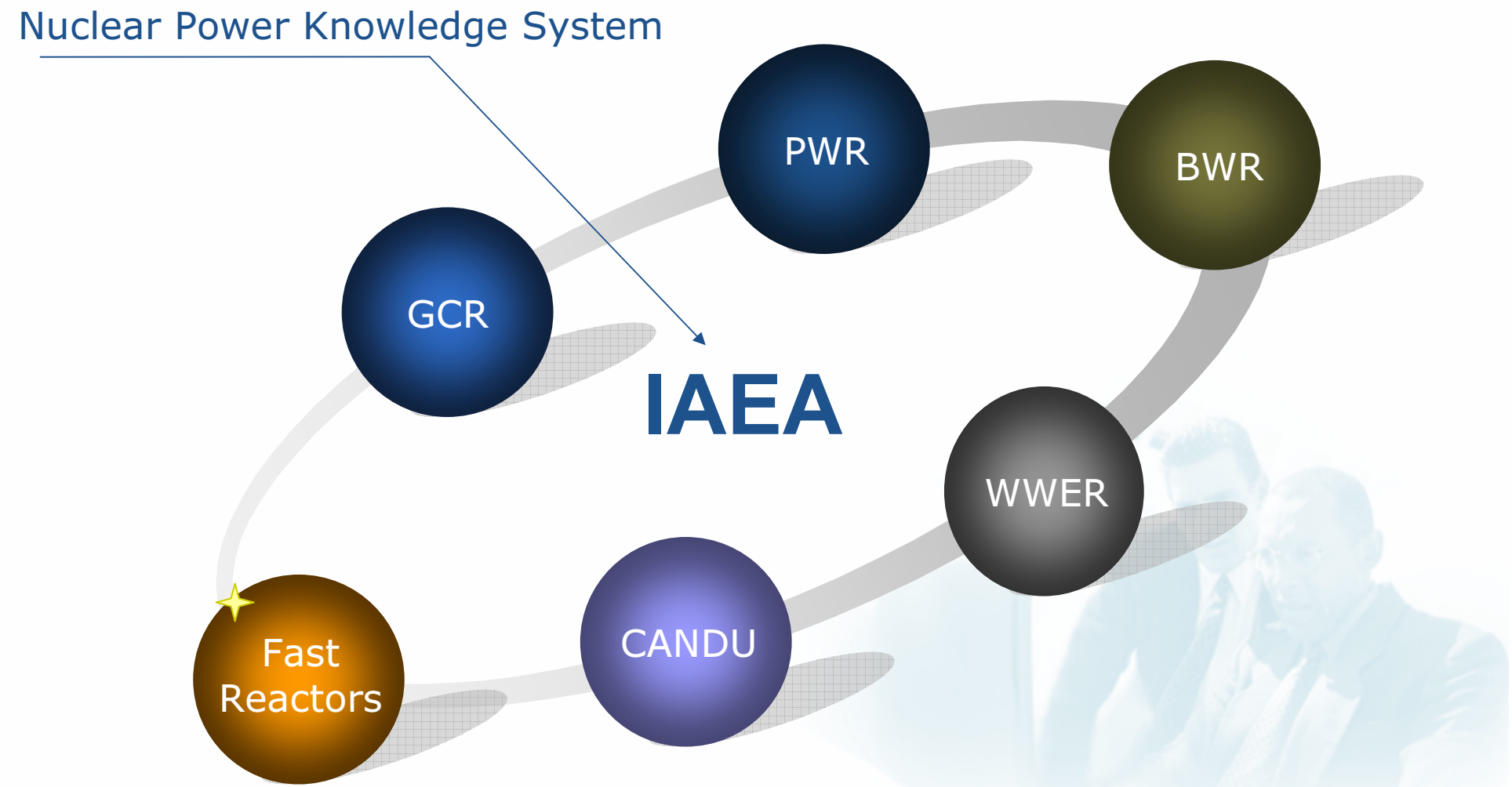
- IAEA Contribution
  - 3 collections:
    - KNK-II, IAEA-TECDOCS, INIS Fast Reactors records
  - 50 000 metadata records, 9 000 full texts

- Member States
  - China, France, Germany, India, Japan, Russia, UK, USA
  - ?

Conclusions

- Fast Reactors Knowledge Preservation (FRKP)
  - A unique experience to preserve comprehensive knowledge for future generations
  - International innovation in knowledge management technology
- Fast Reactor Knowledge Taxonomy
  - Unique and Single in the Nuclear World
  - 2 000 elements cover R&D, Design, Operation, Maintenance, Decommissioning and all fast reactor technology elements as well;
- IAEA contribution to Knowledge Base
  - 50 000 metadata records; 9 000 full texts
- Contribution from Member States
  - Russia submitted more than 500 records; format is a challenge
  - Contribution from other Member States is being encouraged
- Interest for Countries introducing Nuclear Power
  - Capacity building and Intellectual Capital
- Available for all participating members

Future KOS Opportunities



Fast Reactor Knowledge Organization System

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- Prepared by

Nuclear Knowledge Management Unit (NKM Unit) ,
INIS&NKM Section,
Department of Nuclear Energy,
International Atomic Energy Agency

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