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Overview and Progress of FNCA

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FNCA Symposium
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FNCA

- 1990 ICNCA (International Conference for Nuclear Cooperation in Asia) held by Atomic Energy Commission of Japan
 - Exchange of frank views by ministers in charge of development and utilization of nuclear energy on how to proceed with regional cooperation
 - Practical cooperation on specified subjects
- 2000 FNCA (Forum for Nuclear Cooperation in Asia)
 - Ministerial Level Meeting, Coordinator and Project Leader System
 - Four Fields: (1) Radiation Utilization Development (Industrial Utilization/Environmental Utilization, and Healthcare Utilization), (2) Research Reactor Utilization Development, (3) Nuclear Safety Strengthening, and (4) Nuclear Infrastructure Strengthening.

The FNCA Framework



R&D Projects on Applications of Radiation and Isotopes

Applications for Sustainable Agriculture

- Mutation Breeding
- Bio-fertilizer
- Electron Accelerator Application

Application for Medical Care

- Radiation Oncology

Research Reactor Utilization

- Neutron Activation Analysis (NAA)
- Research Reactor Network

Projects for Building Infrastructure

Nuclear Safety Strengthening

- Safety Management Systems for Nuclear Facilities
- Radiation Safety and Radioactive Waste Management

Nuclear Infrastructure Strengthening

- Human Resources Development
- Nuclear Security and Safeguards

Study Panel for Cooperation in the Field of
Nuclear Energy In Asia

Project on Mutation Breeding

- 2002-2006 Drought tolerance of Sorghum and Soy beans
- 2003-2009 Insect resistance of Orchids
- 2004-2010 Disease resistance of Bananas
- 2007-2012 Composition or quality of Rice
- 2013~ Mutation breeding of Rice for sustainable agriculture

Using gamma-ray and/or ion beams to develop mutant varieties that are resistant to various environmental stresses, early-maturity, and low-input mutant varieties relevant to the demands of each country.

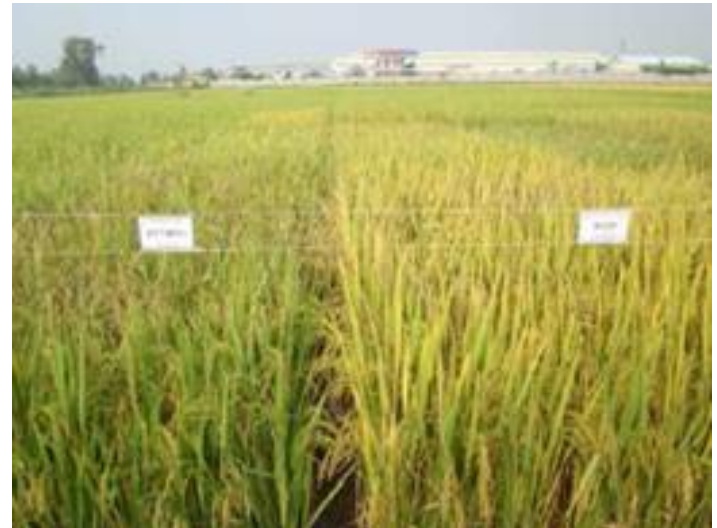
Mutation Breeding



Disease resistant banana in the Philippines



Insect resistant orchid in Malaysia



**New disease resistant rice variety in Vietnam (right):
5-14% yield increase**

Mutant Varieties of Rice

- Malaysia



Mutant NMR152

Parent MR 219

Drought tolerance and high yielding mutant NMR 152 (Left) with gamma irradiation and parent MR 219 (Right).

- Bangladesh



Mutant

Parent

High yielding and early mature mutant line (Left) derived from the original variety BRRi dhan29 (Right) with carbon ion irradiation

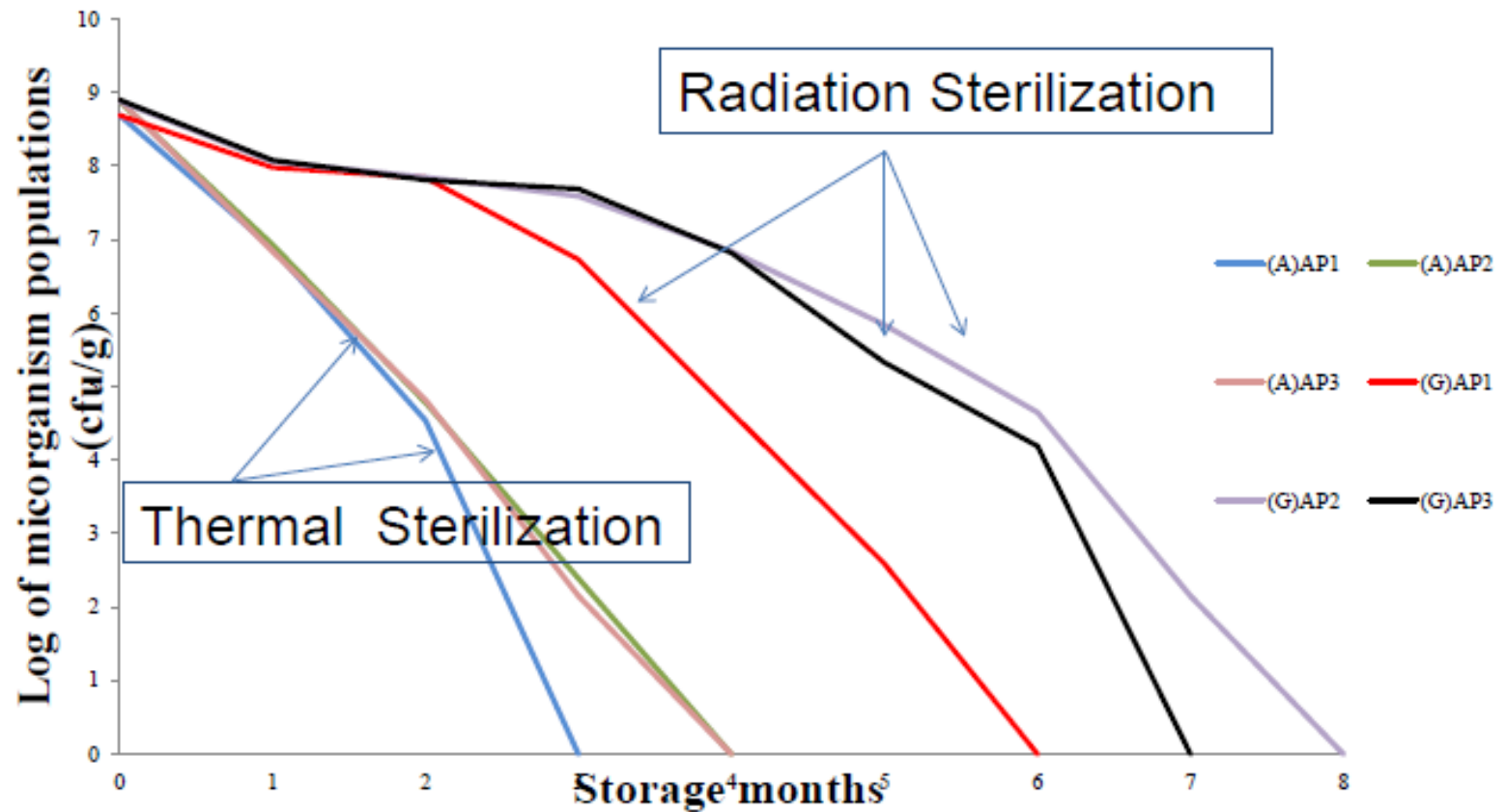
Project on Bio-fertilizer by Radiation

- Increasing plant yields (20-50%) by Micro-organism, Rhizobium and Mycorrhiza.
- Less-expensive and more environmentally friendly than chemical fertilizers.
- Carrier of bio-fertilizer is sterilized by radiation to bring about better QA/QC and longer shelf-life of Inoculants.
- Commercial application : Indonesia, Malaysia, the Philippines, and Japan
- Focusing on development of multi-functional bio-fertilizer, especially research on the synergy of bio-fertilizer with the oligo-chitosan plant-growth promoter.
- Joint workshop was held with Electron Accelerator Application Project last year.

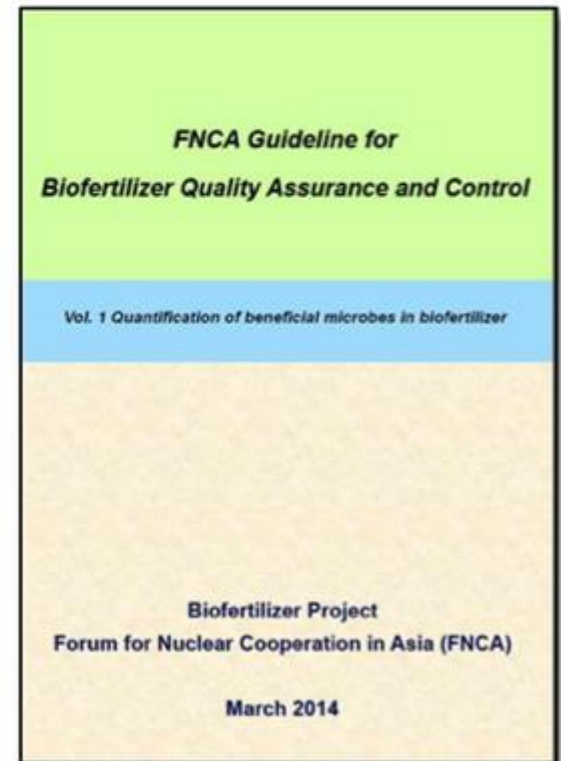


Soybeans with Bio-fertilizer (Rhizobium)

The shelf life of Bio-fertilizer with a radiation-sterilized carrier is much longer than that with a thermal-sterilized carrier



Application of Bio-fertilizer



Multi-functional bio-fertilizer commercialized In Malaysia

FNCA Guideline for Bio-fertilizer QA and QC

Project on Electron Accelerator Application

- 2002-2005 Treatment of flue-gas
- 2006-2008 Radiation processing of natural polymers
- 2009~ R&D on plant growth promoter/elicitor and super water absorbent
- Joint workshop was held with Biofertilizer Project last year.
- To develop a plant growth promoter and elicitor by degradation of natural polymers as well as applications of radiation cross-linked hydrogel for super water absorbent, aiming for technical transfer to the end users.

Oligo-chitosan Effect on Bitter Cucumber Indonesia, BATAN, 2012

The crop yield increases by about 40% by application of Oligochitosan



Without Oligochitosan



With Oligochitosan

Rice fields sprayed with PGP exposed to typhoons in the Philippines



Ricefields sprayed with PGPs (left) proved much more resilient to lodging compared to the ricefields without PGPs (right) when exposed to typhoons. (2015)

Effects of Super Water Absorbent on Baby Corn Thailand, TINT, 2013



AAc grafted starch by radiation

Field test in Kanchanaburi Province

**-Yield increase: 43.5%-
Reduced watering.**



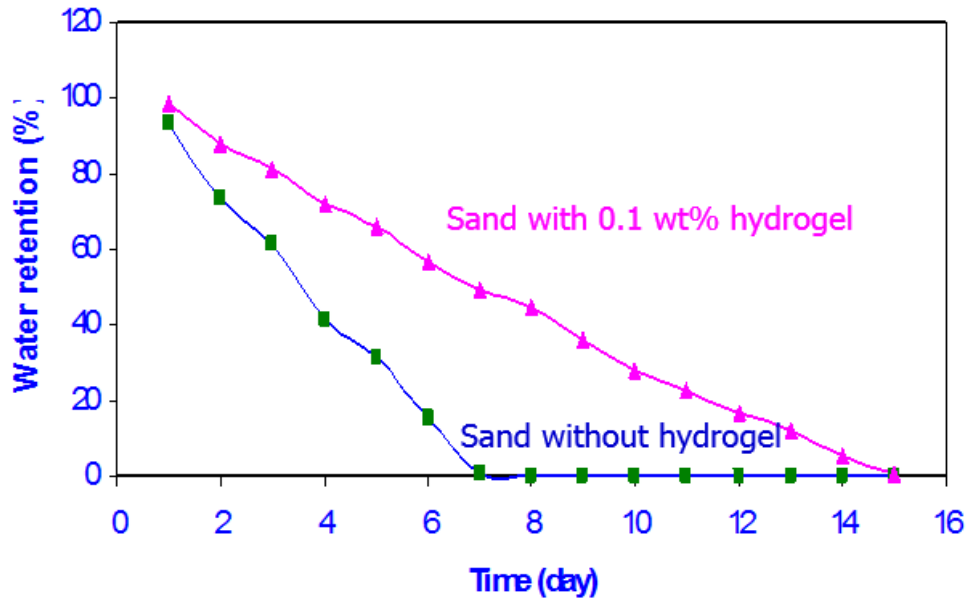
Without SWA



With SWA

Water holding capacity of soil with super water absorbent (Thailand)

Cassava starch-g-PAA : Water Retention



•After seven days the sand without hydrogel had nearly given off all water, while the sand with 0.1% wt hydrogel still retained 50 % water.

Effects of Oligochitosan and SWA on shallots (Indonesia)



Without Oligo-chitosan and SWA

With Oligo-chitosan and SWA

Project on Radiation Oncology

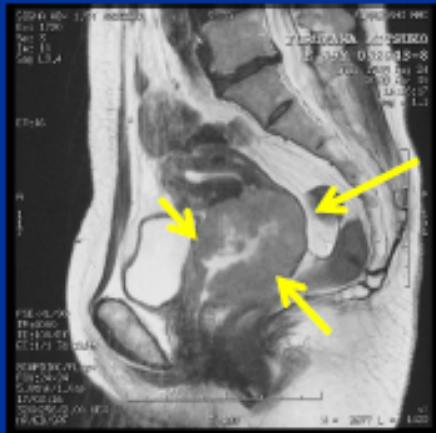
- 1996~ Radiation Therapy or Chemo-radiotherapy for Cervical Cancer
- 2005~ Chemo-radiotherapy for Nasopharyngeal Cancer
- 2009~ Hypofractionated Radiotherapy for Breast Cancer
- 2017~ CERVIX-V is planned to start.

In CERVIX-V, 3-D IGBT (Three Dimension Image Guided Brachytherapy) is newly introduced.

- The aim of this project is to contribute to improving the radiation treatment techniques for cancers that are more prevalent in the Asian region.
- The protocols established by this project have been utilized in all the FNCA member countries.
- The next challenge is the adoption of these protocols in hospitals in member countries.

Protocol Study for Radiation Therapy of Uterine Cervix Cancer·Head/neck Cancer

Advanced uterine cervix cancer treated by new protocol (CRT) 5-y survival 55% (40% by RT)



Before



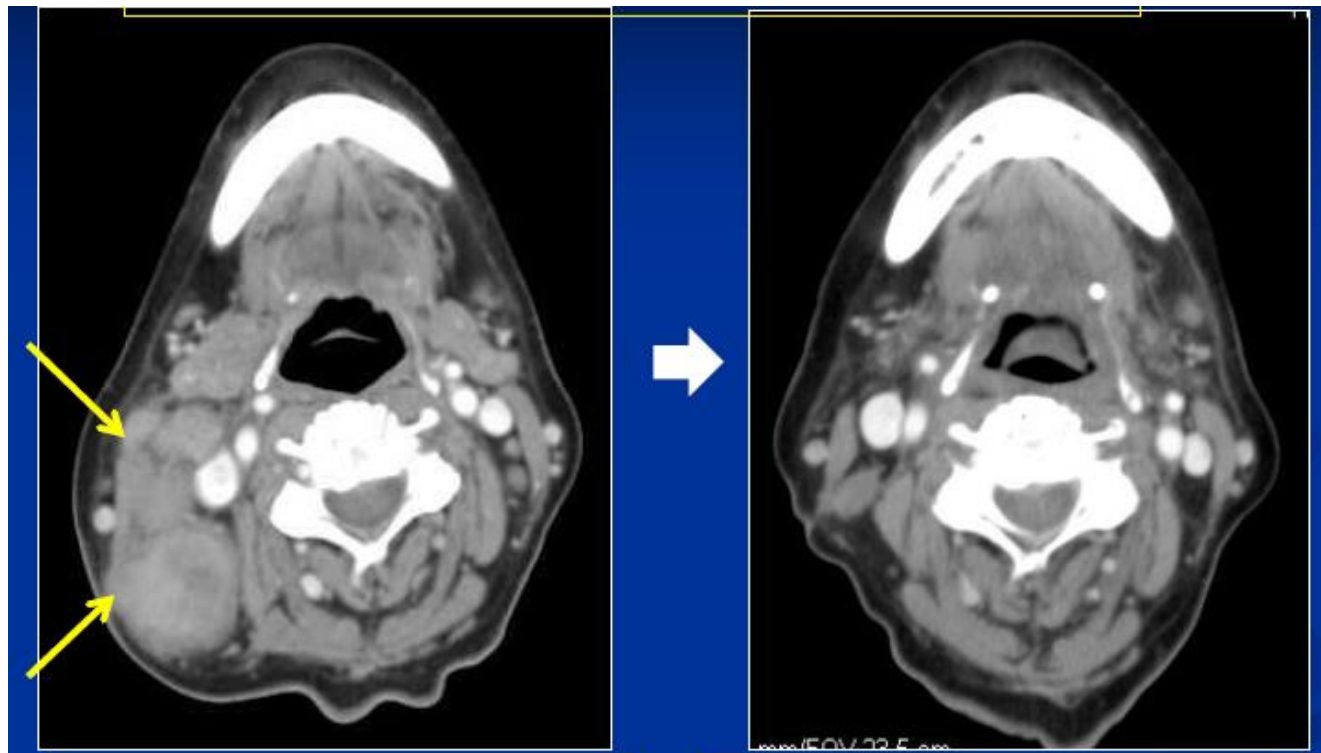
After

WS held in China, Jan. 2012

Standard Protocol in Indonesia, Malaysia, Thailand.

Challenge: Dissemination to all hospitals in MCs

Concurrent Chemo-radiotherapy (CCRT) for Nasopharyngeal Cancer (NPC)



Before Treatment:
Large neck node metastases

After treatment:
Complete response

NPC-I Protocol: 5 year survival rate of 81%

Project on Research Reactor Network

- 2011-2013
Information exchange on RI production and supply in each country, aimed at building a regional network for the stable supply of medical RI, Mo-99
- 2013~
 - Activities intended to establish a regional network for stable production and supply of medical RI
 - Development of n-gamma technology for Mo-99 production
 - Sharing experience for designing new multipurpose research reactors in member countries
 - International cooperation for sharing multi-purpose research reactors in the region
 - Joint workshop with NAA Project was held in December 2016.

Project on Nuclear Activation Analysis (NAA)

- With neutron activation analysis (NAA), multiple elements can be determined with high accuracy for a common and single sample, and even solid samples can be non-destructively analyzed.
- 2002-2004 Introduction of k0 standardization method in each country, common analysis of SPM (suspended particulate matter)
- 2005-2007 establishment of k0 standardization method in each country
- 2008-2014 NAA for geochemical samples, food samples, and marine sediments
- 2015~
 - (1) NAA of PM_{2.5} for environmental monitoring in Asian region
 - (2) NAA of rare-earth elements for resource exploration in Asian region
- Joint workshop with Research Reactor Network Project was held in December 2016.

Project on Safety Management Systems for Nuclear Facilities

- 1996-2007 Safety Culture for Nuclear Facilities
- 2009~ Safety Management Systems (SMS) for Nuclear Facilities
 - To identify key aspects of safety management systems for nuclear facilities
 - To develop self-assessment/peer-review methodologies for nuclear safety management
 - By mutual agreement, to undertake peer reviews at designated institutes in project countries
- Peer reviews conducted at following institutes and reactors
 - 2010 RSG-GAS, BATAN, Indonesia
 - 2011 RTP, Nuclear Malaysia
 - 2012 HANARO, KAERI, Korea
 - 2014 BTRR, BAEC, Bangladesh
 - 2015 DNRR, VINATOM, Vietnam
 - 2016 TRR-1/M1, TINT, Thailand

Project on Radiation Safety and Radioactive Waste Management

- 2002-2004 SRSM(Spent Radiation Source Management), TENORM(Technologically Enhanced Naturally Occurring Radioactive Management)
- 2005-2007 Decommissioning and Clearance
- 2008-2013 Radiation Safety and Radioactive Waste Management
- 2014~ Nuclear/Radiological Emergency Preparedness and Response,
- 2017~ Discussion on low level radioactive waste repository

Project on Radiation Safety and Radioactive Waste Management

FNCA Consolidated Report on Radiation Safety

March 2014

Radiation Safety and Radioactive
Waste Management Group,
Forum for Nuclear Cooperation in
Asia (FNCA)

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Project on Nuclear Security and Safeguards

- Due to rapid increase of nuclear material in Asian region, nuclear security and nuclear safeguards in order to promote peaceful use of nuclear power will become more important. This project aims to remind FNCA countries of the importance of nuclear security as well as nuclear safeguards, and to support human resource and infrastructure development.
- 2011-2013 discussion on 3S (safety, safeguards, and security), Joint open seminar with APSN
- 2014~ sharing information on nuclear security and safeguards system in each country, and focusing on activities and good practices for fostering nuclear security culture.
- Following the nuclear security summit, nuclear forensics in the Asian region and cyber security become more important.

Project on Human Resource Development (HRD)

- 2002~
- This project aims to promote mutual exchange in HRD and strengthen nuclear technology foundation in Asian countries.
- Main activities have been understanding the needs of HRD in the nuclear field, exchanging information and survey on nuclear HRD, building domestic HRD network, joint study of training materials.
- This project has produced successful achievements

Ministerial Level Meeting in November 2016 (Tokyo)

- Strengthening cooperation in low level radioactive waste disposal/storage facilities among member states
- Promoting cooperation with international organizations in the field of legal matters
- Improving management of FNCA activities (evaluation framework)
- Inauguration of “FNCA Award”



FNCA Activities and MEXT Training Programs on Nuclear Energy and Radiation Utilization

Forum for Nuclear Cooperation in Asia (FNCA)

Nuclear Researchers Training Program

1. FNCA Research Course

This course is set up to perform research activities related to the FNCA project themes. (3~6months)

2. Individual Research Course

This course is set up to match the ANTEP Needs from Asian Countries. (3~6months)

3. Basic and Fundamental Course

This course is set up to give various lectures on Nuclear Engineering/Nuclear Safety Engineering. (1~3months)

NSRA



Instructors Training Program

1. Instructors Training Course

This course is set up to invite participants, who are expected to be instructors in their countries in the future. (6~8weeks)

2. Follow-up Training Course

Japanese experts visit Asian countries and give a technical advice to local instructors who have participated in Instructors Training Course. (1~2weeks)

3. Seminars on Nuclear Technologies

- (1) Nuclear Plant Safety
 - (2) Atomic Energy Administration
 - (3) Basic knowledge of Radiation
 - (4) Site Location of Nuclear Facility
- (1~4weeks)

JAEA

MEXT Human Resources Development Program

<Nuclear Researchers Training Program>

	JFY2013	JFY2014	JFY2015
Bangladesh	4	2	4
China	1	1	1
Indonesia	4	1	3
Kazakhstan	2	1	1
Malaysia	2	1	1
Mongolia	1	1	0
The Philippines	2	1	2
Sri Lanka	2	2	1
Thailand	2	3	3
Vietnam	3	7	4
Total	23	20	20

<Nuclear Instructors Training Program>

	JFY2013	JFY2014	JFY2015
Bangladesh	9	8	8
China	0	0	0
Indonesia	9	8	8
Kazakhstan	9	3	5
Malaysia	17	9	8
Mongolia	7	8	6
The Philippines	5	5	5
Sri Lanka	2	3	5
Thailand	10	10	8
Vietnam	21	15	13
Turkey	-	4	10
Saudi Arabia	-	0	1
Total	89	73	77

Summary

- FNCA has produced many remarkable achievements in research activities especially in the field of radiation utilization.
- Ministerial Level Meetings and Project Meetings since 1990 have established a solid and functioning network of cooperation among member countries.
- Human resource development in nuclear field of member countries has been greatly promoted through MEXT HRD programs carried out in cooperation with FNCA research activities.

THANK YOU
FOR
YOUR ATTENTION