Improving Public Perception of Radiation Processing by Involving Students

Dr. Mark Driscoll, SUNY College of Environmental Science and Forestry

Anthony Berejka, Ionicorp+

Public Perceptions of Radiation

Medical Uses:

What’s wrong with me?

+ Diagnostic radiology

Cure me!

+ Beam therapy

+ Nuclear medicine

Public Perceptions of Radiation

Radiation Processing = Industrial Uses:

World-wide Industrial Uses

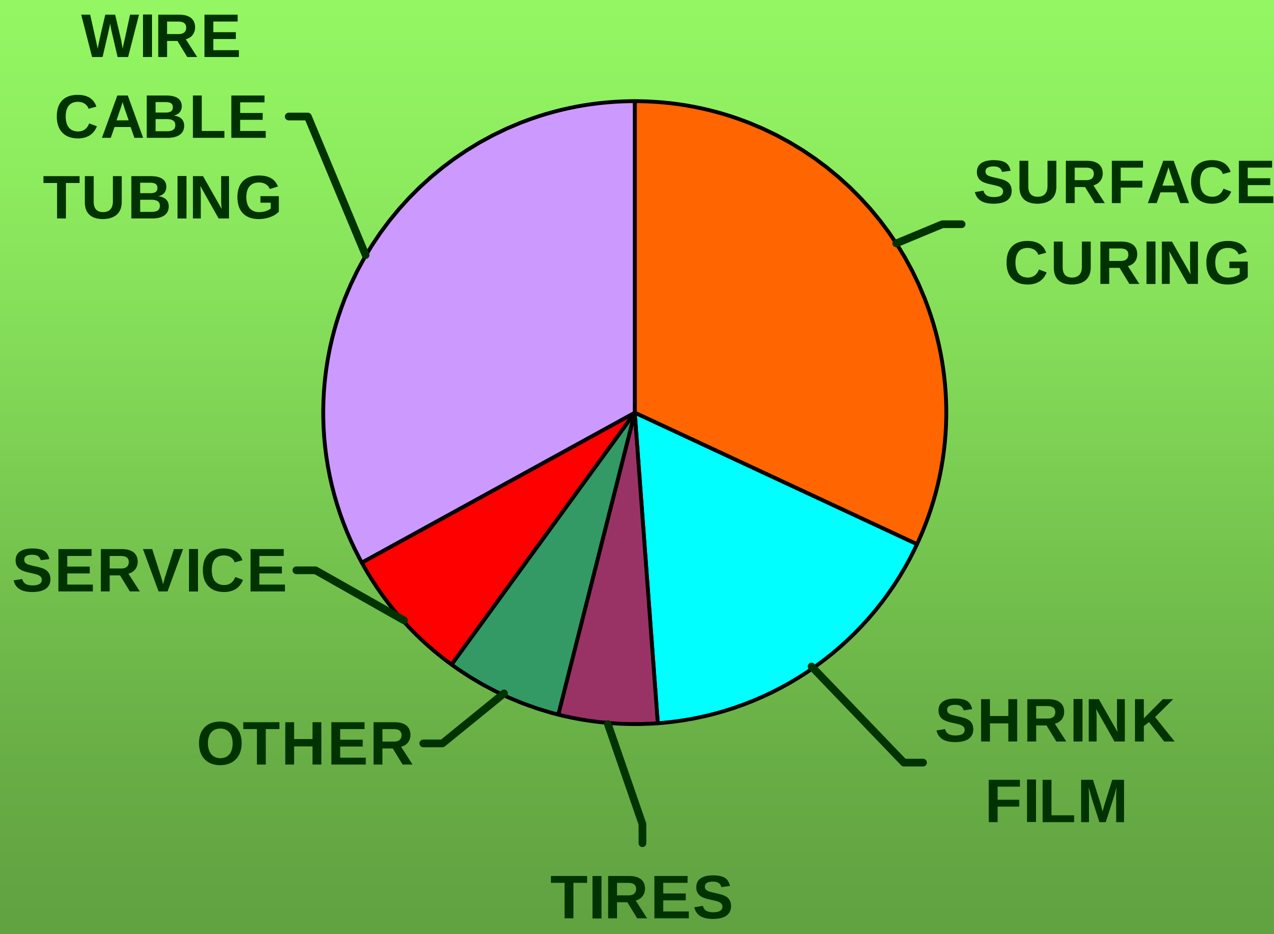
>1700 high current electron beams

Diverse markets; multiple suppliers

~160 gamma ray facilities

Mostly sterilization; some food

Industrial Radiation Processing



>$75 billion USD value-added market

Accepted Industrial Processes

+ Crosslinking wire insulation
(RayTherm founded in 1957; many users)

+ Heat shrinkable tubing
(Raychem/Tyco Electronics; others)

+ Heat shrinkable food packaging films
(Cryovac with ~130 EB units; few others)

+ Tire manufacture
(Bridgestone/Firestone; Goodyear; others)

Competitive Industrial Processes

+/- **Surface curing of inks, coatings and adhesives – fastest growing**
(eliminate volatile organic compounds; conserve energy; printers; web coaters; few adhesive users, e.g. 3M)

+/- **Foam manufacture**
(Sekisui Voltek; few others; other techniques)

+/- **PEX tubing**
(Mercury Plastics; thermal techniques)

+/- **Medical device sterilization**
(Gamma rays; EtO; heat)

Non-Industrial Processes

- **Environmental remediation**
  (Stack gas irradiation; sludge and wastewater treatment; toxic chemical reduction from soils)

- **Food irradiation**
  (Extensive studies; few commercial radiation processing facilities; very limited acceptance by food processors, e.g. mainly for spices)

The Public Reticence

- Generally poor public education, training and background in science and technology

- Fear advocates, e.g. anti-nukes, radiation = cancers, etc.

- Lack of distinction between radioactivity and radiation sources

  (Most radiation processing is based on electrical sources, EB accelerators)

National Responses

+ **National laboratories with industrial radiation processing equipment**

Brazil (IPEN): two 1.5 MeV Dynamitrons
Egypt (NCRRT): a 1.5 MeV ICT
India (BARC): a 2.5 MeV EB accelerator
Japan (JAERI): four EB accelerators
Malaysia: three EB accelerators
Poland (INCT): six EB accelerators
Russia: two suppliers; several EB facilities

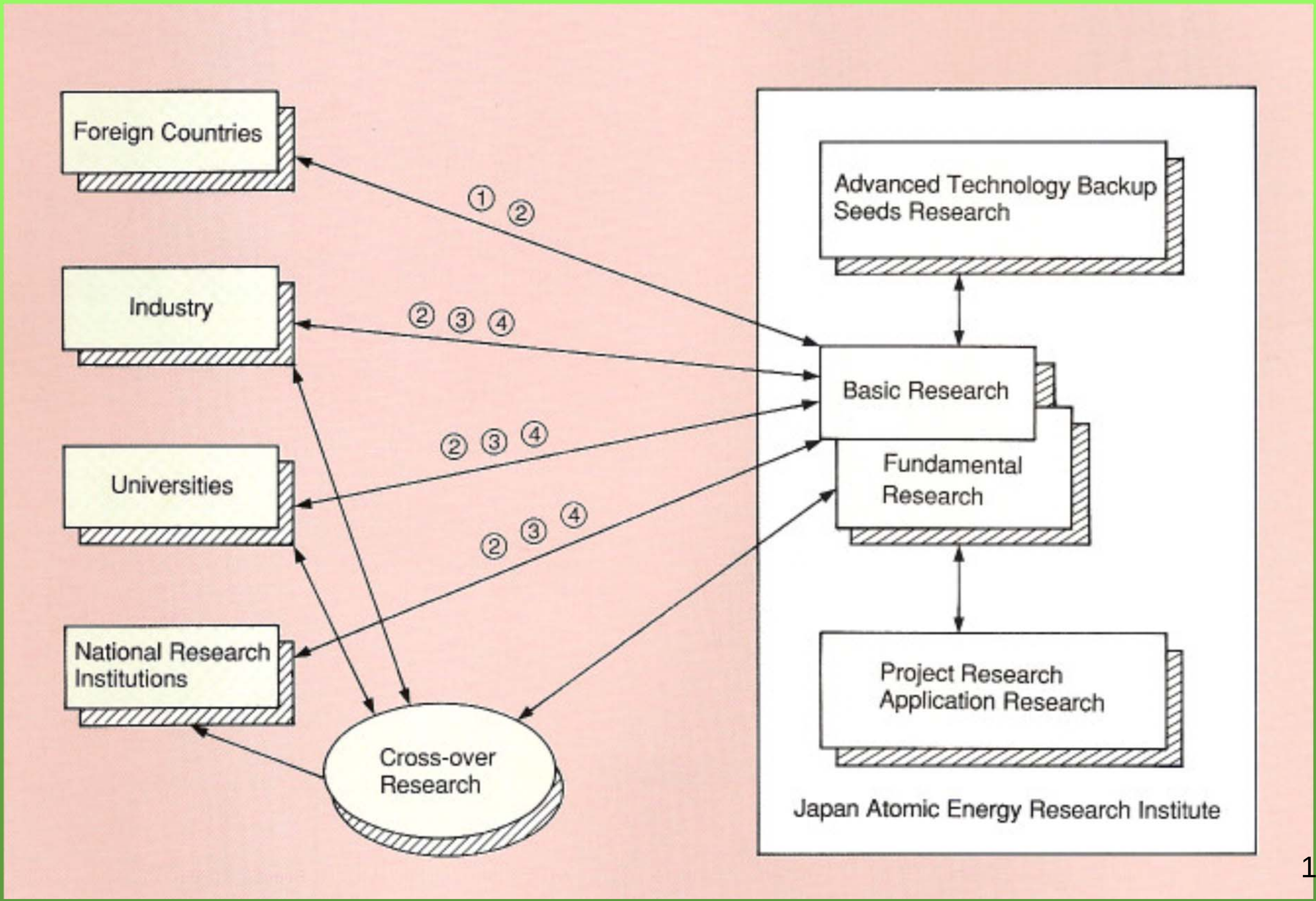
National Strategies

+ Involve industry, academia and government expertise and national facilities to facilitate the acceptance of radiation processing in diverse applications

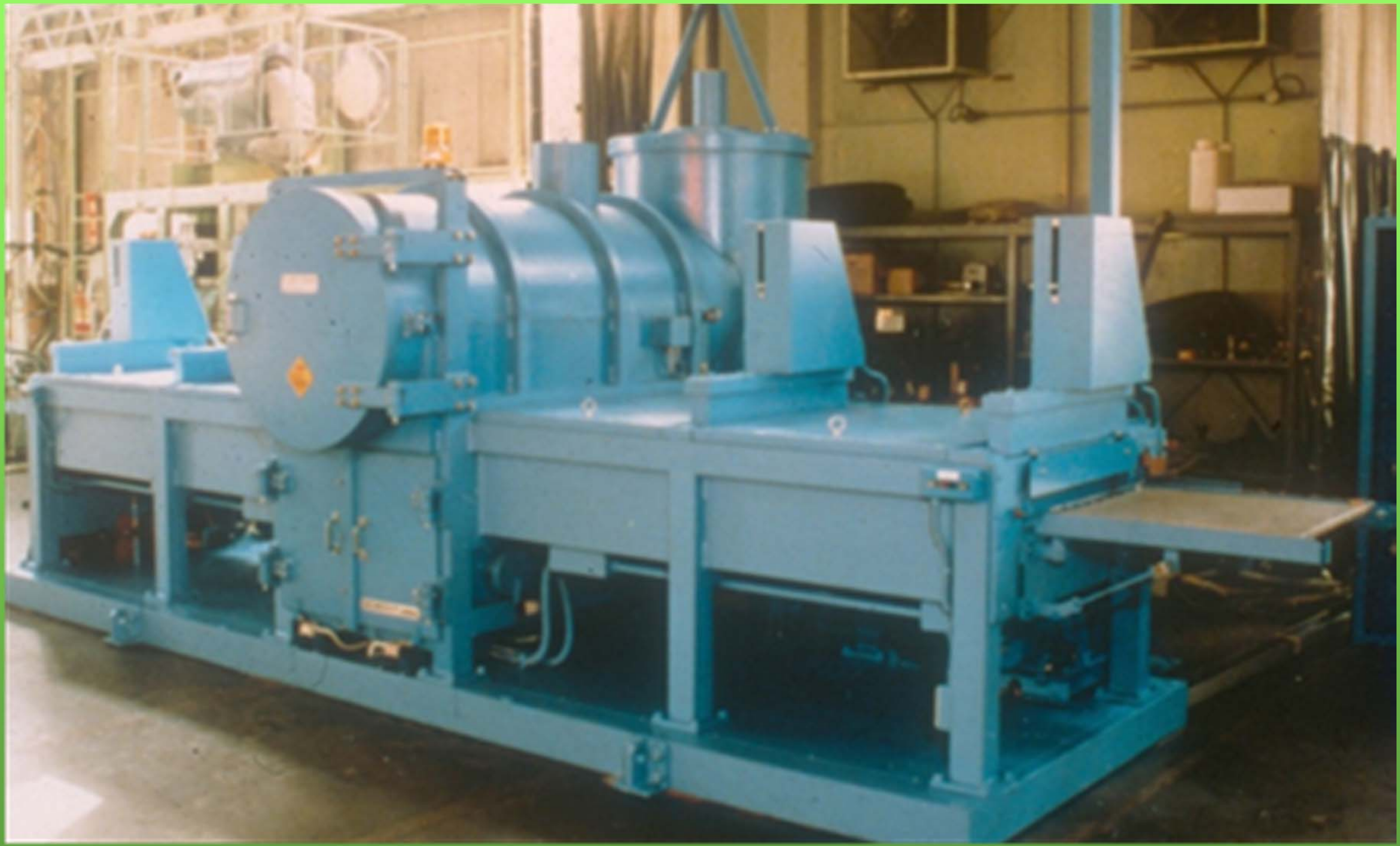
+ Educate and train personnel on the use and safety of industrial radiation processing equipment

+ Use industrial EB and X-ray equipment

JAERI Strategy

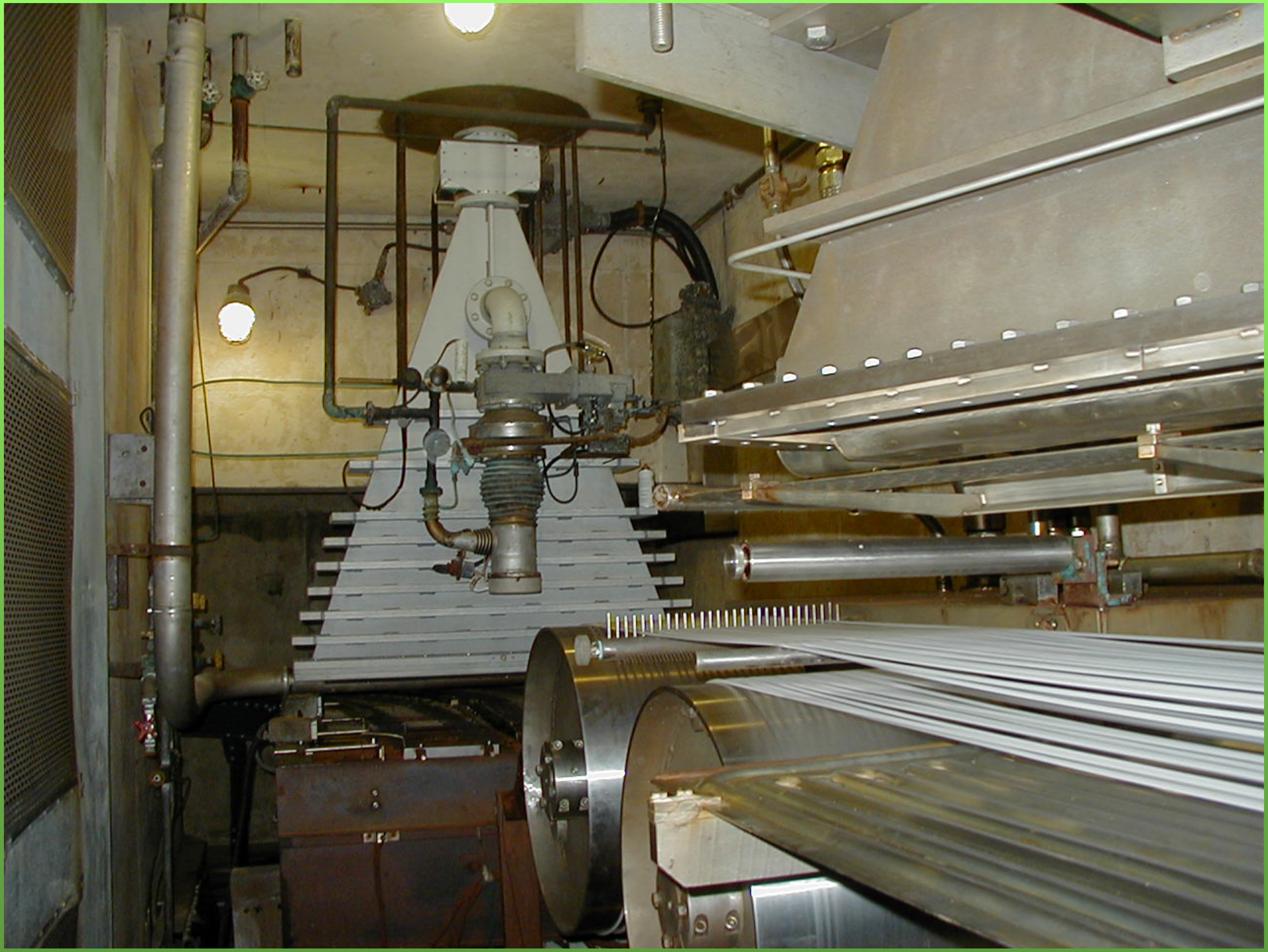


Low-energy EB Line at JAERI

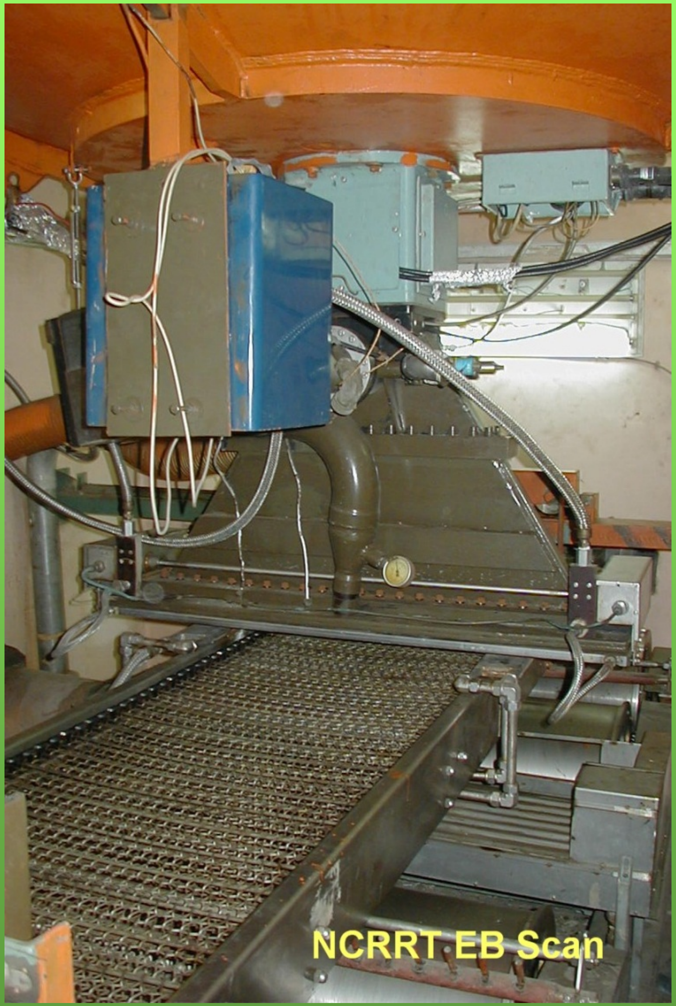


300 keV, 100 ma EB Unit for Surface Curing on Flat Substrates

EB Vault Interior at IPEN

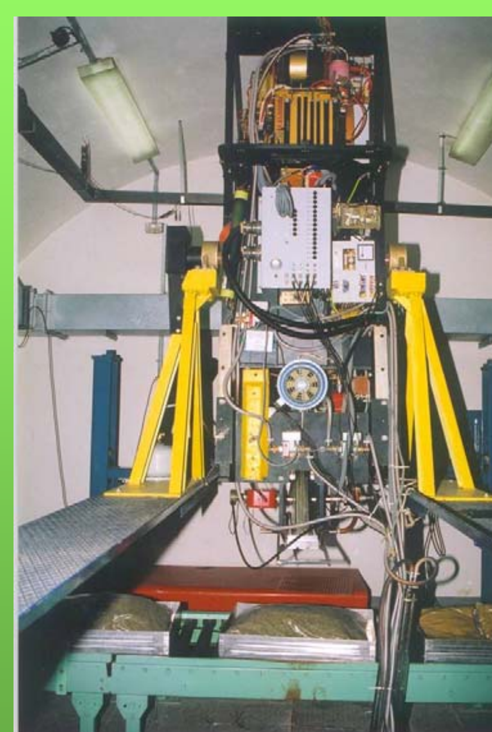


ICT at NCRRT in Cairo



Food EB System at INCT Poland

Conveyor system with
prepacked spices in boxes



Elektronika U-003
10 MeV, 10 kW linac

EU validated as a food processing facility

RadTech Survey of US Academia

- In 1995, 51 universities surveyed for capabilities in EB and UV radiation

- 6 then had some EB capability:

  1. Florida International University: 1.5 MeV, 50ma ICT for water
  2. University of Maryland: 1 to 8 MeV, 0.5ma linac + others
  3. University of Miami: 8 MeV, 0.5ma linac with conveyor + 4 MeV, 50 ma linac + use of Florida International EB
  4. University of Notre Dame: 8 MeV pulsed linac + 2.8 MeV and 2.0 MeV pulsed Van de Graaffs
  5. RPI: 500 to 800 KeV, resonant transformer
  6. Virginia Tech University: 175 keV ESI Electrocurtain

US University Changes in EB Capabilities since 1995

- Florida International/University of Miami water treatment project terminated

- University of Miami investigation of EB for treating medical waste terminated

- RPI GE resonant transformer beam (the very first one made by GE) scrapped

- Virginia Tech low-energy EB not used

US University Changes in EB Capabilities since 1995

+ Kent State University access to 5 MeV Dynamitron at the NeoBeam facility

+ Texas A&M National Center for Electron Beam Food Research with a 10 MeV linac

+ University of Maryland addition of 10 MeV linac capability

+ Survival of the DOE supported University of Notre Dame RadLab

Key Conclusions of the RadTech 1995 Survey

+ The array of research projects being worked on at these responding universities follows the specific interests and involvement of key academic personnel. Projects are at the graduate and post-doctoral level.

- There is no standard text nor apparent core curriculum outline being followed by these universities. In some cases, personal notes are relied upon as the course materials.

- These 1995 results still hold in 2011.

US Academic Posture in Radiation Processing

+ **Excellent graduate and post-doc project performance with some relevance to industrial radiation processing.**

Notre Dame RadLab: Students, postdocs and visitors, June 2010

CIRMS Recognition of Student Achievement

Since 1999:

+ 47 Student Travel Grant winners

+ Representing 20 universities

State University of New York College of Environmental Science and Forestry

- + Part of the New York state university system – SUNY
- + 2000 students
- + 9 Ph.D. tracks
- + Adjacent to Syracuse University

SUNY-ESF UV/EB Tech Center

SUNY-ESF UV/EB Tech Center

+ Inaugurated in May 2011 with $900,000 funding from the New York State Energy Research and Development Authority (NYSERDA).

+ Two EB units: an older Energy Sciences laboratory unit and a new Advanced Electron Beam Applications Development Unit.

+ Access to university laboratory facilities with participation of faculty members.

SUNY-ESF UV/EB Tech Center

Energy Sciences, Inc. lab unit

SUNY-ESF UV/EB Tech Center

AEB Applications Development Unit

SUNY-ESF UV/EB Tech Center

Objectives:

+ Grant a post-baccalaureate certificate in radiation processing (minimum of five courses, including “hands on” lab experience and internships).

+ Engage undergraduates in radiation courses and laboratory programs.

SUNY-ESF UV/EB Tech Center

Objectives:

- **+ Improve “public perception” by engaging undergraduates and baccalaureates.**
- **+ Provide much needed trained personnel to the radiation processing industry.**
- **+ Demonstrate that results attained at low-energy EB processing can be scaled up to higher EB energy levels.**

SUNY-ESF UV/EB Tech Center

Courses taught by Dr. Mark Driscoll:

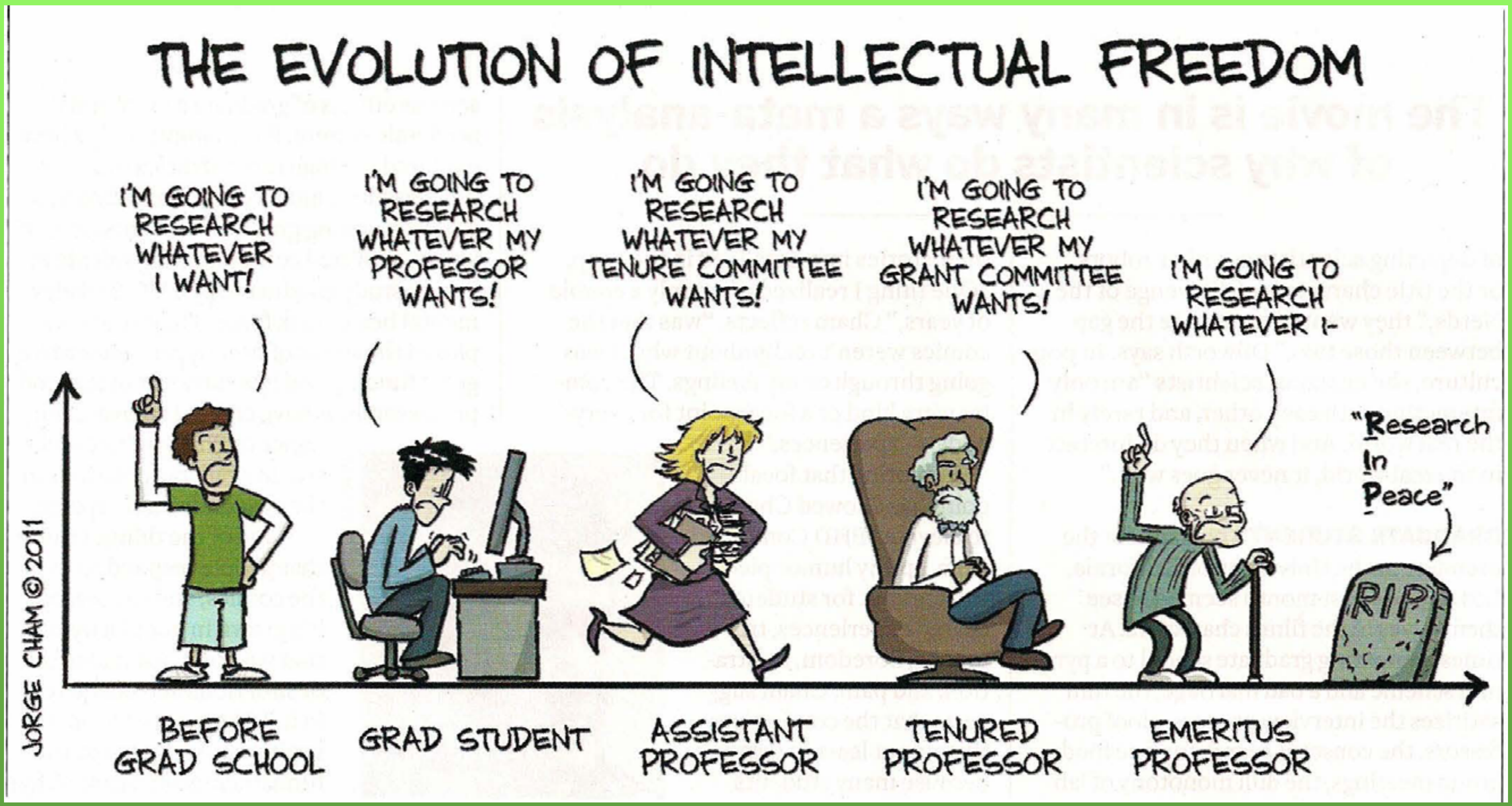
+ Nuclear and Radiation Chemistry

+ Radiation and Polymers

+ Undergraduate and graduate student involvement in topics such as:

Monte-Carlo calculations with low energy electron beams.
Electron beam degradation of chemical warfare surrogates.
Polymers as thin film dosimeters.
The effects of EB radiation on the strength of hard maple.
The use of radiation for curing composites.
The effects of EB on PHA's (Polyhydroxyalkanoates).
The depolymerization of cellulose.

The Research Dilemma



Thanks and Questions?

Dr. Mark Driscoll

Cairo and Sao Paulo – 2005