CIRMS: A Retrospective & Look Forward

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CIRMS 2017
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CIRMS 2017

- Brief history on coordination of standards in ionizing radiation
- Founding of CIRMS in 1991 – 1992
- CIRMS Needs Reports & Measurement Program Descriptions (MPDs)
- Successes and Priorities
- The Future!

CIRMS Early History

1981 Cannon Report from House of Representatives recommends system of secondary laboratories for NIST

1988 Major restructuring, reduction in resources in Ionizing Radiation Division

1989 Letters to NIST from US Council for Energy Awareness, HPS, AAPM expressing concern over NIST support for ionizing radiation programs

1990 Difficulty of working with many organizations one-on-one leads to idea of a Council

1991 NIST holds organizational meeting of CIRMS

1992 Inaugural meeting of CIRMS at NIST October 22 - 23

Pre-History of CIRMS

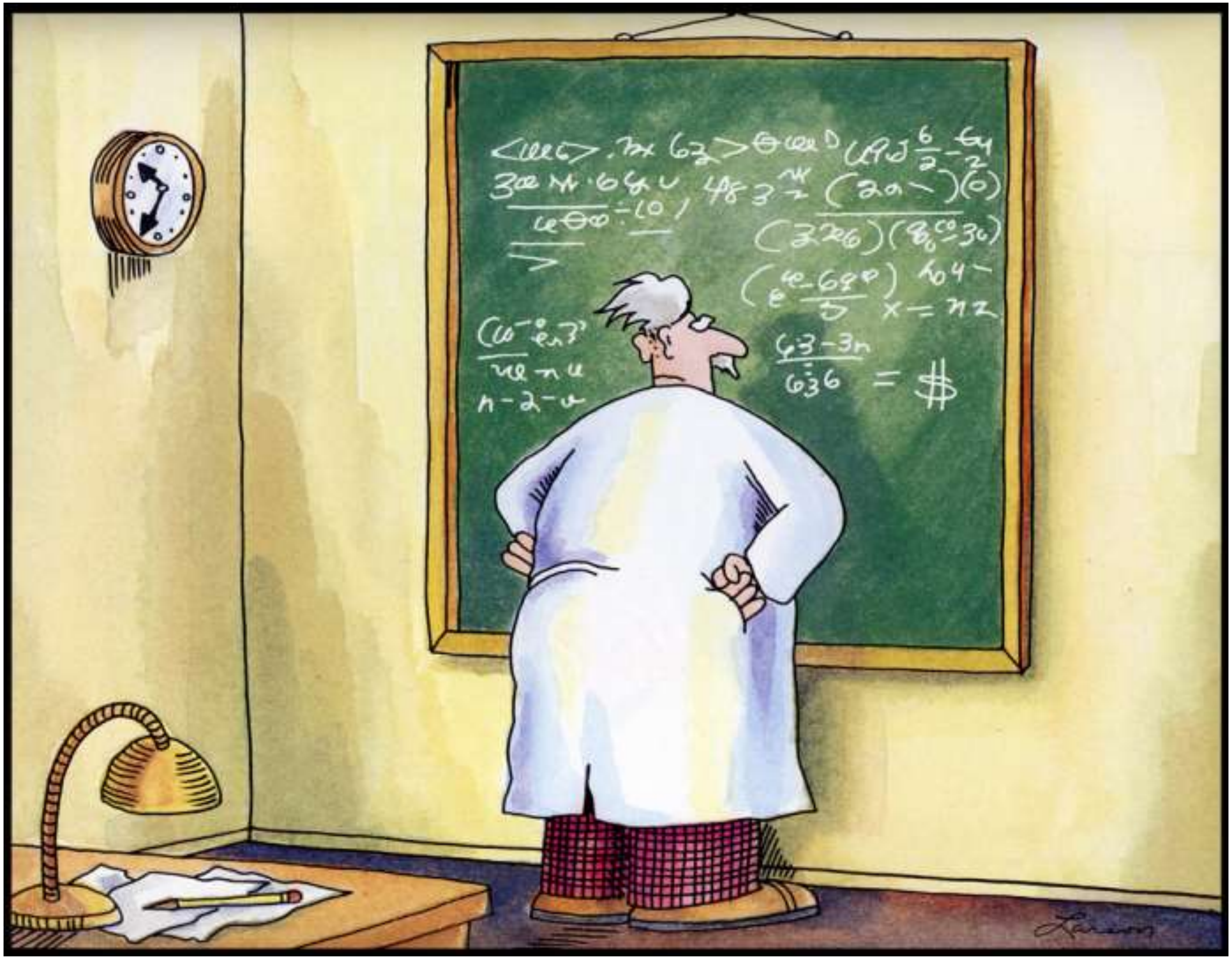
1932 Cockcroft-Walton proton accelerator splits lithium nucleus

1935 Irene and Frederick Joliot-Curie produce artificial radioactivity

1950 Commercial production of cesium-137 and cobalt-60 for product irradiations

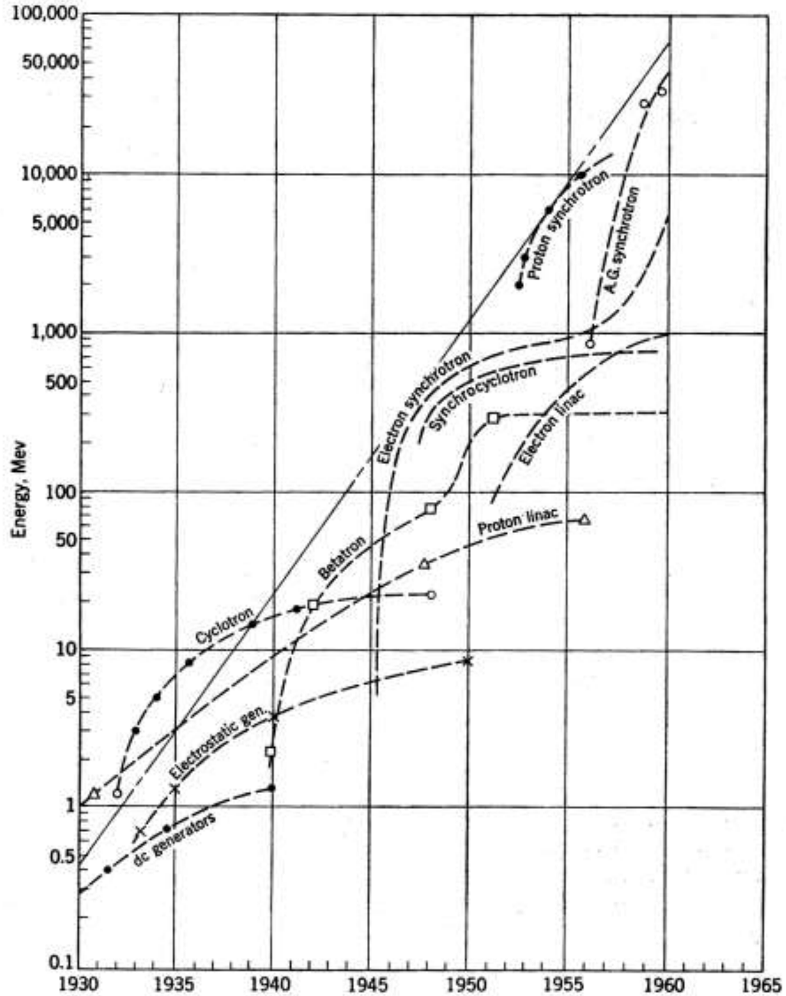
1955 Vienna, *International Atoms for Peace Conference*

Einstein Discovers that Time = $



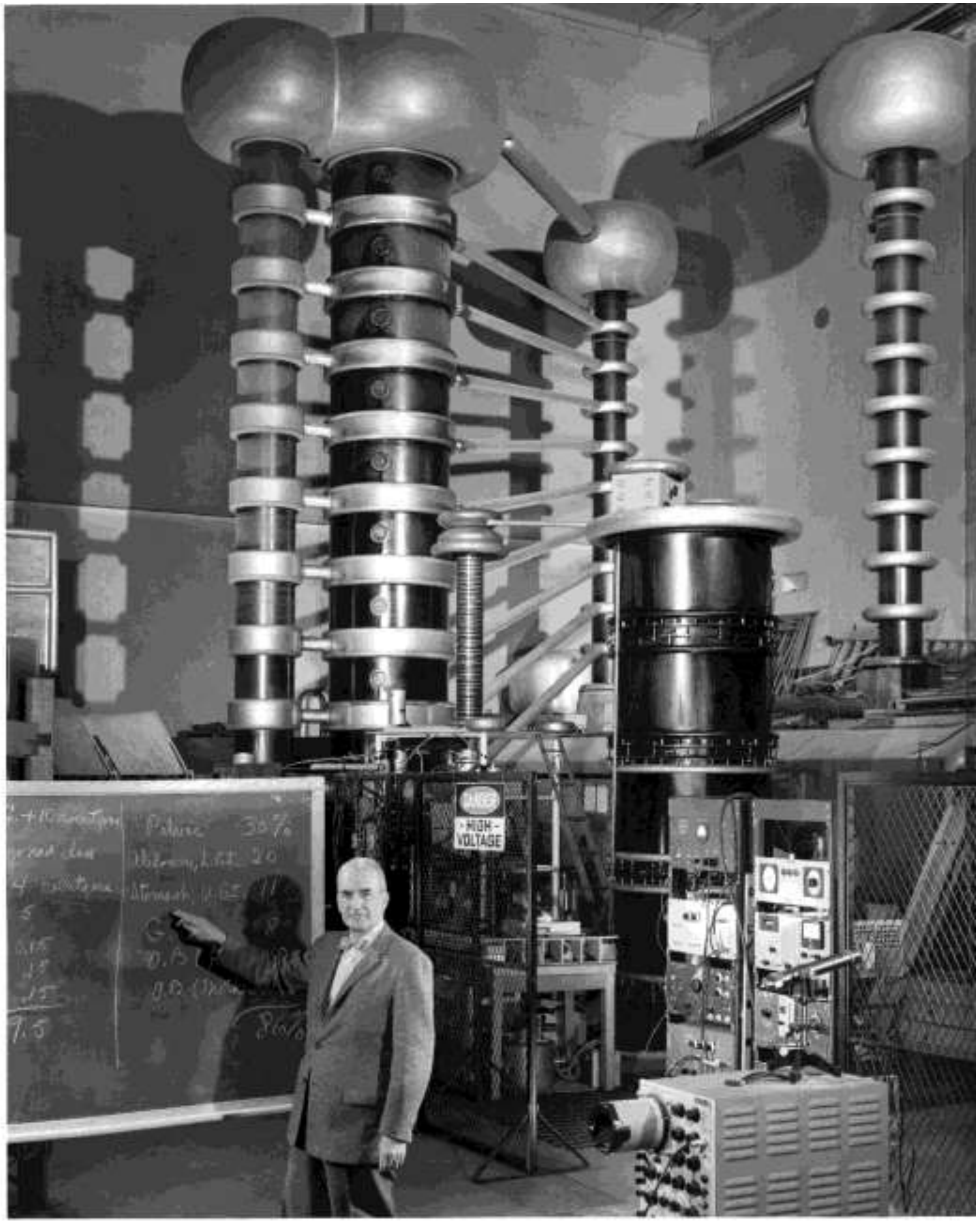
Livingston curve
Energy vs. Time for accelerators

10 MeV



180 MeV

Fig. 1-1. Energies achieved by accelerators from 1930 to 1960. The linear envelope of the individual curves shows an average tenfold increase in energy every six years.



Lauriston S. Taylor

1.4 MeV constant
potential
X-ray generator

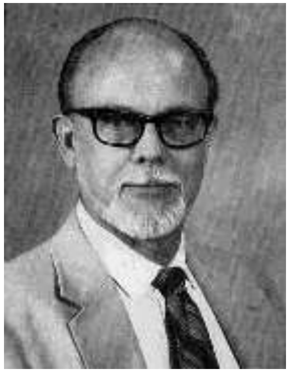
A Generation of young US scientists develop the metrology for this new discipline

Martin Berger

Randy Caswell

Wilfrid Mann

Ugo Fano



Herb Attix

Bob Loevinger

John Hubbell

Greta Ehrlich

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Pioneers of CIRMS

- 1991 Organizing Committee

H. Thompson Heaton	Food and Drug Administration
William Eckelman	National Institutes of Health
Tony Berejka	RadTech International North America
Randall Caswell	NIST, Chairman

- 1992 -1993 First Officers

President	Marshall Cleland	Radiation Processing
1st Vice President	Peter Almond	Medical Physics
2nd Vice President	R. Thomas Bell	Health Physics
Secretary	Elmer Eisenhower	Measurement quality assurance

National Needs in Ionizing Radiation Measurements and Standards

Measurement Program Descriptions (MPDs)

- Five Needs Reports between 1994 and 2011
- Sixth Needs Report is online
- Now Six Subcommittees of CIRMS S&T Committee
    - A. Medical (Med)
    - B. Public & Environmental Protection (PERP)
    - C. Occupational Radiation Protection (ORP)
    - D. Industrial and Materials Effects (IAME)
    - E. Homeland Security (HS) (from 2004)
    - F. Computational Needs (from 2004)

MPDs Evolve over 15 Years
Five Needs Reports

	1994	1998	2001	2004	2011
	I	II	III	IV	V
A. Medical	4	6	3	4	8
B. Public & Environmental Protection	6	5	3	3	3
C. Occupational Radiation Protection	8	7	6	5	4
D. Industrial and Radiation Effects	4	5	4	5	6
E. Homeland Security				3	3
F. Computational Needs				1	1
Totals	22	25	16	21	25

Factors in Successful MPD's

In reviewing progress on the 22 original MPDs, it was found that success depended on three factors:

1) programs that moved the fastest involved three or more institutions with a strong need for the technical work.

2) a focus workshop organized by one of the subcommittees was very effective in forging agreements that could advance the work. (Thirteen focused workshops were held over the last four years.)

3) a roadmap or timeline that established milestones for the collaborators was most effective in keeping the project on track

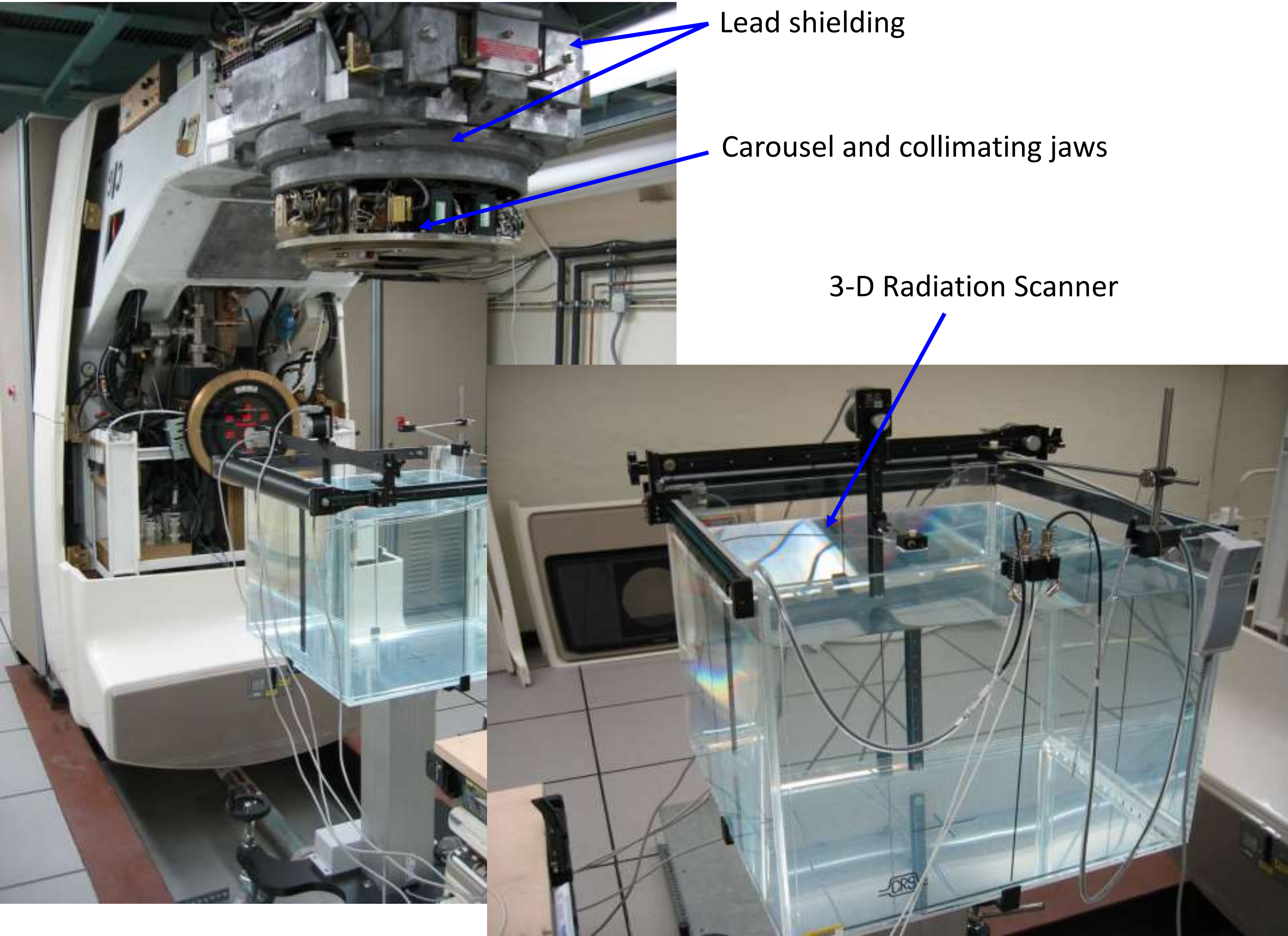
Medical Subcommittee MPDs
Successes & Priorities

Successes

Standards for mammographic x-rays
Calorimetry for absorbed dose to water standards for cobalt-60
Standards for low-energy brachytherapy seeds
Installation of clinical linac for photon and electron dosimetry
Installation of PET/CT scanner for diagnostic imaging
Development of TDCR and CNET for LS standardizations

Priorities

Standards for proton therapy
Standards for radiobiology
Standards for small fields for external beam therapy


Lead shielding
Carousel and collimating jaws
3-D Radiation Scanner

Medical Subcommittee MPD Standards for Proton Therapy

Radiation Protection & Homeland Security

Successes

Commissioning new cesium-137 calibration range for gamma-ray calibrations

Validation of methods for irradiating contaminated mail

Development of suite of ANSI N42 standards for radiation detectors

Development of suite of ANSI N42 standards for x- and gamma-ray inspection

Development of reference materials for nuclear forensics

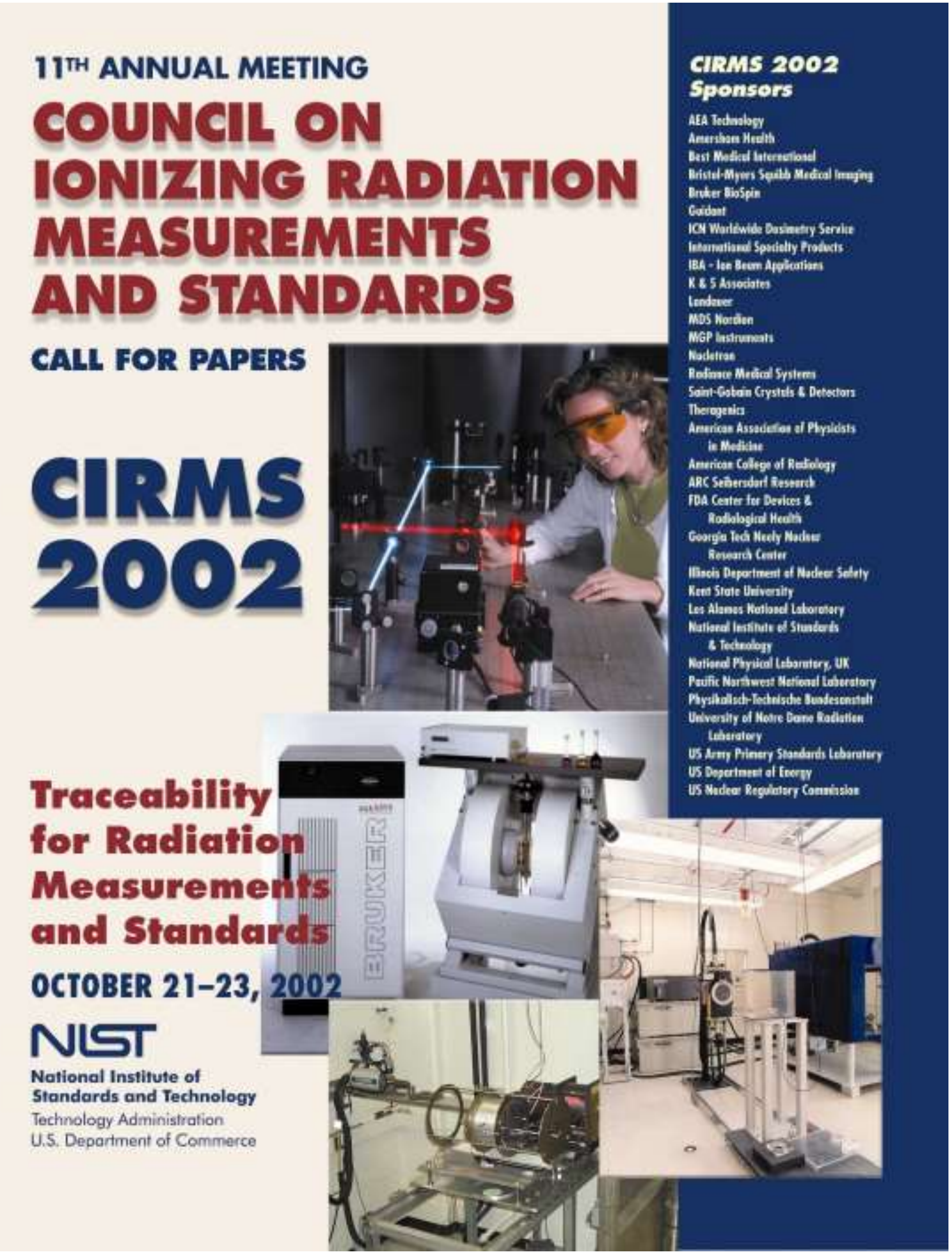
Priorities

Measurement and Calibration for Surface Contamination Monitoring

Traceability for High Energy Photon Dosimetry for Non-Intrusive Inspection Systems

Traceability of Neutron Cross Sections, Measurements, and Detector Development


UNITED



Sessions on RDD & Nuclear: Standards and Measurement for 1st Responders

Federal
State
Local emergency planners

Standards organizations
Manufacturers
Testing laboratories

http://www.cirms.org

Radiation Detection Equipment for Detect/Prevent and Respond/Recovery

Radiation Portal Monitors

Radiation Pagers

Radioisotope Identifiers

Survey Meters

Electronic Personnel Dosimeters

Radiochromic Passive Dosimeters

National and International Standards for X-Ray and Gamma-Ray Inspection

Venue	Technical Performance	Radiation Safety
Checkpoint (cabinet x-ray systems)	**IEC 62963** ANSI N42.44 **ASTM F792**   	**ASTM F1039** (21 CFR 1020.40)
CT / EDS (checked luggage)	 **IEC 62945** ANSI N42.45 **IEC 62963** 	**ASTM F1039** (21 CFR 1020.40) 
Cargo / Vehicle (radiographic imaging & active interrogation systems)	 ANSI N42.46 **IEC 62523** ANSI N42.41	  ANSI N43.16 **IEC 62523** ANSI N43.14 (10 CFR 20)
Whole Body Imaging (AIT)	ANSI N42.47 **IEC 62709** ANSI N42.59  	ANSI/HPS N43.17 **IEC 62463**  
Bomb Squads (portable x-ray sources)	 ANSI N42.55 NIJ 0603.01 	[see list below] 
All Venues	[NEMA DICOS IIC 1 v02] 	 ANSI/HPS N43.3 ANSI/ANS 6.1.1 (29 CFR 1910)

Industrial & Materials Effects (IAME)

Successes

Development of alanine-EPR dosimetry service

Development of MIRF accelerator for radiation effects studies

EPR measurements for biological dosimetry

Development of radiochromic film dosimetry for radiation beam and field mapping

Industrial & Materials Effects (IAME) Subcommittee MPDs

Active MPDs

Roadmap to Resource Gammacell 220 Irradiators
Low Alpha Standard
Radiation Hardness Testing and Mixed-Field Radiation Effects
Medical Device Sterilization
Pollution Prevention
Food Irradiation
Low-voltage Electron Beam and X-ray Dosimetry (80 to 300 KeV)
Traceability of Neutron Cross Sections, Measurements .

Proposed MPD's

High-energy Electron Beam Dosimetry (> 300 KeV)
Fast Neutron Reactor Research and Development
Reprocessing of Used Nuclear Fuel
Link Absorbed Dose and Irradiation Temperature to Properties of Polymeric Materials

MIRF Accelerator

- Radiotherapy accelerator installed ca. 1970 at Yale New Haven hospital
- Donated to NIST in 1993
- Adapted for “industrial” and research uses
  - Radiation hardness and radiation resistance
  - Materials modification (e.g. grafting)
  - Detector calibrations and radiation shielding tests
  - Fundamental physics studies

Titan Accelerator (AIMS Facility)

- Industrial 10 MeV, 17 kW e-beam accelerator
- Installation has begun
- Irradiation conditions will match those of industry
- High-dose dosimetry, sterilization applications etc.

The Future for Ionizing Radiation Science & Technology

Contributions to the New Physics

Health Science Applications and Radiation Protection

Homeland Security

Future Materials and Devices

The Future for CIRMS!

Tuesday

Quantitative Imaging, Edward F. Jackson
Medical Product Sterilization, Kevin O'Hara
Cosmic Radiation Hazards to Humans in Space, Ruthan Lewis

Wednesday

Alpha-particle Therapy, Jonathan Engle
Chip-scale Calorimetry for Industrial Dosimetry, Ileana Pazos
Food Defense During a Radiological Emergency, Stephanie Healey
Optoacoustics meets Ionoacoustics:
    3 D Imaging of the Bragg Peak, Vasilis Ntziachristos