IEC Subcommittee 62C (Equipment for Radiotherapy, Nuclear Medicine and Radiation Dosimetry): Recent and Active Projects

2015 AAPM Annual Meeting
Anaheim, CA

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Topics Covered

1. Getting involved in the IEC
2. Scope of IEC 62C
3. Structure of 62C
4. List of current projects for the working groups of 62C

Getting Involved

- Each person has a story of how they became involved in the IEC
- For seven years I worked as a clinical medical physicist
  - I (like others) assumed that the manufacturers and ADCLs were providing accurate calibrations on equipment that worked
- Then after working in an accredited dosimetry calibration laboratory (ADCL), I recognized the impact of technical standards

Clinical Physicists

- Front line clinical physicists care about their equipment and that it functions properly
- Without standards, equipment may not operate properly in conditions outside of ADCL calibration environments
- Clinical physicists do not have the time or resources to test every piece of equipment for all technical aspects!
- Observations:
  - Many more standards should be proposed
  - System is difficult to navigates – acronyms!!!
  - Very formal, but opinions welcomed
  - Slow to create standards, but well thought through

Participation

- Countries are members of IEC SC 62C / People are members of the working groups (as experts)
- Each member nation participates in the IEC through its national committee
- The U.S. National Committee (USNC) is located at the offices of American National Standards Institute (ANSI) in New York.
- The USNC established a technical advisory group (TAG) associated with subcommittee 62C, whose role is to advise the USNC
- This setup helps assure that the standards are scientifically and clinically meaningful

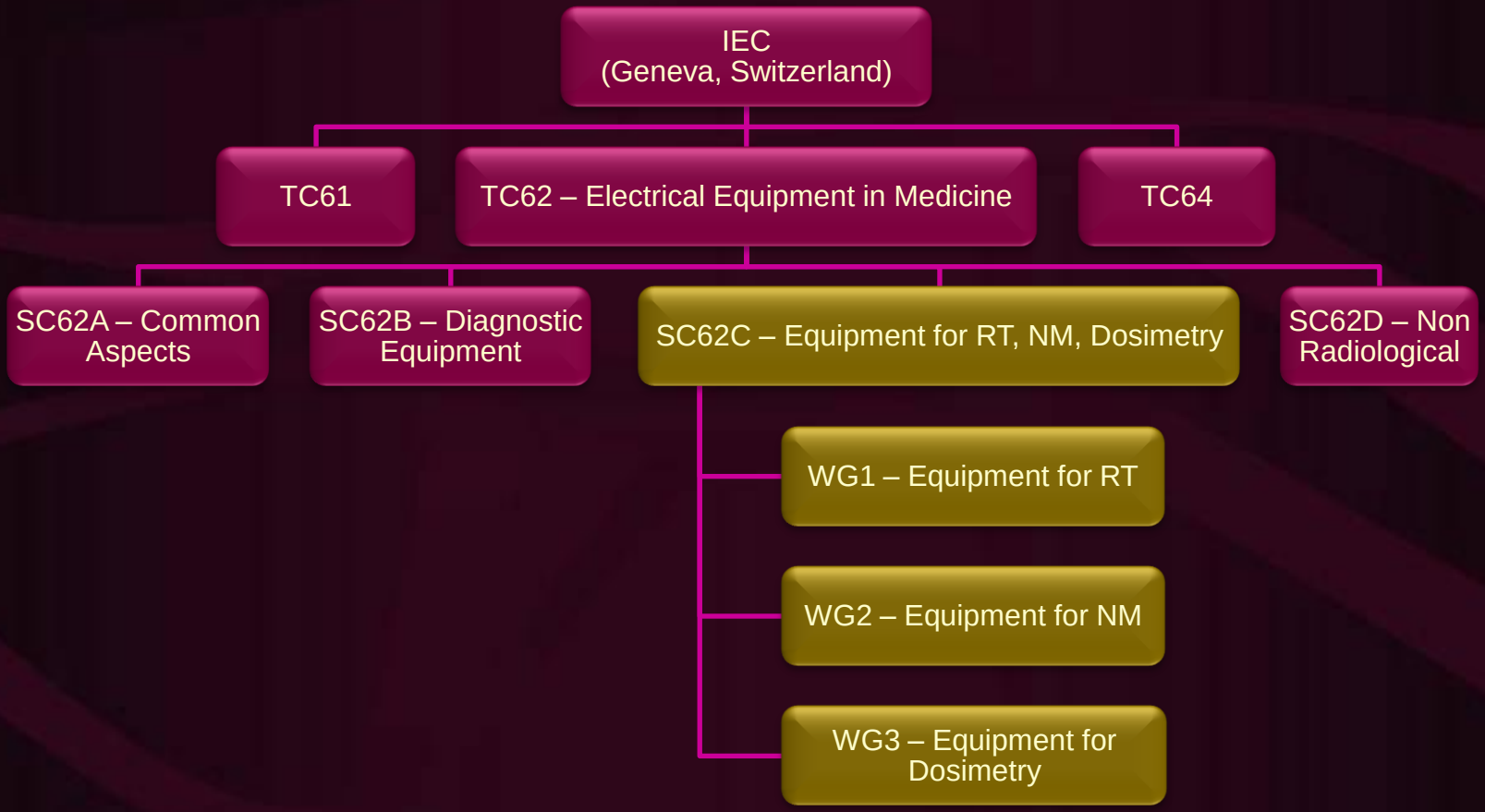
Rationale and history of IEC 62C

- Technical Committee No 62: Electrical Equipment in Medical Practice
  - Subcommittee 62C is responsible for equipment for
    - Radiation therapy
    - Nuclear medicine
    - Radiation dosimetry
  - SC 62C is the smallest of the SC in 62 (in membership)
    - Small but mighty
    - Many active projects

Scope of 62C

- The preparation of standards
  - for the safety and performance of medical equipment and systems using ionizing radiation for the treatment of disease
  - associated equipment and software used in planning, delivering and monitoring such treatments
  - instruments measuring ionising radiation used in the diagnosis and treatment of disease
    - radiation conditions for testing them
  - nuclear medicine equipment
- Proposed scope change
  - "*and nuclear medicine equipment used for imaging the distribution of radioactive substances within the human body for both diagnostic purposes and radionuclide therapies.*""

Structure of 62C



SC62C Officers

- Chairman: Geoff Ibbott (USA)
- Secretary: Norbert Bischof (Germany)
- Technical Officer: Laurent Mailly

Liasons

- Digital Imaging and Communications in Medicine (DICOM)
- International Atomic Energy Agency (IAEA)
- International Commission on Radiological Protection (ICRP)

Collaborations

- ASTRO
- AAPM
- ACR

Meetings

- Annually
- Last meeting was held in New Orleans in Nov, 2014
- Next meeting in Kobe, Japan in Nov, 2015

Within SC 62C

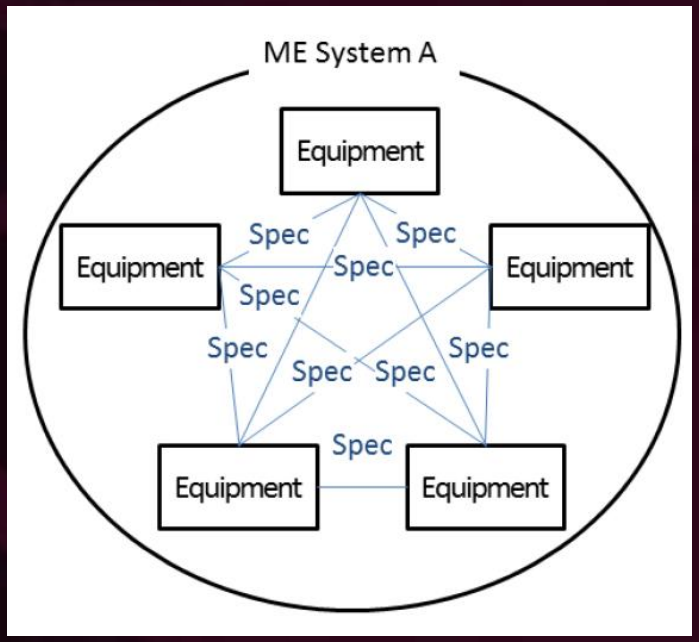
- Working Groups
  - Meet periodically
  - Actively work on new and existing standards
  - Comprised of a convenor and experts
- Project Teams
  - Single specific theme
  - Comprised of a project team leader and experts

3 Working Groups

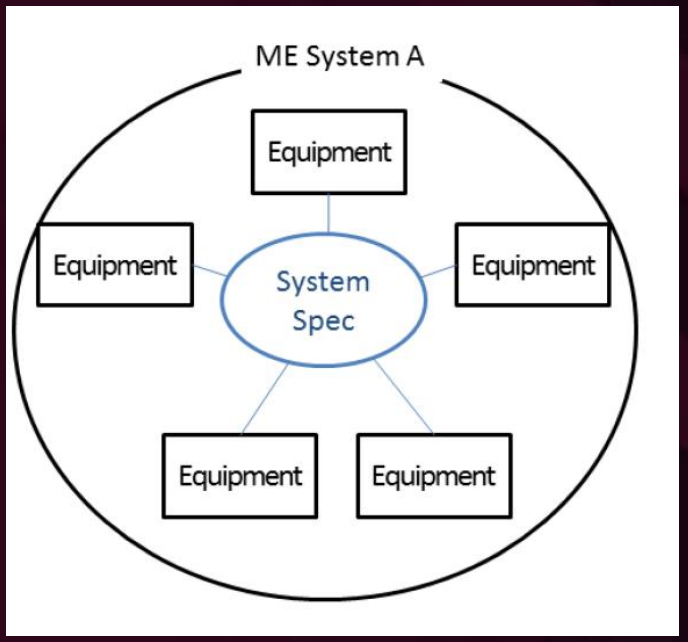
- WG1
  - Radiation therapy equipment
- WG2
  - Nuclear medicine equipment
- WG3
  - Radiation dosimetry measurement equipment

Project Teams

- Project Team (PT) 62926 within WG1: Medical electrical equipment – Requirements of safety and performance of complex real-time controlled radiotherapy systems for a moving target



Individual Approach



Systems Approach

Project Team Discussions

- Information communicated to other working groups via documents online
- Example: 62C/618/DC is a document for comments within SC62C
- All participating countries can give feedback
- “P-members” vote and comment on documents

Comments summarized

	Comments received	No comments	No response
P-members	10	11	6
O-members	0	3	16
Non-members	1	0	0
Total	10	14	22

P-members with no response: Denmark; France; Korea, Republic of; Pakistan; Romania;

*Comments rejected because they were not submitted in the IEC Comment form.

Current AAPM Involvement

WG1 (Radiation Therapy)

- Geoff Ibbott, PhD (chair of SC62C, Technical Advisor to USNC, Convenor of WG-1, Chair of TAG dealing with 62C standards)
- Michael Moyers, PhD
- Raymond Wu, PhD
- Frank Bova, PhD
- Alan Cohen, MS (Accuray)
- Anuj Purwar, PhD (Varian)

WG2 (Nuclear Medicine)

- James Halama, PhD

WG3 (Radiation Dosimetry)

- Wes Culberson, PhD
- Larry DeWerd, PhD
- Douglas Pfeiffer, PhD
- Tom Heaton – FDA
- Michele Obrien - NIST
- Paul Sunde - RadCal
- Bill Zimmerman – Fluke
- Ray Riddle - SI
- William Maloney - FDA

WG1 List of Projects

(Green items indicates active)

- IEC 60601-2-1
  - Basic safety
  - Electron accelerators in the range 1 MeV to 50 MeV
  - Preparing new 4th edition
- IEC 60601-2-8
  - Basic safety and essential performance of therapeutic x-ray equipment operating in the range 10 kV to 1 MV
  - Working on Amendment 1
- IEC 62667
  - Light ion beam medical equipment – Performance characteristics

WG1 Safety Standards

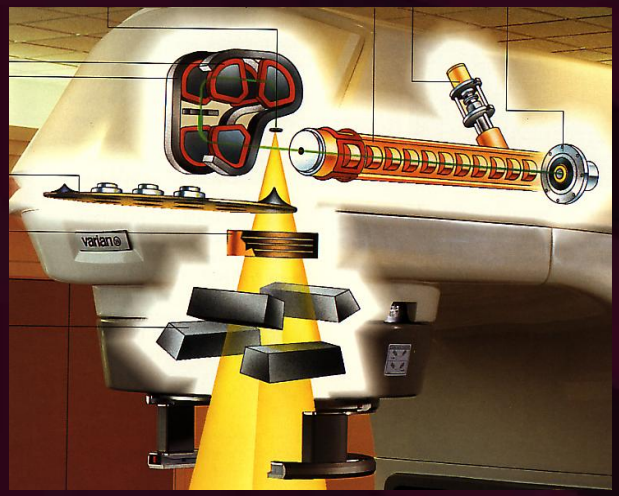
- IEC 60601-2-64
  - Light ion beam equipment
- IEC 60601-2-68
  - X-ray based IGRT equipment for use with electron accelerators, light ion beam therapy systems and radionuclide beam therapy systems
- IEC 60601-2-29: 2008
  - radiotherapy simulators

WG1 Safety Standards

- IEC 60601-2-17: 2013
  - Applies to performance of remote HDR afterloaders
  - Applies to sealed sources and electronic brachytherapy (eBT)
  - Requirements for manufacturers
  - Places limits on the degradation of equipment
  - Interlocks
  - Assumes that the TPS and source strength are known

WG1 – Project IEC 60601-2-1

- Is the third edition of IEC 60601-2-1, known as the Accelerator Safety Standard.
- Edition 4 is bringing accelerator technology up to today's standards
- Probably the most comprehensive, far-reaching and influential recent work of WG-1
- Dictates the design of important safety features of medical linear accelerators
  - including requirements for a dual-channel dosimetry system, testing of interlocks, permitted levels of radiation leakage and certain important characteristics of the radiation beams.



WG1
IEC 60601-2-64

- Published last year and is stable now
- For proton and light ion accelerators.
- US Spearheaded
- Addresses aspects of beam control considered important for safety such as
  - selection and verification of the correct beam energy (or range),
  - range modulation
  - lateral beam spreading and uniformity
  - correct dose delivery.
- It also specifies safety provisions such as collision avoidance, correct treatment couch positioning and avoidance of electrical hazards.

WG1
IEC 60601-2-68

- Addresses the use of equipment for x-ray image guidance of radiation therapy
- Published last year and is stable
- Provisions specify
  - limits on the control of movements of the equipment and allowable speeds
  - controls on the delivery of radiation
  - Resolution on monitors is addressed
  - Types of images that can be used as reference images (orientation, DICOM conformance statement as an example)
  - IGRT dose quantities
  - other safety aspects.

WG2 (Nuc Med)

- Recent meeting held April 27-29, 2015 in Vancouver, Canada
- Maintenance Projects have been initiated for the following Technical Reports:
  - IEC 61303: 1994
  - IEC TR 61948-1: 2001
  - IEC TR 61948-2: 2001
  - IEC TR 61948-3: 2005
  - IEC TR 61948-4: 2006
- New item work proposal (NP) on cardiac cameras
  - The US National Committee has agreed to submit a proposal

WG2 – Current Project

- IEC TR 61948-1
  - Nuclear medicine instrumentation – Routine tests – Part 1: Radiation counting systems, copyright 2001
    - This technical report describes test methods of counting instruments for measuring RADIONUCLIDES in vivo and in vitro without the option of imaging.
- IEC 61675-2
  - Gamma cameras for planar, wholebody, and SPECT imaging, Part 2
  - Combines two standards: 61675-1-1 and 60789 (Anger type gamma cameras)
  - Copyright 2015

WG3 (Radiation Dosimetry)

- Convenor – Ludwig Buermman (PTB – Germany)
- New secretariat is Norbert Bischof from Germany
- Recent meeting held June 25-26, 2015 in Stockholm, Sweden

WG3 List of Standards

- IEC 60580
  - Dose area product meters (2nd edition 2000-01)
- IEC 60731
  - Dosimeters with ionization chambers as used in radiotherapy
- IEC 61267
  - Radiation conditions for use in the determination of characteristics
  - Lots of x-ray beam qualities standardized
    - No therapeutic beam qualities addressed
- IEC 62467-1
  - Dosimetric instruments as used in brachytherapy – Part 1: instruments based on well-type ionization chambers
- IEC 61676
  - Dosimetric instruments used for non-invasive measurements of x-ray tube voltage in diagnostic radiology

IEC 60731

- Chambers + Electrometers
- Dosimeters with ionization chambers as used in radiotherapy
  - Includes requirements for ionization chamber performance
    - Assembly
    - Humidity
    - Temperature
    - Pressure changes
    - Sealed chamber designs
- Survey sent out to countries in 2014
  - Survey results showed interest in including other types of dosimeters such as semiconductors
- At WG3 meeting in Sweden it was decided to investigate further. Likely result is to break into two standards: chambers and diodes

60731 Details

- Defines reference-class vs field-class dosimeters
- Reference-class
  - Chamber assembly
    - Long-term stability
    - Post-irradiation leakage
  - Measuring assembly
    - Long-term stability
    - Resolution
    - Repeatability
    - Zero drift
  - No sealed chambers

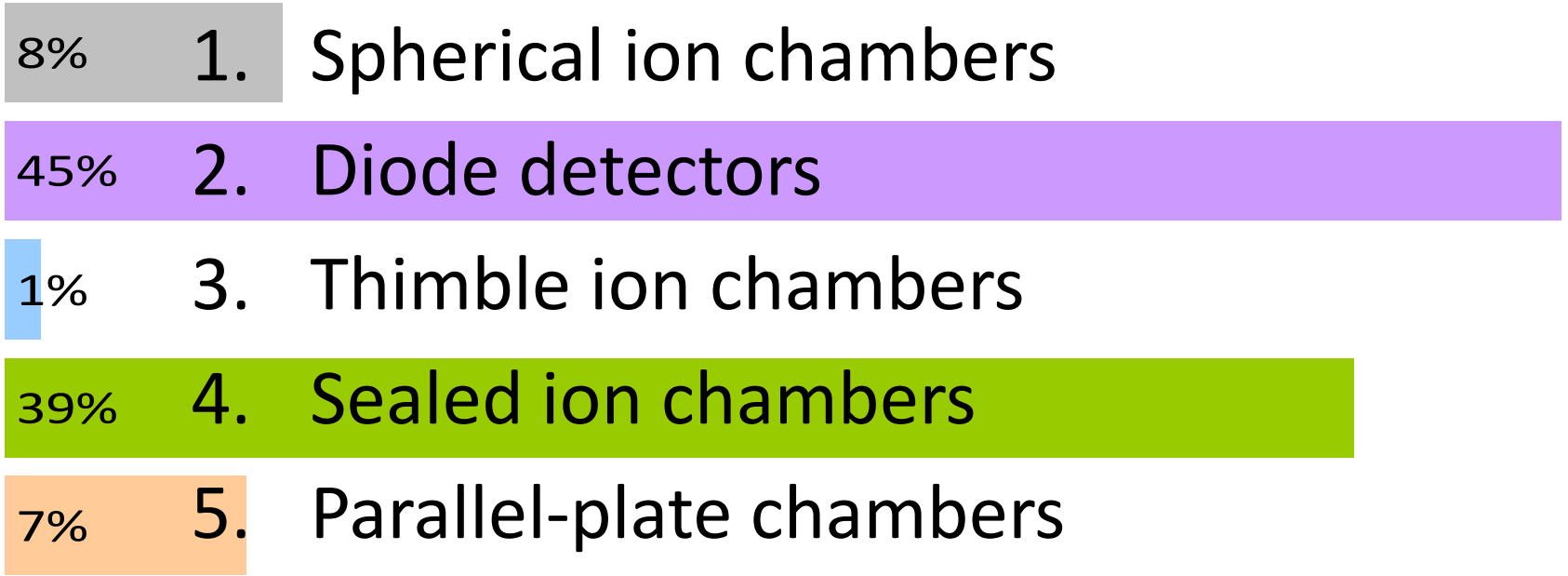
WG3 60731 Update

- Correcting for zero drift
  - During a step and shoot IMRT, beams will have intermittent times of zero output.
  - Zero drift can be tested by looking at known charges injected and pausing for different amounts of time.

- Zero Drift

  Dm = (Q2-Q1)/T

Which of the following detectors is not covered under the IEC 60731 standard?



SAM Q1 Answer

- Answer: 2 – Diode detectors

Ref: *IEC 60731 – Medical electrical equipment – dosimeters with ionization chambers as used in radiotherapy*, IEC, Geneva, Switzerland, 2011.

Which of the following is not a requirement of a reference class dosimeter according to the IEC 60731 standard?

3% 1. Long-term stability

0% 2. Repeatability

19% 3. Zero drift

10% 4. Resolution

68% 5. Waterproof

SAM Q2 Answer

- Answer: 5 – Waterproof

Ref: *IEC 60731 – Medical electrical equipment – dosimeters with ionization chambers as used in radiotherapy*, IEC, Geneva, Switzerland, 2011.

Conclusions

- AAPM members are involved in the working groups of IEC SC62C
- SC62C created to maintain safe standards for manufacturers of radiotherapy equipment and nuclear medicine equipment
- Several projects are actively being revised
- More input from AAPM members is better

Questions?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