# Dose Comparison between AAPM TG-61 protocol and MOSFET-based Phantom Dosimetry

*Maryann O. Abogunde*
*Greta Toncheva, Colin Anderson-Evans, Sua Yoo, Mark Dewhirst, Oana Cracuinescu, Beverly Steffey, and Terry Yoshizumi*

Medical Physics Graduate Program
*Duke Radiation Dosimetry Laboratory*
*Department of Radiation Oncology*
Duke University

RadCCORE

Radiation Countermeasures Center of Research Excellence

# Objective

- To evaluate the accuracy of dose measurements between AAPM TG-61 and MOSFET-based phantom technique for mice dosimetry in an AGFA XRAD-320 Orthovoltage Irradiator.

# Materials & Methods

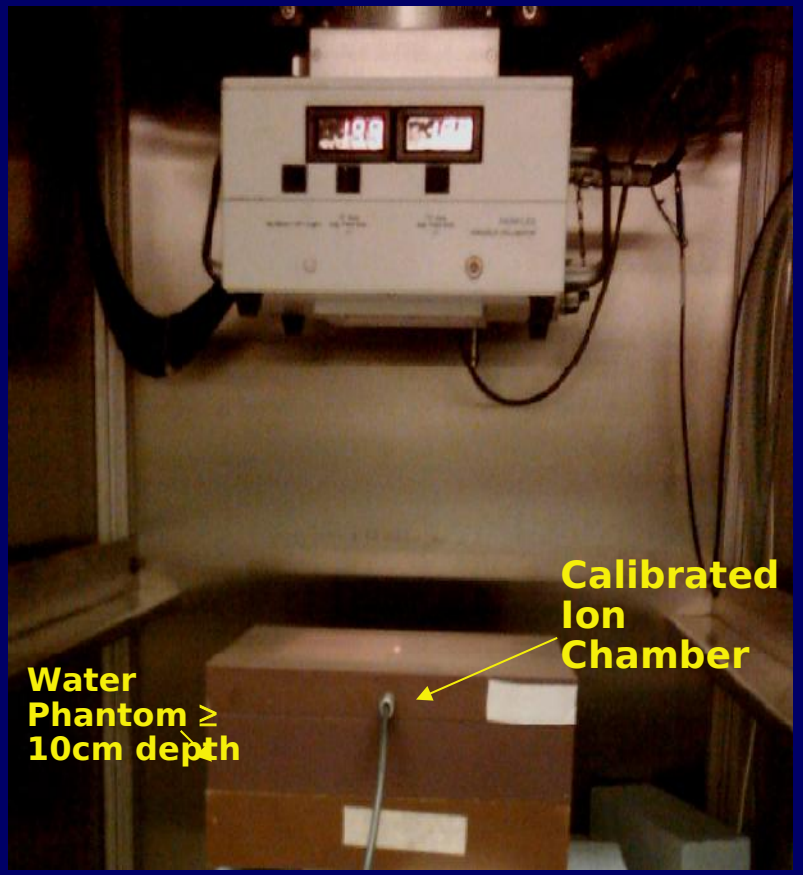
- Dose rate measurements in an orthovoltage x-ray irradiator (Ahrensburg, Germany), were evaluated for the following parameters:


- Settings: 135kVp, 23.7mA
  320kVp, 10.0mA
- Filters: F1 - 2mmAl
  F4 - 0.1mm Cu and 2.5mm Al
- Field of View: ~20x20 $cm^2$
- SSD: 50cm

# Materials & Methods

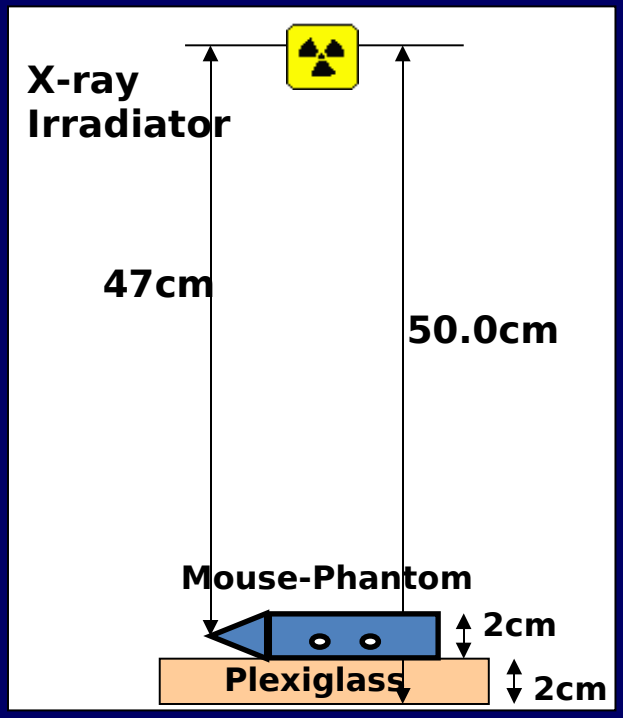
- Ionization chamber:
  - Farmer-type cylindrical 0.6cc chamber
  - Nuclear Enterprise Ltd (NEL) 2571
- The American Association of Physicists in Medicine – Task Group 61 (AAPM TG-61) dosimetry protocol recommends:
- An *"in-air"* method:
  - Absorbed dose to water at water surface.
  - (40kV ≤ tube potential ≤ 100kV)
- An *"in-phantom"* method:
  - Absorbed dose to water at 2cm depth in water.
  - (100kV ≤ tube potential ≤ 300kV)

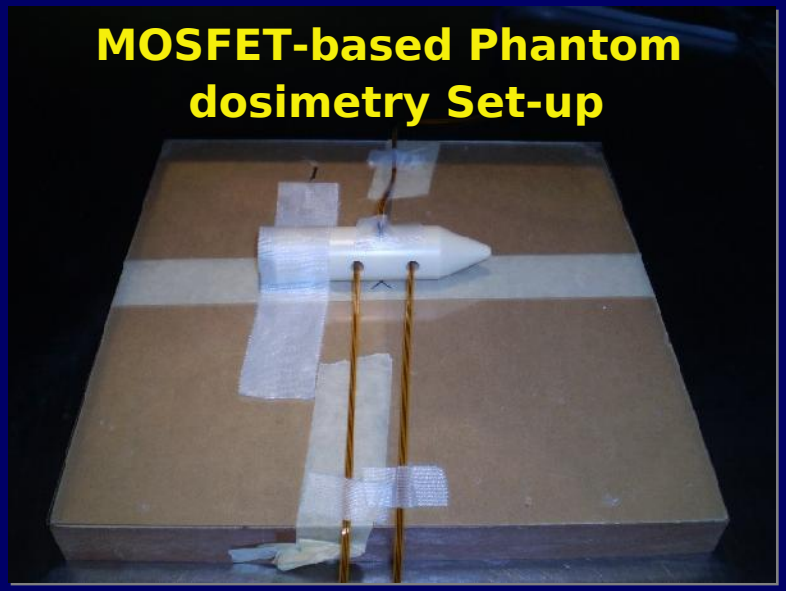
**AAPM TG-61 protocol**



# Materials & Methods

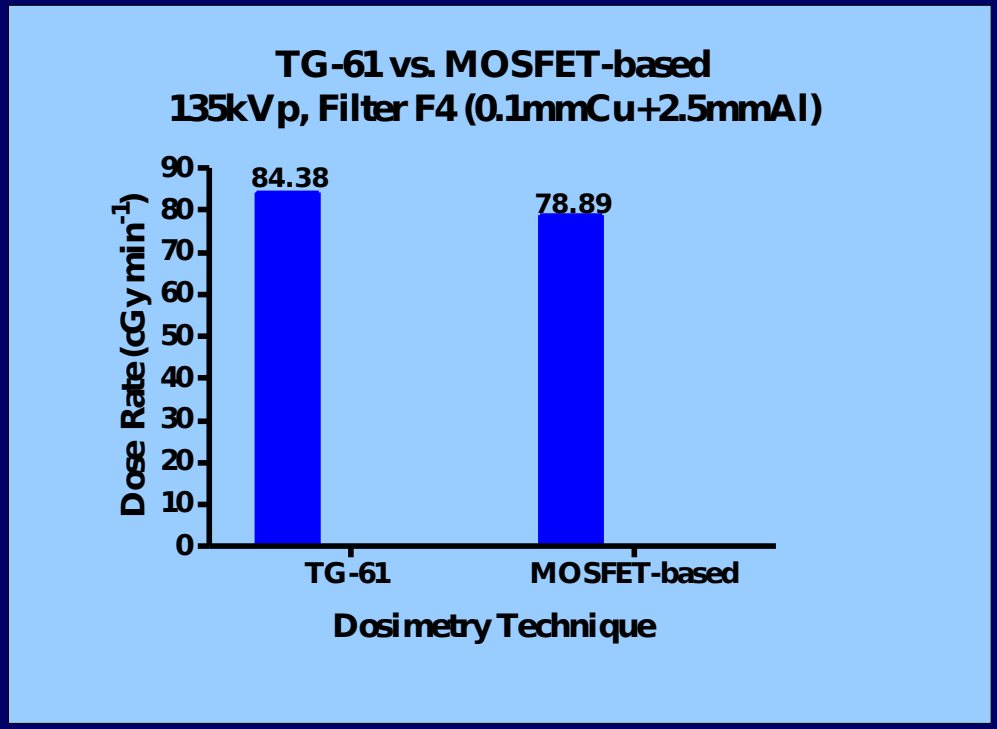
- The MOSFET-based Phantom dosimetry:
  - Mobile Metal Oxide Semiconductor Field Effect Transistor (MOSFET) wireless dosimetry system
    - (Best Medical Canada, Ltd. Ottawa, Canada)
  - Mouse Tissue Equivalent Phantom



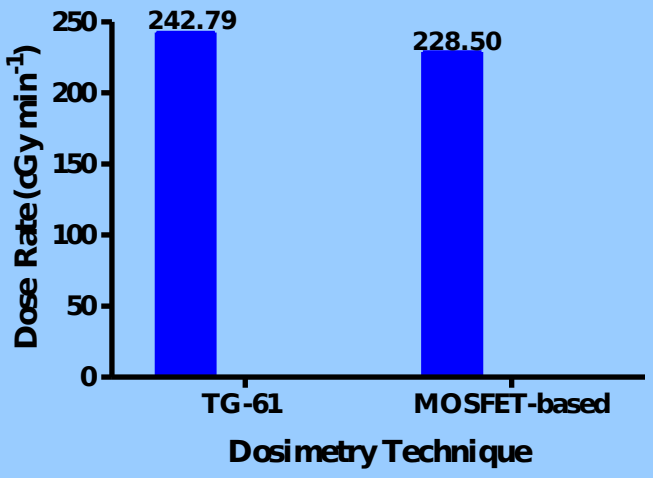
# Results

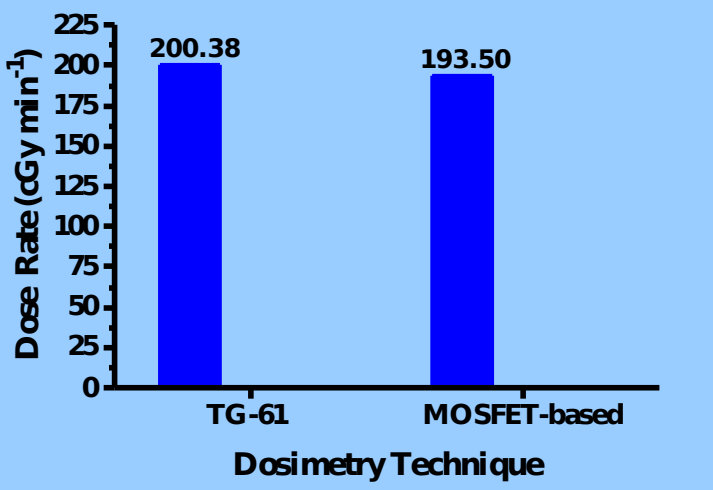
| X-ray Setting: 135kVp, 23.7mA<br>Filter F4: 0.1mmCu + 2.5mmAl | | |
|---|---|---|
| Dose Rate (cGy $min^{-1}$) | | |
| TG-61 | MOSFET | % diff. |
| 84.38 | 78.89 | 6.96 |



# Results

| X-ray Setting: 320kVp, 10mA Filter F1: 2.0mmAl | | | | X-ray Setting: 320kVp, 10mA Filter F4: 0.1mmCu + 2.5mmAl | | |
|---|---|---|---|---|---|---|
| Dose Rate (cGy min$^{-1}$) | | | | Dose Rate (cGy min$^{-1}$) | | |
| TG-61 | MOSFET | % diff. | | TG-61 | MOSFET | % diff. |
| 242.79 | 228.50 | 6.25% | | 200.38 | 193.50 | 3.56% |



# Results

## *Dose Rate Clinical Implications*

✦ Given a target dose of 10Gy:

| X-ray Setting: 135kVp, 23.7mA<br>Filter F4: 0.1mmCu + 2.5mmAl | |
|---|---|
| TG-61 | MOSFET-based |
| 9.3 Gy | 10 Gy |

| X-ray Setting: 320kVp, 10mA<br>Filter F1: 2.0mmAl | | | X-ray Setting: 320kVp, 10mA<br>Filter F4: 0.1mmCu + 2.5mmAl | |
|---|---|---|---|---|
| TG-61 | MOSFET | | TG-61 | MOSFET |
| 9.4 Gy | 10 Gy | | 9.7 | 10 Gy |

# Conclusion

- TG-61 has limitations in accurately predicting absorbed doses in small animal dosimetry.
- TG-61 does not represent real-life small animal geometry
- The MOSFET-based method proves to be accurate for small animal dosimetry and provides the advantage of immediate readout after exposure.

***Duke Radiation Dosimetry Lab***
Dr. Terry Yoshizumi
Greta Toncheva
Colin Anderson-Evans

***Department of Radiation Oncology***
Dr. Sua Yoo
Dr. Oana Cracuinescu
Beverly Steffey