

# A Custom-Made Jig for In-Air Ionization Chamber Measurements and Quality Assurance of the Mark I-68 Cs-137 Irradiator

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## INTRODUCTION

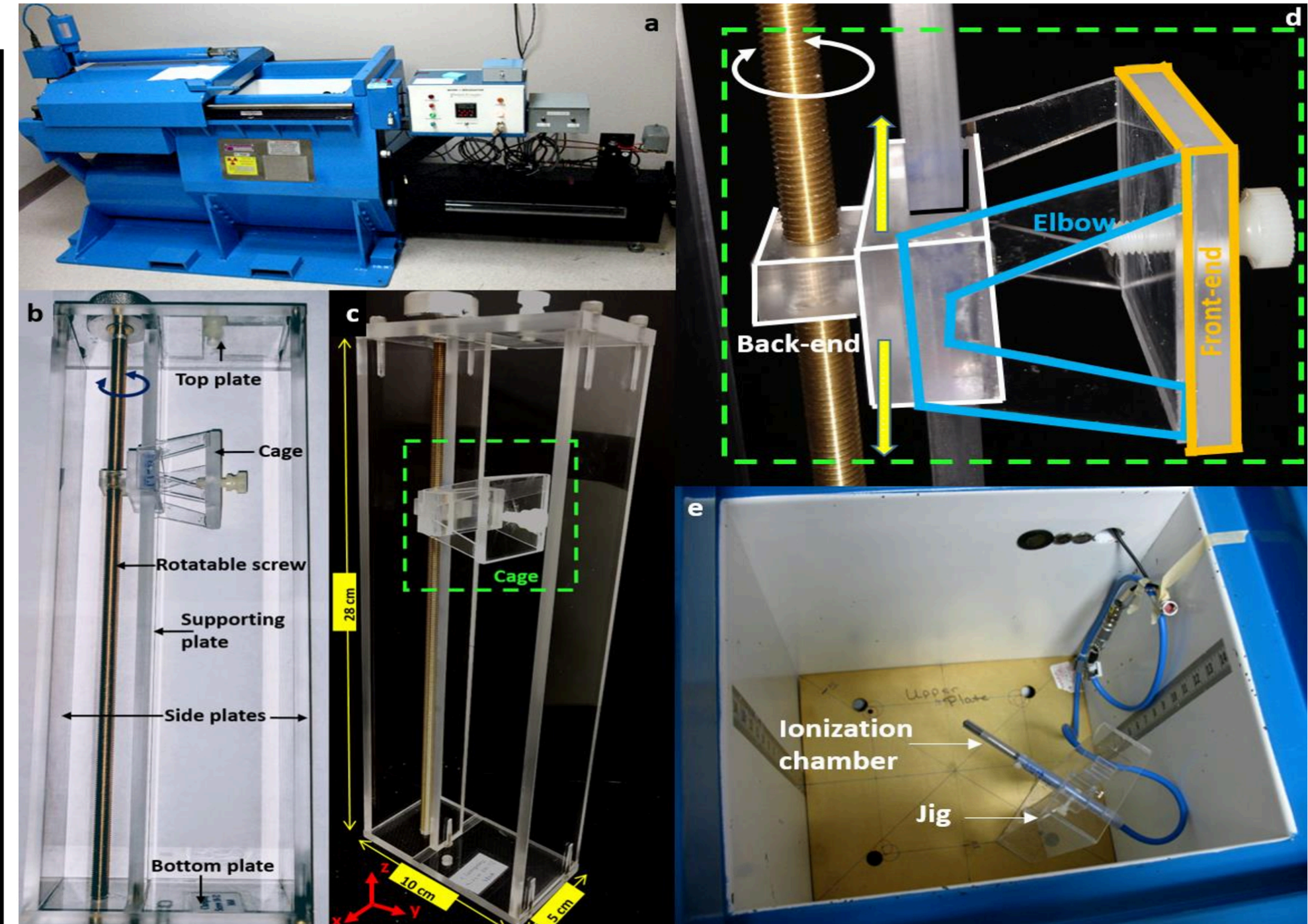
- ❑ J.L. Shepherd Mark I-68<sup>1</sup> (Cs-137) has been widely used in preclinical research.
- ❑ Ionization chamber needs to be positioned horizontally inside the irradiation chamber for routine in-air dose output calibration.
- ❑ Dedicated mounting jig is needed to firmly hold an ionization chamber for Mark I-68.

## METHOD

- ❑ The design has minimal amount of Lexan to prevent significant scatter reaching the ionization chamber's thimble.
- ❑ The jig has top and bottom horizontal plates ( $5 \times 10 \times 0.5 \text{ cm}^3$ ) glued to two vertical side plates ( $5 \times 0.5 \times 28 \text{ cm}^3$ ).
- ❑ A rotatable screw (30 cm long, 0.93 mm/turn) was inserted from top to the bottom plate to support a cage, which holds the chamber.
- ❑ Cage has two supporting plates in the back-end connected to a larger front-end plate via two thin plate angular elbows.
- ❑ The first back-end plate is inserted into the rotatable screw and the second plate is glanced through another plate ( $3.5 \times 0.5 \times 28 \text{ cm}^3$ ).
- ❑ Screw enables precise adjustment of the source-to-chamber distance.
- ❑ Bottom plate is screwed onto the irradiator table and the ionization chamber is inserted horizontally through the elbows.
- ❑ The AAPM TG-61 was employed to determine in-air dose rates.

## RESULTS

1. The irradiator shown in Figure 1 (a) has a encapsulated horizontal linear Cs-137 source and a source guide.
2. The mounting jig is shown in Figure 2 (b) and (c):
  - ❑ Top, bottom base-plates and two vertical side plates.
  - ❑ Rotatable screw with the knob.
  - ❑ Cage to hold the ionization chamber.
  - ❑ Supporting plate to glide the cage
3. The cage is shown in Figure 2 (d):
  - ❑ Front-end plate.
  - ❑ Back-end plate connected to the rotatable screw.
  - ❑ Supporting plate connected to the back-end plate for glide the cage up and down.
4. The jig can be placed on the table, where the major axis of the vertical tube is along the rotation axis of the table.
5. An ionization chamber ( $0.3 \text{ cm}^3$  Semiflex, Type N31013) can be mounted inside the elbows at a desired height upstream from the table.
6. Once the ionization chamber is inserted from the elbows of the cage, the screw in the front-end is able to tightly hold the ionization chamber horizontally (center of the thimble is 11.6 cm upstream from the table center).



## CONCLUSIONS

- ❑ This jig can allow for in-air ionization chamber measurements of different source-to-chamber distance.
- ❑ Dose output results using the proposed jig and TG-61 agreed well (within 2%) with the reference dose rates decayed to the measurement dates.

## REFERENCE

- 1 Brady S.L et al. Characterization of a Cs-137 irradiator from a new perspective with modern dosimetric tools. *Health physics* 2009; 97; 195-205

## CONTACT INFORMATION

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