United Lincolnshire Hospitals NHS
NHS Trust

CT chamber calibration issues

David Platten

Clinical Scientist, Radiation Protection and Radiology Physics

david.platten@ulh.nhs.uk

Our measurement equipment

- RTI Piranha
- RTI chamber adapter v 1.0
- Capintec C114P ionisation chamber
  - The issue I'm describing here doesn't apply if you have an RTI chamber

- Calibrated by RTI in Sweden

New scanners

- Canon Aquilion Prime SP
- Measured CTDI in air and CTDI in phantoms and compared to Canon specification (technical manual)
- Canon specification is ± 20 %
- Concerned about our results
  - borrowed an Unfors system from Leicester to repeat the measurements

In-air

- Head mode (M fov); 300 mA; 1 s; 5.0 x 4 mm

kV	measured CTDI (mGy)	Canon spec (mGy)	deviation (%)	Leicester (mGy)	deviation (%)
80	23.2	18.2	**27**	21.6	**19**
100	44.3	38.4	**15**	41.4	**8**
120	71.2	65.0	**10**	66.6	**2**
135	94.9	90.4	**5**	88.8	**-2**

In-air

- Body mode (L fov); 300 mA; 1 s; 5.0 x 4 mm

kV	measured CTDI (mGy)	Canon spec (mGy)	deviation (%)	Leicester (mGy)	deviation (%)
80	14.9	14.0	**6**	13.9	**-1**
100	31.6	29.5	**7**	29.7	**1**
120	53.8	50.0	**8**	50.8	**2**
135	74.5	69.5	**7**	70.2	**1**

16 cm phantom

- Head mode (M fov); 300 mA; 1 s; 5.0 x 4 mm

kV	measured CTDI (mGy)	Canon spec (mGy)	deviation (%)	Leicester (mGy)	deviation (%)
80	16.0	13.7	**16**	14.7	**7**
100	32.5	27.8	**17**	29.8	**7**
120	53.6	46.1	**16**	48.6	**5**
135	72.2	62.3	**16**	66.4	**7**

32 cm phantom

- Body mode (L fov); 300 mA; 1 s; 5.0 x 4 mm

kV	measured CTDI (mGy)	Canon spec (mGy)	deviation (%)	Leicester (mGy)	deviation (%)
80	5.3	4.6	**16**	4.8	**5**
100	12.4	10.8	**15**	11.2	**4**
120	21.4	19.4	**10**	19.5	**0**
135	30.9	27.4	**13**	29.1	**6**

Discussed calibration with RTI

- Each component separately calibrated
  - Chamber adapter connected to a current calibrator and response measured; passed
  - CT chamber connected to a standard electrometer and response compared with a reference instrument; passed

Independent calibration

- RRPPS in Birmingham
- Calibrated as a system

Radiation quality	kV	First HVL (mm Al)	Response	Calibration factor
RQR5	70	2.6	**1.12**	**0.90**
RQR7	90	3.5	**1.12**	**0.89**
RQR9	120	5.0	**1.11**	**0.90**
RQR10	150	6.6	**1.11**	**0.90**
RQT8	100	6.9	**1.11**	**0.90**
RQT9	120	8.4	**1.10**	**0.92**
RQT10	150	10.1	**1.10**	**0.91**

Discussed with RTI again

- Known issue with chamber adapter v 1.0 when used with large volume ionisation chambers
  - A hardware upgrade fixes this issue (v 1.1)
  - Perhaps the same hardware upgrade would help with our Capintec chamber?
- Chamber adapter and chamber sent to Sweden
  - Chamber adapter upgraded to v 1.1; response changed by ~ 5 %
  - Recalibrated
  - Now works as expected

Thanks for listening

Any questions?