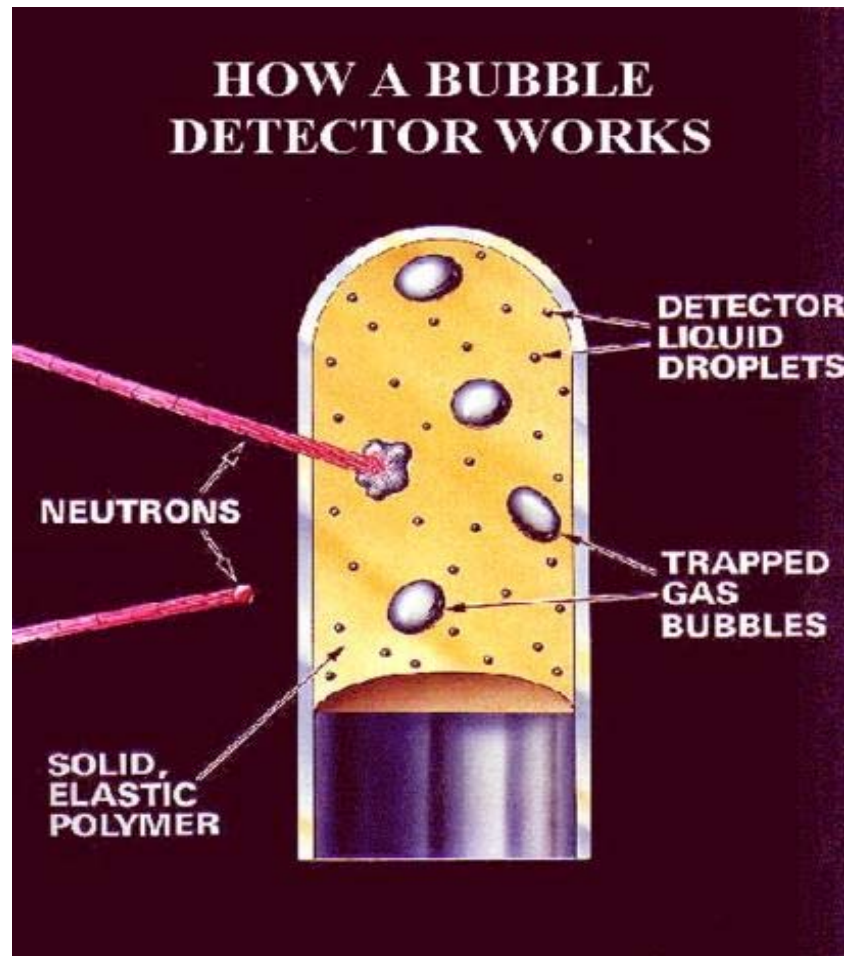


Investigation of the linearity and temperature characteristics of bubble detectors

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Mechanics of Bubble Production

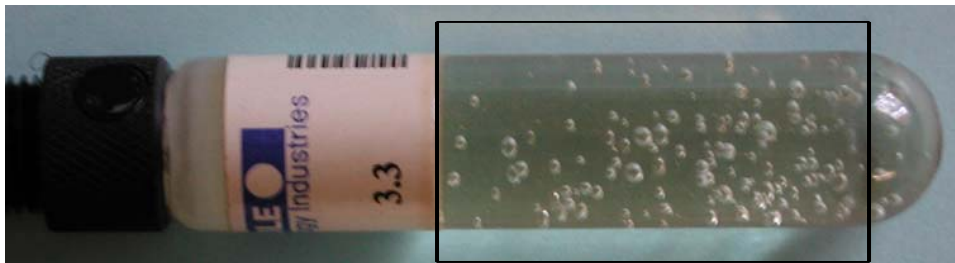


- Bubbles produced through secondary ionisation
- Neutrons collide with nuclei in drops of superheated liquid
- Recoil fluorine ions create bubbles
- Bubbles fixed “trapped” in detector

Bubble detector details

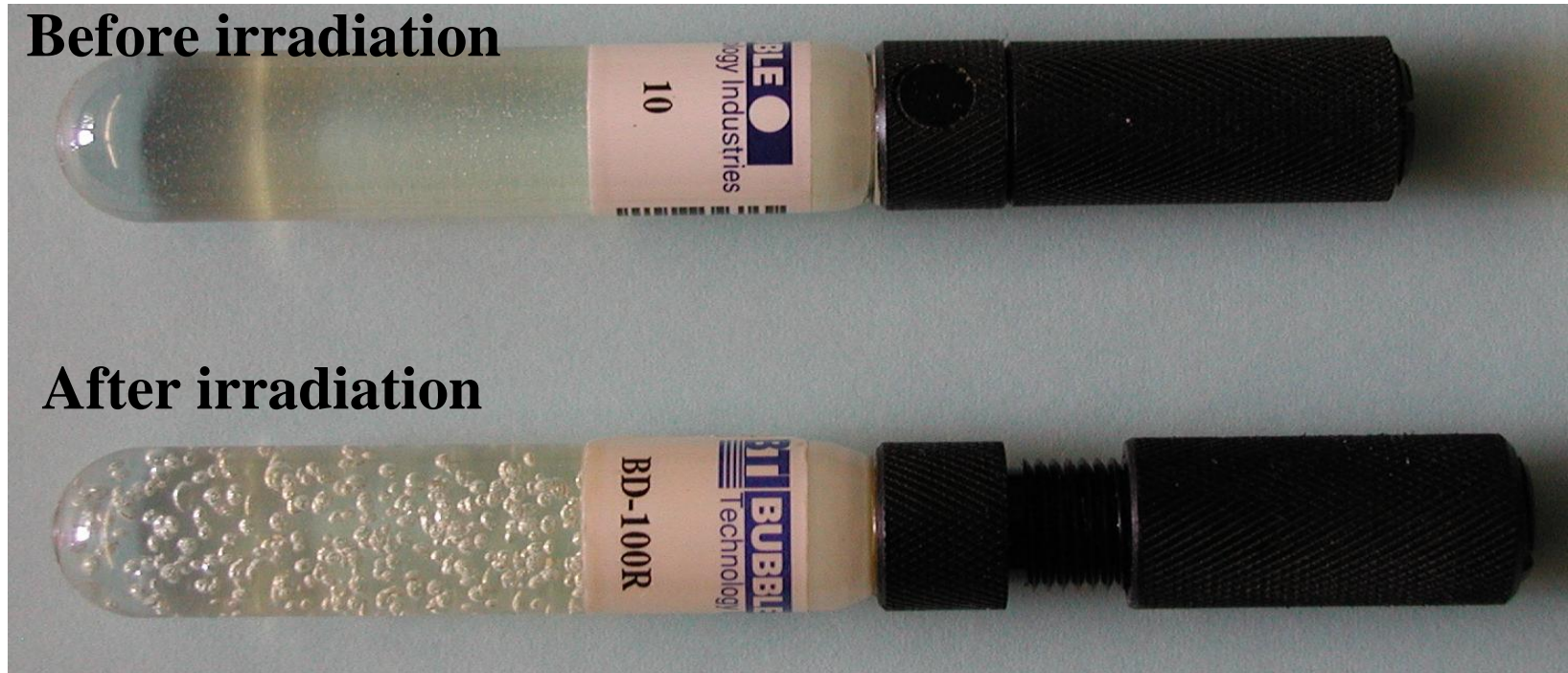
BTI BD-100R bubble detectors

- Sensitivities used: 0.33 b/mrem, 3.3 b/mrem & 10 b/mrem (i.e. 0.033, 0.33, and 1 b/ μ Sv)
- Detectors are reported to be insensitive to photons
- They are re-usable
- Only bubbles in indicated region are counted



Measurements at hospital Linacs

6 MV Linacs at Maidstone Hospital



- Measurements made at 6 MV on both a dual energy Linac and single energy 6 MV Linac
- Bubbles formed at the isocenter for each Linac

Measurements at hospital Linacs

Off-set Measurements at 6 MV and 15 MV

Photon dose of 0.5Gy at 15 MV Linac



Photon dose of 5Gy at 6 MV Linac

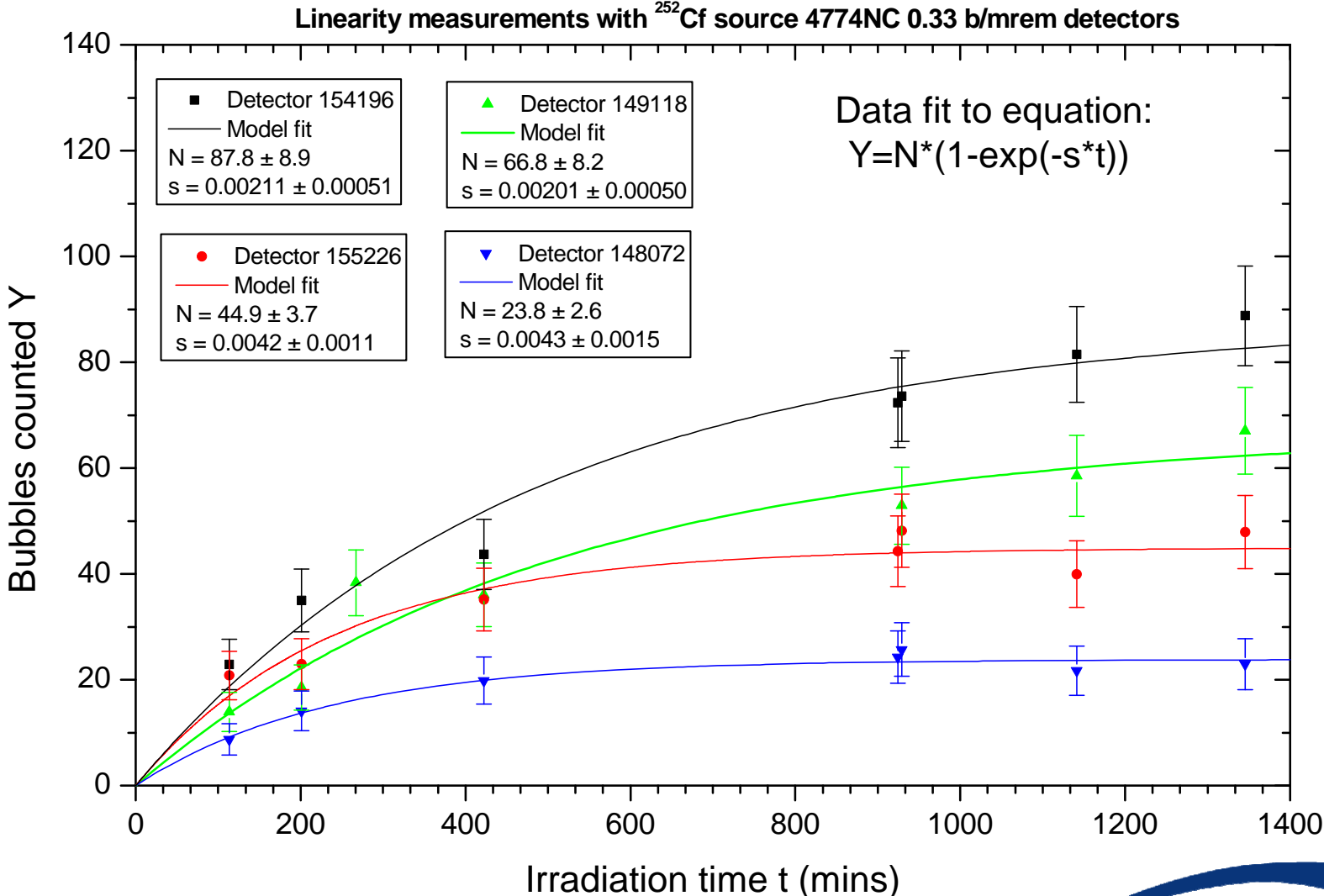


Analysis of Linac results

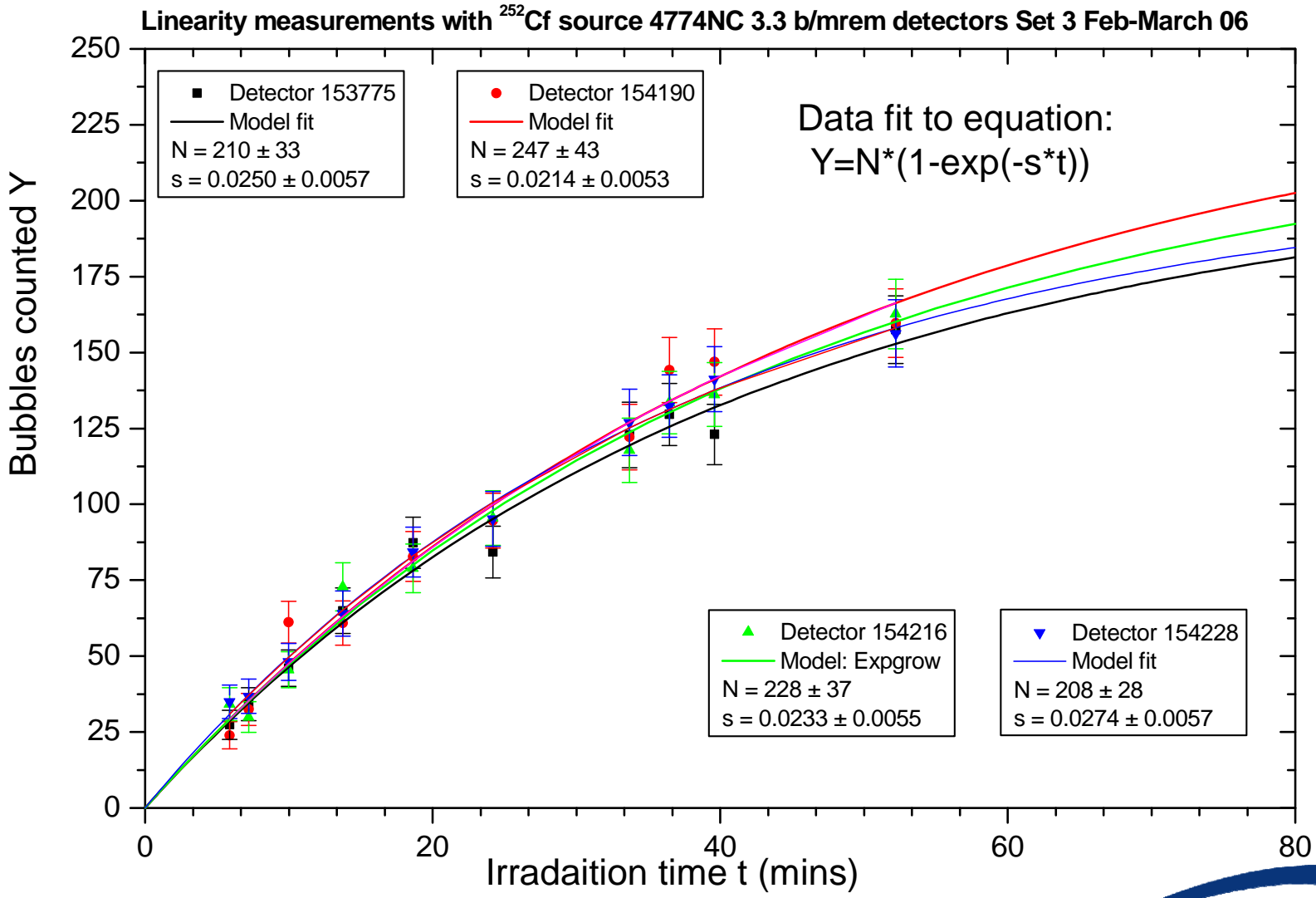
- Result for 15 MV run shows an apparently random distribution of bubbles
- Result for 6 MV run clearly shows bubbles were only formed within the collimated incident photon beam

Conclusion: these devices are not as photon insensitive as we would like!

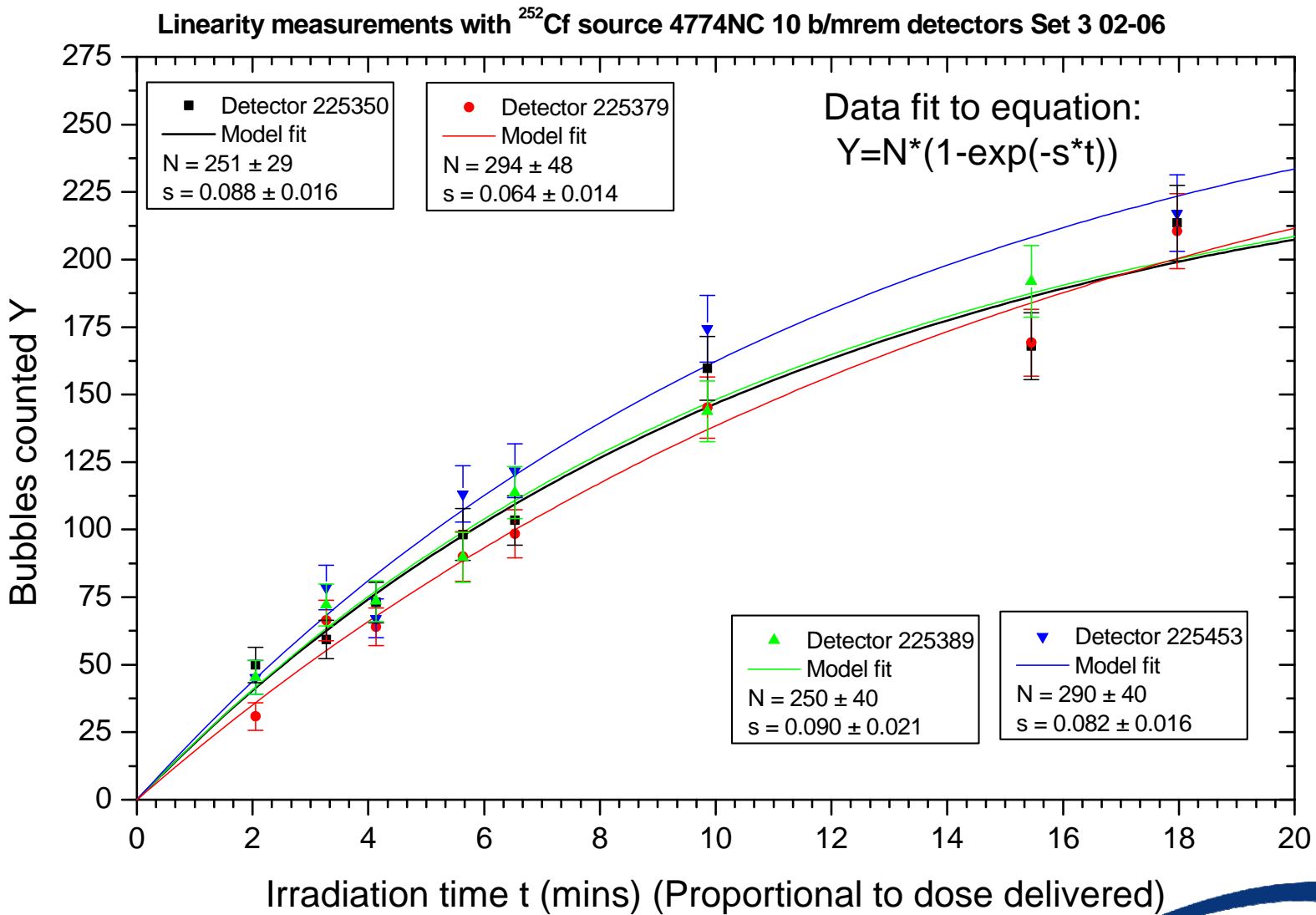
Linearity measurements for 0.33 b/mrem detectors



Linearity measurements for 3.3 b/mrem detectors



Linearity measurements for 10 b/mrem detectors



Linearity analysis

- All detectors show non-linear characteristics
- Most pronounced in 0.33b/mrem detectors
- Limited number of superheated sites being used up during irradiation **could be** cause of saturation effects
- Pressure build up in detector during irradiation due to bubble formation is another **possible** cause

Damage to bubble detectors during storage



- Vaseline leaks from detectors and white residue remains
- Lack of Vaseline leads to lack of pressure for recompression
- Unable to re-use as bubbles stay in detector

Conclusions

- Bubbles seen at the isocenter during hospital Linac measurements at both 6 MV and 15 MV
- Neutron production in the Linac target at 6 MV is possible but very unlikely
- Investigation has shown non-linear characteristics of detectors
- An individual calibration is needed for each detector
- Some problems with storage