

Can GATE Be Used For Monte Carlo Calibrations Of Whole Body Counters?

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1. Background

GATE is an open source software, on a GEANT4 platform, dedicated to medical use such as PET and SPECT.

Is it possible to use GATE for problems specific to whole body counting, WBC, as well?

For Monte Carlo calibrations of WBCs, can GATE be used instead of in-house codes, or general-purpose codes that may not be specific enough for WBC purposes?

If so, then a rather small field of research could benefit from the already extensive work done in a larger.

2. Purpose

To determine if GATE be used for Monte Carlo calibrations of WBC scintillator spectrometer systems

3. Method

Figure 1 shows a schematics of a whole body counting system at the University of Gothenburg. The WBC consists of four large plastic detectors, each connected to 2 photomultiplier tubes.

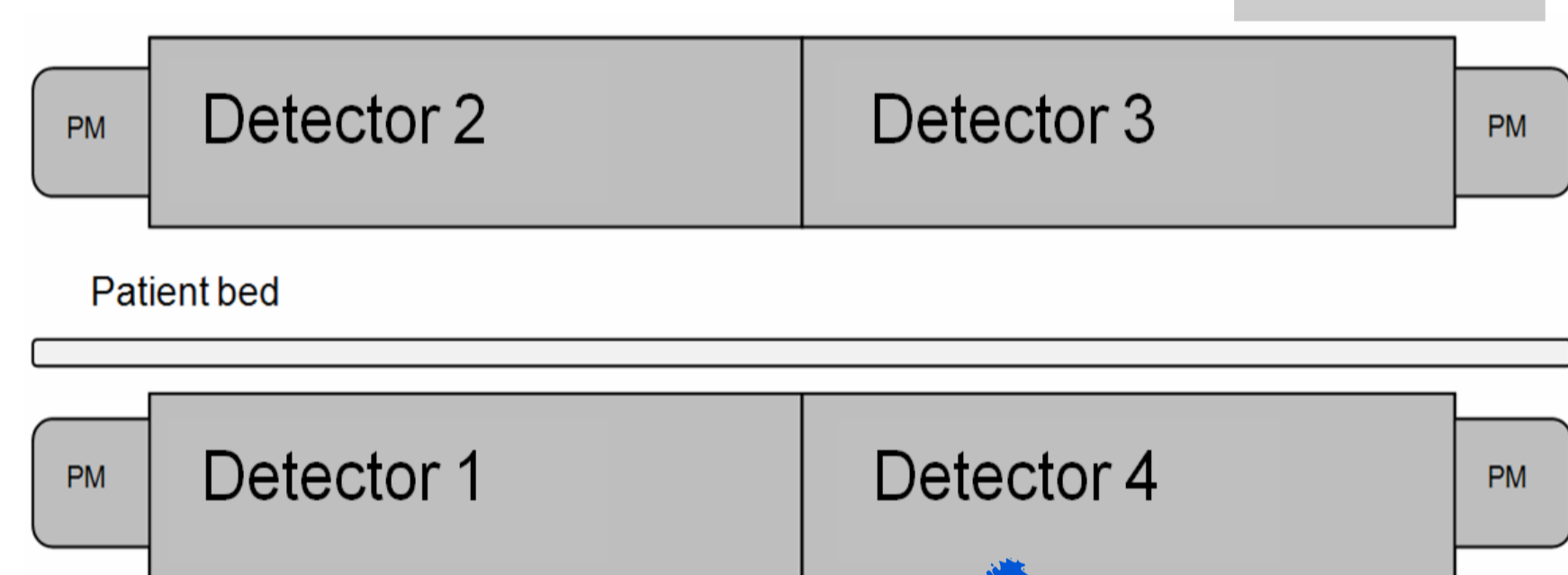
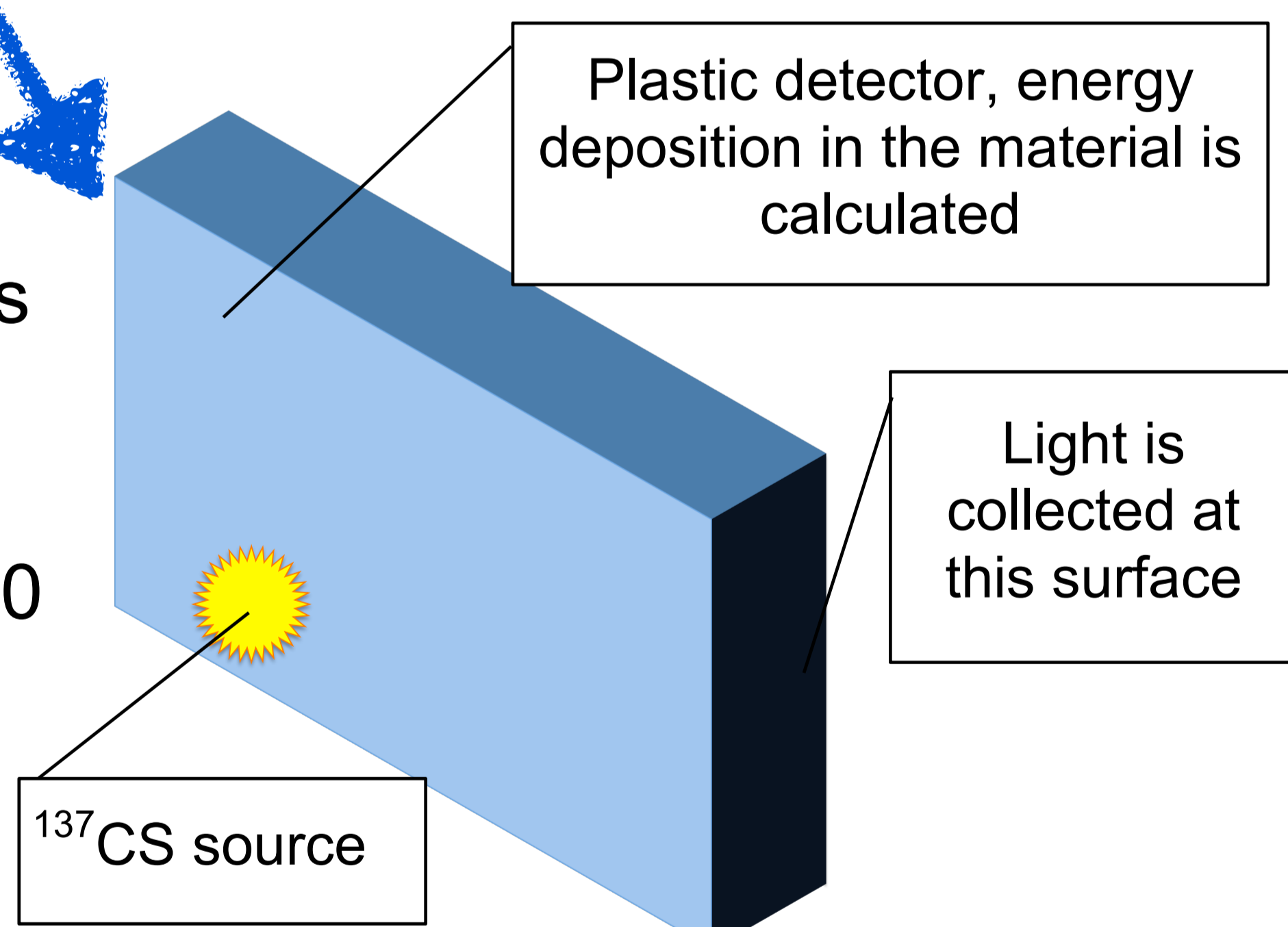


Figure 1.
A WBC where each detector measures $91.5 \times 76.0 \times 25.4 \text{ cm}^3$.

To determine if GATE can be used for systems like this and alike we looked at **one generic detector**.

Plastic material: C9, H10
Density: 1.032 g/cm^3
Measurements: $91.5 \times 76.0 \times 25.4 \text{ cm}^3$.



The following was calculated for a ^{137}Cs point source

- ✓ Energy deposition, results in figure 2
- ✓ Light transport for a teflon wrapped detector with two finishes: rough and polished, results in figure 3
- ✓ Spectrum broadening (15 % at 661.7 keV) of energy deposition and spectrum broadening of collected light spectrum (both to mimic the effect of multiplication in a PMT). Results for the energy broadening is in figure 2

If GATE could be used with ease to model these quantities then it would be an appealing code for Monte Carlo calibrations of WBC spectrometer systems.

4. Results

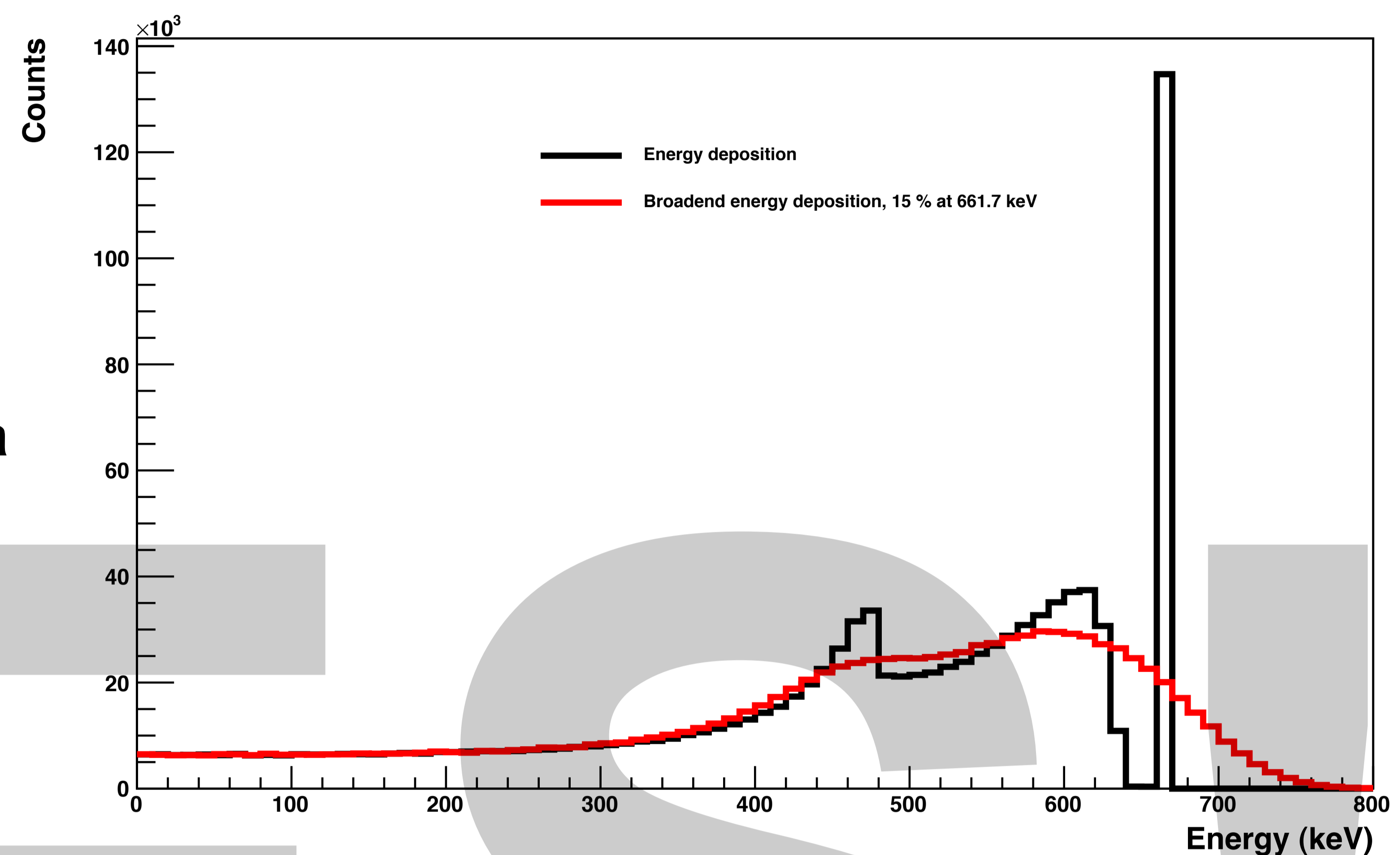


Figure 2. The energy deposition and spectrum broadening

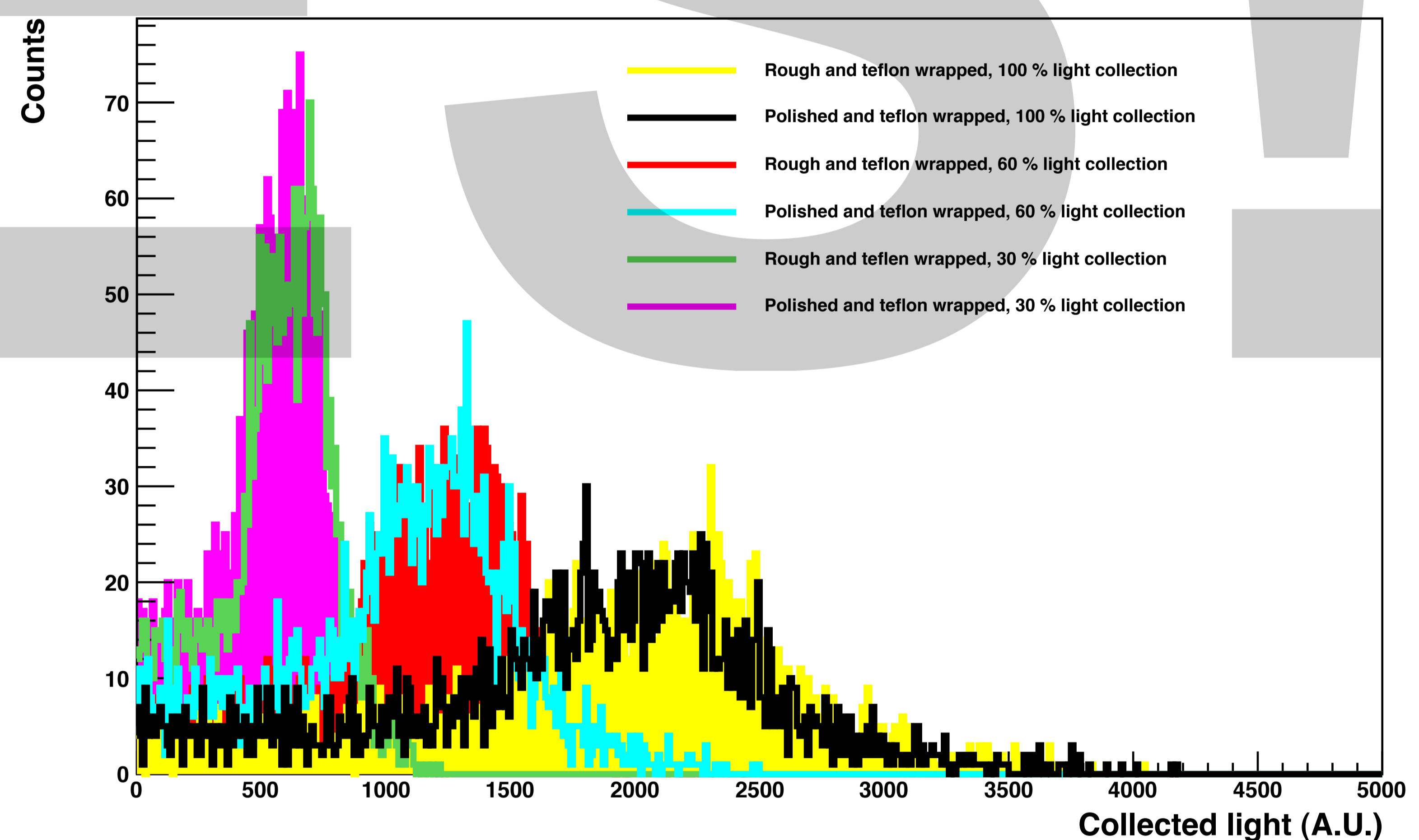


Figure 3. The collected light for different different finishes and light collection efficiency.

About the results

- + GATE can model light transport and signal processing
- + GATE is general enough to model whole body counters
- Hard to know what's really going on without knowing a little bit of GEANT4
- Don't expect further GATE development to take WBC issues into account

5. Conclusion

YES! GATE can be used for calibration of whole body counters!

(And we're working on an article about it)

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