

# EVALUATION OF CLINICAL SPECT ACQUISITION PARAMETERS FOR QUANTITATIVE AND QUALITATIVE <sup>177</sup>Lu IMAGING USING A NEMA IEC PHANTOM

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## INTRODUCTION

Post-therapy <sup>177</sup>Lu SPECT/CT supports radioligand biodistribution assessment and patient-specific dosimetry. High image quality and quantitative accuracy are essential for reliable clinical interpretation and organ/lesion dose assessment. SPECT performance may be **influenced by the acquisition parameters: time per view, matrix size, and number of projection views.**

## OBJECTIVE

To evaluate the **individual and combined effects of manipulating SPECT acquisition parameters** on <sup>177</sup>Lu SPECT image quality (CNR, FWHM) and quantitative accuracy (RC<sub>mean</sub>), and determine whether modification of the current clinical protocol is justified.

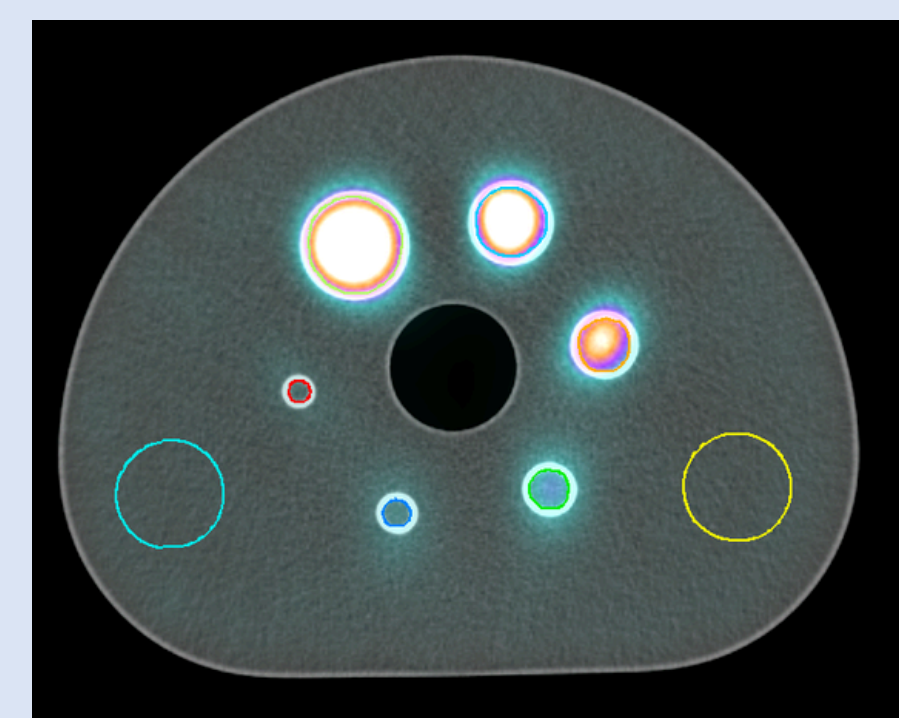


Figure 1: NEMA IQ Phantom used in this study for SPECT acquisition.

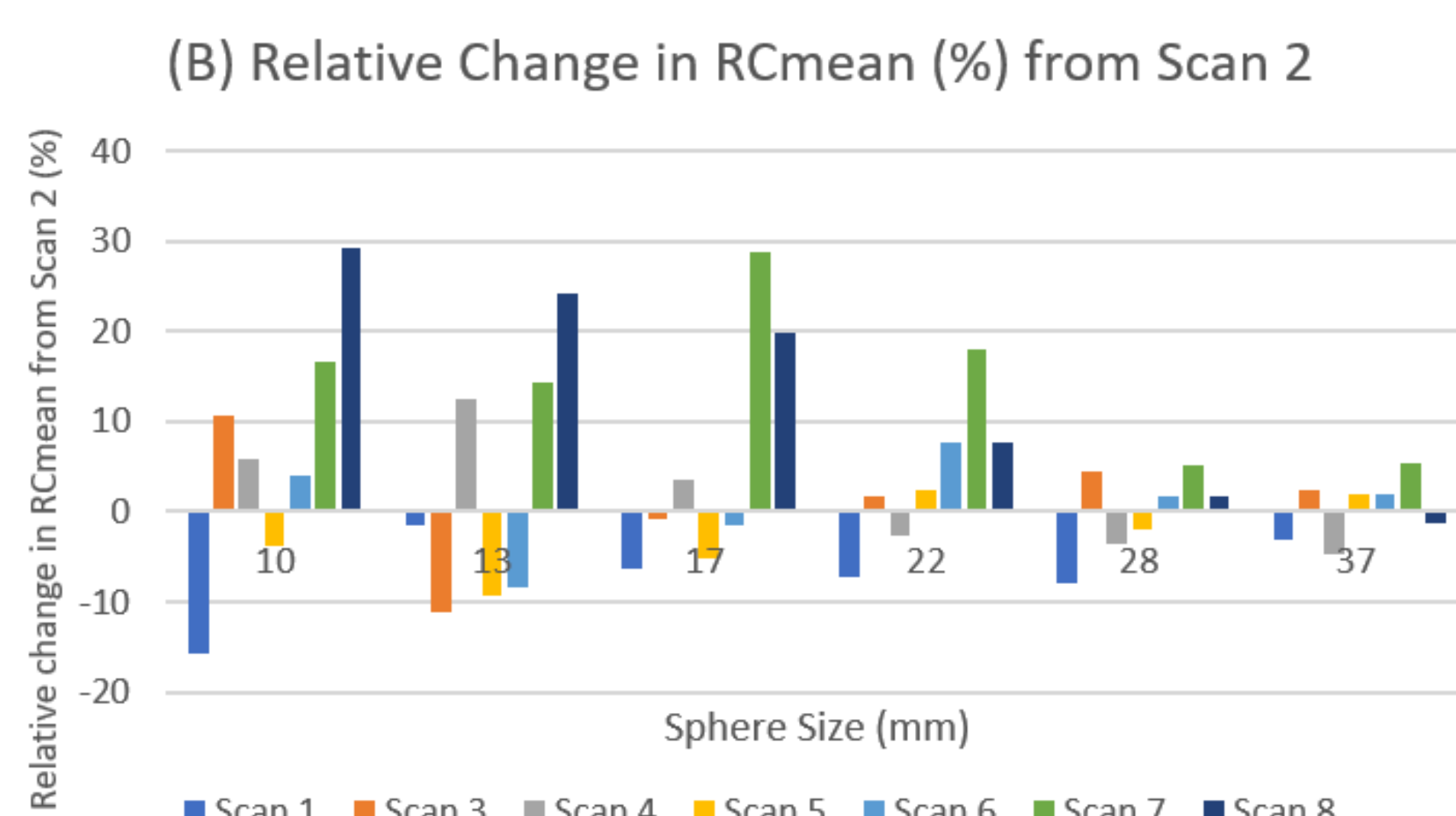
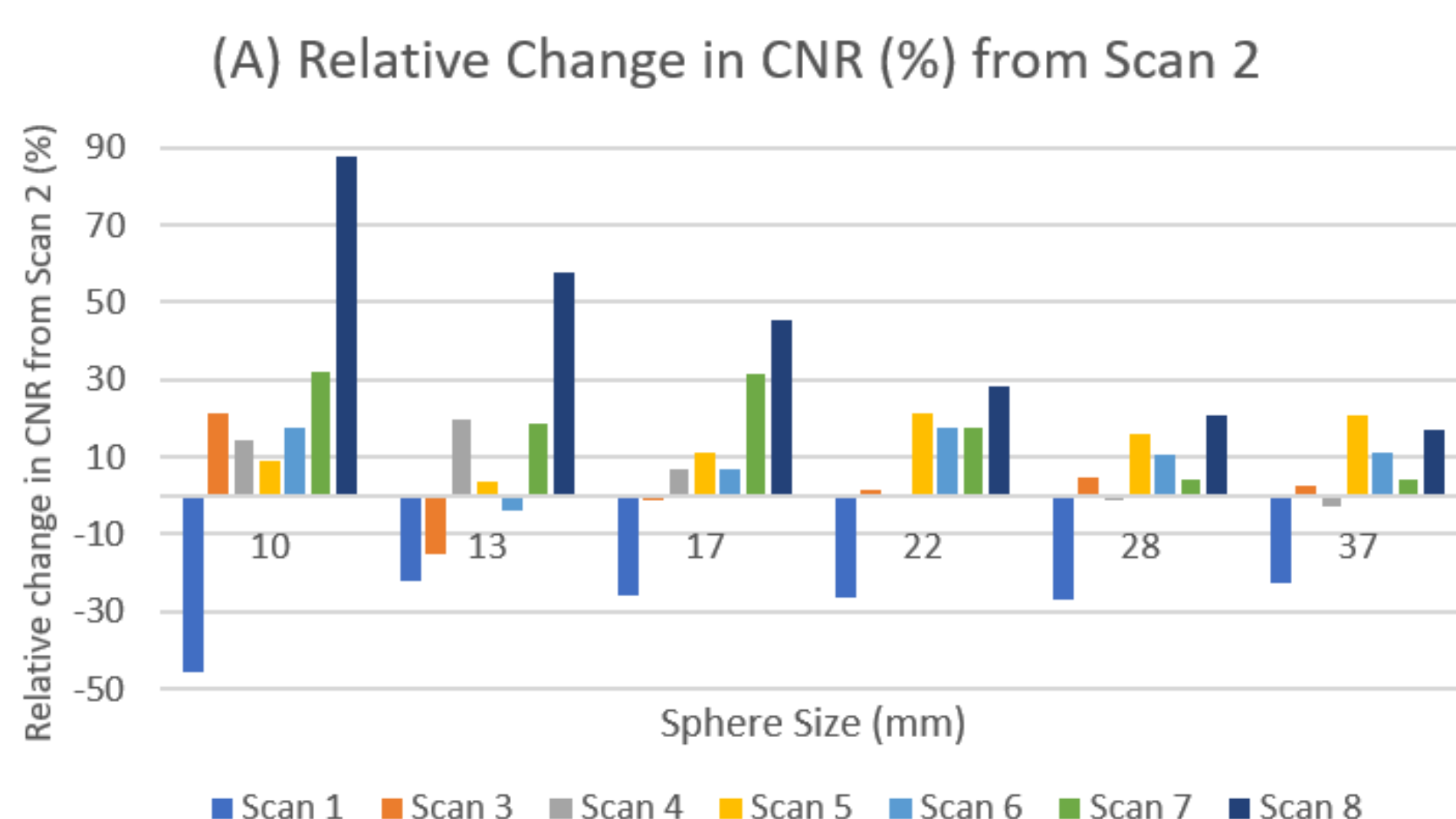
## METHODOLOGY

A NEMA IEC image quality phantom with six fillable spheres (10–37 mm) was prepared at a 50:1 sphere-to-background activity concentration ratio using <sup>177</sup>Lu-PSMA (Pluvicto), representative of clinical tumor-to-blood-pool activity accumulation. Eight SPECT/CT acquisitions were performed using a Siemens Symbia Intevo 16 system according to the acquisition protocols shown in Table 1, and images were analyzed using MIM. Relative changes in CNR, FWHM, and RC<sub>mean</sub> were calculated relative to the current clinical protocol (Scan 2).

Table 1: Acquisition Parameters for the 8 Scans (Scan 2: Current Clinical Protocol)

| Scan | Time per view (s) | Matrix size | No. of projection view |
|------|-------------------|-------------|------------------------|
| 1    | 15                | 128 × 128   | 32                     |
| 2    | 25                | 128 × 128   | 32                     |
| 3    | 35                | 128 × 128   | 32                     |
| 4    | 25                | 256 × 256   | 32                     |
| 5    | 25                | 128 × 128   | 36                     |
| 6    | 25                | 128 × 128   | 40                     |
| 7    | 35                | 128 × 128   | 36                     |
| 8    | 35                | 256 × 256   | 36                     |

## RESULTS



- Time per view:** 15 s/view (Scan 1) reduced CNR by 21.8–45.4% and RC<sub>mean</sub> by 1.6–15.8%, **due to reduced photon statistics**. At 35 s/view (Scan 3), variable changes in CNR (–15.2 to +21.5%) and RC<sub>mean</sub> (–11.2 to +10.7%) likely **due to statistical variation**.
- Matrix size:** 256 × 256 (Scan 4) improved CNR by 6.7–19.7% and RC<sub>mean</sub> by 3.6–12.4% in smaller spheres (10–17 mm), **due to finer spatial sampling with smaller pixel size**. Benefits were limited for larger spheres (22 to 37 mm).
- No of Projection views:** 36 and 40 views (Scans 5 and 6) improved CNR by 3.4–21.2% and 6.9–17.6%, respectively, **due to improved angular sampling**. RC<sub>mean</sub> changes remained variable (–9.3% to +7.6%), indicating limited quantitative benefit.
- Combined parameter manipulation:** Both Scans 7 and 8 improved CNR and RC<sub>mean</sub>, with Scan 8 showing **greater CNR** (16.9–87.9%) and **RC<sub>mean</sub>** (1.8–29.3%) **improvements for most spheres than individual changes**.
- FWHM:** Changes remained minimal across all protocols (≤6.5%), **indicating limited influence on spatial resolution**.

## CONCLUSION

Individual parameter manipulation showed limited benefits, with the current clinical protocol remaining a practical compromise. Combined manipulation outperformed individual changes and warrants further clinical evaluation for <sup>177</sup>Lu SPECT lesion quantification.

## REFERENCES

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