2026 JULY 19–22 VANCOUVER, BC
JOINT AAPM | COMP MEETING

Commissioning and Clinical Validation of Geneva Universal Brachytherapy Applicator: Acceptance Testing and TPS Integration

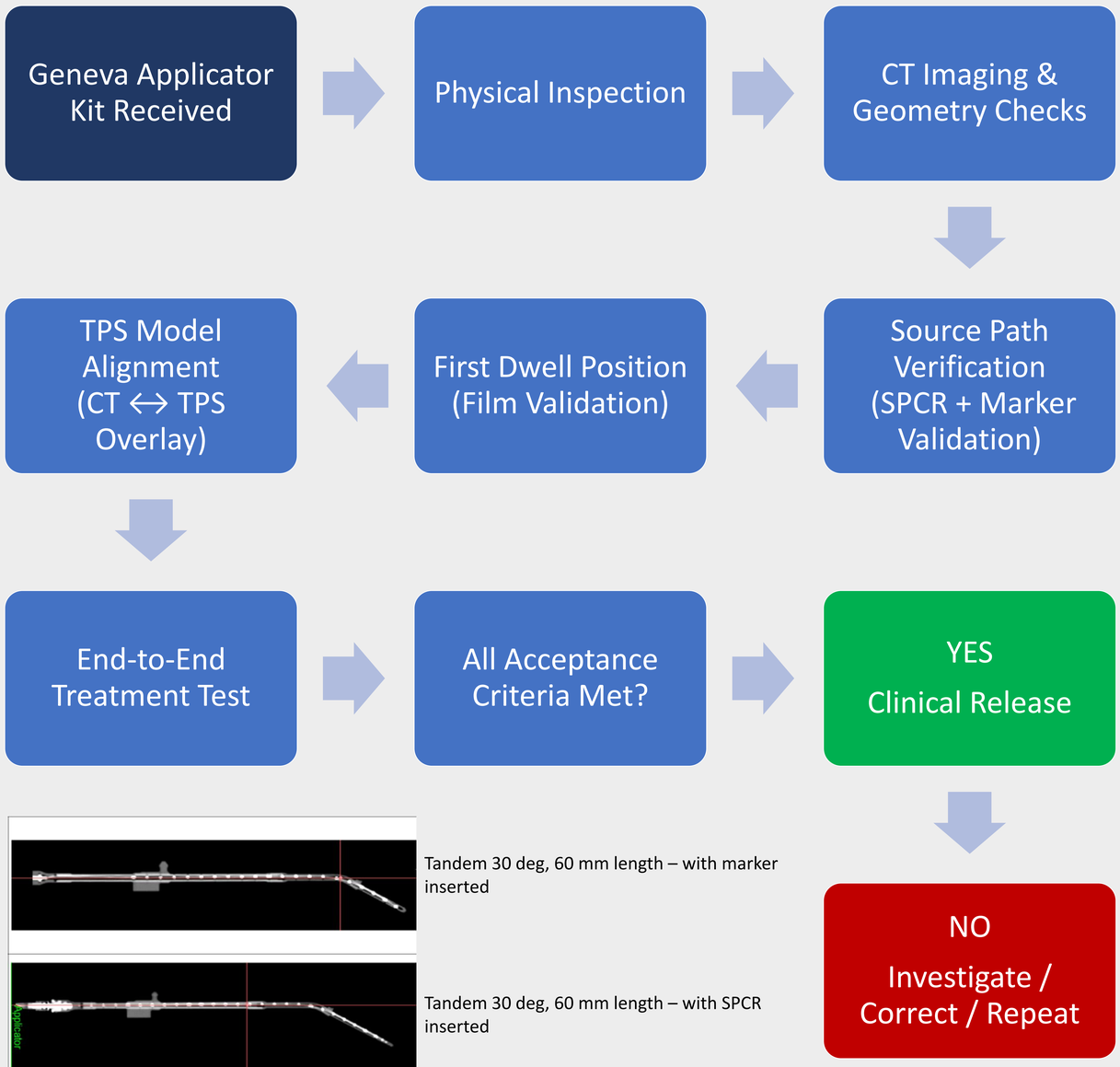
Nicholas Becerra-Espinosa, MS[1]; Michael Ashenafi, MS[2]
[1]Department of Radiation Oncology, University of Rochester, Rochester, NY

INTRODUCTION

High-dose-rate (HDR) brachytherapy applicators require comprehensive acceptance testing prior to clinical use to verify mechanical integrity, geometric accuracy, source positioning, and Treatment Planning System (TPS) representation. The Elekta/Nucletron Geneva Universal Applicator is a modular intracavitary/interstitial system that requires validation of multiple interchangeable components. This study describes the commissioning workflow developed to ensure safe clinical implementation.

METHODS AND MATERIALS

A complete Geneva applicator kit including 0°, 30°, and 45° tandems, 15–30 mm interstitial ovoids, rectal retractors, needle-access tandem, and accessories underwent acceptance testing. Evaluation consisted of physical inspection, CT-based geometric verification, source path verification using a Source Position Check Ruler (SPCR), first dwell position validation using film and a 3D printed phantom, TPS model verification overlaying CAD models onto CT datasets, and end-to-end validation.

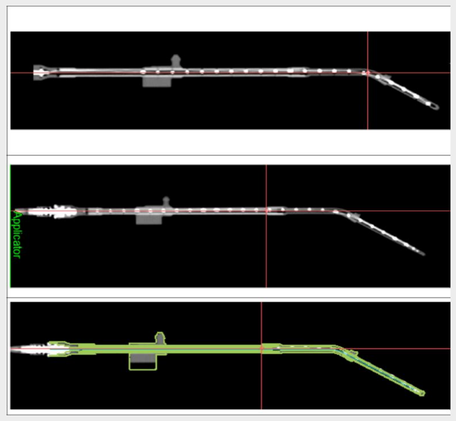


RESULTS

All acceptance criteria were successfully met:

- No mechanical defects identified
- CT measurements agreed with specifications within 1 mm
- Source paths matched SPCR reference positions
- First dwell positions agreed within 0.5 mm
- TPS applicator models accurately overlaid CT images
- End-to-end treatment plans were successfully delivered

.



Tandem 30 deg, 60 mm length – with marker inserted

Tandem 30 deg, 60 mm length – with SPCR inserted

Tandem 30 deg, 60 mm length – Model

DISCUSSION

Commissioning of modular HDR applicators requires verification beyond physical inspection alone. Combining geometric validation, source path testing, TPS model confirmation, and treatment simulation provides confidence that the virtual applicator accurately represents the physical device. This workflow establishes a reproducible framework for commissioning advanced gynecologic brachytherapy applicators while improving clinical safety.

CONCLUSIONS

The Geneva Universal Applicator successfully passed all acceptance tests prior to first patient use. Mechanical integrity, geometric accuracy, source positioning, TPS model alignment, and end-to-end treatment delivery met institutional acceptance criteria. The developed methodology provides a standardized and practical commissioning protocol for HDR brachytherapy applicators.

REFERENCES

1. Geneva Applicator Instructions for Use (Elekta)
2. AAPM TG-56
3. University of Rochester Geneva Acceptance Report

KEY FINDINGS

- **Comprehensive acceptance testing verified mechanical integrity and dimensional accuracy of all Geneva applicator components.**
- **CT imaging, SPCR measurements, and radiographic film confirmed accurate source path geometry and first dwell position.**
- **TPS applicator models demonstrated excellent agreement with CT-acquired applicator geometry.**
- **End-to-end treatment simulation confirmed safe clinical implementation prior to first patient use.**

IMPLICATIONS

- **Acceptance testing should extend beyond physical inspection to include imaging, source path verification, TPS validation, and treatment delivery simulation.**
- **Combining these verification steps improves confidence in applicator accuracy before clinical implementation.**
- **The presented workflow offers a practical commissioning template that can be adopted for Geneva and similar modular HDR brachytherapy systems.**

1850 MELIORA
UNIVERSITY of ROCHESTER

CONTACT

Nicholas Becerra-Espinosa
NM Delnor Cancer Center
300 S Randall Rd
Geneva, IL 60134
nicholas.becerraespinosa@nm.org
708-789-0259

© Poster Template by Genigraphics® 1.800.790.4001 www.genigraphics.com