Poster #13

Modeling and Simulation for Flexible Ureteroscopy

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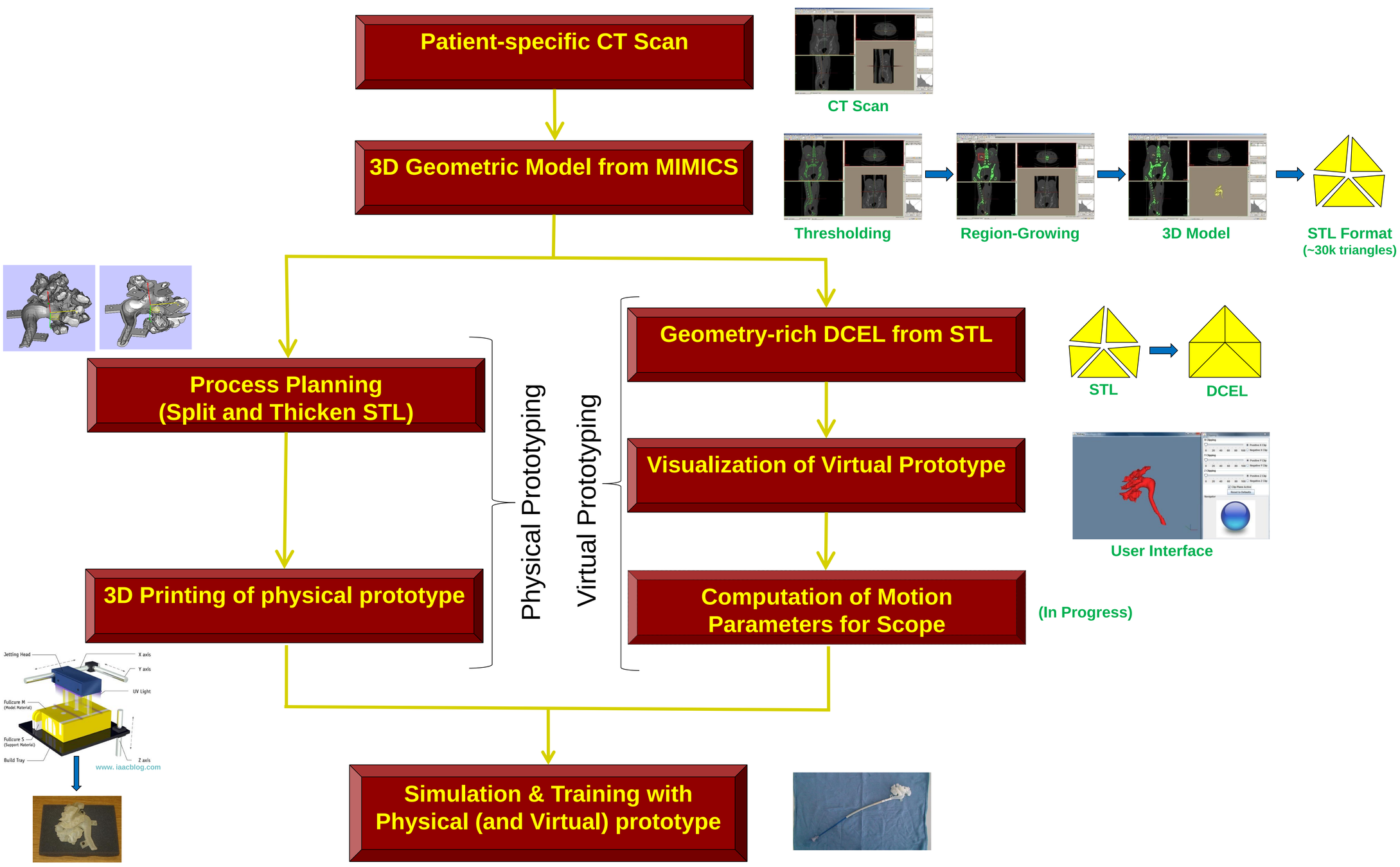
Introduction

Background: *A* flexible ureteroscope is a small-caliber endoscope for treating stones, scar tissue, and tumors in the ureter and collecting system of the kidney. Presently, surgical planning decisions (e.g., understanding patient-specific calyceal anatomy, identifying stone size and location, and scope selection and manipulation) are based on images taken externally via X-Ray fluoroscopy and CT, and internally by a fiber-optics-based system at the tip of the scope. Synthesis of these (essentially 2D) data modalities into a common mental model is done by the practitioner, with no opportunity for patient-specific procedural rehearsal.

Goal: This project aims to improve the quality and efficacy of the surgical decisions made by the urologist by using a combination of physical and virtual prototyping in 3D. Specifically, 3D-printing techniques are used to generate, from CT scan data, a physical model of the collecting system (calyces) on which scope manipulations can be practiced. A computer-based interface and associated algorithms are also under development to facilitate simulation studies and interaction with a virtual model.

Methods



Results

- Built soft, flexible physical prototype via PolyJet process using TangoPlus material at Solid Concepts (www.solidconcepts.com)
- Tested soft prototype in saline bath with DUR8E scope, single action pump navigability, and stone extraction capability
- Experienced realistic tactile and visual feedback
- Able to snare stones in renal pelvis (but not in calyx)



Conclusion

The development of a patient-specific physical prototype of the collecting system is feasible and, with proper validation, may prove beneficial in training residents in flexible ureteroscopy.

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