

# Sixth National Image-Guided Therapy Workshop



**March 21-23, 2013**  
**Washington, DC**

[www.ncigt.org](http://www.ncigt.org)

## **Workshop Chairs**

Ferenc Jolesz, MD  
Clare Tempany, MD  
Kevin Cleary, PhD  
Andreas Melzer, MD  
Michael Marohn, MD

## **Program Chairs**

Tina Kapur, PhD  
Raj Shekhar, PhD  
Keyvan Farahani, PhD  
Steven Krosnick, MD

## Towards Open Source Infrastructure for Joint MRI/TRUS Guided Prostate Interventions

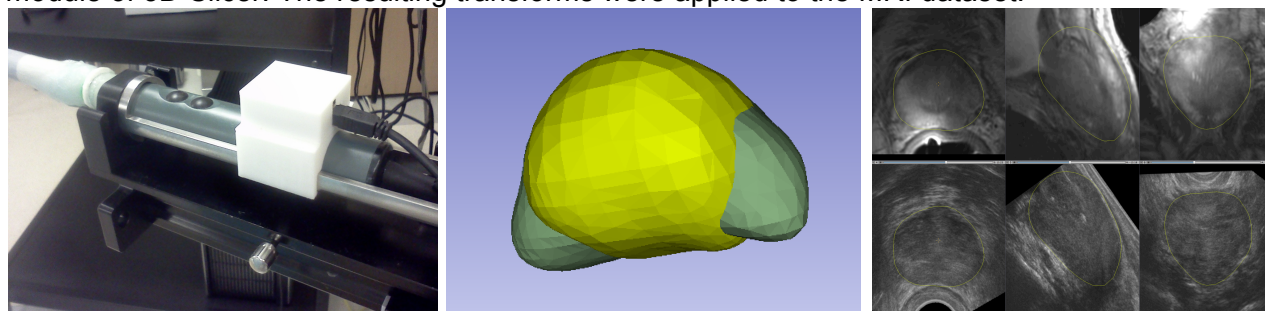
A. Fedorov<sup>1</sup>, A. Lasso<sup>2</sup>, M. Moradi<sup>3</sup>, E. Neubauer Sugar<sup>1</sup>, S.-E. Song<sup>1</sup>, R. Owen<sup>4</sup>,  
T. Kapur<sup>1</sup>, W.M. Wells<sup>1</sup>, P. Nguyen<sup>1</sup>, G. Fichtinger<sup>2</sup>, C. Tempny<sup>1</sup>

<sup>1</sup>Brigham and Women's Hospital, Boston, MA <sup>2</sup>Queens University, Kingston, ON

<sup>3</sup>University of British Columbia, Vancouver, BC <sup>4</sup>BK Medical, Peabody, MA

**Purpose** Transrectal Ultrasound (TRUS) and Magnetic Resonance Imaging (MRI) are complementary imaging modalities in visualizing anatomy of the prostate and characterizing the tissue for cancer presence. Our goal is to develop a free open-source infrastructure to facilitate image acquisition, visualization, analysis, and joint guidance for prostate interventions using these two modalities. Towards this goal, our initial step was to establish the feasibility and technical setup for research data acquisition of TRUS and TRUS/MRI registration.

**Methods** Clinical Setup TRUS image acquisition was performed during brachytherapy prostate volume studies. Per standard clinical setup, TRUS probe (BK 8848) was attached to a motorized mover (Nucletron EndoCavity Rotational Mover (ECRM)) and mounted on a stepper (Nucletron OncoSelect). Imaging was performed using the sagittal array of the probe rotated by ECRM. Research setup Camera link and OEM research interfaces of the BK ProFocus US scanner (BK Medical) were used to collect radiofrequency (RF) TRUS concurrently with the clinical image acquisition. Spatial sensor (Phidget Spatial) was attached to the handle of the probe to track sagittal array orientation during motorized sweep. Synchronous collection of the RF and tracking data was performed using Public Library for UltraSound research (PLUS)<sup>1</sup> on a workstation equipped with a camera link interface (Dalsa X64 CL Express). Post-processing We used PLUS for brightness and scan conversion, and 3D reconstruction from the tracked data. Reconstructed volumes were aligned with the T2-weighted MRI images, and the prostate gland was contoured in both volumes using 3D Slicer (<http://slicer.org>). Distance transform was applied to the gland contours. The distance maps were registered non-rigidly using BRAINS module of 3D Slicer. The resulting transforms were applied to the MRI dataset.



*Fig. 1: Left: transrectal probe setup with the tracking device attached. Middle: Rendering of the prostate gland surfaces recovered from MRI (green) and reconstructed TRUS (yellow) after rigid alignment. Right: Reformats of the T2w MRI and 3D TRUS after non-rigid registration.*

**Results** The described approach was applied in an cohort of clinical patients (n=10). Our setup was compatible with the clinical workflow and did not introduce delays or complications during the procedure. Based on the initial analysis (n=2), deformable registration was feasible and qualitative assessment deemed the results satisfactory.

**Conclusions** We demonstrated the feasibility of tracked acquisition of TRUS RF data during conventional prostate volume study procedures, and established the post-processing workflow for joint visualization of TRUS and MR imaging data. Our approach requires availability of US research interface, but otherwise relies on publicly available software and tracking components.

**Acknowledgments** Partial support by U.S. NIH CA111288 and Cancer Care Ontario, Canada.

<sup>1</sup> Public Library for UltraSound research (PLUS): <http://www.plustoolkit.org/>