Current tracked ultrasound related activities in the PerkLab

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Perk Lab perk.cs.queensu.ca

laboratory for Percutaneous Surgery

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PerkLab research profile

- Scope:
  - Minimally invasive interventions
  - Image-guided (mostly ultrasound)
  - Translational
- Implementation: open, reproducible

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Breast cancer surgery milestones

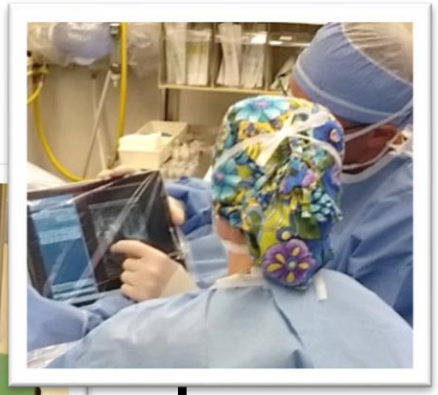
Initial idea

Clinical translation

Customized touch-screen interface

Proof of concept in phantom models

Clinical feasibility



Timeline

6 months

12 months

18 months

Ungi *et al.*, IEEE Trans Biomed Eng, 2015

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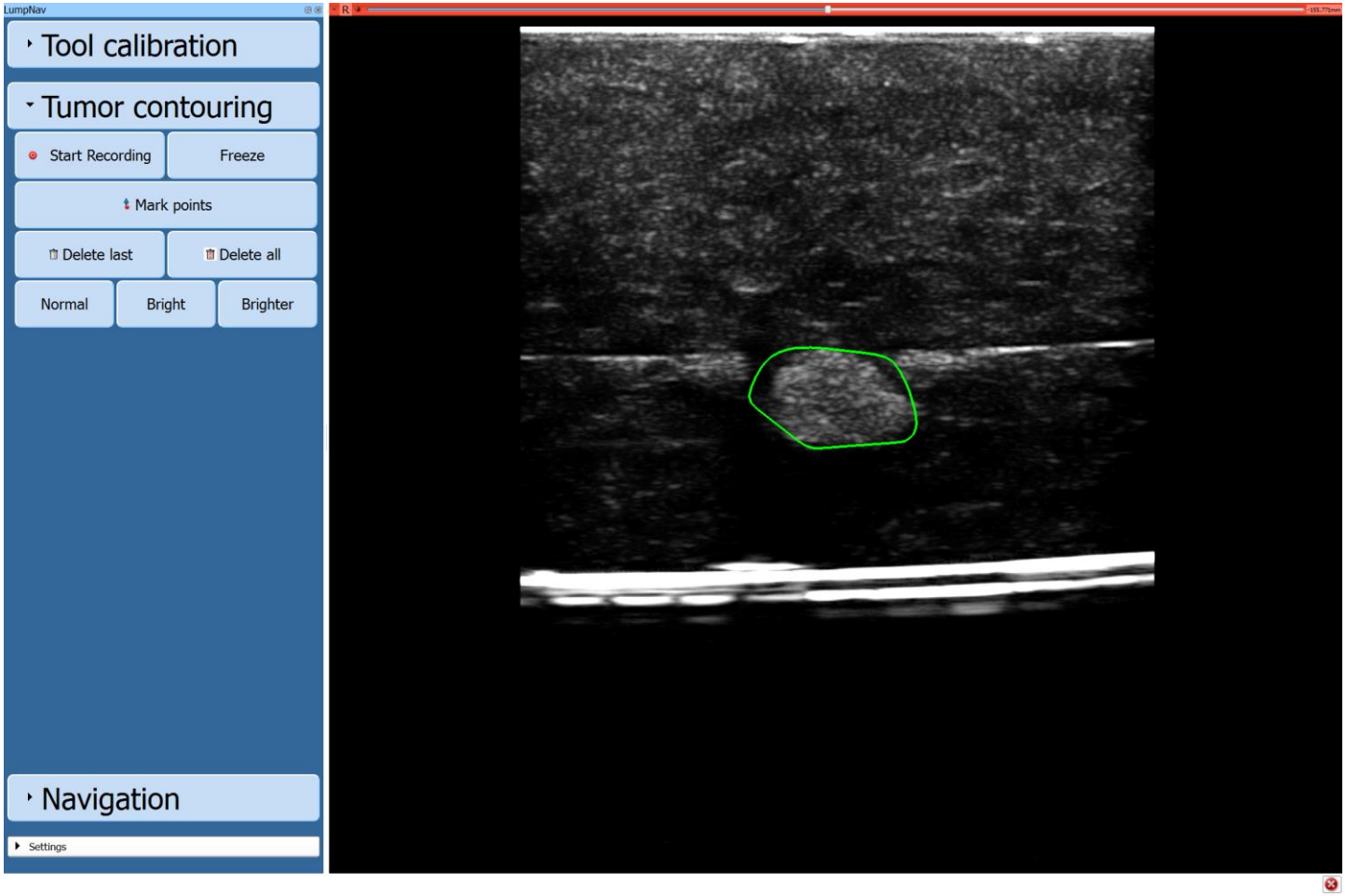
LumpNav – touch optimized slicelet

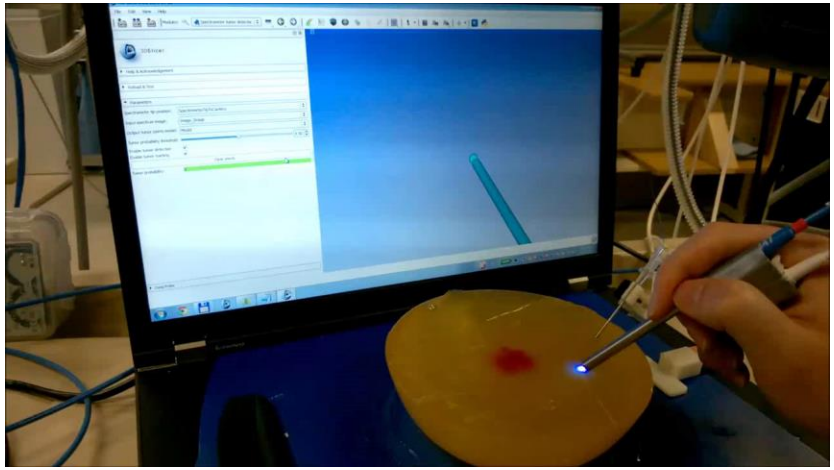


http://www.slicerigt.org/wp/breast-cancer-surgery/

Freely available as a Slicer extension

Patient case (HDH, Kingston)

Margin probes: real-time, navigated, *in situ* tissue characterization - WIP



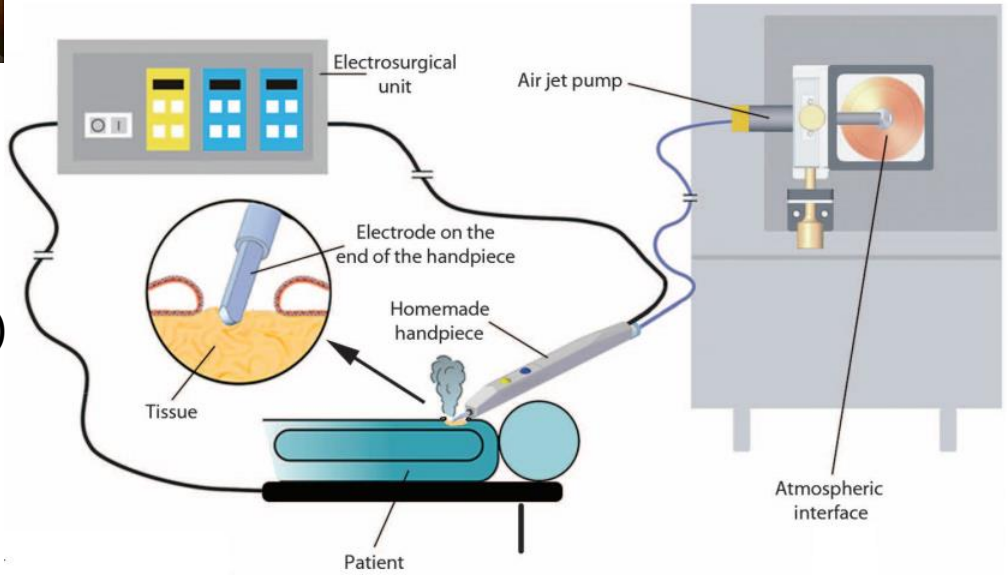
Credit: Lasso, Pezeshki, Vaughan, Ungi *et al.*

Diffuse reflectance spectroscopy

- Testbed for evaluating margin probes
- May be usable for actual tissue typing
- Progress: Already working using Plus+SlicerIGT

Mass spectrography

- From cautery fume
- NaviKnife = iKnife (Balog *et al.* 2013) + Spatial Navigation
- Progress: iKnife hardware at Queen's, OpenIGTLink interface to tissue classifier fully functional

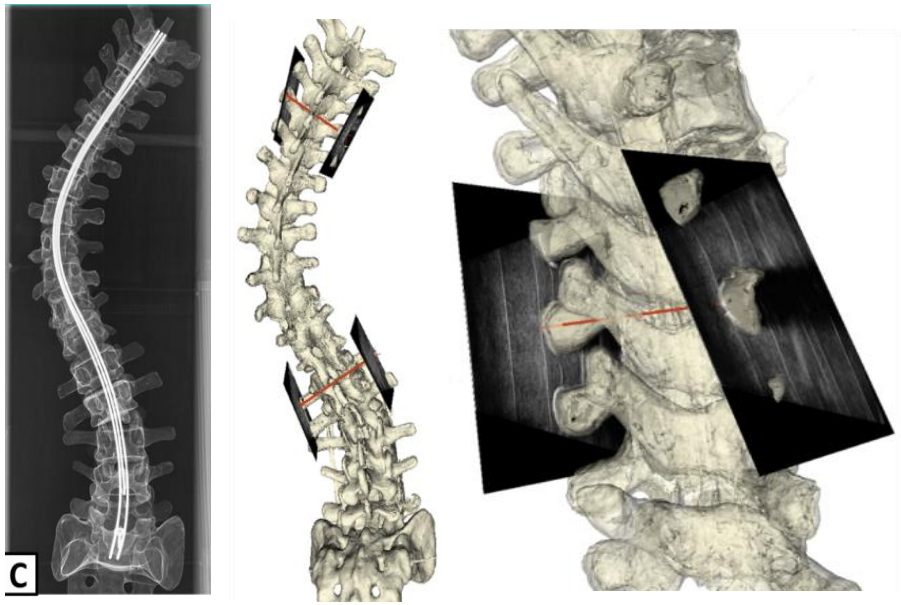


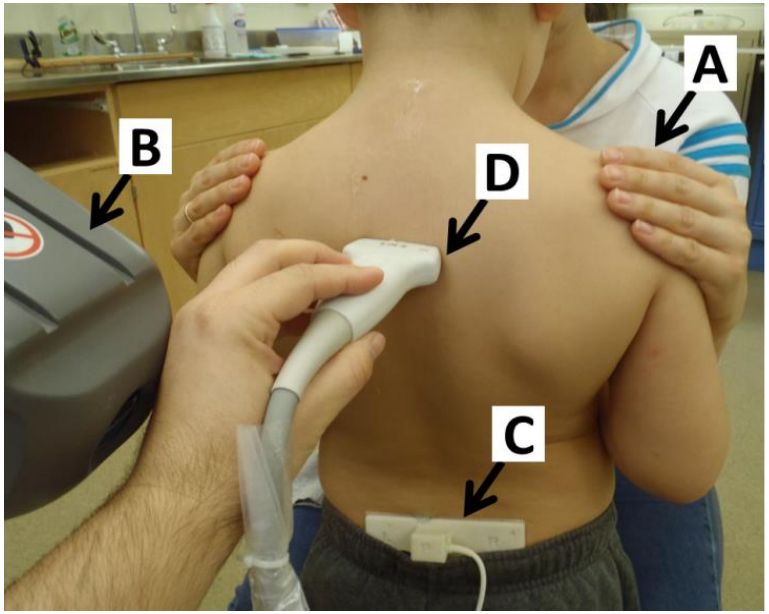
Credit: Balog et al. Sci Transl Med 2013

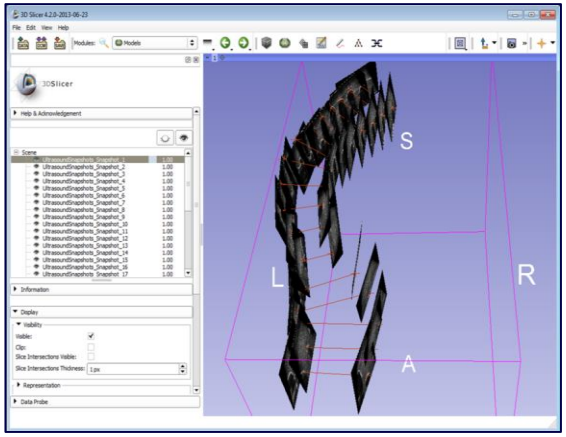
Scoliosis measurement (Queen's)

US-based radiation free approach

- Builds on SlicerIGT and PLUS
- Records tracked US images
- Reconstructs US volumes
- Segments spinal landmarks
- Measures the Cobb Angle







Result: US is more accurate & consistent than 2D X-ray, when compared to CT ground truth

Ungi *et al.*, IEEE TBME, 2013

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Perk Tutor

Facet Joint Tutor

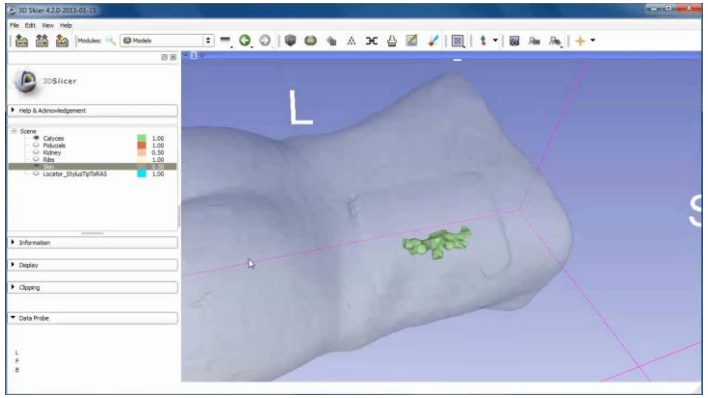
Lumbar Puncture Tutor

Femoral Line Tutor

Prostate Biopsy Tutor

FAST Tutor

Nephrostomy Tutor



- CBME curriculum development
- HMA for both hands
- Performance metrics
- Skill acquisition & retention

Yeo et al. IEEE Trans Biomed Eng, 2011
Ungi *et al.*, IEEE Trans Biomed Eng, 2012
Ungi *et al.*, IEEE Trans Biomed Eng, 2013
Moult *et al.*, IJCARS, 2013
Keri *et al.*, Can J Anesth, 2015

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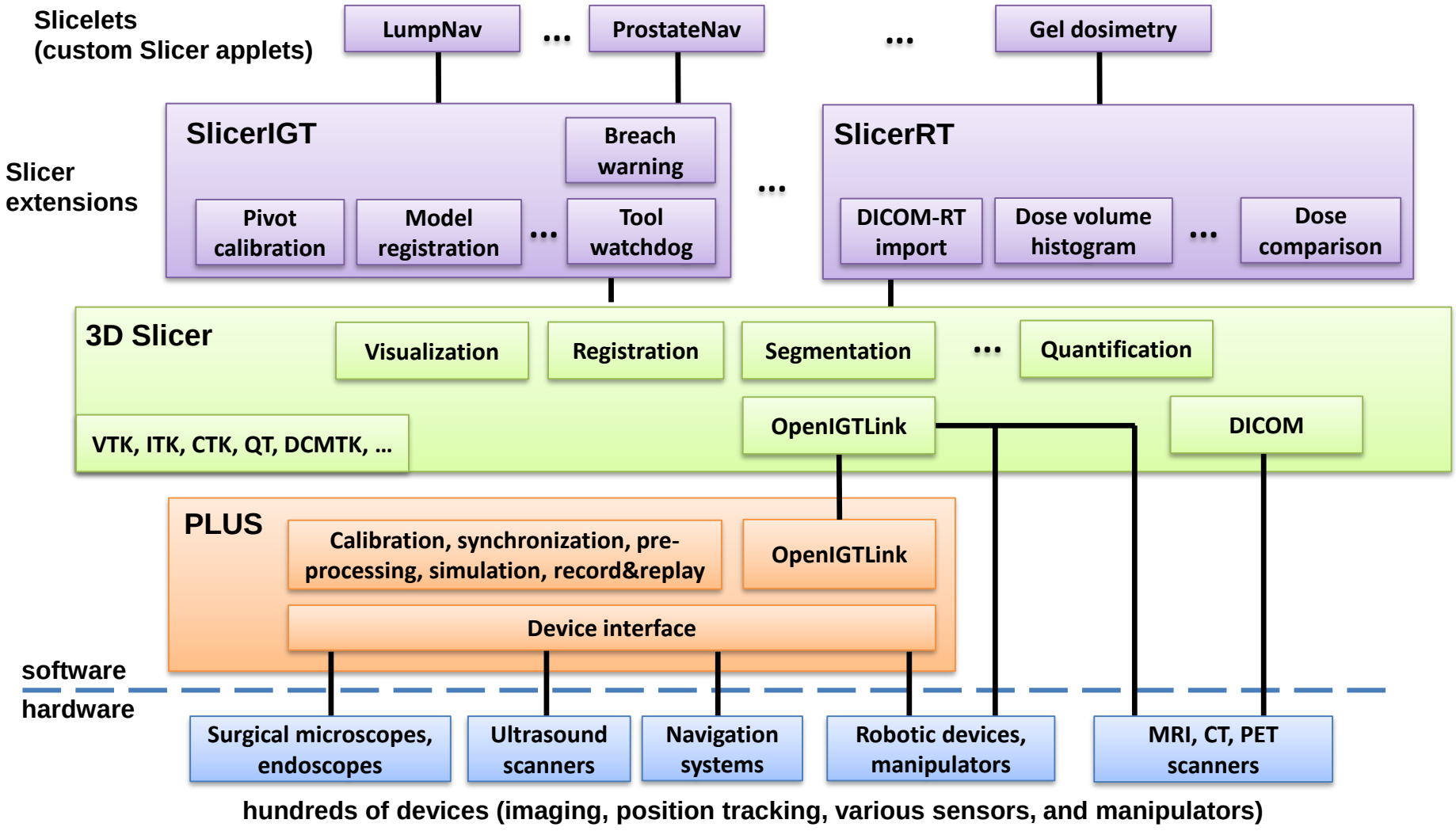
Common software platform



Platform plans

- Share software platform development and maintenance work (Plus and SlicerIGT)
- Clean up/standardize ultrasound device control
- Share algorithms between Plus, SlicerIGT, and other research groups
- Encourage device manufacturers and research groups to use standard OpenIGTLink interface
- Make it easier to build regulatory approved products based on Plus + SlicerIGT + 3D Slicer

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