



NA-MIC

*National Alliance for Medical Image Computing*

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# **Image overlay guided needle insertion using 3D Slicer**

Tamas Ungi, Andras Lasso,  
Paweena U-Thainual, Siddharth Vikal,  
Iulian Iordachita, Gabor Fichtinger

Queen's University

Johns Hopkins University

[ungi@cs.queensu.ca](mailto:ungi@cs.queensu.ca)

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# Learning Objective

This tutorial demonstrates how to perform image overlay guided needle insertion using 3D Slicer.

It is not necessary to have access to a PERK Station hardware, or any other image overlay system to complete the tutorial.





# Pre-requisite

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- This tutorial assumes that you have already completed the **Slicer3Visualization Tutorial** (by Sonia Pujol)
- The tutorial is available at:  
<http://www.slicer.org/slicerWiki/index.php/Slicer3.6:Training>



# Material

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- This tutorial requires the installation of the **Slicer3.6 release** and the tutorial dataset. They are available at the following locations:

- **Slicer3.6** download page

<http://www.slicer.org/pages/Downloads/>

- **Tutorial dataset:**

PerkStationData\_TutorialContestSummer2010

[http://wiki.na-mic.org/Wiki/index.php/File:PerkStationData\\_TutorialContestSummer2010.zip](http://wiki.na-mic.org/Wiki/index.php/File:PerkStationData_TutorialContestSummer2010.zip)

**Disclaimer:** *It is the responsibility of the user of Slicer to comply with both the terms of the license and with the applicable laws, regulations, and rules.*



# Platform

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- The tutorial has been developed and tested on Windows XP and Windows 7 platforms.



# Installation

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- PerkStationModule is not part of the core modules, but an external loadable module. Installation of Slicer3 will not show this module in the modules list.
- To show PerkStationModule in the modules list, install Slicer3 first, then copy the PerkStationModule.dll file (in the downloaded tutorial dataset package) into `\SLICER_INSTALL_DIR\lib\Slicer3\Modules`



# Overview

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- Clinical background
- Systems overview
- Clinical workflow
  - Calibration
  - Planning
  - Insertion
  - Verification
- Conclusion



# Clinical Background

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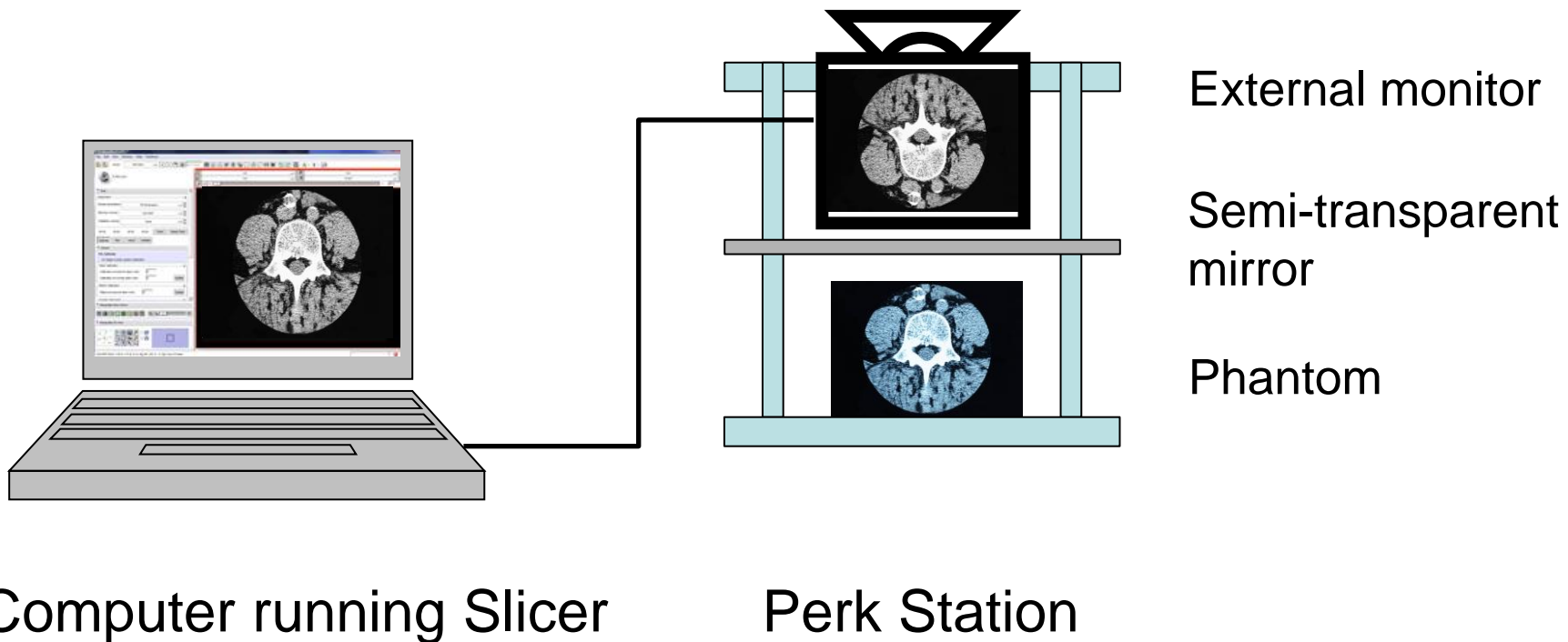
- For image guided needle interventions, e.g.
  - Tumor biopsy
  - Neurological pain management
  - Tissue ablations
- Perk Station reduces time and limitations of training under senior supervision.
- Integrates three popular assistance techniques in one system (Image overlay, laser overlay, freehand).
- Phantom provides a means for objective assessment across trainees.





# Systems overview

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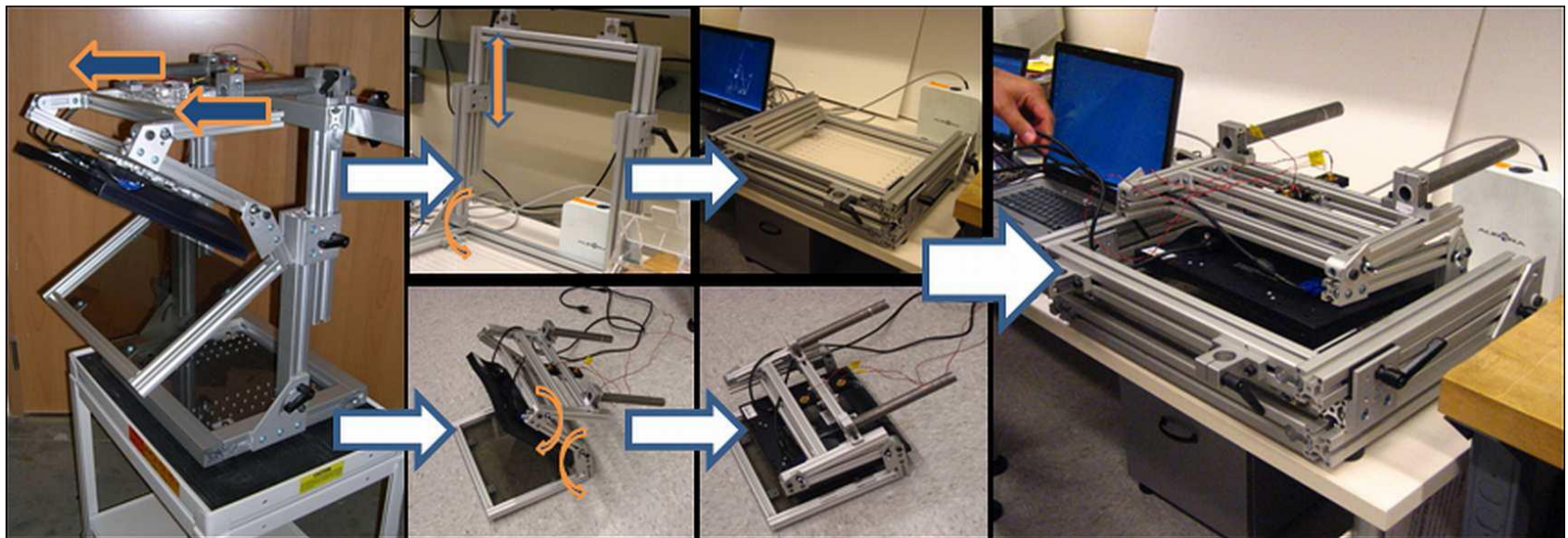




# Perk Station hardware

Structure: Extruded aluminum frame, weights 16.5 kg.

Dimensions: 57 x 55 x 29 cm.





# Open the planning image

1. Select the PERK Station module

2. Click "Load planning volume"

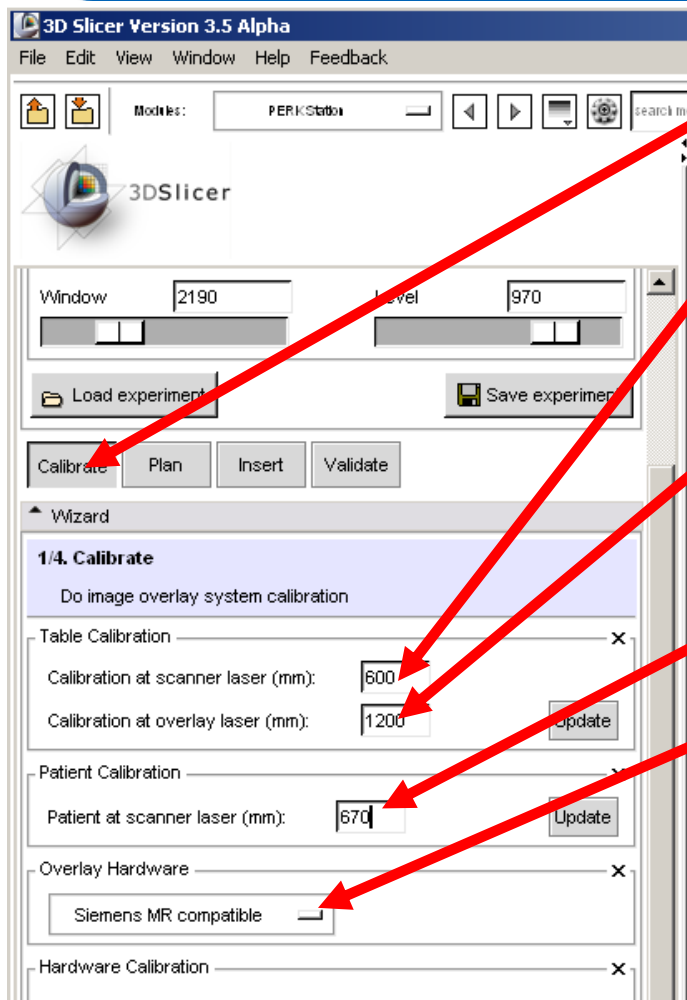
3. Select the sample image

4. Click "Open"

Name	Size	Modified time
Plan.dcm	476 KB	01/27/09 13:56:20



# Calibration



1. Select the Calibrate workphase

2. Enter the table position value when the calibration object is under the scanner laser.

3. Enter the table position value when the calibration object is under the overlay laser.

4. Enter the table position value when patient target is under the scanner laser.

5. Select the overlay hardware type.

Follow instructions on the second monitor.

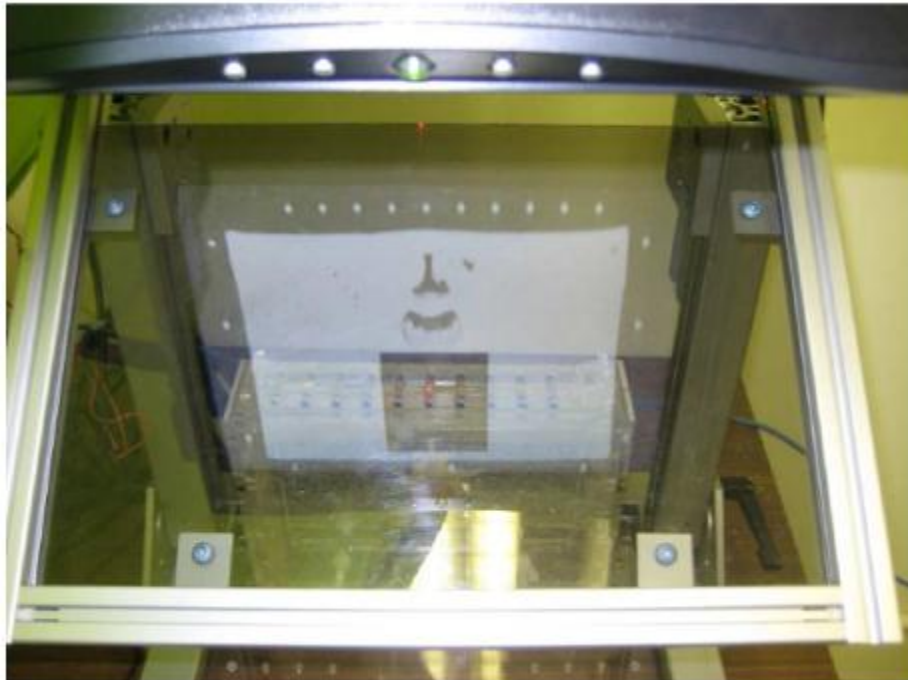
**Note: Without an overlay hardware, you can leave default values in these fields.**



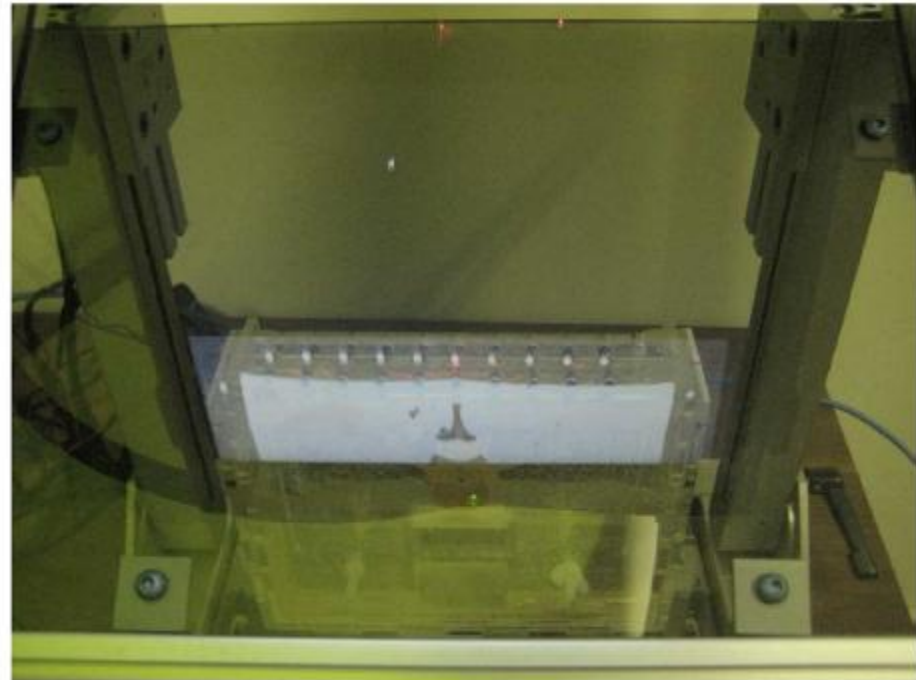
# Calibration

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Overlaid image before alignment.



Overlaid image after alignment.





# Planning

1. Select the Plan workphase

2. Click on the target, then the entry point

3D Slicer Version 3.5 Alpha

File Edit View Window Help Feedback

PERKStation

3D Slicer

Load experiment Save experiment

Calibrate Plan Insert Validate

Wizard

2/4. Plan

Plan the needle insertion

Select target point first

Entry point: -24.363 90.389 -9.8006

Target point: -15.536 49.432 -9.8006

Bg I: 355  
Bg J: 59  
Bg K: 0  
PP: HFS

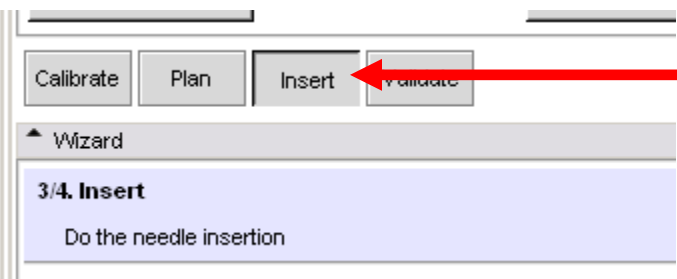
Entry

Target





# Insertion

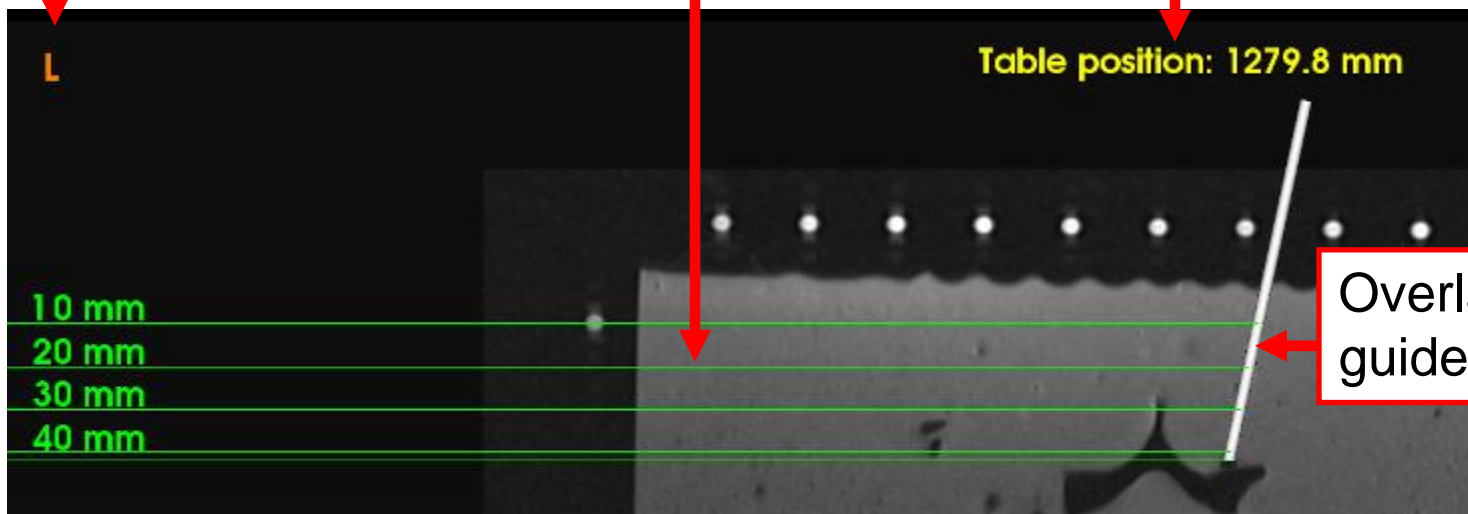


After clicking the Insert workphase button, visual guides will appear on the second monitor.

Signs for the patients left and right side.

Depth perception lines and labels.

Table position for the current slice.



Overlaid needle guide.



# Verification

1. Click on the Validate workphase button.

2. Load validation volume. In this example, the same image is loaded.

3. Click on real entry and target points to mark inserted needle. In this example, just click near needle guide.

4. See computed accuracy values.

Field	Value
Entry point:	-19.066 89.33 -9.8006
Target point:	-9.5332 46.96 -9.8006
Insertion depth (in mm):	43.429
Error in entry point (mm):	5.4011
Error in target point (mm):	6.4914





# Conclusion

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- 3D Slicer with PerkStationModule and a reproducible hardware component allows planning and performing image-overlay guided needle insertions.
- A training and performance evaluation system is introduced and presented.



# Acknowledgments

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