

## SurgeryPad

A mobile augmented reality application using MITK

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# How it came: Navigated Prostatectomy (2010)

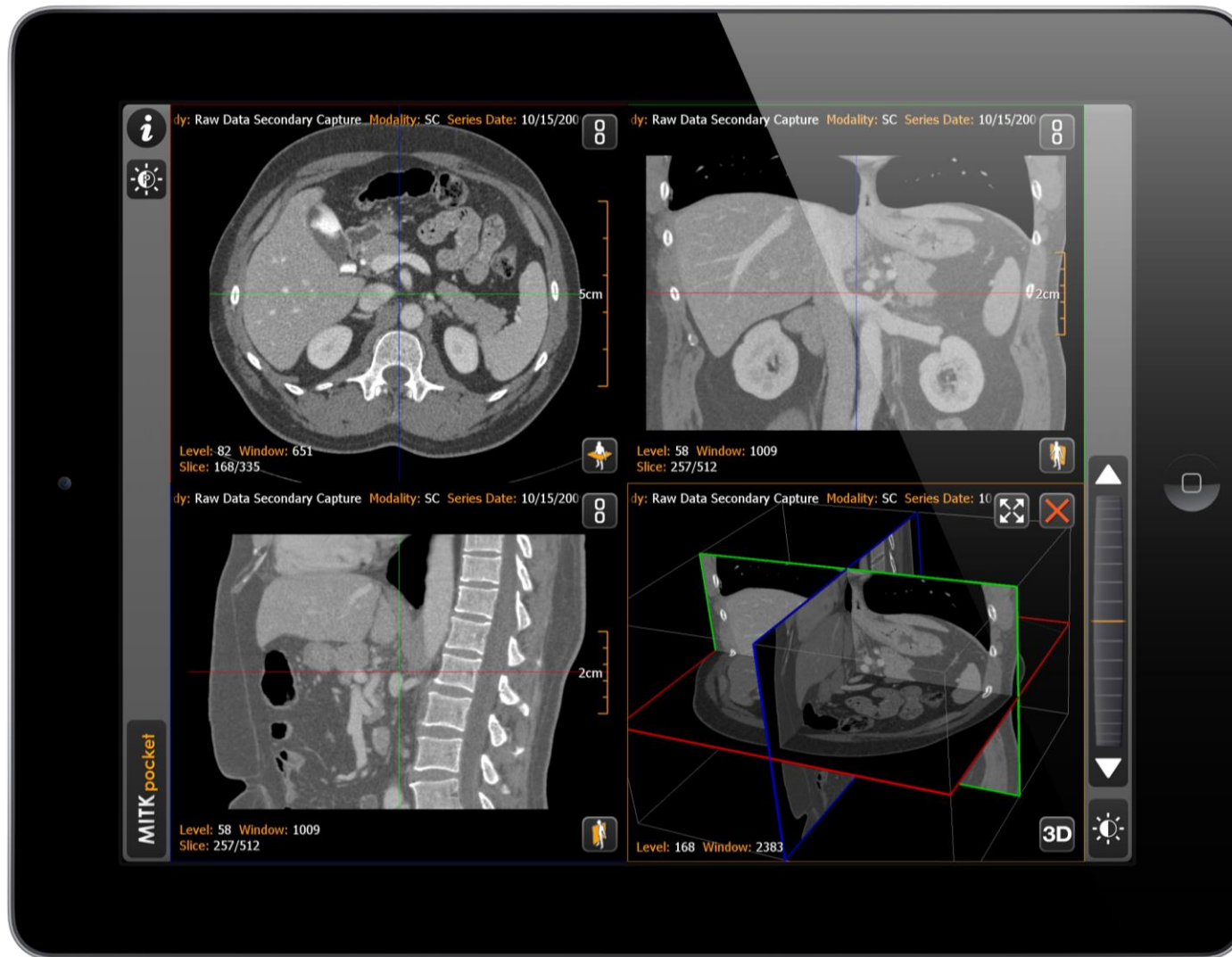


Matthias Baumhauer:  
*Real-Time Compensation of Organ Motion for Augmented Reality in Laparoscopic Surgery*  
(Dissertation, 2009)



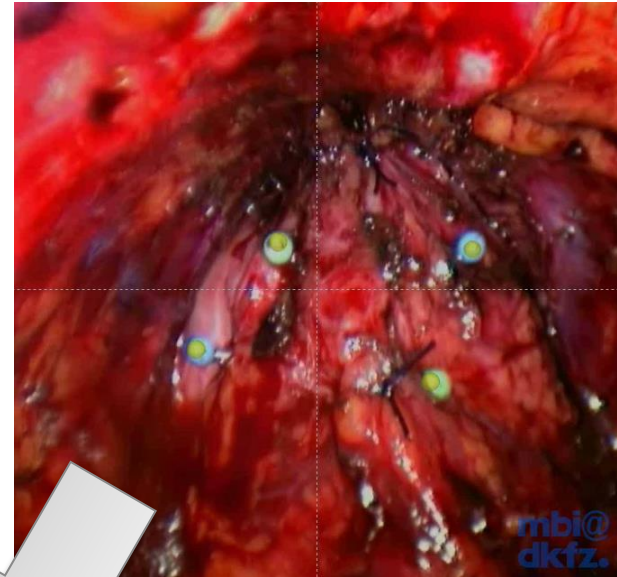
# 2011: Reworked Navigated Prostatectomy



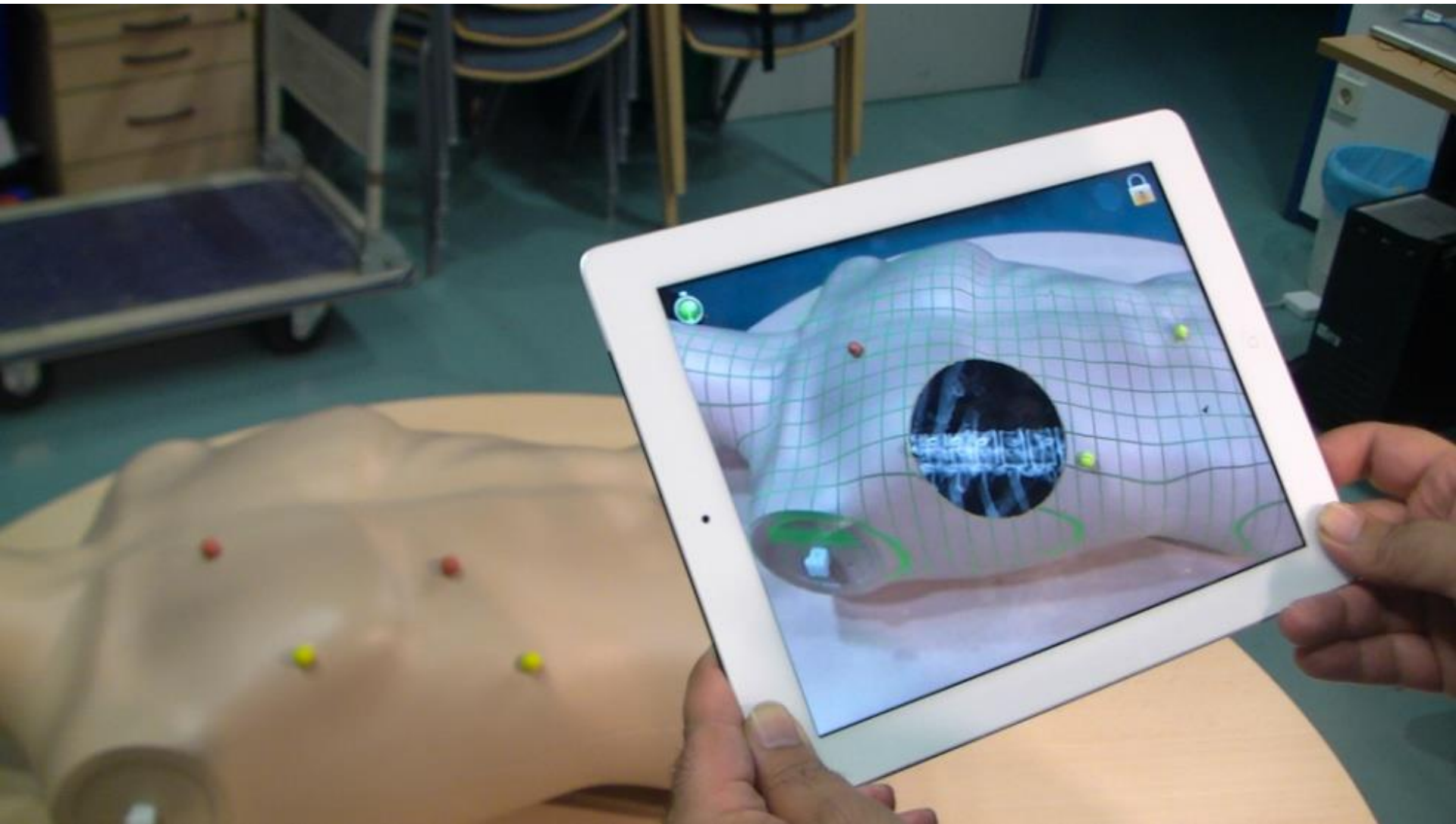




# 2011: The idea



# Initial Trials



# SurgeryPad at EAU 2014 Live Surgery

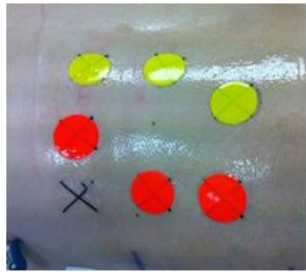


# MITK Integration



# The Workflow

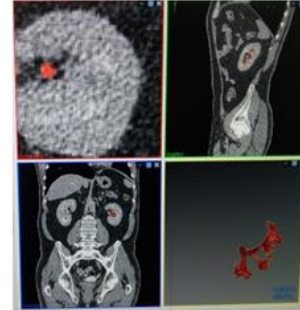
## Preparation



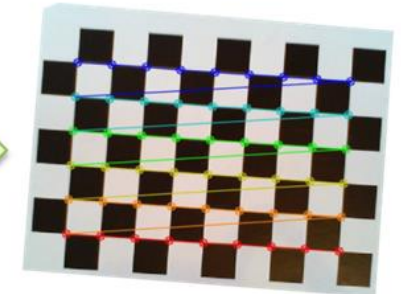
Marker attachment



Imaging

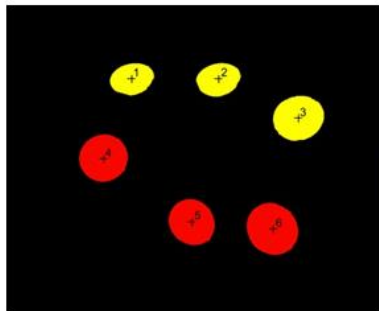


Segmentation

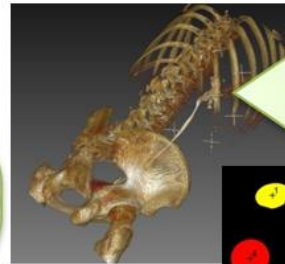


Camera calibration

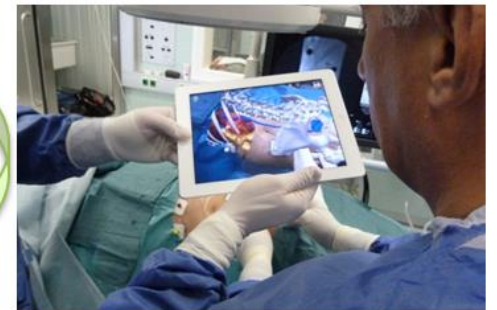
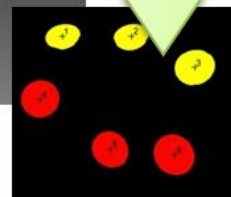
## During intervention



Marker detection

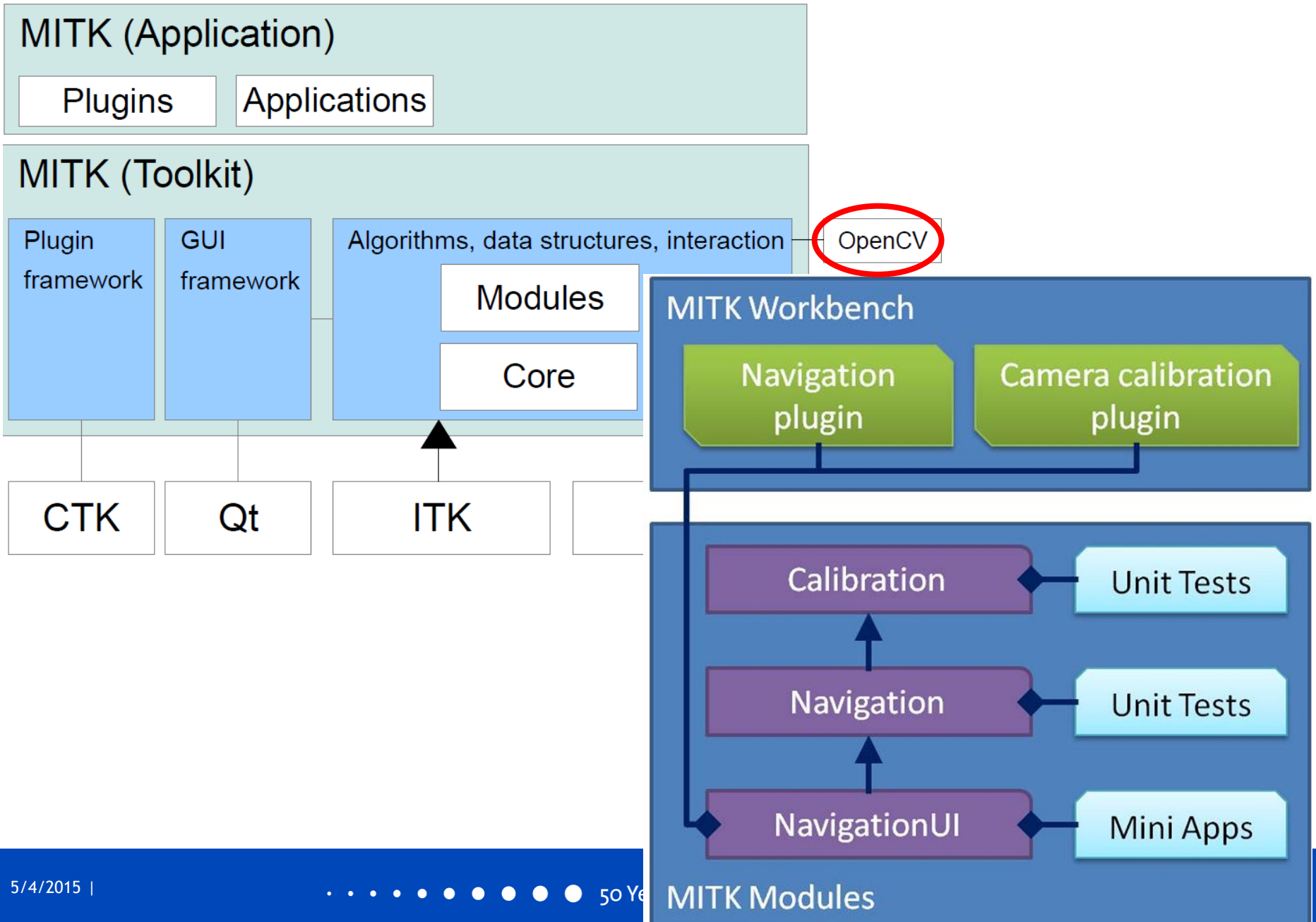


Registration



Visualization

# Architecture: Modules, Plugins





# DICOM Import & Segmentation: Standard Workbench tasks

Research - MBIApp 2014.10.00 (ITK 4.5.1 VTK 6.1.0 Qt 4.8.5 MITK 2014.10.00) (Not for use in diagnosis or treatment of patients)

File Edit Window Help

Open Save Project Close Project Undo Redo DICOM Image Navigator

Data Manager

- Abdomen nativ 0
  - Stone
  - Pankreas
  - Liver
  - Kidney
  - Kelch
  - Bones
  - 5
  - 4

Segmentation

Data Selection

Patient Image: Abdomen nativ 0

Segmentation: Kelch

2D Tools / 3D Tools

- Add
- Subtract
- Correction
- Paint
- Wipe
- Region Growing
- Fill
- Erase
- Live Wire
- 2D Fast Marching

Interpolation: Disabled

Image Navigator

Location (mm): -0,37 294,63 -1309,71

Axial: 211

Sagittal: 128

Coronal: 128

Time: 0

Display

Axial

Sagittal

mbi@dkfz

# Calibration

Research - MBIAApp 2012.09.99-b3029fa7 (ITK 3.20.1 VTK 5.8.0 Qt 4.7.2 MITK 2012.09.99-b3029fa7) (Not for use in diagnosis or treatment of patients)

File Edit Window Help

Open Save Project Close Project Undo Redo Image Navigator

Display

Data Manager

Data Manager

Camera Calibration

Take screenshots, calibrate and test

Focal length: 671,60 674,07

Principal point: 318,74 238,46

Distortion coefficients: 0,1226 -1,0049

-0,0010 -0,0011

Valid

Stop video

Take screenshots

Take screenshot

Remove all screenshots

Calibration & test

6 screenshots available

Run calibration

Test parameters

Evaluate reprojection error (Page\_Up: Activate; Page\_Down: Go to next button)

Undistort images

Image Navigator Logging

Filter:

Level	Message
Info	GEFileReader Module loaded
Info	BlueBerry Workbench ready
Info	Running Calibration ... please wait
Info	Calibration successfully finished

Show  categories  advanced fields Copy to clipboard

Axial

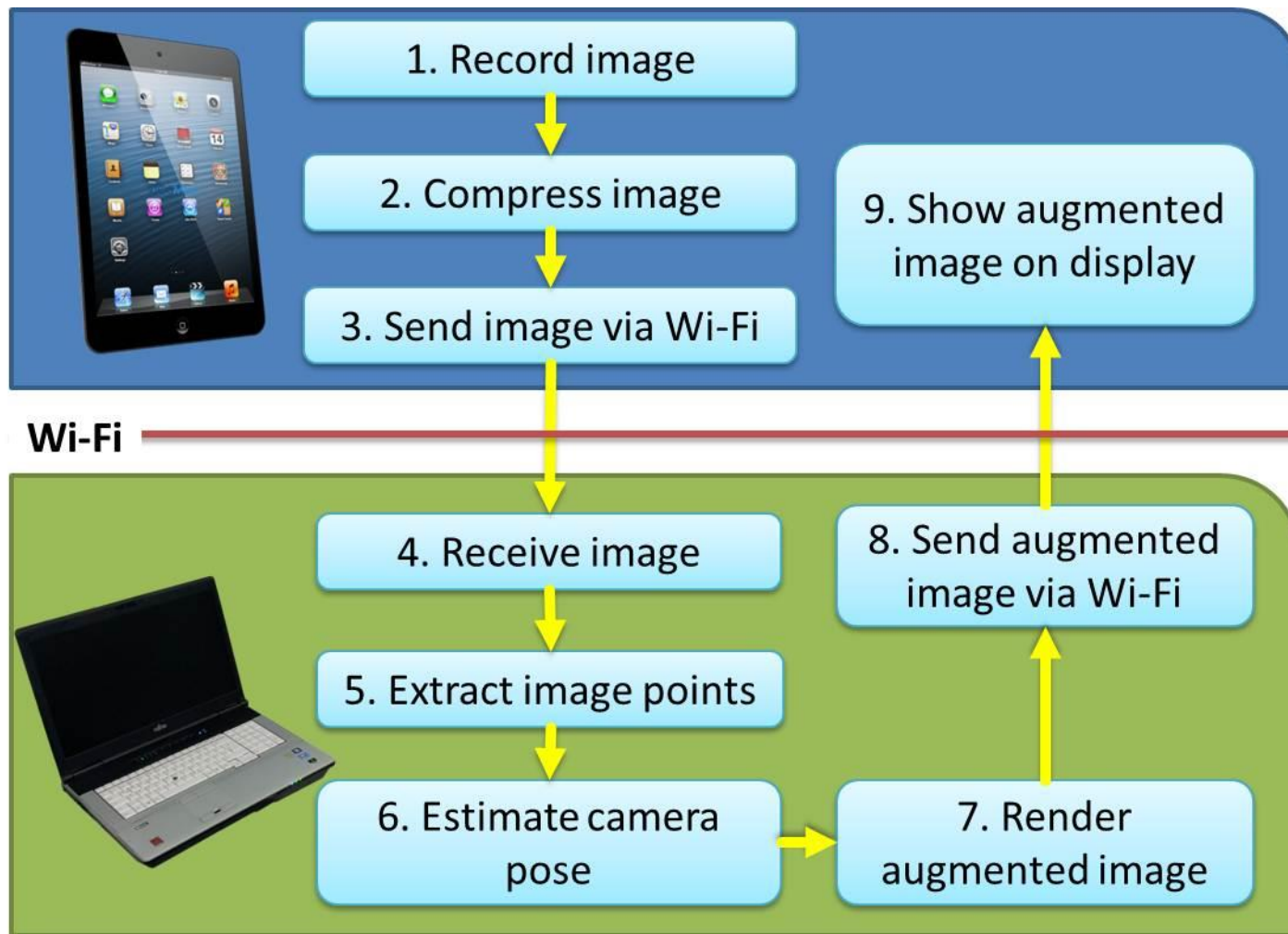
Sagittal

Coronal

Reprojection Error: 0.24



# Finally: The Navigation pipeline



# Navigation

The image displays a software interface for medical image navigation, divided into several panels:

- Top Panel:** A menu bar with "File", "Edit", "Window", and "Help". Below it is a toolbar with icons for "Open", "Save Project", "Close Project", "Undo", "Redo", "Image Navigator", and various navigation tools.
- Data Manager (Left):** A tree view showing a project named "ken-big-markers-red-yellow" with sub-items "bild", "9", "8", "7", "6", and "5".
- Navigation Panel (Left):** Contains a "Color Blob Detection" source, a list of "Orange" and "Yellow" markers, and sliders for "Lower Hue" (set to 6), "Upper Hue" (set to 12), "Saturation" (set to 40), and "Value" (set to 40). A "Color preview" bar is shown below.
- Display (Top Right):** A 2D view of a dark image with several colored markers (orange, yellow, green) and a red dashed border. A red letter "b" is in the bottom right corner.
- Volume Visualization (Bottom Right):** A 3D view of a white anatomical volume with internal structures colored in red, yellow, and green. A red letter "c" is in the bottom right corner.
- Status Bar (Bottom Left):** Displays "Navigation works. Current reprojection error: 2.50083" and "Image size: 640 x 480". A red letter "a" is in the bottom right corner.



## Benefits of using MITK:

### 1. Reused functionalities:

1. DICOM Import
2. Scene Management
3. Segmentation
4. Registration
5. Visualization

### 2. Own code based on:

1. Existing Module system and dependency logic
2. Automatic setup of external toolkits (OpenCV!)
3. Plugins integrated into given application frame

→ Thank you MITK.



# Things where MITK cannot help...



Thank you  
?Questions?