

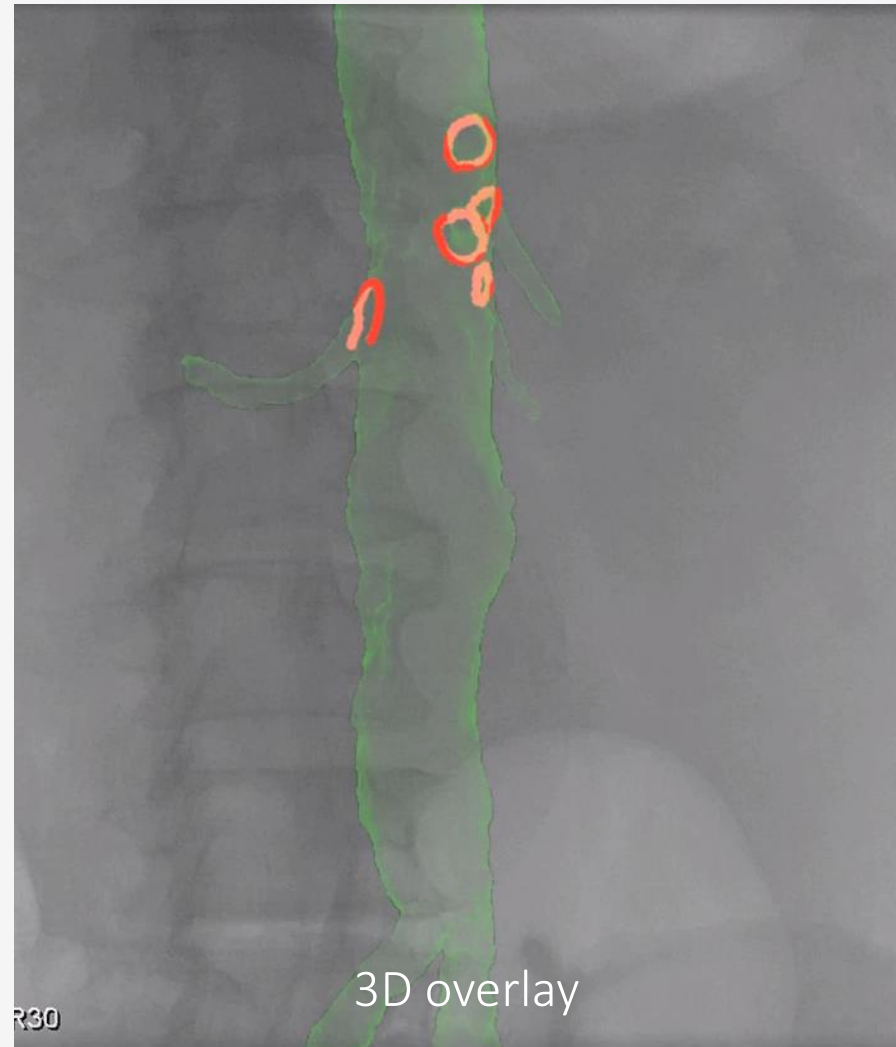
Can You Do A Registration without a fancy machine?

Critical Issues May 2016

Tom Carrell

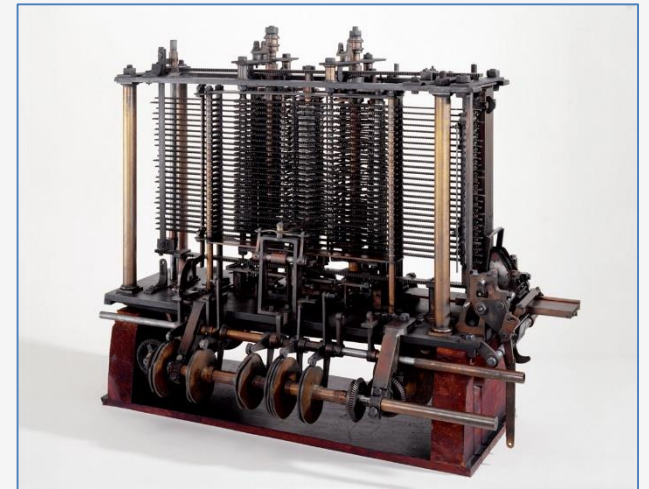
- Guy's and St Thomas' Hospitals London
- King's College London
- Cydar Ltd and Cydar Medical Inc (US)

3D overlays depend on image registration



YES

- By using just software to register and generate 3D overlays
- Advantages:
 - Digital technology improves much faster than hardware
 - Works with your existing X-ray set
 - Hands-free automation
 - Enhanced accuracy



Works with your current X-ray set



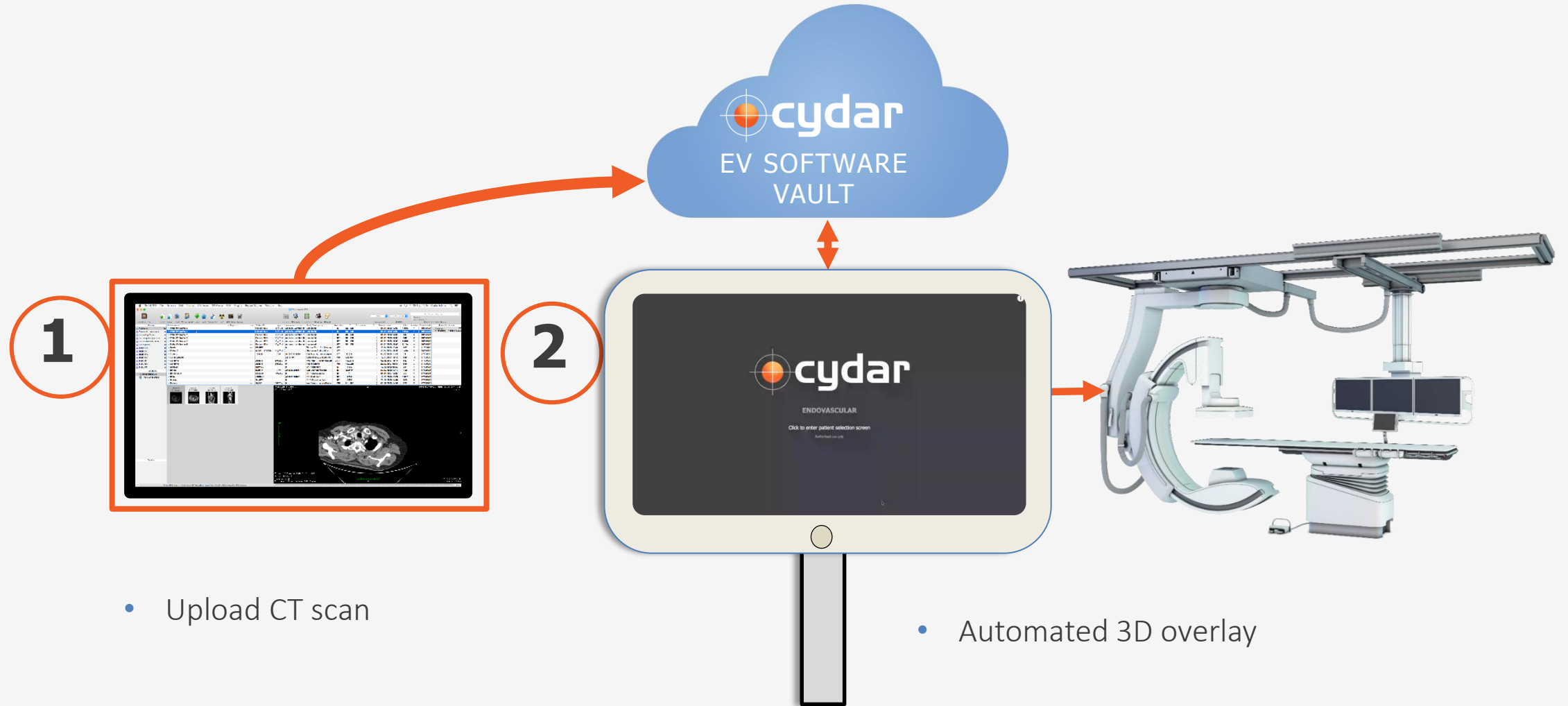
- Mobile C-arm, or
- Fixed fluoro set

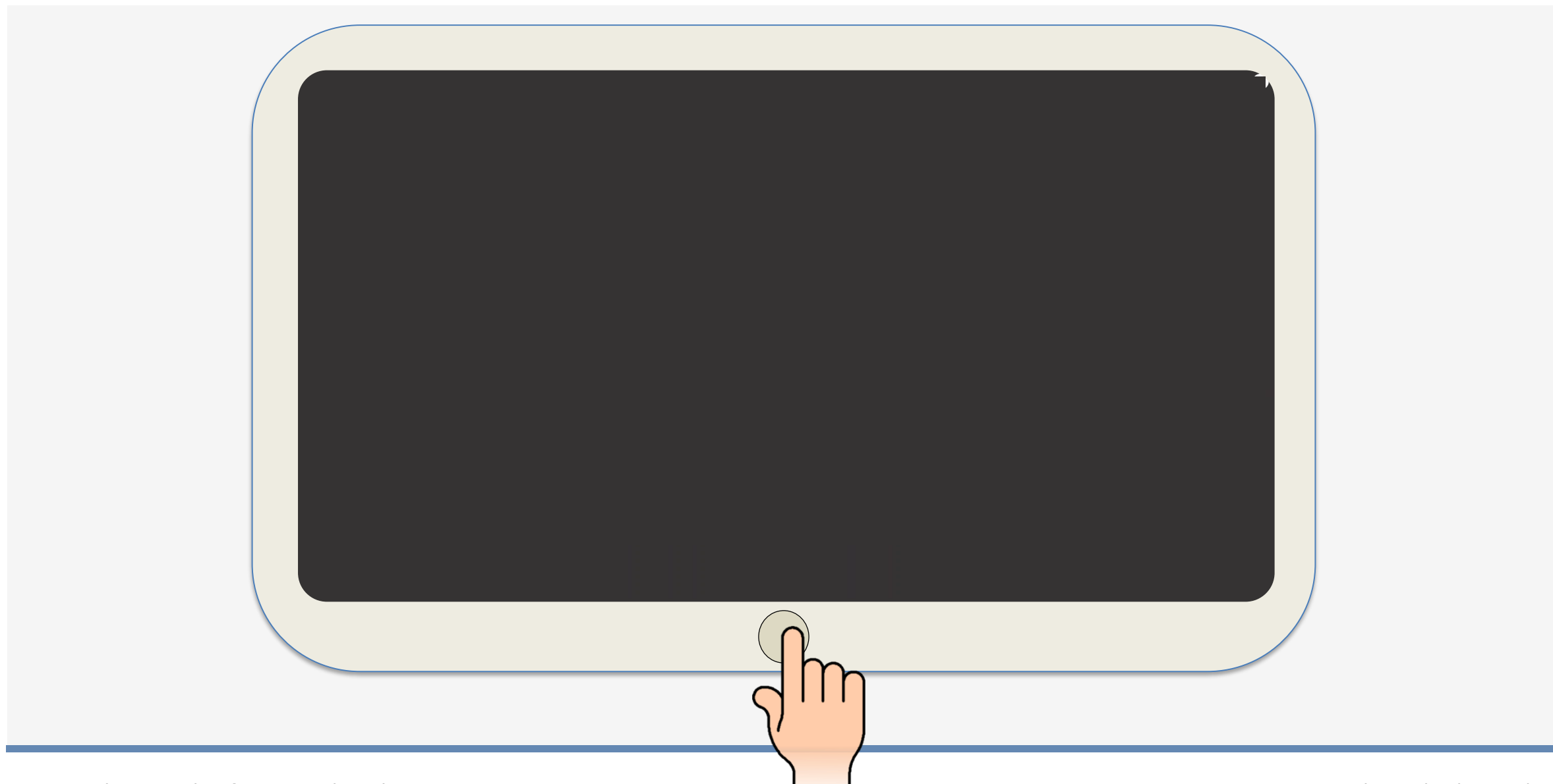


Cable or wireless

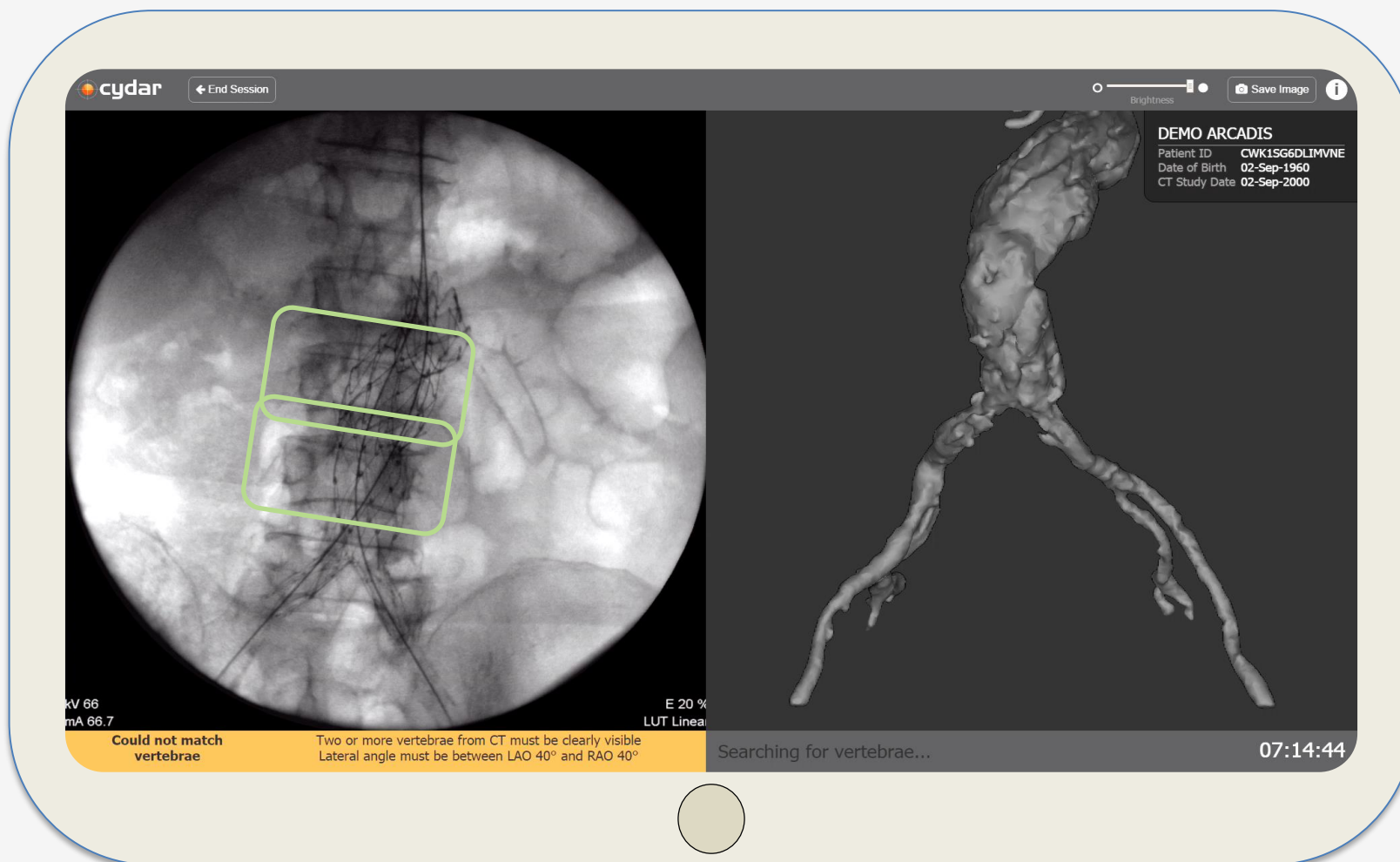


All-in-one
touchscreen
Windows PC



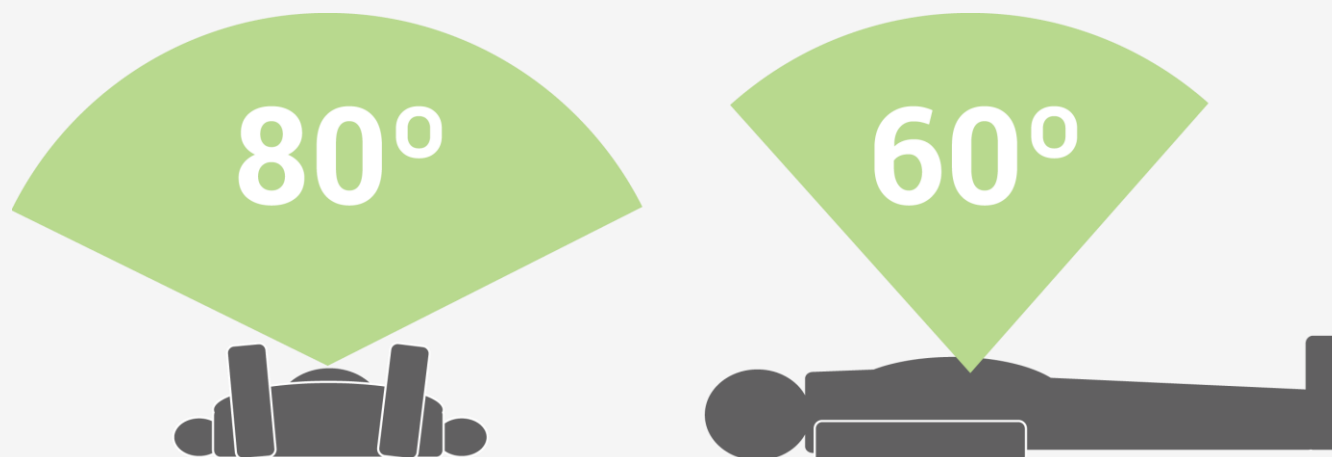


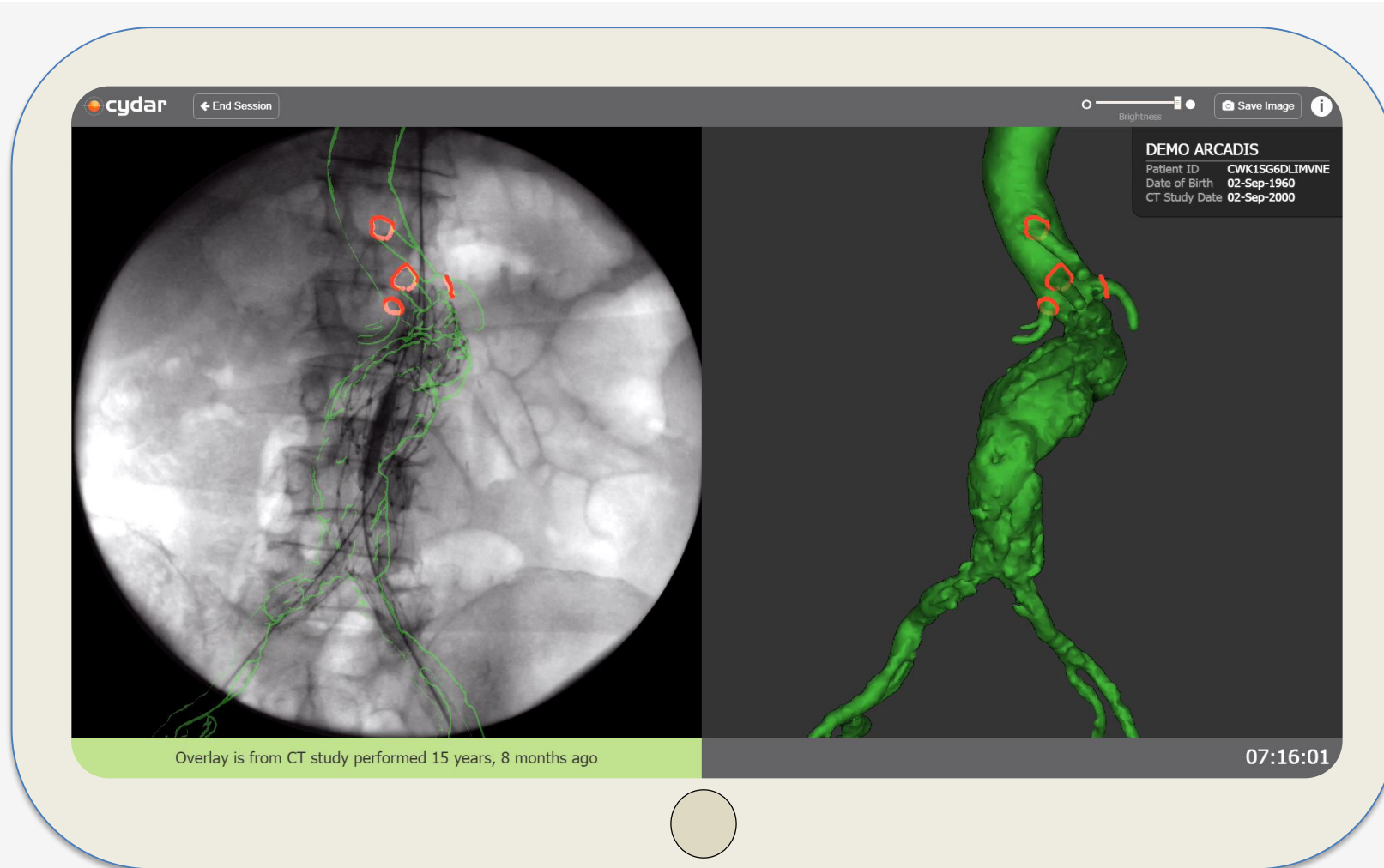
Computer vision searches for vertebrae in 3D space



- Protected by USA Patent No. 9,240,046

Current capture range for Cydar 3D overlay

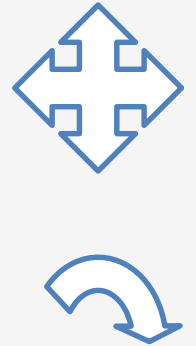
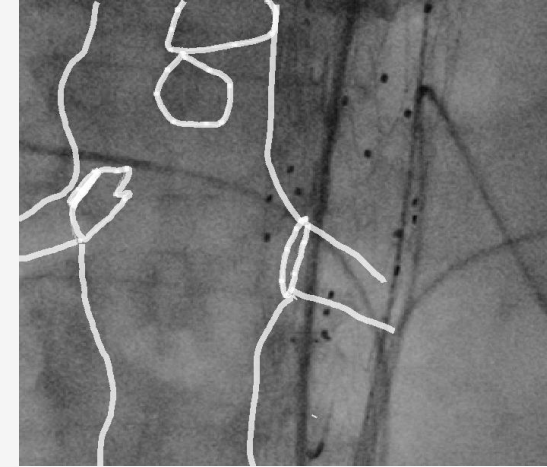




- Protected by USA Patent No. 9,240,046

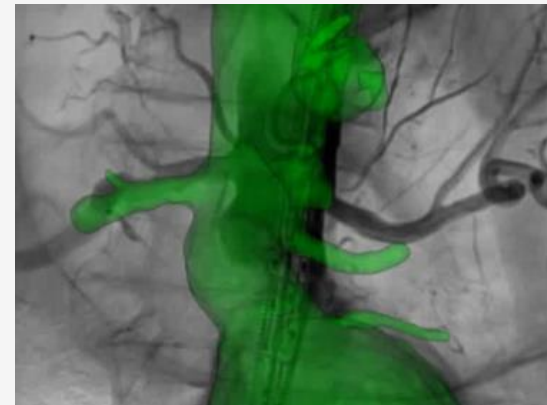
Misregistration

- Pre-operative anatomy shown in wrong position
- Correctable by panning and rotating image



Deformation

- Pre-operative anatomy has straightened
- Caused by wires and devices
- Cannot be corrected by panning and rotation



Accurate against gold standard:

- Test data set in imaging literature
- Less than 1mm and 1° error

A. Varnavas et al. / Medical Image Analysis 26 (2015) 108–119

Table 9

Target Registration Reprojection Error (TRRE) and Rotation Error (γ)^a before and after 2D/3D registration produced with Gold Standard Data. Percentage of successful registrations for three ranges of initial displacement from gold standard position, within the algorithm's operating range.

Before registration				After registration				Successful registrations (%)		
TRRE (mm)		γ (°)		TRRE (mm)		γ (°)		0–6 mm	6–12 mm	12–18 mm
RMS	Max	RMS	Max	RMS	Max	RMS	Max	$\gamma < 16.7^\circ$	$\gamma < 32.7^\circ$	$\gamma < 42.7^\circ$
5.9	23.4	14.2	43.7	0.21	0.62	0.24	0.69	100	100	100

^a The rotation γ between two poses was computed by decomposing the pose difference into translation and rotation components using the same approach as [Tomažević et al. \(2003\)](#).

Robust in multicentre trial:

- No false overlays
- Networks reliable
- CI/2014/0040

0

False overlays
out of 15 331
displayed

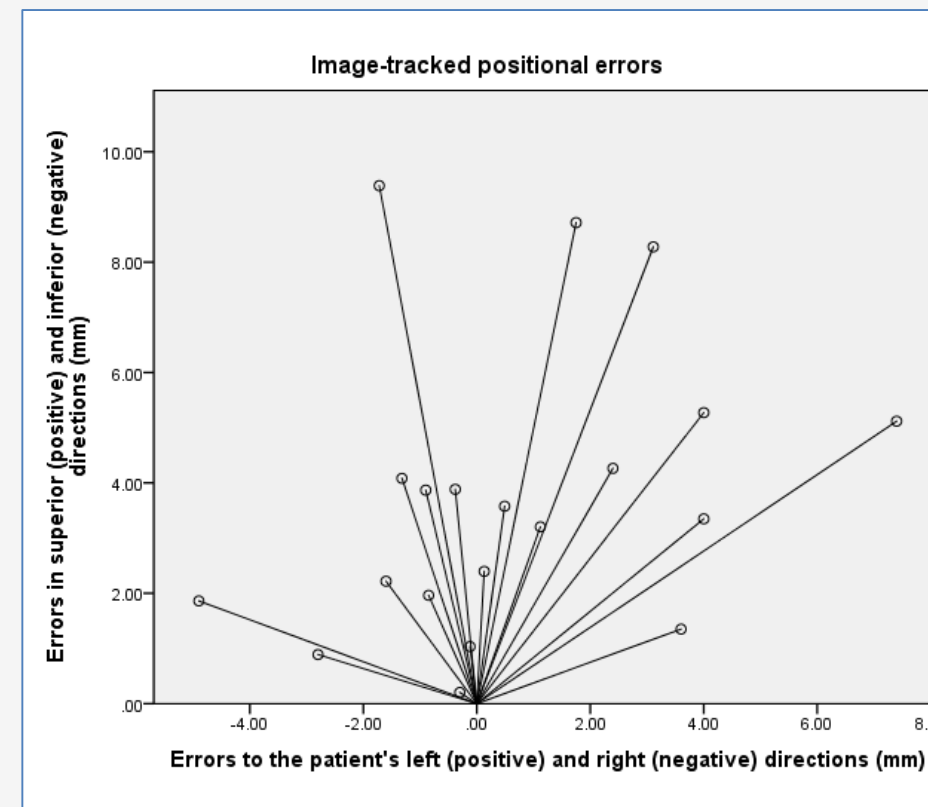
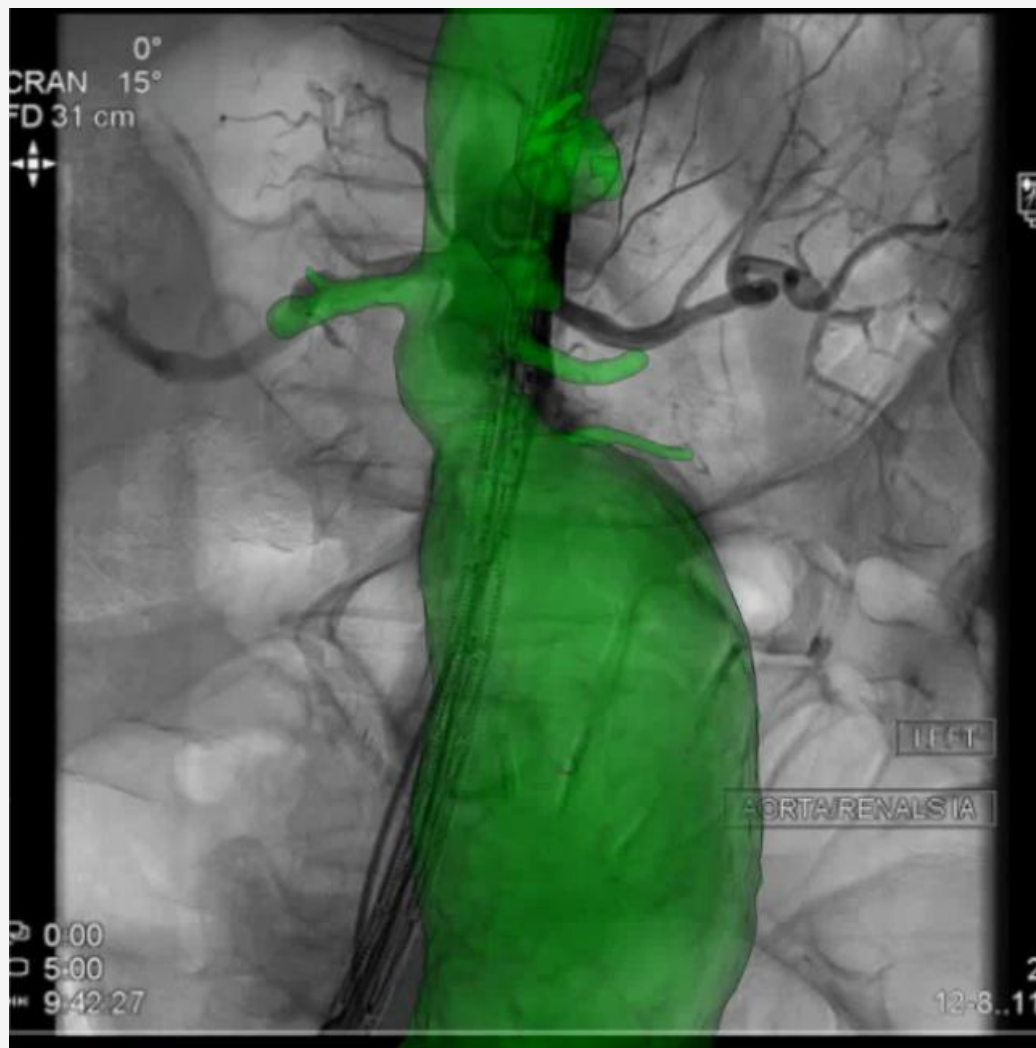
288

Hours of 3D
overlays

99.94

Percent
uptime

Deformation caused by straightening

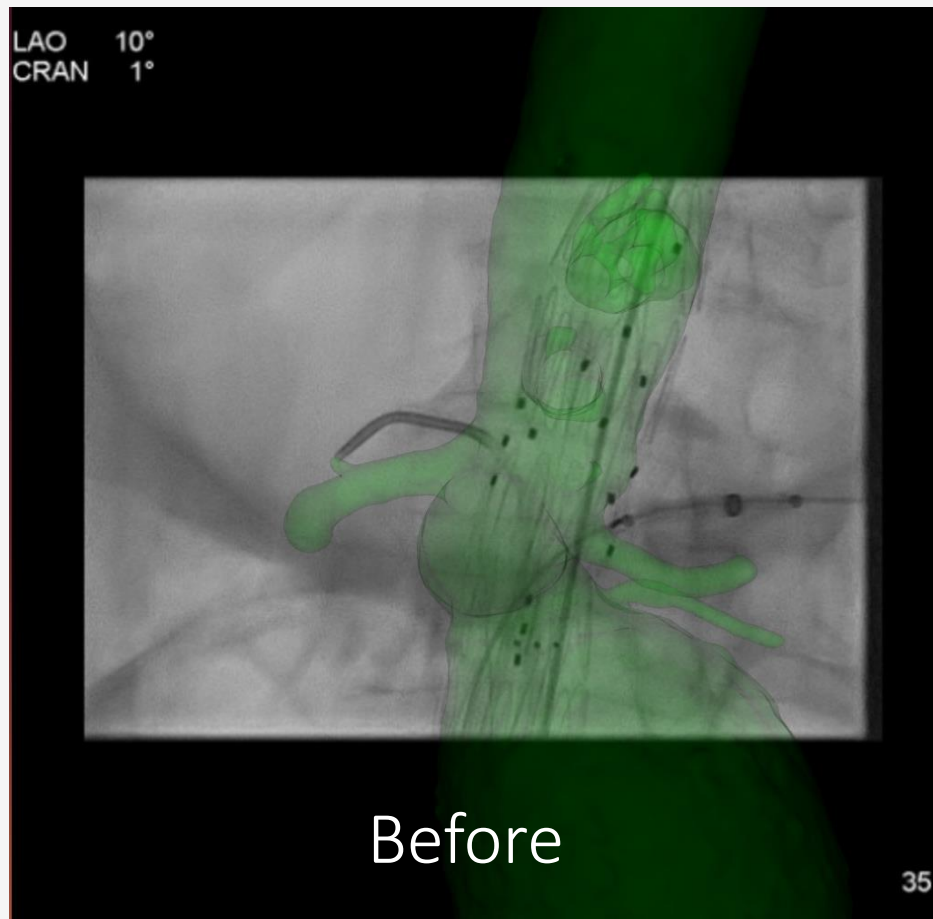


Rolls A, Maurel B, Davis M, Constantinou J, Hamilton G, Mastracci T. Presented ESVS Spring Meeting 2016

New feature for late 2016: adjusting for straightening



Overlay adjusted for straightening



Can You Do A Registration without a fancy machine?



YES

Use software



Thank you

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www.cydarmedical.com