3D reconstruction of the surgical scene using structured light

RODRIGUES, Marcos <http://orcid.org/0000-0002-6083-1303>

Marcos A Rodrigues
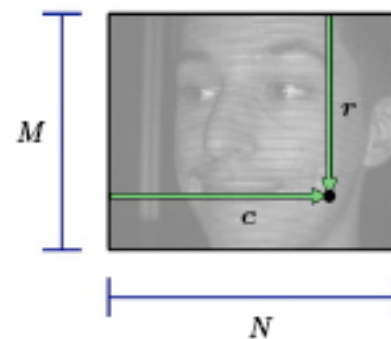Geometric Modelling and Pattern Recognition Research Group - GMPR
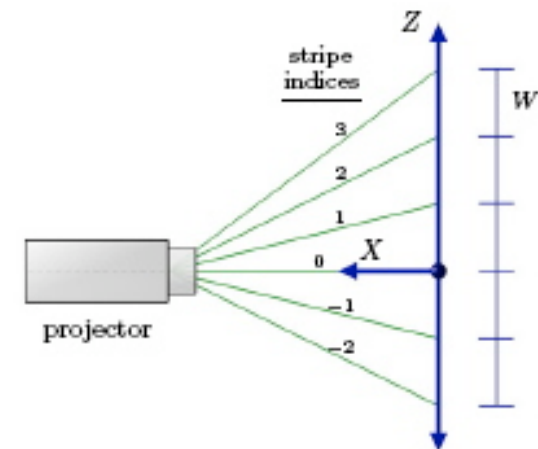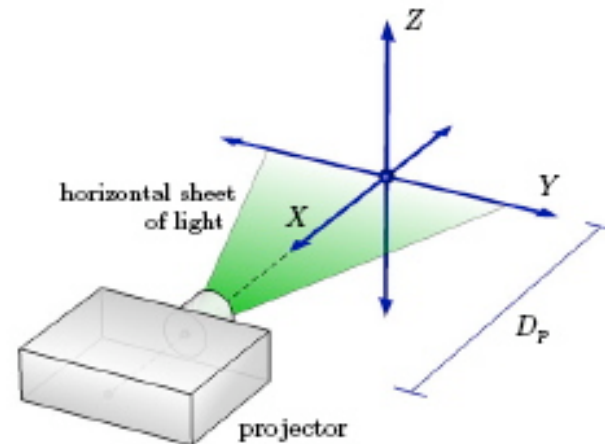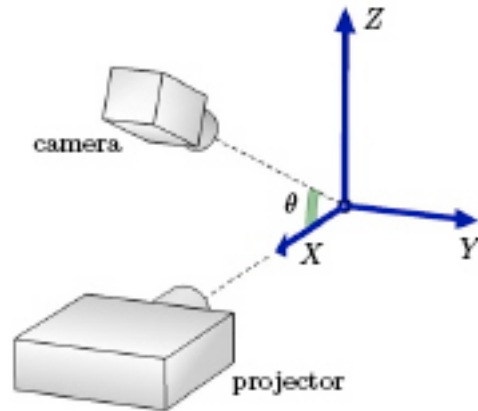Sheffield Hallam University, Sheffield UK
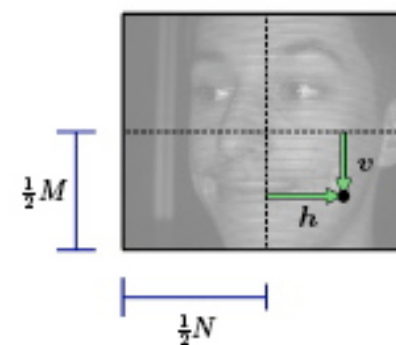*m.rodrigues*@shu.ac.uk
www.shu.ac.uk/gmpr

3D RECONSTRUCTION OF THE SURGICAL SCENE USING STRUCTURED LIGHT
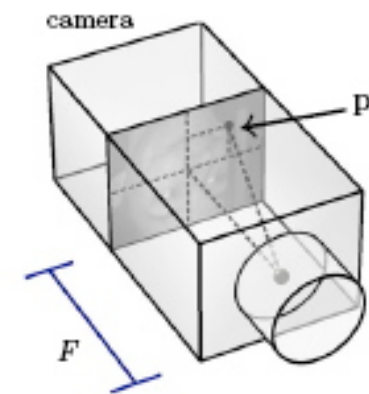
The technique:
Camera + projector
Visible + NIR

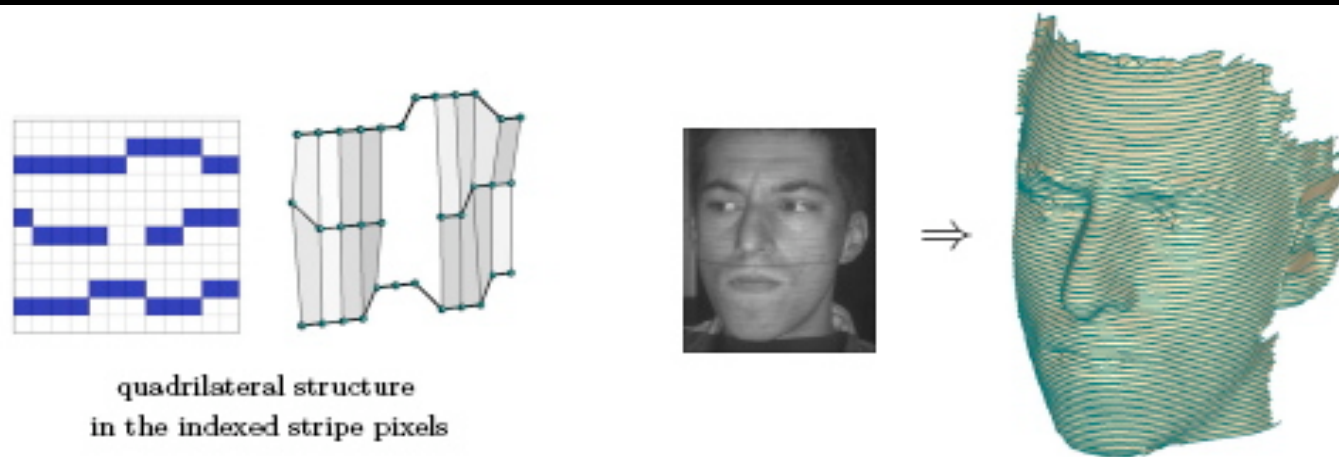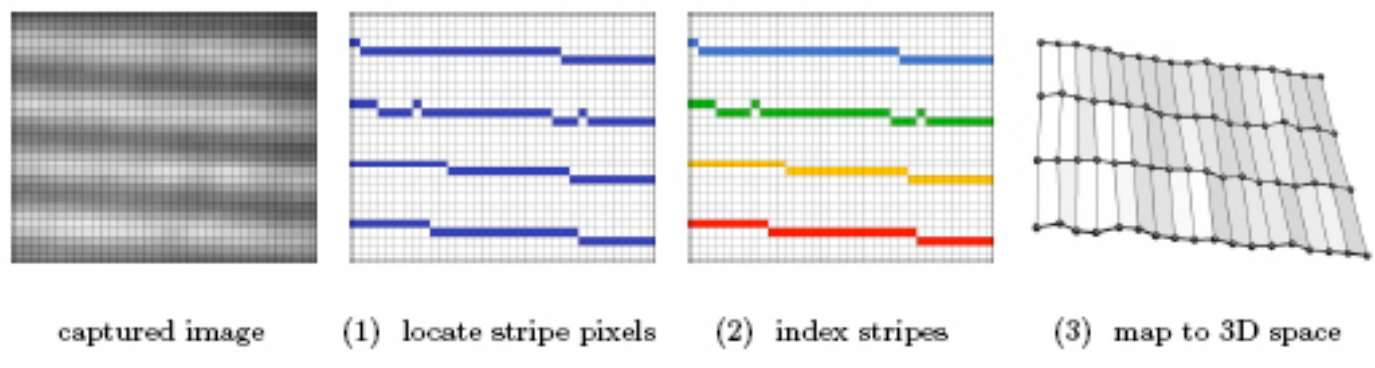(a) image space (b) centred (c) system space

The core of the technology: Stripe indexing and generation of 3D data

captured image   (1) locate stripe pixels   (2) index stripes   (3) map to 3D space

quadrilateral structure
in the indexed stripe pixels

Steps in 3D reconstruction

Pre-processing operations (2D):

- image acquisition (visible and NIR)
- image filtering
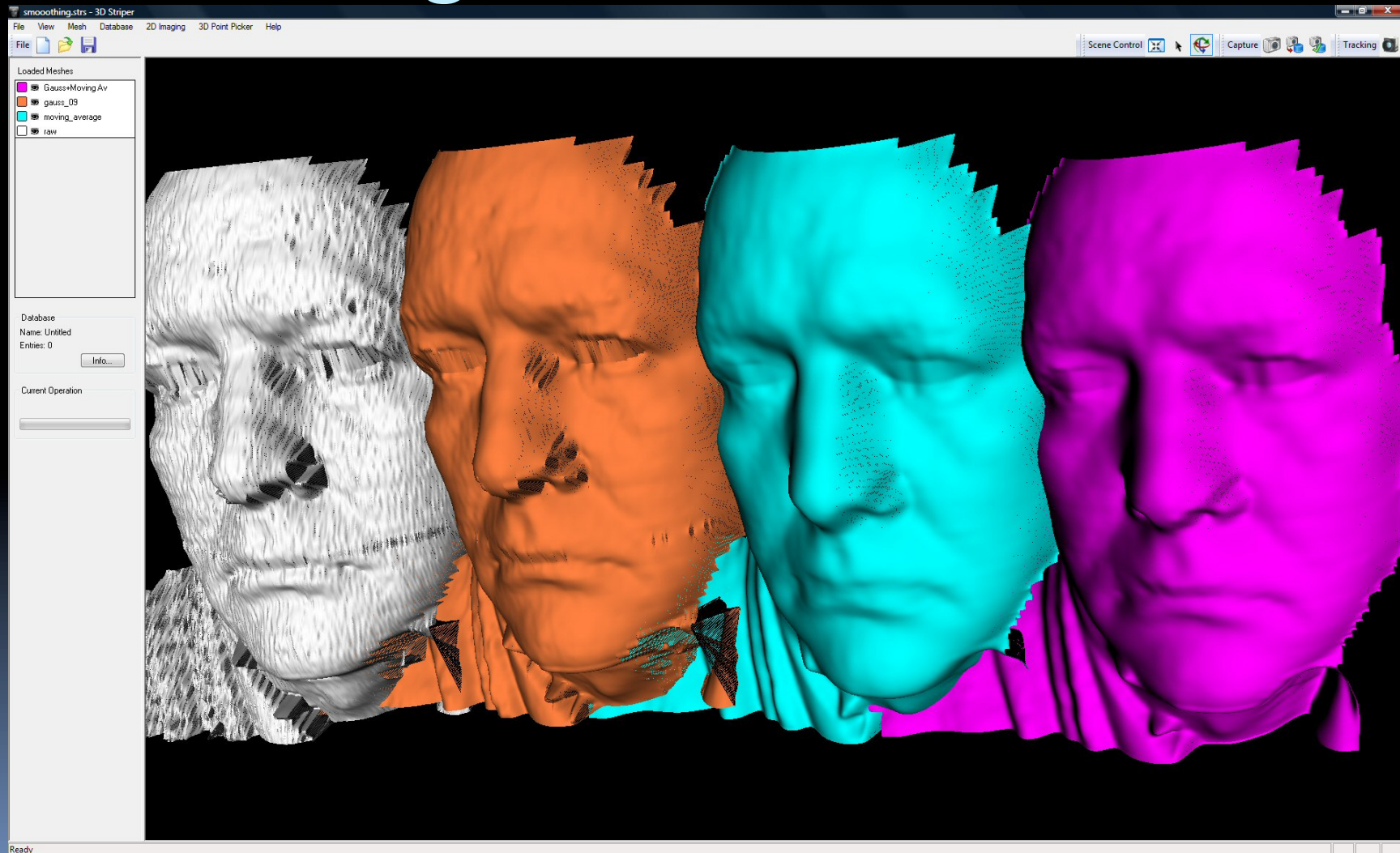- stripe indexing/image correspondence

Post-processing operations (3D):

- generation of 3D point cloud and triangulation
- noise removal, hole filling, mesh smoothing
- mesh subdivision
- pose normalization / registration
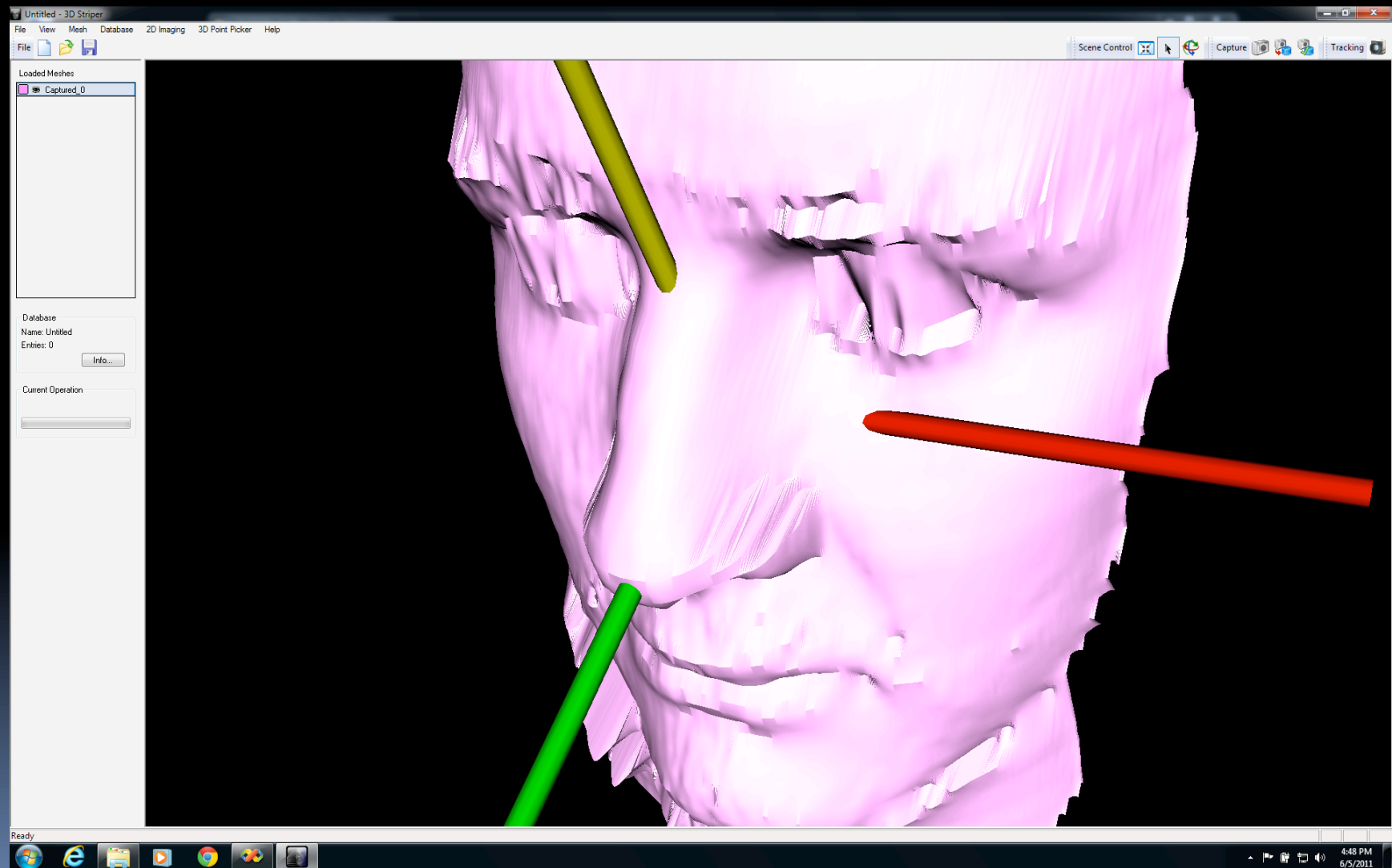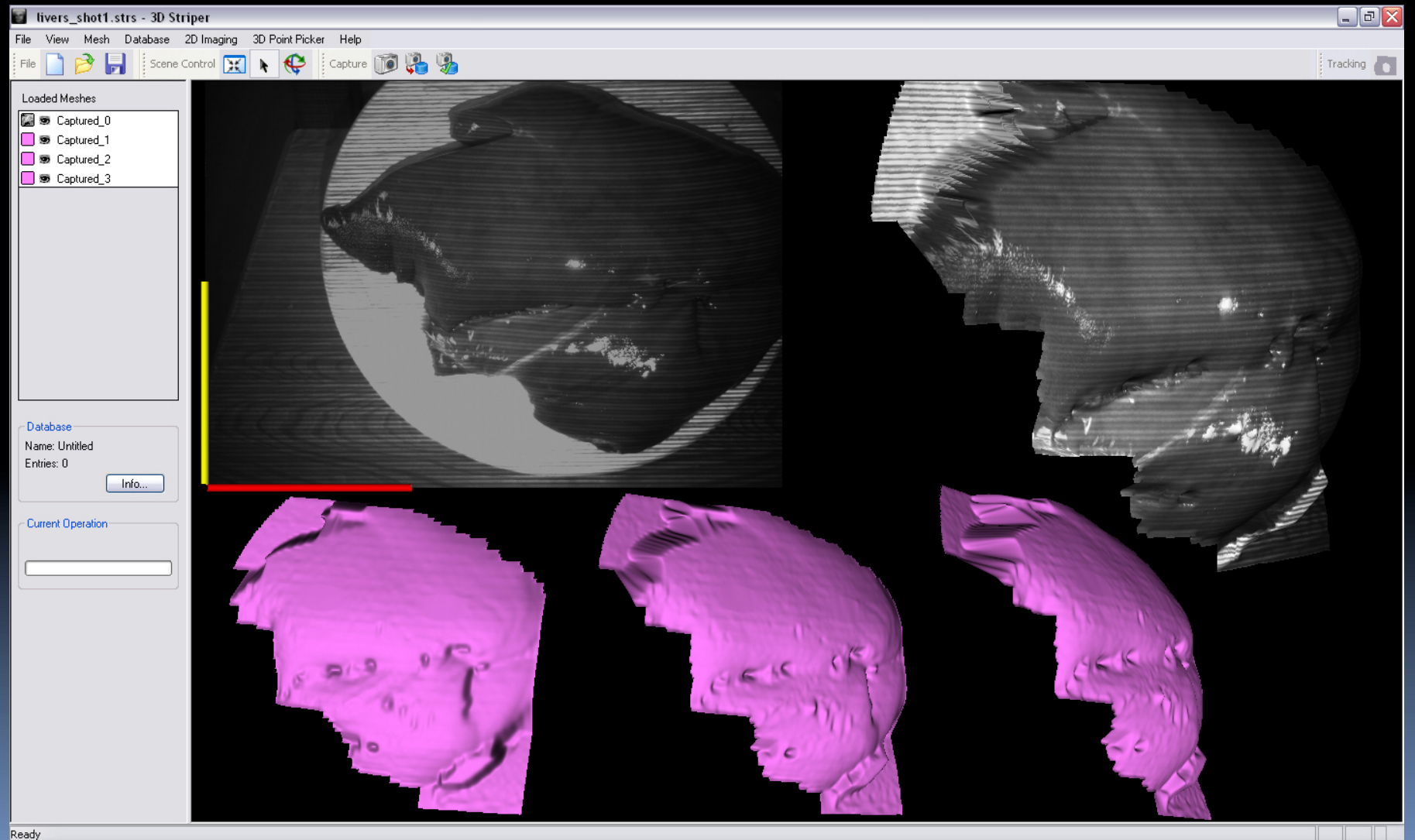- inclusion in an AR system

3D post-processing: hole filling
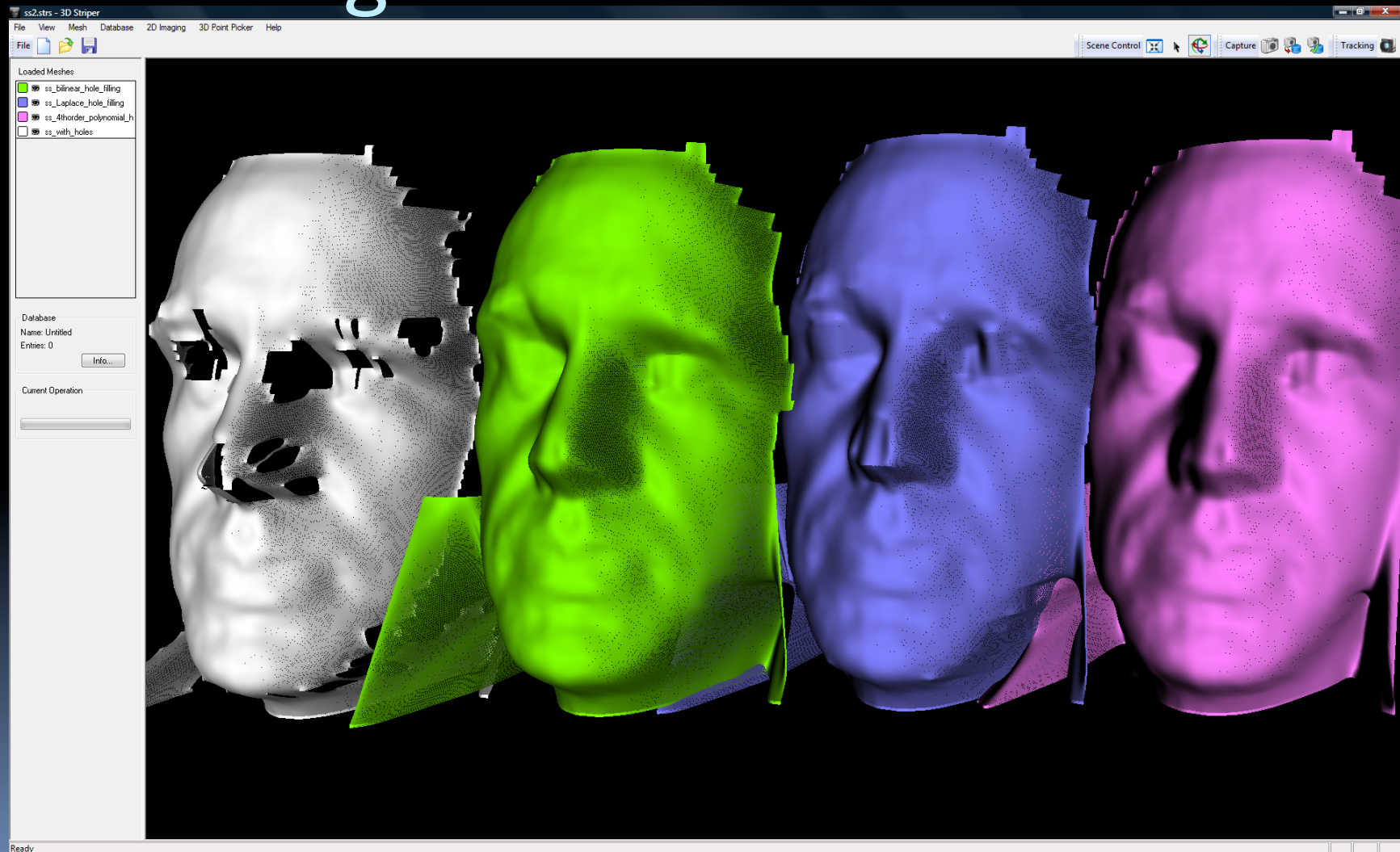
3D post-processing: smoothing

Pose registration

Need external markers for liver registration

Performance and the future

- Real-time performance
- Tracking features and registration to a standard pose
- Embed into AR systems

Future work:

- Embedding the design into DSPs
- New optics
- Develop methods for 3D image compression