SlicerOCT: A 3-D visualization platform for orthoplane viewing of OCT(A) datasets

Lennart Husvogt[1,3], Eric M. Moult[2,3], ByungKun Lee[3], Nadia K. Waheed[4], Joachim Hornegger[1,5], Richard F. Spaide[6], Andreas Maier[1,5], James G. Fujimoto[3]

[1] Pattern Recognition Lab, Friedrich-Alexander University Erlangen-Nürnberg (FAU), Erlangen-Nürnberg, Germany; [2] Health Sciences and Technology, Harvard-MIT, Cambridge, MA, United States;
[3] Department of Electrical Engineering and Computer Science, Massachusetts Institute of Technology, Cambridge, MA, United States; [4] New England Eye Center, Tufts Medical Center, Boston, MA, United States
[5] Graduate School in Advanced Optical Technologies, Friedrich-Alexander University Erlangen-Nürnberg (FAU), Erlangen-Nürnberg, Germany; [6] Vitreous-Retina-Macula Consultants of New York, New York, NY, United States

Introduction

3D Slicer is a cross-platform open-source medical image processing and visualization system that was developed for radiology [1]. The purpose of this study is to develop a comprehensive processing, visualization and analysis platform, **SlicerOCT**, for specifically designed for volumetric optical coherence tomography (OCT) and OCT angiography (OCTA) data.

Methods

We propose an OCT specific 3D Slicer extension, SlicerOCT, which is pictorially depicted in **Figure 1**:
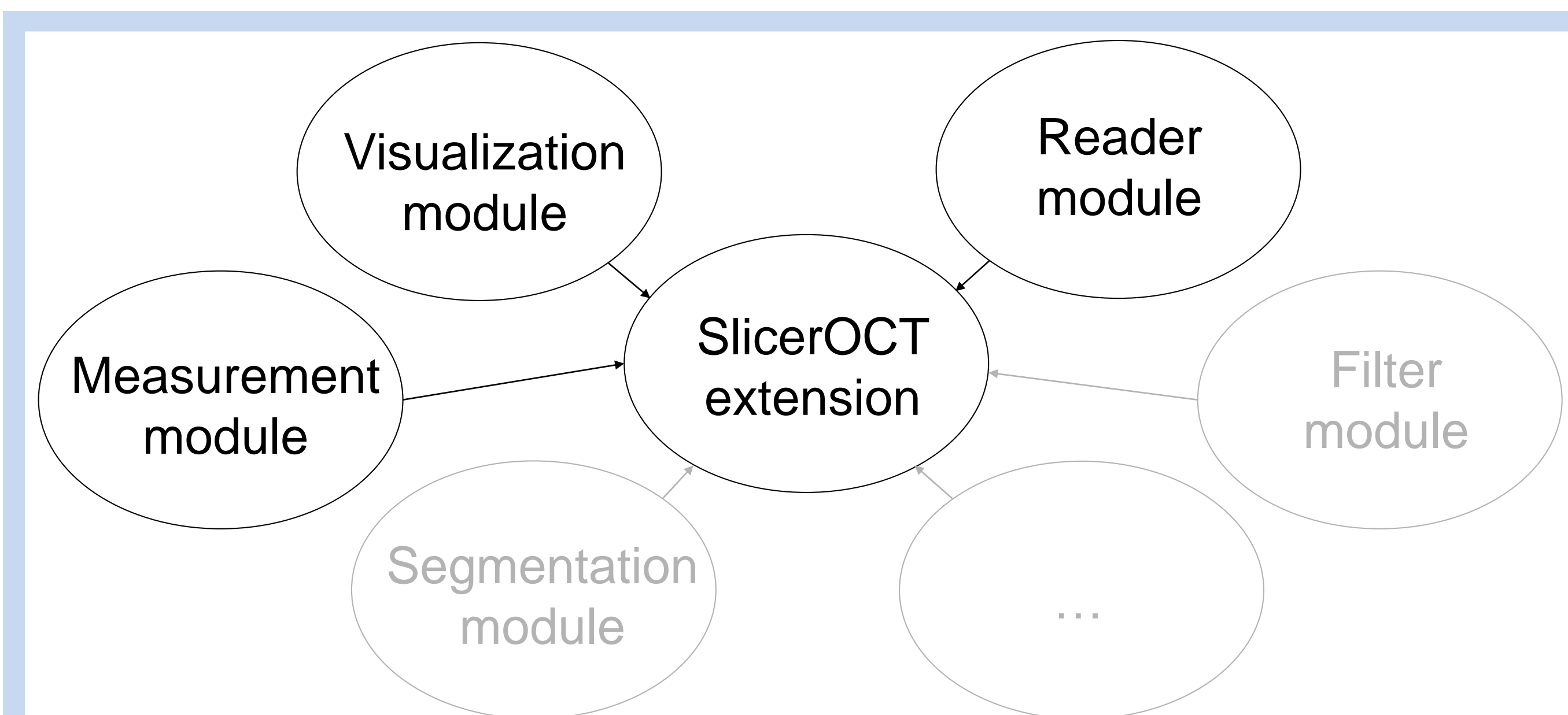
Figure 1: structure of the SlicerOCT extension (black: existing modules; grey: future modules)

Reader module:
- Load data
- Specify volume information (dimension, spacing, …)

Visualization module:
- Display OCT and OCTA data
  - Three orthogonal planes and 3D slice intersections
  - Display OCT and OCTA alone, side-by-side or overlaid
  - Scroll through volumes or navigate with crosshair
  - Adjust brightness, contrast and transparency
  - Display scalebar and orientation marker
  - Magnifying glass
  - Display moving average view in all directions
  - Save views and underlying data
- Depth projection of volumes
  - Depth range selectable
 - Different projections methods (mean, max, min, sum)

Measurement module:
- Define measurements by name, color (adjustment of transparency possible and dimension (distance, area, volume)
- Export of measurements to .csv file

Results and Discussion
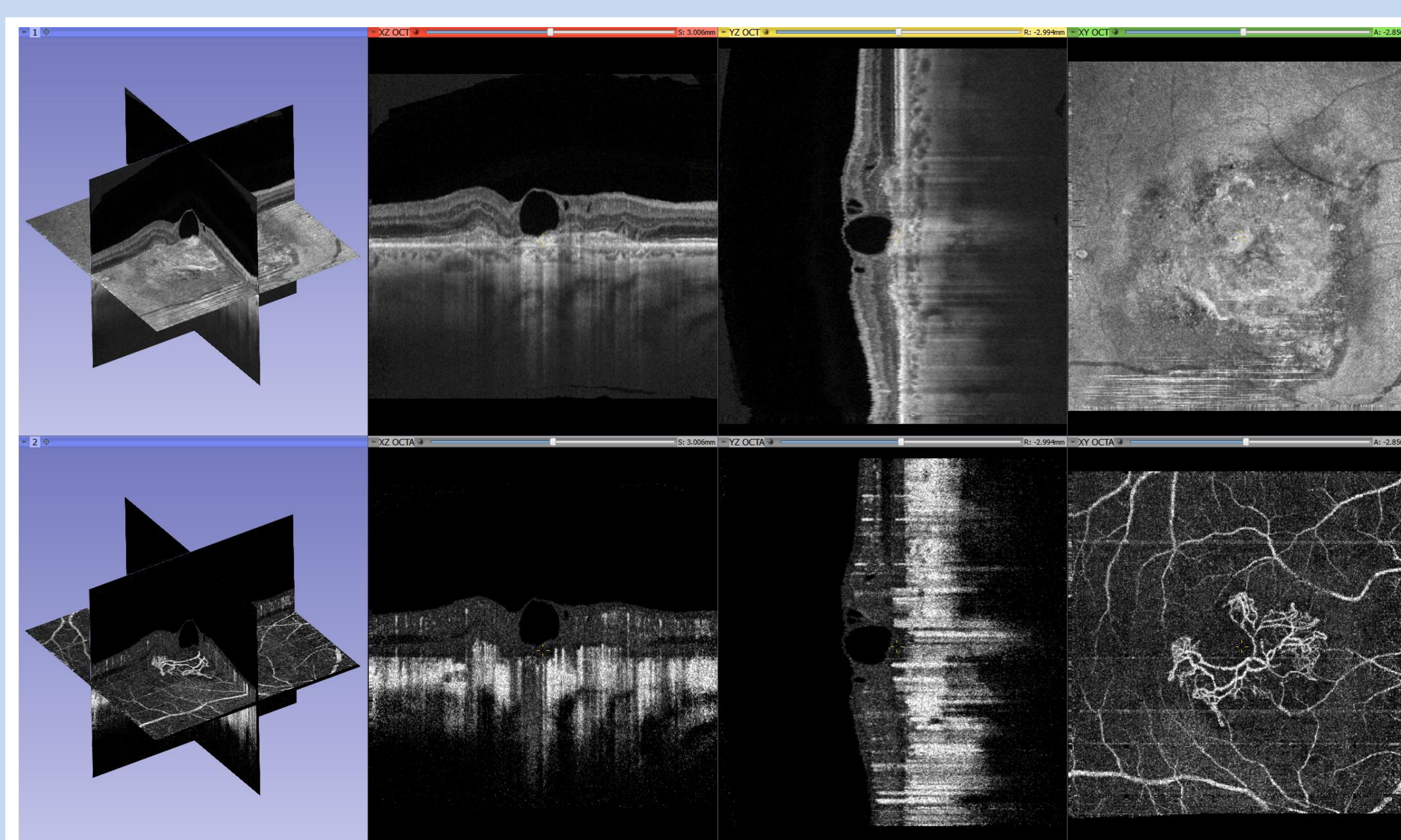
Figure 2: Slicer OCT side-by-side display of OCT and OCTA data from a patient with CNV. We can visualize lesion position through the combination of en face and cross-section views. Field size: 6x6mm.
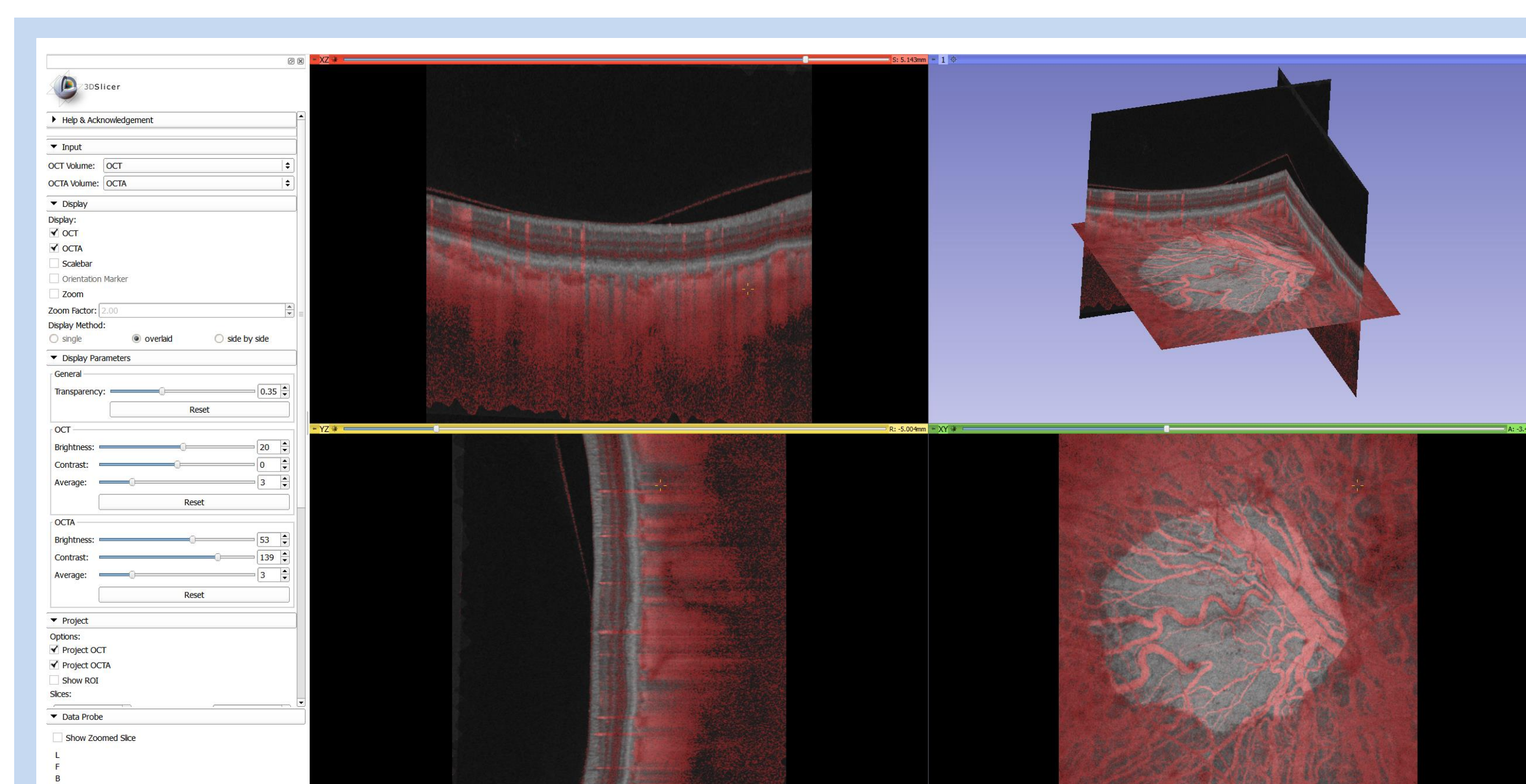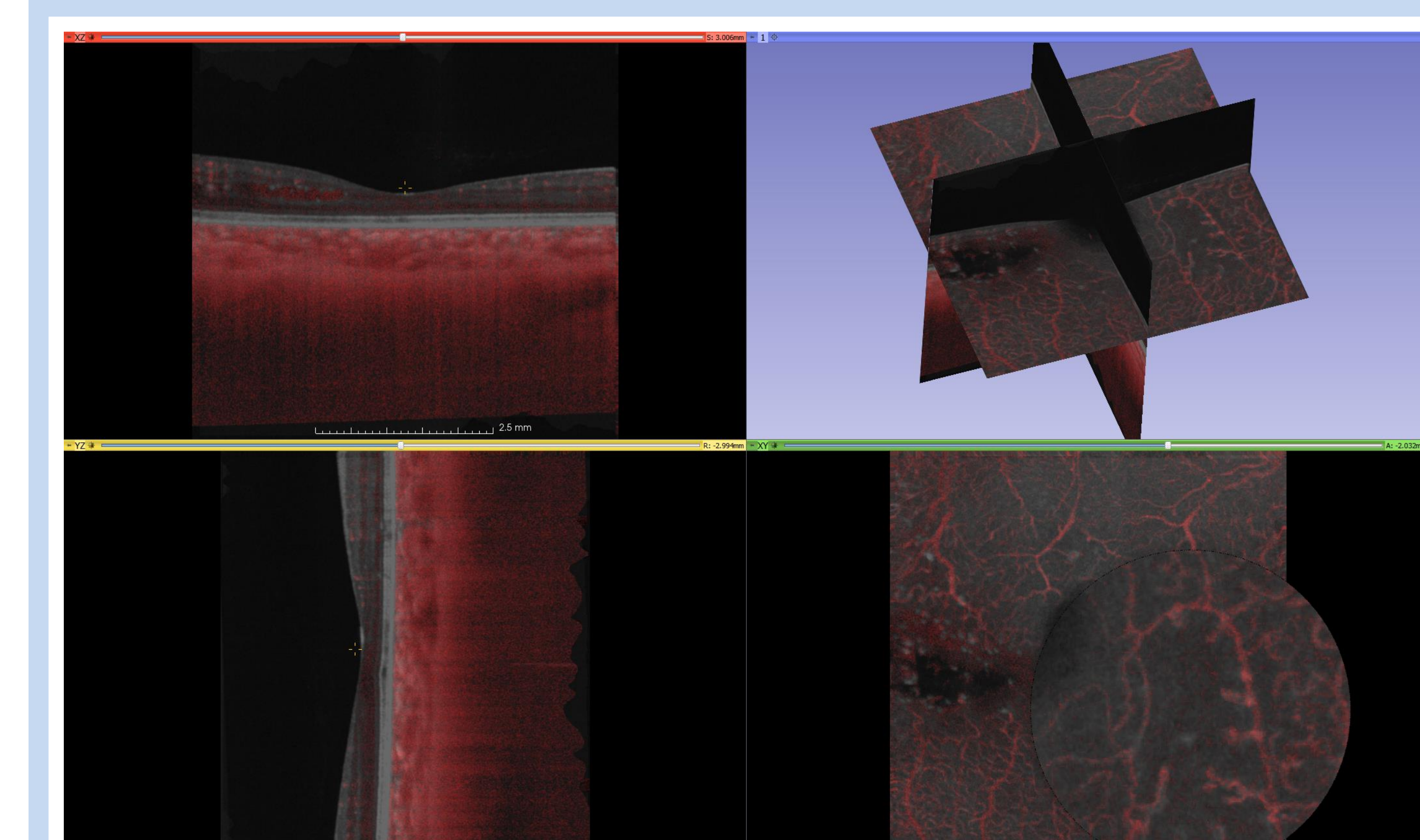

Figure 3: SlicerOCT overlaid display of OCT and OCTA data from a patient with GA. OCT data are shown in grey; OCTA data are shown in red overlay, with brighter red indicating higher decorrelation. Combined OCT and OCTA views allow choriocapillaris loss to be associated with RPE atrophy. Field size: 6x6mm.
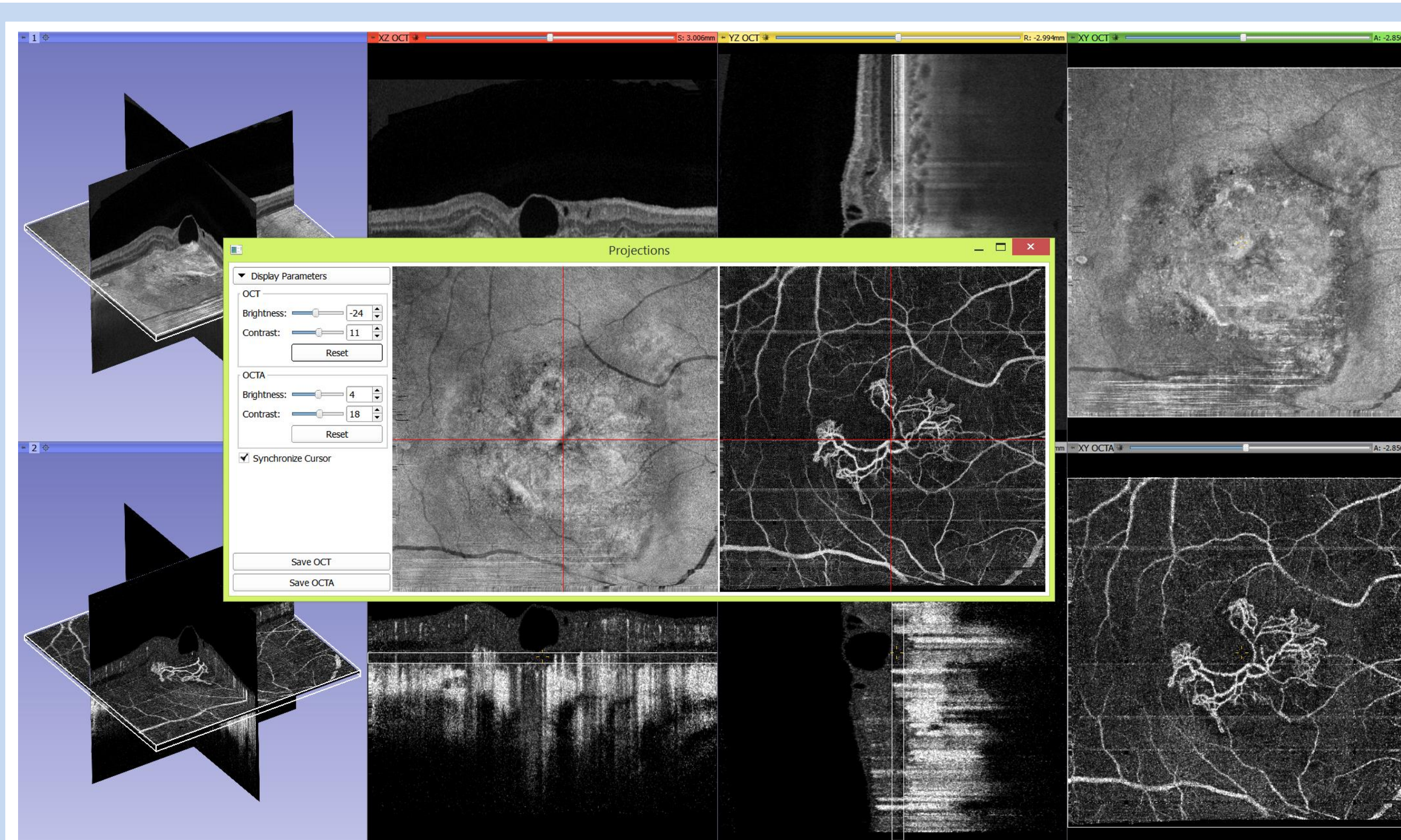
Figure 4: Looking at the OCT and OCTA en face projection over the depths indicated by the white box in the views in the same CNV patient as in Figure 2. Field size: 6x6mm.
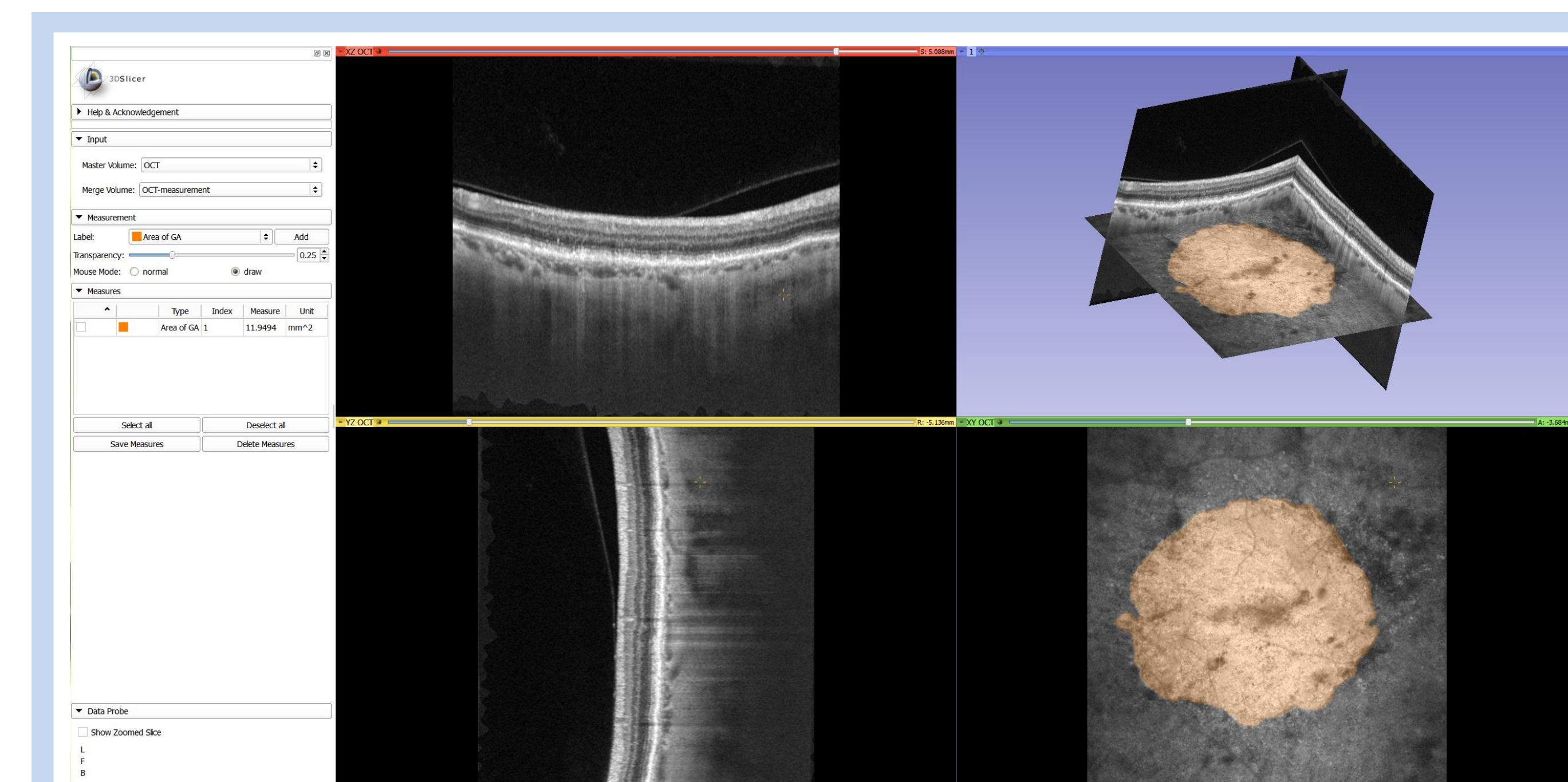
Figure 5: Measuring the area of GA in the measurement module by tracing the borders of this region in the same GA patient as in Figure 3. Field size: 6x6mm.

Figure 6: SlicerOCT overlaid display of OCT and OCTA data from a patient with NPDR, using the magnifying glass to zoom in a region with microaneurysms. Field size: 3x3mm

Conclusions

SlicerOCT allows the simultaneous handling of OCT and OCTA datasets, which promises to enable more accurate interpretation of OCTA data and is especially crucial for studying diseases whose progression alters through both structure and blood flow. By making SlicerOCT freely available for download, we hope that it will find widespread usage within the clinical and research communities.

References

[1] https://www.slicer.org/

Author Disclosure Block
Lennart Husvogt: None|Eric Moult: None|ByungKun Lee: None| Nadia Waheed: Commercial Relationship(s); Carl Zeiss Meditec Inc.:Code F (Financial Support); Iconic Therapeutics; ThromboGenics: Code C (Consultant)|Joachim Hornegger: Commercial Relationship(s); Royalties from property owned by MIT and licensed to Optovue:Code P (Patent)|Richard Spaide: Commercial Relationship(s); Topcon Medical Systems, Genentech Inc.:Code C (Consultant); Rotalties from Topcon Medical Systems:Code P (Patent)|Andreas Maier: None| James Fujimoto: Commercial Relationship(s); Optovue Inc.:Code I (Personal Financial Interest); Royalties from intellectual property owned by MIT and licensed to Carl Zeiss Meditec Inc., Optovue:Code P (Patent)

Contact: ✉ julia.schottenhamml@fau.de