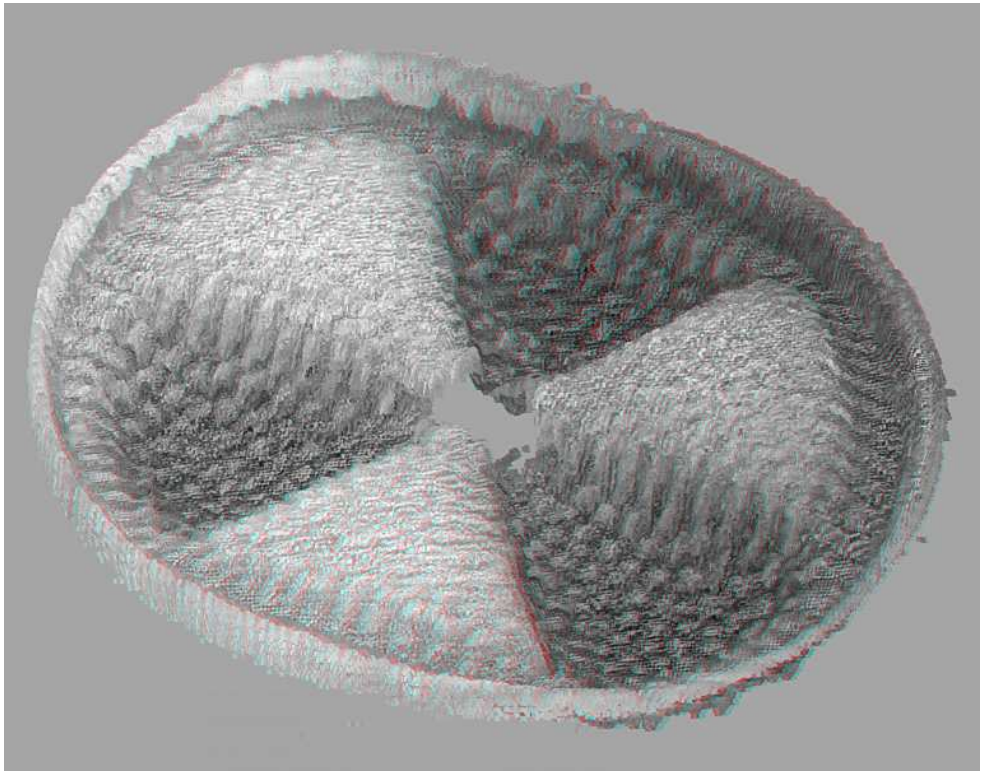
Zwei- und dreidimensionale Stapelverarbeitung von Mikrobildern mit PICOLAY



Vortrag auf
der IME am
18.9.2010

Heribert Cypionka

Institut für Chemie und Biologie des Meeres

Universität Oldenburg

www.pmbio.icbm.de

Themen

Theorie (wenig) und Anwendung

3D-Visualisierung:

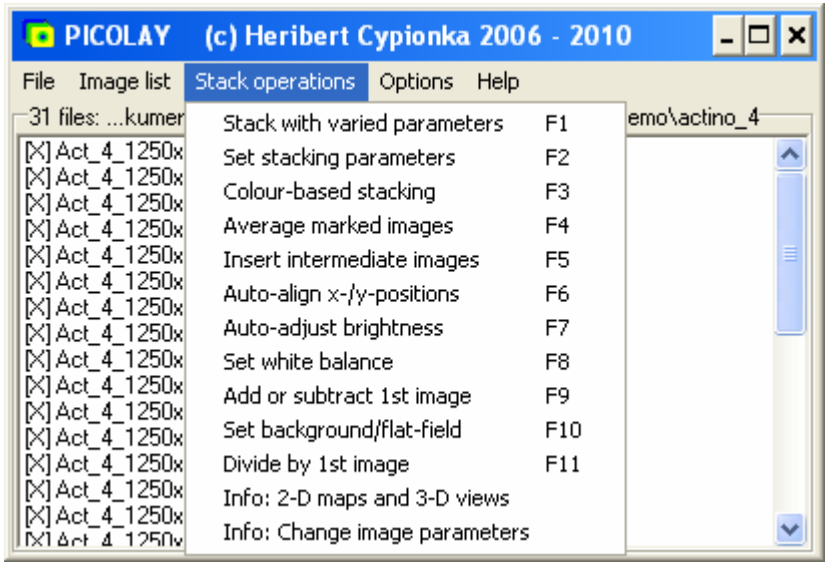
→ **Tiefenkarten-basiert**

→ **Hologramm-Verfahren**

www.mikrobiologischer-garten.de

www.microbiological-garden.net

www.picolay.de



Das kleinste und schnellste Stacking-Programm

Erzeugt 2D- und 3D-Bilder

Erledigt nötige Bildbearbeitung

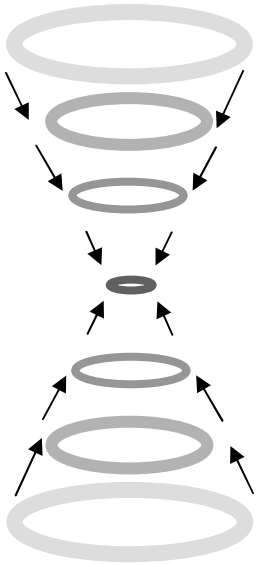
Braucht keine Installation

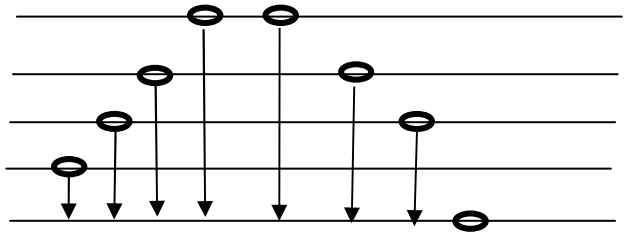
Freeware

Things you can do with PICOLAY

- 1. Browse images of a list at constant position and size
- 2. Display images of a list as slide show
- 3. Generate an animated gif file
- 4. Cut the edges of one or all images in the list
- 5. Resize one or all images of the list
- 6. Rename images
- 7. Change the file format of images
- 8. Delete selected images from disk
- 9. Add or subtract images from one another
- 10. Convert coloured images to grey scale
- 11. Increase sharpness
- 12. Increase contrast
- 13. Increase colour saturation
- 14. Change gamma value
- 15. Change brightness
- 16. Add or subtract offset or percentage to the red, green or blue channel
- 17. Run a median filter over one or all images of your list
- 18. Rotate images by any angle
- 19. Flip images horizontally or vertically
- 20. Generate negatives of images
- 21. Select sharp areas from an image stack (focus stacking)
- 22. Select areas with a target colour from your stack
- 23. Average images
- 24. Generate and insert intermediate images betweeen the images of your stack
- 25. Align displaced images of your stack with respect to x- and y-positions
- 26. Harmonise brightness of the images in your stack
- 27. Set white balance of one or all images in your stack
- 28. Set a smooth background (flat field) by removal of disturbing items from your stack
- 29. Divide RGB values of images by those of the first image in the list
- 30. Generate a depth map of your stack
- 31. Generate 3D images from depth map and stacked image.
- 32. Generate red-cyan images for anaglyph goggles
- 33. Generate (2 or 4) separate images for a 3D observation with parallel of crossed eyes
- 34.Generate spatial projections of stacked objects from any angle
- 35. Generate 3D hologram views that allow to display covered structural details
- 36. Generate rocking and rotating animations in 3D
- 37. Generate 3D images for defined observation distances (viewing angles)
- 38. Let 3D images appear in front of or behind the screen
- 39. Paint on images
- 40. Blur disturbing details
- 41. Clone (= copy) parts of an image to other areas
- 42. Clone areas of original images to the stacked result (including depth map information)
- 43. Write text on images horizontally or vertically with any font and size
- 44. Draw a scale bar (rectangle with any colour and size)

Dekonvolution and Fokus-Stacking

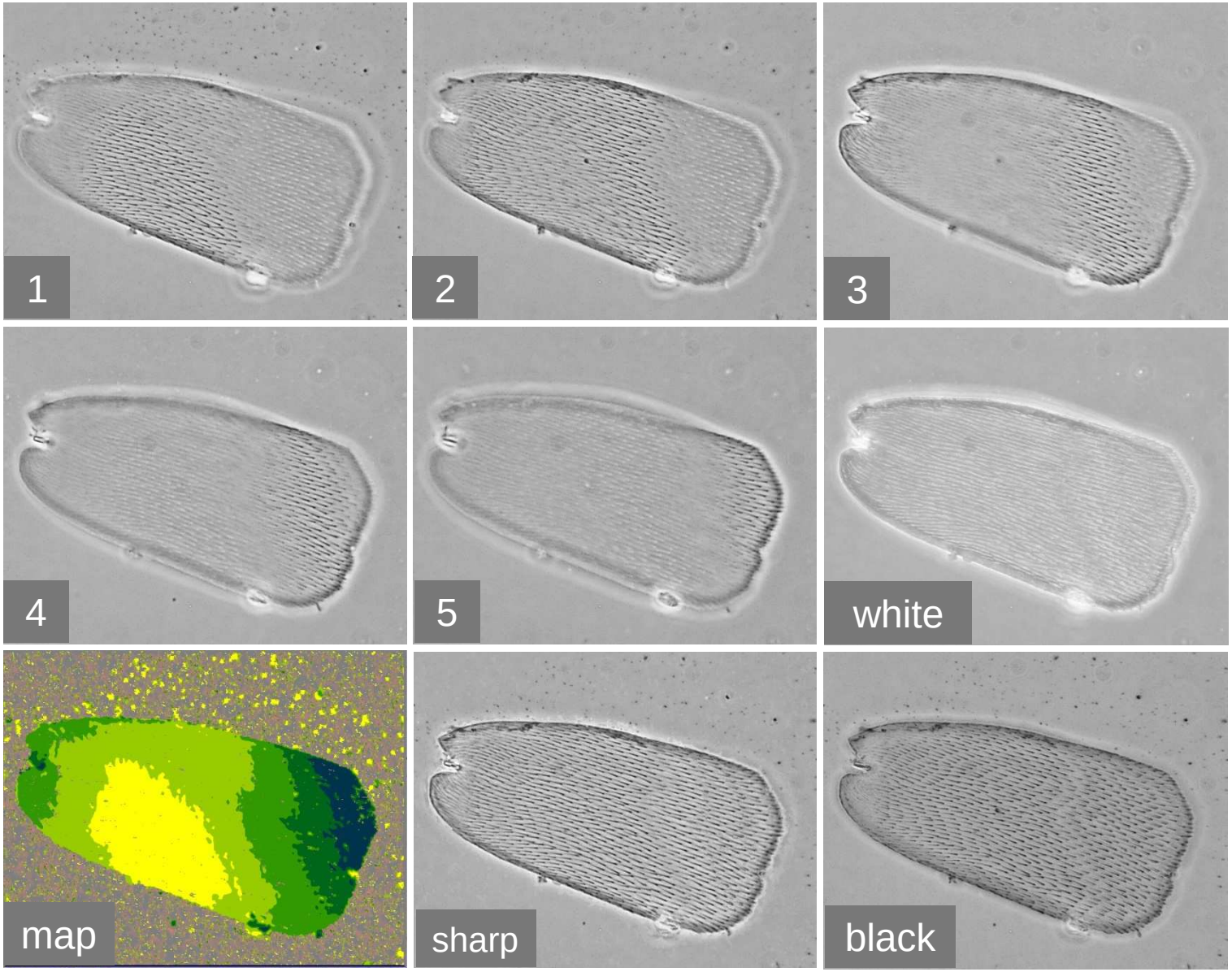




Dekonvolution: Rekonstruktion basierend auf Information aus allen Schichten

Stacking: Selektion einer einzelnen Ebene (nach Schärfe oder Farbe)

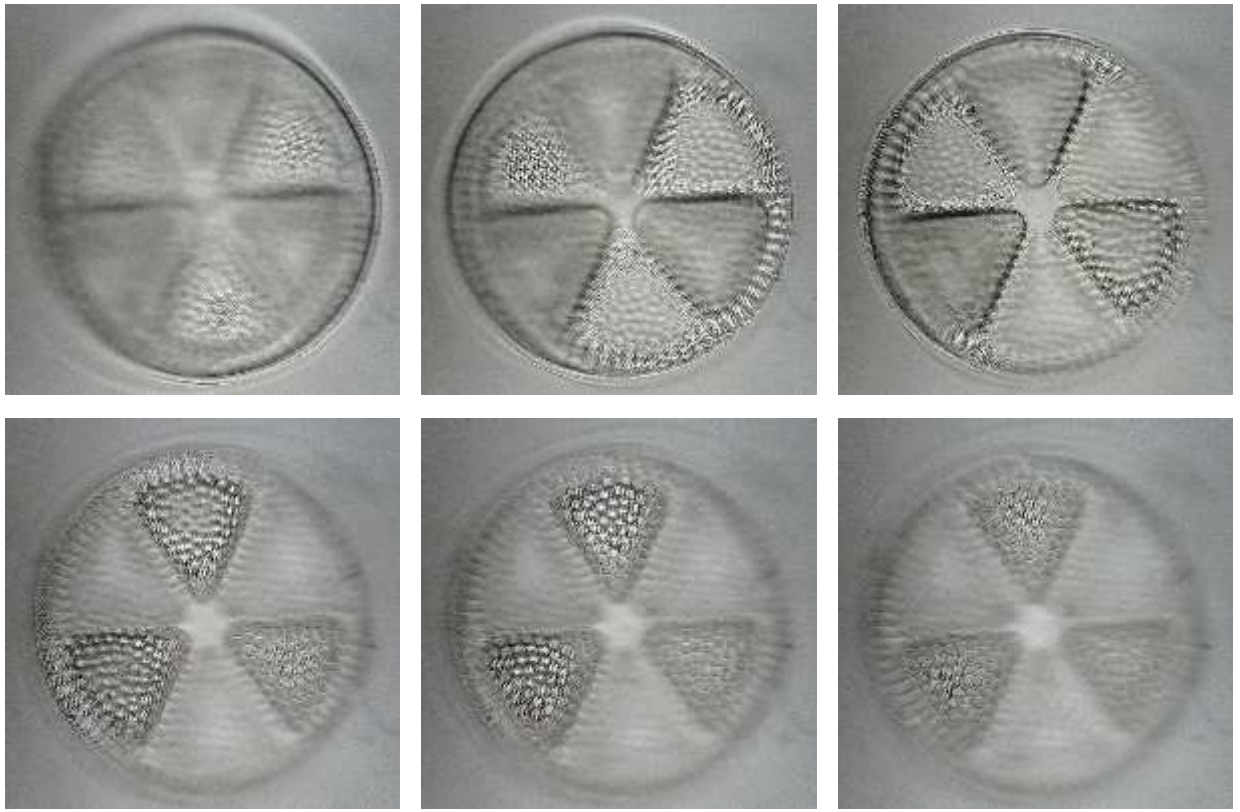
Farbe, Schärfe, Höhe



Schmetterlingsschuppe

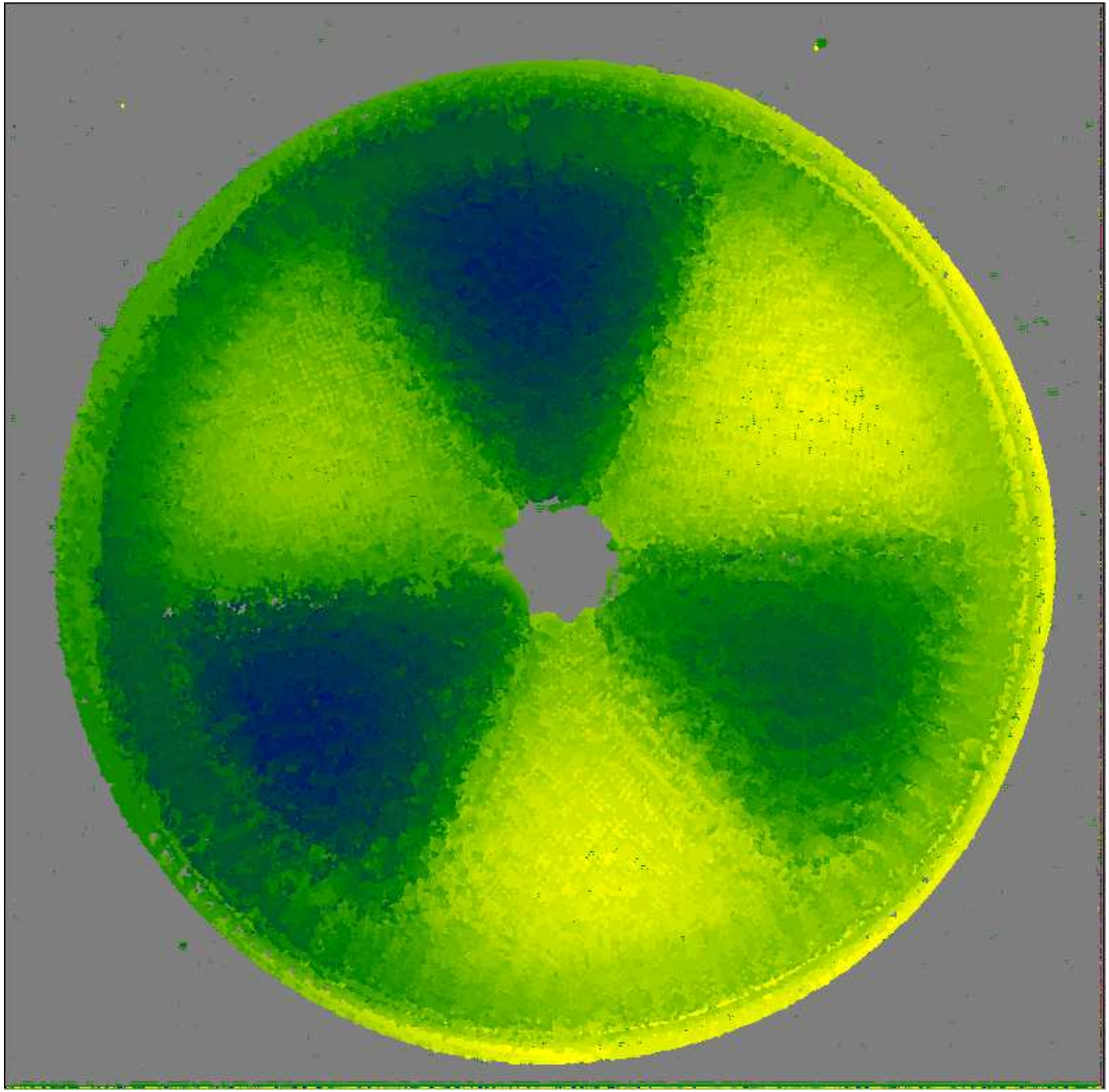
www.picolay.de

Actinoptychus

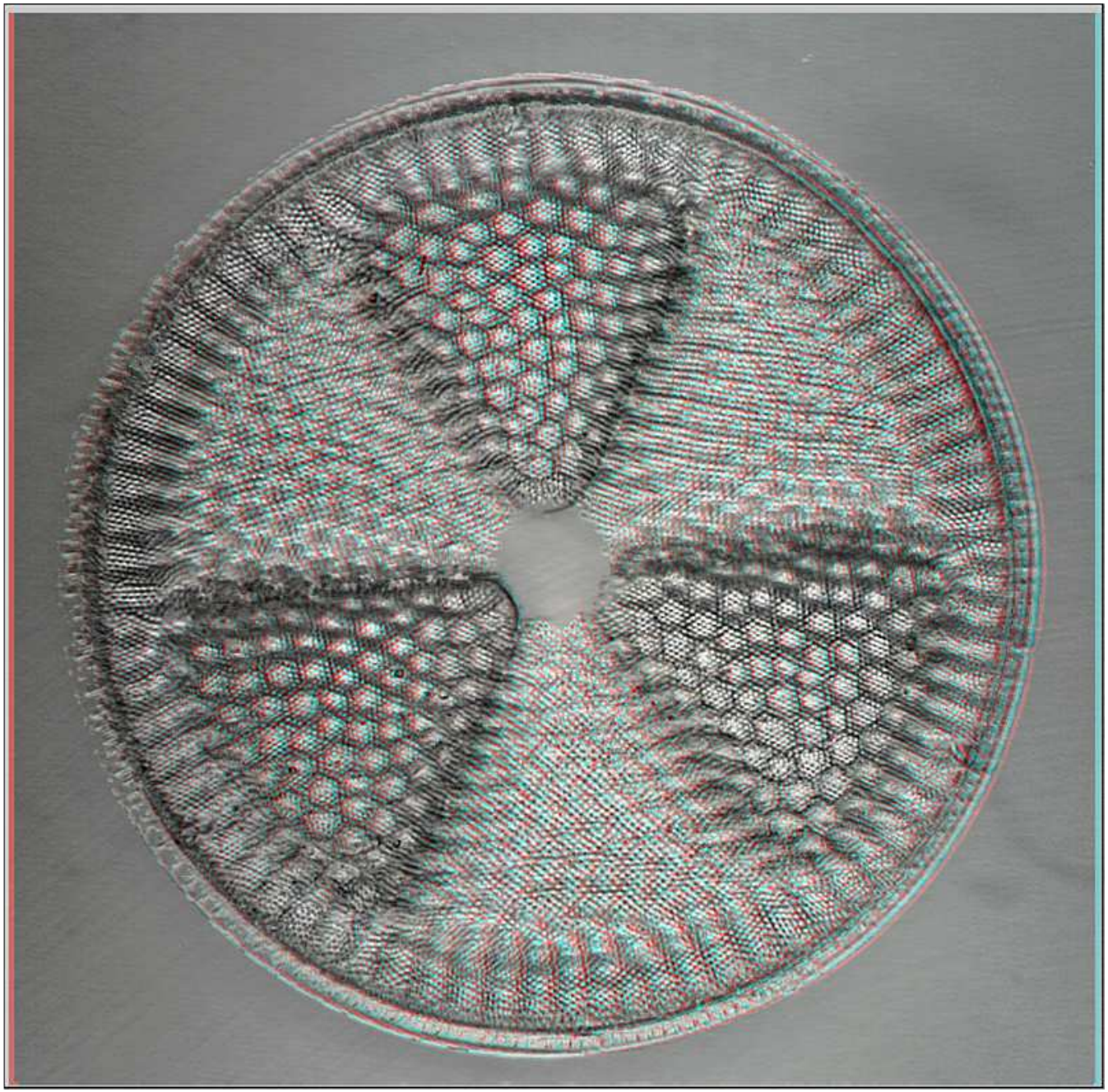


6 von 31 Bilder aus dem Stapel

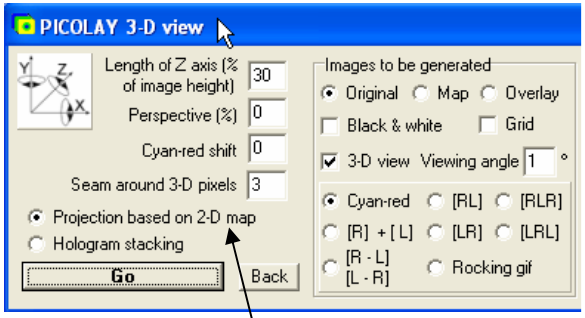
gestackt



Tiefenkarte



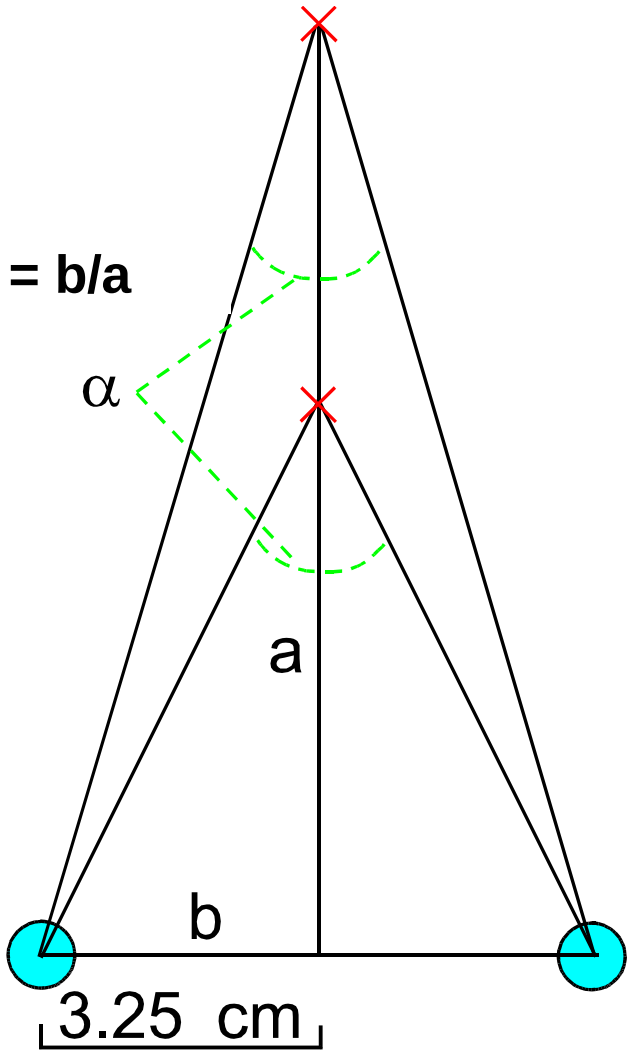
3D



Auf der Tiefenkarte basierend

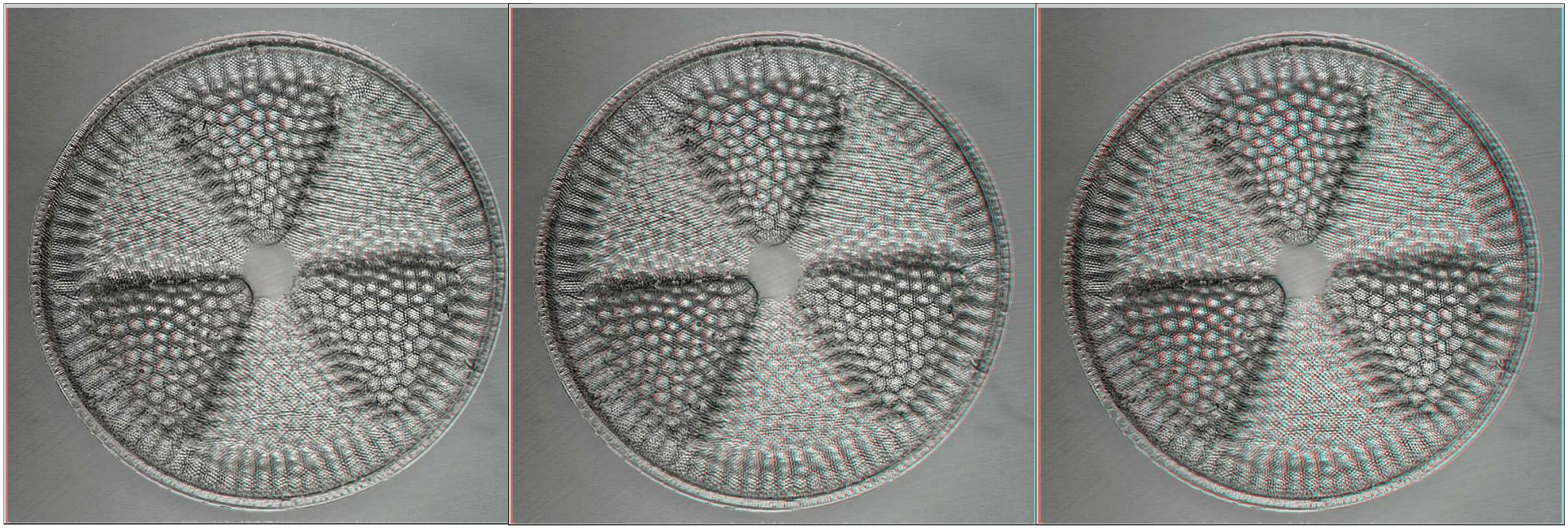
Blickwinkel aus verschiedenen Abständen

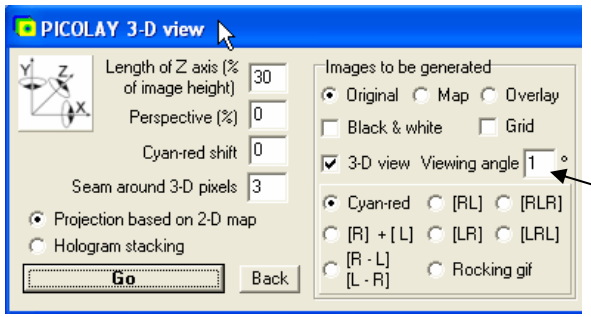
tan (α/2) = b/a



Augenabstand:
Basis = 6.5 cm

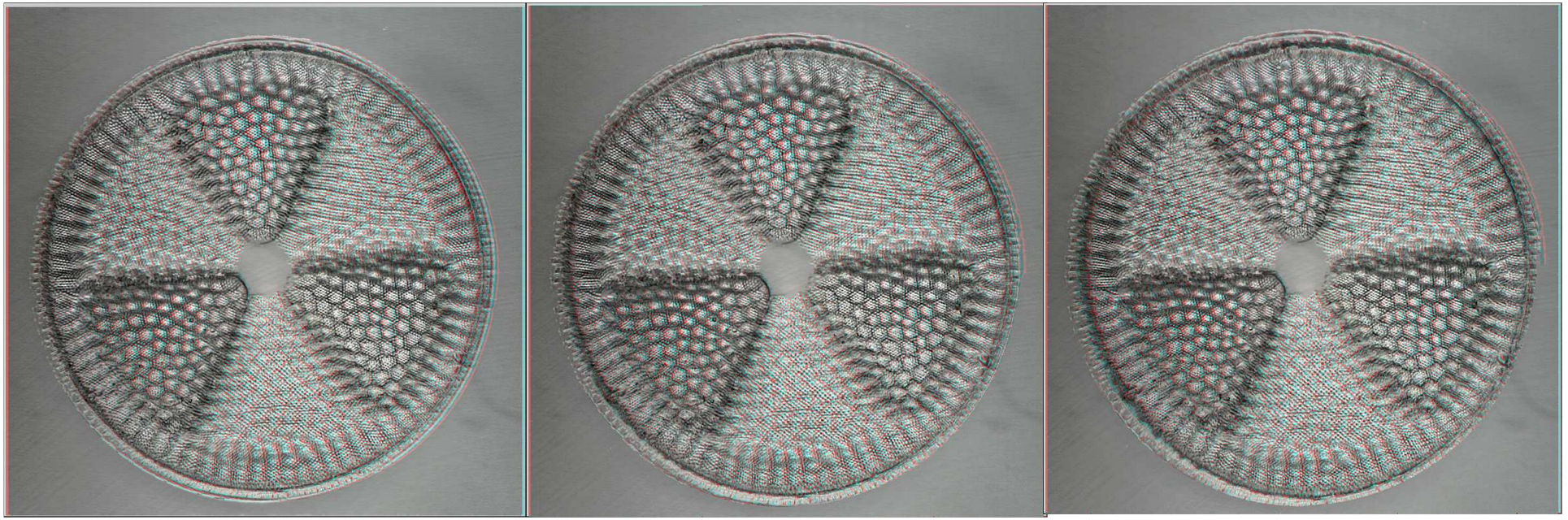
Objekt-abstand	Betrachtungs-winkel
a	α
6.5 cm →	53°
0.3 m →	12°
0.5 m →	7.4°
1 m →	3.7°
2 m →	1.9°
4 m →	0.9°
8 m →	0.5°
100 m →	0.04°

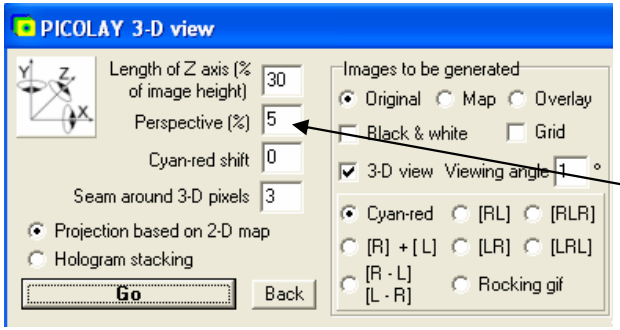




3D

Betrachtungswinkel 1, 2 und 4 °



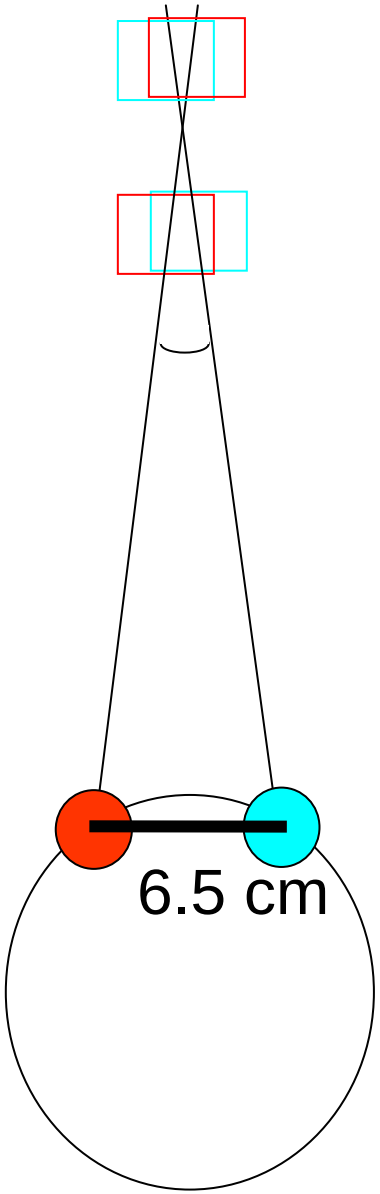


3D

0, 5 und 10 %
Perspektive

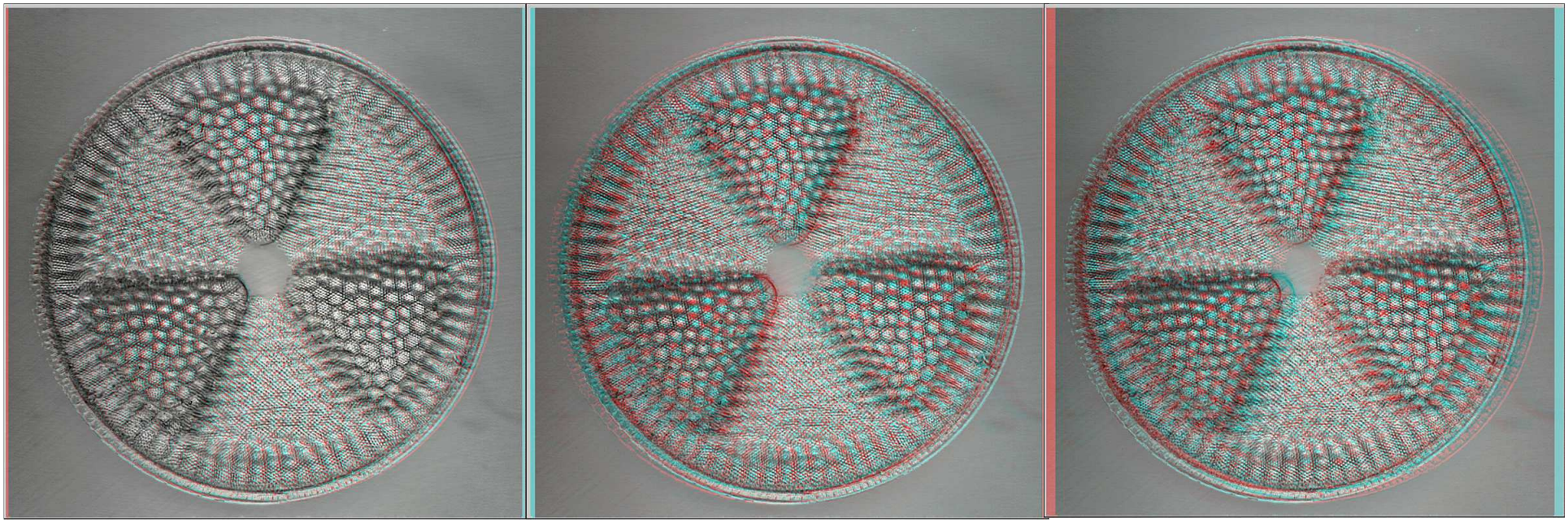
Veränderungen der Betrachtungsweise

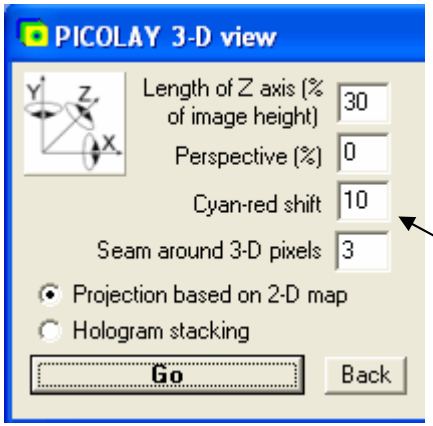
Anaglyphenbrillen (z.B. Rot-Cyan) erlauben es, zwei farbseparierte 3D-Bilder übereinander zu projizieren und das Ergebnis mit normalem Kreuzblick zu betrachten.



Änderungen im Versatz der Bilder lässt das Objekt nach vorn oder hinten wandern

Vertauschen der Bilder (oder Gläser der Anaglyphenbrille) vertauscht hinten und vorne und lässt das Objekt konkav statt konvex erscheinen.

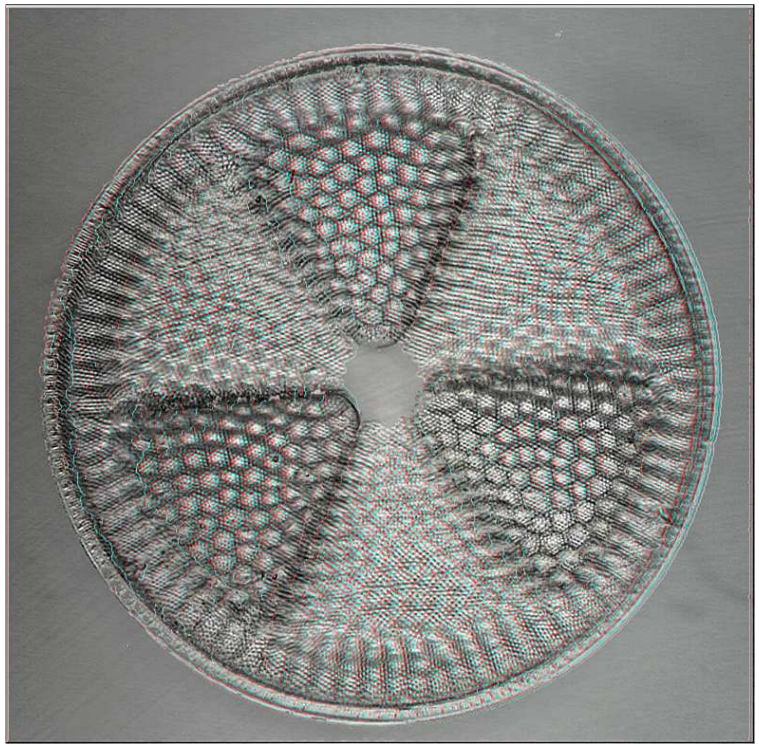




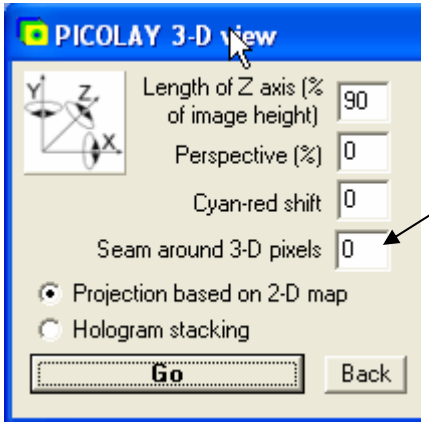
3D

Cyan-red shift

0, 10, -10

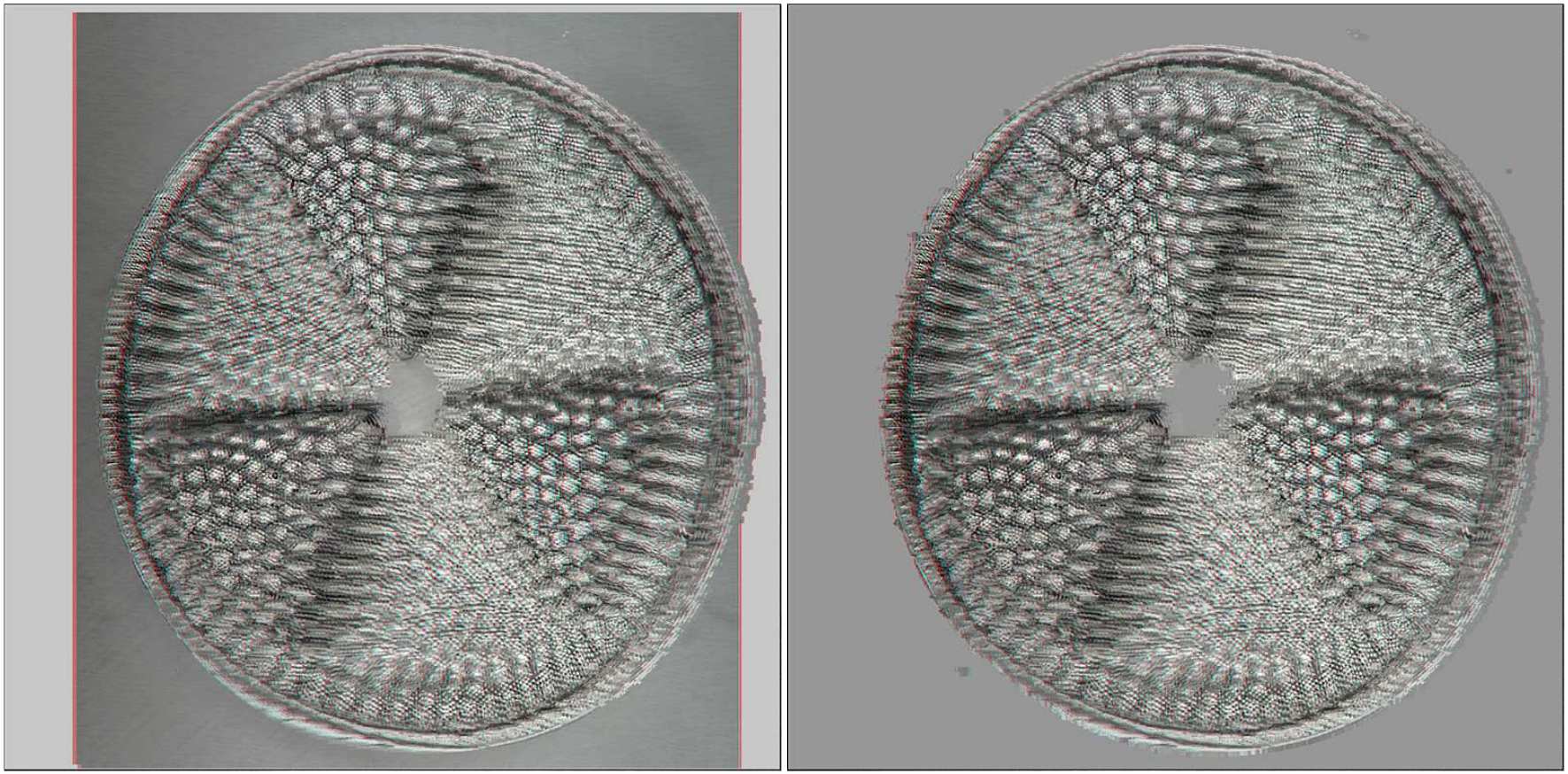


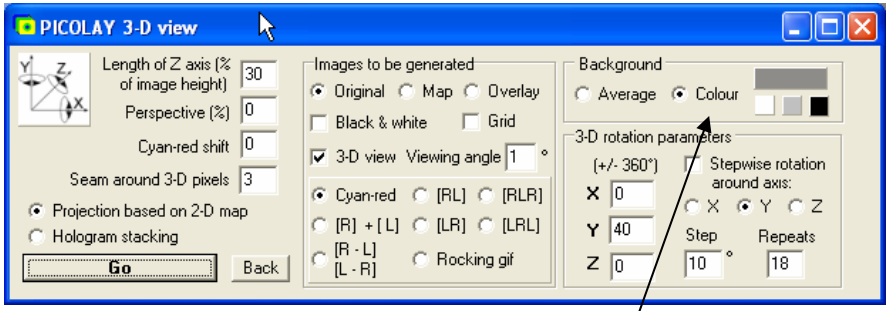
Objekt 40° um y-Achse gedreht



Saum

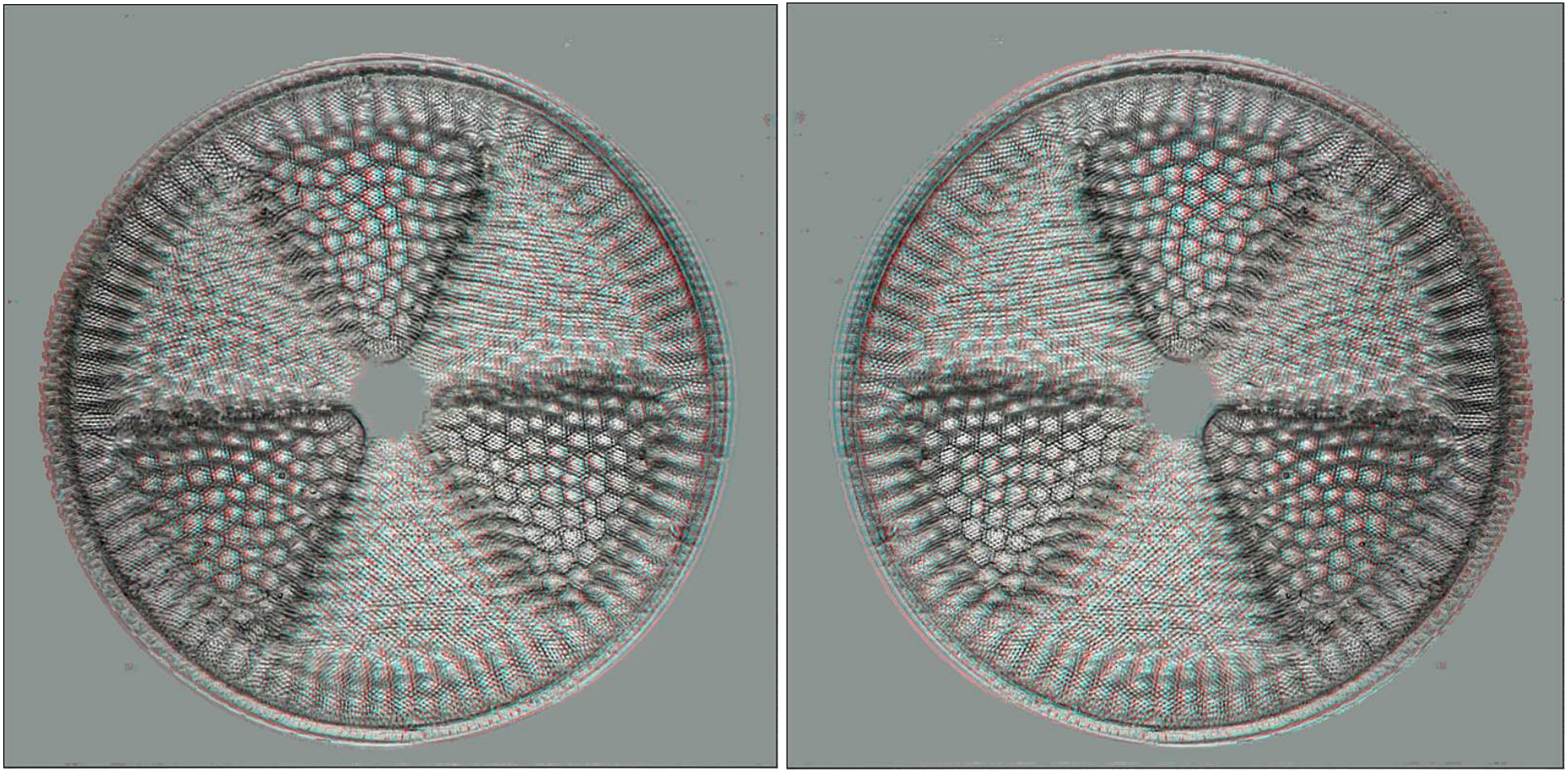
Ohne Saum ‚zerreißen‘ Tiefenkarten-basierte 3D-Bilder (Karte nicht größer als Grundfläche)





Hintergrund:
Farbe statt
Mittelwert

Tiefenkarten-basiert

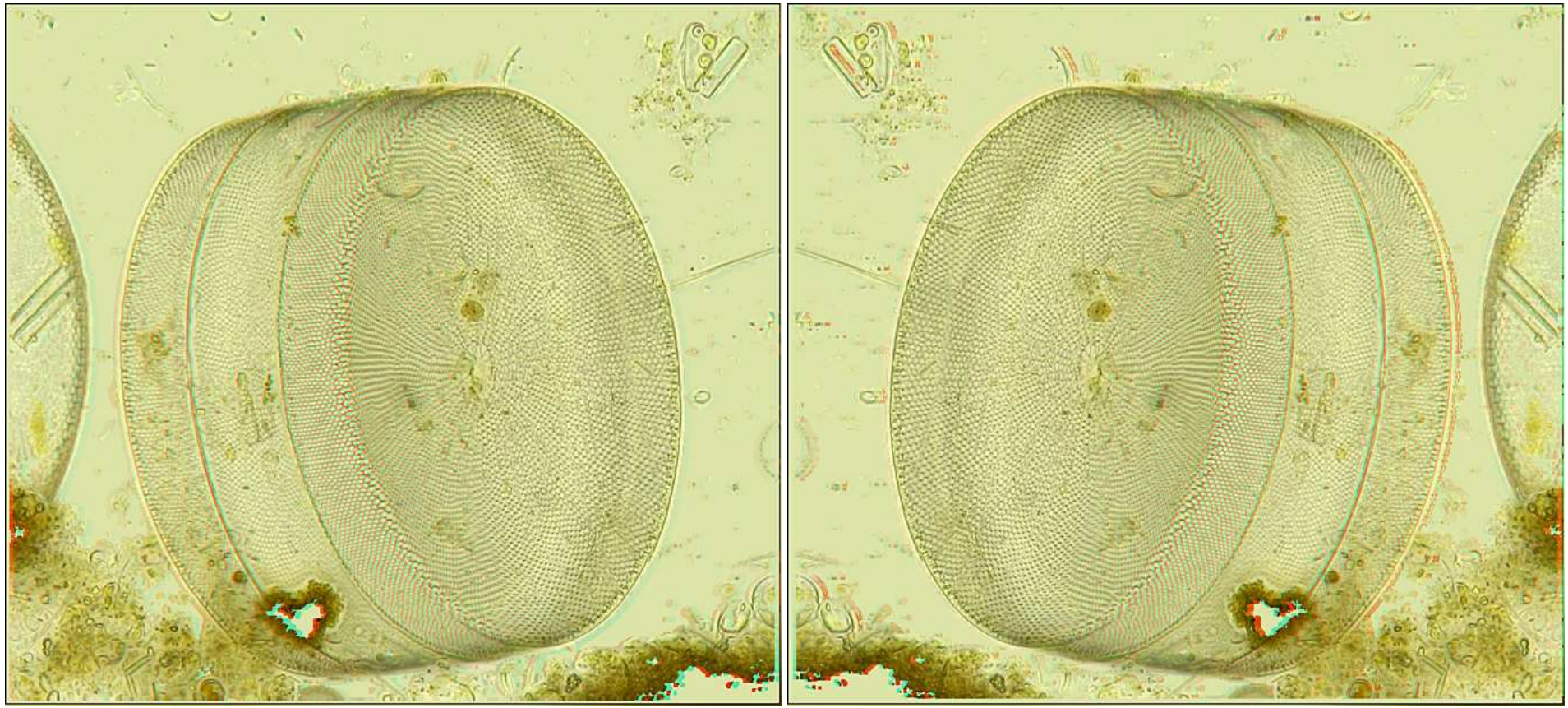


0°

y 180°

Actinoptychus

Karten-basierte Darstellung

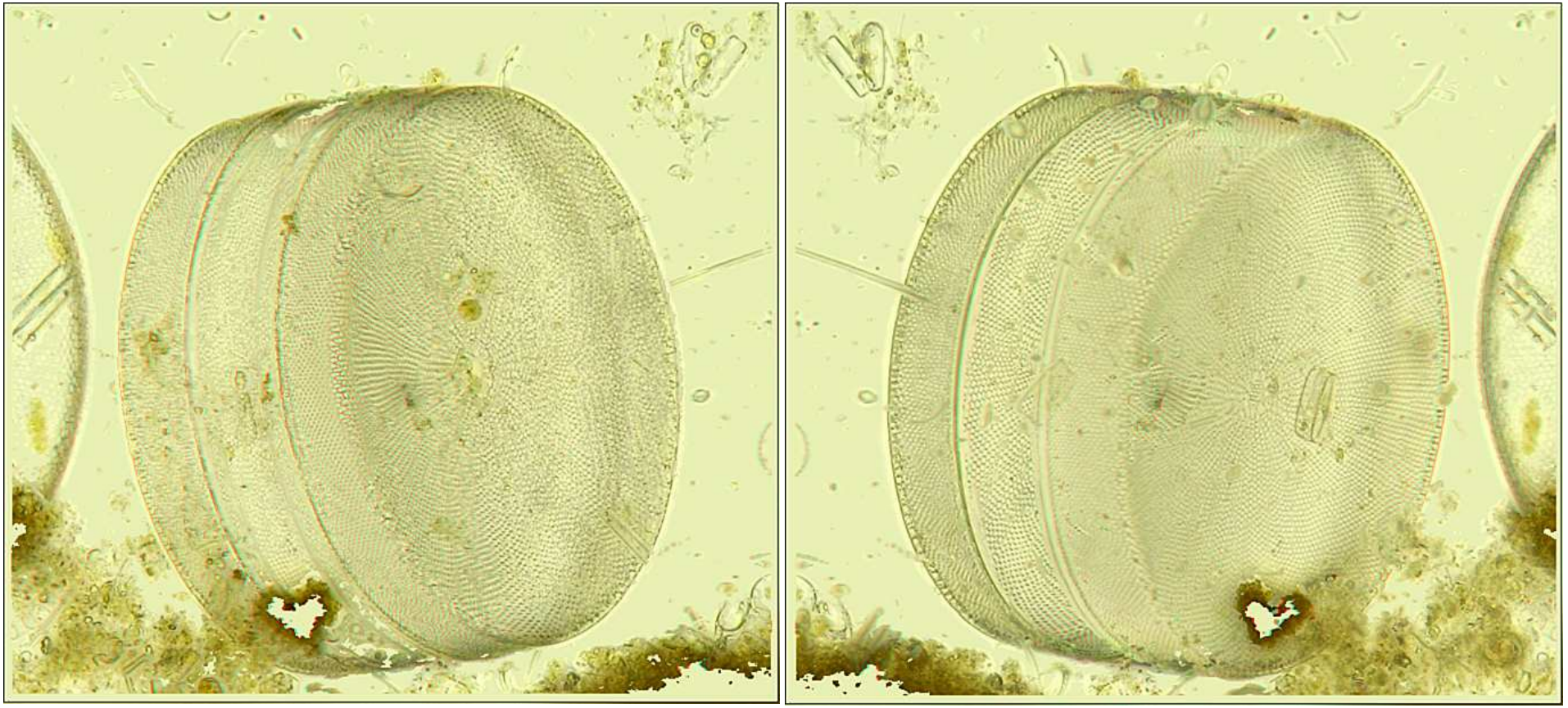


0°

y 180°

Coscinodiscus

Hologramm

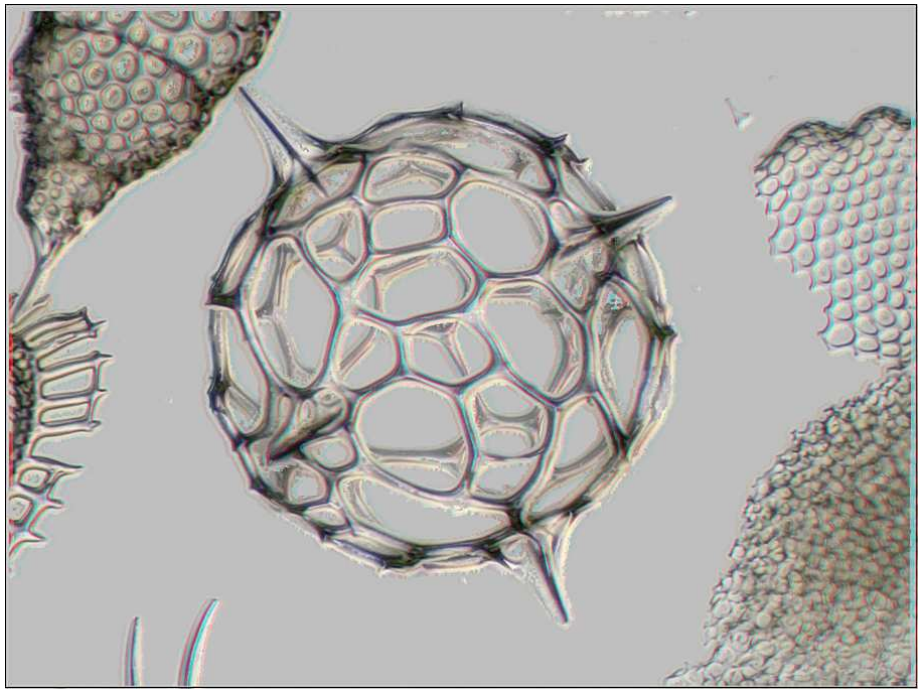


0°

Coscinodiscus

y 180°

Karten-basierte Darstellung

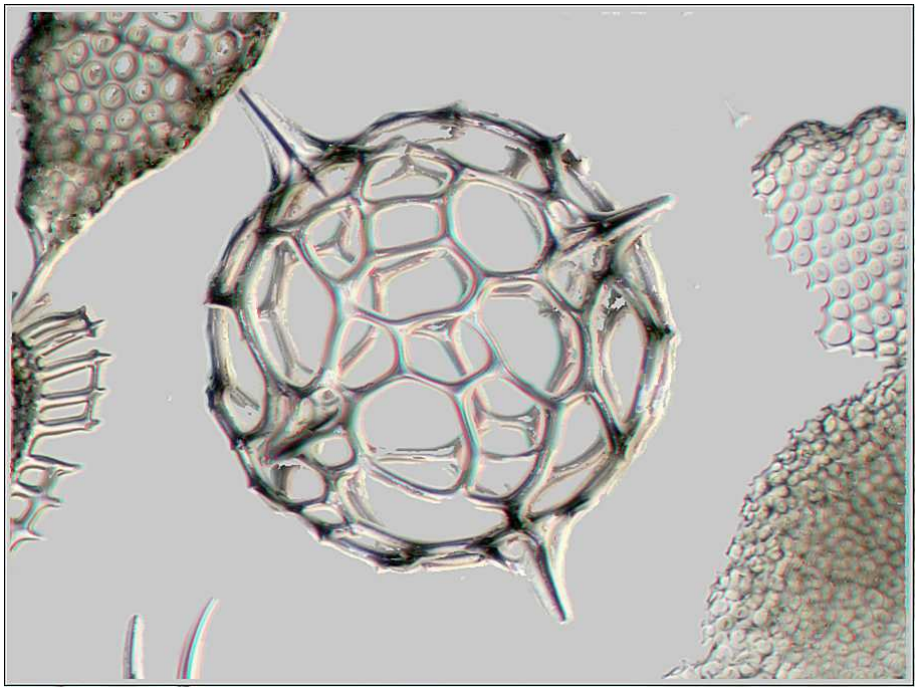


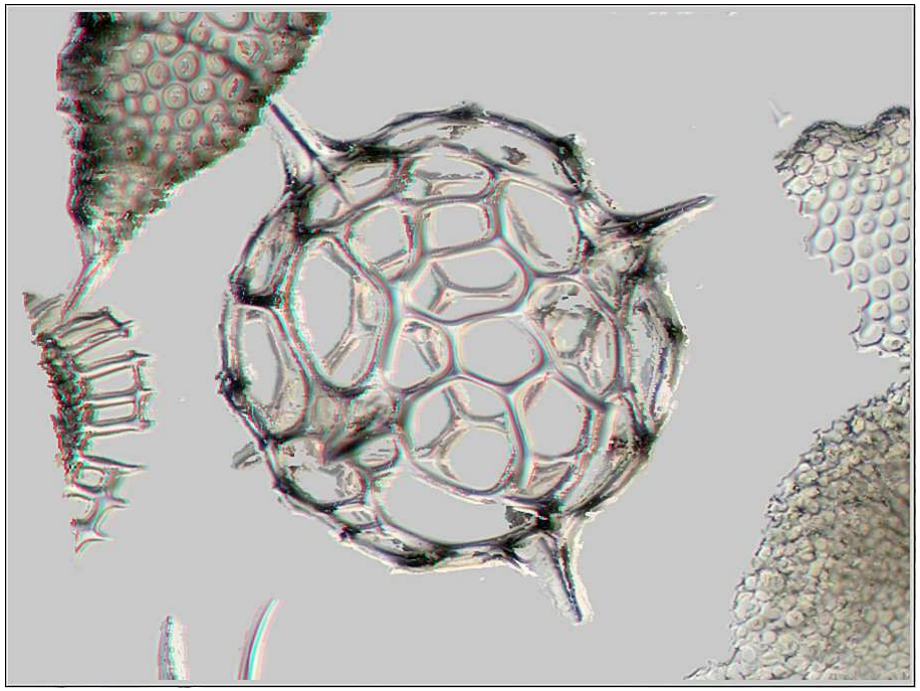
0°

y 15°

Bilderstapel Eberhard Raap

Hologramm



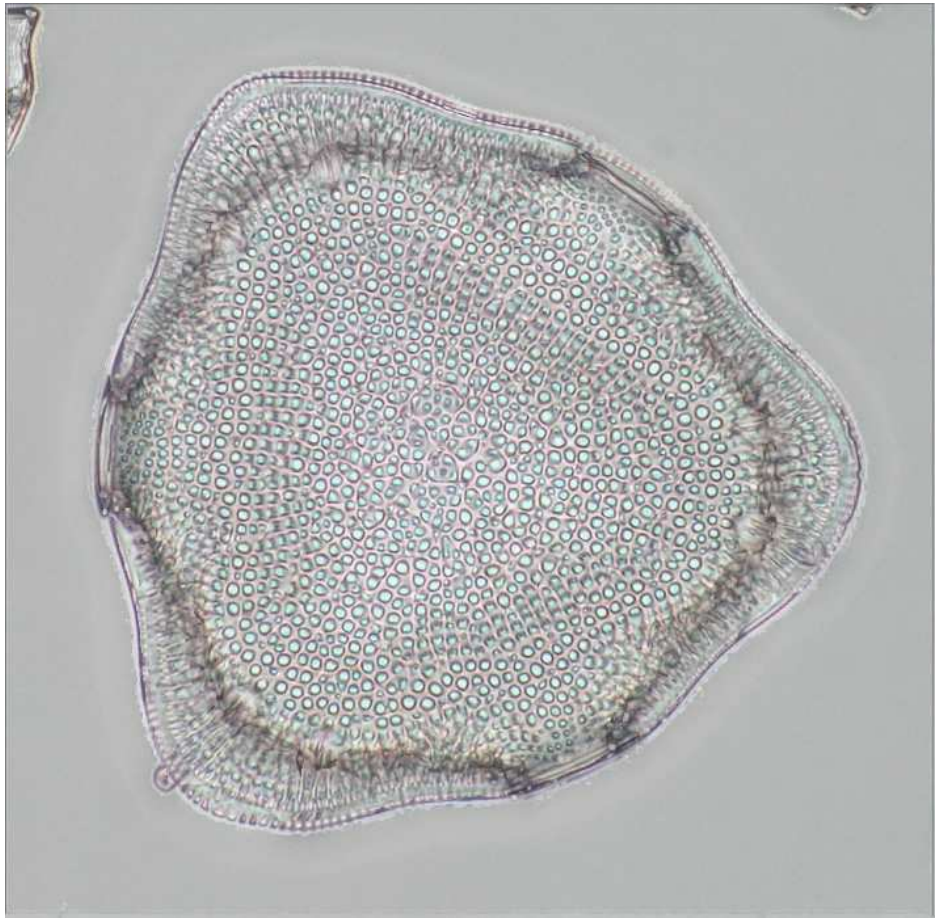


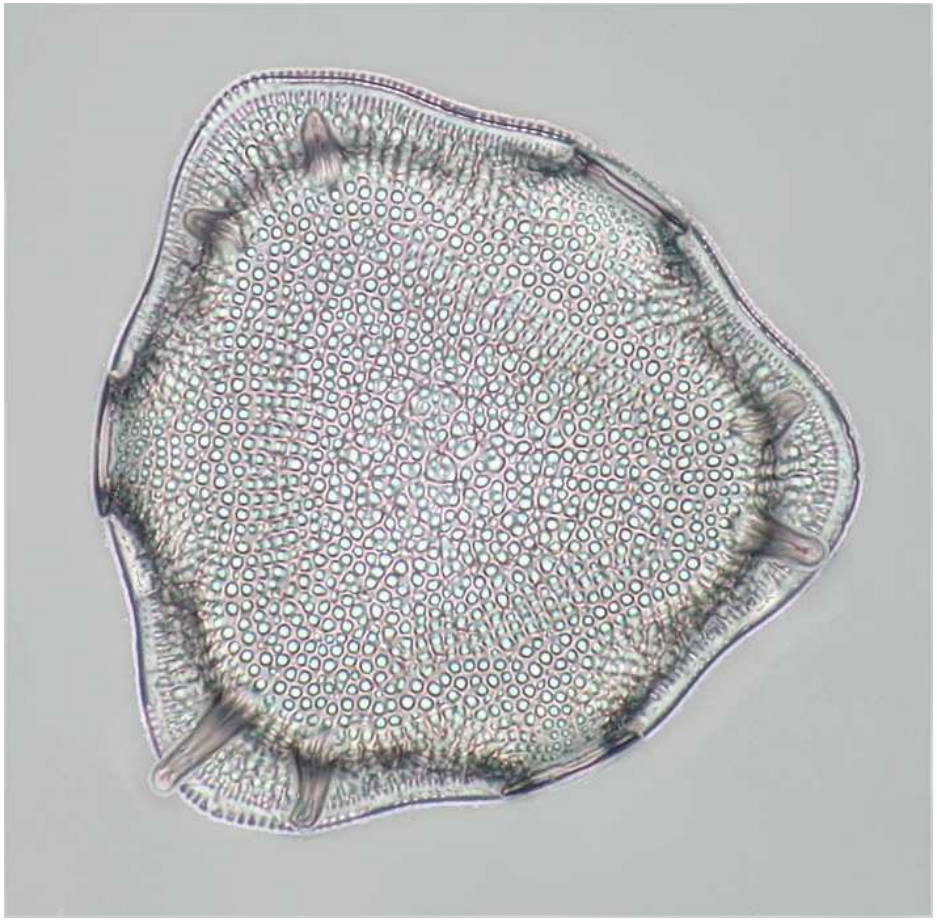
0°

y 15°

Bilderstapel Eberhard Raap

Cerataulus



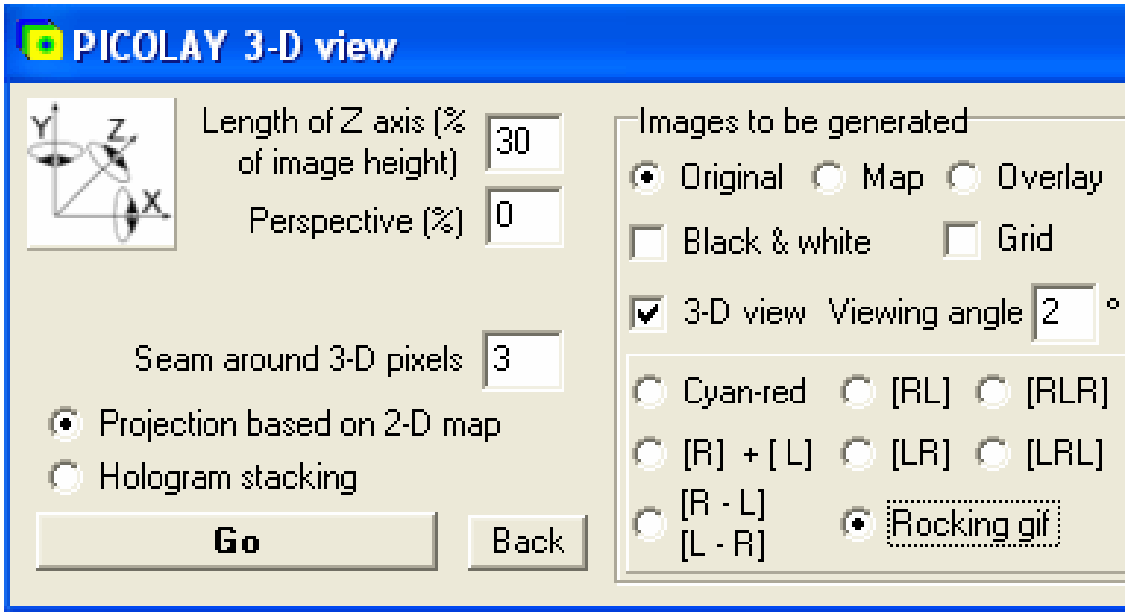


Erster Stack-Versuch

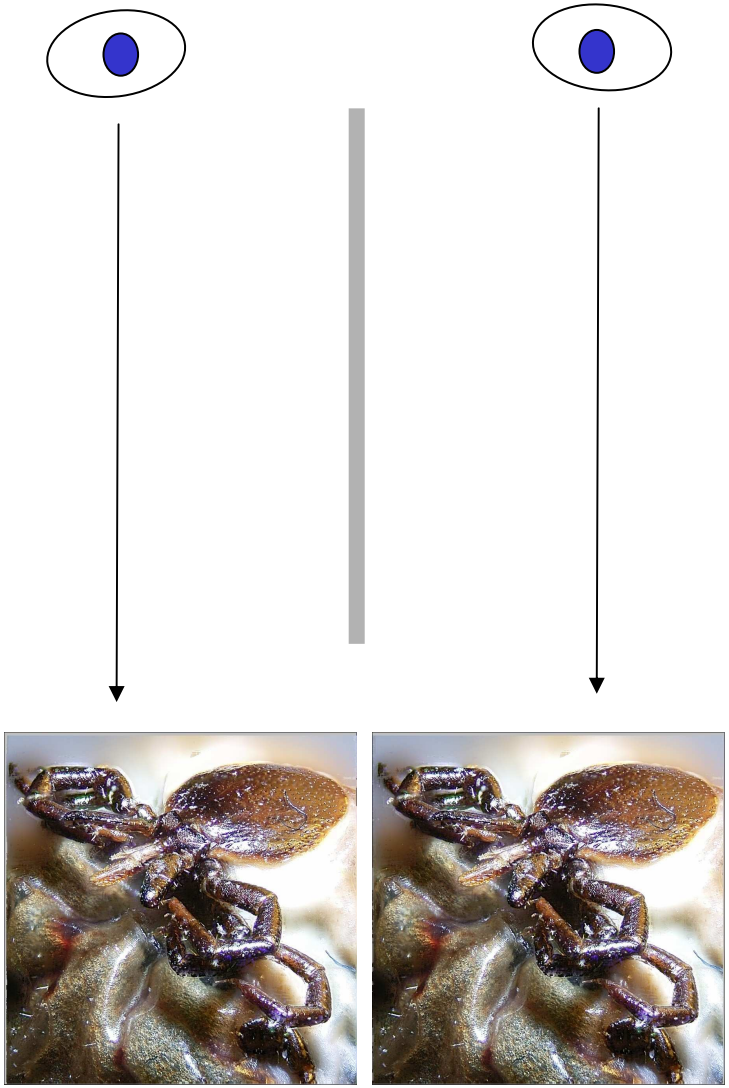
Bilderstapel Eberhard Raap

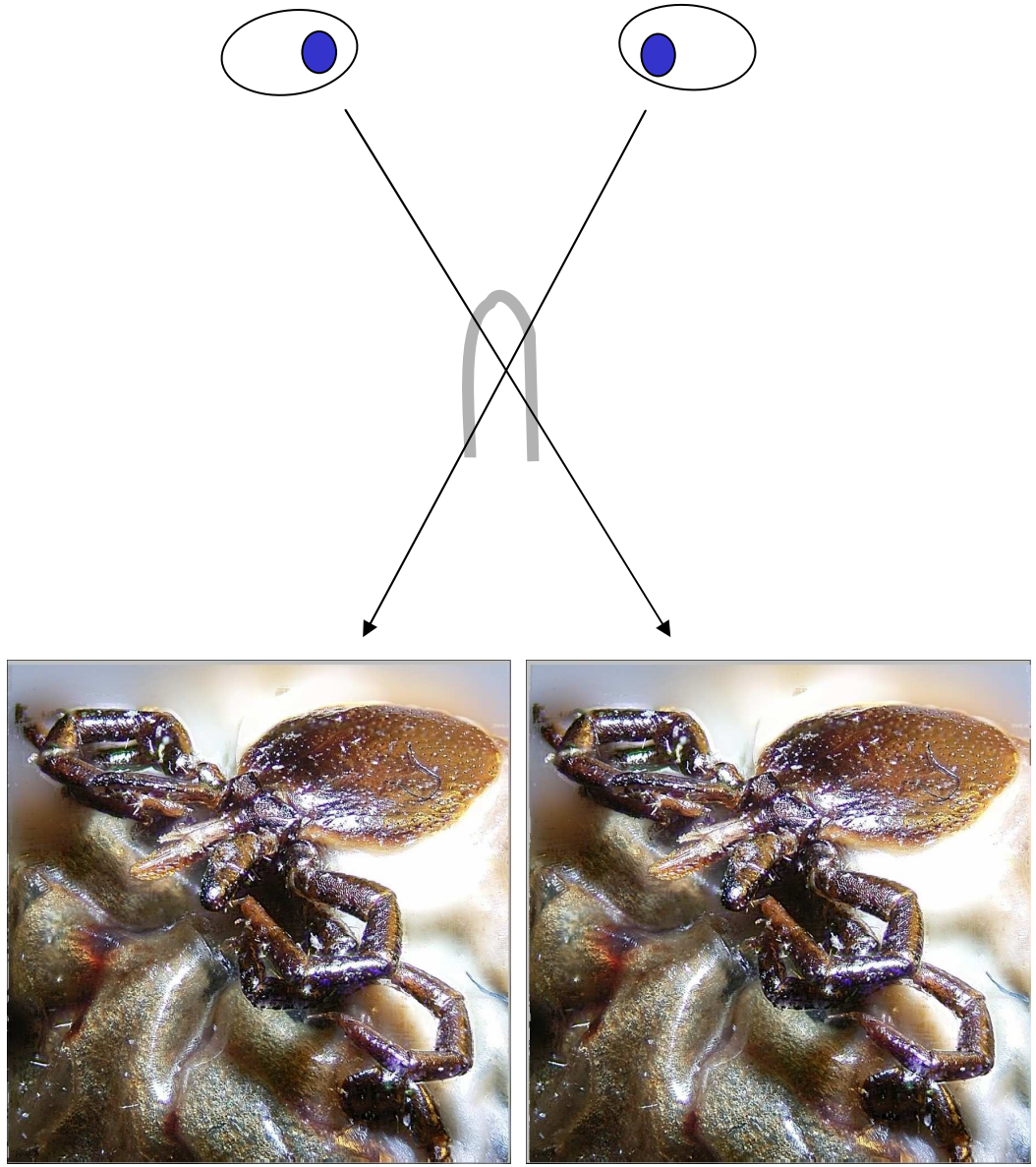
Nach Bearbeitung mit PICOLAY:
Umkehrung der Reihenfolge,
Bevorzugung oberer Strukturen,
ein wenig Klonen, Reinigung des Hintergrunds
und Verstärkung von Kontrast und Schärfe

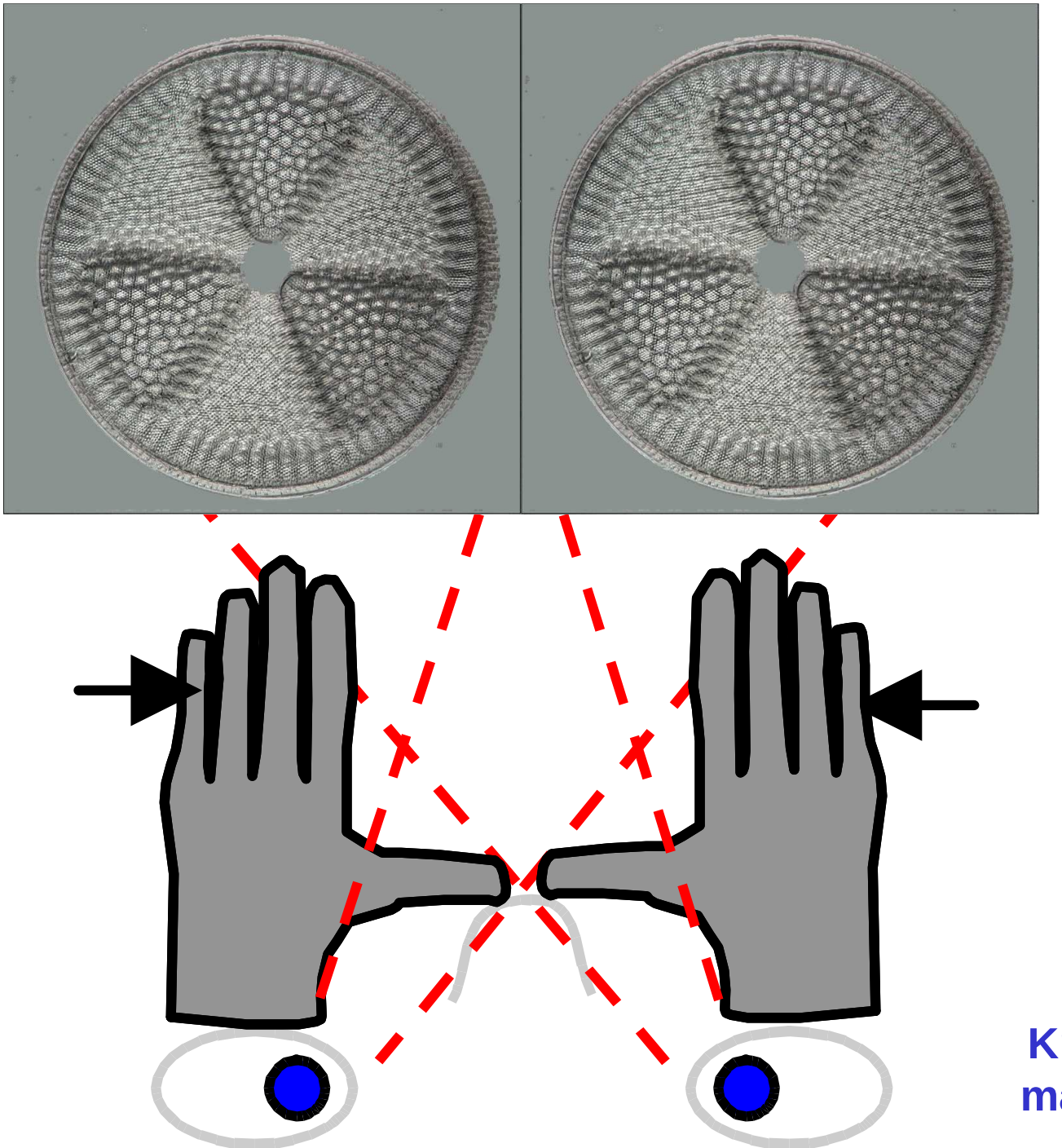
Verschiedene 3D-Darstellungsweisen



Parallel- und Kreuzblick



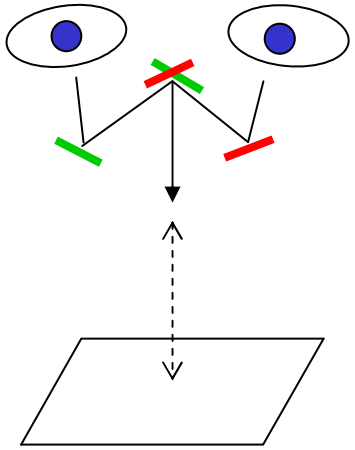


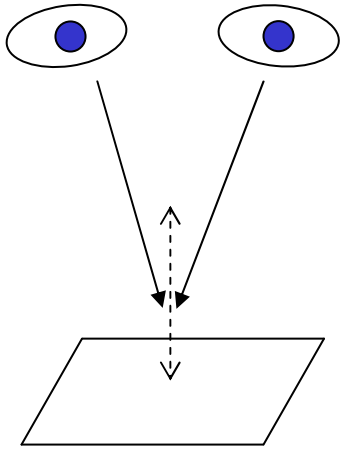


Kreuzblick mit manueller Hilfe

Vergleich von normalem und Stereo-Mikroskop

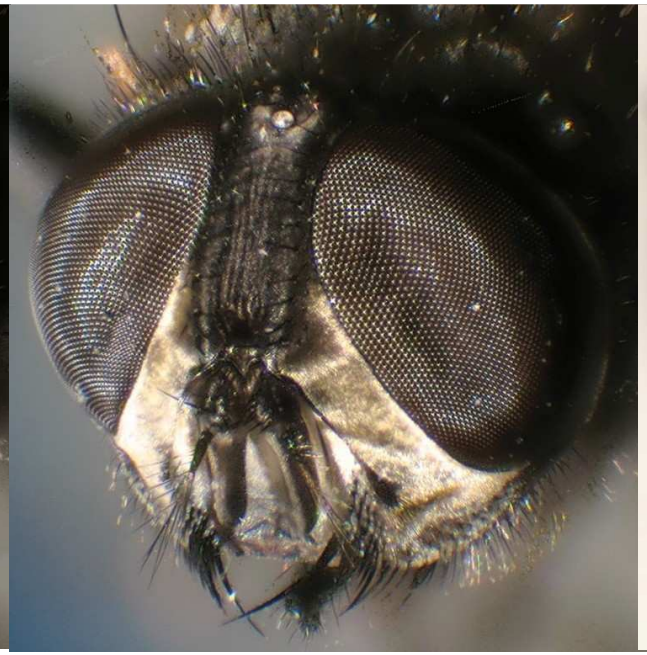
Wenn man bei fixierter Optik ausschließlich die Distanz verändert, braucht man keine Größenkorrektur





Im Stereo-Mikroskop wandern Mittelpunkt und Blickwinkel mit dem Fokus

Stereo-Mikroskop,
ohne Korrektur gestackt



x-/y-korrigiert
& gestackt

Normales
Mikroskop,

gestackt