# **Cirrus HD-OCT:** How to read the Cirrus reports





We make it visible.

Cirrus<sup>™</sup> HD-OCT analysis reports offer clinically relevant qualitative and quantitative information in an easy-to-read format. Analysis results can be printed, viewed via Cirrus Review Software, or integrated with other instrument data through the FORUM<sup>®</sup> Eye Care data management system. This guide explains the various areas of each report and the valuable information it provides for your clinical assessment.

This guide is intended to help provide basic information, it is not intended to replace your User Manual.

## **Advanced RPE Analysis Printout**

Based on the Macular Cube 512x128 or 200x200 scan, this analysis provides information on RPE elevation (area and volume) and Sub-RPE illumination (area and distance to fovea) for both the current and prior visits.

- **RPE Elevation Map** overlaid on fundus image. Note: The minimum RPE elevation that the software will include in the quantitative result is 19.5 µm.
- 2 Circles on the RPE Elevation Map 3 mm and 5 mm in diameter, centered on the fovea location.
- **Fovea location coordinates.**
- 4 Sub-RPE Slab, an *en face* image of the reflectivity of tissue beneath Bruch's membrane. The automatic sub-RPE illumination segmentation is shown with an outline.
- 5 RPE Profile<sup>™</sup>, a map that combines the RPE Elevation Map and the areas of sub-RPE illumination identified by the software, outlined in yellow.
- **Table of values,** including assessment of change versus prior period.



# **Cirrus HD-OCT Ganglion Cell Analysis Report**

Based on the Macular Cube 512x128 or 200x200 scan, this analysis provides quantitative and qualitative evaluation of the ganglion cell layer (GCL) plus Inner Plexiform Layer (IPL).

- **Maps** for GCL+IPL thickness are shown on fundus image. Also shown is the elliptical measurement annulus centered about the fovea.
- 2 Deviation Maps show deviations from normal for GCL + IPL thickness.
- 3 Sector maps divide the elliptical annulus of the Thickness Map into six regions. Values are compared to normative data.
- 4 **Thickness table** shows average and minimum thickness within the elliptical annulus. Values are compared to normative data.

5 Horizontal B-scans.



The values below are based on a 46 year old patient.

Parameter	Normal Range
Average Thickness	72.9 - 92.5
Minimum Thickness	70.6 - 90.3
Temporal-Superior Thickness	72.7 - 92.1
Superior Thickness	73.3 - 94.7
Nasal-Superior Thickness	73.4 - 94.8
Nasal-Inferior Thickness	70.9 - 92.9
Inferior Thickness	69.3 - 90.4
Temporal-Inferior Thickness	72.0 - 91.6

## Cirrus HD-OCT GPA Report Page 1

With Guided Progression Analysis<sup>™</sup> (GPA<sup>™</sup>), Cirrus HD-OCT can perform event analysis and trend analysis of RNFL thickness and ONH parameters (e.g. Average Cup-to-Disc ratio). Event analysis assesses change from baseline compared to expected variability. If change is outside the range of expected variability, it is identified as progression. Trend analysis looks at the rate of change over time, using linear regression to determine rate of change.

- **RNFL Thickness Maps** provide a color-coded display of RNFL for two baseline exams and two most recent exams.
- 2 RNFL Thickness Change Maps demonstrate change in RNFL thickness. Up to 8 exams are automatically registered to baseline for precise pointto-point comparison. Areas of change are color-coded yellow when first noted and then red when the change is sustained over consecutive visits.
- 3 RNFL Thickness (Average, Superior, and Inferior) and Average Cup-to Disc Ratio values are plotted for each exam. Orange marker denotes change when it is first noted. Maroon marker denotes change sustained over consecutive visits. Rate of change is shown in text.
- 4 RNFL Thickness Profiles. TSNIT values from exams are plotted. Areas of statistically significant change are colorcoded orange when first noted and maroon when the change is sustained over consecutive visits.
- 5 RNFL/ONH Summary summarizes Guided Progression Analysis (GPA) analyses and indicates with a check mark if there is possible or likely loss of RNFL:



RNFL Thickness Map Progression (best for focal change) RNFL Thickness Profiles Progression (best for broader focal change) Average RNFL Thickness Progression (best for diffuse change) Average Cup-to-Disc Progression (best for global change)

### Cirrus HD-OCT GPA Report Page 2

Printout includes an optional second page with table of values, including Rim Area, Disc Area, Average & Vertical Cup-to-Disc Ratio and Cup Volume. Each cell of the table can be color coded if change is detected.

- RNFL Thickness Maps provide a color-coded display of RNFL for each exam, up to 8 including baseline.
- 2 RNFL Thickness Change Maps demonstrate change in RNFL thickness for up to 8 exams including baseline.
- **Table of values** for each exam, up to 8 including baseline. For each exam there is information on exam date/time, registration method and signal strength. Values shown for RNFL thickness, Rim Area, Disc Area, Average & Vertical Cup-to-Disc Ratio and Cup Volume. Each cell of the table is color-coded if change is detected.
- Information on abbreviations for registration methods and color coding.

D: DOB: Gender: Doctor:	Male			Exam Date: Exam Time: Serial Numbe Signal Streng	6 6 9r: 4 9th: 7	/24/2008 :33 AM 000-1063 /10	3/4/2011 9:08 AM 4000-10 7/10	cz 53	м			ZEINN
Guided Progression Analysis: (GPA™) OD ○ OS												
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3		Exam Dete/Time	Serial Number	RINFL and Registration Method	SS	Avg RNFL Thickness (um)	Paramet Quadrant RNFL (um)	ers Sup Quadrant RNFL (um)	Rin Area (nn²)	Average Cup-to- Disc Ratio	Vertical Cup-to- Disc Ratio	Cup Volume (nm <sup>3</sup> )
Baseline1	1: 1	6/24/2008 6:33:03 AM	4000- 1063		7/10	87	96	119	1.29	0.29	0.33	0.026
Baseline2	2: 2	8/7/2008 8:42:44 AM	4000- 1063	R2	8/10	88	97	121	1.28	0.28	0.29	0.025
	3	4/2/2009 3:44:24 PM	4000- 1063	R2	7/10	83	82	119	1.20	0.30	0.31	0.026
	4	11/18/2009 2:27:57 PM	4000- 1063	R2	7/10	83		120	1.23	0.31	0.33	0.030
	5	8/4/2010 11:01:20 AM	4000- 1063	R2	9/10	84	81	125	1.24	0.37	0.42	0.036
Current:	6	3/4/2011 9:08:34 AM	4000- 1063	R2	7/10	81	76	116	1.27	0.35	0.39	0.039
Likely Li Possible In Possible In	4 055 L055	Registration R2 - Regist R1 - Regist Inferior RNF Increased. Compared b Inferior RNF decreased.	h Methodi ration bas ration bas baseline L, Rim Ar L, Rim Ar	ed on translat sed only on tra e, statistically : ea the values e, statistically : ea values hav	ion and nslation signific have d signific re incre	I rotation of not disc cer ant loss of t locreased. ant increase ased. For t	OCT fundu ter Issue detec For Cup-to be detected. Cup-to-Disc	s Cled. For A Disc Ratio For Aven Ratios an	Average s and C age RNI d Cup V	e RNFL, Su Cup Volum FL, Superio	eperior RNI o values h or RNFL, dues have	FL., ave

# **Cirrus HD-OCT RNFL and ONH Analysis Report**

Based on the 6 mm x 6 mm data cube captured by the Optic Disc Cube 200x200 scan, this report shows assessment of RNFL and ONH for both eyes.

- Key parameters, compared to normative data, are displayed in table format.
- 2 Nerve Fiber Layer (RNFL) thickness map is a topographical display of RNFL. An hourglass shape of yellow and red colors is typical of normal eyes.
- 3 The RNFL Deviation Map shows deviation from normal. OCT *en face* fundus image shows boundaries of the cup and disc and the RNFL calculation circle.
- Neuro-retinal Rim Thickness profile is matched to normative data.
- 5 RNFL TSNIT graph displays patient's RNFL measurement along the calculation circle, compared to normative data.
- 6 RNFL Quadrant and Clock Hour average thickness is matched to normative data.
  - Horizontal and vertical
    B-scans are extracted from the data cube through the center of the disc. RPE layer and disc boundaries are shown in black.
    ILM and cup boundaries are shown in red.



8 **RNFL calculation circle** is automatically centered on the optic disc and extracted from the data cube. Boundaries of the RNFL layer segmentation is illustrated.

### **Cirrus HD-OCT RNFL and ONH Analysis Report**

Key parameters, compared to Normative Data, are displayed in table and chart formats.

Cirrus normative comparison for ONH parameters is based on the patient's age and disc size and for RNFL it is based on the patient's age. For a particular age and disc size, the patient is expected to have rim volume, C/D ratio, etc. within certain ranges. Those parameters will be shaded red, yellow, green and white based on how they compare to normal ranges. Consequently, disc area values are not compared to normative data, and therefore shaded gray on the summary table. When the disc area is outside normal limits, normative data comparison is not applied. When there is no normative data available for comparison, the parameters are shaded gray instead of the green yellow, red shown in this example. The normative database is not available for patients under 18 years of age.

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The Disc Area values of patients in the Cirrus ethnically diverse normative database (see User Manual for details on the study) fell within these ranges: one third of patients had Disc Area values less than 1.58 mm<sup>2</sup>, one third of patients had Disc Area values between 1.58 and 1.88 mm<sup>2</sup>, and one third of patients had Disc Area values larger than 1.88 mm<sup>2</sup>

In the table of values, Rim Area, Average C/D Ratio, Vertical C/D Ratio and Cup Volume have a gray background color when the Disc Area is less than 1.3mm<sup>2</sup> or greater than 2.5 mm<sup>2</sup>. The normative data is not applicable because the database has insufficient number of subjects with the disc areas of these sizes.

	OD	05
Average RNFL Thickness	73 µm	61 µm
RNFL Symmetry	58	5%
Rim Area	1.12 mm <sup>2</sup>	0.70 mm <sup>2</sup>
Disc Area	1.58 mm <sup>2</sup>	1.68 mm <sup>2</sup>
Average C/D Ratio	0.53	0.75
Vertical C/D Ratio	0.49	0.75
Cup Volume	0.036 mm <sup>3</sup>	0.201 mm*

### **RNFL Quadrant and Clock Hour**



The values below are based on a 69 year old patient.

Parameter	Normal Range*
Average RNFL Thickness	75.0 - 107.2
RNFL Symmetry	76% - 95%
Rim Area	1.03 - 1.69
Average C/D Ratio	0.64 - 0.21
Vertical C/D Ratio	0.62 - 0.21
Cup Volume	0.01 - 0.035

Parameter	Normal Range*
Temporal Quadrant	45.1 - 82.2
Superior Quadrant	88.9 - 136.7
Nasal Quadrant	50.0 - 86.2
Inferior Quadrant	89.4 - 138.3

Clock Hour	Normal Range <sup>3</sup>	k
9	36.4 - 67.4	4
10	52.7 - 100.	5
11	87.2 - 154.	6
12	70.7 - 155.	7
1	72.6 - 133.	9
2	52.4 - 109.	7
3	41.7 - 70.4	4
4	44.8 - 89.	0
5	61.9 - 12	5
6	85.7 - 163.	2
7	84.8 - 159.	4
8	42.2 - 90.	2

\* Normal range is in micrometers. See User Manual for more information on normative data.

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# **RNFL and ONH Analysis Report**

**Optional Patient Education Page** 



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**RNFL peripapillary thickness** profile is shown for each eye.



### **Distribution of Normals**

The gray color, shown in the legend above, represents "Not applicable." Values will be shown in gray when normative data is not applicable because the database has insufficient data to match with the disc area.

The Distribution of Normals color scheme is used for both the RNFL and the Optic Nerve Head analysis parameters. The table below clarifies how the color scheme is used for each of the parameters.



Measurement	Matched to Normal Based On	Gray	White	Green	Yellow	Red	
RNFL							
Average RNFL Thickness, RNFL Symmetry, RNFL Clock Hours, RNFL Quadrants, RNFL Thickness (graph)	Age	Gray shading does not apply to RNFL measurements	The thickest 5% of measurements fall in the white area (white > 95%).	90% of measurements fall in the green area (5% <green<95%).< td=""><td>The thinnest 5% of measurements fall in the yellow area or below (1% &lt; yellow &lt; 5%, suspect).</td><td>The thinnest 1% of measurements: Measurements in red are considered outside normal limits (red &lt; 1%, outside normal limits).</td></green<95%).<>	The thinnest 5% of measurements fall in the yellow area or below (1% < yellow < 5%, suspect).	The thinnest 1% of measurements: Measurements in red are considered outside normal limits (red < 1%, outside normal limits).	
Optic Nerve Head							
Rim Area and Neuroretinal Rim Thickness (graph)	Disc Area	ONH Normative Database is not applicable if: 1) The disc area is larger than 2.5mm <sup>2</sup> or smaller than 1.33mm <sup>2</sup> , or	The largest 5% of measurements fall in the white area (white > 95%).	90% of measurements fall in the green area (5% <green<95%).< td=""><td>The smallest 5% of measurements fall in the yellow area or below (1% &lt; yellow &lt; 5%, suspect).</td><td>The smallest 1% of measurements: Measurements in red are considered outside normal limits (red &lt; 1%, outside normal limits).</td></green<95%).<>	The smallest 5% of measurements fall in the yellow area or below (1% < yellow < 5%, suspect).	The smallest 1% of measurements: Measurements in red are considered outside normal limits (red < 1%, outside normal limits).	
Average C/D Ratio, Vertical C/D Ratio, Cup Volume	and Age	2) The Average or Vertical C/D Ratio is below 0.25, or 3) The ONH Normative Database license has not been activated.	The smallest 5% of measurements fall in the white area (white > 95%).	90% of measurements fall in the green area (5% <green<95%).< td=""><td>The largest 5% of measurements fall in the yellow area or below (1% &lt; yellow &lt; 5%, suspect).</td><td>The largest 1% of measurements: Measurements in red are considered outside normal limits (red &lt; 1%, outside normal limits).</td></green<95%).<>	The largest 5% of measurements fall in the yellow area or below (1% < yellow < 5%, suspect).	The largest 1% of measurements: Measurements in red are considered outside normal limits (red < 1%, outside normal limits).	

# **Cirrus HD-OCT Anterior Segment Cube**

Based on the 4 mm x 4 mm data cube captured by the Anterior Segment Cube 512x128 scan, this analysis provides qualitative and quantitative evaluation of the cornea, including visualization of pathology and measurement of central corneal thickness.

- 1 Location of the scan is shown on the iris image.
- Slice navigator enables a simultaneous view of a selected point on the cornea image and OCT image displays.
- 3 Central corneal thickness, in microns, is measured with calipers.
- 4. Framed in blue, this image corresponds to the horizontal crosshair line on the iris image above.
- 5 Framed in pink, this image corresponds to the vertical crosshair line on the iris image above.



### **Cirrus HD-OCT Anterior Segment 5 Line Raster**

The Anterior Segment 5 Line Raster is used for the assessment and documentation of the cornea and irido-corneal angle.

- Scan angle and spacing length are adjustable. Parameters for the scan are indicated.
- 2 Location of scan lines is shown on the iris image.
- 3 The enlarged image corresponds with the location of the blue line on iris image above. The default is the center (third) scan of the five.
- Legend on each scan image indicates which of the 5 scan lines is displayed.



### **Cirrus HD-OCT HD 5 Line Raster Report**

The HD 5 Line Raster scan protocol collects more data per scan location than the other Cirrus scans, and proprietary Selective Pixel Profiling<sup>M</sup> evaluates all of the pixel data to construct the best possible image.

- Scan angle, spacing, and length are adjustable. Parameters for the scan are indicated.
- 2 Location of scan lines is shown on the **LSO fundus image**.
- 3 Each of the **5 lines** is scanned 4 times and, with **Selective Pixel Profiling**, the optimal image is displayed. The enlarged image corresponds with the location of the blue line on fundus image above. The default is the center (third) scan of the five.
- Legend on each scan image indicates which of the 5 scan lines is displayed.



## **Cirrus HD-OCT HD 5 Line Raster Single Line Report**

The Enhanced HD 5 Line Raster scan protocol can be used to scan a single high-density line.

- Scan angle, spacing, and length are adjustable. Parameters for the scan are indicated.
- 2 Location of scan line is shown on the **LSO fundus image**.
- 3 With 0 mm spacing, the 20 lines of the Enhanced HD raster are collapsed into a single line scanned 20 times and with Selective Pixel Profiling, the optimal image is displayed.



### **Cirrus HD-OCT Macular Thickness Analysis Report**

Based on the 6 mm x 6 mm data cube captured by the Macular Cube 512x128 or 200x200 scan, this analysis provides qualitative and quantitative evaluation of the retina.

- LSO fundus image is shown here with a ILM-RPE retinal thickness map overlay.
- Slice navigator enables a simultaneous view of a selected point on LSO image, OCT fundus image, retinal thickness map, layer maps, and OCT image displays.
- 3 ETDRS grid is automatically centered on the fovea with Fovea Finder.<sup>™</sup> Retinal thickness values, from ILM to RPE, in microns, are compared to normative data.
- **OCT fundus image** is shown.
- 5 Fovea Finder enables precise placement of ETDRS grid.
- Framed in blue, this image corresponds to the horizontal crosshair line of the fundus image above.
- Framed in pink, this image corresponds to the vertical crosshair line of the fundus image above.
- 3D macular thickness map shows retinal thickness in a topographical display.
- Segmented **ILM map**.
- Segmented **RPE map**.
- **11** Macular parameters, compared to normative data.

\* Normal range is in micrometers.

See User Manual for more information on normative data.



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Parameter	Normal Range*
Central Subfield	220.5 - 294.8
OuterTemp	239.3 - 278.6
OuterSup	254.1 - 293.8
OuterNas	263.8 - 312.5
OuterInf	245.7 - 286.4
InnerTemp	285.1 - 333.0
InnerSup	295.2 - 344.6
InnerNas	296.9 - 347.7
InnerInf	292.4 - 342.3

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Parameter	Normal Range*
Average Thickness	257.1 - 295.0
Average Volume	9.39 - 10.75
Parameter	Normal Range*
rarameter	Ronnan Range
Central Subfield	9.26 - 10.62

The values are based on a 71-year old patient.

## **Cirrus HD-OCT Macular Change Analysis Report**

Change analysis can be performed with Macular Cube 512x128 or 200x200 scans. Post-acquisition registration and Fovea Finder<sup>™</sup> ensures the repeatability of thickness measurements, even in subjects with AMD, DME or VRI disorders. Data is displayed for prior and current scans.

- Macular thickness (ILM to RPE) over the 6 mm x 6 mm cube of data is displayed in color-coded map for both exams.
- 2 Macular thickness values are displayed for each sector of the ETDRS grid.
- 3 Placement of the cube scan is visualized on the LSO fundus image. The Fovea Finder™ feature automatically centers the analysis on the fovea.
- 4 OCT fundus image from follow-up exam is AUTOMATICALLY REGISTERED to previous.
- 5 Change analysis map shows difference from previous, in micrometers and represented in color.
- 6 A **B-Scan image** from the previous scan and a precisely registered image from the current scan are viewed side by side. Simultaneous visualization of corresponding images from the two scans is possible on screen in a movie mode, or by moving the slice navigators.



## **Cirrus HD-OCT Advanced Visualization Custom Report**

From the Macular Cube  $512 \times 128$  or  $200 \times 200$  scan analysis, Advanced Visualization<sup>M</sup> displays cross-sections of the image cube through three dimensions. B-scans through the X and Y axis and C-scans, or C-slabs, through the Z axis reveal unique views of the retinal tissue.

The custom print mode generates a single or multi-page report of tagged images from any Advanced Visualization analysis screen. Each selection is displayed with a description or companion image. Shown here are some examples.

Other overlays are possible.

- 2 User-defined borders of the ILM slab, RPE-fit slab, or RPE slab (shown here) can be seen on horizontal and vertical b-scans images.
- 3 The resulting **RPE slab image** represents an average signal intensity value for each A-scan location through the defined depth of the slab. This provides a C-scan image of the RPE.
- 4 LSO fundus image with ILM slab overlay reveals features of epiretinal membrane.
- 5 B-scan image corresponds to the horizontal crosshair line on the fundus image.



# **Cirrus HD-OCT Single Eye Summary Report**

This report provides an at-a-glance overview of a single eye, and helps you identify if additional analysis is necessary. Showing an analysis of the macula, RNFL and ONH, it is valuable for patient education and peace of mind.

- OCT fundus image is shown.
- 2 The analysis is automatically centered on the fovea post-acquisition with Fovea Finder™.
- 3 Retinal Thickness (ILM to RPE) over the 6mm x 6mm cube of data is displayed in a color-coded map.
- 4. Retinal thickness values, in microns, are compared to normative data.
- 5 Cross section through the fovea center is shown.
- 6 OCT fundus image of the ONH is shown.
- 7 Analysis is automatically centered on the optic disc, post acquisition.
- 8 RNFL calculation circle shows where the TSNIT analysis is extracted from the cube of data.
- 9 The RNFL Deviation Map shows deviation from normal.
- 10 Key parameters, compared to normative data, are displayed in table format.
- **11 RNFL thickness** over the 6mm x 6mm cube of data is displayed in a color-coded map.



- 12 RNFL TSNIT graph plots measurements along the calculation circle, compared to normative data.
- 13 A horizontal B-scan is extracted from the data cube through the center of the disc.

### **HFA Cirrus Combined Report**

Available exclusively with the ZEISS FORUM management system, the combined report is generated automatically from Cirrus HD-OCT and HFA data. It provides a summary of structural and functional exams in a single page display.



### **HFA Visual Field Section**

- HFA Graytone Plot, OD
- 2 HFA Testing Strategy
- 3 HFA Total Deviation and Pattern Deviation Plots, OS
- 4. HFA Reliability Indices, OS
- 5 HFA Global Indices, OS

### **Cirrus HD-OCT Section**

- 6 RNFL Thickness Graph, OU
- Table of RNFL and optic disc parameters with normative data comparison, OU
- RNFL Thickness Map
- O RNFL Quadrants and Clock Hours

- **1** RNFL Deviation Map
  - Neuro-retinal Rim Thickness Graph, OU
  - Degend of distribution of normals

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