EyeSuite Application Note

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1 Introduction

A smooth transition from Humphrey to Octopus includes various aspects:

a) Importation of existing visual fields into Octopus or co-existence of HFA and Octopus feeding one database

b) Decision which HFA program and strategy are followed with which Octopus program and strategy

c) Visual Field Analysis in EyeSuite: Choice of display and printout preferences, evaluation functions and limitations

This application note addresses b and c).

Note:
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OCTOPUS and OCTOPUS 900 are trademarks of Haag-Streit AG

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Specifications are subject to change without notice. The following information is according to our best knowledge but does not imply any warranty or promise. The application of all information provided herewith is at your own risk.

Any corrections and suggestions are welcome. Please forward them to Stefan.zysset@haag-streit.com

Document history

<table>
<thead>
<tr>
<th>Version</th>
<th>Changes</th>
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<tr>
<td>Rev 2</td>
<td>FAQ 1-2</td>
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<td>Rev 3</td>
<td>FAQ on HFA normal values</td>
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<tr>
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2 Follow up from HFA: Choice of programs and strategies

2.1 Practical aspects of the follow up between HFA and Octopus

In general, the HFA SITA strategy is compared with the Octopus Dynamic strategy: The SITA Fast strategy is compared with the TOP strategy. When in the HFA the most commonly used test pattern is the 24-2, in the Octopus it is the G-pattern. The most advanced Octopus visual field analysis research is based on the G-pattern.

There are two suggested options on how to proceed:

**Existing patients; conservative procedure:**

For practical reasons, the Octopus 900 includes the programs 10-2, 24-2 and 30-2 to allow continuing examining patients with the same programs they were examined in the HFA.

**New patients; progressive procedure:**

For new patients and if a change of program pattern is considered, we recommend to switch to the G-pattern for tests in the central 30° and to the M-pattern for Macular examinations.

### 2.1.1 Switching strategies

<table>
<thead>
<tr>
<th>HFA strategy</th>
<th>OCTOPUS strategy</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Full Threshold</td>
<td>Normal</td>
<td>Works with all threshold tests</td>
</tr>
<tr>
<td>Fastpac</td>
<td>Dynamic</td>
<td>Works with all threshold tests</td>
</tr>
<tr>
<td>SITA Standard</td>
<td>Dynamic (or TOP)</td>
<td>TOP works with G, 32 and M</td>
</tr>
<tr>
<td>SITA Fast</td>
<td>TOP</td>
<td>TOP works with G, 32 and M</td>
</tr>
<tr>
<td>Two-zone</td>
<td>1-LT</td>
<td>Limited to special programs</td>
</tr>
<tr>
<td>Three-zone</td>
<td>2-LT</td>
<td>For screening programs; however, most screening programs can be extended to quantify defects with the dynamic or normal strategy</td>
</tr>
</tbody>
</table>

### 2.1.2 Switching pattern

<table>
<thead>
<tr>
<th>HFA pattern</th>
<th>OCTOPUS pattern</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>30-2</td>
<td>30-2 / 32. / G</td>
<td>For continuous progression analysis use the 30-2 or the 32 program</td>
</tr>
<tr>
<td>24-2</td>
<td>24-2 / 32 / G</td>
<td>For continuous progression analysis use the 24-2 Dynamic</td>
</tr>
<tr>
<td>10-2</td>
<td>10-2 / M</td>
<td>For continuous progression analysis use the 10-2 Dynamic</td>
</tr>
</tbody>
</table>

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2. Capris P., Corillo G., Torre P., Camisone P., Nasciutt F, Papadia M, Biasotti B., Comparison of TOP strategy (Octopus) and SITA Fast (Humphrey) algorithm in damaged visual fields. IPS 2002 meeting abstract
5. Urbančič M, Hawlina M, Brecelj J, Comparison of the normal, dynamic and TOP strategy in the macular program, Doctoral thesis at the University of Ljubljana, Slovenia, 2002
60-4
07 with Dynamic strategy
One test for central and peripheral thresholds out to 70°

Screening tests
07 with 2-LT strategy
130 test locations from 0 – 70°

Nasal step
G program from 0° - 60°
G pattern can be continued after testing the central 30°. It adds 14 test locations from 30°-60° adding nasal step and one peripheral ring

Estermann monocular / binocular
Esterman monocular / binocular
This test is standardized

2.1.3 Combining different strategies in trend analysis

EyeSuite Trend analysis allows mixing different strategies as long as the same program pattern is used. In addition it allows the combination of 30-2 and 32 patterns since the blind spot test locations X15/Y3 and X15/Y-3 (for OD) are excluded in the visual field analysis anyway, and the remaining test locations are the same.

How do different strategies (like TOP, Dynamic, SITA and SITA Fast) affect the quality of the trend analysis?

Each strategy has its own properties making it unique in a certain way. Step sizes may be adapted depending on the local defect depth (Dynamic, SITA Standard and SITA Fast), spatial averaging may occur due to the algorithm (TOP) or due to post processing (SITA Standard and SITA Fast), then there are other factors possibly influencing the comparability of single points further. This is why trend analysis should be performed based on the global indices and clusters (regions where the single test location results are averaged).

EyeSuite is applying the respective age matched normal values for each combination of strategy and instrument and does further calculation based on the local age matched deviation only. It then applies the same formula to each visual field test during the trend analysis and thus receives comparable global indices and cluster deviations. Averaging as used in the global and cluster analysis significantly reduces the influence of the different strategies on the MD value and the cluster deviations. However, care should be taken when looking at the polar trend, as this is again a point wise analysis that will be affected by mixing strategies, as well as the index sLV (PSD) that evaluates the point wise variation.

2.2 General questions and remarks

2.2.1 Are the results of Octopus and HFA perimeters comparable?

The absolute sensitivities differ by about 3dB, but only apply to the “values” plot on the printout. What we compare are the local deviations, cluster deviations and global indices, referring to each instrument’s age matched norms. On this level the results are comparable.

Only the characteristics of the TOP strategy differs slightly from all other strategies with the consequence that focal defects appear less pronounced compared to other strategies like SITA Fast⁶ or Dynamic⁶.

The whitepaper “Comparison of original HFA visual field printouts with EyeSuite Perimetry PC software printouts following importation” is available on the Haag-Streit website (Perimetry/Publications section) and addresses the ability to do a follow up using EyeSuite Perimetry after importation of HFA data.

2.2.2 Why is there a difference in the absolute sensitivities?

The absolute sensitivities reflect the attenuation in dB, where 10dB is a factor of 10, based on the maximum of the luminance scale selected for a test.

Octopus scales for the stimulus are:

Default 1: 4'000asb at a 10cd/m² (31.4asb) background
Default 2: 1'000asb at a 1.27cd/m² (4asb) background
Option: 10'000asb at a 10cd/m² (31.4asb) background (This is also the HFA default scale)

Octopus and HFA intensity scales – theoretic comparison

| Available combinations | Octopus 101 / 900 Default 1 | Octopus 1-2-3 & 300* | HFA700/700i Default 2 | Octopus 900 Option |

*In the direct projection system the light measurement is accomplished in a different way and the respective luminance is sometimes referred to as 4800asb instead of 4000asb. Though for comparison reasons, the 4000asb that relate to cupola perimeters should be used.

2.2.3 What is the basis for the Octopus normal values?

For the Octopus 900, a normal value study with two different background conditions (4asb/1.27cd/m² and 31.4asb/10cd/m²) has been performed by the University of Tuebingen, from Schiefer et al. Normal subjects from 10 to 80 years, 12 per decade, have been examined in randomized order under the different conditions. The results have been implemented in EyeSuite Perimetry.

Octopus is using patterns that are close to the G-pattern and allow modeling the hill-of-vision in the aging patient. These models are described mathematically and furthermore allow to test with any kind of test patterns in the Octopus perimeter.

The Octopus 300 and 1-2-3 that use an optical system have separate normal values. These direct projection type perimeters only use 31.4asb/10cd/m² background intensity for standard white/white perimetry. To best compare the results between the direct projection Octopus 1-2-3/300 and the mirror projection Octopus 900 we recommend applying the 10cd/m² background in both instrument types.

2.2.4 What can you expect to gain/loss data-wise when switching to Dynamic / to TOP?

The philosophy and hence the resulting thresholds of different test strategies have an effect on the outcome. The principle differences have been well evaluated in comparative studies within the same instrument.

A study comparing the Octopus Normal, Dynamic and TOP strategy was done by Maeda et al, confirming the shorter test durations (time savings for Dynamic 52% and for TOP 78%), no difference in the Mean Sensitivity and a lower Loss Variance LV in TOP. They also noted that the ability to detect early stage Glaucoma was inferior in TOP and Dynamic compared to normal strategy. However, when comparing the diagnostic ability, González-Hernandez et al found that the optimum parameters would be sLV in TOP and MD in the normal strategy and that the ROC for sLV in TOP would be larger than the ROC for MD in the normal strategy.

Scherrer et al found by screening 171 eyes of 89 consecutive patients no false positive results with TOP while with the dynamic strategy produced 4 abnormal initial test results that showed:

normal fields in a follow up examination. This finding suggests that there is more learning involved in the dynamic strategy than in the TOP strategy and the TOP strategy produces more accurate results in their initial examinations.

When it comes to a comparison between the HFA full threshold strategy, SITA Standard and SITA Fast, Budenz et al\textsuperscript{10} found a good correlation in general between the 3 strategies but also recognized and reported cases, where initial and non-characteristic defects were present in the full threshold tests but were wiped out in SITA Standard and SITA Fast resulting in a lower sensitivity for early Glaucoma.

This leads to the maybe most characteristic differences that appear to be between HFA and Octopus fast strategy results: While the Dynamic and the TOP strategy show a continuous transition between normal fields, border line and early glaucoma fields, the SITA strategies appear to categorize the result as normal or abnormal, prior to perform their post processing. Since only the result of the post processing is available for evaluation, it is difficult to prove this, but the correlation between the Octopus sLV and the corresponding HFA index PSD suggests such a non-linear behavior.

\begin{figure}[h]
\centering
\includegraphics[width=\textwidth]{chart.png}
\caption{Dynamic sLV and SITA Standard PSD data from Langerhorst et al\textsuperscript{1} TOP sLV and SITA Fast PSD data from Wadood et al\textsuperscript{11} (This graph was not included in the publication)}
\end{figure}

\begin{table}[h]
\centering
\begin{tabular}{|c|c|}
\hline
Range A is the transition from normal to borderline and early glaucoma \hspace{1cm} Range B is early to moderate to severe glaucoma \hline
\end{tabular}
\end{table}

2.3 Progression analysis

2.3.1 Trend analysis today

As a starting point, EyeSuite Perimetry allows to perform progression analysis only when using the same patterns. The exception to the rule is that the programs 30-2 and 32 can be mixed. This is because these programs only differ in the 2 blind spot test locations and these test points are neither used in single field nor in trend analysis.

2.3.2 Trend analysis tomorrow

Trend analysis based on the global indices – even when using different test patterns – would be feasible if the indices are weighted according to their regional density of test locations.\textsuperscript{12} The same


should hold true for cluster analysis. Hence it is a goal and a subject for studies and validation to allow progression analysis including different test patterns. The most interest in this regard is the switch from the HFA 24-2 to the Octopus G program.

In addition it is foreseen to allow follow up the 24-2 program with the 32 program. In trend analysis only the test locations of the 24-2 program would be used, until a sufficient number of 32 TOP visual fields are available.

### 2.3.3 General considerations about trend analysis

Various considerations should be considered when studying the subject of trend analysis with different patterns:

- Cutting off the local defect depth depending on the test location may minimize the influence of floor effects
- Weighing test locations proportional to the test location density of the target test pattern (when switching to the Octopus – mostly the G-pattern to calculate comparable global indices)
- Possibly interpolating local sensitivities for each test location of the target test pattern from the prior pattern
- Applying the above principles when performing cluster analysis
- Comparing the influence of logarithmic versus non-logarithmic averaging of deviations in the clusters.

What is a floor effect? If a patient does not recognize the brightest light in a perimeter, the location is considered to have an absolute defect. It is thus unknown if the retina is blind in that location or if a brighter light could still be perceived. If the light is too bright, other, more healthy locations in the retina might pick the light up. To prevent such unwanted influence (floor effect), the local deviations could be limited to a certain level, e.g. (-) 27dB.

### 2.4 Result representation and calculation

EyeSuite Perimetry has 3 display modes, “Octopus”, “PeriData” and “HFA”

**Octopus mode**

![Octopus mode graph](image)

Values: Sensitivities in dB

**PeriData mode**

![PeriData mode graph](image)

as in Octopus mode

**HFA mode**

![HFA mode graph](image)

HFA style thresholds
2.4.1 Cluster graph definition

The nerve fiber bundle model has been evaluated in a comparison with various existing and published drawings and models. The chosen one – based on a drawing of Hogan et al – best correlated Octopus G pattern visual fields with visible HRT wedge defects. The basis to EyeSuite Perimetry and the underlying research software Octopus FieldAnalysis has been described in various Ophta articles and in a publication in the French Ophthalmic Journal[13]. In addition a review article by Buerki et al[14] and a separate manual[15] are available. On request by research teams we provide our internal documentation.

14 Buerki E, Monhart M, An Update to Octopus Perimetry, European Ophthalmic Review 2007
15 Monhart M, Description of new EyeSuite visual field and trend analysis functions, Haag-Streit 2009
2.4.2 Polar graph definition

The polar graph shows a red line with its length corresponding with the defect of each test location at the nerve fiber angle at the optic disc. The orientation is vertically mirrored compared to the representation in the visual field to match morphologic representation as HRT or Fundus images. The Polar Graph helps correlate functional with structural findings – e.g. with the TCA of the HRT software. This is facilitated by using the same orientation and color coding. Even subtle changes that do not appear significant can be identified and judged.
Legend to the Polar Graph:

Orientation: S / N / I / T: Superior, Nasal, Inferior, Temporal (corresponding with fundus images and digital imaging results)

Grey area: Normal range (local defect of -4dB to +4dB)

Blue rings: 10/20/30dB local defect. Local defects around 30dB are absolute defects.

2.4.3 Cluster and polar display in EyeSuite Perimetry

EyeSuite Perimetry is performing a cluster analysis. The defects (deviations) in dB are averaged for all test locations in a cluster and then evaluated. In the Polar analysis, the local defects are projected along the nerve fibers to the optic disc and vertically mirrored to match the representation known from HRT, GDX or Fundus images. Cluster and Polar analysis are part of the EyeSuite Perimetry Advanced upgrade.

**Single Field Analysis**

- cluster defects > 5% probability as “+” signs
- cluster defects ≤ 5% probability in dB, normal font
- cluster defects ≤ 1% probability in dB, bold font

**Trend Analysis**

- the progression rate per cluster in dB/year
- an open icon for ≤ 5% probability (progression red, recovery green, increased fluctuation yellow)

The Cluster single field analysis displays

The cluster trend analysis displays
- a filled icon for ≤ 1% probability
- Probabilities are based on a stable glaucoma population

Every test location is represented by a black square if the local defect is ≤ 0dB and by a square and red line if the local defect is > 0dB

The change of height in the linear regression of each test location is represented as red line if the local defect got worse (current state is the outer end of the red line) or as green line if there was recovery in a test location (current state is the inner end of the green line).
3 FAQ – Frequently asked questions

3.1 Can I run the 60-4 program with the Octopus?

You can add the 60-4 program as custom test, but we don’t recommend it. The 60-4 is examining the periphery only. If the periphery is of concern, we recommend running the program 07 with the dynamic strategy instead.

Program 07 has 130 test locations from 0-70° of eccentricity and takes 8-10 minutes with the dynamic strategy.

3.2 What is the difference between the software versions Lite, Advanced and Pro?

The Lite version is included in the Octopus 900 Basic. It performs trend analysis on the global indices and therefore calculates the rate of progression in dB/year and the significance of the trends. This complies with the recommendations of the international Glaucoma Societies.

The Advanced version has two more methods for trend analysis:

a) The cluster trend analysis, separating the visual field into 10 clusters and calculating the rate of progression in dB/year and the trend-probability for each cluster.

b) The polar trend analysis calculates the point wise linear regression analysis PLRA and projects the trends to the optic disc. This allows directly comparing even small changes with structural findings and vice versa.

The Pro software in addition includes statistical export functions required for evaluating studies.

EyeSuite Perimetry receives improvements throughout the following years. Various new developments for the Pro and the Advanced software are in our pipeline. Owners of EyeSuite Perimetry Advanced and Pro can upgrade to these new functions free of charge as soon as they are available on the Haag-Streit website.

3.3 When and where are false negative catch trials presented

During the course of the visual field test, EyeSuite randomly picks test locations that fulfill the criteria that the patient did see them at values of at least 10dB. The Octopus 900 then presents negative catch trials in these locations, using a 10dB brighter stimulus than the previously seen ones. The percentage of catch trials shown through the test usually is 10% but can be changed to values between 0 and 20%.

Example: If the patient did respond to a 25dB stimulus in the location X=8, Y=8, then in this location a negative catch trial could be shown with 15dB.
3.4 Can an Esterman binocular test be performed in kinetic perimetry?

The Esterman binocular test has 120 defined test locations to be displayed for 500ms each, with a Goldmann size III and a luminance of 1000asb on a 31.4asb (10cd/m²) background. This exactly matched the static stimulus III4e in the Octopus 900 Goldmann Kinetic Perimetry. Therefore you could reproduce the Esterman binocular test in the Goldman Kinetic. However, the binocular Esterman test is available as a standard in the Octopus 900 static perimetry part and there it automatically calculates the Esterman score – the percentage of seen points.

3.5 What information from an HFA is imported into EyeSuite Perimetry?

EyeSuite Perimetry imports the absolute local sensitivities as numerical values via the serial interface.

In addition it imports all available parameters that identify the patient, program and strategy. All available information is then saved in the EyeSuite database, processed and displayed.

Comparison of the original HFA printout value table and grayscale…

…and in EyeSuite Perimetry when using the HFA Style printout
3.6 How much do the HFA reference values in EyeSuite Perimetry differ from the original printouts?

EyeSuite used the local deviations given on the printout of HFA 700series version 12.5 and 700i-series version 4.0 from SITA Standard and SITA Fast examinations to calculate two reference value data sets for the evaluation of imported HFA data, again one for SITA Standard and one for SITA Fast. In order to be able to use this data for any kind of HFA test pattern, we shaped these data according to the hill-of-vision to get a smooth, accurate data set.

Depending on which software version of the HFA visual field analyzer you are using, you will find that the same examination prints with slightly different total deviation values. The same holds true when printing an HFA examination from EyeSuite Perimetry.

3.7 Total deviation in the dB scale

<table>
<thead>
<tr>
<th>HFA original printout</th>
<th>EyeSuitePerimetry HFA Style printout</th>
</tr>
</thead>
<tbody>
<tr>
<td>-18 -12</td>
<td>-15 -14</td>
</tr>
<tr>
<td>-9 -7</td>
<td>-12 -10 -5</td>
</tr>
<tr>
<td>-8 -4 -9</td>
<td>-11 -10 -5 -30</td>
</tr>
<tr>
<td>-16 -6 -5 -7</td>
<td>-33 -11 -9 -12</td>
</tr>
<tr>
<td>-8 -6 -6 -10 -34</td>
<td>-14 -22 -2 -8</td>
</tr>
<tr>
<td>-20 -4 -5 -4 -3</td>
<td>-3 -4 -7 -7</td>
</tr>
<tr>
<td>-6 -9 -8 -3 -3 -5</td>
<td>-6 -11 -24 -8</td>
</tr>
<tr>
<td>-2 -2 -3 -6 -7 -12</td>
<td>-7 -12 -9 -8</td>
</tr>
<tr>
<td>TOTAL DEVIATION</td>
<td>5 -3 -7 -10 -23 -12</td>
</tr>
</tbody>
</table>

The difference to the original printout is 0-1dB, in exceptions 2dB, mainly resulting from different rounding.

A 1dB difference in Perimetry is not considered significant. The squares identify absolute scotoma.

3.8 Total deviation in the probability scale

<table>
<thead>
<tr>
<th>HFA original printout</th>
<th>EyeSuitePerimetry HFA Style printout</th>
</tr>
</thead>
</table>

The squares represent the probability of a scotoma for each point on the visual field.
The probabilities show a slight difference because in EyeSuite Perimetry, the probabilities from the Octopus 900 normal value study are applied. These show slightly narrower confidence intervals than the original HFA probabilities but the "picture" very much remains the same. This procedure has been chosen because perimetry is compared on the base of global indices and local deviations. Taking our approach, a 5dB defect in a certain location will show the same probability pattern, indifferent if coming from an HFA 700 or an Octopus 900.

One needs to know that the transition from a normal probability (> 5%) to the black <0.5% probability level can be as little as the difference between -4dB and -10dB. As a result, the probability map does not permit to differentiate between a defect depth of 12dB or 30dB. Especially in eccentricities up to 20° this is always <0.5% black.

3.9 **Pattern deviation**

The calculation of the pattern deviation from the local deviation is slightly different in EyeSuite compared to the Zeiss Humphrey way of calculating it. In the Octopus, the difference between total deviation and pattern deviation is named “Diffuse Defect”, DD. DD is the average of the 20%-25% best deviations. Please refer to the general documentation on EyeSuite Perimetry to learn more about the basis for this calculation.

3.10 **Global indices**

The global indices in the HFA are weighted. This means, that the deviations of central test locations have more influence to the global indices than the peripheral test locations. While the exact weighing is not published, the principle is known and the studies show, that the weighing function applied by Zeiss Humphrey is producing similar results as the Octopus G pattern.  

Test location in the 32 (30-2) pattern

Test locations in the Octopus G pattern

In order to better reflect ganglion cell density and quality of life, the MD and PSD calculation in the most common HFA patterns are weighed stronger in the center than in the periphery. This neglects the fact, that doing so instead of using a more appropriate test pattern means amplifying errors induced by inaccurate test results in the central region.

In the Octopus Perimetry, no weighing of the MD and sLV (PSD) is required because 29% of test locations are within the central 10°, much better reflecting the ganglion cell density and quality of life than the traditional HFA pattern. 

In the Octopus mode, no weighing is done and every test location has the same influence to the result.

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3.11 Accuracy of MD and PSD

### Accuracy of MD (Mean Deviation) in HFA mode

In 755 of 780 (97%) cases the difference between the EyeSuite MD and the HFA MD on the printout is within ±0.2dB, in 772 of 780 (99%) cases, the difference was within ±0.3dB.

### Accuracy of PSD (Pattern standard deviation) in HFA mode

Deviation within ±0.2dB in 744 of 780 (95%) cases

Deviation within ±0.3dB in 753 of 780 (97%) cases
3.12 How similar are Octopus and HFA printouts? HFA vs. EyeSuite HFA Style

Original HFA printout:
Gaze track and GHT are only available on original HFA printouts

EyeSuite Perimetry, “HFA Style” printout
Octopus perimeters control the examination flow based on eye position and automatically repeat stimuli that interfere with blinks. A clear text analysis is under review and being implemented soon.

SITA Standard and SITA Fast calculate catch trials but don’t display real positive catch trials during the test. For imported SITA tests, there is no catch trial percentage shown. For all other tests, the false positive and false negative percentage is shown and printed.
3.13 How similar are Octopus and HFA printouts? HFA vs. EyeSuite OCTOPUS Style

**Humphrey Octopus**
- **PSD**: square root of loss variance
- **MD**: Mean Deviation vs. Mean Defect

**Reliability**
1. Correct Patient & age
2. Correct refraction
3. Pupil size
   - > 3mm ok
   - 2.5 .. 3 mm borderline
   - < 2.5mm critical
4. Catch trials
   - < 15..20% false pos
   - < % of severely depressed field false neg
5. Method, Strategy, Test duration

**Result**
1. Greyscale of comparisons:
   - "all white" or max. 3 small light yellow non-cluster dots
   - Comparisons:
     - < 4 numbers with 5.8dB in case of cataract evaluate "Corrected comparison"
2. Defect (Bebie) curve
   - Within 5..95% bandwidth overshoot left: happy trigger parallel lower: diffuse defect drop on the right side: local defect
3. Global indices
   - MD < 2dB "normal" &
   - sLV < 2.5 dB "normal"
   - MD 2..6dB "early"
   - MD 6..12dB "moderate"
   - MD > 12dB "advanced"
3.14 How to look at visual field results on screen in EyeSuite Perimetry?

EyeSuite allows looking at both eyes at the same time, switching between all available graphs including Clustergraph and Polargraph. Alternatively, 4 graphs can be user defined and be displayed simultaneously. More details on this feature can be found in the “Octopus 900 Handbook” and “Setup manual”.

### Reliability

- **Correct age**
- **Examination time**
- **Pupil size**
  - > 3mm ok
  - 2.5 .. 3 mm borderline
  - < 2.5mm critical
- **Catch trials**
  - < 15..20% false pos
  - < % of severely depressed field false neg

### Method, Strategy, Test duration

### Result

- **Greyscale of comparisons**: “all white” or max. 3 small red non-cluster dots
  **Comparisons**: < 4 numbers with 5.8dB
  in case of cataract evaluate “Corrected comparison”

- **Quadrant values & left/right comparison**
  - ΔMD < 1.3dB
  - ΔsLV < 0.6dB

- **Global indices**
  - MD < 2dB “normal” & sLV < 2.5 dB “normal”
  - MD 2.6dB “early”
  - MD 6.12dB “moderate”
  - MD > 12dB “advanced”

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**Eye/Pupil [mm]**
- Test duration: 80.00
- Program/Strategy: Standard / WhiteWhite
- Method: Background [std]: 4
- Questions / Repetitions: 50/3 / 3
- Catch trials: 8/25(1), 1/25(1)
3.15 What is the Octopus alternative to the GHT?

The information provided by the GHT (Glaucoma Hemifield test) is similar to the information provided by looking at the Cumulative Defect Curve, known as Bebie-Curve.

To draw the Bebie-Curve you first calculate all local defects (local deviations). Then you line them up, from best to worst. The Bebie curve thus removes local information and unveils the patient response characteristic. In a normal visual field, the shape of the Bebie-Curve approximately matched the 50th percentile or midline of the template.

**Correspondence between GHT and Bebie-Curve**

| “Within normal limits” | Patient curve remains inside the 5%..95% band |
| “Borderline” | Patient curve runs along or slightly below the 95th percentile – or – Patient curve is within the 5th to 95th percentile but shows a distinct step down – eg starts on the left close to the 5th percentile and ends to the right close to the 95th percentile |
| “Outside normal limits” | Patient curve is falling below the 95th percentile – only on the right side of the curve or even in complete |
| “General reduction of sensitivity” | Patient curve runs below, but in parallel to the 95th percentile |
| “Abnormally high sensitivity” | Patient curve overshoots the 5th percentile on the left side |

**Interpretation examples**
3.16 Will there be a “GHT” in EyeSuite?

A clear text analysis (working title PIA, Perimetry Interpretation Aid) has been developed by a team around Professor Hans Bebie and Ernst Buerki, MD, to provide a short statement on the severity of the disease (Brusini classification), detection of characteristic glaucomatous and neuro-ophthalmic conditions, trend analysis and judgement of reliability.

This analysis is already available for evaluation in the Octopus research software OFA (Octopus Field Analysis) and is designed to evaluate Octopus G (including G1, G2) visual fields.

PIA is based on an analysis combining the information of clusters and sectors applying analysis of absolute or pattern deviations, superior/inferior, temporal/nasal and intereye differences as well as global indices and reliability indicators.

3.17 What is the base for the population based statistics in EyeSuite?

EyeSuite Perimetry applies population based statistics to calculate probabilities for stability of trends respectively progression.

The advantage of population based statistics is to provide earlier, more significant trend detection, even with 3 or 4 visual fields, when regular statistics fails to provide meaningful results.

To establish the parameters for stability, visual field series with 4 to 8 tests from 100 eyes were chosen fulfilling the criteria of stability according to the “TCA Topographic Change Analysis” and “progression of stereometric parameters” in HRT-II, software version 3.1. The original data come from the private practice of Ernst Buerki, MD.¹⁷ A validation of the population based statistics has been performed at the University of Basel.

3.18 Some comparative studies between Octopus and HFA

HFA SITA and TOP Strategy

- Capris P., Corillo G., Torre P., Camiscione P., Nasciutt F, Papadia M, Biasotti B., Comparison of TOP strategy (Octopus) and SITA Fast (Humphrey) algorithm in damaged visual fields. IPS 2002 meeting abstract (manuscript available on request)

¹⁷ Monhart M, Bebie H, Buerki E, Receiver Operating Characteristics of a Novel Method of Visual Field Trend Analysis, ARVO 2008 presentation #1154


HFA SITA and Octopus Dynamic strategy


HFA Fastpac and TOP Strategy


Various


3.19 Is there a VFI (Visual Field Index) in the Octopus?

The visual field index is a construct in the HFA to quantify deviations from normal that fall outside the 5% probability. Since the usual HFA 24-2 and 30-2 patterns do “undersample” the important central portion of the visual field, the VFI gives more weight to the very few central test locations of those patterns.

The Octopus has a different concept: The most used G-pattern has a higher resolution in the center of the visual field, making artificial weighing of test locations unnecessary. In order to look at pattern deviations only, Octopus created the index “LD Local Defect” that allows early detection of changes from normal.
3.20 How do the HFA GPA and GPA2 compare to the Octopus Trend analysis?

**OCTOPUS MD / Global Trend**
- Follows the Glaucoma Society recommendations and calculates MD trend in dB/year
- Shows actual progression rate in dB/year. Reflects current treatment situation
- MD based on the G-Pattern. Natural weighing given by the test pattern
- Easy interpretation with intuitive colors. No icon → no significant change. Meaningful landmarks → lines for impaired vision and legal blindness

**Humphrey GPA-2**
- Modified implementation of the progression rate concept. VFI does not appear to have any real advantages over MD progression rate but shows lower sensitivity for early defects, especially below up to -5dB
- Shows all time change rate if baseline is not altered. May over- or underestimate actual progression rate.
- VFI Visual Field Index is based on the 24-2 pattern. Fewer central test points with up to 9 fold more influence than peripheral test points amplify signal and errors too.
- Percentage scale appears more easy to read, but impaired vision around 40–50%. Legal blindness between 25–30%

**OCTOPUS Polar & Cluster Trend**
- Polar-Trend: Pointwise linear regression projected to the optic disc. Display of current state and amount of change in one graph.
- Cluster-Trend: Significant changes and progression rate for each cluster. Easily focus on important regional changes.

**HFA deviation from baseline & GPA**
- Local deviation from Baseline in dB. Requires the baseline graph to make sense. No rate of progression.
- GPA – Glaucoma Progression Analysis. Identifies locations that significantly worsened compared to baseline. Information if deterioration is quick or slow is not available.