



# INTERPRETATION OF AUTOMATED PERIMETRY

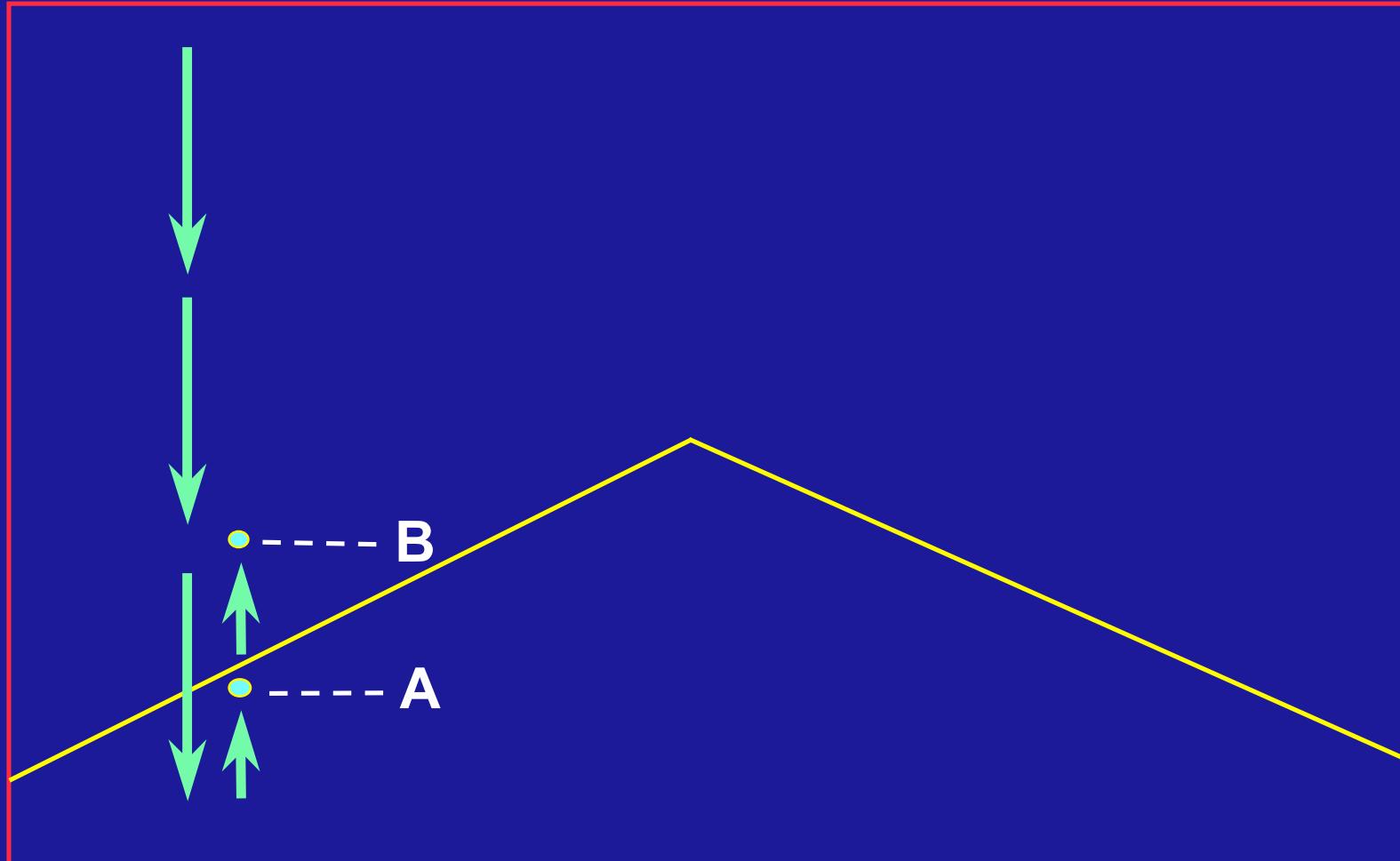
# Automated perimetry



# Automated perimetry

- I. Perimetry logic
- II. Identifying field defects
- III. Criteria for glaucomatous defects
- IV. Detecting glaucomatous progression
- V. Advanced field defects

# Bracketing strategy



# Normal thresholds

- Mean threshold in disease-free fields
- In a given age group
- At a given location in the visual field
- Mean normal values are stored in the automated perimeter and compared against patient data

# Computers and ease of interpretation

Sensitivity



Simple set of rules



Computer



Diagnosis

# Perimeter logic (1)

- Sensitivity determined at each location
- Normal range developed
- Normal range is arbitrary
  - Includes the values of 95% of the normal population

## Perimeter logic (2)

- ‘Abnormal’ values include the lowest 5% of those in normal individuals
- Therefore, 5% of normal individuals will be labelled abnormal

‘Abnormal’ is not the same as diseased

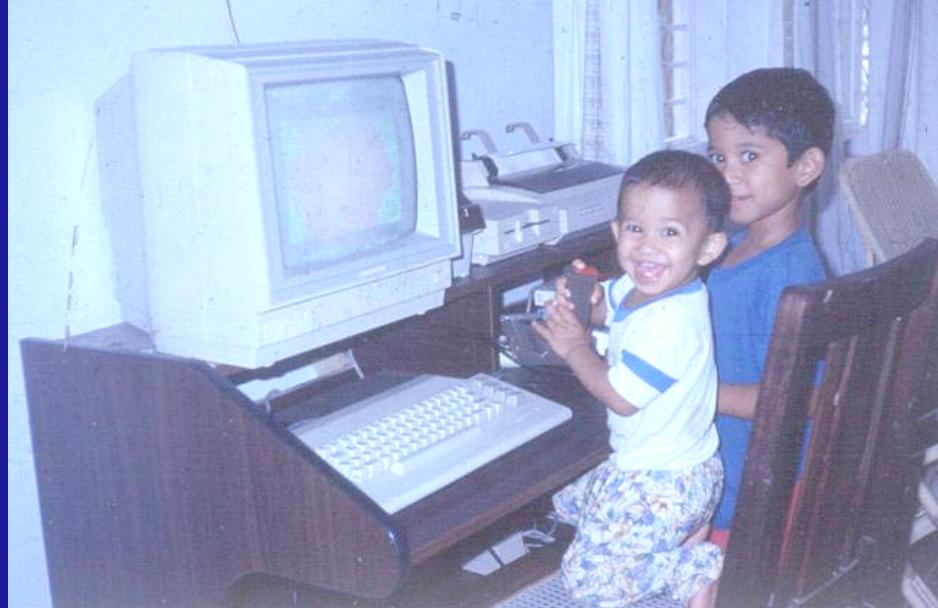
# Perimeter logic (3)

- General population – 100 tested
- 1% glaucoma; 99% normal
- Six will have abnormal tests:
  - 1 glaucoma patient
  - 5 normal individuals

# Perimeter logic (4)

- Clinic population – 100 tested
- 30% glaucoma; 70% normal
- 33 will have abnormal tests
  - 30 glaucoma patients
  - 3 normal individuals

# Interpretation is not child's play



Automated perimeters still need interpretation



# Before interpretation ...

... a few principles

# Rely on threshold tests

- First real evidence of glaucoma
- Detect scotoma
- Detect depression of the 'hill' of vision
- May predict visual loss

# Screening tests

- Screening
- Fishing
- Fatigue

# Interpreting decibel values is just half the challenge ...

- False positives
- False negatives
- Fixation
- Fluctuation
- Strategy
- Experience
- Technicians
- Artefacts

Single Field Analysis  
 Name: XXXXX ID: 000000 DOB: 01-11-1940  
 Eye: Right

Central 30-2 Threshold Test

Fixation Monitor: Gaze/Blindsight

Fixation Target: Central

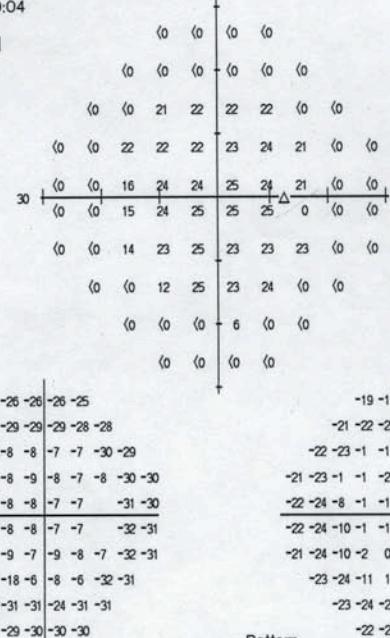
Fixation Losses: 2/18

False POS Errors: 0 %

False NEG Errors: 8 %

Test Duration: 09:04

Fovea: 26 dB ■



Stimulus: III, White

Background: 31.5 ASB

Strategy: SITA-Standard

Pupil Diameter: 6.0 mm

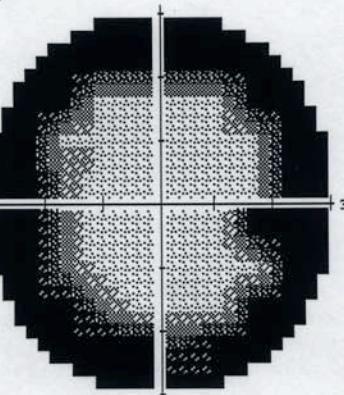
Visual Acuity: 6/6

RX: +13.00 DS DC X

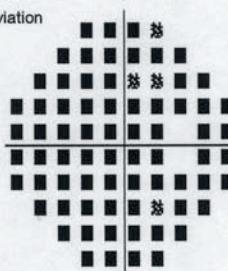
Date: 31-03-2000

Time: 3:40 PM

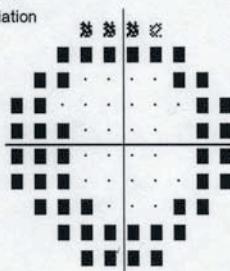
Age: 59



Total Deviation



Pattern Deviation



:: < 5%  
 ≈ < 2%  
 ⚡ < 1%  
 ■ < 0.5%

GHT

Outside normal limits

MD -17.93 dB P < 0.5%  
 PSD 12.69 dB P < 0.5%

Pupil Diameter: 6.0 mm

Visual Acuity: 6/6

RX: +13.00 DS DC X

Date: 31-03-2000

Time: 3:40 PM

Age: 59

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# Optimising patient performance

- Choose the most appropriate investigation
  - Test pattern and strategy
- Ensure the patient is comfortably positioned
  - Support feet, back and arms
  - Adjust chin rest
  - Cover the other eye fully
- Provide careful instructions prior to the test
- Support the patient during the test
- Give feedback on test performance

# A word about the grey scale

- Never use the grey scale alone for interpretation
- It is useful to educate the patient and to identify false-positive and false-negative errors

Single Field Analysis	Eye: Left
Name: 692344	ID: 692344 DOB: 06-05-1986

#### Central 30-2 Threshold Test

Fixation Monitor: OFF

Fixation Target: Central

### Fixation Losses

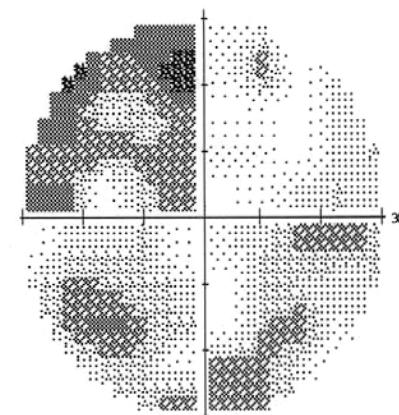
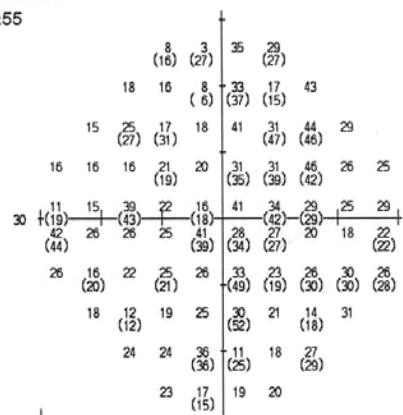
False POS Errors: 15/26 xx

False NEG Errors: 7 / 20 xx

Test Duration: 00:55

Test Duration: 22:55

### Fovea: OFF

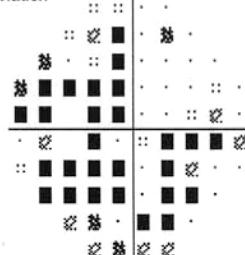


**GHT**  
Outside normal limits

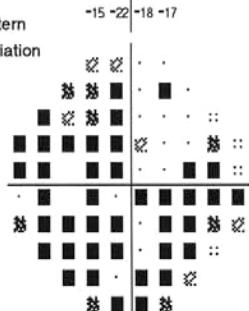
MD -6.68 dB P < 0.5%  
 PSD 9.97 dB P < 0.5%  
 SF 5.33 dB P < 0.5%  
 CPSD 7.94 dB P < 0.5%

Total -9 -16 -12 -11

## Deviation

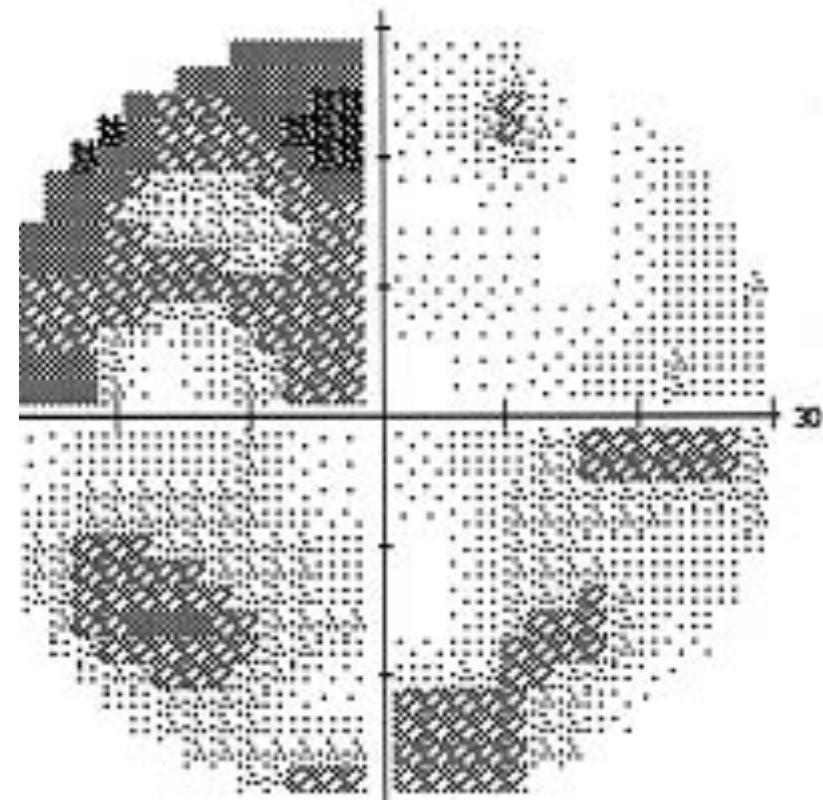


:: < 5%  
◎ < 2%  
● < 1%  
■ < 0.5%



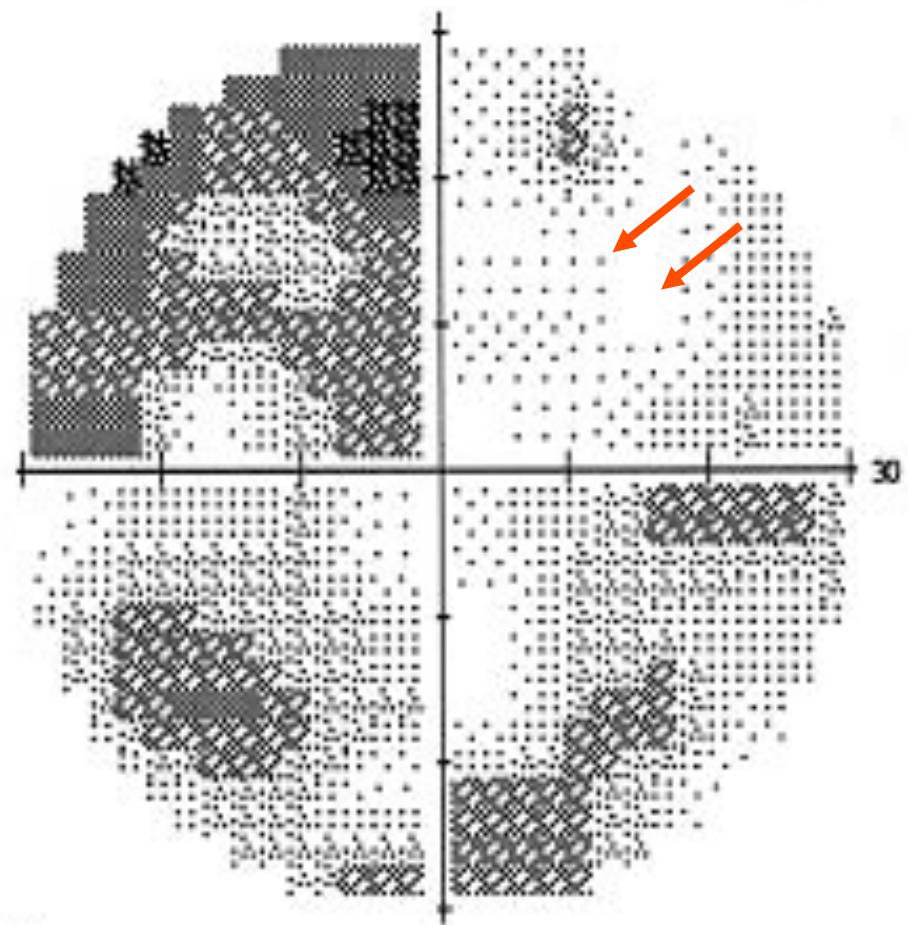
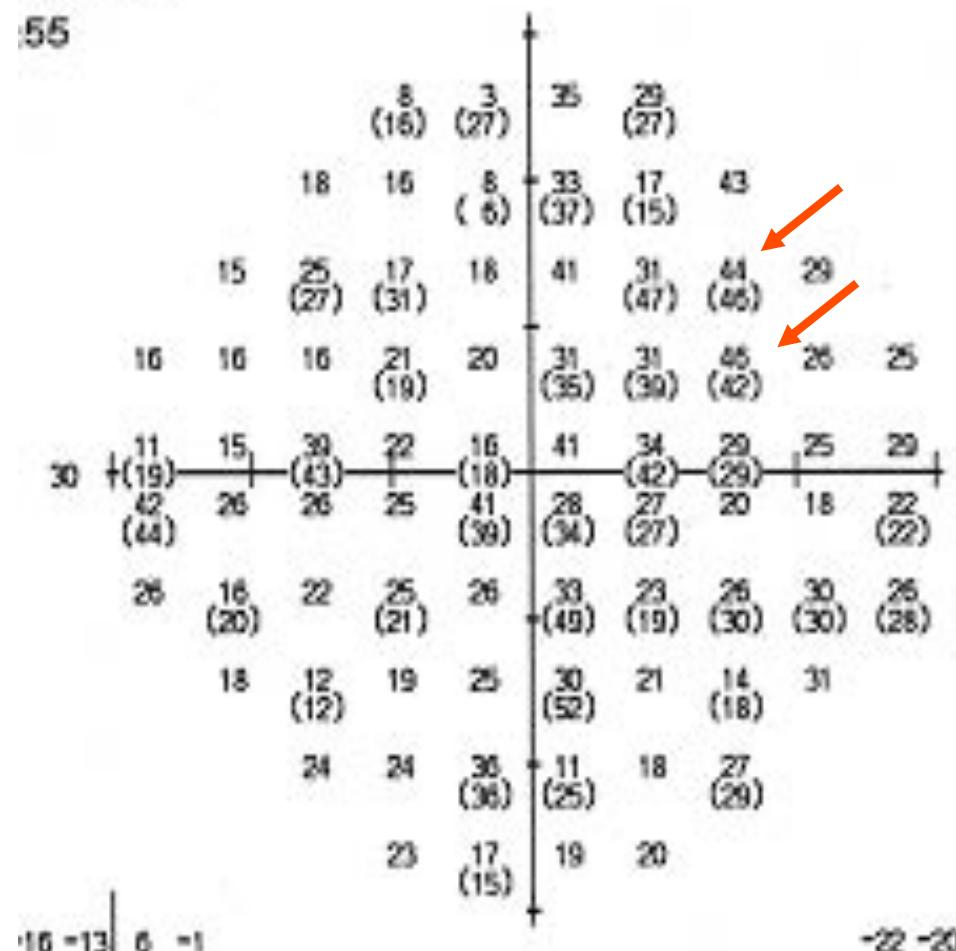
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## ‘White’ scotomas associated with false positives

: 7/20 xx



Single Field Analysis

Name: 555016

ID: 555016

Eye: Right

DOB: 01-07-1930

## Central 30-2 Threshold Test

Fixation Monitor: Blindepot

Stimulus: III, White

Pupil Diameter: 2.5 mm

Date: 20-04-1995

Fixation Target: Central

Background: 31.5 ASB

Visual Acuity: 6/9

Time: 3:28 PM

Fixation Losses: 2/31.

Strategy: Full Threshold

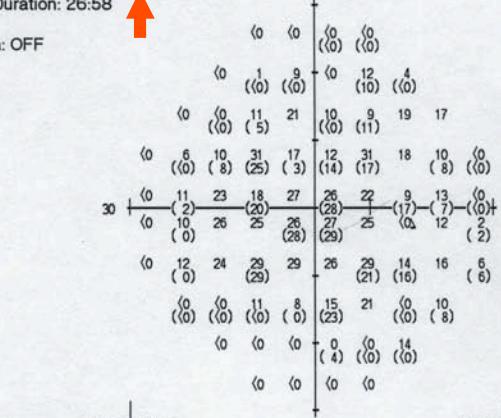
RX: +4.50 DS +1.50 DC X 180 Age: 64

False POS Errors: 0/24

False NEG Errors: 8/16 xx

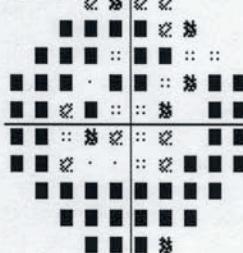
Test Duration: 26:58

Fovea: OFF

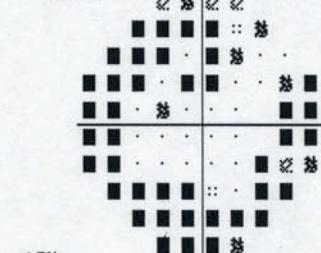


-24 -24 -23 -23  
-26 -25 -22 -27 -13 -23  
-27 -29 -19 -7 -23 -17 -7 -8  
-26 -25 -19 -2 -20 -16 -5 -10 -18 -28  
-27 -21 -7 -12 -4 -4 -8 -18 -29  
-27 -23 -4 -6 -5 -4 -5 -17 -26  
-27 -21 -5 -2 -2 -5 -5 -14 -12 -21  
-28 -30 -25 -25 -10 -8 -31 -19  
-28 -29 -30 -26 -30 -22  
Total -27 -28 -29 -28

Deviation



Pattern Deviation



:: < 5%  
:: < 2%  
&lt; 1%  
■ < 0.5%

Eye: Right

DOB: 01-07-1930

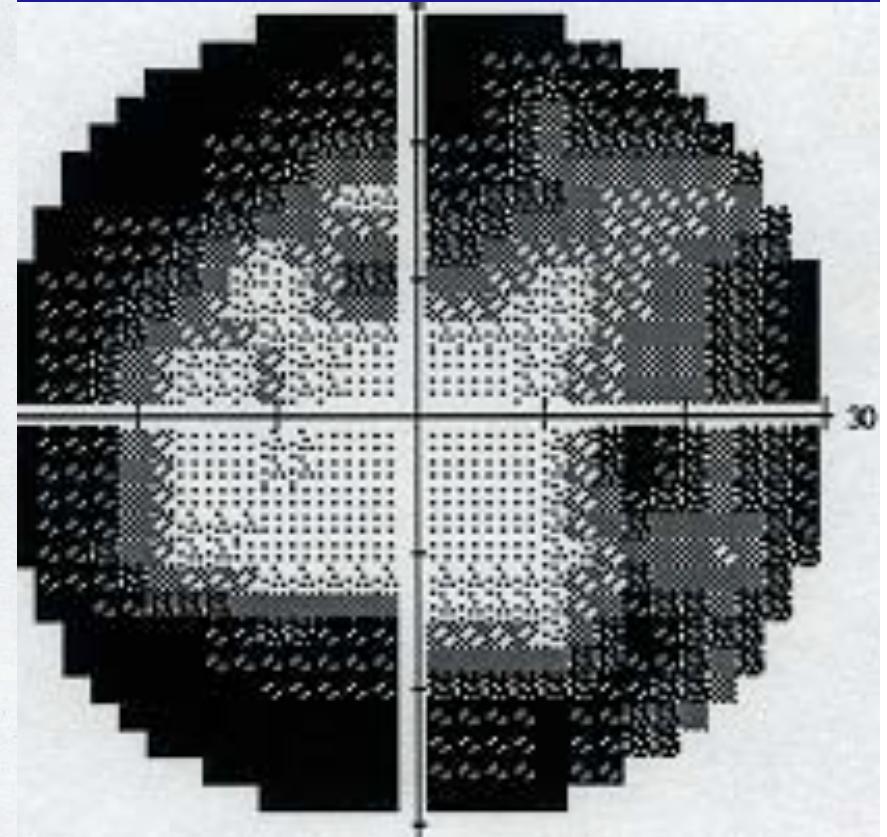
Pupil Diameter: 2.5 mm

Date: 20-04-1995

Visual Acuity: 6/9

Time: 3:28 PM

RX: +4.50 DS +1.50 DC X 180 Age: 64



Low Patient Reliability

GHT

Outside normal limits

MD -15.11 dB P < 0.5%  
PSD 11.50 dB P < 0.5%  
SF 4.78 dB P < 1%  
CPSD 10.14 dB P < 0.5%

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'Clover leaf' pattern associated with false negatives

# Using the grey scale

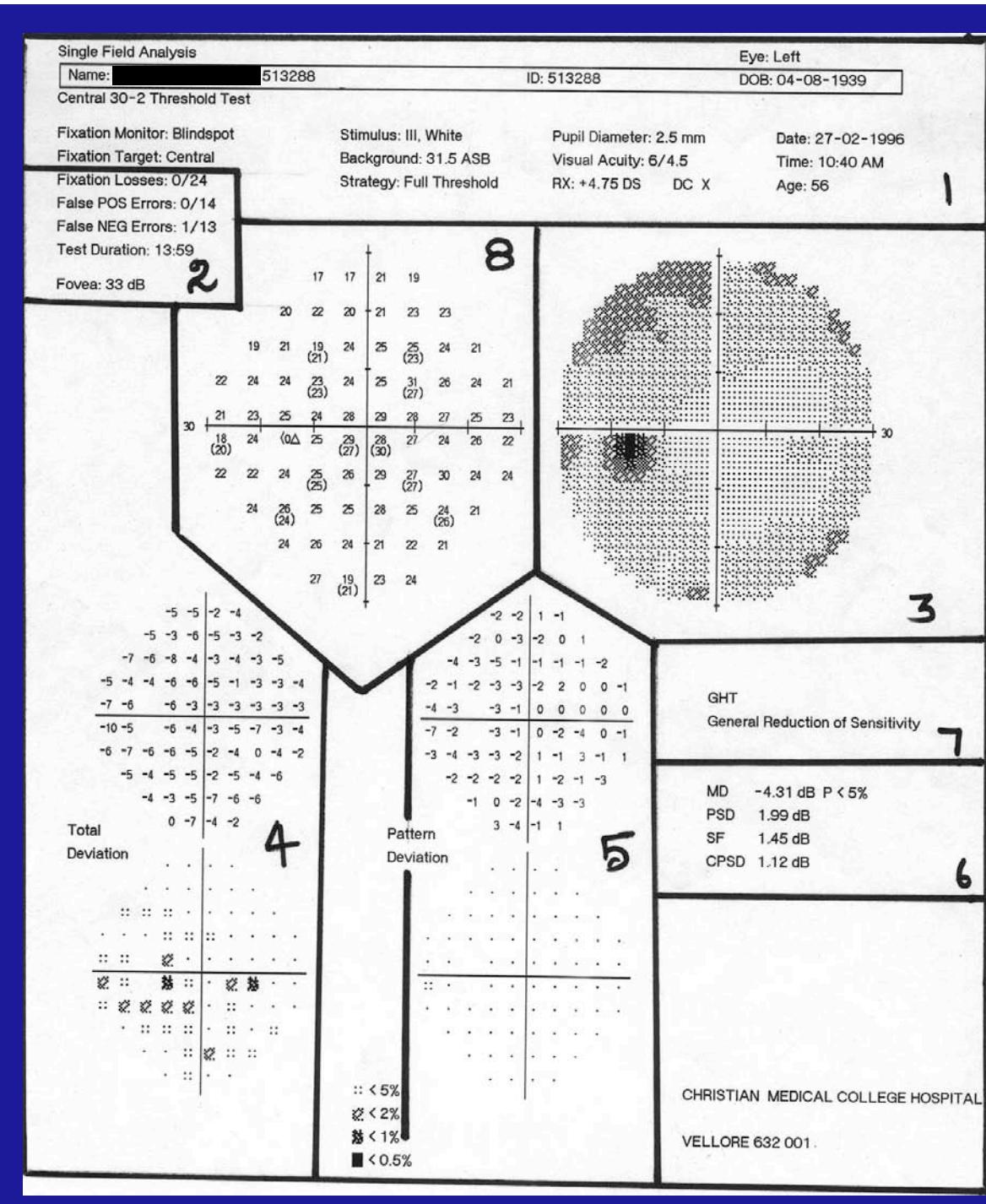
- To educate the patient
- White scotomas with false positives
- Clover leaf pattern with false negatives
- Never interpret using the grey scale alone

# Questions

- Is there a field defect?
- Is it due to glaucoma?
- Is the defect progressing?

# Is the field abnormal?

- Without obvious defects, it is difficult to make a decision based on the first field
- Repeat examinations provide definitive information
- Never make a diagnosis based on the visual field alone



Interpret the field  
systematically using  
zones 1–8

**Single Field Analysis**

Eye: Left

Name: 513288

ID: 513288

DOB: 04-08-1939

**Central 30-2 Threshold Test**

Fixation Monitor: Blindsight

Stimulus: III, White

Pupil Diameter: 2.5 mm

Date: 27-02-1996

Fixation Target: Central

Background: 31.5 ASB

Visual Acuity: 6/4.5

Time: 10:40 AM

Fixation Losses: 0/24

Strategy: Full Threshold

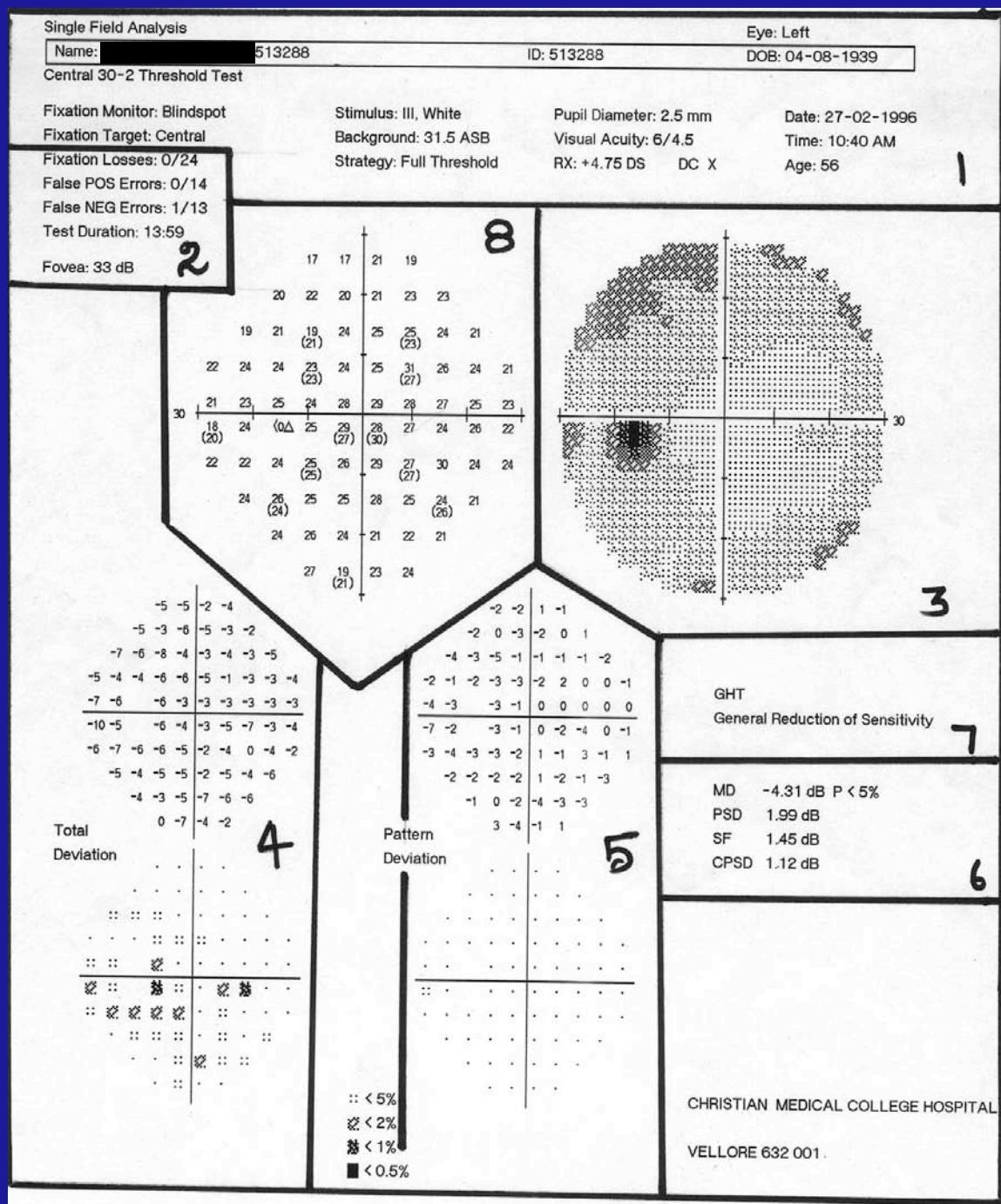
RX: +4.75 DS DC X

Age: 56

False POS Errors: 0/14

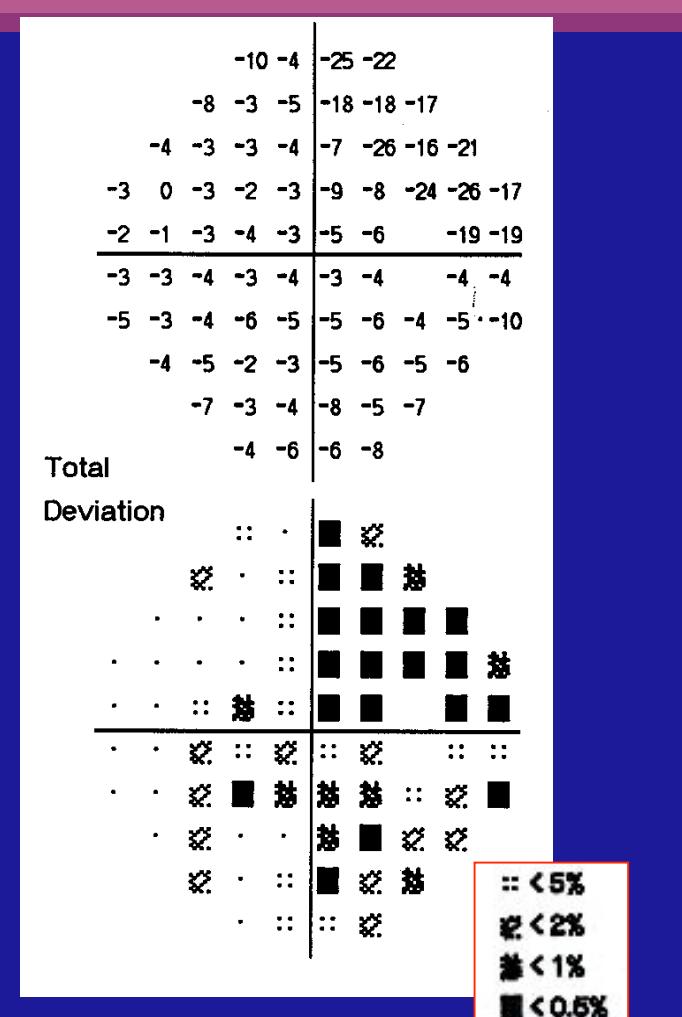


<b>AGE</b>	57	2
<b>FIXATION LOSSES</b>	0/24	
<b>FALSE POS ERRORS</b>	0/14	
<b>FALSE NEG ERRORS</b>	1/13	
<b>QUESTIONS ASKED</b>	449	
<b>FOVEA:</b>	33 DB	
<b>TEST TIME</b>	13:59	

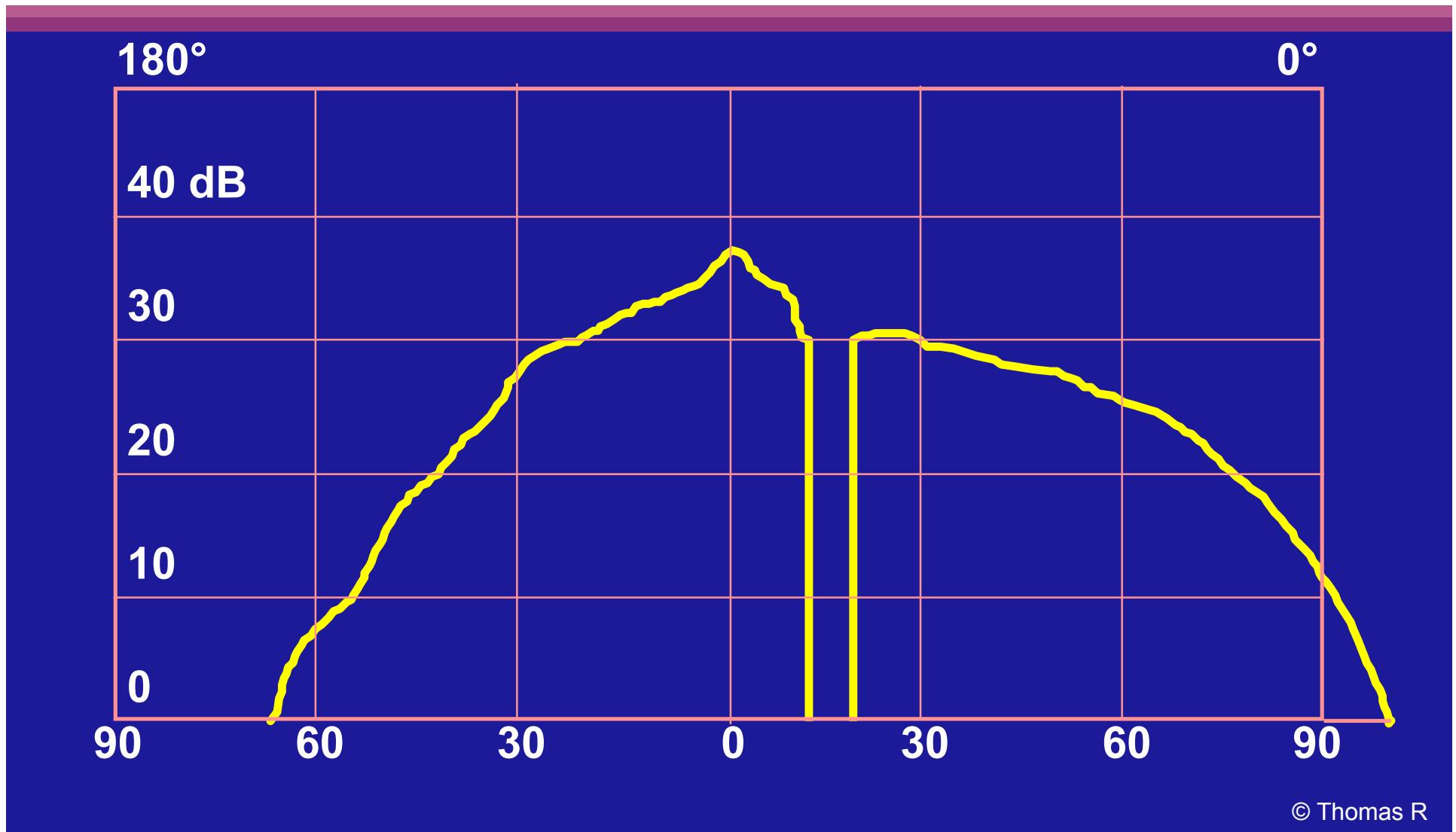


# Zone 4: total deviation

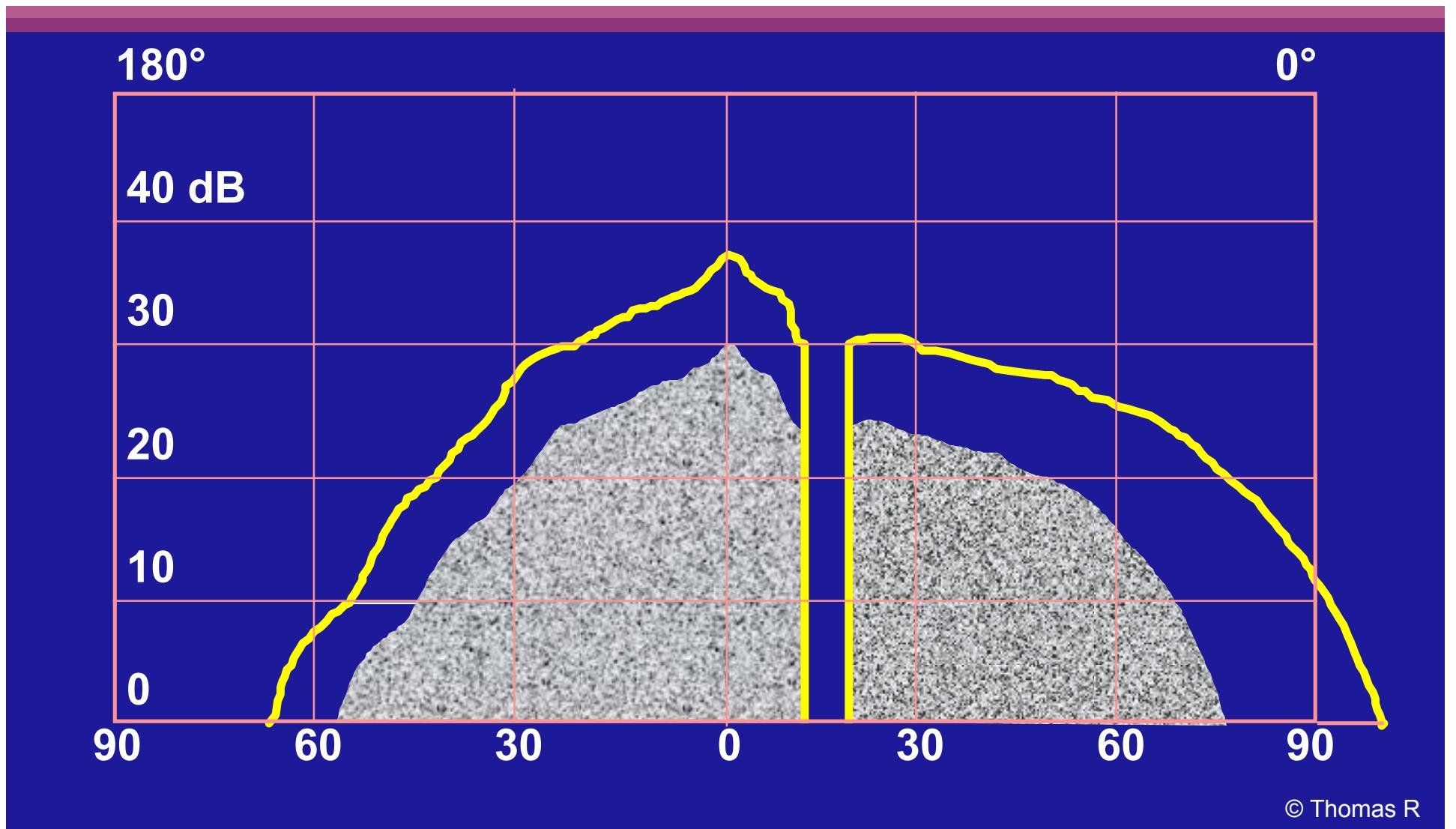
- Point-by-point difference from the expected value for age-related normal individuals
- Reveals generalised depression
- Cannot confirm a scotoma
- Look at the number and pattern of symbols



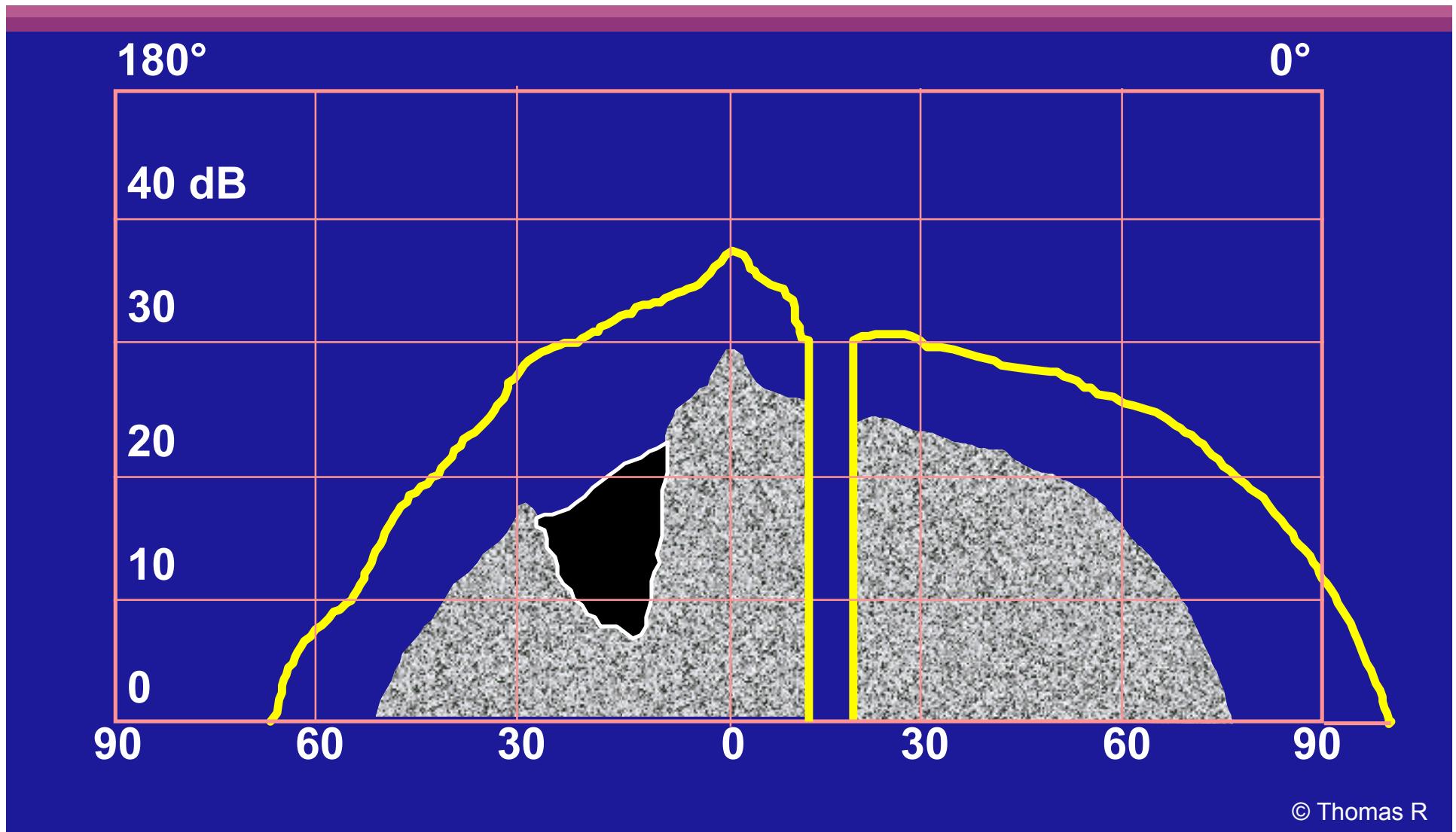
# Normal 'hill' of vision



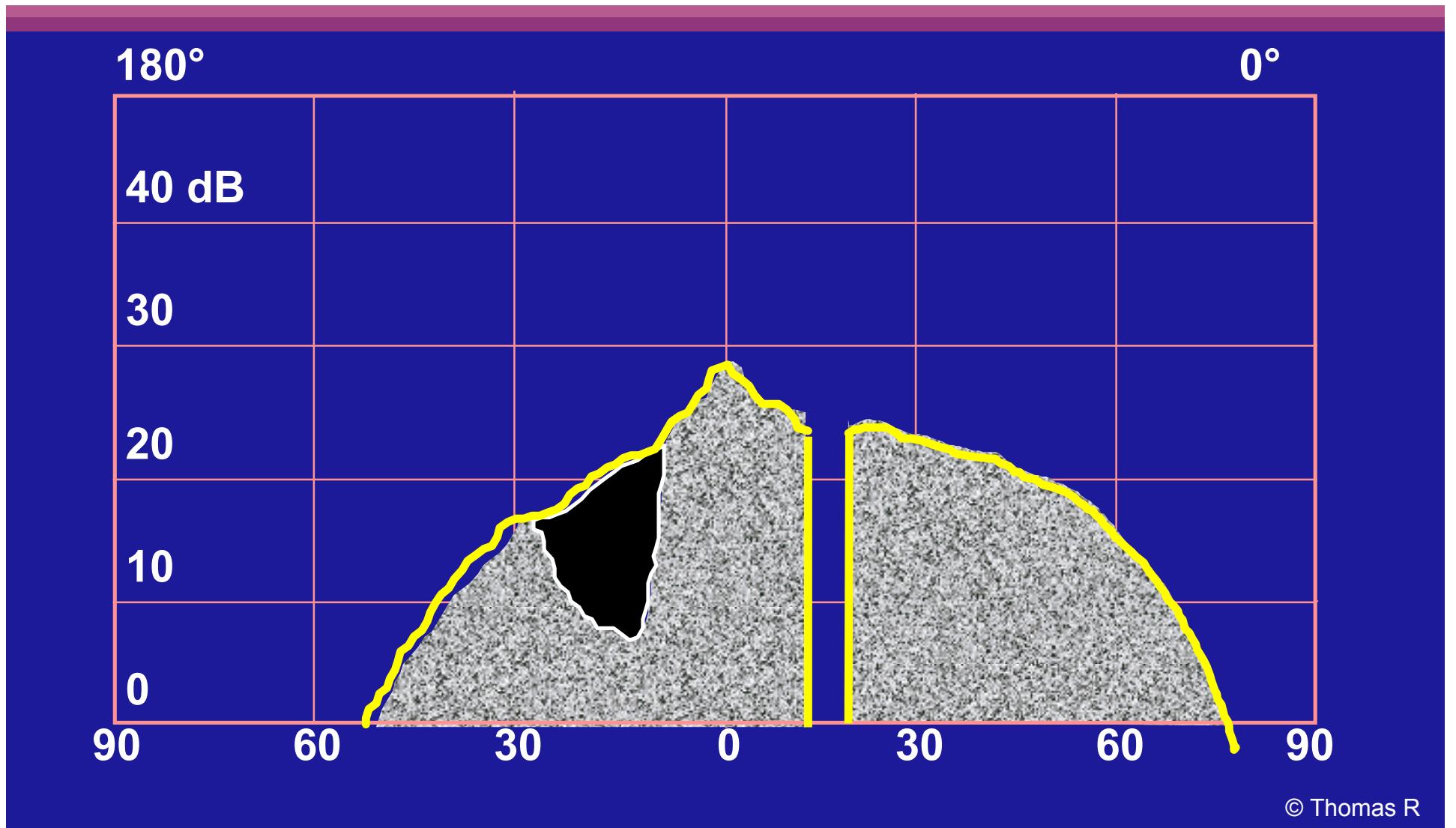
# Generalised depression



# Generalised depression with 'hidden' localised scotoma



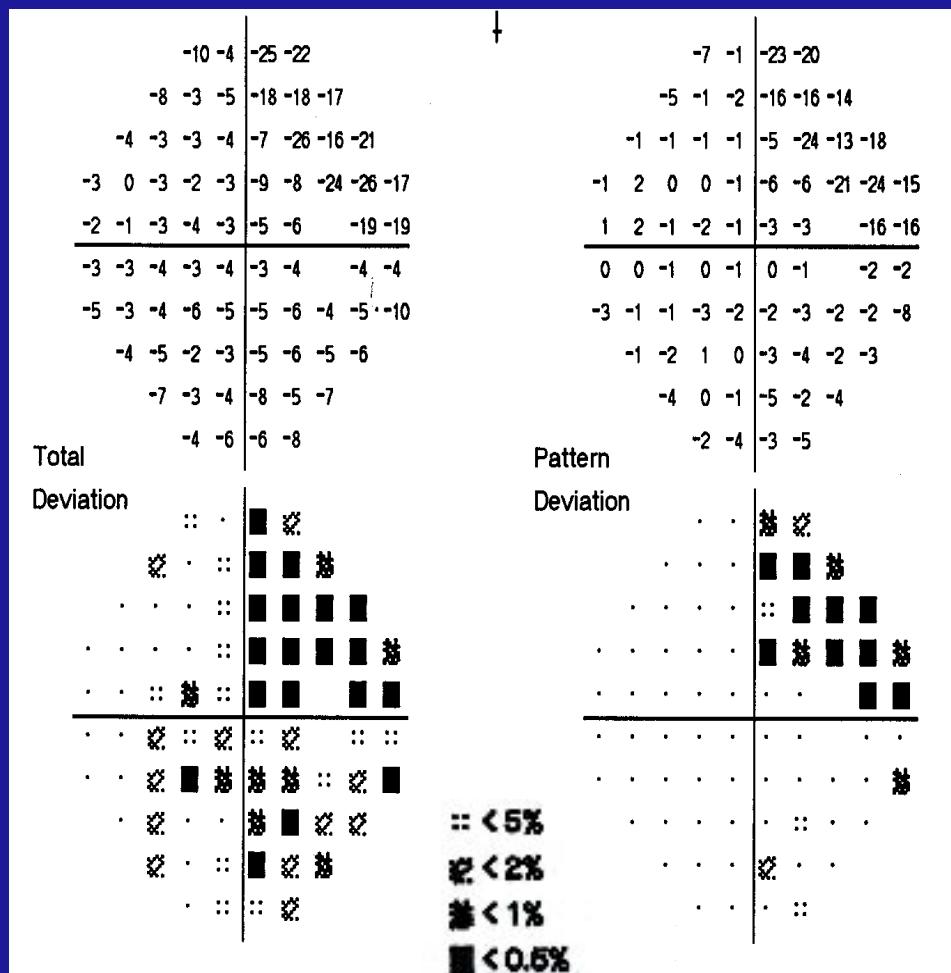
# Pattern deviation plot: scotoma revealed after adjusting for generalised depression





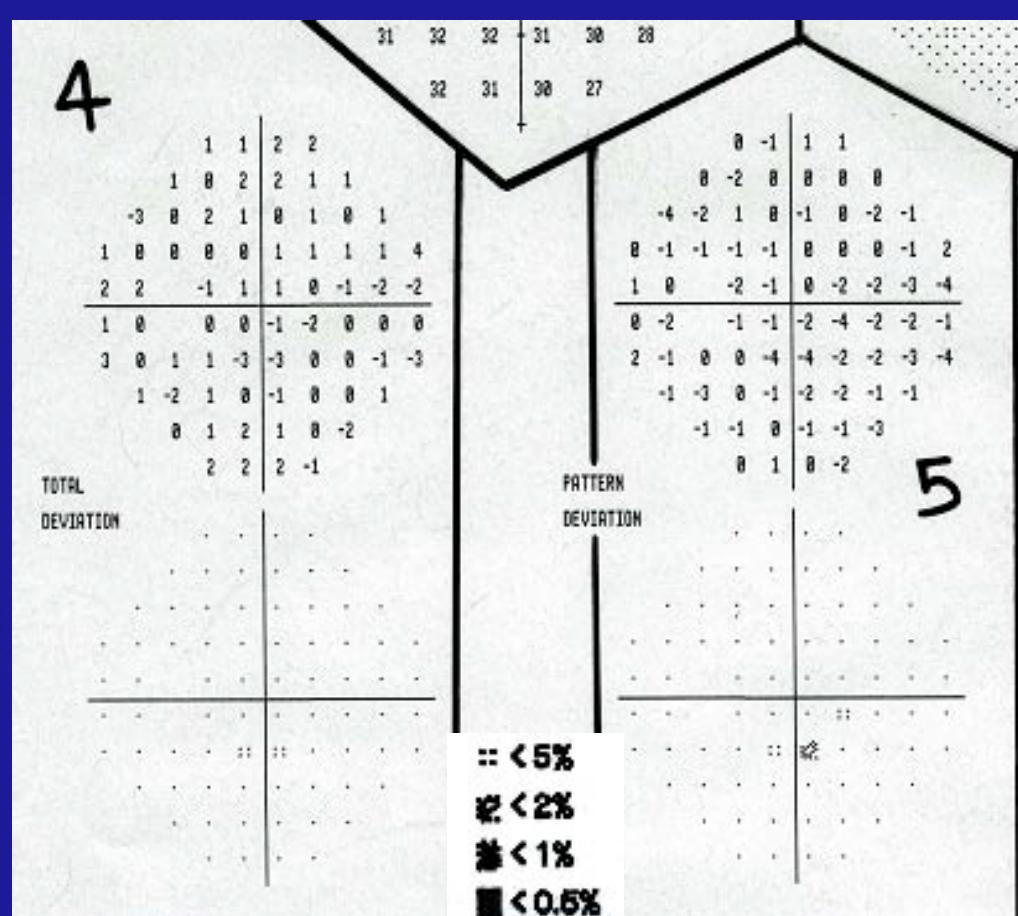
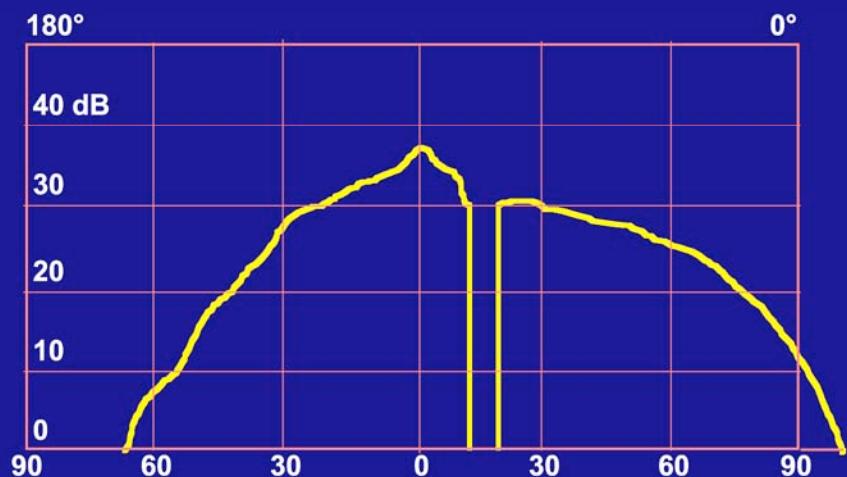
# Zone 5: pattern deviation

- Reveals focal defects after adjusting for overall depression (or elevation) of the hill of vision
  - Confirms a scotoma

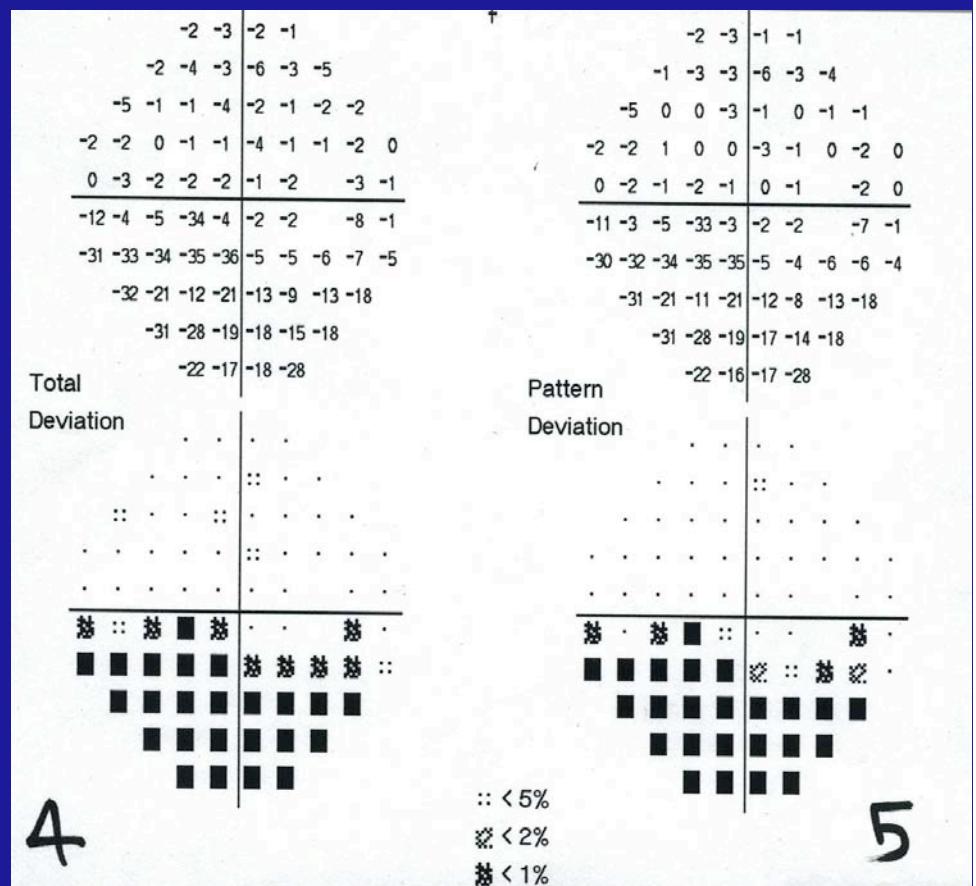


**Examples of total and pattern  
deviation plots in different situations**

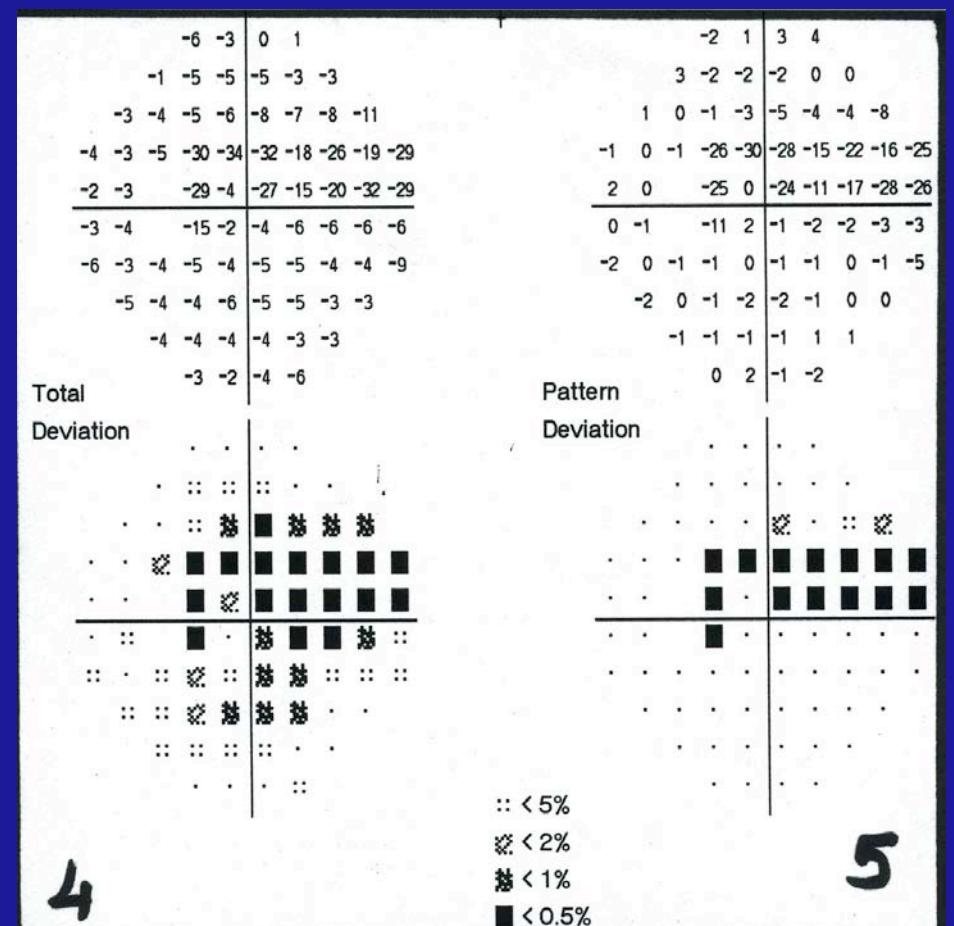
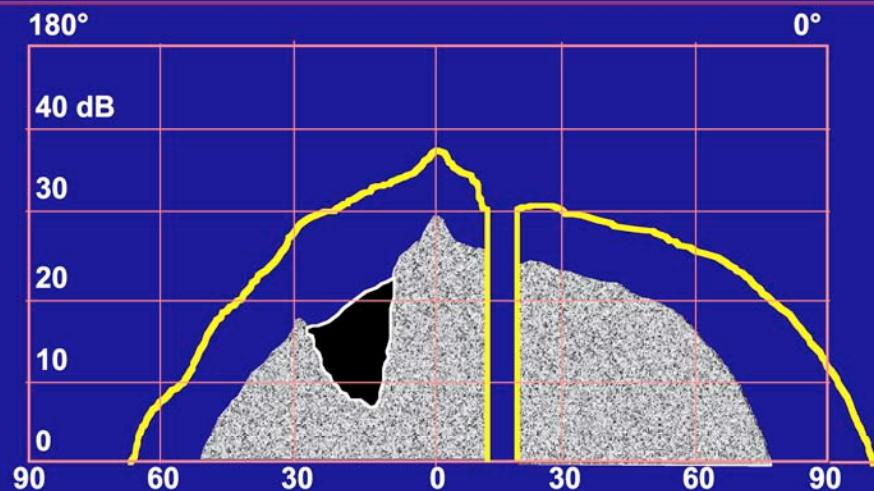
# Normal 'hill' of vision



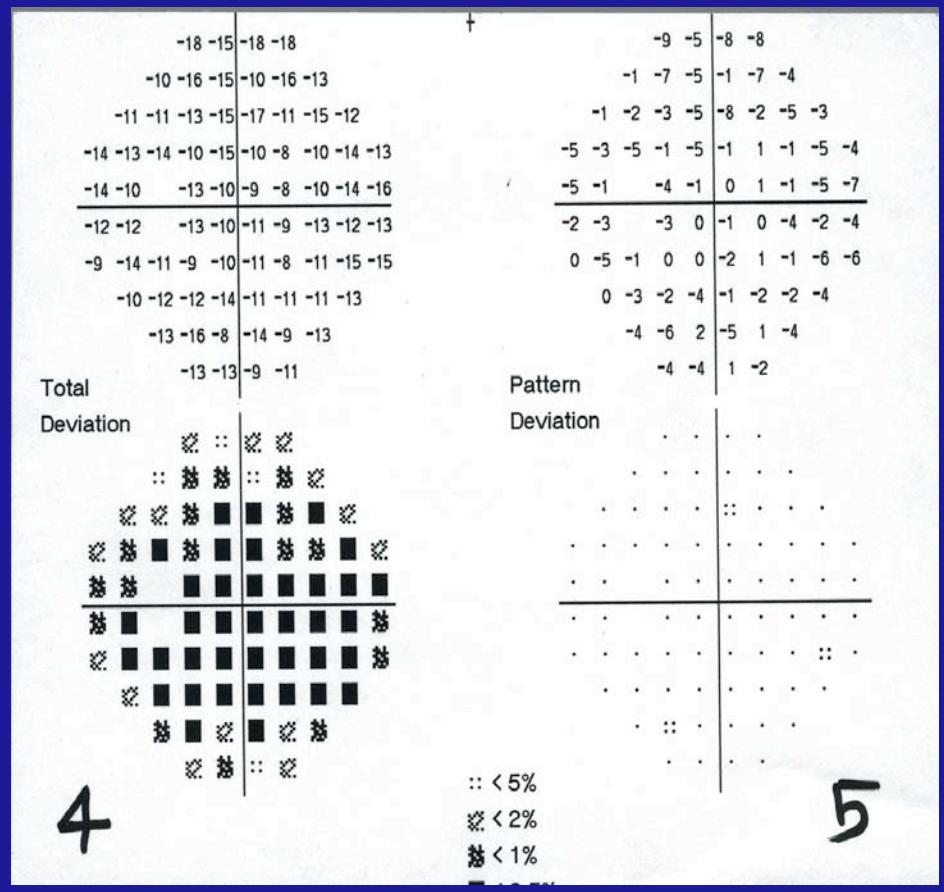
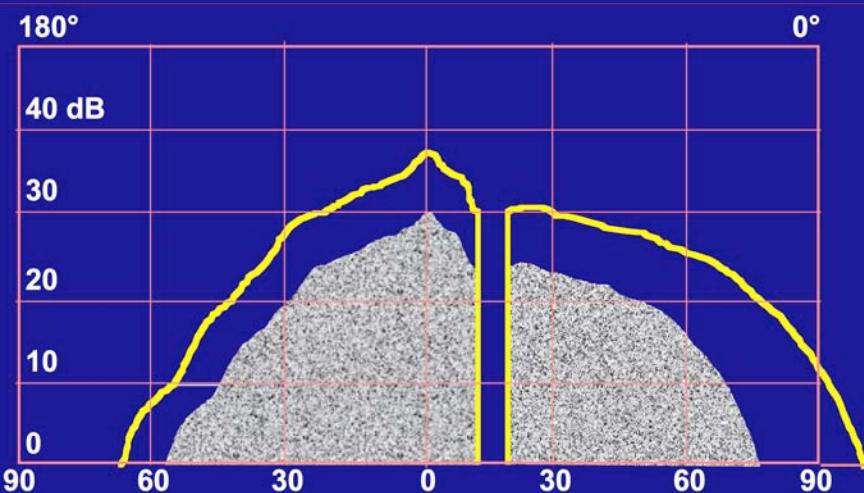
# ‘Normal’ hill of vision with localised scotoma



# Generalised depression with ‘hidden’ localised scotoma



# Generalised depression



MD	-4.31 dB	P < 5%
PSD	1.99 dB	
SF	1.45 dB	
CPSD	1.12 dB	

## GHT General Reduction of Sensitivity

MD -4.31 dB P < 5%  
 PSD 1.99 dB  
 SF 1.45 dB  
 CPSD 1.12 dB

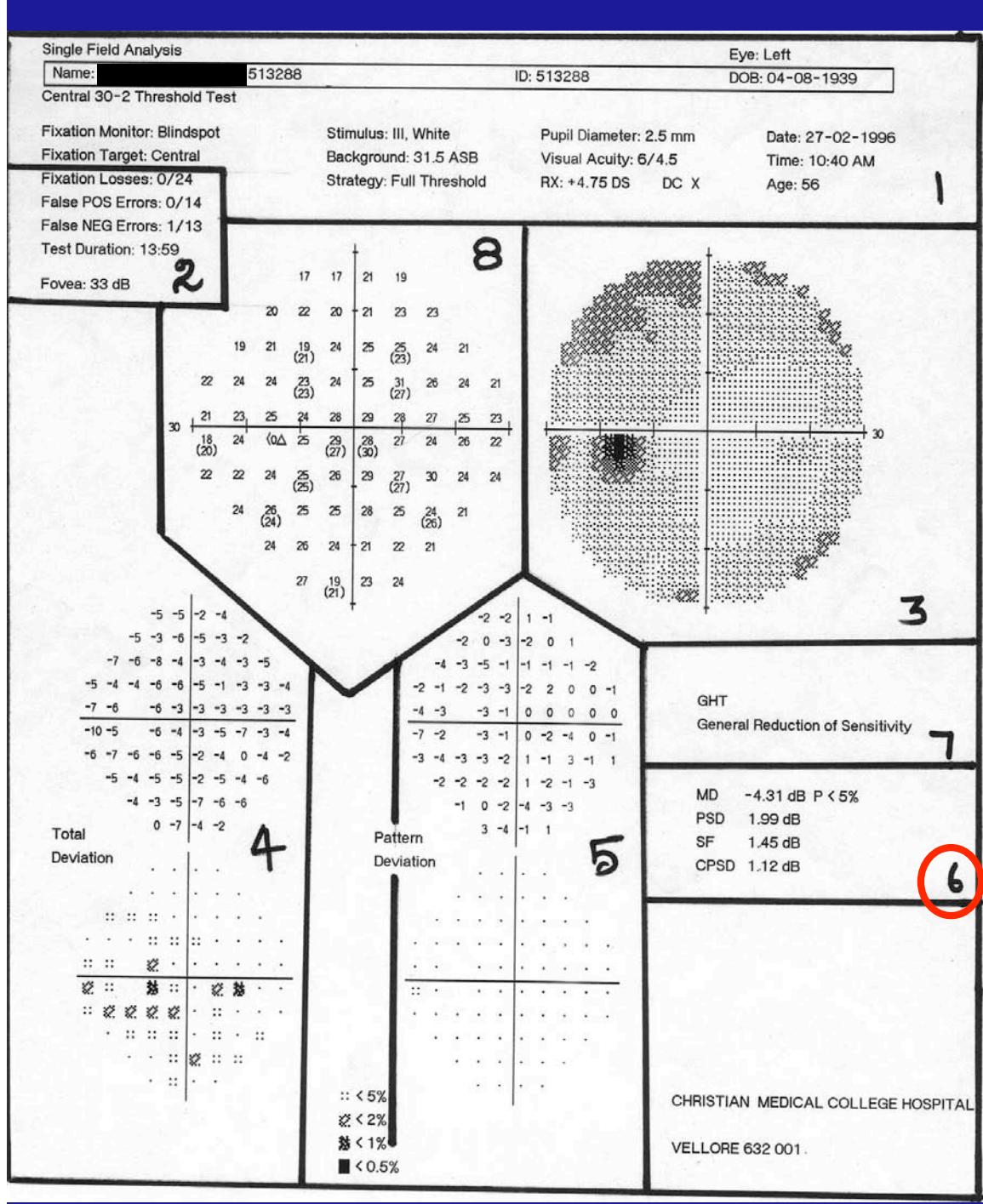
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# Global indices

All the information from all the points tested is reduced to single numbers

MD	-2.18 dB
PSD	4.63 dB; p < 1%
SF	1.24 dB
CPSD	4.44 dB; p < 0.5%

MD, mean deviation; PSD, pattern standard deviation; SF, short-term fluctuation; CPSD, corrected PSD.



- Both MD and PSD are derived from the total deviation plot
- However, they provide different types of information

MD -4.31 dB P < 5%  
PSD 1.99 dB  
SF 1.45 dB  
CPSD 1.12 dB

# Global indices: mean deviation (1)

- Average of all the numbers in the total deviation plot
- Indicates overall deviation of the visual field from normal
- Positive numbers indicate an ‘elevated’ field
- Negative numbers indicate a ‘depressed’ field

MD	-2.18 dB
PSD	4.63 dB; p < 1%
SF	1.24 dB
CPSD	4.44 dB; p < 0.5%

## Global indices: mean deviation (2)

- Provides similar information to total deviation
- Cannot confirm the presence of a scotoma

MD	-2.18 dB
PSD	4.63 dB; p < 1%
SF	1.24 dB
CPSD	4.44 dB; p < 0.5%

# Global indices: pattern standard deviation (1)

- Also derived from the total deviation plot
- Indicates the degree to which the numbers differ from each other
- Highlights ‘roughness’ or ‘pot-holes’ in the hill of vision

MD	-2.18 dB
PSD	4.63 dB; p < 1%
SF	1.24 dB
CPSD	4.44 dB; p < 0.5%

# Global indices: pattern standard deviation (2)

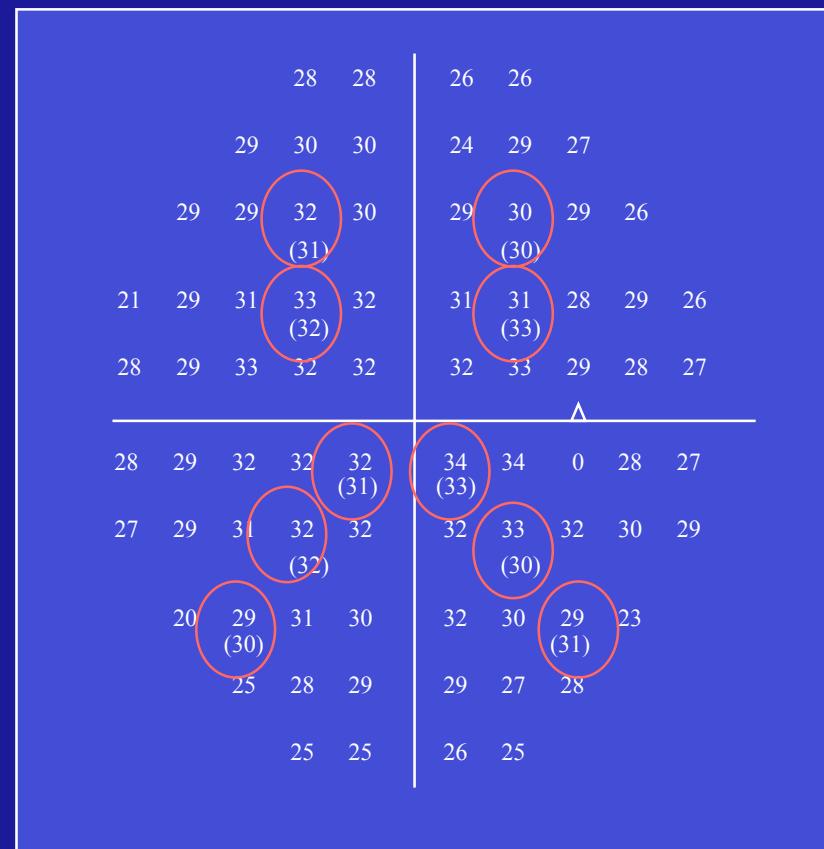
- Provides similar information to the pattern deviation
- Calls attention to scotomas



MD	-2.18 dB
PSD	4.63 dB; p < 1%
SF	1.24 dB
CPSD	4.44 dB; p < 0.5%

# Global indices: short-term fluctuation

- Intra-test error in threshold determination
- Standard deviation of 10 predetermined points that are each tested twice

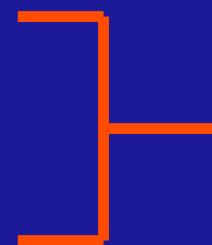


# Global indices: corrected pattern standard deviation

- CPSD is PSD corrected for the SF
  - If SF is due to unreliability, then CPSD is better
  - If SF is due to pathology, then PSD is better

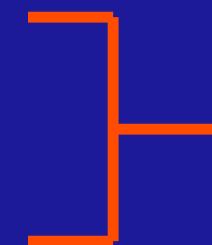
# Review of key points

MD  
Total  
deviation plot

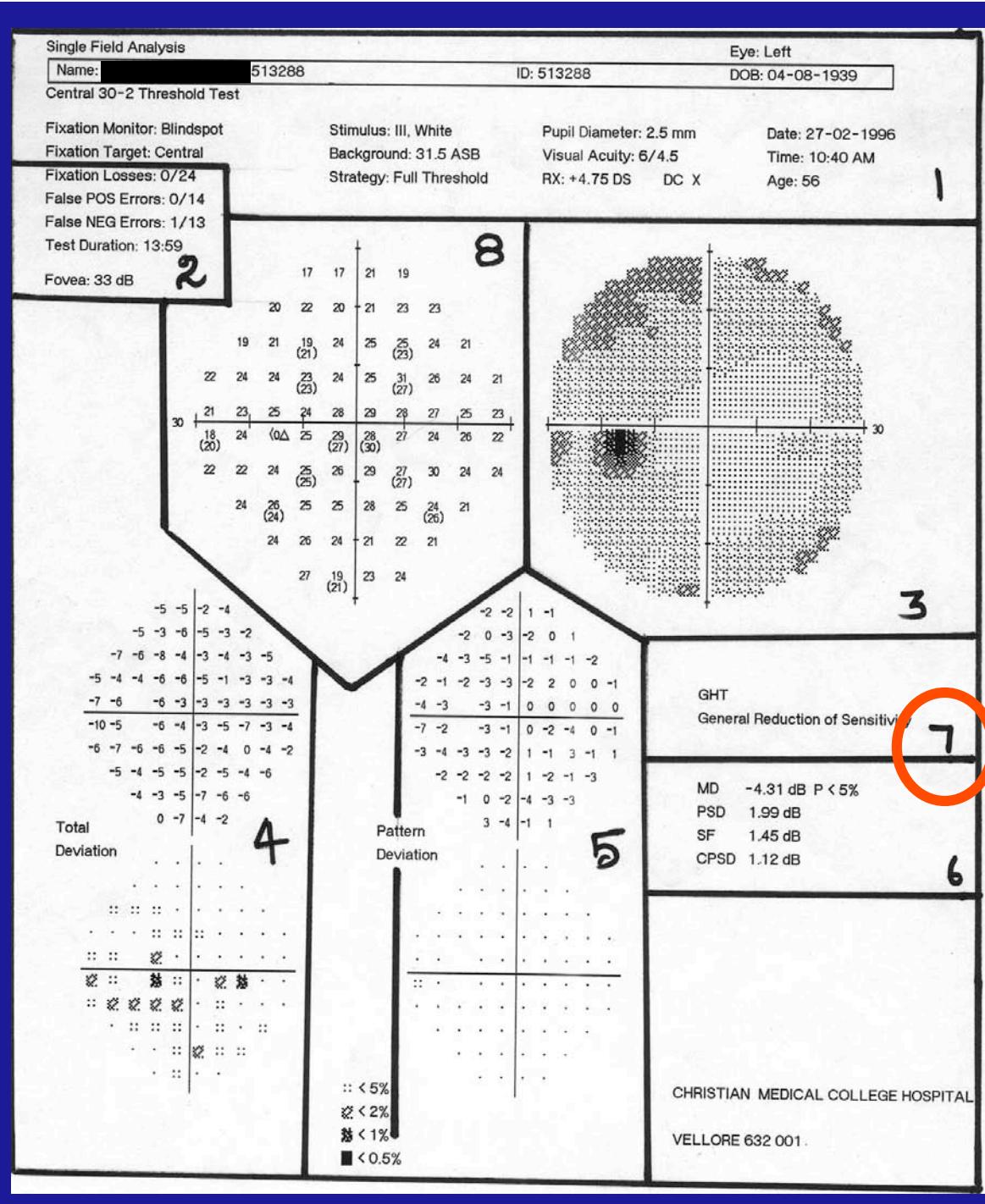


Generalised depression  
Can suspect a scotoma

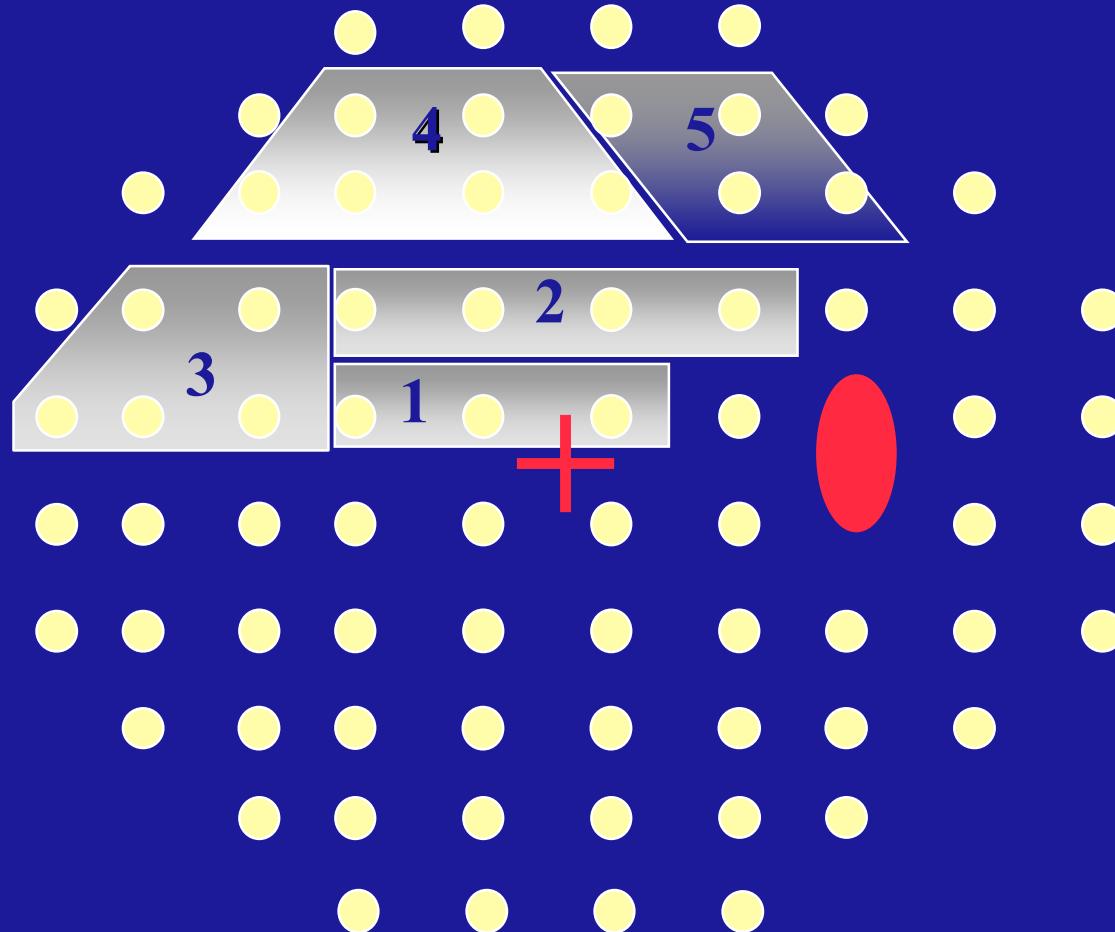
PSD  
Pattern  
deviation plot



Local irregularity  
Confirms scotoma



# Zone 7: Glaucoma Hemifield Test



GHT

Within normal limits

GHT

Outside normal limits

7

GHT

Borderline

GHT

General Reduction of Sensitivity

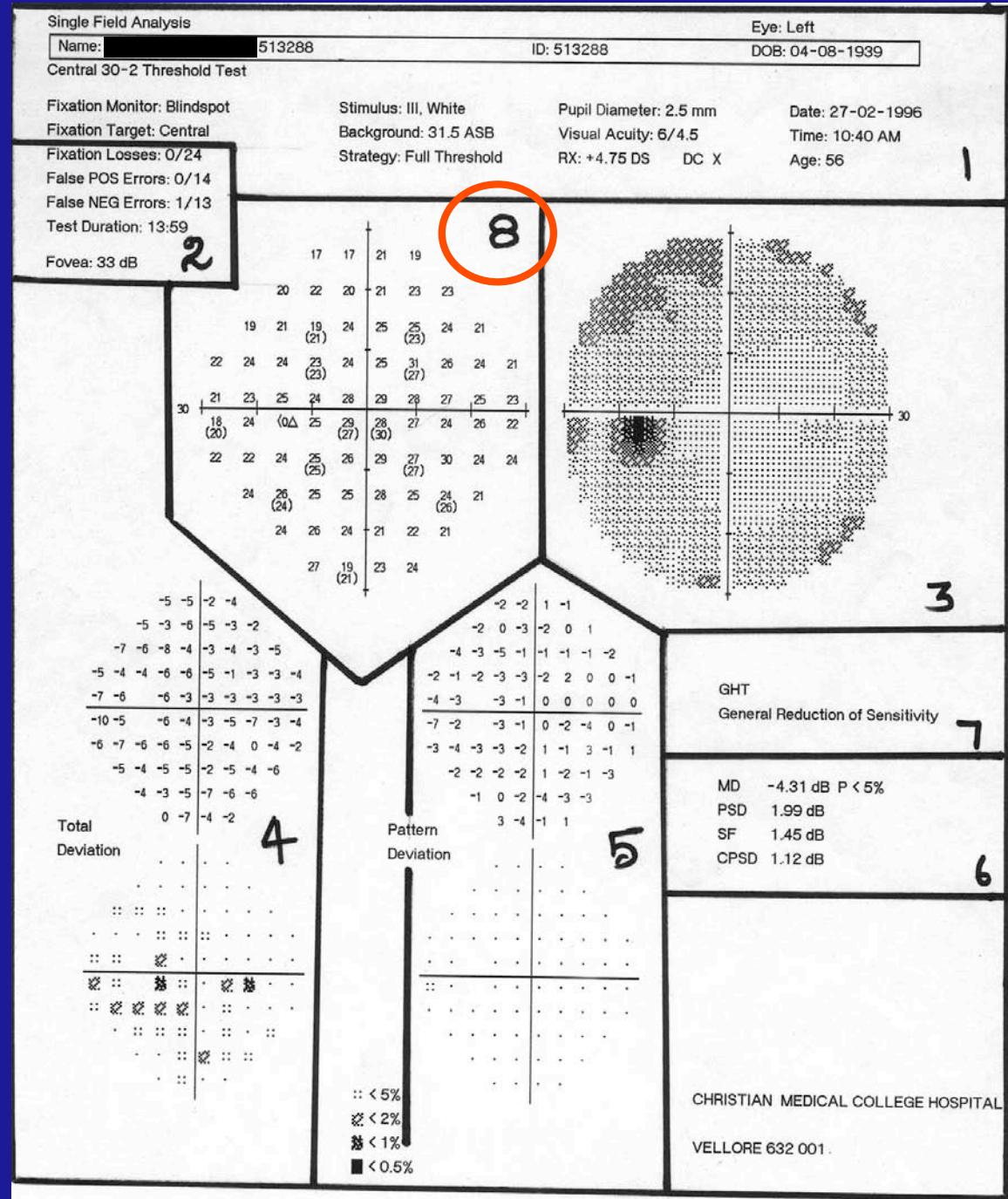
Low Patient Reliability

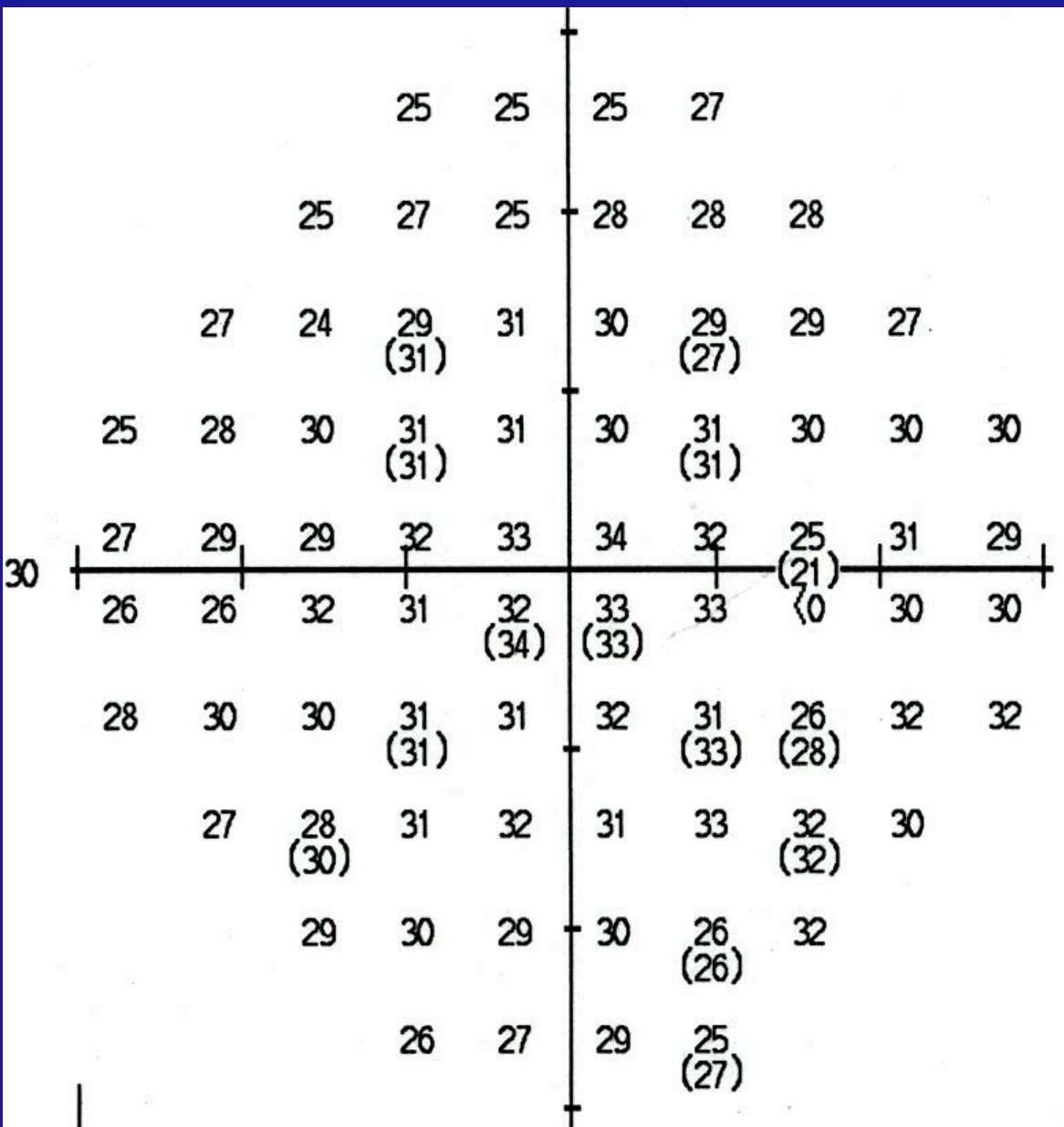
GHT

Abnormally High Sensitivity

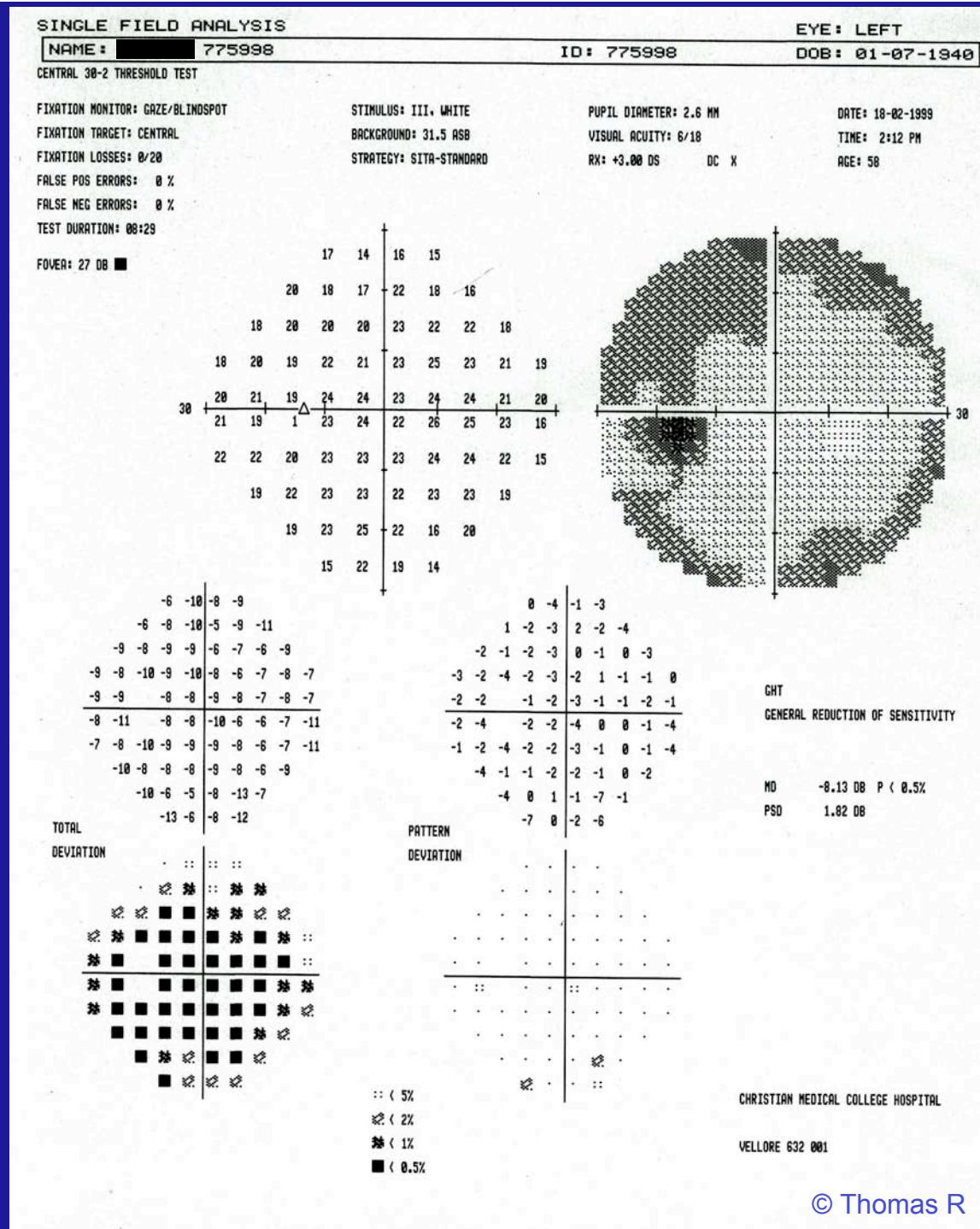
GHT, Glaucoma Hemifield Test.

© Thomas R





- Never rely on the grey scale alone to make a diagnosis
- Never rely on the visual field alone to make a diagnosis
- Always correlate with the clinical findings



# Questions

- ✓ Is there a field defect?
  - Is it due to glaucoma?
  - Is the defect progressing?

# Glaucomatous defects

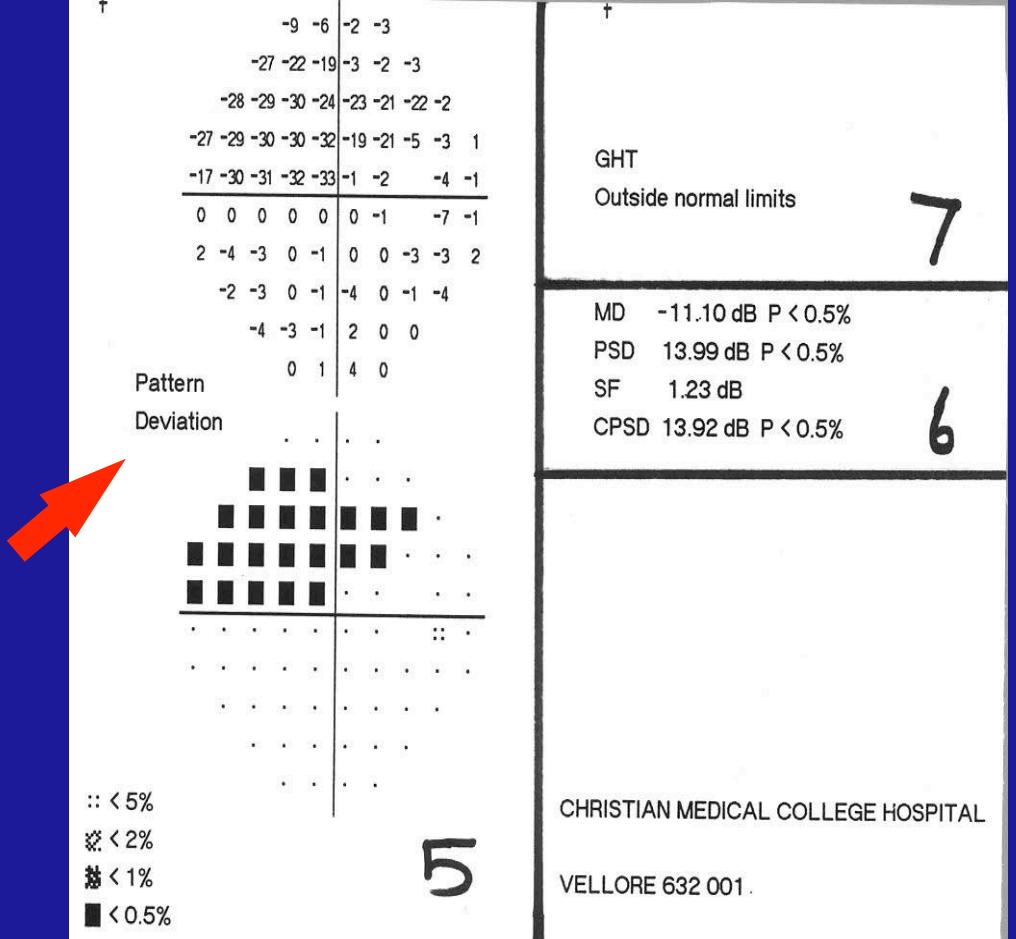
- Characteristics of glaucomatous defects:
  - Asymmetrical across the horizontal midline\*
  - Located in the mid-periphery\*  
(5–25 degrees from fixation)
  - Reproducible
  - Not attributable to other pathology
  - Localised
  - Correlating with the appearance of the optic disc and neighbouring areas

\* Applicable to early/moderate cases.

# Criteria for glaucomatous defects (1)

## Pattern deviation plot

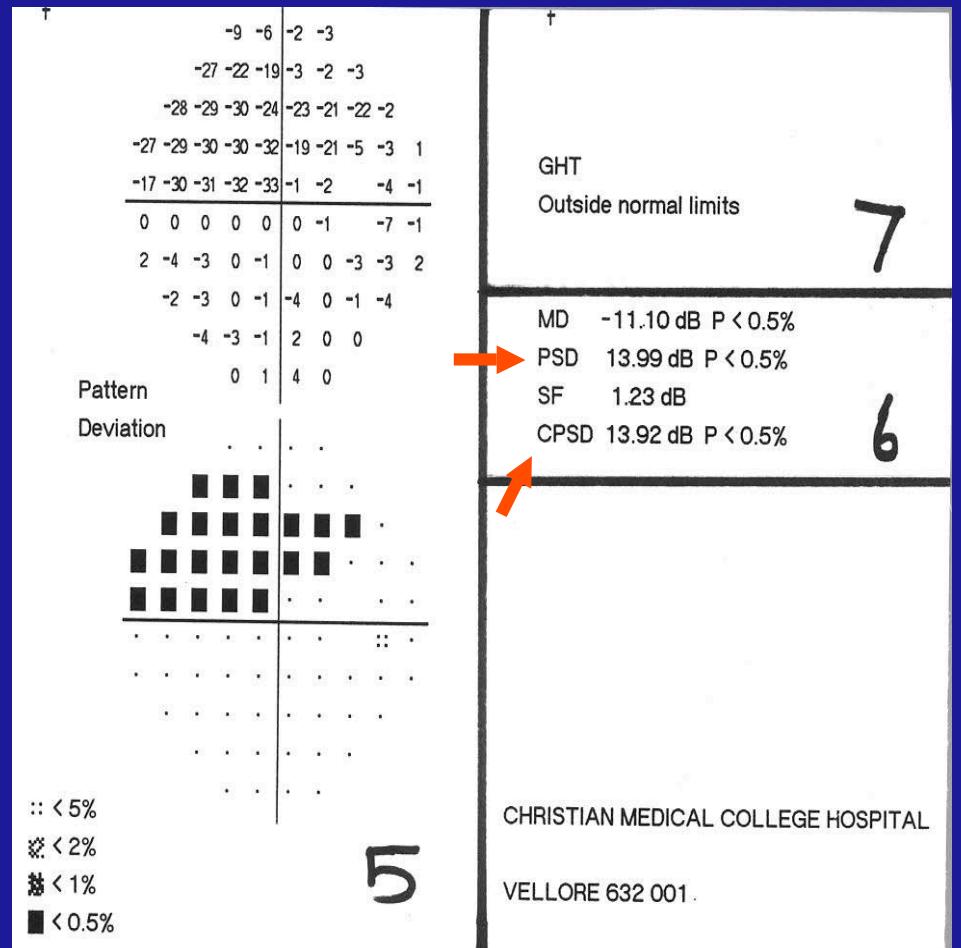
- $\geq 3$  non-edge points with  $p < 5\%$
- One point with  $p < 1\%$
- Cluster in arcuate area



# Criteria for glaucomatous defects (2)

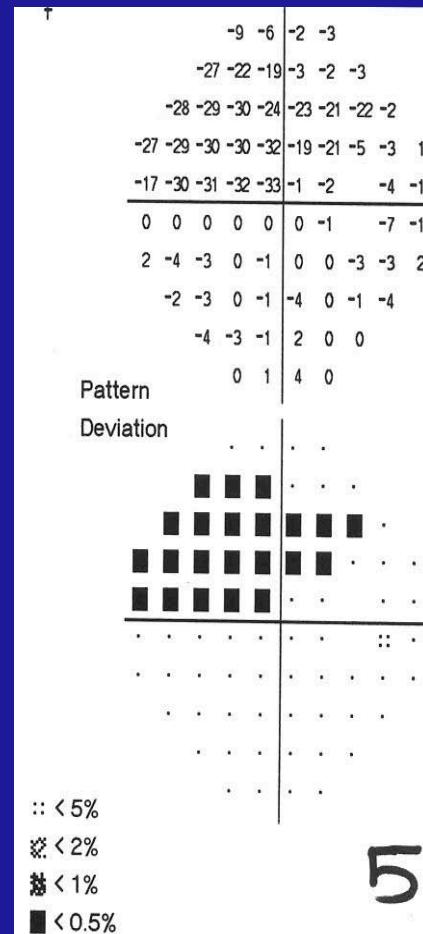


CPSD or PSD  
depressed  
with  $p < 5\%$

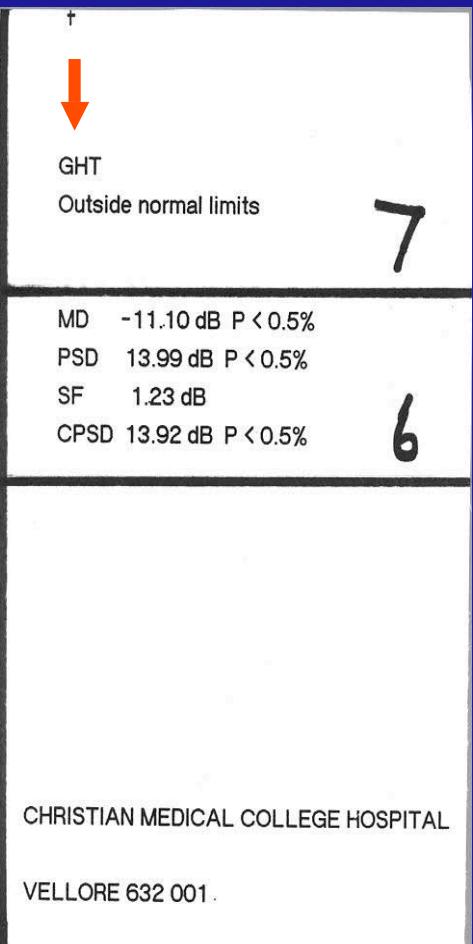


# Criteria for glaucomatous defects (3)

## Abnormal GHT

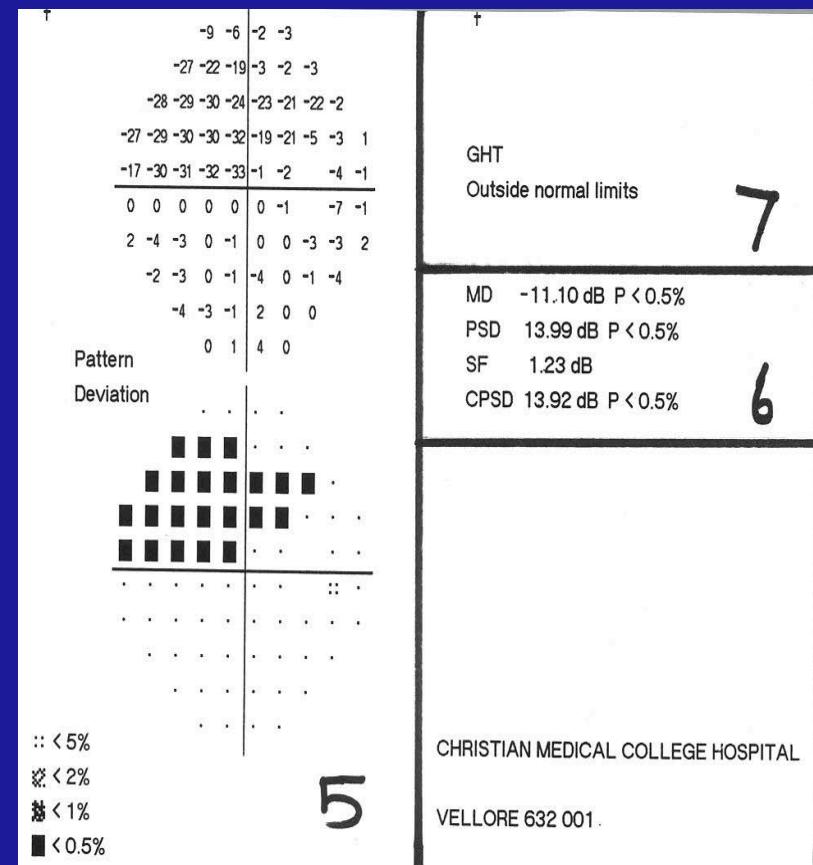


5



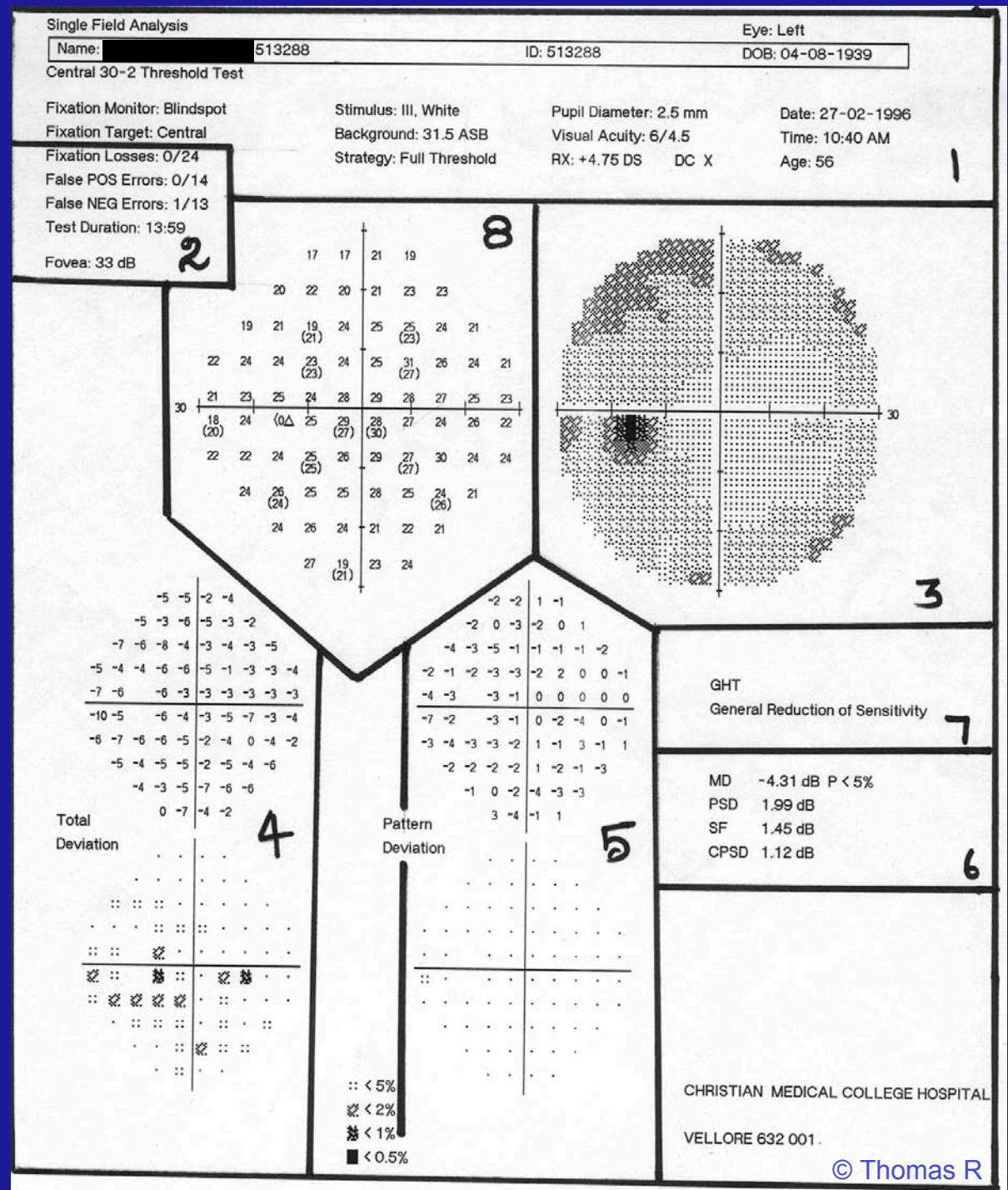
# Three criteria for glaucomatous defects\*

1. Pattern deviation plot
  - $\geq 3$  non-edge points with  $p < 5\%$
  - One point with  $p < 1\%$
  - Cluster in arcuate area
2. CPSD or PSD depressed with  $p < 5\%$
3. Abnormal GHT



\*Anderson DR, Patella VM. *Automated Static Perimetry*. 2<sup>nd</sup> Edn. St Louis: Mosby, 1999.

- Try interpreting this visual field, going from zones 1–8



## Single Field Analysis

Eye: Left

Name: [REDACTED]

ID: 513288

DOB: 04-08-1939

## Central 30-2 Threshold Test

Fixation Monitor: Blindsight

Stimulus: III, White

Pupil Diameter: 2.5 mm

Date: 27-02-1996

Fixation Target: Central

Background: 31.5 ASB

Visual Acuity: 6/4.5

Time: 10:40 AM

Strategy: Full Threshold

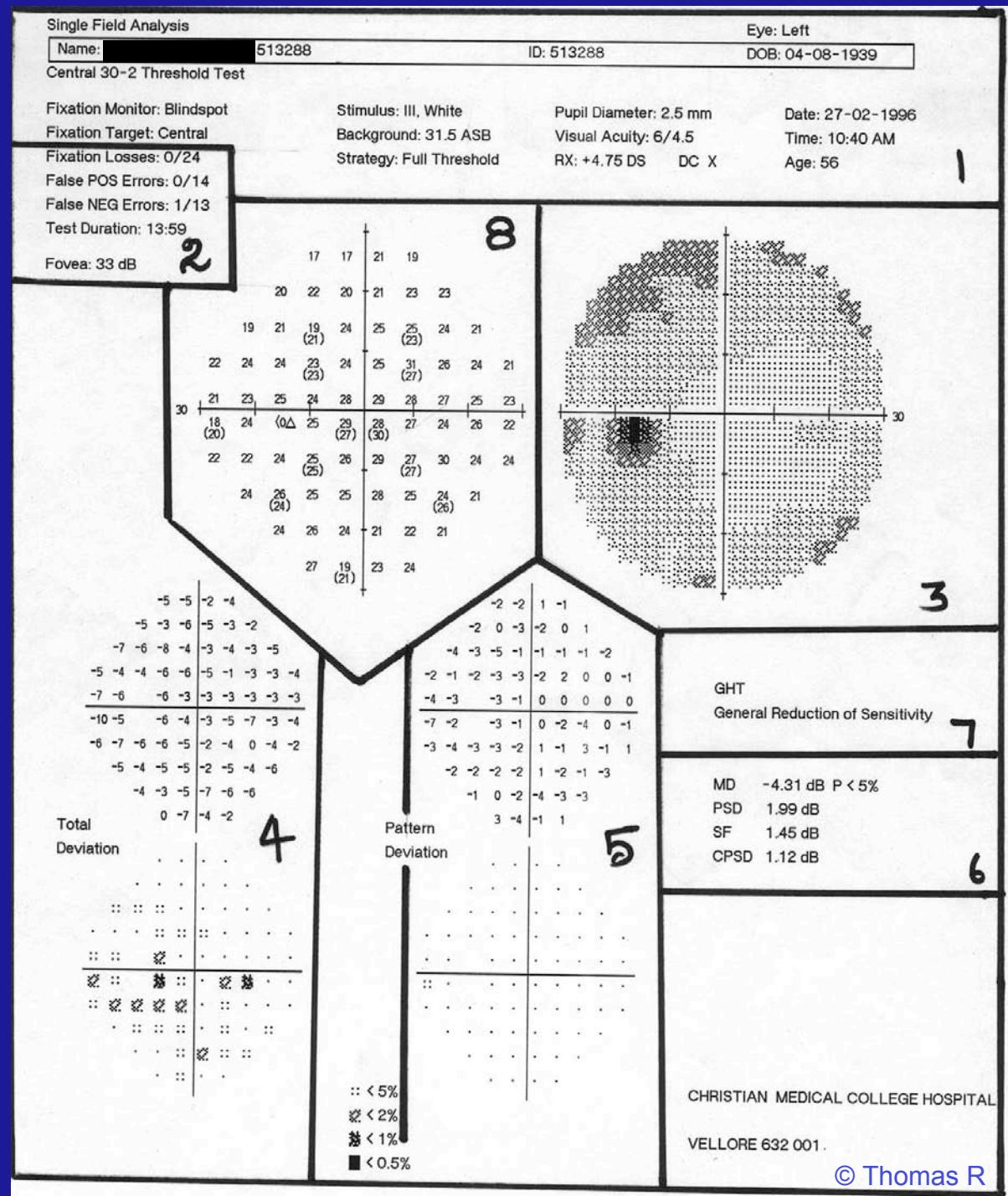
RX: +4.75 DC X

Age: 56

AGE	57	2
FIXATION LOSSES	0/24	
FALSE POS ERRORS	0/14	
FALSE NEG ERRORS	1/13	
QUESTIONS ASKED	449	
FOVER:	33 DB	
TEST TIME	13:59	

Visual acuity should correlate  
with the foveal threshold

- Continue interpreting this visual field: zones 3–8
- Remember: no more than a glance at the grey scale





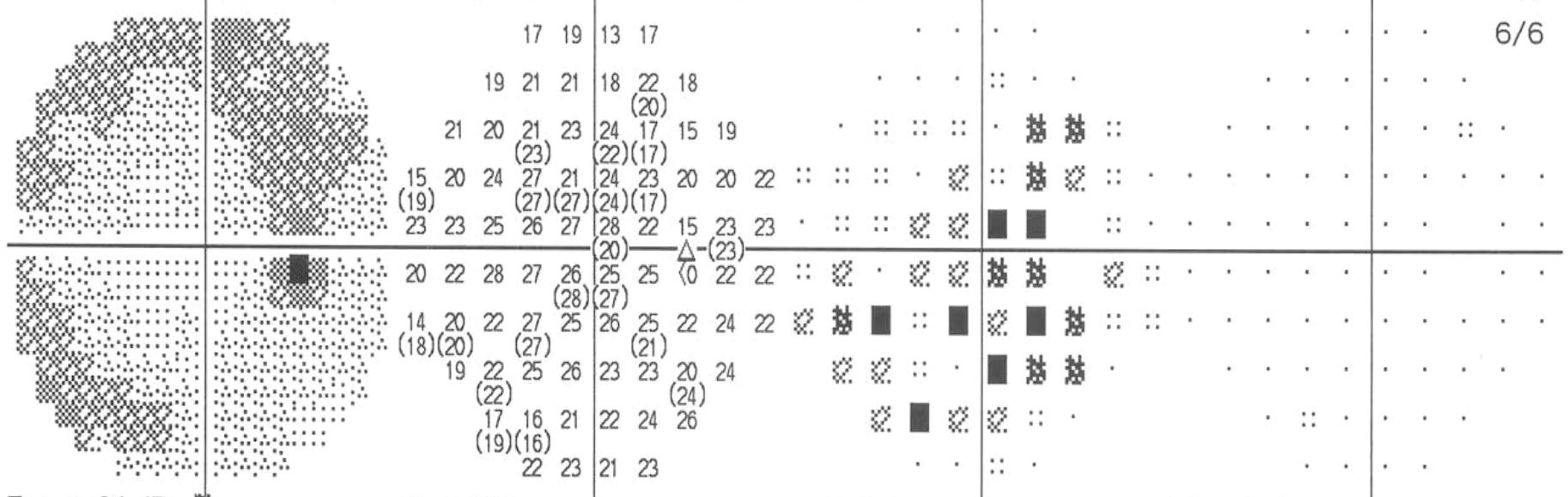
# Revision: typical cataract

05-07-1995 Full Threshold

## GHT: General Reduction of Sensitivity

25 mm

6/6



Fovea: 31 dB

FL: 3/26

FN: 0/15

FP-0/11

MD: -6.25 dB P < 0.5%

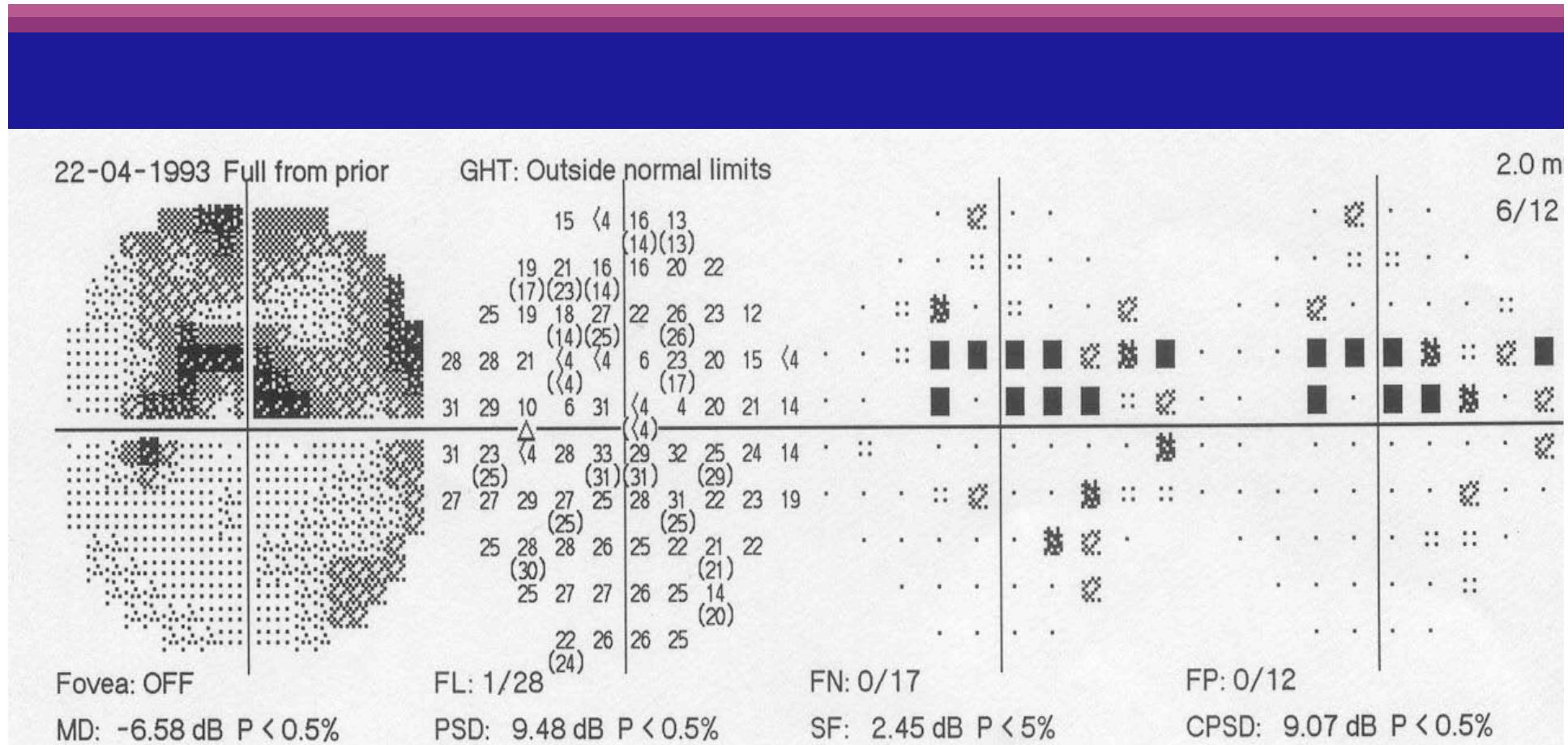
PSD: -213 dB

SF: 205 dB

CPSD: 0.00 dB

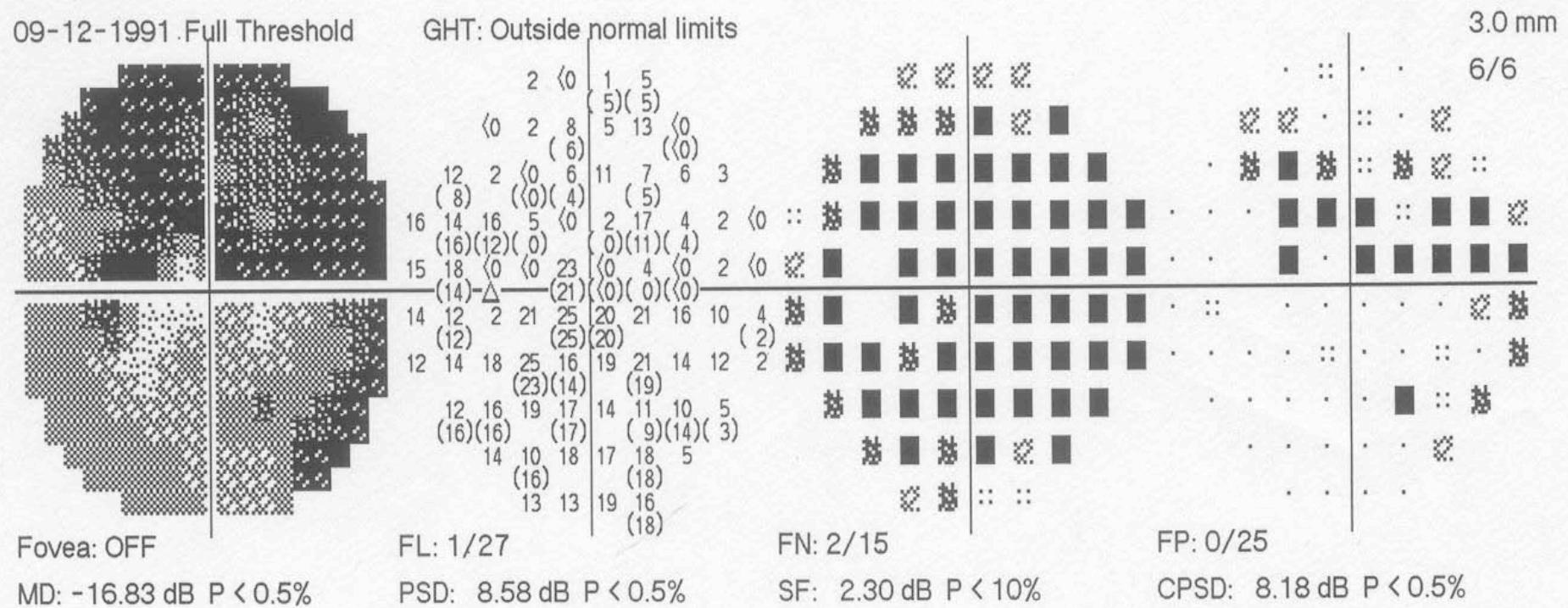


# Revision: typical glaucoma



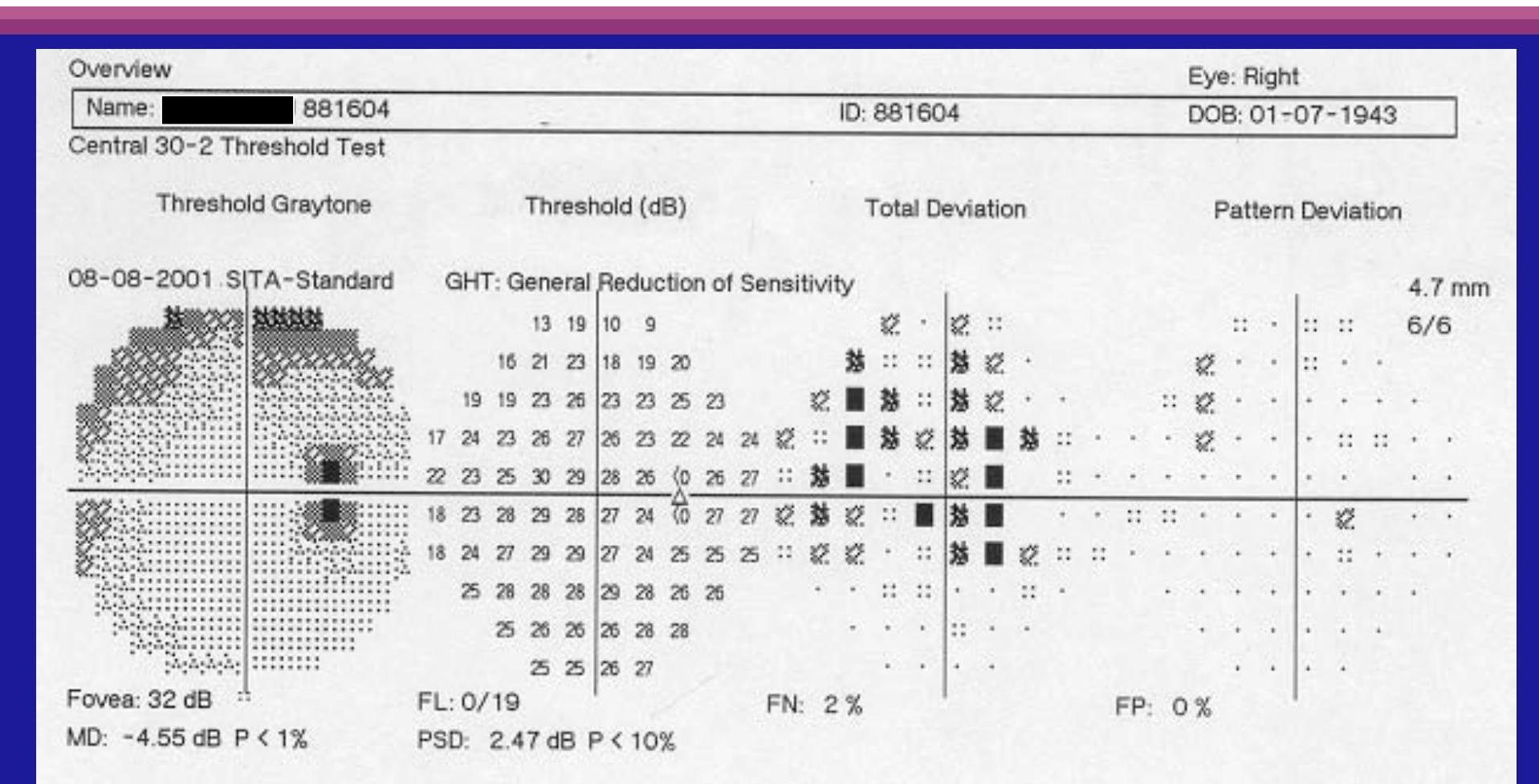


# Revision: glaucoma and cataract





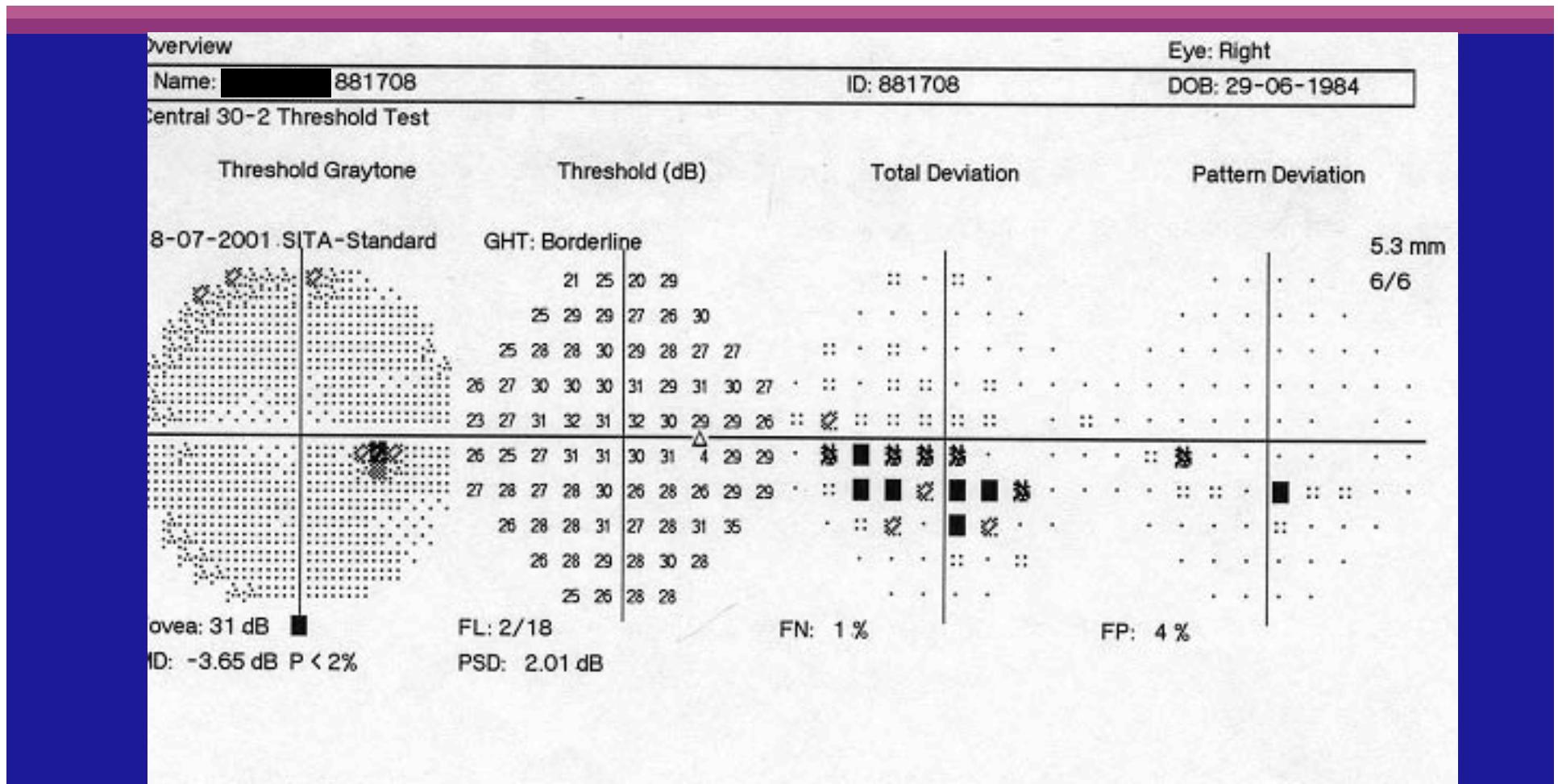
# Does this patient have glaucoma? (1)



Only if the defects are repeatable and correlate with disc and clinical findings

© Thomas R

# Does *this* patient have glaucoma? (2)



Only if the defects are repeatable and correlate with disc and clinical findings

# Questions

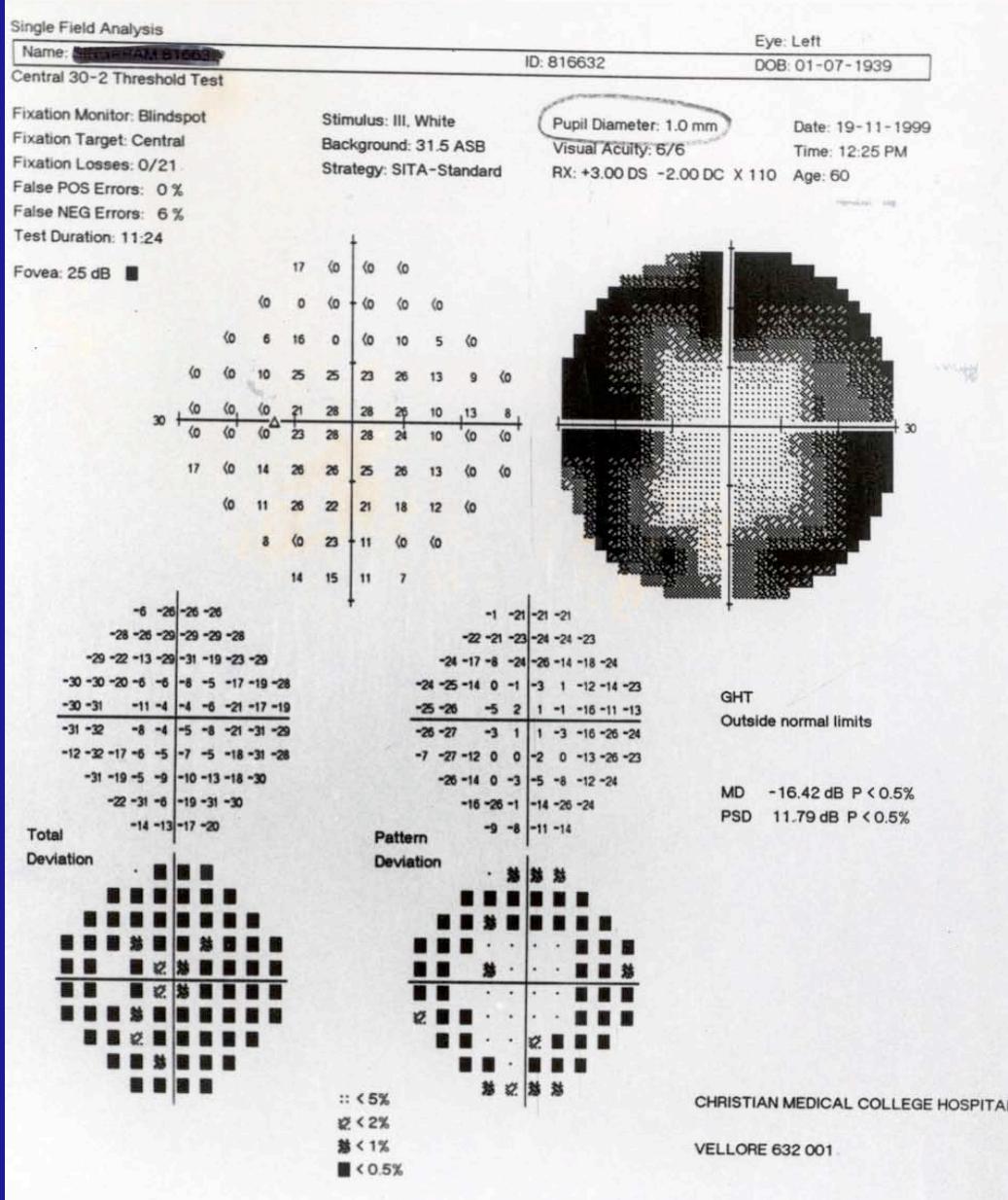
- ✓ Is there a field defect?
- ✓ Is it due to glaucoma?
- Is the defect progressing?

# Principle

- Is there a field defect?
- Is it due to glaucoma?
- Is the defect progressing?
  - Compare to selected baseline
  - Discard learning fields from baseline
  - Recognise ‘false’ progression

# False progression

- Learning curve
- Long-term fluctuation
- Artefacts
- Patient factors
- Pupil size



# Pupil: 1 mm

## Single Field Analysis

Name: SINGHAM 31632

ID: 816632

Eye: Left

DOB: 01-07-1939

## Central 30-2 Threshold Test

Fixation Monitor: Blindsight

Fixation Target: Central

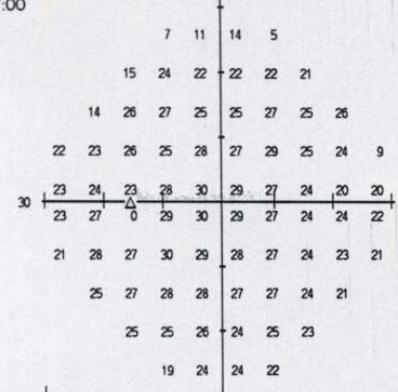
Fixation Losses: 1/19

False POS Errors: 0 %

False NEG Errors: 7 %

Test Duration: 07:00

Fovea: 33 dB



Stimulus: III, White

Background: 31.5 ASB

Strategy: SITA-Standard

Pupil Diameter: 2.5 mm

Visual Acuity: 6/6

Date: 19-11-1999

Time: 5:02 PM

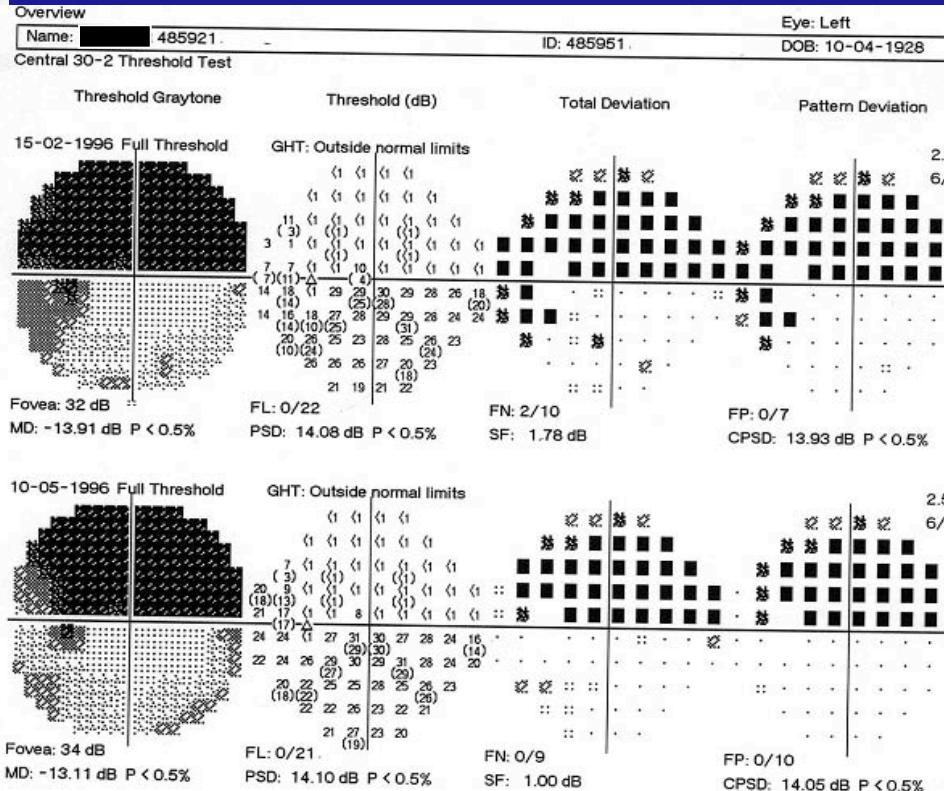
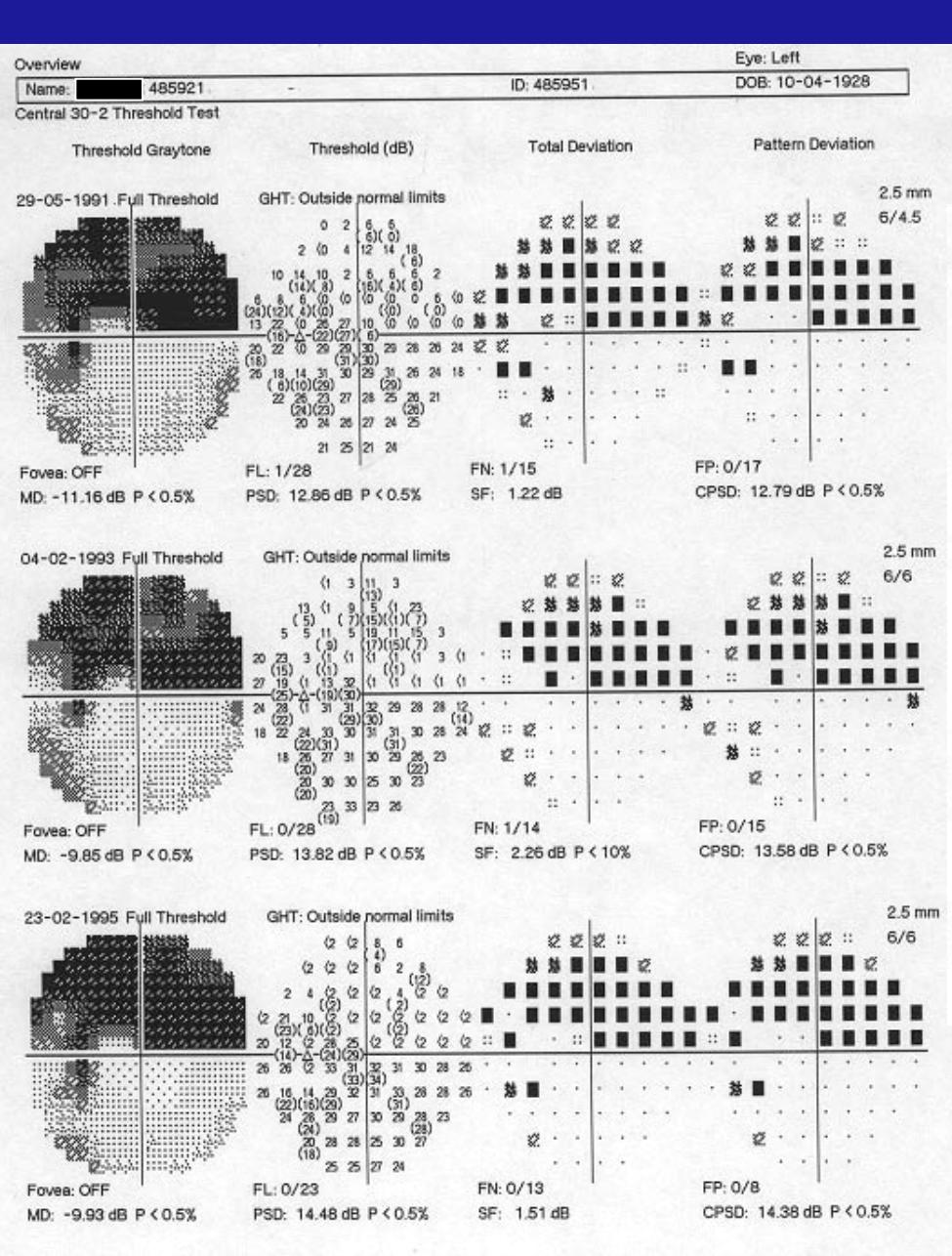
RX: +3.00 DS -2.00 DC X 110 Age: 60

# Detecting change

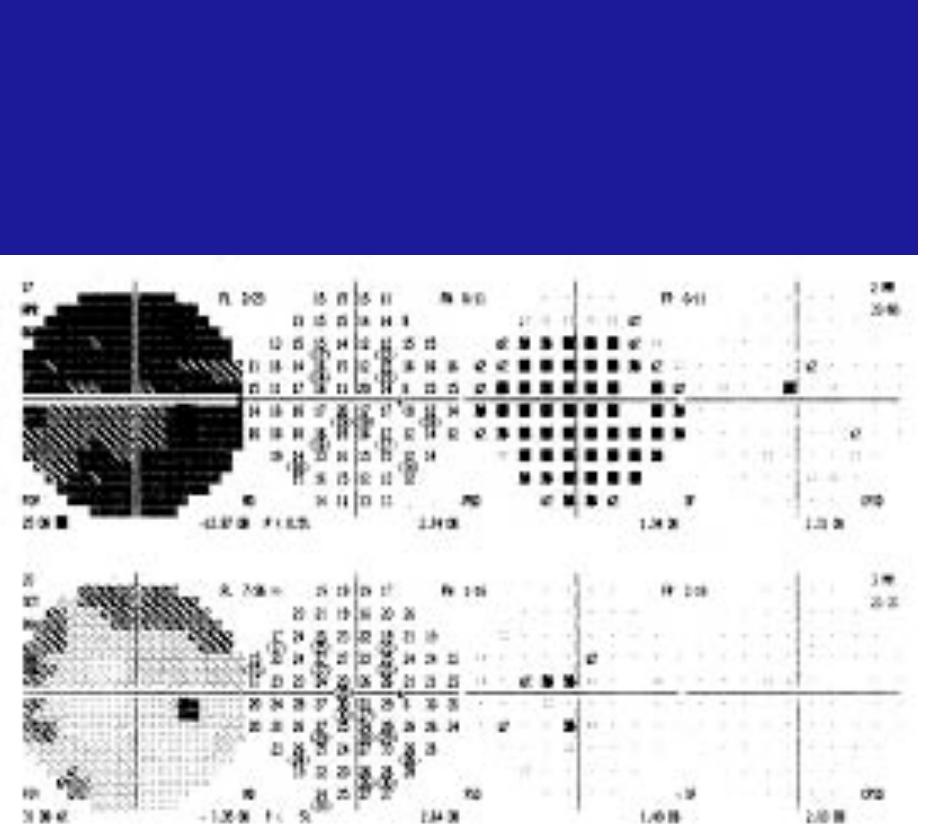
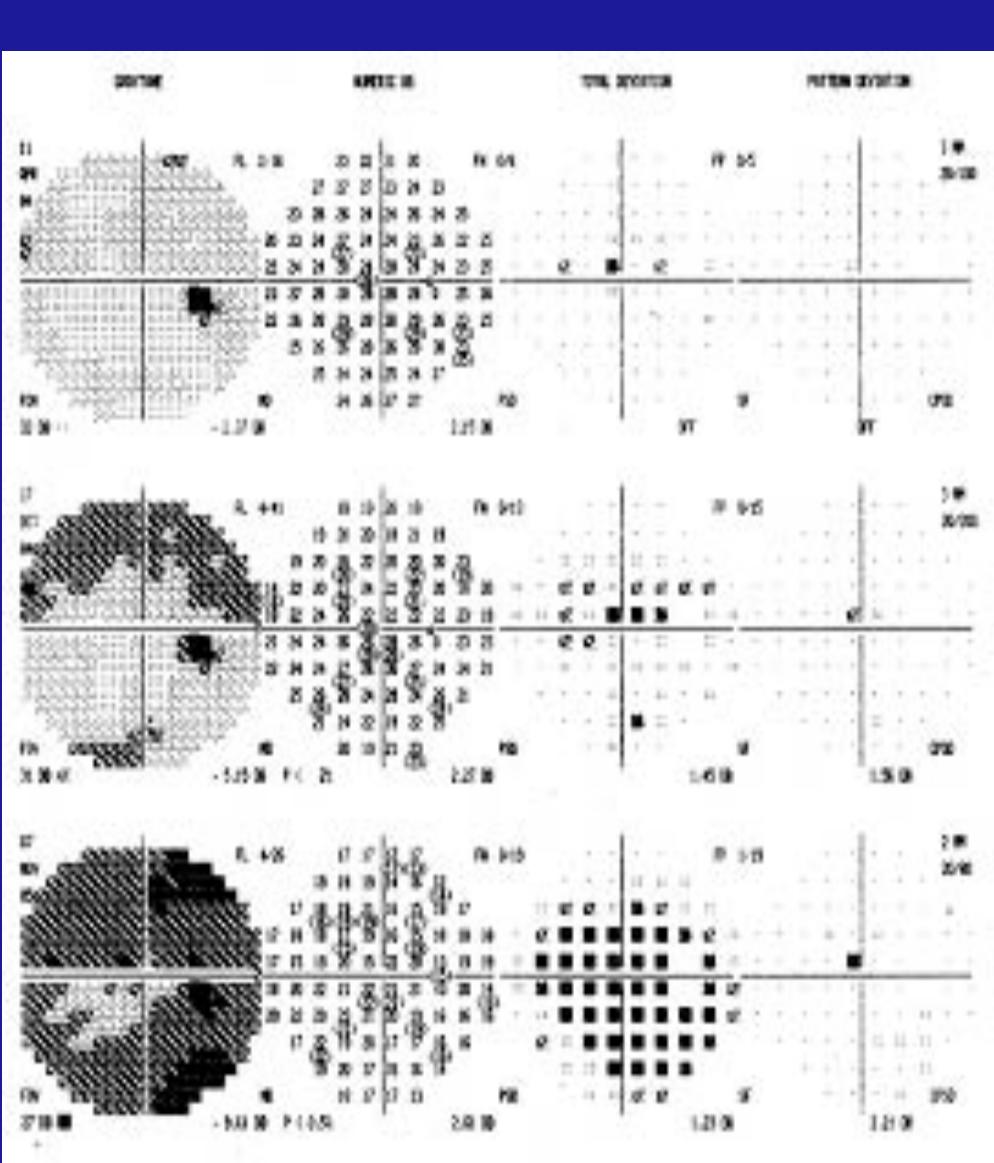
- Change analysis – box plot
  - Overview programme
  - Glaucoma progression analysis™  
(GPA™)
- 
1. Select appropriate baseline
  2. Discard learning fields from baseline

# Overview programme

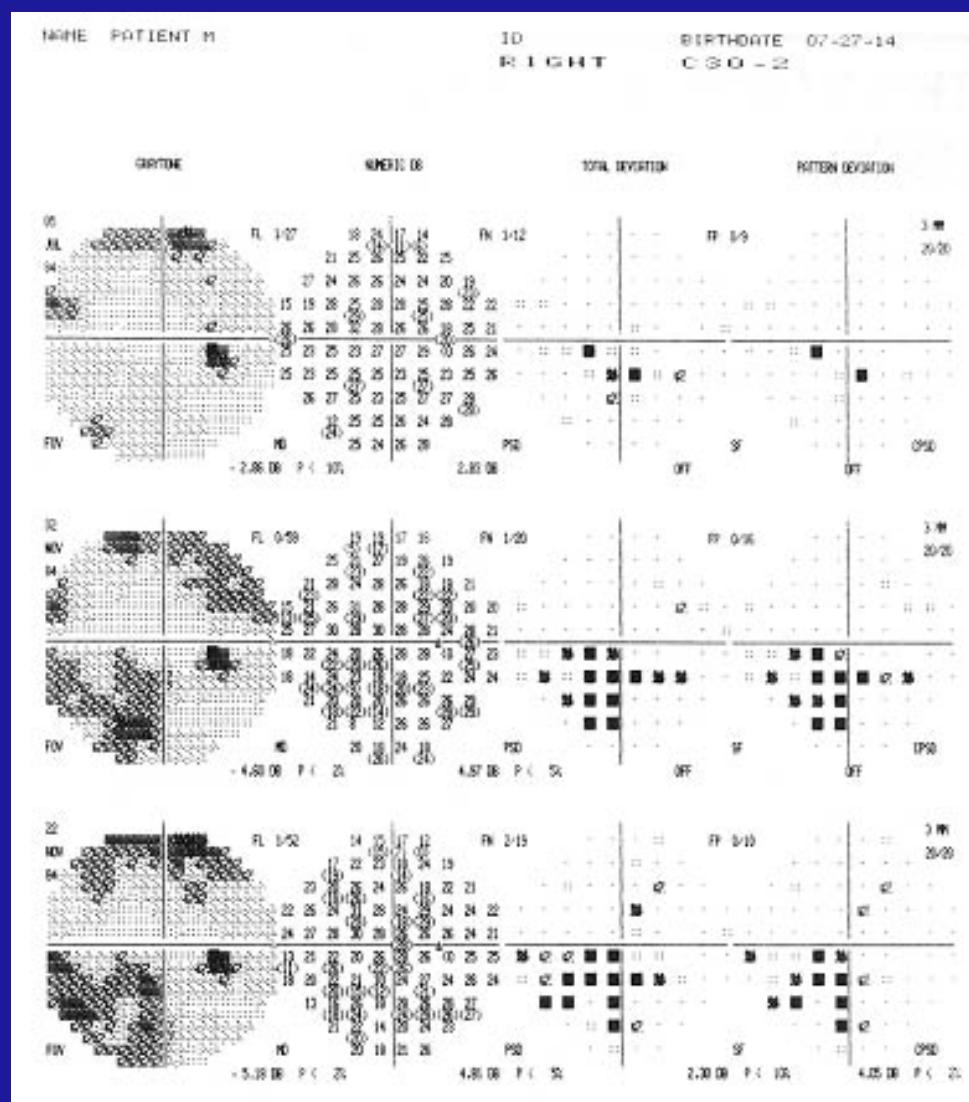
- Sequential series of fields for the same patient over a period of time
- Has all the single field information, including total and pattern deviation plots
- Tells us at a glance what is happening and allows us to deduce WHY it is happening



# Fluctuation over time



Overview: the patient developed a cataract, which was extracted. Note that the pattern deviation plot remains clear.



Overview: glaucoma is progressing. Both the total and pattern deviation plots show worsening.

# Overview programme shows progression

# Full threshold

# SITA standard

SITA, Swedish Interactive Threshold Algorithm.

# Overview programme shows progression

- SITA is different from full threshold
  - Can't compare apples to oranges
  - Fields may fluctuate

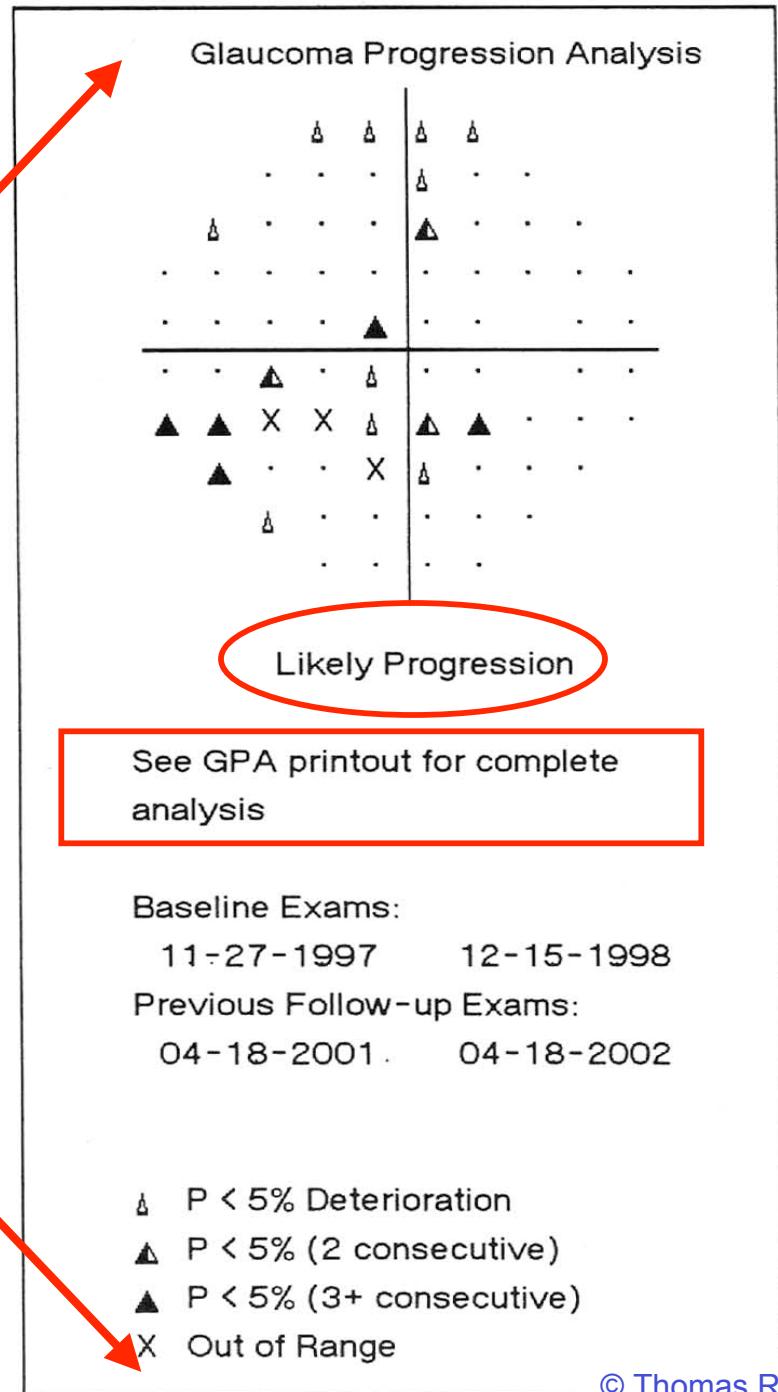
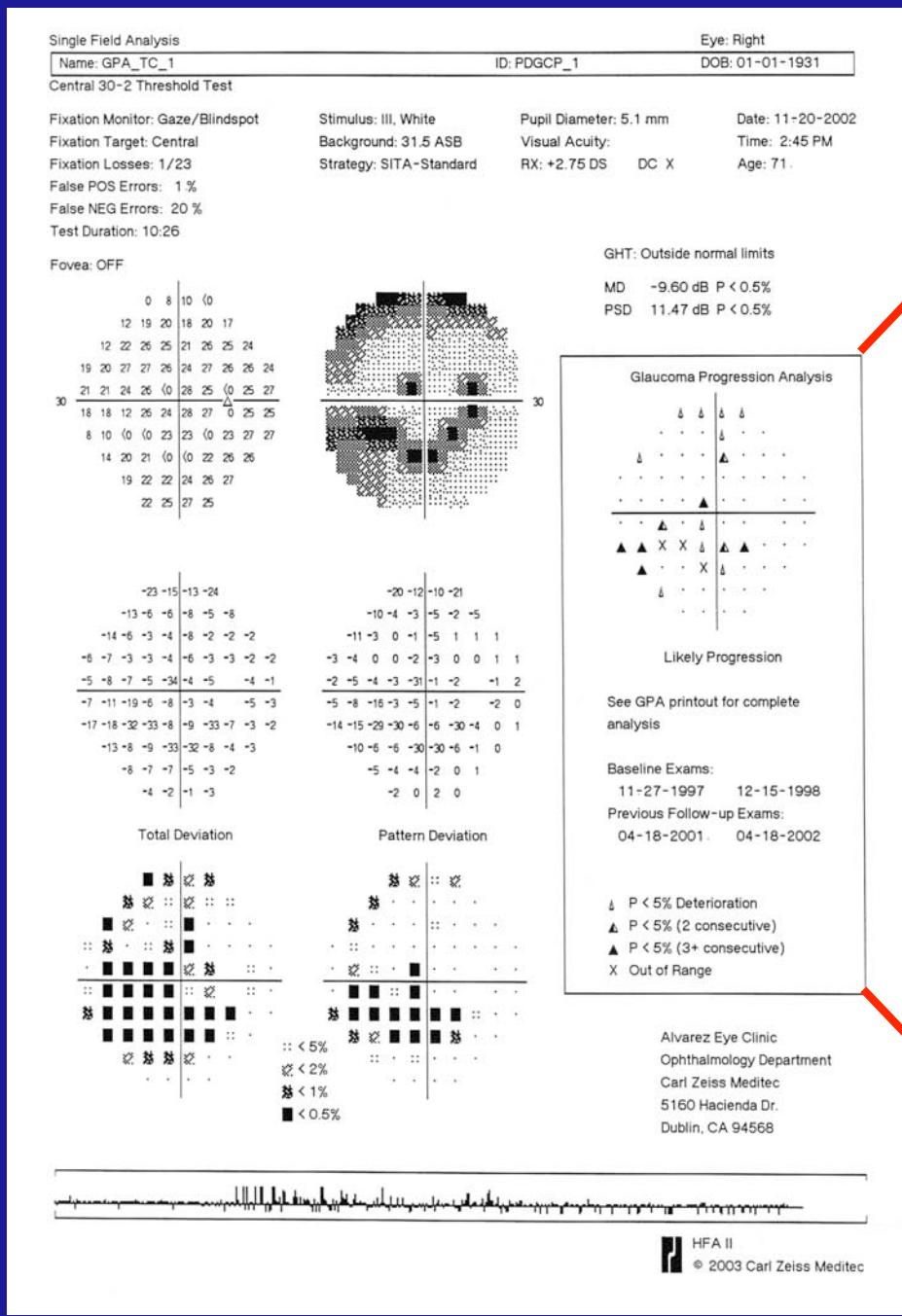
Overview		Eye: Right																																																																												
Name:	778562	ID: 778562	DOB: 13-07-1952																																																																											
Central 30-2 Threshold Test																																																																														
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11-05-1998 Full Threshold	GHT: Outside normal limits		2.4 mm 6/6																																																																											
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Fovea: 37 dB	FL: 1/26	FN: 2/16	FP: 0/17																																																																											
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30-11-1998 SITA-Standard	GHT: Outside normal limits		4.3 mm 6/6																																																																											
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Fovea: 37 dB	FL: 2/20	FN: 8 %	FP: 1 %																																																																											
MD: -3.32 dB P < 2%	PSD: 5.24 dB P < 0.5%																																																																													



# Glaucoma Progression Analysis™\*

- GPA™ is now in clinical use
- Change is based on the pattern deviation plot
- Compatible with both SITA and full threshold (baseline only)

\*Carl Zeiss Meditec.

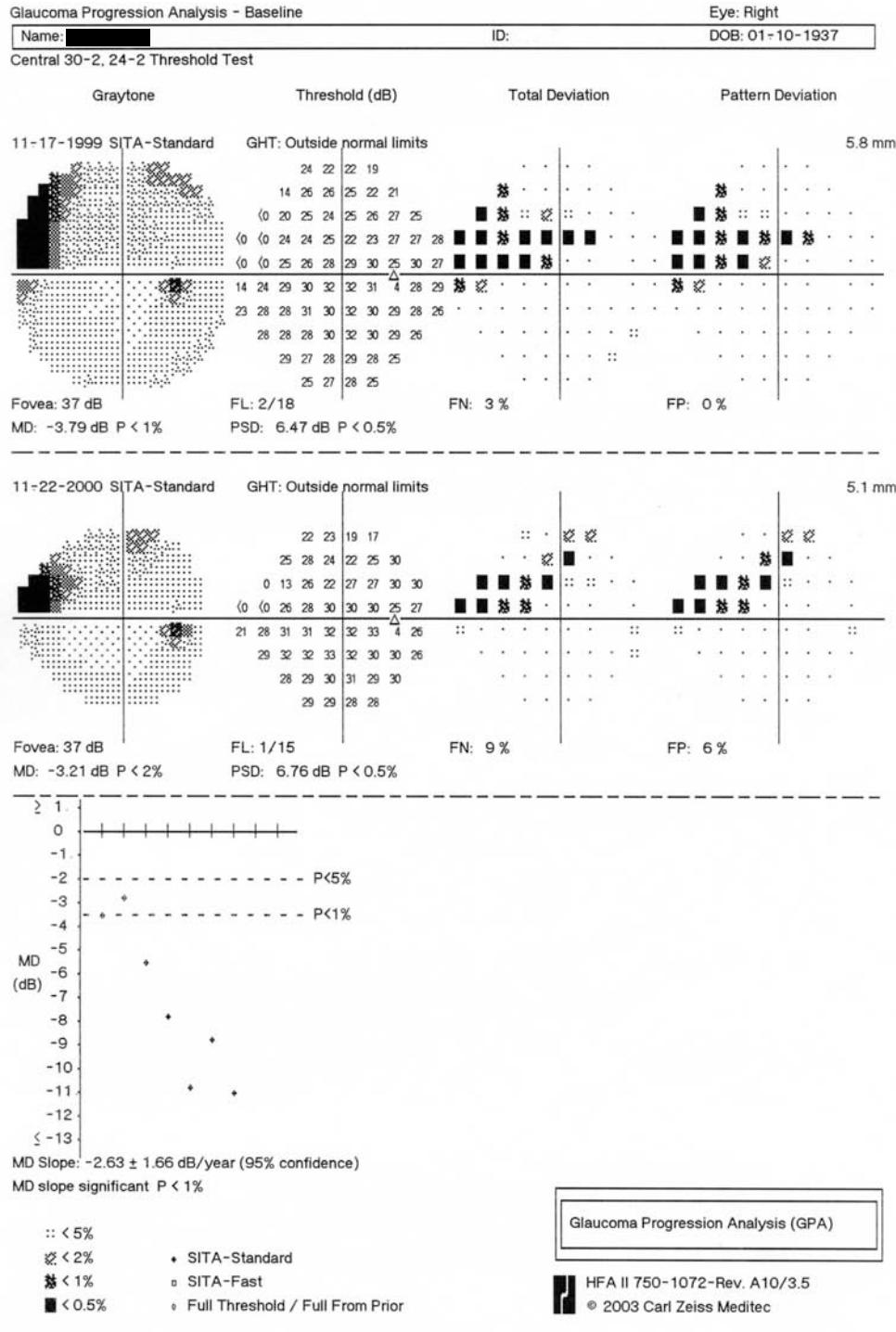


© Thomas R

# GPA™

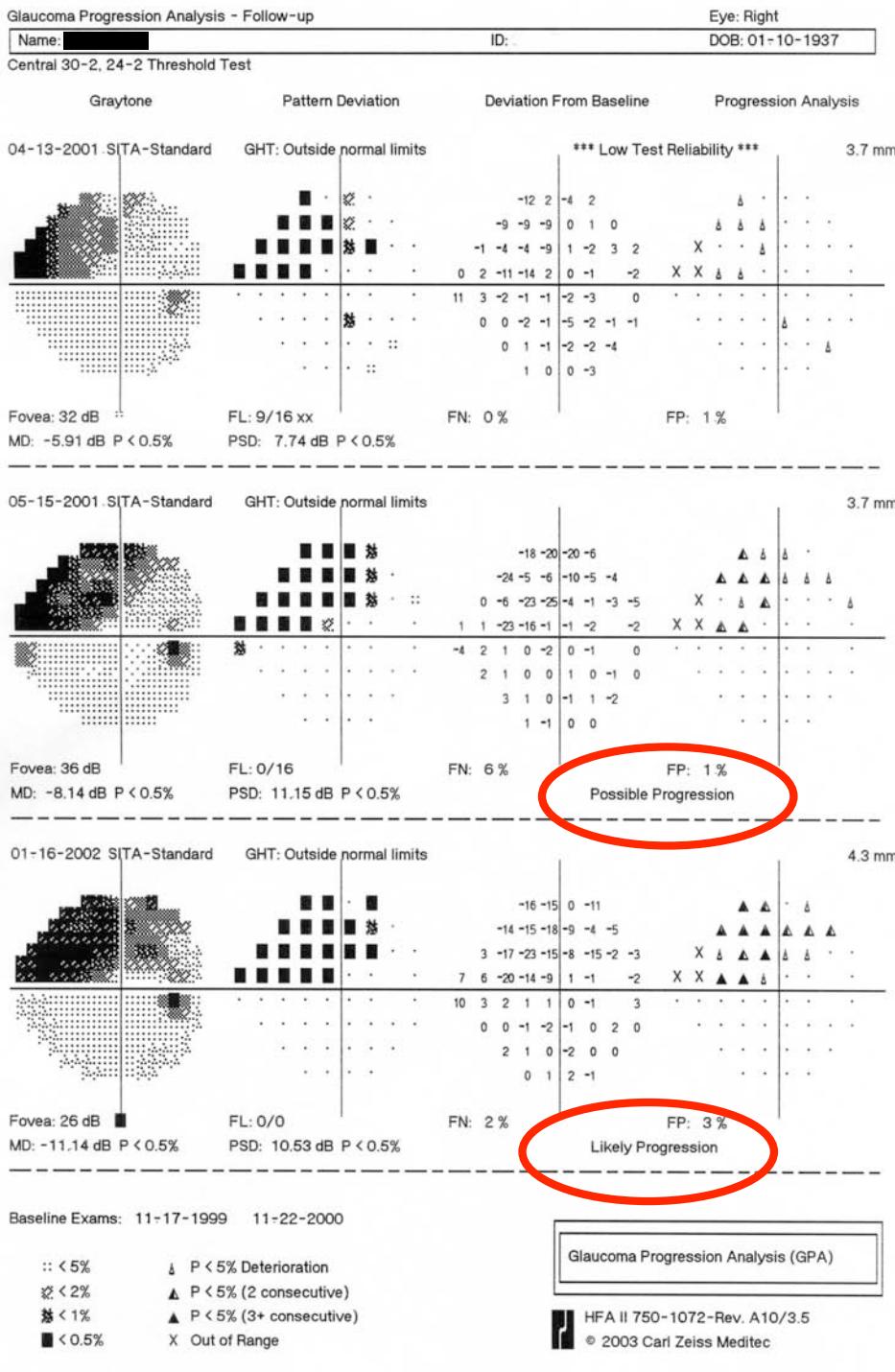
## Right eye: baseline

GPA™, Glaucoma Progression  
Analysis™.



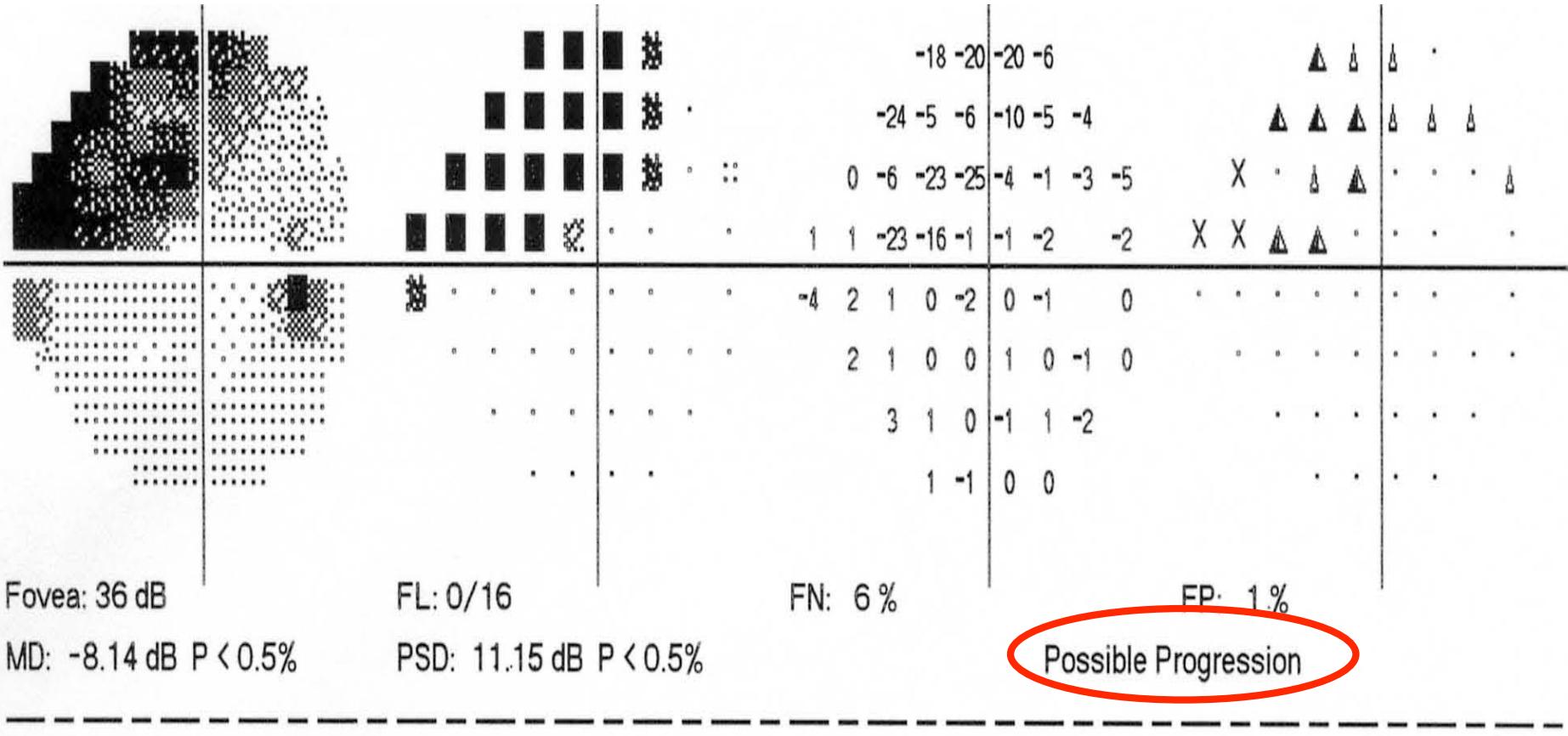
# GPA™

## Right eye: follow-up



GPA™, Glaucoma Progression Analysis™.

© Thomas R



**3 or more points deteriorate in at least 2 consecutive tests**

Baseline Exams: 11-17-1999 11-22-2000

:: < 5%      ▲ P < 5% Deterioration

⊗ < 2%      ▲ P < 5% (2 consecutive)

✖ < 1%      ▲ P < 5% (3+ consecutive)

■ < 0.5%      X Out of Range

Glaucoma Progression Analysis (GPA)

HFA II 750-1072-Rev. A10/3.5

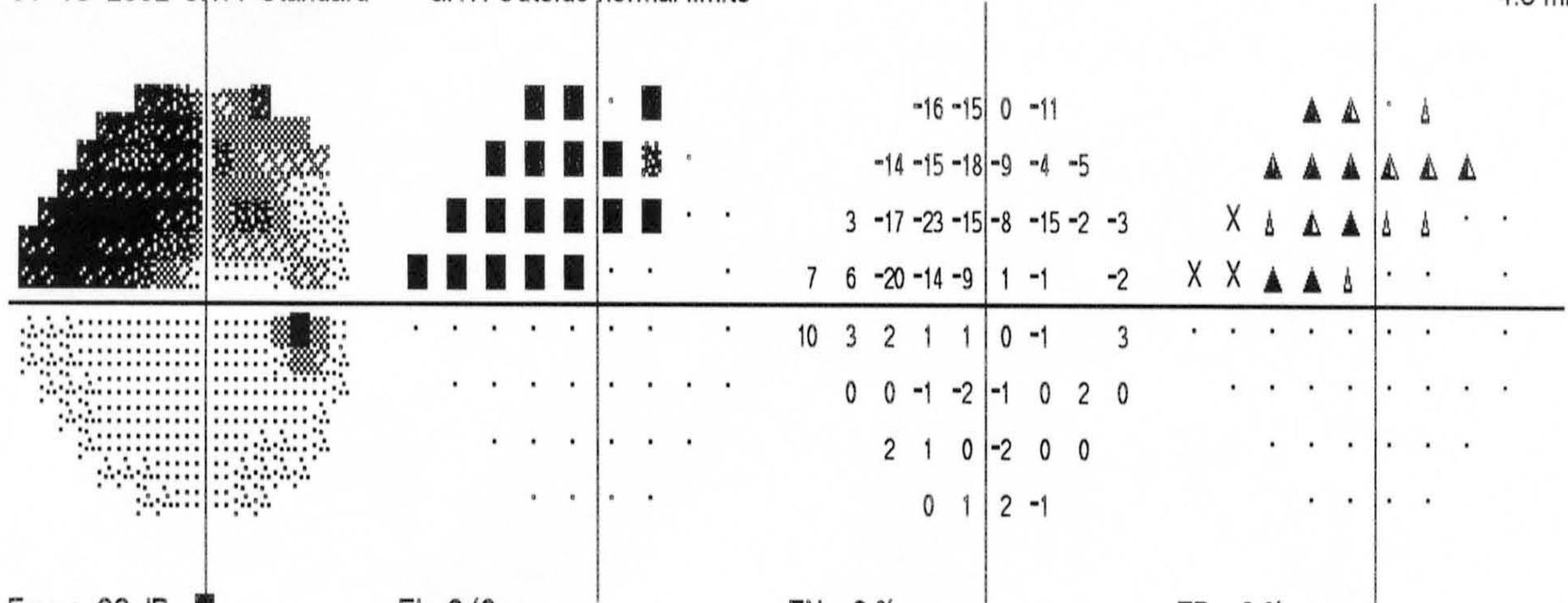
© 2003 Carl Zeiss Meditec

© Thomas R

01-16-2002 SITA-Standard

GHT: Outside normal limits

4.3 mm



Fovea: 26 dB

FL:0/0

FN: 2 %

FP: 3 %

MD: -11.14 dB P < 0.5%

PSD: 10.53 dB P < 0.5%

## Likely Progression

**3 or more points deteriorate in at least 3 consecutive tests**

Baseline Exams: 11-17-1999 11-22-2000

$\therefore < 5\%$

#### A P < 5% Deterioration

$\otimes < 2\%$

▲ P < 5% (2 consecutive)

$\leq 1\%$

▲ P < 5% (3+ consecutive)

■ < 0.5%

X Out of Range

Glaucoma Progression Analysis (GPA)



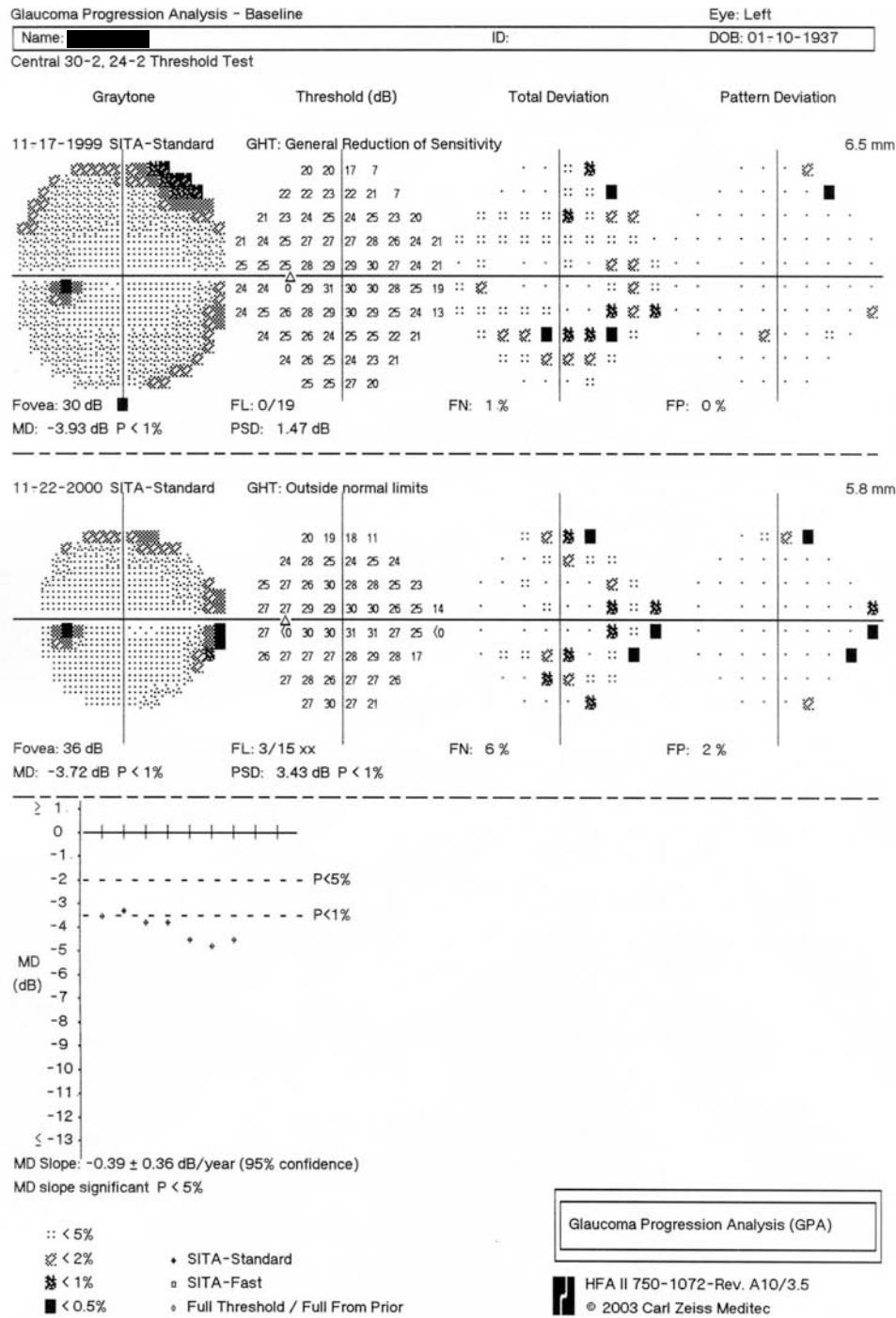
HFA II 750-1072-Rev. A10/3.5

© 2003 Carl Zeiss Meditec

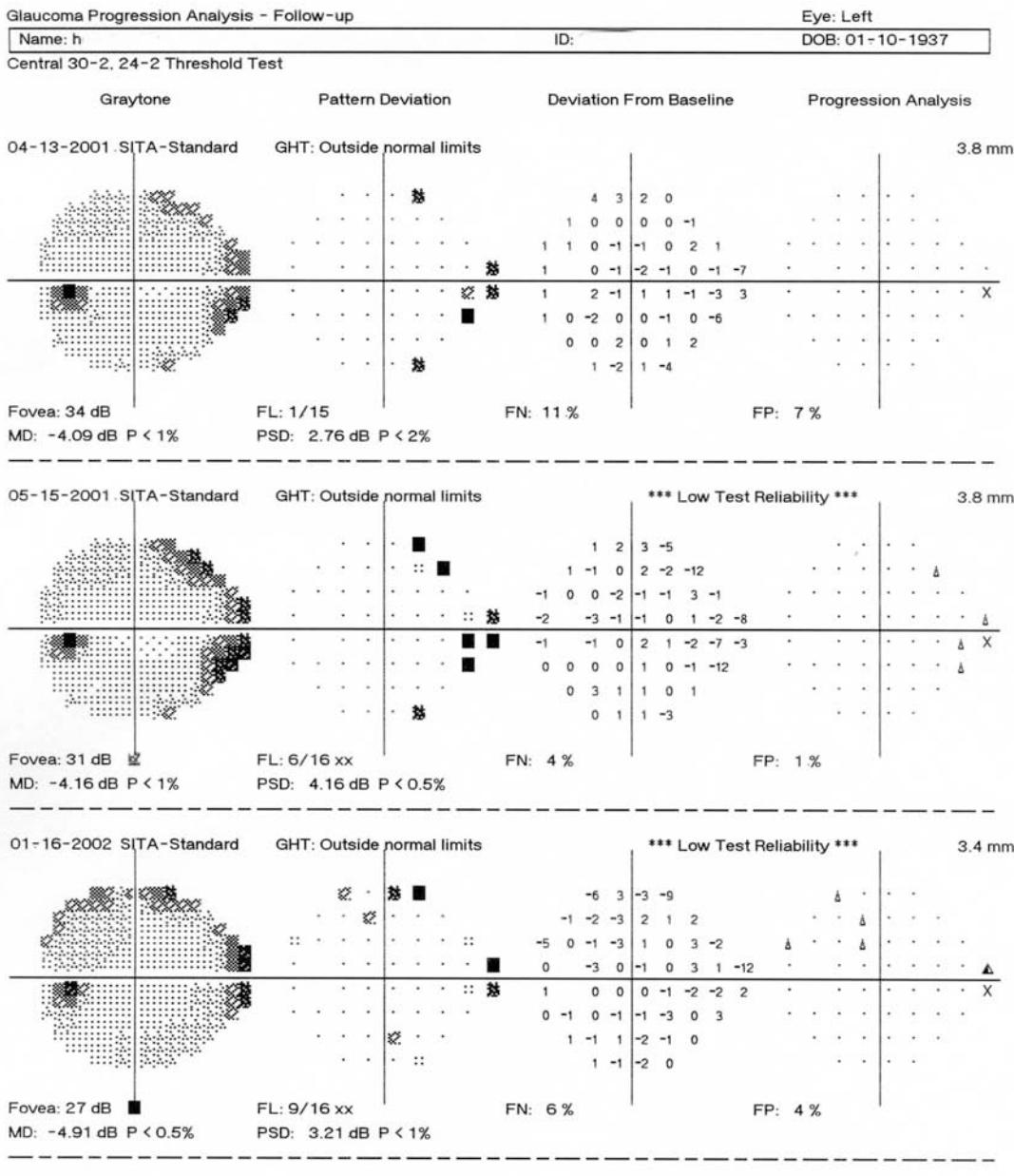
© Thomas B

# GPA™ Left eye: baseline

GPA™, Glaucoma Progression  
Analysis™.



# GPA™ Left eye: follow-up

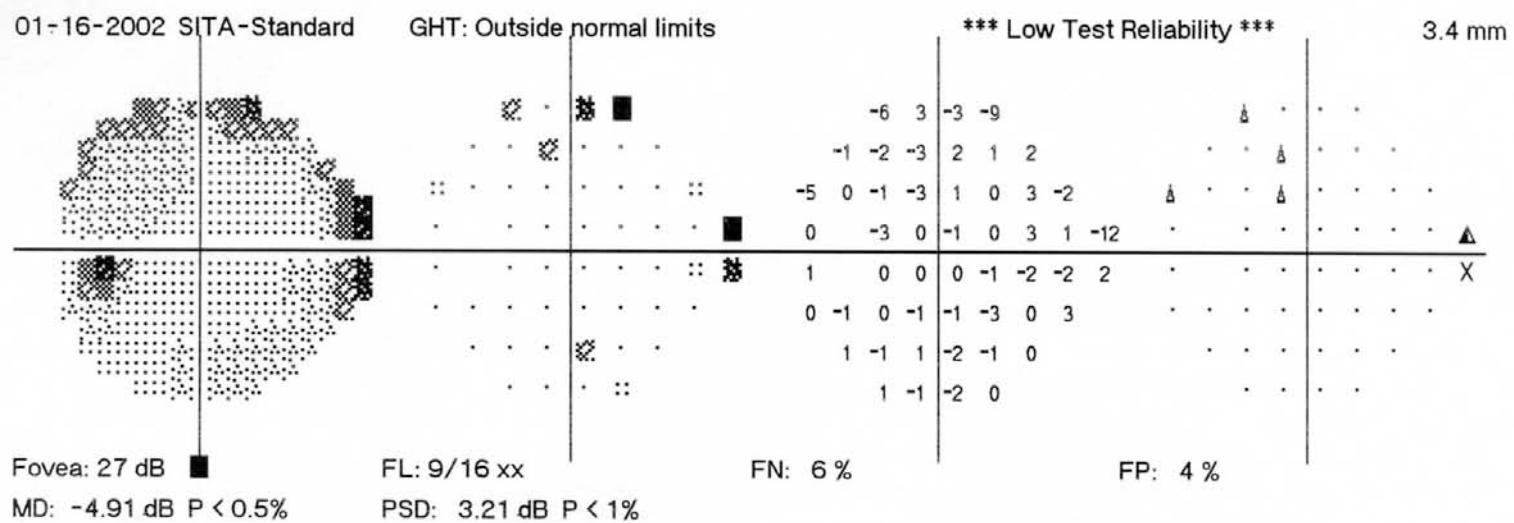
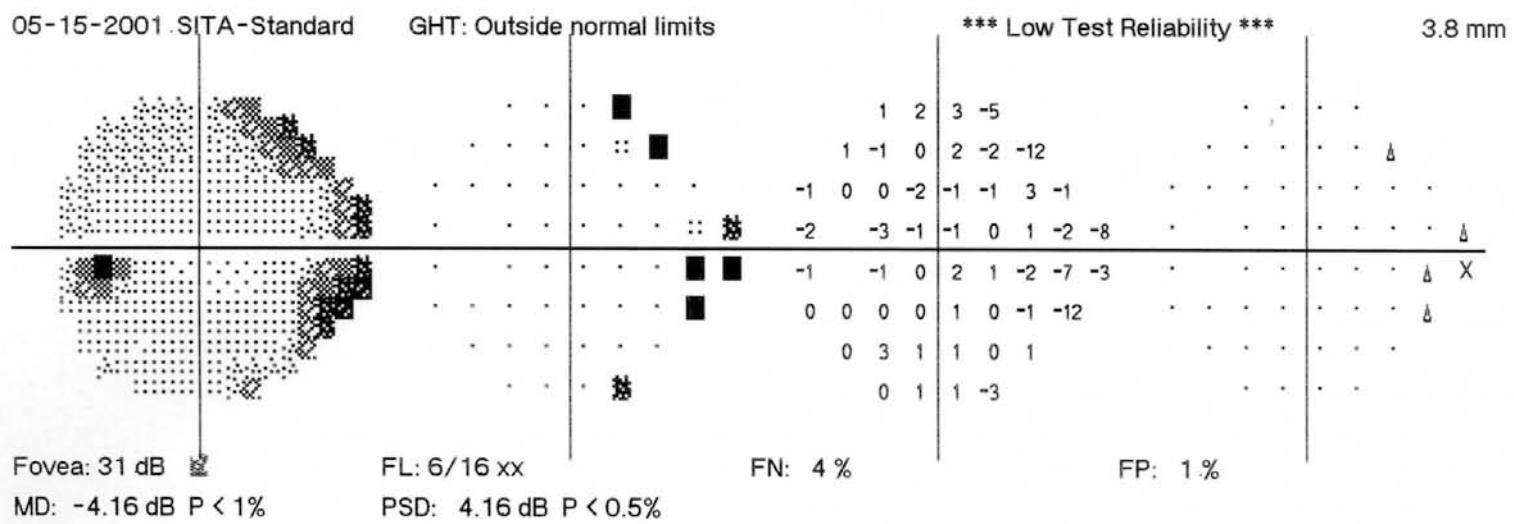


:: < 5%      ▲ P < 5% Deterioration  
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 ☻ < 1%      ▲ P < 5% (3+ consecutive)  
 ■ < 0.5%      X Out of Range

Glaucoma Progression Analysis (GPA)

HFA II 750-1072-Rev. A10/3.5  
 © 2003 Carl Zeiss Meditec

© Thomas R



Baseline Exams: 11-17-1999    11-22-2000

- :: < 5%      ▲ P < 5% Deterioration
- ⊗ < 2%      ▲ P < 5% (2 consecutive)
- ✖ < 1%      ▲ P < 5% (3+ consecutive)
- < 0.5%      X Out of Range

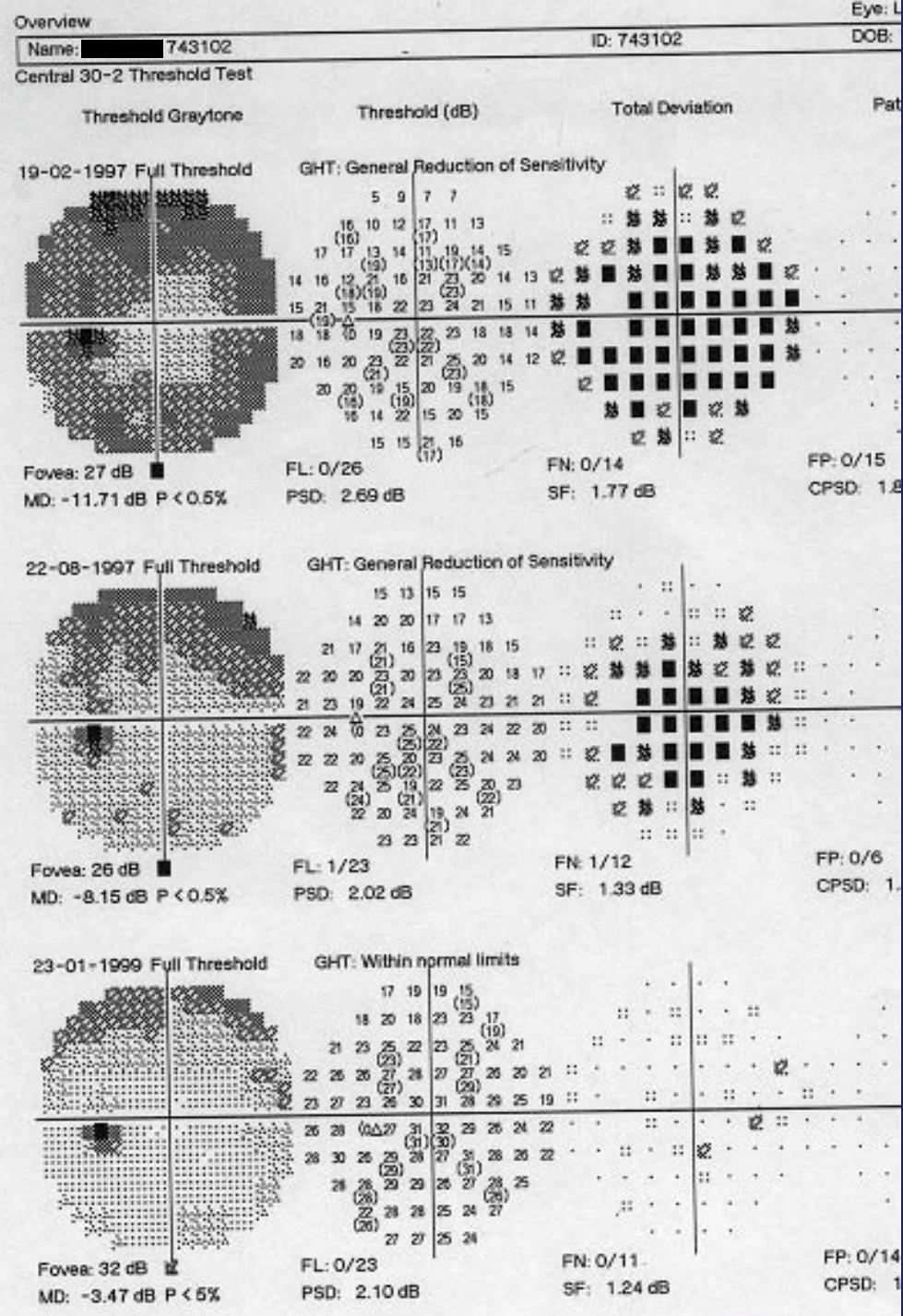
Glaucoma Progression Analysis (GPA)

HFA II 750-1072-Rev. A10/3.5  
© 2003 Carl Zeiss Meditec

© Thomas R

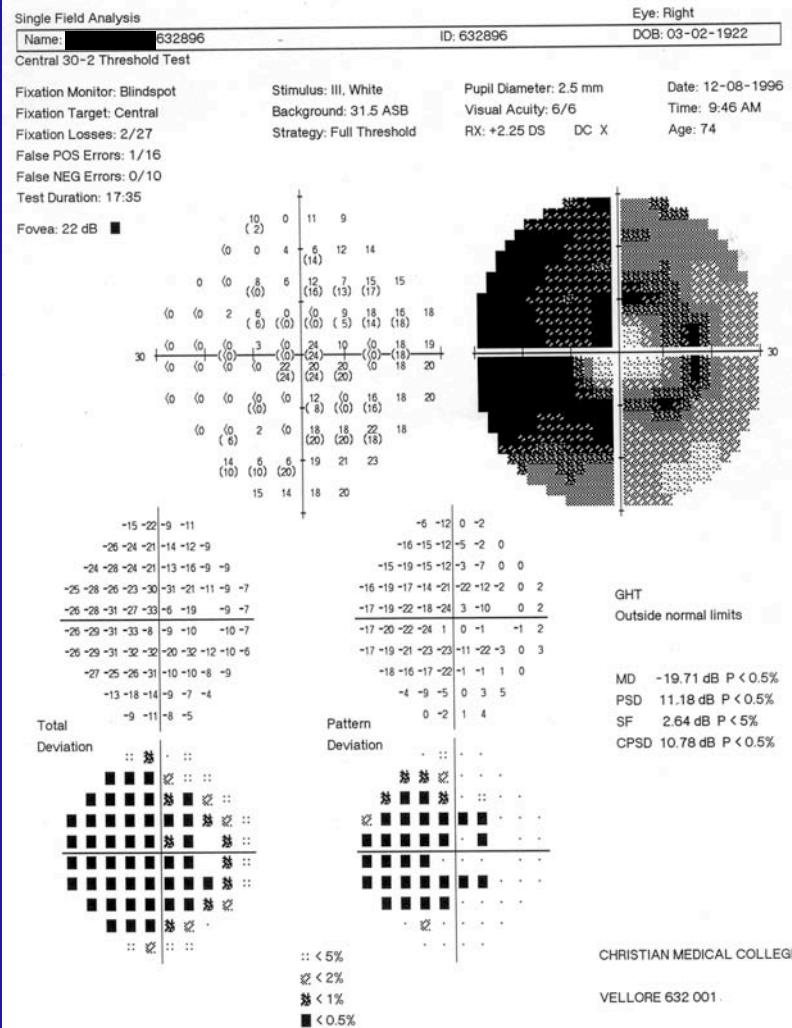
# Diagnosis of visual field progression

- Different for research purposes
  - Set criteria in isolation
- Clinical follow-up scenario
  - Other criteria (IOP, disc changes) to consider
  - A corresponding repeatable change is sufficient
  - If in doubt, REPEAT
- Baseline fields are not constant
  - Select accordingly



Don't forget to discard  
'learning' fields from  
baseline

# Follow-up of advanced field defects



## Single Field Analysis

Name: [REDACTED] 771928

ID: 771928

Eye: Right

DOB: 01-11-1939

## Central 30-2 Threshold Test

Fixation Monitor: Blindsight

Fixation Target: Central

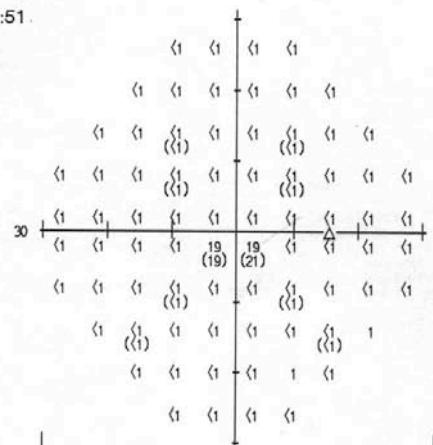
Fixation Losses: 0/13

False POS Errors: 0/4

False NEG Errors: 0/0

Test Duration: 05:51.

Fovea: 24 dB ■



Stimulus: III, White

Background: 31.5 ASB

Strategy: Full Threshold

Pupil Diameter: 2.5 mm

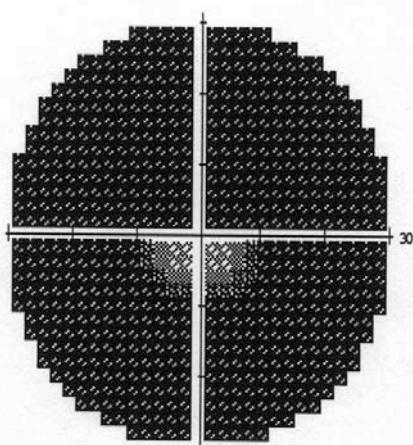
Visual Acuity: 6/6

RX: +5.75 DS DC X

Date: 19-02-1998

Time: 8:30 AM

Age: 58



GHT

General Reduction of Sensitivity

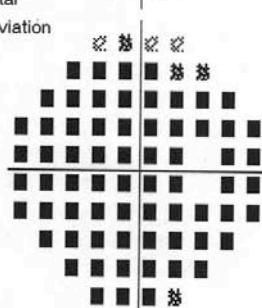
MD -28.83 dB P &lt; 0.5%

PSD 5.14 dB P &lt; 2%

SF 1.00 dB

CPSD 5.01 dB P &lt; 2%

Total Deviation



:: &lt; 5%

◎ &lt; 2%

✖ &lt; 1%

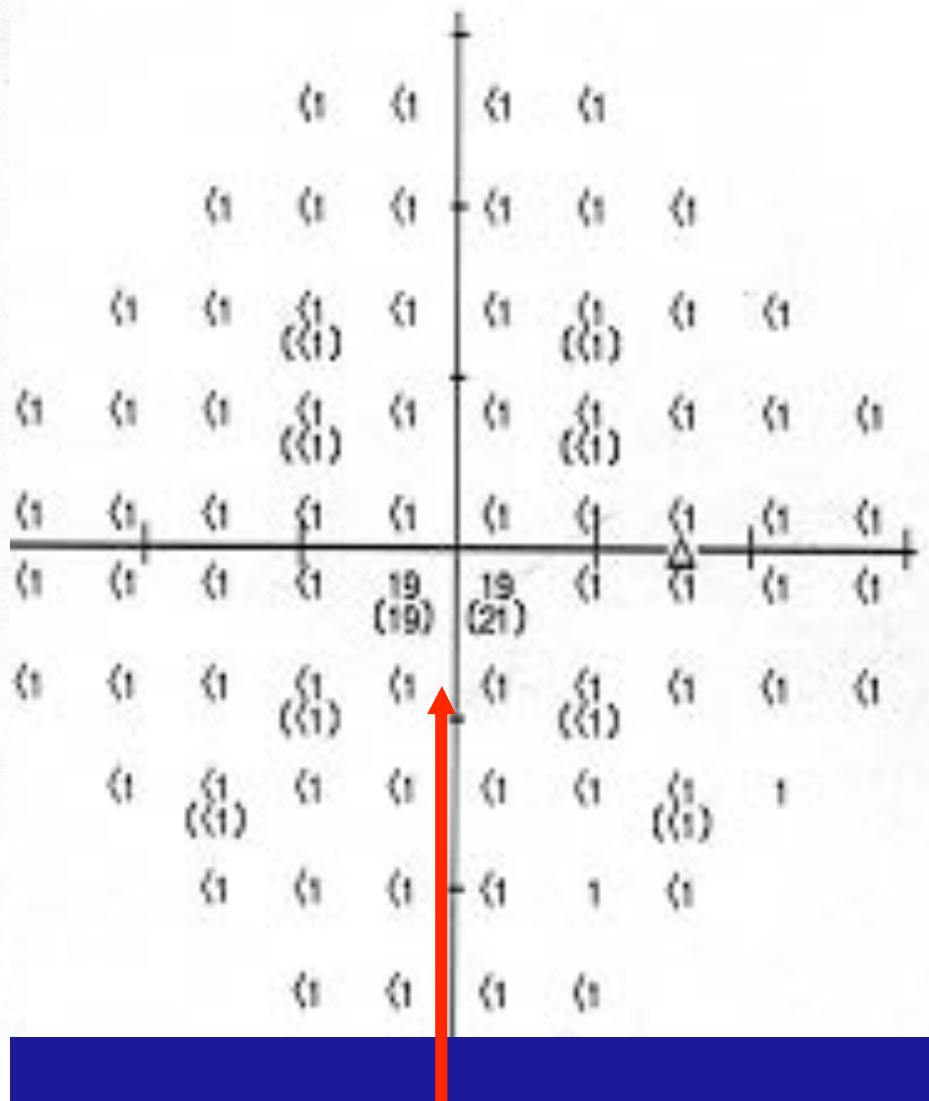
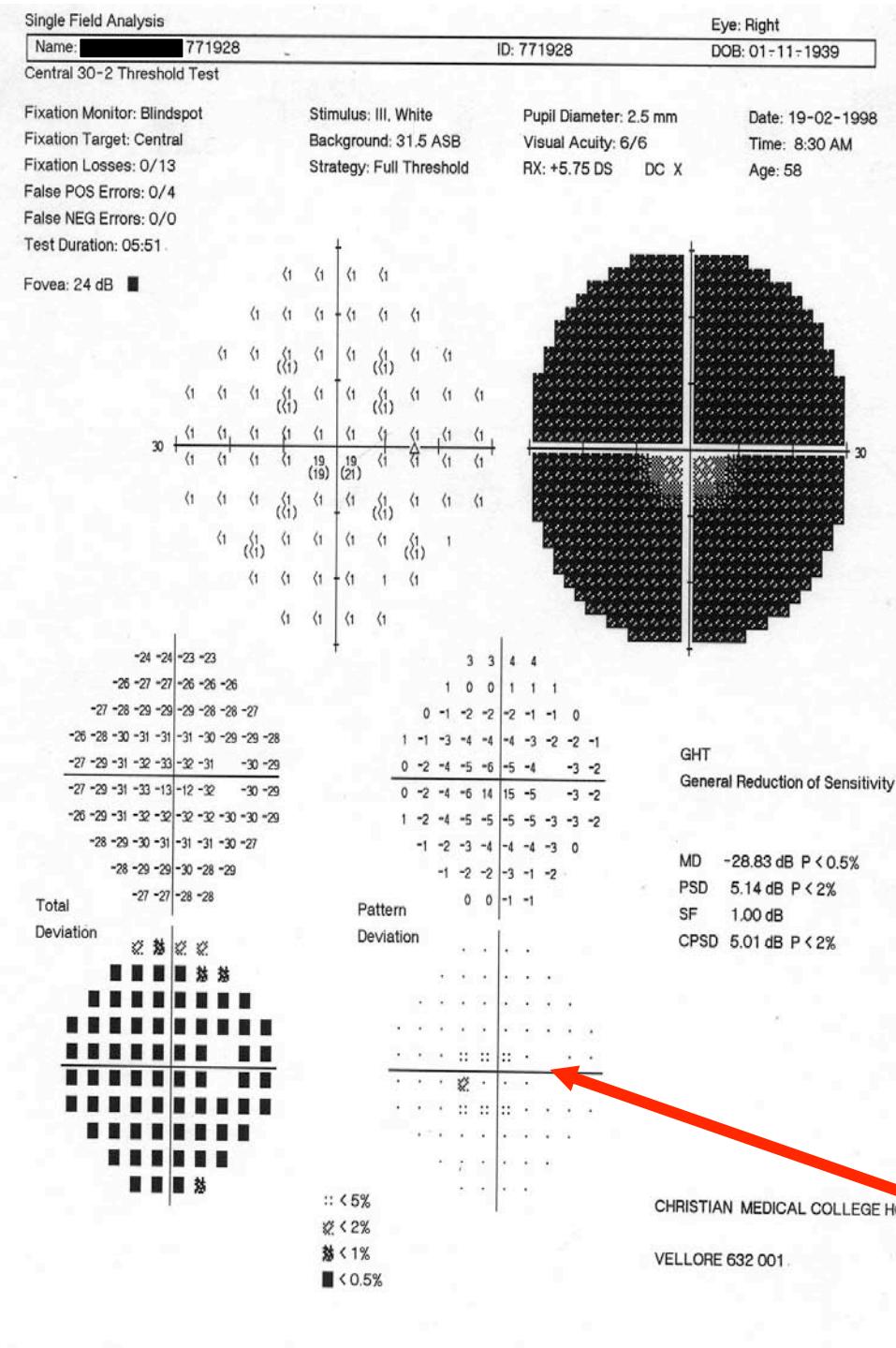
■ &lt; 0.5%

CHRISTIAN MEDICAL COLLEGE HC

VELLORE 632 001

Advanced field defect

Why is the pattern deviation plot not showing a defect?



## Single Field Analysis

Name: 771928

ID: 771928

Eye: Right

DOB: 01-11-1939

## Central 10-2 Threshold Test

Fixation Monitor: Blindsight

Stimulus: III, White

Pupil Diameter: 2.5 mm

Date: 19-02-1998

Fixation Target: Central

Background: 31.5 ASB

Visual Acuity: 6/6

Time: 8:43 AM

Fixation Losses: 0/18

Strategy: Full Threshold

RX: +5.75 DS DC X

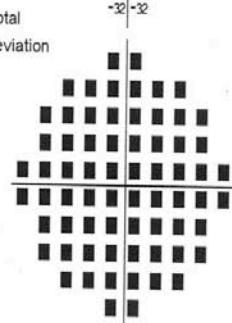
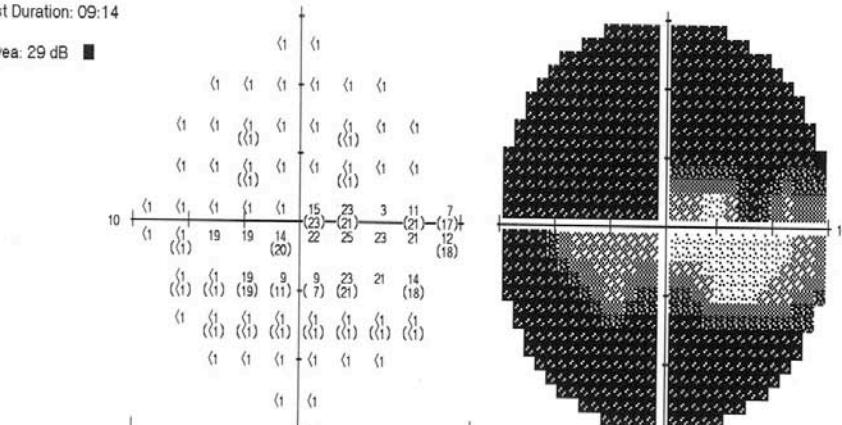
Age: 58

False POS Errors: 0/9

False NEG Errors: 3/8 xx

Test Duration: 09:14

Fovea: 29 dB ■



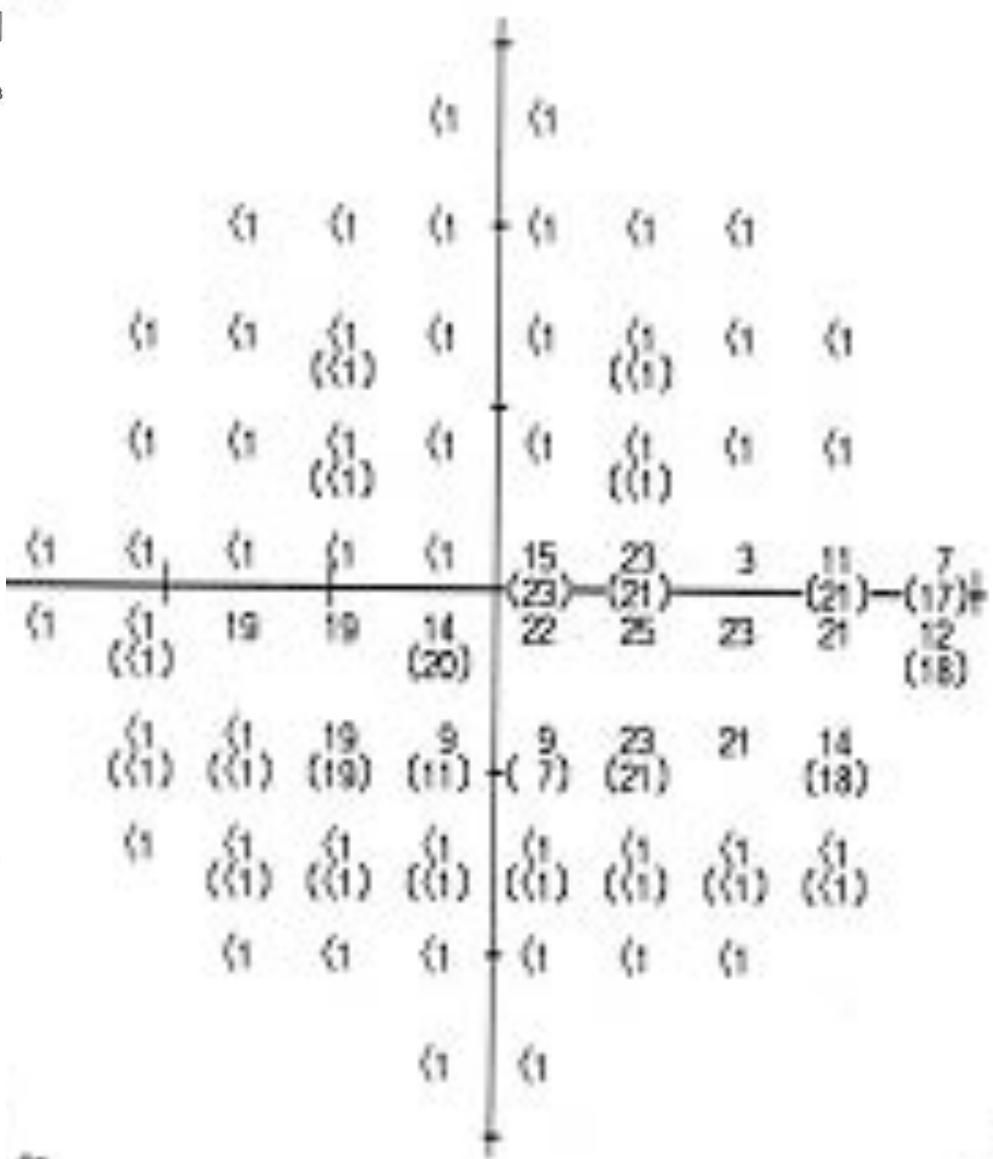
:: < 5%  
◎ < 2%  
✖ < 1%  
■ < 0.5%

Eye: Right

DOB: 01-11-1939

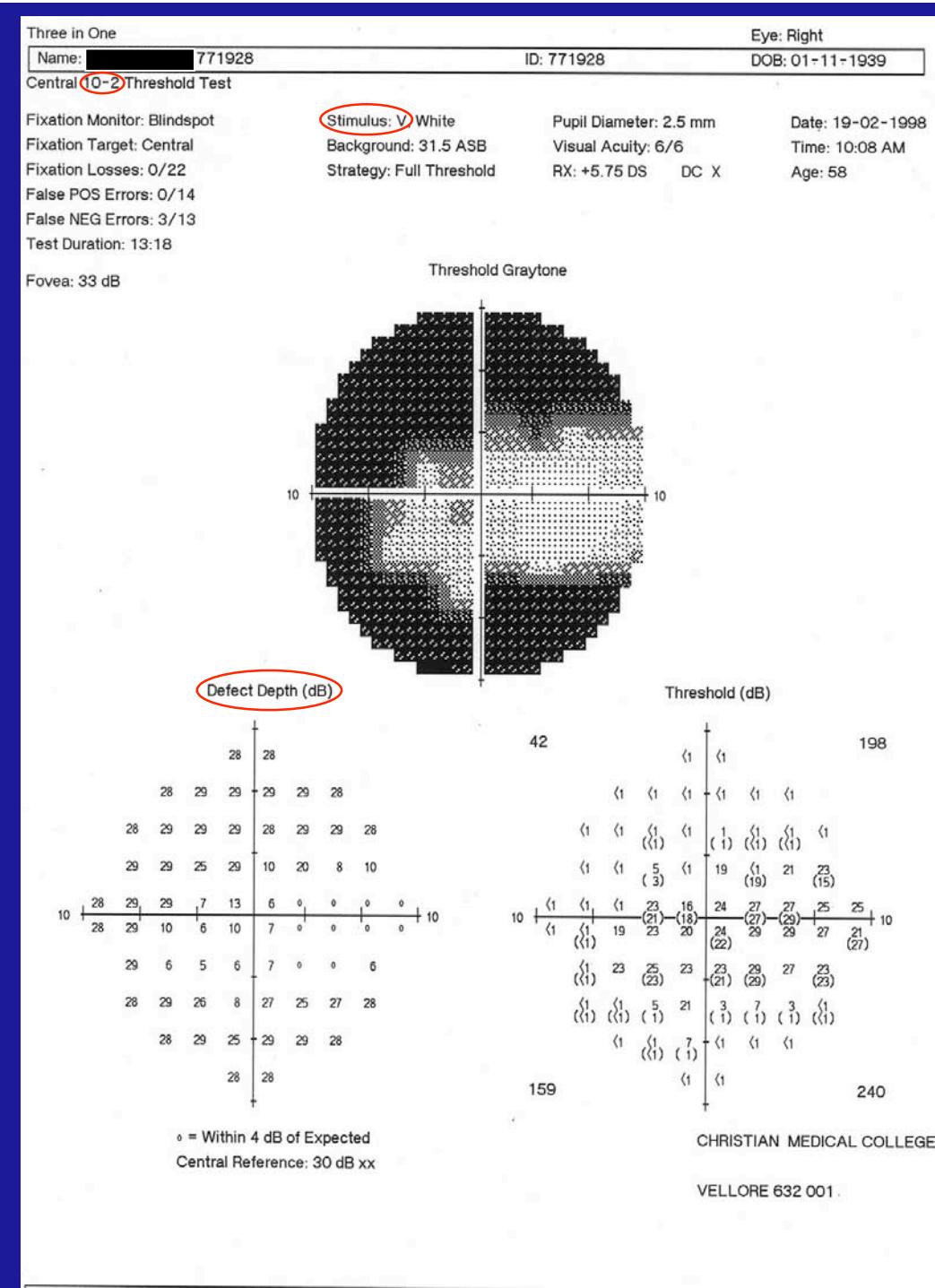
CHRISTIAN MEDICAL COLLEGE

VELLORE 632 001



Follow-up with a 10–2 programme – now there are enough sensitive points to produce a pattern deviation plot

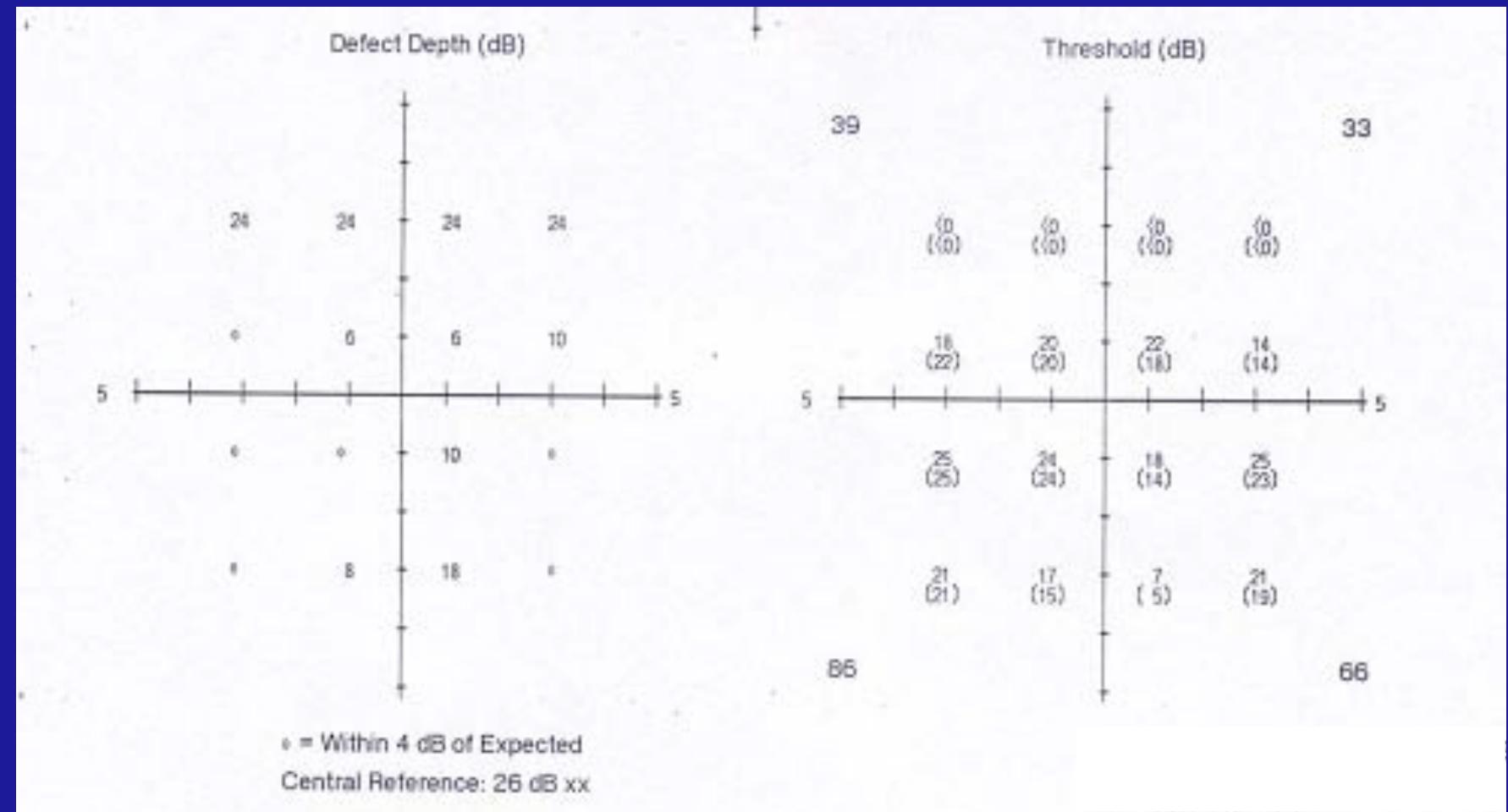
© Thomas R

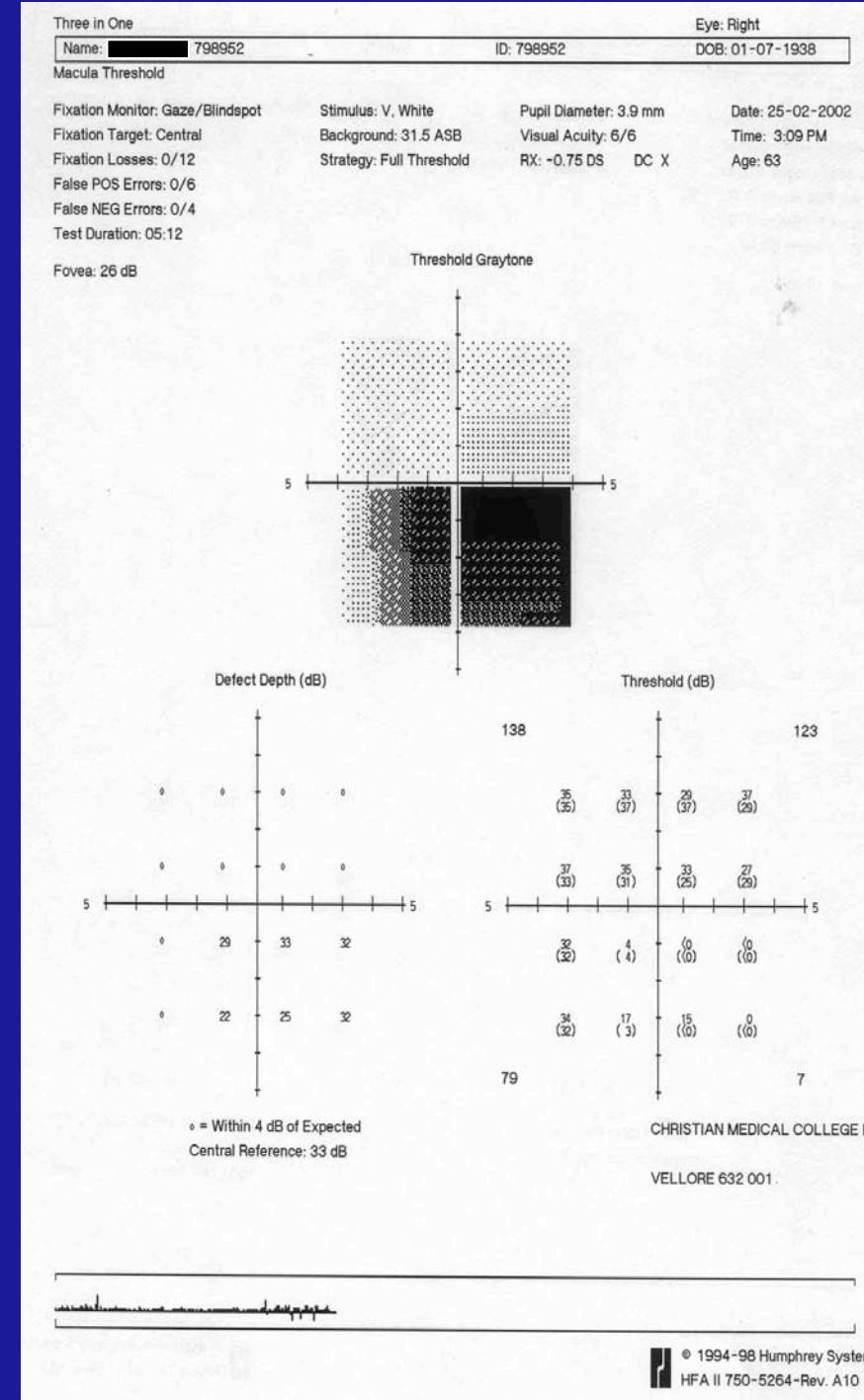


Advanced defect  
and/or low sensitivities –  
follow-up with a size V  
target

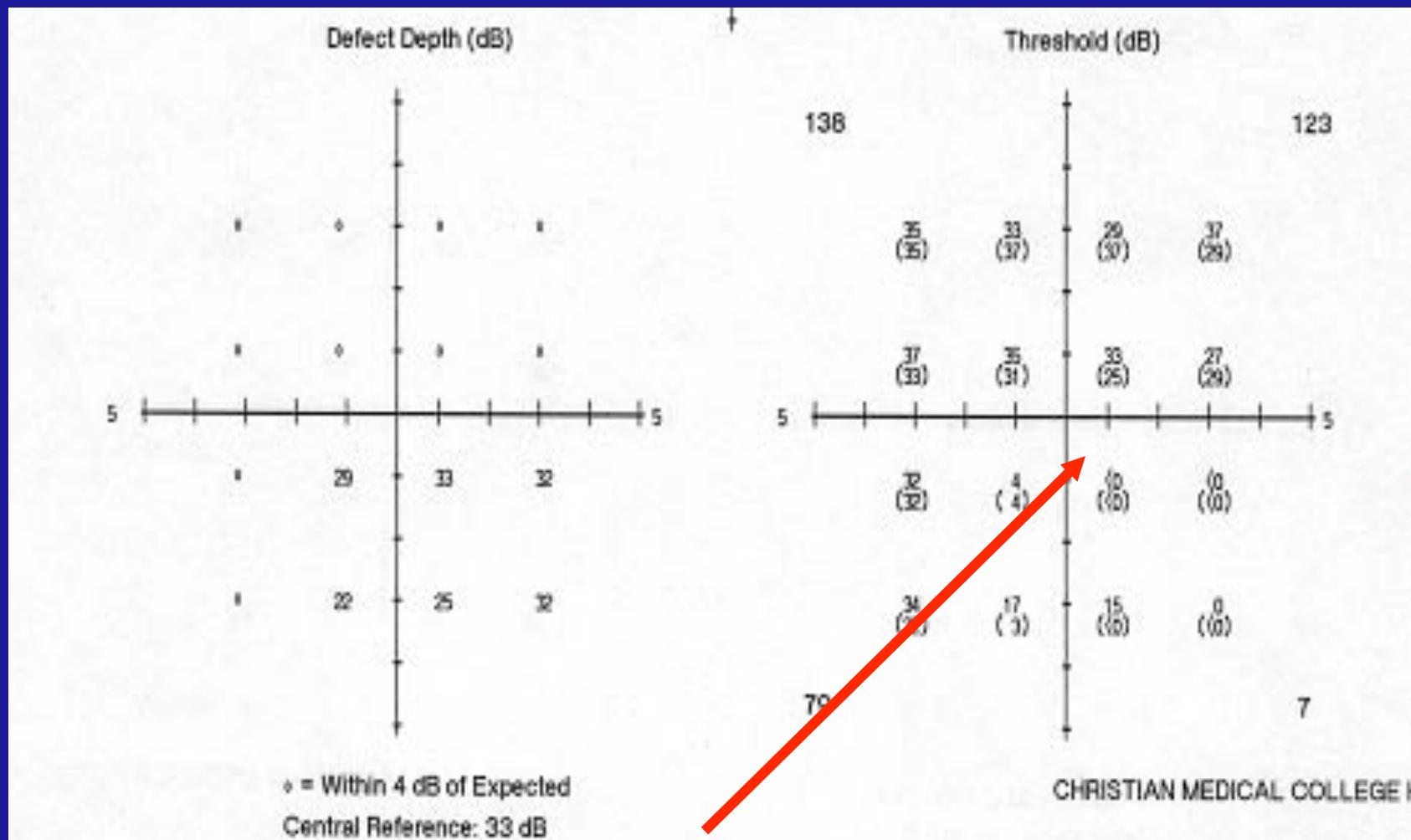
Disadvantage: we lose  
statistical help for  
interpreting the total and  
pattern deviation plots

# More advanced defects: follow with macular programme





# Macular programme in advanced glaucoma

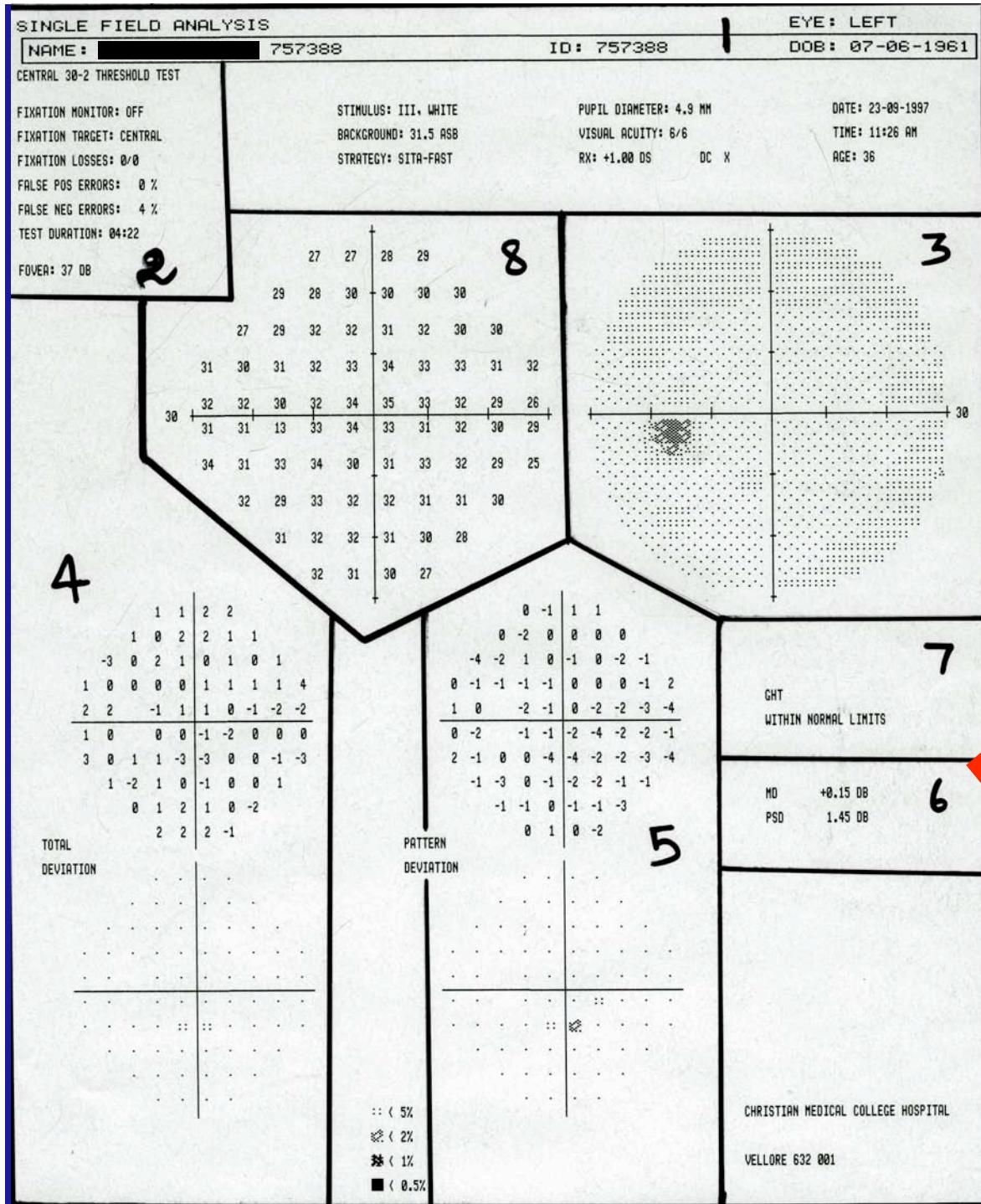


Size V target: macular split

Macular split (0 dB) next to the fovea  
with a size V target may predict 'wipe out'

# Recent developments: SITA

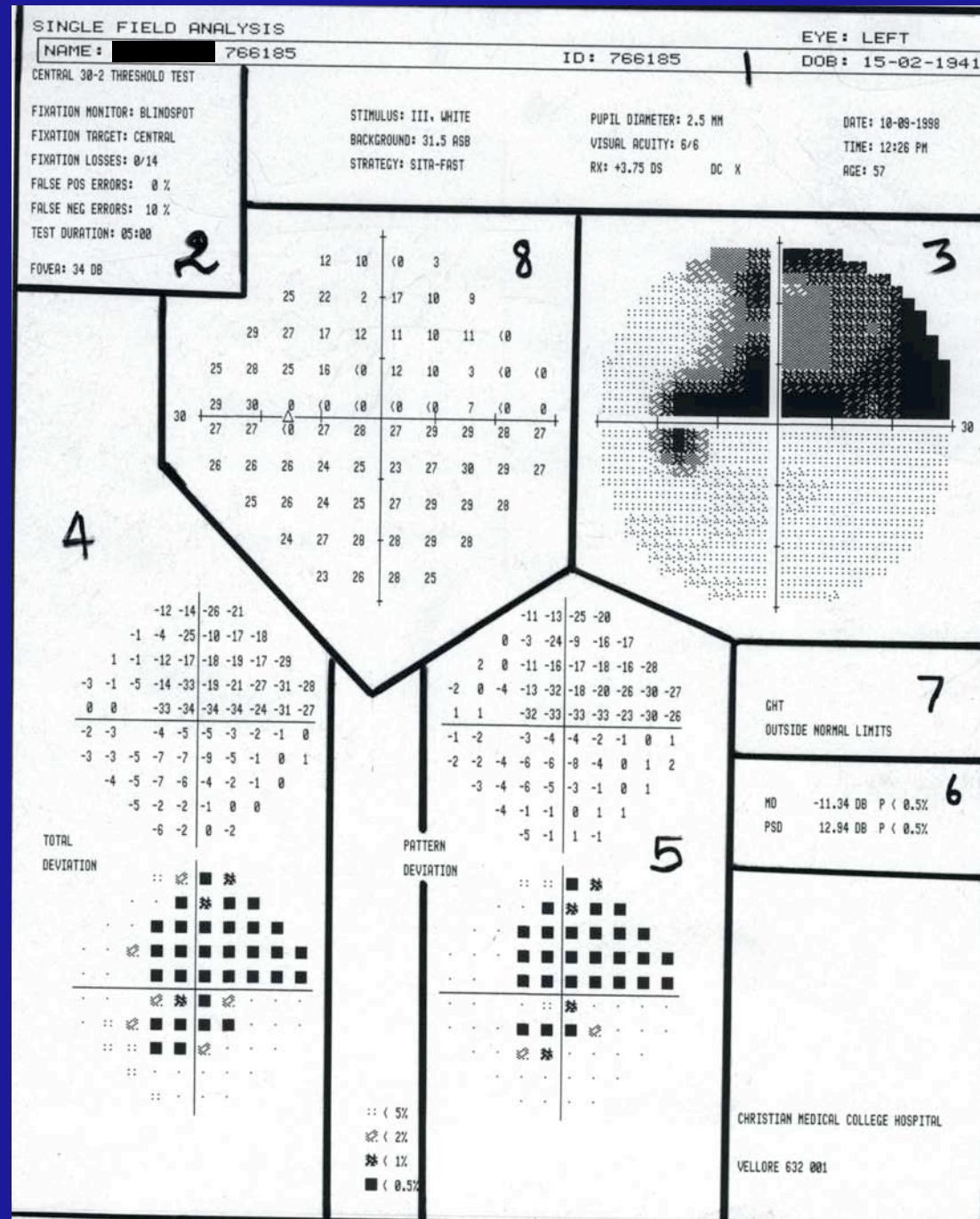
- Asks smart questions
- Gold standard
- More abnormal points on pattern deviation
- Shallower defects
- Significant because of less variability



SITA is interpreted in the same 8 zones as previously described

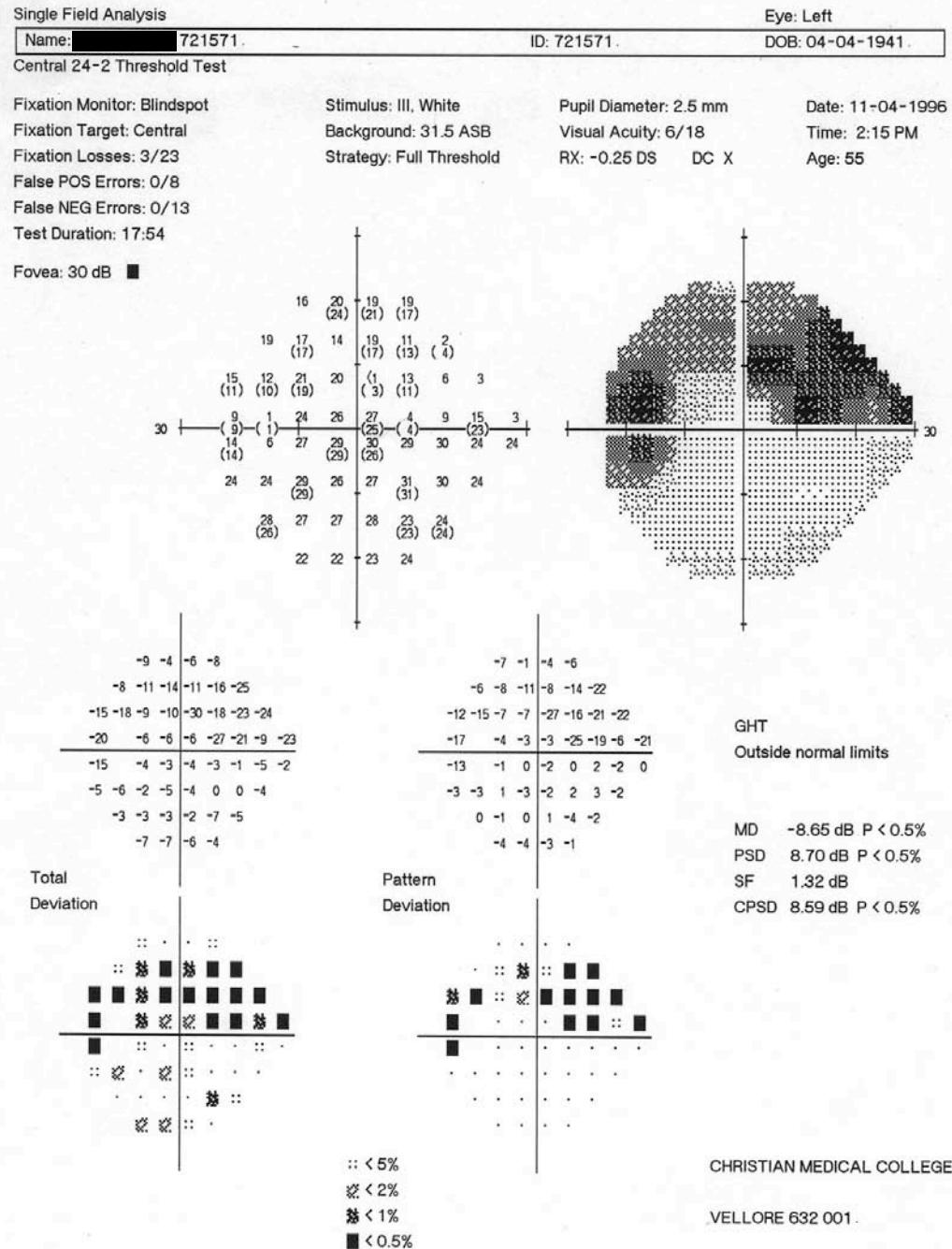
SITA, Swedish Interactive Threshold Algorithm.

© Thomas R

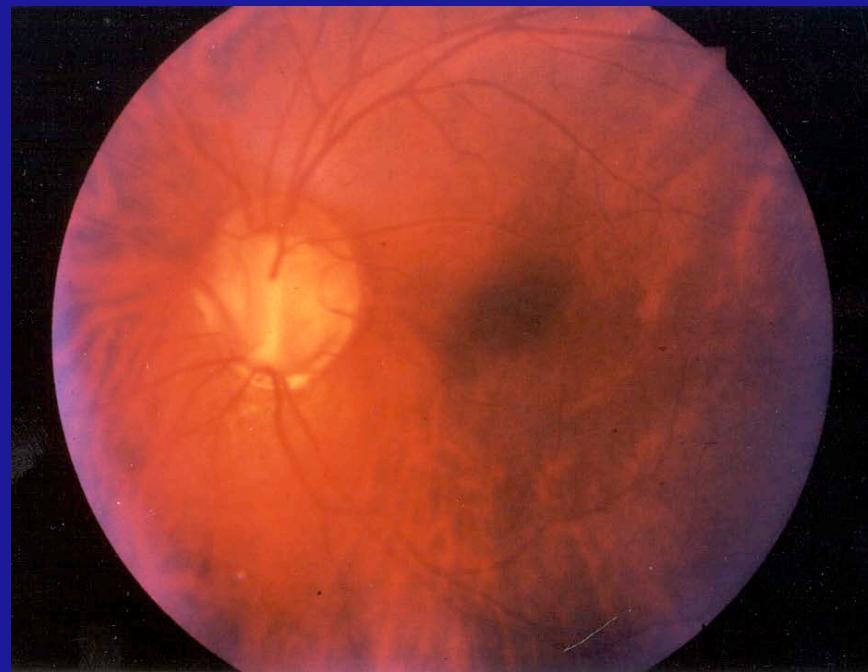


SITA uses the same criteria to identify a glaucomatous field defect

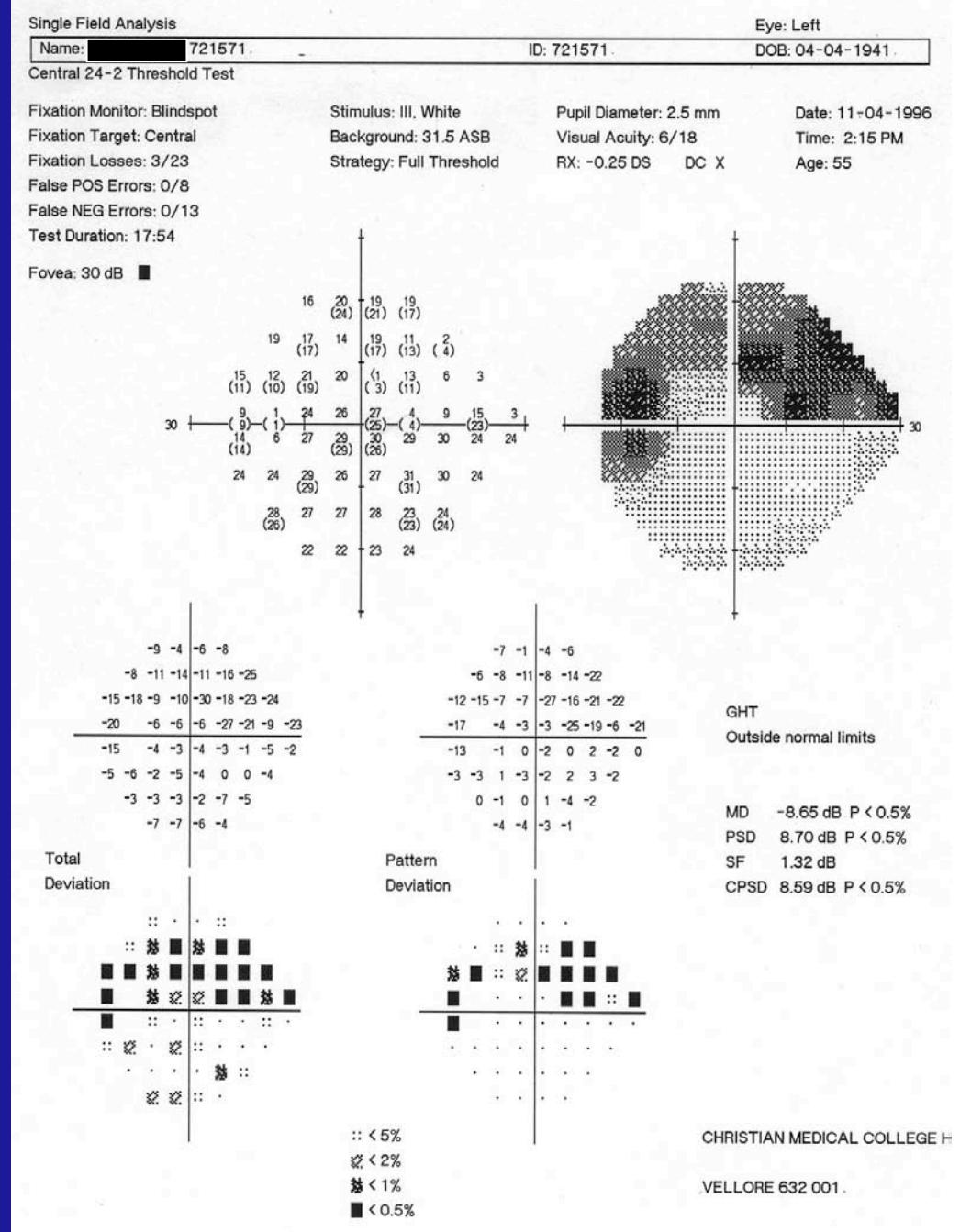
# SITA, Swedish Interactive Threshold Algorithm.



# Not unless the field defect correlates with clinical findings



Never diagnose  
based on the visual  
field ALONE





# Automated perimetry: warning

Sophisticated techniques and elaborate data printouts should not seduce us into a false sense of security or a misplaced belief in the validity or reliability of automated perimetry\*

\*Zalta AH. *Ophthalmology* 1989; 96: 1302–11.



# INTERPRETATION OF OCTOPUS FIELDS

# Test parameters – Octopus vs. HFA

Parameter	Octopus 300	HFA 700 series
Bowl type	Direct projection	Aspherical bowl
Background luminance	10 cd/m <sup>2</sup> (31.4 asb)	10 cd/m <sup>2</sup> (31.5 asb)
Stimulus size	Goldmann III and V	Goldmann I–V
Stimulus duration	100 ms	200 ms
Luminance for 0 dB	4800 asb	10,000 asb
Measuring range	0–40 dB	0–40 dB
Test strategies	4–2–1 dB bracketing strategy Dynamic Tendency oriented perimetry (TOP)	4–2 dB bracketing strategy SITA standard SITA fast

RP: permission requested

Patient data and refraction

INTERZEAG  
Seven-in-One

OCTOPUS 1-2-3

V 3.16

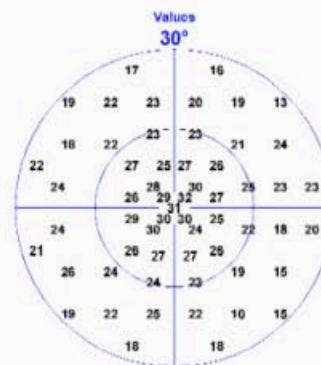
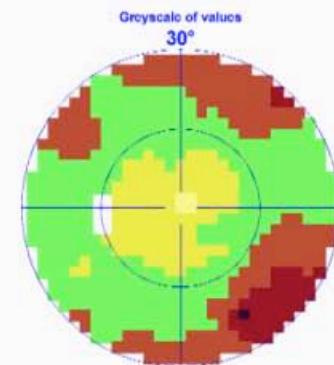
Name:  
First name:  
ID #:  
Birthdate:  
Age:  
Sex:  
Refr. S / C / A:  
Acuity:  
IOP:  
Diagnostics:

Case

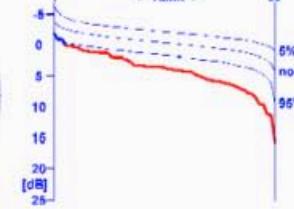
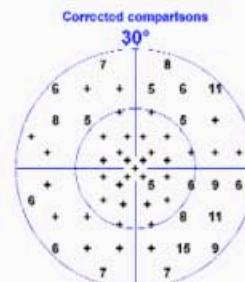
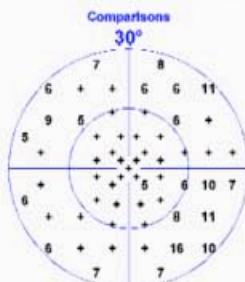
06

Date / Time:  
Test duration:  
Program / Code:  
# Stages / Phases  
Strategy / Method:  
Test target / duration:  
Background:  
# Questions / Repetitions:  
# Catch trials:

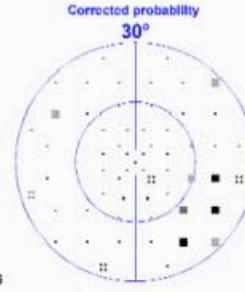
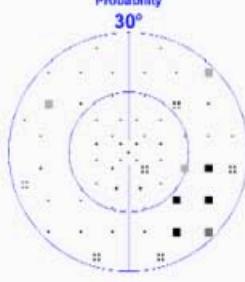
Eye / Pupil[mm]:  
Left (OS) / 5.2  
25.04.1991 13:15  
9:15  
GIX / 3  
4 / 1  
Normal / Normal  
III / 100 ms  
31.4 osb  
271 / 1  
pos 0 / 18, neg 0 / 18



Comparison tables



Probability plots



Strategy and test parameters

Actual values

Bebie (defect) curve

Deviation

Global indices

[[Credit line to be added]]

# Octopus global indices

- **MS** Mean sensitivity
  - Average of all measured values
- **MD** Mean defect
  - Average of all values corrected for age
- **LV** Loss variance
  - Equivalent to PSD
- **SF** Short-term fluctuation
- **CLV** ‘Corrected’ loss variance
  - Equivalent to corrected PSD
- **RF** Reliability factor

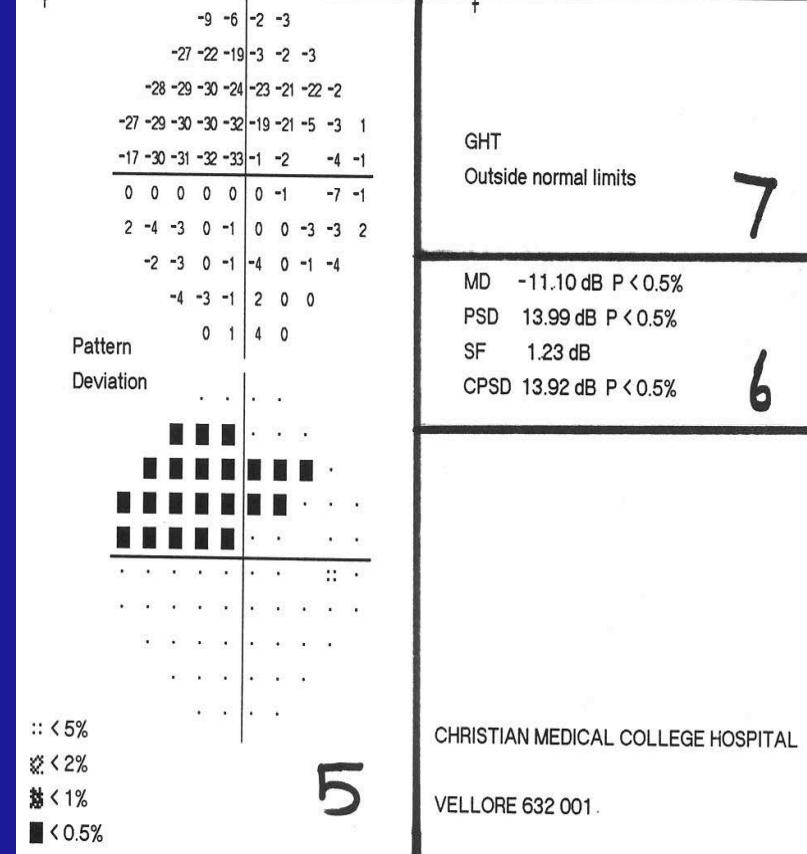
# Is the visual field abnormal?

- Octopus criteria for a visual field defect<sup>1</sup>
  - MD greater than 2 dB
  - LV greater than 6 dB
  - At least 7 points with sensitivity decreased by  $\geq 5$  dB, three of them being contiguous
- How do these compare to HFA criteria?

1. Morales J et al. *Ophthalmology* 2000; 107: 134–42.

# HFA criteria for glaucomatous defects\*

1. Pattern deviation plot
  - $\geq 3$  non-edge points with  $p < 5\%$
  - One point with  $p < 1\%$
  - Cluster in arcuate area
2. CPSD or PSD depressed with  $p < 5\%$
3. Abnormal GHT



\*Anderson DR, Patella VM. *Automated Static Perimetry*. 2<sup>nd</sup> Edn. St Louis: Mosby, 1999.



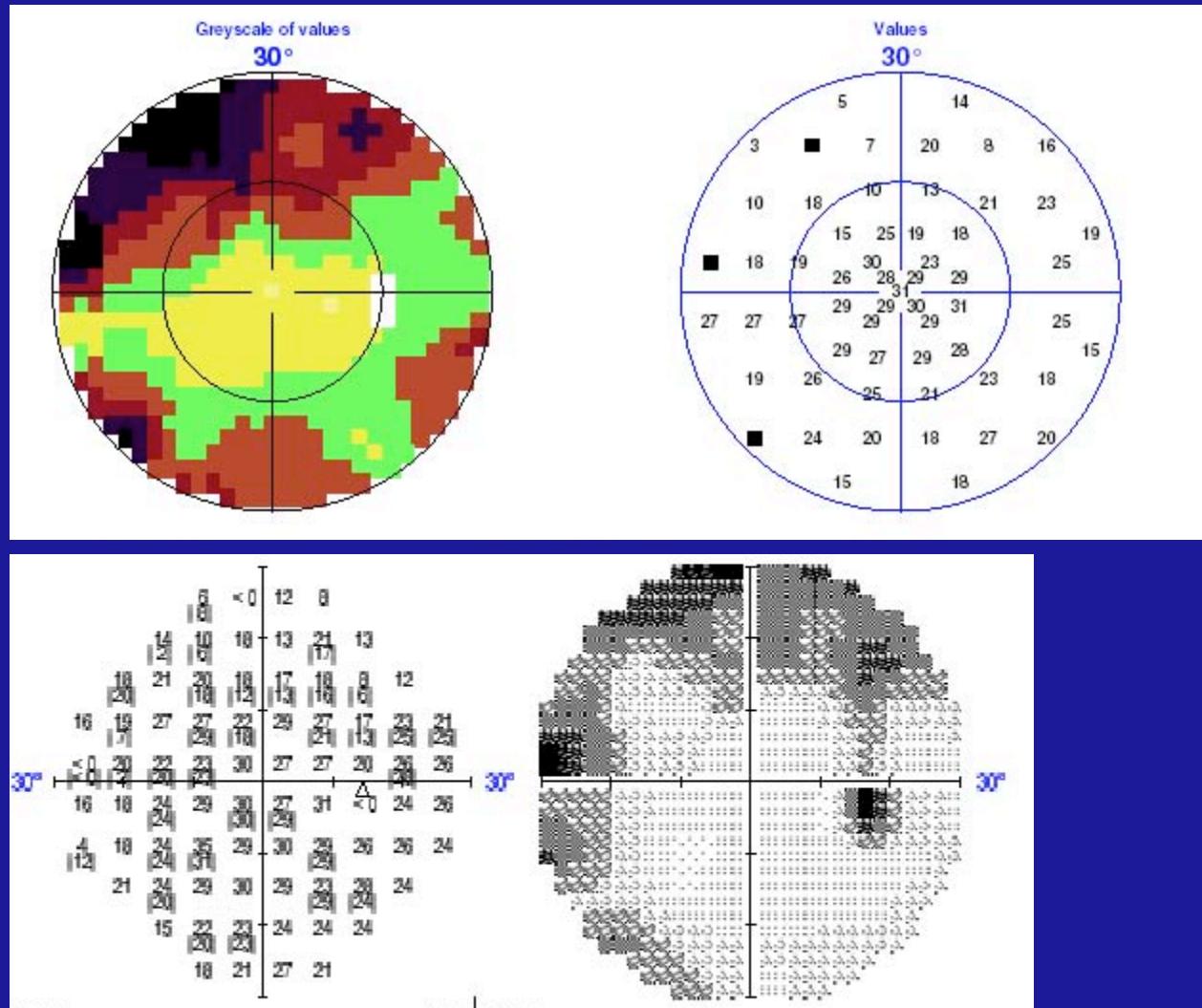
# Comparison of Octopus and HFA fields from a single patient

# Patient data, strategy and test parameters

INTERZEAG Seven-in-One	OCTOPUS 301	V 6.04c	GLAUCOMA LAB. 6TH FLOOR DR R P CENTRE, AIIMS, NEW DELHI
Name:	[REDACTED]	Eye / Pupil [mm]:	Right(OD) / 3
First name:		Date / Time:	07/24/2006 05:06 AM
ID #:	GF1039	Test duration:	12:36
Birthdate:	11/05/1971	Program / Code:	G1
Age:	34	# Stages / Phases:	8 / 2
Sex:	female	Strategy / Method:	Dynamic / Normal
Refr. S / C / A:	-2.5 / 0 / 0	Test target / duration:	III / 100 ms
Acuity:	6/6	Background:	10 cd/m <sup>2</sup>
IOP:		# Questions / Repetitions:	315 / 0
Diagnostics:		# Catch trials:	pos 0 / 16, neg 1 / 16
Patient file:		C:\Program Files\Octopus\ExDat\DEMO.PVD	

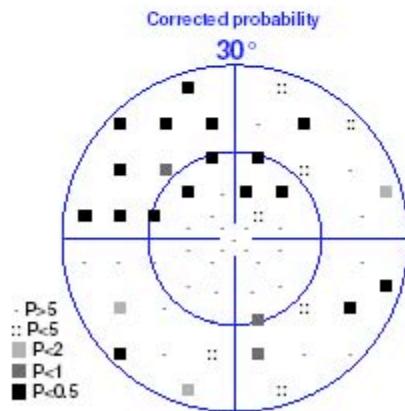
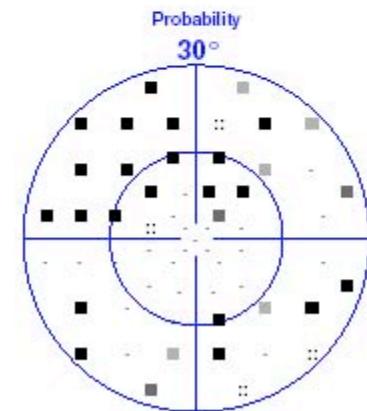
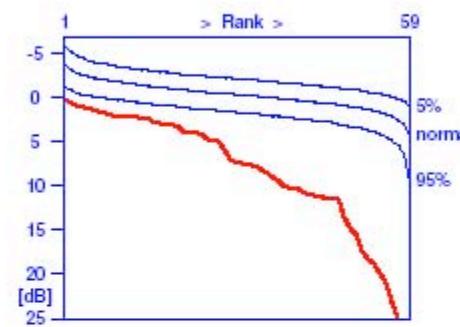
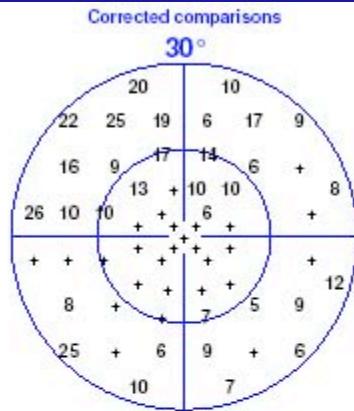
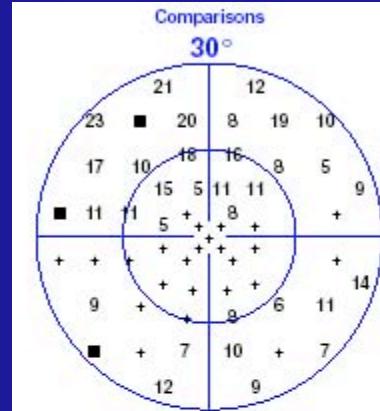
<i>Single Field Analysis</i>		Eye:	Right
Name:	[REDACTED]	ID:	610978
<b>Central 30-2 Threshold Test</b>			
Fixation Monitor:	Blindsight	Stimulus:	III, White
Fixation Target:	Central	Background:	315 asb
Fixation Losses:	1/29	Strategy:	Full Threshold
False Pos Errors:	0/20	Pupil Diameter:	3.00 mm
False Neg Errors:	2/19	Visual Acuity:	1.00
		Rbc	DS
		DC	X
		*	*
		Test Date:	01/08/06
		Test Time:	10:44:23
		Test Duration:	18:24
		Age:	34

# Grey scale



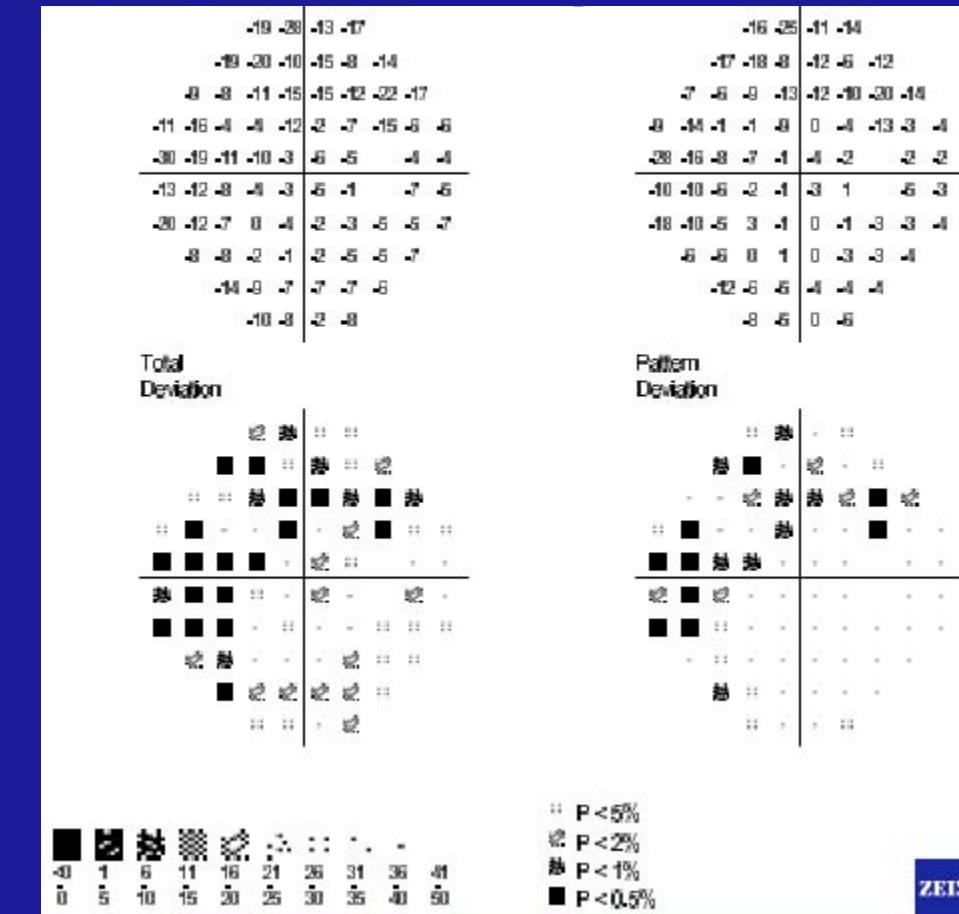
© Sihota R

# Octopus: comparison tables



	Phase I	Phase 2	Mean
#	59	59	59
MS	21.8	18.6	20.2
MD	6.8	10.1	8.5
LV	46.6	73.2	51.0
CLV			42.2
SF			4.9
RF			3.1

# HFA: total and pattern deviation



GHT	Outside normal limits
MD	-7.58 dB; p < 0.5%
PSD	6.30 dB; p < 2%
SF	2.27 dB; p < 10%
CPSD	5.75 dB; p < 1%