LSAH Data Requirements

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Lifetime Surveillance of Astronaut Health

Purpose: Articulate drivers for a robust OCT data set to provide evidence needed to support clinical care as it relates to Space-flight Associated Neuro Ocular Syndrome (SANS)

Acknowledgements:

- Tyson Brunstetter, OD, PhD[1]
- C. Robert Gibson, OD[2]
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Lifetime Surveillance of Astronaut Health

The Lifetime Surveillance of Astronaut Health (LSAH) is a proactive occupational surveillance program for the astronaut corps to screen and monitor astronauts for occupational related injury or disease.

- From the evidence obtained, individually tailored follow-up medical examinations to track the astronaut population more rigorously and capture sub-clinical medical events.
- This enables systematic evaluation of astronauts to detect potential health problems at an early state and to facilitate action to prevent the development or progression of occupationally-related diseases.

The "To Research, Evaluate, Assess, and Treat" Astronauts Act (TREAT Act) passed March 21, 2017. This act authorizes NASA to provide:

- medical and psychological monitoring and diagnosis to former U.S. astronauts and payload specialists for conditions potentially associated with spaceflight
- medical and psychological treatment to former U.S. astronauts and payload specialists for conditions associated with spaceflight

Spaceflight OCT Data Collected to Date

Flight Related OCT Data

		Subjects
Zeiss Stratus Pre or Post-Flight Only		3
Zeiss Cirrus Post-flight Only		5*
Zeiss Cirrus Pre and Post-flight		21
Heidelberg Spectralis	Pre and Post	28
	Partial Inflight	2
	Full Inflight**	26

* Some these subjects have pre-flight OCT on Zeiss Stratus
** Includes the 1 year and the extended duration crewmember

Retiree OCT Data

		Subjects
Long Duration		39
Short Duration	3 or less	95
	> 3	50

(Post 2013 Deployment in JSC Clinic)

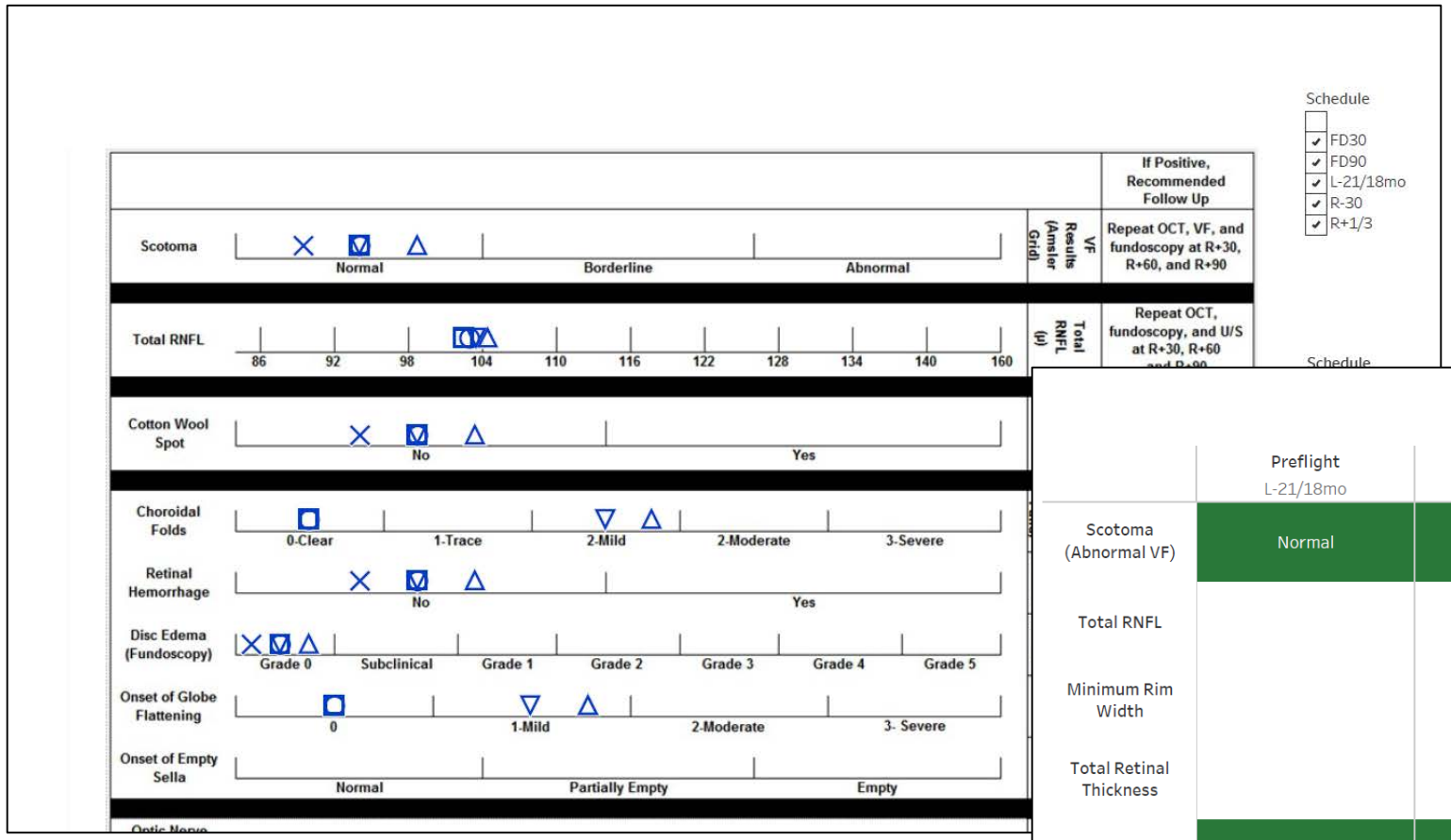
Research Data Use – SD-OCT

- NASA directed research study, “SD-OCT”, utilized data collected clinically Zeiss for MEDB 1.10
  - Evaluated for measures that change due to spaceflight.
  - Evaluated baseline measures in the astronaut corps compared to a control population, since most flyers had previous spaceflight experiences.

Publication: Patel N, Pass A, Mason S, Gibson CR, Otto C. “Optical Coherence Tomography Analysis of the Optic Nerve Head and Surrounding Structures in Long-Duration International Space Station Astronauts.” JAMA Ophthalmol. 2018 Feb 1;136(2):193-200.

- Current scan protocol was optimized to collect these key clinical measures from this work. These measures include:
  - Minimum Rim Width
  - Total Retinal Thickness
  - RPE Angle

Spaceflight Clinical Data Use

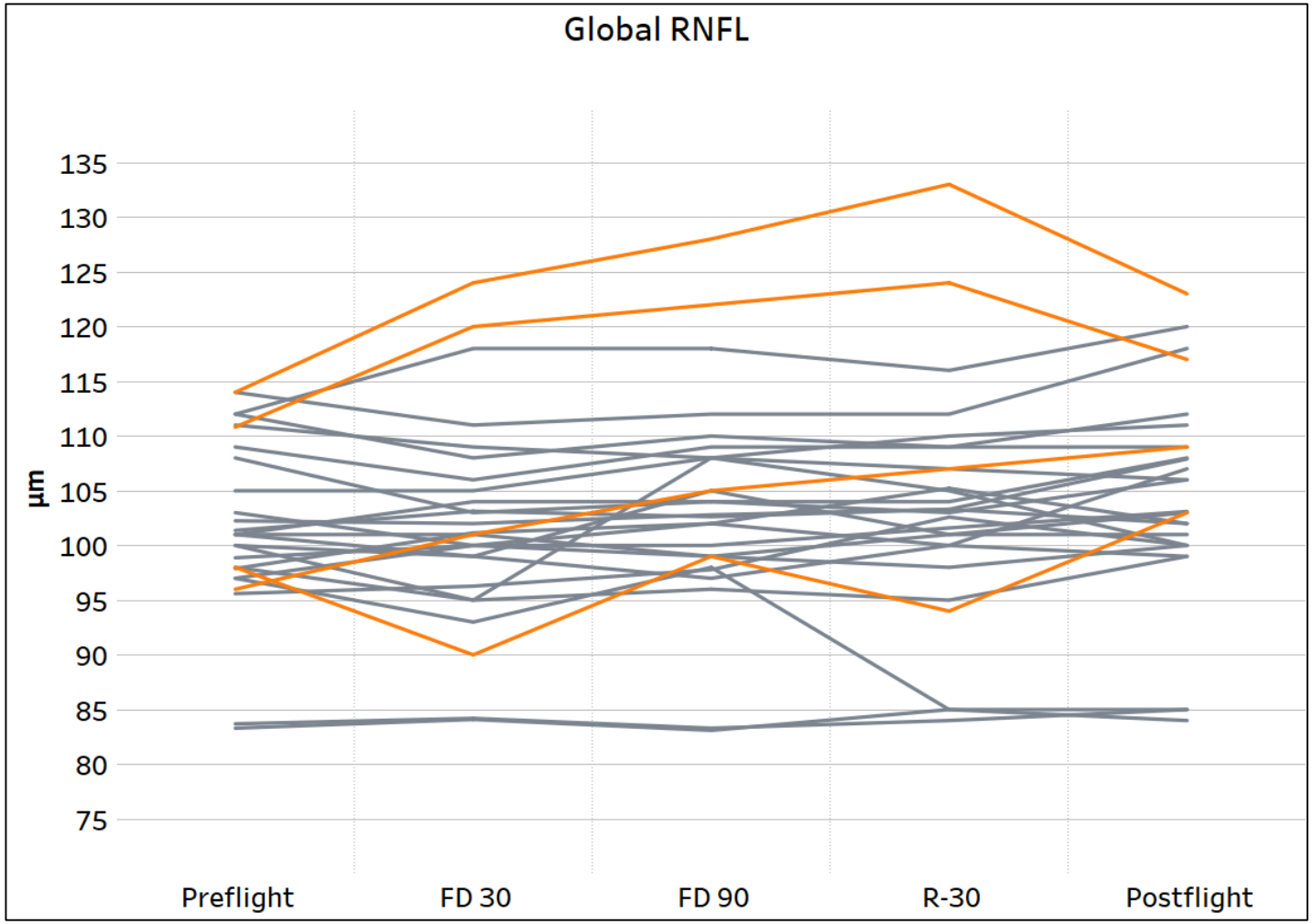


Left Eye

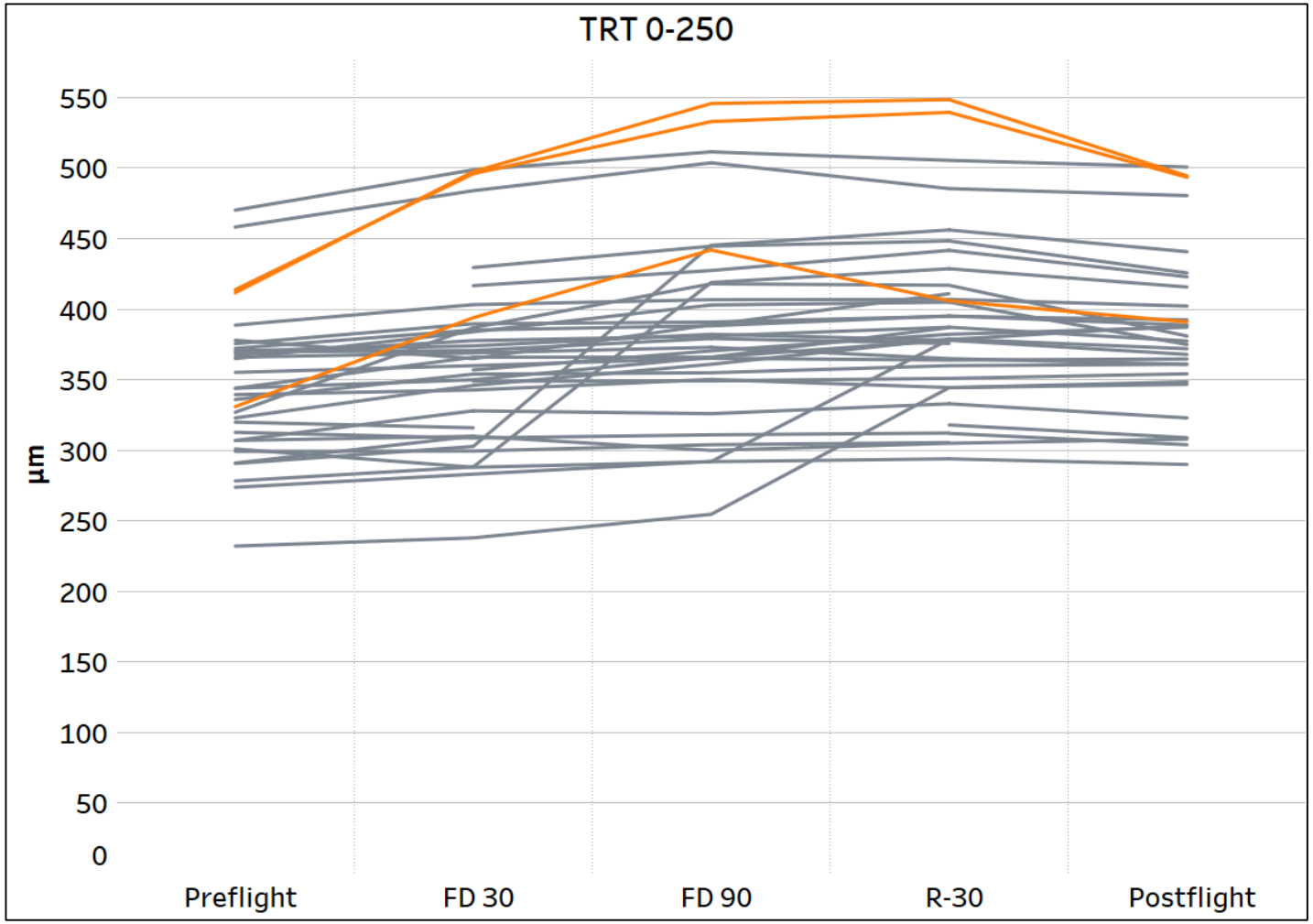
	Preflight L-21/18mo	Inflight FD30	Inflight FD90	Inflight R-30	Postflight R+1/3
Scotoma (Abnormal VF)	Normal	Normal	Normal	Normal	Normal
Total RNFL		103.00	103.00	104.00	104.00
Minimum Rim Width		362.00	369.00	387.00	377.00
Total Retinal Thickness		372.25	378.75	391.75	390.25
Cotton Wool Spots	Absent	Absent	Absent	Absent	Absent
Choroidal Folds		0 - Clear	0 - Clear	2 - Mild	2 - Mild
Retinal Hemorrhage	Absent	Absent	Absent	Absent	Absent

Global Retinal Nerve Fiber Layer Thickness

3 In-flight measures

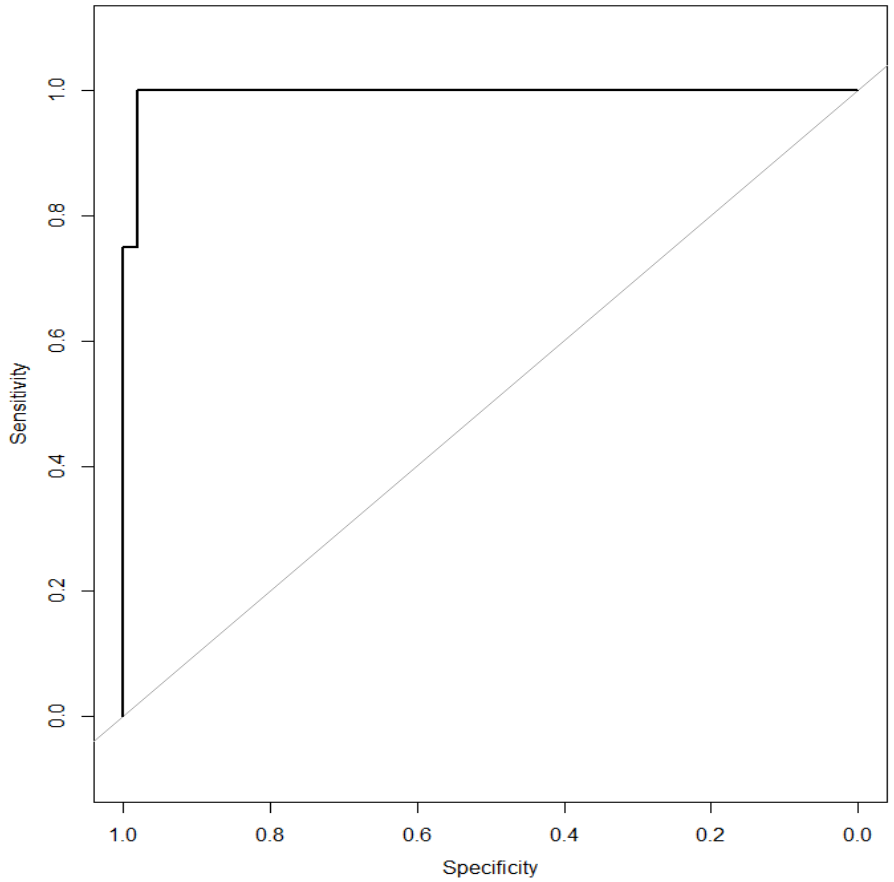


Total Retinal Thickness –
3 In-flight measures

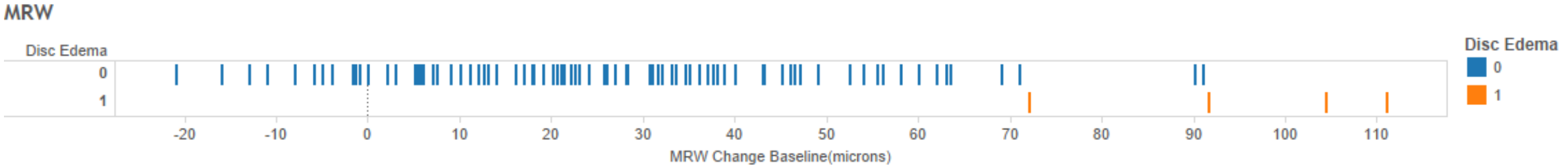


MRW- Change From Baseline

ROC Curve

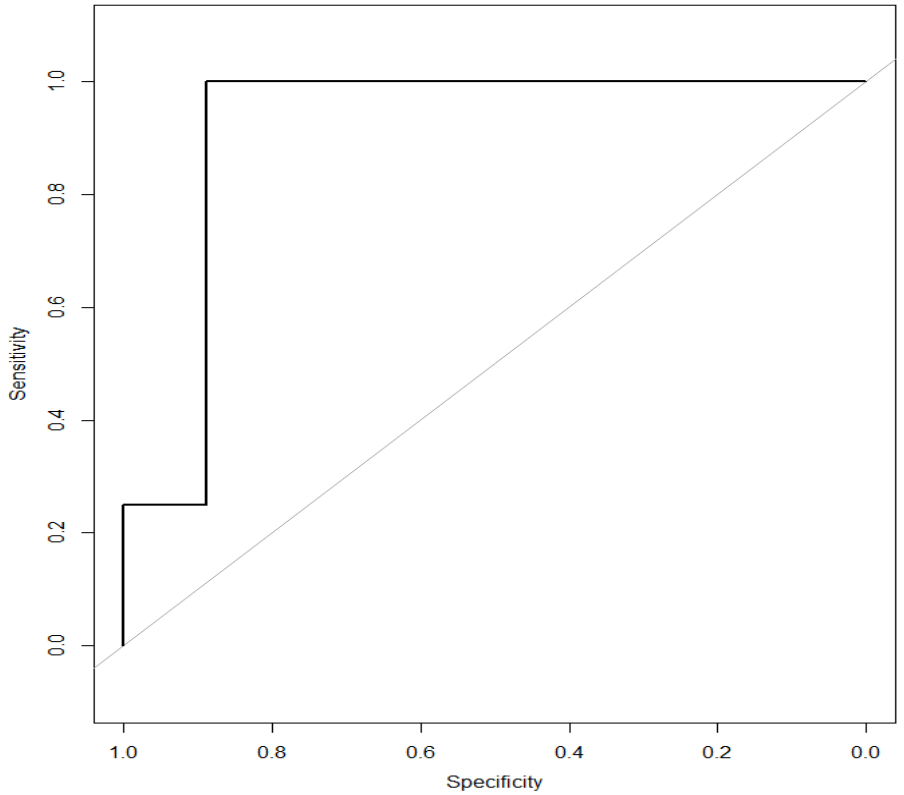


Scatter Plot

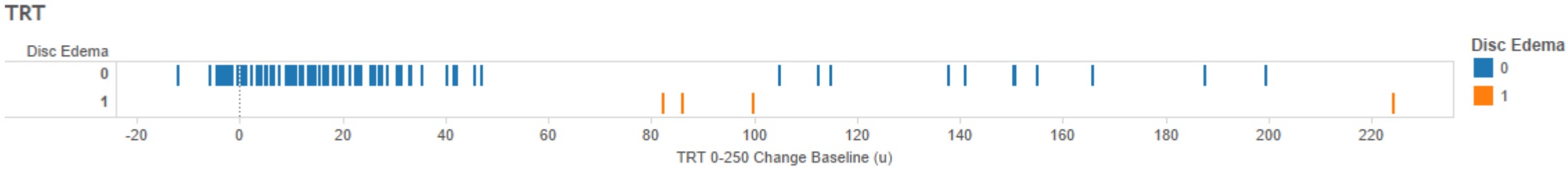


TRT-Change From Baseline

ROC Curve

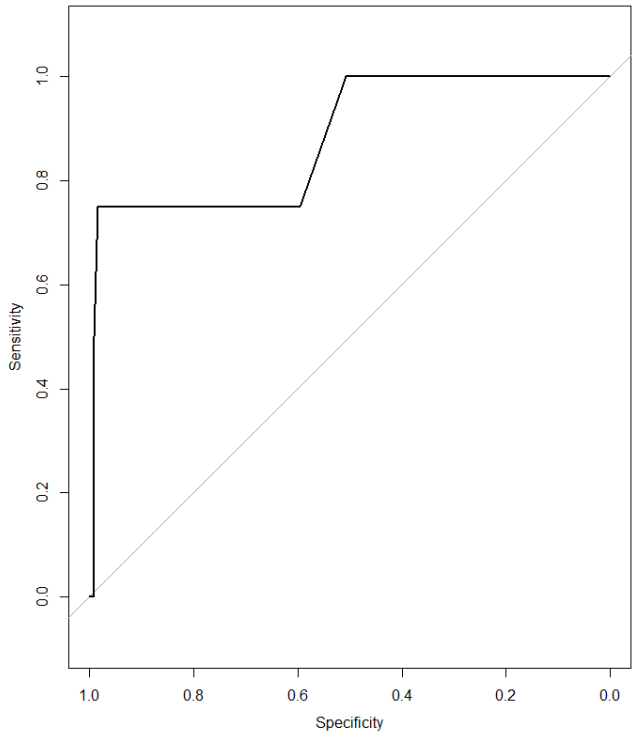


Scatter Plot

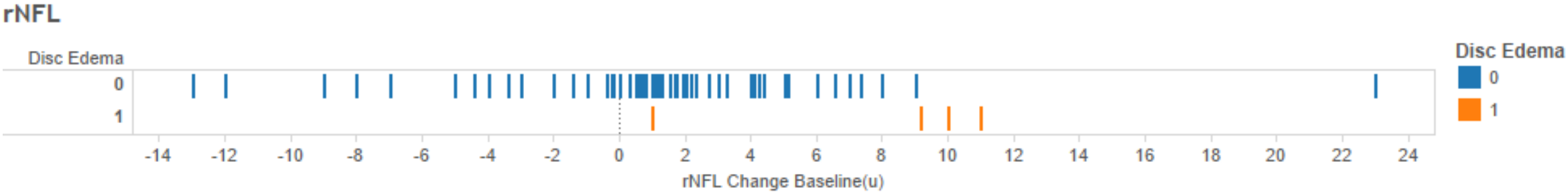


rNFL- Change From Baseline

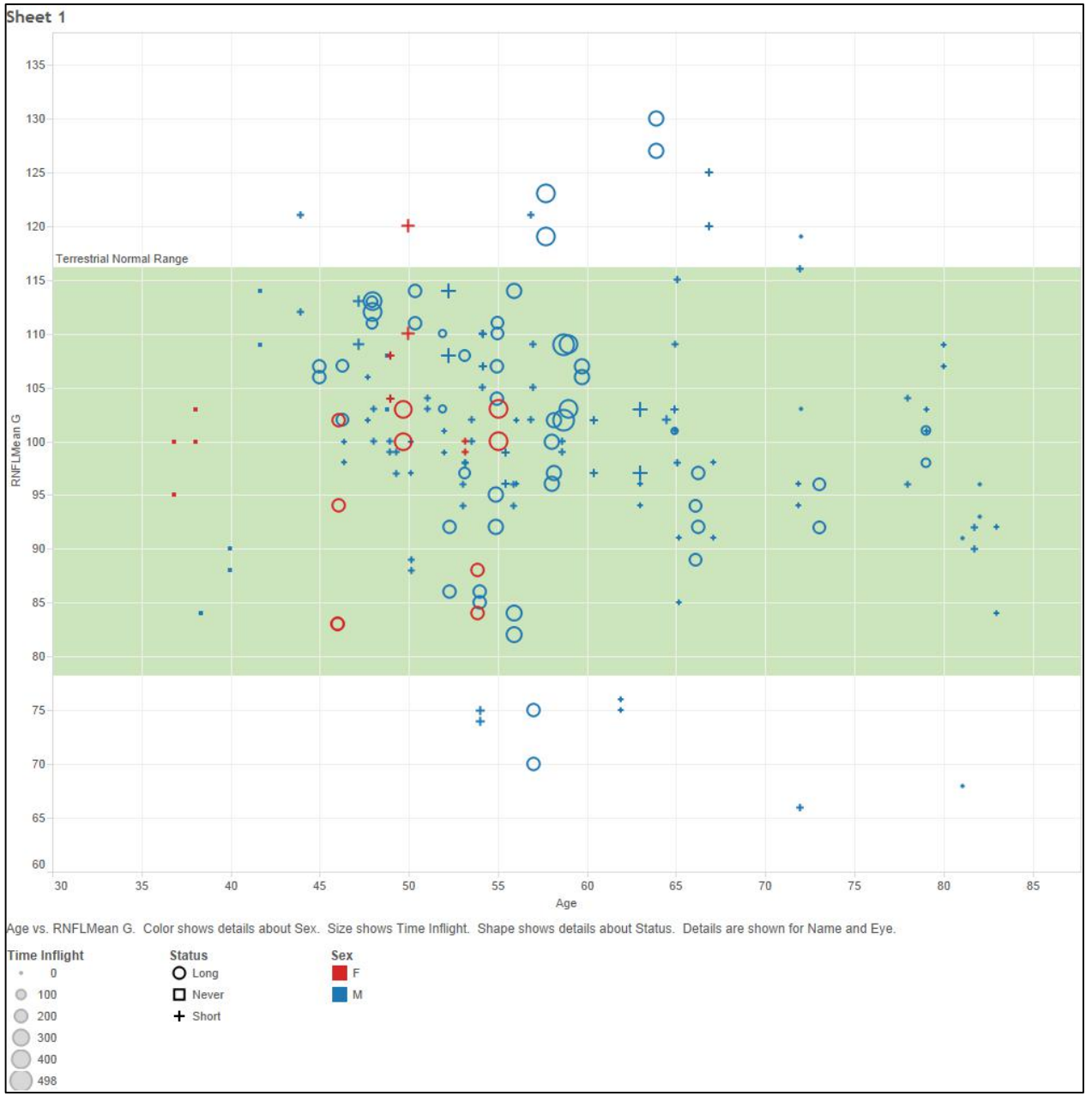
ROC Curve



Scatter Plot



Cross-sectional look rNFL in 2015



- Active and former astronauts
- >1Year post-flight
- Summary below:

Summary	All
N	85
M	75
F	10
Long	32
Short	46
Never	7
Age	56.99 ± 10.71
Time Inflight	111.8 ± 111.9
Time Since Last Flight	2889 ± 2883

Note: Terrestrial Normal Range-Not Age Adjusted; 2µ/decade decrease expected

Discussion

Back-up

Current Clinical Parameters

Circle Scan

- rNFL Thickness
- Global Peripapillary Choroid Thickness

Radial Scan

- Total Retinal Thickness
- Minimum Rim Width
- Bruch's Membrane Opening

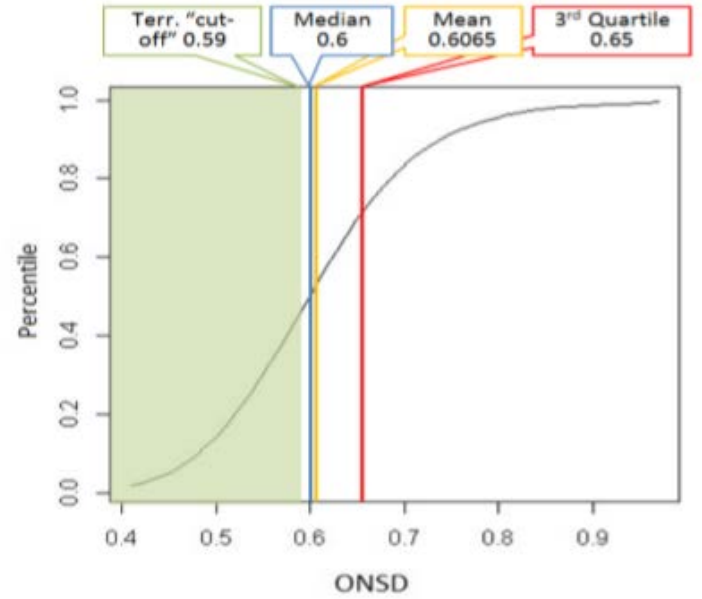
Macula Scan

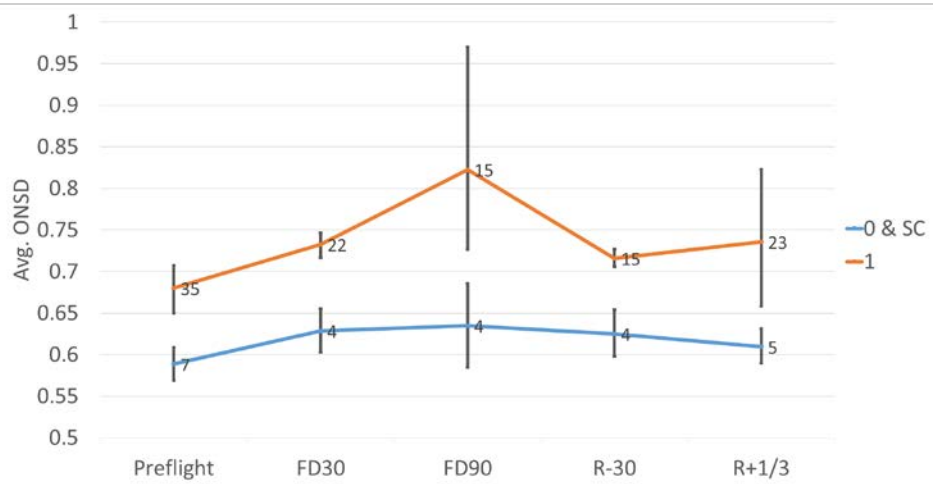
- Macula Thickness

Line Scan

- Submacula Choroidal Thickness

More Robust SANS Data Sets





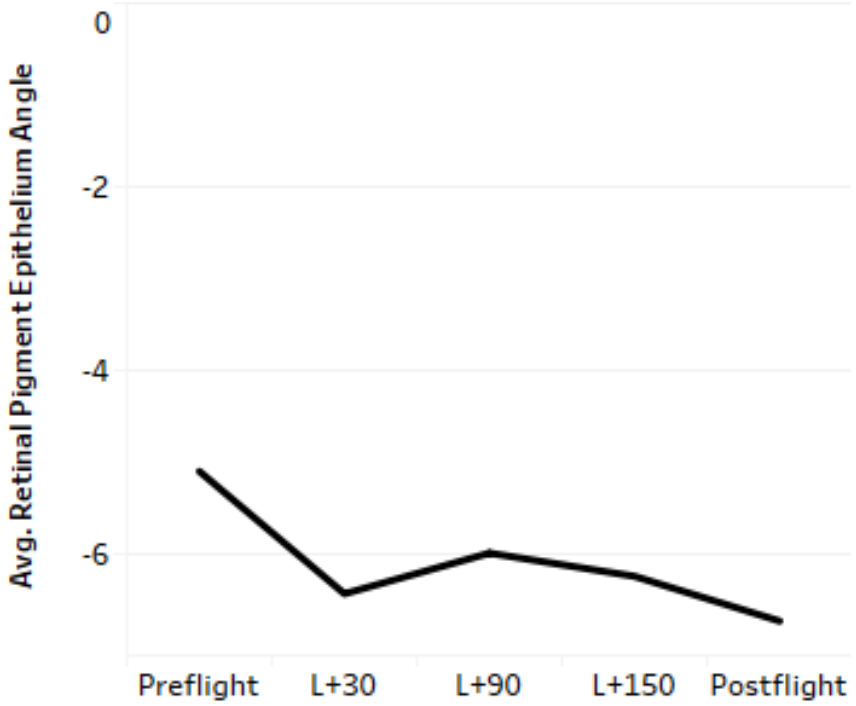
1. A cohort-specific distribution curve of the ONSD values was successfully created, thus providing a reference framework for clinical use of ONSD.

2. Astronauts who developed disc edema started out with larger preflight ONSD values (difference of 0.09; 95%CI: 0.06, 0.13; $p<0.001$).

3. Inflight ONSD appears to moderately increase when compared to preflight (difference of 0.05; 95%CI: 0.01, 0.10; $p<0.0001$)

Other Key Measures- RPE Angle

Overall



NonCase/Case (Disc Edema)