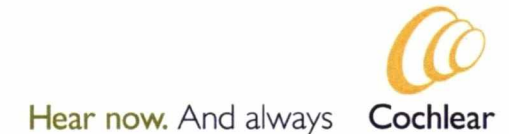


Enhancements to the Nucleus Neural Response Telemetry (NRT™) Software and Guidelines for Clinical Use



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Confidence, Confirmation & Convenience

The large contribution of Nucleus Neural Response Telemetry in making paediatric patient management more efficient has become widely accepted.

The upcoming version NRT 3.1 brings numerous enhancements with a focus on further increased ease of use. Many of which are in response to requests by routine NRT users.

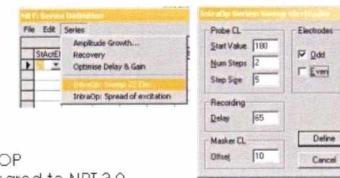
- Intra-operative T-NRT estimation across the electrode array in ~5 minutes
- Toolkit to simplify and speed-up NRT data analysis
- Compatibility with Windows XP and IF6 interface card.

Conclusion

With NRT 3.1, the novice user enjoys increased ease of use, the NRT enthusiast will benefit from completing tasks even faster, compared to previous versions.

Integrated Intra-OP Series

After determining the starting Probe CL and selecting suitable Delay & Gain parameters, T-NRT is conveniently estimated by sweeping across the electrode array using 3 to 4 different constant current levels (1). The new built-in sweep functionality allows intra-OP estimation of T-NRT in roughly half the time compared to NRT 3.0.



To reduce the effect of neural fatigue, the stimulation order in the sweep maximises the distance between consecutively used electrodes (2).

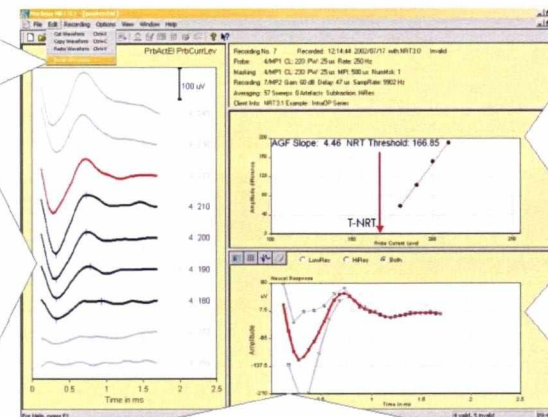
Research into electrode specificity is now facilitated through a dedicated built-in Intra-OP series generator. Whilst keeping the Probe Electrode fixed, the Masker Electrode automatically sweeps through the array. The decay of the response amplitude vs. the Probe Masker distance is a measure for spatial spread of excitation (3).

NRT Waveform Analysis

Quick re-analysis of NRT data is easily possible with the "Reset All Cursor" function.

Immediately after recording, T-NRT is automatically estimated with the built-in NRT recognition algorithm:

N1 and P1 peaks are only picked from recordings which have been automatically classified as "valid" neural response. Other recordings are displayed in grey in the Cascade Pane (4, 5). Manual editing can be applied as usual for detailed analysis.



Quick visual validity check of extrapolated T-NRT to ensure only points are included which adhere to the linear regression model.

Note that the data displayed in the Analysis Pane now is automatically filtered according to the selected Recording in the Cascade Pane.

Subjective estimation of the Recording's signal to noise ratio, to exclude Recordings with low SNR (as shown below in red).

Note that the Graph Pane now automatically scales, to snugly fit the displayed Recording.

Visual assessment at a glance of the recording's validity, by displaying high- and low-resolution components simultaneously (dots represent samples).

The selected (red) example in the cascade pane looks like a valid neural response. However, here in the graph pane it can be seen, that the two low resolution components (grey) have different amplitudes, which is due to a recording artefact. Such a Recording should not be included in the calculation of the amplitude growth function.

In this example, the automatic NRT recognition algorithm correctly classified this Recording as "invalid".

- 1) Waikong Lai, Norbert Dillier; A Procedure for performing Neural Response Telemetry Measurements in the Operating Room; Poster presentation 1st International Symposium Objective Measures in Cochlear Implants, Nottingham 1998
- 2) Joachim Mueller-Deile; Is the Recording Rate influencing Electrically Evoked Compound Action Potential Thresholds?; Presentation 7th International Cochlear Implant Conference 2002, Manchester
- 3) Laurie Cohen, Norbert Dillier; Spatial Spread of Excitation using NRT3; Presentation 9th NRT Research Workshop, Las Palmas 2002
- 4) Basile Charasse; A mathematical neuronal network used for automatically recognizing and analysing NRT patients' data. Implications for future NRT systems, Presentation 9th NRT Research Workshop, Las Palmas 2002
- 5) Joachim Mueller-Deile; NRT Recovery Function Measurements with higher rates of stimulation, Presentation 9th NRT Research Workshop, Las Palmas 2002