

EEG for Precision Psychiatry: Validation of the Cumulus NeuLogiq™ platform

John Dyer¹, Florentine Barbey¹, Alison R. Buick¹, Laura Rueda-Delgado¹, Md Nurul Islam¹, Hugh Nolan¹, Brian Murphy¹
¹Cumulus Neuroscience Ltd.



Cumulus NeuLogiq Platform for cognitive and EEG data collection at scale

Developed in collaboration with leading pharma companies and KOLs (below).

- Cumulus provides full service:
- Protocol / study / SAP design
 - On-site training, off-site support
 - Data package
 - Reporting and custom analytics

Audit ready including FDA 510(k), UKCA, HIPAA, GDPR, ISO13485.

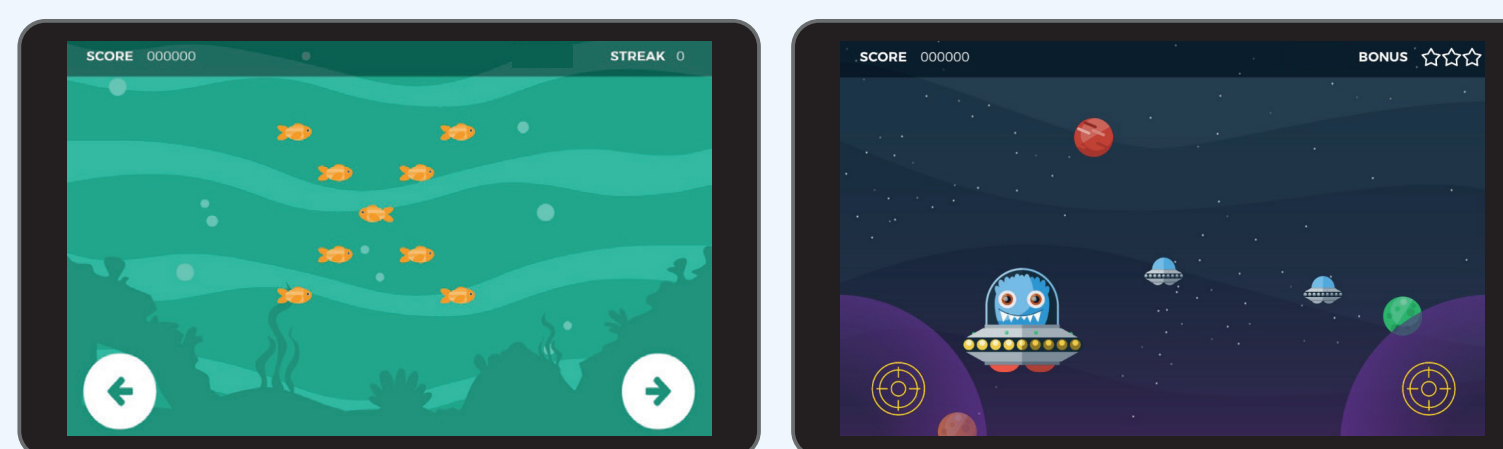
Designed for and with patients and clinicians, deployed in Phase 0-1b CNS trials.

Secure automatic upload and QC.

Real-time dashboard monitoring of decentralized and home-based data collection.

Cumulus cognitive-EEG tests are designed to be highly repeatable, quick to run and low-burden for participants.

- Objectively administered and automatically scored
- Results, including ERPs, available in minutes, enabling remote monitoring
- Tasks designed to be approachable and low burden vs. classical ERP paradigms



Go with the Flow:
Gamified Flanker ERN

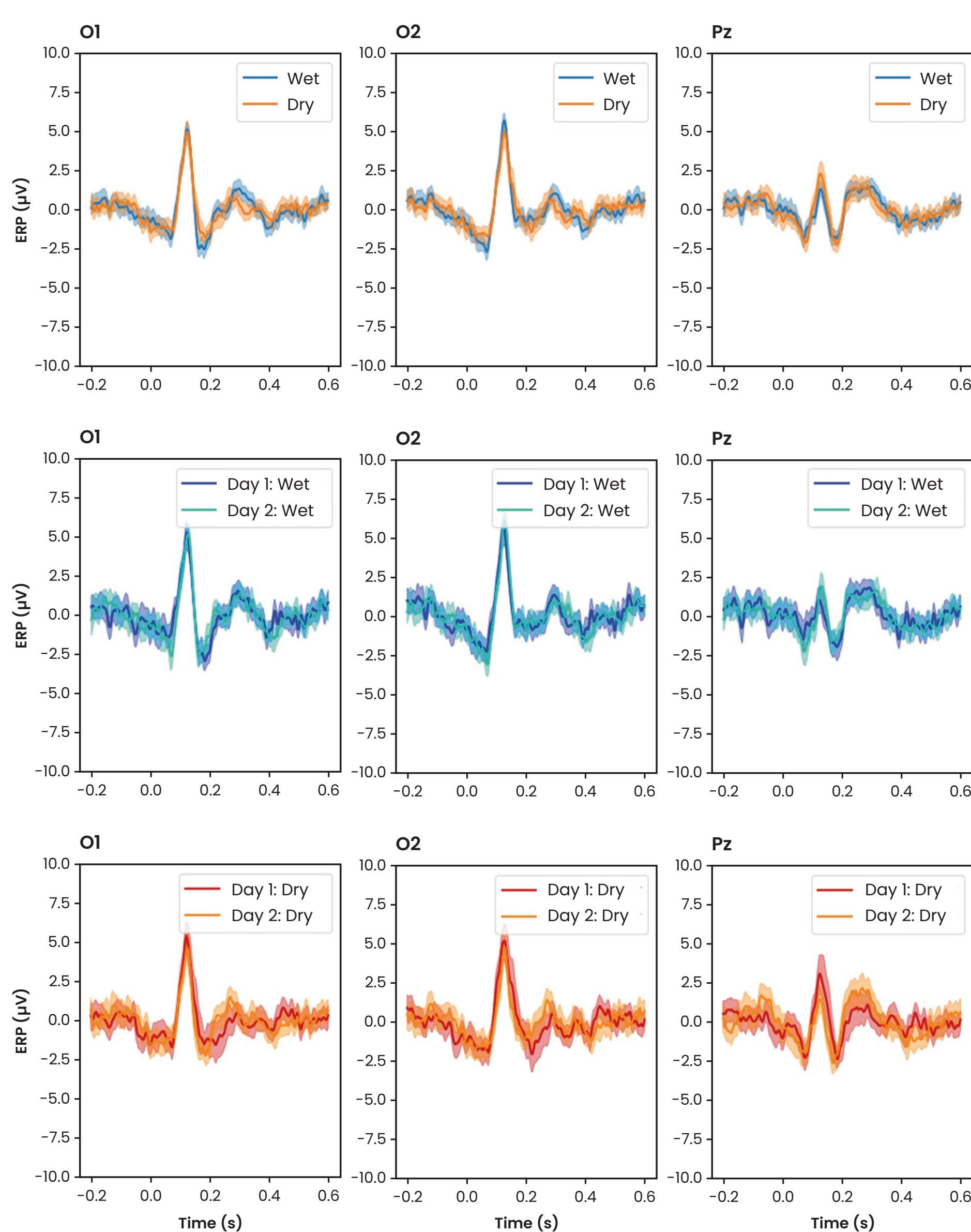
AstroTap:
Gamified P300 visual oddball



Comparison between wet and dry EEG systems

Technical validation against BioSemi EEG

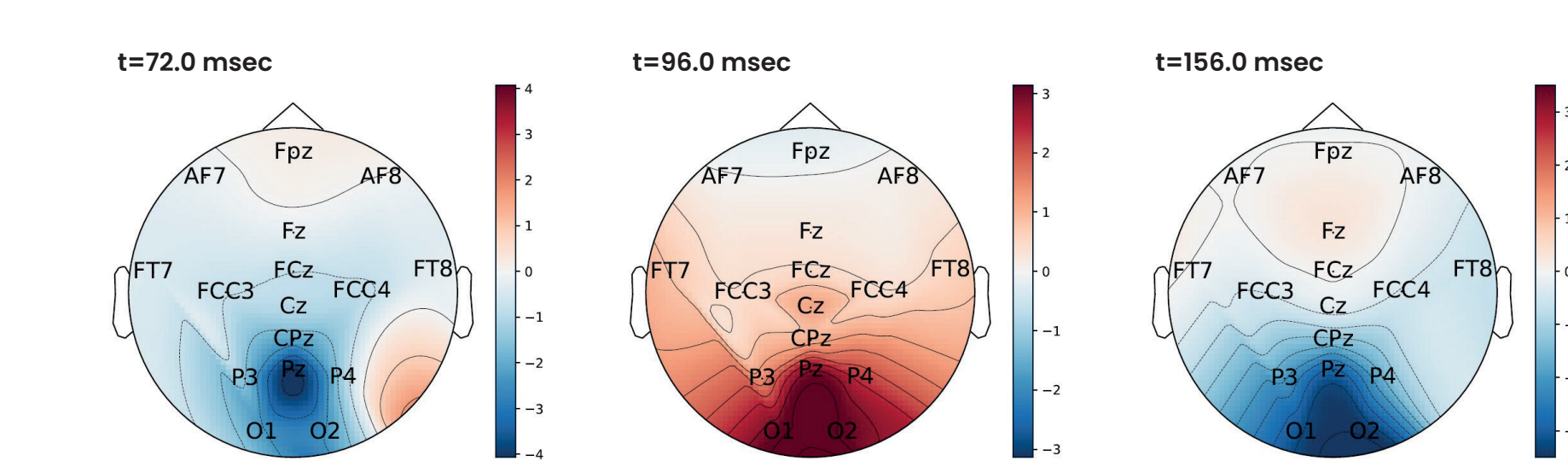
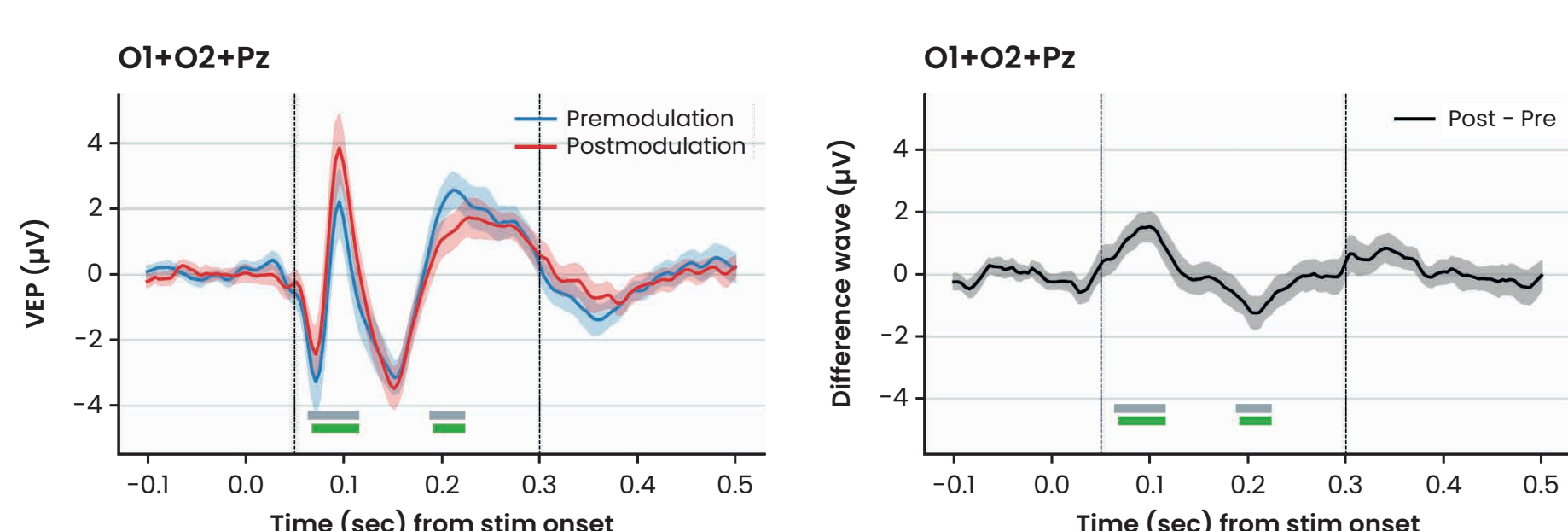
- 8 healthy adult male participants, in a controlled lab environment
- Two sessions, each 7 days apart, in counterbalanced order, presenting simple visual stimulus
- Grand average EP calculated across all sessions per system
- 100-wise Monte Carlo estimation of confidence intervals
- Matched processing: filtering 0.25–85Hz with notch at 50Hz



VEP amplitude and morphology: Highly similar across wet/dry systems, and across days. Barbey et al. (2020), AD/PD. Error bars 95% CIs.

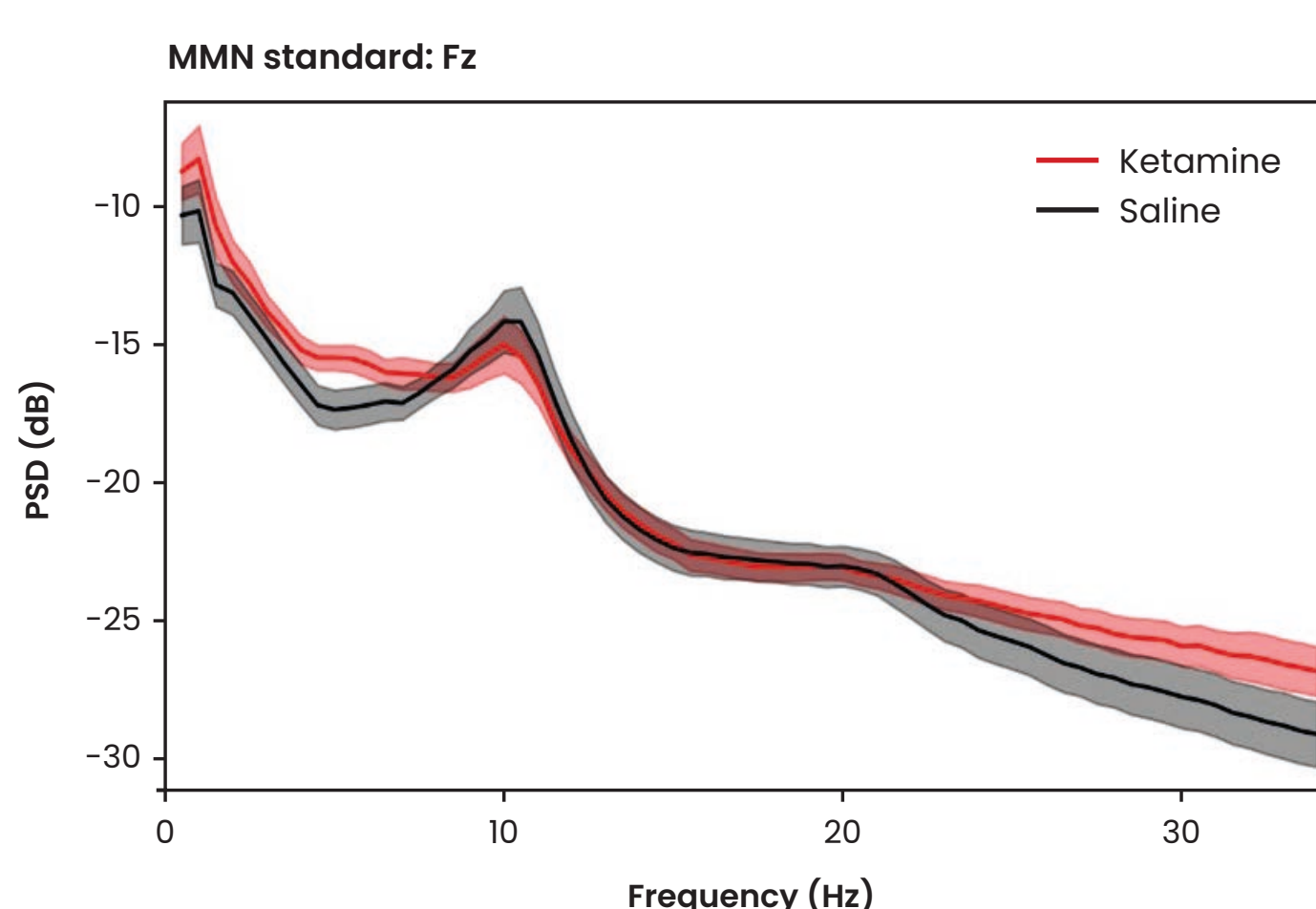
Non-invasive measurement of neuroplasticity

- Data from 11-minute in-clinic VEP-LTP task in off-drug baseline of 24-person phase 1a clinical trial for psychiatric indication.
- **Very robust group level neuroplasticity observed.** Topography and morphology of signals consistent with high-burden conventional task.

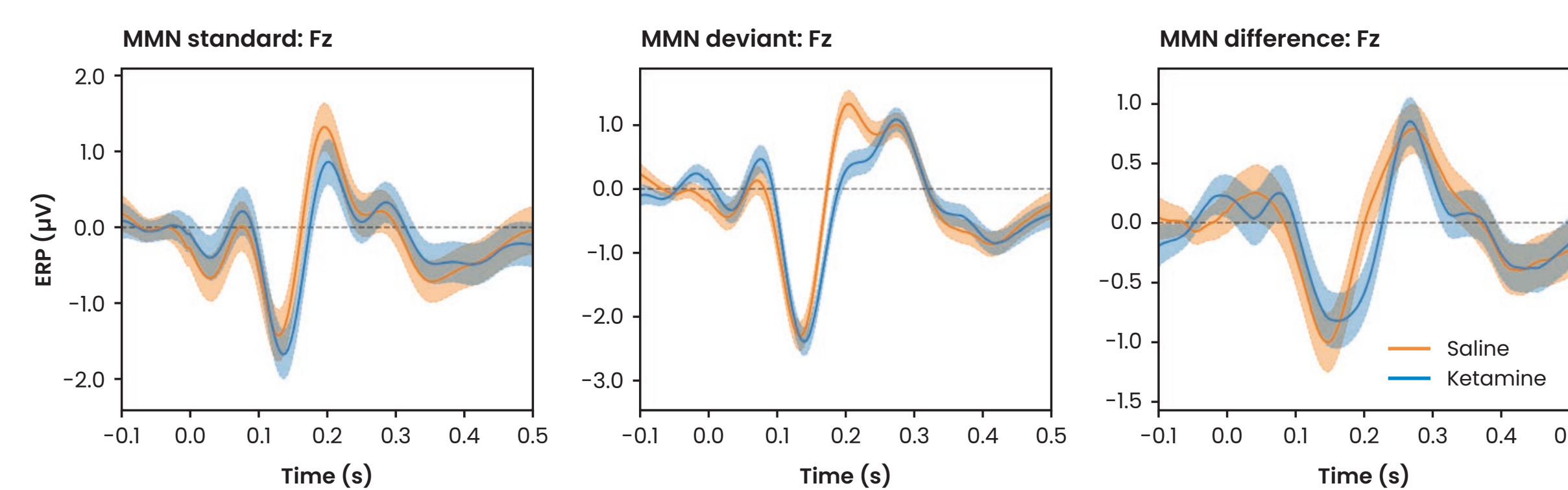


Detecting pharmacodynamics of ketamine infusion

- Double blind cross over design: racemic ketamine (0.5 mg/kg) vs. saline.
- 16-channel dry EEG Cumulus headset.
- EEG paradigms: 20-min eyes-closed resting state recordings, gamified 12-min visual Oddball, 7-min Flanker and 15-min MMN tasks.
- In-lab recordings: before, 1h-post and 24h-post infusions.
- Remote at home recordings for a week before and after infusions.

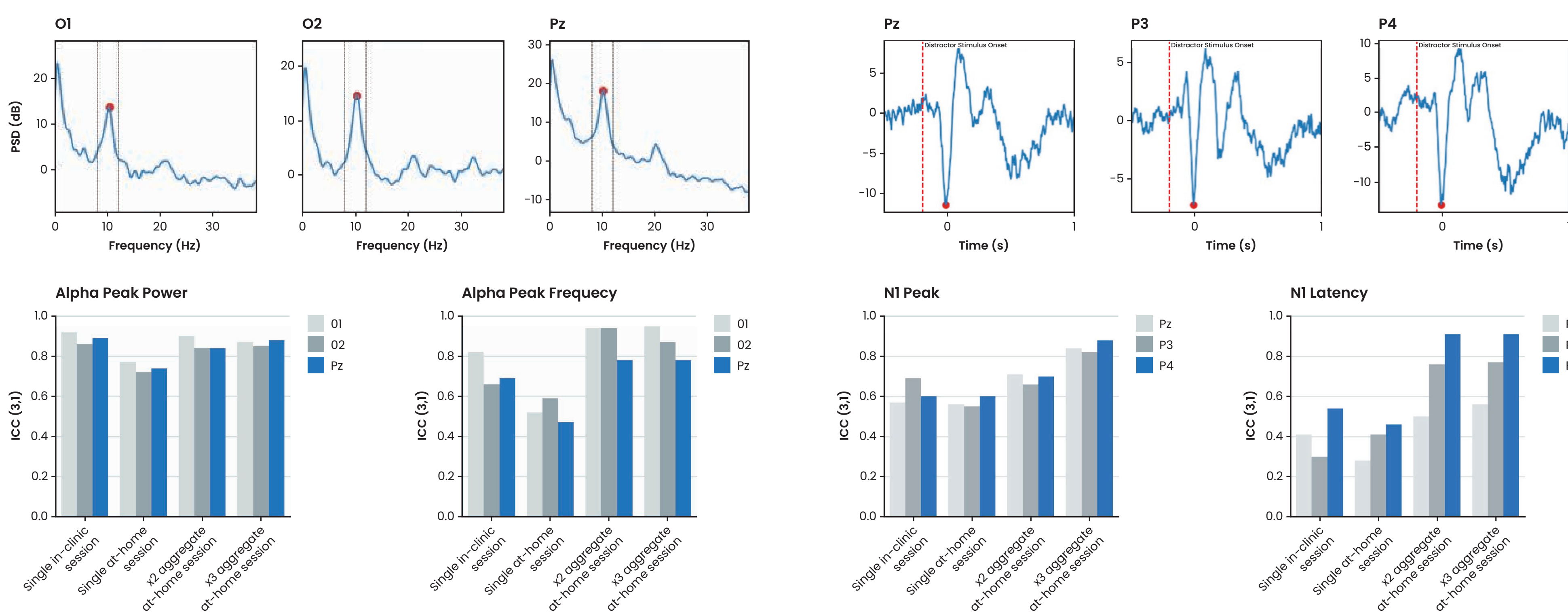


Eyes-closed qEEG changes seen during acute phase: disruption of alpha/beta activity, and enhancement of gamma activity.



Disruption of MMN: MMN peak is delayed and reduced in amplitude during ketamine infusion, reflecting NMDA receptor engagement.

How reliable are real-world EEG end-points (pre-ketamine)?



ICC for automatically extracted qEEG power and frequency measures, during a tablet-based resting task paradigm.

Dry-EEG headset designed for lab, home and hybrid trials

Case study 1: Timesaver in the lab

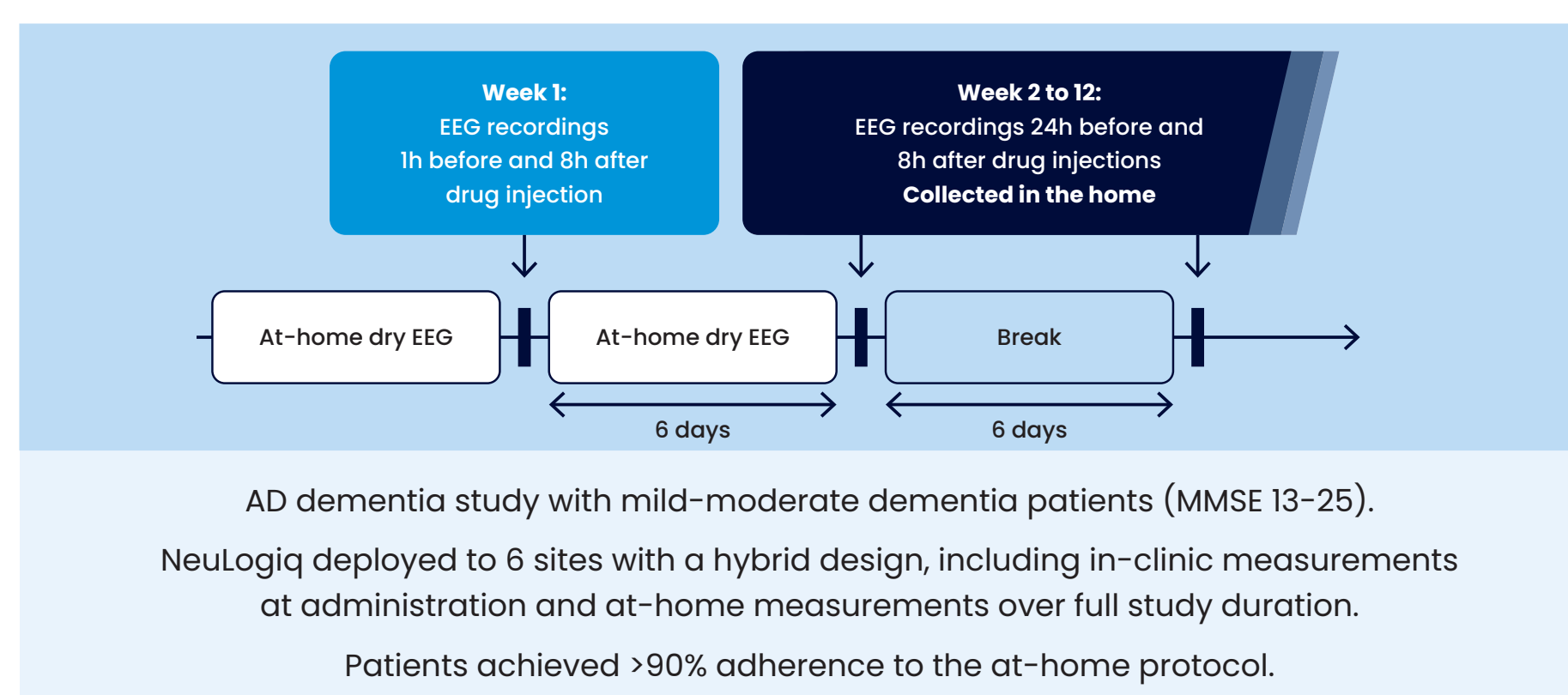
Comparison with traditional, wet-gel lab-based alternative



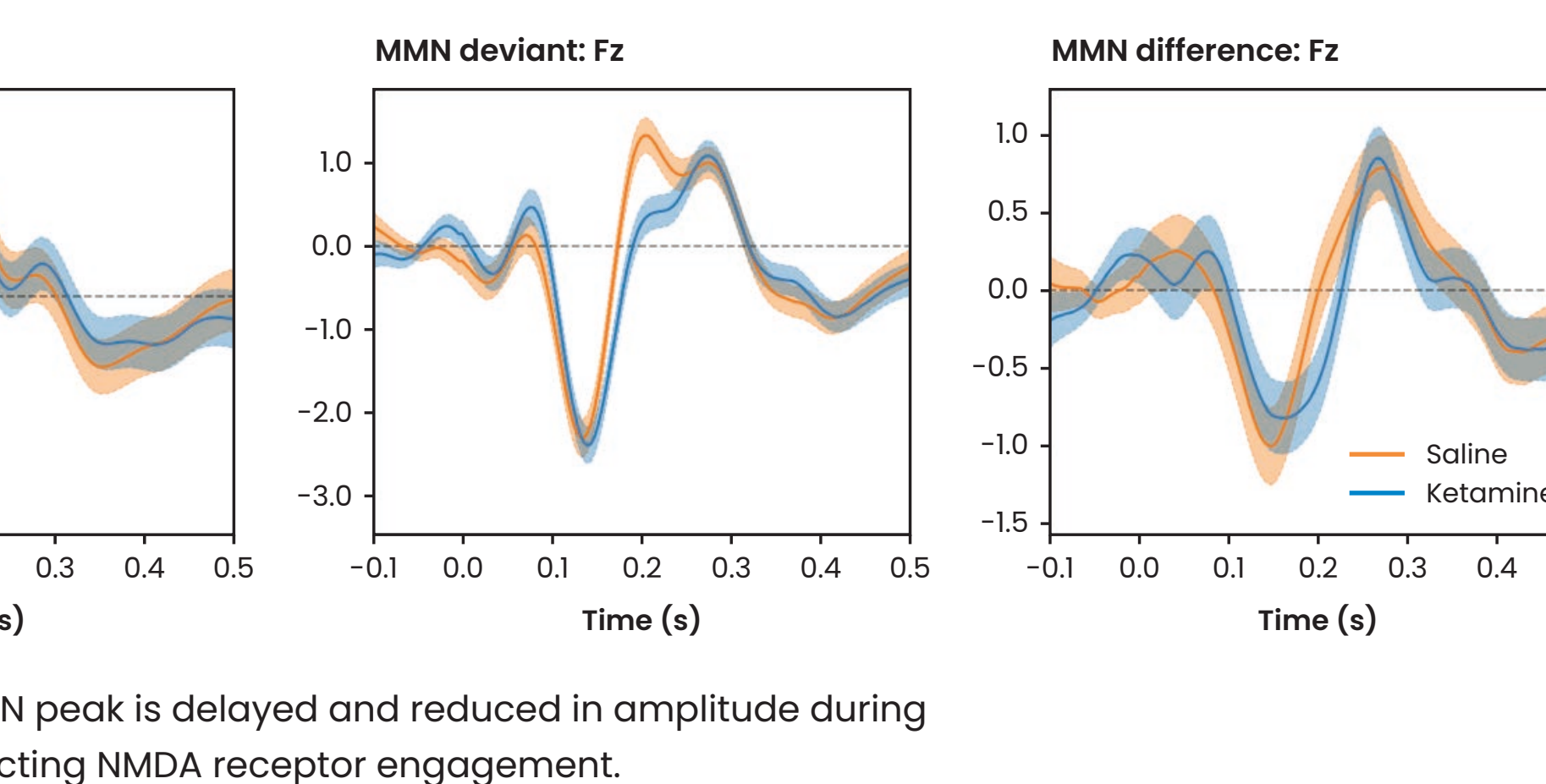
- | | |
|--|---|
| <ul style="list-style-type: none"> • <30 minutes for a typical EEG session (multi-domain, EEG and cognitive assessment) • Dry sensor design penetrates hair with no need for wet gel • Can be applied by non-technical users in low-support environments | <ul style="list-style-type: none"> • 90 minutes minimum session duration is typical • Hair washing required after each session • Requires staff who are expert EEG technicians |
|--|---|

Case study 2: Hybrid home and lab multisite deployment

Late addition to an ongoing trial in Australia, during Covid-19 pandemic



- AD dementia study with mild-moderate dementia patients (MMSE 13–25). NeuLogiq deployed to 6 sites with a hybrid design, including in-clinic measurements at administration and at-home measurements over full study duration. Patients achieved >90% adherence to the at-home protocol.
- Impact**
- Phase 1 inpatient clinical trial setting was made possible with acceptable user burden, **reducing conventional VEP-LTP paradigm time by ~75%**.
- Reported that use of Cumulus made it feasible to collect in **low-support environments**.
Milanovic et al., ECNP 2023



Significant improvement in EEG markers of brain function following drug infusion was found.
Barbey et al., CTAD 2023

Selected ongoing and upcoming Cumulus studies

- Biopharma-Academic BPD study (upcoming)**
 - Tolerability and utility of digital biomarkers outside the clinic
 - Measuring inherent variability vs controls
- Biopharma AD Phase 2 (ongoing)**
 - Digital biomarkers of cognition to assess treatment response
 - Frequent at-home measurement of cognition
- Biopharma MDD Phase 1 (ongoing)**
 - Digital cognitive and EEG biomarkers of target engagement and response
 - Tracking change over several days
- Academic ADHD study (ongoing)**
 - EEG metrics of ADHD adolescent response to methylphenidate treatment
 - Frequent at-home measurement



View this poster online