

External Validation of Fatigue Monitoring Technologies

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Fatigue Monitoring Technologies

- **Eye & Face Behavior**
- **EEG state classification & event detection**
- **Steering & Throttle Behavior**
- **Heart Rate Variability**
- **Skin Conductance**

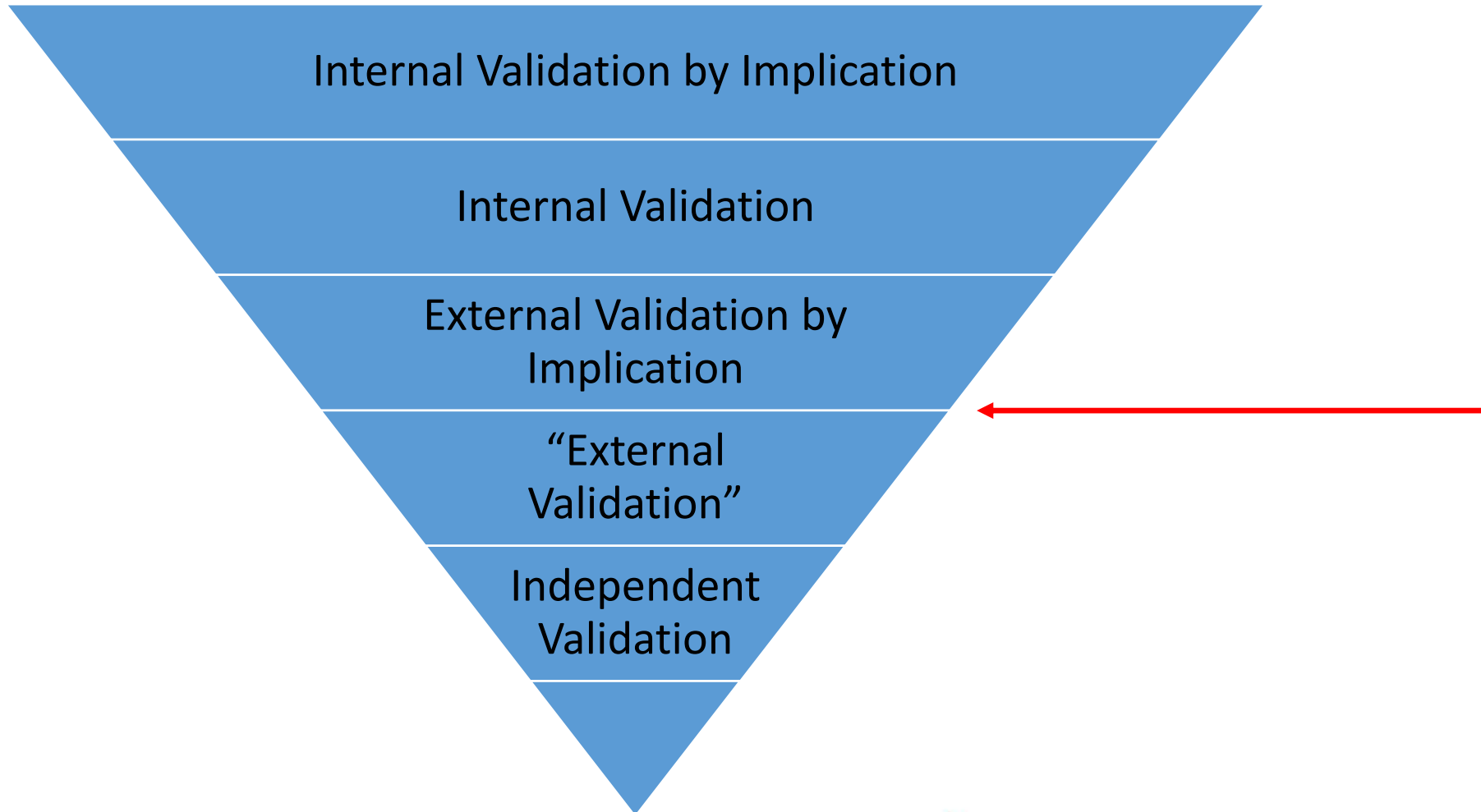


The (not so) curious buyer....

- **Accuracy** – Does it work?
- **Acceptance** – Does the workforce buy in to the initiative?
- **Data** – Do we have a fatigue problem?
- **Results** – Does we see it helping?
- **We're Different** – Does it work with our equipment/site?



The validation space



Some ideals for data-based validation

- **Time-independent** – does not use local time within algorithm
- **History-independent** – all measures are independent of previous measures
- **Quantity-ignorant** – algorithm ignorant of relative interpretations
- **Verified inputs** – input measures have been verified as whole and accurate



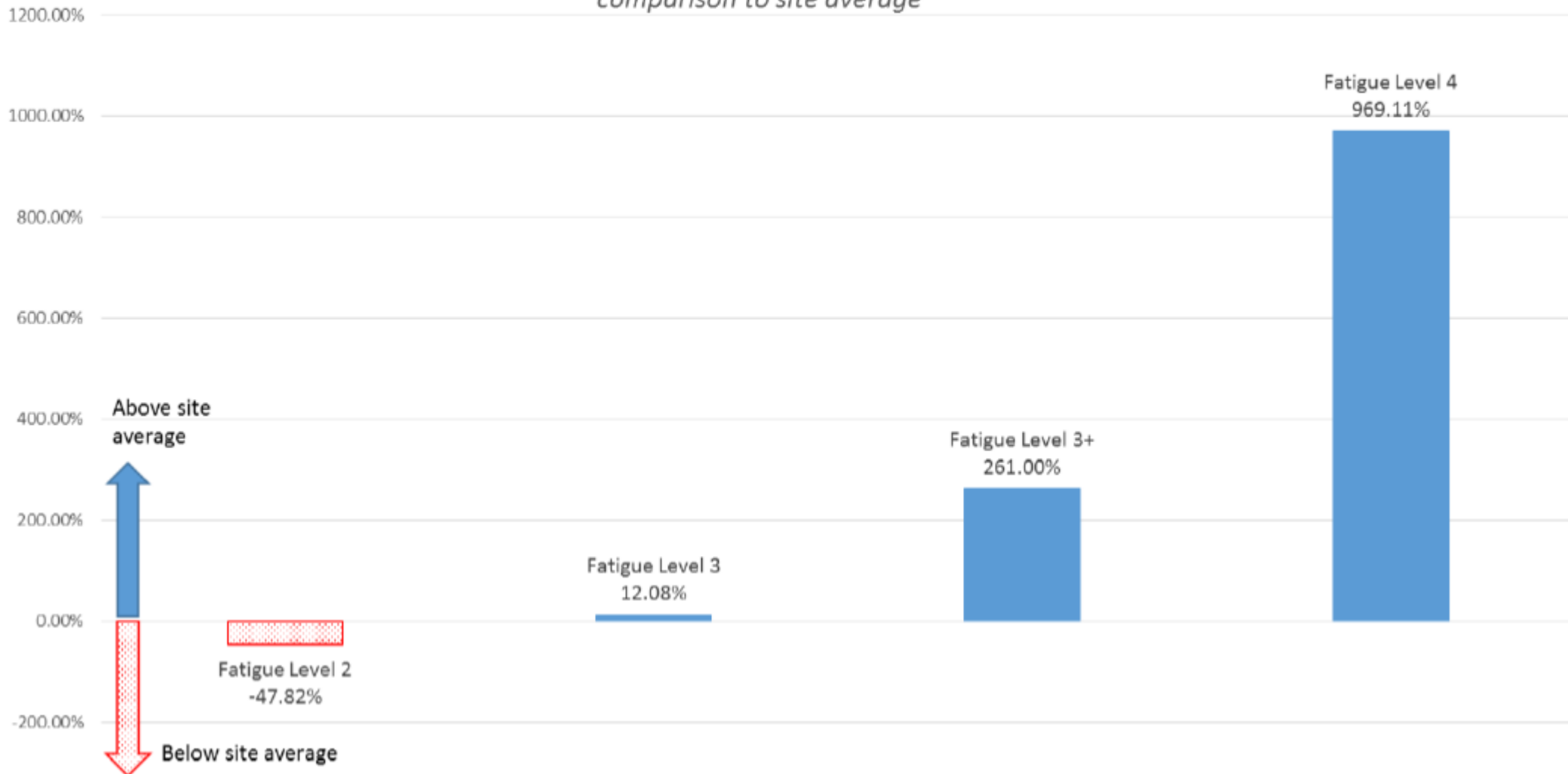
Hypotheses

- **Meaningful circadian variance** – How can we test the meaningfulness?
- **Stimulus response** – An external stimulus results in an increase in alertness
- **Interpretable skew** – Relative alarm rates are associated with an equivalent relative skew in fatigue scores
- **Shift roster variance** – Fatigue scores across roster show interpretable repeatability
- **Alarm / Level correlation** – Periods of greater alarm rates are correlated with periods of higher fatigue scores

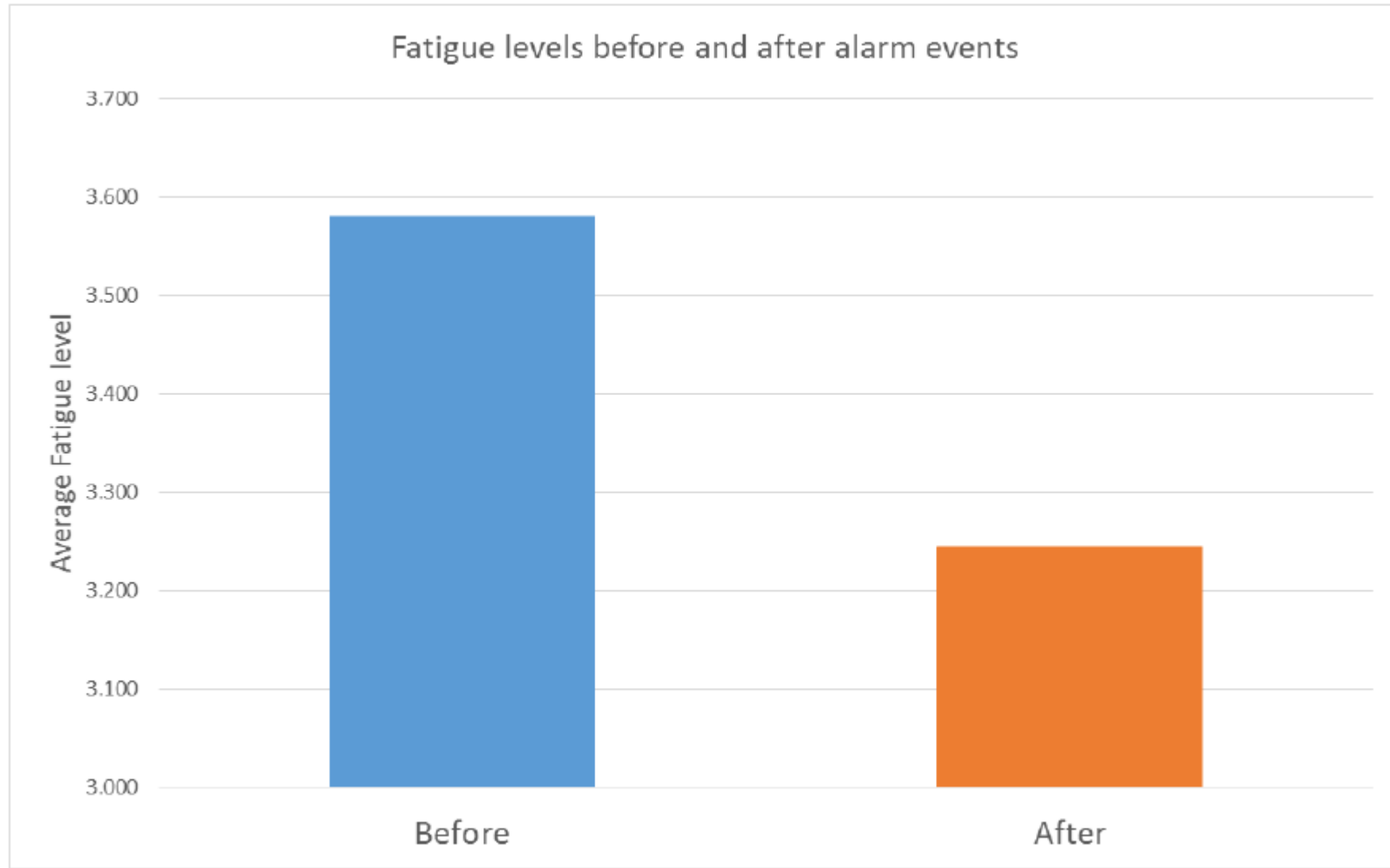


Relative skew test

Fatigue Level Distribution
comparison to site average

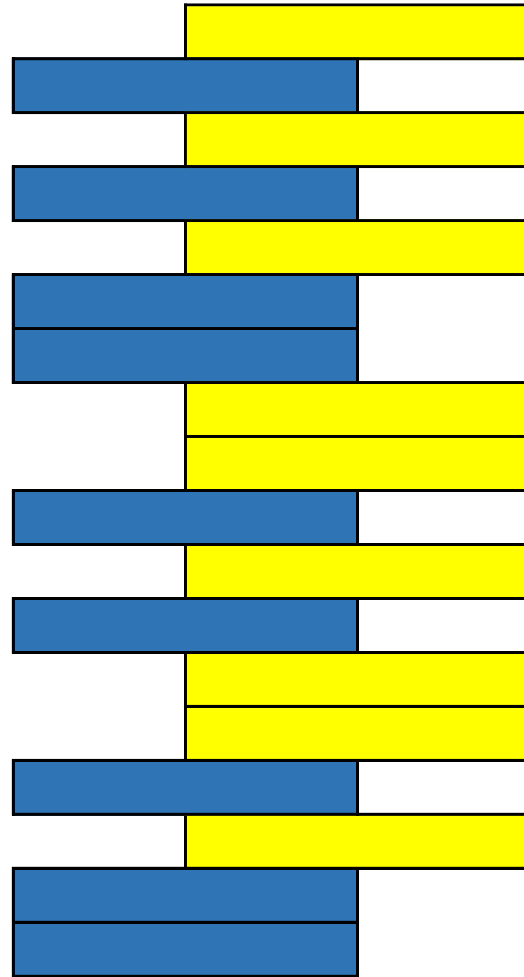


Stimulus response test



Data splicing

Original



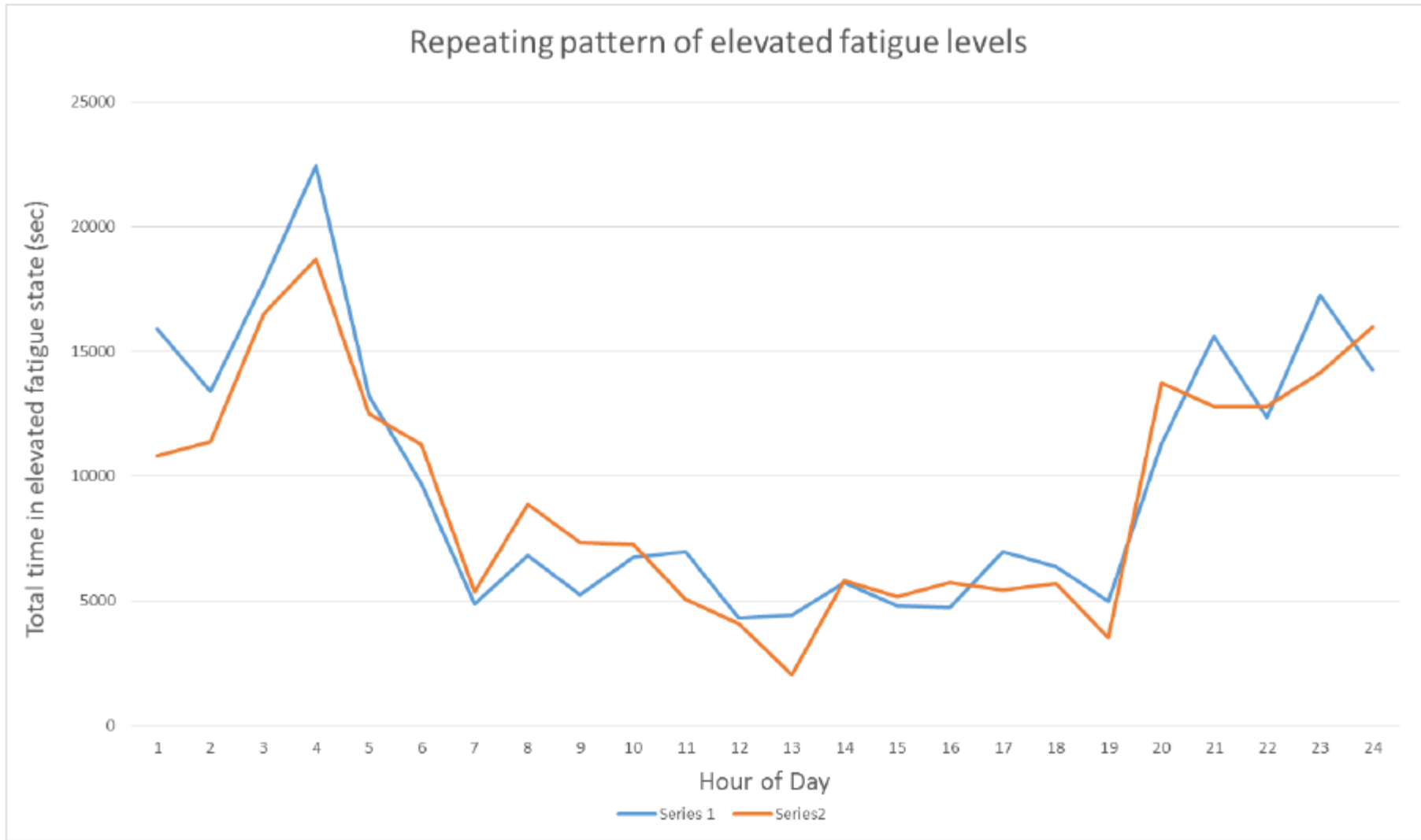
Dataset A



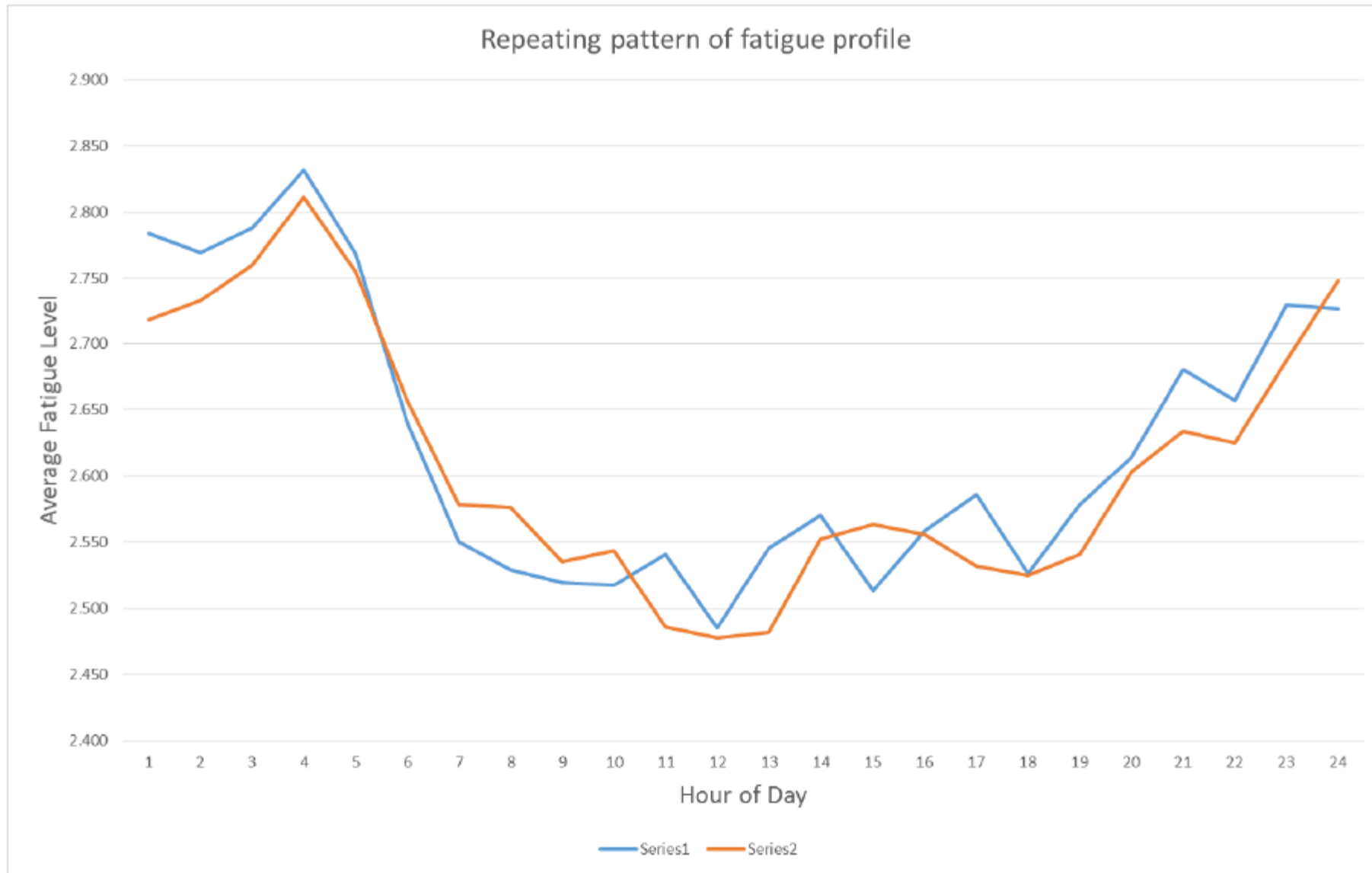
Dataset B



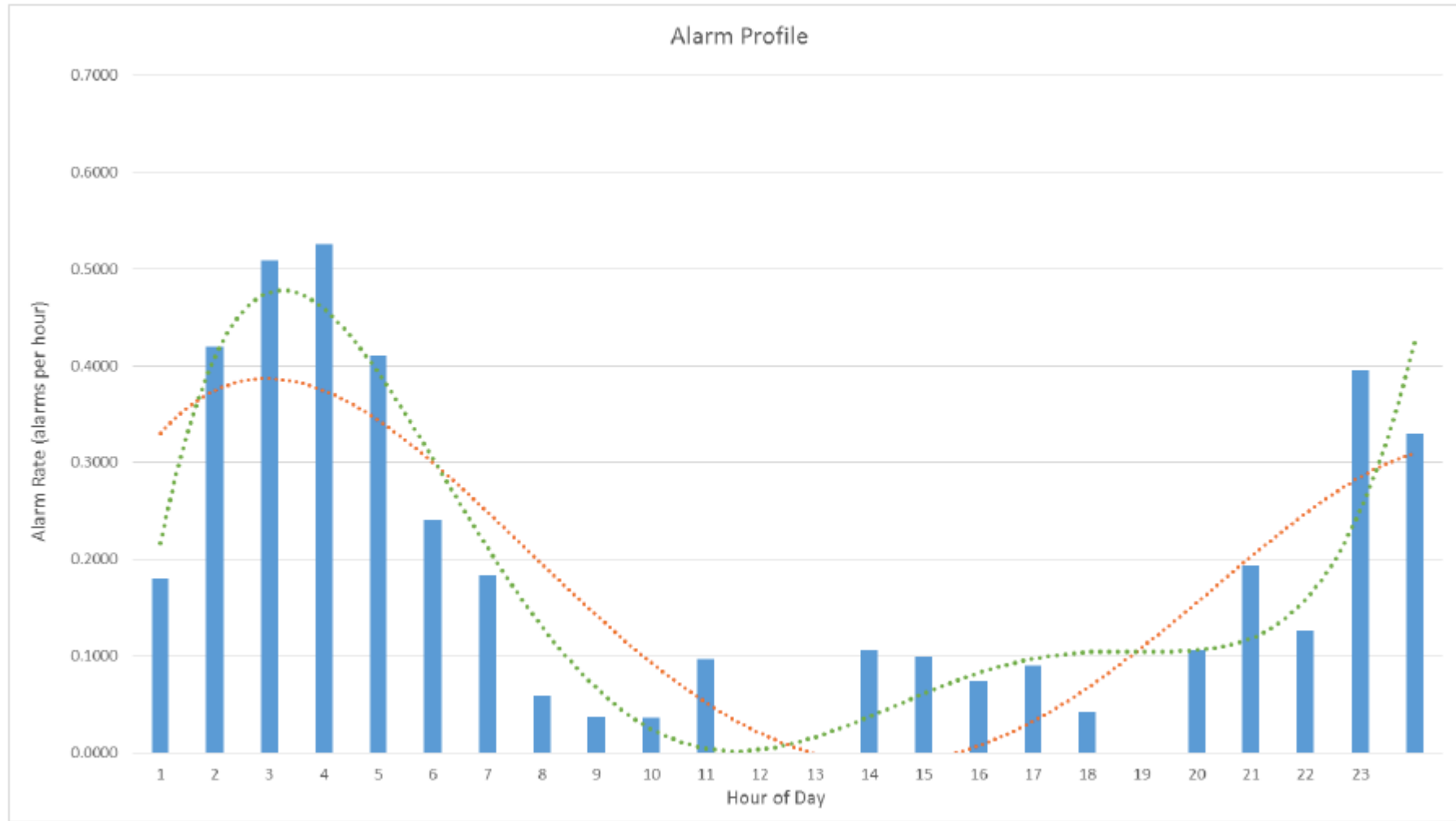
Repeatability of circadian variance test



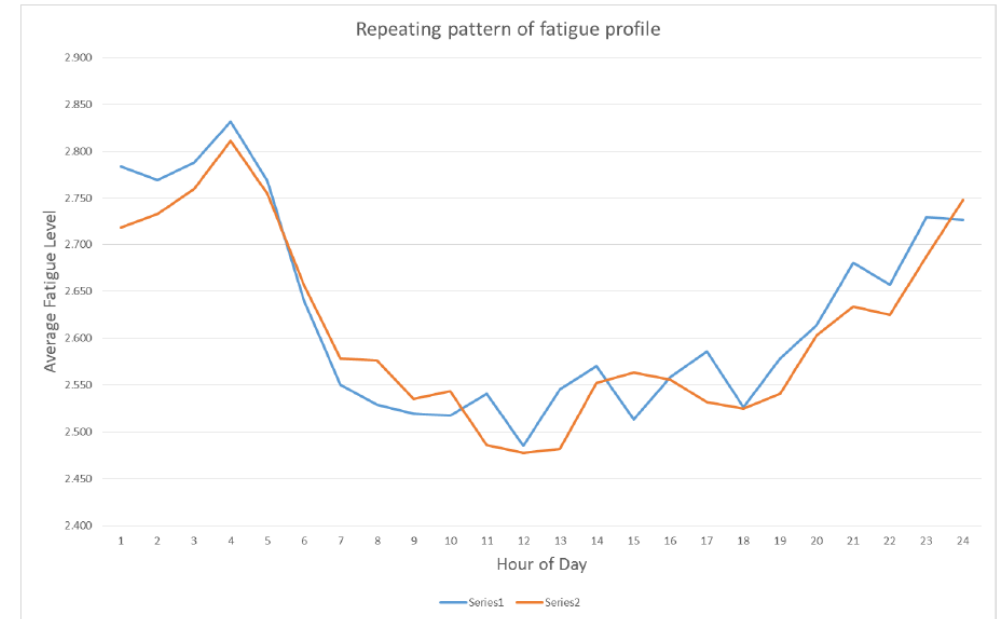
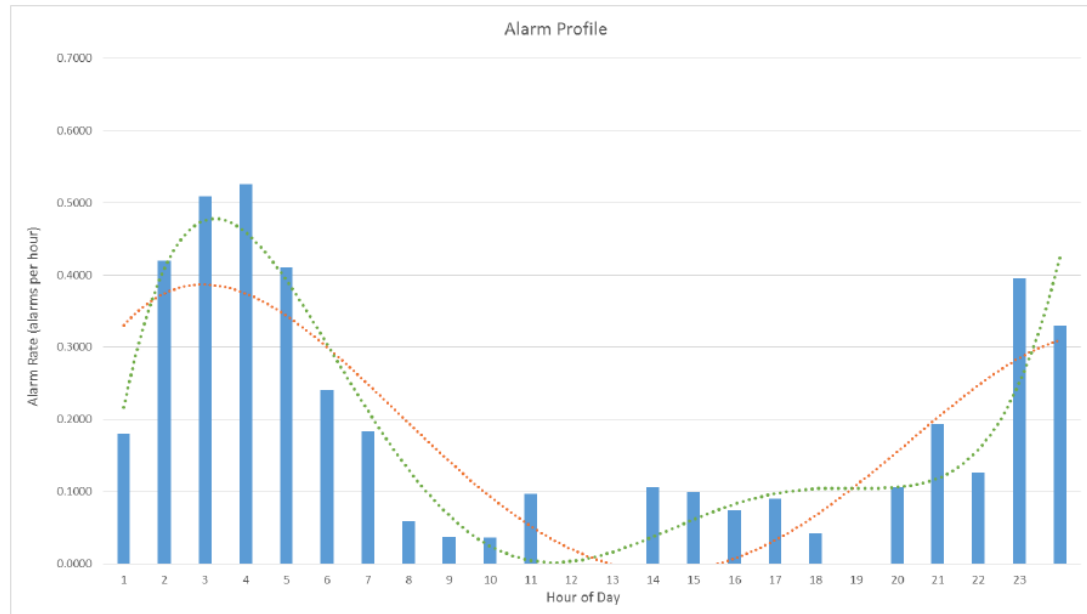
Repeatability of circadian variance test



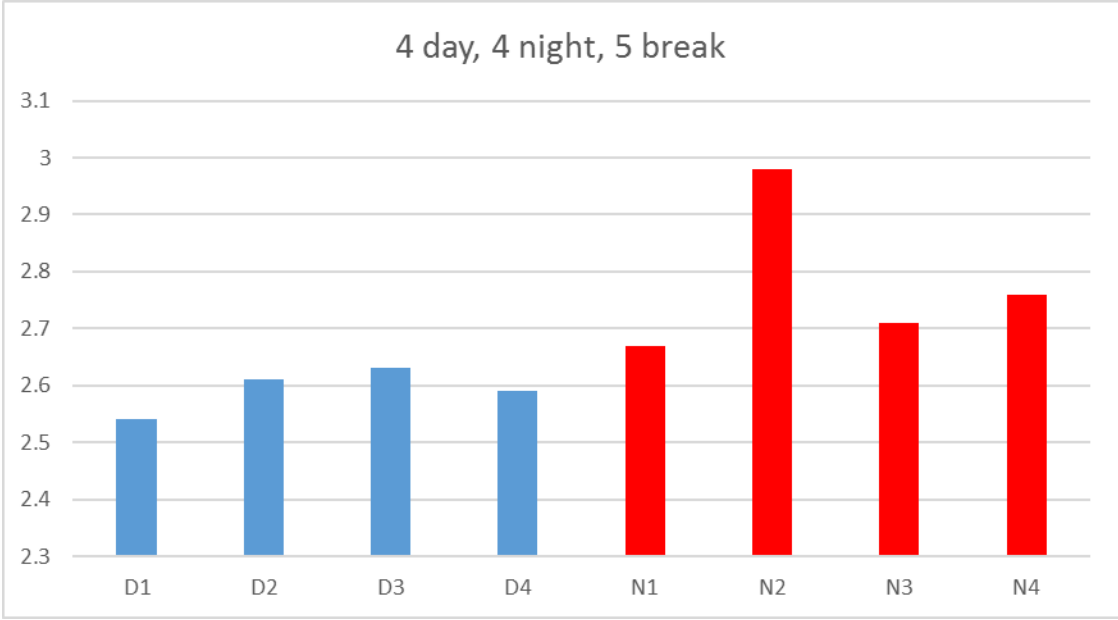
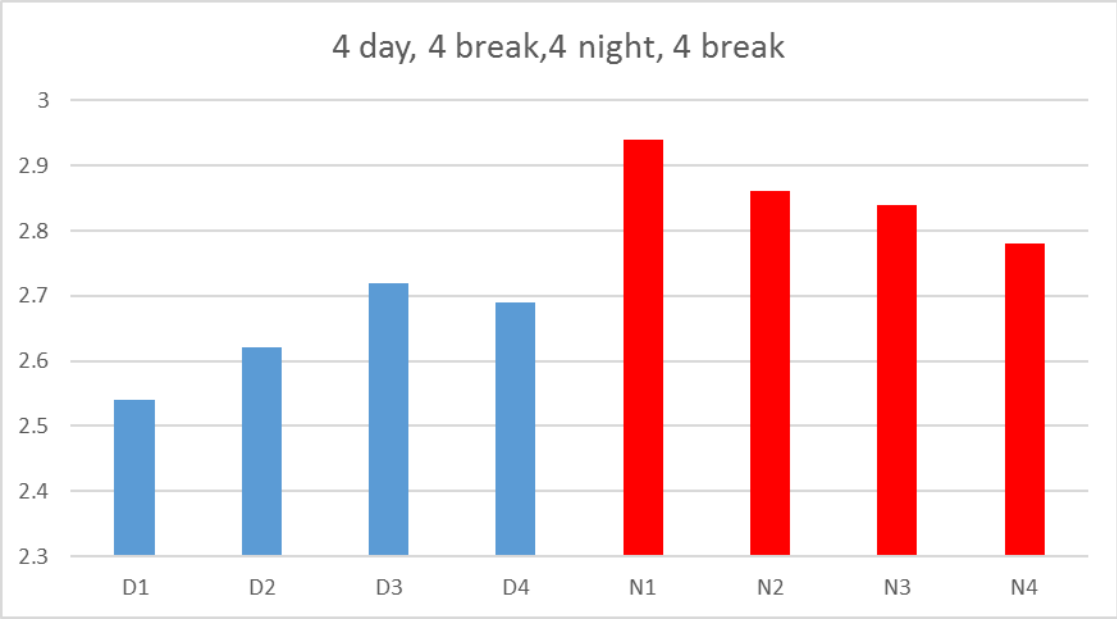
Alarm / Level correlation test



Alarm / Level correlation test



Shift patterns



Concluding remarks

- Data-based external validation is plausible
- Simple, **preliminary step** to experimental validation
- Can be modified to test “does it work for me”?
- Provides **quantifiable** test for prospective users

