

Dissecting the processing of color vision in the primary visual cortex (V1) at the center-of-gaze

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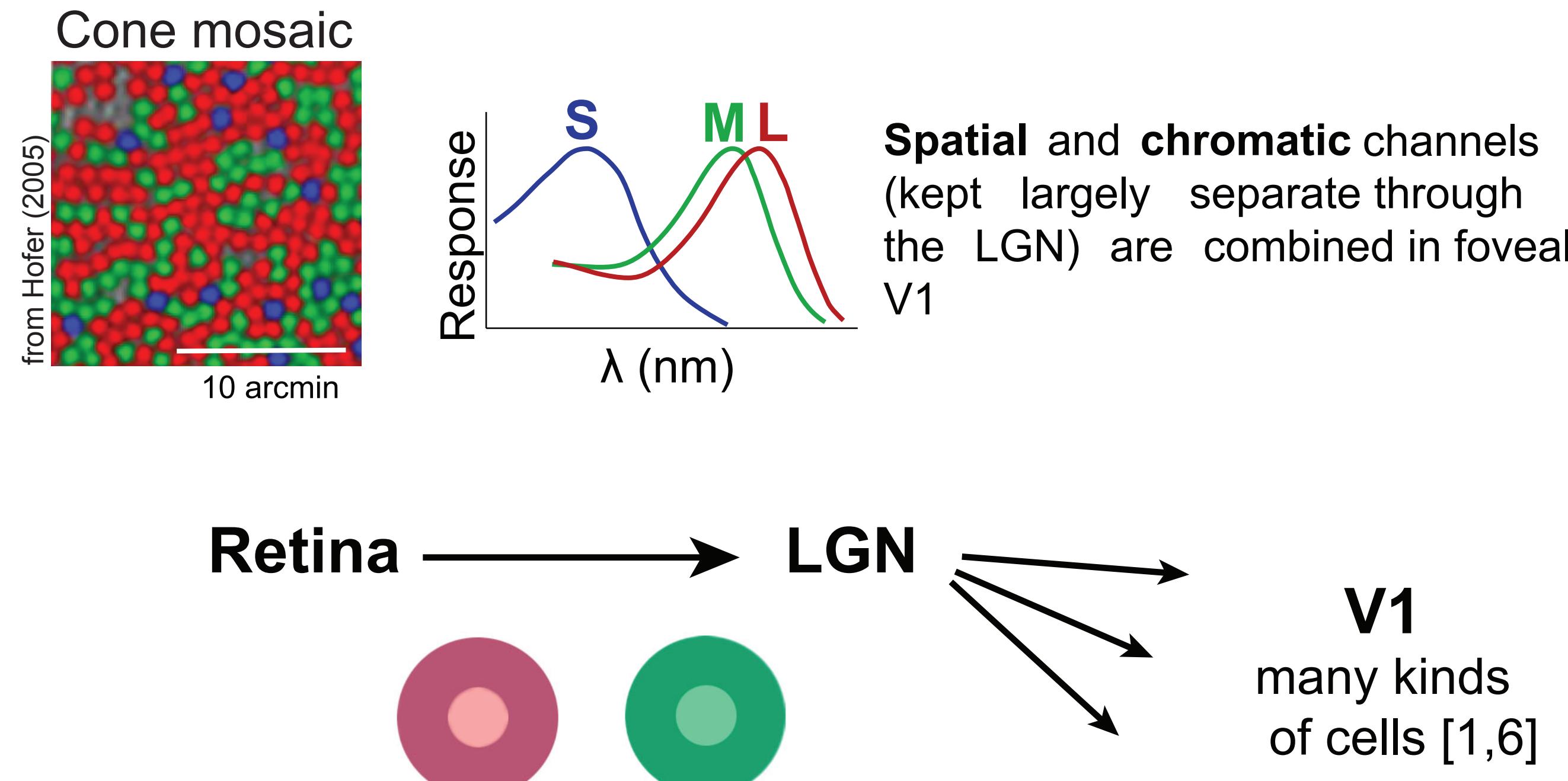
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Background

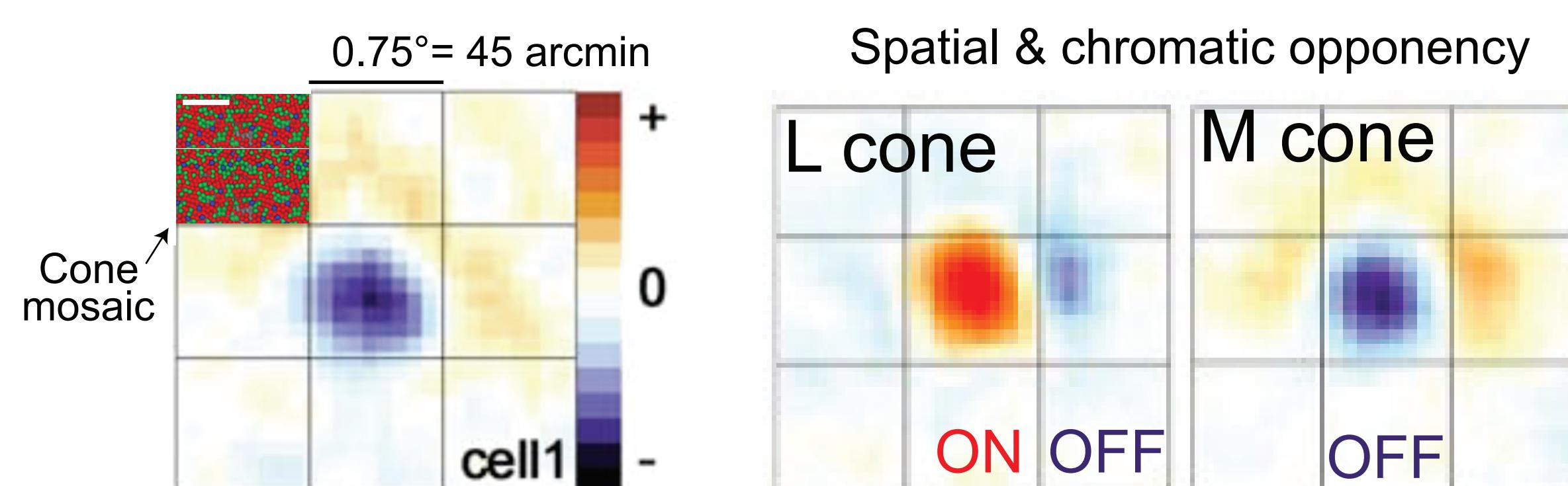
How does the cortex process high-acuity vision?

High-acuity occurs in the **fovea**, within the center 1° of visual angle. Perception is at cone resolution (1 arcmin or 1/60°). Pre-cortical circuitry is at this resolution.



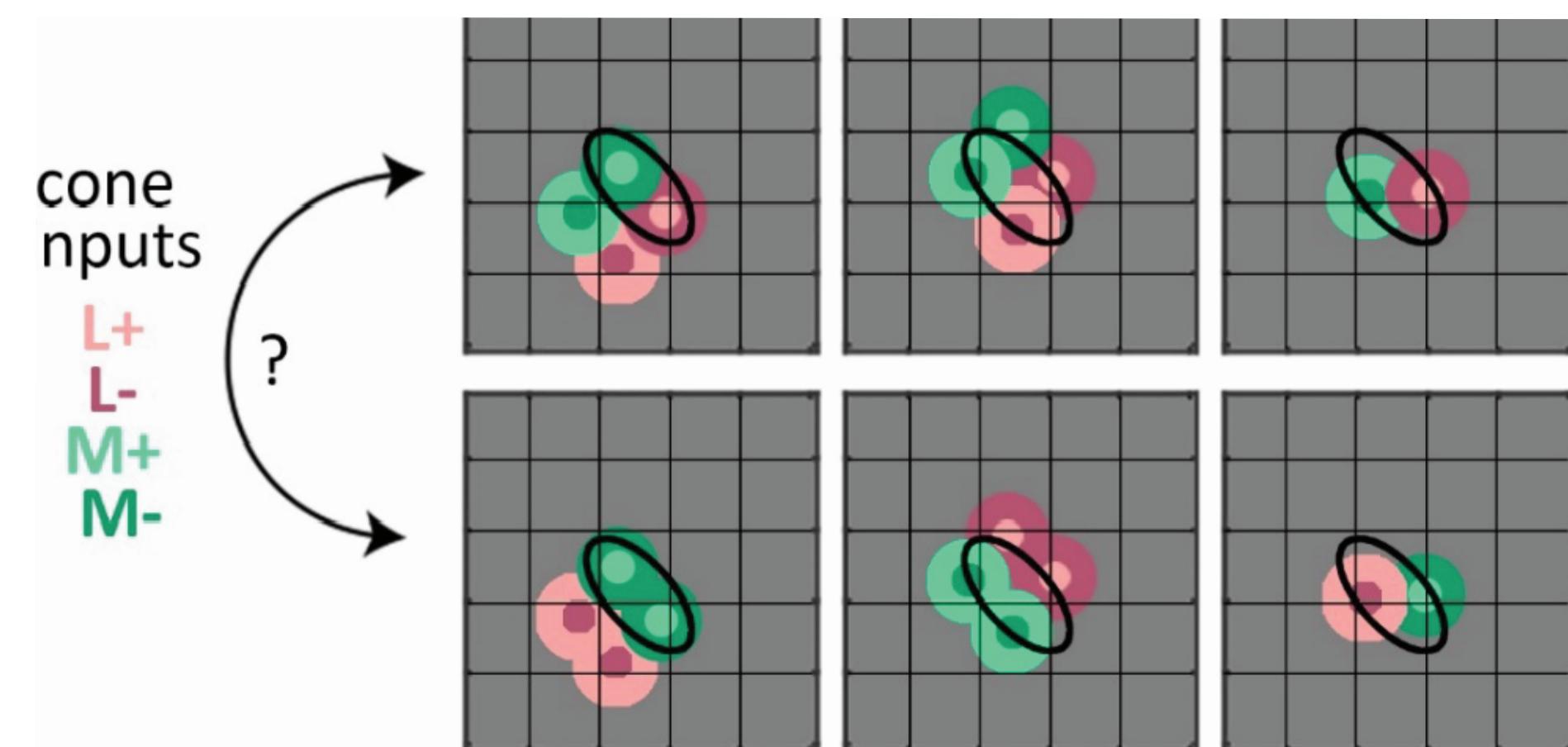
Foveal V1 is all but unstudied

V1 neurons are typically studied in parafovea (>2°) and higher to avoid problems with knowing the true eye position, which must be at ~arcmin resolution for fovea V1.

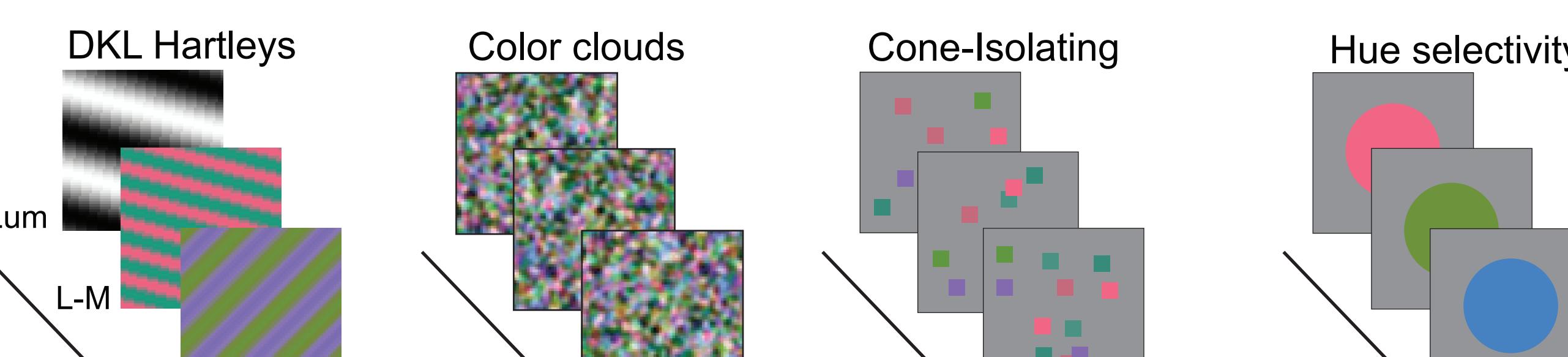
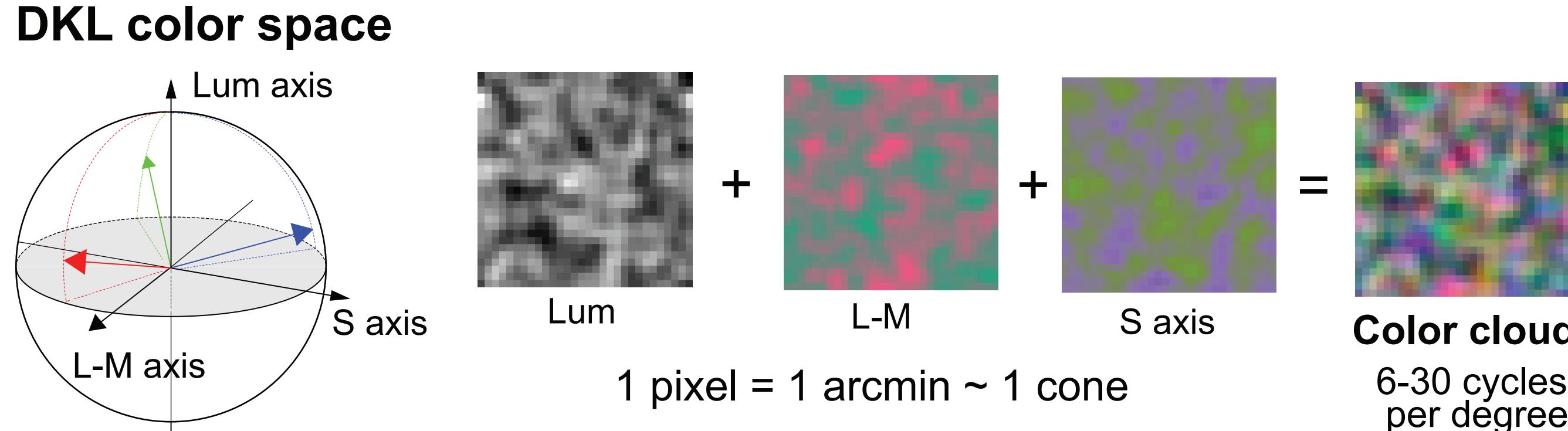


How is spatial and chromatic information combined in foveal V1?

V1 neurons are typically nonlinear, and mixing of spatial and chromatic information will only be clear with nonlinear models.

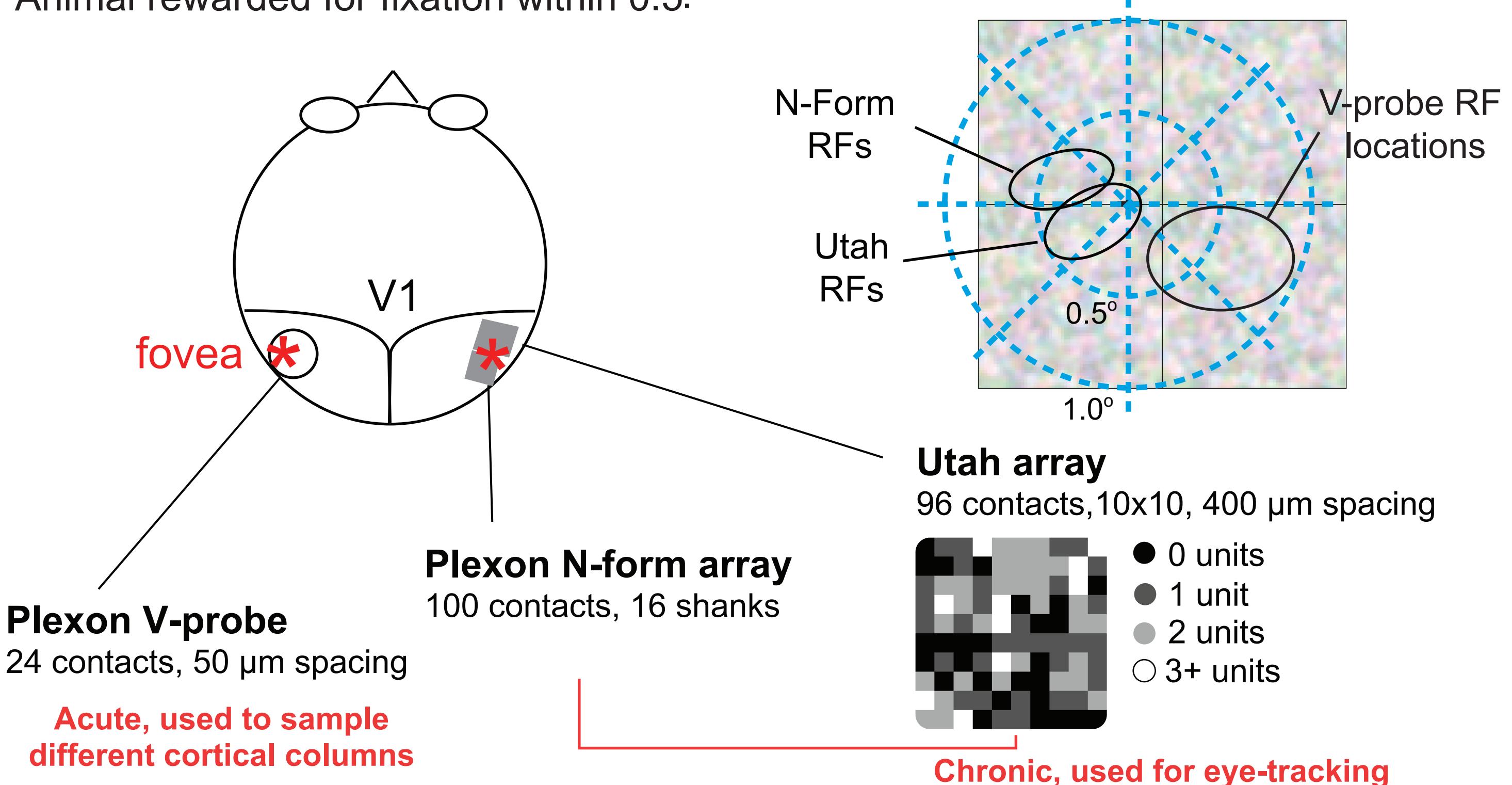


Spatio-chromatic stimuli



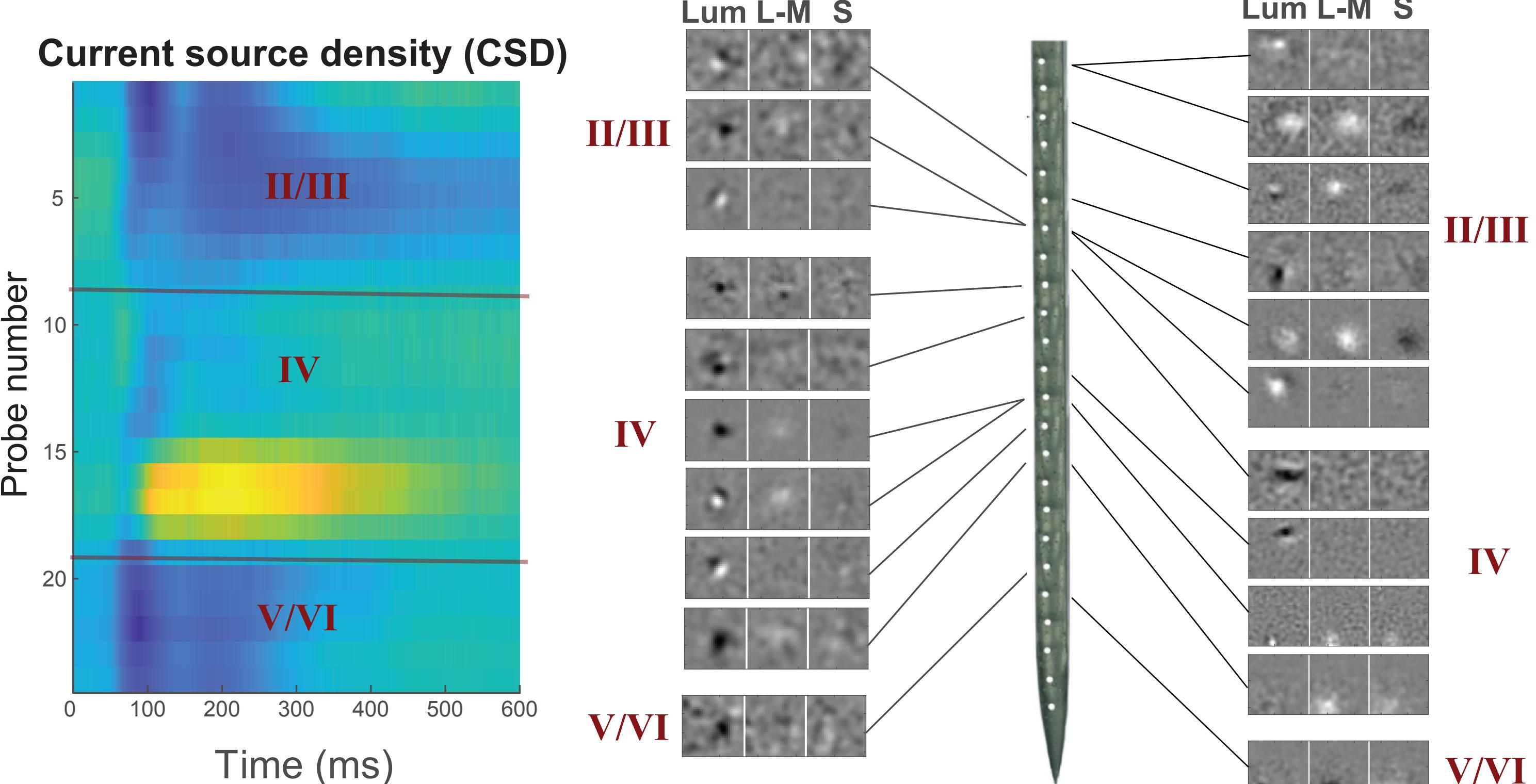
Large-scale recordings from foveal V1

Recording using 3 multielectrode arrays.
Animal rewarded for fixation within 0.5°.



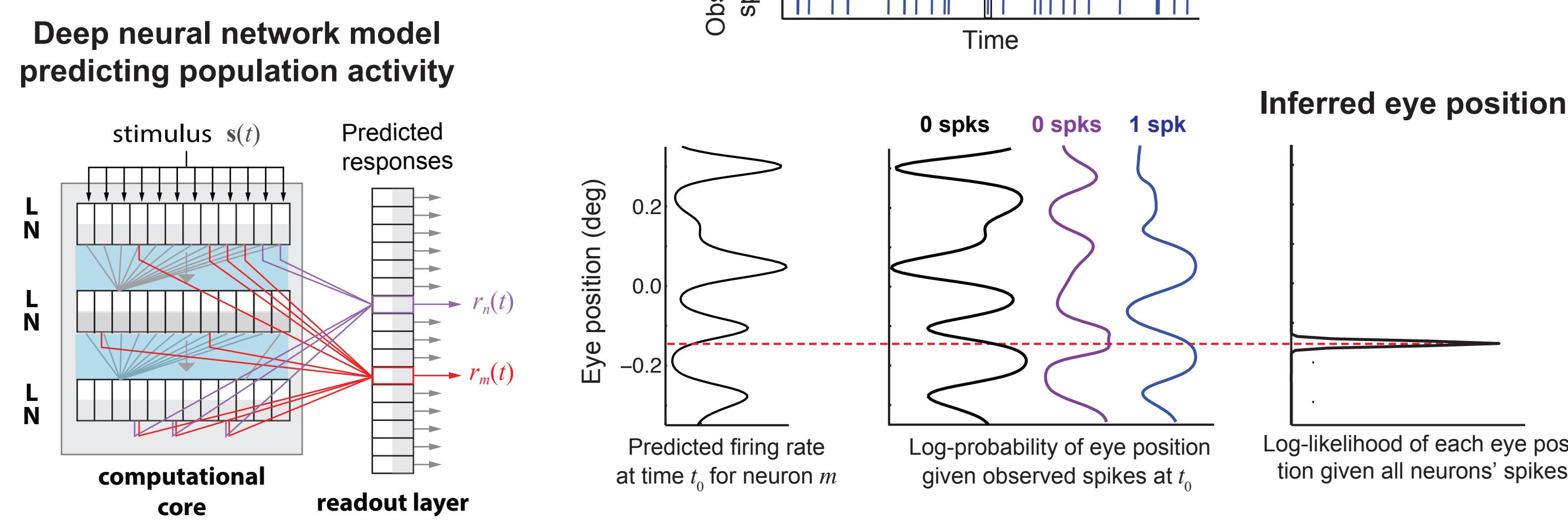
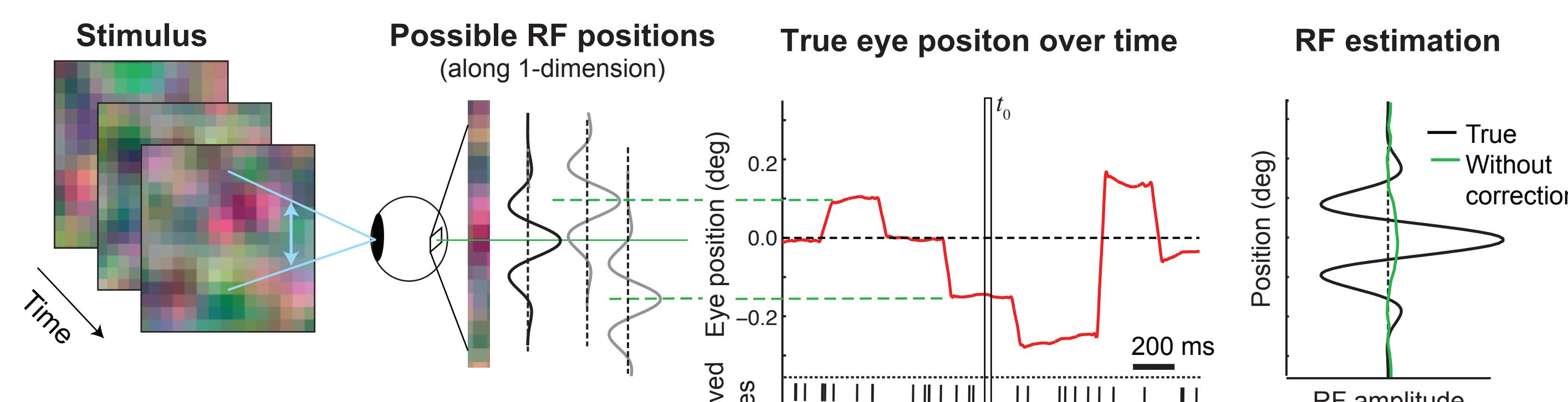
Computation across the cortical column

We sample a different cortical column with the V-probe in each experiment, and can use population models to understand how spatio-chromatic selectivity is constructed across the cortical column.

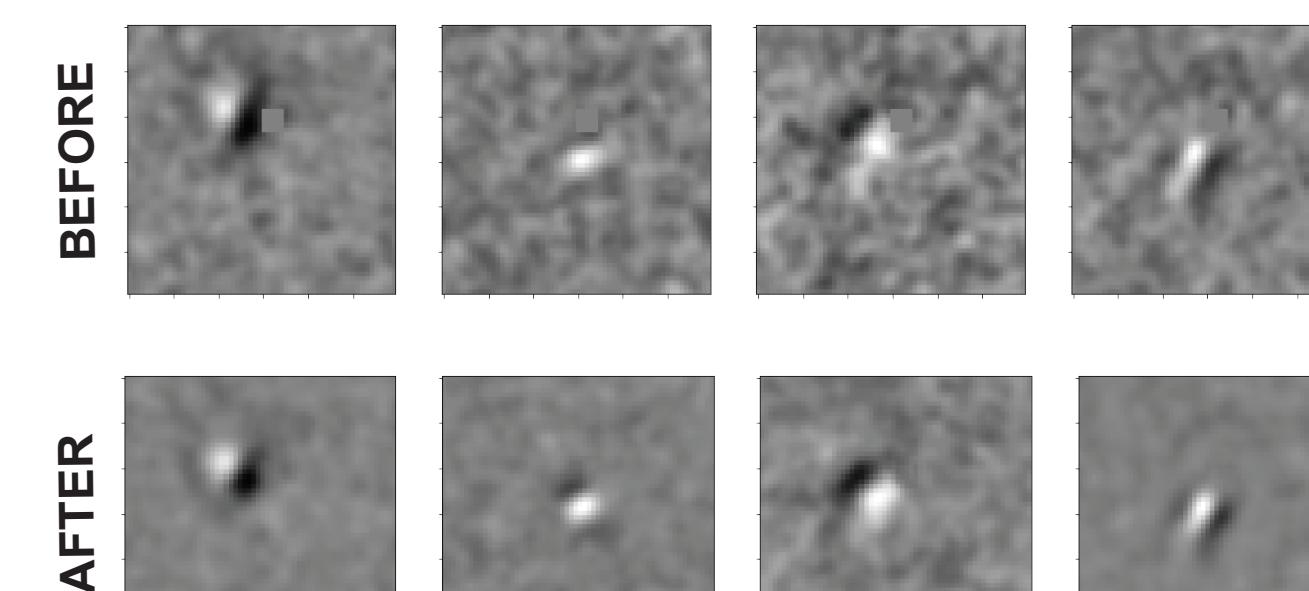


Model-based eye tracking

To infer the eye-position precisely, we use the population activity of foveal V1 neurons [4] combined with deep neural network models of each neuron.

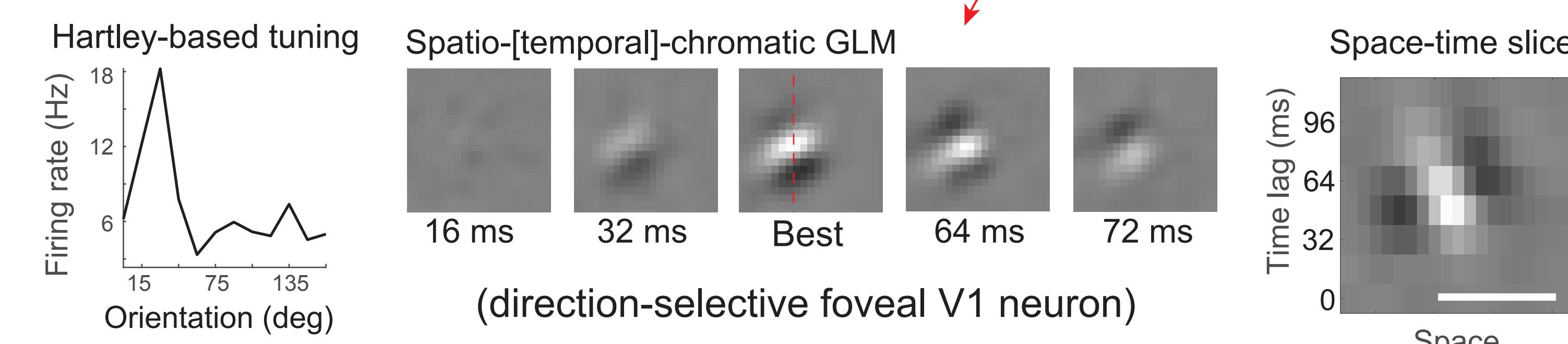
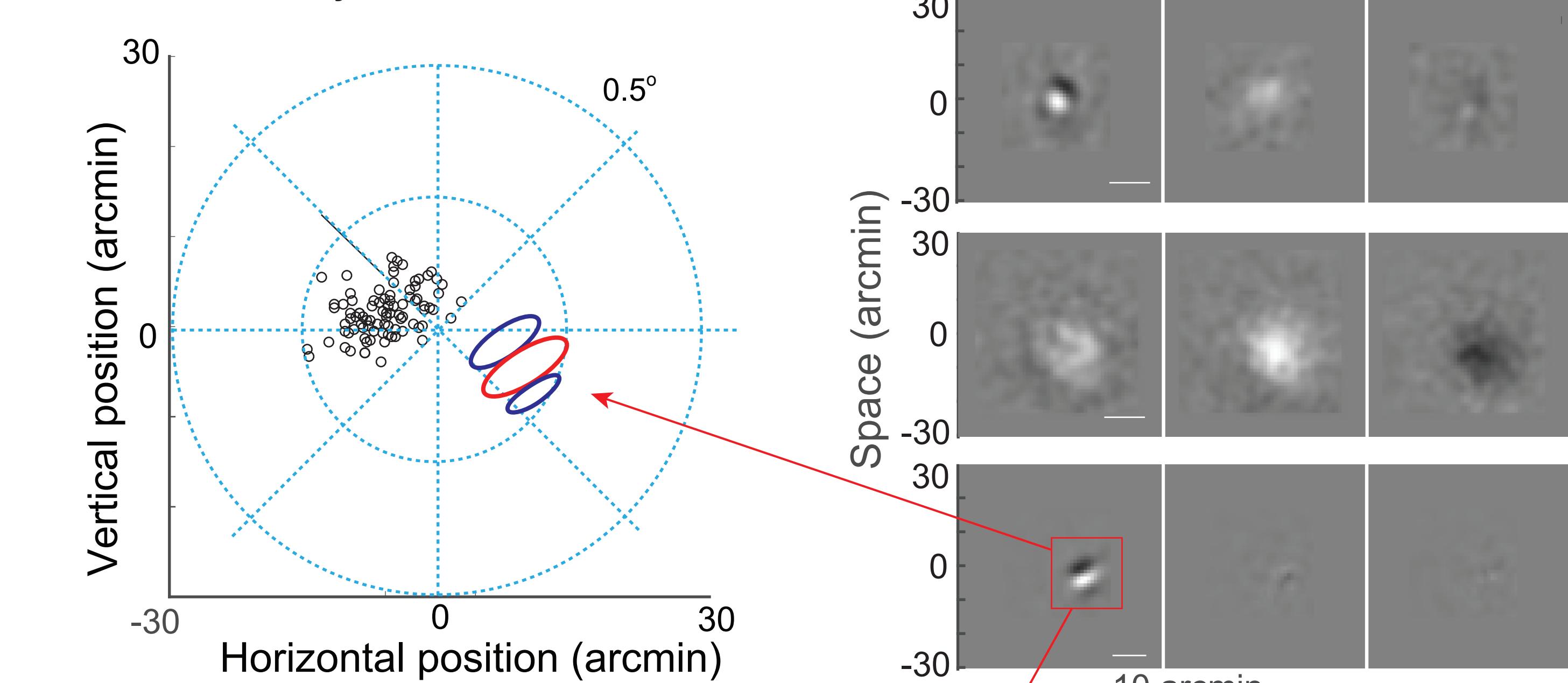


STAs before and after ET correction

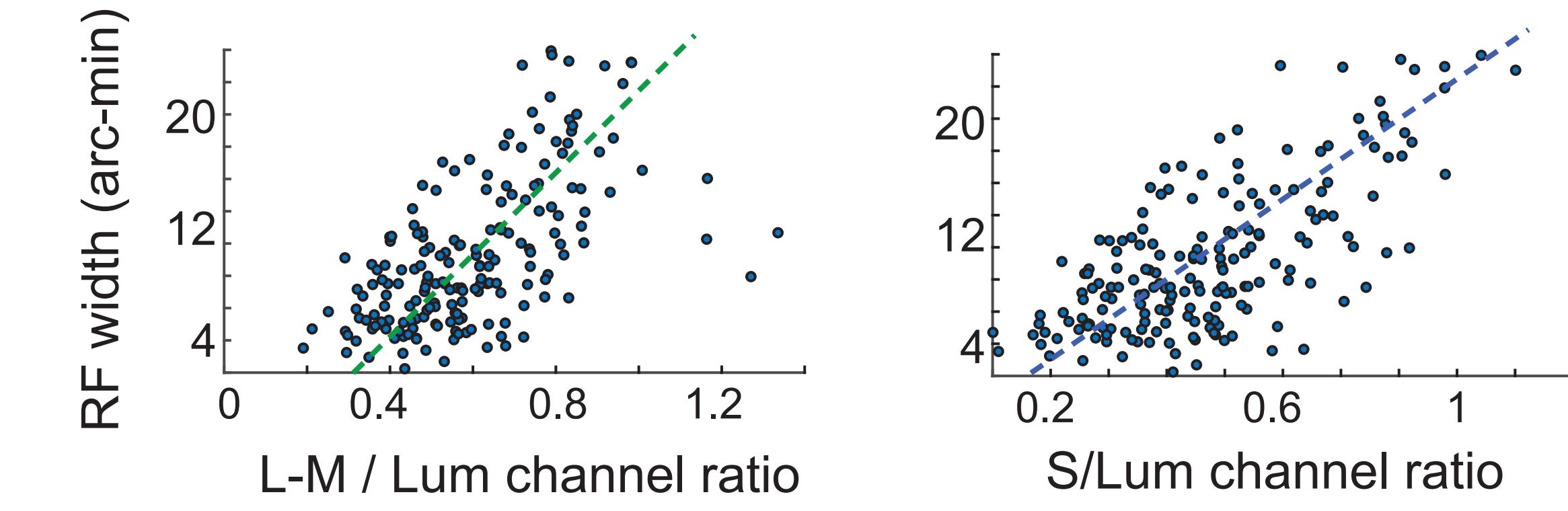


Spatio-chromatic selectivity in foveal V1

Utah array RF center locations

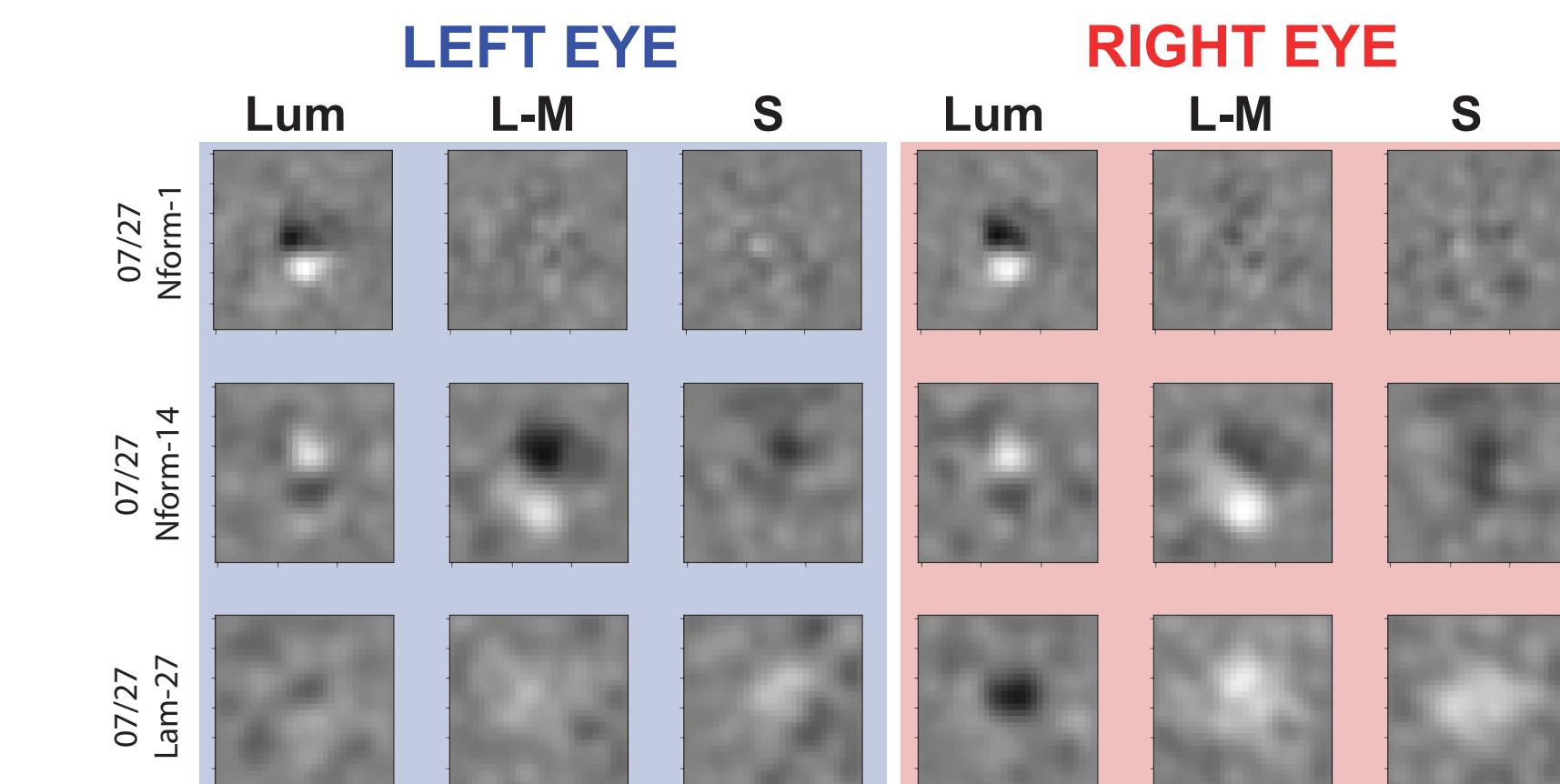


Relationship between color selectivity and RF size in fovea



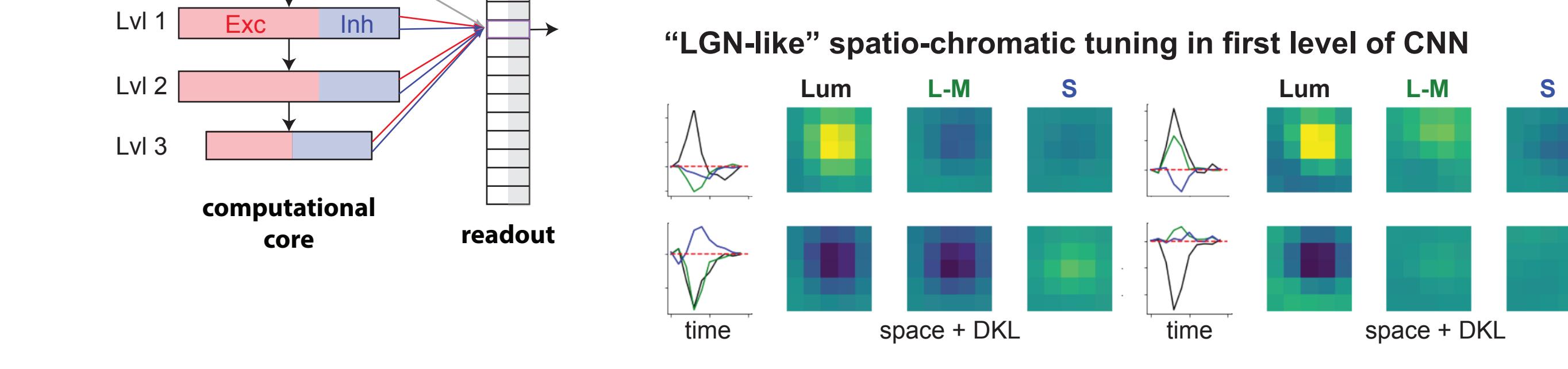
Other preliminary analyses

Binocular GLMs can isolate each eye's S-C selectivity



Deep neural networks to trace the construction of S-C selectivity across (different) cortical columns

Different deep neural network structures can be explored to best explain selectivity across multiple datasets and be interpretable: for example isolate LGN-like first stages and determine how they are combined.



References

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