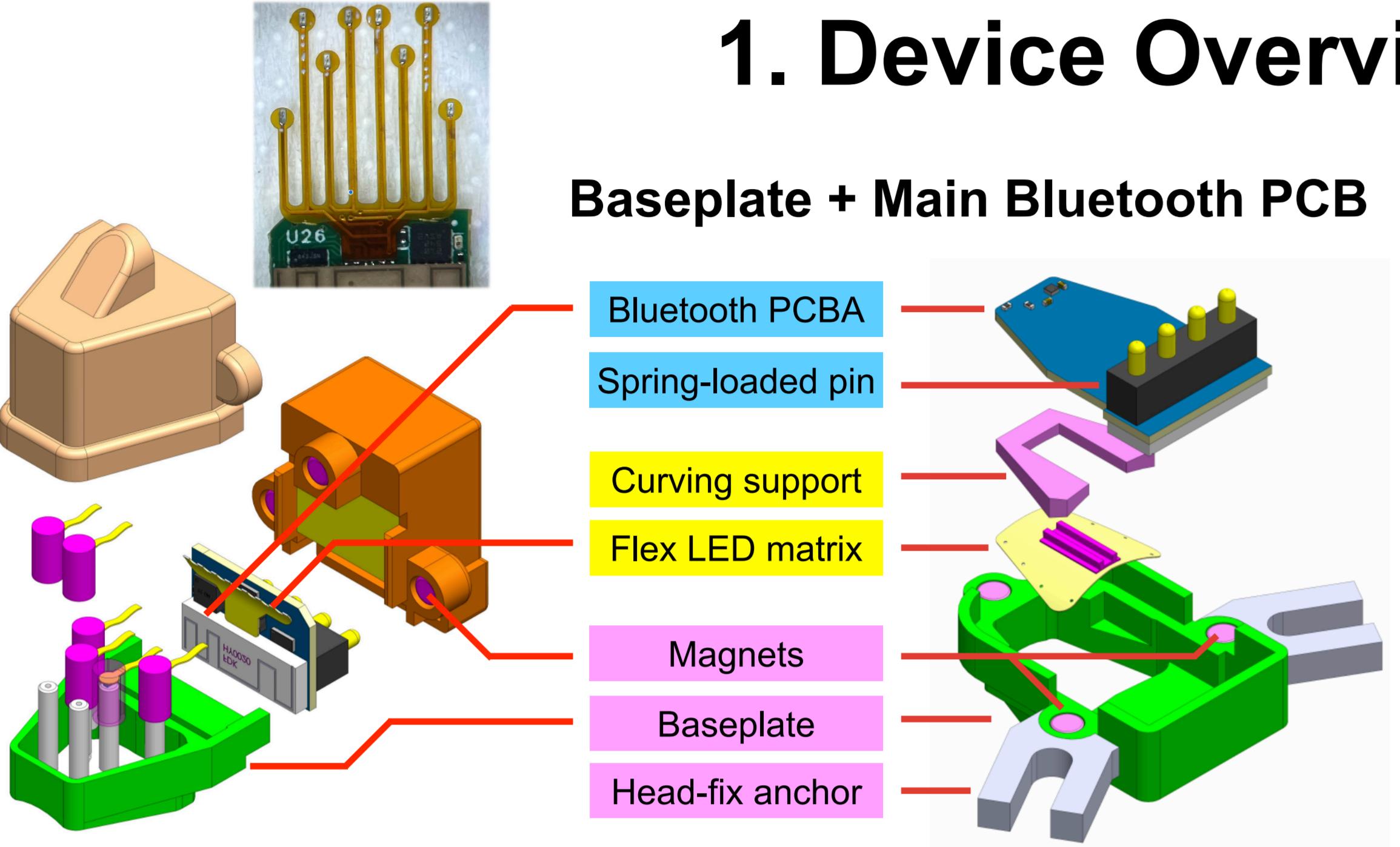


Low-cost open-source wireless random-access opto-stimulation

PSTR422.04 / XX10

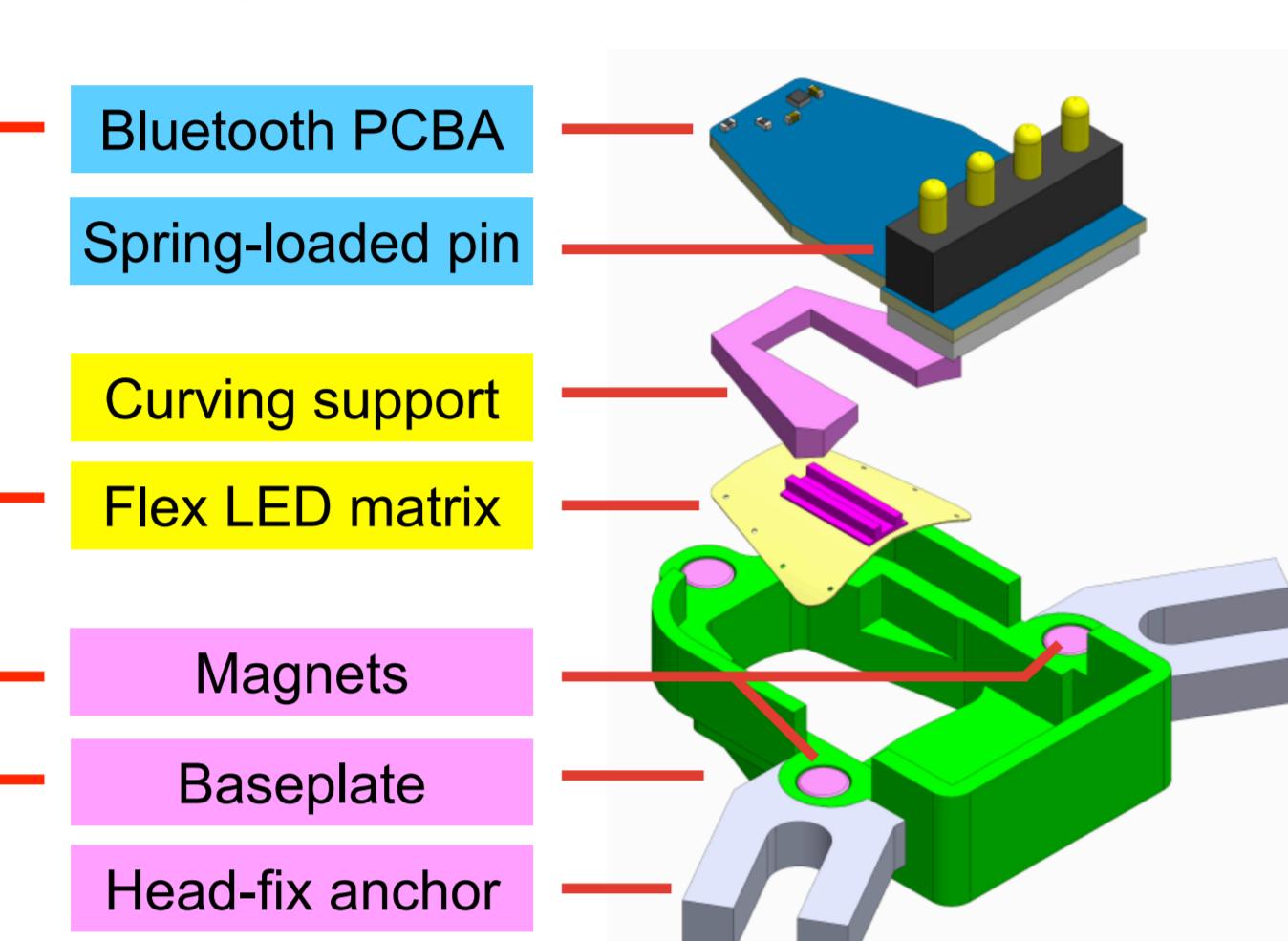
Fukui (Daniel) Yang, Jingjie Li, Jeffrey C. Erlich

Sainsbury Wellcome Centre, UCL, London UK

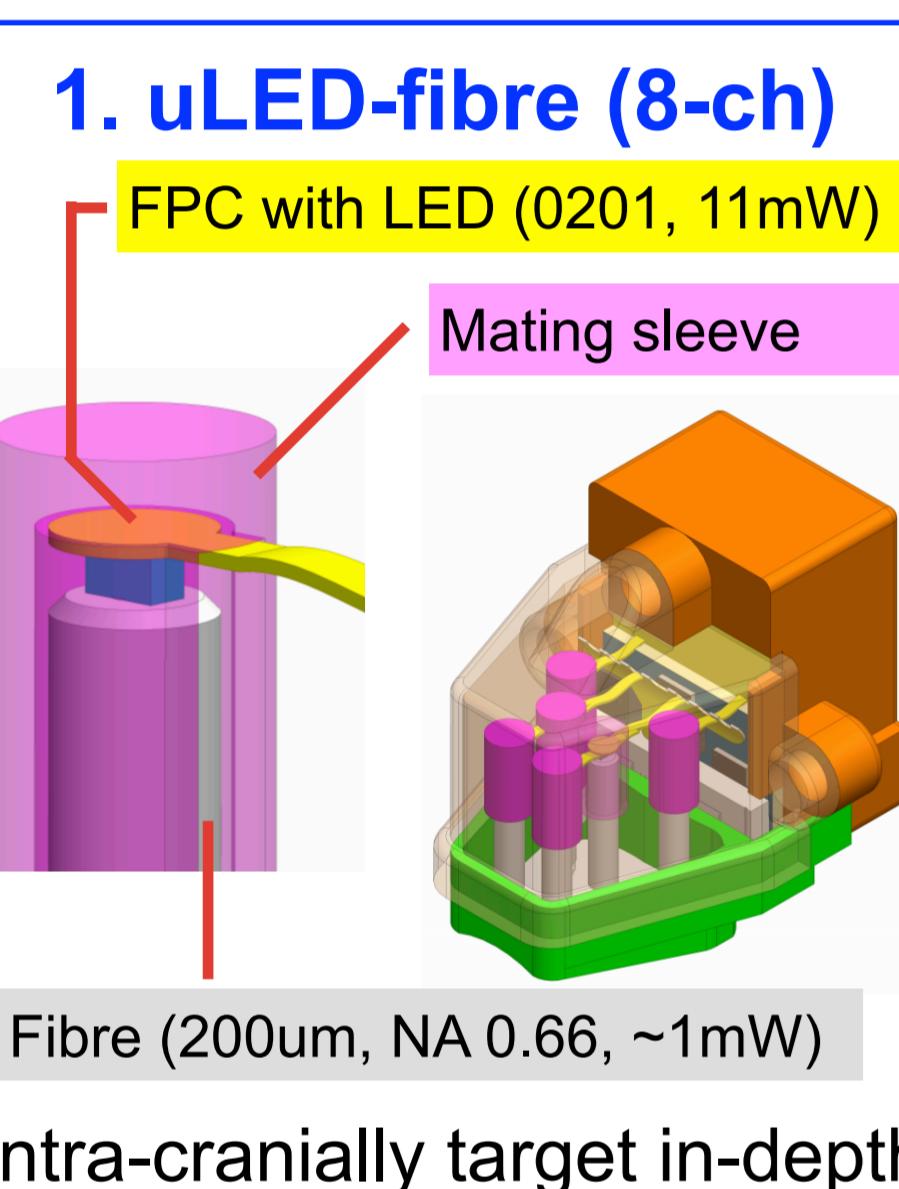
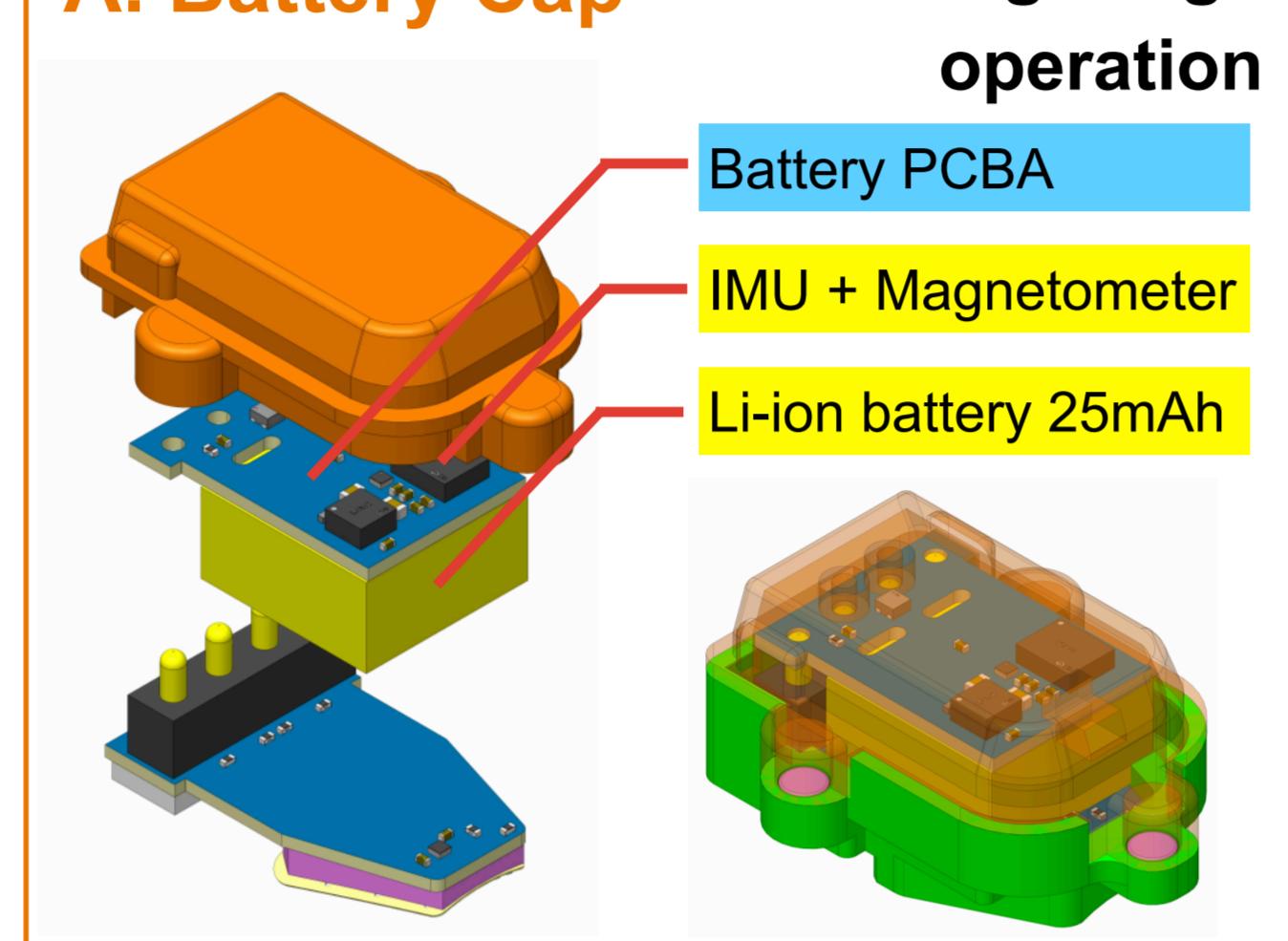


1. Device Overview

Baseplate + Main Bluetooth PCB



A. Battery Cap Long-range operation



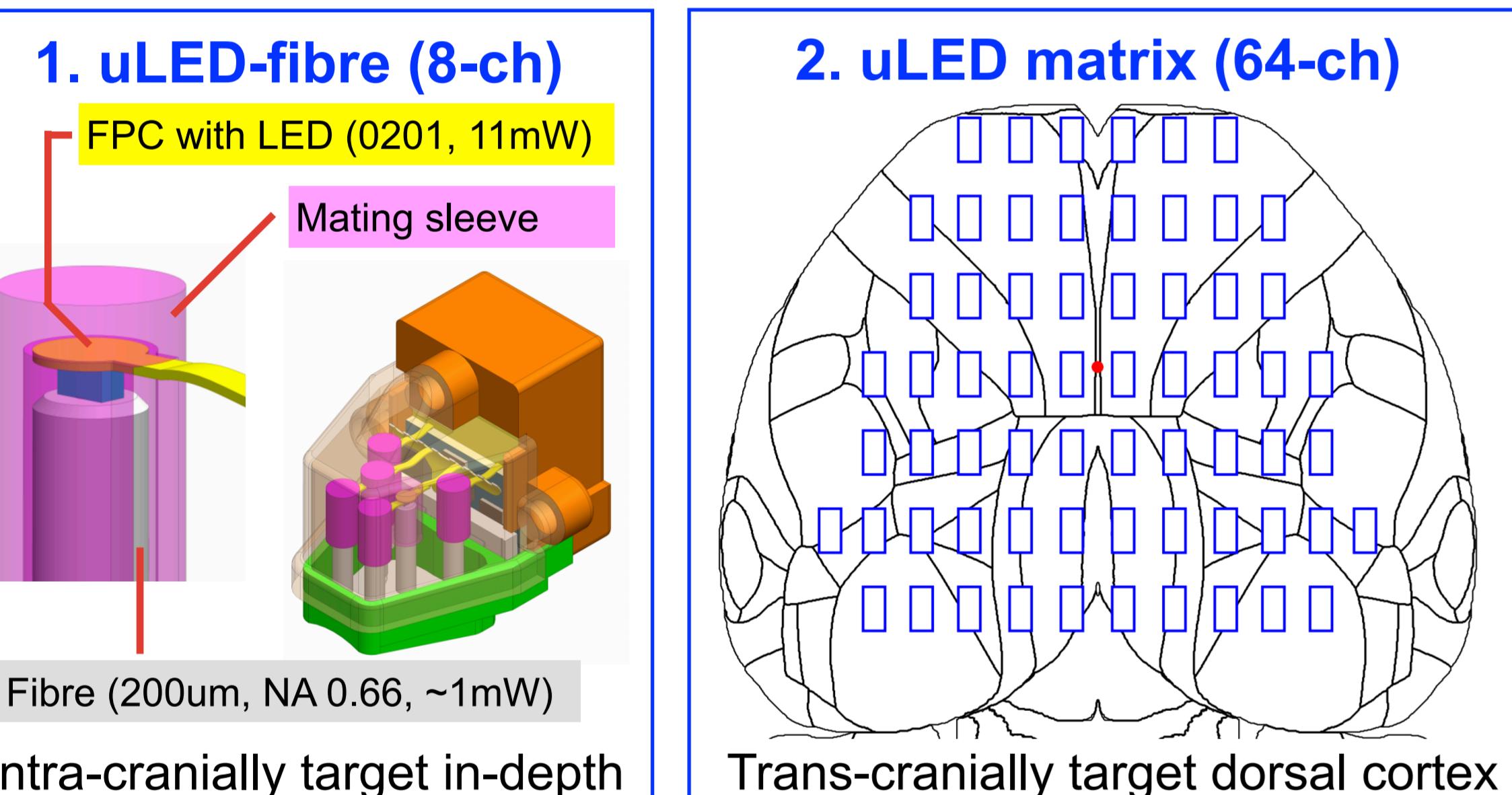
1. uLED-fibre (8-ch)

FPC with LED (0201, 11mW)

Mating sleeve

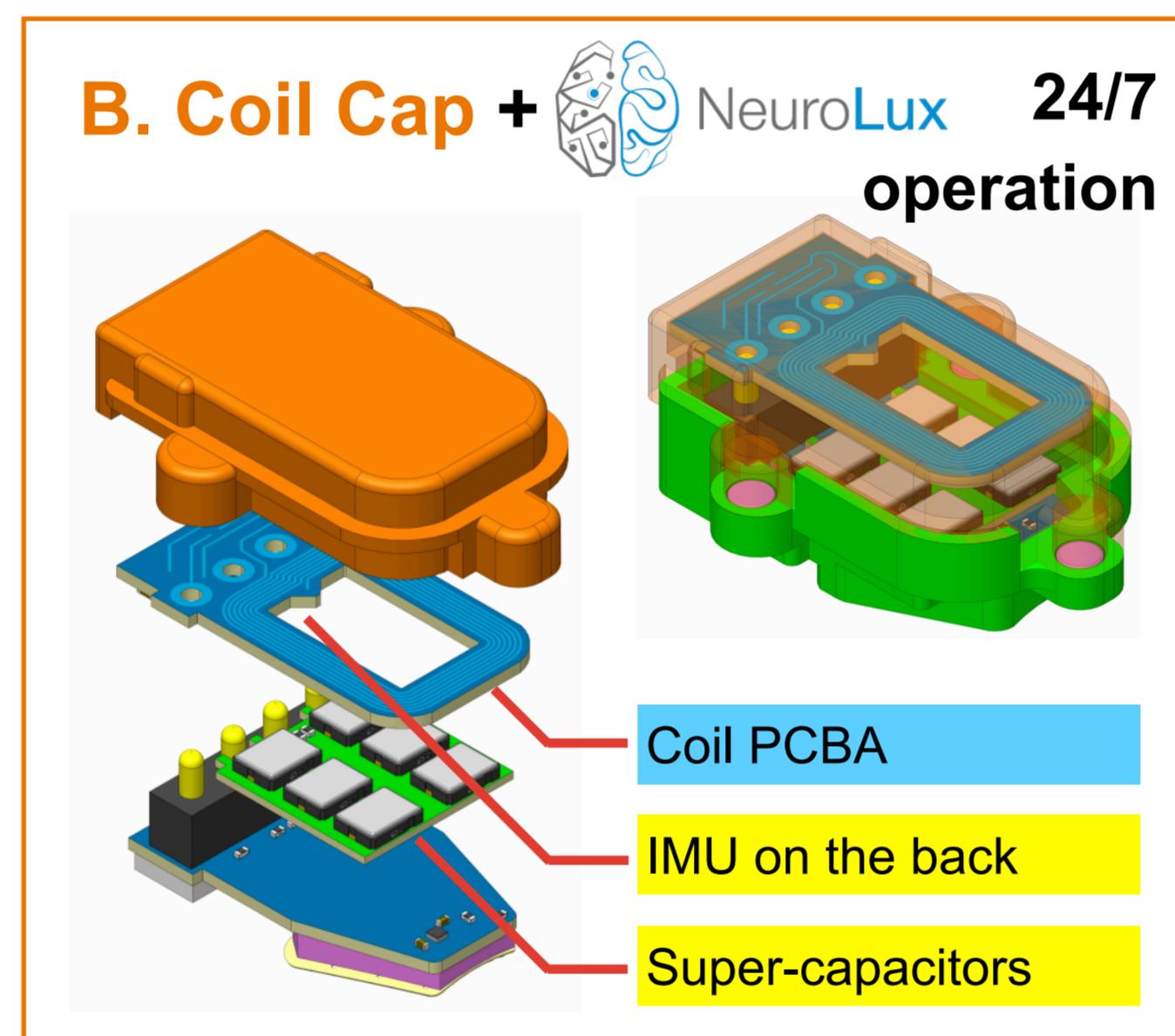
Fibre (200μm, NA 0.66, ~1mW)

Intra-cranially target in-depth



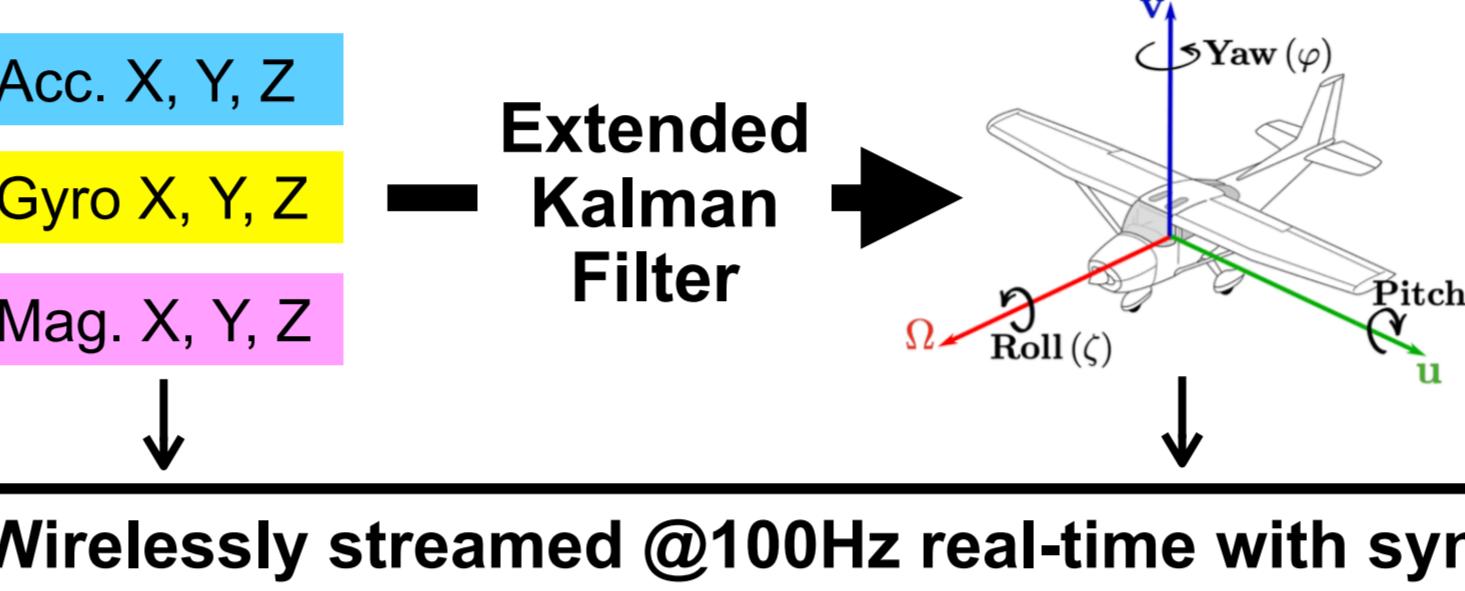
2. uLED matrix (64-ch)

Trans-cranially target dorsal cortex



B. Coil Cap + NeuroLux 24/7 operation

2. Head movement tracking (9-axis)



Scan me for video demonstration

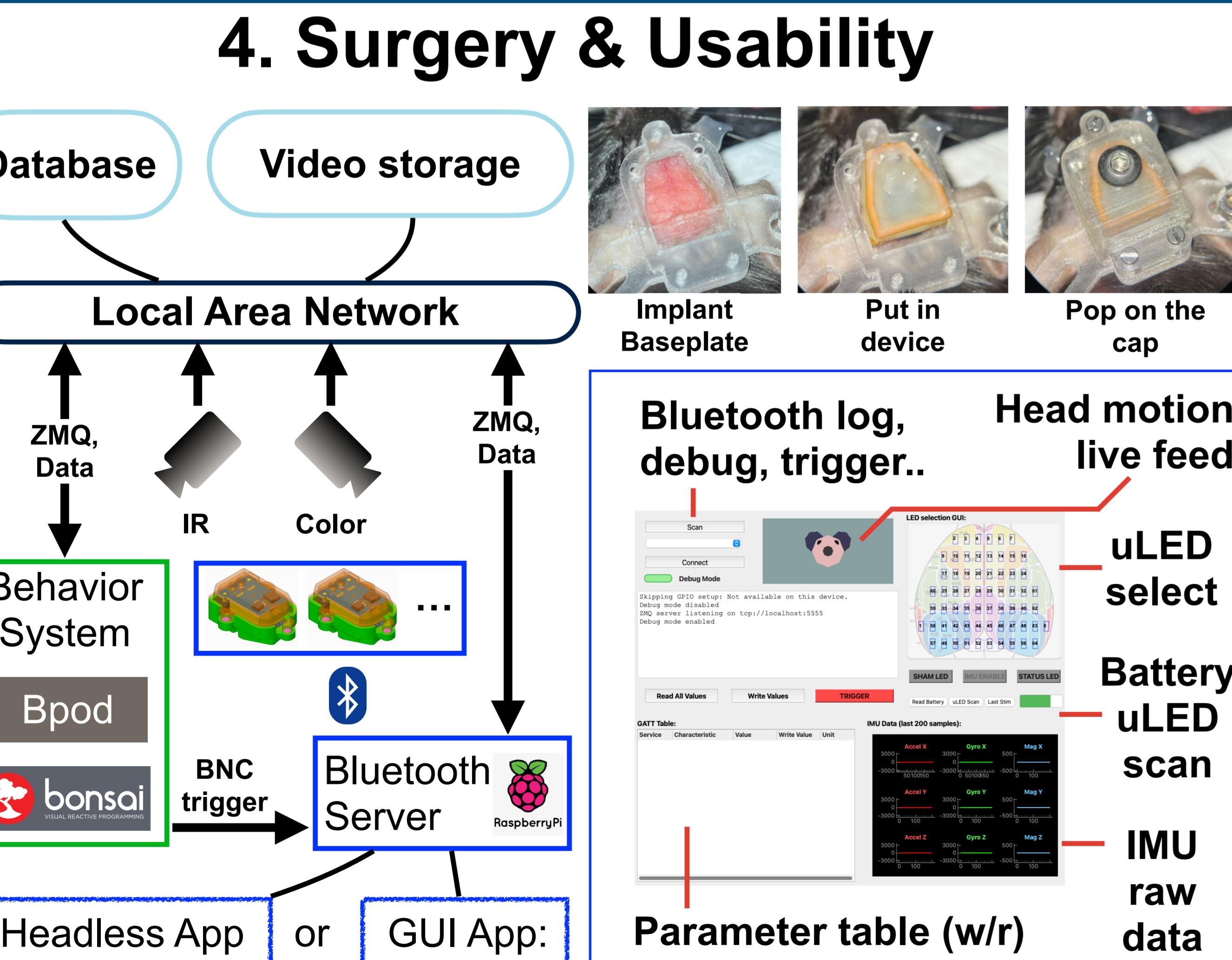
zenodo.org/records/17546536

3. Device Specification

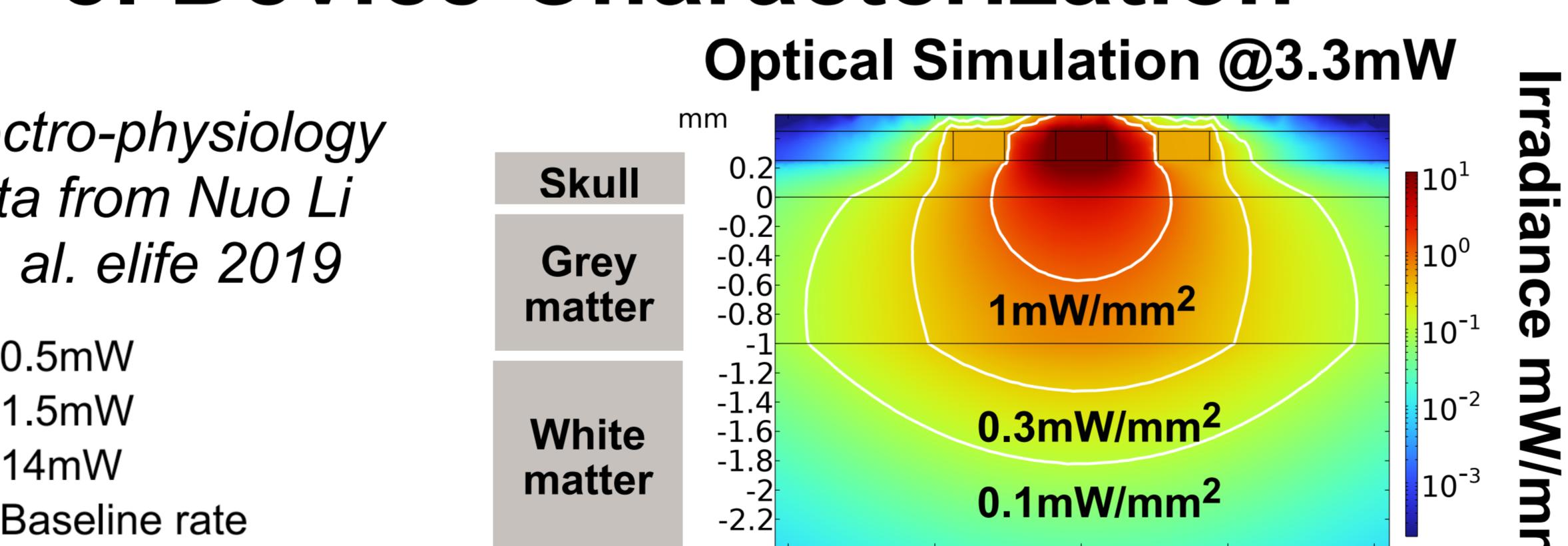
Specification	Value	Programmable
Latency	~10ms	Param.
Optical Power	3.3mW	Range
ML/AP Res.	1.2mm	LED select
Battery log	✓	0-100%
Stim. log	✓	Period
uLED scan log	✓	Pulsewidth
Assembly Weight Cost*		
2A	2.4 g	Duration
2B	2.0 g	0 - 2 ¹⁶ ms
	\$92	Ramp up
	\$96	Ramp down
		PWM freq. 0 - 2 ³² Hz

*Batch of 20 SET, exclude labor cost

4. Surgery & Usability

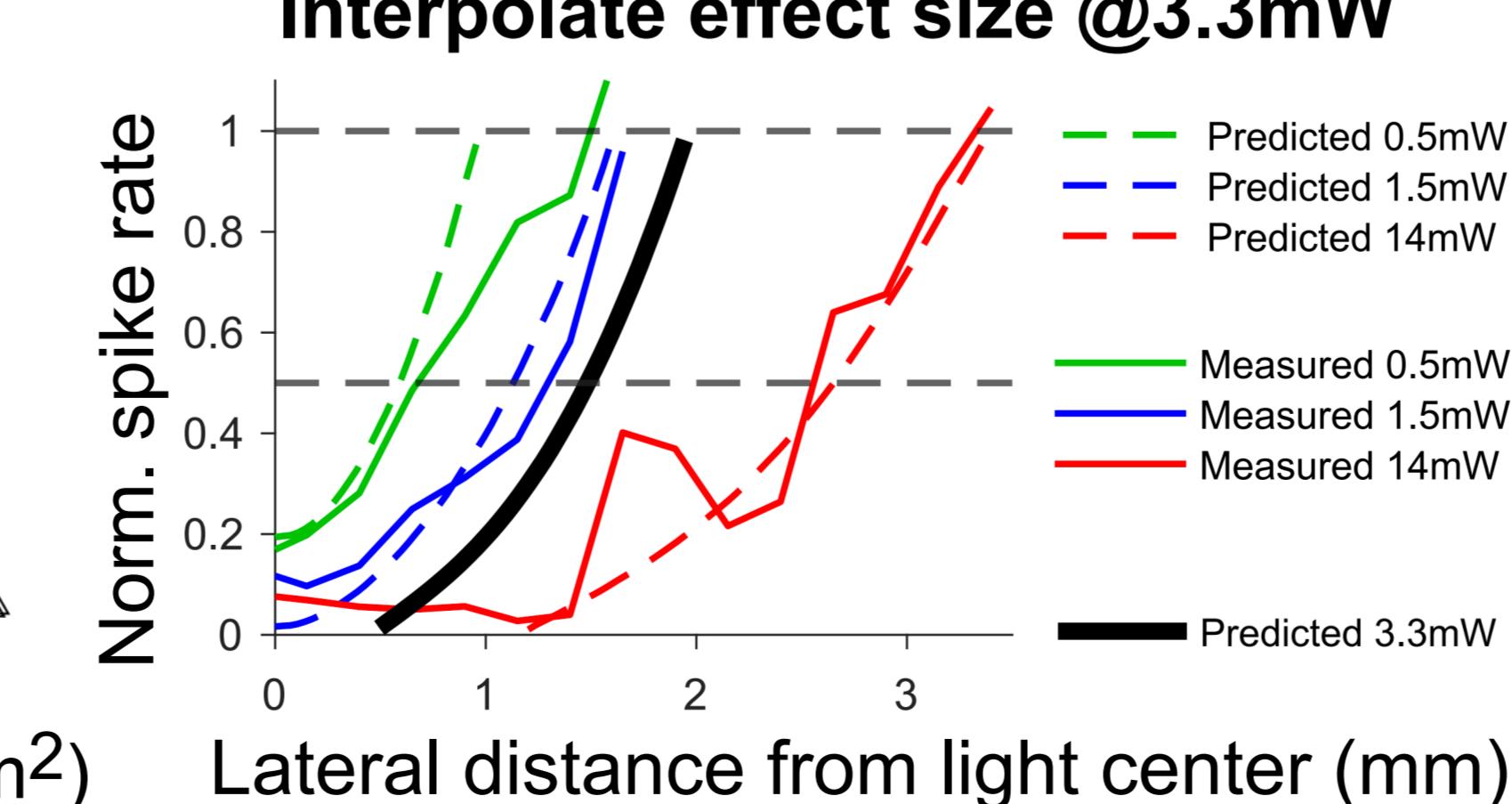


5. Device Characterization



Mingjie Zhou, et al., Nature Comm., 2025

Interpolate effect size @3.3mW



Norm. spike rate

Irradiance (mW/mm²)

Lateral distance from light center (mm)

● Bias right
● Bias left
○ p < 0.001
○ p < 0.01
○ p < 0.05

— Baseline rate
— Fitted Curve

— Predicted 0.5mW
— Predicted 1.5mW
— Predicted 14mW

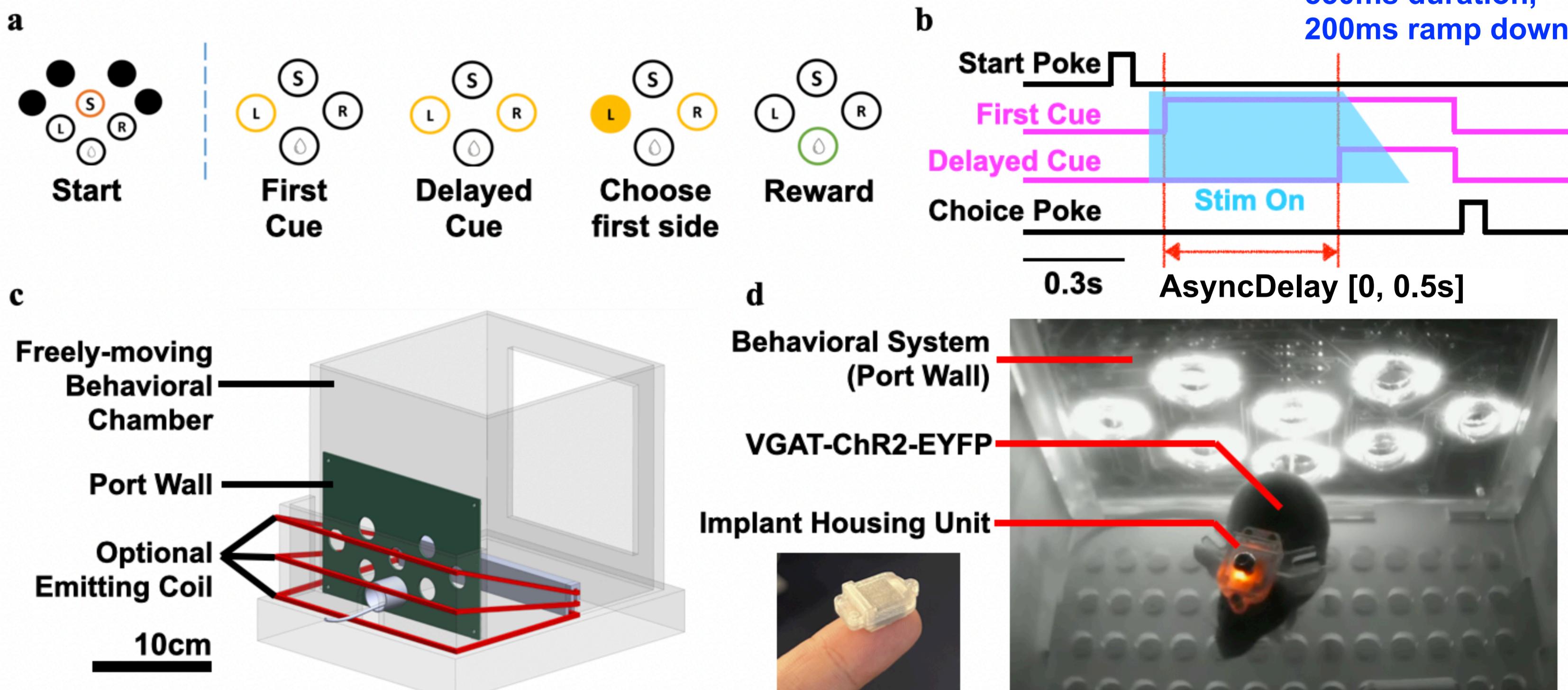
— Measured 0.5mW
— Measured 1.5mW
— Measured 14mW

— Predicted 3.3mW

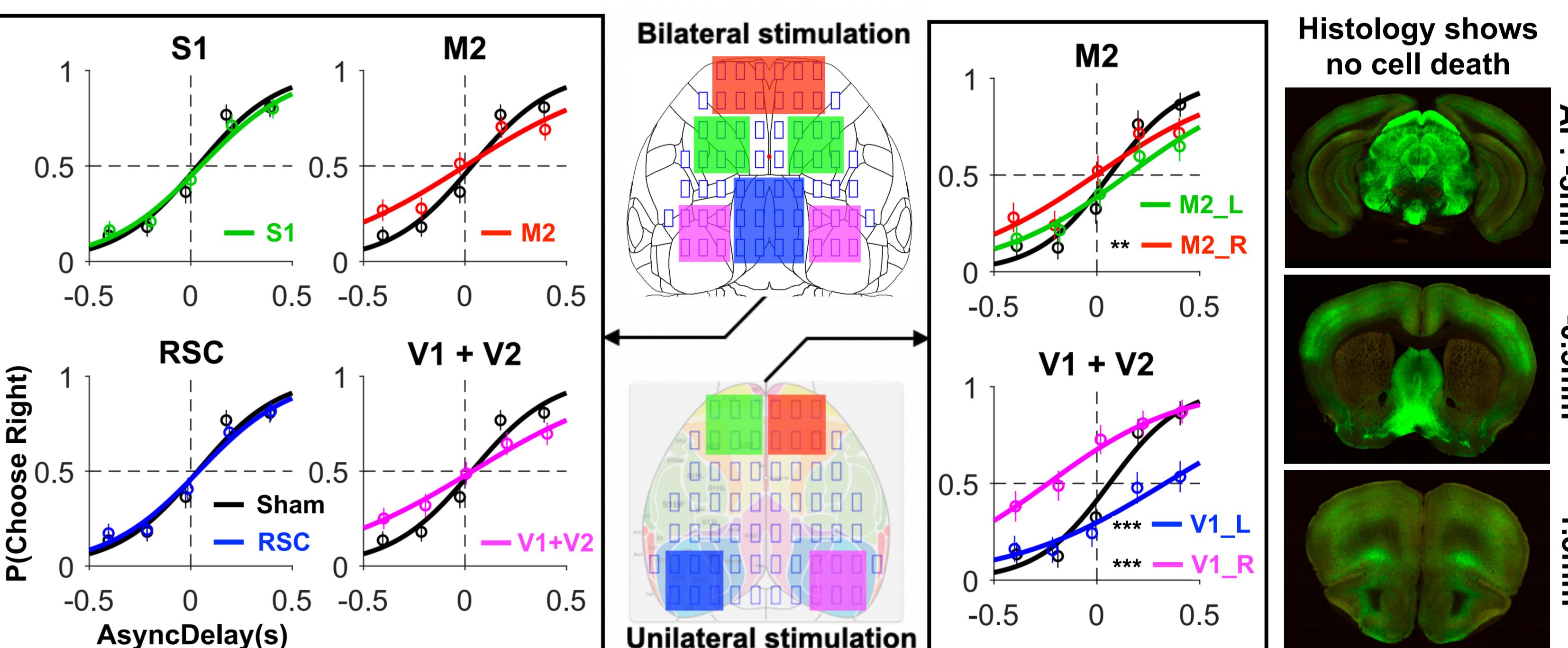
chose_r ~ 1 + async + opto:async + opto + (async:sessid)

Included: 80,730 trials
379 sessions
7 animals

6. Behavioral Validation



Regional silencing shows both significant slope and main effects to choice



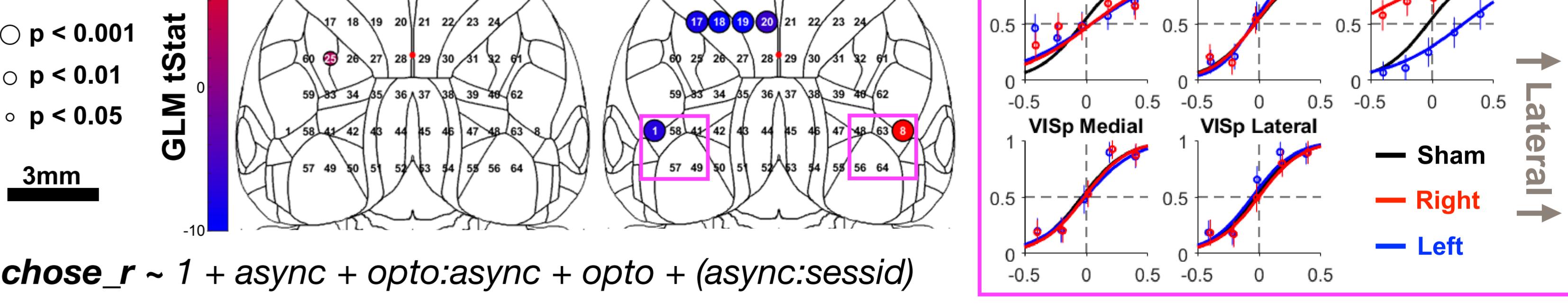
Bilateral stimulation

Unilateral stimulation

Histology shows no cell death

AP: -3mm
-0.5mm
1.5mm

Single LED screening reveals task-critical areas on cortex



● Bias right
● Bias left
○ p < 0.001
○ p < 0.01
○ p < 0.05

— Baseline rate
— Fitted Curve

— Predicted 0.5mW
— Predicted 1.5mW
— Predicted 14mW

— Measured 0.5mW
— Measured 1.5mW
— Measured 14mW

— Predicted 3.3mW

chose_r ~ 1 + async + opto:async + opto + (async:sessid)

Included: 80,730 trials
379 sessions
7 animals

Summary:

- Device cost < \$100, reusable, implant weight < 2.5g, manufacturable

- Reliable behavioral effects over 64-ch of selective optical stimulation

fukui.yang.23@ucl.ac.uk

Mouse opto-trial demo:
zenodo.org/records/14982327



Amplitude ramp demo:
zenodo.org/records/17567003



Design files available:
github.com/erlichlab/optogrid

