CPS TTP: A Bi-Directional Brain-Computer Interface for Restoration of Walking and Lower Extremity Sensation after Spinal Cord Injury

PIs: Payam Heydari (UCI), Zoran Nenadic (UCI), An Do (UCI), Charles Liu (USC), Richard Andersen (CalTech)

- ICs specialized for BD-BCI operation were designed, fabricated, and validated
  - An ECoG amplifier array IC: 1 µW/channel power consumption
  - A stimulation IC: ±12.75 mA balanced square pulse wave with charge balancing (2 mV precision)

- A prototype ECoG-based BD-BCI system was implemented
  - Includes a fully programmable stimulator system in parallel to an embedded BCI system
  - Equivalency to FDA-approved cortical stimulator established
  - Ability to elicit sensory percepts in humans validated

- To reduce stimulation artifact from ECoG data during BD-BCI operation, we developed the pre-whitening and null-projection (PWNP) approach, which can achieve up to ~59 dB artifact reduction