SEGREGATING THE PREFRONTAL CORTEX BY MEANS OF DBS

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INTRODUCTION

Fronto-subcortical neurocircuits are involved in the **motor, cognitive, and affective dysfunctions** of multiple brain disorders which can be treated by DBS

AIM

To investigate the **functional segregation of the prefrontal cortex** via optimal connectivity profiles from DBS electrodes to the **subthalamic nucleus** (STN) treating 4 different disorders
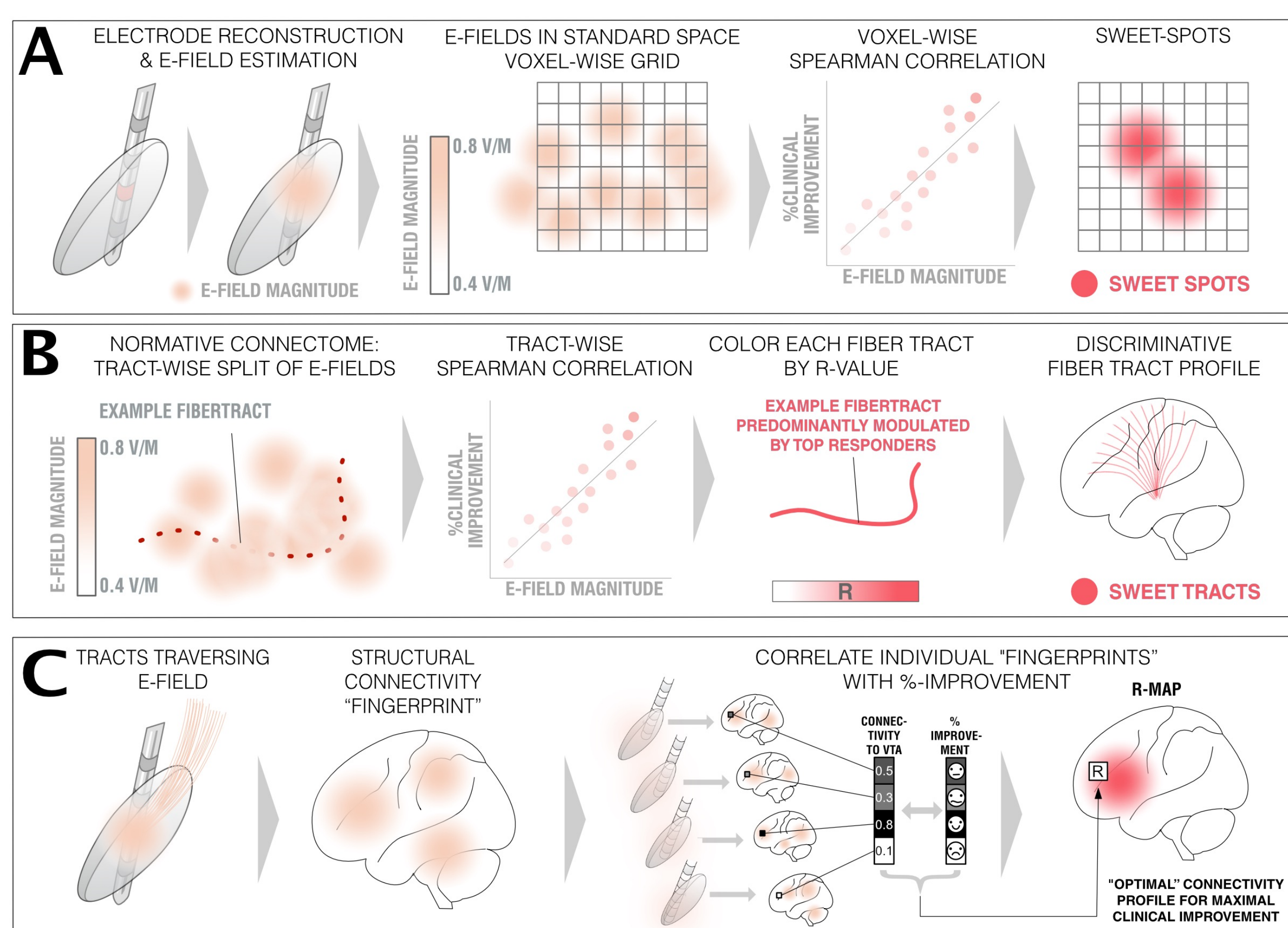

DYT · PD · TS · OCD

METHODS

PATIENTS: 8 DBS patient cohorts from 7 centers – **dystonia** (DYT; N = 76), **Parkinson's disease** (PD; N = 95), **Tourette syndrome** (TS; N = 14), and **obsessive-compulsive disorder** (OCD; N = 19)
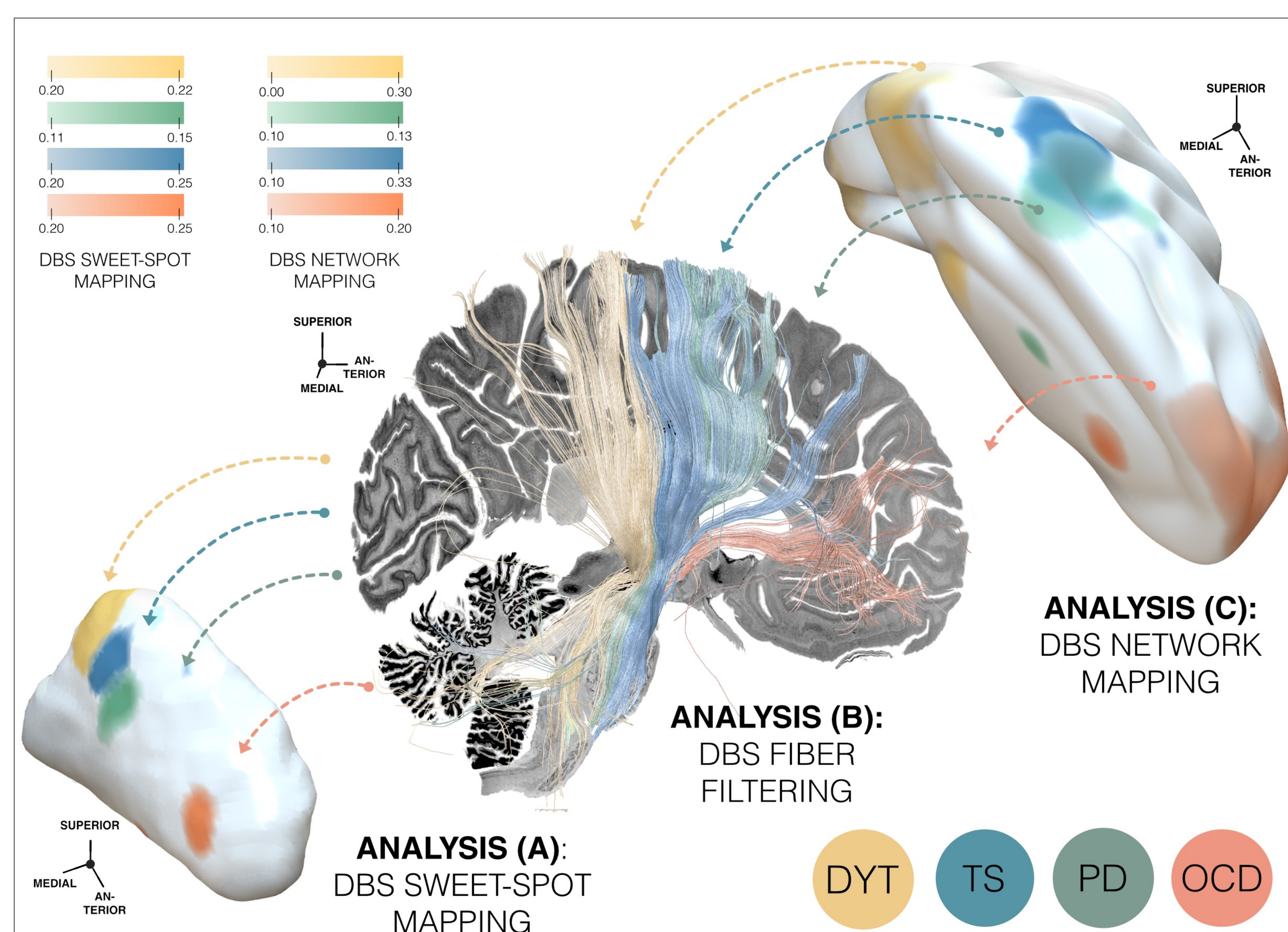
CLINICAL IMPROVEMENT: Burke-Fahn-Marsden Dystonia Rating Scale (DYT), **Unified Parkinson's Disease Rating Scale–Part III** (PD), **Yale Global Tic Severity Scale** (TS), and **Yale-Brown Obsessive-Compulsive Scale** (OCD)

METHODOLOGICAL WORKFLOW:

(1) Reconstruction of precise DBS electrode placement and stimulation volumes (E-fields) using Lead-DBS software

(2) **DBS Sweet-Spot Mapping** (**A**), **DBS Fiber Filtering** (**B**) and **DBS Network Mapping** (**C**) to identify voxels and *normative* tracts / cortical projection sites related to optimal clinical outcome

A ELECTRODE RECONSTRUCTION & E-FIELD ESTIMATION · E-FIELDS IN STANDARD SPACE VOXEL-WISE GRID · VOXEL-WISE SPEARMAN CORRELATION · SWEET-SPOTS

B NORMATIVE CONNECTOME: TRACT-WISE SPLIT OF E-FIELDS · TRACT-WISE SPEARMAN CORRELATION · COLOR EACH FIBER TRACT BY R-VALUE · DISCRIMINATIVE FIBER TRACT PROFILE

C TRACTS TRAVERSING E-FIELD · STRUCTURAL CONNECTIVITY "FINGERPRINT" · CORRELATE INDIVIDUAL "FINGERPRINTS" WITH %-IMPROVEMENT · R-MAP

MAIN RESULTS

DBS SWEET-SPOT MAPPING · DBS NETWORK MAPPING

ANALYSIS (A): DBS SWEET-SPOT MAPPING

ANALYSIS (B): DBS FIBER FILTERING

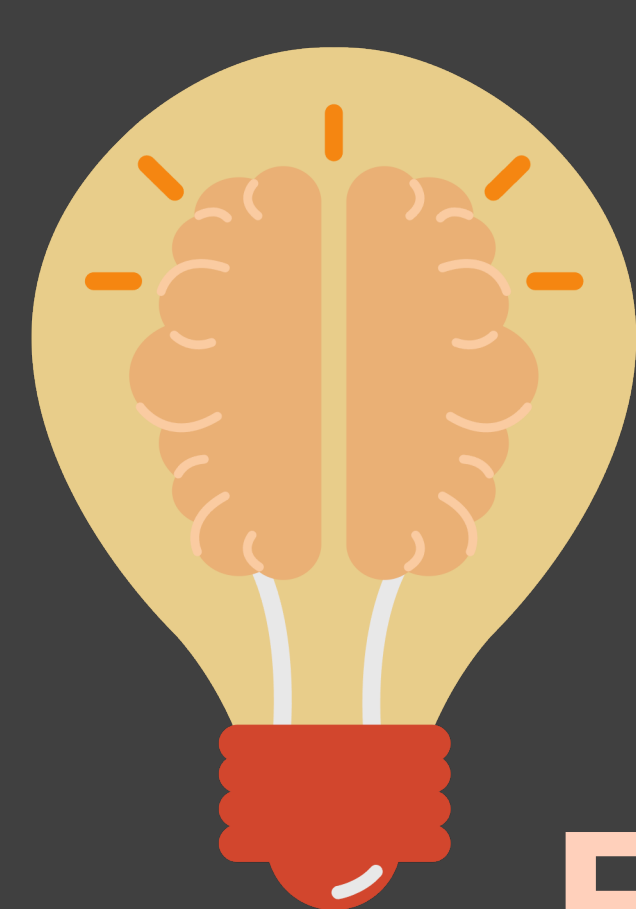**ANALYSIS (C):** DBS NETWORK MAPPING

DYT · TS · PD · OCD

CONCLUSIONS

By its impact on distributed networks, DBS is a meaningful tool to **functionally segregate the prefrontal cortex**.

A functionally selective, caudo-rostral gradient of cortical organization is **mirrored within the subcortex** – in spatially compressed form.

This **"information funnel effect"** may explain why DBS to **integrator hubs** (e.g., the STN) is an effective treatment for a variety of brain disorders of heterogeneous phenomenology.

DBS OPENS A WINDOW INTO THE ORGANIZATIONAL GRADIENT OF FRONTAL NETWORK (DYS)FUNCTION.

SCAN FOR POSTER PITCH (VIDEO), POSTER PDF, REFERENCES & FULL AFFILIATION INFORMATION!

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