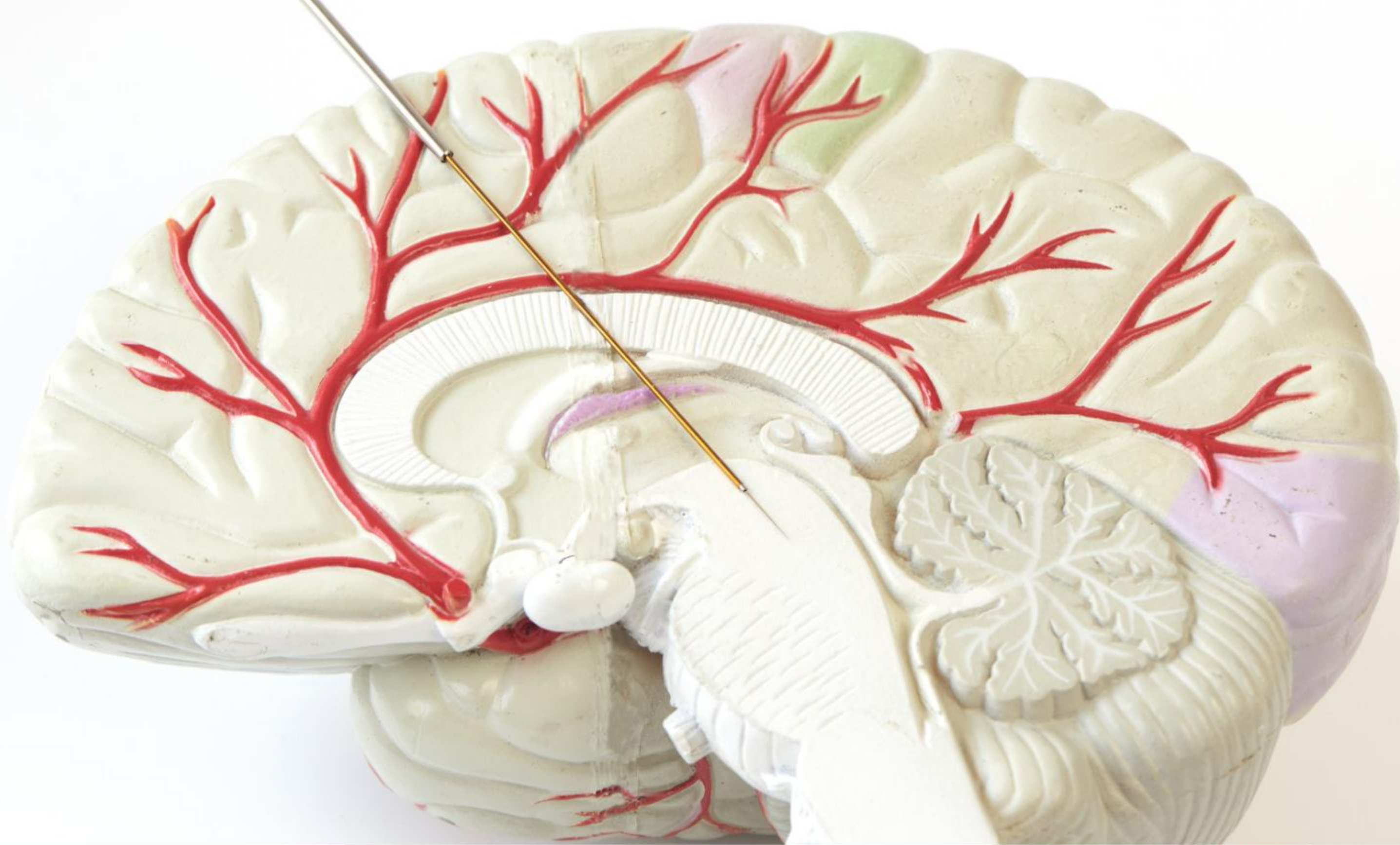




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Essentials On Image Guided Programming

Britt Stone, MD

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Disclosure:
I serve on the advisory board for
Boston Scientific.

Historically, this has been initial programming

- But, with image guided programming:
- Merging pre-op MRI to post-op CT
- Patient specific anatomy
- Helps visualization and effectively shaping VTA



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Where We are Going:

- Quick anatomy recap
- Modified Monopolar Review
- Image based visualization of anatomy
- Ring versus Directional stimulation
- Troubleshooting techniques
 - Anodic blocking
 - AI-enhanced programming

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But First,

ANATOMY RECAP

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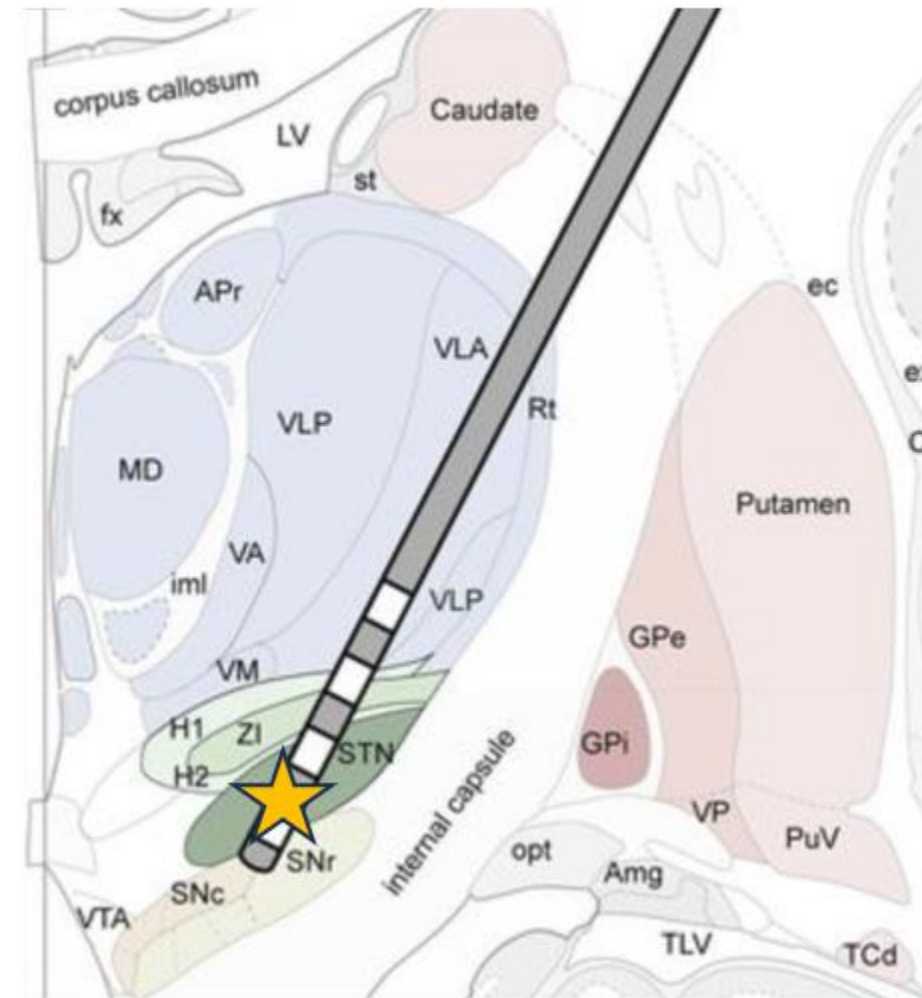
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STN anatomy

- Almond shaped nucleus in the midbrain
- Surrounding structures
 - Zona incerta
 - Internal capsule
 - Cerebral peduncle
 - Medial lemniscus
 - CN III
 - Red nucleus
 - Substantia nigra



Fagerland et al, JoBe
(2024)

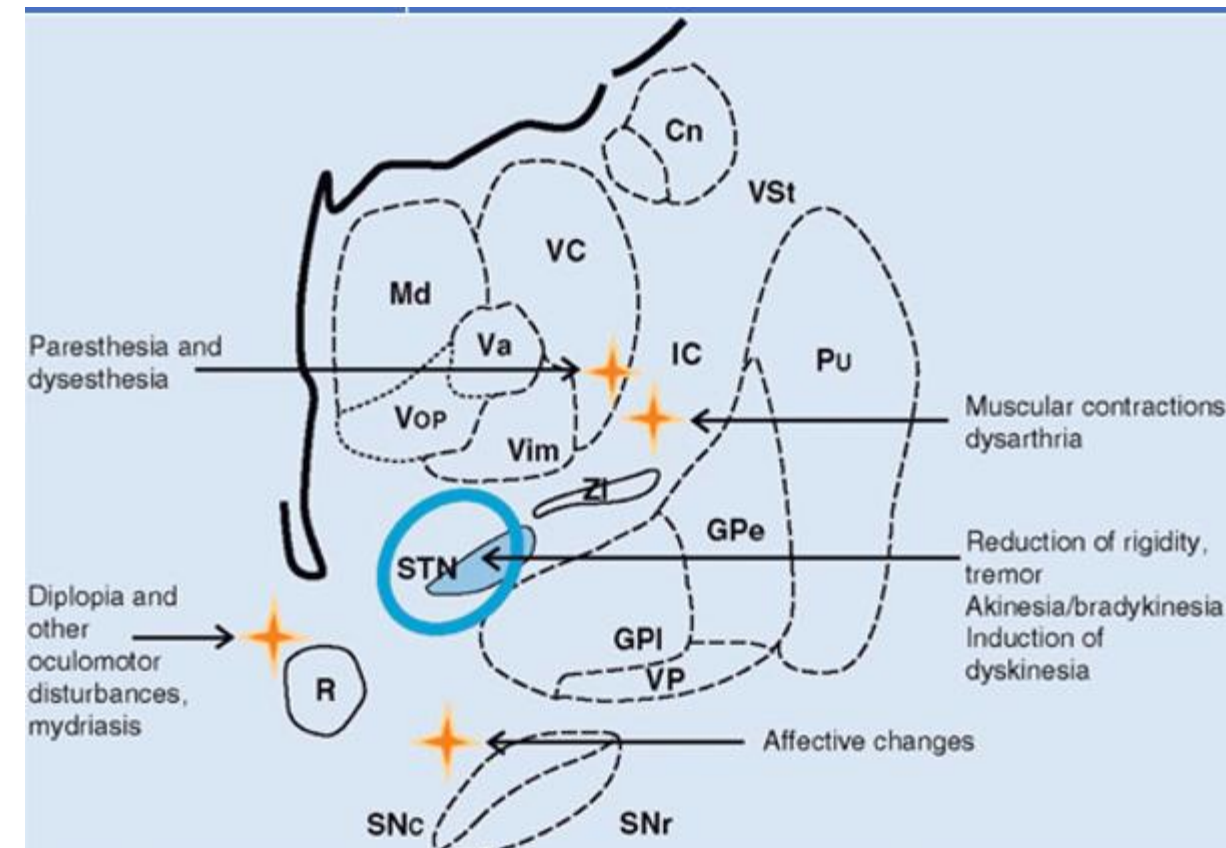
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STN STIMULATION EFFECTS



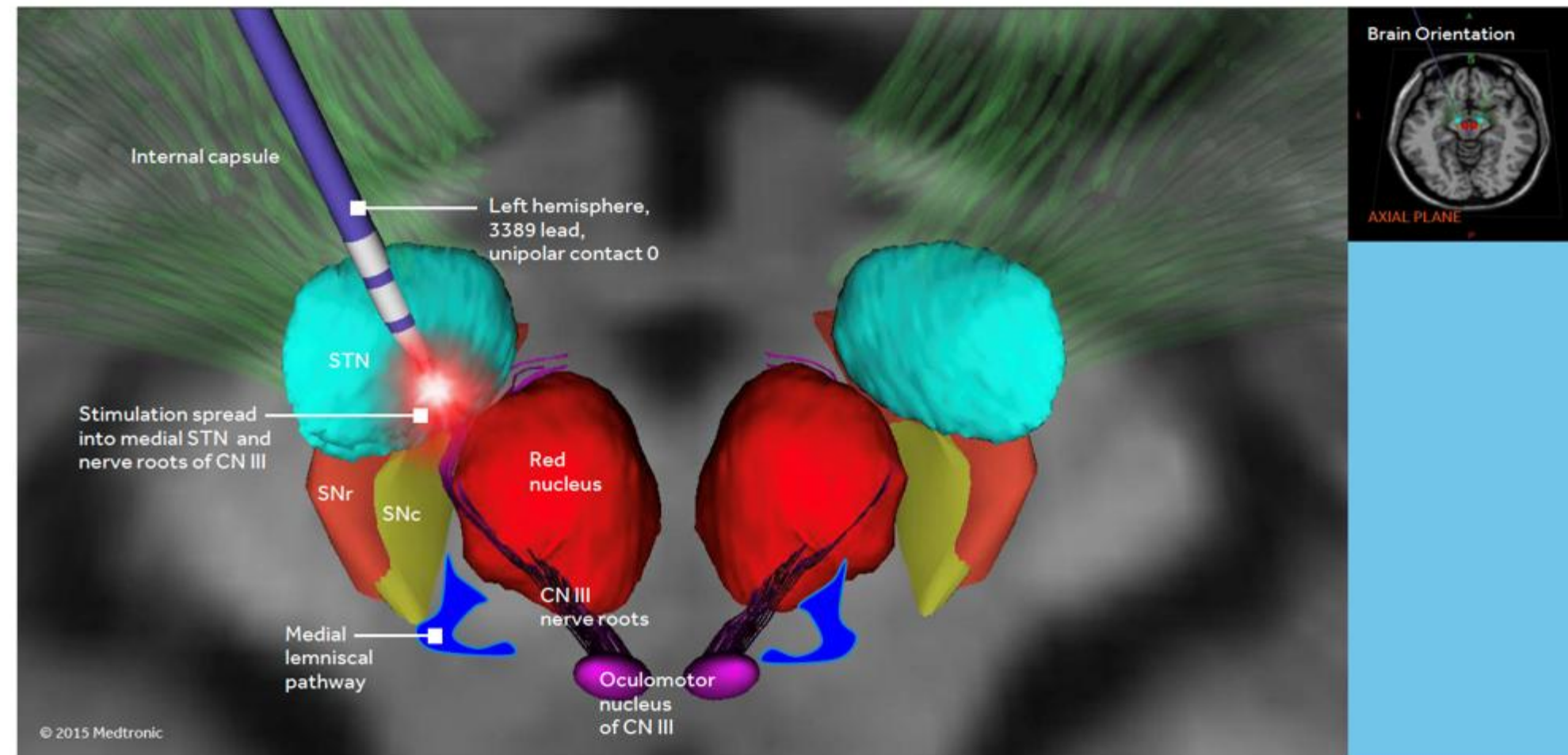
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STN medial stim effects



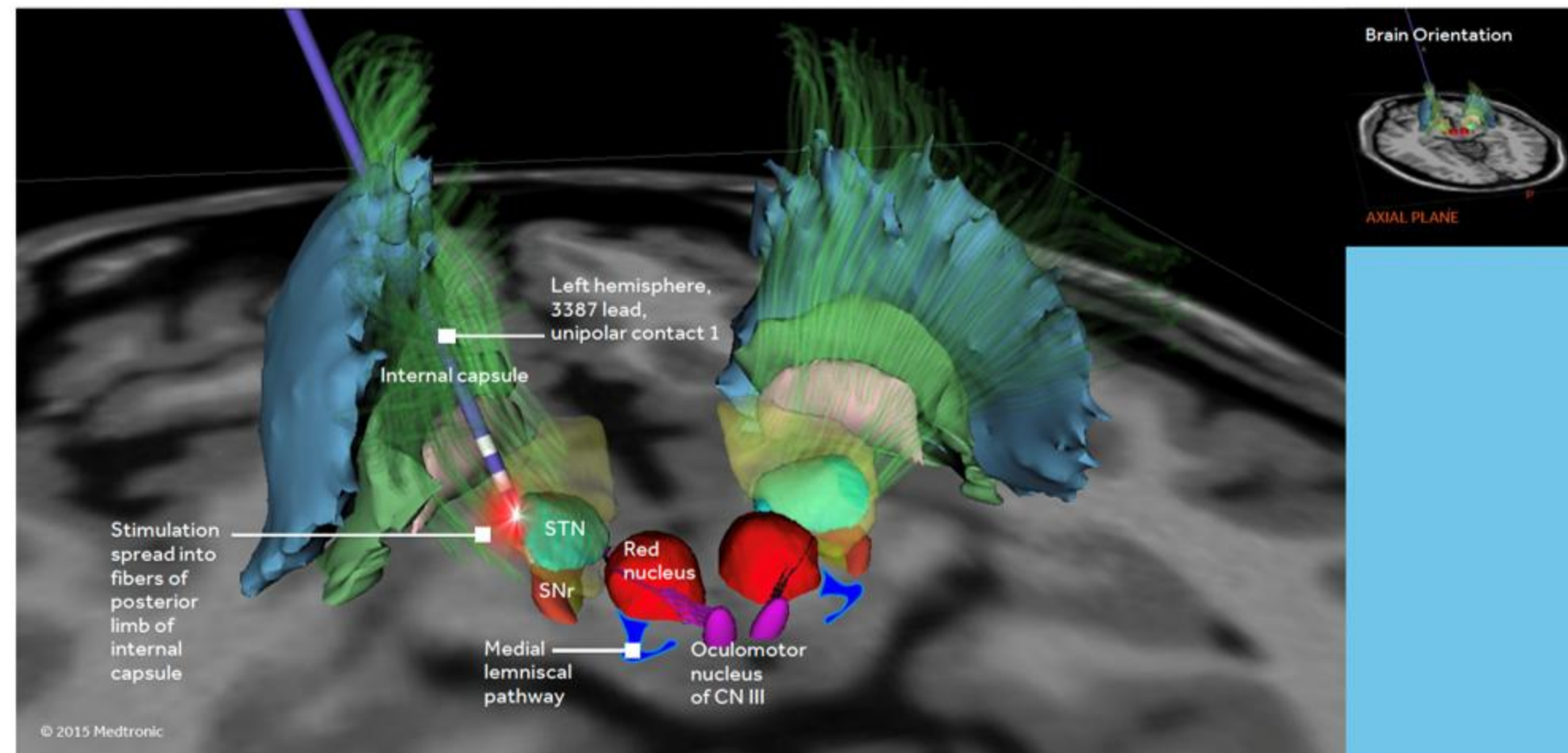
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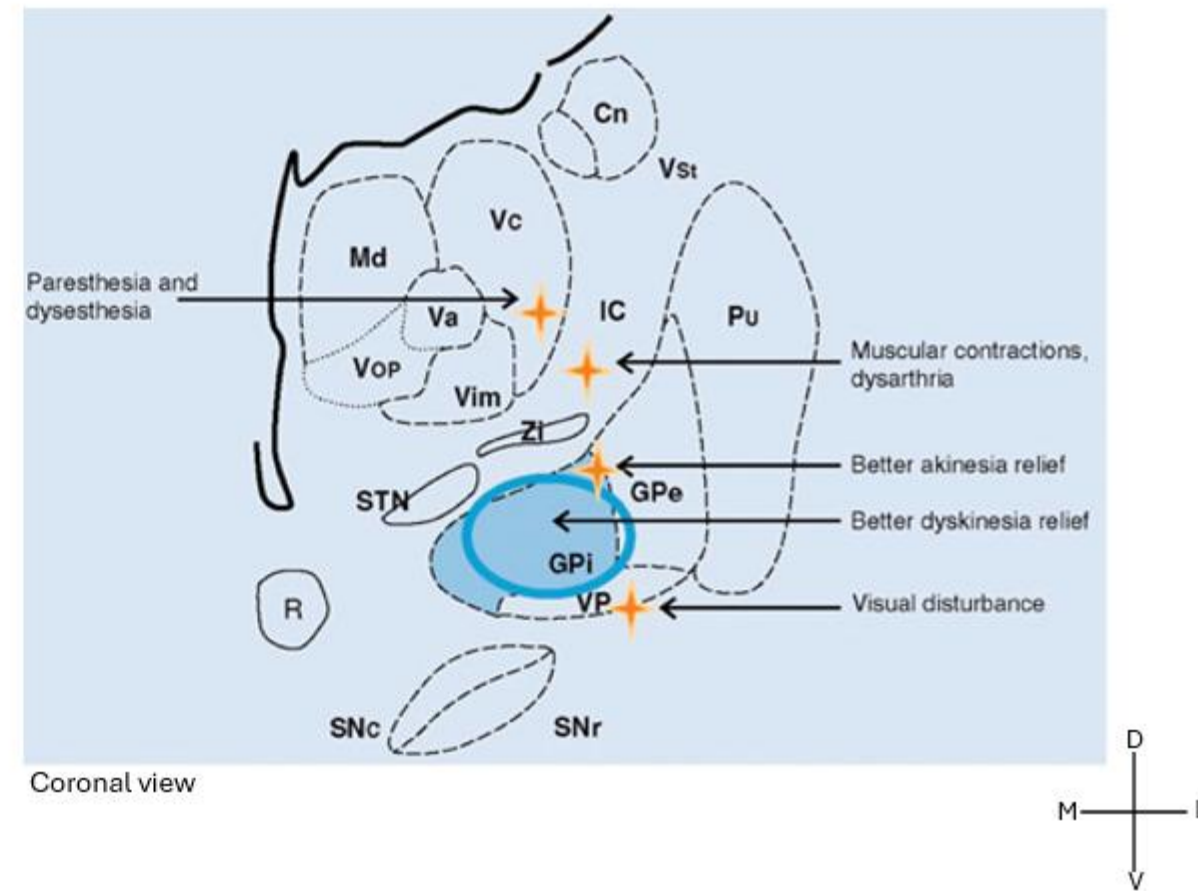
STN lateral stim effects



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Sagittal view



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GPe Stimulation effects

Location	Anatomic structure	Effects
Effective placement	Posteroventral	Improve parkinsonian symptoms, improve dyskinesia and dystonia
Too anterior	<u>GPe</u> or putamen	No effect
Too posterior	Internal capsule	Muscle contractions
Too lateral	<u>GPe</u> or putamen	No effect
Too medial	Internal capsule	Muscle contractions
Too superior	<u>GPe</u> /Putamen	No effects
Too inferior	Optic tract	Phosphenes in contralateral visual field

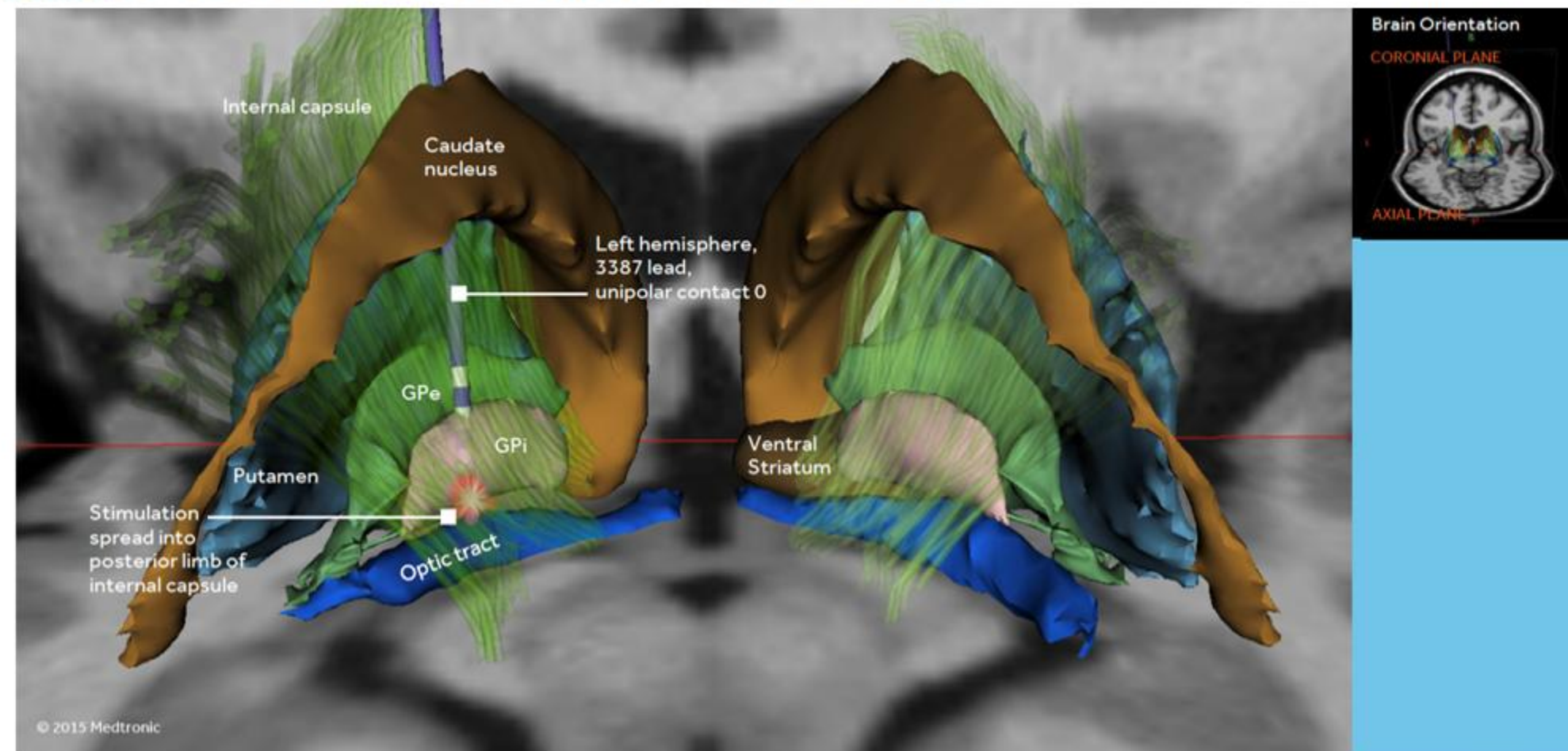
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GPe medial stim effects



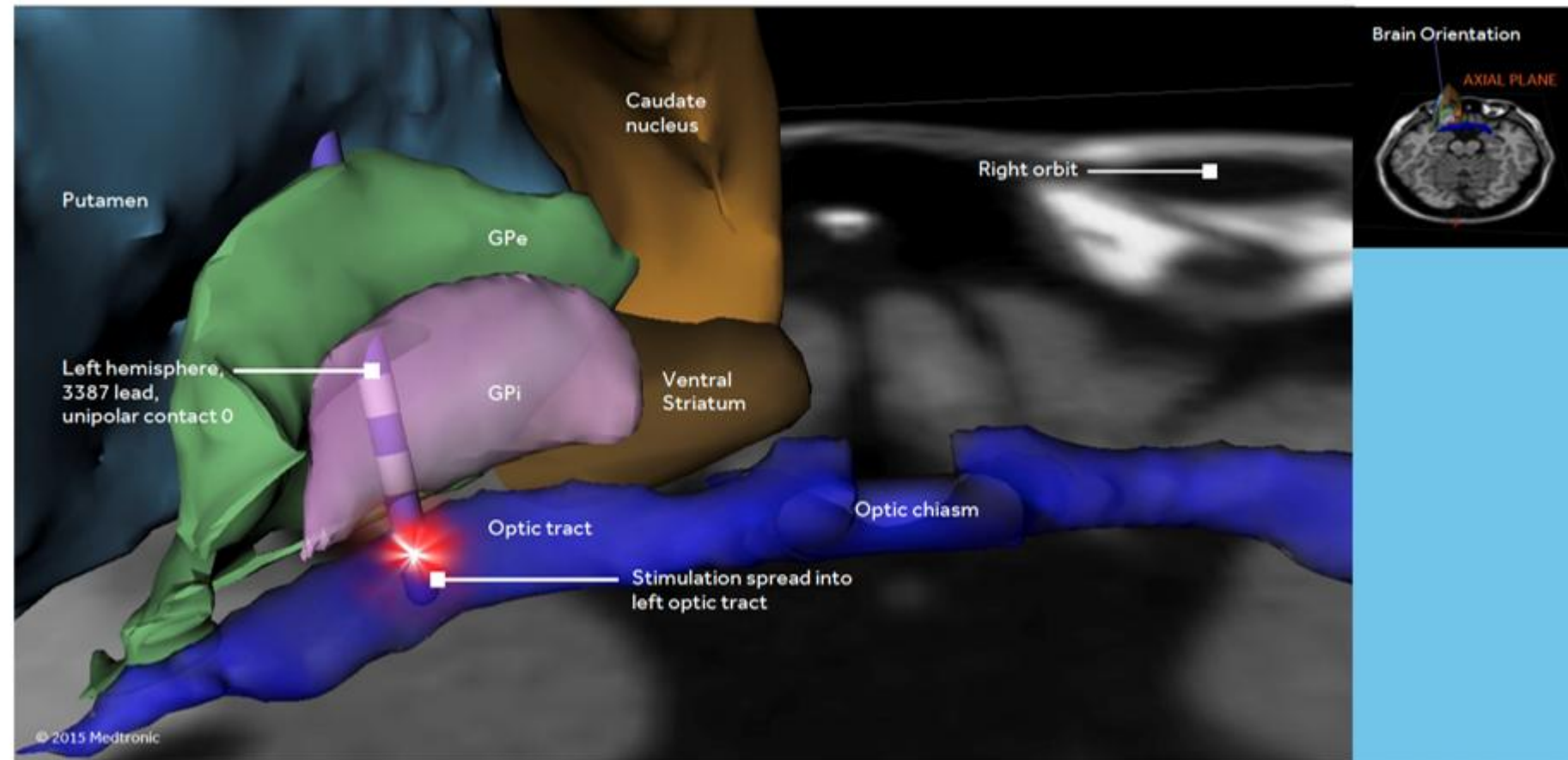
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GPI inferior/ventral stim effects



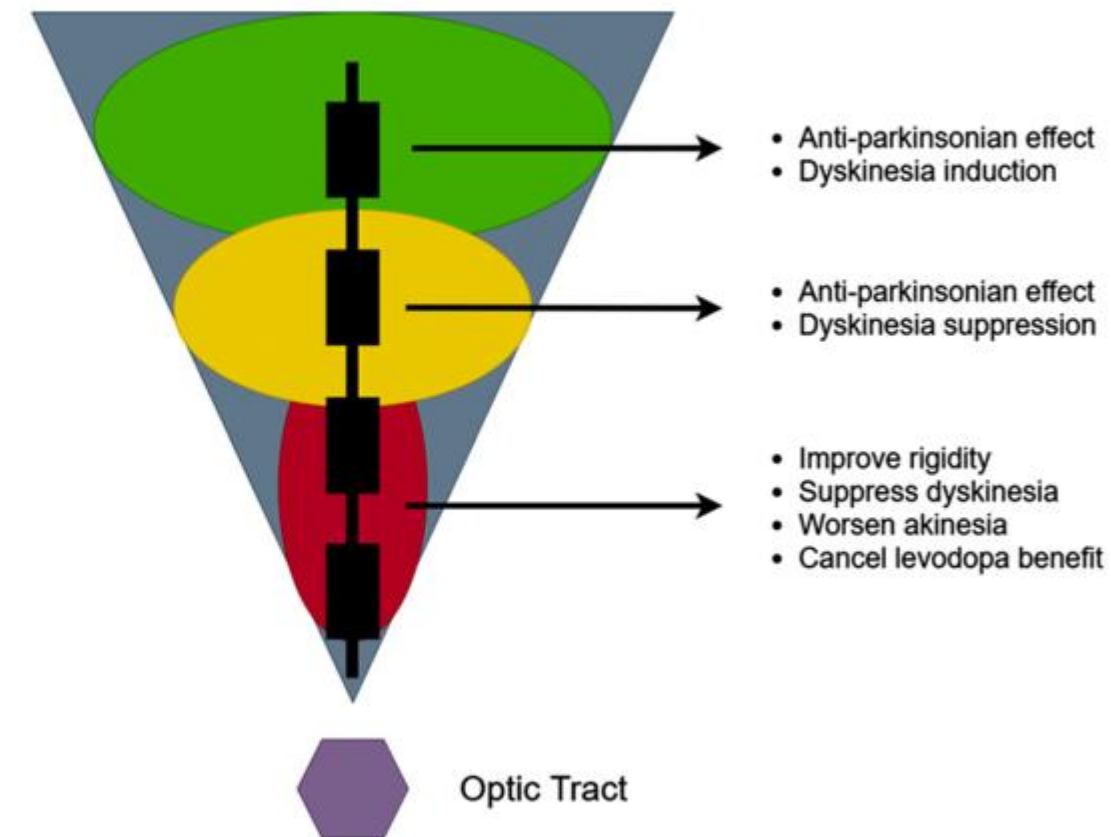
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GPI triangle



Wong et al, Journal of Parkinson's disease. 2021.

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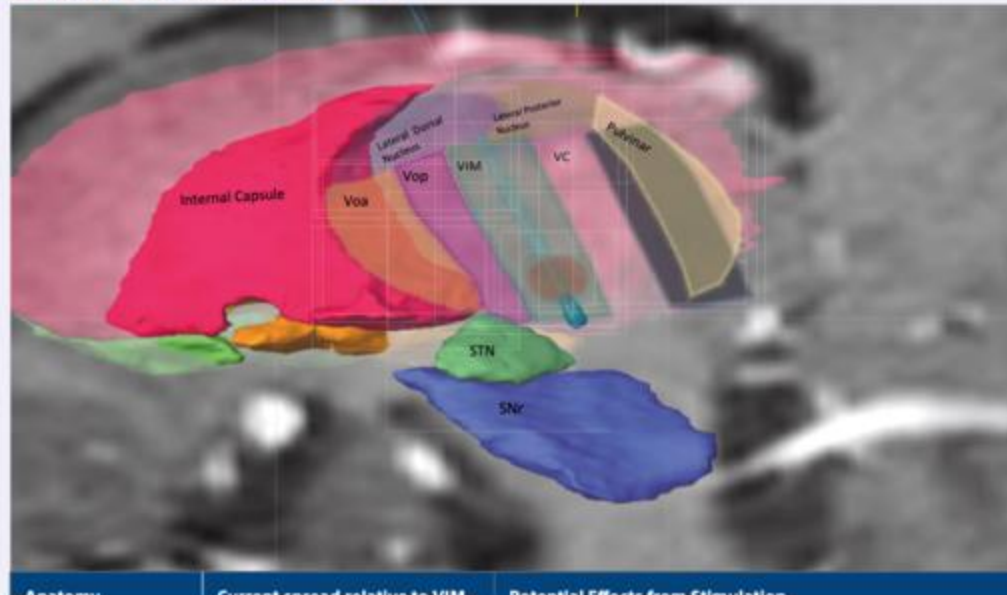
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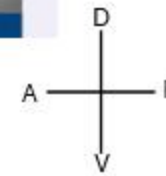
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VIM Anatomy

Ventral Intermediate Nucleus (VIM) of the Thalamus



- VOa/VOp: receives input from GPI and cerebellum
- VIM: receives input from cerebellum, greatest concentration of tremor cells
- Vc: termination site of medial lemniscus and spinothalamic tracts



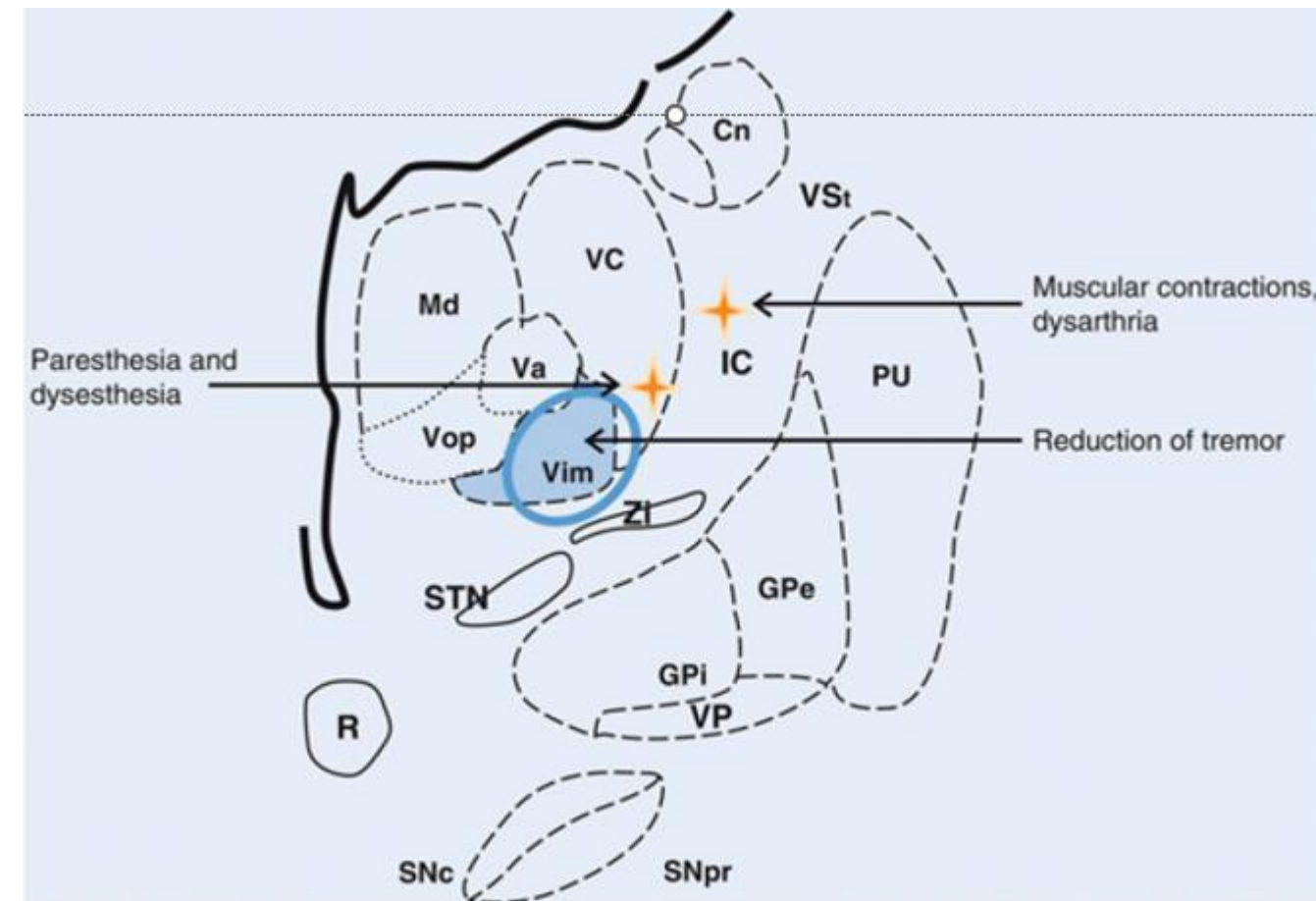
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VIM Stimulation Effects



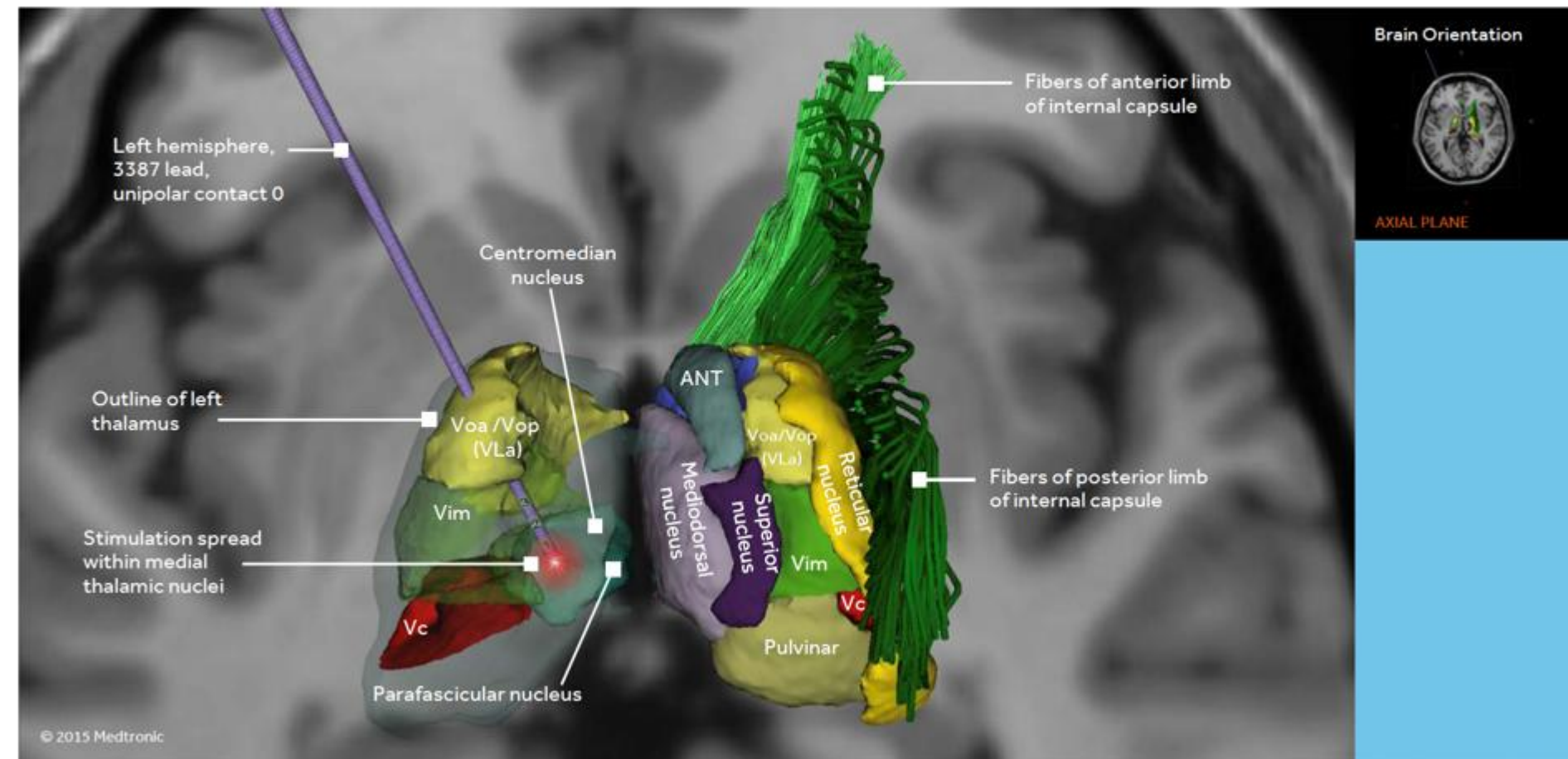
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VIM medial stim effects



- For clarity, only Vim, Vc, Voa/Vop and CM/Pf thalamic nuclei are shown in left hemisphere. Full thalamus shown in right hemisphere

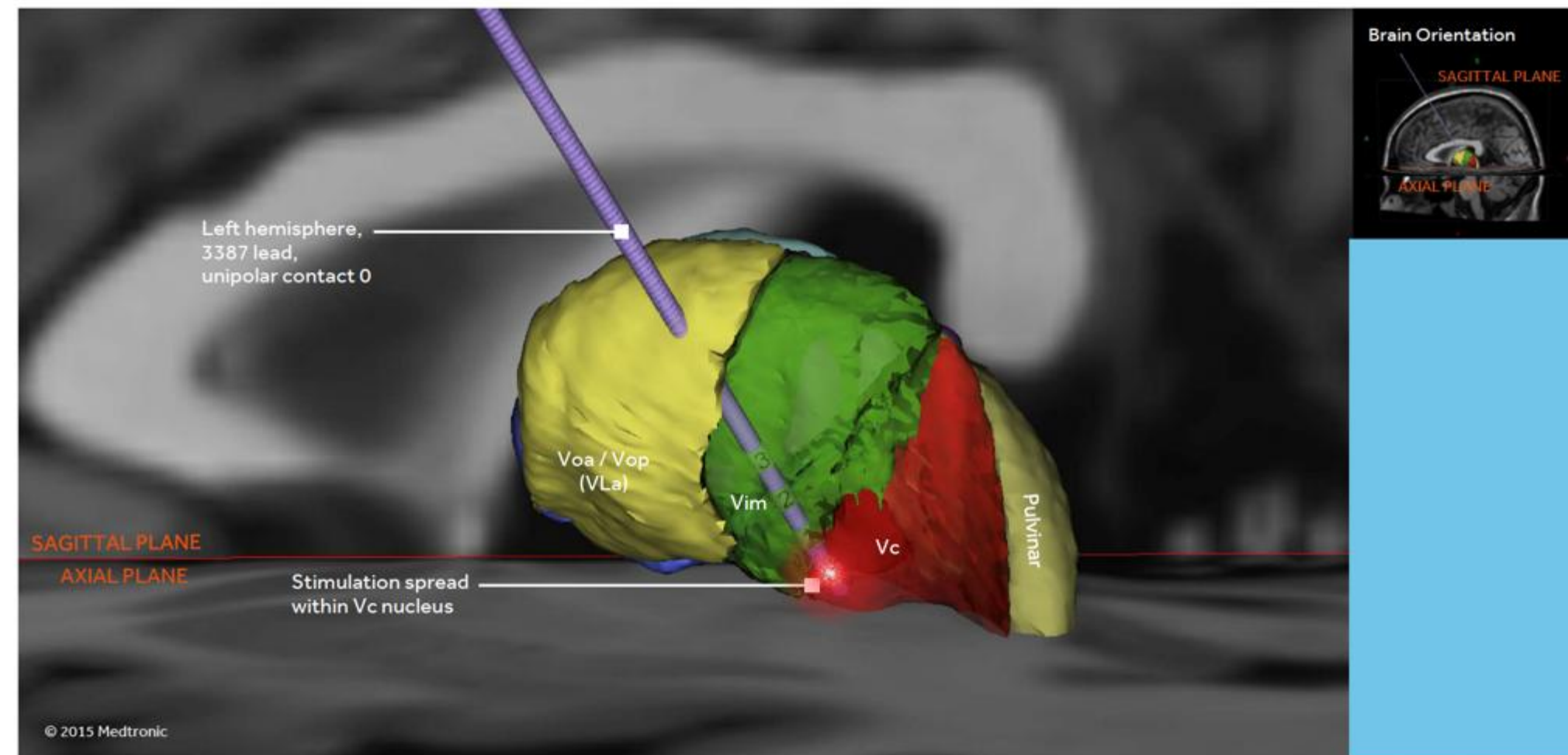
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VIM ventral stim effects



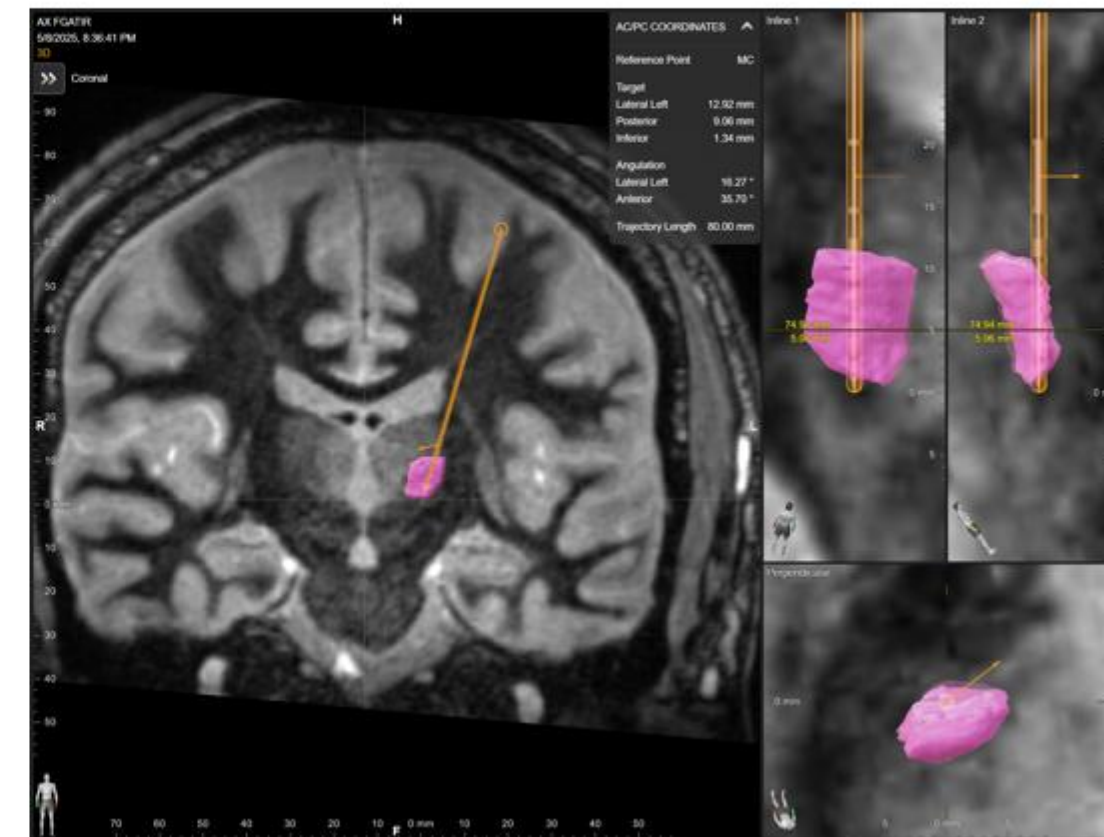
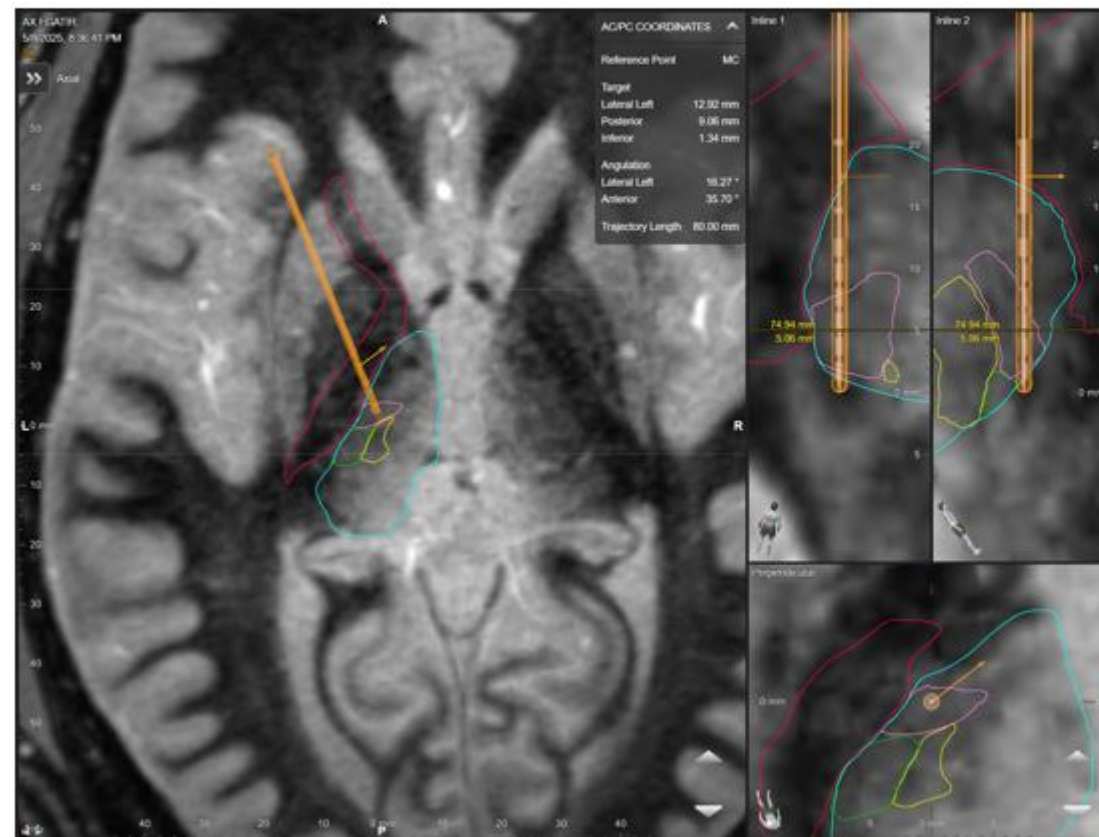
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Example: VIM DBS



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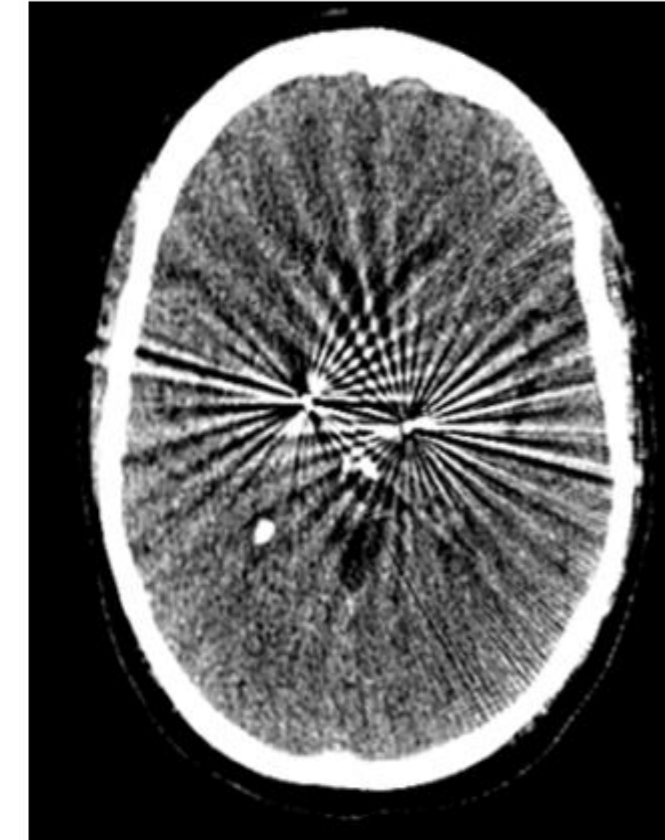
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- Reminder!!!
- Image guidance is only as good as the imaging!

Immediately post-op



6 weeks post-op



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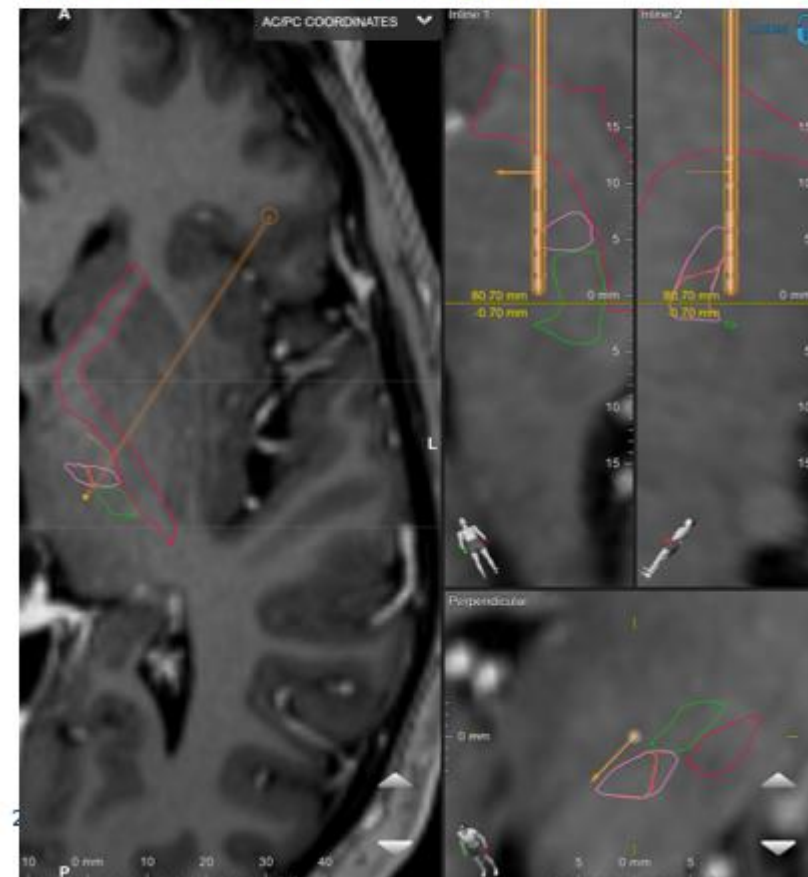
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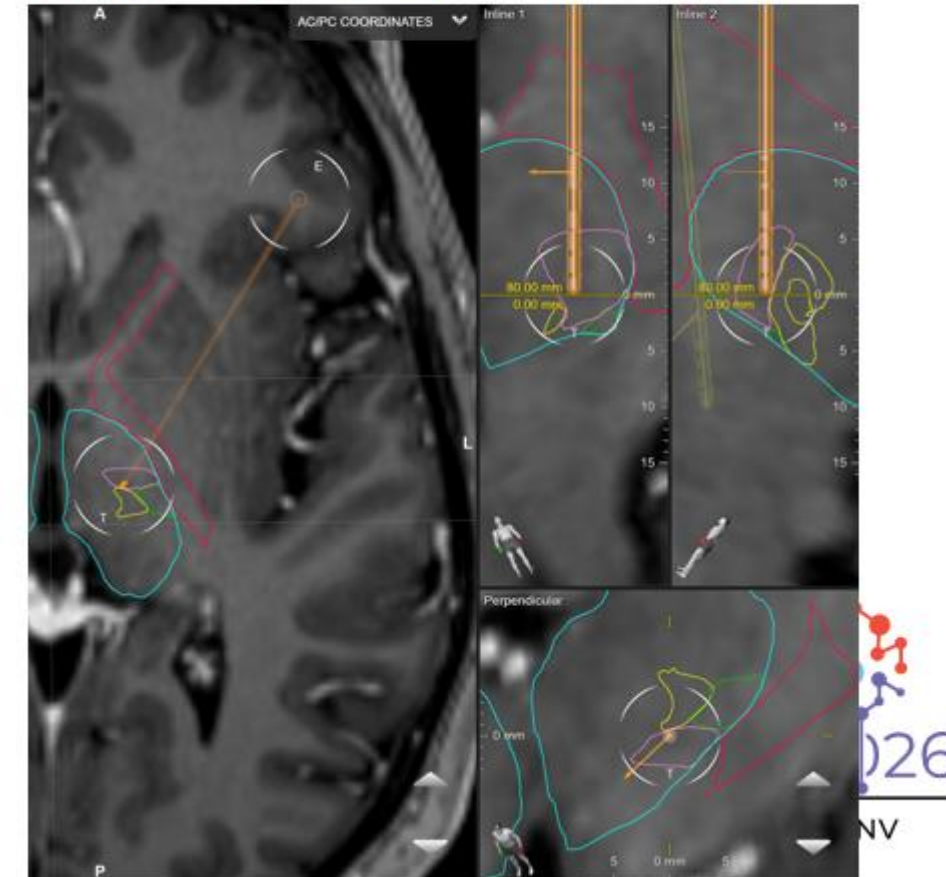
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A tale of two CTs

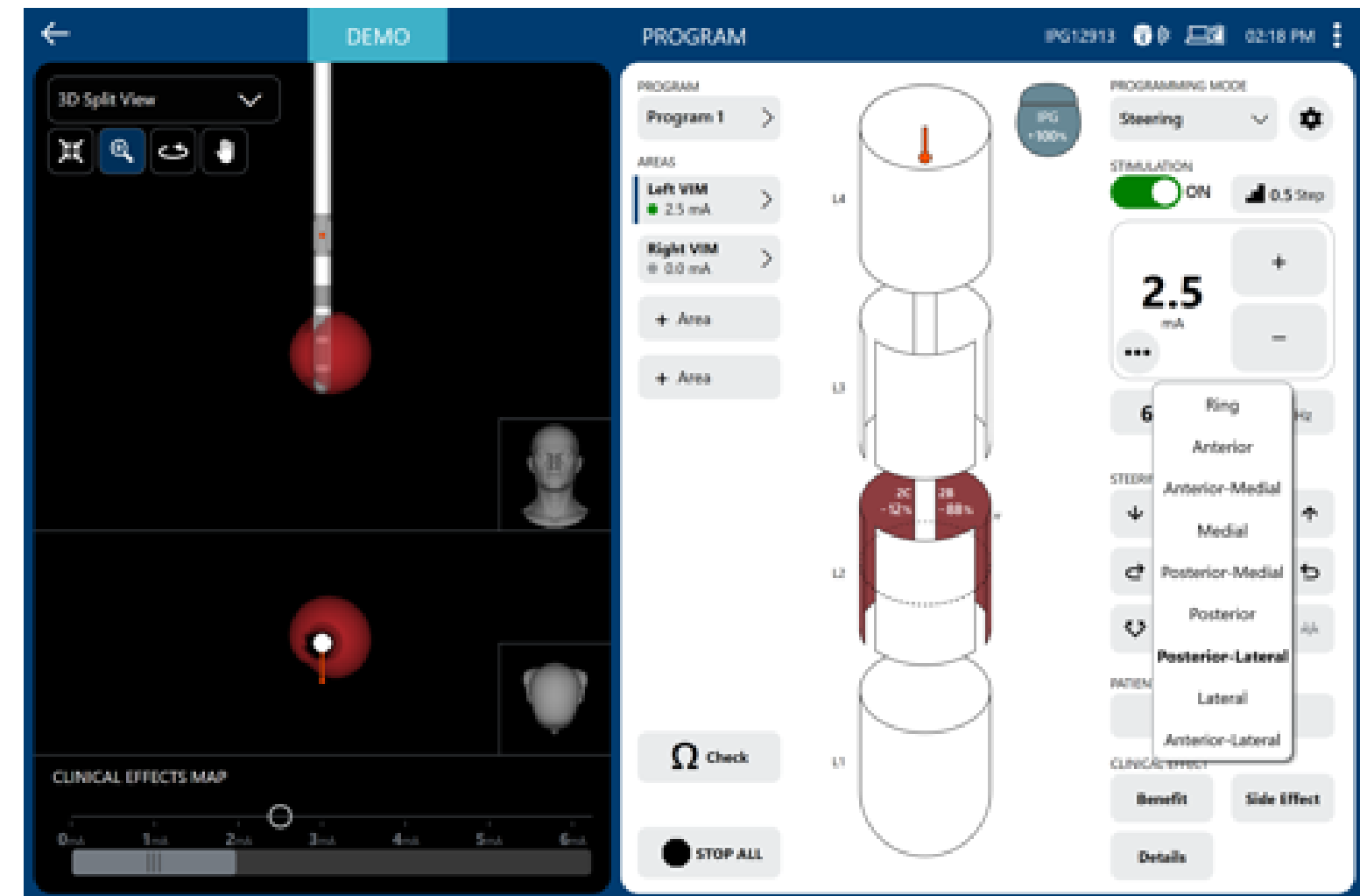
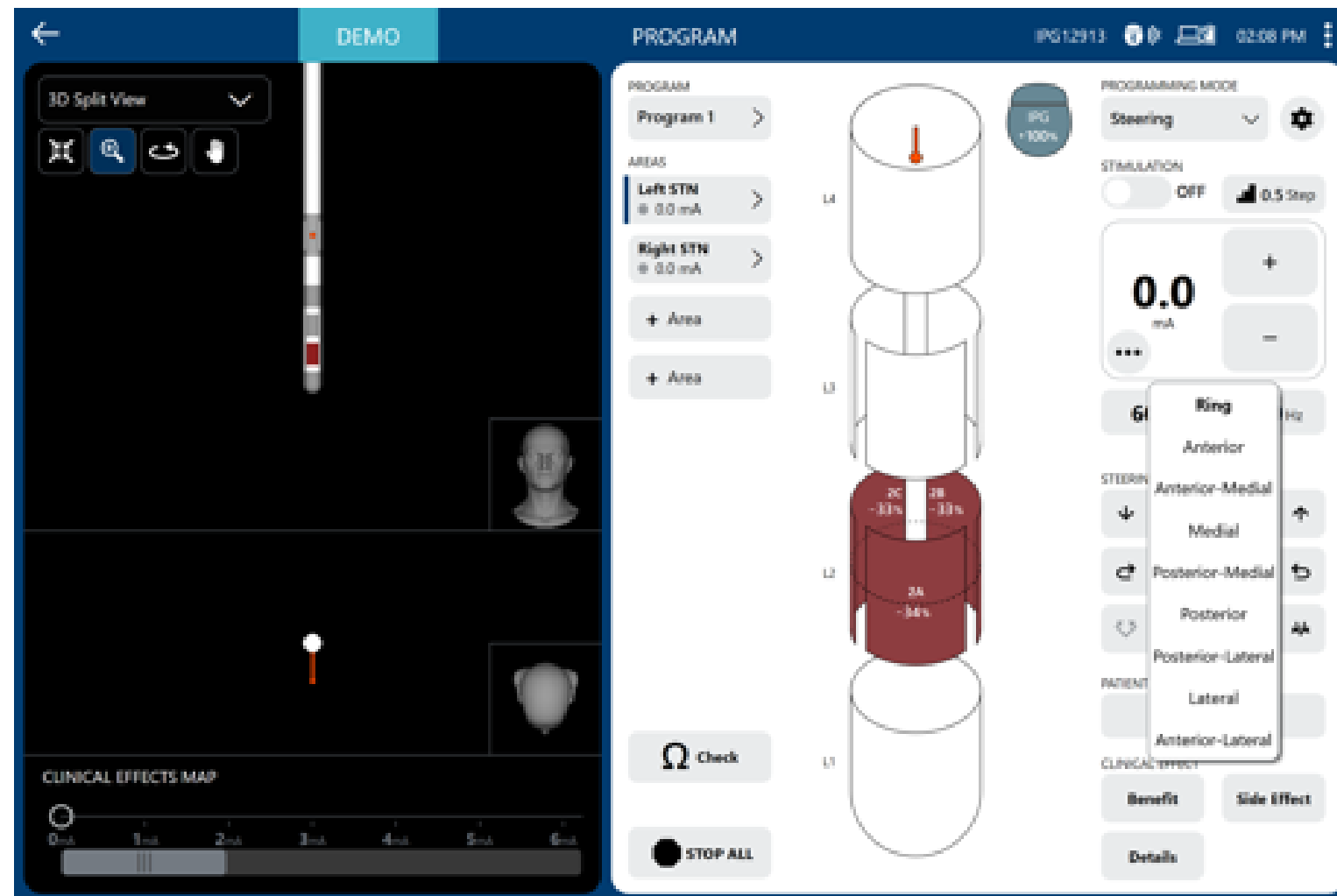
Immediate post-op



6 weeks post op



Directional steering

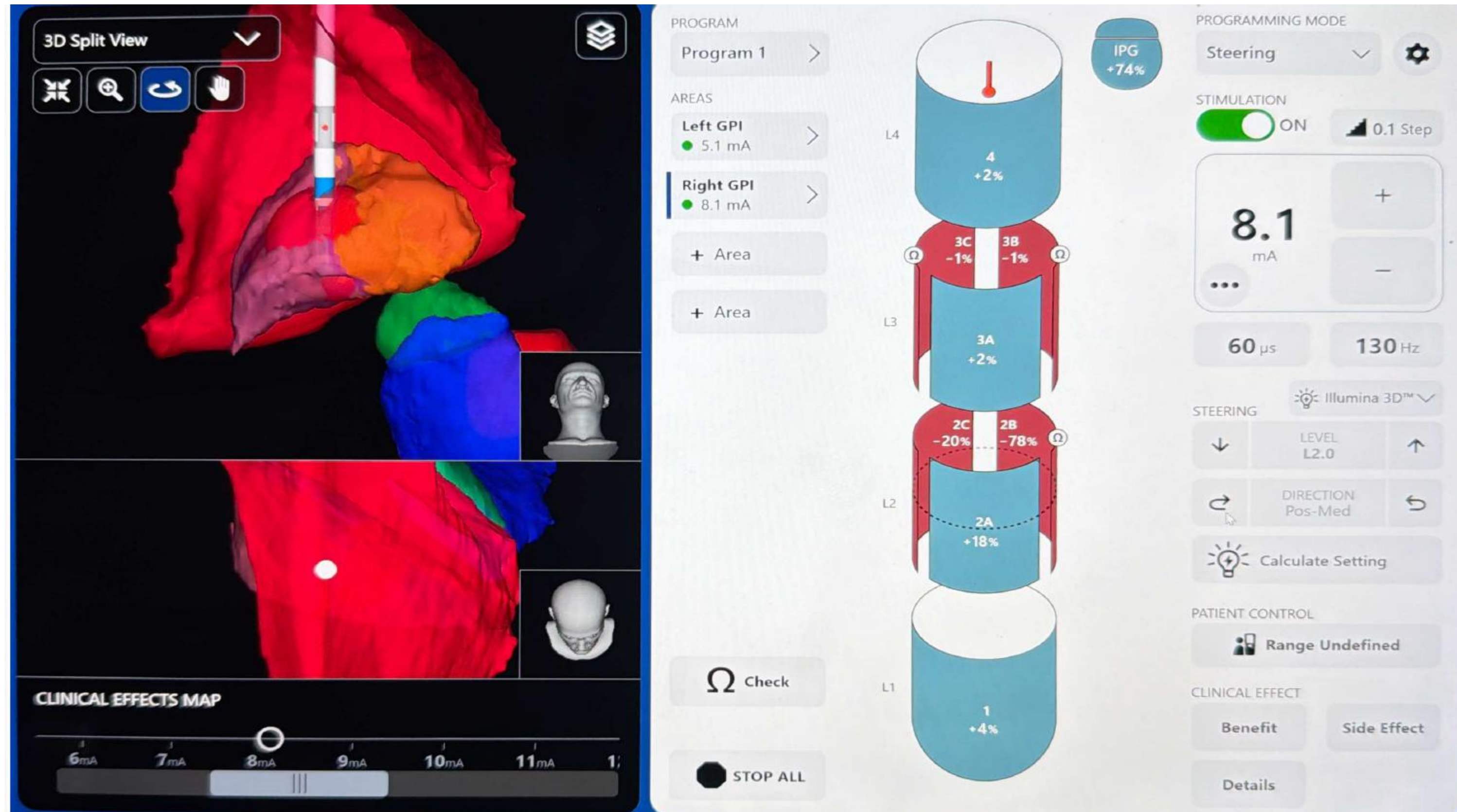


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Questions?