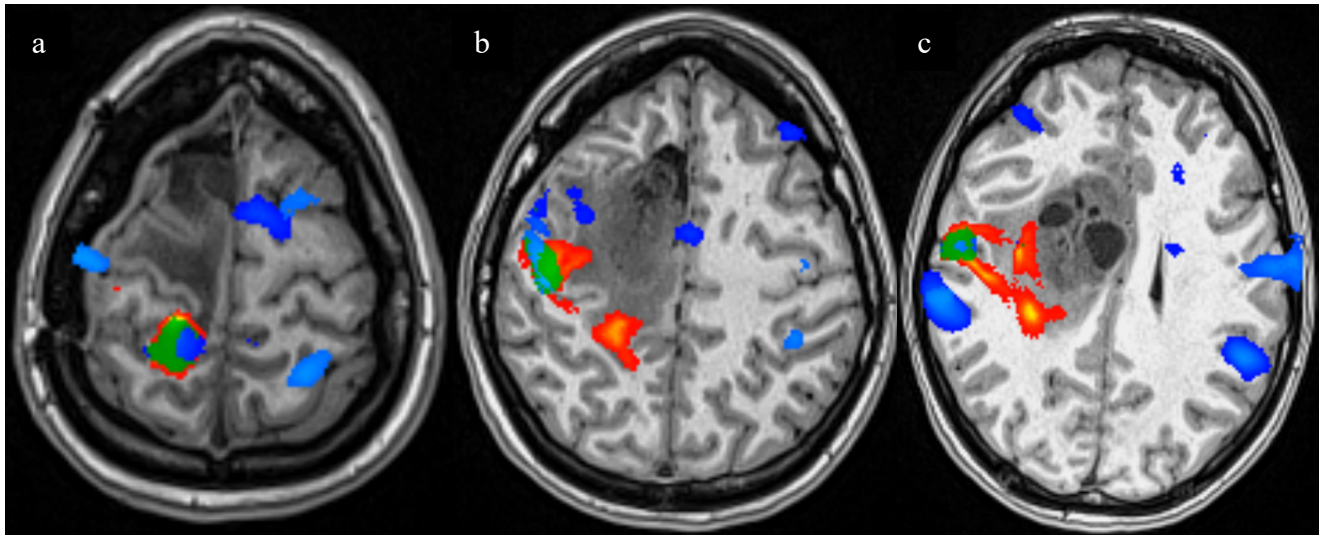
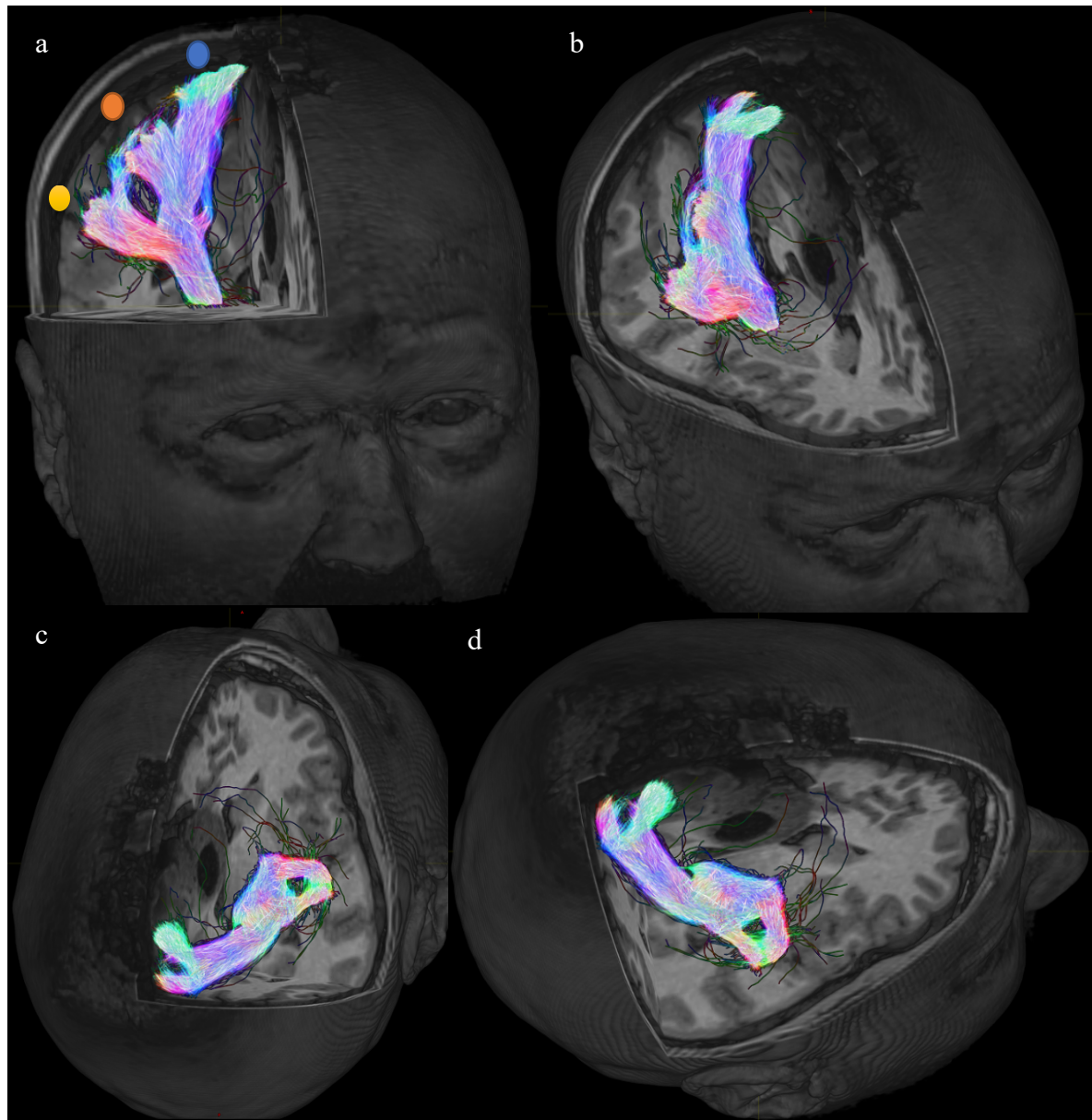


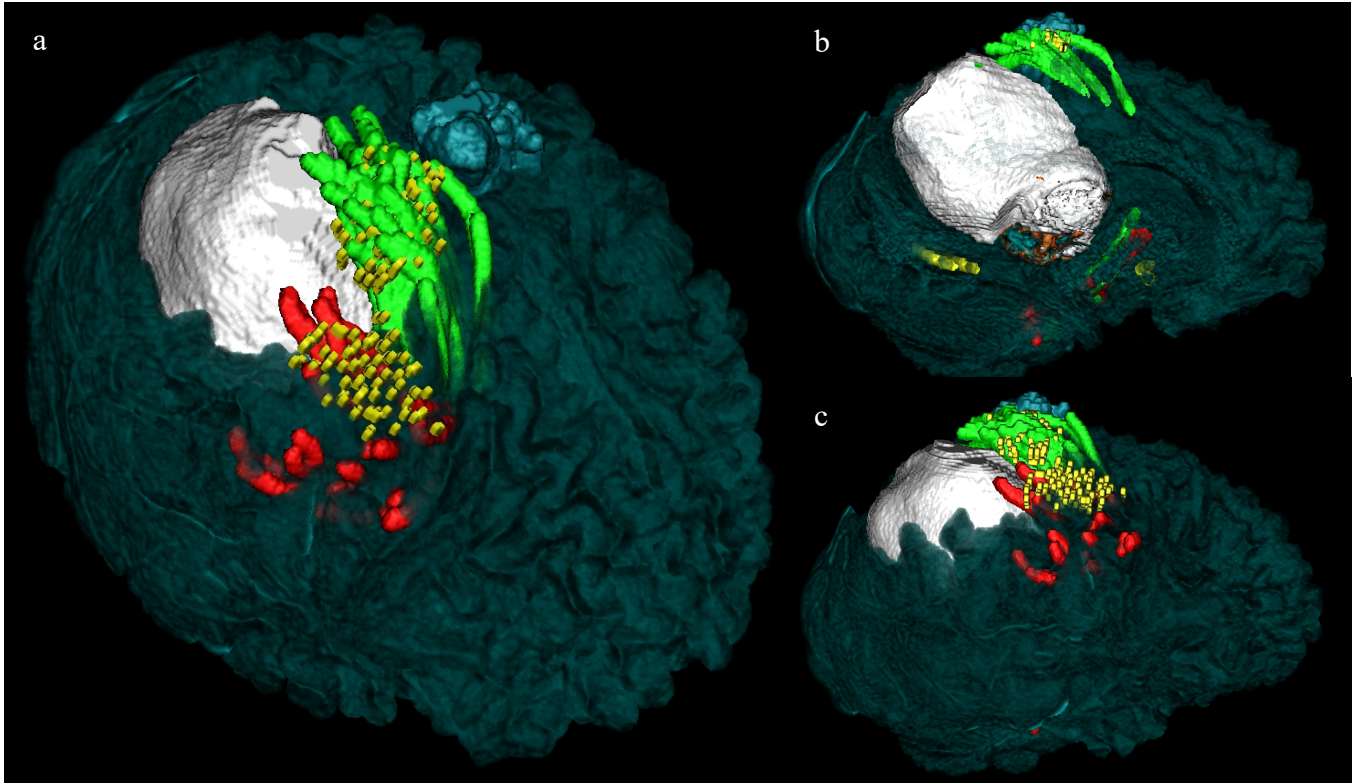
## Supplemental Materials



**Supplemental Figure 1 (a,b,c): fMRI demonstrating complex motor function mapping (a-foot rock task, b-Finger tapping, c-lip smacking) demonstrating cortical complex motor function representation of CST (36y left-handed female with recurrent right frontal transformed WHO Grade III IDH 1 mutant MGMT methylated anaplastic gemistocytic astrocytoma who underwent subtotal resection)**

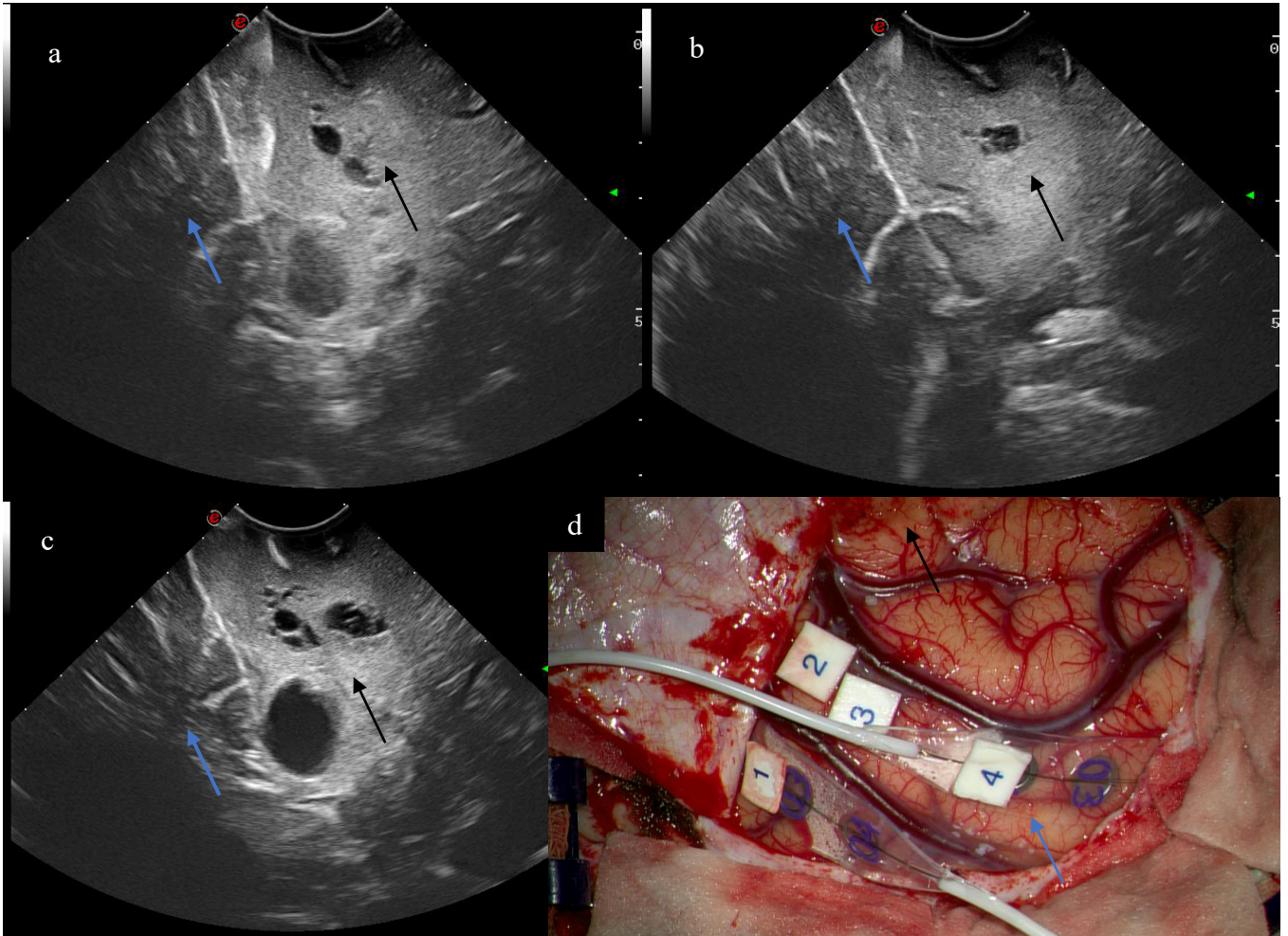


**Supplementary Figure 2 (a,b,c,d): Pre-operative 3D Reconstruction of Cortical and subcortical corticospinal tract**(*foot: blue circle, hand:orange circle, face: yellow circle representation*) utilizing Constrained Probabilistic tractography and modelling (MRTrix opensource software<sup>16</sup>)(*36y left-handed female with recurrent right frontal transformed WHO Grade III IDH 1 mutant MGMT methylated anaplastic gemistocytic astrocytoma who underwent subtotal resection*)



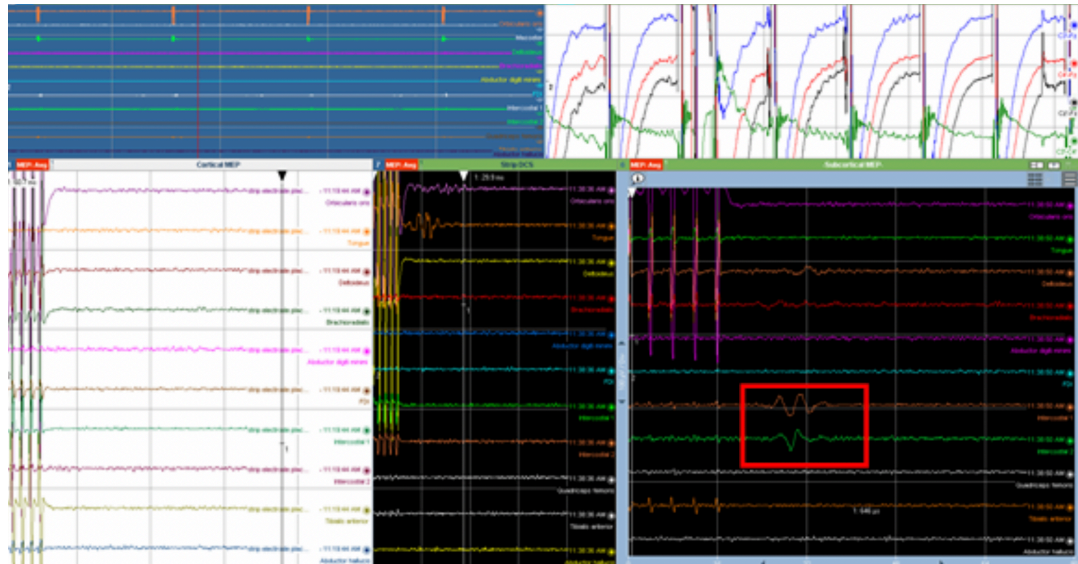
**Supplemental Figure 3 (a,b,c):** Integration of nTMS motor stimulation points with DTI reconstruction with neuronavigation (StealthStation Medtronic S7 machine, StealthViz software) (*White -Tumour, Red – CST (Face + Upper Limb), Green – CST (Lower Limb), Yellow dots – TMS Motor map, Blue Tractography – CST (contralateral to the lesion)*)(22y male with right cystic-solid parietal WHO grade I IDH wildtype, ATRX wildtype, MGMT unmethylated pilocytic astrocytoma who underwent gross total resection)





**Supplemental Figure 4 (a,b,c) :Intraoperative pre-resection ultrasound (ioUS) demonstrating right frontal tumour and its relation to the pre-central cortex at the cortical and subcortical level ; (d) : Intraoperative image with cortical mapping (Tag 1 – Lower Limb, Tag 2 – Lower Limb and Intercostal Muscles, Tag 3 – Intercostal Muscles, Tag 4 – Forearm, Strip Number 1 – Monitoring the Foot, Strip Number 2 – Monitoring the Hand)(Black arrow: tumour location, blue arrow: cortical motor cortex and subcortical CST)(36y left-handed female with recurrent right frontal transformed WHO Grade III IDH 1 mutant MGMT methylated anaplastic gemistocytic astrocytoma who underwent subtotal resection)**





**Supplemental Figure 5: Isolated Subcortical stimulation of intercostal muscles during intraoperative subcortical mapping**

**Supplemental Table 1: Literature Review of Subcortical intraoperative mapping demonstrating each mapped area**

S N	Articles	N	Technique	Pathology	Mapped Areas					MT (mA)
					Leg	Trunk	Arm	Hand	Face	
1.	(Duffau <i>et al.</i> , 2003) <sup>36</sup>	39	Bipolar	Glioma	+	-	+	+	+	-
2.	(Mikuni <i>et al.</i> , 2007) <sup>10</sup>	21	Monopolar Train of 4 (cortical) Bipolar train of 4 (subcortical)	Glioma Cavernoma Ependy- mo- ma	+	-	+	+	-	5-15
3.	(Bello <i>et al.</i> , 2008) <sup>8</sup>	57	Monopolar	Glioma	+	-	+	+	-	3.5-16
4.	(Vassal <i>et al.</i> , 2013) <sup>9</sup>	10	Monopolar	Glioma	+	-	+	+	+	-
5.	(Bello <i>et al.</i> , 2014) <sup>37</sup>	59 1	High frequency (monopolar) vs Low frequency (bipolar)	Glioma	+	-	+	+	+	HF: 5- 13 LF: 2-6
6.	(Ghimire <i>et al.</i> , 2019) <sup>7</sup>	1	Monopolar (Train of 5)	Glioma	-	+ Intercost- al muscle	-	-	-	5

*MT: motor threshold, mA: milliamperes*

**Supplemental Table 2: Case series of cortical and subcortical intercostal muscles Stimulation (MEP)**

SN	Age	Location of lesion	Histopathology	Cortical stimulation	Subcortical stimulation	nTMS pre-op
1	53y	Right SMA	Anaplastic Oligodendroglioma Grade III (IDH -, ATRX preserved)	N	Y; 4mA	Yes
2	64y	Right parietal	Metastatic malignant melanoma	N	Y; 4mA	Yes
3	35y	Right SMA	Oligodendroglioma Grade III (IDH1 mutant, ATRX preserved)	N	Y; 5mA	Yes
4	69y	Left Precentral	Radiation induced Vascular malformation	Y; 14 mA	Y; 6mA	No
5	31y	Right parietal	Glioblastoma Grade IV (IDH wild; ATRX preserved; MGMT unmethylated)	N	Y; 6mA	No
6	62y	Left Precentral	Metastatic Carcinoma Lung	Y;12mA	N	Yes
7	41y	Left Central lobule	Metastatic Breast Carcinoma	Y: 10mA	N	Yes
8	56y	Left precentral	Metastatic lung Carcinoma	Y: 6mA	Y; 12 mA	Yes
9	57y	Right frontal	Anaplastic oligodendroglioma (IDH-mutant, grade III IDH1 R132H clone positive (IHC) ATRX retained)	Y: 10mA	Y	Yes
10	36y	Right frontal	Anaplastic gemistocytic astrocytoma (IDH mutant, WHO grade III ATRX lost)	Y	N	Yes
11	36y	Left precentral	Glioblastoma, IDH-wildtype, grade IV (WHO) (IDH wildtype ATRX expression retained Unmethylated MGMT promoter)	N	Y; 5mA	Yes



*nTMS: navigated transcranial magnetic stimulation; SMA: supplementary motor area; IDH: isocitrate dehydrogenase ; ATRX: alpha-thalassemia/mental retardation, X-linked; MGMT: Methyl Guanine Methyl Transferase ; IHC: immunohistochemistry ; mA: milliamperes*