

Figure S1. $D_{RBE|LEM-1}$ and $D_{RBE|mMKM}$ statistics for GTV, HD-CTV and HD-PTV : D2%, D50%, D98%.
Solid and dashed line represent threshold for respective clinical goal.

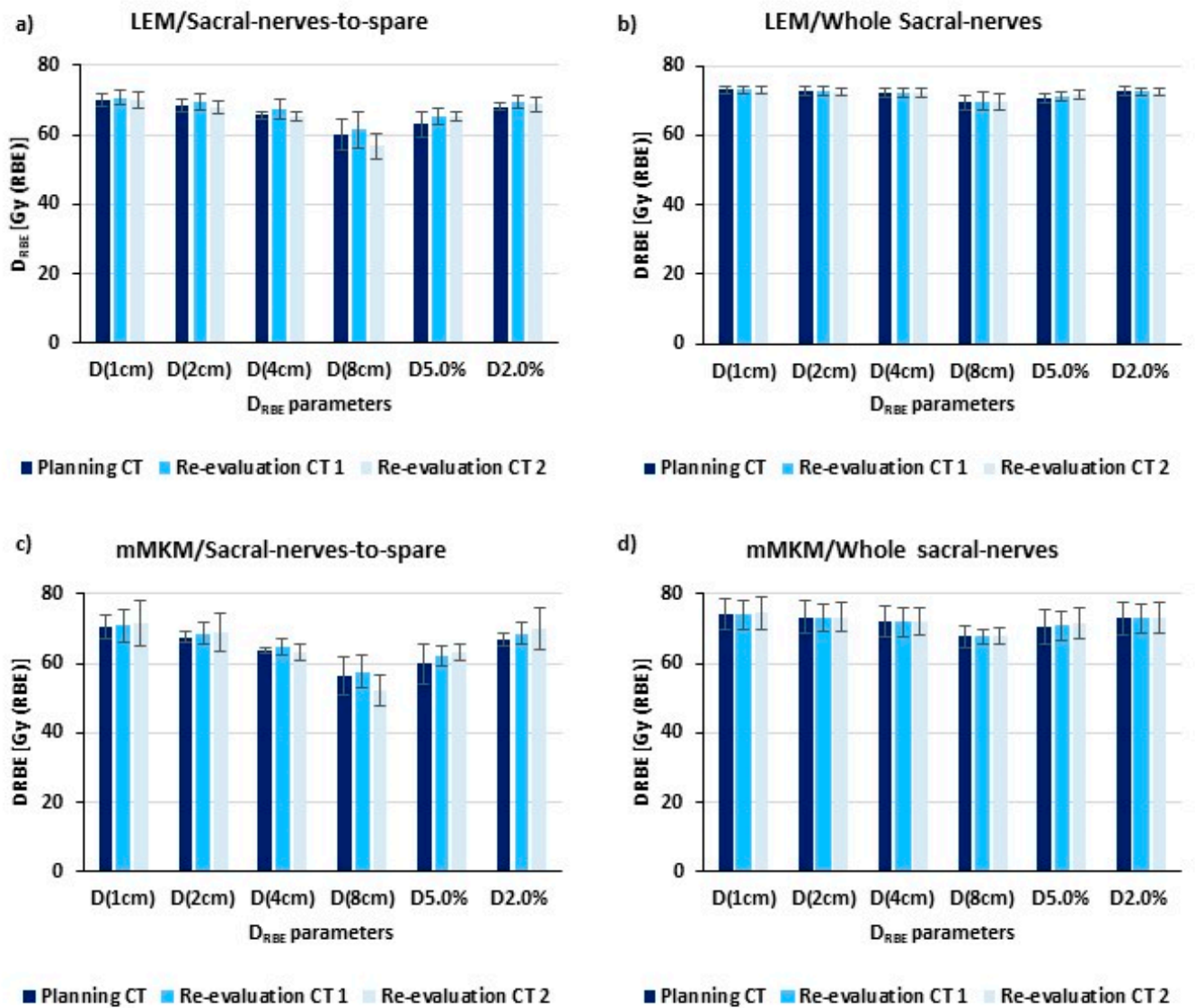


Figure S2. Robustness analysis SNSo-CIRT strategy: Comparison of $D_{RBE|LEM-I}$ and $D_{RBE|mMKM}$ statistics for sacral-nerve-to-spare and whole sacral-nerve on re-evaluation CT scans compared to original planning CT. (n = 7).

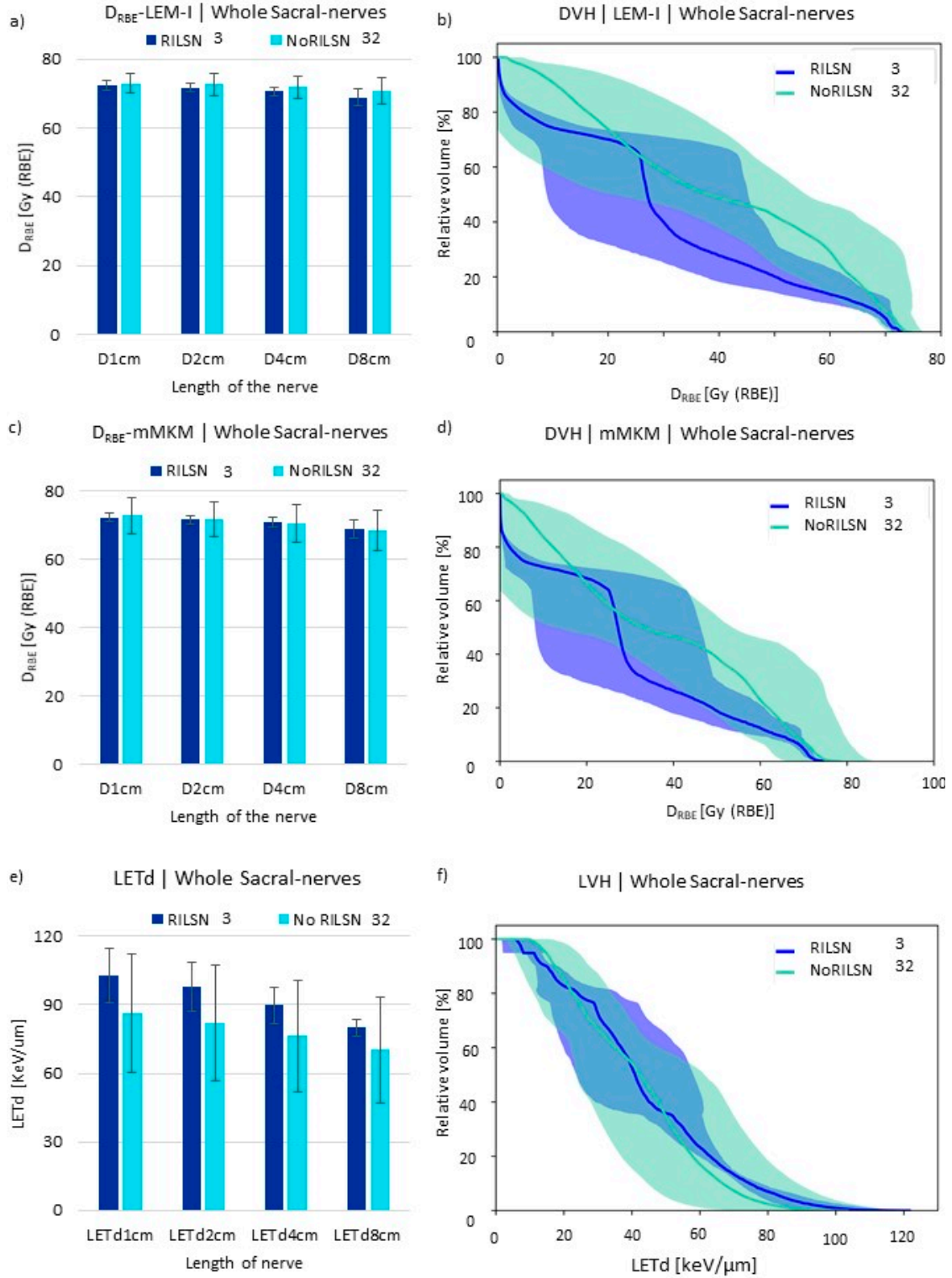


Figure S3. D_{RBE}^{LEM-I} and D_{RBE}^{mMKM} and LETd statistics. a) LEM-I doses, c) mMKM doses and e) LETd received by 1 cm, 2 cm, 4 cm and 8 cm lengths of the whole sacral nerves in patients with and without RILSN. DVH analysis of whole sacral nerves in patients with and without RILSN with respect to b) LEM-I and d) mMKM model-based dose calculation. f) Relative- volume LVH of the whole sacral nerves of patient with RILSN and those without RILSN.

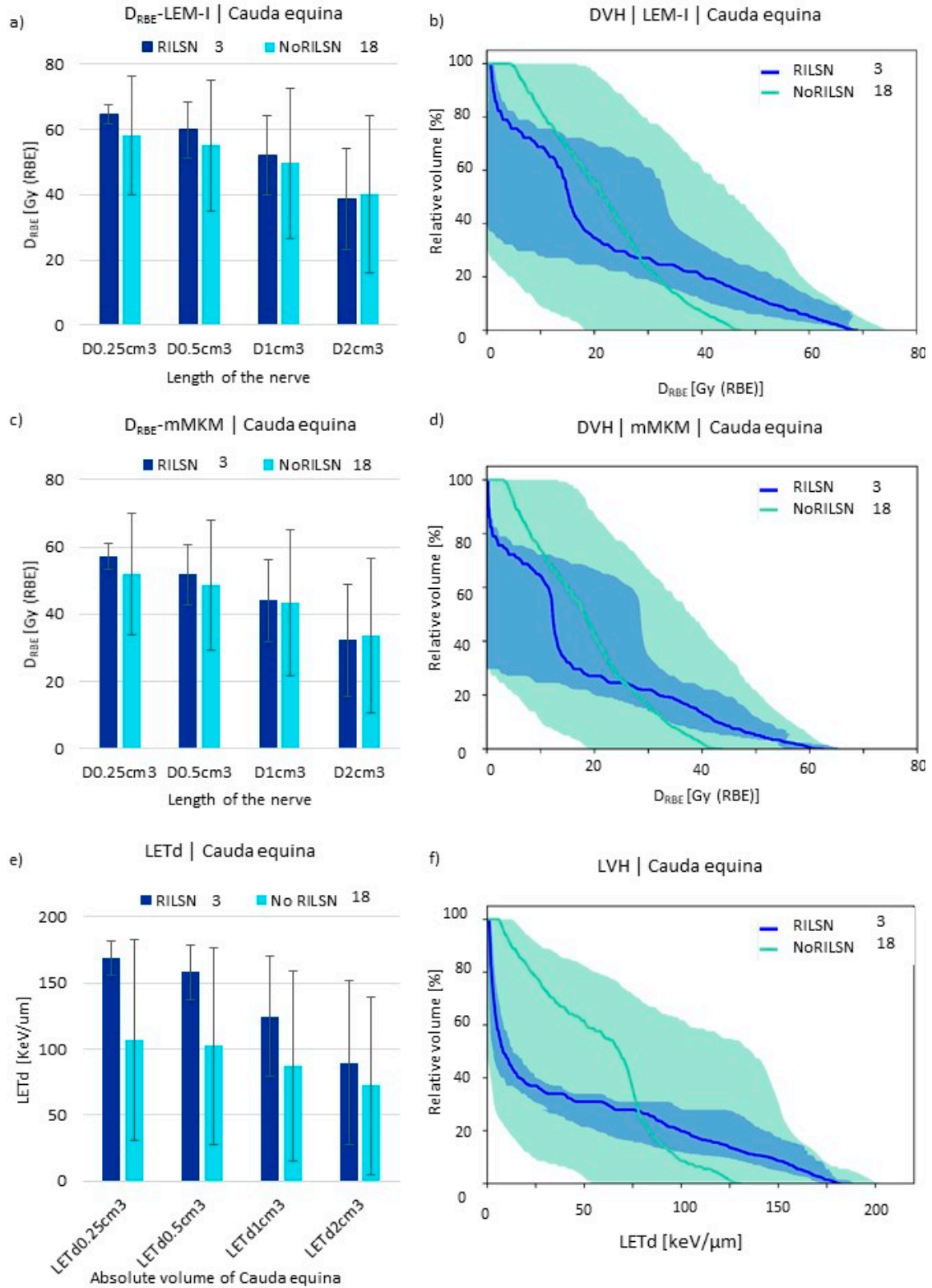


Figure S4. $D_{RBE|LEM-I}$ and $D_{RBE|mMKM}$ and LETd statistics. a) LEM-I doses, c) mMKM doses and e) LETd received by doses to 0.25 cm³, 0.5 cm³, 1 cm³, 2 cm³ of cauda equina in patients with and without RILSN. DVH analysis of cauda equina in patients with and without RILSN with respect to b) LEM-I and d) mMKM model-based dose calculation. f) Relative- volume LVH of the cauda equina of patient with RILSN and those without RILSN. (p = not significant).

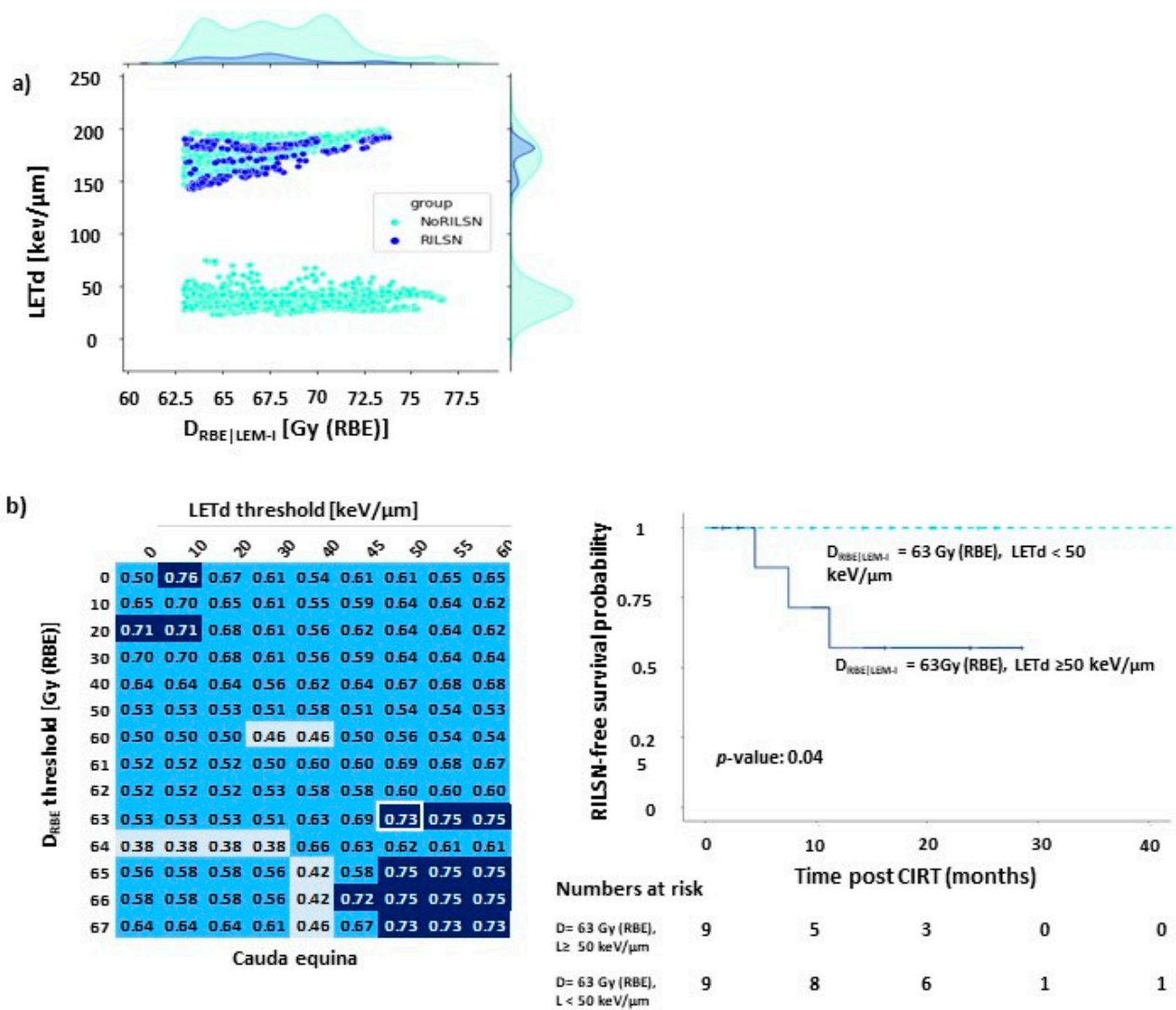


Figure S5: Voxel by voxel LETd analysis plot for a) cauda equina at D_{RBE} cutoff = 63 Gy (RBE). AUC value matrix for D_{RBE} -filtered-LETd for b) cauda equina. c) Kaplan Meier survival analysis of cases with for $D_{RBE|LEM-I}$ cutoff = 63 Gy (RBE) and LETd cutoff = 50 keV/and μ m for (Note: n: RILSN = 3, NoRILSN = 15).