Library of RF exposure from generic birdcages for comprehensive implant-safety evaluation

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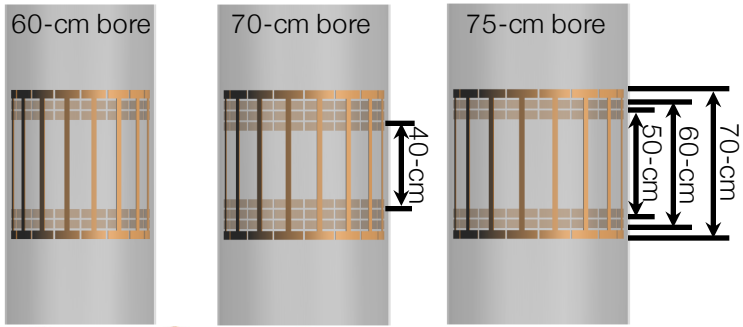
RF-birdcage exposure library



- to promote convergence and uniformity of exposure conditions for implant-safety evaluation
- support regulatory and compliant review
- expansion- and version-control- friendly

- 6 virtual patients
- 10 (cylindrical) coils
- 64 and 128 MHz

RF-birdcage exposure library

64 MHz

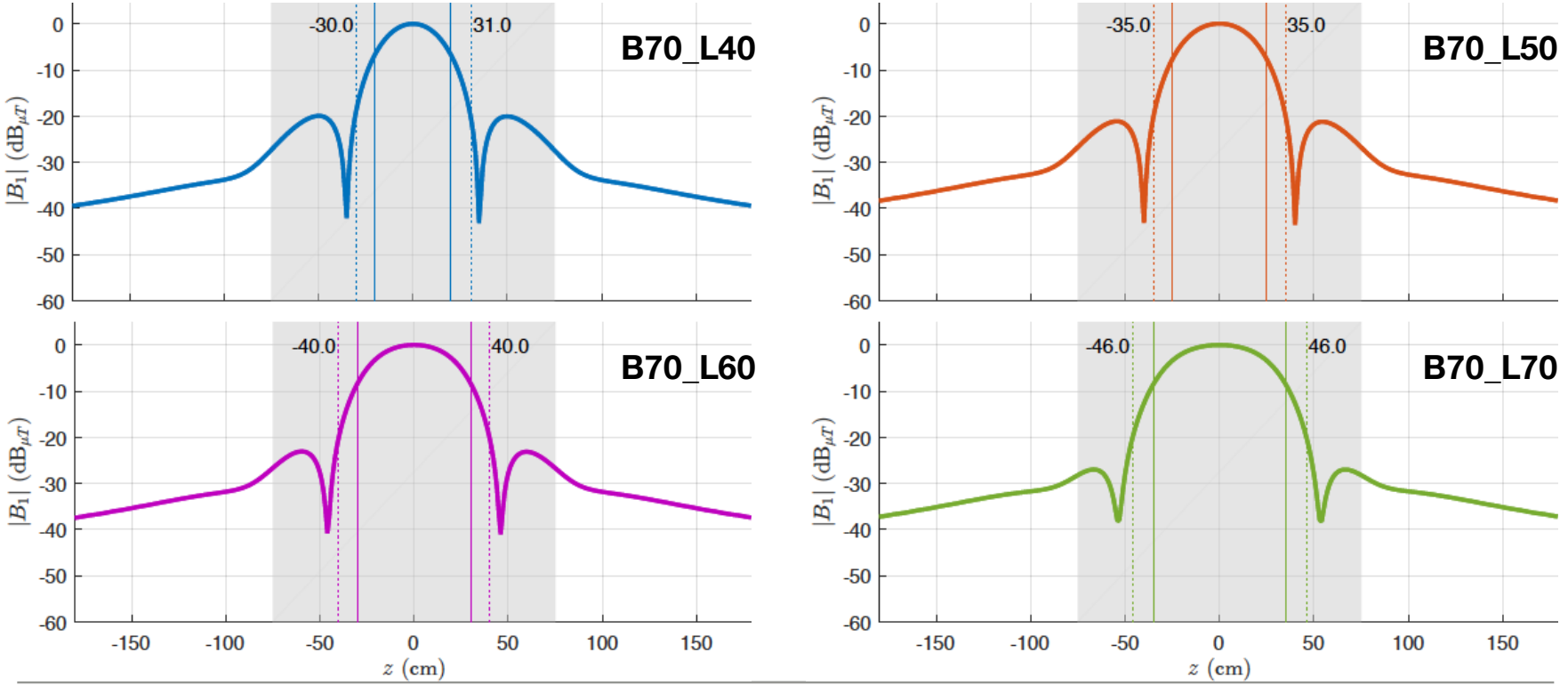
BORE \ LENGTH	40-cm	50-cm	60-cm	70-cm
60-cm		110.6	104.5	97.5
70-cm	106.9	100.0	96.0	91.0
75-cm		96.9	92.0	87.3

128 MHz

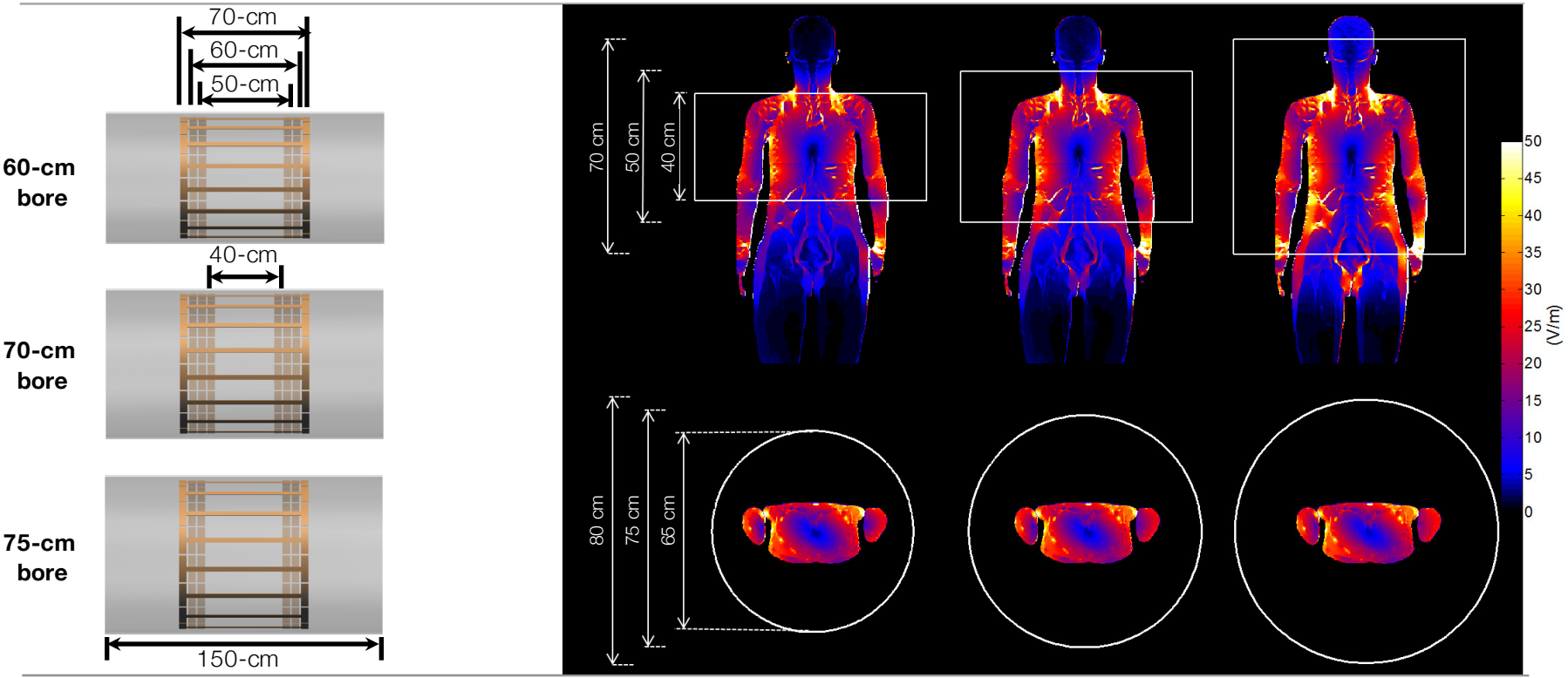
BORE \ LENGTH	40-cm	50-cm	60-cm	70-cm
60-cm		25.1	22.1	17.8
70-cm	25.1	22.1	19.9	16.4
75-cm		21.7	18.9	15.4

All values provided in pF

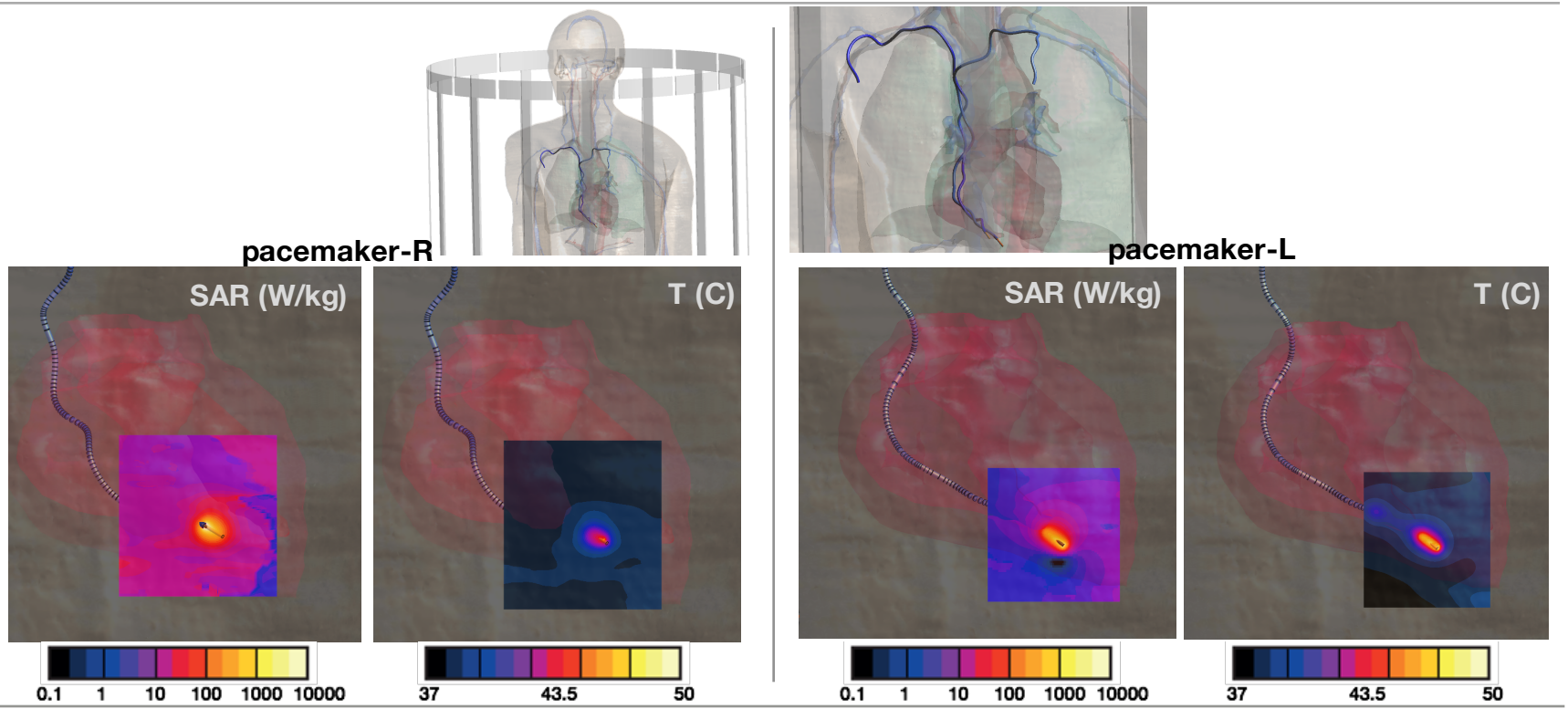
RF-birdcage exposure library



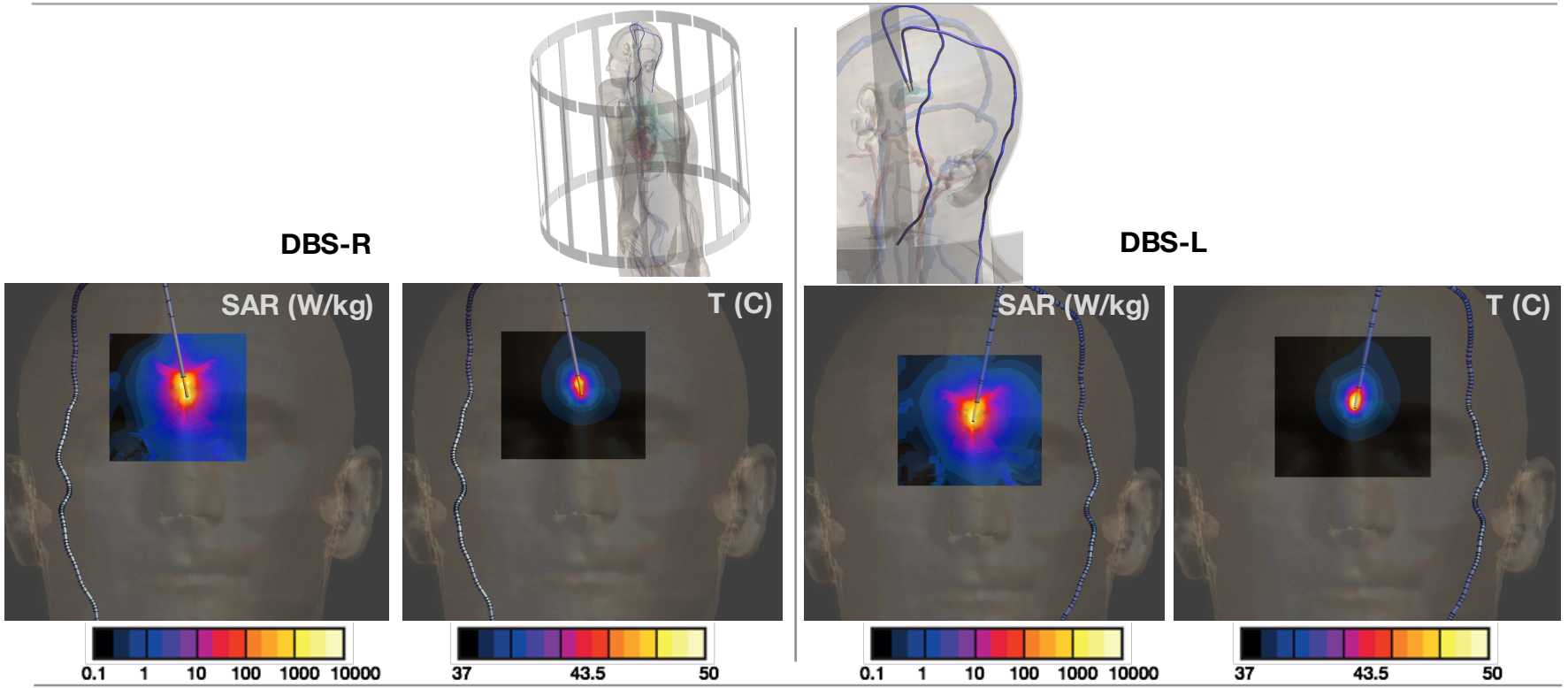
Induced EMF evaluation



RF-induced implant heating



RF-induced implant heating



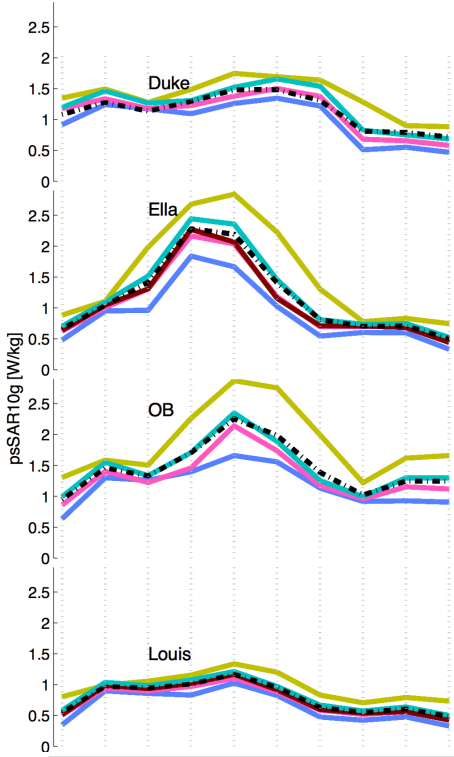
RF-induced implant heating

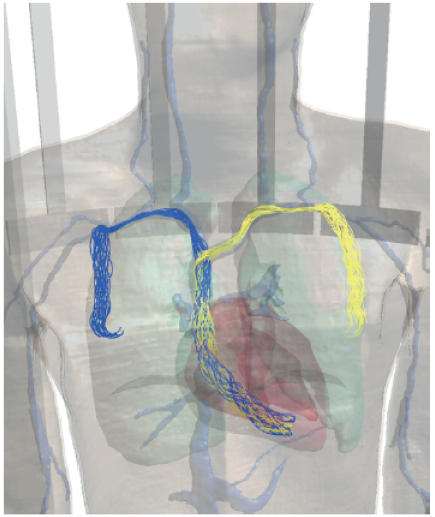
ΔT @ first-level controlled mode exposure limit*

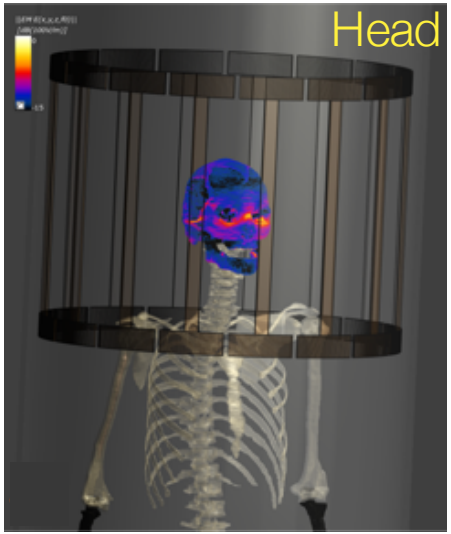
		DBS (R)	DBS (L)	Pacemaker (R)	Pacemaker (L)
head	ΔT w/ implant (K)	92.5	96.4	1.3	6.3
	ΔT w/o implant (K)	<1	<1	<1	<1
thorax	ΔT w/ implant (K)	11	22.7	7.9	11
	ΔT w/o implant (K)	<1	<1	<1	<1

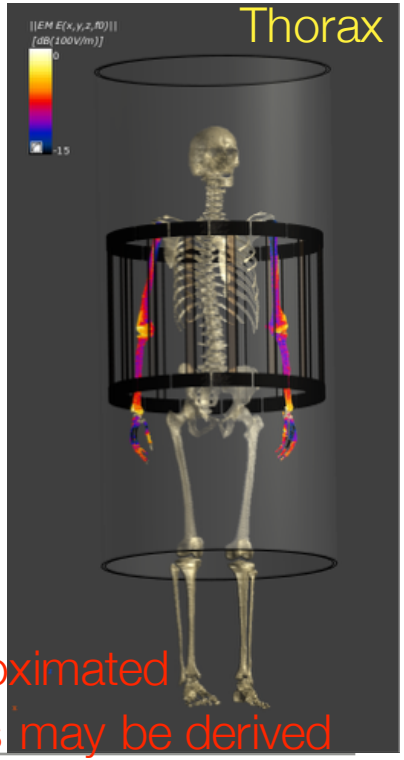
***head imaging position: headSAR = 3.2 W/kg**
***thorax imaging position: wbSAR = 4.0 W/kg**

in vivo incident to implants and safety limits derivation



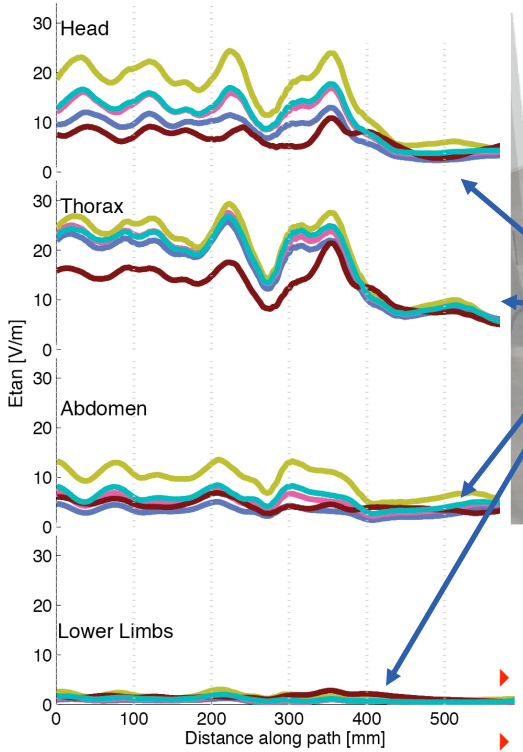


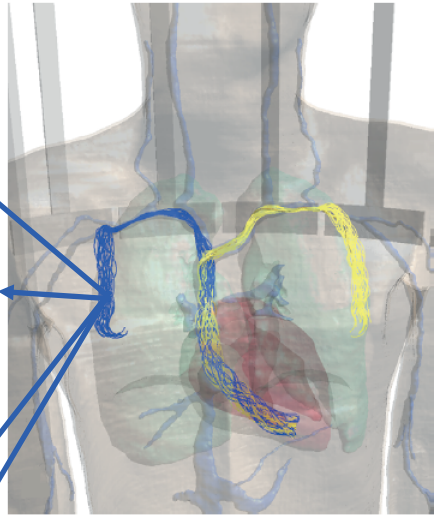


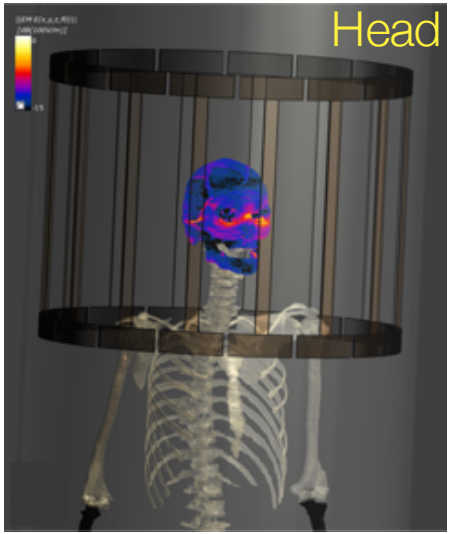


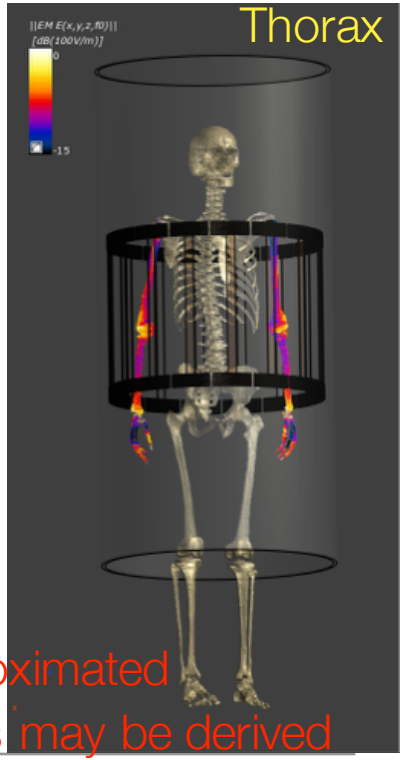
- *in vivo* incident to the implants can be approximated
- safety criteria due to RF-implant interactions may be derived

in vivo incident to implants and safety limits derivation









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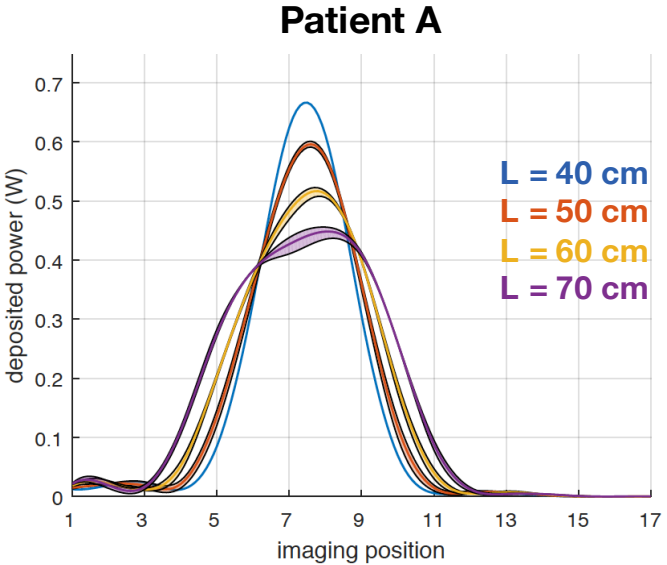
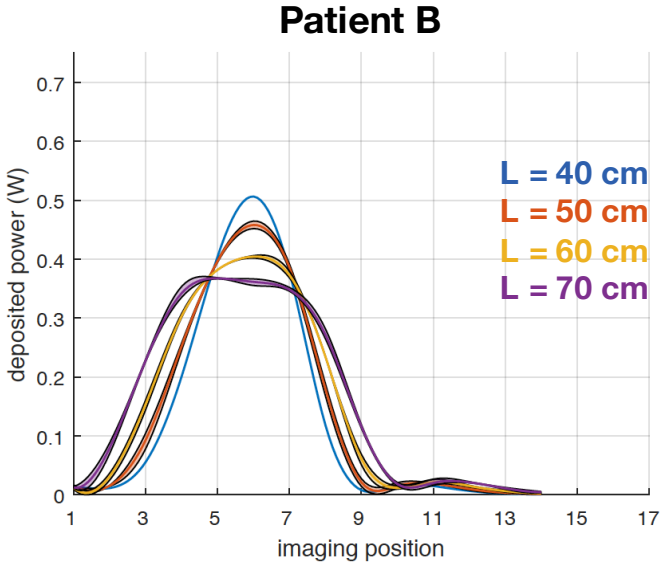
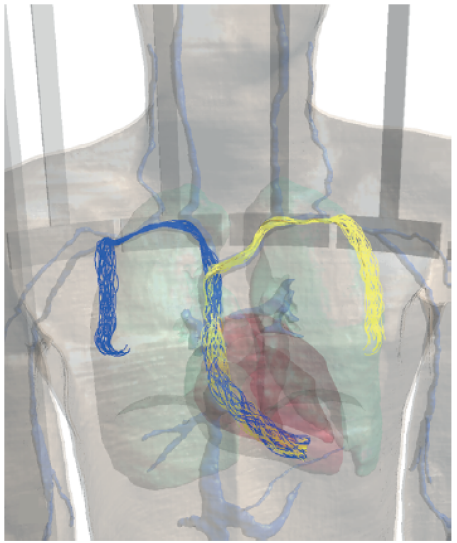
Application: safety evaluation from RF-heating







- implant-heating: f(anatomy, RF-coil, imaging position, routings)
- different permutations are needed for safety evaluation

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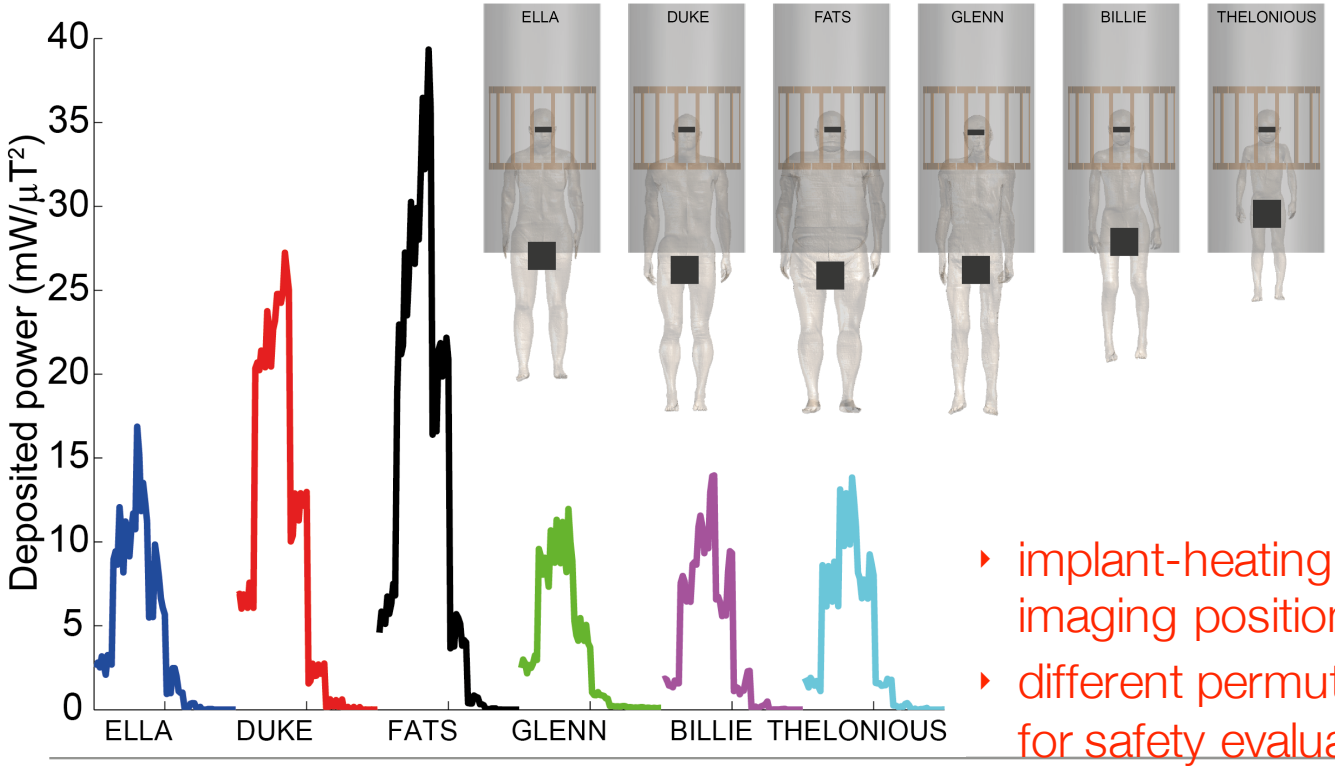

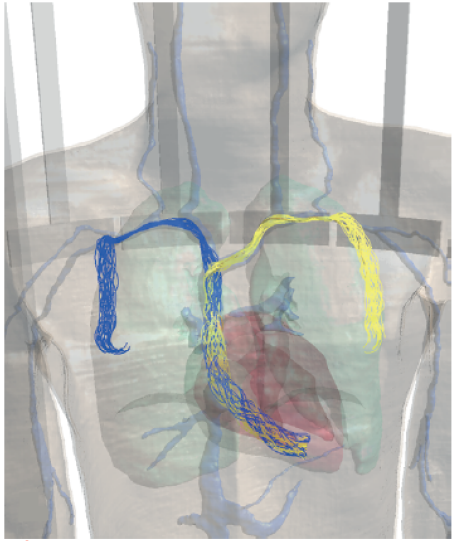

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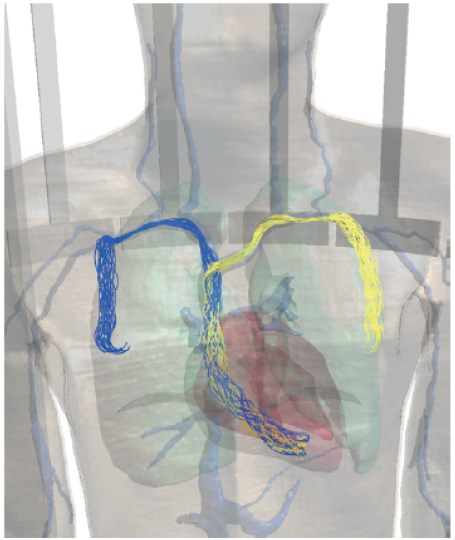
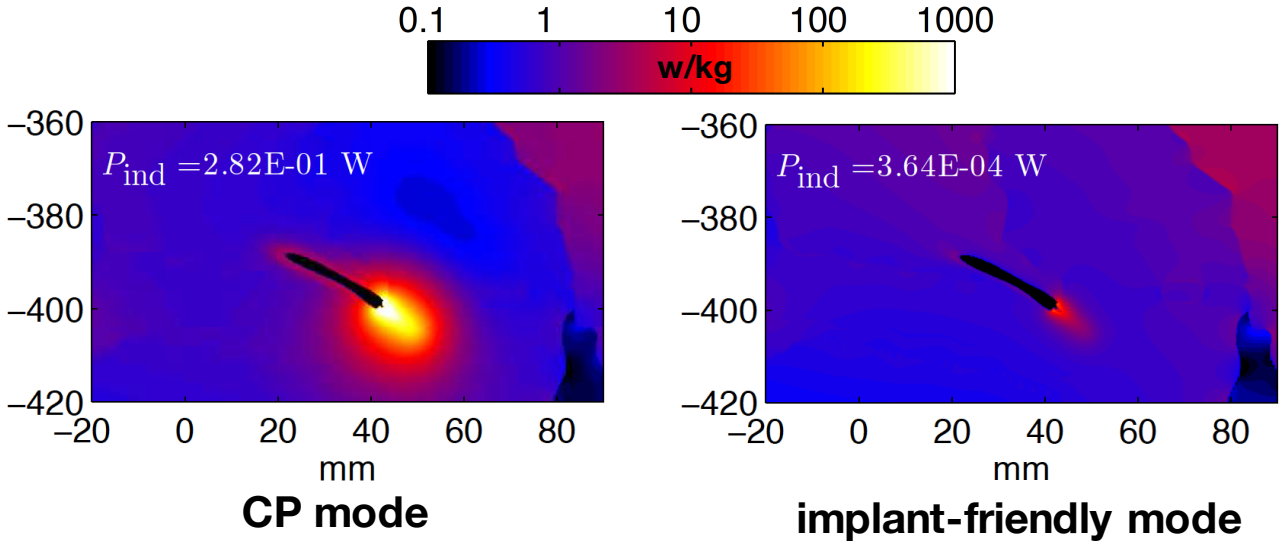
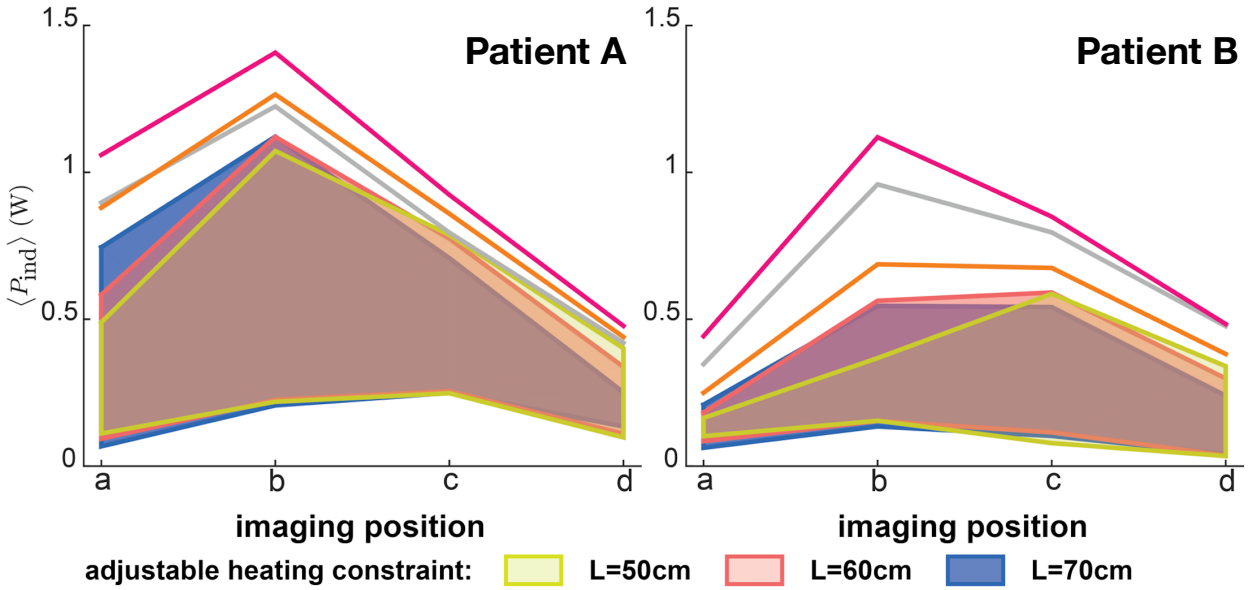
Application: implant-heating mitigation during MRI

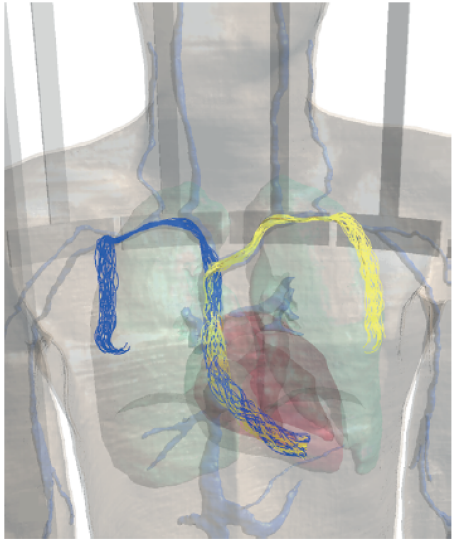




- establish safety margin from theoretical bounds
- establish patient-specific safety-concept

Application: implant-heating mitigation during MRI





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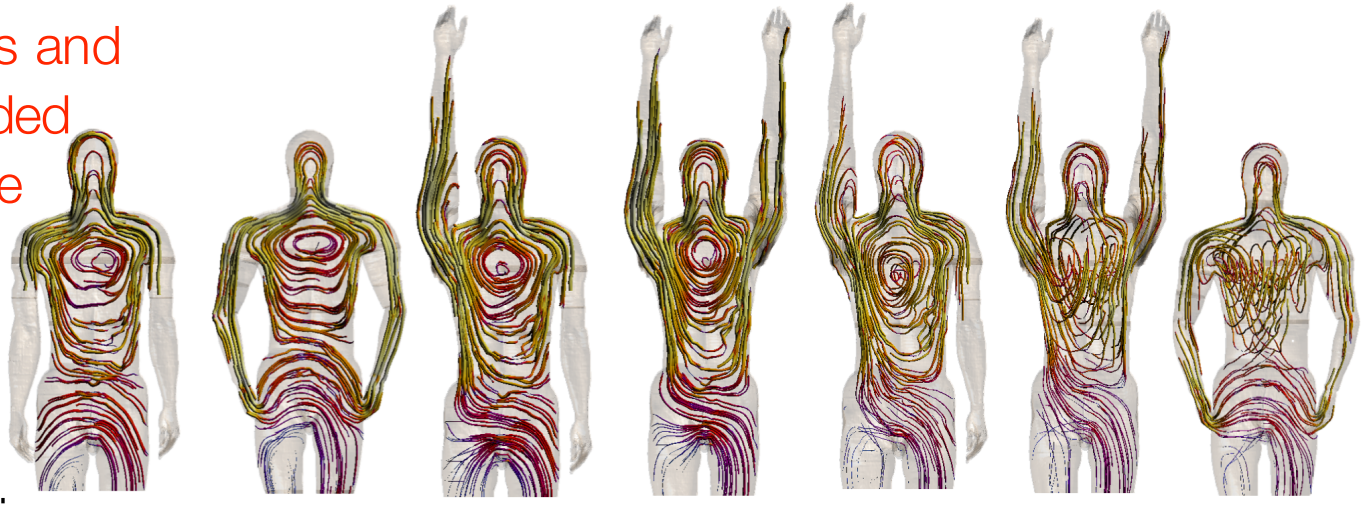
Future considerations

- population expansion
  - more body types and postures are needed for comprehensive evaluation



- on-line data solution
  - data version control feasible
  - support regulatory and compliant review