GERMAN
CANCER RESEARCH CENTER

Carleton UNIVERSITY

Lung EIT: Should we reconstruct conductivity or resistivity?

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How does choice of physics affect reconstruction?

Sensitivity (conductivity)

$$S = \frac{\partial v}{\partial \sigma}$$

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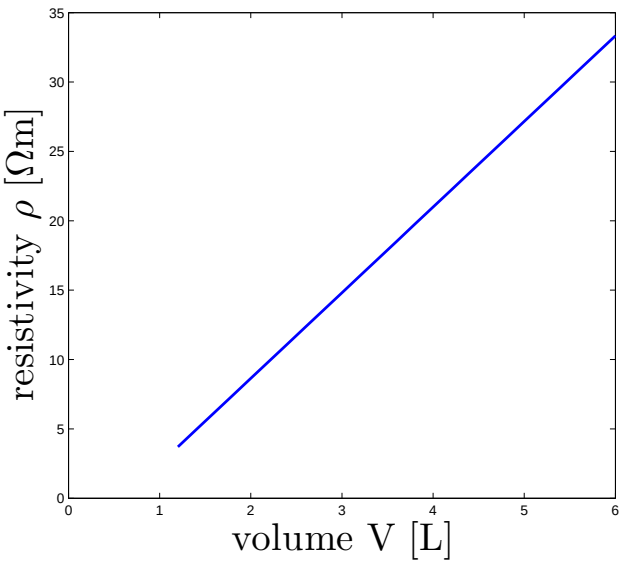

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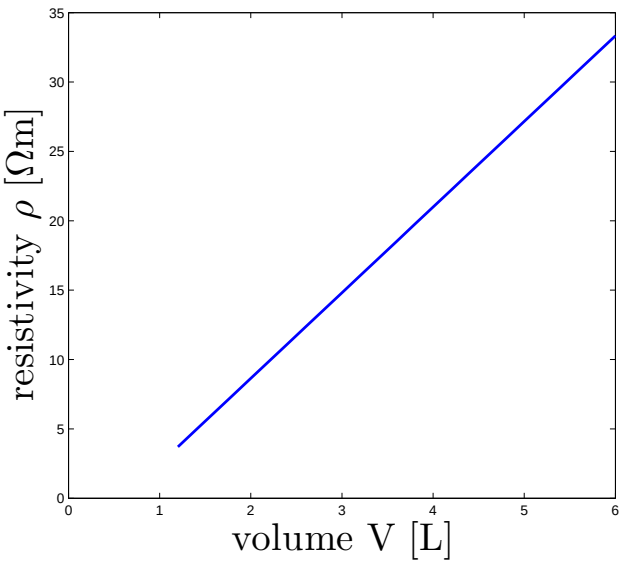

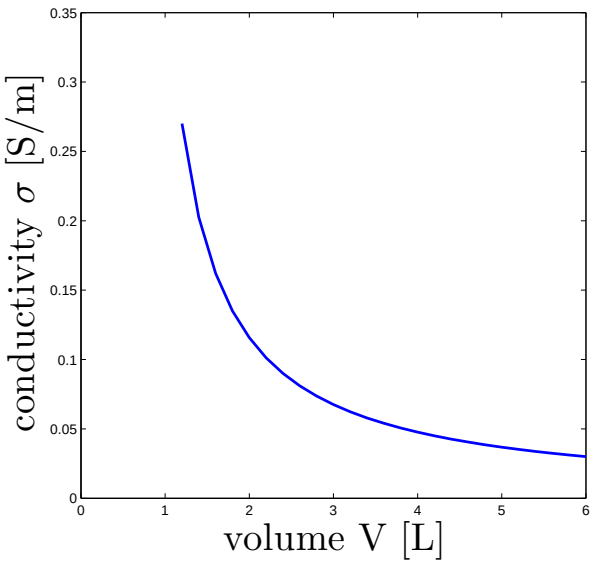

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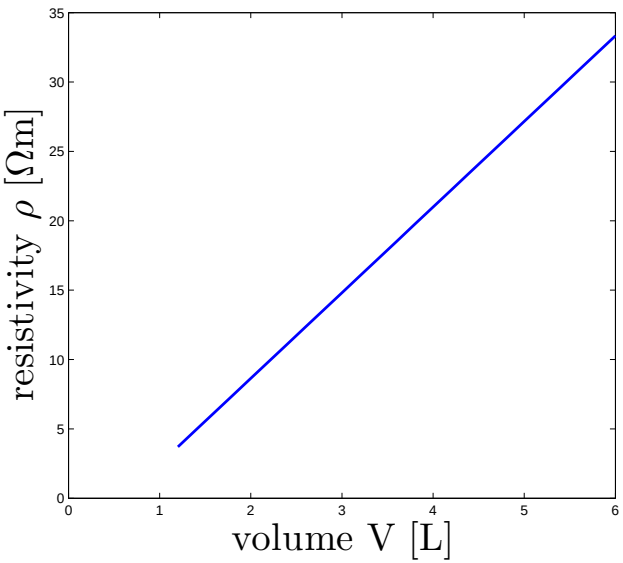
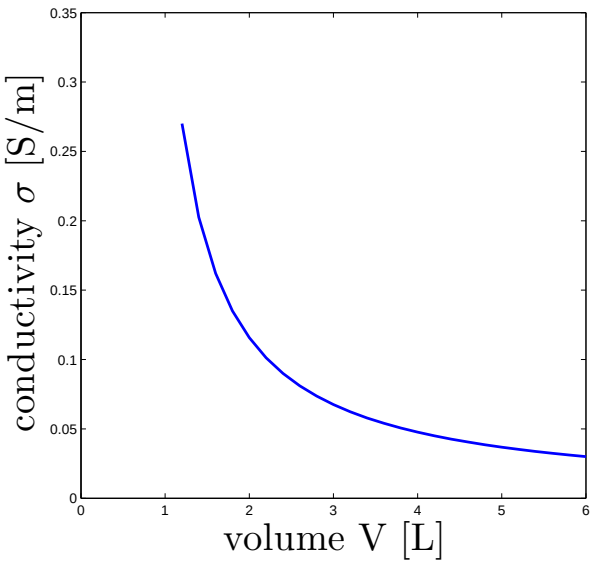
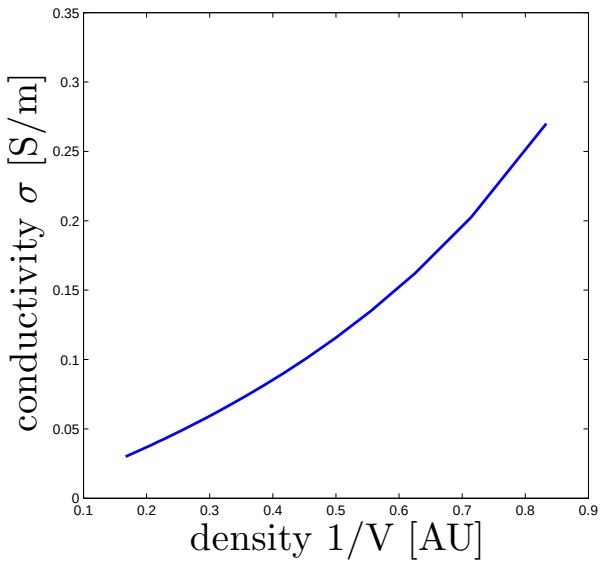
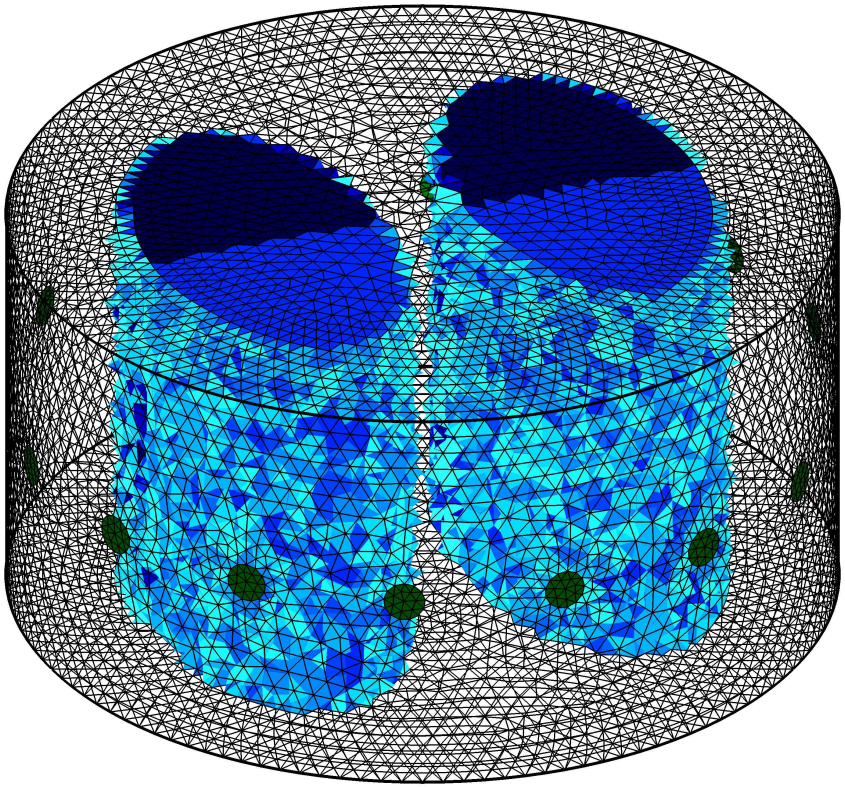


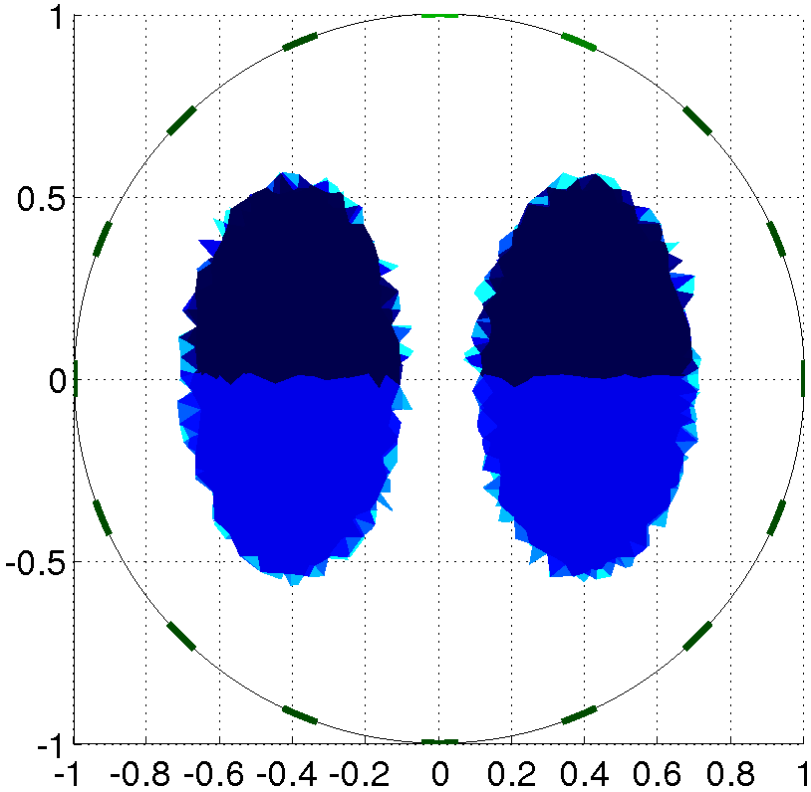




Non-homogeneous lungs



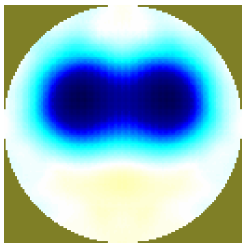
(a)

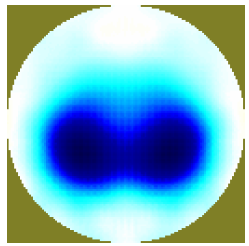


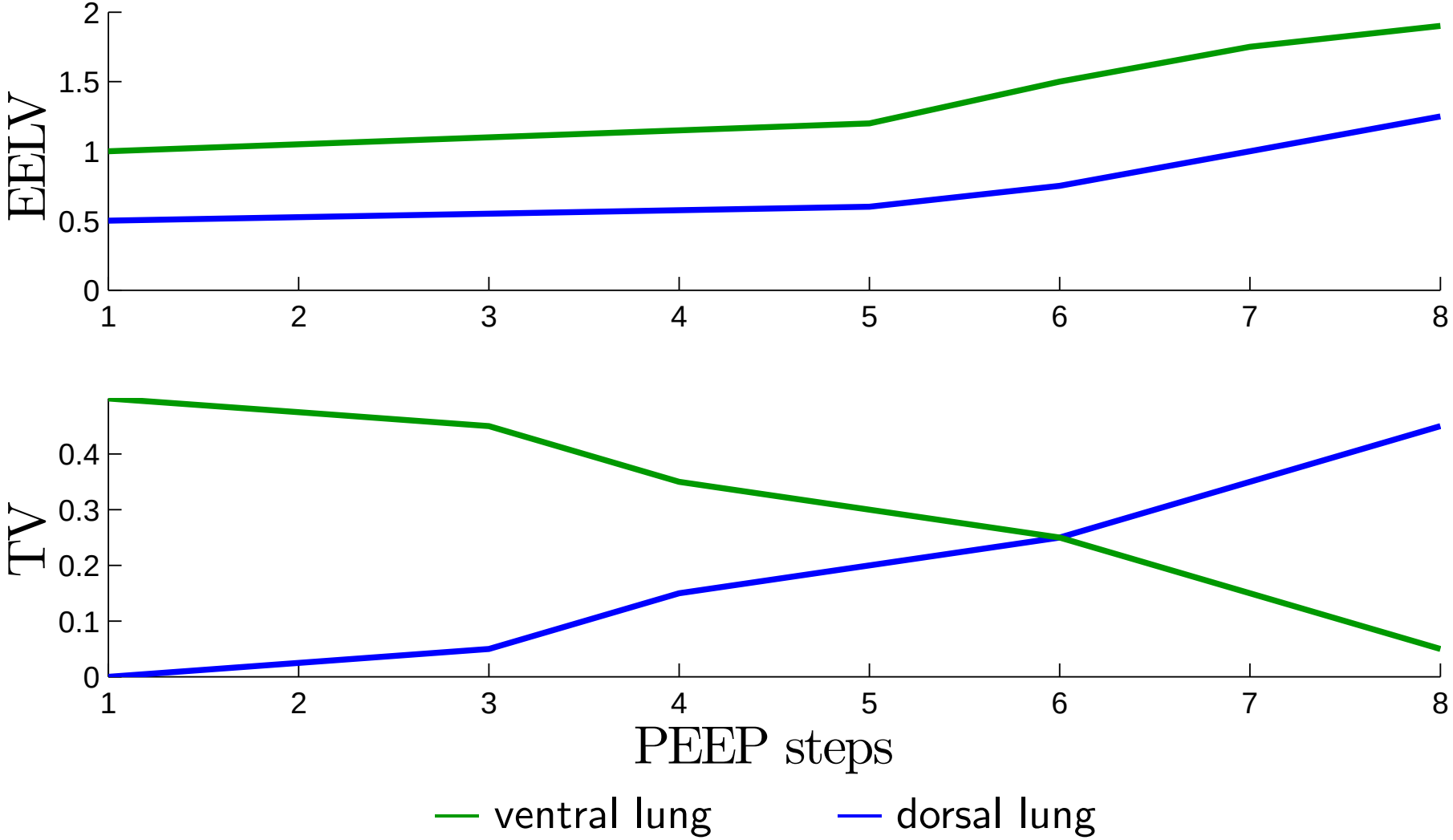
(b)

Figure: Model setup for lung background conductivity investigation: **??** 3D view; **??** 2D cut through at the level of the electrodes. Colour code: navy — ventral lung (less conductive); blue — dorsal lung (more conductive);

A mock recruitment manoeuvre







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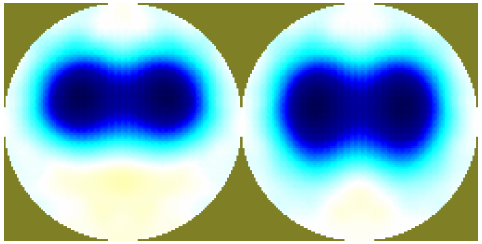

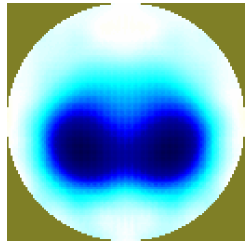

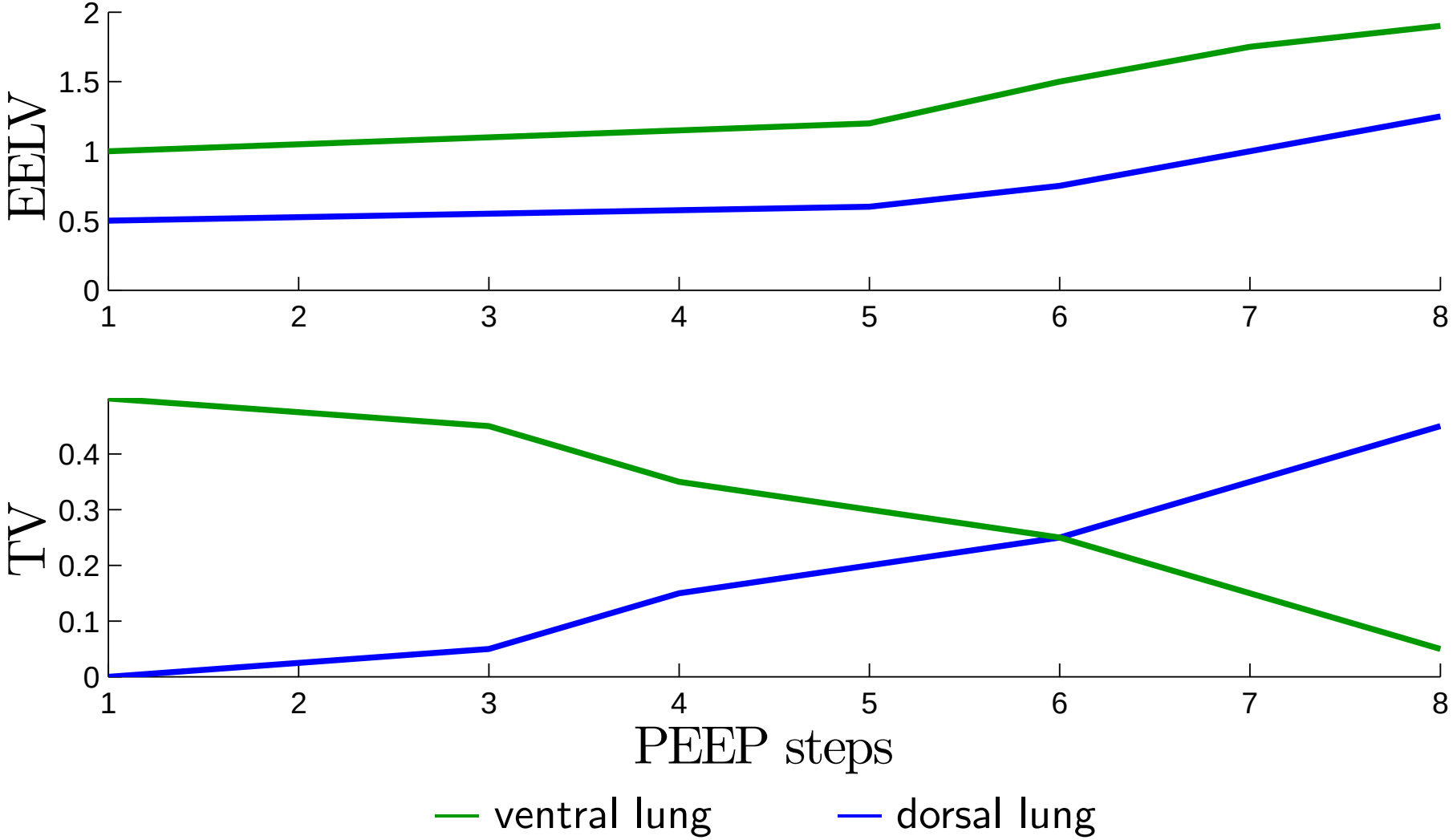

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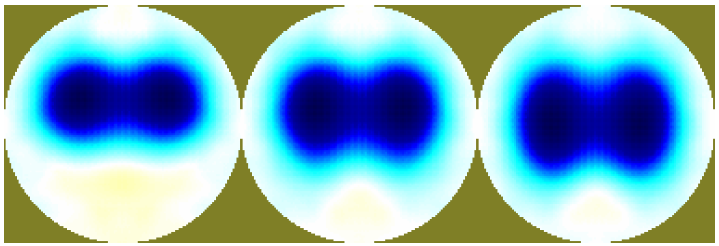

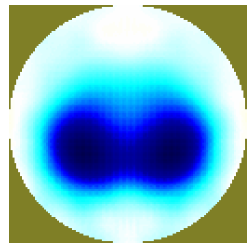

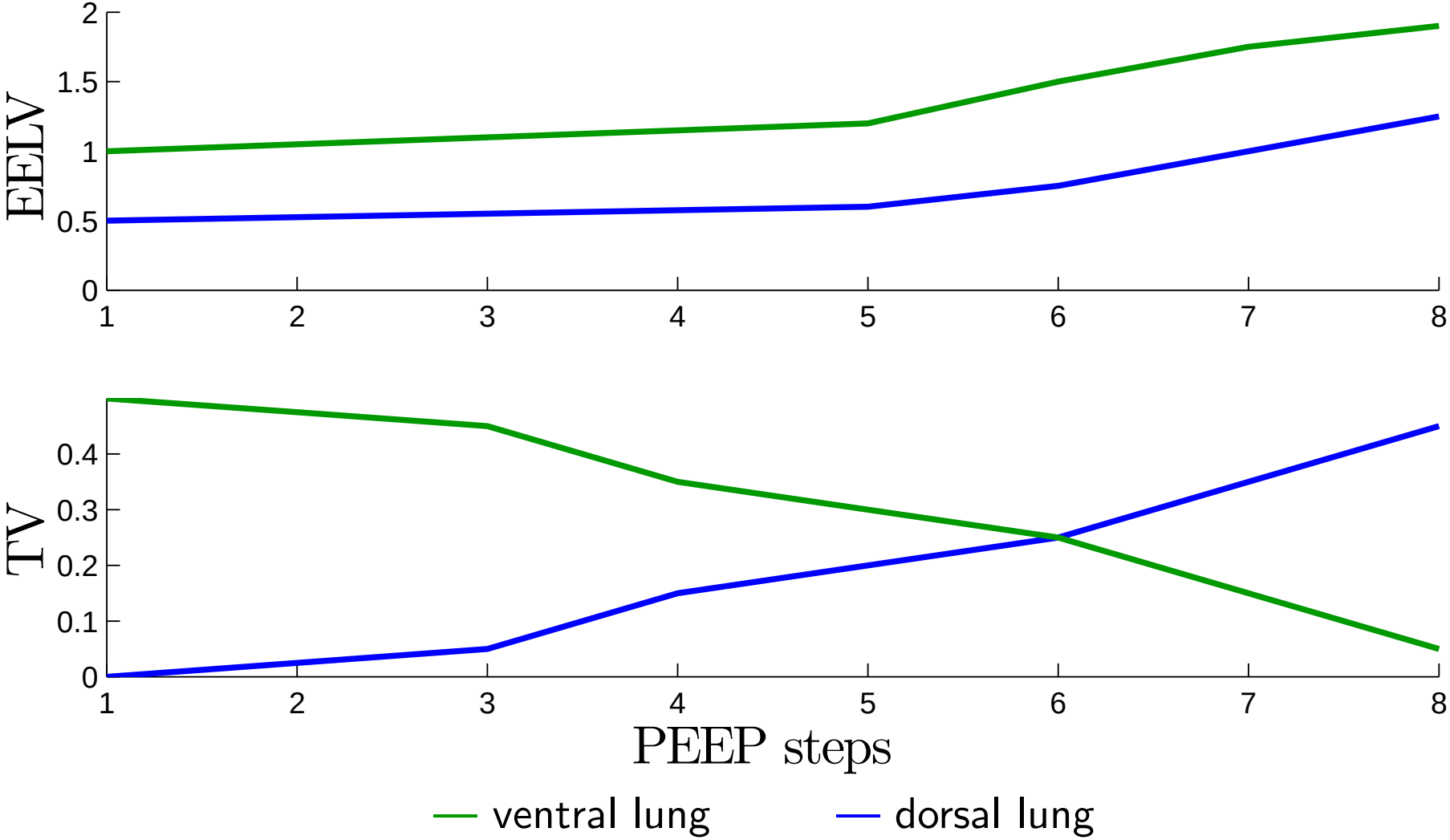

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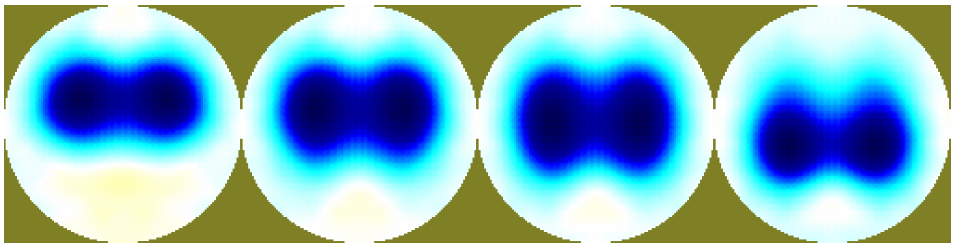

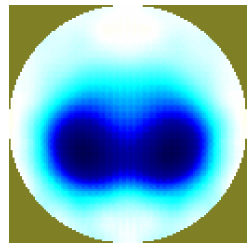

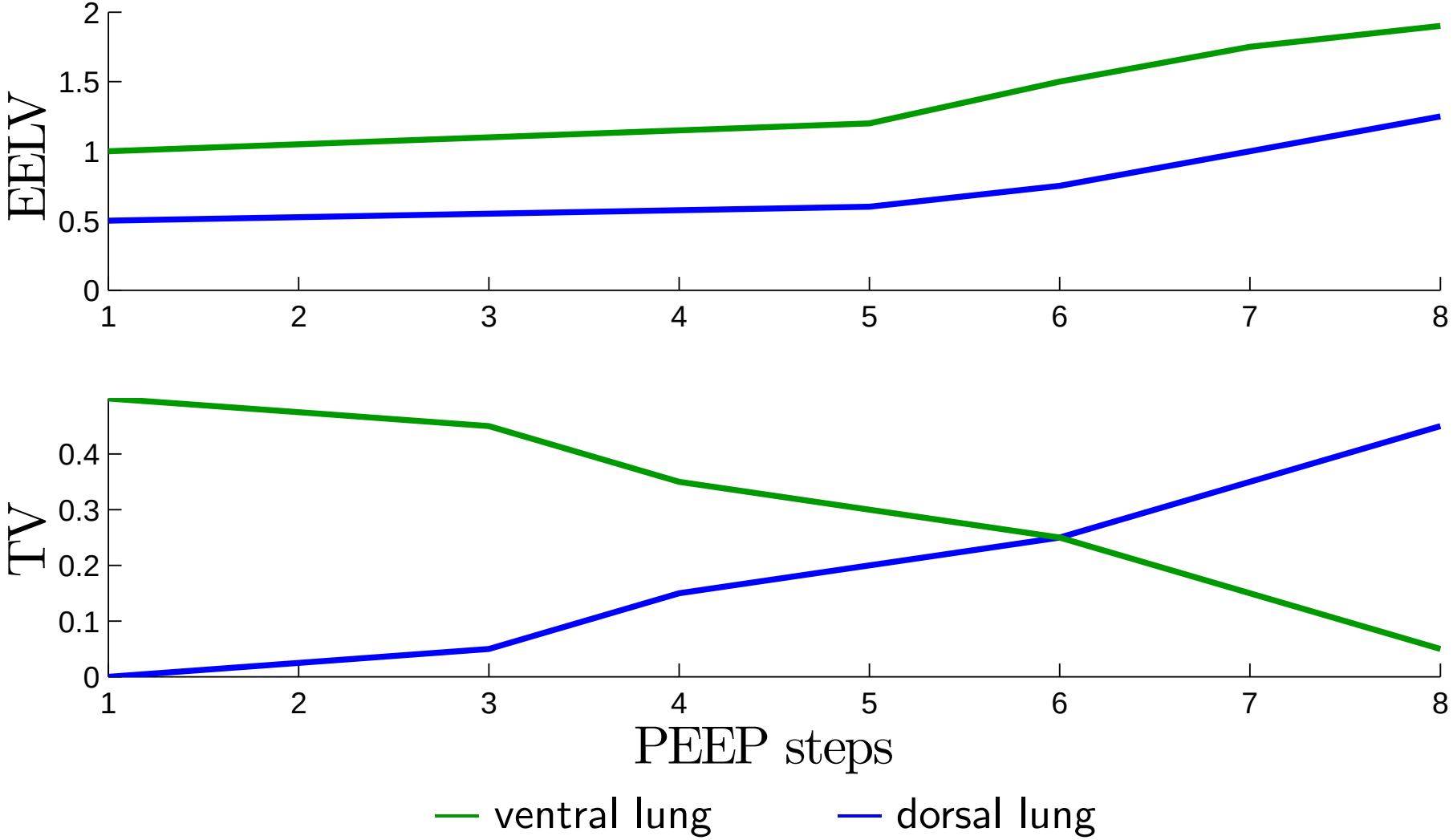

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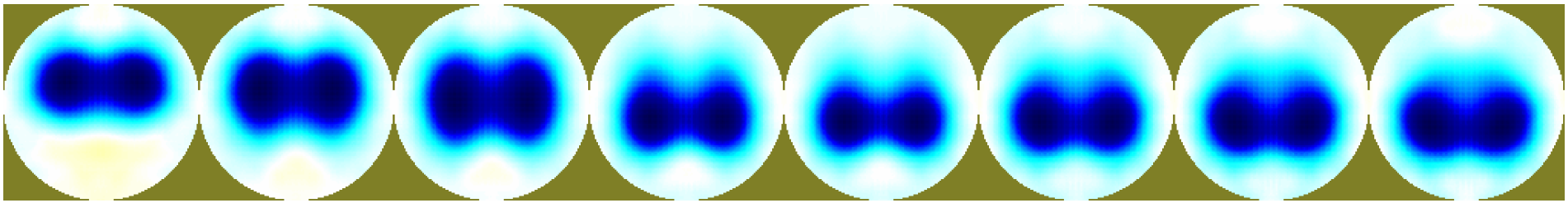

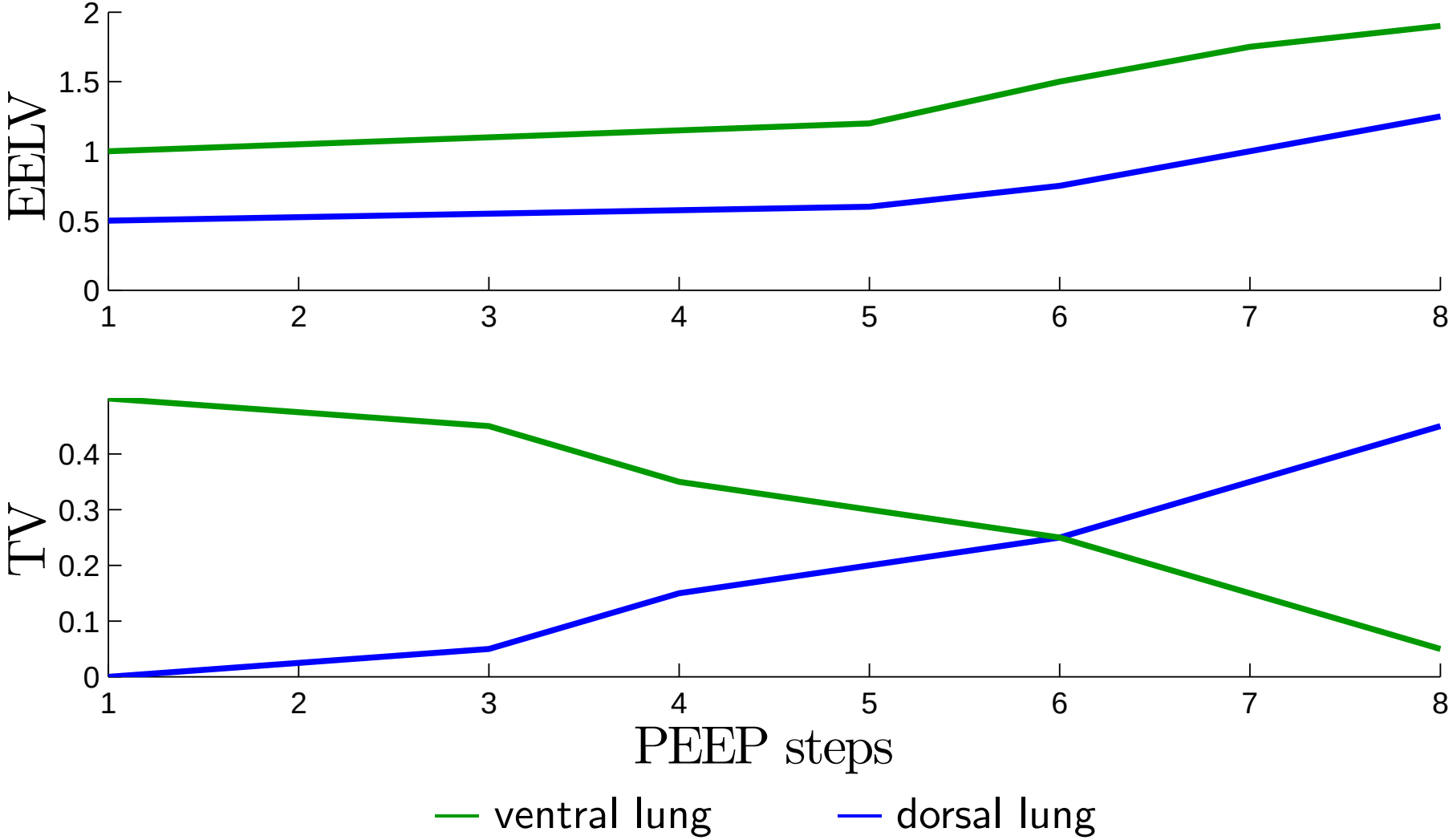

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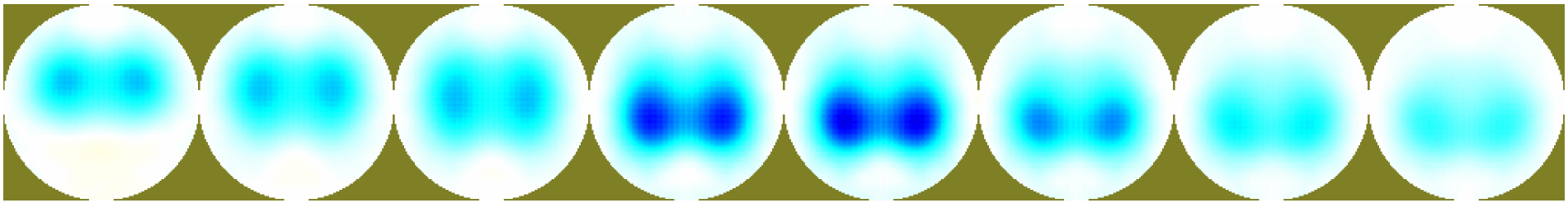

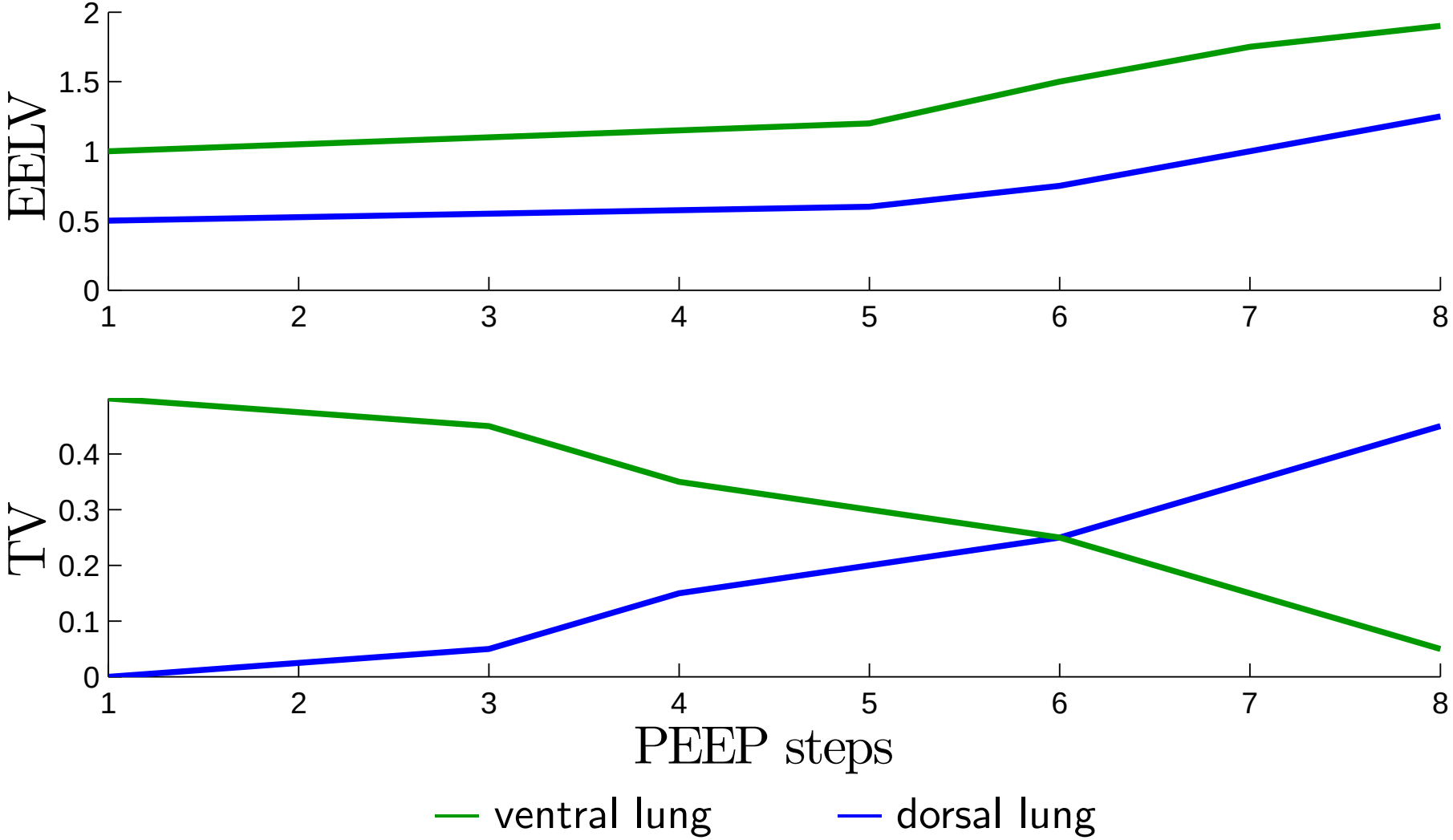

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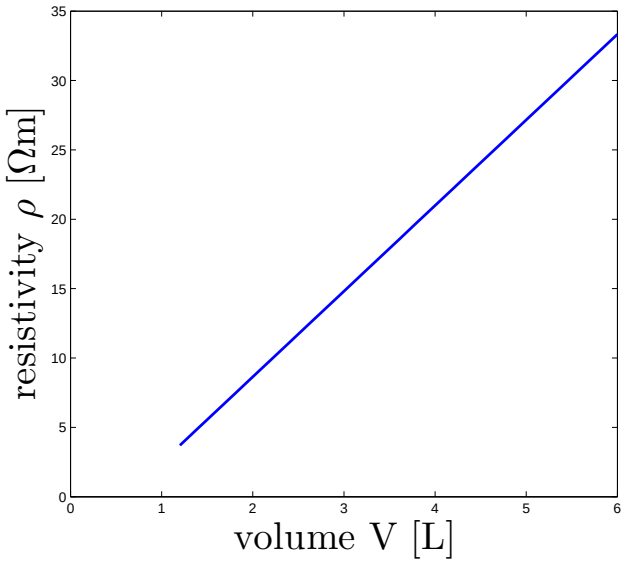

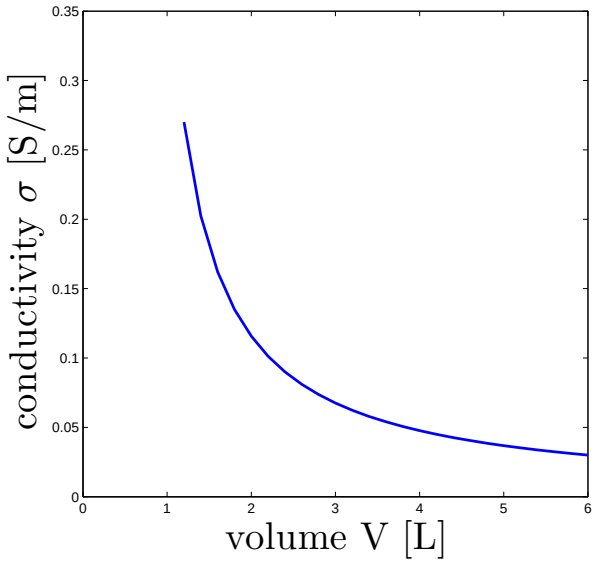

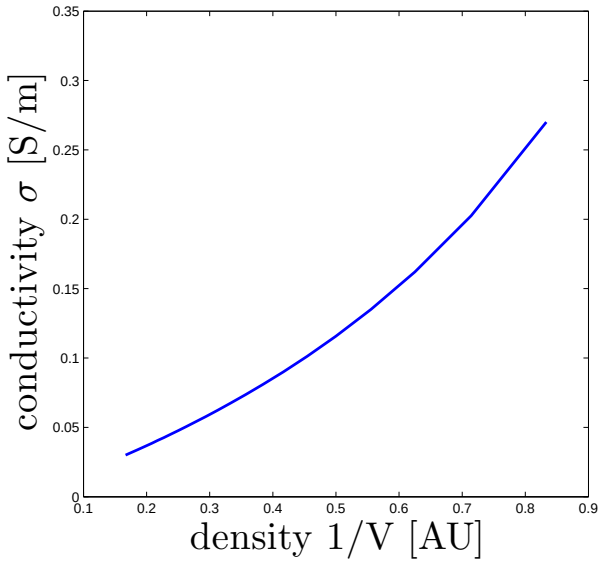

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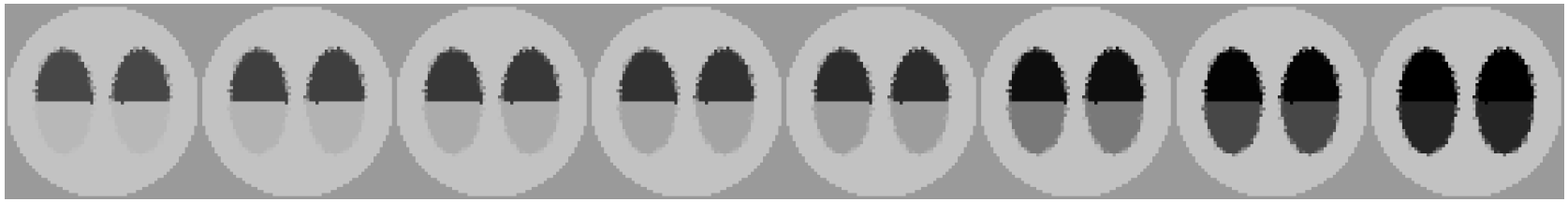
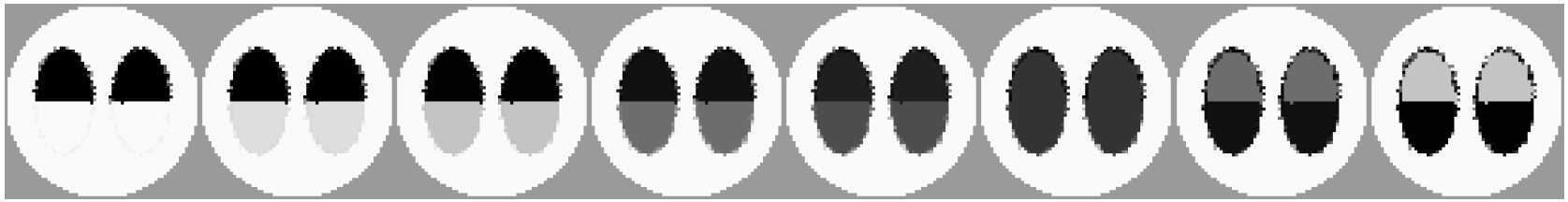
EELV:



TV:



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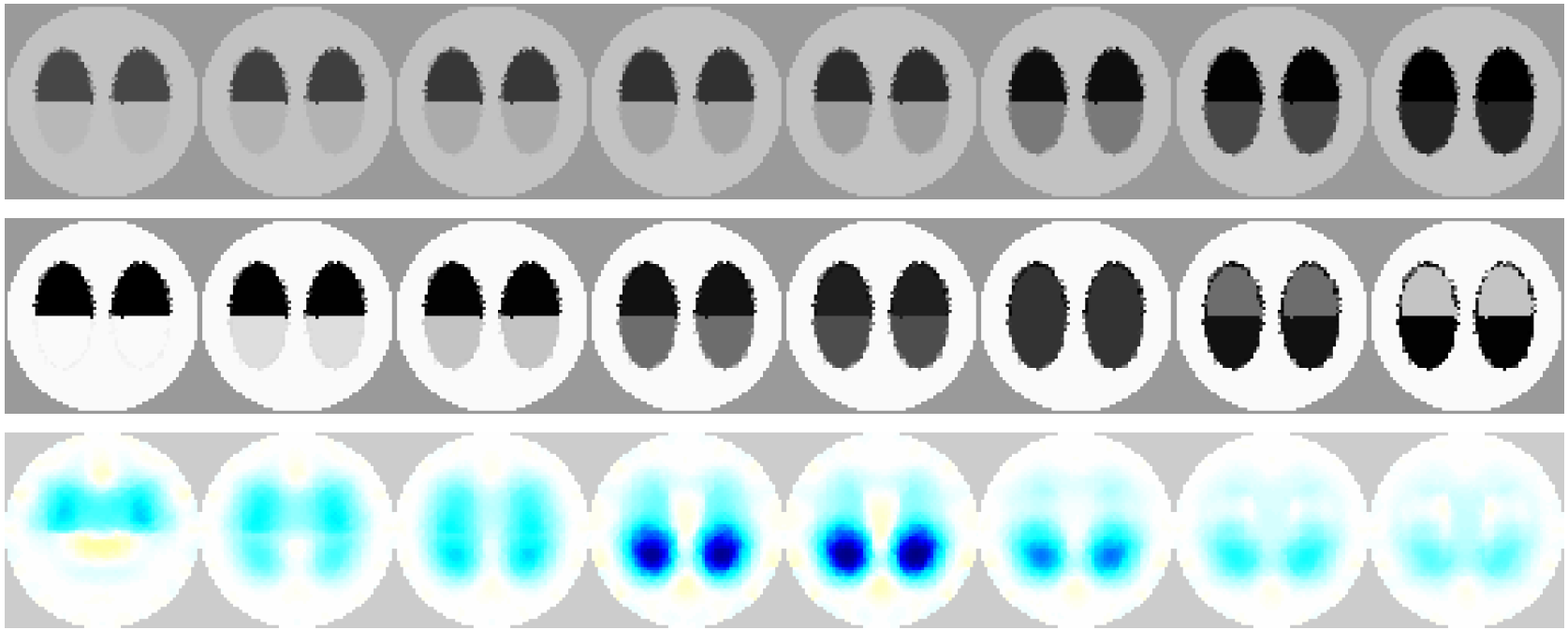

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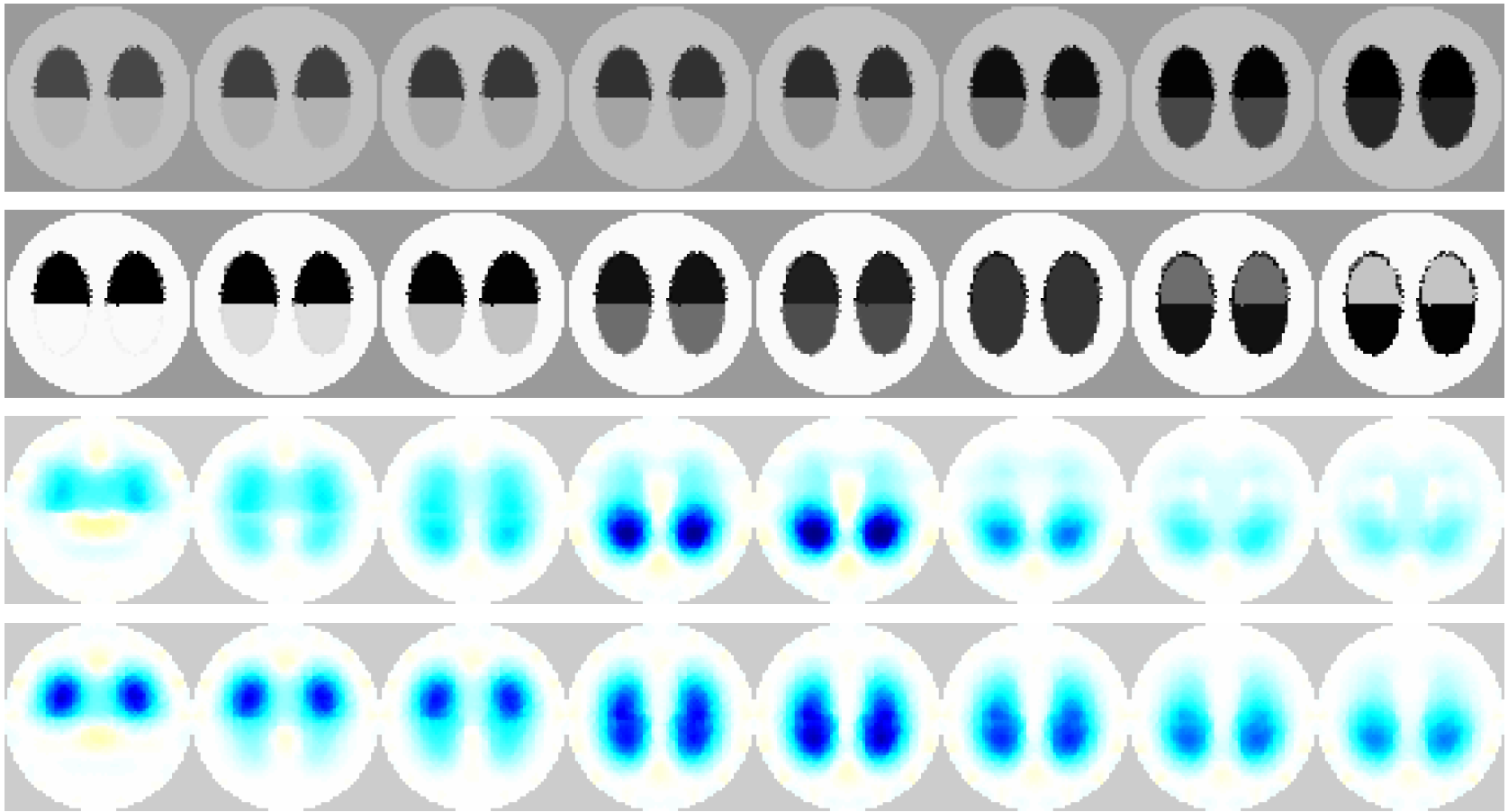
EELV:

TV:

σ:

$\log(\sigma)$:



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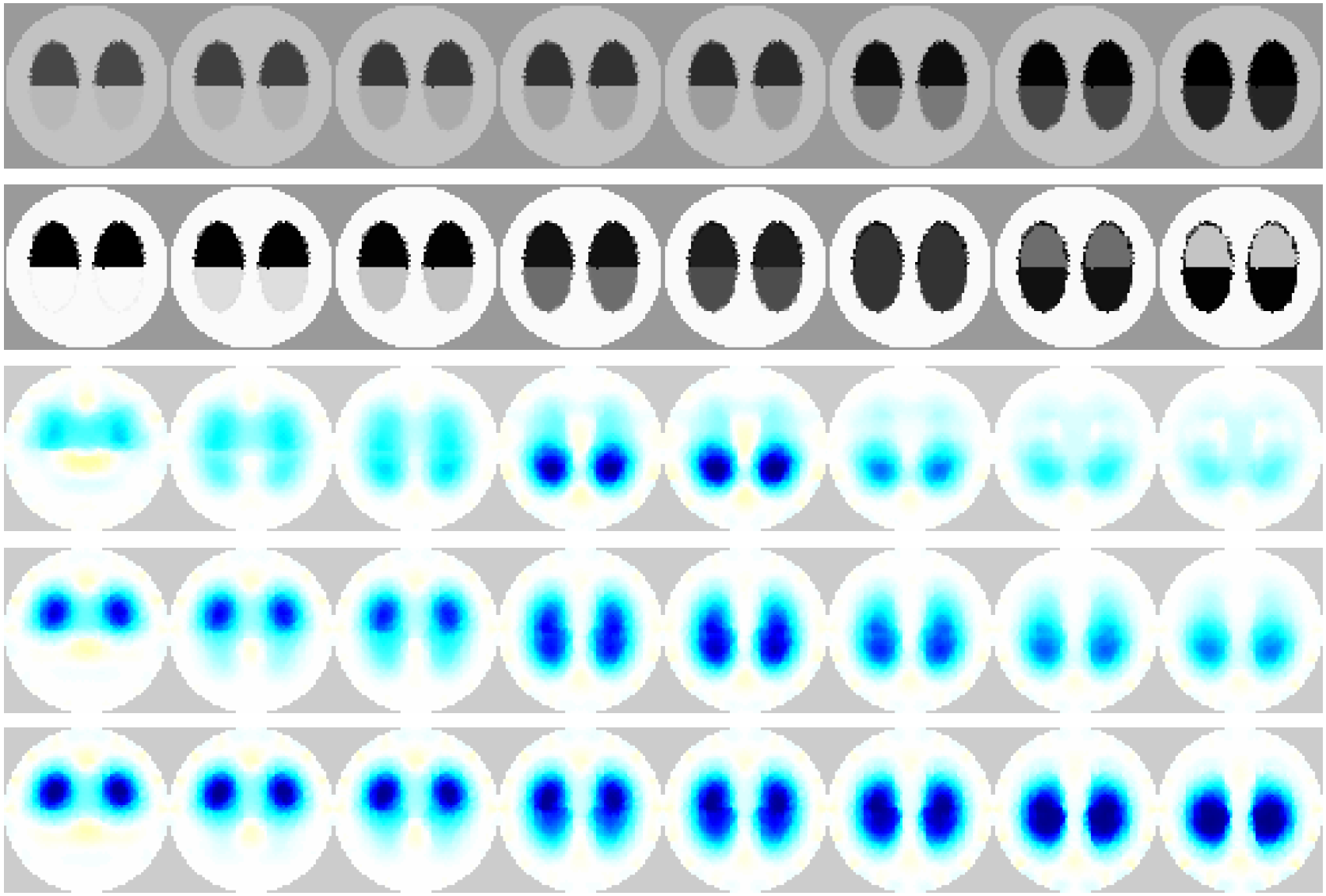
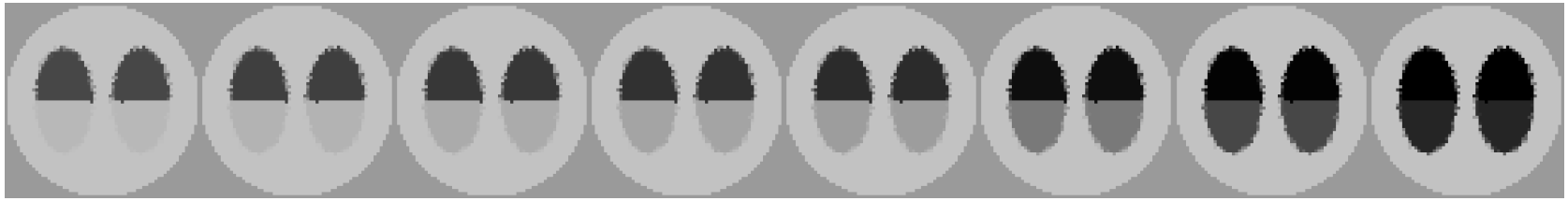


Sensitivity

EELV:



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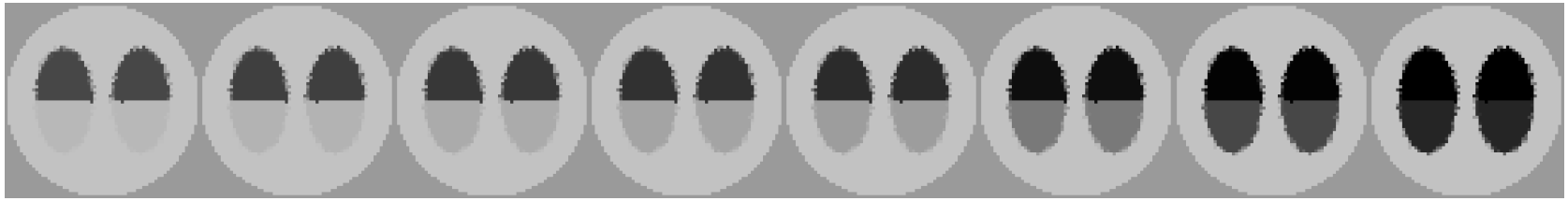

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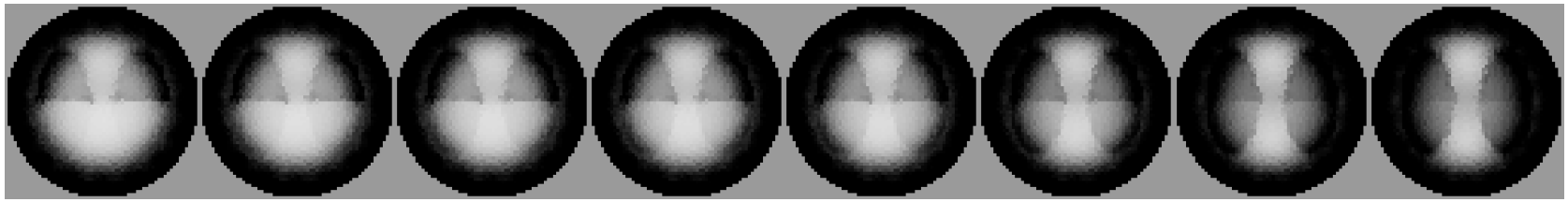

Sensitivity

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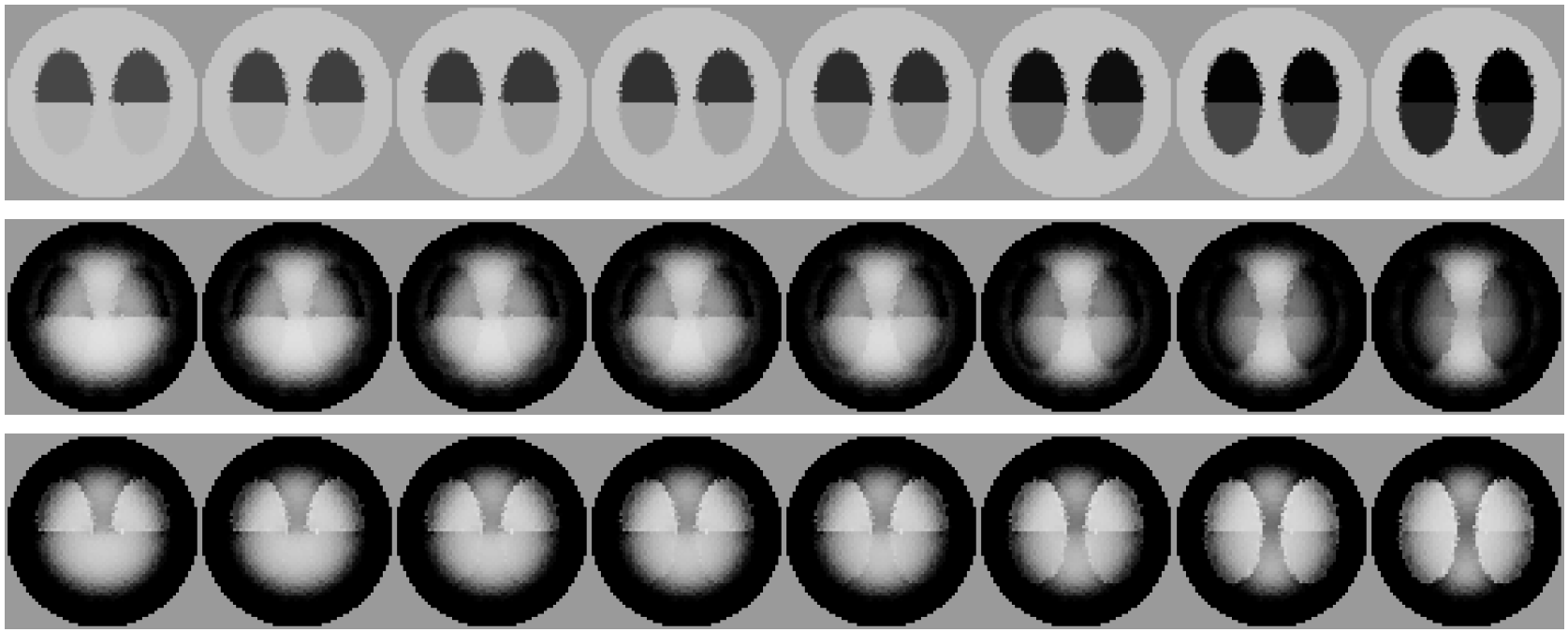


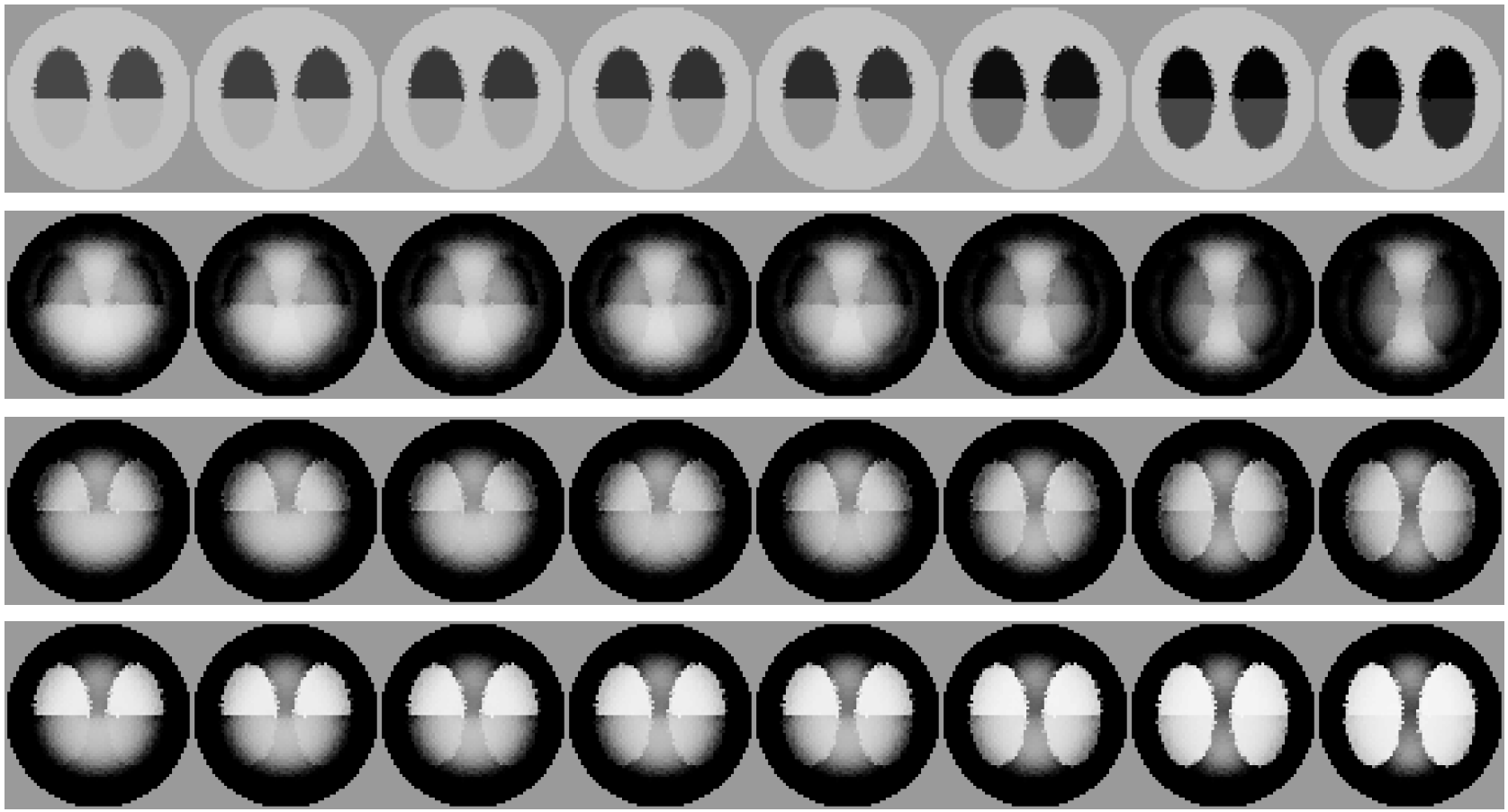
Sensitivity

EELV:

σ:

$\log(\sigma)$:

ρ:



Homogeneous background

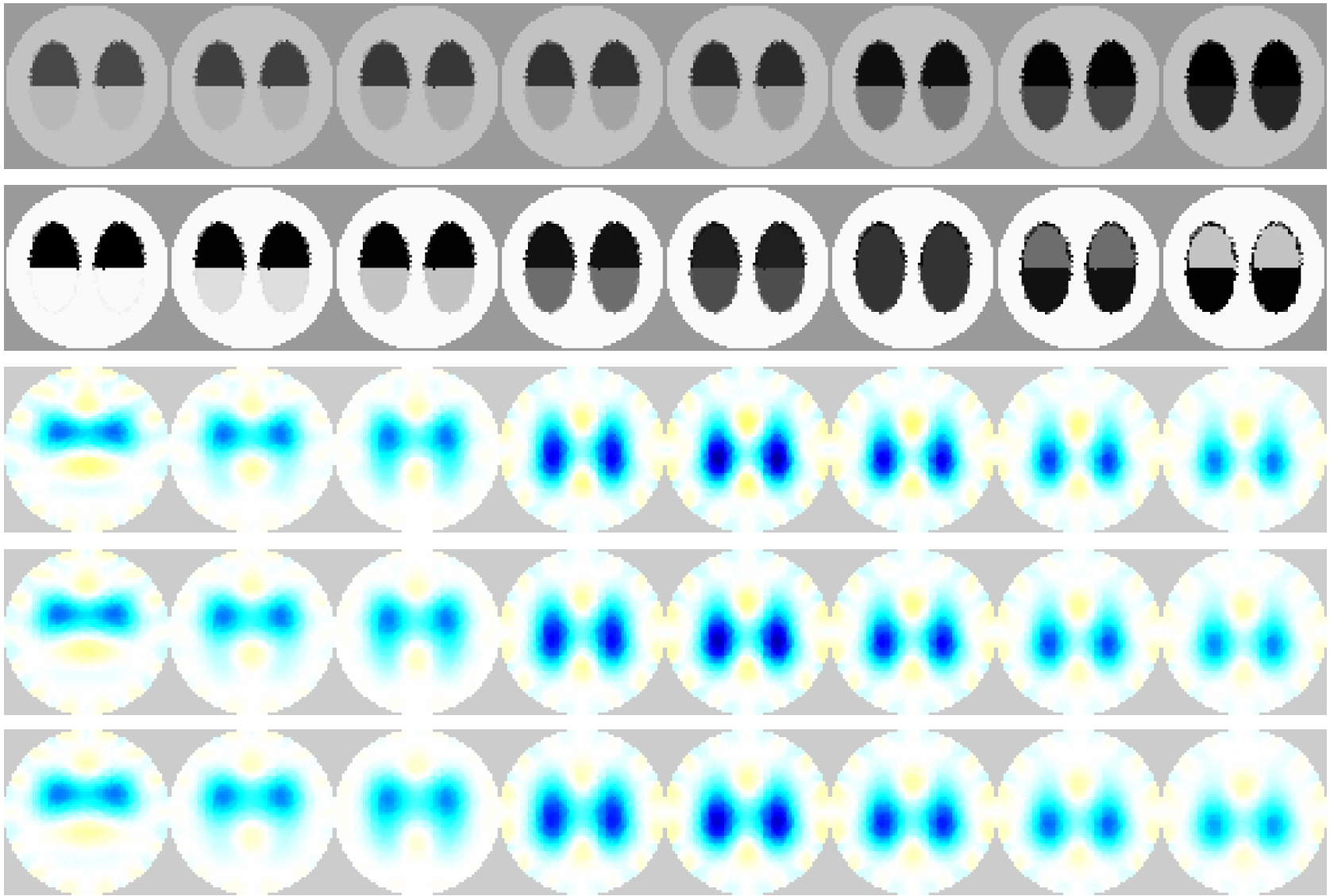
EELV:

TV:

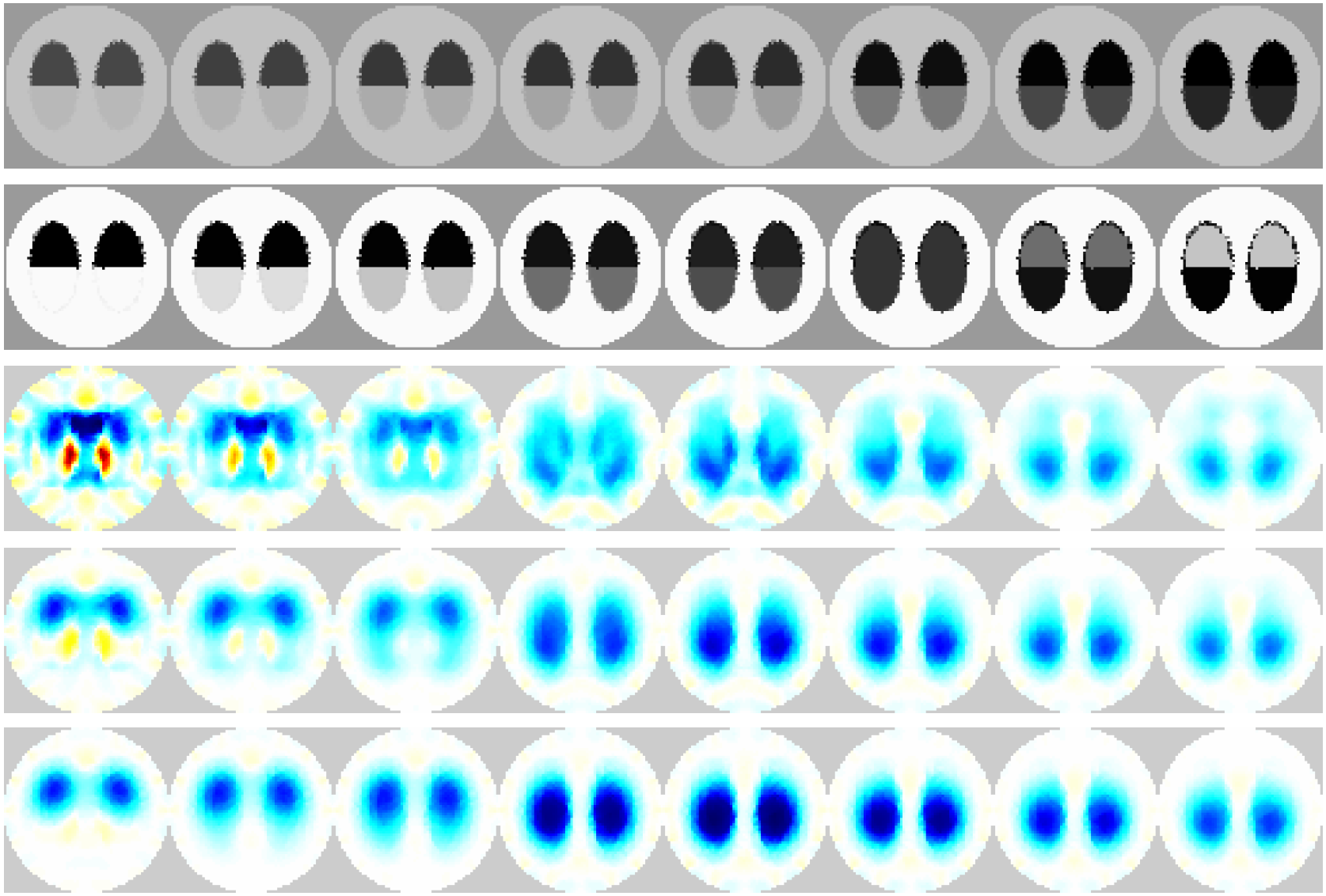
σ:

$\log(\sigma)$:

ρ:



Fixed background with lungs



Implications

- Need a better idea about the background conductivity distribution
- Need to be careful about what we reconstruct
- **It is impossible to separate ventilation and mean aeration in difference EIT** even when only tidal differences are considered.

Moving forward

Some ideas:

- Use a coarse absolute solution for background conductivity
  - difficult
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  - expensive
  - will need new RM each time
- Reconstruct a small number of the actual parameters of interest instead of the perfect image
  - different model for each application
- Need more research into the actual electrical properties of the lung

The good news

Multi-physics support in EIDORS 3.7

Thank You!

Questions?

References I