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# Guides and gravity in McStas

Peter Willendrup

Adapted from slide by Mads Bertelsen, ESS

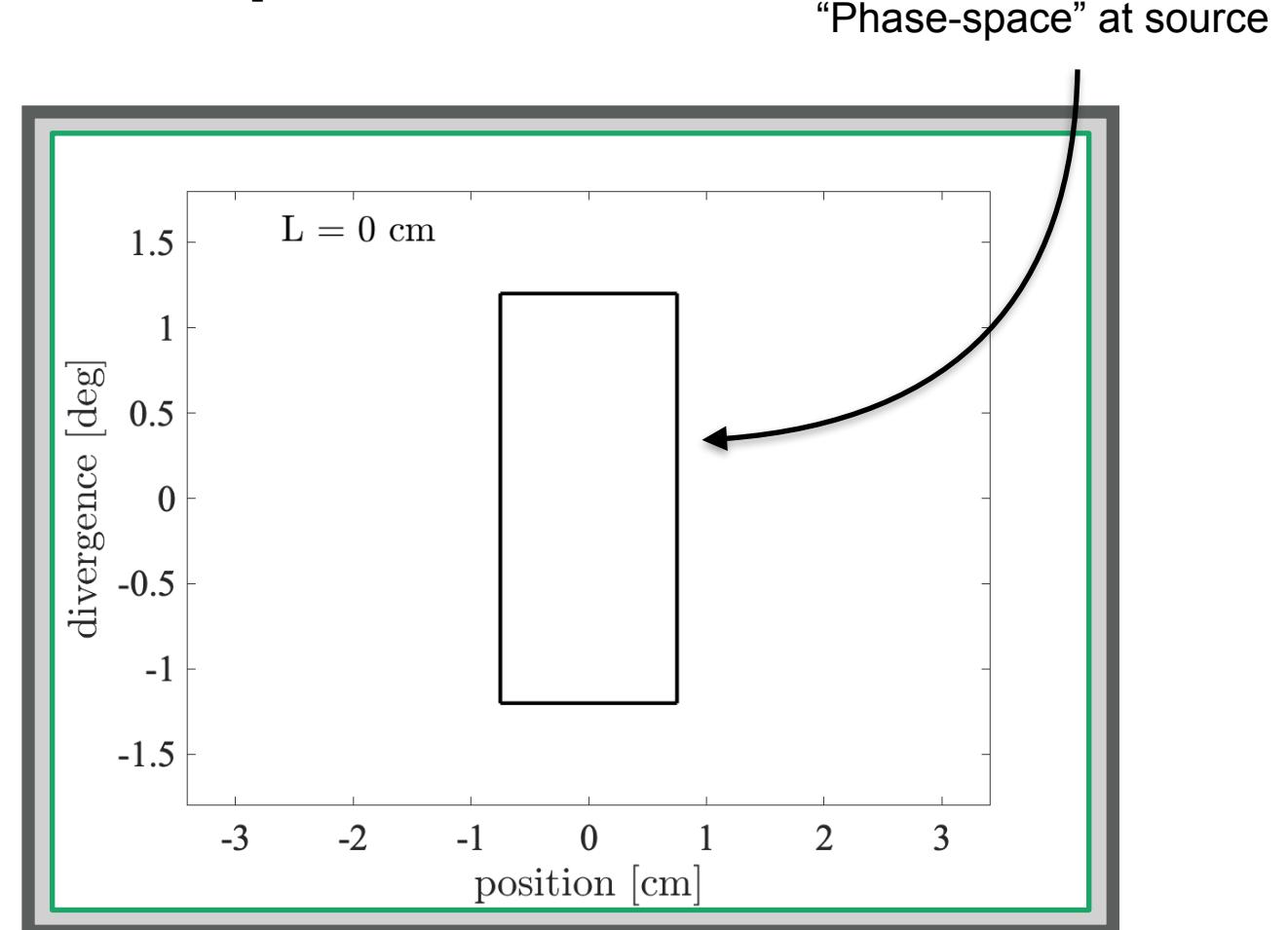
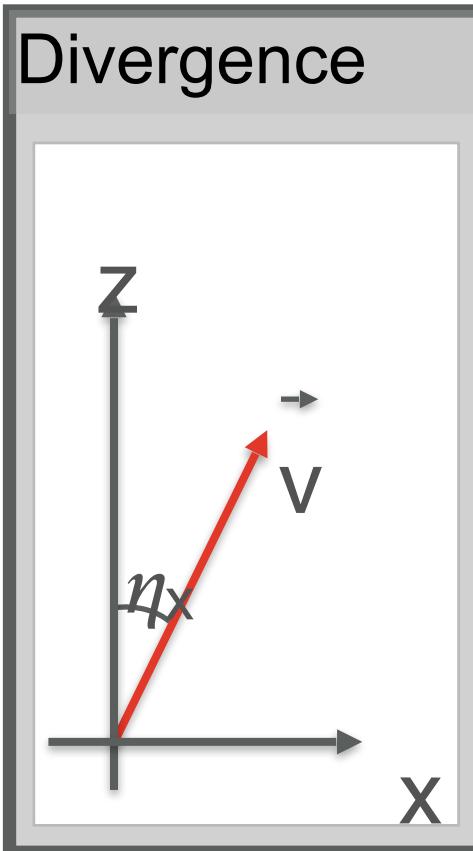


# Overview

- Description of phase-space and propagation
- Reflectivity
- McStas coordinate system
- Gravitation in McStas
- Guide components with support for gravity
  - Guide\_gravity
  - Elliptic\_guide\_gravity
- Breaking line of sight
- Example
- Exercise



# Beam propagation in free space

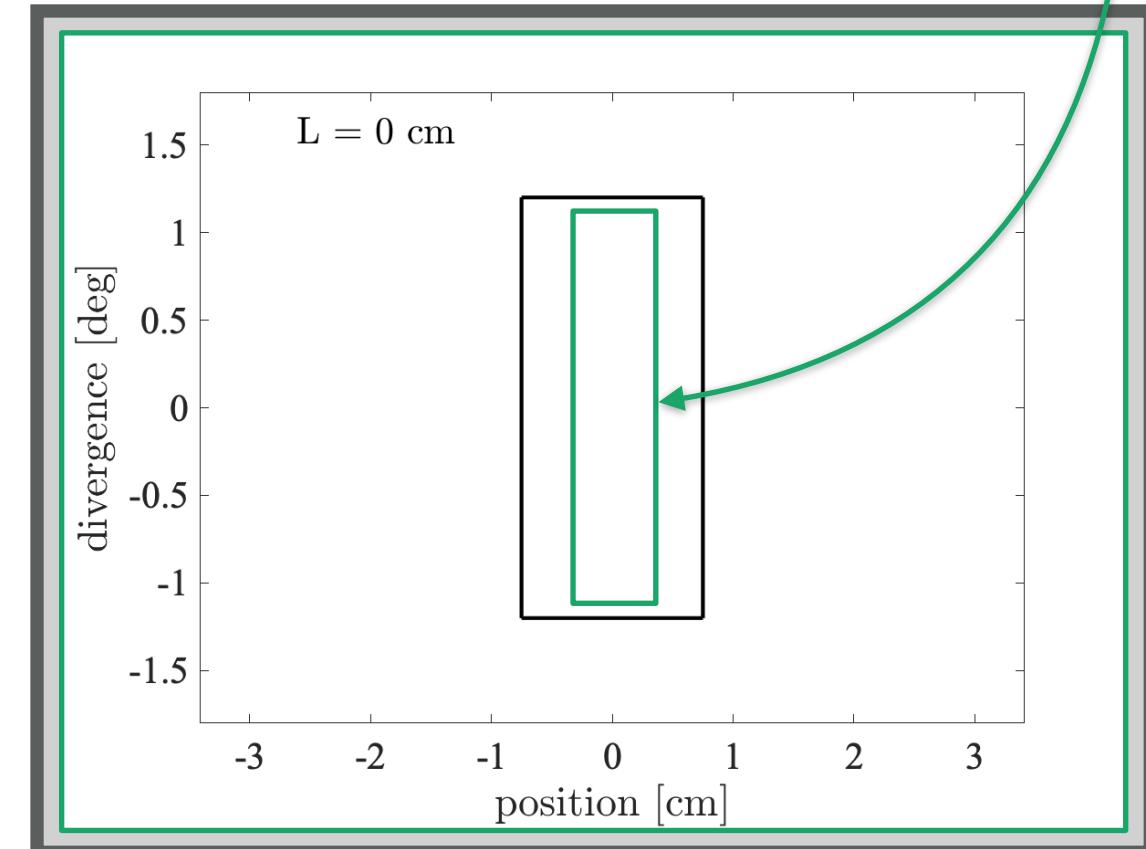
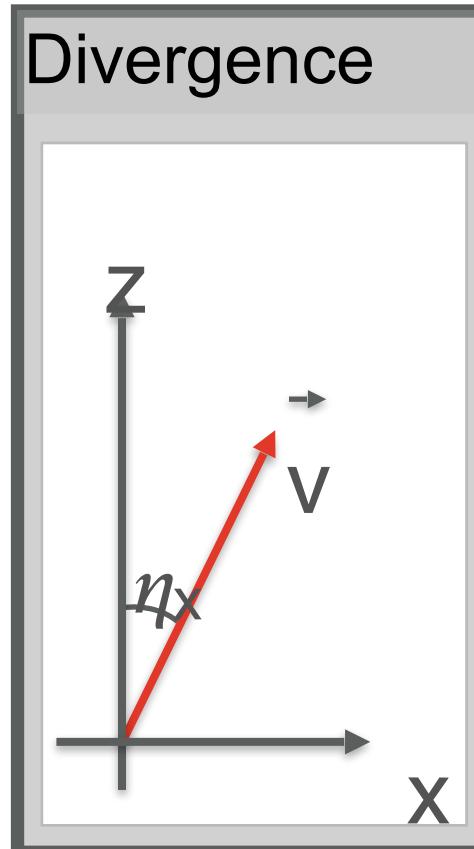




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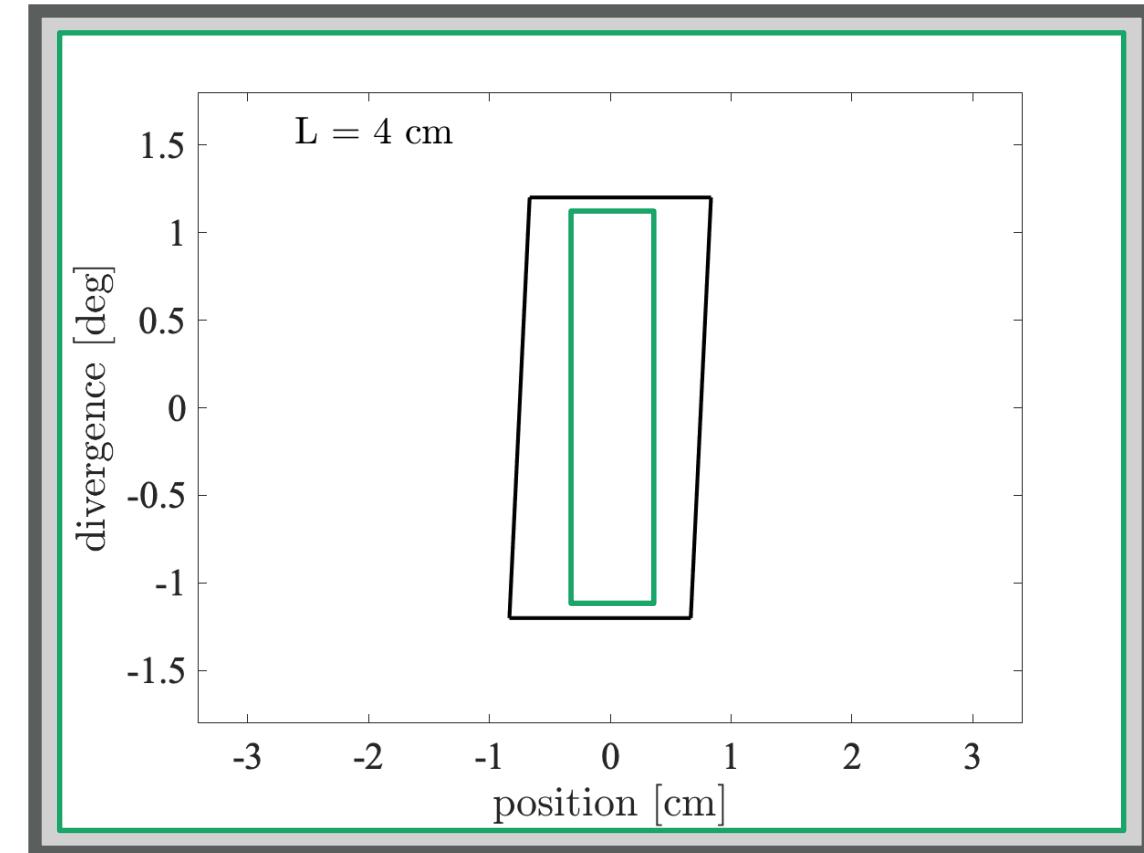
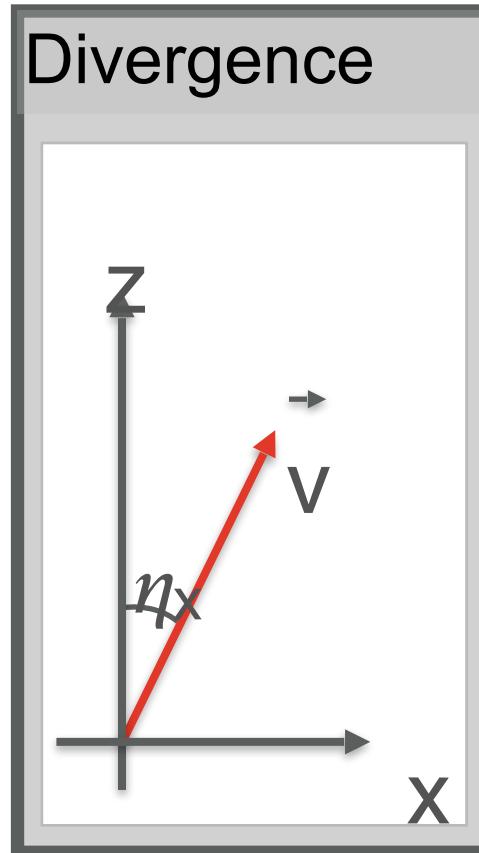


Wanted “phase-space” at sample



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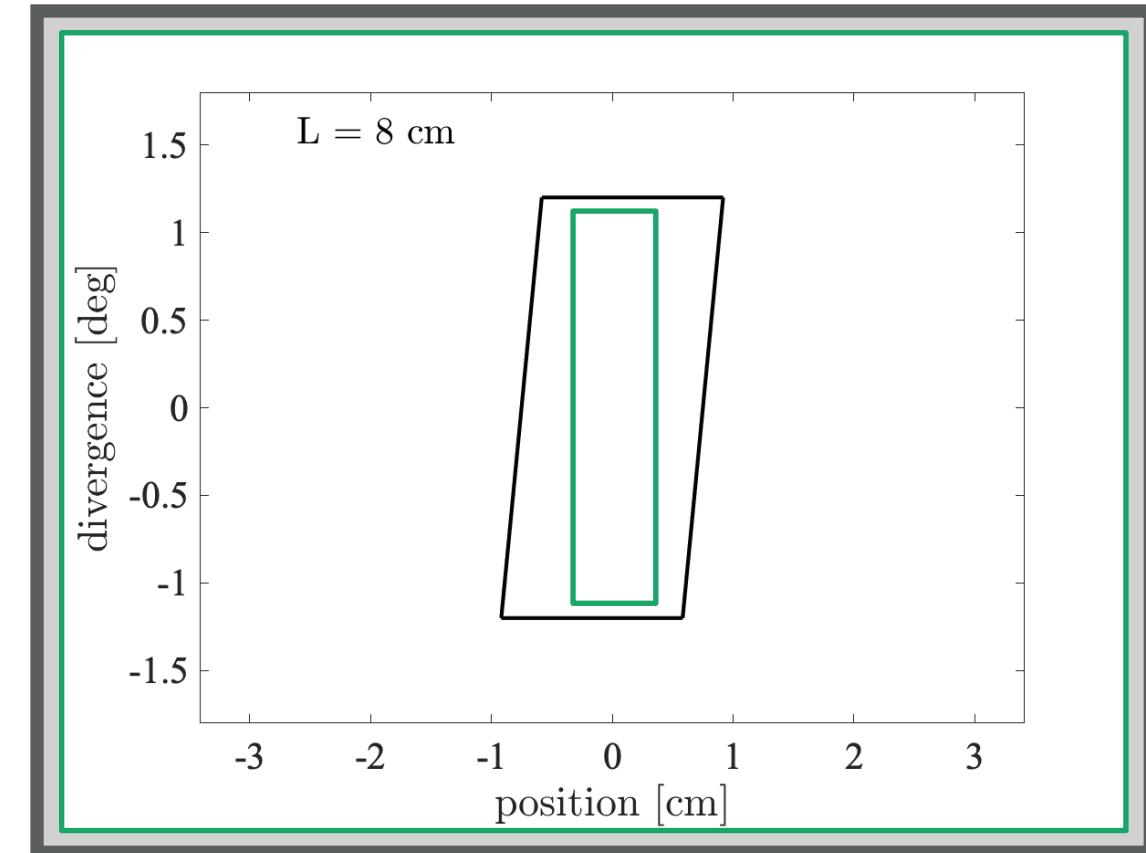
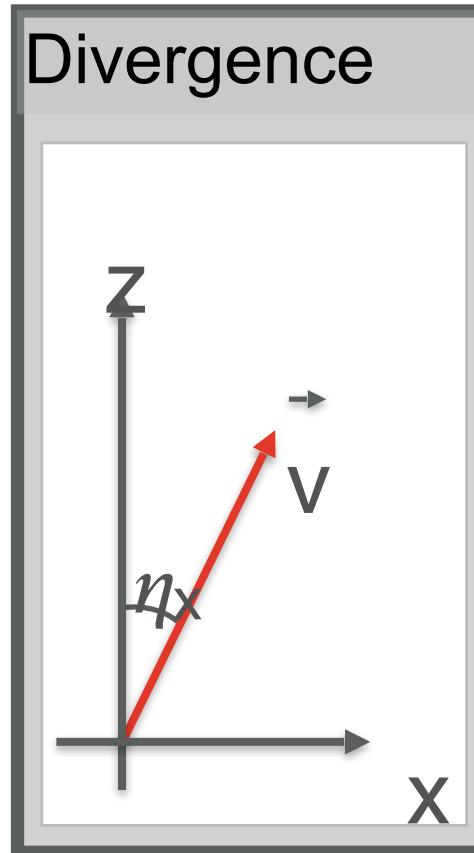
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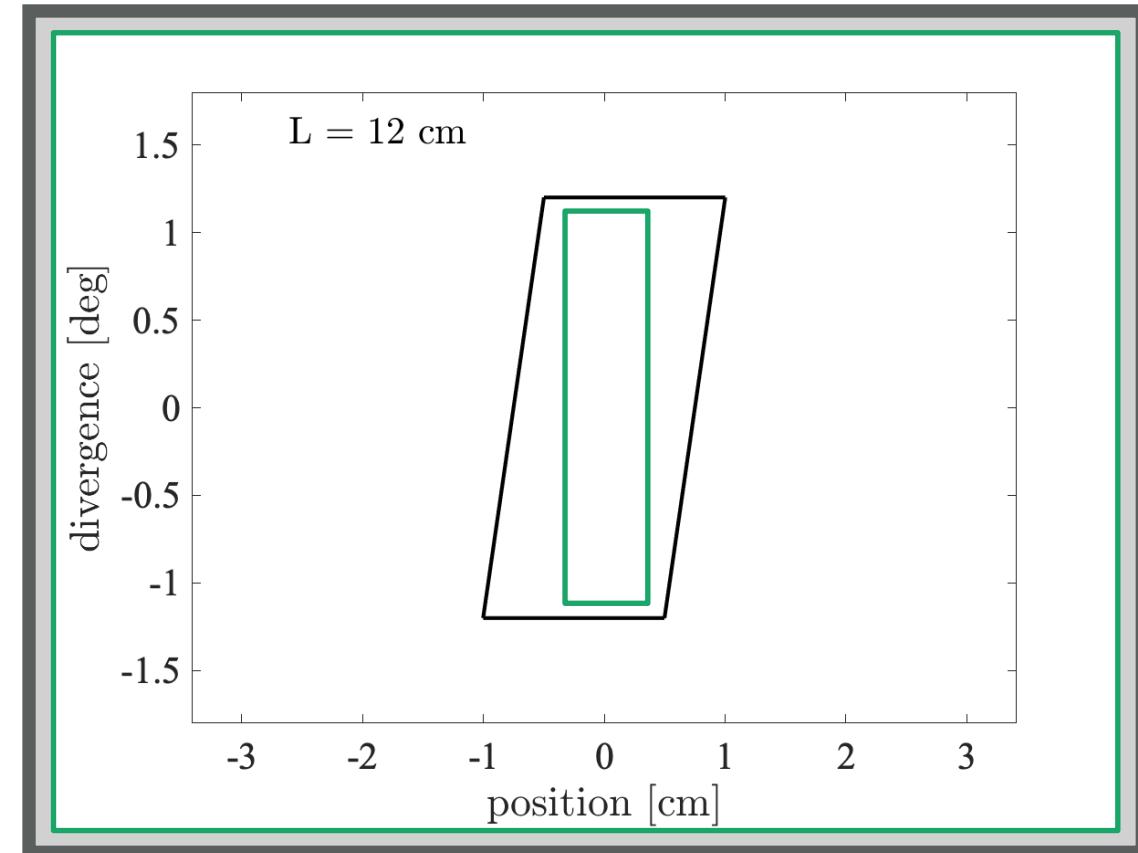
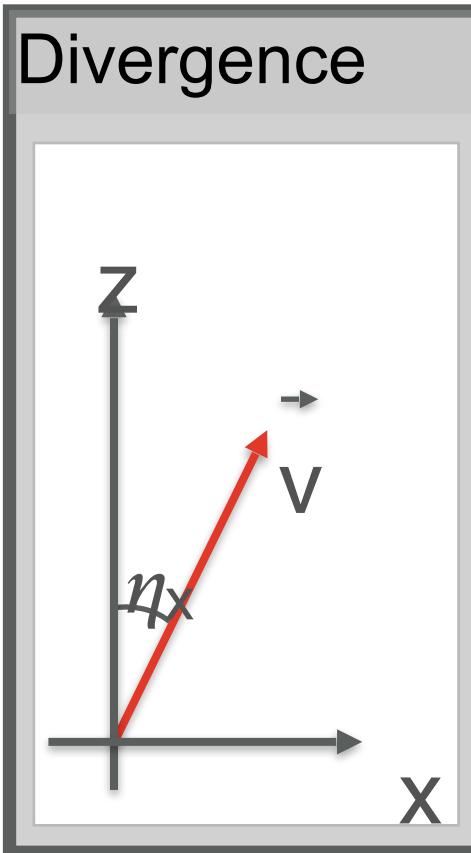
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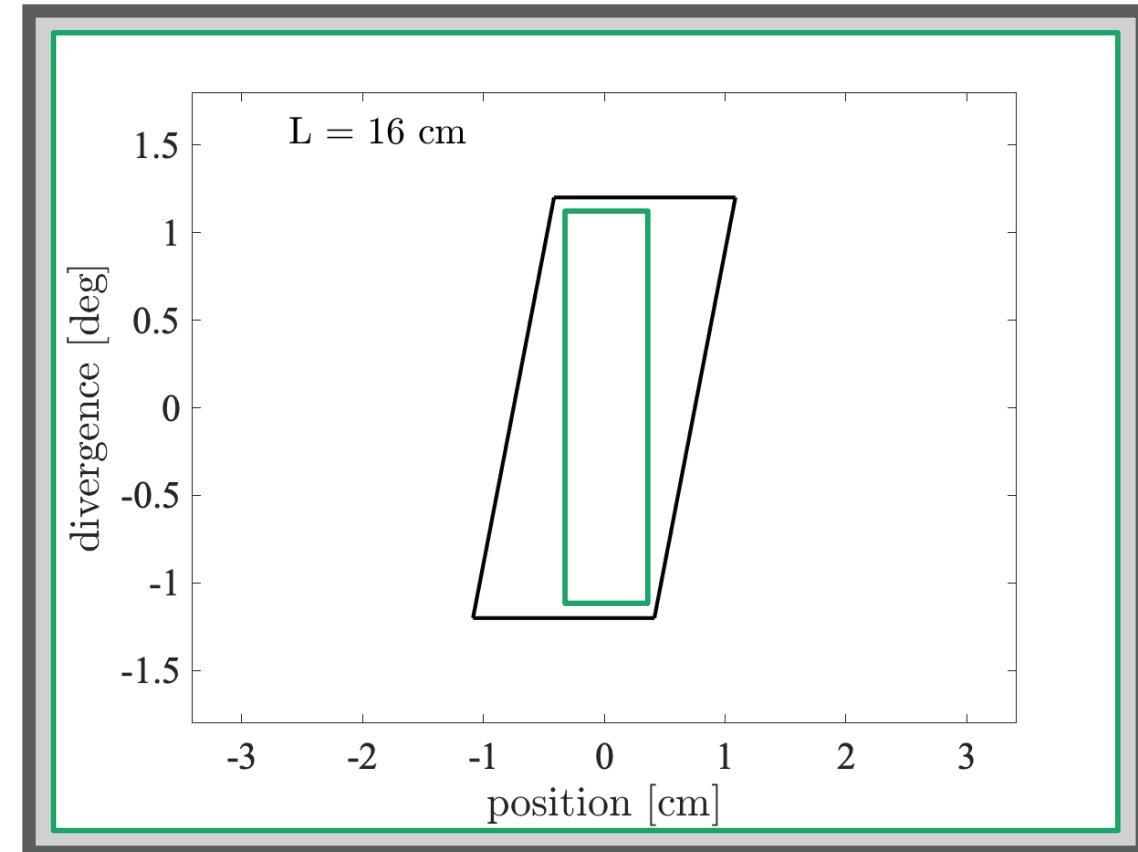
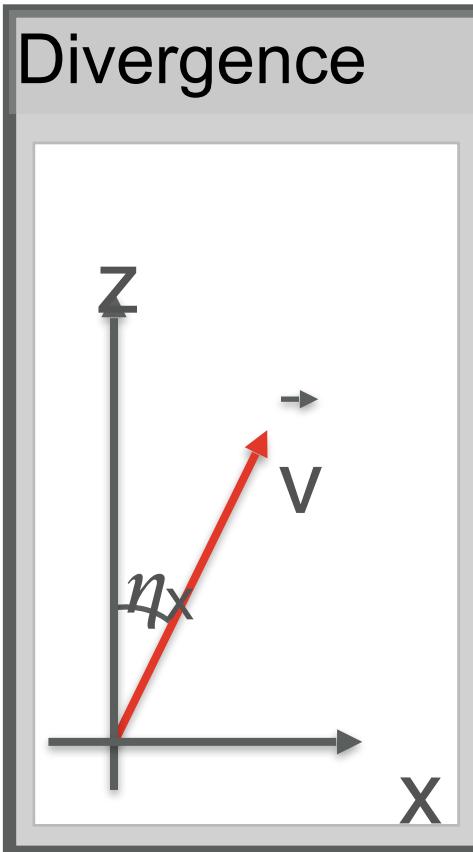
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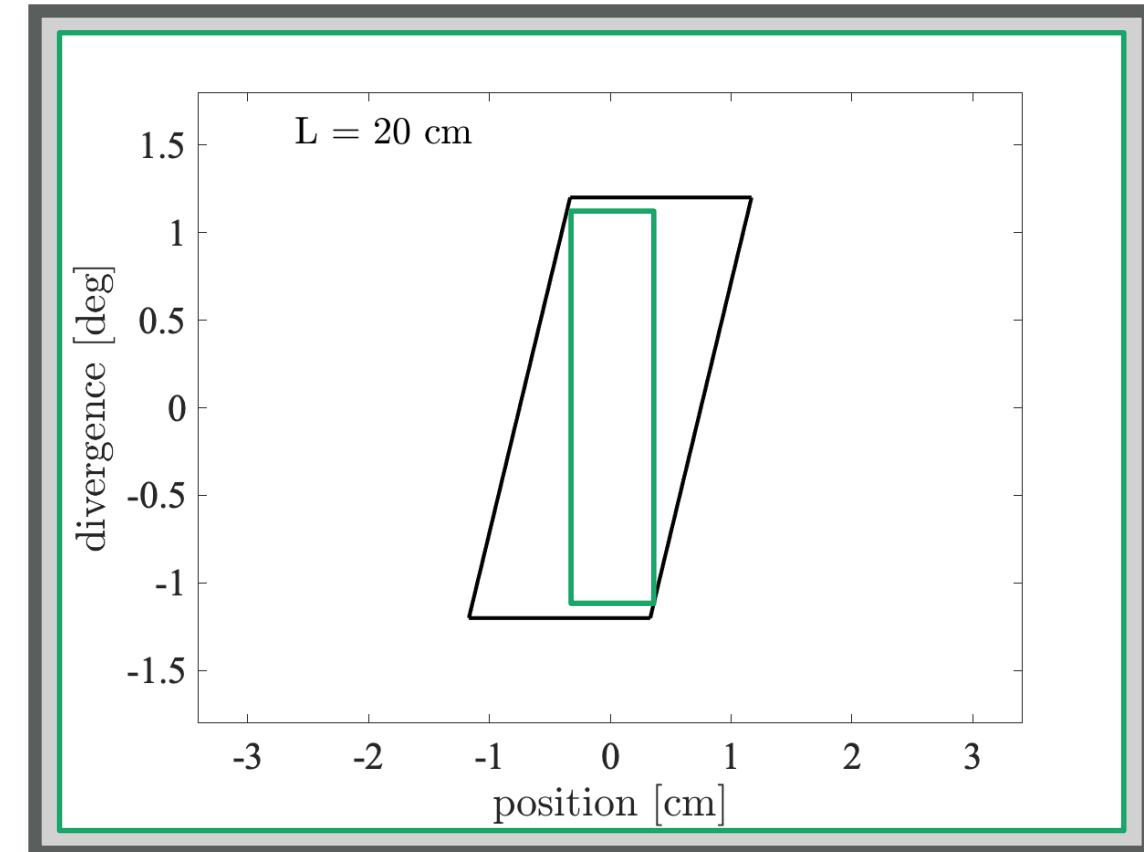
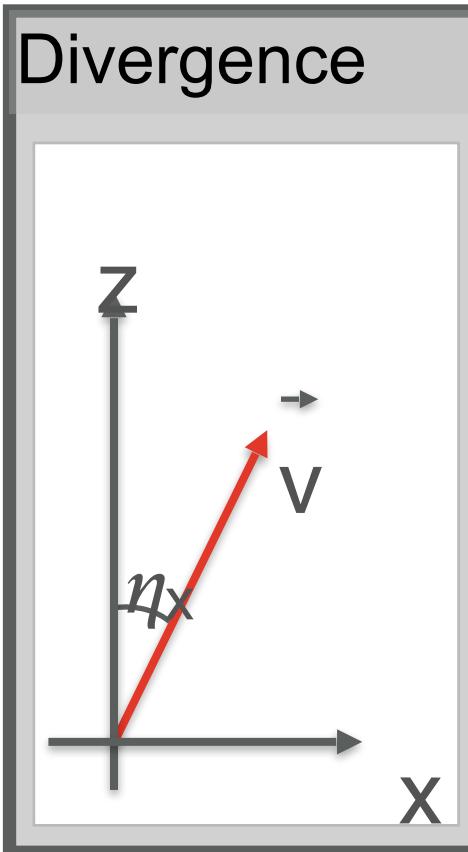
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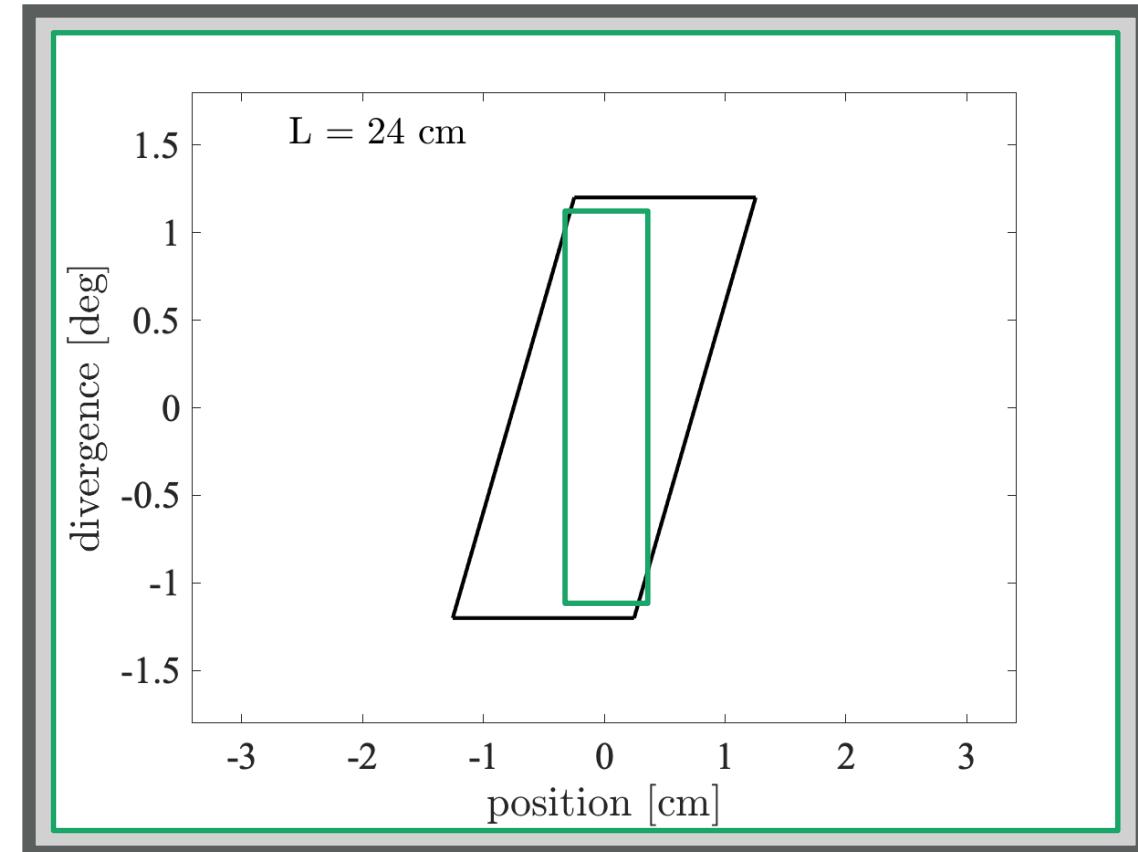
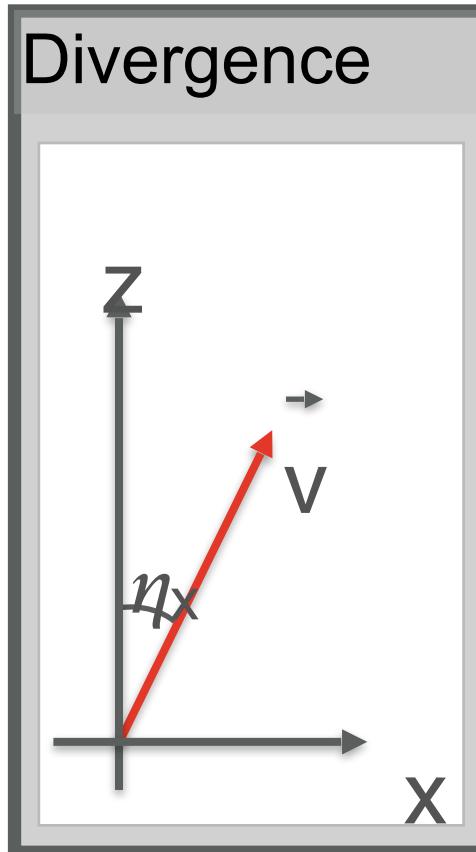
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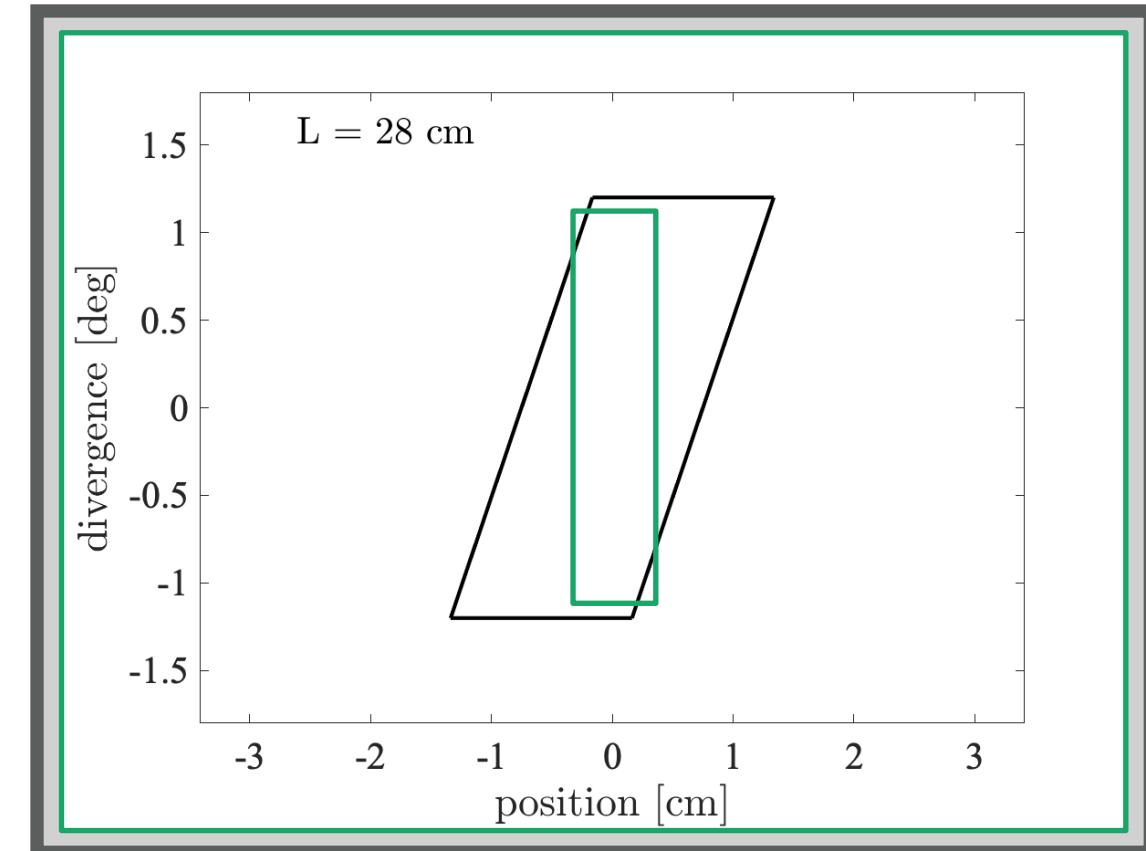
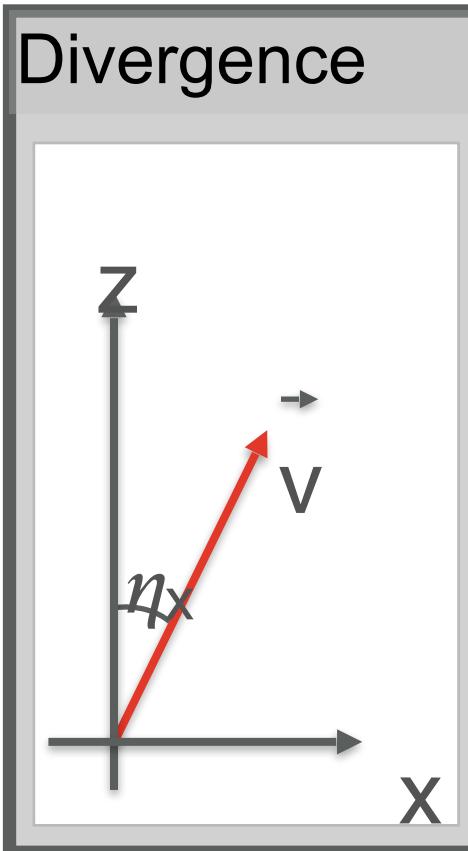
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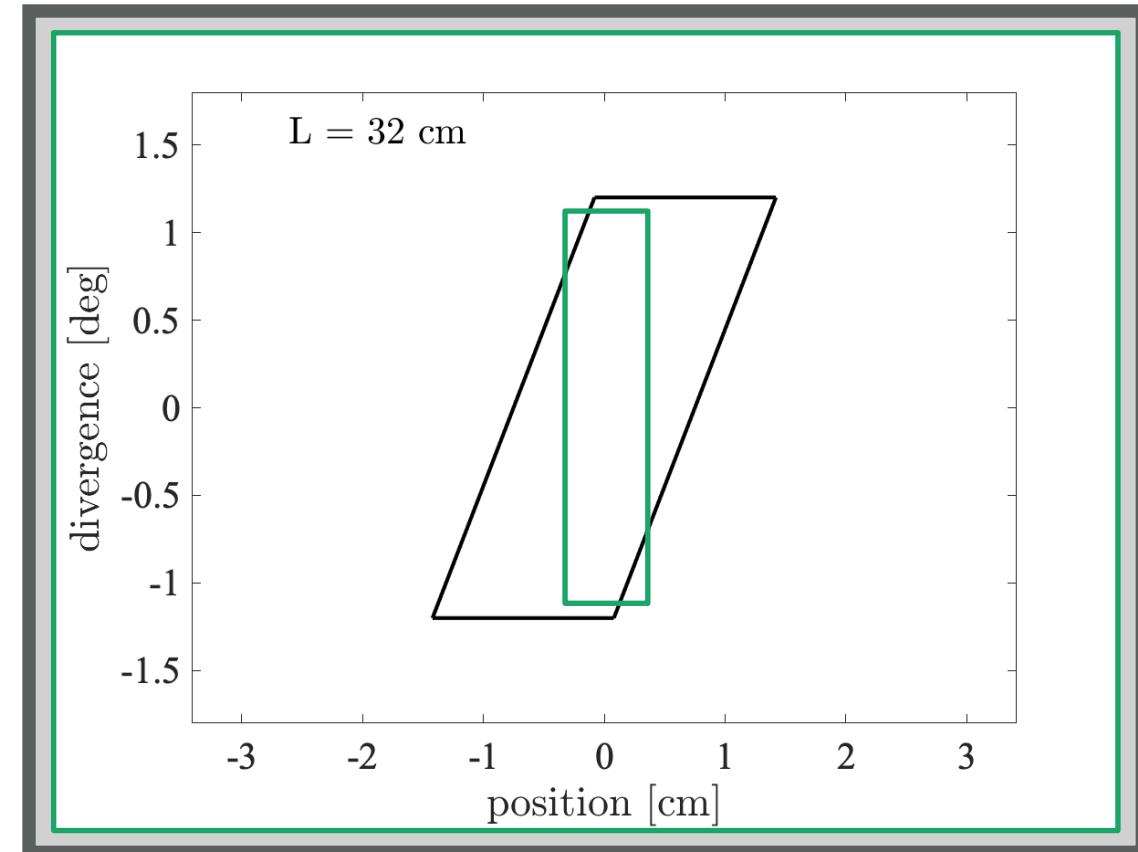
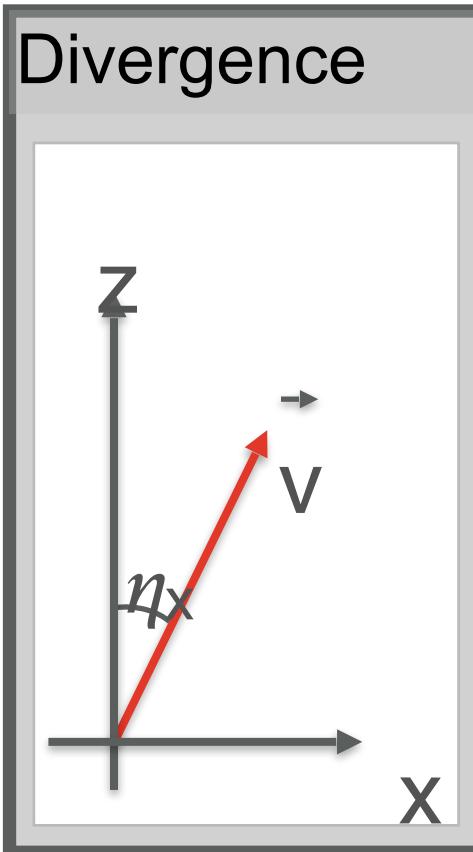
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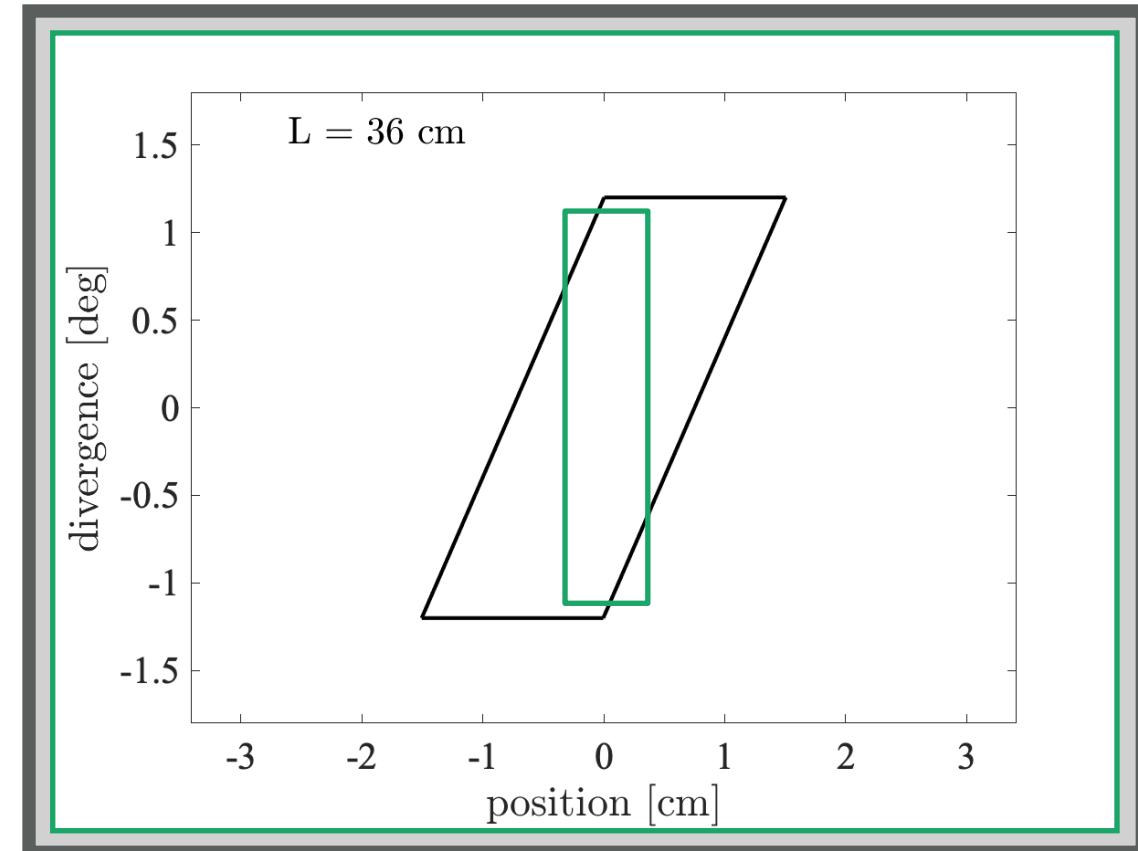
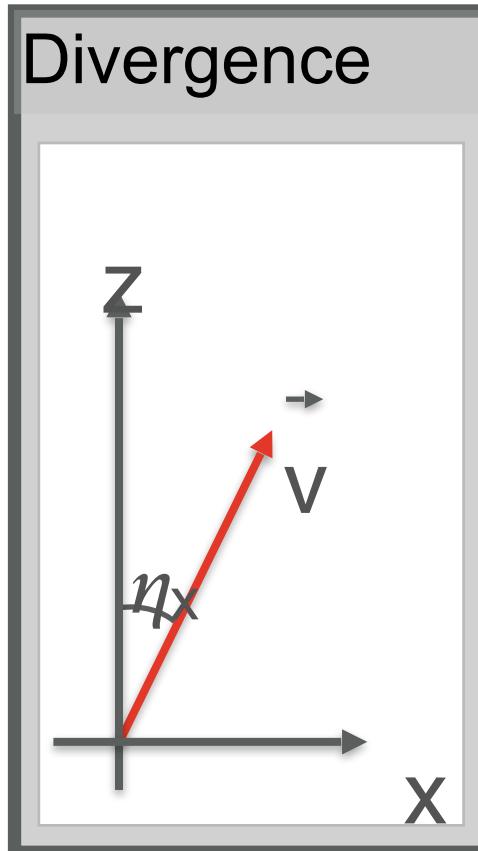
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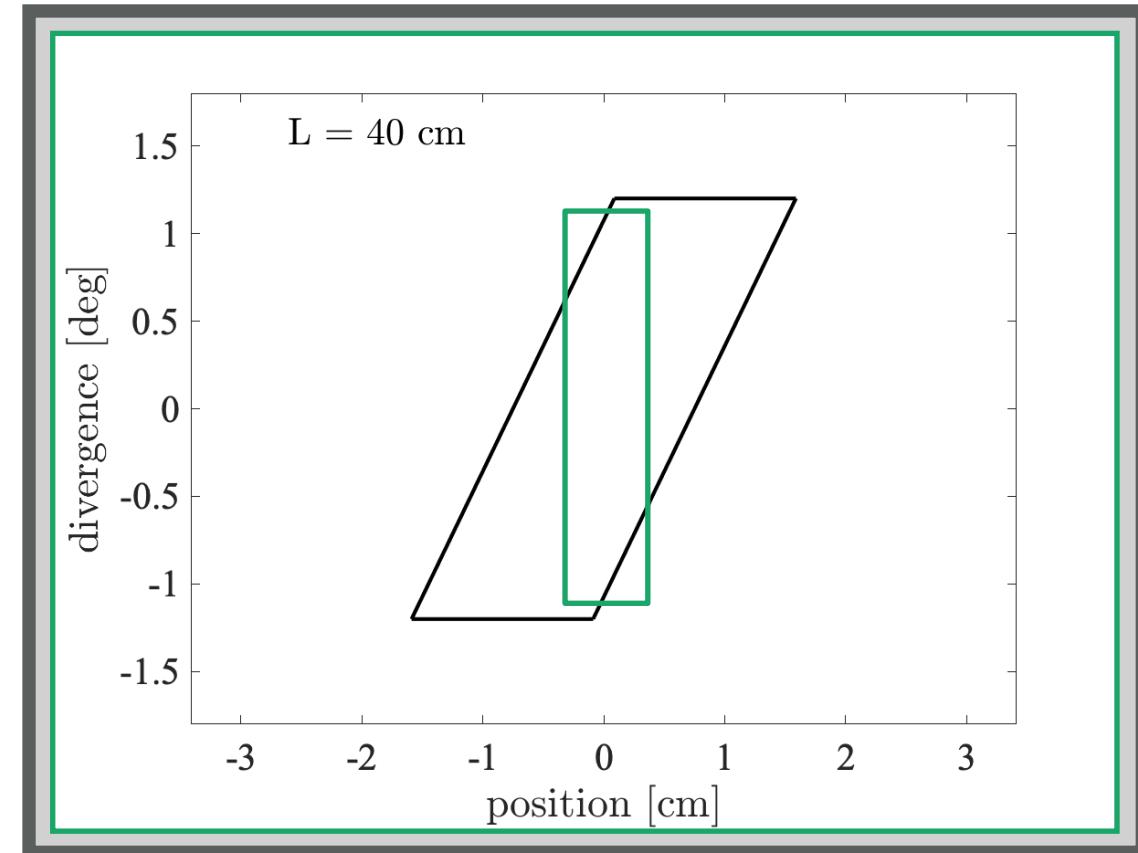
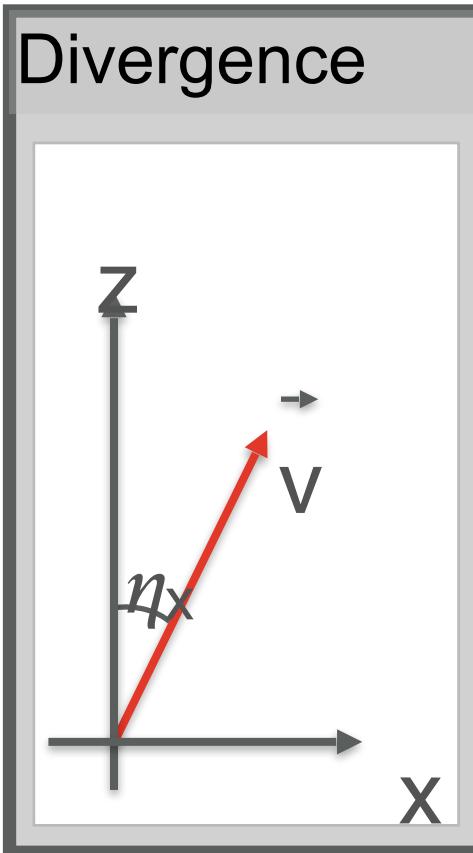
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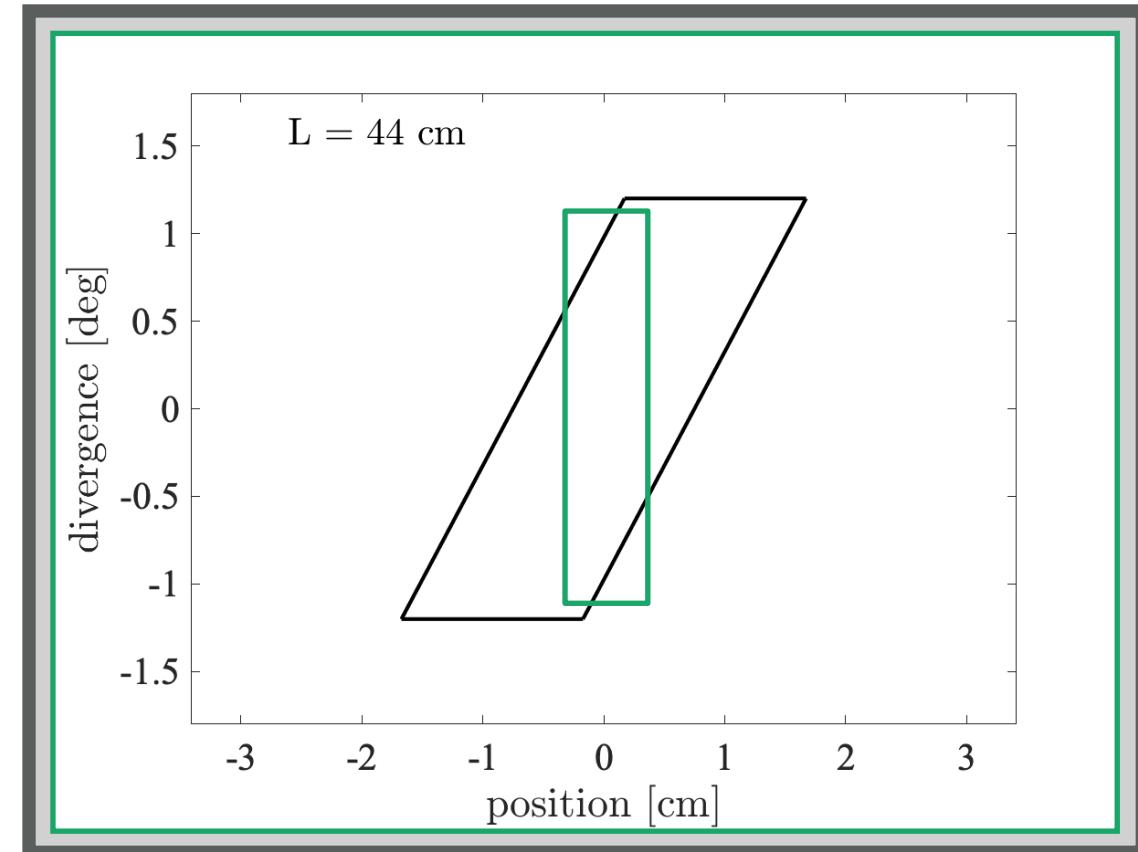
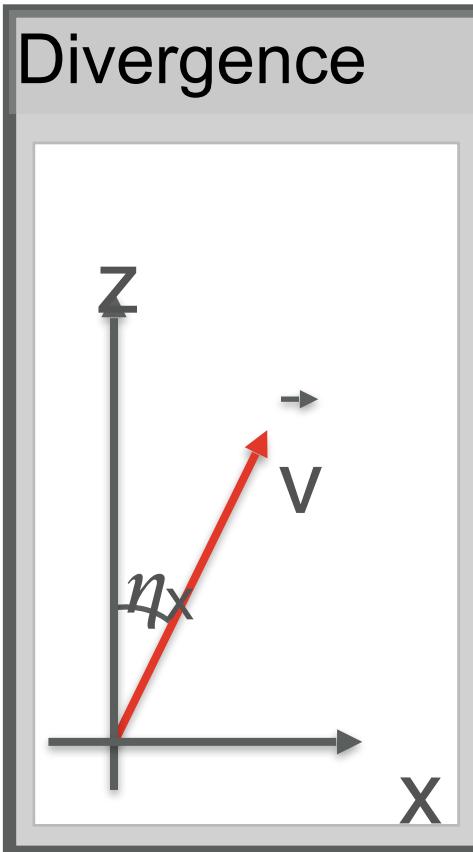
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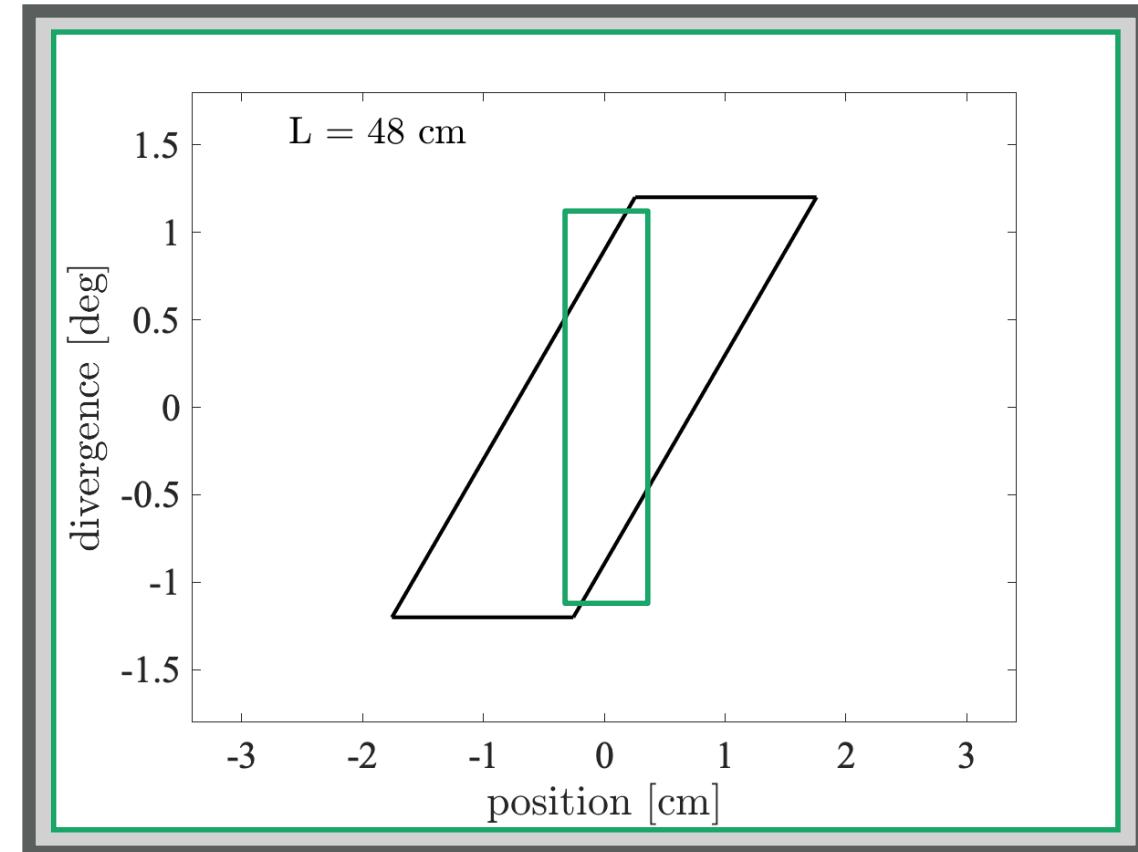
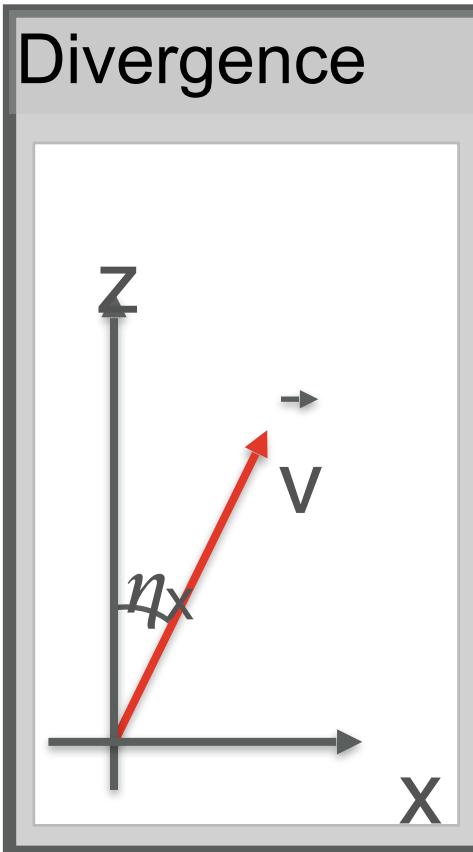
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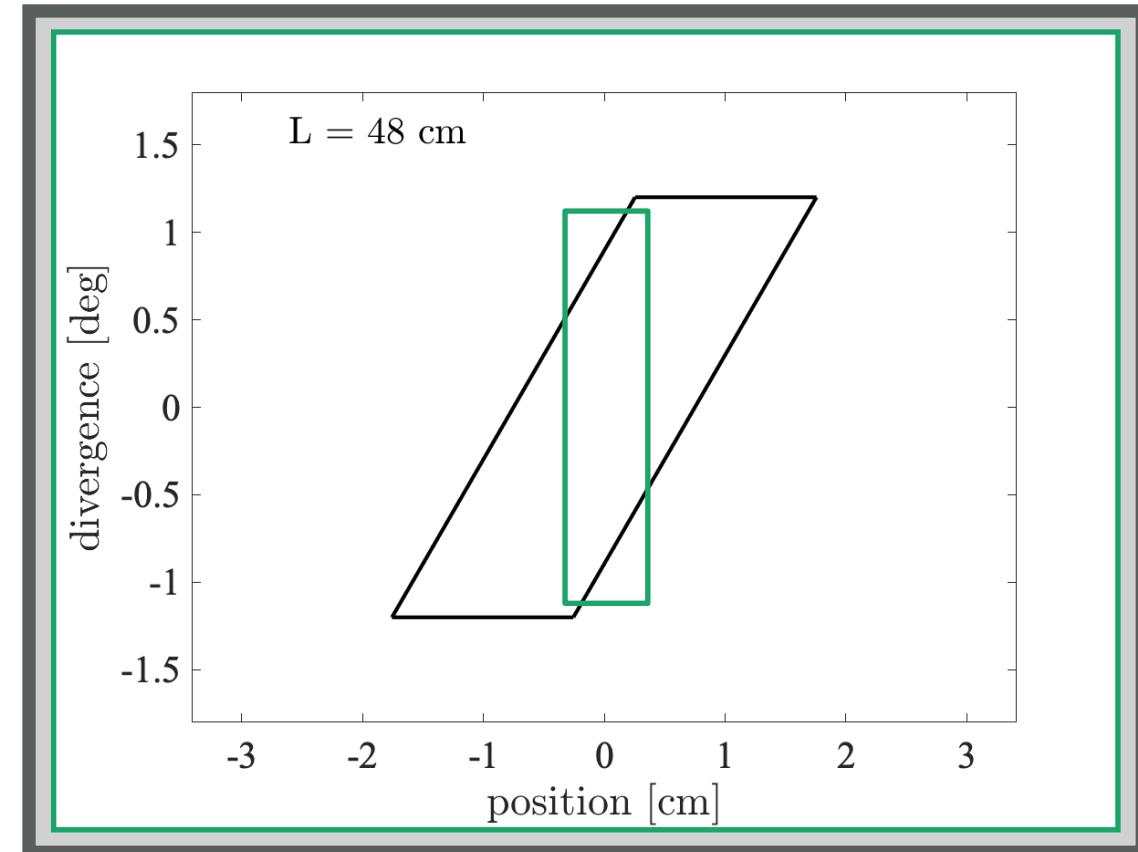
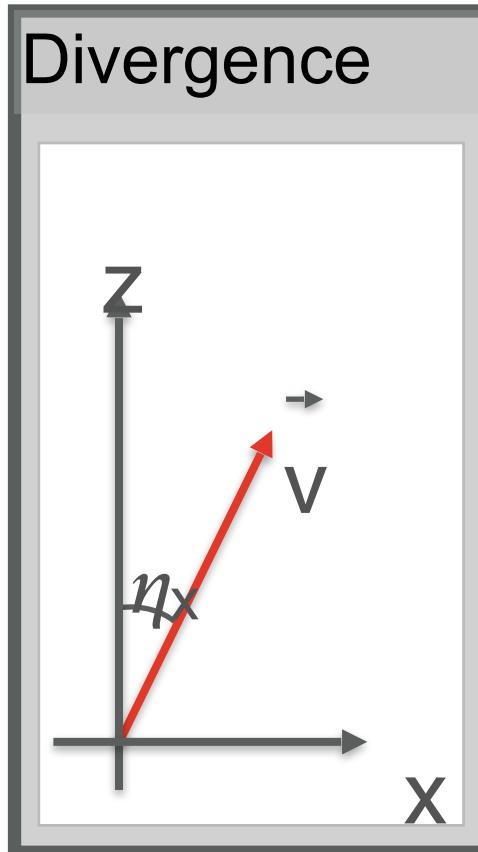
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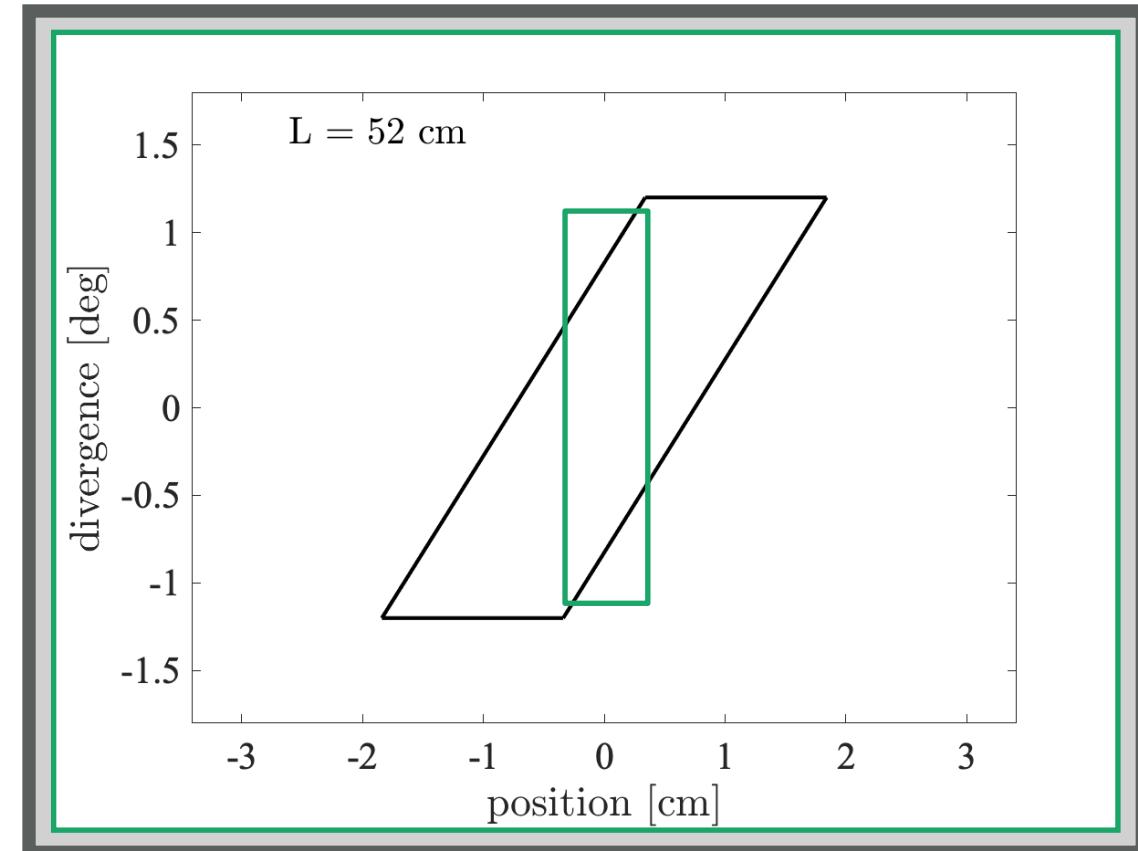
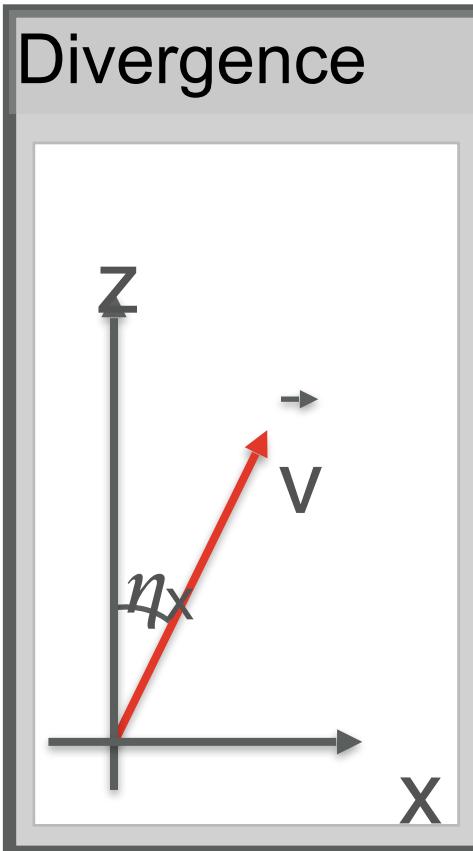
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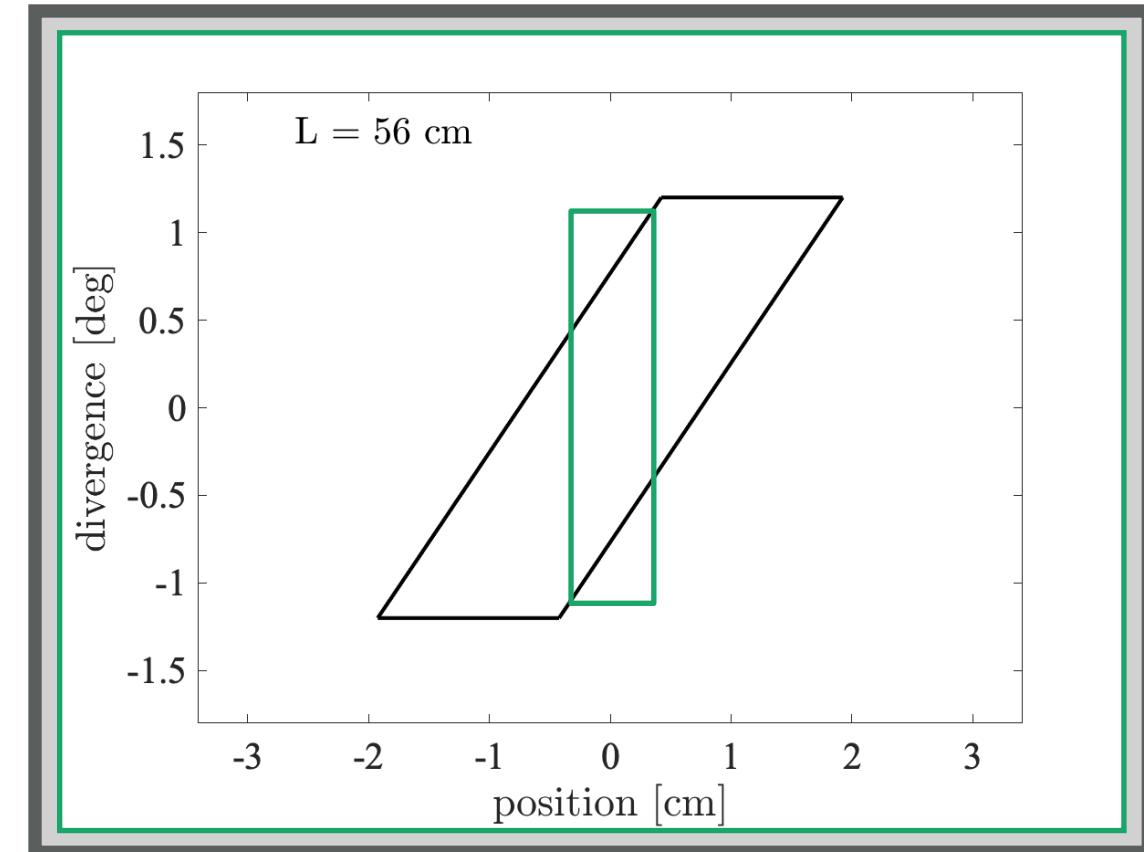
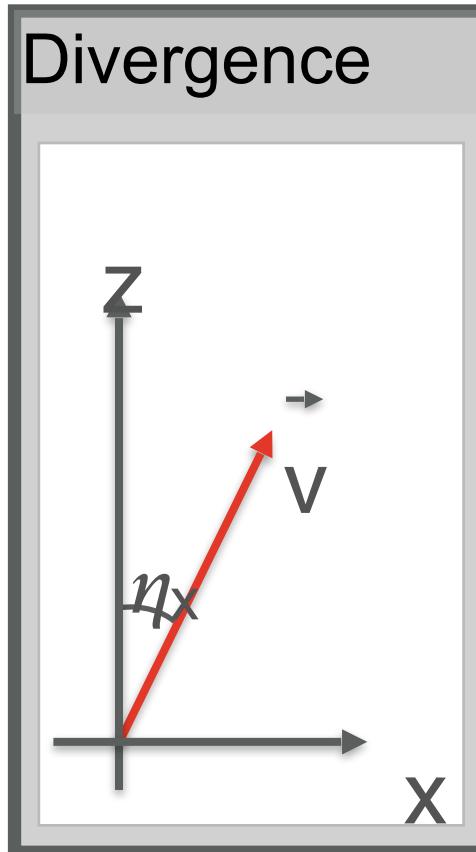
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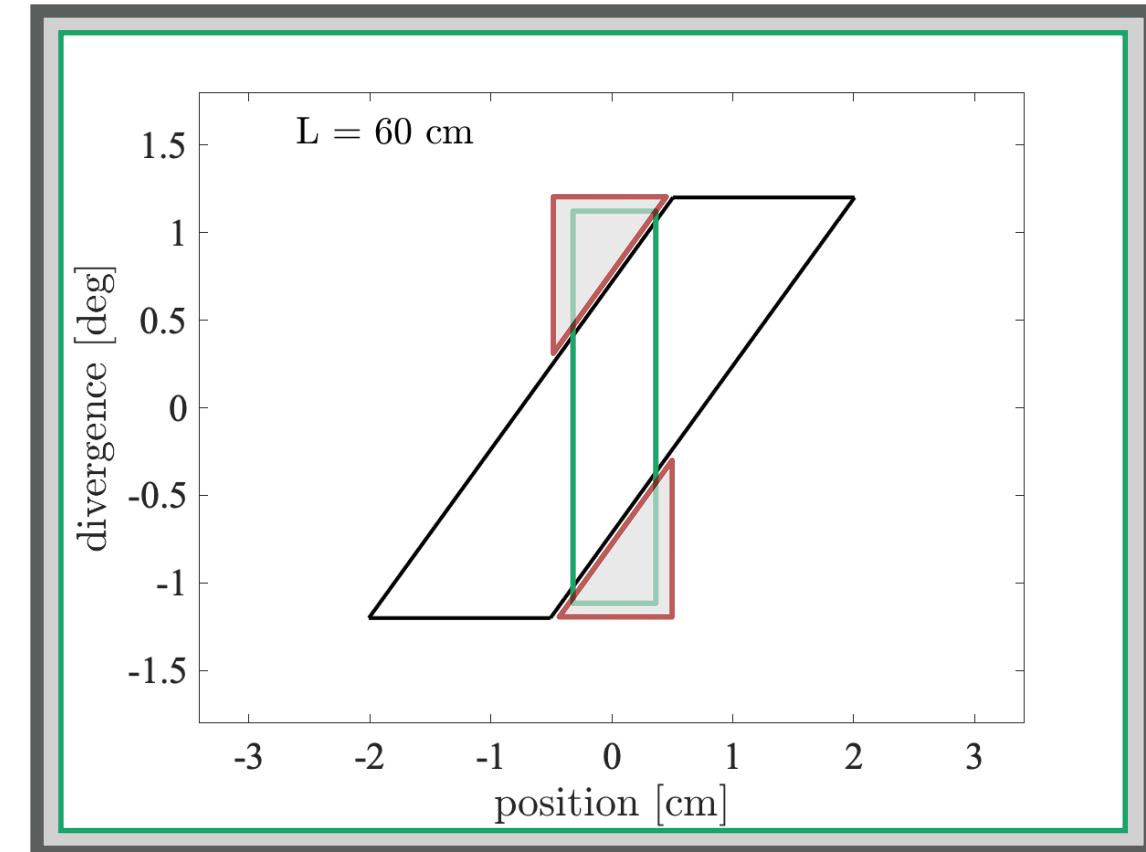
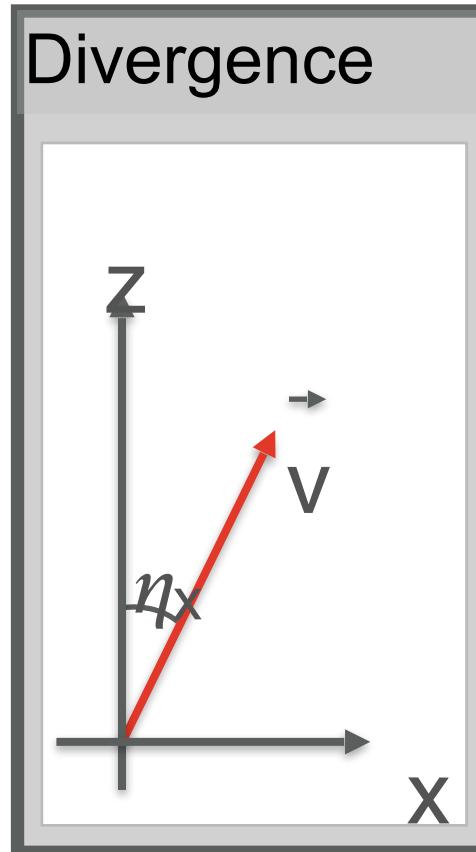




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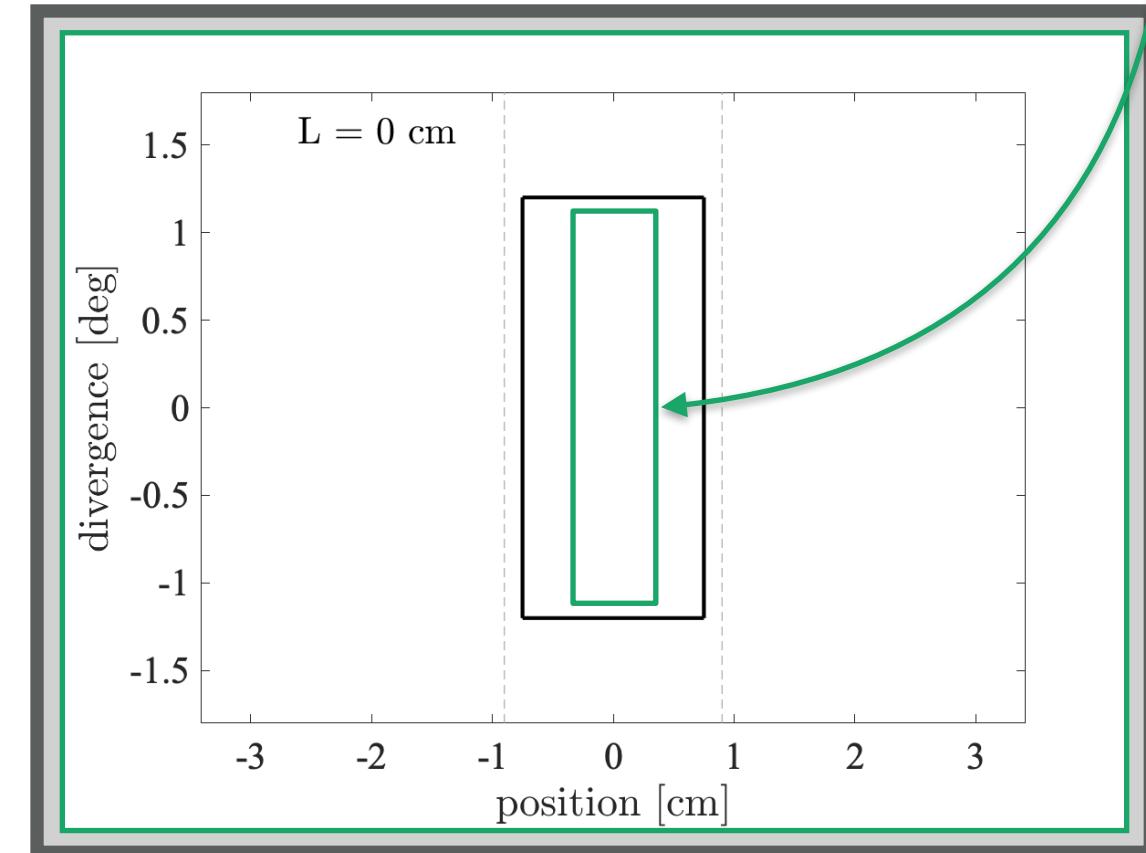
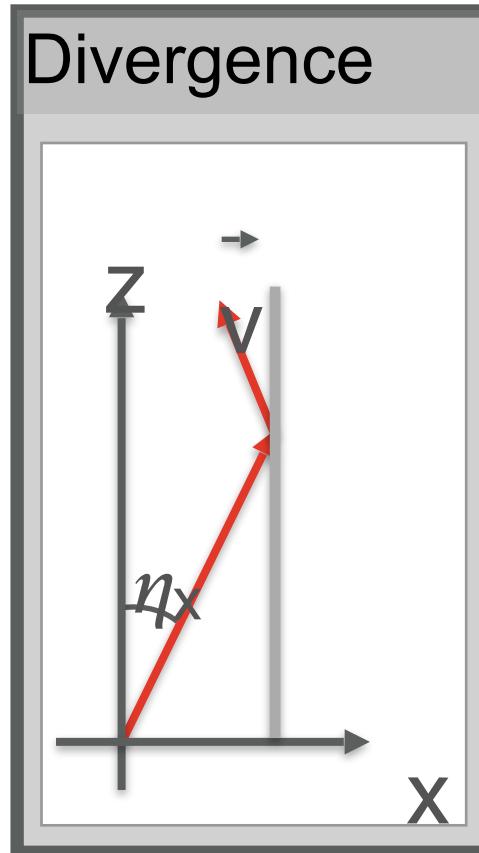
# Beam propagation in free space

- We lost some phase-space to propagation





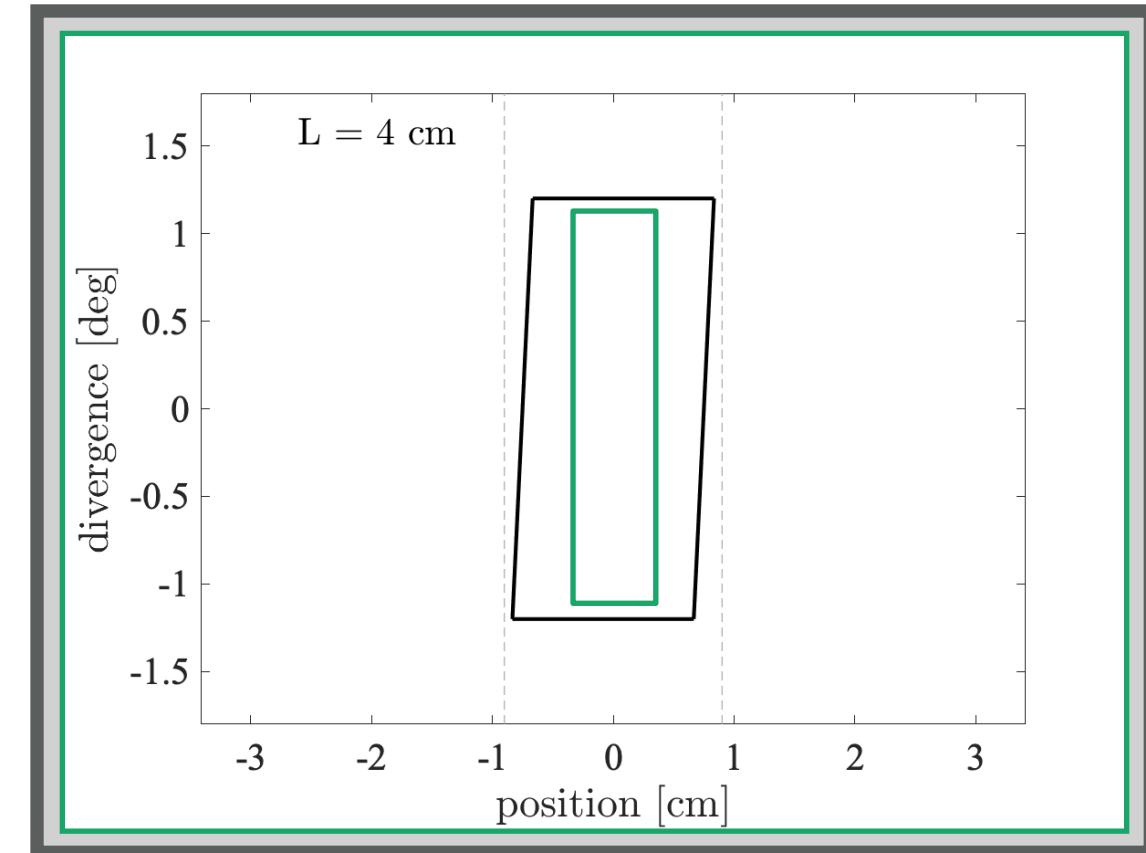
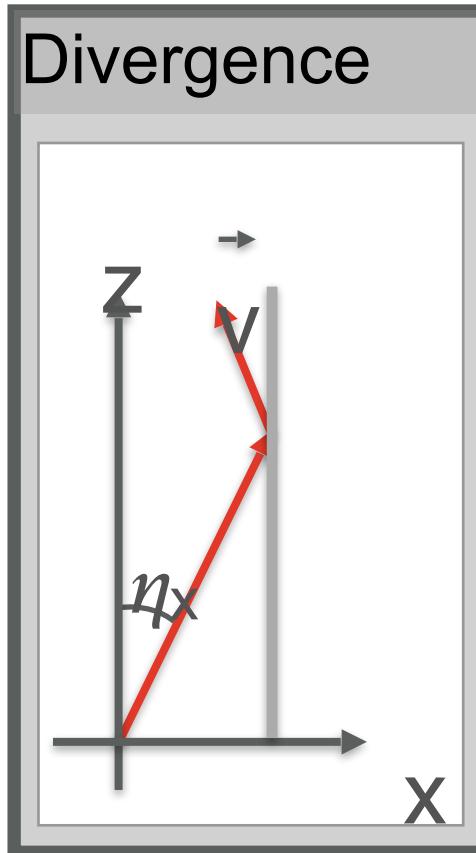
# Beam propagation in guide





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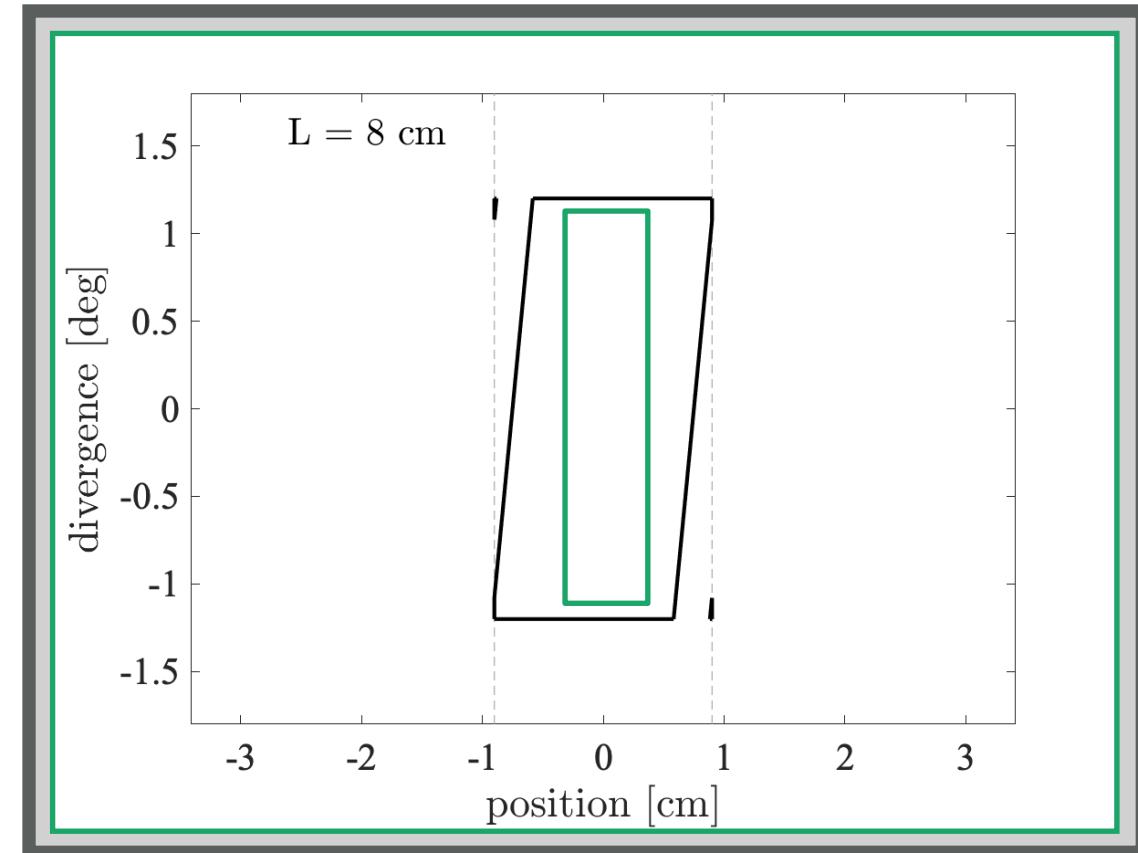
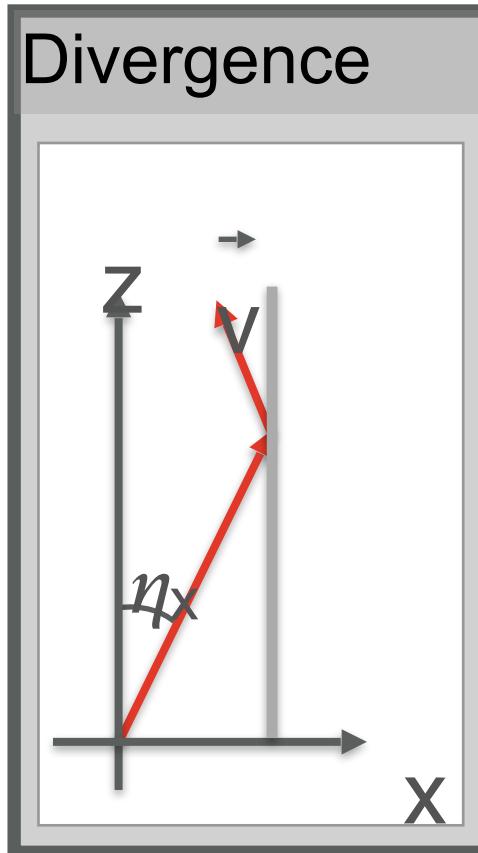
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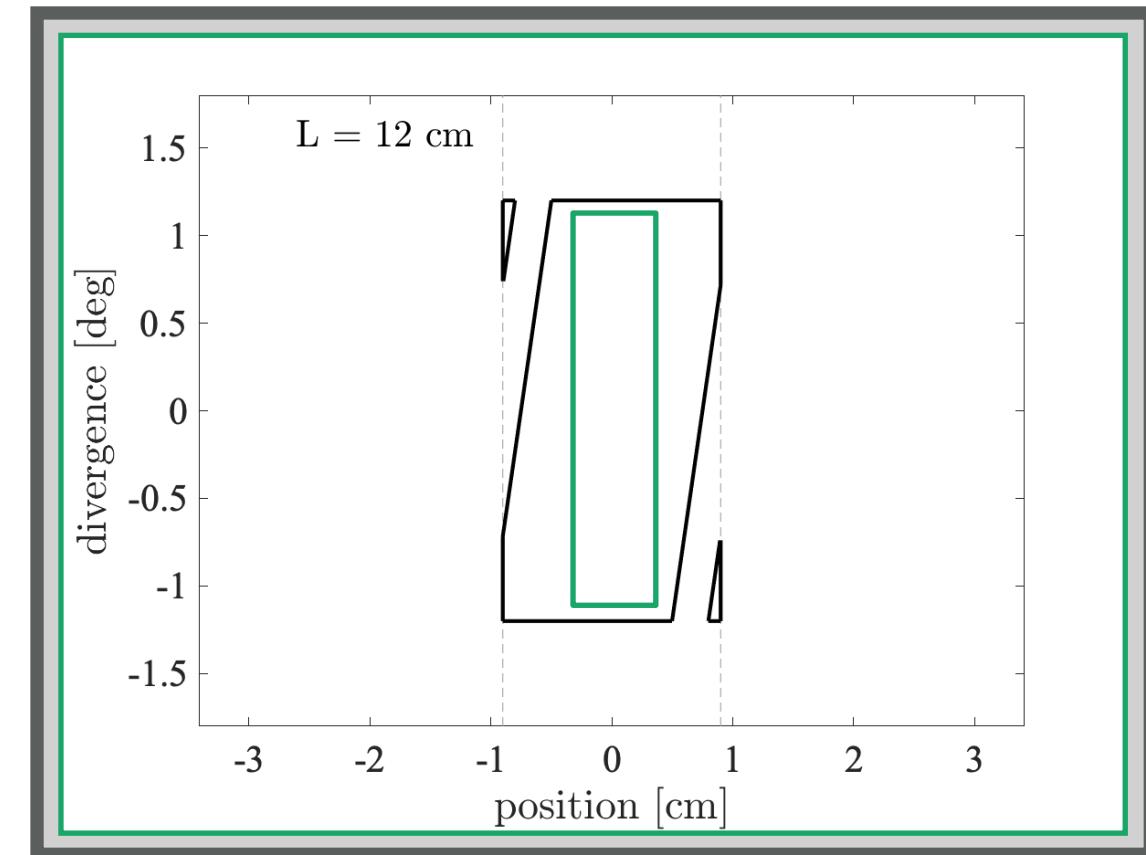
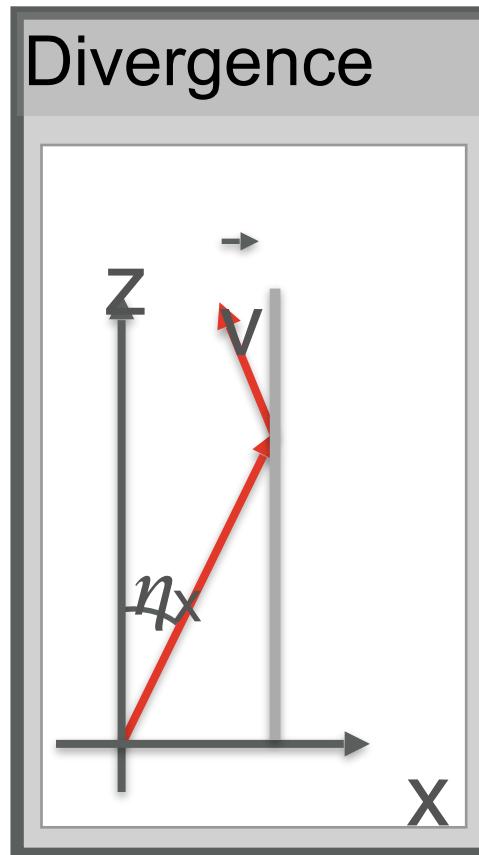
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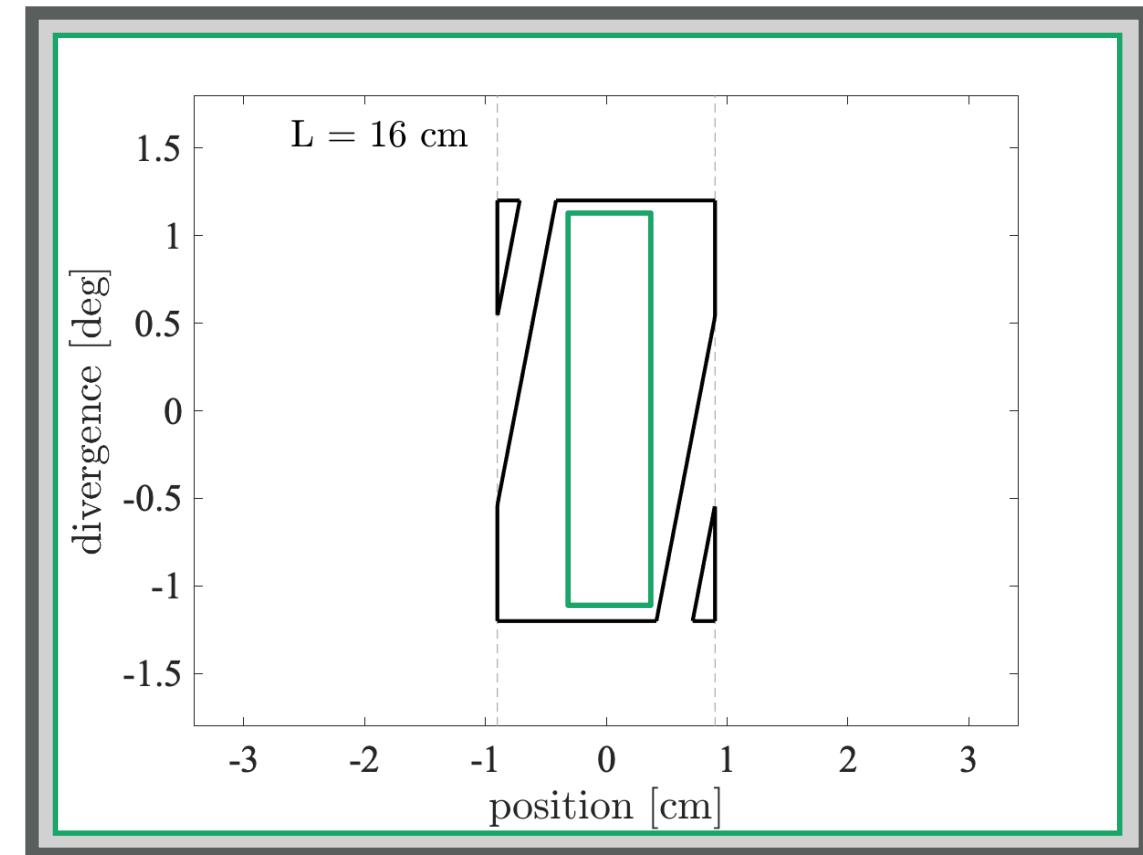
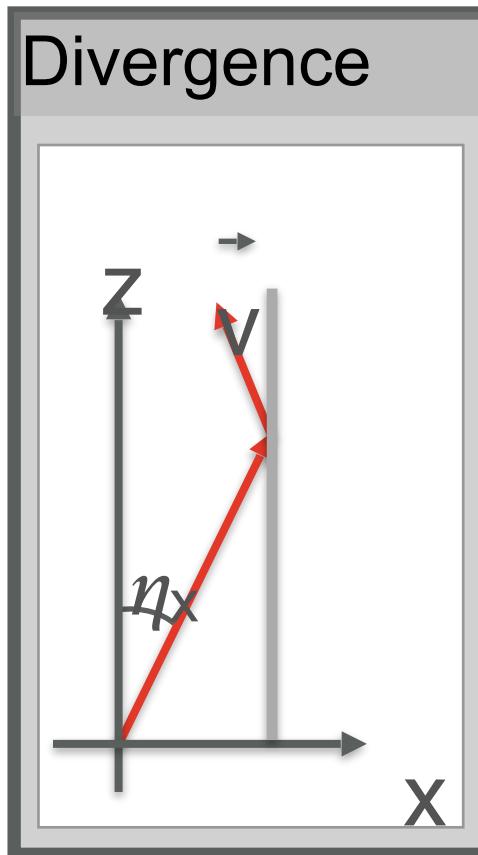
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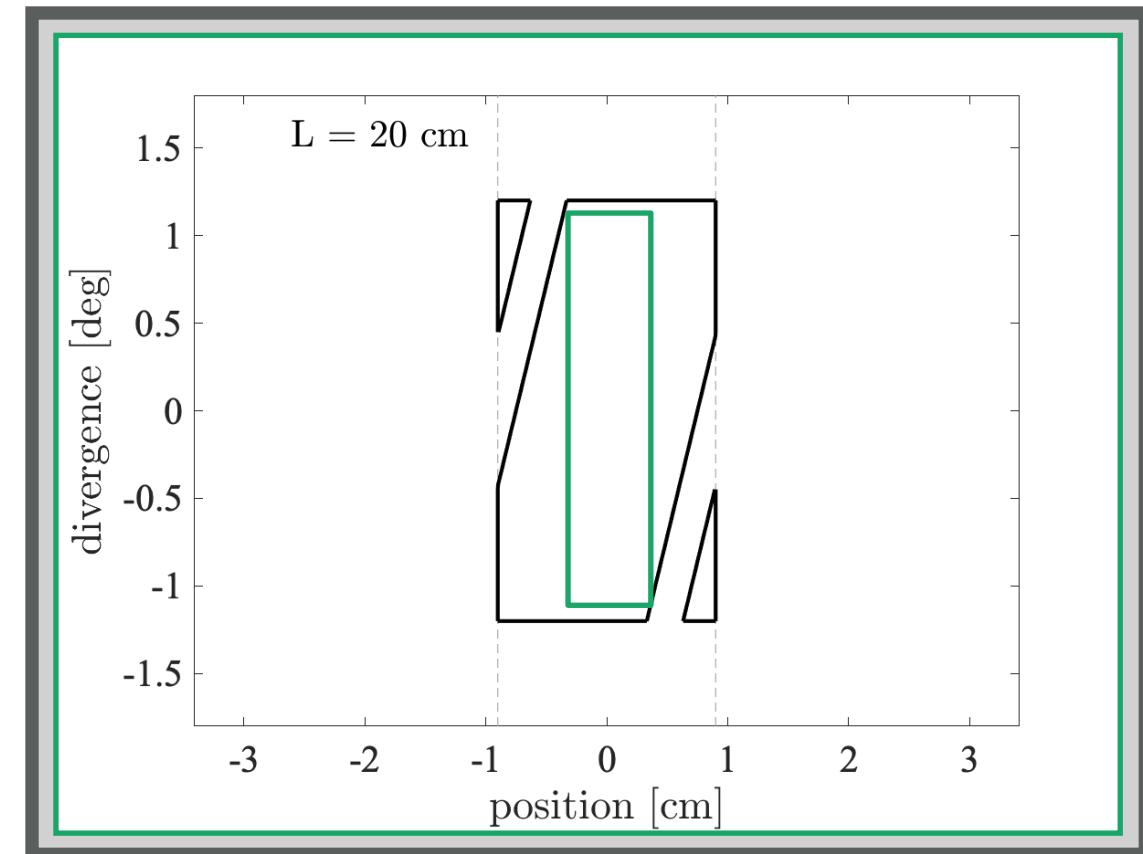
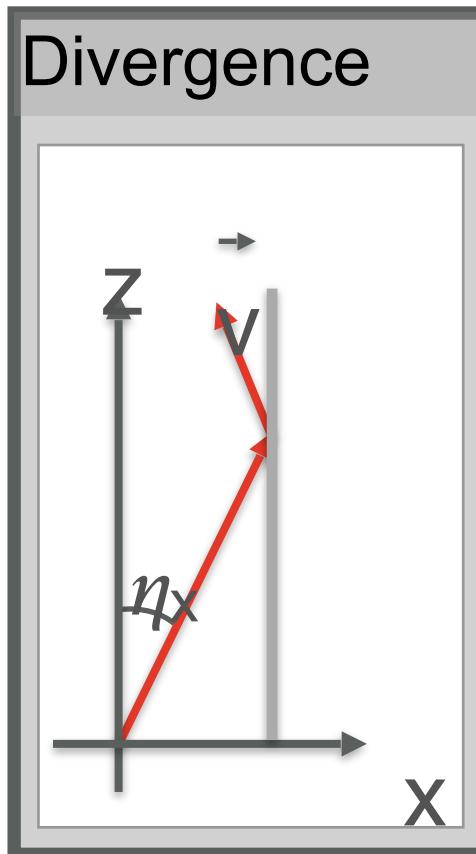


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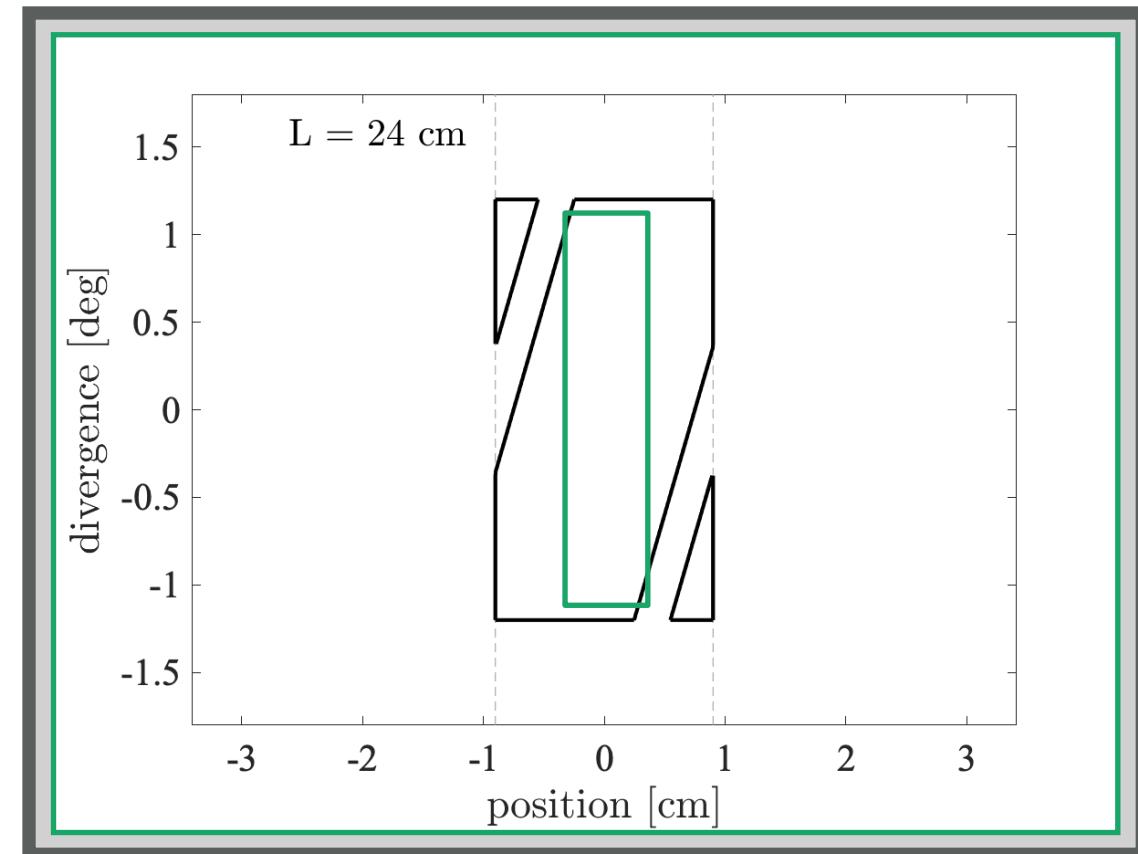
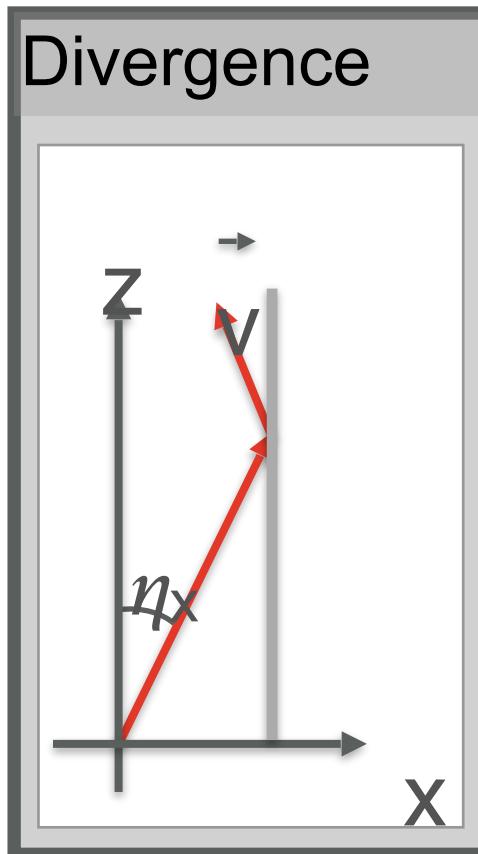


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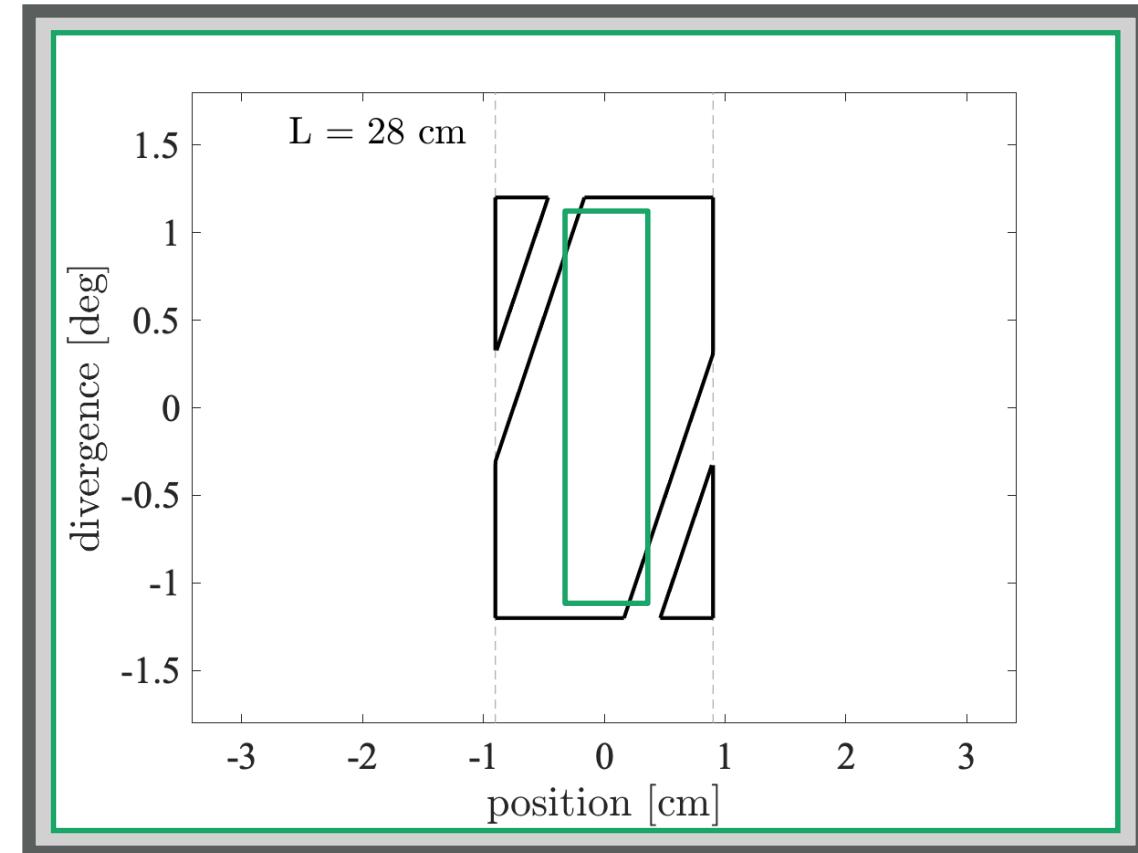
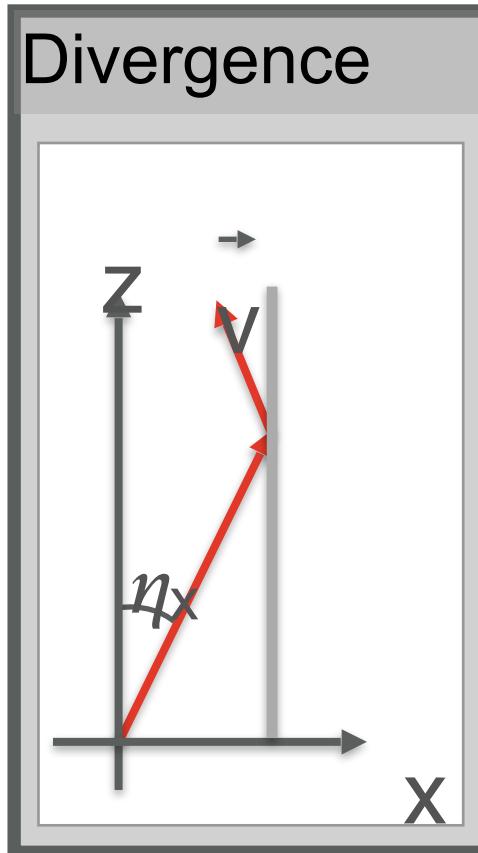
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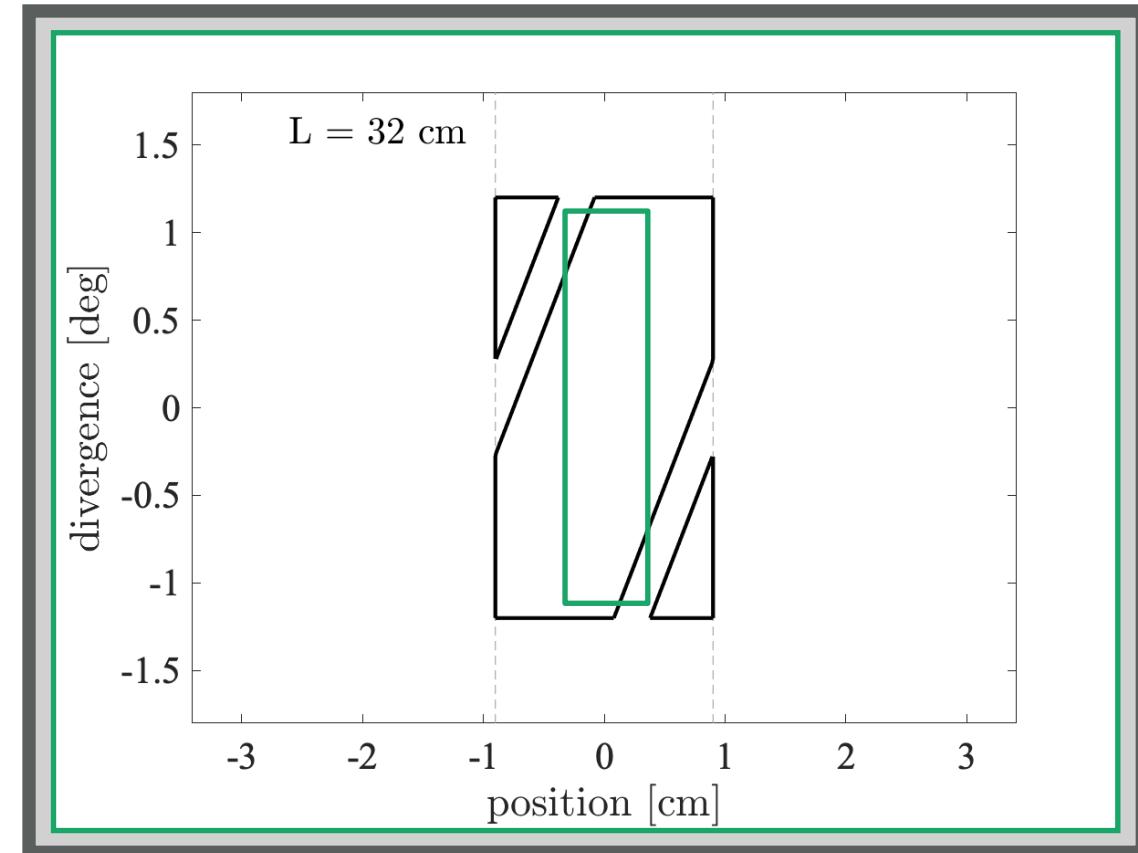
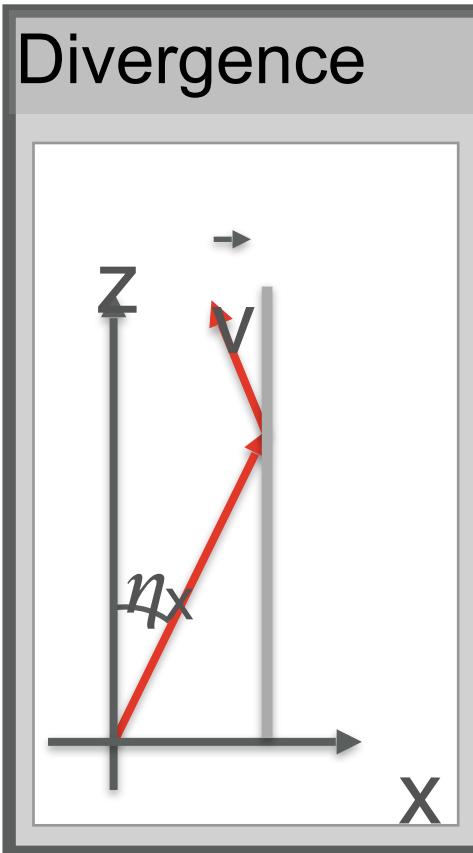
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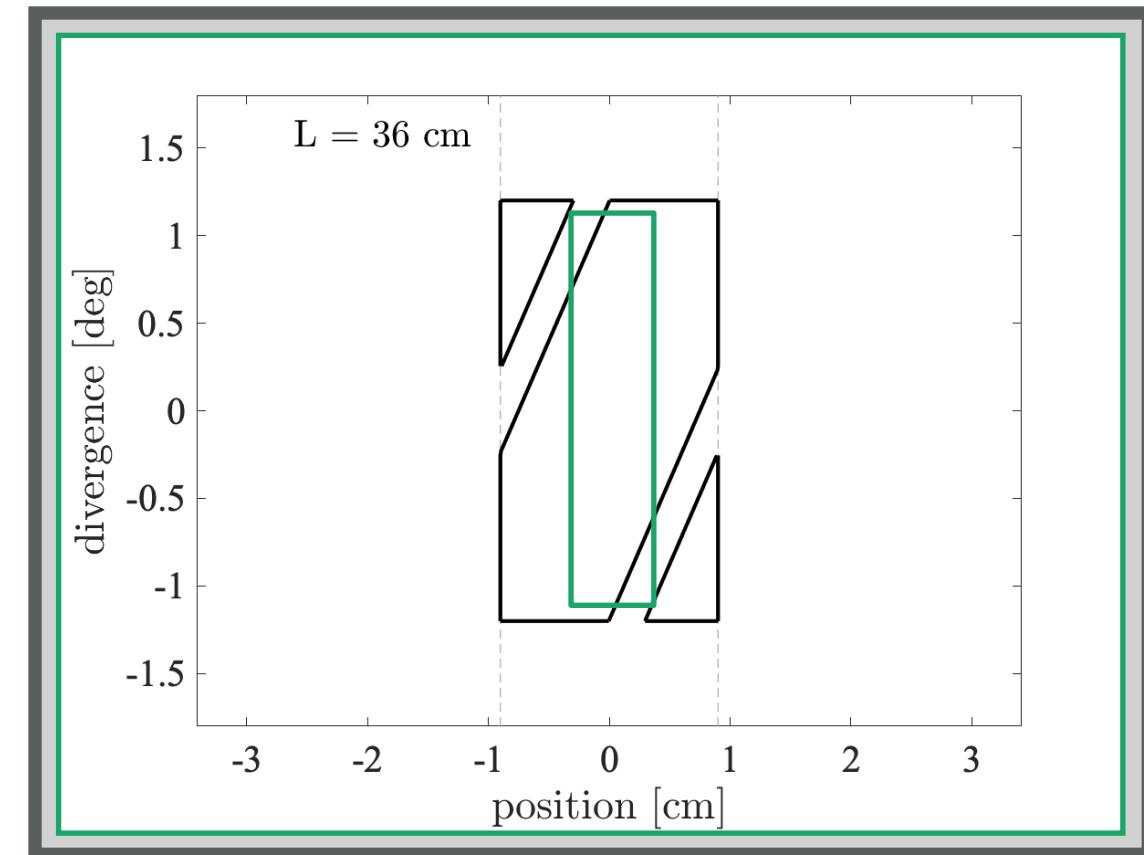
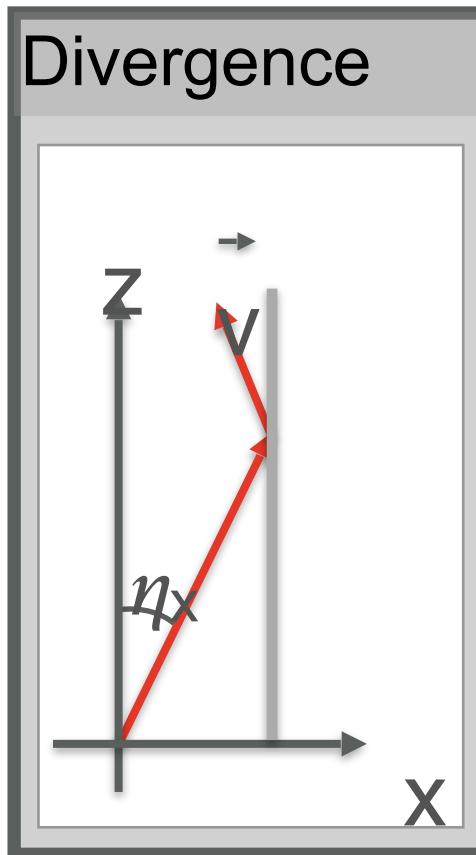
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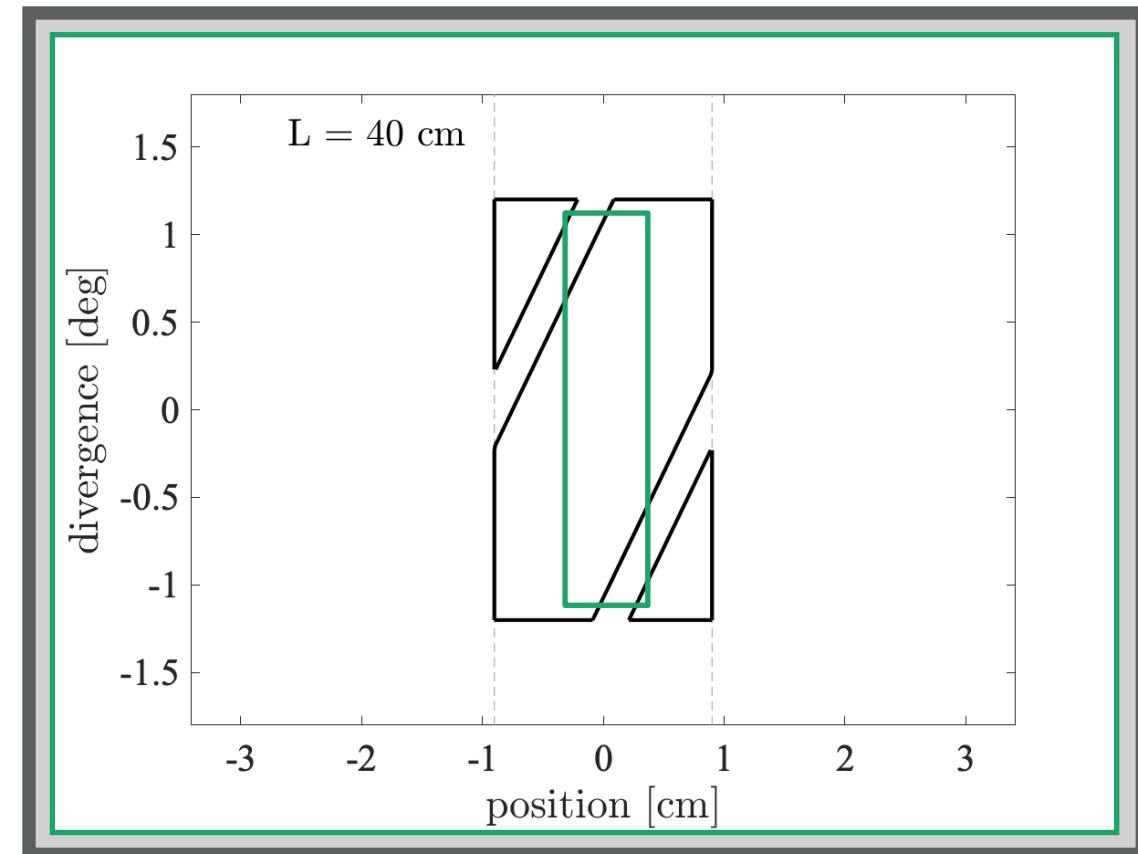
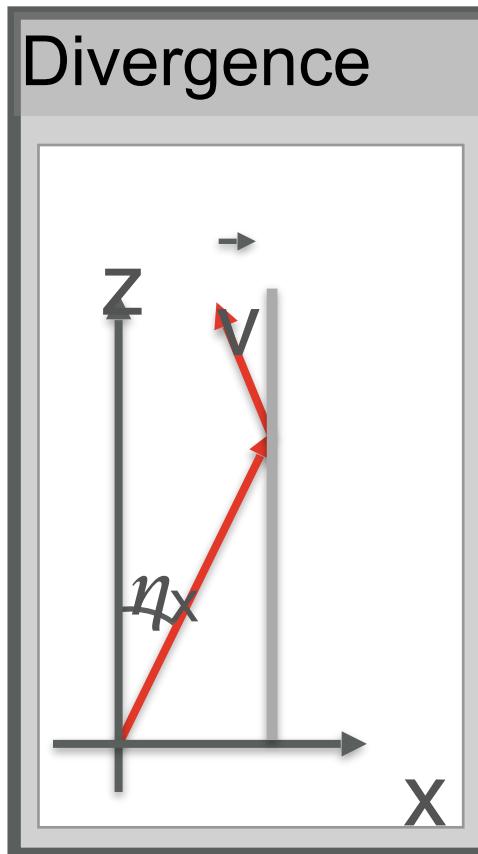


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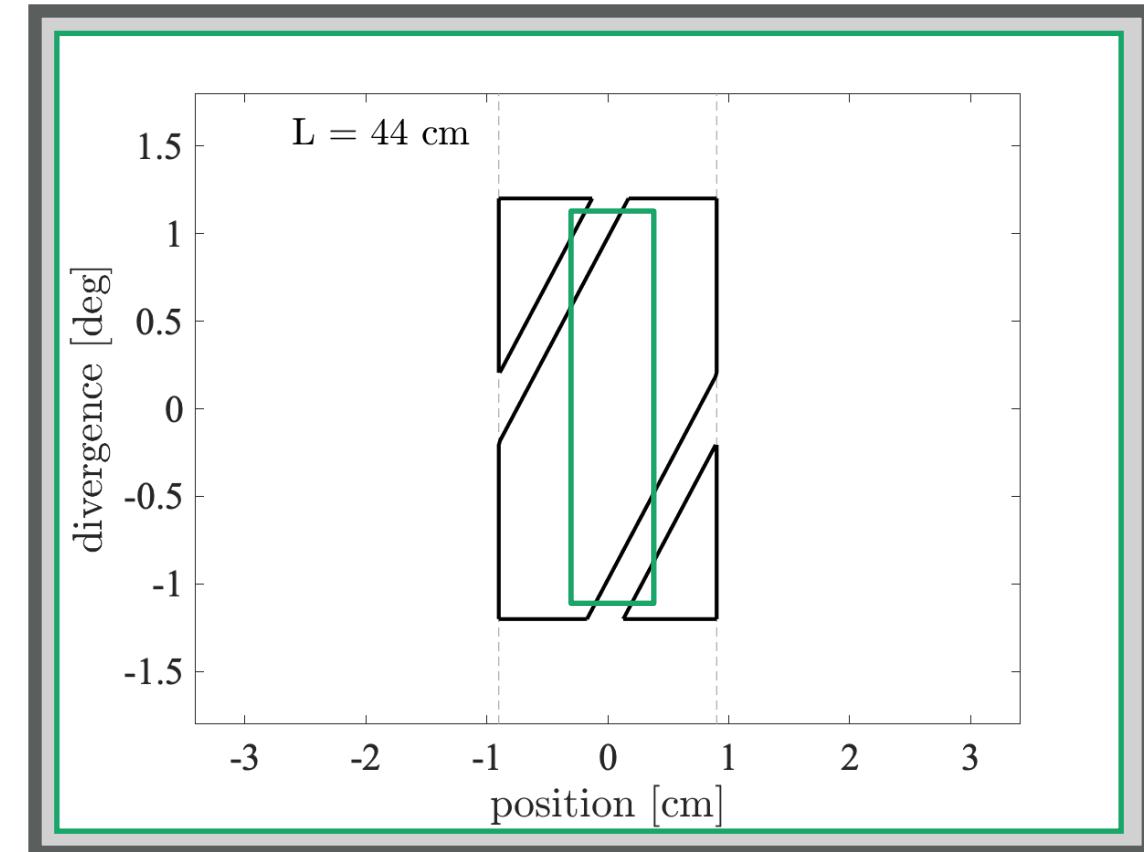
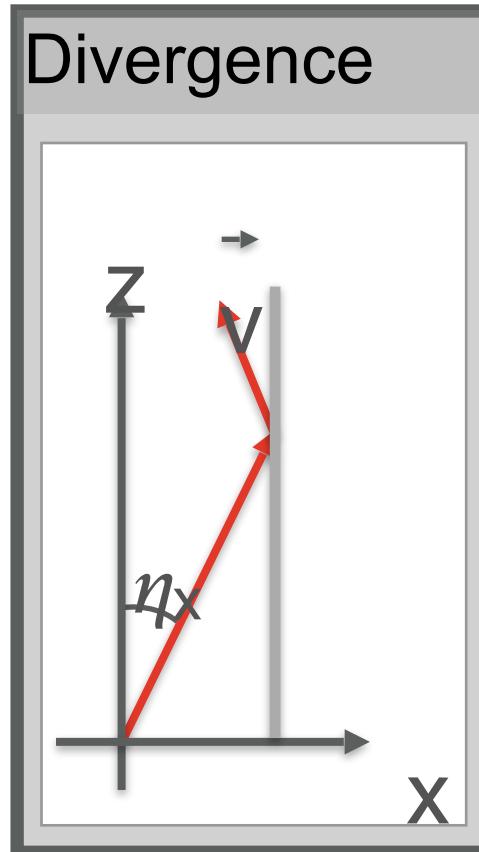
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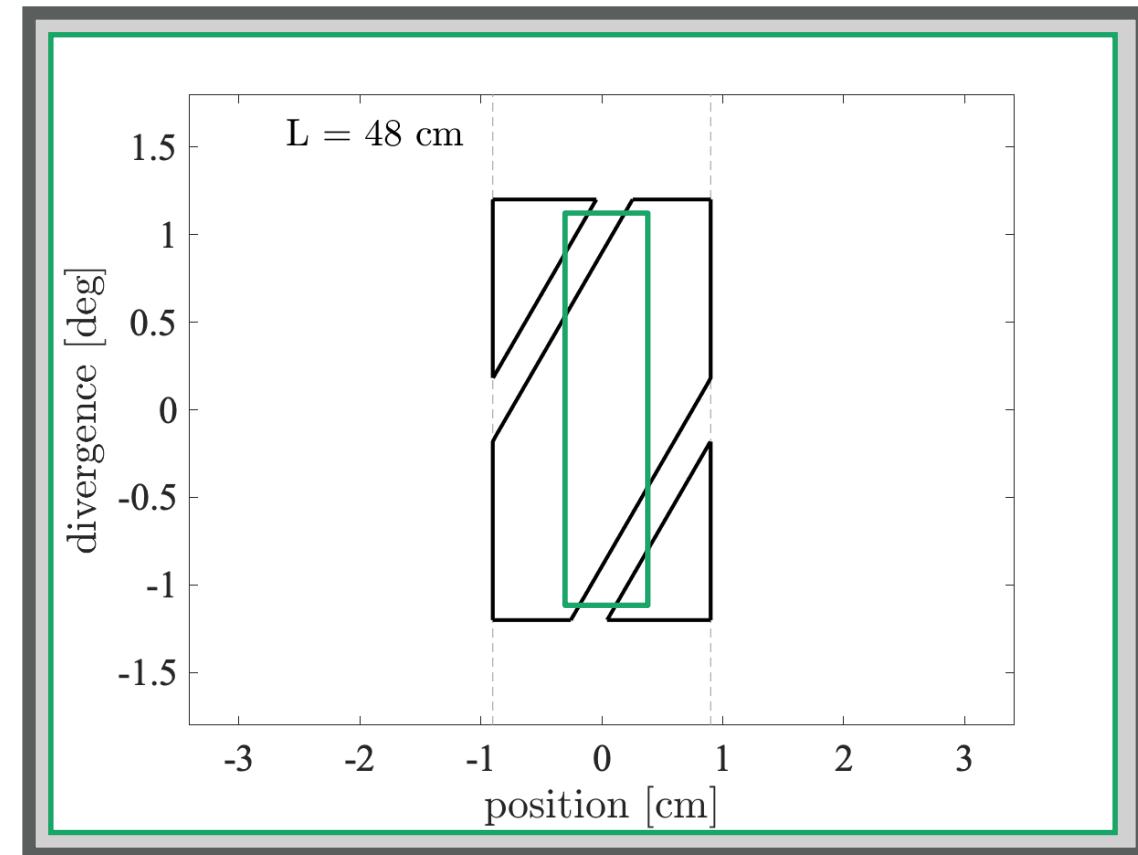
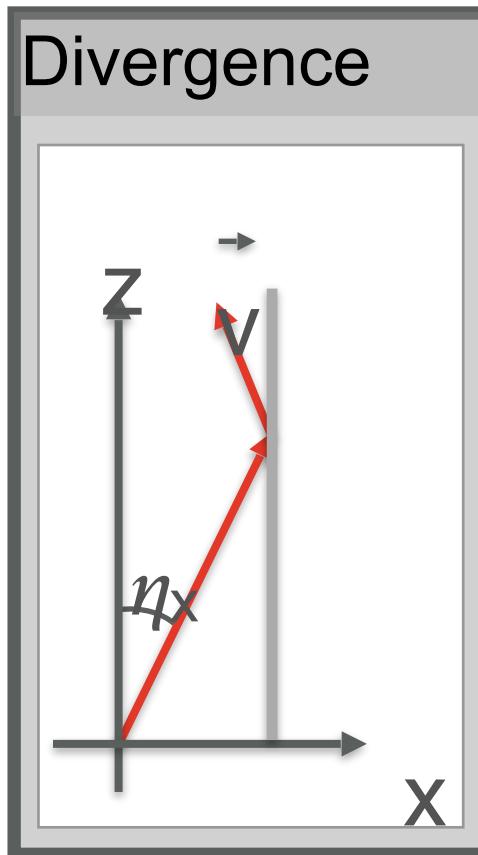
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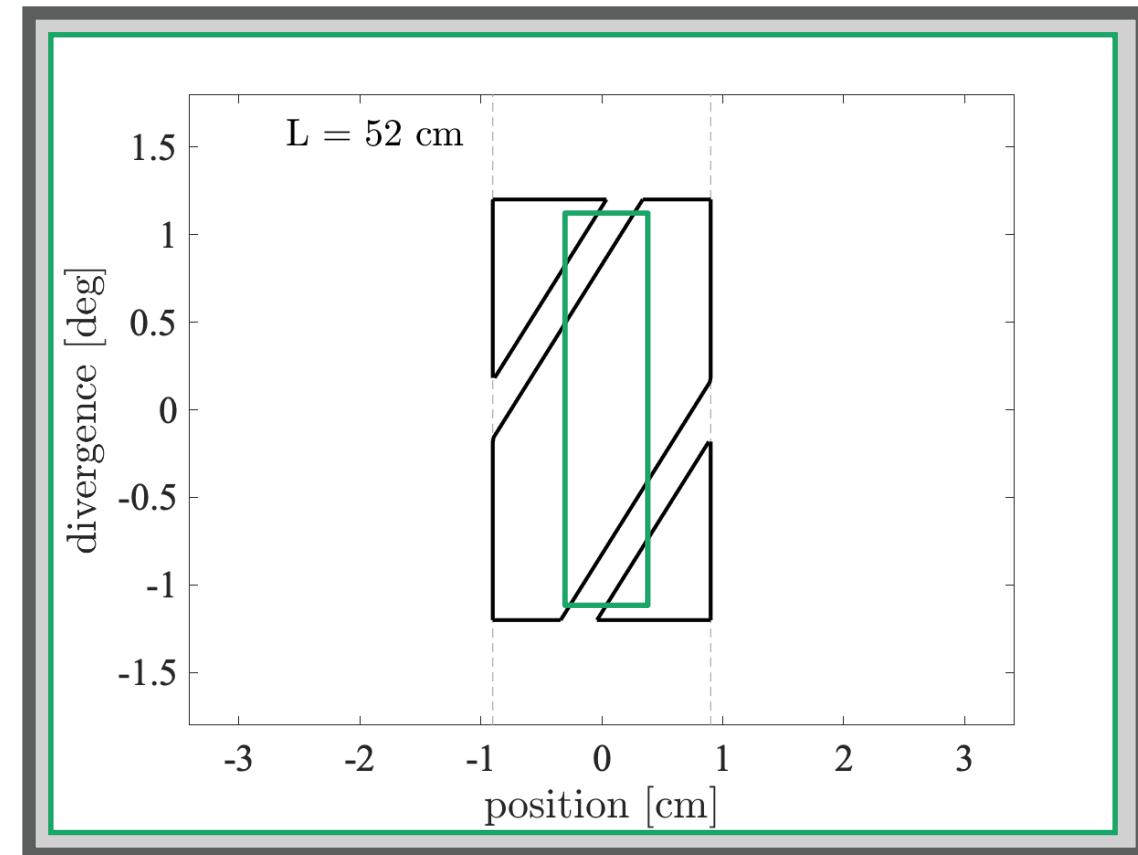
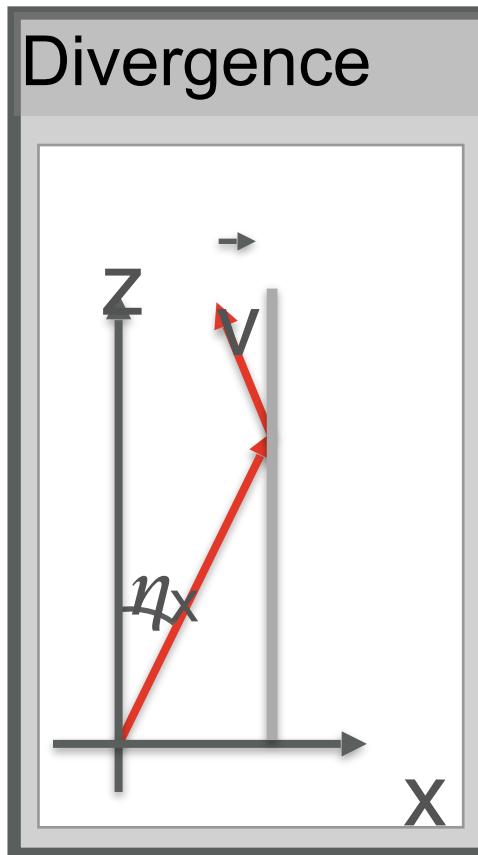


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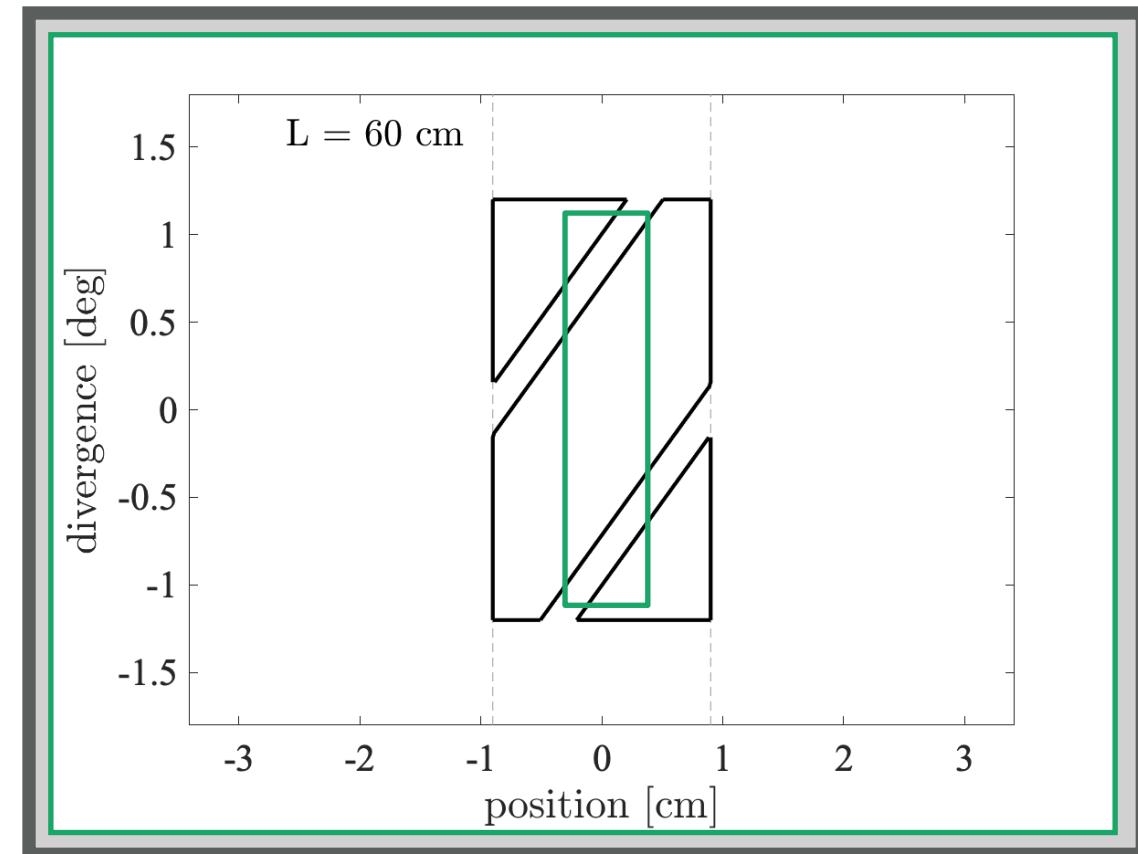
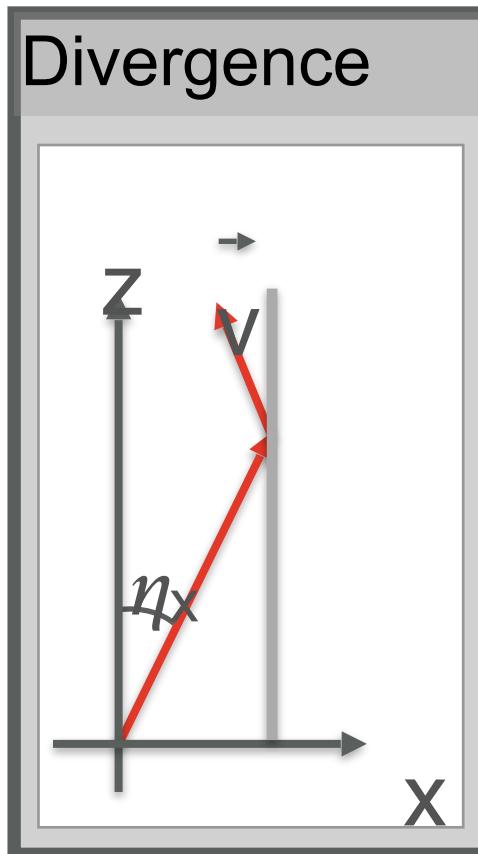


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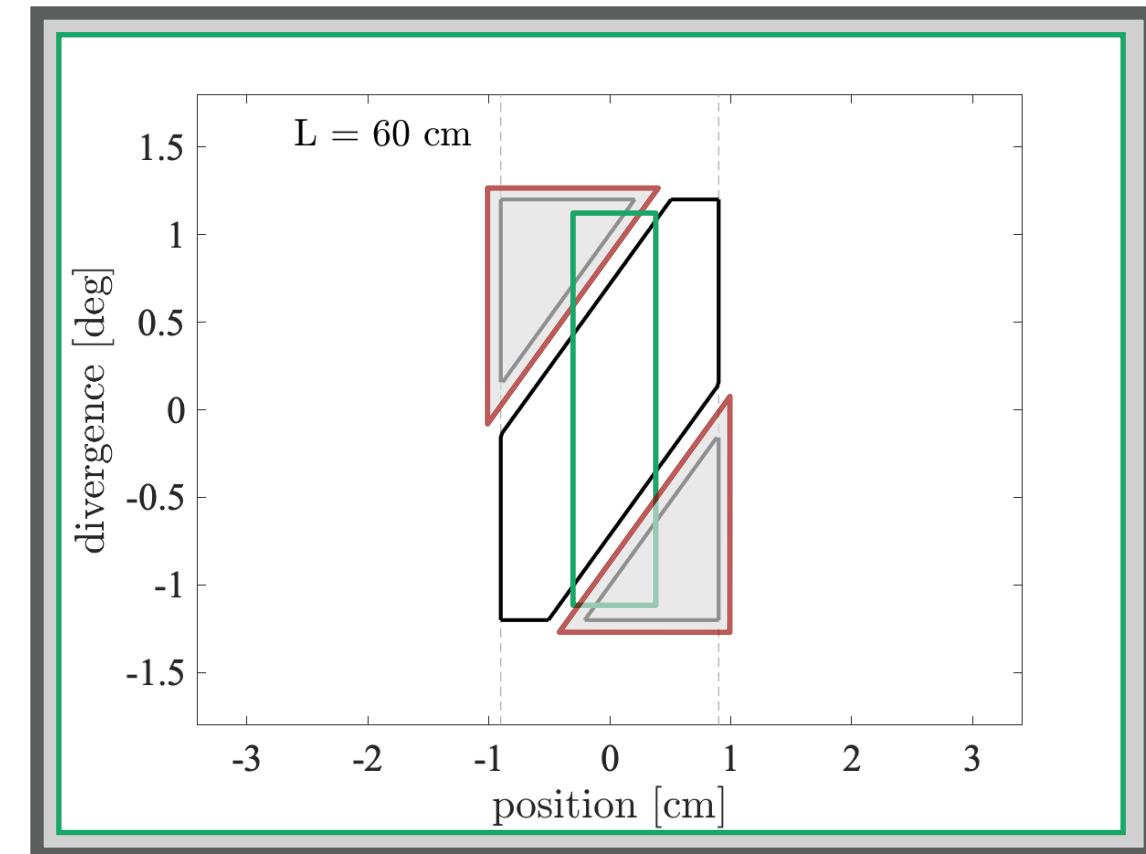
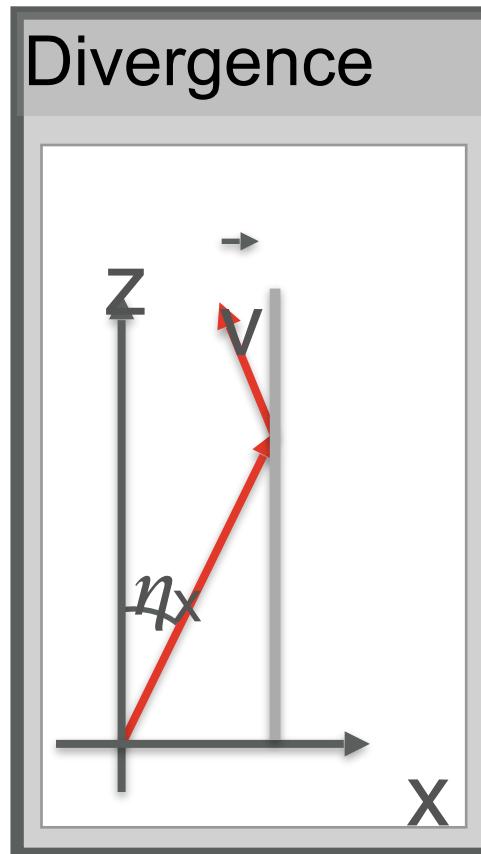
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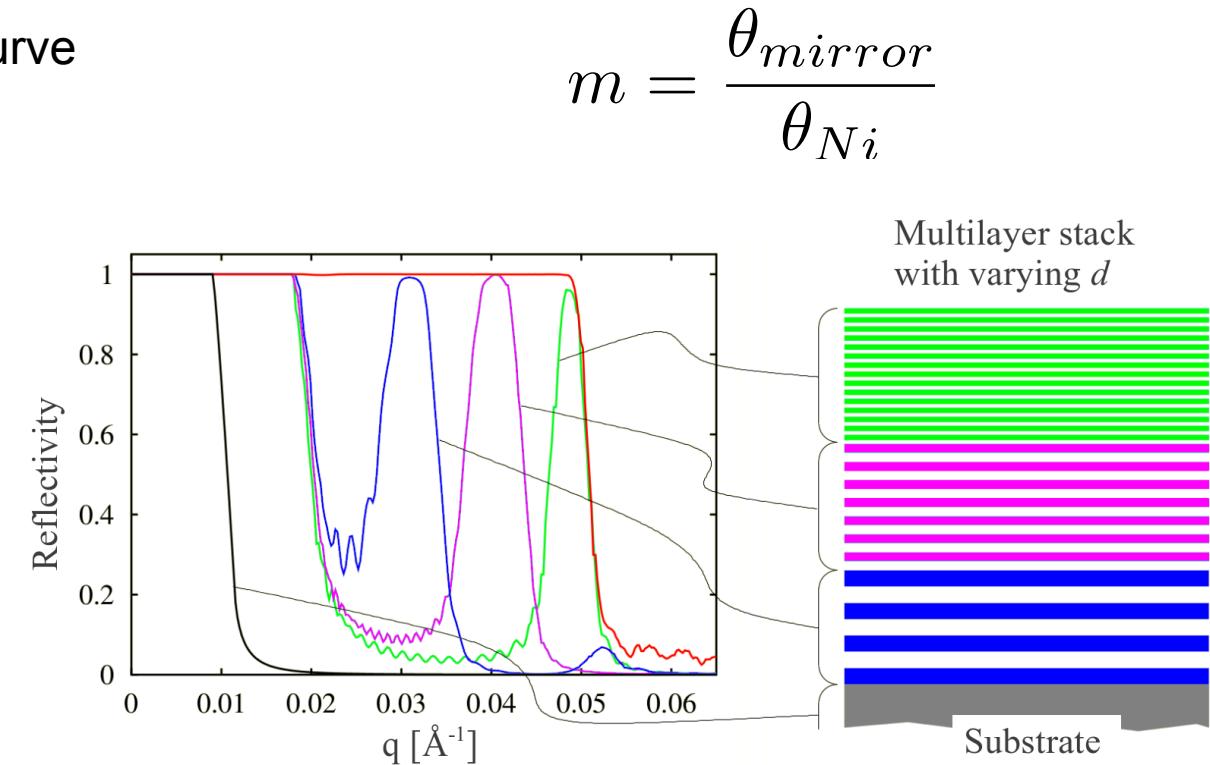
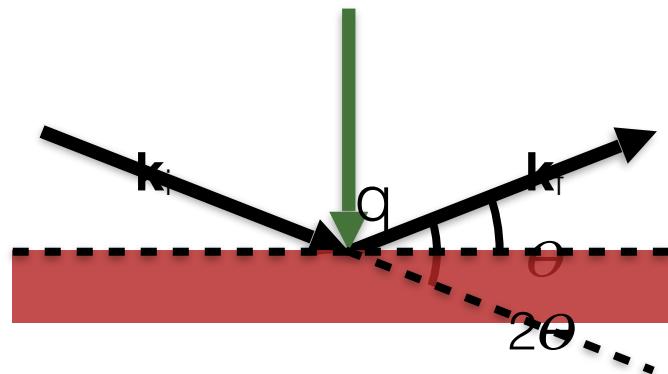
# Beam propagation in guide





# Reflectivity curves

- Reflectivity, super mirror, reflectivity curve

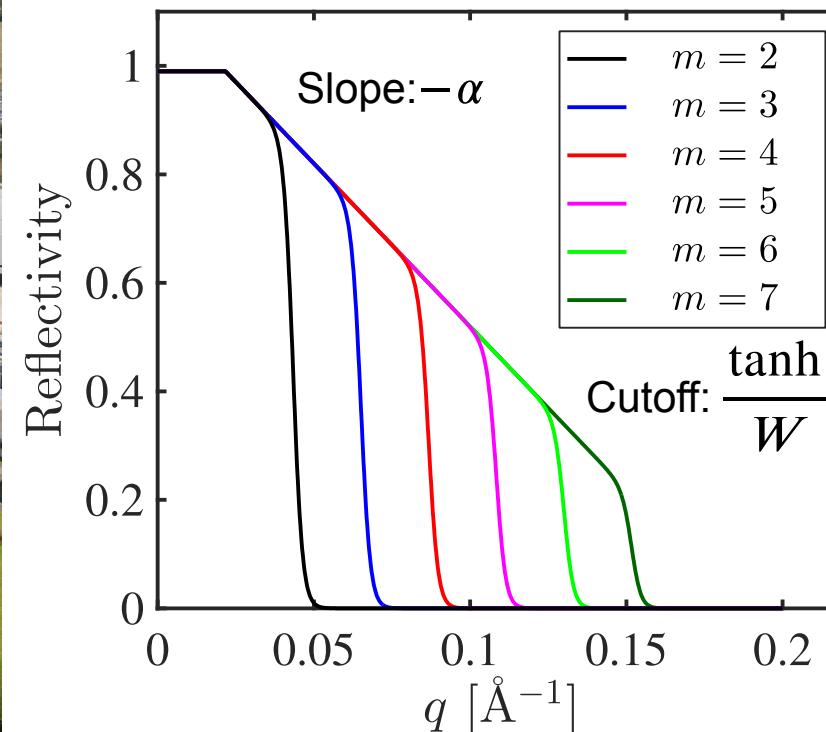




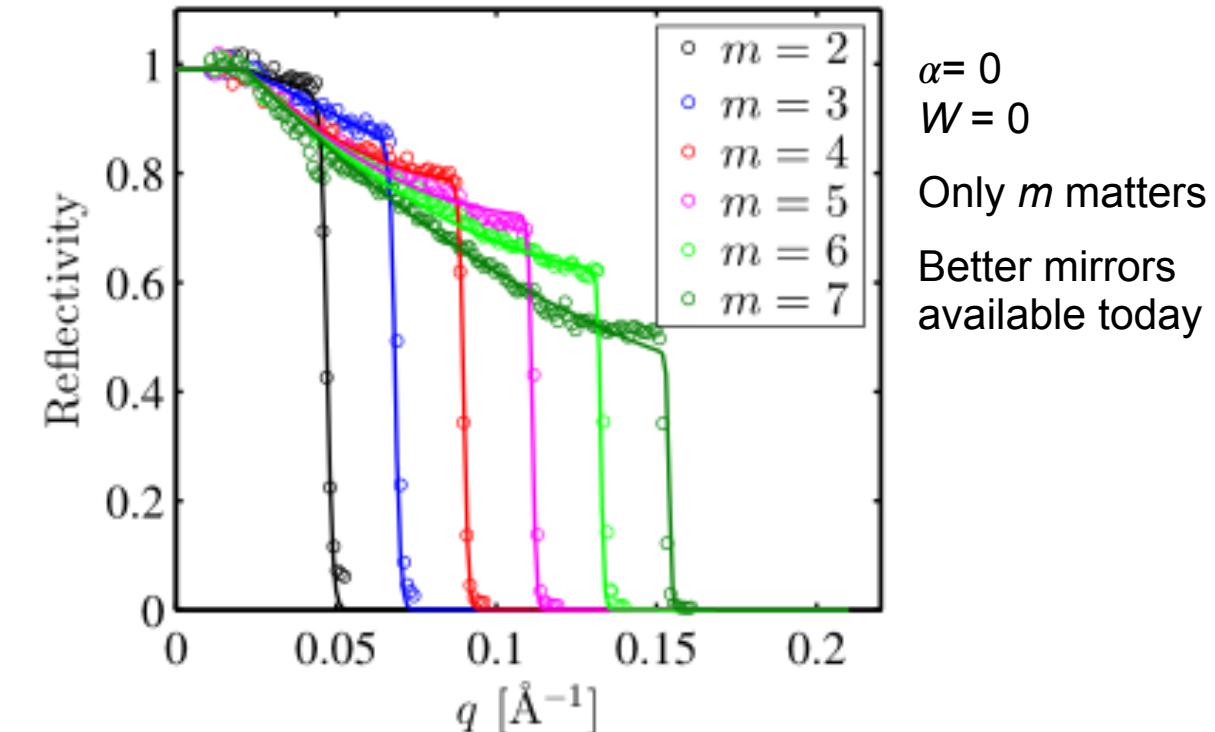
# Reflectivity curves in McStas

$$R(q) = \begin{cases} R_0 & \text{if } q < q_c \\ R_0(1 - \tanh((q - mq_c)/W))(1 - \alpha(q - q_c))/2 & \text{otherwise} \end{cases}$$

McStas standard model



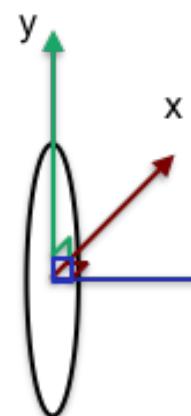
McStas fitted model



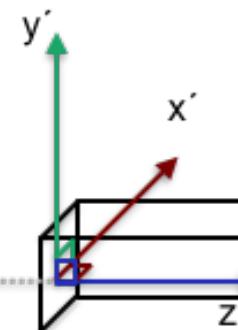


# Guide placement in McStas

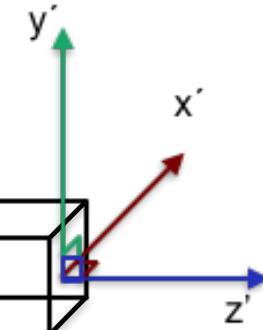
- The center is the front of the guide element
- Tip: Insert a guide at the end of the guide



COMPONENT Source  
AT (0,0,0) ABSOLUTE



COMPONENT Guide(length=A)  
AT (0,0,2) RELATIVE Source

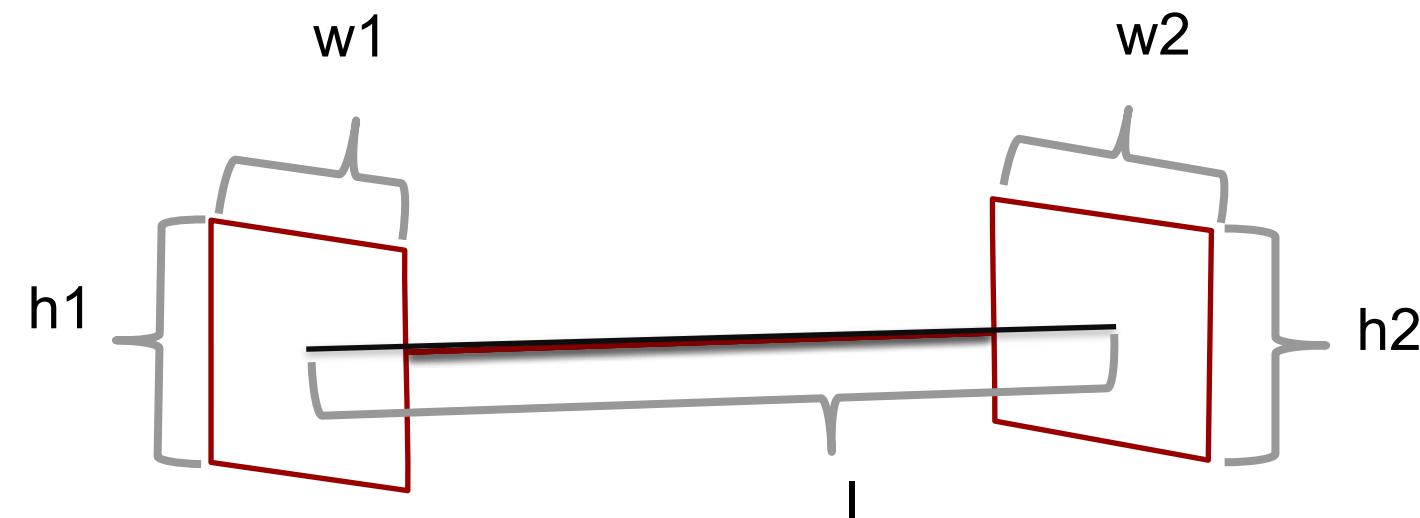


COMPONENT Arm  
AT (0,0,A) RELATIVE Guide



# Popular guide components: Guide\_gravity

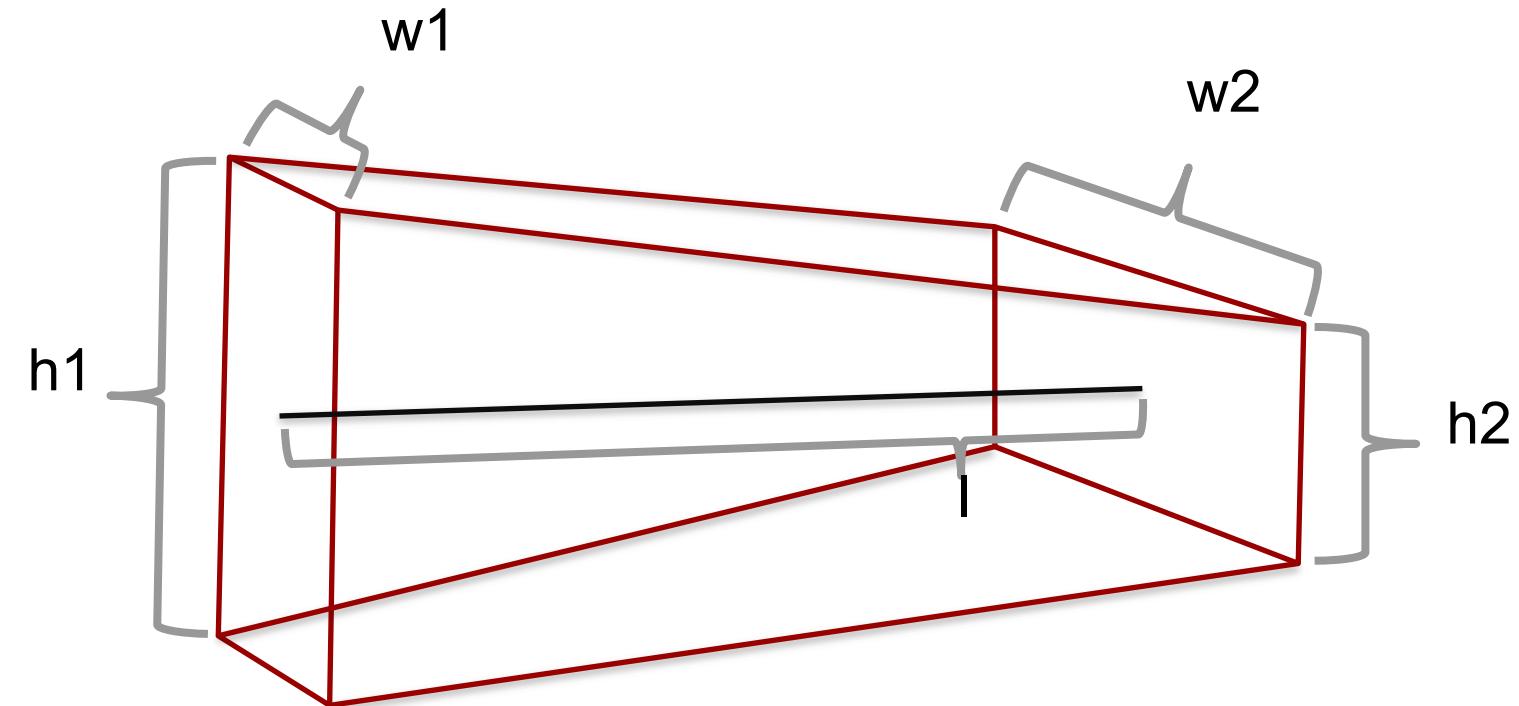
- Typical guide component with gravity
- Many additional features, channels, fermi chopper, ...





# Popular guide components: Guide\_gravity

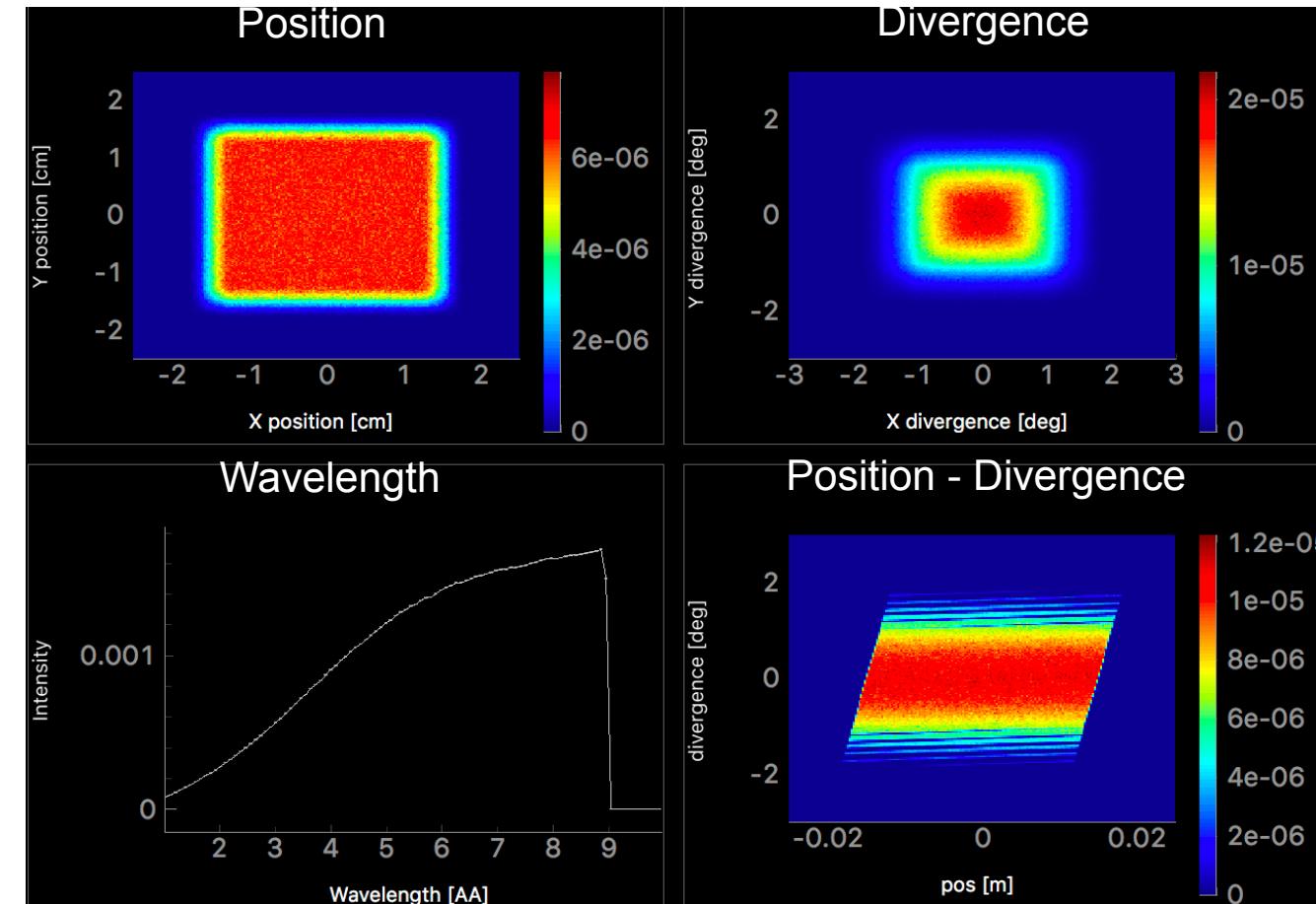
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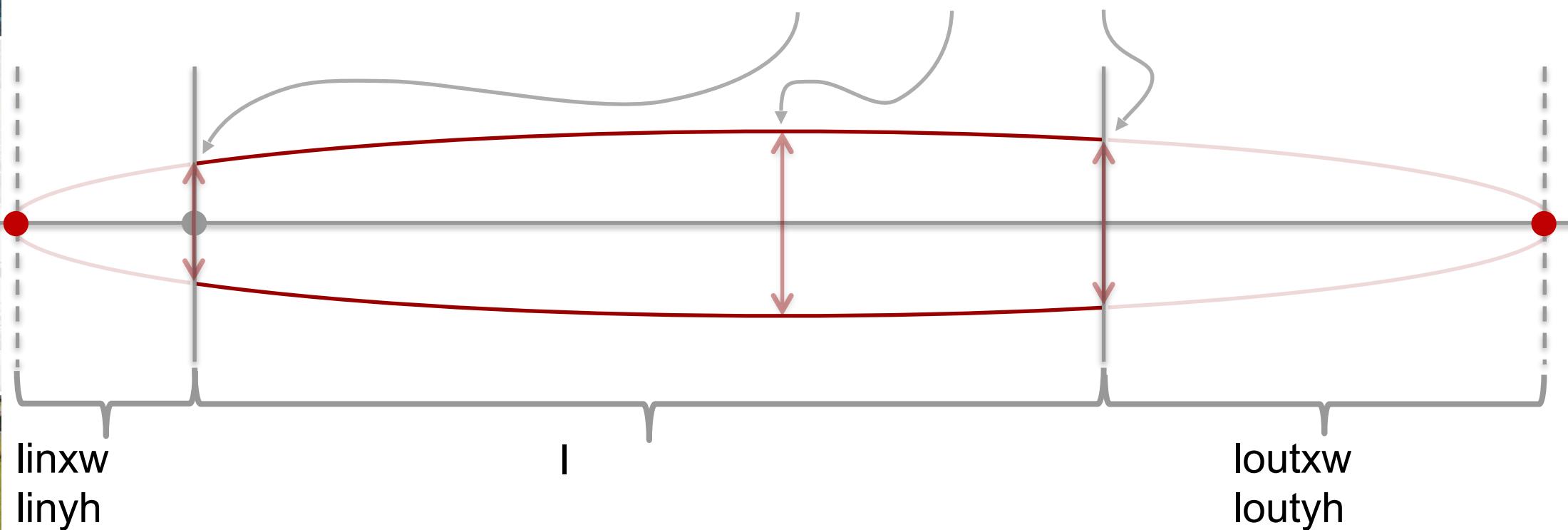
- Typical guide component with gravity





# Popular guide components: Elliptical\_guide\_gravity

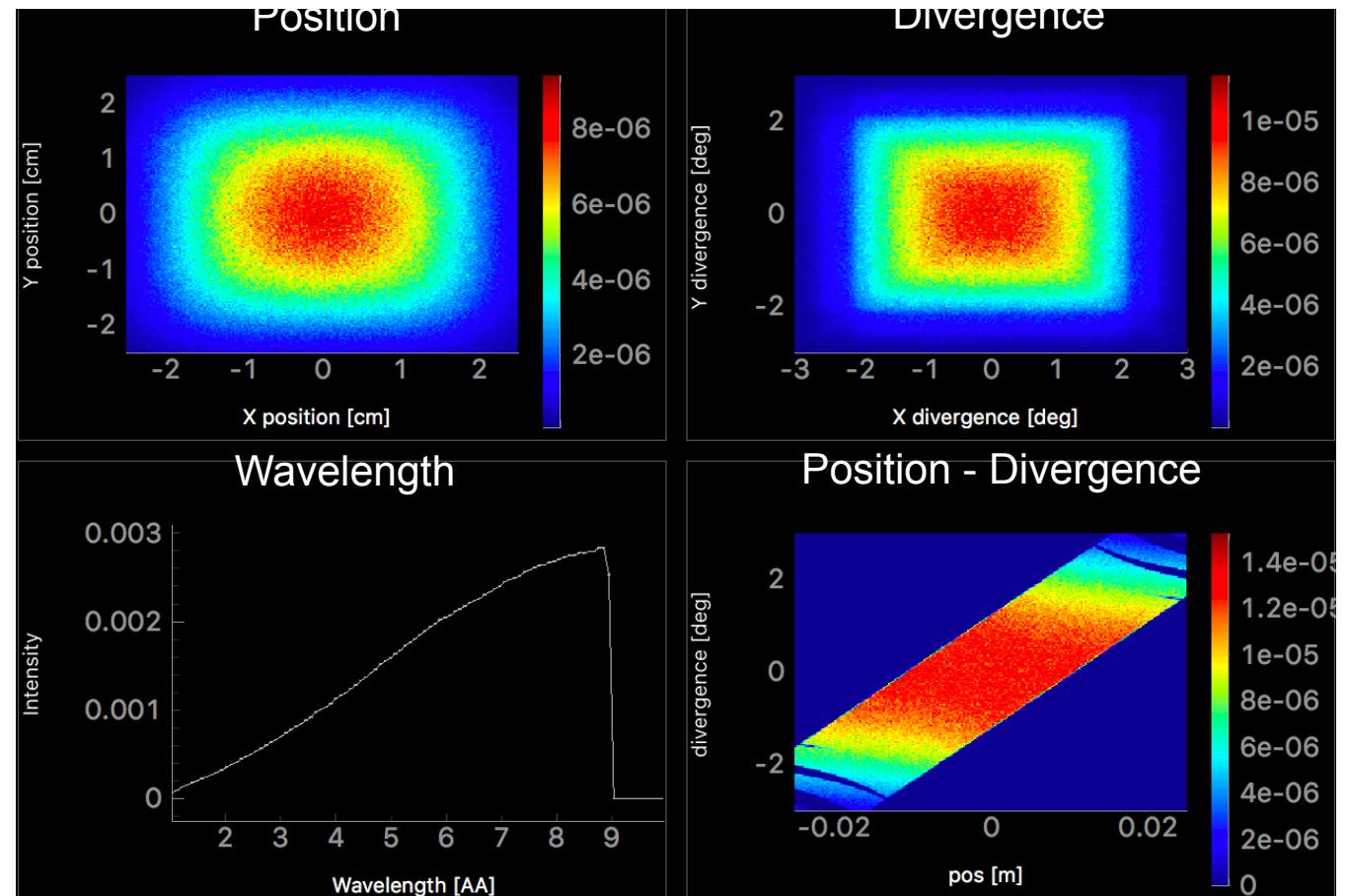
- Useful for elliptic and parabolic guide geometries, focusing, ballistic, coating distribution, xwidth and yheight at DimensionsAt = "entrance" , "mid" or "exit"





# Popular guide components: Elliptical\_guide\_gravity

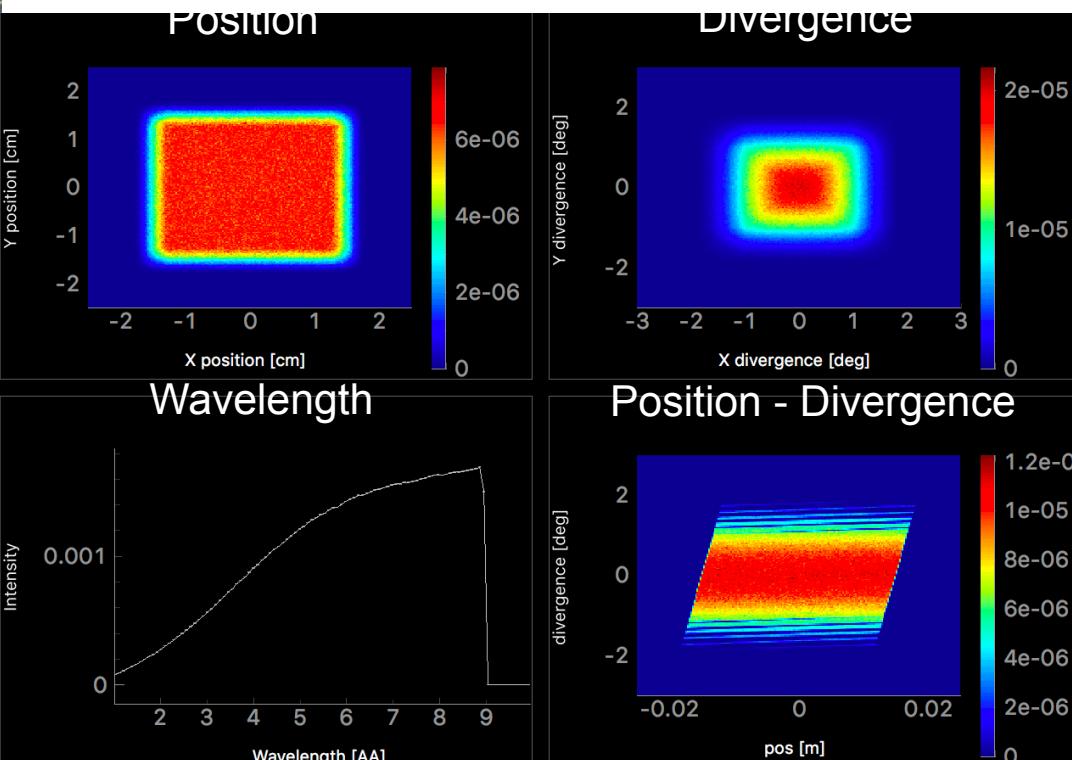
- Useful for elliptic and parabolic guide geometries, focusing, ballistic, coating distribution,  
...



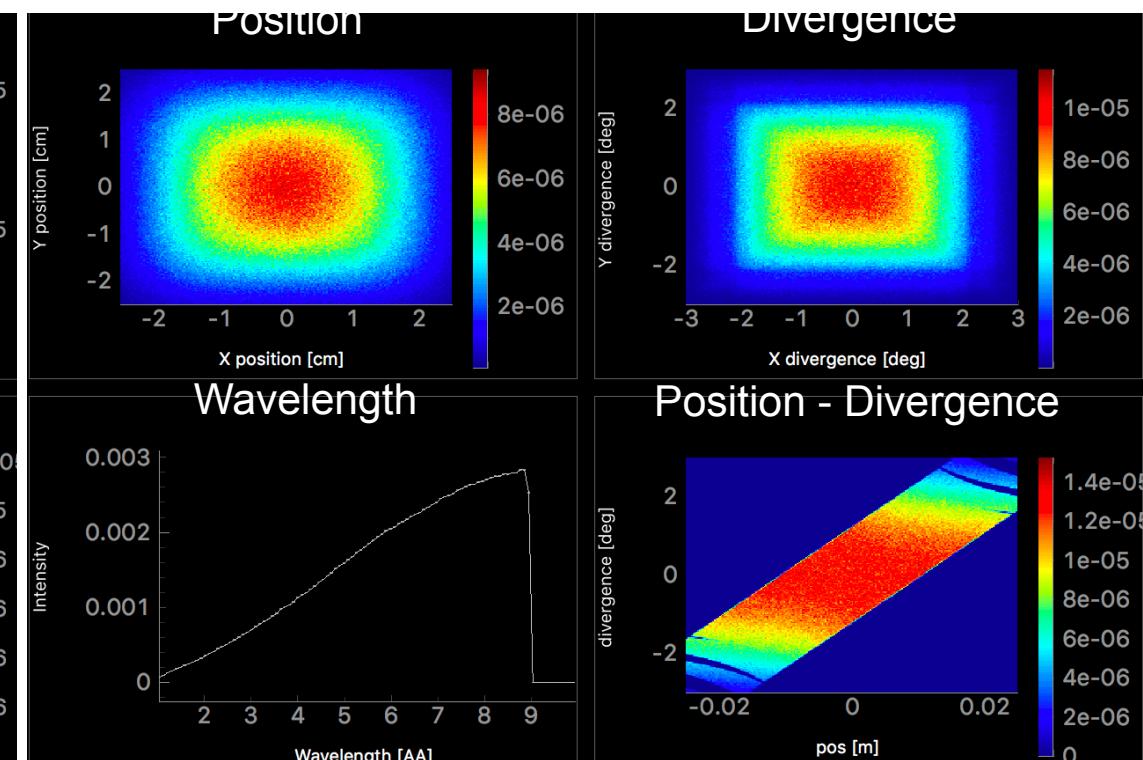


# Comparison: Guide\_gravity and Elliptic\_guide\_gravity

## Guide\_gravity



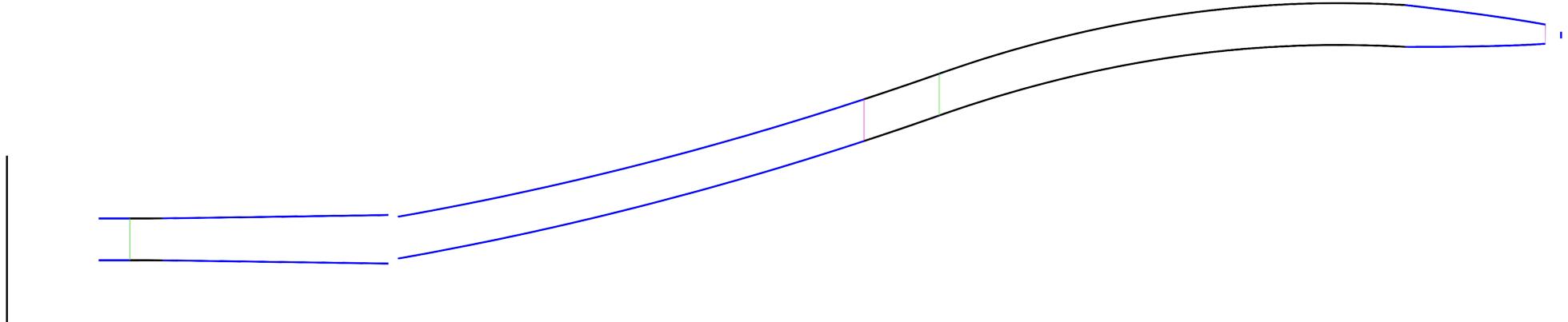
## Elliptic\_guide\_gravity





# Breaking line of sight

- Importance of breaking line of sight, ways of doing so, ...

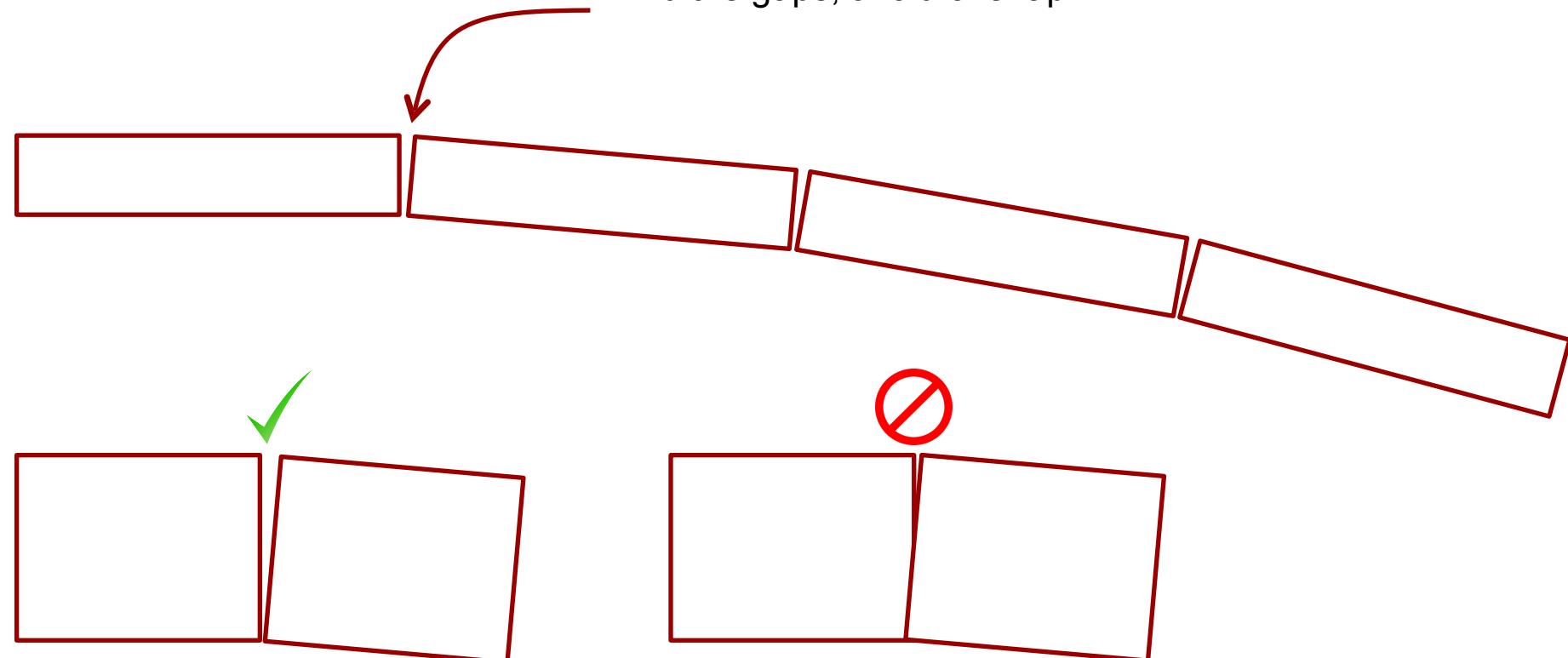




# Breaking line of sight

- Bender component or many straight sections

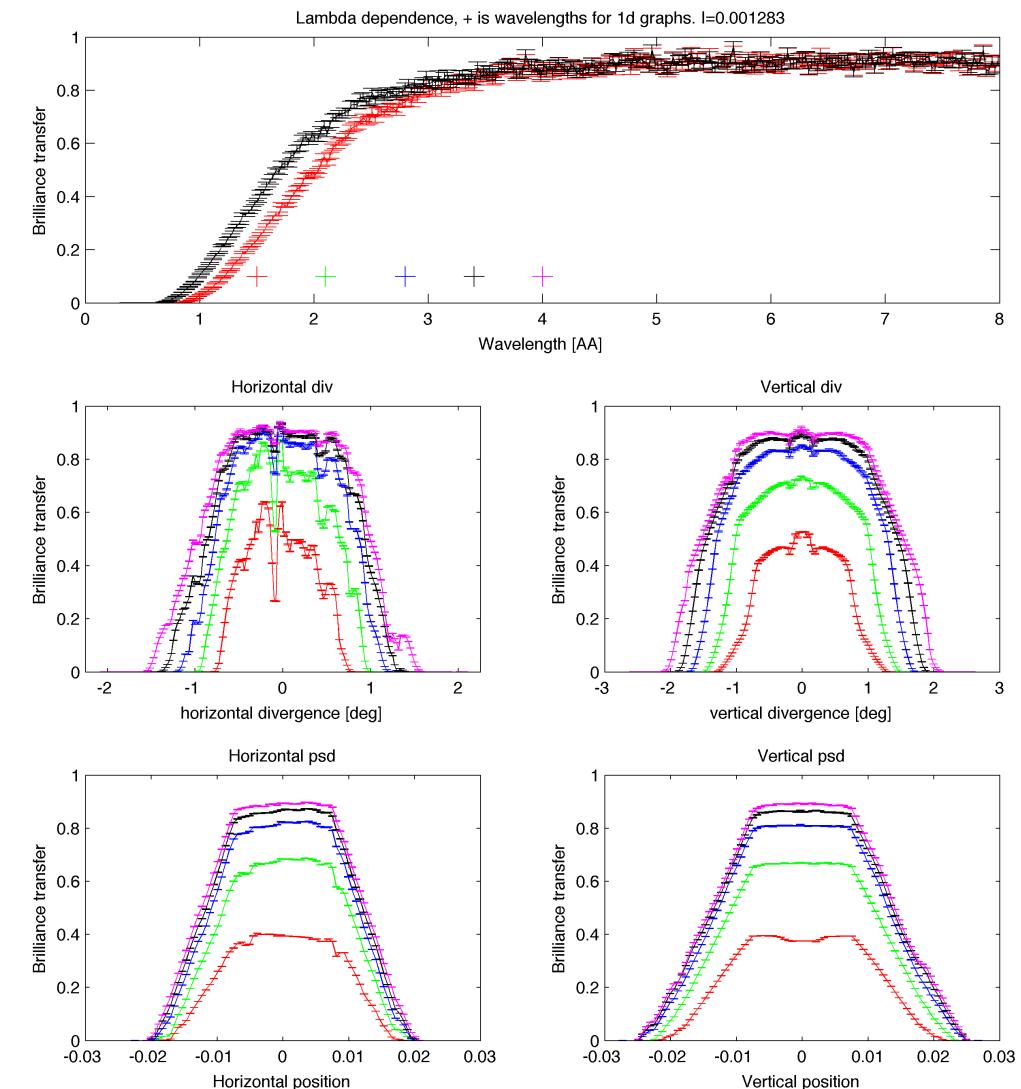
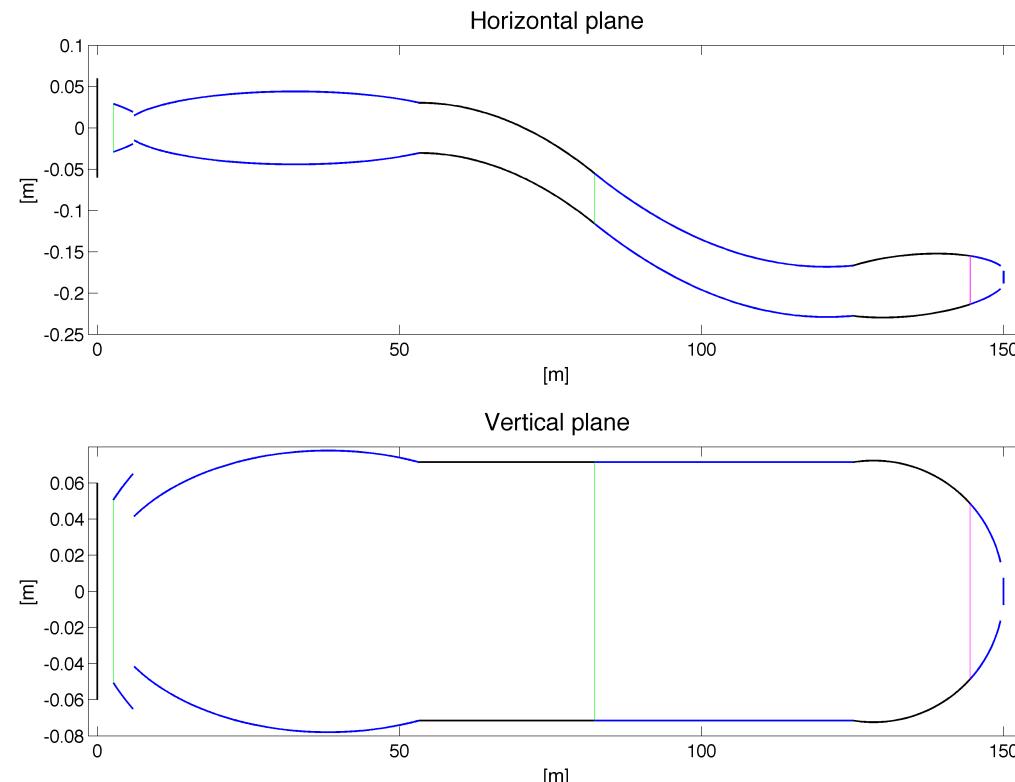
Mind the gaps, avoid overlap





# A guide design

- To be continued in Thursday guidebot talk by Mads Bertelsen





Solution on [github](#), use if you are stuck

# Guide exercise

- Insert a guide and use an instrument input parameter to set the length
- Use monitors to see the resulting beam
  - PSD\_monitor (spatial distribution)
  - Divergence\_monitor (divergence distribution)
  - L\_monitor (wavelength distribution)
  - Posdiv\_monitor (acceptance diagram)
- Extra tasks:
  - Scan guide length
  - Introduce a gap by using two guide components
  - Use Guide\_gravity and extend to 100 m length
  - Investigate the effect of gravity on the transport of long-wavelength neutrons