Fluid dynamics in syringomyelia cavities

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NEURORADIOLOGY
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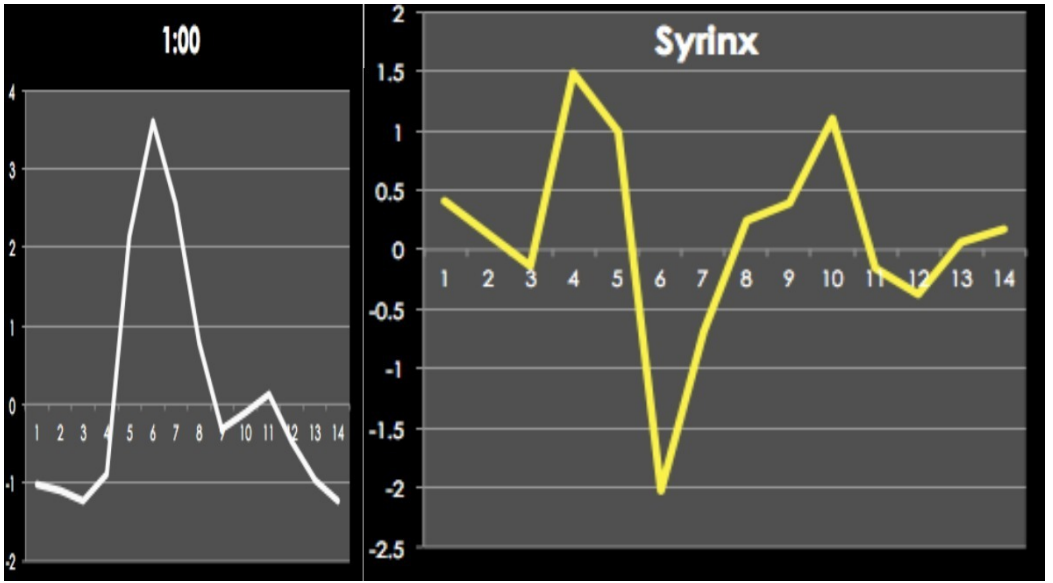
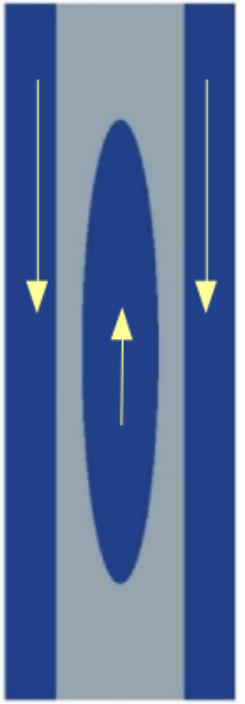
In this study, we identify changes in syrinx flow associated with post-surgical changes and with changes in CSF flow

Chiari I malformation with syringomyelia



PC-MRI to measure flow in SAS and syrinx



Computational Fluid Dynamics

Syringomyelia is commonly seen together with the Chiari I malformation and may vanish following decompression surgery

Pre-surgery

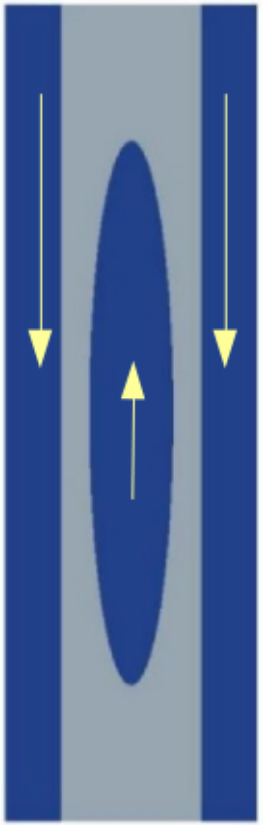
2 months post-surgery

10 months post-surgery

Fluid in a syrinx displays oscillatory motion[1], sometimes uncoupled[2] to CSF flow in the SAS

Fluid (CSF and syrinx fluid)

Spinal cord tissue



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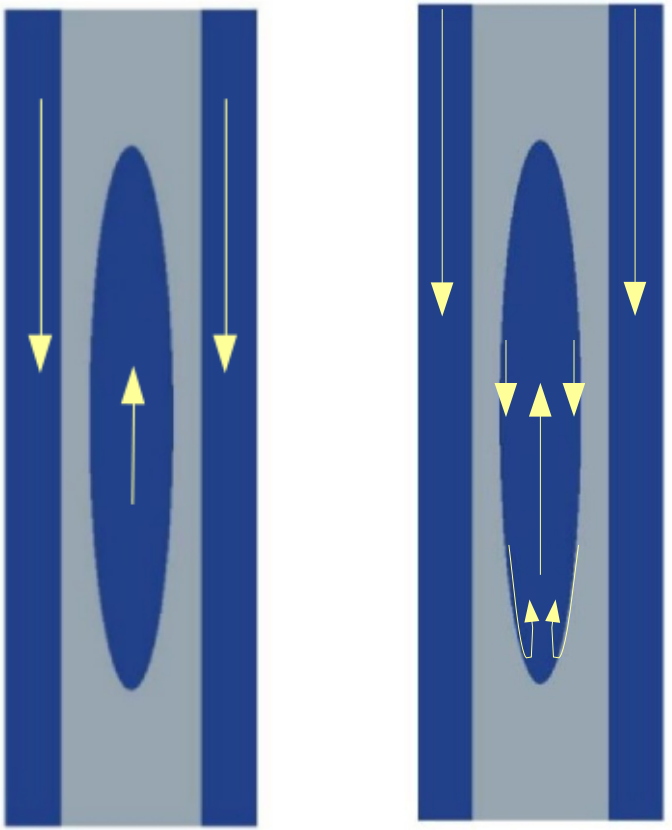

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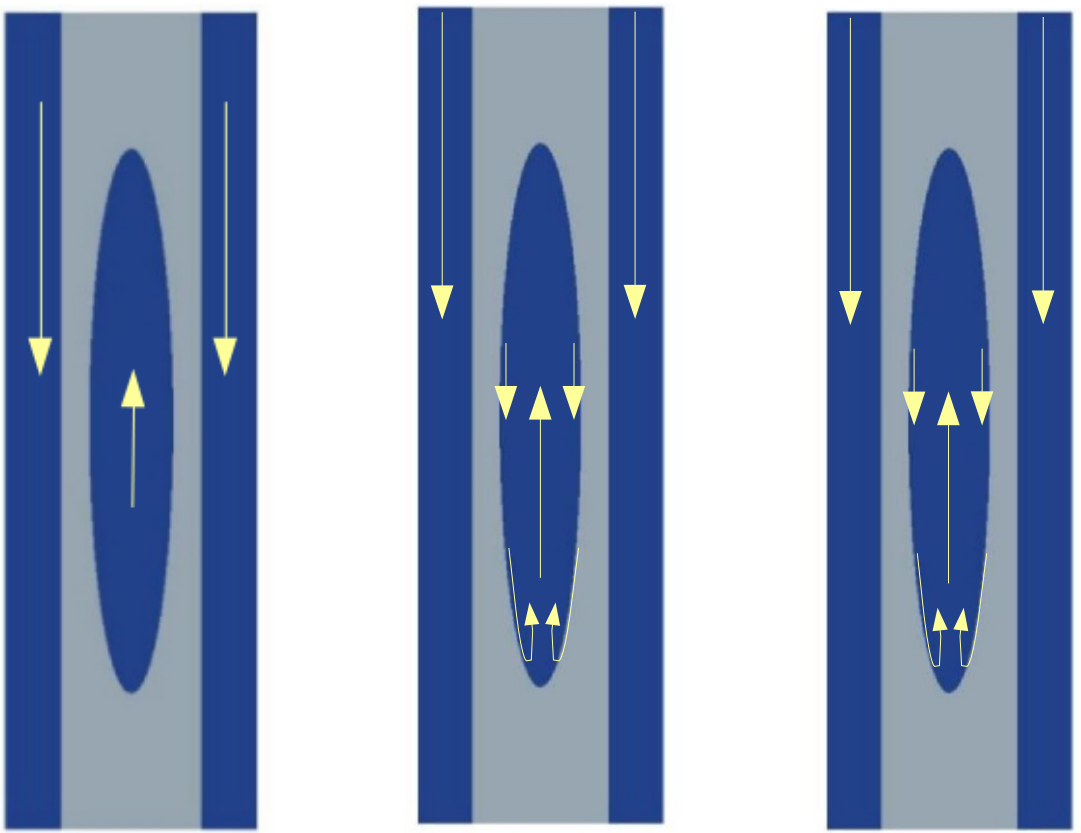

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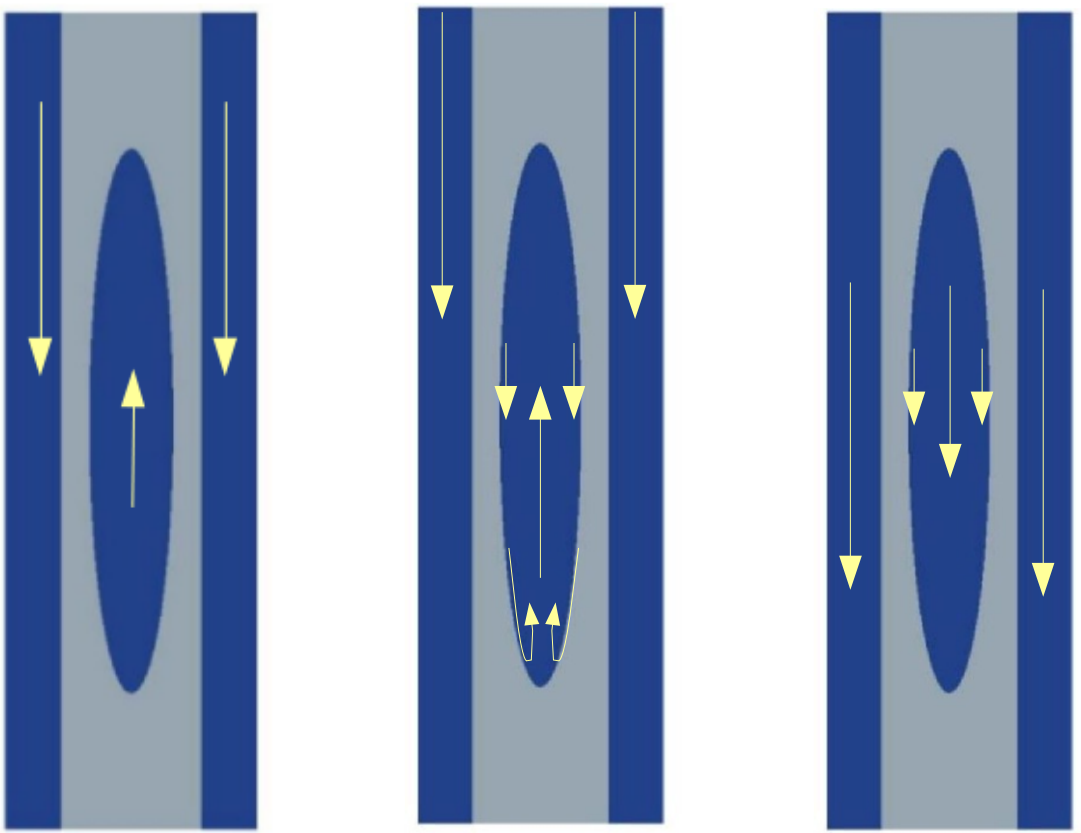

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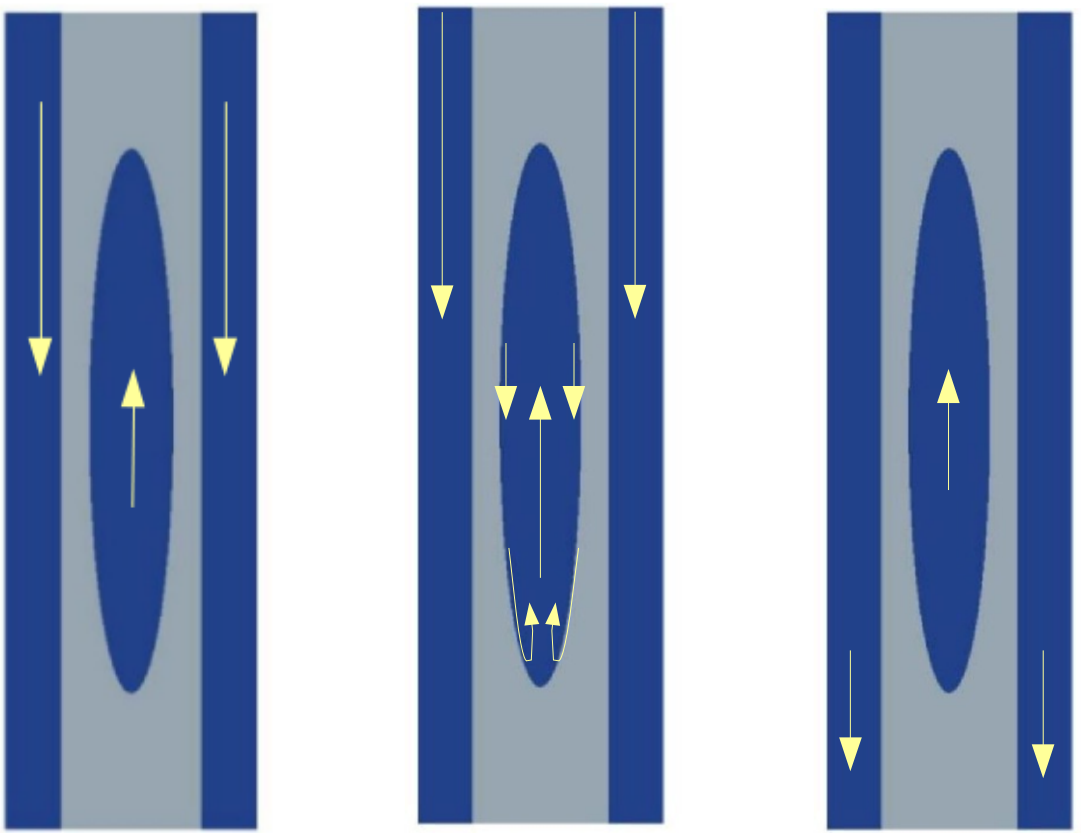

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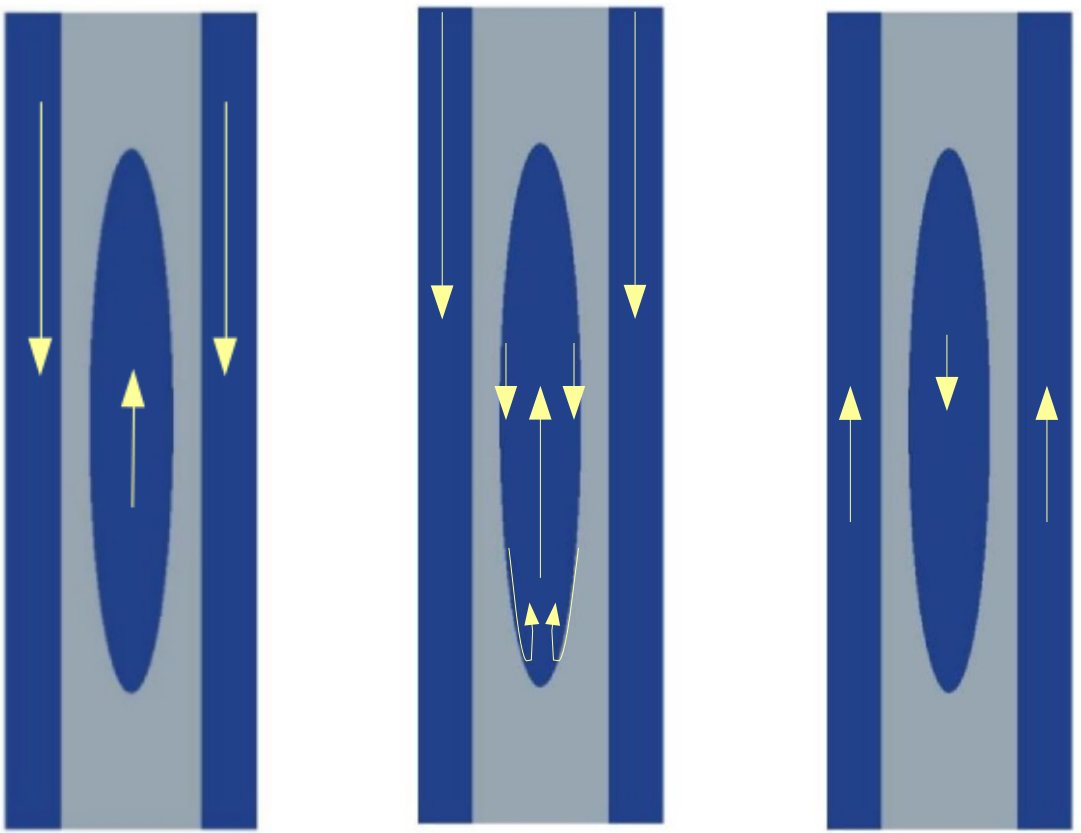

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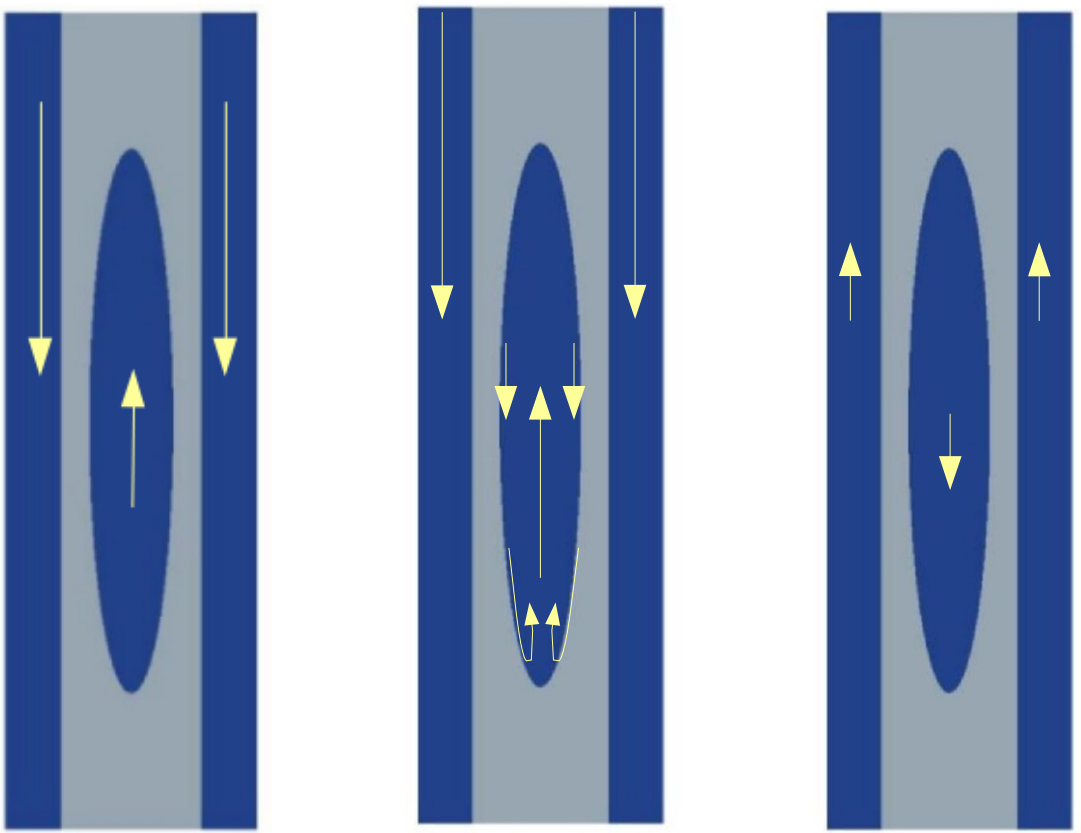

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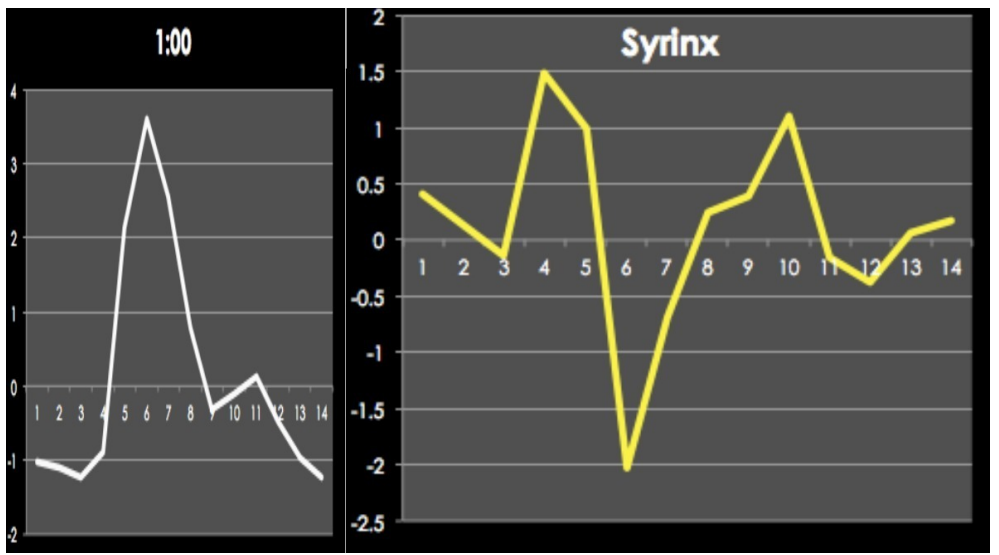
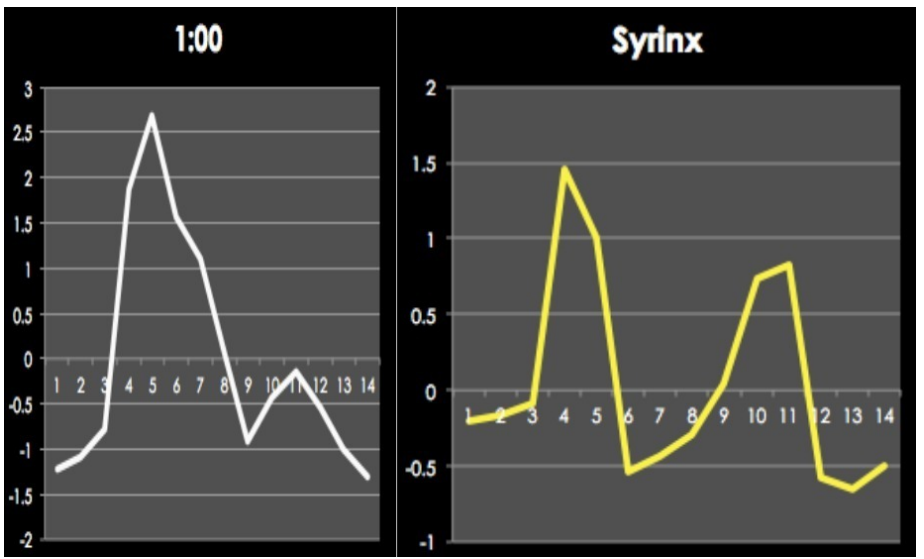
We studied CSF and syrinx fluid flow before and after craniovertebral decompression

Cardiac cycle in 14 phases
v_{enc} = 20 cm/sec
5 mm slice thikness

Caudal direction (cm/sec)



Pre-surgery



2 months post-surgery

A fluid-structure interaction model was used to simulate CSF and syrinx fluid flow

Fluid (CSF and syrinx fluid)

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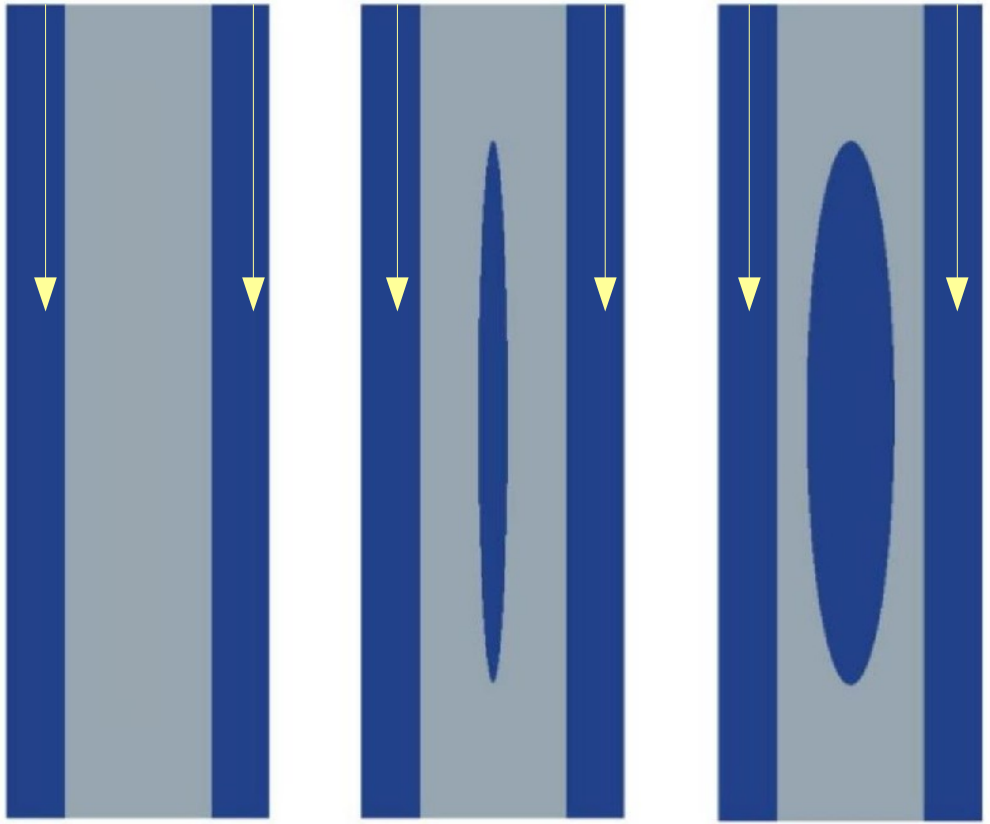
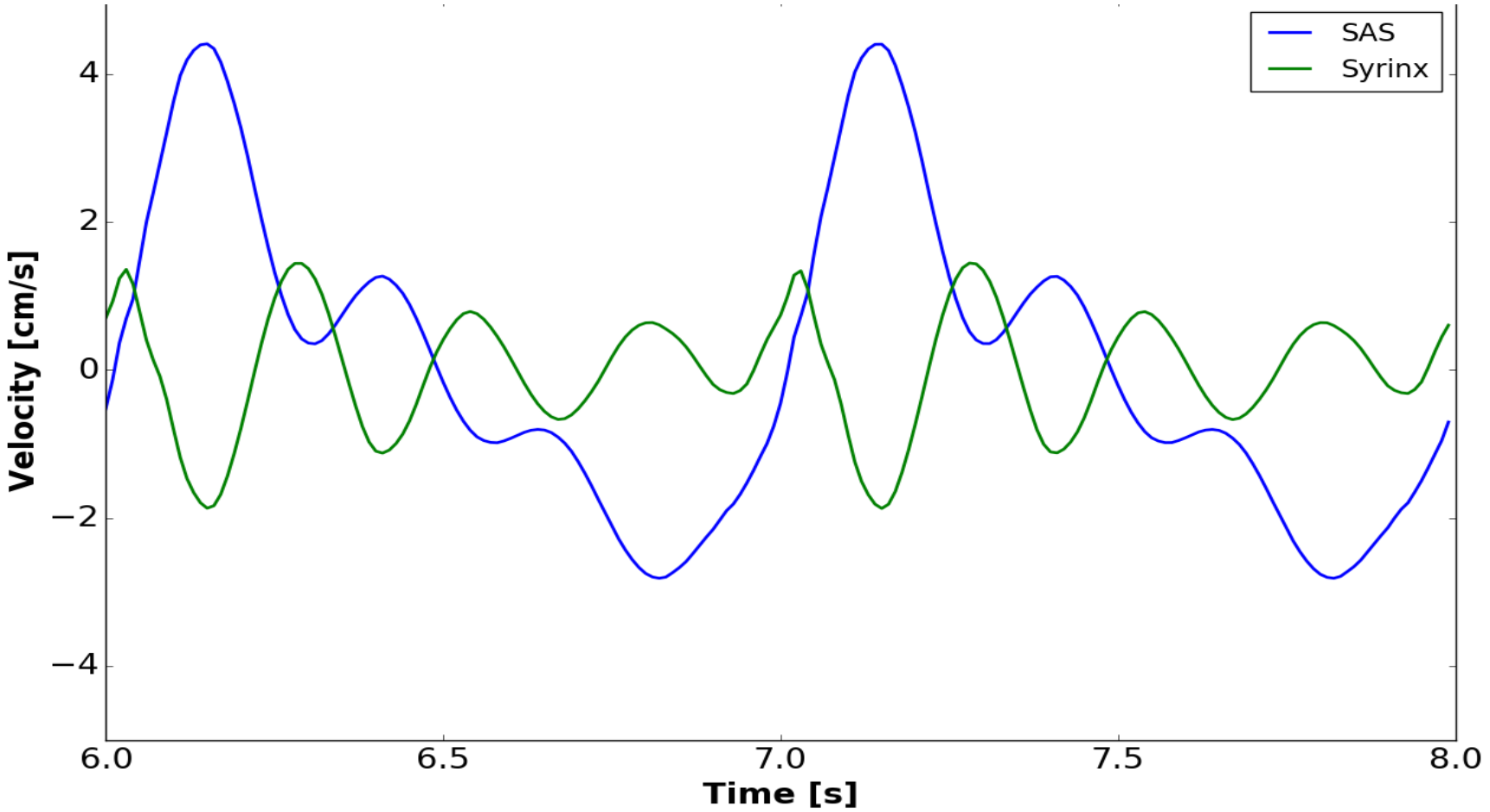


Syrinx fluid display high-frequent oscillatory motion



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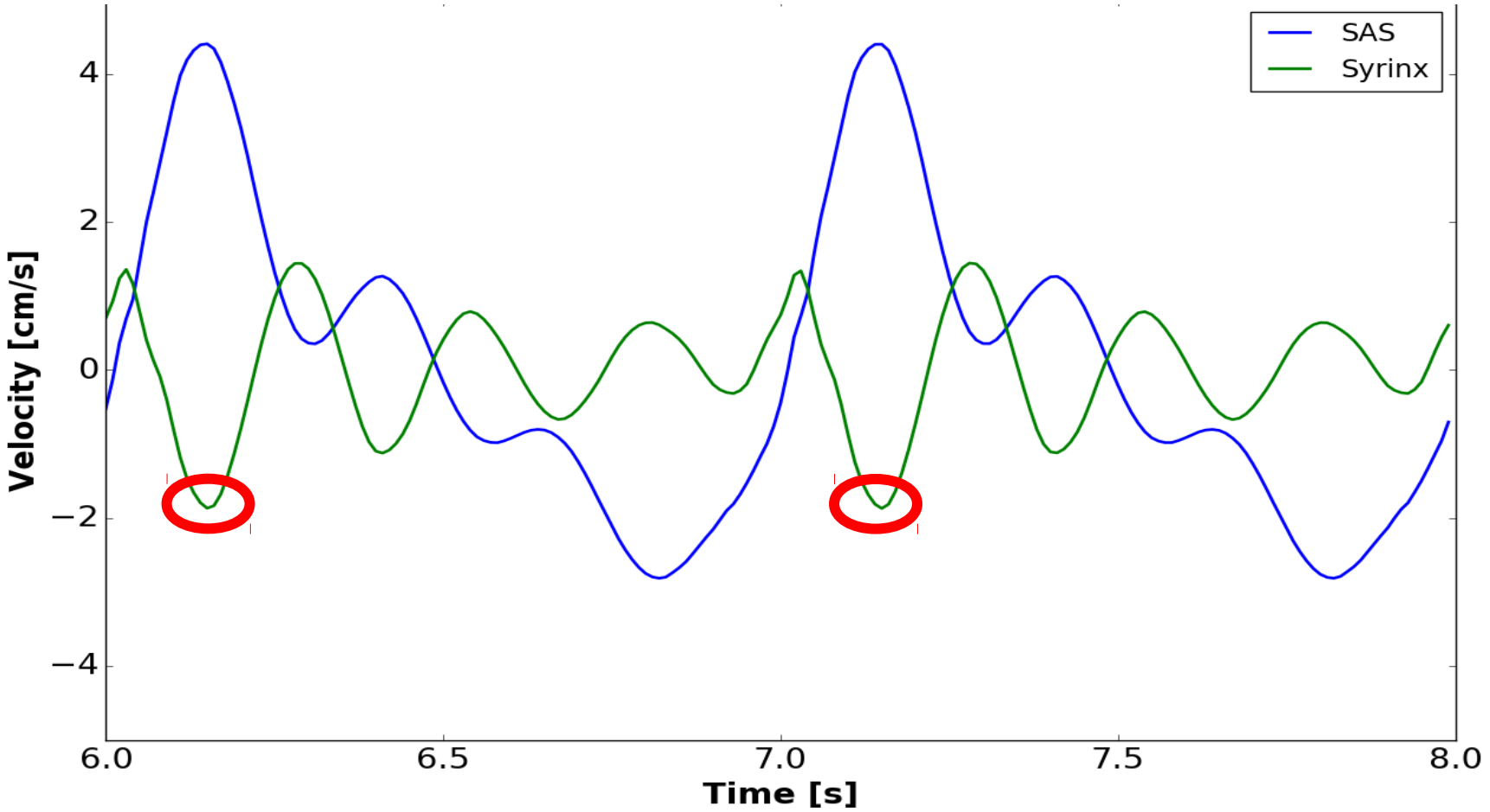
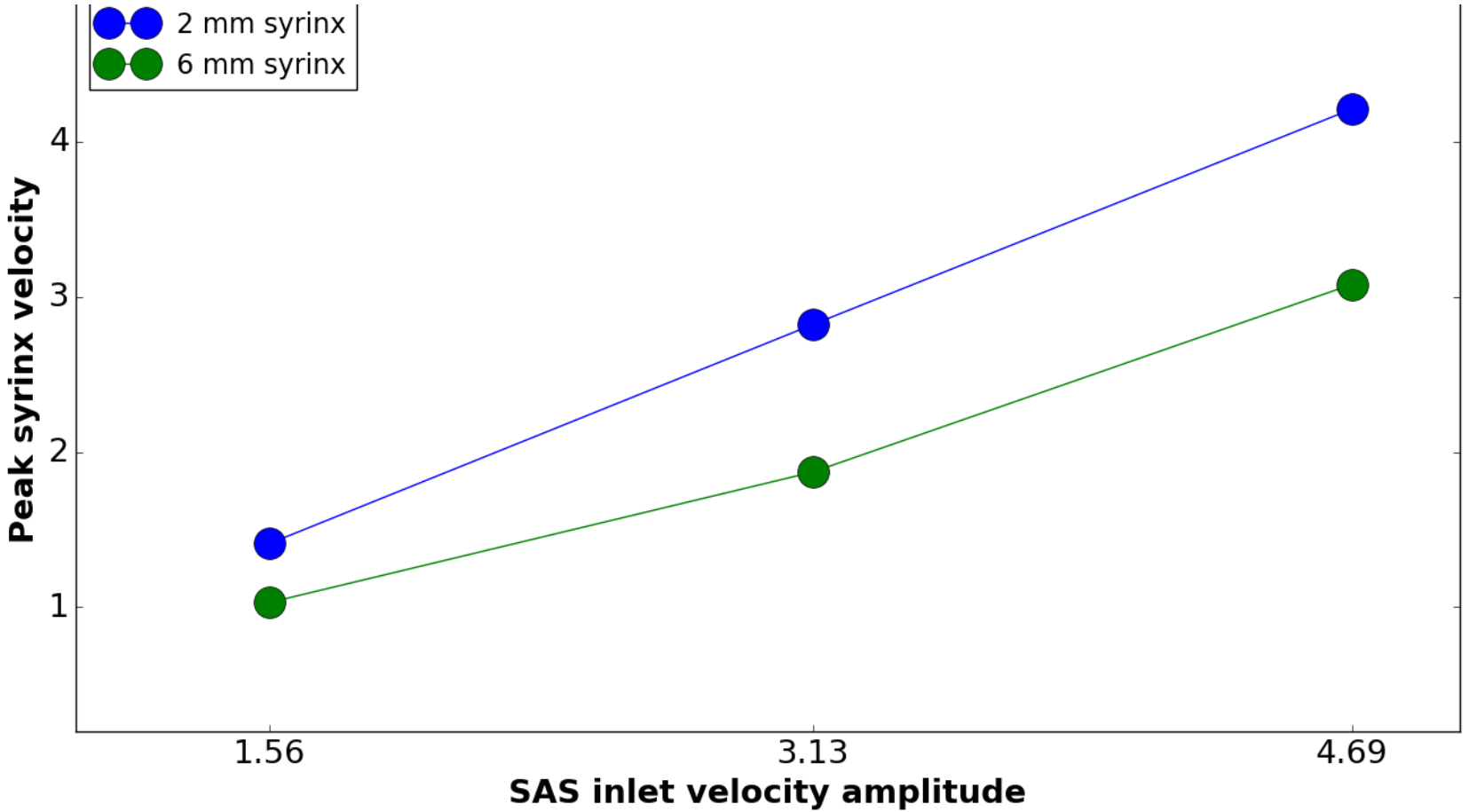
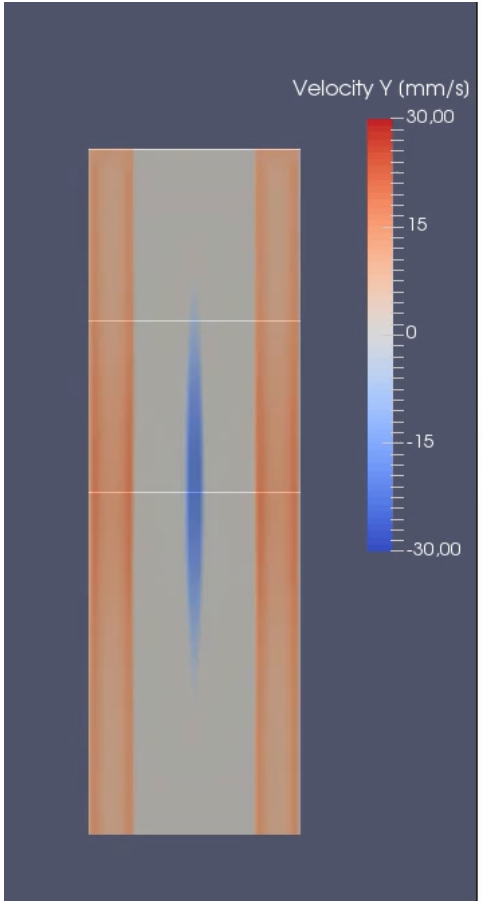
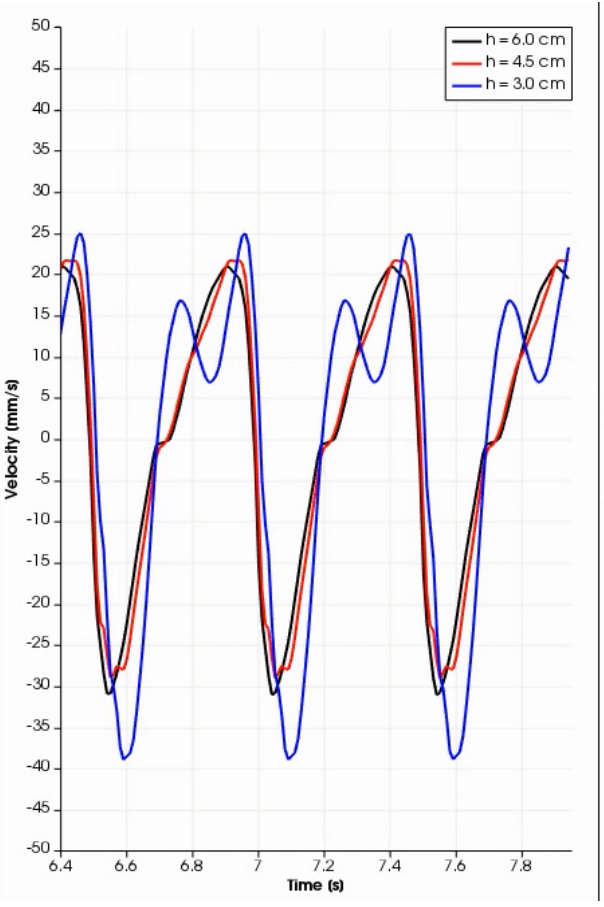


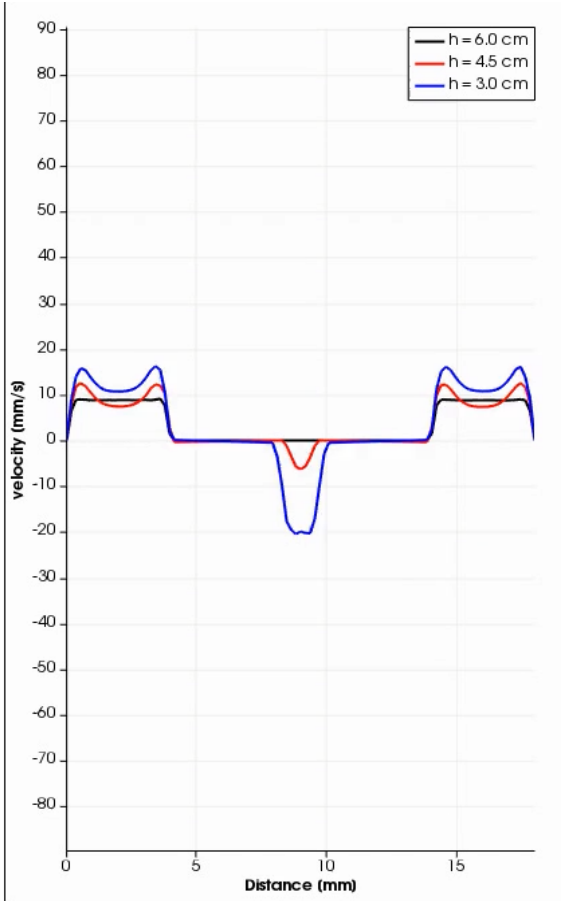
Peak syrinx fluid velocities increased proportionally with fluid velocity in the SAS



Further studies include investigation of resonance, cord motion and pressure relationships

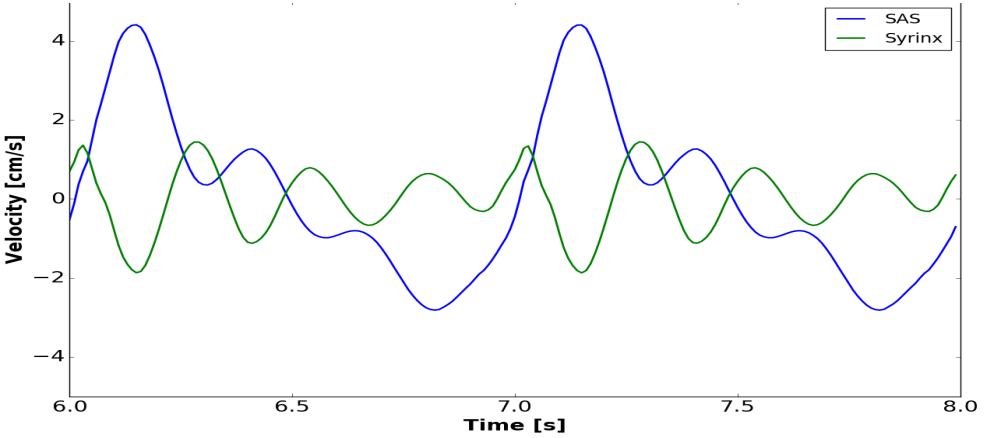


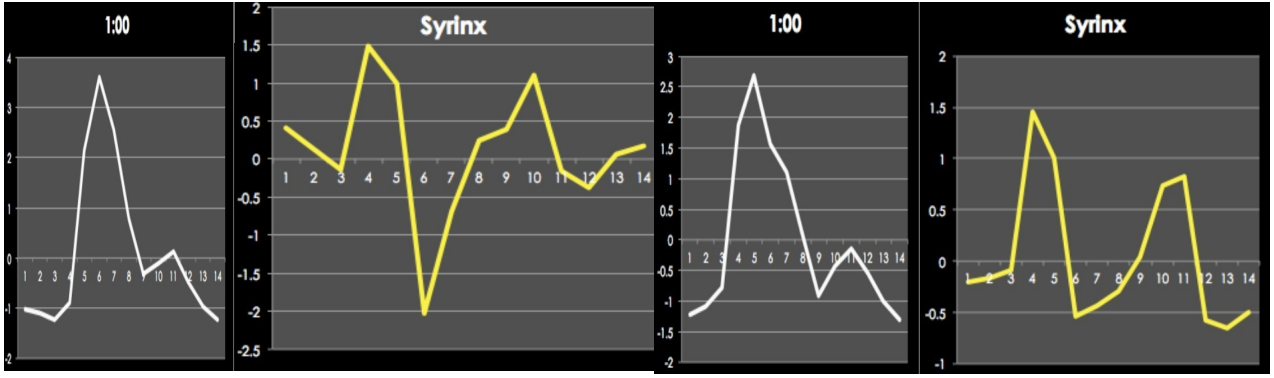




Model and imaging revealed high oscillatory syrinx fluid motion

- Oscillatory CSF flow and syrinx fluid interacts in syringomyelia patients
- Imaging may help clarify the role of abnormal fluid dynamics in syringomyelia





Thank you!

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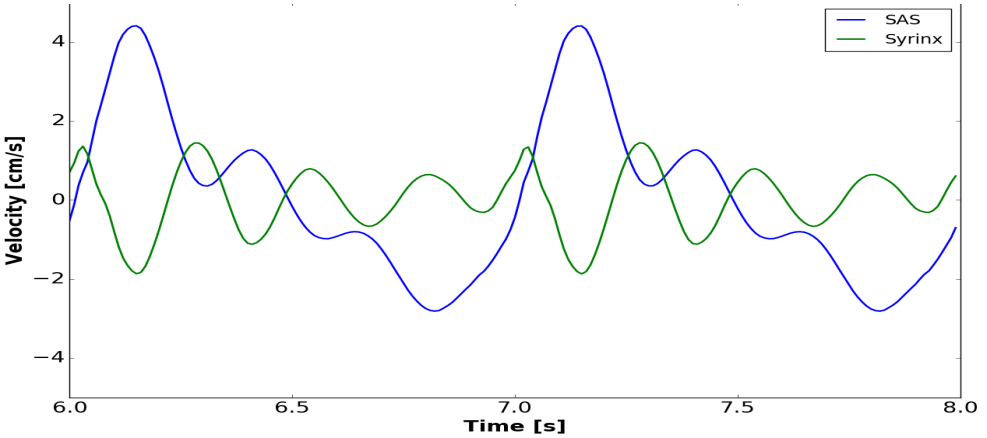

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