Automating Background Phase Correction in Cranial 4D Flow MRI

Grant Roberts, Kevin Johnson, Carson Hoffman, Laura Eisenmenger, and Oliver Wieben

Poster #30

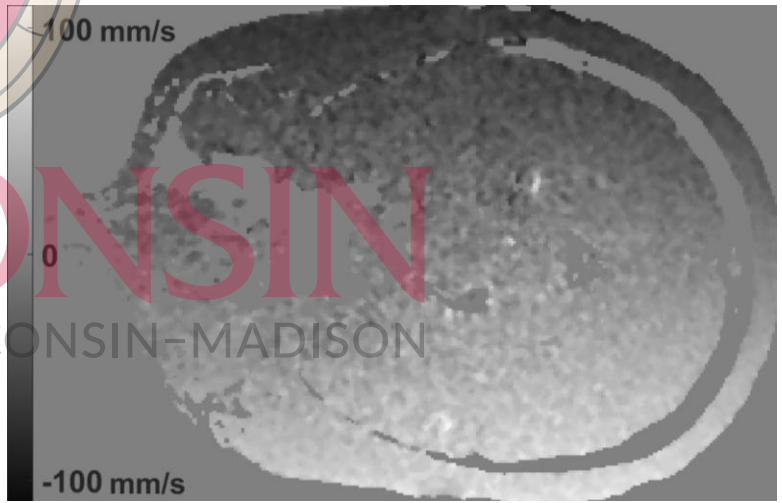
4D Flow MRI

- Motion encoding using bipolar gradients
- Velocity ∝ phase

Background phase

- Non-linear gradients
- Concomitant fields
- **Eddy currents**

Velocity in Background Tissue



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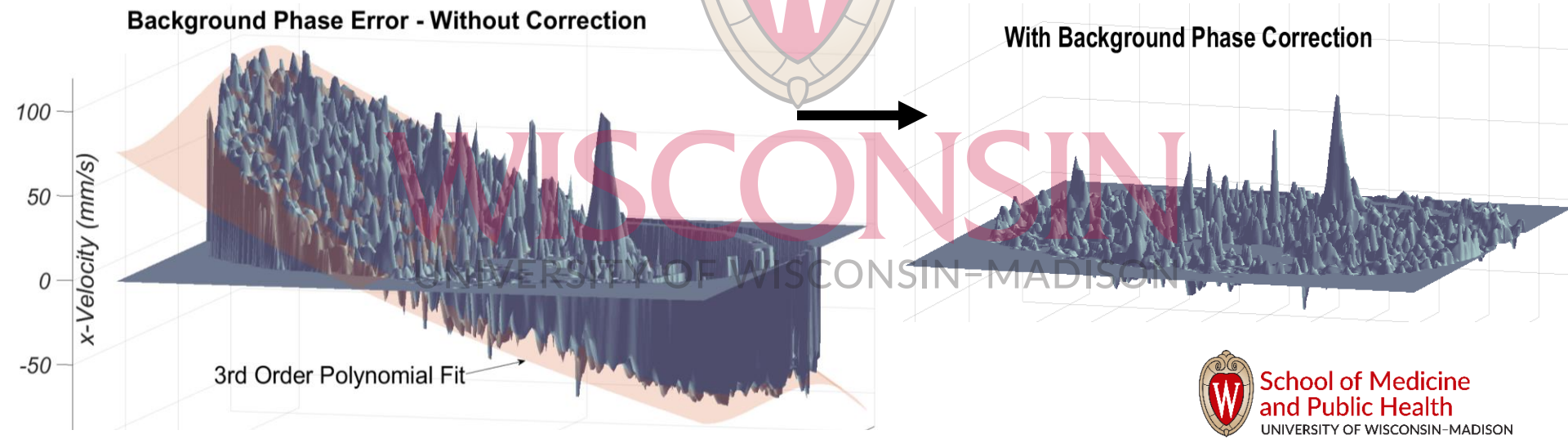
Manual background phase correction (BPC)

- Subtract Polynomial fit from velocity data
  - $\phi(x,y,z) = a_1x^3 + a_2y^3 + a_3z^3 + a_4x^2z + a_5y^2x + \cdots$



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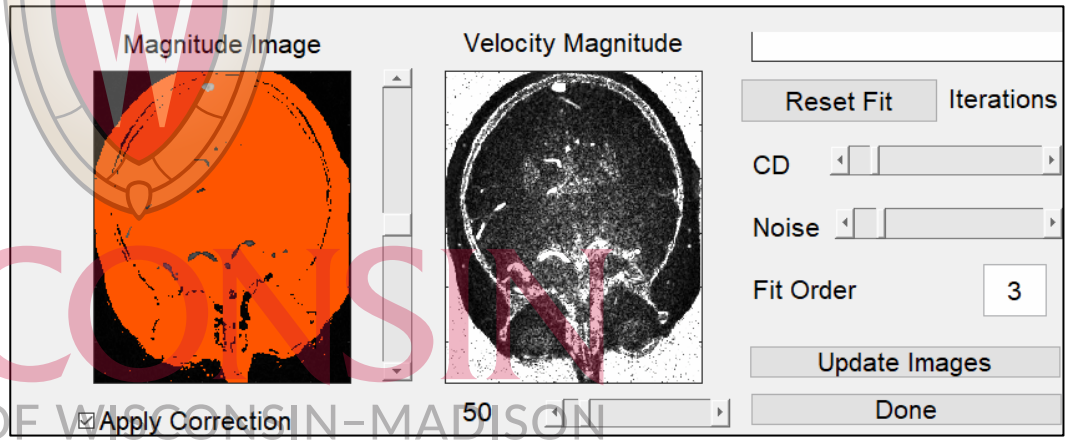
Cranial 4D Flow Analysis Tool

- Condenses 6G 4D flow data to 1G .mat file
  - Can be loaded efficiently
- Requires manual BPC
  - MATLAB GUI



Can we eliminate manual BPC and create preprocessed file in reconstruction?

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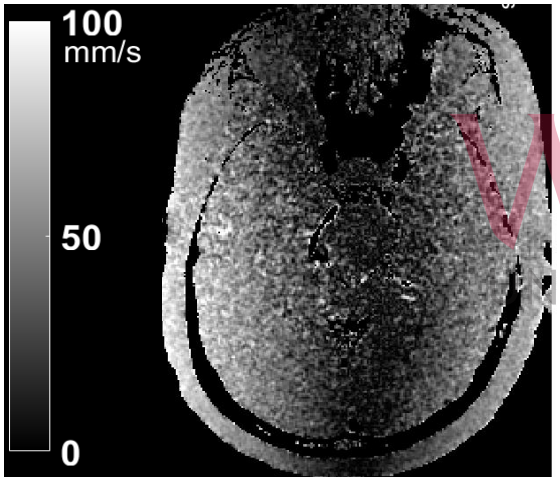
- Manual and automatic BPC tested on 10 subjects.
- Absolute error in background tissue was similar for manual & automatic BPC.

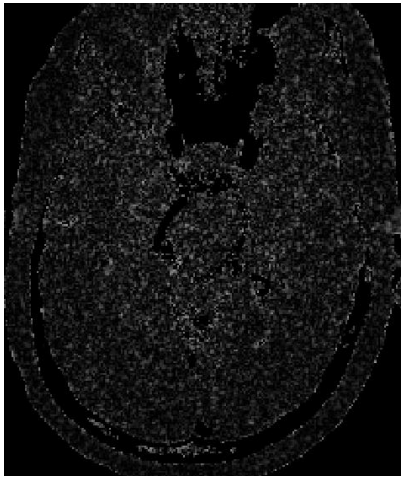
Uncorrected:
Mean Error = 23.5 mm/s



Manual BPC:
Error = 8.94 mm/s

Automatic BPC:
Error = 8.00 mm/s

Manual+Auto. BPC:
Error = 8.00 mm/s



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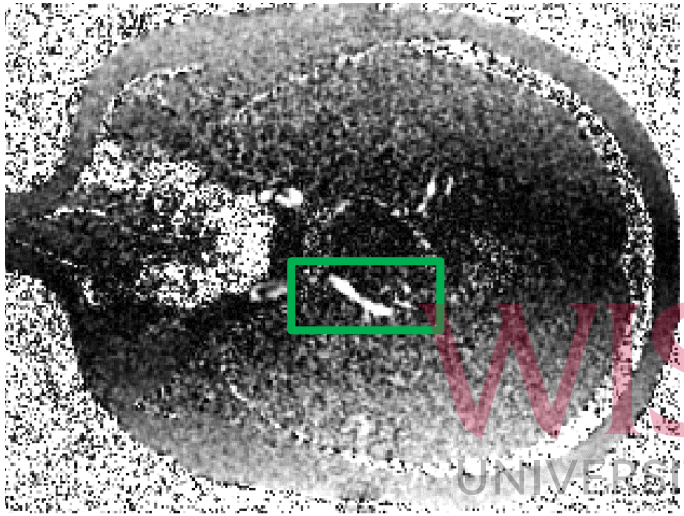
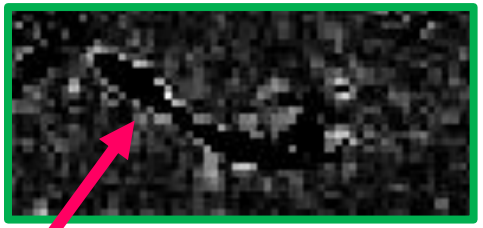
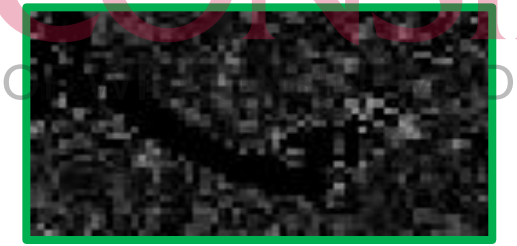


Raw Velocity (x)

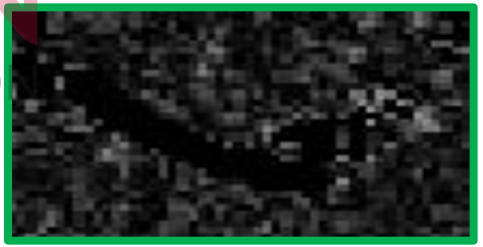
Manual BPC



Automatic BPC



Automatic+Manual BPC



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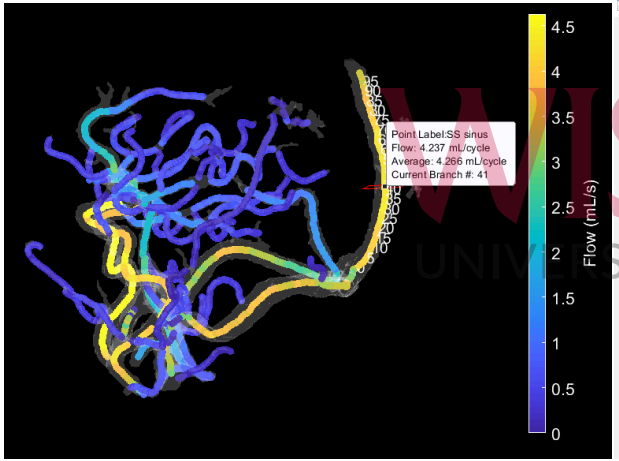
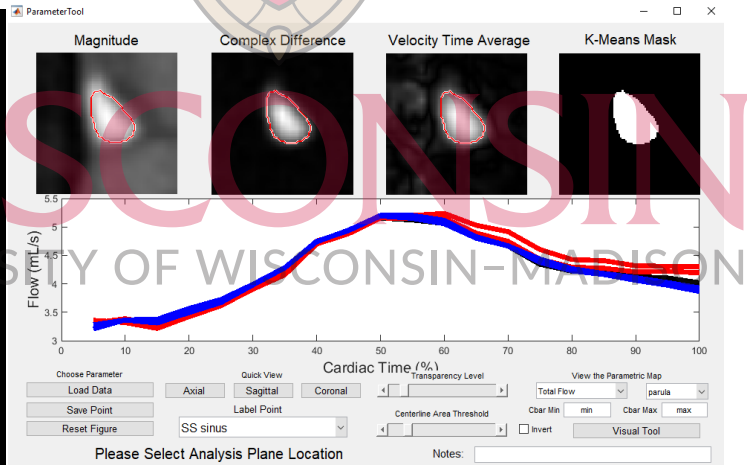
Conclusions

- Automatic BPC was sufficient in reducing phase offsets.
- Data loading time was reduced 6 minutes to 20 seconds and file sizes were reduced from 6G to 1G.





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