Motivation

- Shock wave interaction with a flame bubble is important for supersonic combustion and astrophysics
- 3D reconstruction of the bubble geometry during the interaction aids the understanding of the underlying fluid dynamics
- Limited optical access means sparse-view tomographic reconstruction is needed

Related Work

- Sparse-view computed tomography (CT) has been explored by many in medical imaging using compressive sensing (e.g., [1]) and deep learning (e.g., [2])
- Zang et al. recently performed sparse-view 3D reconstruction of fluid flow using optical-flow-based view interpolation [3]

References

[2] Han et al., IEEE transactions on medical imaging, 37, 1418, 2018
[3] Zang et al., ICVF, 1870-1879, 2020

Methods

- Optical-flow from revolved end-view to the ground truth
- Synthesized view at 45 degree

H = 25

Results

<table>
<thead>
<tr>
<th>Angle</th>
<th>Ground Truth</th>
<th>FBP</th>
<th>Admm Solve</th>
<th>ADMM + TV</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 deg</td>
<td>8.22</td>
<td>15.95</td>
<td>16.04</td>
<td></td>
</tr>
<tr>
<td>60 deg</td>
<td>8.22</td>
<td>15.95</td>
<td>16.04</td>
<td></td>
</tr>
<tr>
<td>90 deg</td>
<td>8.22</td>
<td>15.95</td>
<td>16.04</td>
<td></td>
</tr>
<tr>
<td>120 deg</td>
<td>8.22</td>
<td>15.95</td>
<td>16.04</td>
<td></td>
</tr>
</tbody>
</table>

Horizontal cross-section slices from different methods

h = 25

h = 35

h = 50