# Streamline Curvature Wall Model for Pressure from PIV

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# Motivation: Why Pressure from PIV?

**Pressure Taps (traditional method)**

- Measurements dependent on leakage, hole diameter, flushness
- Difficult to install
- Length of tubing limits sampling rate!

**Pressure from PIV**

- Non-invasive (no installation on model)
- High time resolution possible
- High spatial resolution possible

**References:**

`https://user.engineering.uiowa.edu/~fluids/posting/home/efd/efd_lab3/lab3-exercise_note.pdf`

# Motivation: Literature Review

| Case | Max Cp Error | Extrapolation Approach | Source |
|---|---|---|---|
| NACA 0012 | 0.5 | parabola fit | Tagliabue et al., 2017 |
| Sphere | 0.15 | nearest neighbor | Jux et al., 2020 |
| Cyclist | 0.2* | nearest neighbor | Jux et al., 2020 |
| Bullet Step | 0.02 | nearest neighbot | Gent et al., 2018 |
| NACA 0012 | 0.25 | line fit | Ragni et al., 2009 |

*based on uncertainty analysis (no pressure tap reference)

# Motivation: Issues with Extracting Surface Pressure

- Reflections and low particle density
- Strong gradients due to curvature and boundary layer

**Goals:**

- Avoid extrapolation
- No numerical derivatives close to the wall

# Method: Streamline Coordinates

**[Insert Streamline Diagram]**

# Method: Summary

1. Compute Streamlines
2. Fit Circles
3. Integration
4. Differentiation

# Results: LES Airfoil

- Data from Asada and Kawai, 2018
- Grid coarsened from LES
- Added 2% random velocity error

# Results: Rough Cylinder

**[Details and visualization]**

# Results: NACA 0018 (?)

**[Details and visualization]**

# Conclusions and Next Steps

- Robust to noise
- Robust to distance from wall
- Similar or better results in regions with strong pressure gradient

**Next Steps:**

- Improve treatment of Reynolds stresses
- Improve treatment of critical points (separation, stagnation point)
- Generalization to 3D