MEAS-6-5
Effect of Upstream Piping Configurations on Ultrasonic Meter Bias
(PR-015-17606)

Project Update
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Status

• The final report for the elbow meter data has been submitted and approved.
• The final report for the in-situ meter proving has been submitted and approved.
• The draft final report for the flow conditioner testing has been submitted and comments have been received.
• The draft final report for the header testing has been submitted and is currently under review.
Path Forward

• The comments from the flow conditioner report will be addressed and the final report will be sent to CPA for review and comment.
  ▫ CPA’s comments will be included as an appendix to the final report. SwRI will not change contents the final report, unless CPA identifies an error.
  ▫ After CPA’s comments are received the final report will be submitted to PRCI.
• The comments from the header report will be addressed once the voting closes.
• A no cost project extension is requested until March 15, 2019.
Review of Comments from the Flow Conditioner Project
Comments

• The pressure drop across the flow conditioners were not measured during this project. The report will be updated to clarify this point.
  ▫ The CPA 55E and CPA 65E have more open area compared to the CPA 50E. This should result in a lower pressure drop.
• It was observed that the swirl was reduced in magnitude and changed in direction after passing through the flow conditioners.
  ▫ This matched with previous research (Grimley 2002).
Comments

• There were some comments about the plot that showed the path velocity measurements with and without swirl.
Path Velocities (CPA 50E)
Figure 5.19 8-Path Layout

The flow meter used in this project has eight ultrasonic paths. The ultrasonic paths are represented by the colored lines.
4-Path Layouts

Clockwise Swirl

Speeds up paths: E, B, C, H

Slows down paths: A, F, G, D

Figure 5.20 4-Path Layout
The 8-path design was split into two 4-path designs to estimate the performance of two 4-path flow meter configurations. Meter A represents the layout for a Daniel 4-path ultrasonic flow meter.
Front View of Meter A

Clockwise Swirl

Speeds up: B and C

Slows Down: A and D
Kerry’s Comments

• Nicely written and presented report.

I'm somewhat confused however why the CPA55E would have the best performance with the 8 path meter, but the worst performance for the calculated 4 path A meter. Additionally, why would the calculated 4 path A meter have errors in opposite directions for the CPA50E and 55E conditioners, when the residual swirl is clockwise in both cases? Hoping you can add some comments to the report addressing this unexpected result.
Kerry’s Comments (the fine print)

• Why does the CPA55E would have the best performance with the 8 path meter, but the worst performance for the calculated 4 path A meter?

• Why would the calculated 4 path A meter have errors in opposite directions for the CPA50E and 55E conditioners, when the residual swirl is clockwise in both cases?
8-Path CPA 55E Error Results

![Graph showing error relative to CPA 50E baseline for CPA 55E and CPA 65E as a function of meter velocity (ft/s).]
4-Path CPA 50E Error Results
4-Path CPA 55E Error Results
4-Path CPA 65E Error Results

![Graph showing error results vs velocity for different conditions.](image-url)
4-Path CPA 50E Path Results

![Graph showing 4-Path CPA 50E Path Results](image)
4-Path CPA 55E Path Results
4-Path CPA 65E Path Results