Case Study

BAGGI

ASSOCIAZIONE ITALIANA STRUMENTISTI

ISA Italy Section

MURPHY OIL CORPORATION'S

Agar Multiphase Flow Meter

Shale Oil Case - Eagle Ford Test Results

MURPHY OIL CORPORATION

AGAR CORPORATION
Process Measurement & Control Solutions

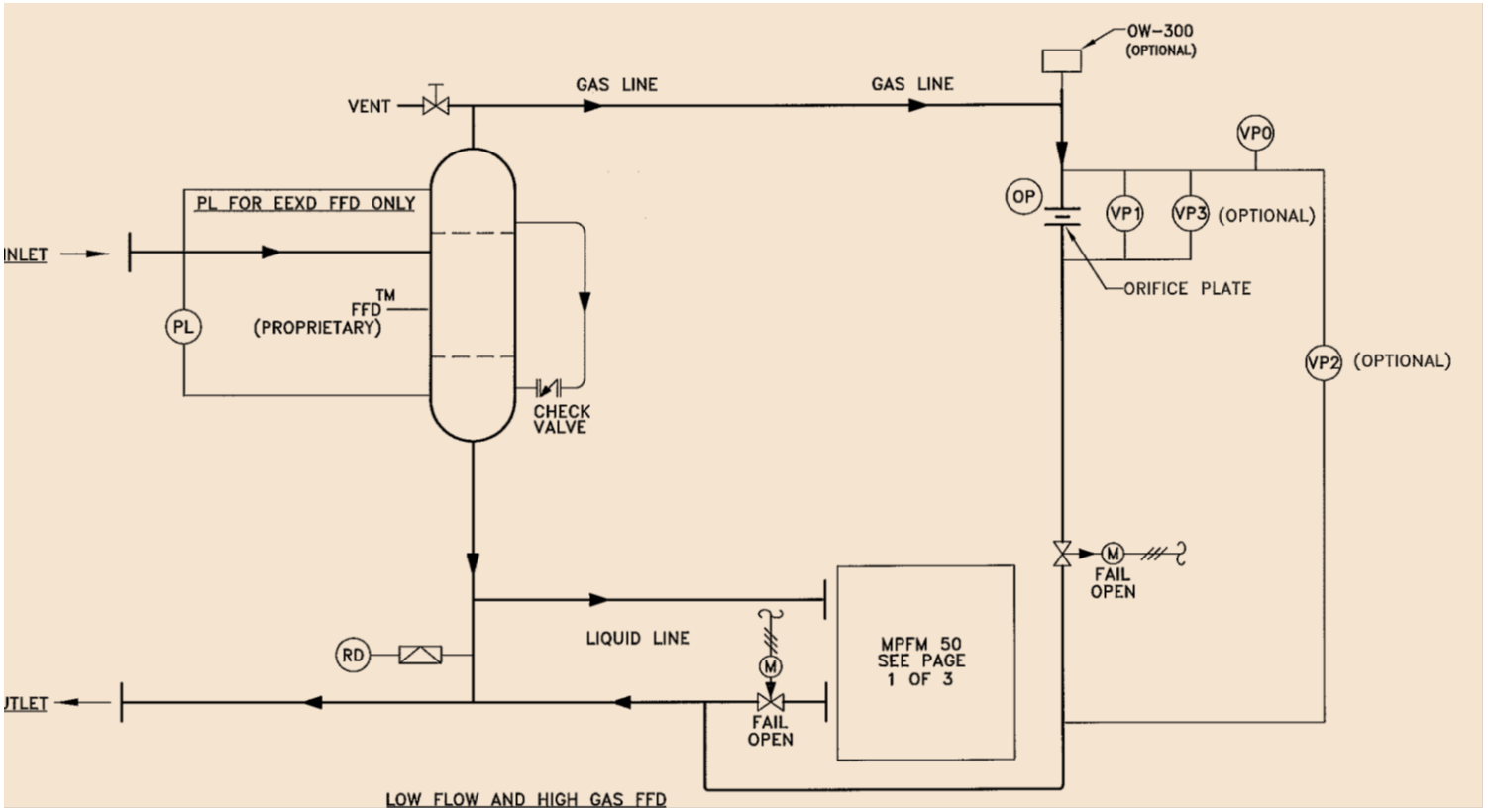
Executive Summary

- A 3-phase test separator was evaluated in parallel with an Agar MPFM by Murphy Oil between Feb 22 and Apr 8.
- MPFM exceeded quoted accuracy, measuring oil and liquid flow rates to an uncertainty of ±5% and the gas flow rates to ±10%.
- MPFM detected several faults in separator operation, and provided overall superior performance to the separator.
- The MPFM demonstrated it was a good alternative to test separator as far as measurement but full utilization will be considered economical only when complete PAD separation will no longer be required.

Brief Overview of MPFM

- Agar MPFM (Multiphase Flow Meter) designed to measure oil, gas and water flow rates.
- Uses 2.45 GHz microwaves to measure water cut.
- A multiphase Coriolis meter measures mass flow and density at 0-100% GVF.
- Dual Venturi meters account for slip.

MPFM Model Used in Test



- Meter used is a model MPFM-50 with FFD.

Test Arrangement-Separator/Tank Issues

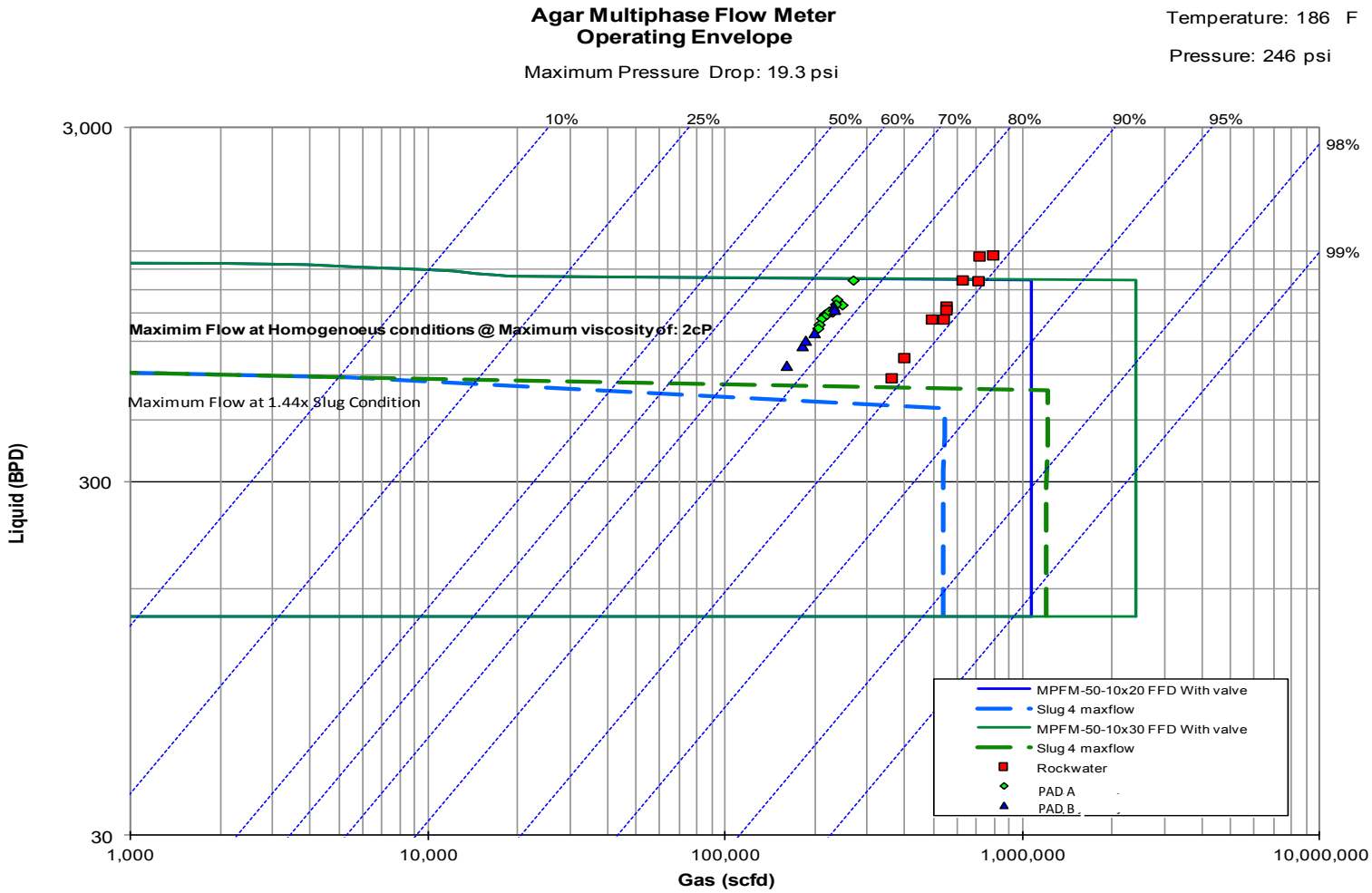
- Separator tank used as reference has several issues.
- Measuring stick -> Operator error and measurement inaccuracies.
- Tank drained into vacuum trucks. Follow up measurement of loaded quantities lacking.
- Insufficient Separation in Separator.
- Due to feeding the water and oil tanks from the water and oil lines of the test separator, issues with test separator become issues for the tank.

Results

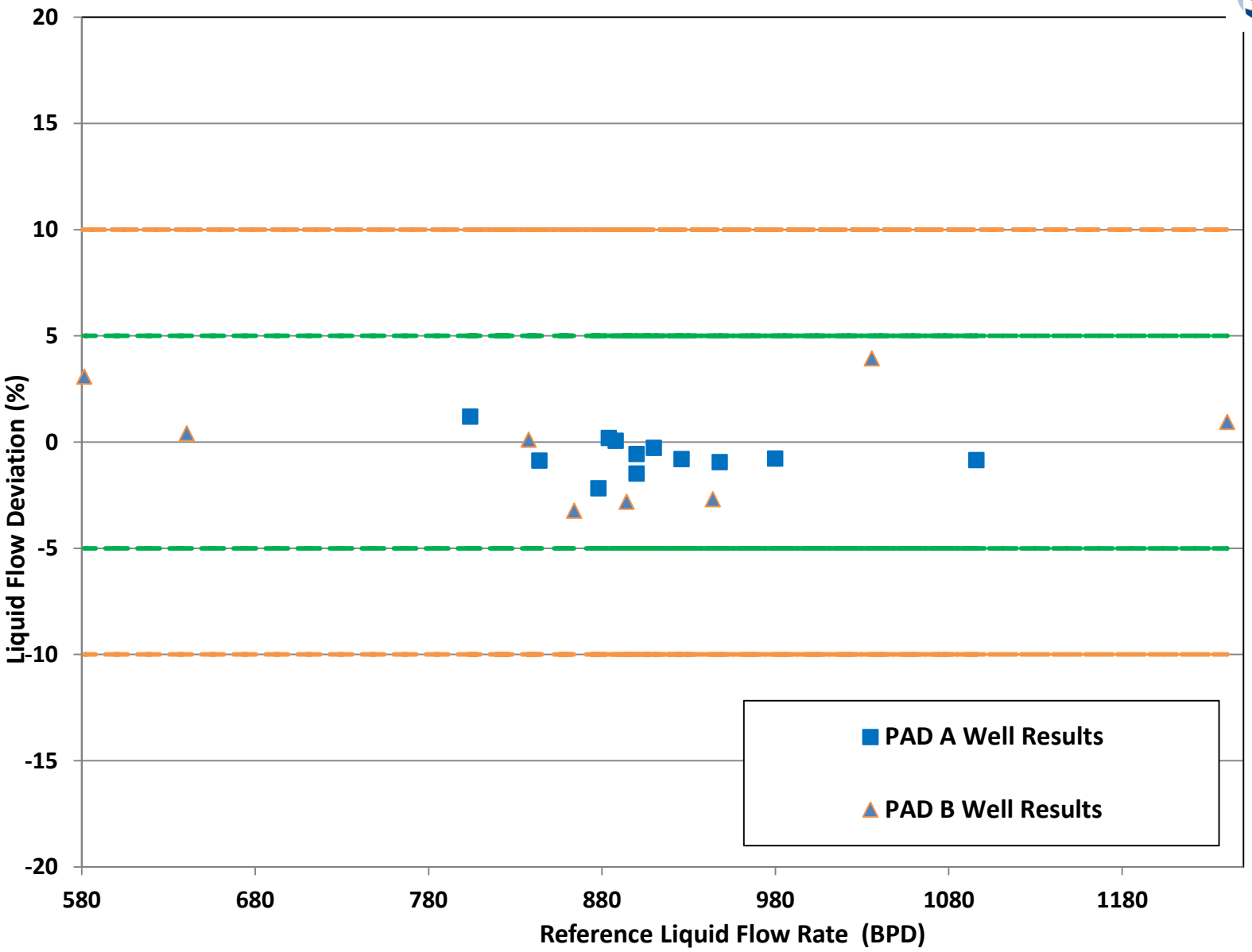
- Pad A and Pad B (Test locations) flow overlay on the MPFM operating envelope show that the MPFM is capable of dealing with the range of operating conditions.
- Raw and processed MPFM data show that analysis of MPFM results can be improved from the already satisfactory out-of-box results by knowledge of local conditions, even after the measurements are taken.
- Note that raw and re-processed MPFM results are shown against “reference” which is the test tank, which was impacted by several issues in the test separator.
- Comparison between MPFM, Tank and Separator results shows superior performance for the MPFM in general operation as well as process indication and detecting anomalous events.

Flow Overlaid on the MPFM Envelope

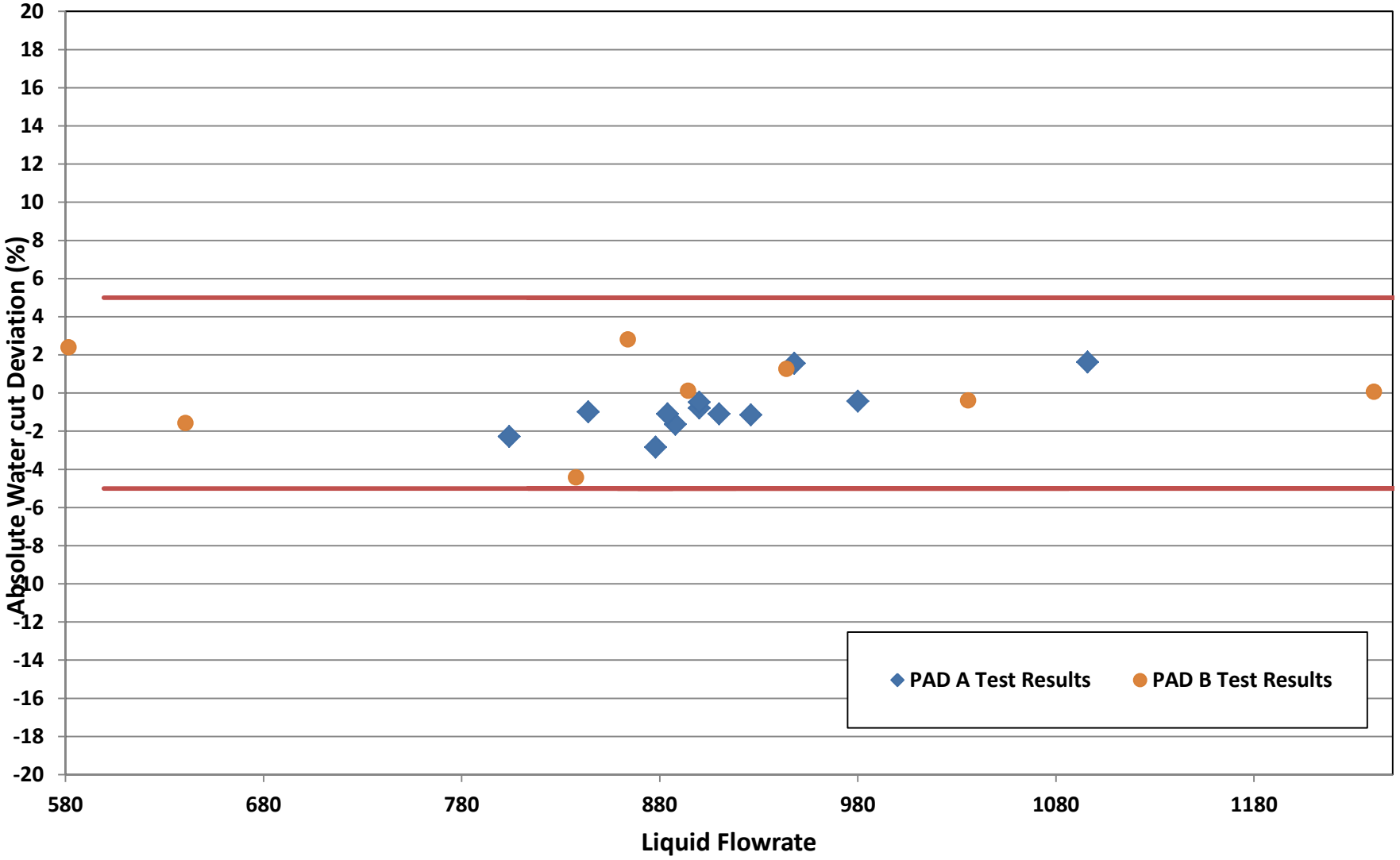
(PAD A and PAD B Locations)



Reference Liquid Flow rate versus Liquid Flow Deviation PAD A & B



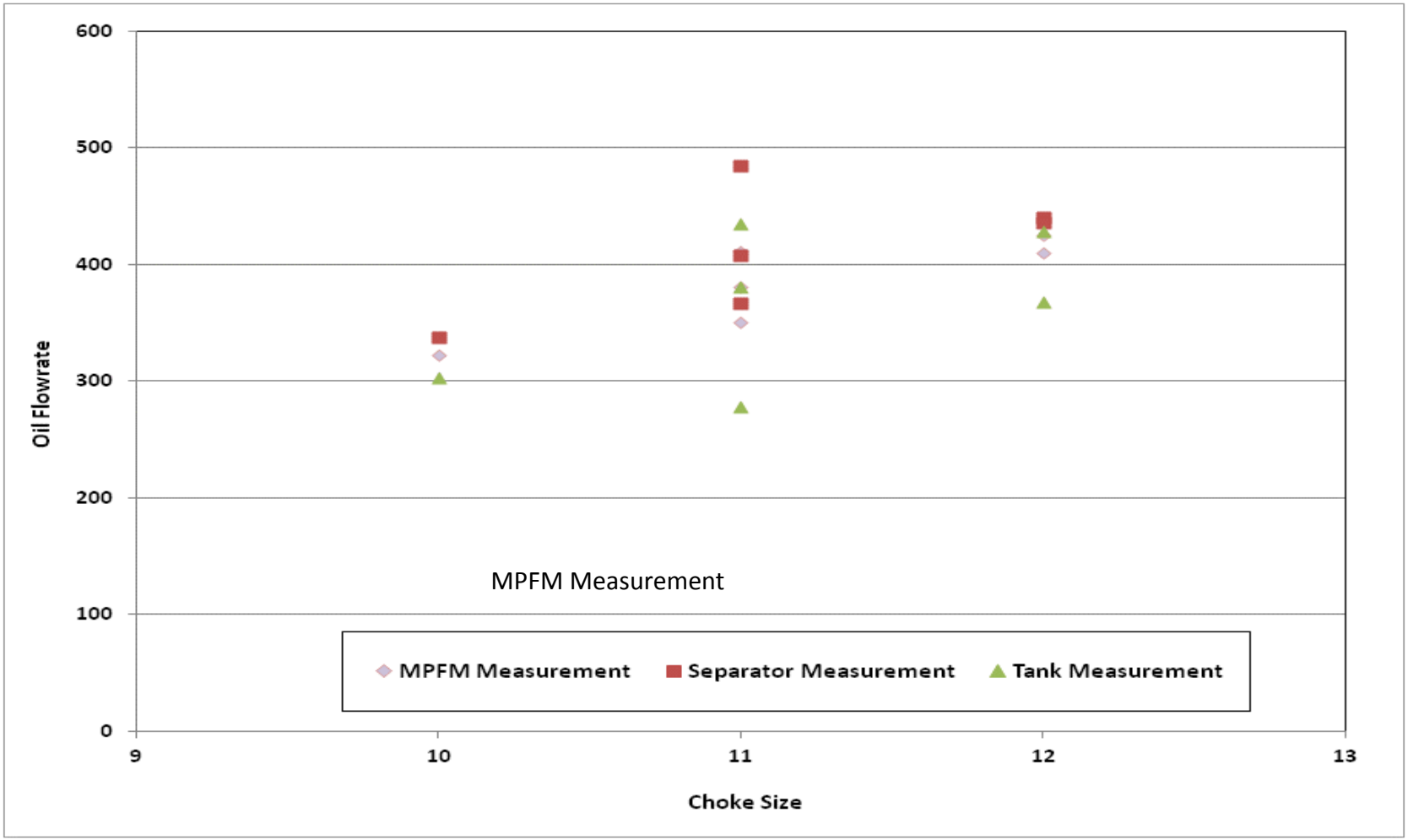
Reference Watercut versus Watercut Deviation - PAD A & B



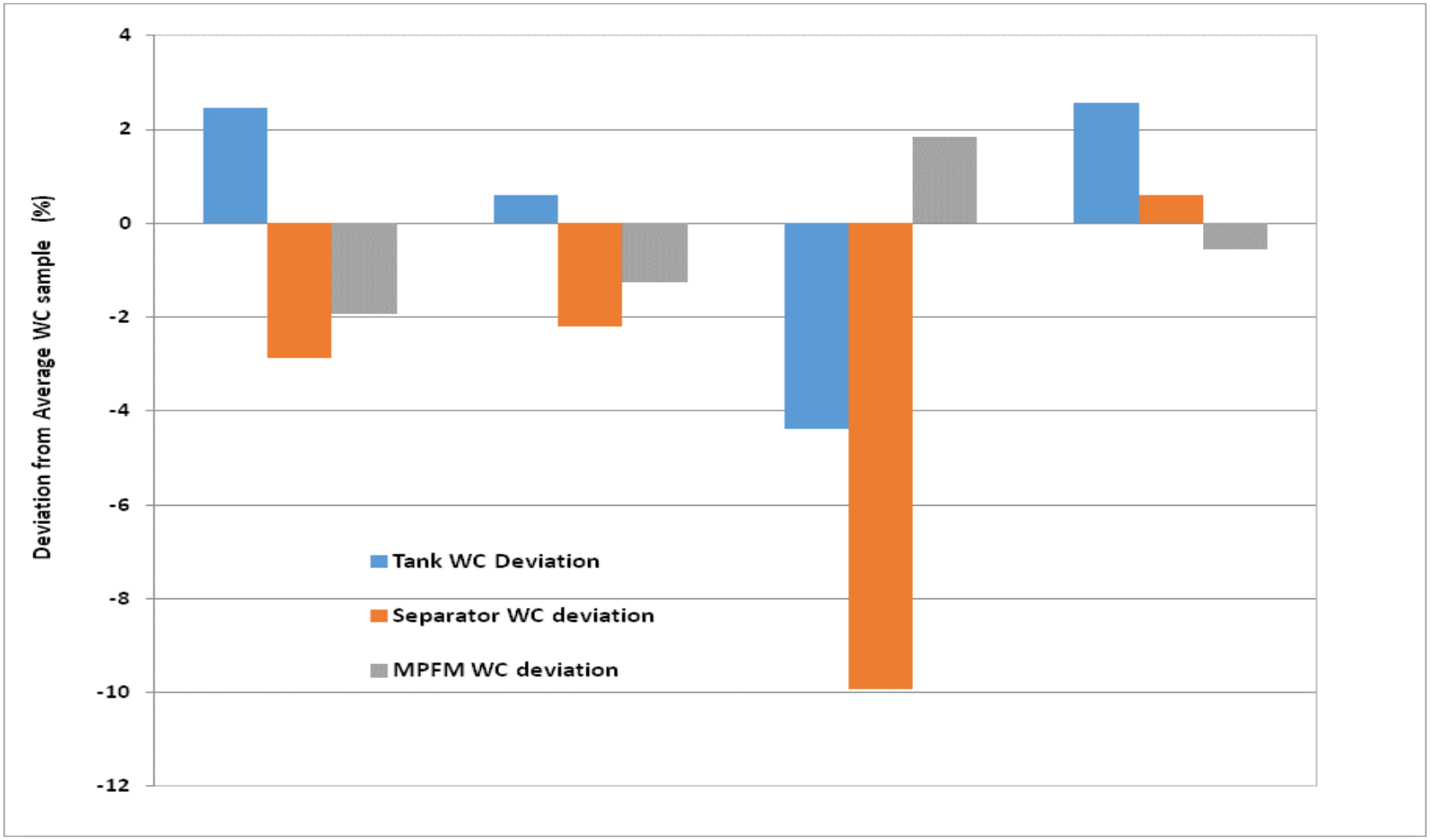
Comparison of MPFM, Tank and Separator

- The MPFM, Tank and Separator are compared on the basis of repeatability, deviation and functionality.
- Relating oil flow rate vs. choke size gives an indication of repeatability.
- Looking at the Deviation is also an indicator as to how good a set of measurements are.
- The relative standard deviation is a good indicator as to measurement repeatability.
- MPFM is capable of detecting process indicators and anomalous incidences.

Oil flow rate vs. Choke Size

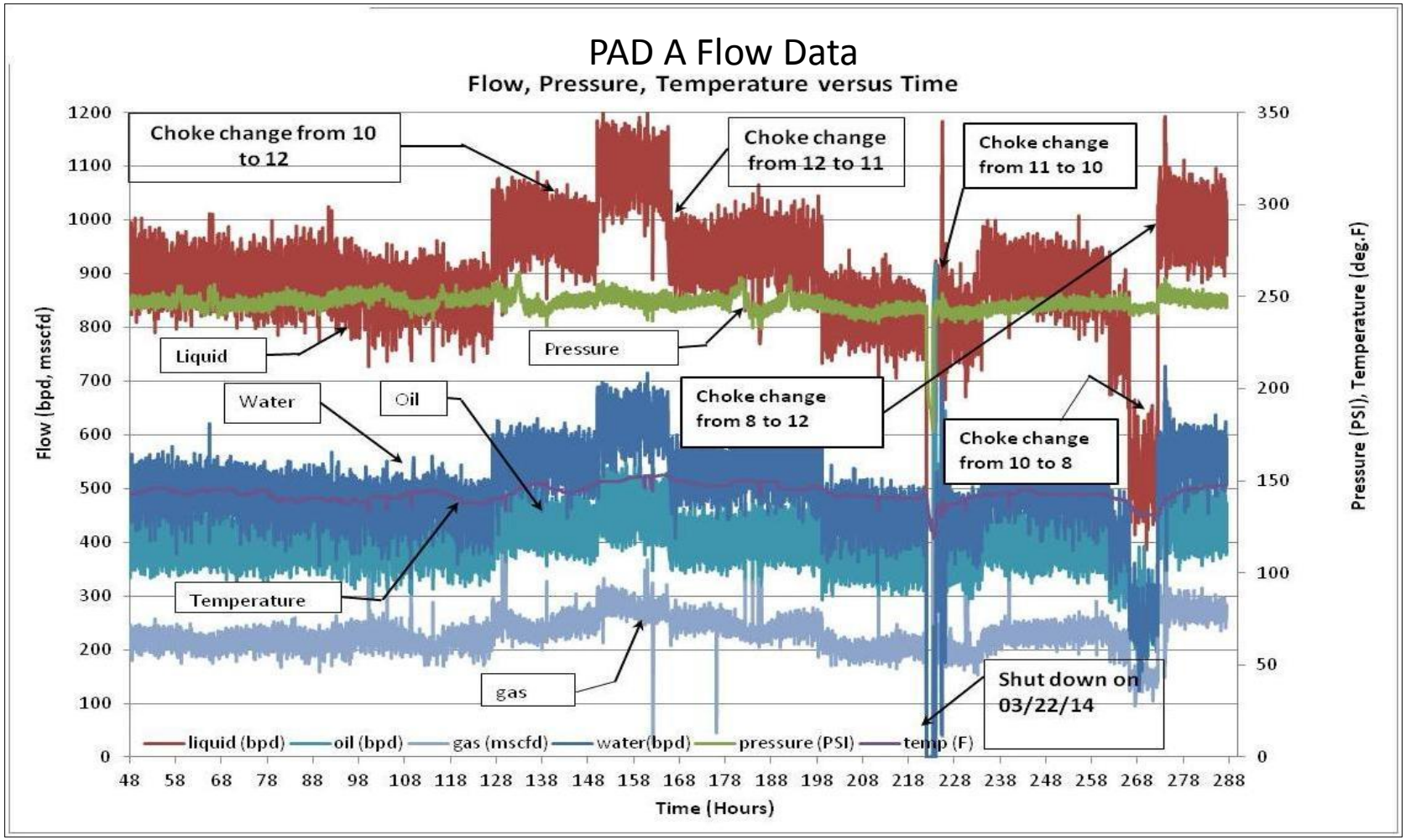


Deviation from Average Watercut Sample

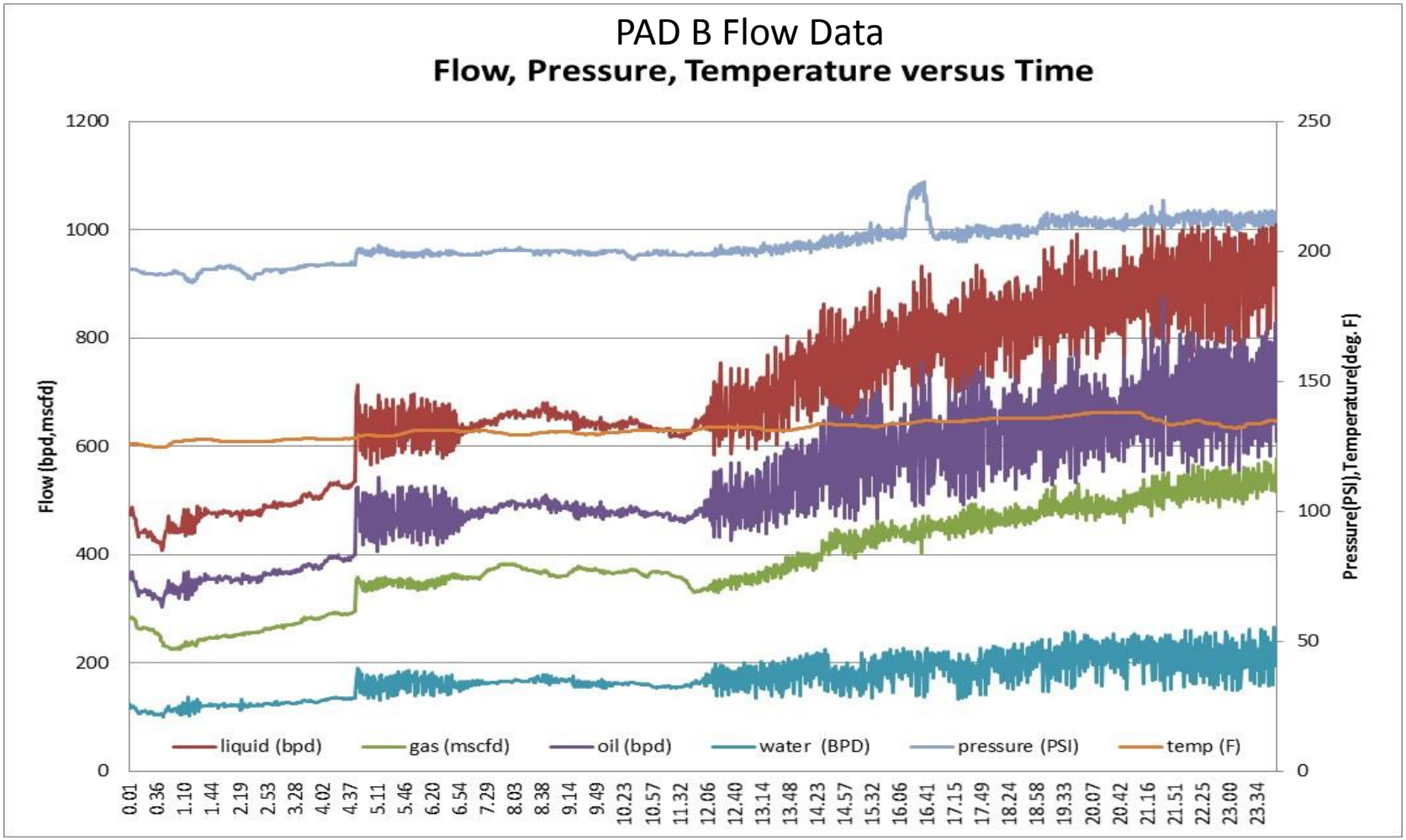


- From the given graph, the water cut of the MPFM has the least deviation, in comparison to the tank and separator.

Process Indicator-Shut down and Choke Change Indicator



Process Indicator-Slug Flow Indicator



Conclusions

- The Agar MPFM offers consistent and accurate oil, liquid and gas flowrate measurement.
- The MPFM was more repeatable than the test separator or tank.
- The MPFM was capable of detecting process indicators, and events including choke changes, shut down and slug flow.
- The results following proper configuration provided a good stated accuracy of ±3% Liquid Flow Rate, ±3% Water cut.
- Future implementations will depend on overall field development strategy and subject to facility design needs.