Multi Phase Flow Measurement
Meter Selection & Uncertainty Assessment*

SOLV™ Flow Measurement

The **Performance** of a Multi Phase Flow Meter (MPFM) needs to be known to enable the selection of a meter for a forecast production to minimise the uncertainty exposure of well rate phase measurements and for allocation of production to fields or wells. SOLV has undertaken a number of studies to assess the performance of both the MPM Meter shown in Figure 1 and the Vx Meter in Figure 2. Phase measurement uncertainty is found using observational data from comparison of the MPFM with a reference meter or with an analytical model of the meter based on the physical characteristics of the fluid, flow element and sensors.

The Observational and Analytical uncertainty approaches provide two complementary and independent means to assess MPFM performance with verification if desired.

Observational performance data is obtained from a number of sources including JIP's, client sponsored trials, field trials and the meter vendors own calibration facilities. The data is collated into database's which are accessed to find the phase uncertainty exposure performance over the operating envelope of the meter. Data should be traceable to the original source for verification of the data and the findings.

Figure 1 MPM Meter

Figure 2 Vx Meter

Analytical performance is found by modelling the physical characteristics of the fluids, flow regimes, the flow element and sensors. The uncertainties of the inputs to the model are simulated using a combination of MCS (Monte Carlo Simulation) and RSS (Root Sum Square) methods to find the oil, water and gas phase measurement uncertainty exposure at standard conditions. Bias may also be modelled to investigate the phase sensitivity to bias in the meter model inputs.

Continued

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The **Production** rates, operating conditions and flow regime are examined to assess the performance at the flowing conditions.

An example of Oil and gas in liquid slug flow in Figure 3 shows a peak liquid flow rate of over twice the steady state rate which must be taken into account in assessing the overall phase uncertainty exposure of the meter. In this example the uncertainty for each phase found at steady state conditions and at peak flow was combined to find the overall phase measurement uncertainty.

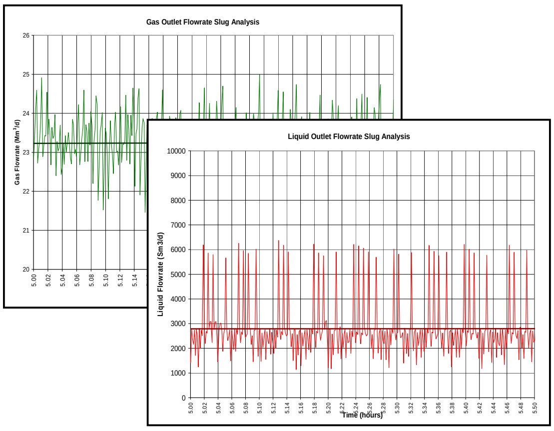

Figure 3 Oil and gas in liquid slug flow

The **Forecast** production and flow regimes are used to find the flowing conditions and operating limits for the field life to select the meter, size, operating mode and the secondary instrument ranges to optimise the meter performance.

Figure 4 shows the Field life profile and operating limits for slug and steady state flow used to specify a meter.

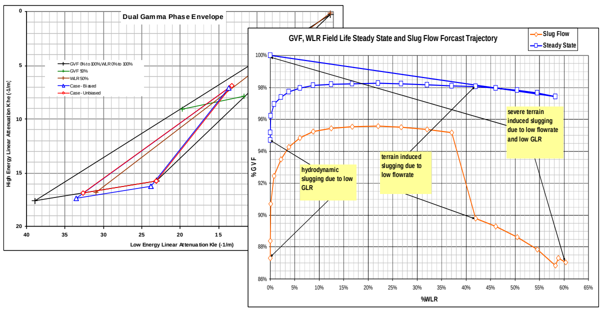

Figure 4 Field life profile and operating limits

Uncertainty exposure results are assessed in relative and absolute terms with bias and sensitivity during conceptual and detailed engineering for new developments and existing installations where flowing conditions have changed or when a new development is utilising existing facilities.

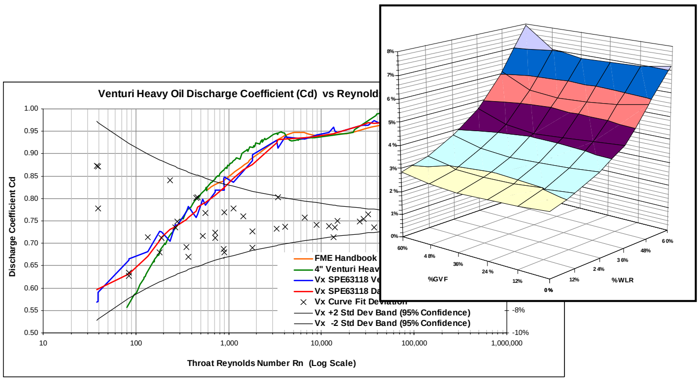

Figure 5 Oil uncertainty profile and heavy oil R_n vs. C_d variation and uncertainty for a venturi based MPFM

For further information call or email us at the contacts listed below or visit our website at www.solv.net

* Due to the terms of confidentiality agreements with our clients company and project names are not shown.

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