

# **PROTOCOL FOR MEASUREMENT UNCERTAINTY ANALYSIS USING REPEATABILITY OF DATA IN DISPERSION CHARACTERIZATION RIG (DCR) <sup>1</sup>.**

N. Urdaneta, L. Gomez, Ph.D., R. Mohan, Ph.D.<sup>2</sup> and O. Shoham, Ph.D.  
The University of Tulsa, Tulsa, OK  
and  
G. Kouba, PhD.<sup>3</sup>, Chevron Energy Technology Company, Houston, TX

## **ABSTRACT**

Water and oil dispersions are usually present in crude oil production from the reservoir to the surface facilities. During the oil production process, the oil/water mixture passes through restrictions, expansion or shearing devices that affect the flow characteristic of the liquid-liquid dispersions. Today, the oil industry is looking at different ways to characterize oil-water dispersions in order to properly select, size and predict the performance of downstream equipment such as surface flow lines and separators. The Dispersion Characterization Rig (DCR) is state-of-the-art laboratory equipment that is being used at The University of Tulsa to characterize the flow and separation behavior of complex oil-water dispersions under controlled conditions. This facility works under the same principle as batch separators. Consequently, the use of the DCR is gaining acceptance in the oil industry, but there are numerous challenges with data analysis process and scaling up the results to field conditions. Gomez-Markovich (2005) and Tian (2006) completed two studies on oil-water dispersions flow characterization utilizing the DCR. Results were presented on the effects of the several parameters on the separation process, such as: properties of oil-phase (light and heavy) and water-phase (tap, distilled and brine); temperature; pressures; water-cut and shear. Both studies showed that characteristics of the oil-water dispersions can be qualitatively observed using this facility under different operating conditions. Also, the facility can be used to validate model predictions to reproduce the physical phenomenon of separation of oil/water dispersions.

However, several problems were identified in the previous work. First, there is no objective criterion for selecting testing time in this facility. The final time was chosen by the experimenter when the phases were visually separated. Second, some of the results showed that there is a lack of repeatability in tests under similar operational conditions. Also, the image processing protocol is very subjective to the human eye of the experimenter. The data of the height vs. time profiles of the coalescing and sedimenting interfaces did not show uncertainty limits on the results. The present work has three main objectives: 1) Define a methodology for analysis of repeatability of DCR tests; 2) Establish a digital image processing protocol to obtain objective uncertainty limits of the separated fluid height measurements; and 3) Develop a formal methodology to carry out an uncertainty analysis in order to determine the level of confidence of this facility. The data from Gomez-Markovich (2005) and Tian (2006) have been analyzed using a digital image processing protocol to obtain for the first time the uncertainty limits of the height measurements. Using these limits an uncertainty analysis was carried out in order to determine a criterion to choose the final time of the experiments. Preliminary results of this study will be presented.

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<sup>2</sup> Corresponding Author: Tulsa University Separation Technology Projects (TUSTP), Mechanical Engineering Department, The University of Tulsa, 800 S. Tucker Drive, Tulsa, Oklahoma, 74104. Ph: (918) 631-2075, E-mail: ram-mohan@utulsa.edu