UPM 2018 Abstract – MGN International

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1. Please describe the challenge in water treatment and/or high-purity chemicals for microelectronics that your topic addresses. (2-3 sentences max)
    a. **Particle contamination in Ultra-Pure Water (UPW) and high-purity chemicals will negatively impact semiconductor / microelectronics production yield, process efficiency, and operating cost. Particle contamination detection upstream of the production process is essential and critical for the detection, reaction, and correction of particle excursions.**

2. Please discuss the specific technical problem your presentation addresses, including the relevant data to prove your solution works. (2-3 sentences max)
    a. UPW distribution, chemical suppliers, and end-users are often faced with challenges in correlating and reconciling particle count data from old/existing instruments to new instruments. If unresolved, valuable historic data become useless and additional investment of time and cost are needed to test and develop new product specifications and control limits. Identification of light scattering technology (LST) particle counters' counting efficiency can help with the determination of numerical factor(s) needed for data normalization across different instruments.

3. Please discuss the novel use or innovation for water treatment and/or high-purity chemicals that your presentation will address in microelectronics manufacturing. (Note: On occasion, there may be a relevant topic that is primarily educational. Should your topic better fit into that category, please explain the box below, and in your abstract why your proposed presentation is of value to our audience.)
    a. **This topic will be primarily educational and instructional. This presentation will address the cause for the difference in data, inform the audience on how to calculate, compare, and project data between different LST instruments, and recommend optimal configurations and setups to collect comparison data. Data will be presented to demonstrate the application of this method and showcase the correlation from the 200nm LST benchmark down to 30nm measurements.**

4. ABSTRACT TITLE
    a. Correlating Particle Counter Data Between Different Instruments

5. ABSTRACT (500 WORDS OR LESS)
    a. Particle detection in UPW and high-purity chemicals upstream of the microelectronic production process allows corrective actions to be taken before the particle excursions impact the entire production lot, therefore, directly impacting a Fab's yield, efficiency, and cost. As the industry evolves to achieve ever smaller nodes, so exists the need for evolving designs of LST particle counters to detect smaller particle sizes. One of the biggest challenges in LST particle detection technology is the exponential decrease of a particle's scatter signal when compared to the decrease in the particle's physical size, making the detection of smaller particle sizes exponentially more challenging. To compensate for the decrease in particle scatter signal, a more powerful excitation light

source is required. This can be achieved through a higher power output, higher energy (shorter wavelength), and higher intensity (more focused) laser beam. At the sub-100nm level, the laser beam requires significant focusing so that it only detects a portion of the sample passing through the instrument; this type of instrument is called a partial detection particle counter and its illumination percentage is referred to as its counting efficiency. Different designs will yield different detection efficiencies that will require a different normalization factor for data comparison between them. Due to the aforementioned variations, it is difficult for operators, engineers, and quality specialists to reconcile historic data with data from new instruments, leading to challenges in setting control limits and product specifications when adopting new particle counting instruments. This can be resolved through the identification and comparison of counting efficiencies between instruments and any volumetric differences to normalize two sets of data for direct comparison, or extrapolate what the new instrument should theoretically measure based on historical SPC data. Empirical testing can be performed to compare the LST instrumentation. Test should be designed to minimize variables through the utilization of the same sample, container, inlet line, fittings, flow controls/syringe sampler, and challenge particle size and concentration. Most cost and time effective method is through the use of a poly-dispersed challenge solution, with a target concentration with statistical significance while minimizing the effect of coincidence loss. Channel sizes within the overlapping dynamic range should be set to match for easier comparison. Data from the LST benchmark of 200nm all the way down to 30nm will be presented to demonstrate the correlation between the LST instruments. In conclusion, the understanding of counting efficiency and implementation of these instructions will save cost, labor, time, and frustration during upgrades in contamination control and monitoring of critical process liquids.