Optimizing Consistency Management In RCF Processes

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ABSTRACT

Consistency management is one of the most critical parameters, be it a chemical pulping, TMP or RCF process, however, the challenges are severe in the RCF processes. A mix of variety of raw material leads to varied fiber type, inconsistent Ash content, ink content and lot of foreign debris. Same type of consistency measurement devices cannot be deployed at all locations in a RCF process and a lot of care is needed while selecting a sensor type for a particular application. Optimized Yield and quality are governed primarily by suitable consistency management in RCF process. Many technologies are available for consistency measurement viz. stationary blade sensors, rotating blade sensors, optical sensors and microwave sensors and every technology has it's advantage or disadvantage on a specific location. This paper is an effort to throw some light on choosing right technology at each point and help improving the yield & quality.

KeyWords:
Fiber Consistency, RCF Process, Ash consistency, Stationary blade, Rotary blade, Microwave, Optical sensors.

Introduction

In a RCF process, running the Paper machine operations consist of four fundamental process area. Each process area has it's own inherent problems. Whether in "Preparing the Furnish", "Forming the Sheet" , Removing the Water" or "Developing the Surface Properties" each has it's own unique challenge in measurement and control. Let's take a look inside from MANAGING CONSISTENCY point of view.

In many cases, consistency is the single most important measurement in the entire RCF line.

- As an example, total Cs of the first flotation stage affects directly on ink removal efficiency; the lower is the consistency the better flotation works and the higher is brightness.
- All consistency transmitters measure consistency indirectly, something what correlates with fiber or filler content

Different kind of Consistency transmitters should be used based on the application point and the given process parameters (Refer Figure 1 and Figure 2).

Mechanical Consistency Transmitters (Stationary Blade and Rotating Type):
- based on shear force
- blade or rotary

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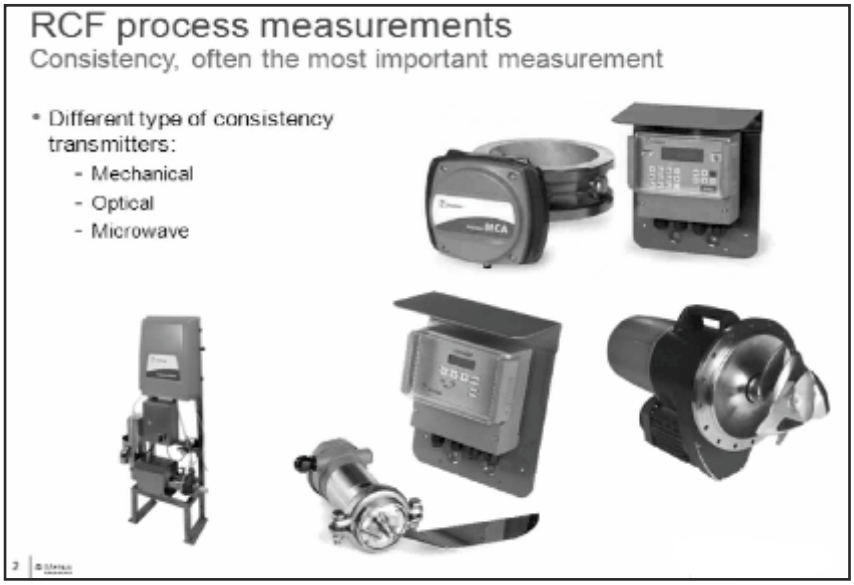

Figure 1- Different measurement technologies for fiber & ash consistency

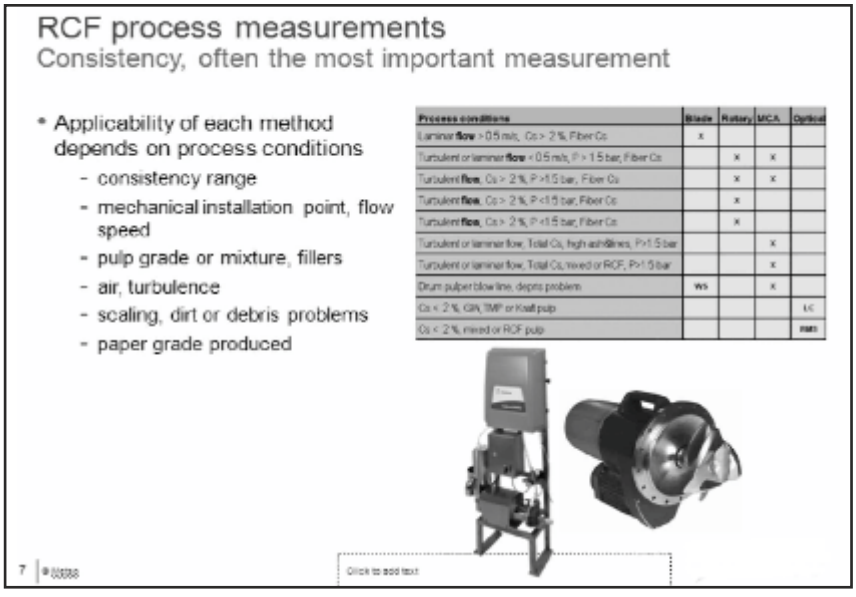

Figure 2- Criteria for selecting a specific technology

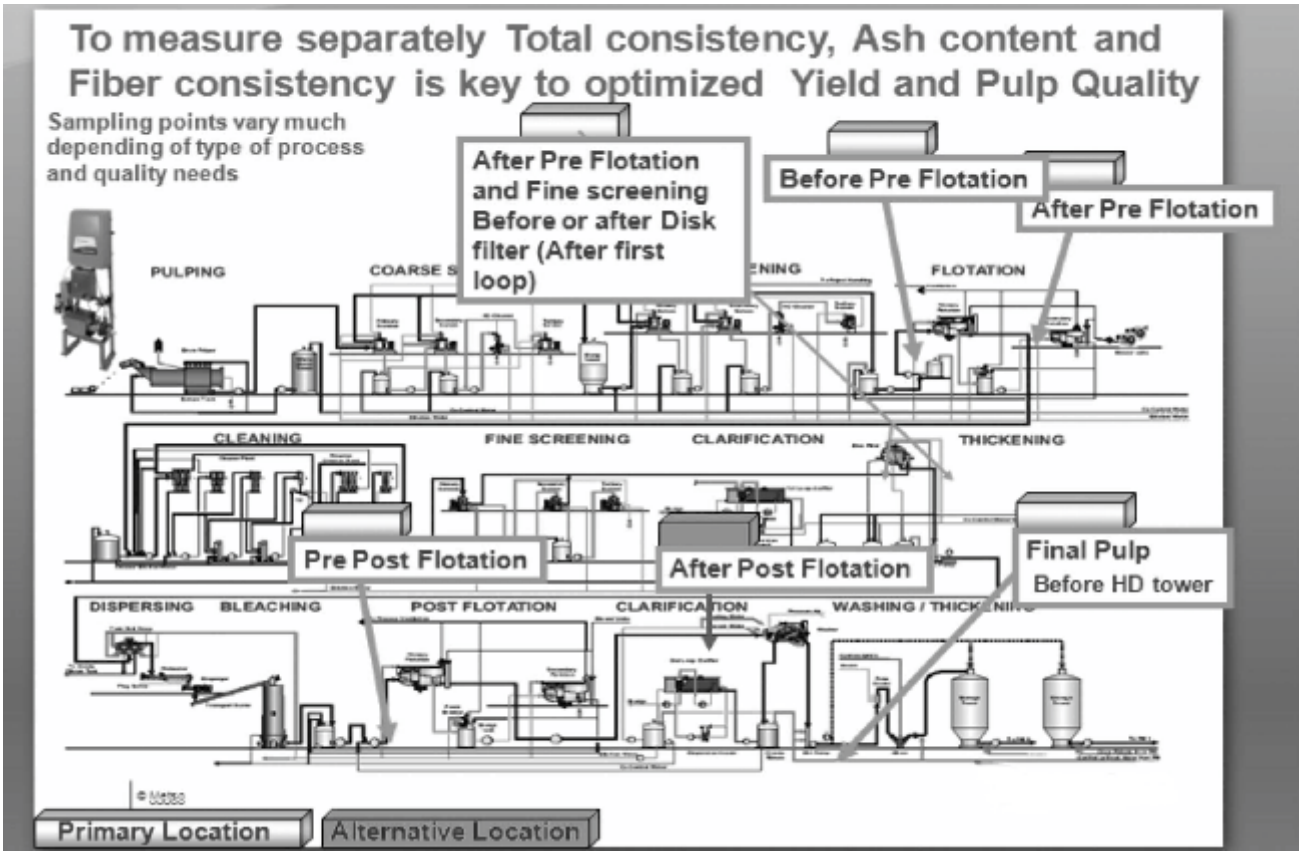

Figure 3- Measuring Ash consistency

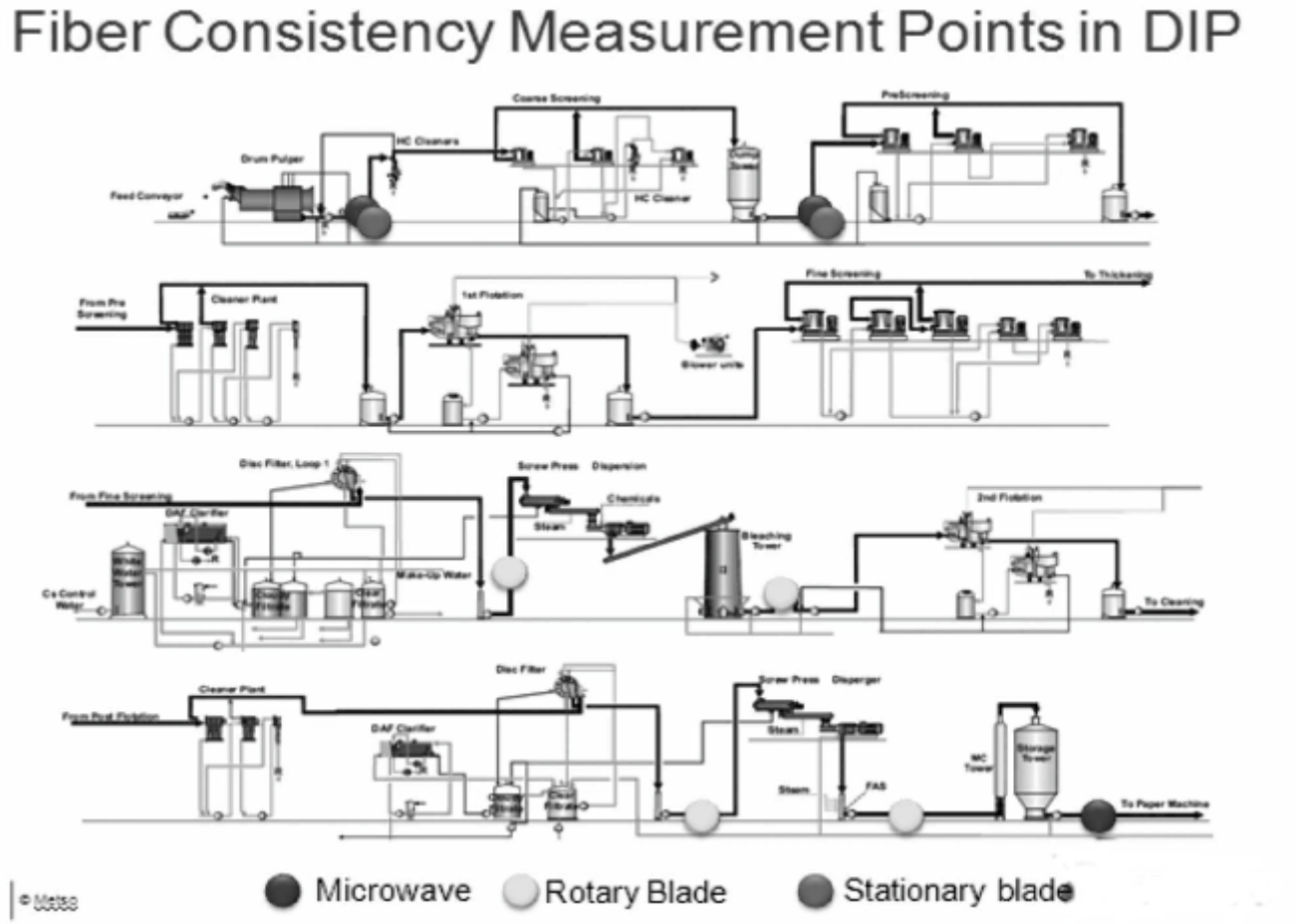

Figure 4- Consistency Measurement in a DIP

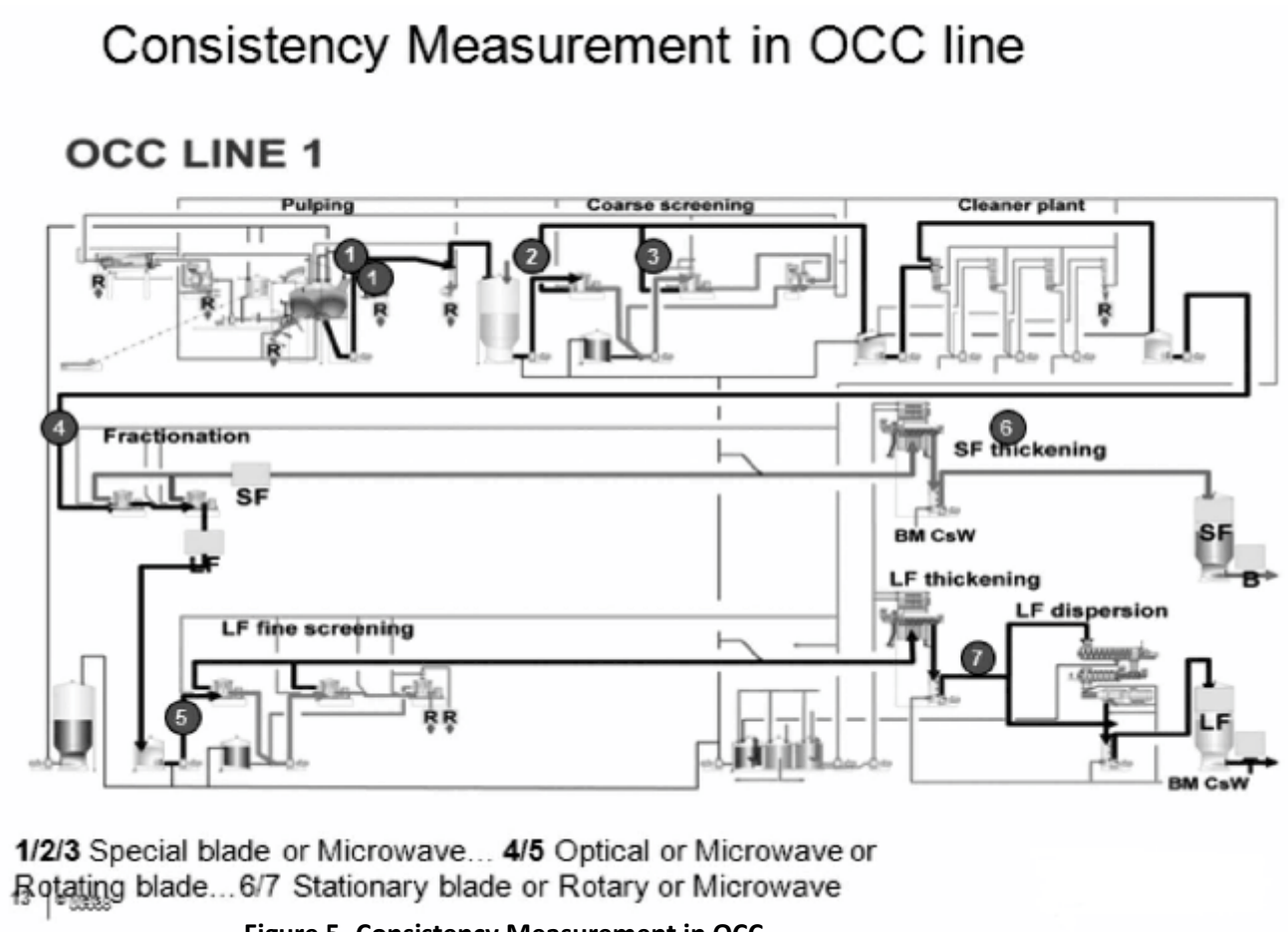

Figure 5- Consistency Measurement in OCC

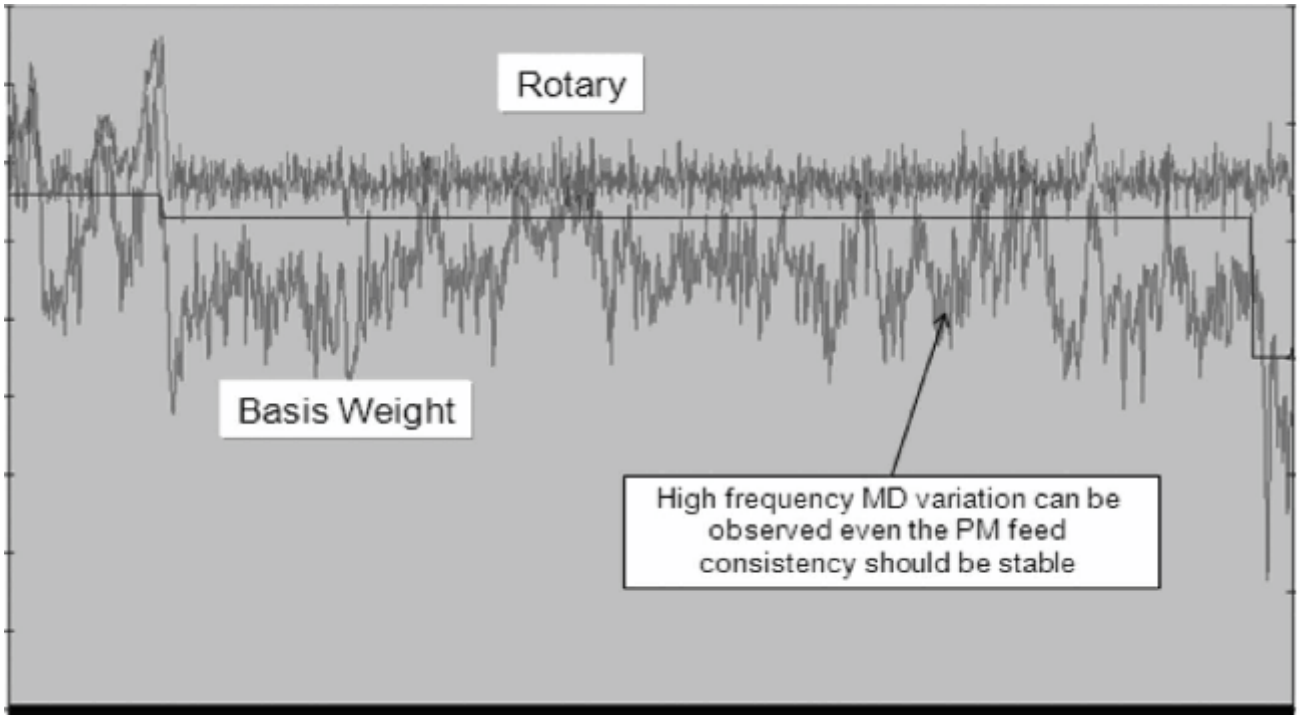

Figure 6- Rotating consistency transmitter in Machine Chest

- velocity/flow dependent
- pulp grade or mixture affects on measurement
- fillers or fines do not change shear force and hence not measured by these

Optical Consistency Transmitters:

- Inline or Online solution
- With the in-line measurement

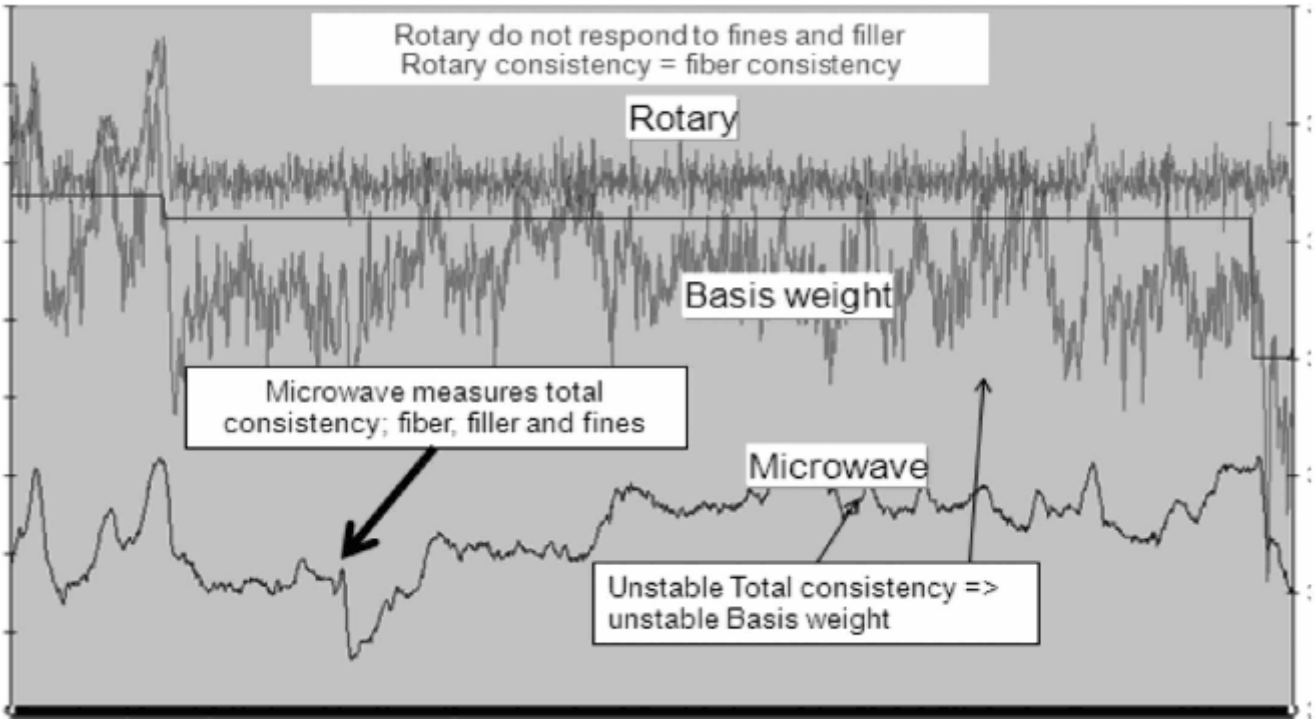

Figure 7- Microwave sensor versus Rotating sensor in machine chest

installation is simple

- With the online solution we have wide range optical information:
- We can separate fillers from fibers
- Accurate measurement with mixed pulp grades.
- We can measure Ash content at various locations viz. floatation cells and help minimizing Ash variations in the process (Refer Figure 3)

Microwave Consistency Transmitters:

- Total consistency measurement
- In-line or flow trough
- independent of pulp grade changes
- independent of flow/turbulence
- independent of ash grade/type

Figure 4 gives us a birds eye-view on what type of transmitters are recommended for a particular application in a DIP process.

The first most important location for Consistency measurement in a DIP is PULPER OUTLET (3-4% consistency). This is the location which determines the yield and quality throughout the DIP process.

Since RAW MATERIAL variations may cause ASH variation, hence measurement of TOTAL CONSISTENCY is required. Normal blade type consistency transmitters measure only FIBRE and not ASH. But Microwave transmitter measures TOTAL CONSISTENCY and hence most suitable for this location.

The next location is COARSE SCREENING INLET (consistency 3-5%). Optimum consistency at desired level is required to have efficient screening. Normal blade type consistency transmitter can be used at this location.

Next important location for Consistency measurement is DISPERSION INLET (consistency 8-12%). Since the consistency is high and better accuracy is required, Rotary Consistency transmitter is proposed here.

Next proposed location is BLEACHING TOWER OUTLET (consistency 8-12%) where consistency measurement and control is important to enable efficient pumping to final chest. Stationary blade type consistency transmitter is suitable for this location.

Finally, the final chest Consistency (8-12%) measurement is very important. Here also, TOTAL CONSISTENCY should be measured to ensure optimum consistency pulp goes to the headbox. Hence Microwave is the best suitable transmitter for this location.

The various locations for consistency measurement and the type of technology used for a typical OCC line is shown in figure 5.

Locations 1/2/3 (re-pulping, discharge and coarse screening) may use Special blade or Microwave transmitters for consistency range 3-5%. Here pulp contains debris and hence special blade or microwave is recommended.
Locations 4/5 (fractionating and fine screening) may use Microwave or Rotating blade transmitters for operating range of 1-3% consistency.
Locations 6/7 (thickening and dispersion) should use Microwave, Rotary or stationary blade depending upon the process situation.

Machine chest applications in RCF process need Total Consistency Measurement and hence shear force based consistency transmitters cannot give true representation of what is happening in the line. This is due to Ash variations in the raw material.

Experiment:

Here's a customer case where initially customer was using Rotating blade transmitter for better accuracy over stationary blade. The device displayed very smooth consistency trends (figure 6), however, the final Basis Weight was showing variations.

Results:

Microwave transmitter was installed to see the real happening in the process and the result was different than what was being shown by the Rotating transmitter. Microwave consistency trends followed the Basis Weight trends exactly (figure 7). Using microwave technology helped the mill to get even basis weight profile. Many of similar cases were noticed in fine paper/ board mills worldwide.

Conclusion:

To summarize, Consistency management forms an important part of the paper making process and technologies like Online Optical measurements and Microwave are very important for RCF processes. The need is to evaluate every particular process, parameters and select suitable type measurement technology to suit a particular application & location. For RCF process, microwave technology is specially recommended in machine chest applications. This will certainly help reduce quality variations, lesser rejects, optimum yield and hence optimized operational costs.