Jitter and Speed Stability

Jitter is calculated using a time-of-flight of a beam reflected off a spinning polygon across two detectors. The time-of-flights are measured by an HP 'Time Interval Analyzer' which has a data capacity for 1000 points. This equates to 22 revolutions for the 45 facet polygon.

Data Reduction:

The 1,000 samples are truncated to an integral number of revolutions, less one full revolution to prevent array data overflow. For example, an 8 faceted MPA will have jitter/stability calculated over 124 revs (INT [(1,000/8)-1]) =124. A 15 faceted MPA would yield 65 revs worth of data (INT [1,000/15)-1]) =65. As you can see, the number of revolutions that jitter/stability is derived from is dependent upon the number of MPA facets.

Jitter Derivation:

To obtain jitter, the stored data is split into per revolution blocks, with each block containing N samples, where N is equal to the number of facets. Within each revolution block, the highest and lowest time intervals are identified and subtracted to obtain a peak-to-peak value. This process repeats for all revolutions (i.e. 124 total times for an 8 faceted MPA). The peak-to-peak values are then all averaged together to yield jitter in time units. Averaging of data reduces effects of spurious detector triggering, windage effects and other unknown entities.

% Jitter Derivation:

To calculate % jitter, the time value derived at above is divided by the time of flight between the SOS and EOS detector and multiplied by 100. The time of flight is recorded in the interval of the first measurement taken (first revolution, between first and second facet. For higher repeatability, the average time of flight could be incorporated in the software in the future.

Stability Derivation:

For stability, again the data is trimmed to an integral number of revolutions. A unique facet is identified and tracked by software over all revolutions. The highest and lowest time intervals for this facet are identified and subtracted to obtain a peak-to-peak stability value.

% Stability Derivation

To calculate % stability, the peak-to-peak value derived at above is divided by the rotational frequency (1/speed) and multiplied by 100.