

DAVID S. SCHWARZ & ASSOCIATES

Statistical Consultants

4261 Americana Drive
Suite 229
Stow, OH 44224
Web Site: <http://www.pobox.com/~david.schwarz>

Phone: (330) 945-4733
Fax: (330) 945-4733
E-Mail: david.schwarz@pobox.com

Short Run SPC

Standard statistical process control techniques rely on reasonably large data sets in order to estimate the process mean and standard deviation.

Often times only short runs of a product or product type are produced at one time (or campaign). Also, a number of related product types might be produced on the same piece of equipment or by a related process (example: bolts of various diameters).

Since the runs are short but the different parts are related, charts can be created by pooling and/or standardizing data in various ways:

1. By Runs (no pooling): Choose to estimate sigma for each run independently.
2. By Product: (pool all runs of same product): Choose to combine the data from runs of the same product together, then estimate sigma for that product. This is repeated to estimate sigma for all products.
3. Constant (pool all data): Choose to pool all the data across runs and products to obtain a common estimate of sigma.
4. Relative to size (pool all data, use $\log(\text{data})$): Choose to take the natural log of the data, then pool the transformed data across all runs and all products to obtain a common estimate of sigma for the transformed data. The natural log transformation stabilizes the variation in cases where variation increases as the size of the measurement increases.
5. Use historical values: Choose to use a historical value of sigma for each product, and then standardize each products' data set with that standard value.

The choice of which procedure to use depends on the circumstances. Number 1 makes no assumptions about run-to-run consistency and hence is the most robust. However, it is also the least sensitive to run-to-run differences and the least powerful, statistically.

At the other extreme, number 5 assumes a long history of the product and a very good estimate of the product mean and sigma. In this case, an argument could be made for using either short range or long range SPC. The long-range option could be exercised if the process was shown to be in control over the long run.

Whichever method is chosen, a procedure that I find attractive is to do both the short run and long run charts at the same time. This allows one to judge the state of control by observing the short run, while guarding against any long range drift in the process that would be masked by the standardized values on the short run charts.

Modern quality software can be programmed to run the charts automatically after a certain amount of production and output in a format that is easy to read. Examples are Minitab and NWA Quality Analyst.