CheckMate, SoftFit Solver: The What, Why & How

SoftFit Solver provides manufacturing engineers the tools to;

- Reduce tooling iterations and produce more robust tooling.
- Determine "best-fix" corrective action for nonconforming parts
- Determine viability of functional acceptance of nonconforming parts.
- Evaluate complex GD&T, eliminating the risk of accepting bad parts or rejecting good ones.

SoftFit Solver is a dimensional metrology application built on best in class fitting capability.

The result of dimensional measurement equipment and operations are deviations between the actual and the mathematical model with respect to some tolerance as applied to a given feature such as a hole, slot, surface point, trim edge etc. What SoftFit Solver does is re-orient or re-align if you will, this result to the nominal of the measured artifact.

This is the mathematical equivalent to shimming a part in a fixture, re-measuring and repeating this cycle repeatedly until a suitable result is obtained. The difference with our Solver is that this process is repeated hundreds or thousands of times in a blink of an eye to determine the optimum orientation.

Why FIT?. When determining corrective action on non conforming parts or tooling it is desirable to establish an orientation that pushes the deviations to areas that are much easier to fix (think cut versus weld) or to areas of lesser importance.

Whether it is necessary to;

- Refine alignments using more features in complex relationships, sometimes with bonus tolerances to be applied including mobility on multiple datums.
- Make corrections due to manufacturing error or tooling problems.
- Push deviations to their limits to allow non conforming features to come into tolerance,

the net result is a new set of feature deviations telling us what to fix or if any rework is required at all.

Utilizing the SoftFit Solver systematic approach engineers are presented with a single browser driven, user friendly interface. The "Root Cause" browser not only displays the real time results from what-if iterations it is also the primary user interface for the application. The browser can be populated with measurement results from all makes and models of dimensional measuring equipment including coordinate measuring machines, laser scanners, trakkers and articulating arms.

Display data in an intuitive feature by feature format, with integrated graphics representation as shown in fig.1 for decisive action.
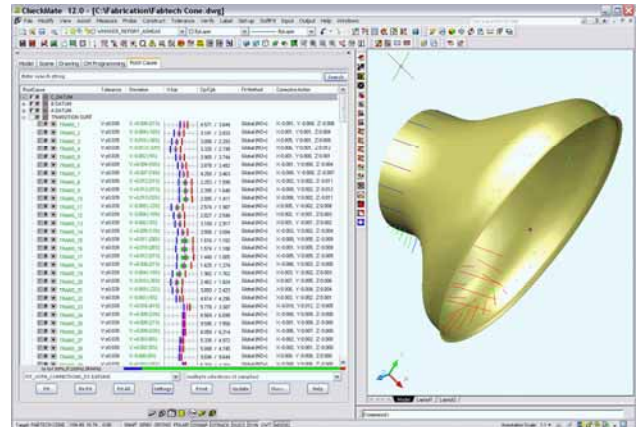

Fig. 1

The expanded view of the browser in fig. 2 shows a typical set up of data fields for a process improvement application on a stamped part.

Fig. 2

Fig. 3 illustrates the expanded set of user definable data that can be presented to meet your needs regardless of your application or process.
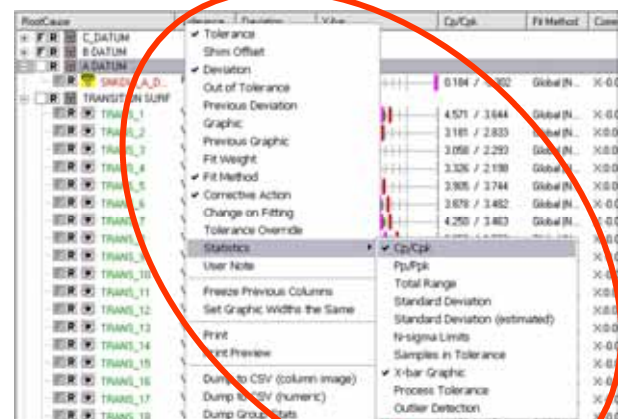

Fig. 3

A common practice in determining the root cause of any problem is to break down the information to functional groups. When populating the "Root Cause" browser the measurement data can be organized into such groups, with each group containing the corresponding features . These groupings play into the "what-if" evaluation scenario's done to determine the corrective action required.
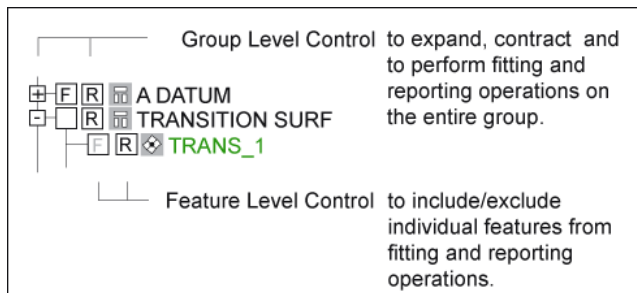

Fig. 4

In fig4 The boxes designated F&R to the right of the expand and minimize boxes are used to select groups or specific features from the fitting [F] or reporting [R] operations.

Some examples of how this technique has been applied by customers;

- Weldments: By isolating the features of individual components on a complex welded assembly it was determined that they were all within tolerance to themselves and that one of the support features was out of place indicating a fix was required on the welding fixture.
- Die Cast: When it was obvious that changes were needed bring the die cast propellers into compliance it took no time at all to realize that the three blades were all of the correct form but their orientation to the propeller axis was off. With one iteration of the tooling they were ready for production.
- Buy-Off: Aerospace customers have found that in the case of non-compliant parts that it is often able to verify that the part is functional or can be made to be functional with minor fixes and achieve buy-off from their customer, avoiding expensive rework or costly scrap. Inherent to this process is the capability of Solver to produce "negotiations targets" which would indicate how much relief would be required on specific features to bring it into specification.
- Datums: Datums and Reference Frames when properly assigned are done so with consideration to the relative function of the features on the part. However, when manufacturing the part they may not be integral to the process and in the case of stamped parts the datum features may very well be struck in the last stage of the die. Aligning to the these features in the measurement process could produce results that indicate extensive tool-

ing changes are required. Our customers have often found that a simple solution of moving a datum feature is much more cost effective than the extensive tooling changes their original measurement data indicated.

SoftFit Solver provides the user with robust selectable settings. With the application specific fitting algorithms, the multiple modes of constraint of degrees freedom and additional user controls as can be seen in fig. 5 SoftFit Solver is capable accomplishing the most demanding of requirements for all applications.
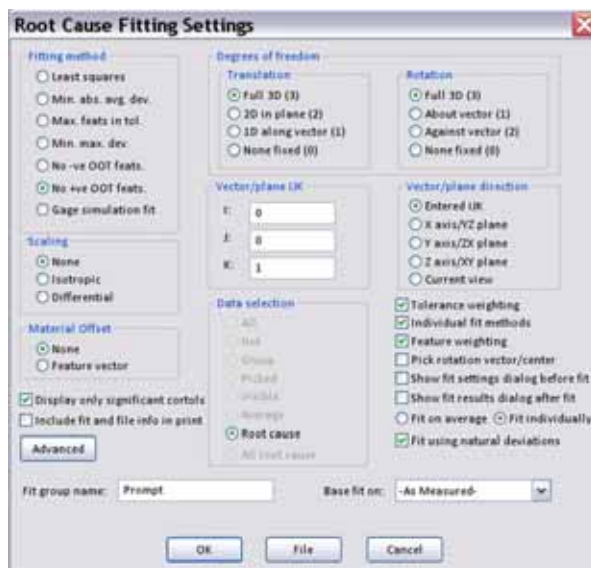

Fig. 5

Additionally SoftFit Solver operations can be performed on multiple parts simultaneously. This capability is crucial when solving process related problems. Avoid making knee jerk solutions based on a single which inevitably lead to yet another tooling iteration.
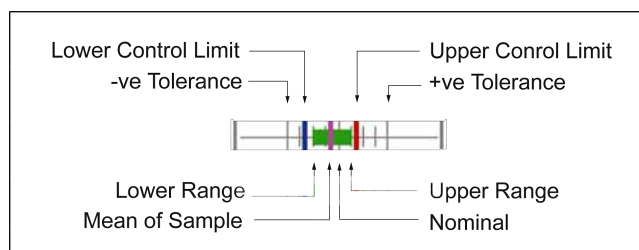

Fig. 6

The effect of proposed corrective action on SPC calculations can also be simulated prior to making tooling changes. Fig. 6. a legend of the information presented in the X-Bar column of the browser, traditionally represented in a histogram.

SoftFit Solver is a production proven application available as a stand alone application or totally integrated with the entire suite of CheckMate dimensional metrology software to provide a seamless solution from inspection planning to final part approval.