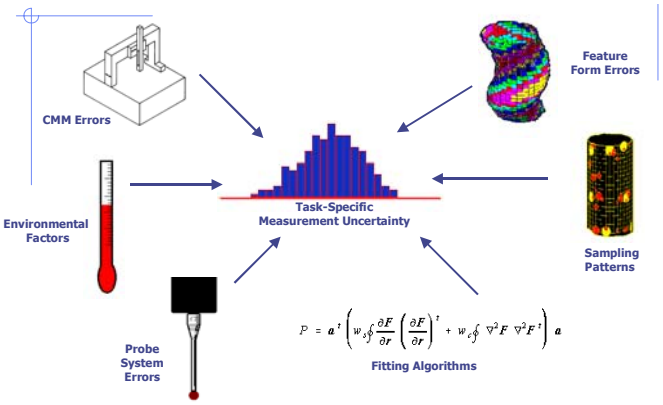
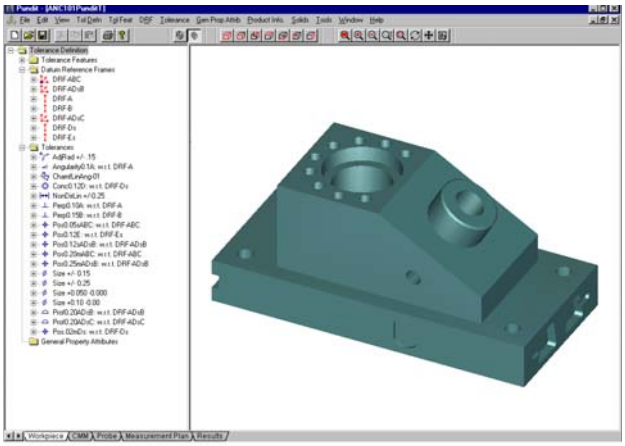
MetroSage

Proudly announces development of PUNDIT/CMM™, a new software product for determining uncertainties in measurements made during CMM-based part inspections.

Many factors contribute to the uncertainties in CMM-based measurements. The part, the CMM, probing systems, environmental conditions, sampling strategies and analysis algorithms all play a role. Combining these factors properly is a difficult and complicated task. PUNDIT/CMM takes full advantage of recently developed statistical methods to provide this capability, yielding an uncertainty estimate for each CMM measurement.





PUNDIT/CMM workpiece window where parts are imported or created, and checked for correct tolerancing

Why is PUNDIT/CMM necessary? ***The simple answer is that it can simultaneously enhance manufacturing credibility and save money. It is designed to directly address important manufacturing issues such as these:***

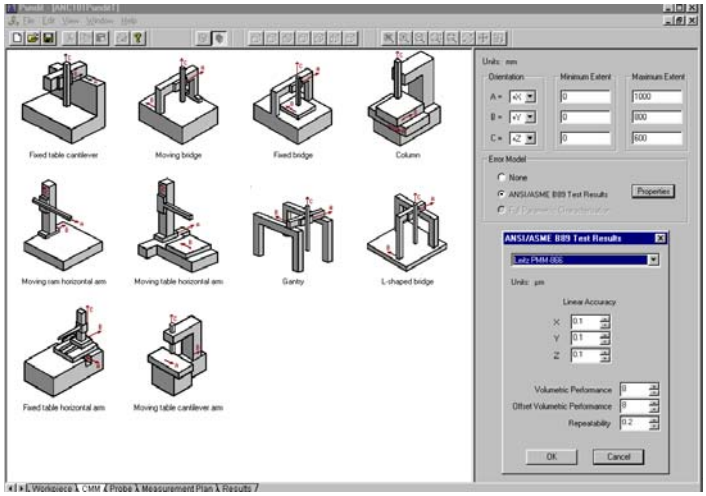
ISO 9000 certification and conformance - ISO 9000 - 2000 stipulates that "Measuring and monitoring devices shall be used in a manner that ensures that measurement uncertainty...is known and is consistent with the required measurement capability." For CMMs, this is a stringent requirement that is not satisfied merely by reporting the manufacturer's estimate of the single point uncertainty. Indeed, it is not satisfied by the B89 test suite or even by a full parametric characterization of the CMM. What is required is a task-specific error estimate for each and every GD&T parameter. It is necessary to make statements like, "The uncertainty of the diameter of this nominally ¼-inch diameter hole is *X*, at *Y*% confidence." All potential sources of error must be considered and must be propagated in a statistically valid way to yield an uncertainty on each measurement result. There is at present no generally valid method for generating such statements for results of CMM measurements.

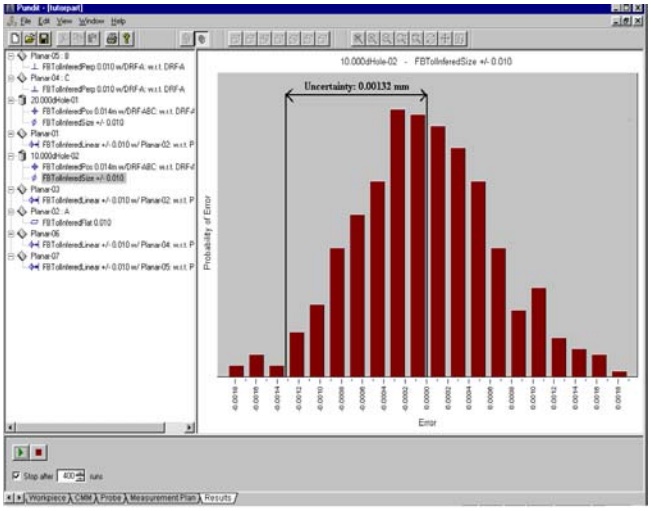
Uncertainty estimates for product conformance or arbitration - In order for a producer to establish conformity to specifications, it must, according to ISO 14253-1, be shown that the product dimension lies within the specified tolerance zone *minus* the magnitude of the uncertainty of the measurement. Thus, measurement uncertainty must be known. Furthermore, to maximize the yield of certifiably good product, steps should be taken to reduce the measurement uncertainty.

PUNDIT can answer specific questions about the measurement of manufactured parts:

- From simple, easy-to-make measures of CMM performance, e.g. the B89 suite of tests, it can produce the required *task-specific* uncertainty statements described above.
- It can determine if the part is completely, consistently and unambiguously toleranced, frequently one of the most contentious issues surrounding the design, production and certification processes. Furthermore, it can make this determination *before* a design is committed to production.
- It can determine which, of a stable of CMMs, are up to the task of a specific measurement or direct the optimum allocation of measurement resources by avoiding unnecessary measurement overkill.
- It can aid in determining which aspect of the measurement process is the "weak link," allowing the user to efficiently focus resources on improving measurement precision.
- It can inform and assist in the process of acquiring new CMM resources or can bring an additional level of confidence in outsourcing measurement work.
- It can be a valuable asset in the development and training of new CMM operators.

The CMM definition window of PUNDIT/CMM allows the user to define CMM geometry and workspace dimensions, and to enter CMM performance data. These might be B89 test results, or just the CMM manufacturer's specifications, or perhaps some other available information. The more specific the data provided by the user, the greater the precision of the uncertainty estimates. Data for a user's entire stable of CMMs can be stored on line, allowing ready comparison of their respective abilities to adequately perform one or more specified measurement tasks.





PUNDIT/CMM simulates part inspections, gathering statistical data on the variability of each measurement result. These are presented in an easy- to-interpret graphical format. The user can see immediately how a specified inspection protocol will perform in providing the level of certainty required for the application at hand. If it is found that the estimated uncertainty is too large, alternative schemes, such as taking additional measurement points or using a different probe system, can be quickly evaluated and compared.

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