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Software to Report Product and Manufacturing Information in QIF Files

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1. Summary

The QIF PMI Report (QPR) software generates a spreadsheet from a Quality Information Framework (QIF)[1] file containing Product and Manufacturing Information (PMI). QIF is a unified XML framework standard for computer-aided quality QIF systems, available free to all implementers. QIF enables the capture, use, and re-use of metrology-related information throughout the Product Lifecycle Management (PLM) and Product Data Management (PDM) domains. QIF was created by the Digital Metrology Standards Consortium[2].

PMI consists of annotations and attributes that define product geometry and product specifications. PMI includes annotations to specify Geometric Dimensioning and Tolerancing (GD&T), as well as non-geometric data such as surface texture specifications, finish requirements, process notes, material specifications, and welding symbols. GD&T is a symbolic language used to communicate tolerances on manufactured parts [1]. PMI in QIF is defined by the QIF MBD (Model-based Definition).

The resulting QPR spreadsheet creates a visual presentation of the PMI from its semantic definition in the QIF file. Measurements and persistent identifiers (QPids) are also reported. QPR does not consider any of the graphical PMI in a QIF file. Figure 1 shows an example of a reference dimension from a QIF file and how it is presented in the QPR spreadsheet.

[1] https://qifstandards.org/
[2] http://www.dmsc-inc.org/

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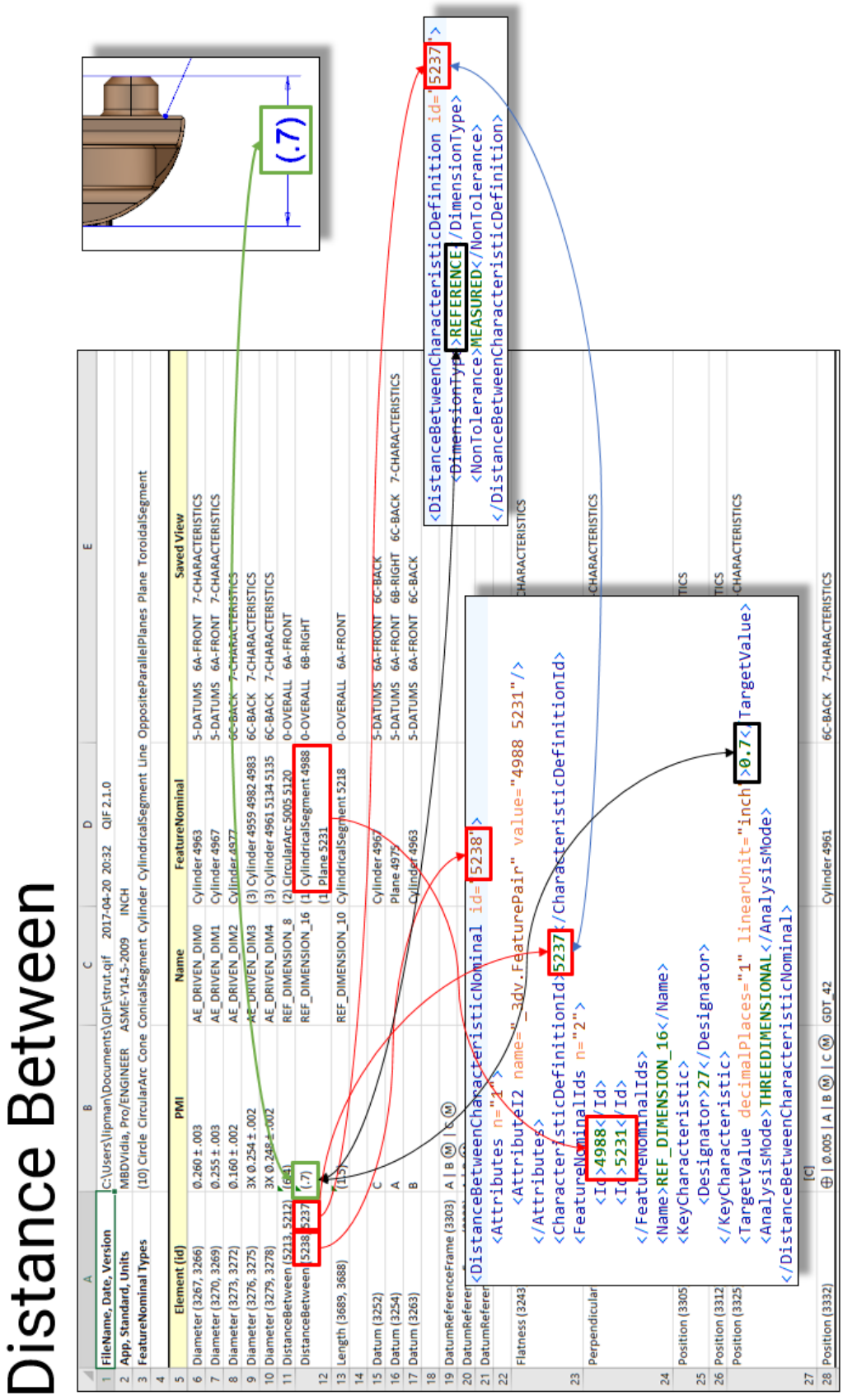

Fig. 1. QPR example of a DistanceBetween from a QIF file.

The upper right of the figure contains a section of a part drawing with a reference dimension of 0.7 units between two surfaces of a part. Reference dimensions have parentheses around the dimension value. The two boxes in the foreground contain sections of a QIF file for information related to the dimension. A dimension that is measured between two surfaces is known in QIF as a DistanceBetween. The box on the left contains the DistanceBetweenCharacteristicNominal information and the box on the right contains the DistanceBetweenCharacteristicDefinition information from the QIF file.

In the background is part of the spreadsheet generated by QPR from the QIF file. Each row, starting with row 6, is a different instance of PMI from the QIF file including dimensions, datums, datum reference frames, and geometric tolerances. Row 12 contains the information for this DistanceBetween example.

The red boxes outlining several IDs show how they correspond between the QIF file and resulting spreadsheet. The blue arrow shows how the IDs relate to each other within the QIF file. The black boxes outline information for the dimension value of 0.7 and dimension type of REFERENCE which is used to create the visual appearance of the reference dimension in cell B12. The reference dimension '(0.7)', outlined in green, corresponds to the reference dimension on the part drawing in the upper right.

The QPR software documentation contains a more detailed explanation of this example and examples for the other types of PMI shown in the spreadsheet.

2. Software Specifications

NIST Operating Unit(s)	Engineering Laboratory, Systems Integration Division
Category	Analysis
Targeted Users	Software developers and end-users of QIF files in CAD software
Operating System(s)	Windows
Programming Language	Tcl
Inputs/Outputs	Input: QIF file, Output: Microsoft Excel spreadsheet
Documentation	Documentation for running QPR and the spreadsheet output is included with the software download at https://www.nist.gov/services-resources/software/qif-pmi-report-software
Accessibility	If applicable, include statement on 508 Compliance.
Disclaimer	https://www.nist.gov/director/licensing

3. Methods for Validation

This software is run from a command-line prompt. The software was tested with QIF version 2.0, 2.1, and 3.0 files from the QIF repository[3].

4. References

[1] Lipman R, Lubell J (2015) Conformance checking of PMI representation in CAD model STEP data exchange files. *Computer-Aided Design* 66:14-23. https://doi.org/10.1016/j.cad.2015.04.002.

About the author: *Robert R. Lipman is a Research Engineer in the Systems Integration Division at NIST. He develops software to support the exchange of product definitions and development of standards for smart manufacturing. The National Institute of Standards and Technology is an agency of the U.S. Department of Commerce.*

[3] https://github.com/QualityInformationFramework?tab=repositories