

MBE & QIF SUMMIT

DMSC: Impacting the **Digital Thread** with Quality

One Consortium with a Trinity of Interoperability Standards



DMSC

*Driving Interoperability in Digital
Metrology & Manufacturing*

DMSC
Digital Metrology Standards Consortium

DMIS
by DMSC

QIF
by DMSC

MBC
by DMSC

Curtis W. Brown
Principal Engineer, Honeywell FM&T*
President, DMSC

**One Consortium;
Trinity of Interoperability Standards**

* The Department of Energy's Kansas City National Security Campus is managed and operated by Honeywell Federal Manufacturing & Technologies, LLC under contract number DE-NA0002839

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Abstract

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- The Dimensional Metrology Standards Consortium (DMSC) is a non-profit, ANSI-accredited standards organization focused on advancing digital metrology through open, interoperable standards. Founded in 1983 and established as an independent legal entity in 2005, the DMSC serves a global membership of manufacturing metrologists, software developers, and technology innovators.
- The DMSC is the maintainer of the Dimensional Measuring Interface Standard (DMIS), the developer and maintainer of the Quality Information Framework (QIF), and the developer of the emerging Model-Based Characteristics (MBC) standard. This presentation provides an overview of the DMSC and its standards portfolio, with updates on DMIS, QIF, and MBC, and explains how these standards work together to support interoperability and connectivity across the digital thread.
- Finally we will share some new initiatives and things you need to know.

Agenda

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- DMSC Brief
- DMSC Interoperability Standard Briefs
 - Dimensional Measuring Interface Standard (DMIS)
 - Quality Information Framework (QIF)
 - Model-Based Characteristics (MBC)
- DMSC New Task Group Initiative
- DMSC Statements
- DMSC Recognitions
- DMSC Final Word

What is the DMSC?

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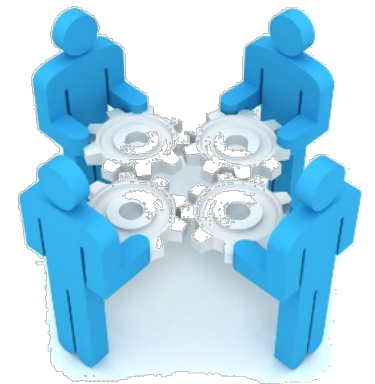
Digital Metrology Standards Consortium (DMSC)

Mission: *We provide a standardized, interoperable, data framework for manufacturing.*

Vision: *Quality Standards that impact the digital thread through digital **metrology** and interoperability.*

Tagline: *Impacting the Digital Thread with Quality*

Goal: *Develop, maintain, and support industry standards that enable and enhance digital metrology workflows in a model-based extended enterprise.*

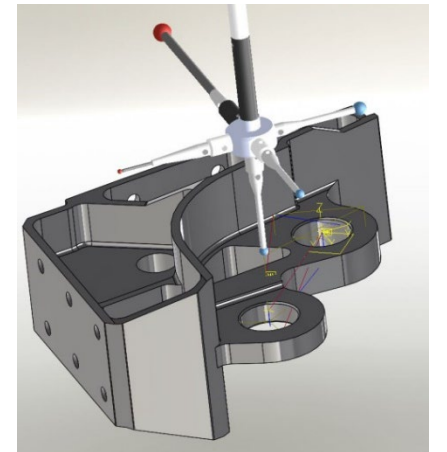


Who is the DMSC?

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Digital Metrology Standards Consortium (DMSC)

- A **not-for-profit**, cooperative sponsorship, **consortium** organization. Conceived & sponsored in 1983; Separate legal entity 2005.
- Dedicated to identifying, promoting, fostering, and encouraging the **development** and **interoperability** of standards that benefit the digital manufacturing metrology community.
- Preparing standards that **impact** the digital **model-based quality** enterprise.
- A professional **group** of manufacturers, metrologists, software developers, and innovators worldwide.
- **ANSI accredited** standards making organization
- Maintainers of **Dimensional Measuring Interface Standard (DMIS)** standard.
- Developers & maintainers of **Quality Information Framework (QIF)** standard.
- Developers of **Model-Based Characteristics (MBC)** DMSC standard.
- **A-Liaison** member of **ISO / TC184 / SC 4** (The makers of STEP)



DMSC Objectives . . .

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- **Reduce the cost of product quality**
- **Develop** and maintain **trusted digital** interoperability standards
- **Interconnect Quality** within the **digital tread**.
- **Enable** digital **metrology** within manufacturing, specifically within Model-Based Enterprise
- **Enable** organizations the **freedom** to choose solutions
 - **Best in class**
 - **Best in value**
 - **Best in connection**

DMSC Expanded our Leadership Team

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- DMSC expanded our leadership team to support our continued growth and increased member engagement. Welcome Alana!

Alana Duma:



Marketing & Membership Director, leading outreach, communications, and membership growth initiative in collaboration with Mark and Board.

Mark Thomas:



Administrative Director, supporting governance, operations, and standards activities while retaining external title of Executive Director.

State of the DMSC

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- **DMSC BoD members:**

- Evan Kissick (Elysium) – New Termed
- Daniel Campbell (Rubypoint) – New Termed

- **Joined BoD Members:**

- Jeremy Hamilton (Deere & Company)
- Sam Gambrell (Lockheed Martin)
- Jennifer Herron (Action Engineering)
- Hermitt Vega (Pratt & Whitney)

- **DMSC Officers:**

- President: Curtis Brown (Honeywell FM&T)
- Treasurer: Rosemary Astheimer (Acting)
- Secretary: Sam Gambrell (Lockheed Martin)

Directors:

- Administrative: Mark Thomas
- Membership & Marketing: Alana Duma

Board-Led Committees

- Financial
- Strategic
- Marketing
- Recognition
- SDO Liaison

DMSC Membership

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- Welcome Most recent DMSC Member:
 - Warwick Manufacturing Group, UK
 - Verisurf
- Joined DMSC Members:
 - 2B Mobile
 - Action Engineering
 - Capvidia
 - Collaboration Synergies
 - Deere & Company
 - Discus Software
 - Elysium
 - High QA
 - Honeywell FM&T
 - Hexagon
 - IIGDT
 - Innovmetric
 - ITI – International TechneGroup
 - LK Metrology
 - Lockheed Martin
 - Los Alamos National Laboratory
 - Metrologic DCS
 - MetroSage
 - Mitutoyo America Corporation
 - National Manufacturing Institute Scotland (NMIS)
 - Newport News Shipyards
 - OGP / Kotem
 - Origin
 - Pratt & Whitney
 - Purdue University
 - Renishaw
 - Rubypoint
 - Samwell Group
 - Sandia National Laboratory
 - Schneider Electric
 - Sigmetrix
 - Smart Product Development
 - TechAzul
 - Thomas Kramer Consulting, LLC
 - University of North Carolina Charlotte

DMSC Restructured Website

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Digital Metrology Standards Consortium Supports QIF Standard

QUALITY INFORMATION FRAMEWORK (QIF)

Unified XML Framework Standard for
CAD Quality Measurement Systems

The **Quality Information Framework (QIF)** is a unified XML framework standard for computer-aided quality QIF systems, available free to all implementers.

Standards

Resources

[Get Involved | Working Groups, Meetings, Events](#)
[Resources](#)
[DMSC in the News](#)
[Community Hub](#)
[Submit Standards Issues & Improvements](#)

Events

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DMSC's Standards

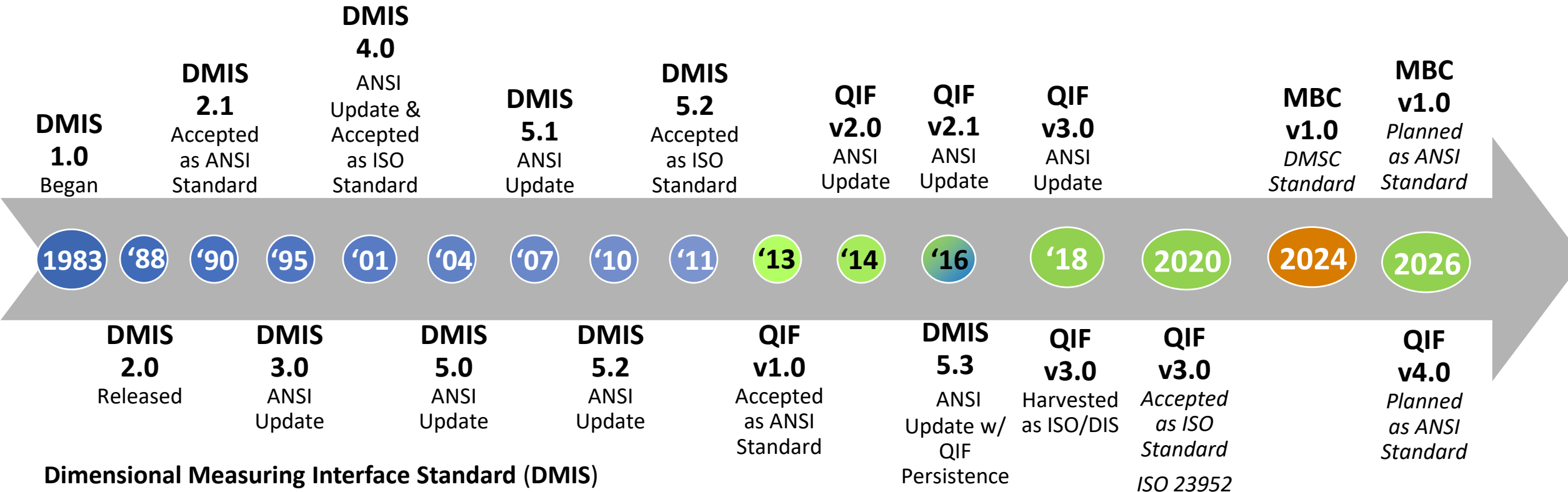
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- **DMIS – Dimensional Measurement Interface Standard**
 - Established ANSI standard & harvested as ISO Standard
- **QIF – Quality Information Framework**
 - Established ANSI standard & harvested as ISO Standard
 - Update in work for future QIF 4.0
- **MBC – Model-Based Characteristics**
 - Established DMSC standard
 - In-work as ANSI standard
 - Delay due to DMSC Special Audit
 - Re-approval of new DMSC ANSI Procedures



DMSC's Quality Standards Pedigree

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Dimensional Measuring Interface Standard (DMIS)

Quality Information Framework (QIF)

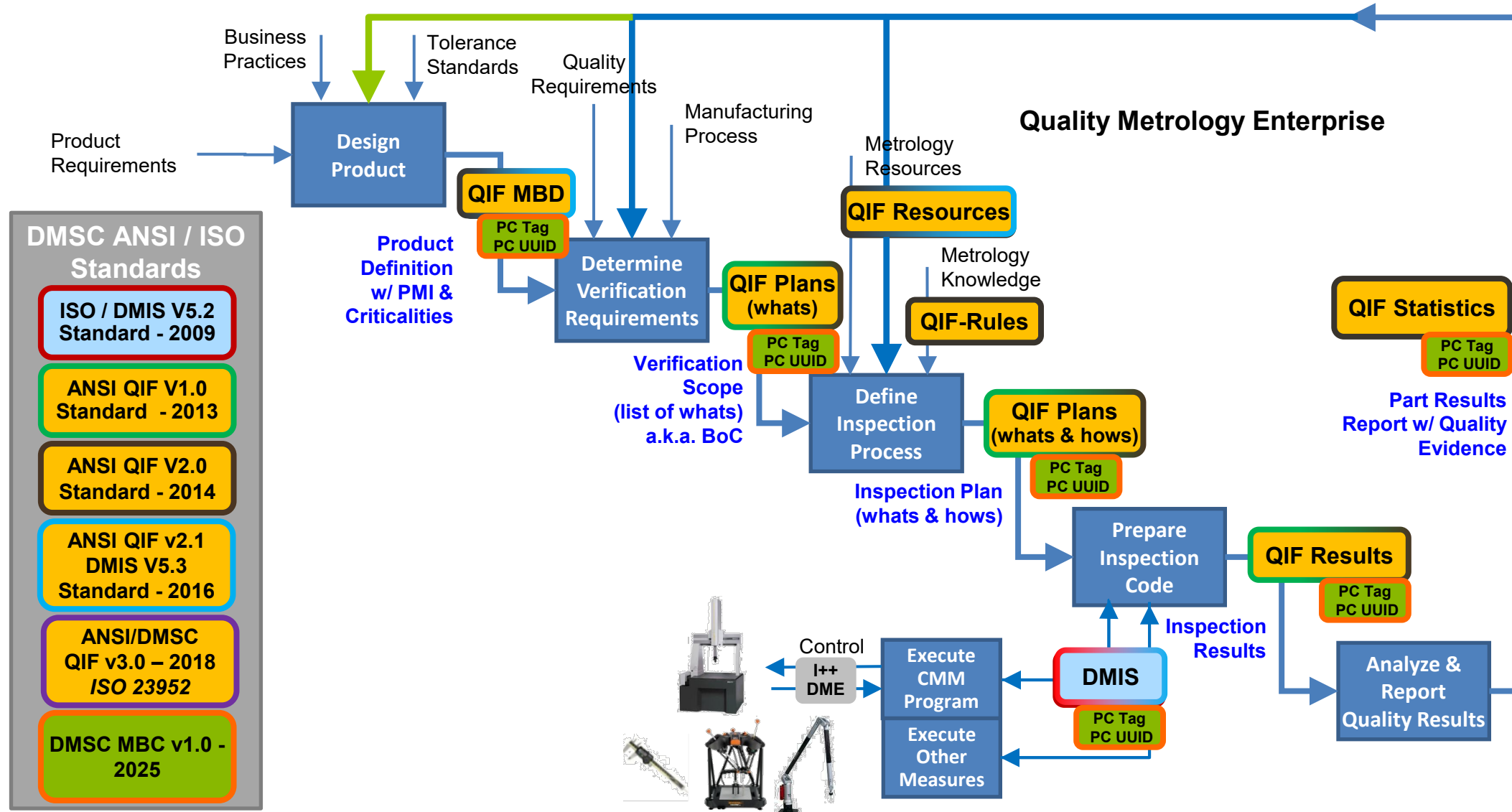
Model-Based Characteristics (MBC)

ISO 22093:2011 – Industrial automation systems and integration – Physical device control – Dimensional Measuring Interface Standard (DMIS)

ISO 23952:2020 – Automation systems and integration — Quality information framework (QIF) — An integrated model for manufacturing quality information

DMSC Standards Activity Workflow

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What is DMIS?

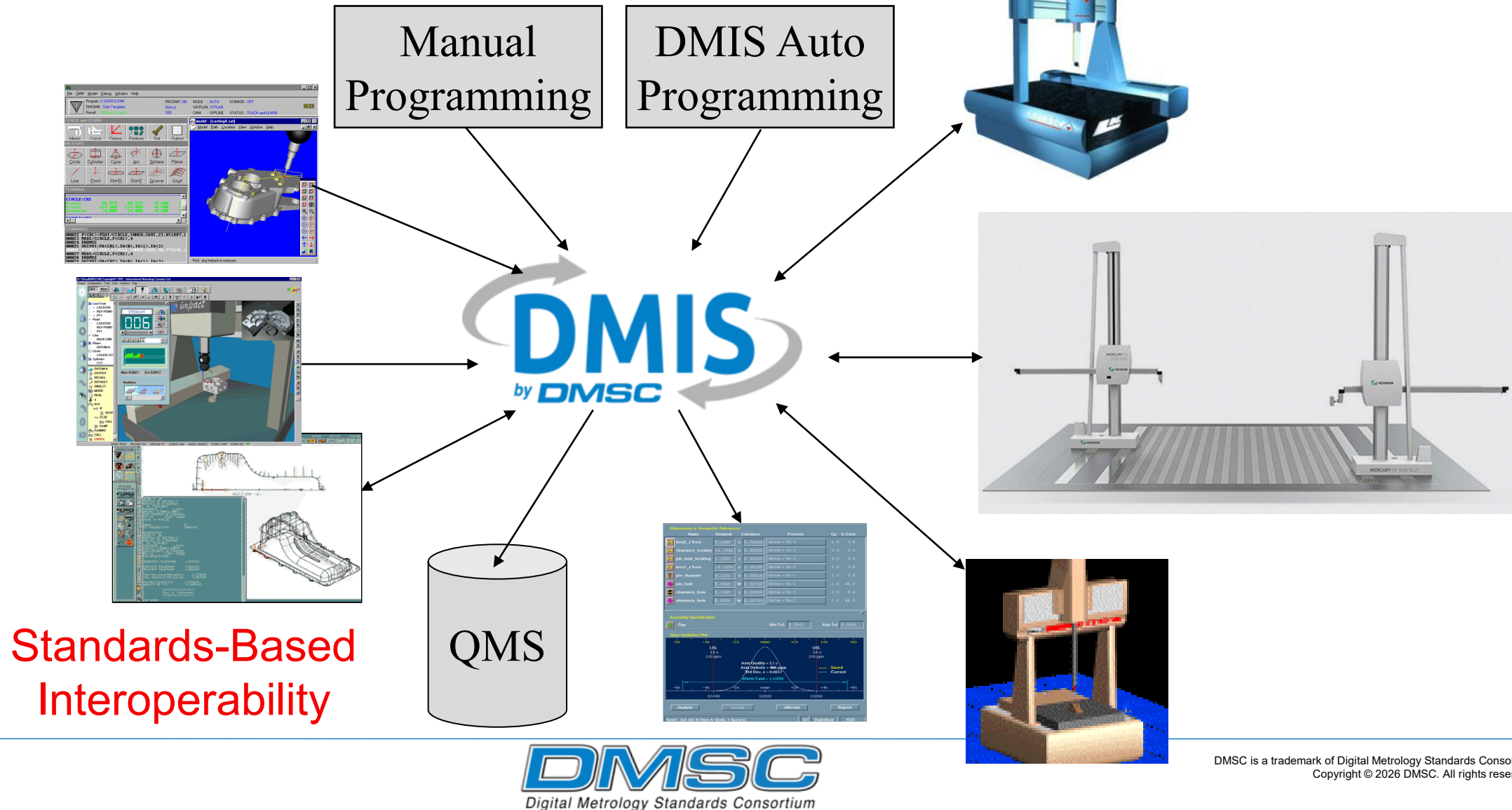
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- **Dimensional Measuring Interface Standard (DMIS)** is an internationally recognized standard carrying **ISO 22093:2011** status and is one of the most widely used standards related to dimensional metrology in the world. This standard has contributed to significant improvement of interoperability between CMMs, and traceability of measurement processes.
 - Bi-direction communication of information between computer systems and inspection equipment (e.g., CMM)
 - Establish neutral format for inspection programs and inspection results data.
 - Enables machine-readable between computer equipment
 - Allows human-readable and human-writable
 - Inspection Program
 - Inspection Results
 - Contains high-level language extensions
 - Functions as a Dimensional Measuring Equipment (DME) language.
 - Provides Standard vocabulary of terms that support
 - Exchange of Inspection Program to DME Execution systems
 - Exchange of measurement and process data back to an analysis, record, and/or archiving systems.



DMIS Part Program Data Exchange Format

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ANSI/DMSC DMIS 5.3

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- ANSI/DMSC DMIS 5.2 – harvested as: ISO 22093:2011
- ANSI/DMSC DMIS 5.3 – includes updates with data traceability mechanisms to QIF (e.g., QIF Persistent IDs (QPIDs) from ANSI/DMSC QIF 3.0 - 2018, aka UUIDs).
- DMIS Standard is Now **FREE**
 - ANSI/DMSC 105.2-2009 (aka DMIS 5.2 (Harvested as ISO 22093:2011))
 - ANSI/DMSC 105.3-2016 (aka DMIS 5.3)



ANSI/DMSC QIF 3.0 - 2018

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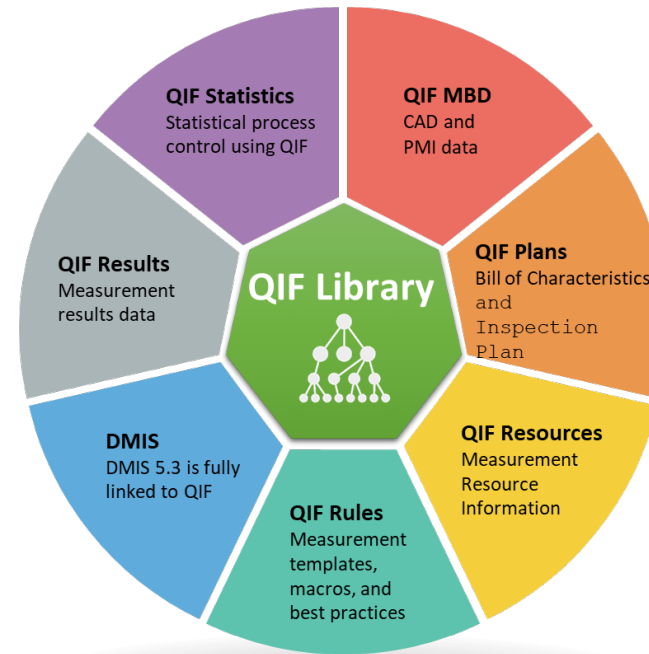
- ANSI Approved: October 5th, 2018
- Information Model: Schema: XSD/XSLT
- Normative Document: PDF



Quality Information Framework (QIF) – An Integrated Model
for Manufacturing Quality Information

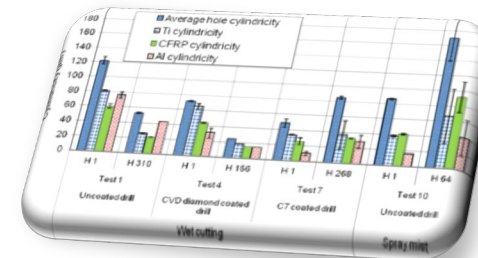


QIF Version 3.0
ANSI/DMSC QIF 3.0 - 2018
Digital Metrology Standards Consortium, Inc. (DMSC)



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-
- A 3D model of a mechanical part, likely a bracket or support, showing various dimensions and tolerances. The model is dark gray and features several holes and slots. Dimensions are indicated by blue arrows and labels:
- Top Left:**
 - Slot width: 0.06 ± 0.01
 - Slot depth: 0.08 ± 0.01
 - Distance from top edge to slot center: 0.08 ± 0.01
 - Top Right:**
 - Overall height: 0.08 ± 0.01
 - Internal hole diameter: Ø 0.08 ± 0.01
 - Internal hole depth: 0.08 ± 0.01
 - Middle Right:**
 - Overall width: 0.08 ± 0.01
 - Internal hole diameter: Ø 0.08 ± 0.01
 - Internal hole depth: 0.08 ± 0.01
 - Bottom Right:**
 - Overall width: 0.08 ± 0.01
 - Internal hole diameter: Ø 0.08 ± 0.01
 - Internal hole depth: 0.08 ± 0.01
 - Bottom Center:**
 - Slot width: 0.06 ± 0.01
 - Slot depth: 0.08 ± 0.01
 - Distance from bottom edge to slot center: 0.08 ± 0.01



QPIDs – Persistent UUID within the QIF

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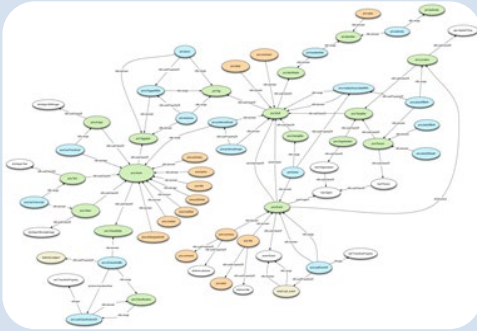
QIF Persistent Identifier (QPId) *noun* Cu·pid \'kyü-pəd\ aka UUID

- QIF - The first open-standard containing persistent UUIDs (QPIDs) 2016
- Universally Unique Identifier (UUID) (adopted by Microsoft as GUID)
 - ISO/IEC 9834-8
 - 550e8400-e29b-41d4-a716-446655440000
- Chances of generating two that are the same within the universe are practically nil.
 - 3400000000000000000000000000000000000000000000000000000000000000 (3.4x10³⁸) possible UUIDs
- **Allows information to be combined later without resolving identifier conflicts**
- Many software development libraries generate UUIDs
- QPIDs (UUIDs) uniquely identify
 - **QIF Document**
 - QIF Plan
 - QIF Result
 - QIF Rule Set
 - Feature Item
 - **Characteristic Item**
 - Product Item
 - Resource Item

An Important Mechanism that facilitates Lifecycle Connectivity w/ Traceability

What is the QIF?

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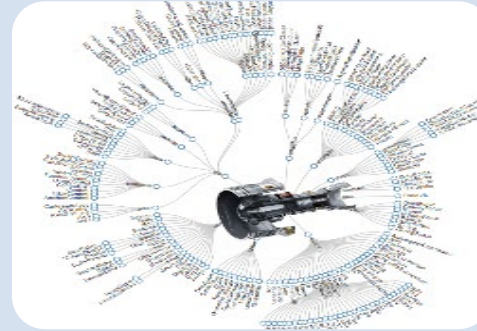
Characteristic-Centric,
Feature-Based
Ontology of
Manufacturing
Quality
Metadata

(Structured Data)



XML
Technology:
Simple, Modern
Implementation
with Built-In
Code Validation

(Modern Approach)



Information
Semantically
Linked to the
Model-Based
Definition for
Full Information
Traceability

(Connected Data)



Approved ANSI
Interoperability
Standard

Harvested by
ISO/TC 184/SC 4
as ISO/QIF 23952

(Standard Artifacts)

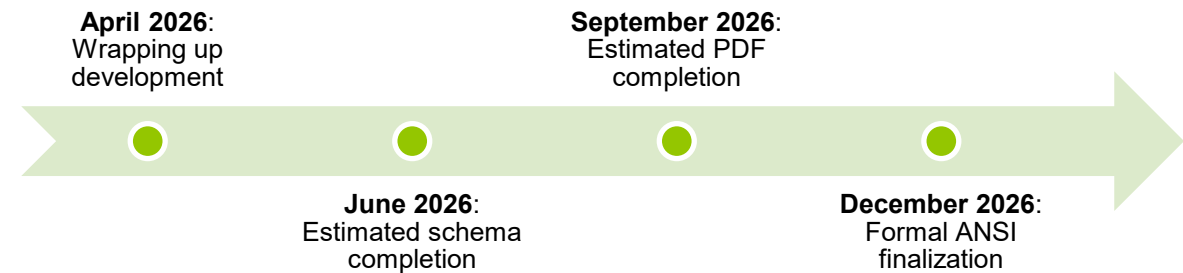
Upcoming QIF 4

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Major Enhancements

- Inclusion of updates to ASME Y14/MBD and ISO GPS standards since QIF 3.0 release
- Improved Resources model with additional measurement devices and digital calibration certificates
- Harmonization with Model-Based Characteristics (MBC)
- Edge condition PMI per emerging standards in this area
- General small improvements to schema friendliness and clarity
- Improved PDF documentation

Timeline



All dates are approximate. Remember that QIF 3 is stable and widely used, so we are not in a rush!

How to get involved

- Join the QIF Working Group meetings
- View the current status and project plan:
<https://github.com/QualityInformationFramework/qif-dev> (DMSC members only)
- Join the DMSC to support the work!

QIF Is Expanding Beyond Metrology

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- **Industry Adoption Is Driving New Use Cases**
 - The **Digital Metrology Standards Consortium (DMSC)** is observing how QIF is being adopted across industry.
 - Increasingly, QIF is used **not only for inspection workflows but for broader model-based interoperability**.
 - The **QIF-MBD** schema is being adopted as a **general-purpose MBD exchange format**.
 - Several **CAM** and **CAE** systems are adding importing of **QIF-MBD** to access semantic product definition.
 - This signals an important shift:
- **QIF is evolving from a metrology standard →
→ to a broader MBX interoperability standard.**

(MBX = Model-Based “Anything”: manufacturing, simulation, analysis, verification, etc.)

Opportunities for Expanding QIF

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- **A Platform for Model-Based Applications**

- The existing QIF architecture already enables expansion beyond inspection.

- **QIF-MBD**
- QIF-Plans



- QIF-Resources
- QIF-Rules

- **Future Opportunity**

These schemas can be extended to support additional model-based workflows:

- **Manufacturing applications** (CAM process planning, toolpaths, setup definitions)
- **Simulation & CAE workflows** (analysis models tied to product characteristics)
- **Digital thread orchestration** linking design intent to downstream execution
- **New domain-specific QIF applications** developed by industry

- **Key Idea**

- QIF can serve as a **neutral, standards-based backbone for the digital thread.**

DMSC Model-Based Characteristics v1.0

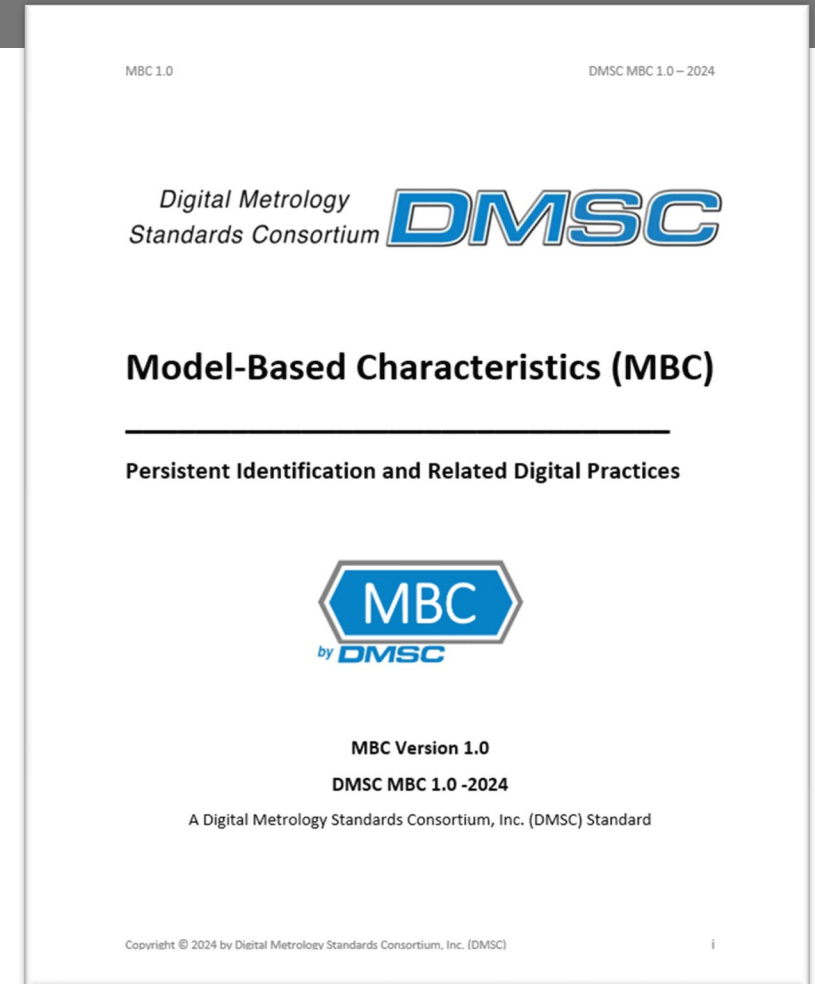
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Newest DMSC Standard:

- **defines** common nomenclature, definitions, symbols, data structures
- **practices** for identifying, communicating, and exchanging model-based characteristics with various optional augmentations
- **behaviors** within a model-based system
- **through** both a logical data model and supporting documentation.

MBC: The Atomic Link for the Digital Thread

Model-Based Characteristics introduce **persistent identifiers (UUIDs)** and **characteristic tags** that create stable references to **individual product characteristics**. This lowers the digital thread anchor from the **part level** to the **characteristic definition level**, enabling true traceability across the lifecycle.

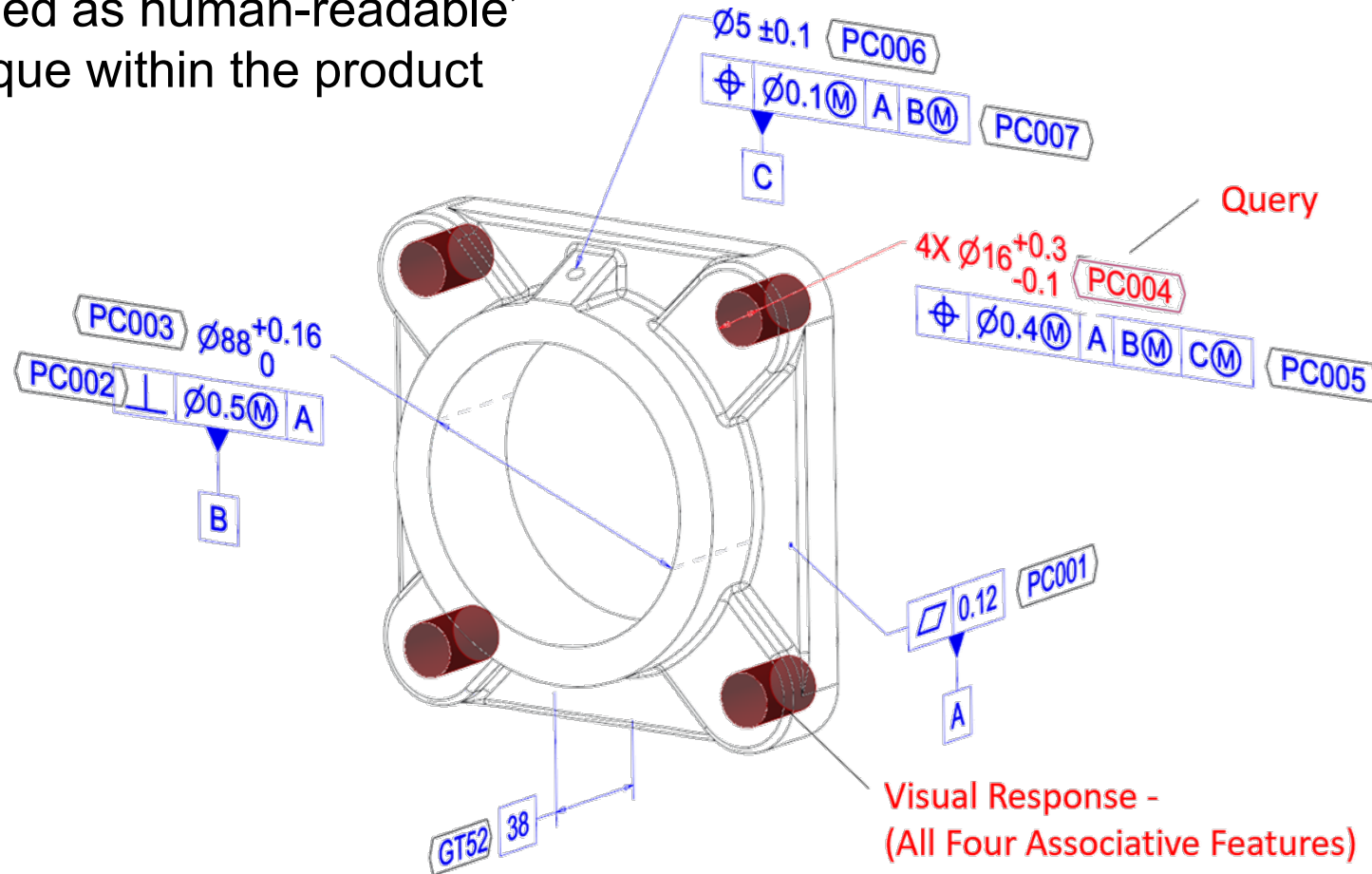


Establishes digital thread connection points at the product characteristic level.

Product Characteristic (PC) Tag w/Annotation

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Electronic – Intended as human-readable'
Persistent and unique within the product

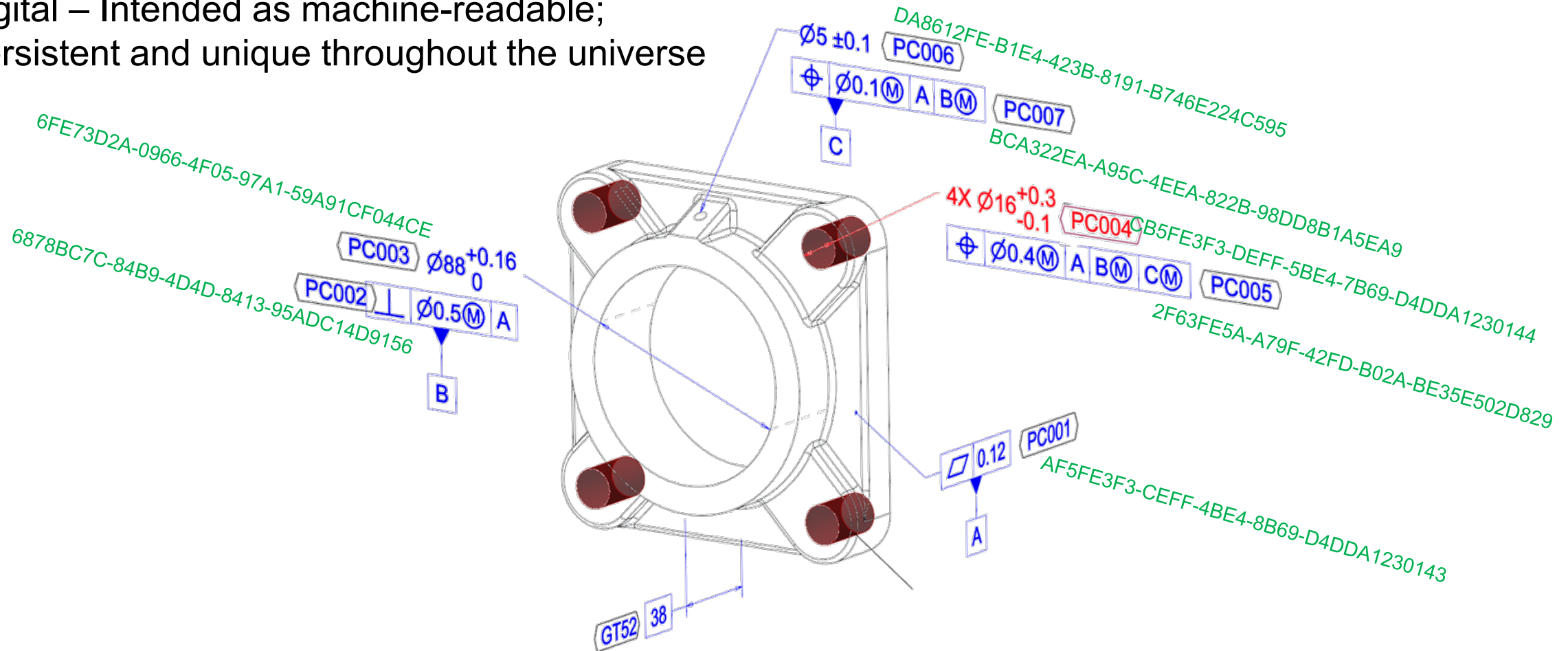


Visualization of a Product Characteristic Reference Tags on a Model-Based Definition

Product Characteristic (PC) UUID Attributes

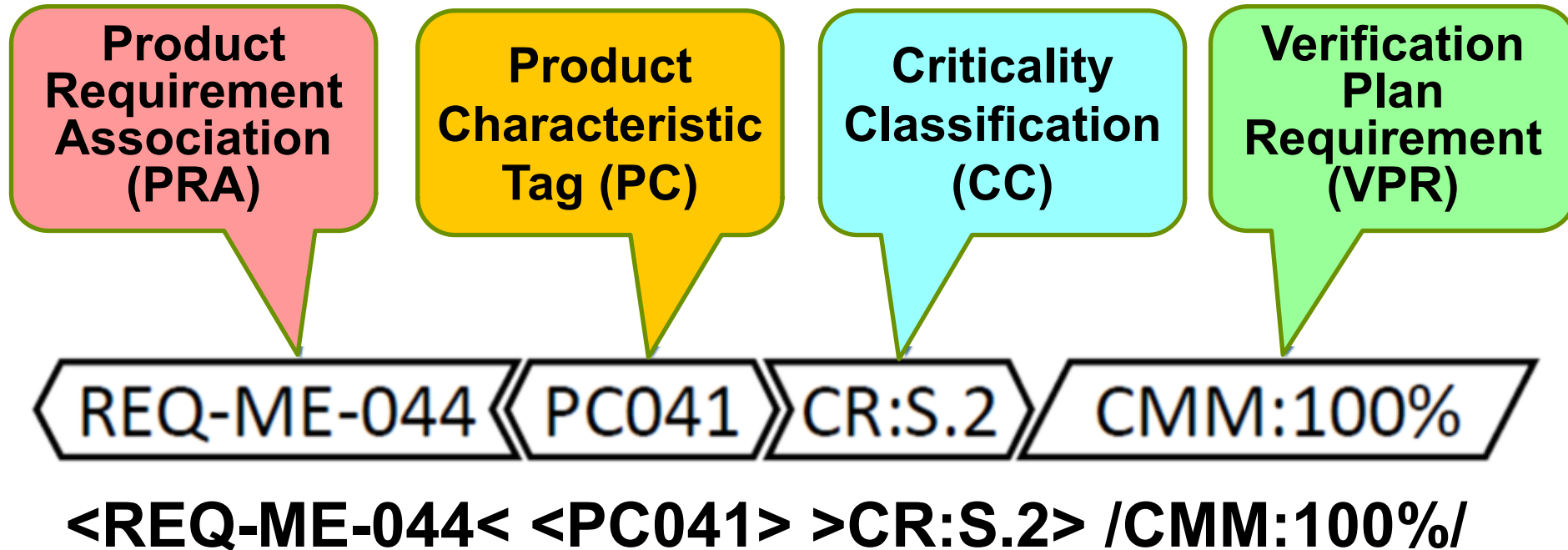
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Digital – Intended as machine-readable;
Persistent and unique throughout the universe



Representation of Product Characteristic Reference Tags & UUIDs within a Model-Based Definition

Product Characteristics Designations with all optional Augmentations Example



Primer Presented at PTC 2024 Global Summit, Jan. 2024
Presenting Primer at QIF Summit, Apr. 2024 @ MxD

Example: PC Reference Tag with Every Augmentations

New Initiative: QIF Interoperability - Task Group

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Why This Task Group Is Needed

- As adoption of **QIF** increases across software platforms, the next stage of standard maturity must address **cross-tool interoperability**.

Current Situation

- Many software vendors have successfully implemented **QIF support**
- **QIF conformance does not always guarantee interoperability**
- Standards-compliant implementations may represent data **in different valid ways**
- Differences can result in **QIF instance files that cannot be reliably exchanged between tools**

Industry Need

- The DMSC must promote the next stage of QIF maturity through:
 - **Measured interoperability testing**
 - **Validated implementation practices**
 - **Feedback into the QIF standard**

Scope

- **QIF 3.0 and newer**
- **Model-Based Characteristics (MBC) ecosystem**

QIF Interoperability - Task Group

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Charter

Advance QIF standard maturity by conducting metered conformance and interoperability testing and delivering tested recommended practices and implementation feedback to standards development and tool providers.

Vision

Ensure that **QIF conformance consistently results in reliable cross-tool interoperability**, enabling:

- Confident use of QIF across tools
- Consistent data interpretation
- Production-ready digital thread workflows

Chair(s):

Sam G - Lockheed Martin

Expected Outcomes

- **Measured interoperability test results**
- **Recommended implementation practices**
- Documentation for **tool providers**
- Feedback to **QIF standards development**
- Increased confidence in **QIF deployments**

Participants:

Jenifer H – Action Engineering

Evan K – Elysium

TBD - Capvidia

MCAD Suppliers

Consumers

Import/Export Suppliers

DMSC's Statements

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- QIF - The first open-standard that contained persistent UUIDs (QPIDs) 2016
- QIF - LOTAR Compliance Statement (working on paper – peer-review)
 - Contact me for details or participation
- QIF – Training & Certification Working Group
 - QIF - Executive Value Proposition
- Website adding a DMSC Marketplace page for DMSC Members
- Exploring offshore opportunities for future MBE & QIF Summit locations
- Dba: Digital Manufacturing Standards Consortium



- DMSC Recognition by Rosemary and others.

DMSC – Who, What, How

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- Who is the DMSC?
 - A professional **group** of **manufacturers**, **metrologists**, **software** engineers, & **digital** innovators worldwide.
- What is the DMSC currently doing?
 - Defining & maintaining quality **information exchange standards** like:
 - Dimensional Measuring Interface Standard (DMIS),
 - Quality Information Framework (QIF),
 - Model-Based Characteristics (MBC)
 - QIF Interoperability – Task Group
 - QIF Training and Certification – Working Group
 - QIF 4.0 – Working Group
 - QIF LOTAR Compliance Statement – Task Group
- How will DMSC membership benefit your company?
 - Next Slide
- How do I join the DMSC?
 - Final Slide

Benefits of DMSC Membership

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- **Influence the direction and evolution of the QIF standard**, including alignment with ISO
- **Participate directly in active DMSC Working Groups** developing new and emerging standards
- **Collaborate with industry leaders**, major OEMs, software developers, solution providers, end users
- **Engage OEMs that have adopted QIF** as part of their Model-Based Enterprise (MBE) strategies
- **Access Subject Matter Experts (SMEs)** with real-world QIF production implementation experience
- **Stay informed on emerging trends** in digital quality, metrology, and data-driven manufacturing
- **Support industry-wide interoperability** and standardized product quality data exchange
- **Gain insight into how QIF integrates with other standards**, STEP, MTConnect, & related frameworks
- **Solve shared metrology and quality challenges** through collaboration with other DMSC members
- **Build relationships with proven technology vendors** offering best-in-class products and services
- **Share and learn best practices** educational webinars, technical workshops, & roundtable discussions
- **Establish your organization as an industry thought leader** in digital metrology & quality standards
- **Access promotional opportunities**, no-cost webinars for solution providers to reach new audiences

Join the DMSC

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www.DMSC-Inc.org

Logos

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