IMTS and JIMTOF 2018 Grand Challenge and QIF
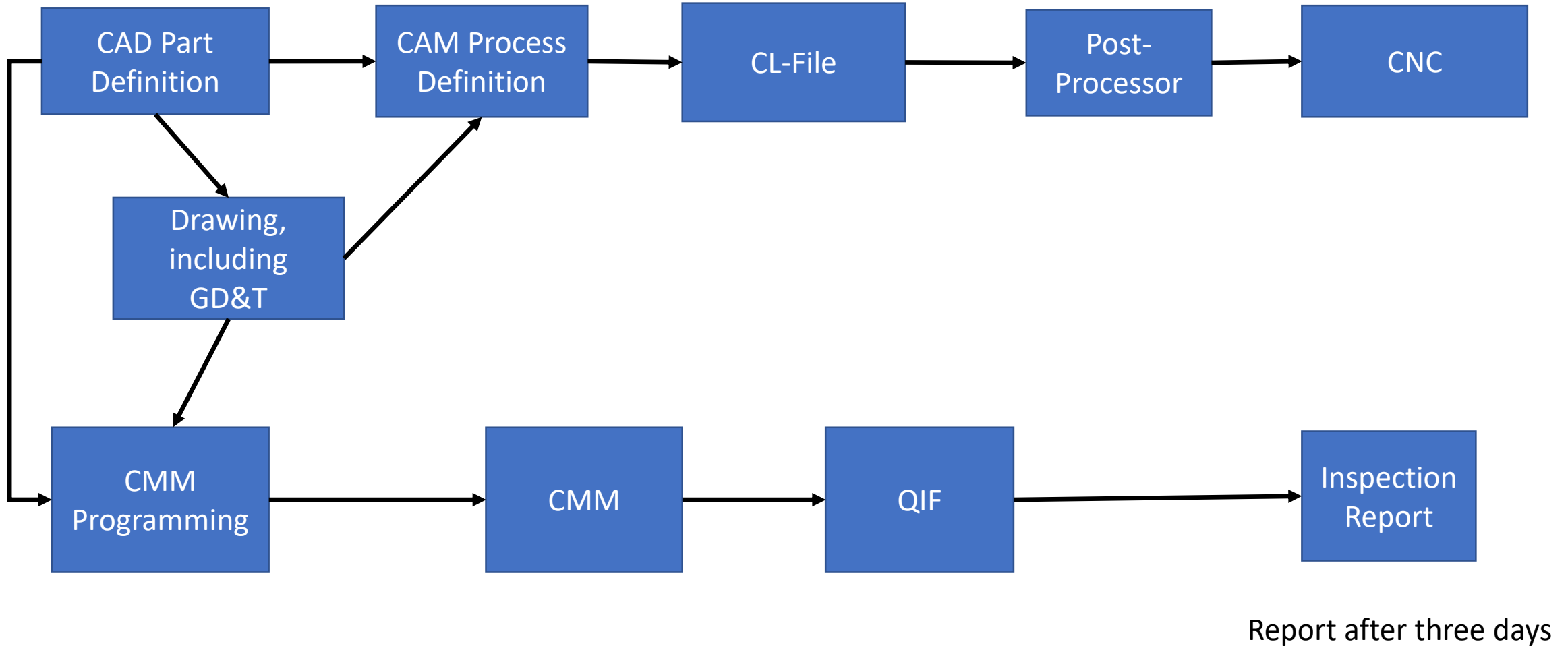
Dr. Martin Hardwick

Professor of Computer Science, RPI
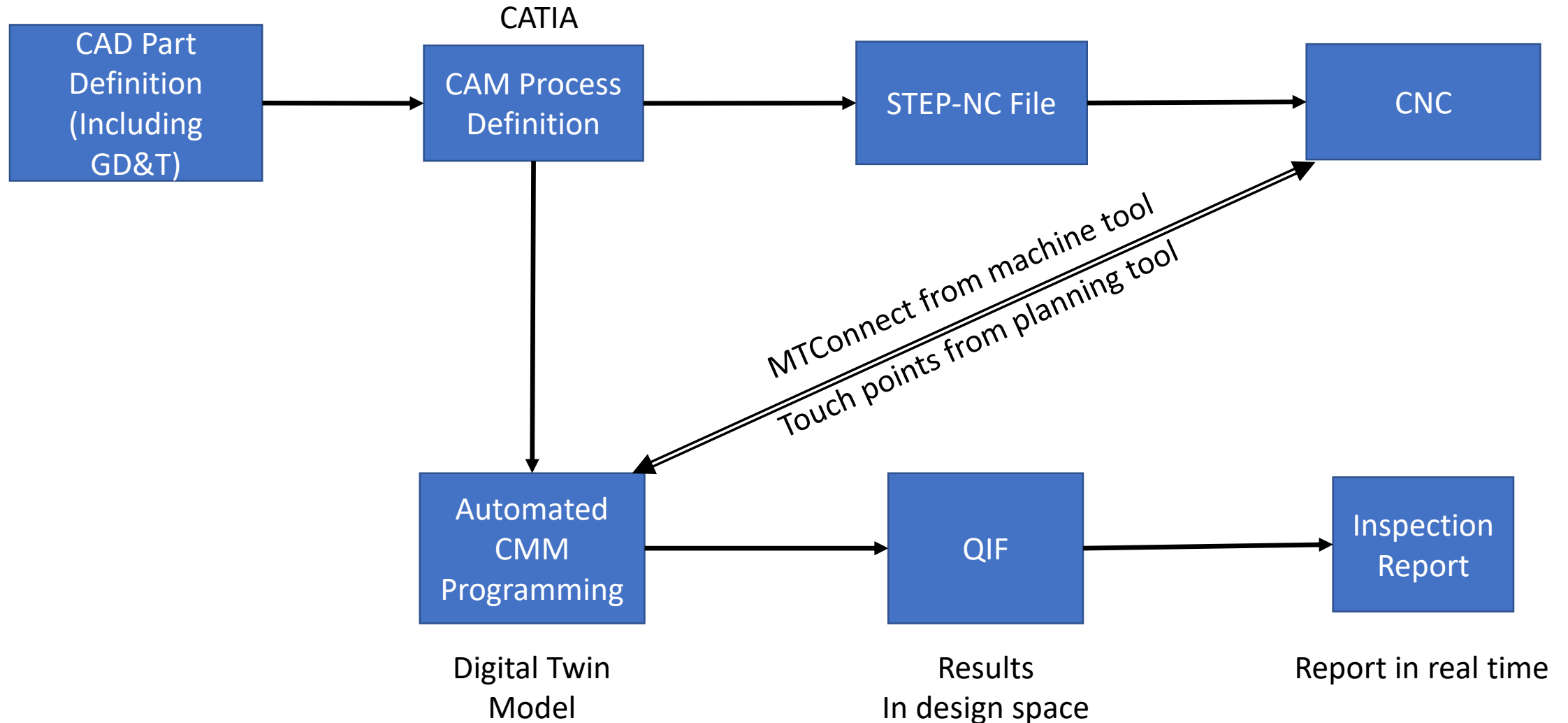
President STEP Tools, Inc.

Convener ISO WG15 Digital Manufacturing

Traditional Inspection Data Flow

Report after three days

# Grand Challenge Inspection Data Flow

The Grand Challenge and QIF

- QIF reports on the quality of a measured part.
  - How well the tolerances have been met
  - Using coordinates measured from the part surface
- Most measurements are made on a CMM but making measurements on the CNC has two advantages
  - Reduces time and costs by not requiring a CMM setup and programming
  - Enables on machine corrections before the machining is finished
- But in order to measure on the CNC we need a coordinate space
  - Machine tools operate in their own coordinate space
 - Designers and planners need the measurements in design or planning space

Design Space

- This is the coordinate system defined by the designer of the part
- He or she is the customer and the tolerances required by the customer must be met.
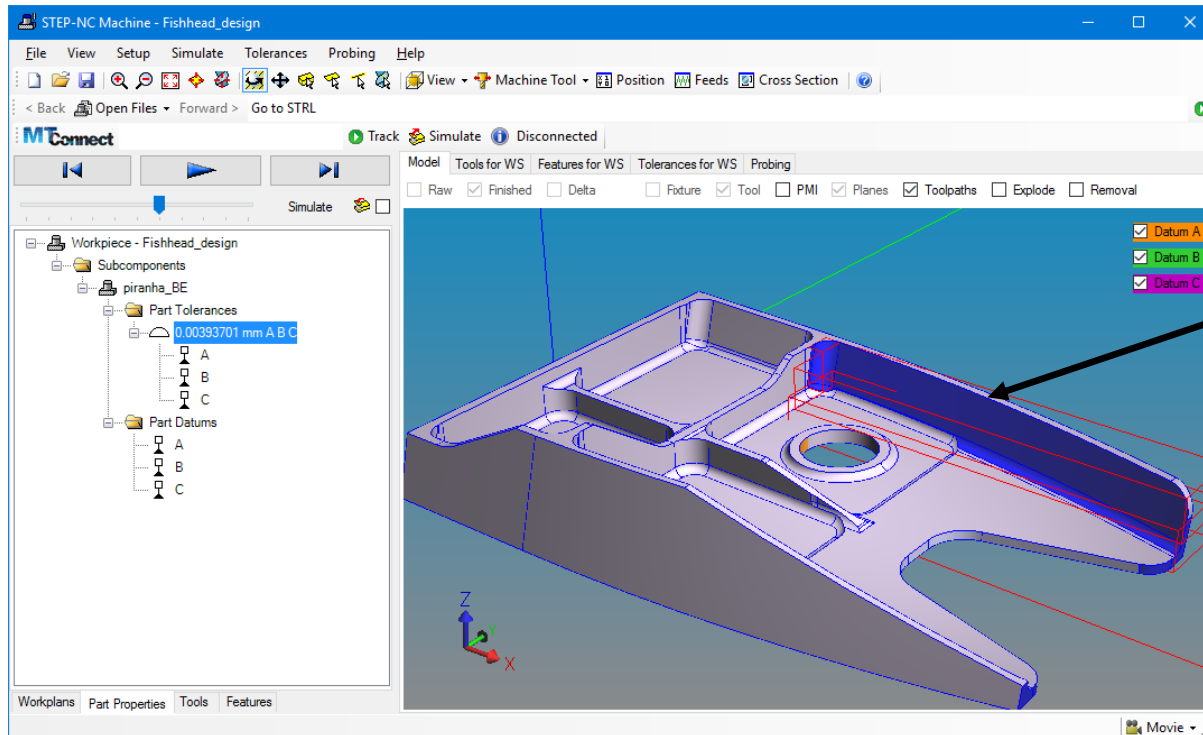
Surface tolerance on a critical design feature
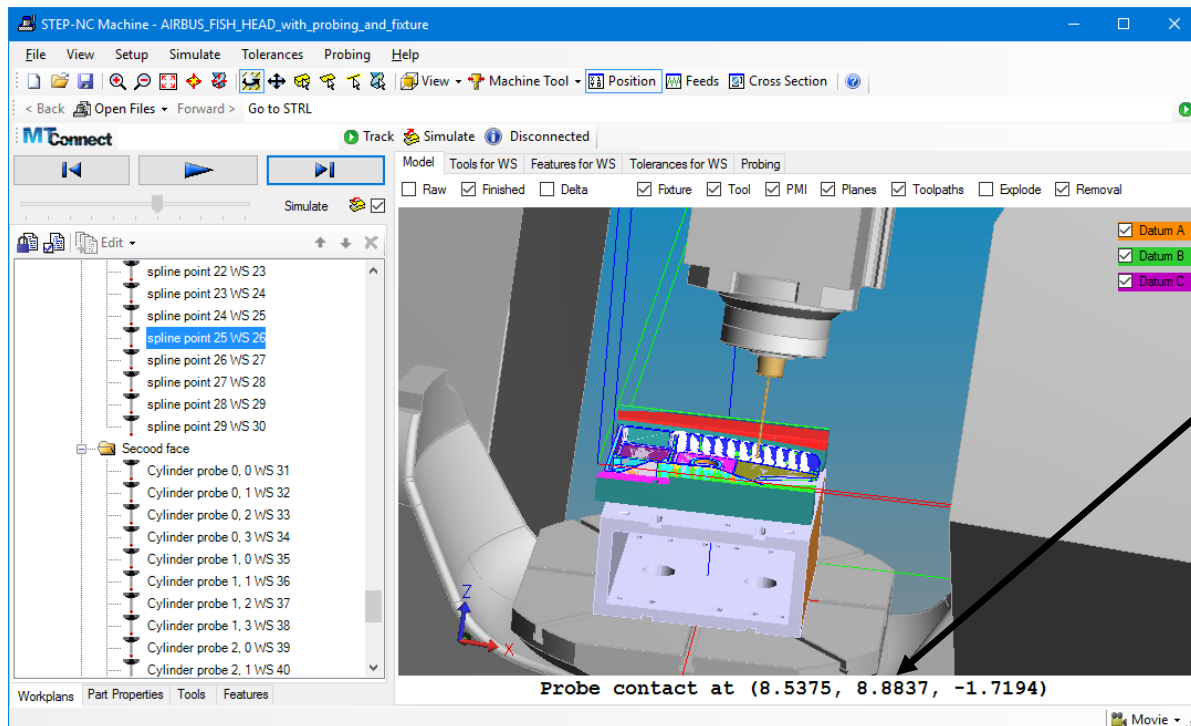
Planning space

- This is the coordinate space defined for the manufacturing solution
- Part is placed on a fixture in a virtual machine
    - For a multi-setup solution the part may be rotated to give better access to a feature
    - For a measured solution touch points may be planned in advance
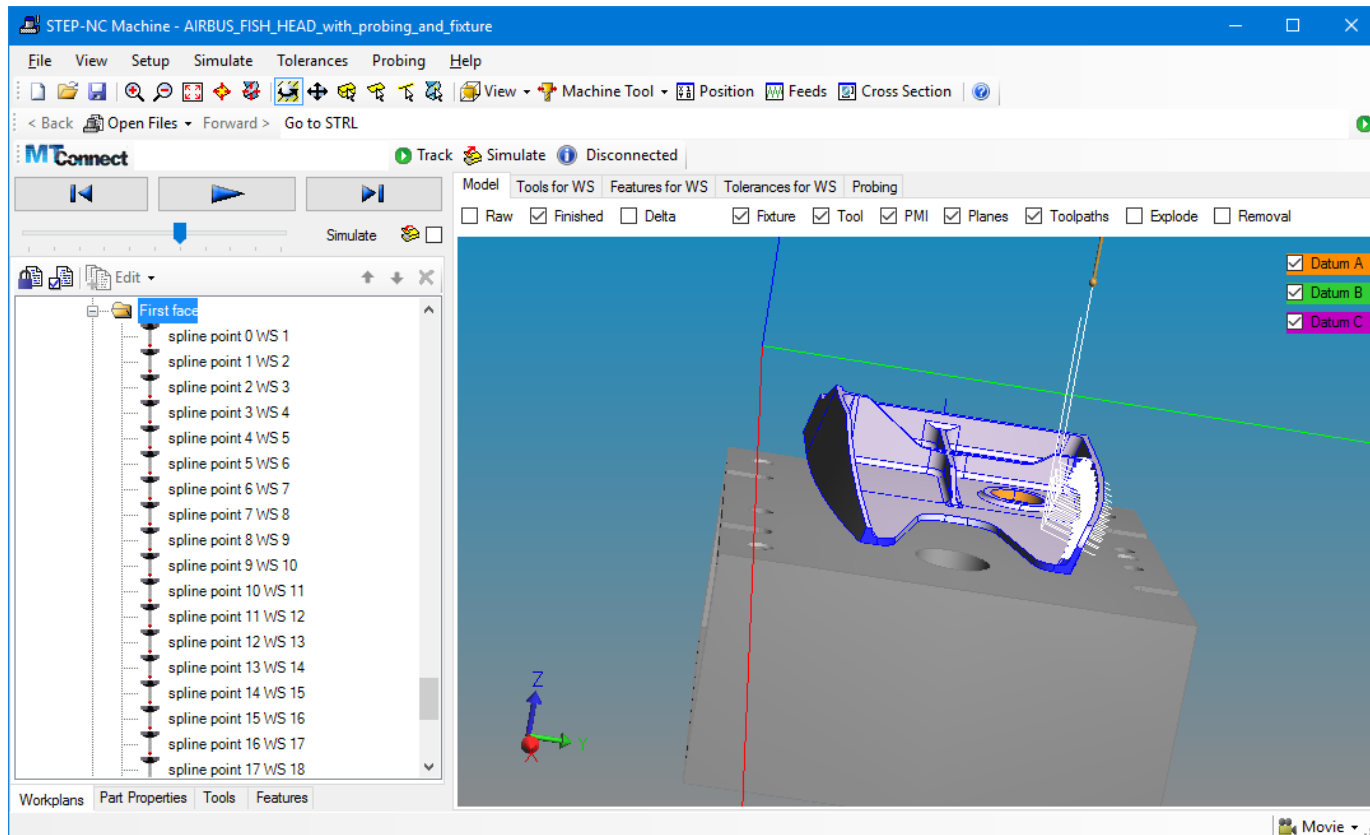
Part on fixture
Clamps holding part not shown
As planned touch points shown

Machining space

- The CNC program executes in machine space
  - Post processor makes the coordinates
  - Operator sets offsets for actual position of part and actual length of tools
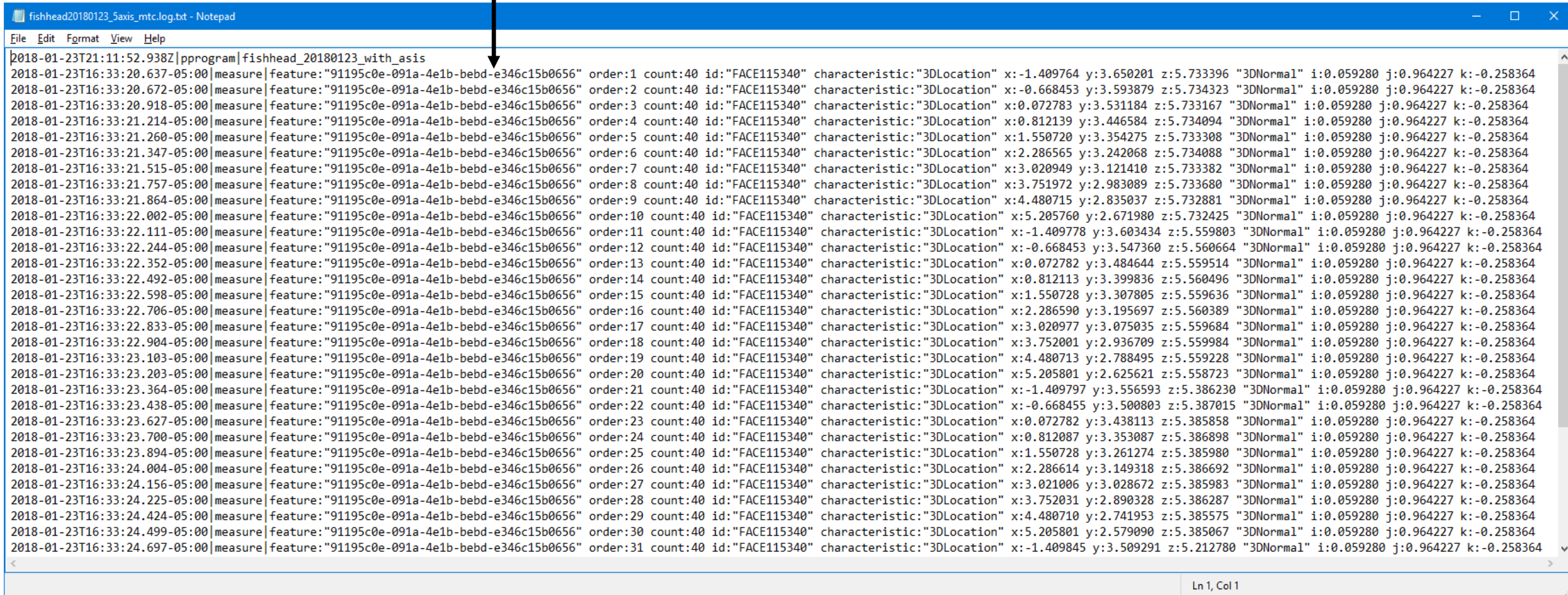

Coordinates of a touch point

QIF and the Grand Challenge

- Results should be reported in design space
  - So the designer gets the data he or she wants, without regard to setup and machine configuration.
- New resources should be defined in planning space
  - To verify that new touch points are able to measure a surface
  - Planning space will be defined/managed by CNC NC program definitions, assisted by automated CMM measurement tools
- Measurements will take place in machine space
  - Touch points must be converted from machine space to design space
  - Digital twin supports all three options (design, planning and machine)

MTConnect results in planning space

QPID / UUID of face being measured   Locations and normals of contact points

fishhead20180123_5axis_mtc.log.txt - Notepad

File   Edit   Format   View   Help

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Ln 1, Col 1

QIF Results in design space

Digital Twin Framework

STEP Data

QIF Data

UUID's

UUID's

MTConnect Adapter Data

Digital Twin Measurement
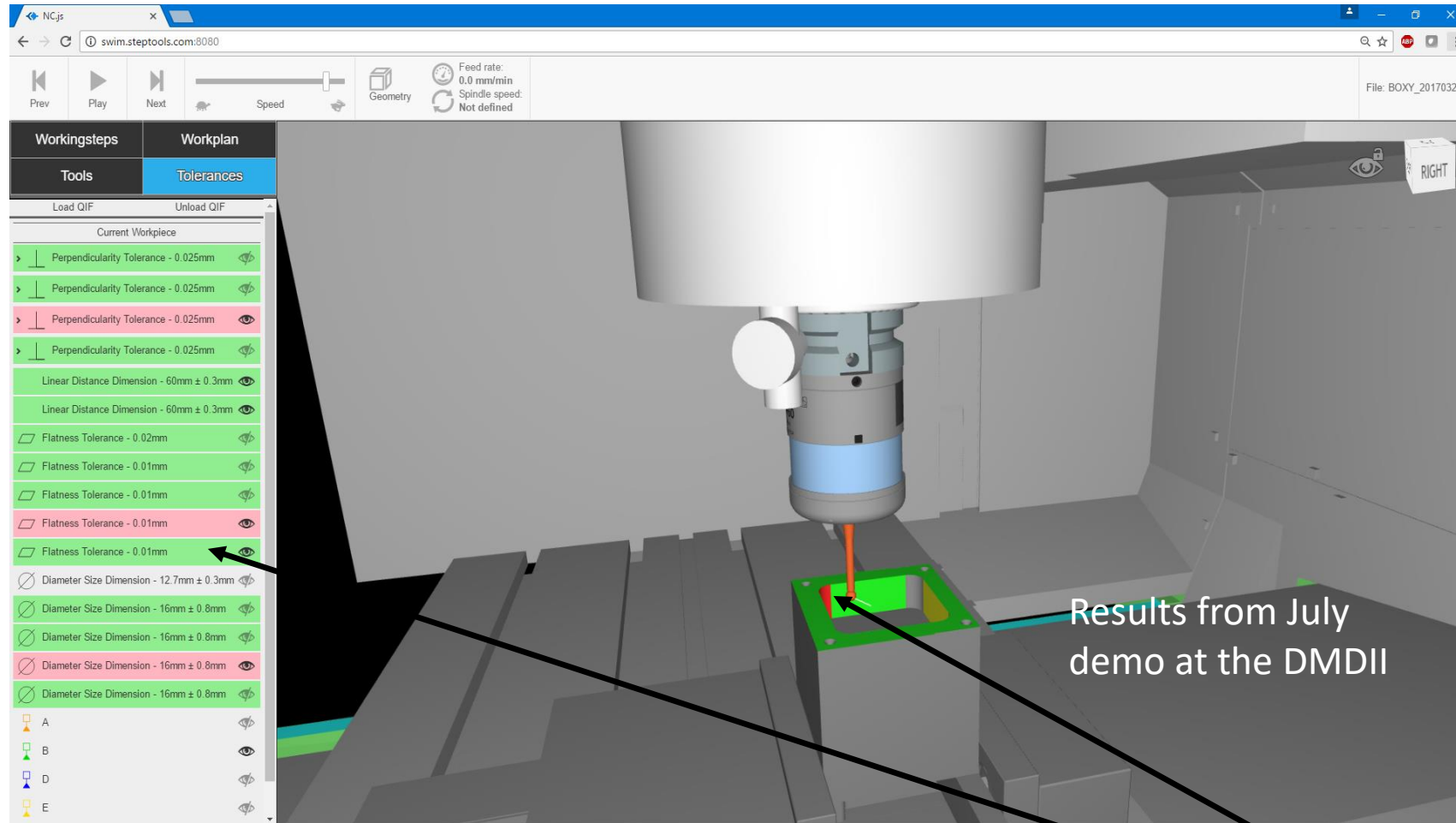
- Green good
- Red bad
- Yellow good and bad

Tablet,
Phone or
Large Screen TV

Results from July
demo at the DMDII

Touch Probe → MTConnect → STEP-NC Model → QIF → Feature or face requiring corrections