ptc LIVEWORX

CNH INDUSTRIAL

Breaking New Ground
Innovation Sustainability Productivity

SESSION ID: CA1041C

THE JOURNEY TO IMPLEMENT CREO WIELDING APPLICATIONS FOR MBE

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CNH Industrial

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KEY POINTS

- 3D Modeling Overview & Benefits
- CNH Industrial Welding Methodology
- Implementation Challenges

ABOUT THE PRESENTER: "MR. WELD"

Roger Mast

- Creo Application Manager, Engineering Process & Tools
- Over 25 years at CNH Industrial in the Engineering Department
- Previous roles included R&D Design Engineer, trainer, and user support
- 4 Patents (3 engineering & 1 design)
- PTC/User TC member & current Welding Working Group leader

ABOUT CNH INDUSTRIAL

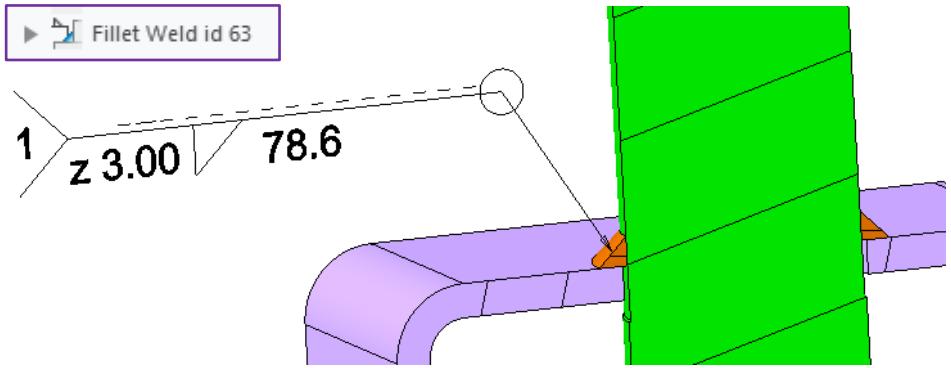
- CNH Industrial is a world -class equipment and services company
- Driven by its purpose of Breaking New Ground, which centers on Innovation, Sustainability and Productivity

Figures provided are on a US GAAP $ basis and updated at the end of 2021

CREO WELDING APPLICATION OVERVIEW

ABOUT WELDING APPLICATION

- Welding Application creates simple and compound welds in a model
- Welds Features are parametrically defined with associative geometry
- Feature driven weld symbols can be used on 2D or 3D drawings
- Obtain information about welds; including location, mass, volume and size



Additional Details:

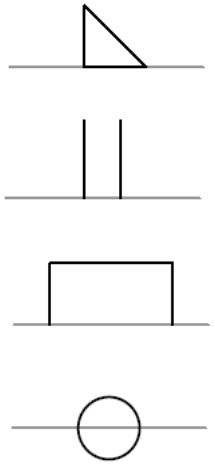
- A weld feature does not change the geometry of welded components
- Welded components are not actually merged in the model

WELD STANDARDS AND TYPES

- Supported Standards:
  - ANSI/AWS A2.4 -93
  - ISO 2553:2013

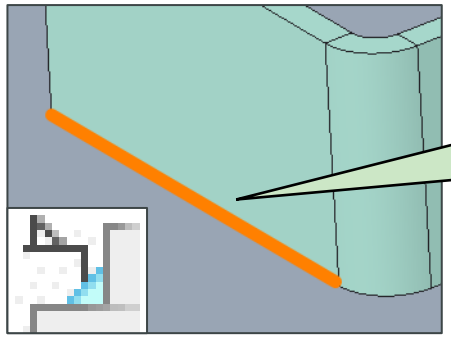
International Organization for Standardization

- Elementary Weld Types:
  - Fillet
  - Groove/Butt
  - Plug/Slot
  - Spot



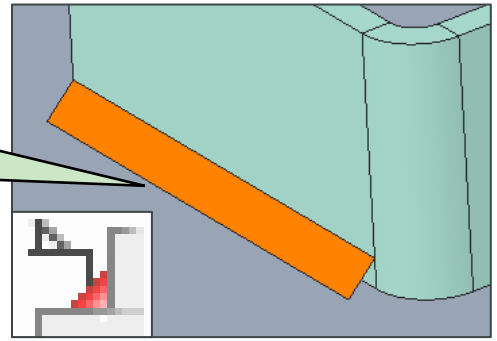
GEOMETRY REPRESENTATION

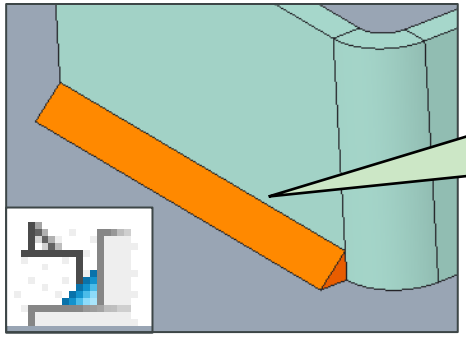
- Light
- Surface
- Solid



- 1D Curve (no geometry)
- Fastest Performance
- Least Benefits
- Mass: Manual

- 2D Surface
- Good Performance
- Some Benefits
- Mass: Semi-Manual





- 3D Solid
- Slowest Performance
- Most Benefits
- Mass: Automatic

BENEFITS OF MODELING WELDS

- Confirm type, location, presence and mass properties of welds
- Clearance/interference checks
- Communicate to downstream customers without a drawing
- Align welding information with symbols on the drawing

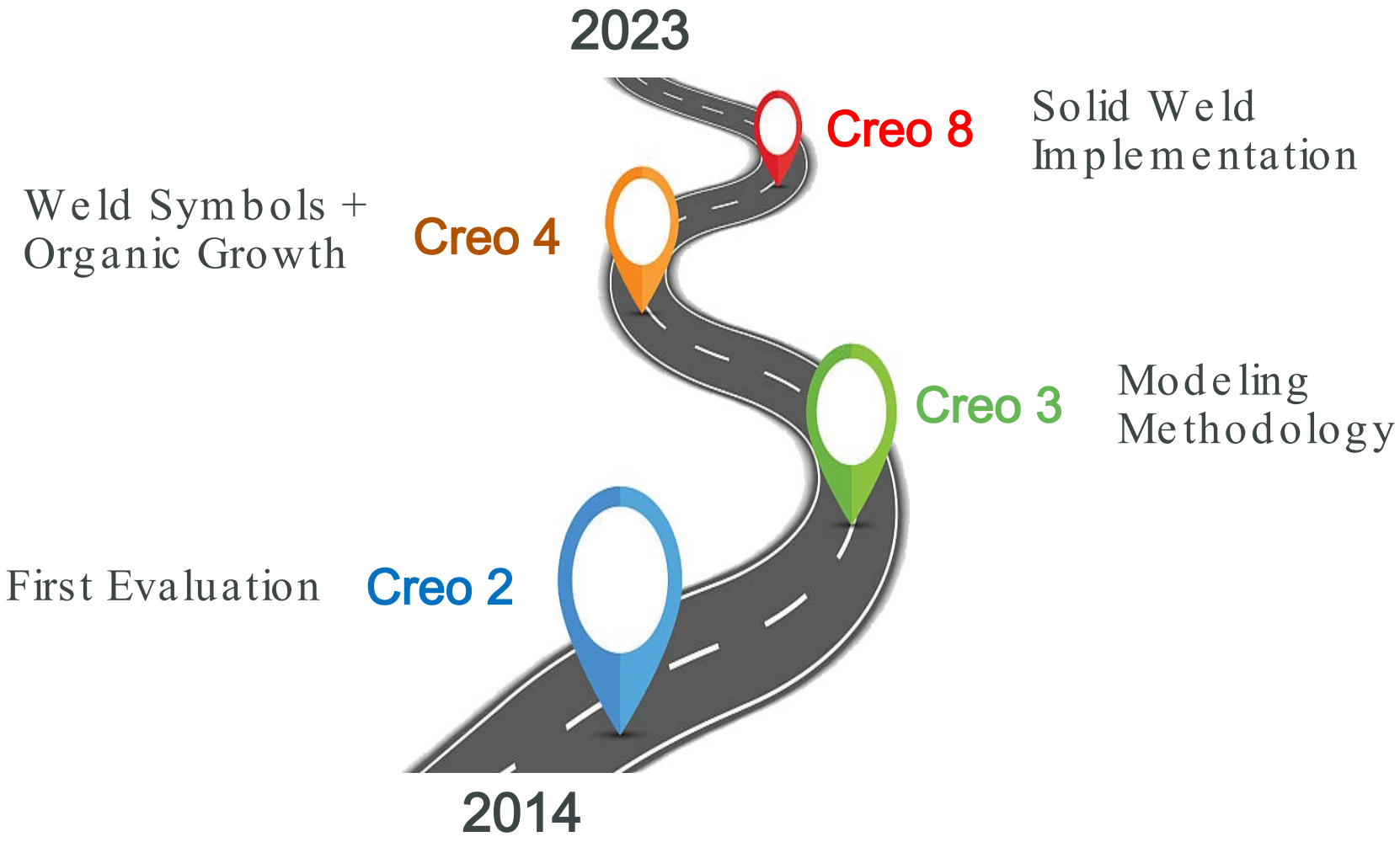
POLL QUESTION

Is your company modeling the welds in Creo?

If yes, what types are you primarily using?

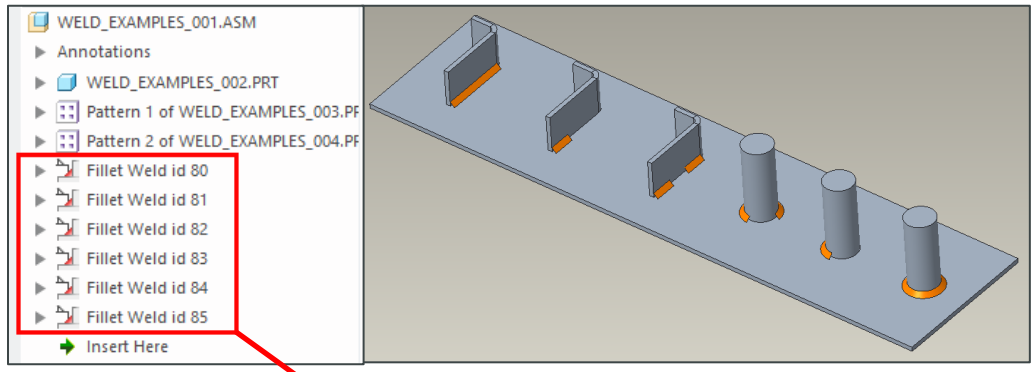
CNH INDUSTRIAL'S WELDING JOURNEY

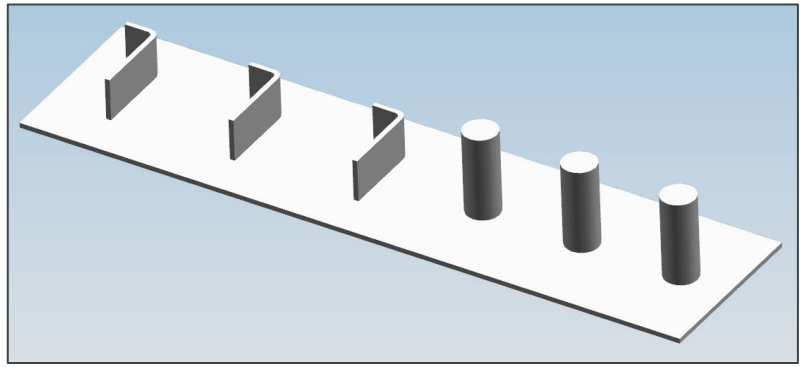
ROADMAP


2023
Creo 8
Solid Weld Implementation
Weld Symbols + Organic Growth
Creo 4
Creo 3
Modeling Methodology
First Evaluation
Creo 2
2014

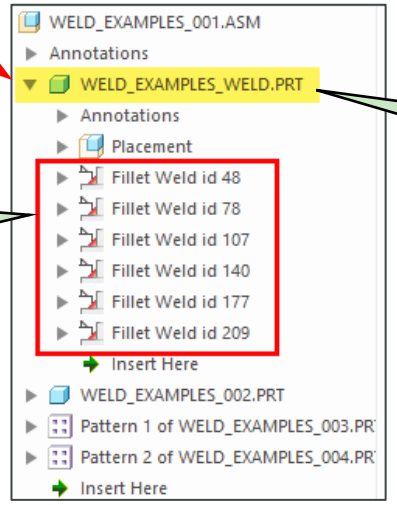
MODELING METHODOLOGY: BACKGROUND

Issue: Assembly level weld features do not appear in the lightweight viewer





Solution:
Model all welds in a part file

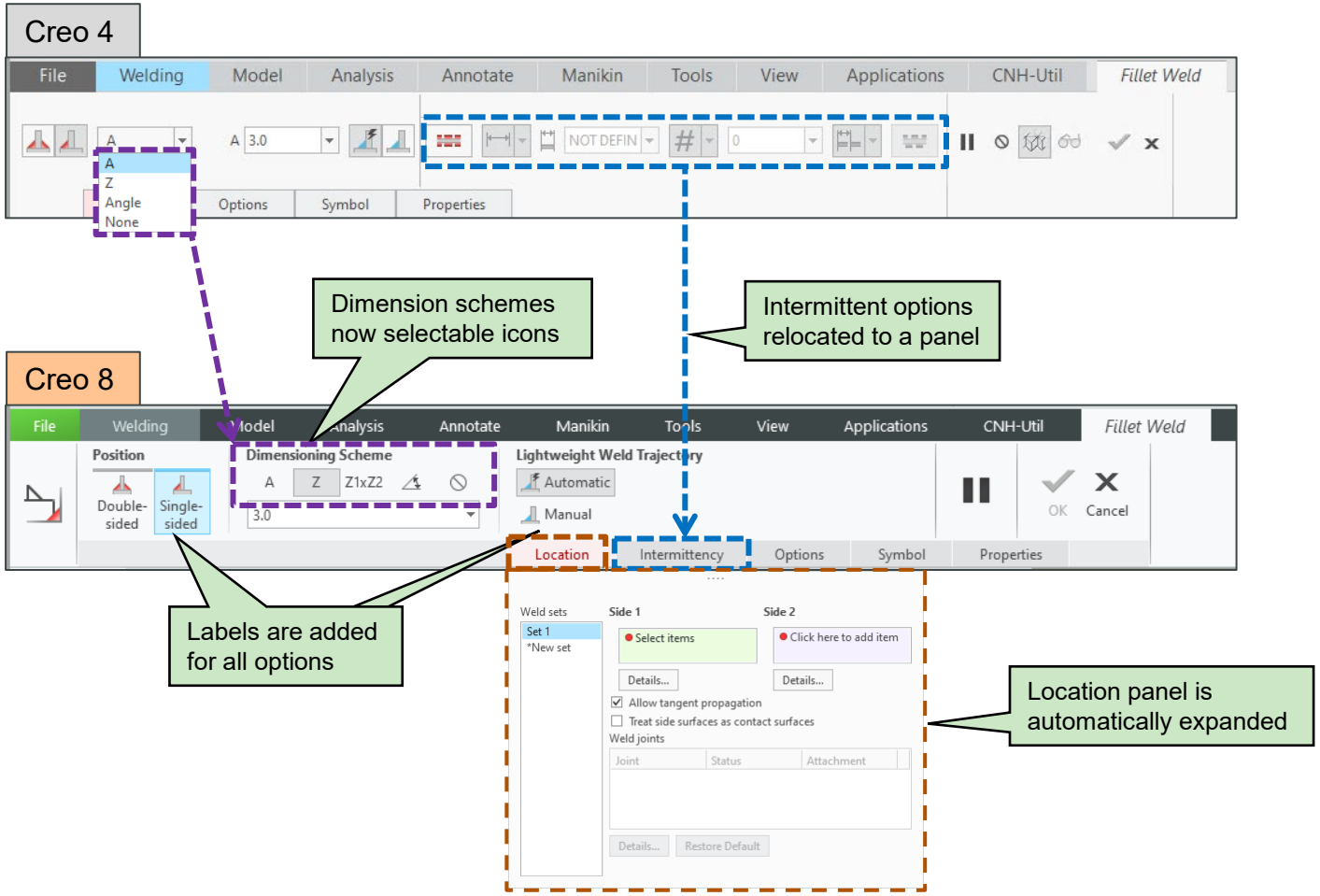


Weld "Part" *container* similar to a skeleton

METHODOLOGY BENEFITS

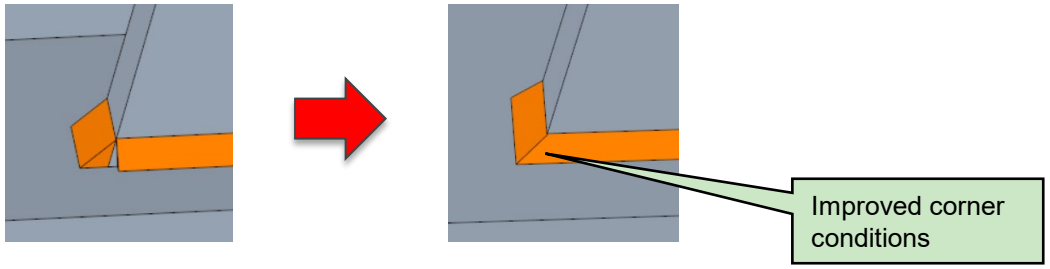
- Lightweight visualization
- Easy Filtering by Simplified Reps
- Independent File Control
- Model Organization

CREO 8 EVALUATION: THE GOOD

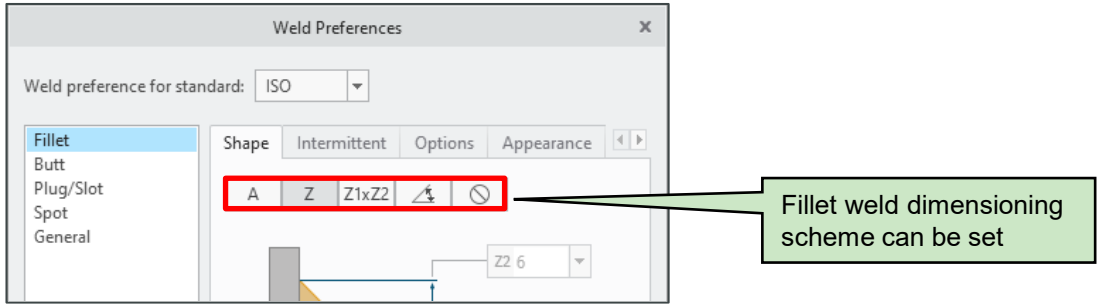


CREO 8 EVALUATION: THE GOOD

- Improved Solid weld geometry representation (Creo 7)

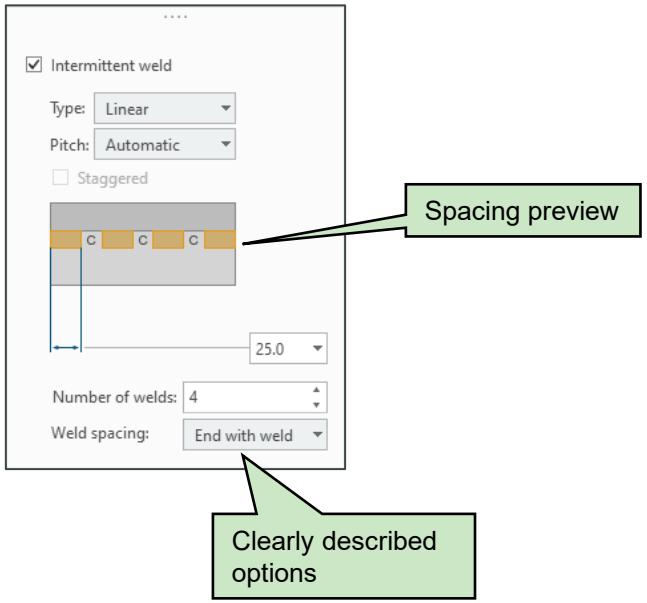


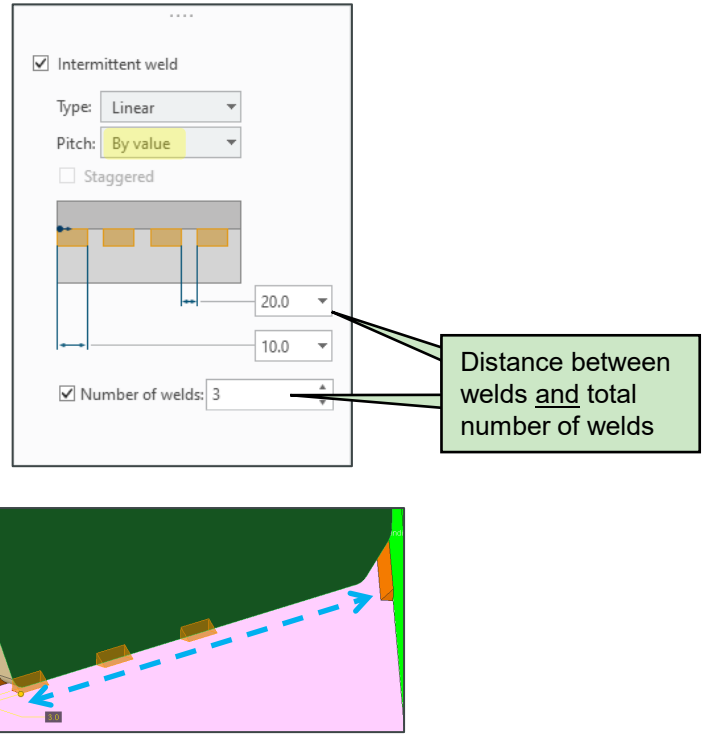
- Weld Preferences support many additional options

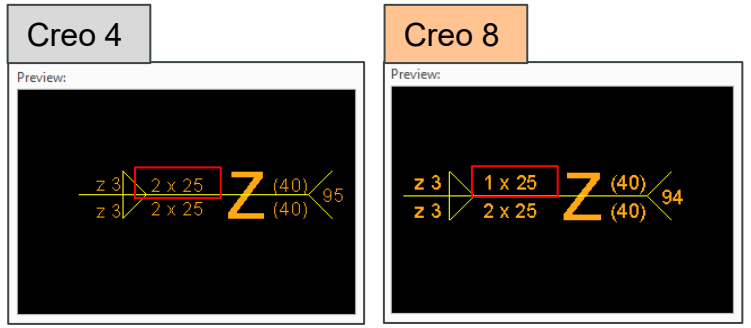


CREO 8 EVALUATION: THE GOOD

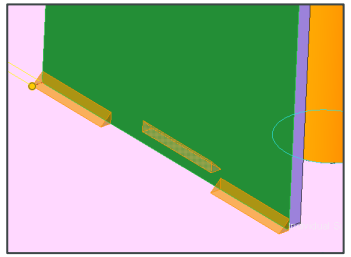
- Improved intermittent weld dialog box and placement options







Correct staggered intermittent weld symbol & parameters



CREO 8 EVALUATION: THE GOOD

- Unequal Leg Length (Z1xZ2) Fillet weld option has been added for ISO
- Semantic References the of weld feature propagate to the weld symbol
- Bug Fixes (vs. Creo 4):
  - Automatic option displays the all -around circle in wrong situations
  - Combined reinforcement welds shows the wrong symbol (some issues remain)
  - Wrong symbol font is displayed on the drawing
  - Intermittent weld symbol dashed line (ISO) is not correct in 3D mode

CREO 8 EVALUATION: THE BAD

- Opened 22 PTC cases for issues and questions
- 15 issues resolved (highlights below):
  - Cannot add solid weld geometry onto a rule -based layer [8.0.5.0]
  - Spot weld representation and model tree icon [8.0.6.0]
  - Creo crashes when using a specific set of configuration options [8.0.6.0]
  - (5) Related to wrong Search Tool results for solid weld features [8.0.6.0, 8.0.7.0]
  - It is possible to embed datums in surface weld features but not solid welds [8.0.7.0]
- Other cases are closed as “known limitations” or “works as designed”
- Expect to encounter different behavior with Solid welds vs Surface welds

DECISIONS

- Selected release 8.0.7.0
- Modeling the welds is now ‘recommended’ practice
- Adopted Solid Weld geometry representation

POLL QUESTION

What version of Creo is you company using?

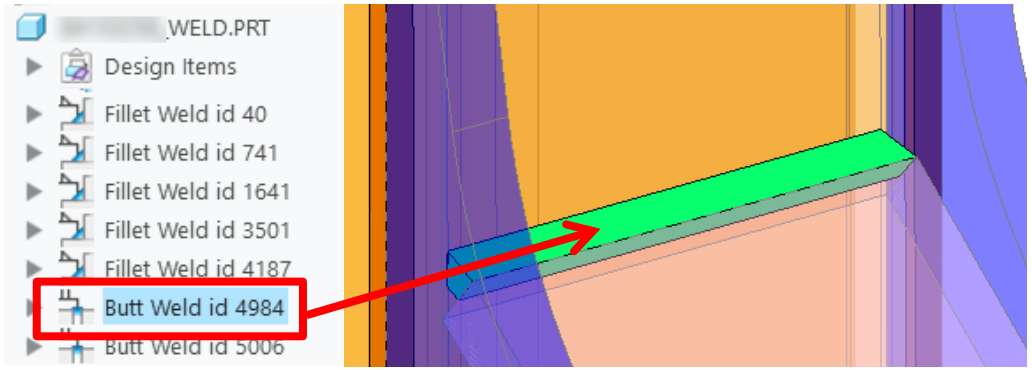
If version 8 or 9, what is your experience so far using the welding application?

IMPLEMENTATION CHALLENGES

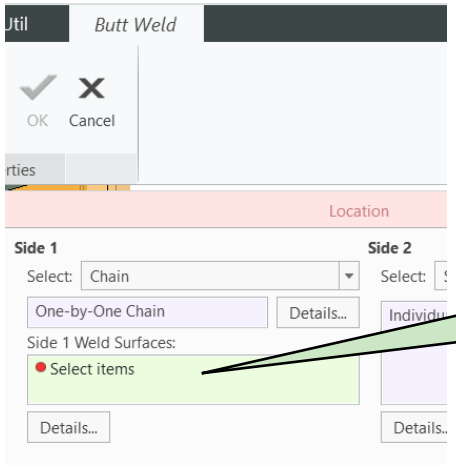
CONVERSION ISSUES: SURFACE TO SOLID

Some relief provided by internal developments

- Feature is in failed state , but not reported in the model tree.

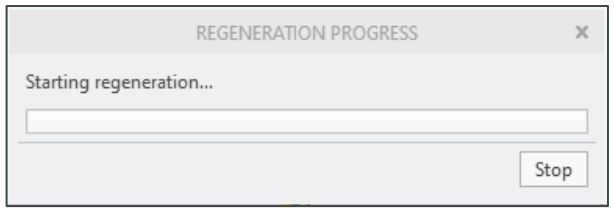


Works to spec per SPR 13738239 (article CS366767)



Feature is in failed state when using PTC conversion tool

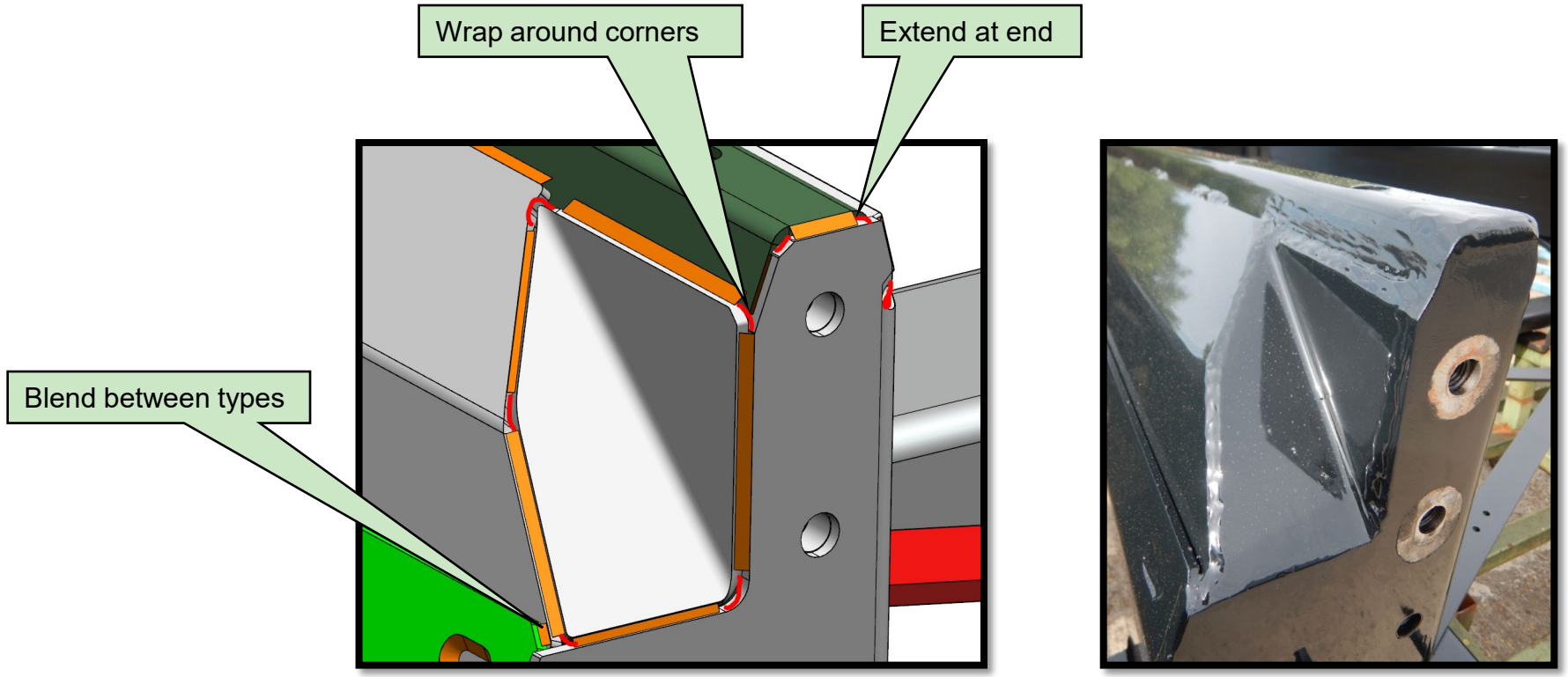
- Excessive regeneration & poor performance during the conversion



SOFTWARE LIMITATIONS

Blocking point for MBD/MBE

Complex geometry of tangent & corner cannot be accurately modeled

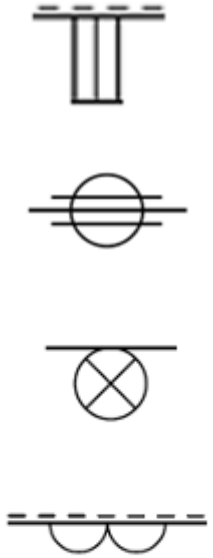


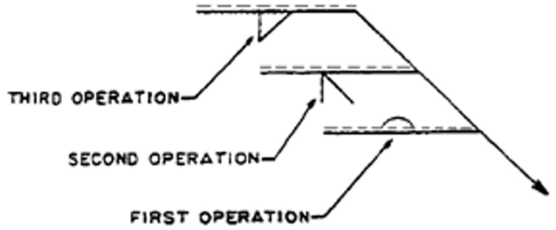
SOFTWARE LIMITATIONS

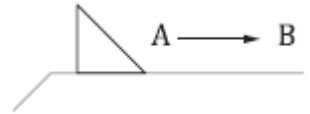
Blocking point for MBD/MBE

Unsupported weld types:

- Edge & Flanged Butt
- Seam
- Stud
- Surfacing
- Sequence
- Weld Between 2 Points
- Root Reinforcement







SOFTWARE LIMITATIONS

- Weld length displayed in the symbol does not follow ISO 2553
- XML export in xMCF format for downstream programming
- Cannot edit symbol leader attachments in the drawing
- Cannot combine similar weld features that are defined as ‘Double Sided’
- Not all weld options can be controlled by weld preferences (plug/slot weld scheme, tangent propagation in fillet welds)
- Cumbersome to edit joints of fillet welds
- Spot welds do not create an axis or usable points
- Poor weld reporting (limited details, top level only, no decimal control)

CONCLUSION & NEXT STEPS

- Many benefits to modeling welds
- Implementation is possible , including solid welds, with effort
- MBD/MBE is not fully supported yet
- Take Action: Get involved in the PTC/ User Weld Working Group
  https://community.ptc.com/t5/Creo-Weld/gh-p/creoweld

QUESTIONS?

Thank you! You can find me at:

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