# The PROMOTE Software

James Farrar
Business Development Manager

- Formed in 1980 as Finite Elements Ltd

- 1000+ clients

- Member of Wilde Group of 70+ employees and £10m + turnover

- 24 employees involved in analysis sales, services and administration
  - 21 are qualified engineers with significant experience using analysis software

- ISO 9001:2008 Approved Quality Management System

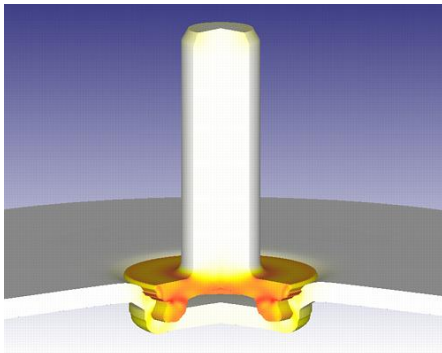- On UK-steering committee for NAFEMS and involvement with many industry associations.
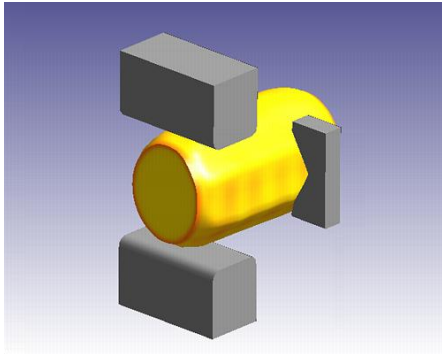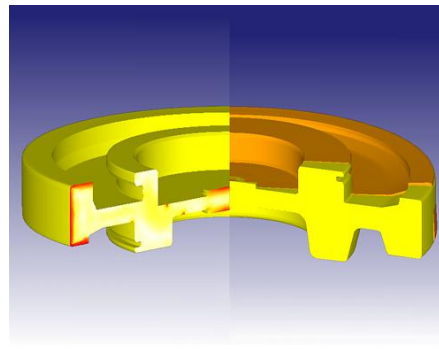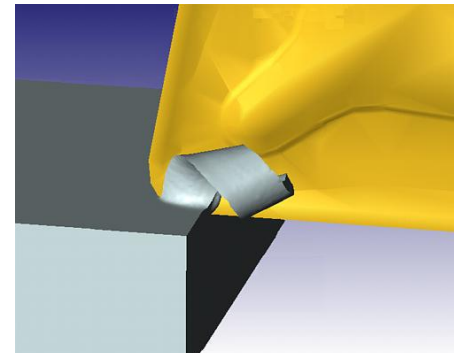
raw material production
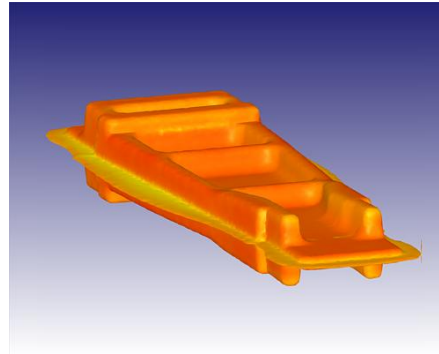
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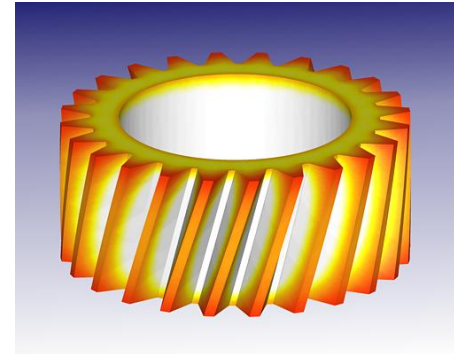
heat treatment & microstructure
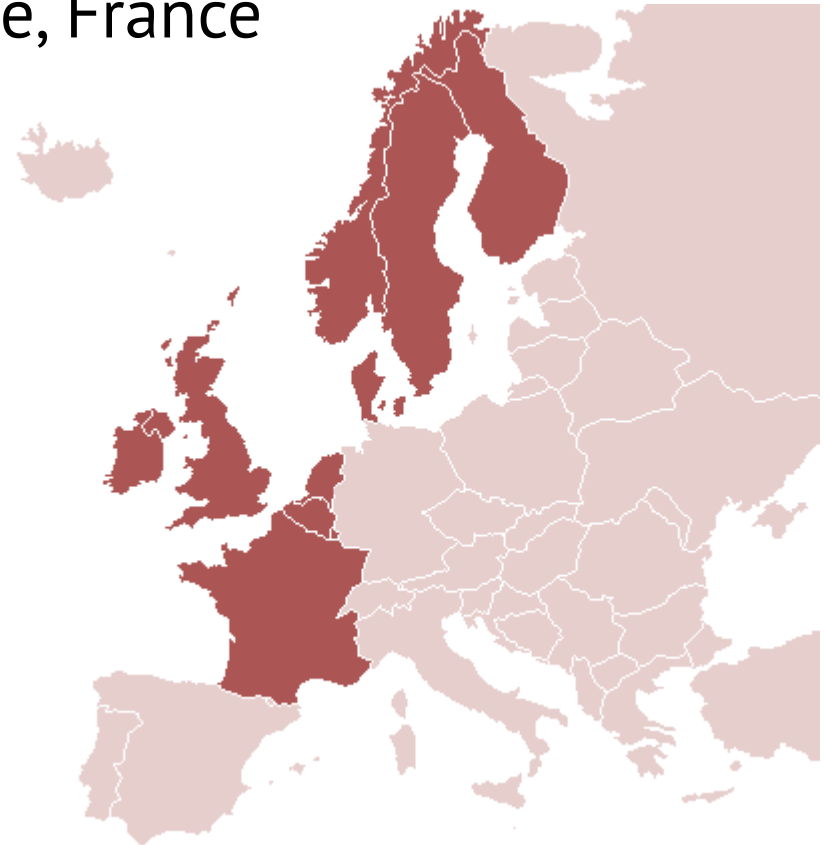
Installation / in-service performance
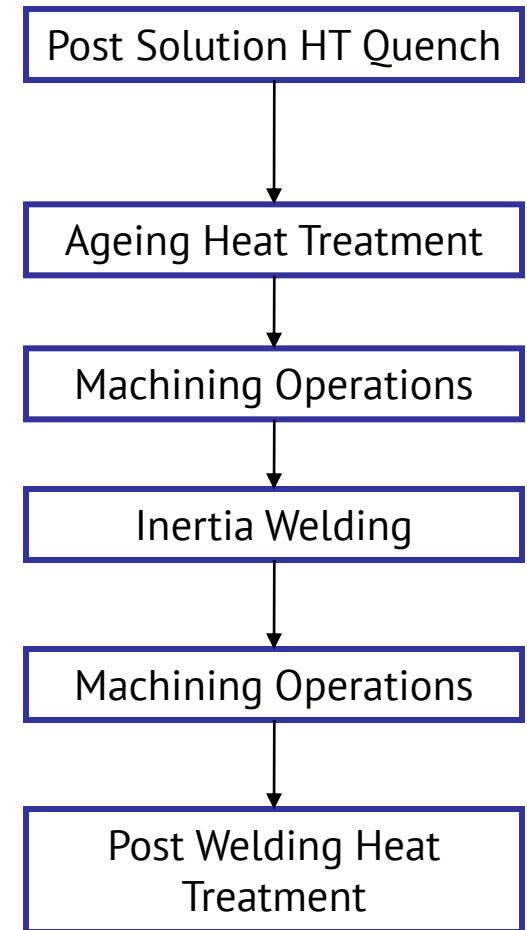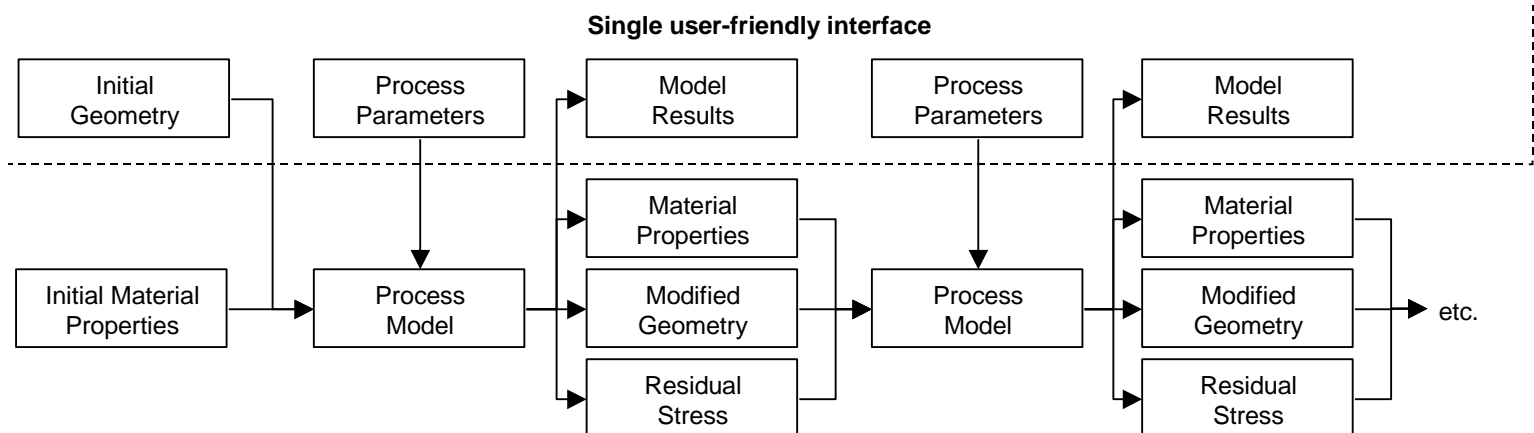
machining distortion & residual stress

machining

- Wilde - UK Distributor for 15 years
- UK, Ireland, Northern Europe, France
- Software
- Training
- Technical support
- Consulting services

DE FORM™

Design Environment for FORMing

- Manufacturing route for turbine discs and shafts is well defined.

- Improved engine performance requires optimisation of the manufacturing process routes in each area.

- Aim of PROMOTE is to deliver a software tool to model all of the processes involved in the manufacture of aerospace disc and shaft assemblies

Post Solution HT Quench

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Ageing Heat Treatment

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Machining Operations

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Inertia Welding

↓

Machining Operations

↓

Post Welding Heat Treatment

# PROMOTE Interface Objective

- Deliver capability for modelling disc and shaft manufacturing routes.

- Provide process modelling capability to process and materials specialists rather than a very small population of process modelling specialists.

- Deliver a user-friendly software environment to enable use of the modelling capability in a quality controlled and efficient manner.

- Without the need for extensive training or specialist background knowledge in process modelling.

- Enable users to input the required process parameters and automatically convert this information to DEFORM requirements.

- Capture current state-of-art for current process modelling.

**Single user-friendly interface**

| Initial Geometry | Process Parameters | Model Results | Process Parameters | Model Results |
|---|---|---|---|---|

| Initial Material Properties | Process Model | Material Properties / Modified Geometry / Residual Stress | Process Model | Material Properties / Modified Geometry / Residual Stress | etc. |

- WP1: Rolls Royce
  - Material acquisition, characterisation, modelling and test sample manufacturing (University of Birmingham)

- WP2: Rolls Royce - Manufacturing Process Modelling
  - Heat Treatment
  - Machining (Distortion)
  - Inertia Welding (University of Nottingham)

- WP3: Wilde Analysis
  - PROMOTE Software integration and system development

- Object-oriented paradigm:
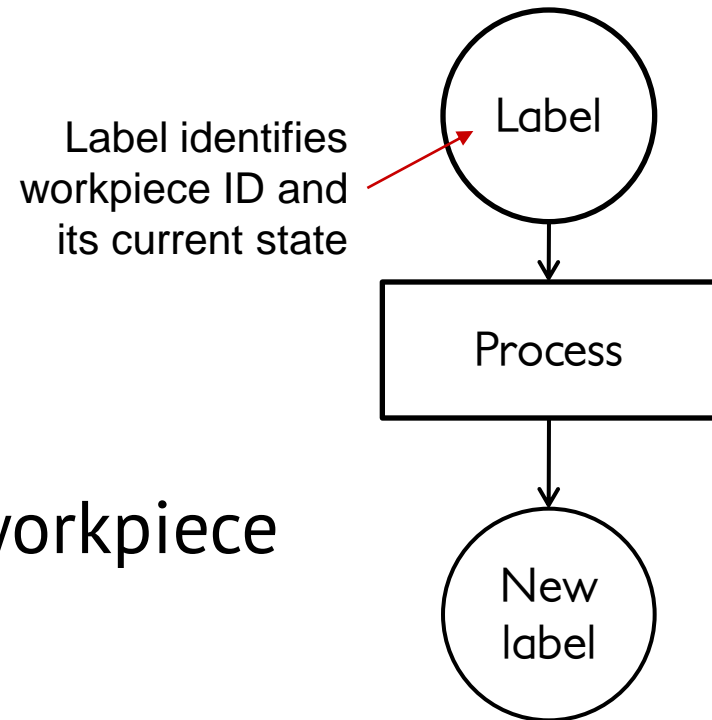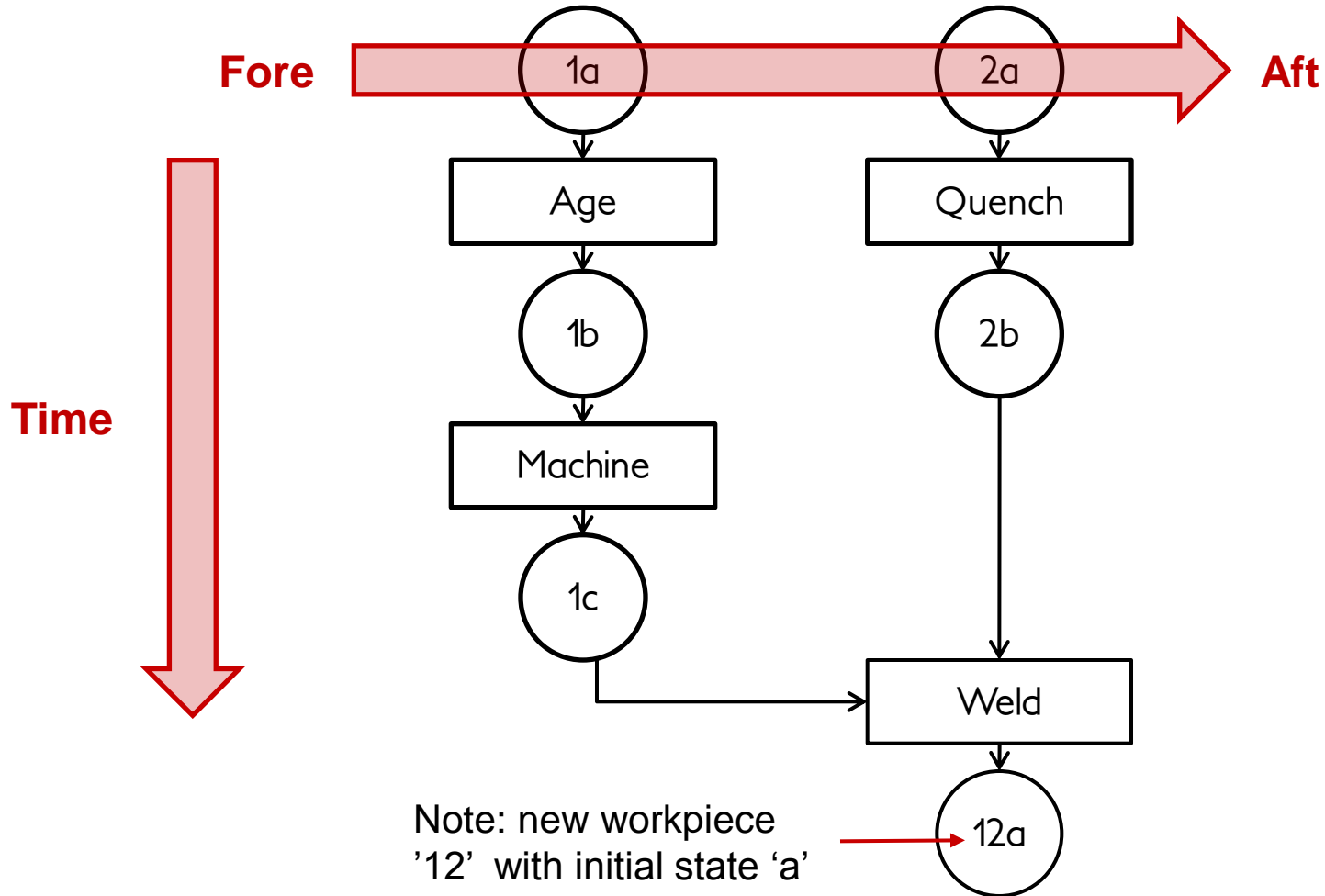
  – "Workpiece" object

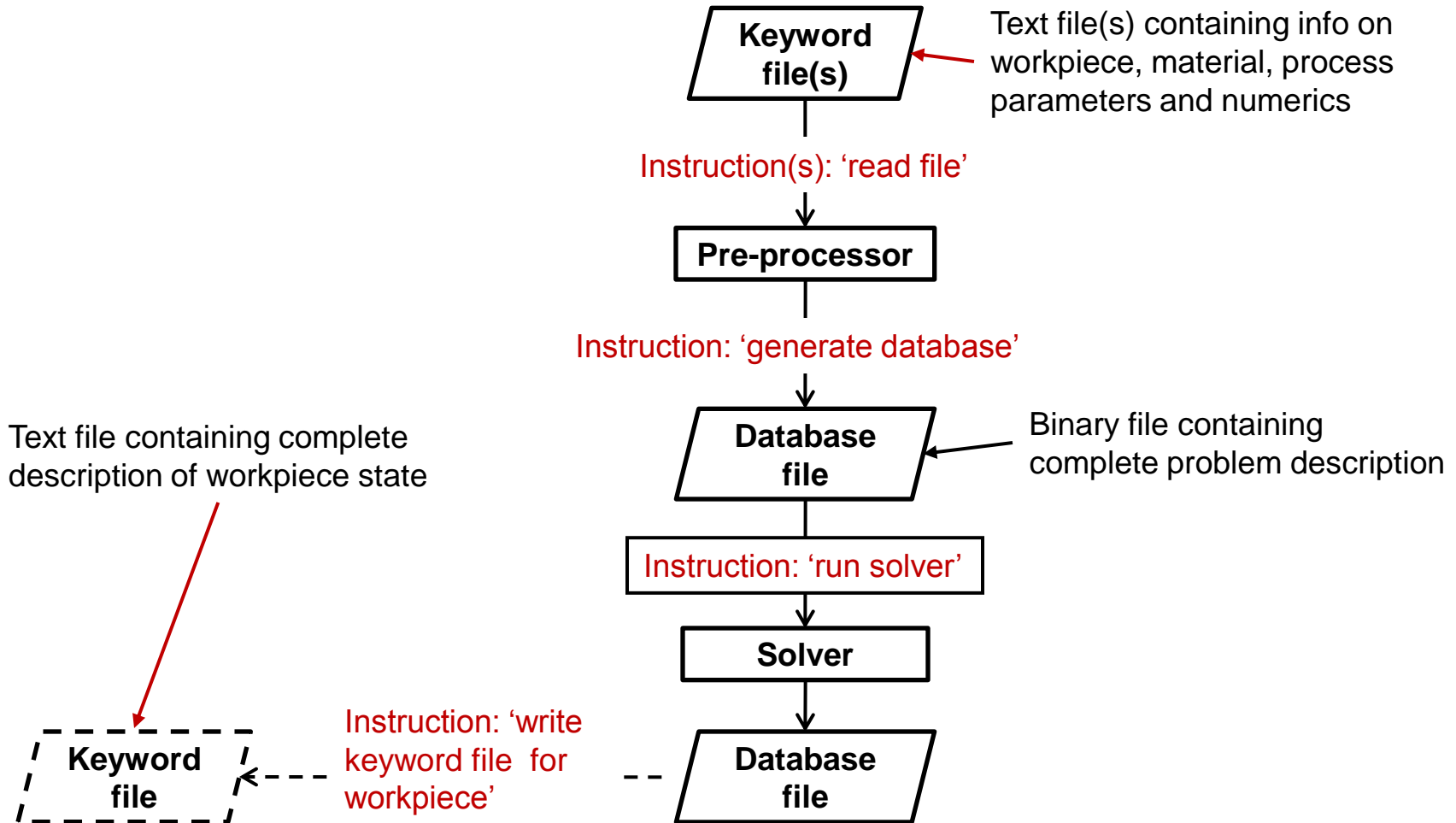  – "Process" object

  – Process changes state of workpiece

Label identifies workpiece ID and its current state → Label

Label

↓

Process

↓

New label

- Representation of manufacturing route



Note: new workpiece
'12' with initial state 'a'

- Define manufacturing route
- Define "process" object attributes
  - Process parameters, jigs & fixtures, etc
- Define initial "workpiece" object attributes
  - geometry, material, etc
- Subsequent object attributes determined by preceding processes

- ## Process simulation in text-driven DEFORM

**Keyword file(s)** → Text file(s) containing info on workpiece, material, process parameters and numerics

Instruction(s): 'read file'

**Pre-processor**

Instruction: 'generate database'

Text file containing complete description of workpiece state

**Database file** ← Binary file containing complete problem description

Instruction: 'run solver'

**Solver**

Instruction: 'write keyword file for workpiece'

**Keyword file**

**Database file**

# Wilde

# PROMOTE Workflow

Workpiece data entry

New Project- Work Piece

Add

Work piece | Machine
Age | Weld
Quench | Delete
Run

Fore ... Aft

Engine assembly display

Project Name: Example
Create Date: 01/09/2010
Archive: ☐

Project | Notes

Import / specify workpiece

Id: 1a
Description: Workpiece1
Source: Specified
MSRR: None
Geometry: Central: T2000HPT A2.GEO  [G]
Y Datum: 0

Geometry

Material: Steel
Mix Material: SCMV
Init. Vol. Fract.: 1,0,0,0,0,0  [VF]
Mesh: Coarse

Material

Mesh

Geometry display

Status: Ready  [Verifiy]

Workflow diagram:
- 1a ✓
- HT Age WP1 HT1 ✓
- 1b ✓
- 2a ✓
- HT Age WP2 HT1 ✓
- 2b ✓
- Weld WELD 1-2 ✓
- 12a ✓
- Machine Post weld mahine ✓
- 12b ✓
- Quench Post weld HT ✓
- 12c ✓

**PROMOTE Interface**

Age process data entry

Engine assembly display

Material model inputs

MSRR file input

Process inputs

Points for auto – post processing

Temperature profile input

# PROMOTE Interface

Weld process inputs

Engine assembly display

Material model inputs

Dies & Fixtures

Weld inputs (Load / inetrtia)

PROMOTE Interface

Machine process inputs

Engine assembly display

Cut profiles

PROMOTE Interface

Machine process inputs

Engine assembly display

Cut profiles

# PROMOTE Interface

Automated batch run scheduling
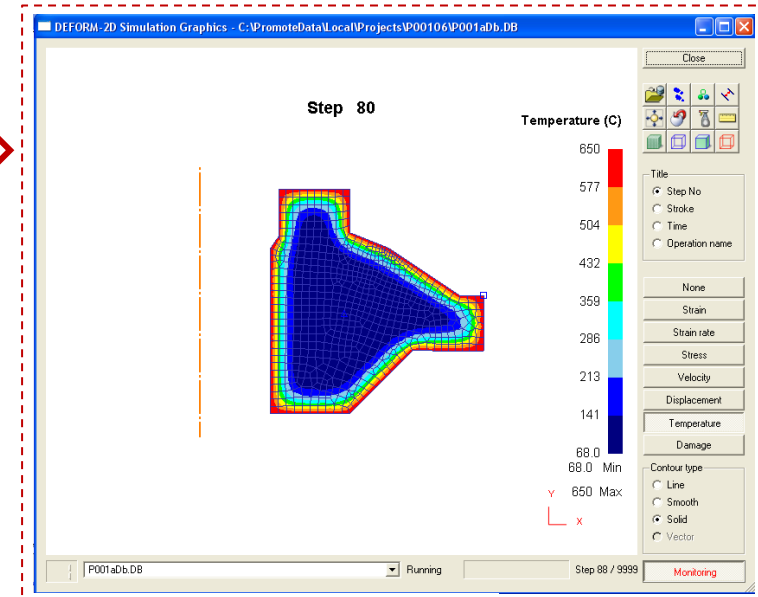
Automated & interactive post –processing options

- Background information on DEFORM:

  www.wildeanalysis.co.uk

  www.deform.com

- Contact James Farrar to:

  – Discuss your simulation requirements

  – Arrange a company-specific web or live meeting on the PROMOTE and DEFORM software

  – Discuss evaluation options

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