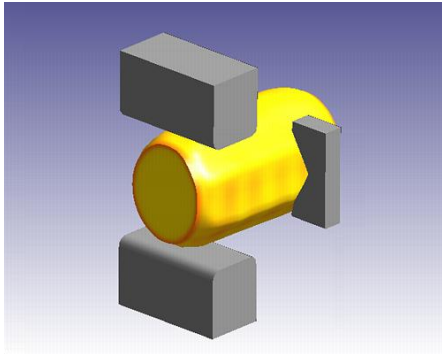


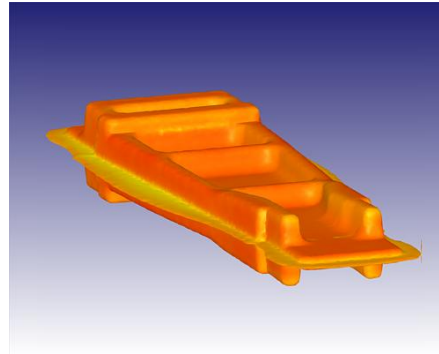
The PROMOTE Software

James Farrar
Business Development Manager

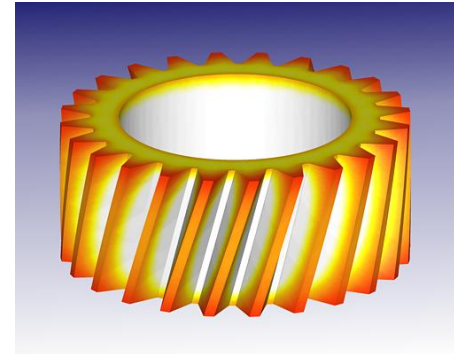
- Formed in 1980 as Finite Elements Ltd
- 1000+ clients
- Member of Wilde Group of 70+ employees and £10m + turnover
- 24 employees involved in analysis sales, services and administration
 - 21 are qualified engineers with significant experience using analysis software
- ISO 9001:2008 Approved Quality Management System
- On UK-steering committee for NAFEMS and involvement with many industry associations.



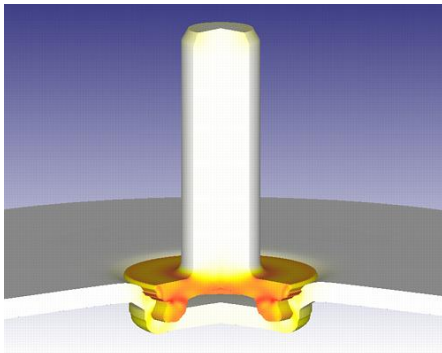
raw material production



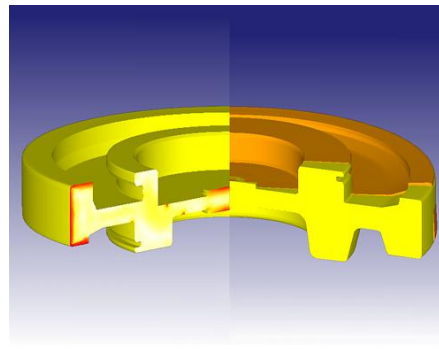
forming



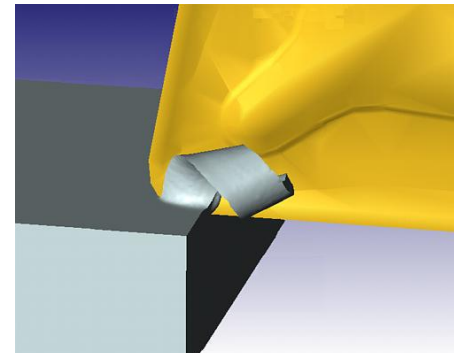
heat treatment &
microstructure



Installation / in-
service performance

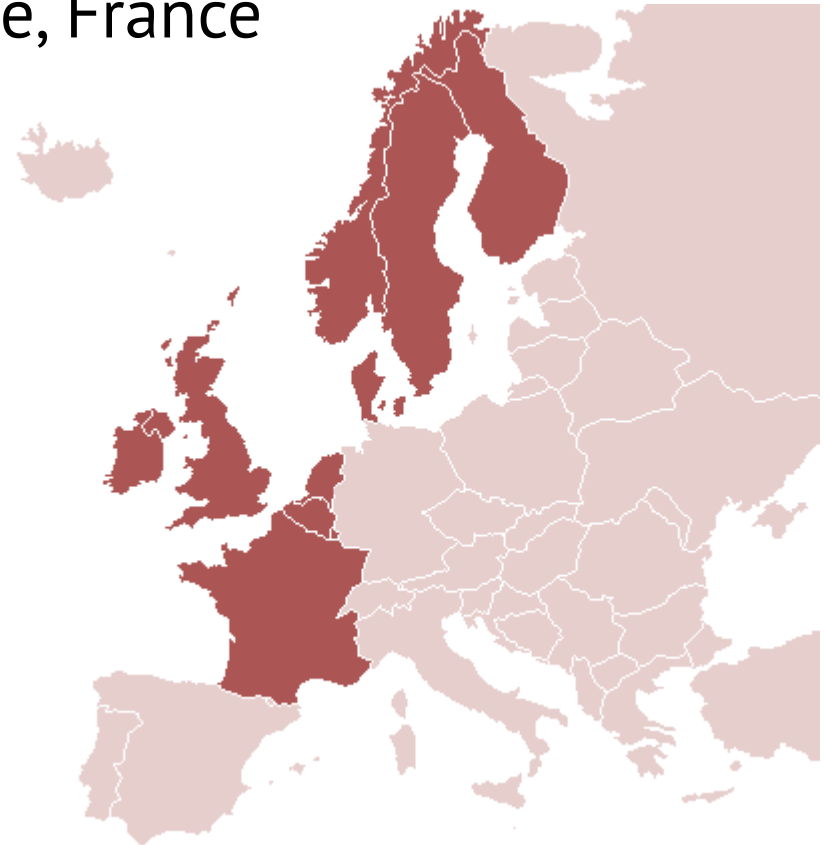


machining distortion
& residual stress

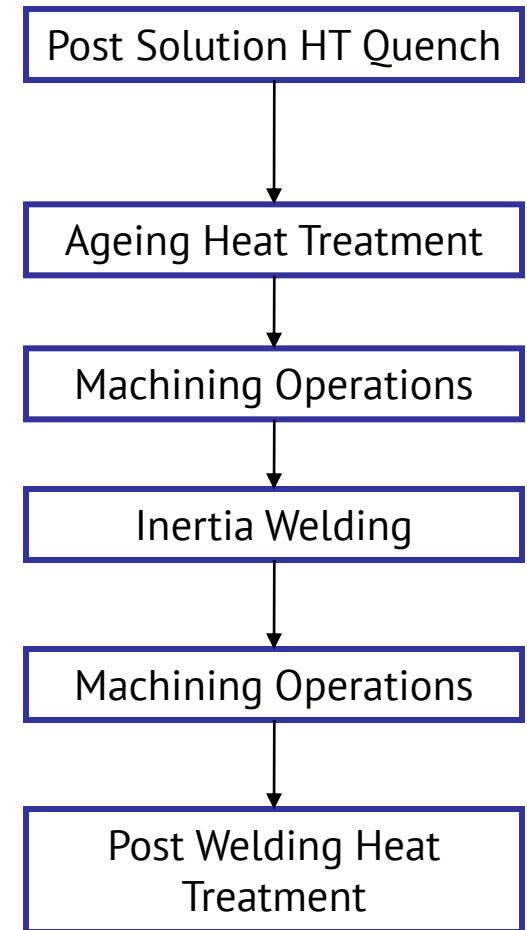


machining

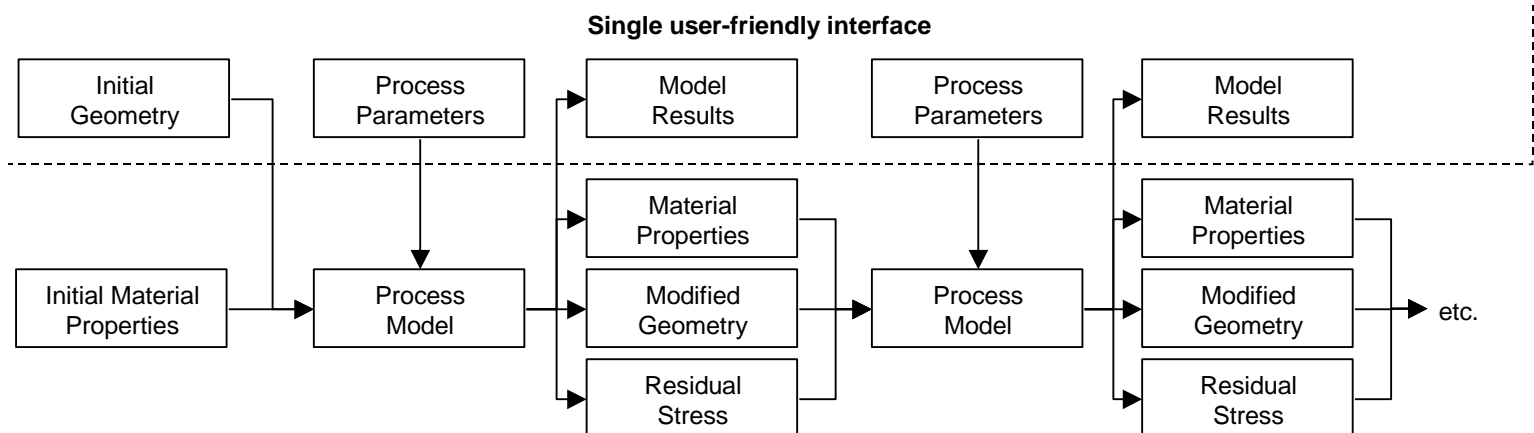
- Wilde - UK Distributor for 15 years
- UK, Ireland, Northern Europe, France
- Software
- Training
- Technical support
- Consulting services



- 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



- 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.



- WP1: Rolls Royce



Rolls-Royce

- Material acquisition, characterisation, modelling and test sample manufacturing (University of Birmingham)



UNIVERSITY OF
BIRMINGHAM

- WP2: Rolls Royce - Manufacturing Process Modelling

- Heat Treatment
- Machining (Distortion)
- Inertia Welding (University of Nottingham)



The University of
Nottingham

- WP3: Wilde Analysis

- PROMOTE Software integration and system development

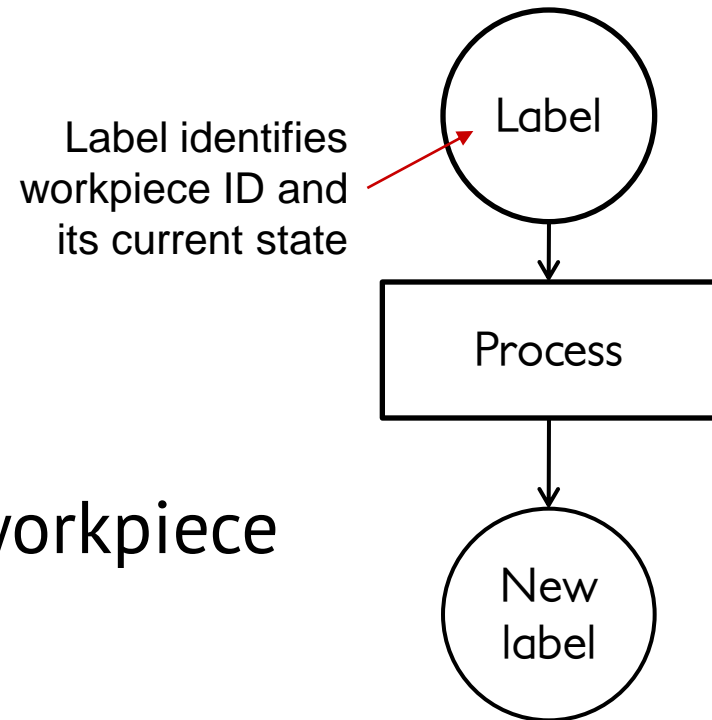
Wilde

- Object-oriented paradigm:

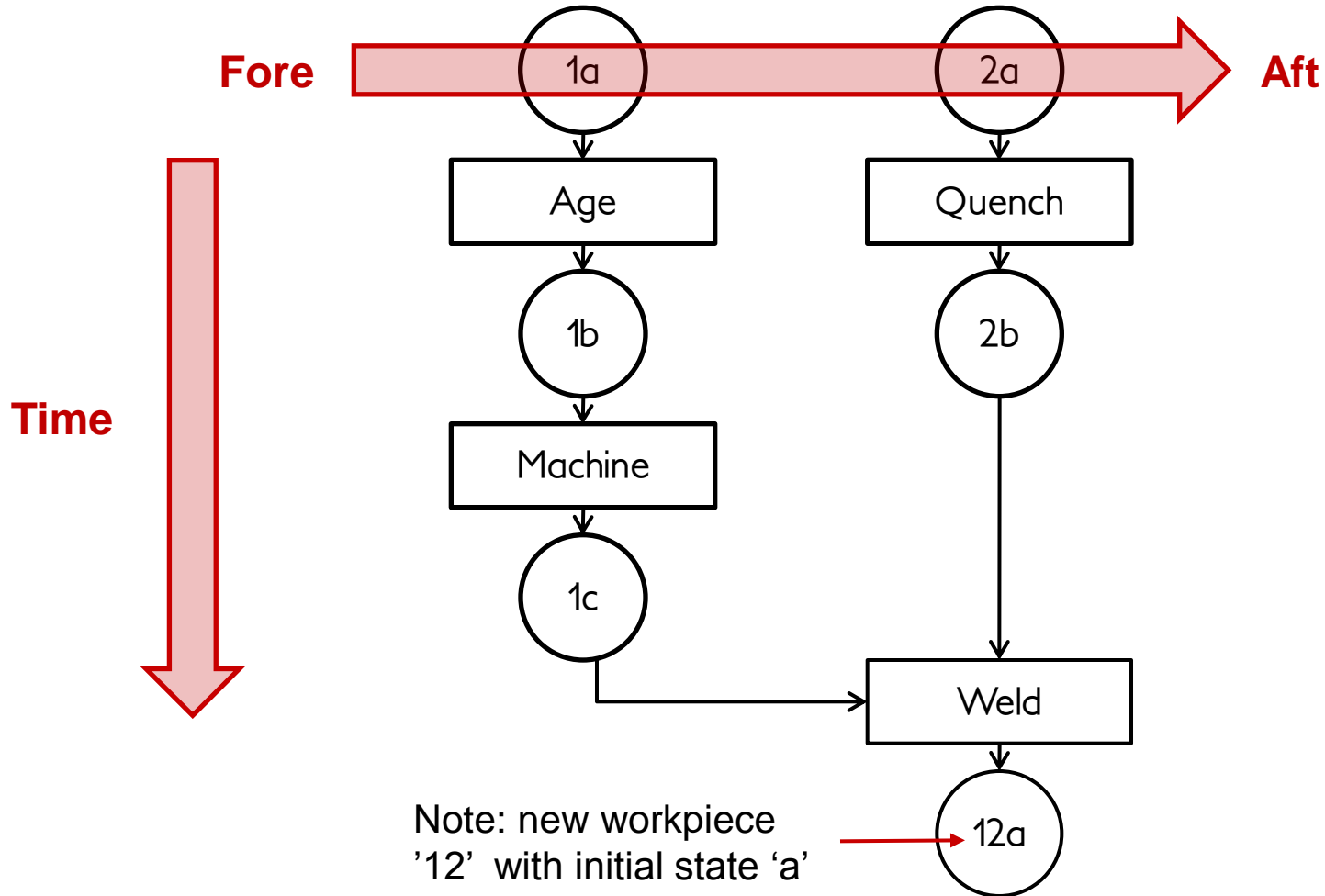
- “Workpiece” object

- “Process” object

- Process changes state of workpiece

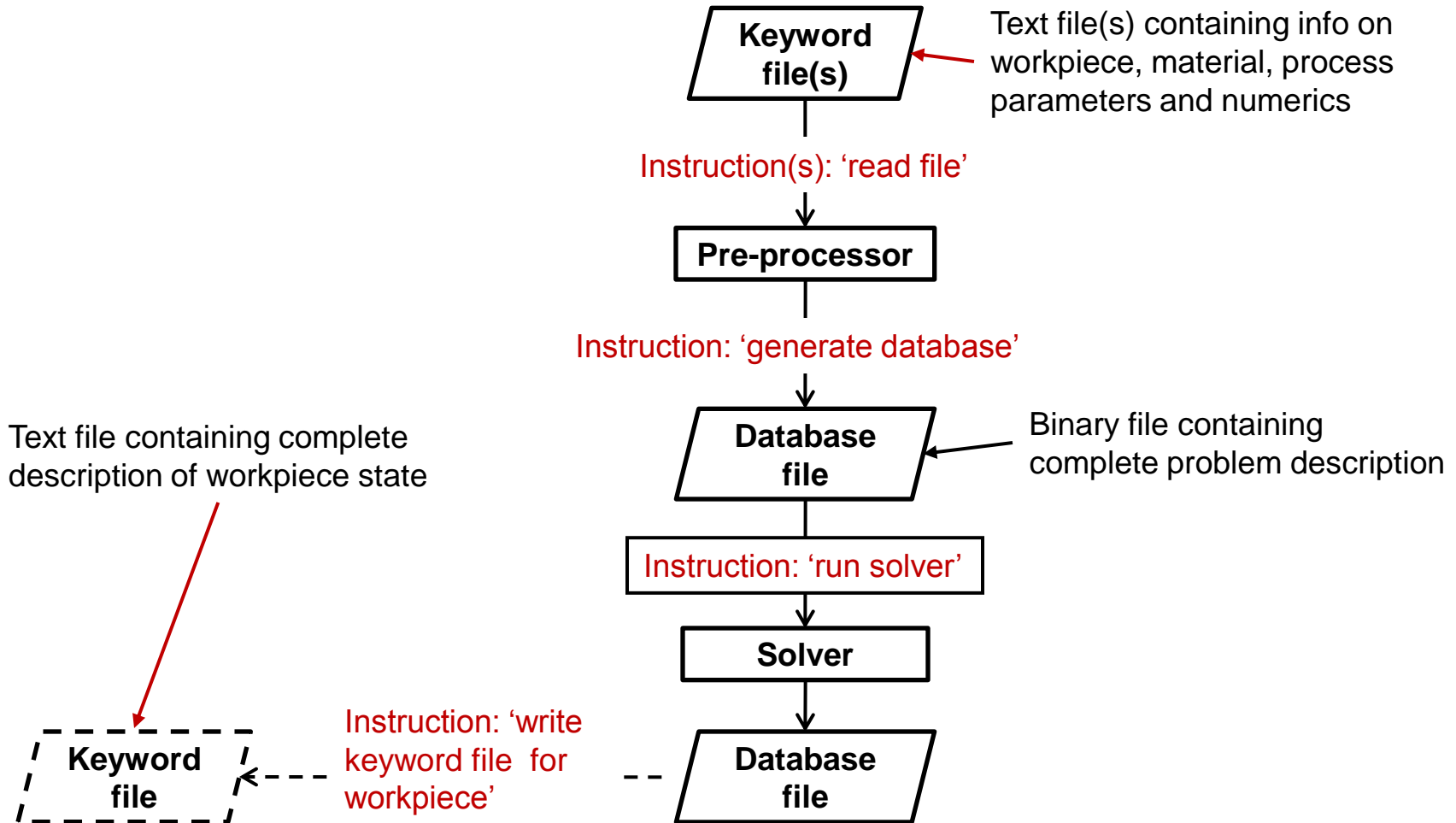


- Representation of manufacturing route



- 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



Workpiece data entry

The screenshot displays the PROMOTE software interface for workpiece data entry. The interface is divided into several key sections:

- Workflow Diagram (Left):** A process flowchart showing steps such as 'HT Age WP1 HT1', 'HT Age WP2 HT1', 'Weld WELD 1-2', 'Machine Post weld mahine', and 'Quench Post weld HT'. Step 1a is highlighted with a red circle.
- Control Panel (Top Center):** A grid of buttons for adding and managing workpieces, including 'Work piece', 'Machine', 'Age', 'Weld', 'Quench', 'Delete', and 'Run'.
- Geometry Display (Bottom Center):** A 2D technical drawing of a workpiece, labeled 'Geometry display'.
- Data Entry Form (Right):** A form for entering workpiece details, including:
 - Project Information:** Project Name (Example), Create Date (01/09/2010), and an Archive checkbox.
 - Engine assembly display:** A yellow highlighted area showing a 3D model of the workpiece.
 - Workpiece Details:** Fields for Id (1a), Description (Workpiece1), Source (Specified), MSRR (None), Geometry (Central: T2000HPT A2.GEO), and Y Datum (0).
 - Material and Mesh:** Fields for Material (Steel), Mix Material (SCMV), Init. Vol. Fract. (1,0,0,0,0,0), and Mesh (Coarse).
 - Status:** A 'Ready' status indicator and a 'Verify' button.

Red arrows point to specific fields in the data entry form with the following labels:

- Import / specify workpiece:** Points to the 'Source' dropdown menu.
- Geometry:** Points to the 'Geometry' dropdown menu.
- Material:** Points to the 'Material' dropdown menu.
- Mesh:** Points to the 'Mesh' dropdown menu.

Age process data entry

Temperature Profile

Action: New View Amend

Filename: Local: Test 1.TP

Time (secs)	Temp. (°C)
0	20
70	650
1000	650
3000	40
4000	20

Temperature profile input

Engine assembly display

Material model inputs

MSRR file input

Process inputs

Points for auto – post processing

Weld process inputs

The interface is titled "New Project - Work Piece". On the left, a process flowchart shows two parallel paths. The left path includes steps 1a (HT Age WP1 HT1) and 1b. The right path includes steps 2a (HT Age WP2 HT1), 2b (Weld WELD 1-2), 12a (Machine Post weld mahine), 12b (Quench Post weld HT), and 12c. Step 2b is highlighted with a red box. In the center, a control panel has buttons for "Work piece", "Machine", "Age", "Weld", "Quench", "Delete", and "Run". The "Weld" button is highlighted with a red box. To the right of the control panel is a 2D cross-section diagram of a flywheel with "Fore" and "Aft" labels. Further right is a metadata section with fields for "Project Name" (Example), "Create Date" (01/09/2010), and "Archive" (checkbox). Below this is a "Notes" section. The main configuration window on the right is titled "WELD 1-2" and contains the following inputs:

- Description: WELD 1-2
- 1b Microstructure: Central: Weld_SCMV_Master.n (Material model input)
- 2b Microstructure: Central: Weld_SCMV_Master.n (Material model input)
- Flywheel: Fore
- Flywheel Die: Local: FlywheelDie.geo (Dies & Fixtures)
- Force Die: Local: ForceDie.geo (Dies & Fixtures)
- Lateral Spindle Constraint: Local: New_Fixture1.geo (Dies & Fixtures)
- Lateral Fixture Constraint: Local: New_Fixture2.geo (Dies & Fixtures)
- Weld Pressure: 40000 psi (Weld inputs)
- Initial Surface Speed: 200 ft/min (Weld inputs)
- Interface Inner Diameter: 5 in (Weld inputs)
- Interface Outer Diameter: 10 in (Weld inputs)
- Energy Per Unit Area: 100000 J/m2 (Weld inputs)
- Efficiency: 0.85 (Weld inputs)
- Initial Rotat'l Speed (rad/s): 8.0000 (Weld inputs)
- Inertia: 118.75956184629 kg.m2 (Weld inputs)
- Total Forge Load Time: 45.0 (Weld inputs)
- Status: Ready
- Buttons: Verify
- Tracking points: 1b Tracking points 0 P, 2b Tracking points 0 P

Material model inputs

Dies & Fixtures

Weld inputs (Load / inertia)

Engine assembly display

Machine process inputs

The screenshot displays the PROMOTE software interface for a 'New Project - Work Piece'. The interface is divided into several sections:

- Process Flowchart (Left):** A sequence of steps: 1a (HT Age WP1 HT1), 1b, 2a (HT Age WP2 HT1), 2b, Weld WELD 1-2, 12a (Machine Post weld machine), 12b, Quench Post weld HT, and 12c. The 'Machine Post weld machine' step is highlighted with a red box.
- Control Panel (Middle-Left):** An 'Add' section with buttons for Work piece, Machine (highlighted with a red box), Age, Weld, Quench, and Delete. A 'Run' button is at the bottom.
- Engine Assembly Display (Middle-Right):** A 2D cross-section of a workpiece with 'Fore' and 'Aft' labels. A red dashed box highlights this area, with a red arrow pointing to it from the text 'Engine assembly display'.
- Project Information (Top-Right):** Fields for Project Name (Example), Create Date (01/09/2010), and an Archive checkbox.
- Machine Process Details (Bottom-Right):** A detailed view of the 'Machine Post weld machine' step. It includes a description 'Post weld mahine', a '12a Microstructure' dropdown, and a 'New - end' button. A 'Cut Profile' button is highlighted with a red box and a red arrow. Below this is a table of cut profiles:

Cut	Cut Profile
1	Local: OD_FLASH2.GEO
2	Local: ID_FLASH2.GEO

A red arrow points from the text 'Cut profiles' to the table. At the bottom, the status is 'Ready' and '12a Tracking points' is 0.

Machine process inputs

The screenshot displays the PROMOTE software interface with several key components:

- Process Flowchart:** A sequence of operations including 'HT Age WP1 HT1', 'HT Age WP2 HT1', 'Weld WELD 1-2', and 'Post weld mahine'. Steps are marked with green checkmarks and labels like 1a, 2a, 1b, 2b, 12a.
- Machine Selection Panel:** A central panel with buttons for 'Work piece', 'Machine', 'Age', 'Weld', 'Quench', 'Delete', and 'Run'. The 'Machine' button is highlighted with a red box.
- Engine Assembly Display:** A 2D cross-sectional view of a mechanical part, labeled 'Fore' and 'Aft', enclosed in a dashed red box with the text 'Engine assembly display'.
- Cut Profile 1 Dialog:** A foreground window for defining a cut profile. It includes a table of coordinates and a graphical preview of the part with a cut line.

	X	Y	Radius
1	210	-132	0
2	210	-172	0
3	260	-172	0
4	260	-82	0
5	210	-132	0

Cut profiles

Promote

File Project Setup Window Help

Amend Project - Run

Add

Work piece Machine Age Weld Quench Delete Run

Project Name: PROMOTE_demo
Create Date: 24/08/2010
Archive:

Do	Process	Status	Last Run	Start	End	Time Taken
<input checked="" type="checkbox"/>	HT Age 1a	Ready	27/08/2010 13:35			
<input checked="" type="checkbox"/>	HT Age 2a	Ready	24/08/2010 10:12			
<input checked="" type="checkbox"/>	Weld 1b and	Ready	27/08/2010 13:38			
<input checked="" type="checkbox"/>	Machine 12a	Ready				
<input checked="" type="checkbox"/>	Quench 12b	Ready				

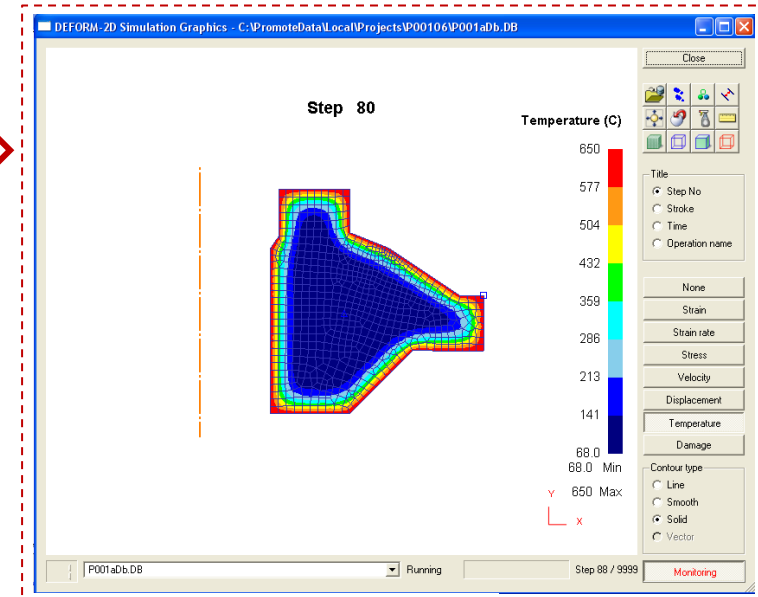
Automated batch run scheduling

Debug Analysis

Analyse Weld Option: All

Report: Quench 12b Report Data Extract Deform View RR PR

Start Simulation Show Simulation Graphics Cancel after current process



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

jfarrar@wildeanalysis.co.uk

Tel: 0161 4747479