Virtual Joining Portal

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A new service from EWI which combines
- Welding Procedure Database
- Welding Management
- Supercomputer Architecture
- Numerical Analysis software
- Internet Delivery

Two of the important challenges faced by ship building:

- Welding related distortion, shrinkage and dimensional instability
  - Acute with thin-sheet high-strength steels
  - Extensive and expensive re-work
  - Difficult to predict and design against these effects
- Management of Weld Procedures and Qualifications
  - Ship building involves extensive geometry, material and process conditions
  - Difficult to track and maintain welding procedures for 100s of designs

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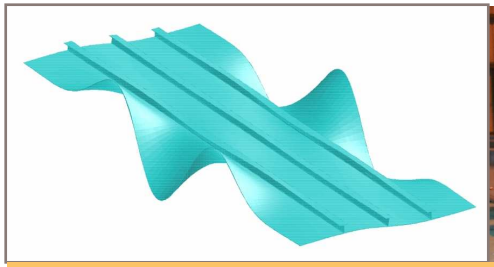
Challenge 1: Distortion, Shrinkage, Residual Stress and Hard Microstructure

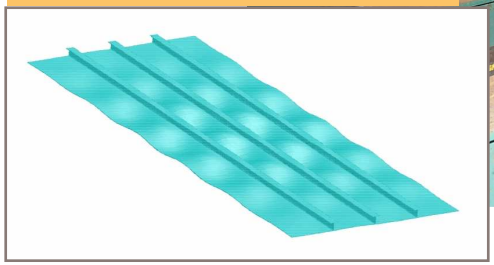
Computational modeling helped to minimize distortion in ship building:

- Distortion, shrinkage, dimensional tolerances leads to extensive re-work:
- EWI and other organizations have developed tools to predict distortions
- Thermal tensioning procedure was developed by using these tools.



Extensive distortion

Minimal distortion



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Bottleneck for use of computational modeling:

- Deployment of the model in their own companies as desktop applications is difficult
- Models should be easy to use and accessible to the welding engineers and should be rapid
- Usage as simple “what-if” scenario without searching for that 100% accuracy!
- Automatic analysis and reporting
- Usage as a way of technology retention and transfer in legacy systems
- Models should not need a full-time FEA expert

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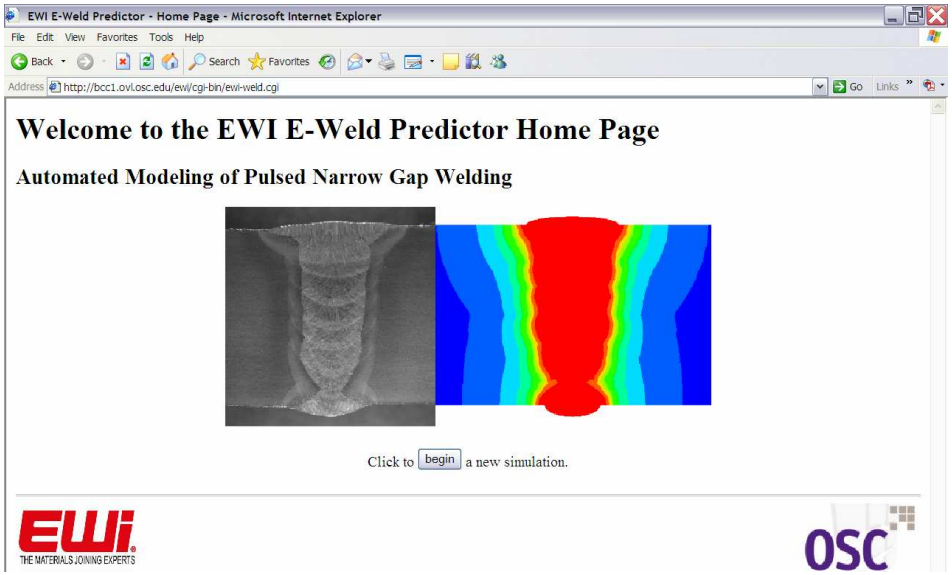
EWeldPredictior© Technology:



Typical analysis time for existing capability = 8 hrs

New EWI/OSC service offering: 3-5 minutes.

- Three different expertise are coupled.
- EWI
  - Weld simulation knowledge
  - Validated by US Government projects
- OSC
  - Supercomputing resources
  - Internet software
- ABAQUS
  - Finite element software expertise
- New direction in the industry
- Being deployed for ESI & LANL already

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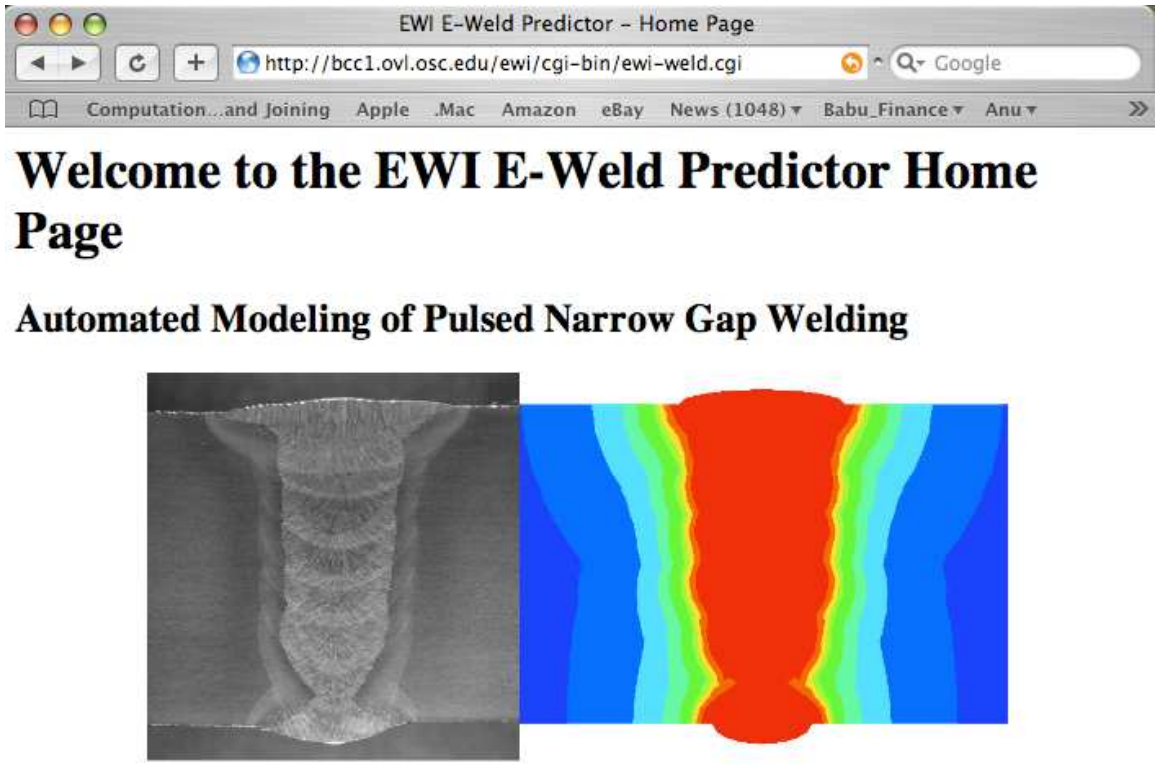
7 seconds tour of the EWeldPrecitor© service

Overview of the service

Step 1: Application



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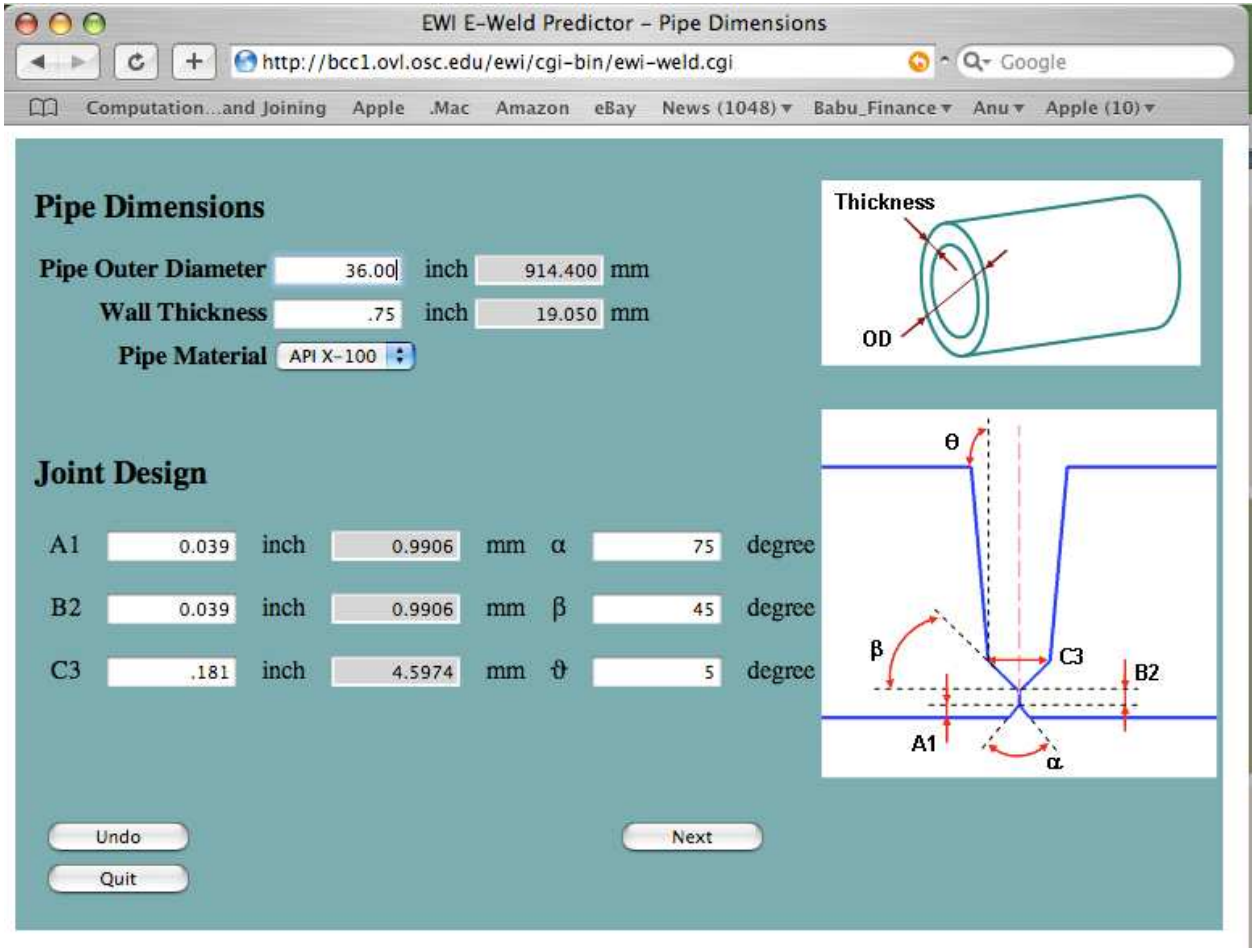
Step 2: Geometry



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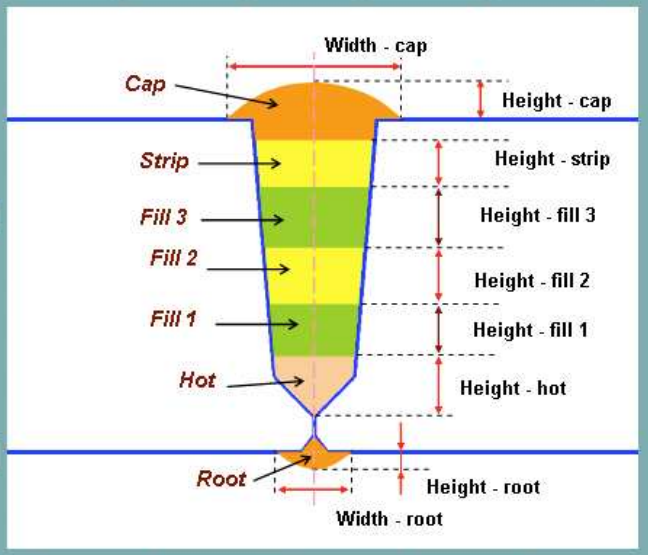
Step 3: Process

Pass	Current (A)	Voltage (V)	TS (mm/s)	Pre/Inter-pass Temp. (F)	(C)	WFS (mm/s)	Heat in. (kJ/mm)
Int. root	178.0	20.5	11.83	212	100	51.2	.31
Hot pass	179.0	21.5	8.00	221	105	130.9	.48
Fill 1	177.0	22.0	7.58	221	105	130.9	.51
Fill 2	176.0	22.0	7.83	230	110	130.9	.49
Fill 3	176.0	23.0	7.67	221	105	130.9	.53
Strip	176.0	23.0	8.00	230	110	130.9	.51
Cap	145.5	24.0	8.33	221	105	146.6	.42

Weld Bead Size

Pass	Height mm	Width (mm/s)
Int. root	0.813	5.600
Hot pass	4.607	
Fill 1	3.266	
Fill 2	2.871	
Fill 3	2.704	
Strip	2.420	
Cap	1.233	9.400



Undo Back Estimate Next

Quit

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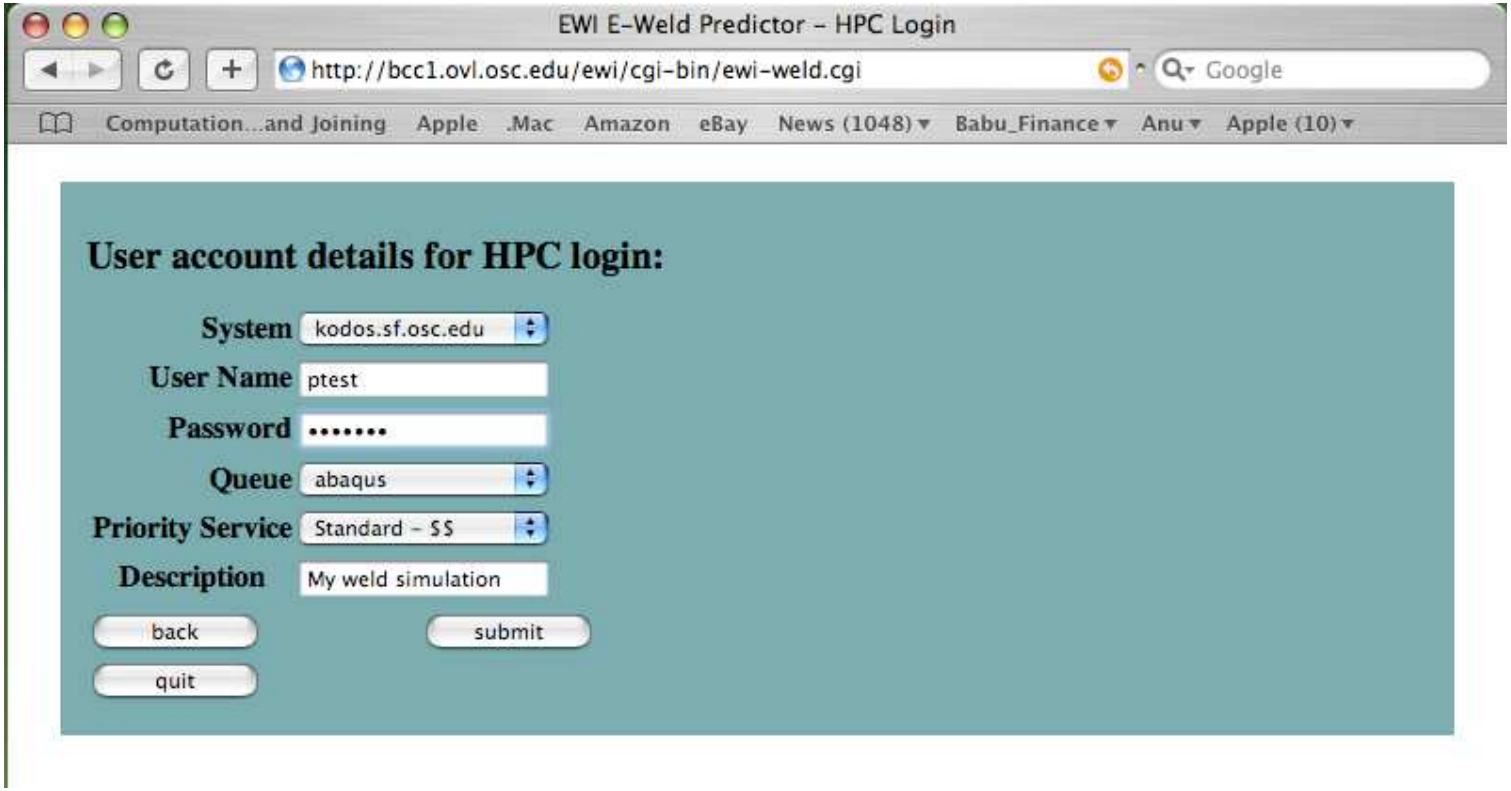
Step 4: Decide on purchase



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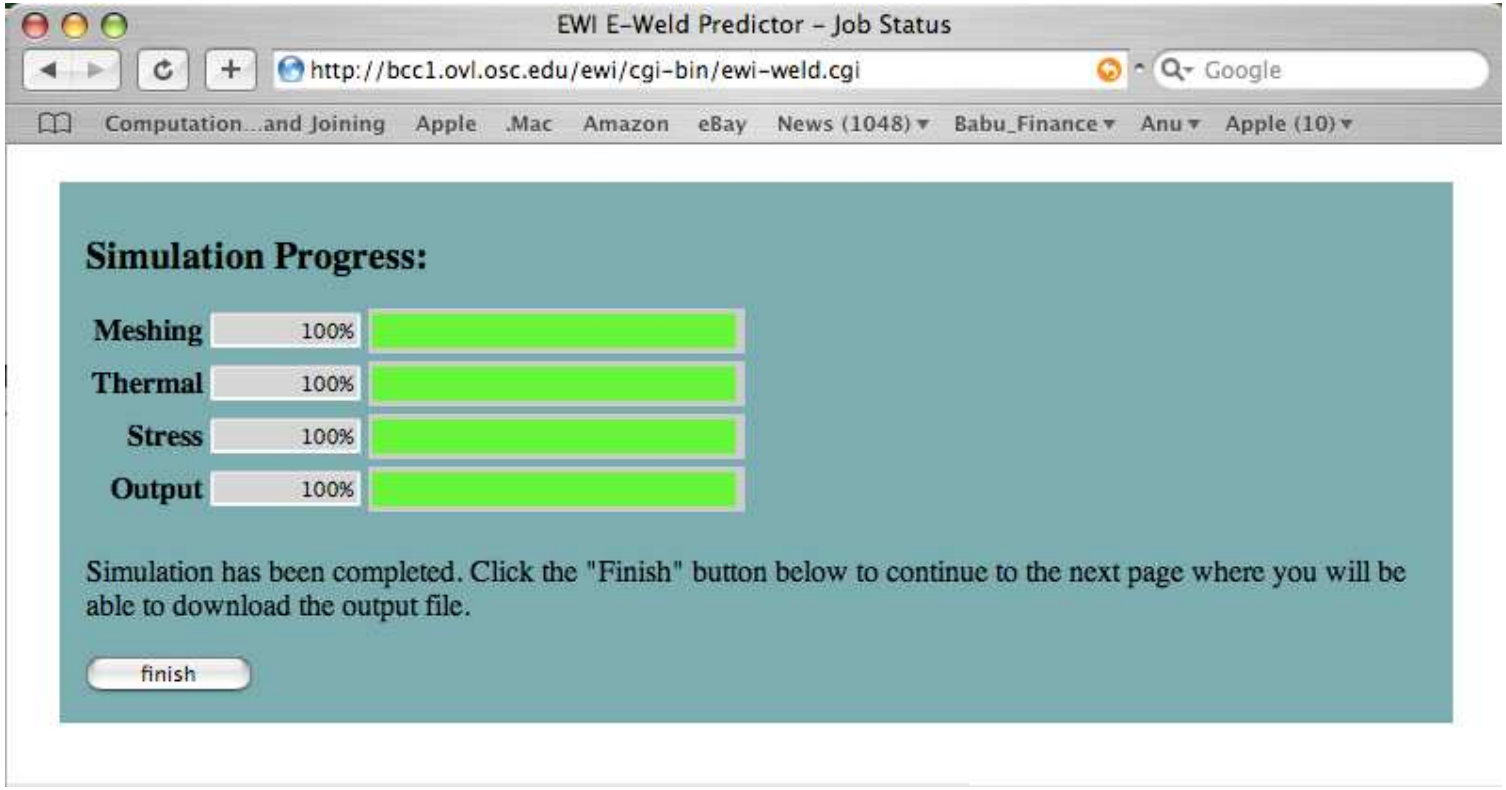
Step 5: Progress



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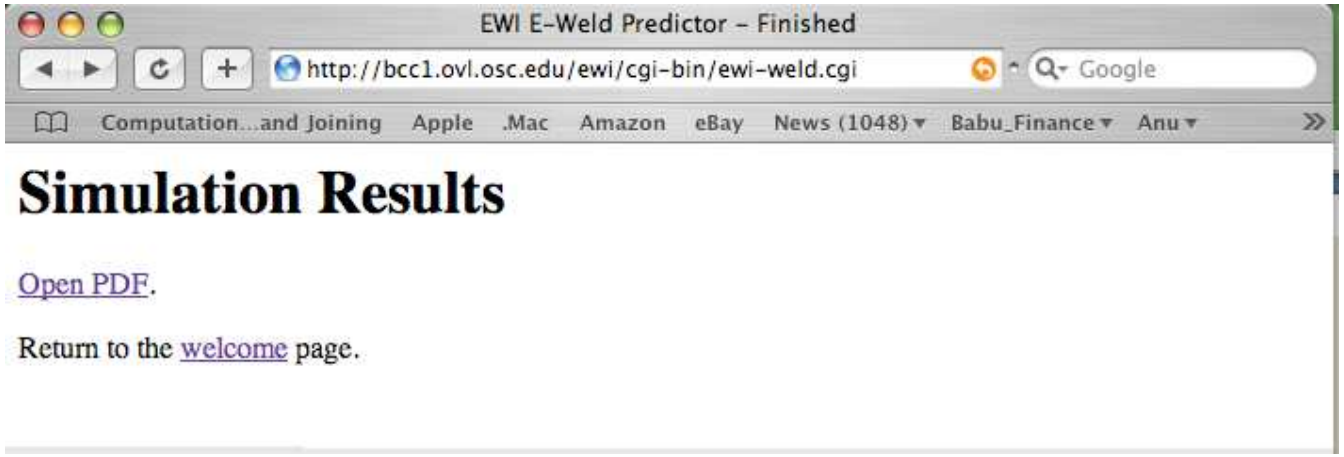
Step 6: Results



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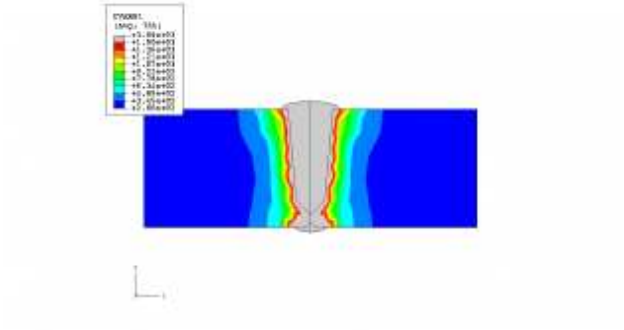
Step 7: Report is created

Section 2 - Thermal Analysis

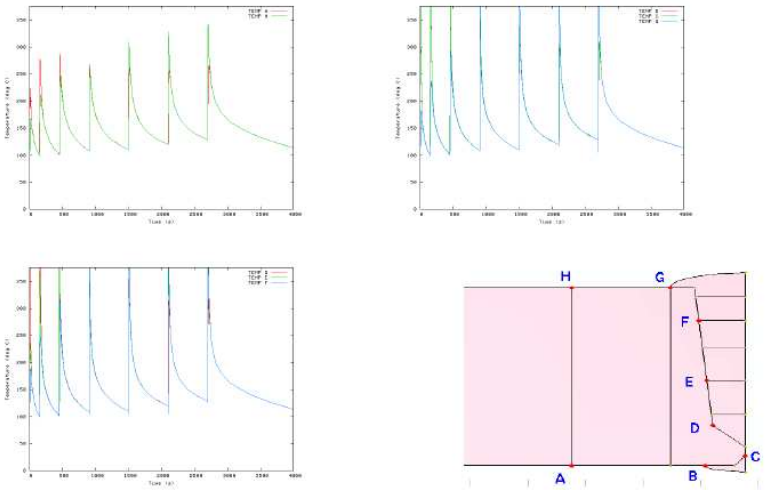
Distribution of peak temperatures



Average cooling rates between 800 and 500 °C. Zero cooling rate means that the peak temperature at that monitoring location is less than 500 °.

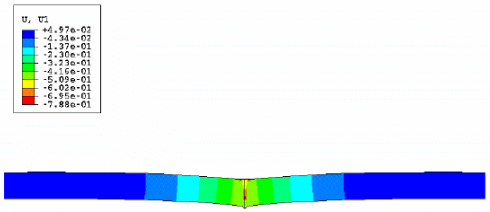
	A	B	C	D	E	F	G	H
Int. root	0.0	113.3	131.3	51.9	0.0	0.0	0.0	0.0
Hot pass	0.0	55.6	64.7	76.5	0.0	0.0	0.0	0.0
Fill 1	0.0	17.2	24.0	50.6	94.3	0.0	0.0	0.0
Fill 2	0.0	0.0	0.0	0.0	120.4	0.0	0.0	0.0
Fill 3	0.0	0.0	0.0	0.0	56.1	83.8	23.6	0.0
Strip	0.0	0.0	0.0	0.0	0.0	72.4	66.9	0.0
Cap	0.0	0.0	0.0	0.0	0.0	53.4	60.6	0.0

Thermal cycles at different monitoring locations



Section 3 - Stress Analysis

Distribution of radial displacements (mm). The deformation is magnified by 10 times.



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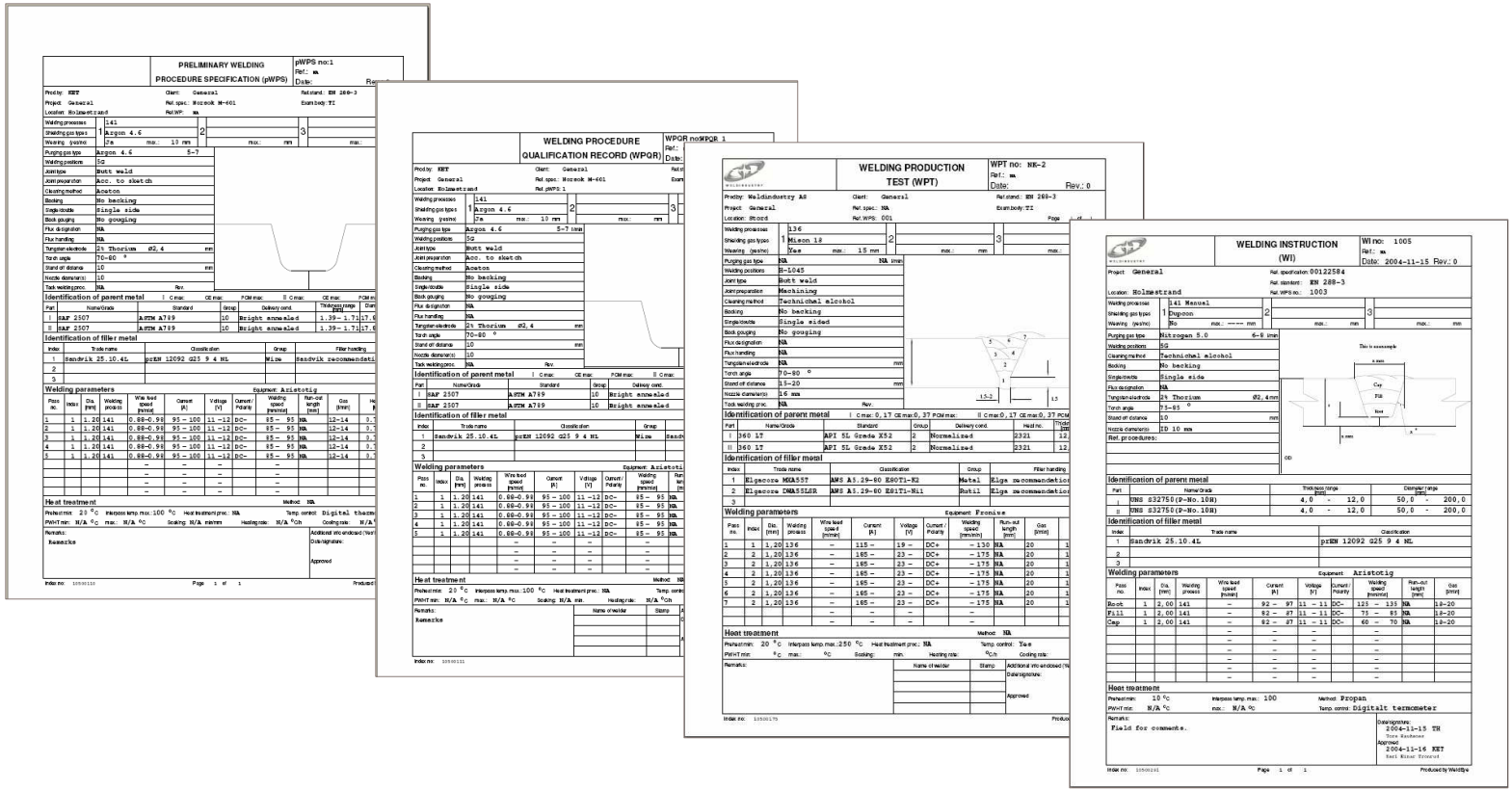
Challenge 2: Extensive Welding Procedure and Data

Large number of welding procedures exist across the organization



- How can we keep track of all these procedures?
- How can we access these procedures over the internet?

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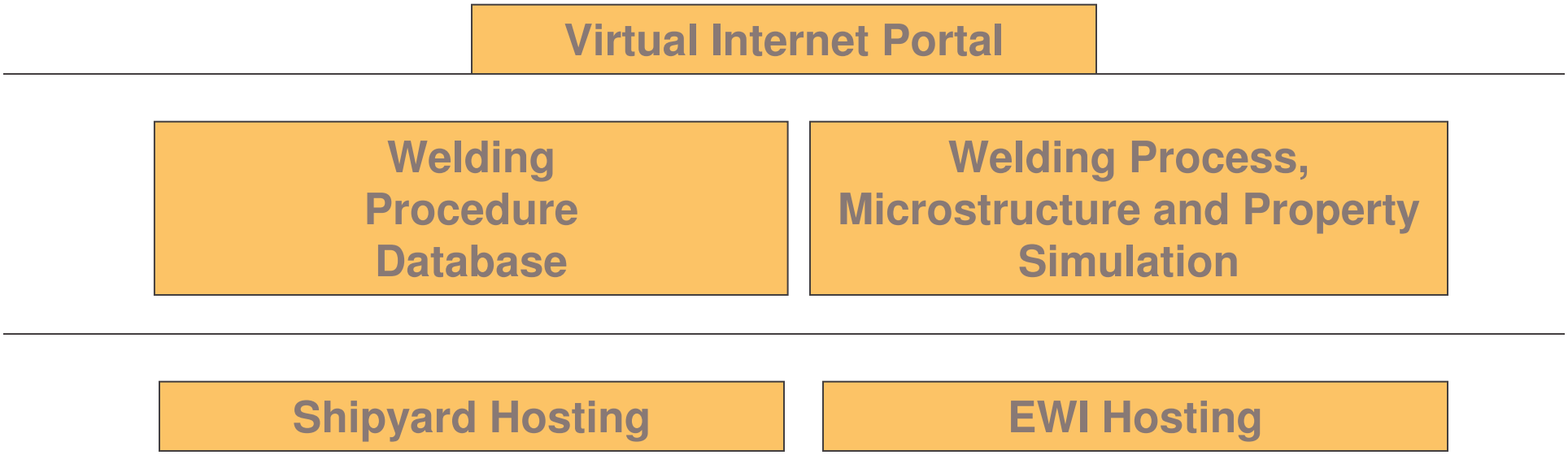
Merging of Data and Modeling



- This tool allows for welding engineer to work off existing procedure and explore the process parameter scope easily

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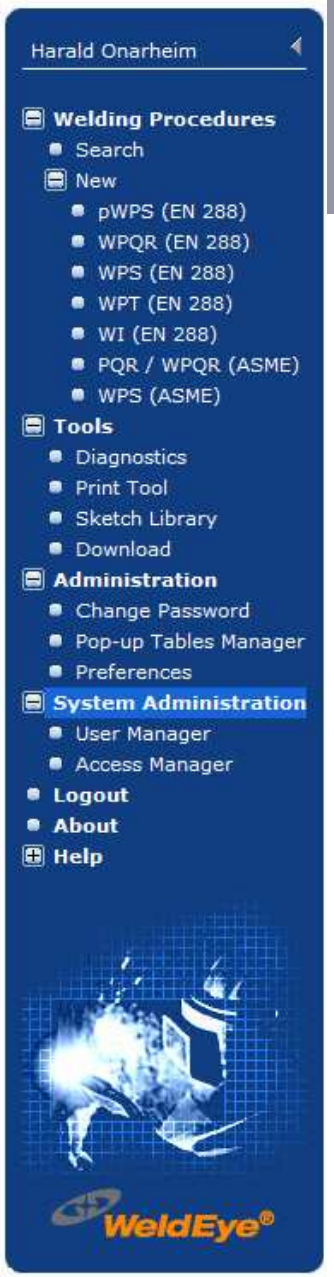
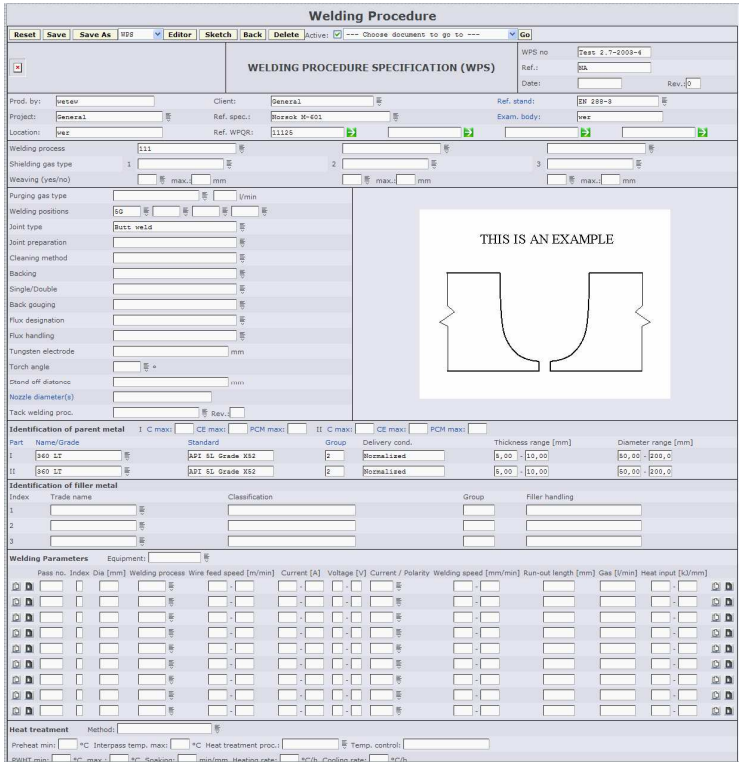
WeldEye® procedures available over the internet

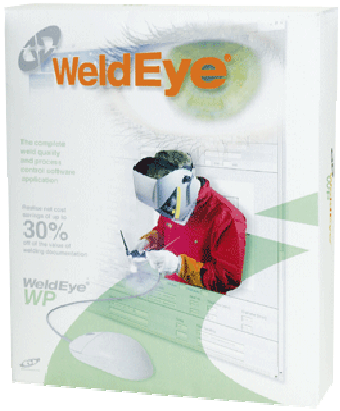


Preliminary Welding Procedure

Welding Procedure Qualification Record

Welding Production Test





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Current Customers of WeldEye

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Future Direction:

Value Proposition for Internet Portal

- Online simulation for welding engineers
  - You do not need PhD in finite element analysis
- Increase accessibility of Data and Simulation
  - Engineering, Software, Hardware, Internet
- Reduce the complexity
  - Simple interface
- Knowledge Retention
  - No reinvention
- Endless cycle of weld procedure development
  - Cost savings:
- Creating Standard
  - Common framework

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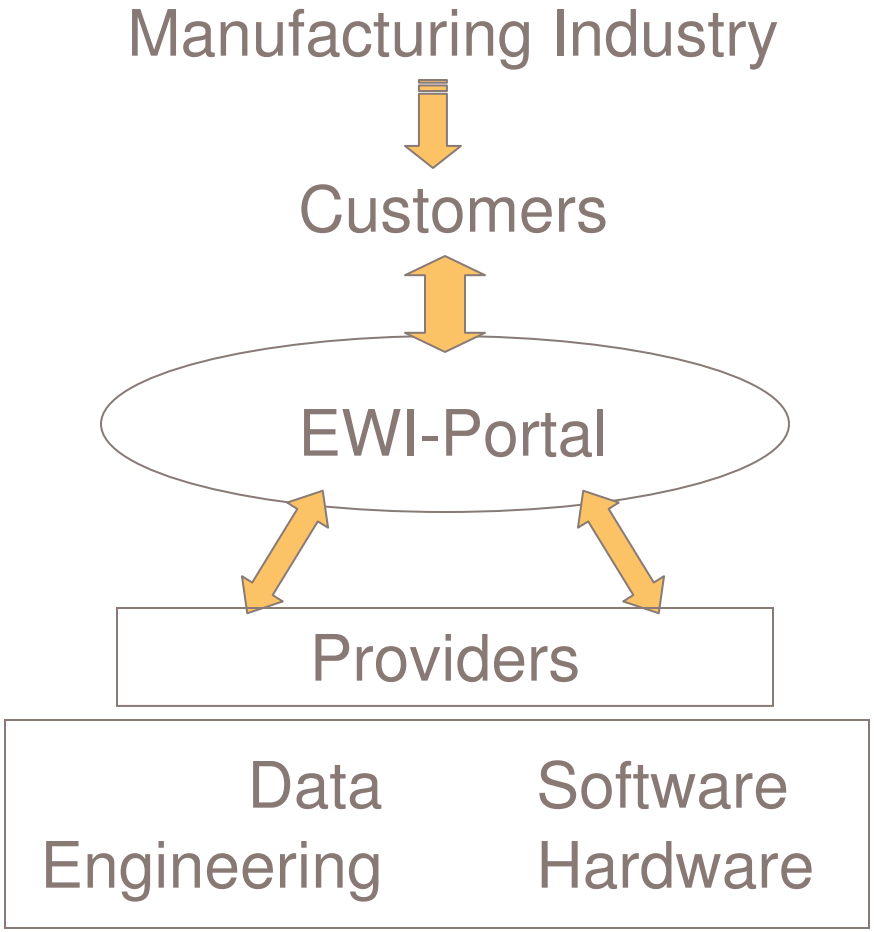
Summary

- EWI customers can access weld simulation over the internet
- EWI service provides cost-avoidance by
  - Reducing the experimental developmental cost
  - Reduces extensive investment on weld simulation
  - Immediate simulation results



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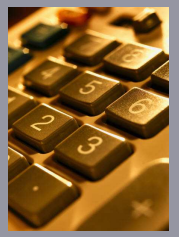
Proposed Service Offering



- Pay per calculation model
  - 1 calculation= 200 dollars
- Block time model (P.O upfront)
  - 1 week :
    - Max. runs = 40; BTM1 = $5,000;
  - 1 month:
    - Max. runs = 160; BTM2 = $15,000;
- Customization possible upon request

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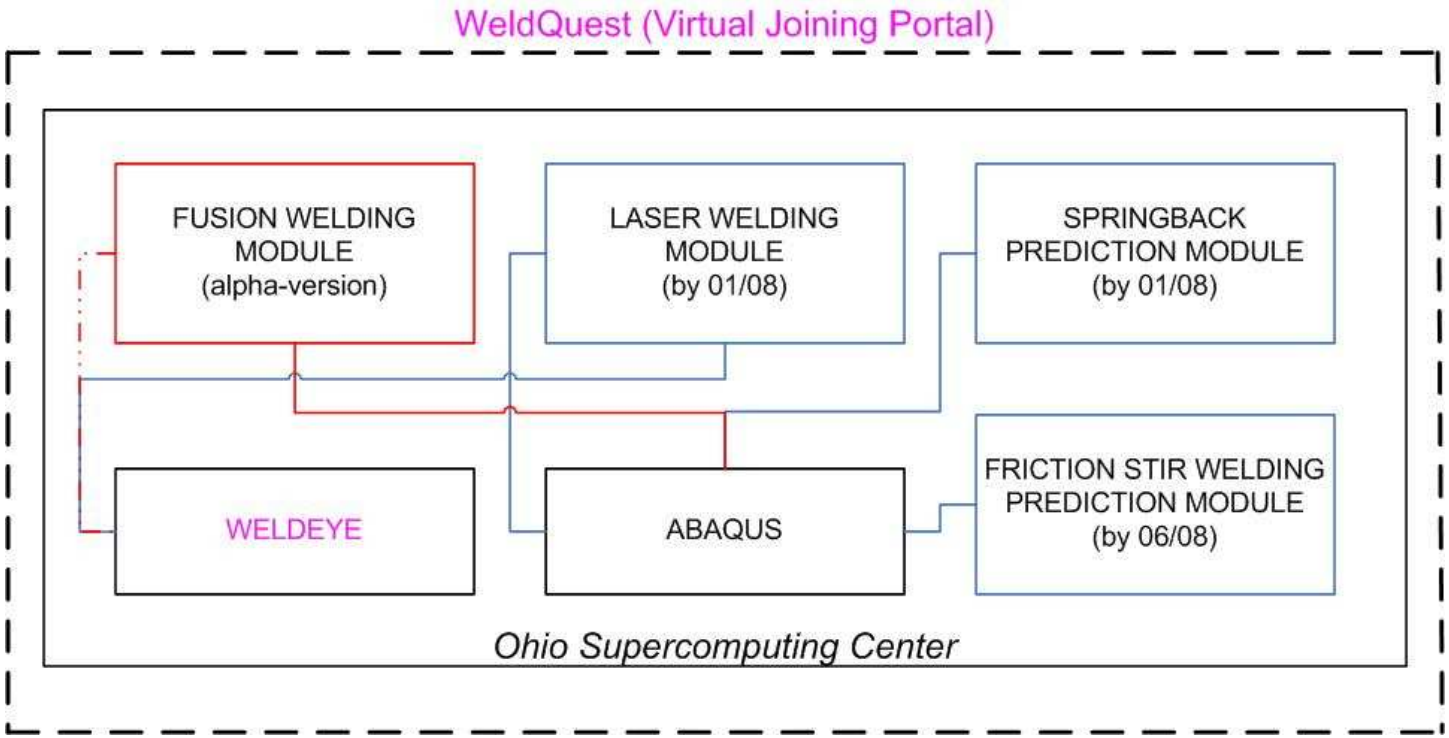
Virtual Joining Portal



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