

The Strategic University Steel Technology and Innovation Network
Presents

Task 5: Intelligent Steel Production

Michael Auinger, University of Warwick
Richard Thackray, University of Sheffield



SUSTAIN

Future Steel Manufacturing Research Hub



UKRI

Engineering and
Physical Sciences
Research Council



The
University
Of
Sheffield.



WMG
THE UNIVERSITY OF WARWICK

Names & Organisations



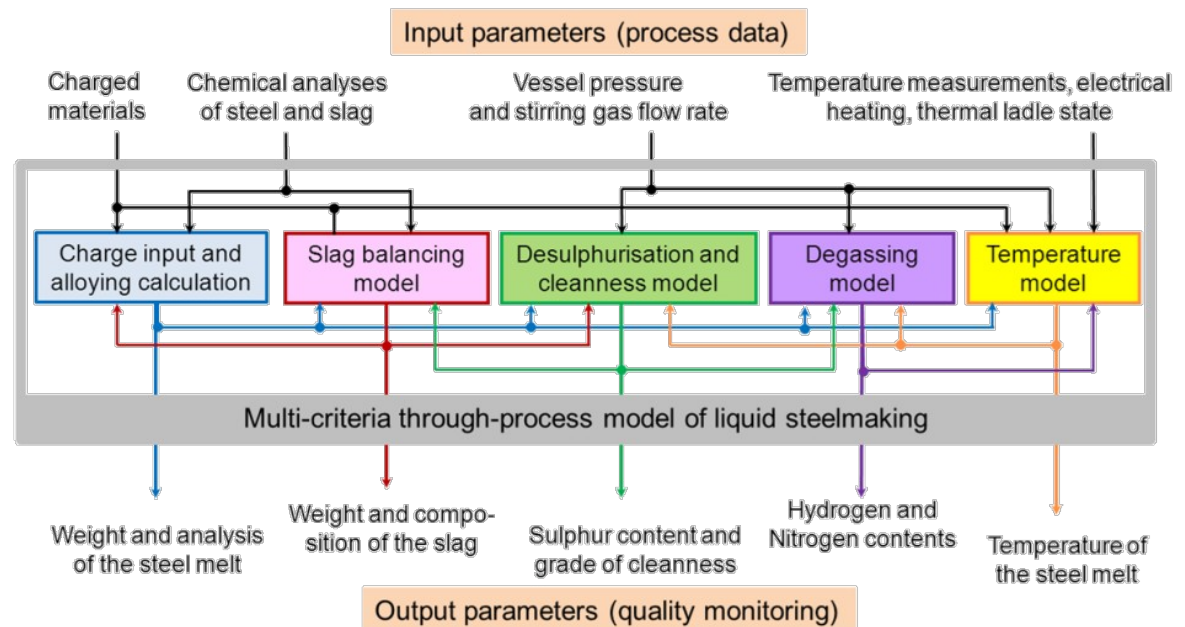
Dr Michael Auinger (Project Lead)
University of Warwick



Dr Richard Thackray
University of Sheffield

Introduction to Project

- Many previous attempts to provide descriptive numerical and analytical computer simulations in virtually all areas of the steelmaking process.
- These are complex models and many have little through process alignment or real time predictive capacity



Schlautmann et al, VDEh

Introduction to Project

Unit Processes



- Fast computation
- Improve performance
- Parameter variation
- Verify accuracy

*In-depth Investigation of
Mechanisms*

Through-Process Model



- In-line optimisation
- Identify bottlenecks
- Link between individual processes

*Material / Cost / Energy
Flow Diagrams*

Process Optimisation



- Generate database
- Verify accuracy of predictions
- Optimise production

*Optimize Production with
respect to critical quantity*

Aims and Impact

Aims

Carry out an *assessment or inventory of existing processes and resource flows*. Use various methodologies to study the resource (energy and material) efficiency of chosen industrial process routes.

Produce a modified LCA, optimise efficiency of building blocks to show the effect of the novel processes developed.

Aims and Impact

Aims

Carry out an *assessment or inventory of existing processes and resource flows*. Use various methodologies to study the resource (energy and material) efficiency of chosen industrial process routes.

Produce a modified LCA, optimise efficiency of building blocks to show the effect of the novel processes developed.

Impact

Delivery of a *coherent process level model for fast and efficient optimisation* of the process chain with respect to cost, energy flow and material usage.

In depth micro model *focussing on the ladle processing steps* for detailed prediction of temperature and chemistry changes over time and produce a series of MFA, LCI and LCA type outputs.

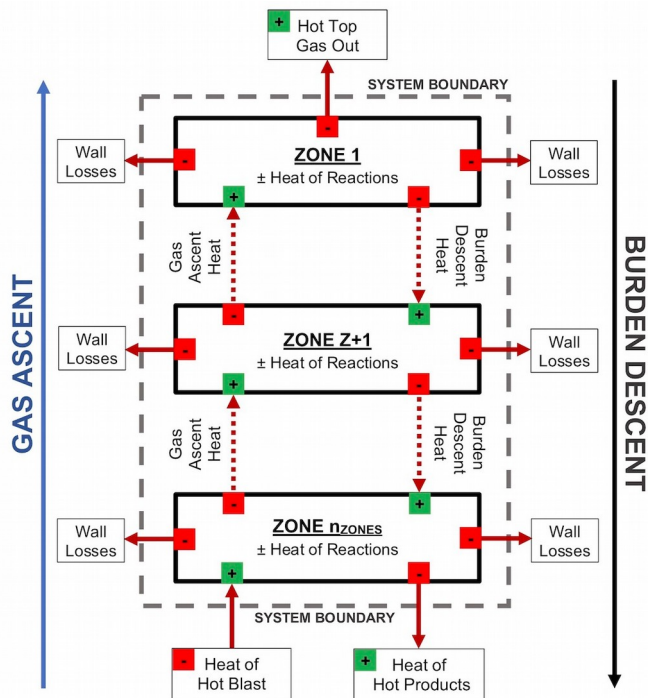
Progress to Date

Example: Zone-model for blast furnace operation

Quick (15s) calculations of product formation rates

Please note: - number of reactions has been simplified

- reaction kinetics were not scrutinised by “real” values



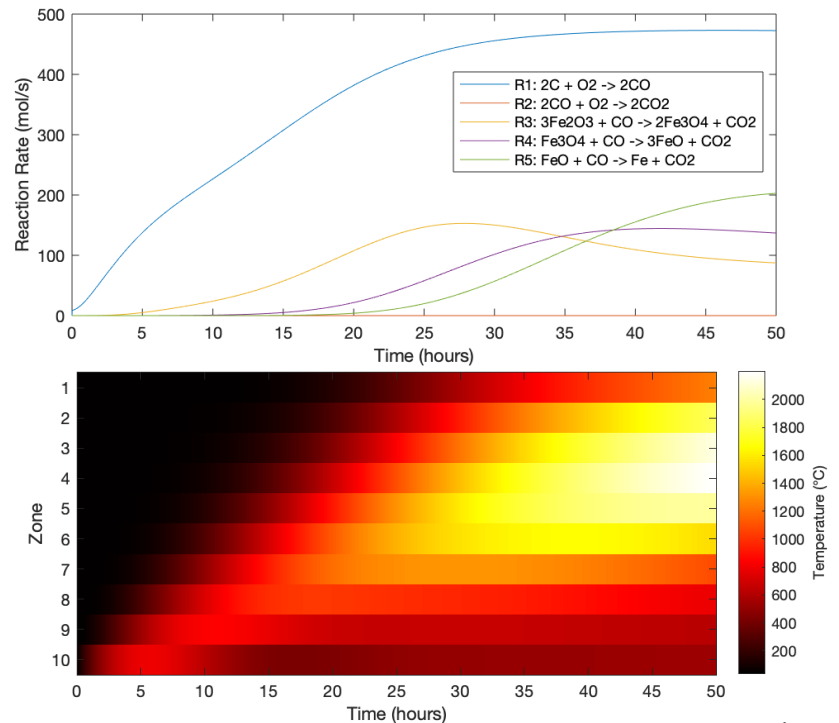
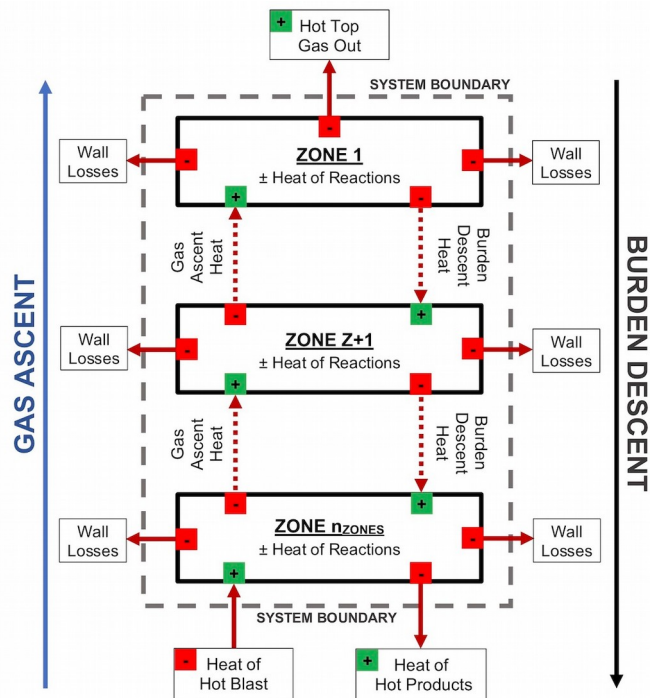
Progress to Date

Example: Zone-model for blast furnace operation

Quick (15s) calculations of product formation rates

Please note: - number of reactions has been simplified

- reaction kinetics were not scrutinised by “real” values

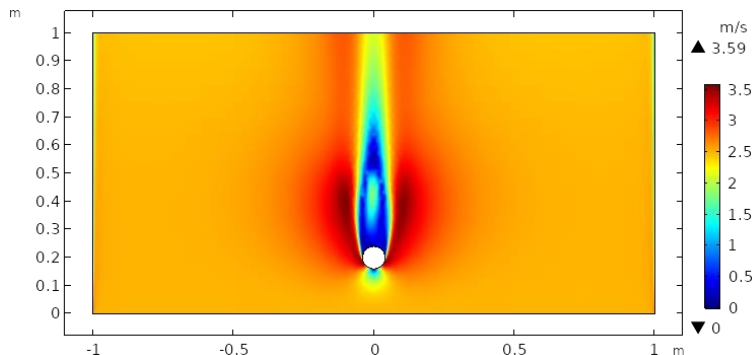
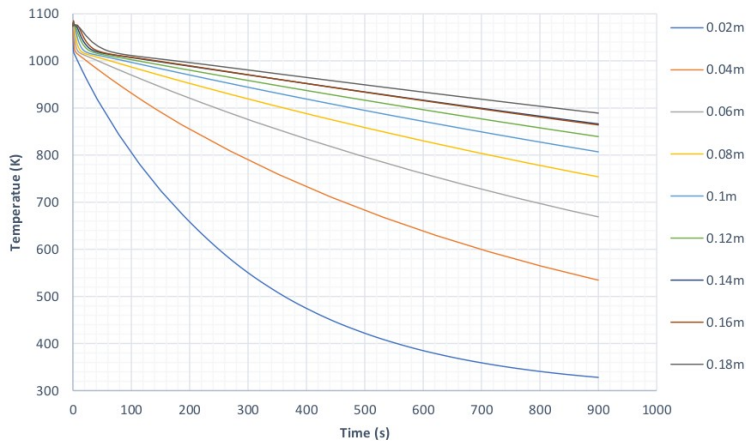


Progress to Date

Example: Local cooling behaviour of porous media

Micro/macro coupling of heat transfer and convection in porous media

Please note that input values were not scrutinised by “real” values.

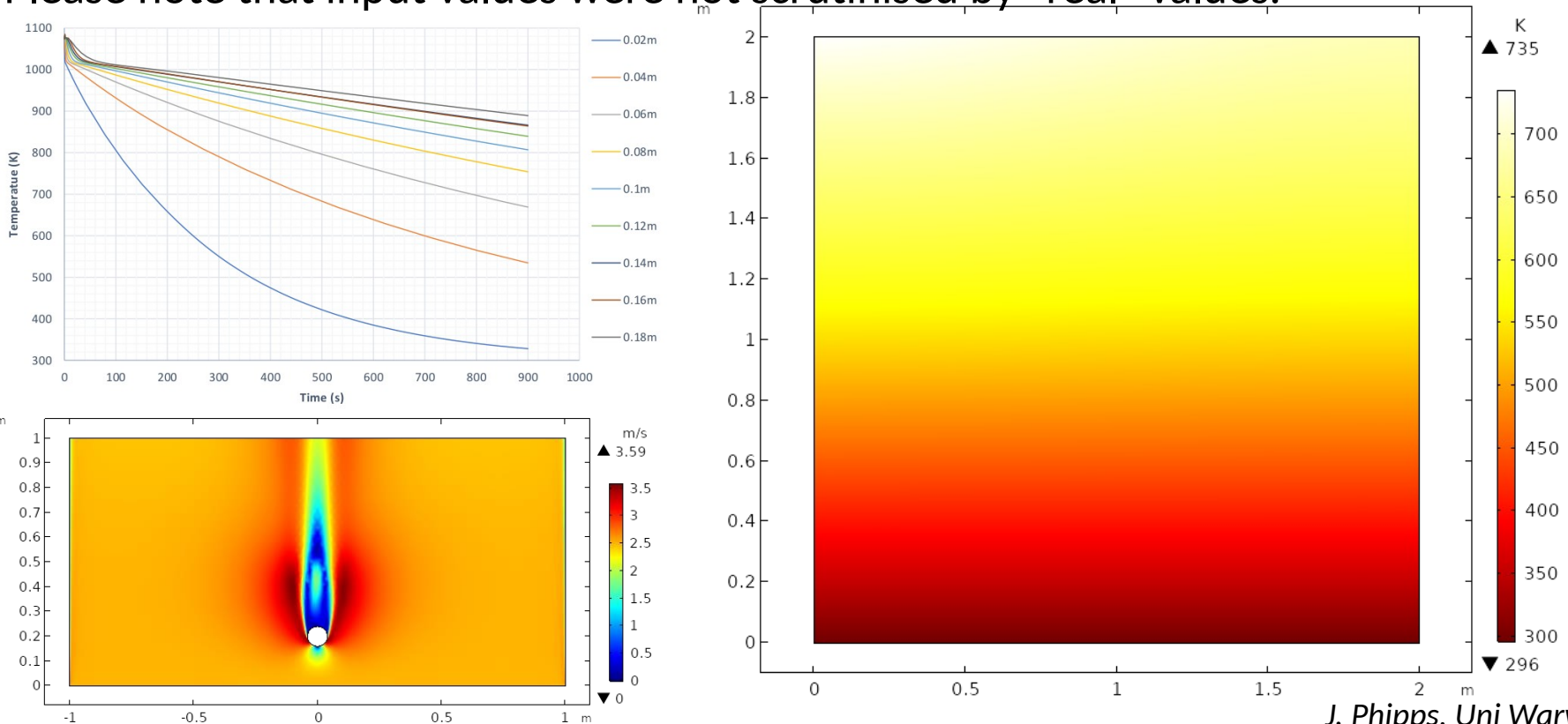


Progress to Date

Example: Local cooling behaviour of porous media

Micro/macro coupling of heat transfer and convection in porous media

Please note that input values were not scrutinised by “real” values.

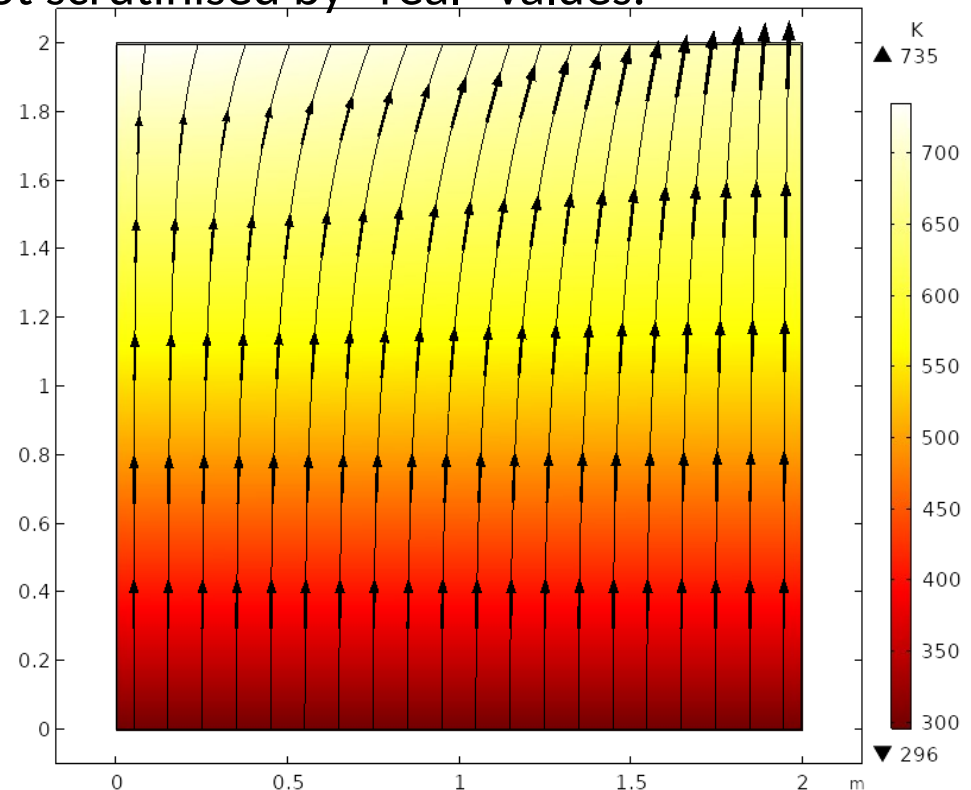
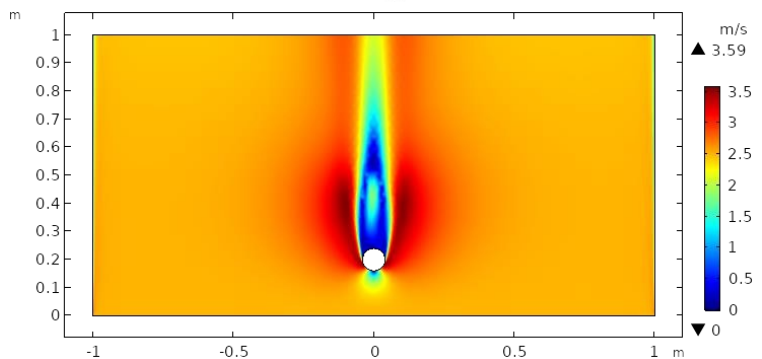
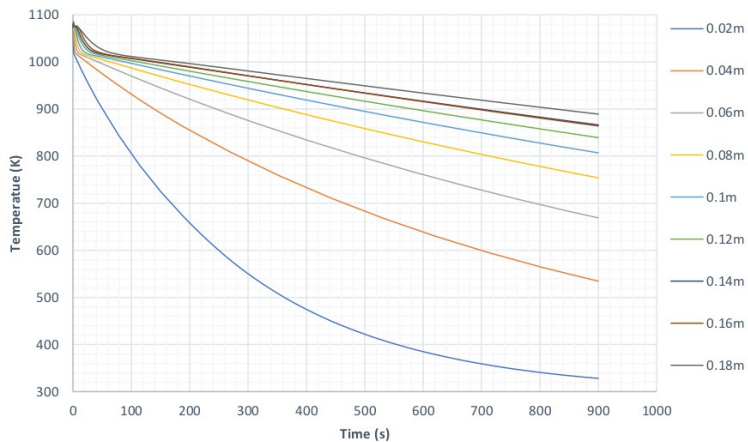


Progress to Date

Example: Local cooling behaviour of porous media

Micro/macro coupling of heat transfer and convection in porous media

Please note that input values were not scrutinised by “real” values.



Progress to Date

- Plans for a virtual workshop for industry and academia to identify areas of priority and to build upon previous discussions
- Extensive literature review to identify relevant previous work and to develop suitable methodologies for the material efficiency assessment



Engineering and
Physical Sciences
Research Council



The
University
Of
Sheffield.



Swansea University
Prifysgol Abertawe



SUSTAIN

Future Steel Manufacturing Research Hub



CELSA
STEEL UK

SHEFFIELD FORGEMASTERS
INTERNATIONAL



TATA STEEL