

**K1-MET  
Competence Center for  
Excellent Technologies in  
Advanced Metallurgical and  
Environmental Process  
Development**

Programme: COMET - Competence Centers for Excellent Technologies

Programme line: COMET-Centre (K1)

Project 4.6 - Process Simulation of Complex Metallurgical Plants



## EVALUATION OF UNCERTAINTY FACTORS IN METALLURGICAL PROCESS OPERATION

THE POTENTIAL INFLUENCE OF UNCERTAINTY FACTORS IN METALLURGICAL PROCESSES HAS BEEN INVESTIGATED USING GLOBAL SYSTEM ANALYSIS (GSA)

### Motivation

Processes in the iron and steel industry rely on raw materials of varying origin and quality. This can therefore introduce a wide range of uncertainty factors into these processes such as changing iron oxide content or moisture content. Further sources of uncertainty are represented by shifting process parameters or external disturbances such as unstable market prices. These uncertainty factors may have a negative impact the economic performance and operational reliability of operation.

A novel approach to evaluate and quantify the influence of such uncertainty factors is presented by the recently introduced global system analysis (GSA)

functionality of the of the gPROMS process simulation platform. This allows for a comprehensive analysis of the of system responses to a number of different input factors. An additional benefit of this type of sensitivity analysis is given by resulting factor sensitivities which can be used to identify those uncertainty factors which have the most significant influence on certain key performance indicators (KPIs) of the analysed system.

### Investigation

Selected processes in iron and steel making have been investigated during an outgoing research stay at Process Systems Enterprise Ltd (PSE) in London. This work was actively supported by the project partners

## SUCCESS STORY

and it was thus possible to investigate process scenarios based on existing plant set-ups such as depicted in Figure 1. Special focus was attributed to the preparation of the raw data to derive uncertainty correlations used in the investigations.

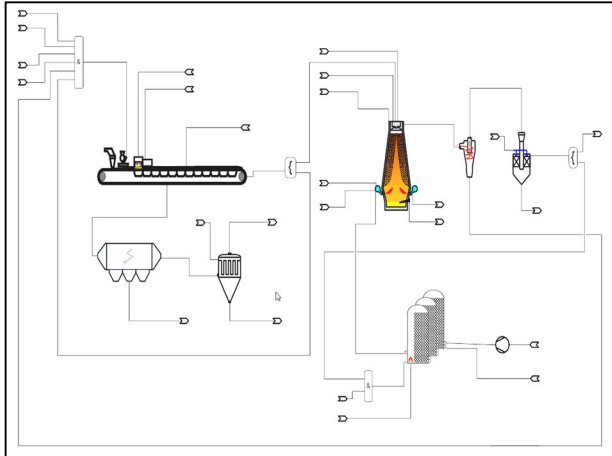


Figure 1: Schematic depiction of an investigated blast furnace iron making process (source K1-MET)

iron and steel industry. As illustrated for example in Figure 2, the concept of global system analysis enabled to identify the impact of multiple uncertainty factors on several key performance indicators of the investigated iron making processes.

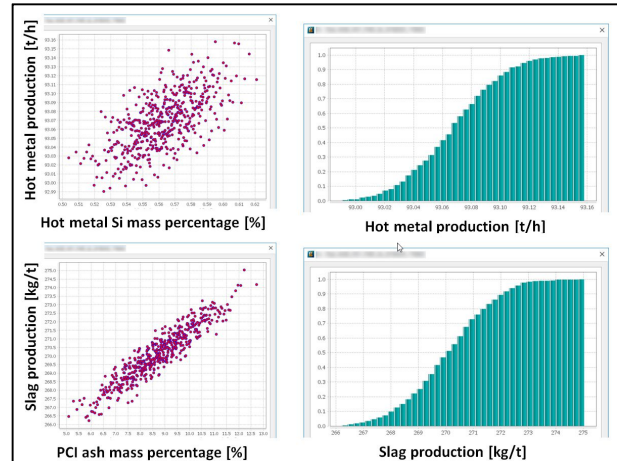


Figure 2: Calculated 2d scatterplots factor/output sensitivities and cumulative histograms of KPIs (source K1-MET)

### Impact and effects

The use of this software-based sensitivity analysis has identified several possible fields of application in the

The quantification of the effect of process uncertainties can help operators and plant manufacturers to minimize operational risks and improve process economics.

### Project coordination (Story)

Andreas Spanlang  
 Researcher  
 K1-MET GmbH

T +43 (0) 732 6989 75682  
 andreas.spanlang@k1-met.com

### COMET Project 4.6

**K1-MET GmbH**  
 Stahlstrasse 14  
 4020 Linz  
 T +43 (0) 732 6989 75607  
 office@k1-met.com  
 www.k1-met.com

### Project partner

- Primetals Technologies  
Austria GmbH, Austria
- voestalpine Stahl GmbH,  
Austria
- TU Wien - Institute of  
Chemical, Environmental  
and Bioscience  
Engineering, Austria

This success story was provided by the consortium leader/centre management and by the mentioned project partners for the purpose of being published on the FFG website. Further information on COMET: [www.ffg.at/comet](http://www.ffg.at/comet)