

Integrated Process Modelling of Ni-Cu Sulphide Treatment at Xstrata Nickel's Sudbury Smelter

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Outline of Presentation

Introduction

Process Models

- Thermo-Chemical Model: FACTSAGE
- Heat and Mass Balance Model: METSIM
- Discrete Event Model: ARENA
- Combination: CHEMSHEET

Smelter Projects

- Operational Troubleshooting
- Capital Projects

Xstrata Nickel's Sudbury Smelter



**Aerial view of Xstrata Nickel Sudbury Smelter
Falconbridge, Ontario, Canada**

Introduction: Xstrata Nickel's Sudbury Smelter

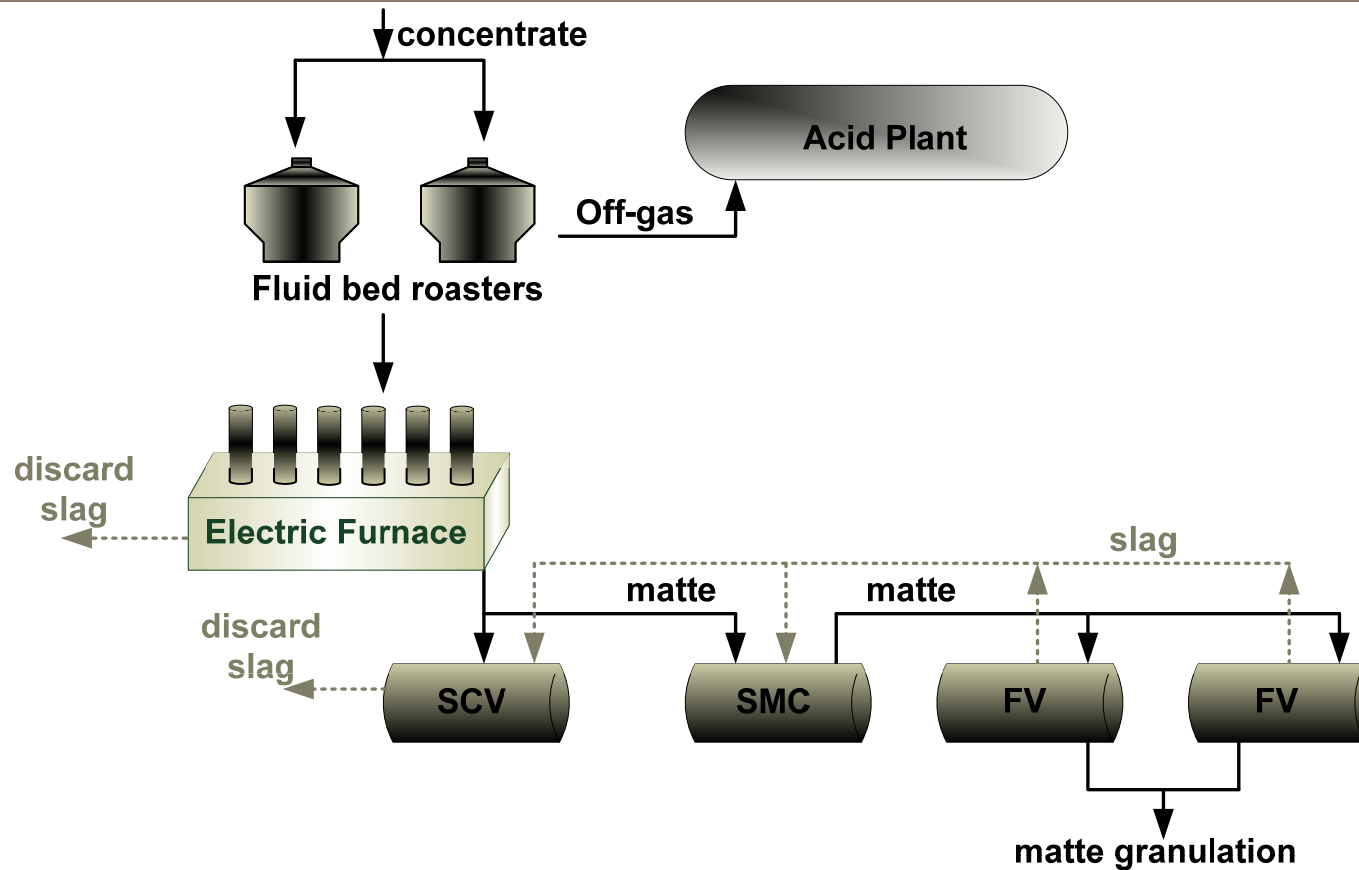


Location: 15km northeast of Sudbury in the township of Falconbridge. Operational since 1930.

Capacity: 550,000 tonnes of Ni/Cu concentrates annually

Recent focus: Operational excellence, emission control, capacity expansions

Xstrata Nickel's Sudbury Operation



Improving plant performances needed process models:

[Thermo-chemical modeling](#)

Heat and Mass Balance Study: Individual Unit Operation

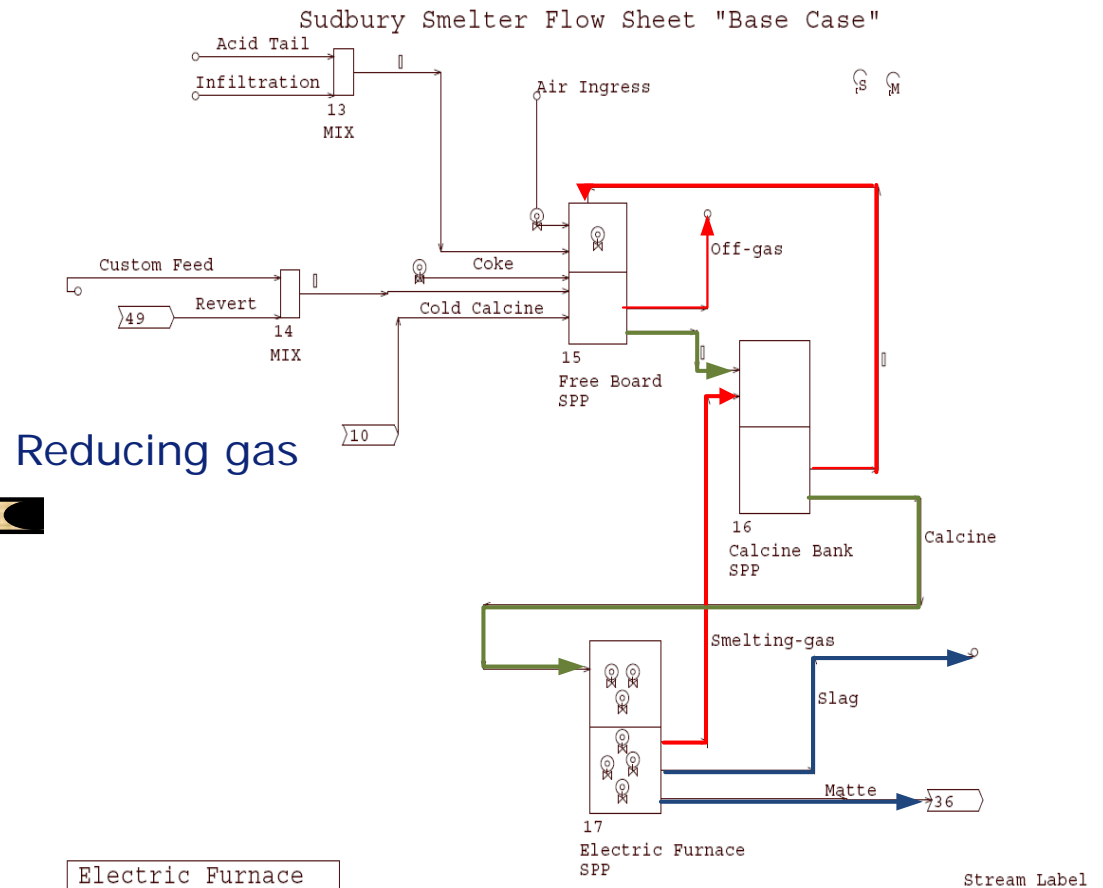
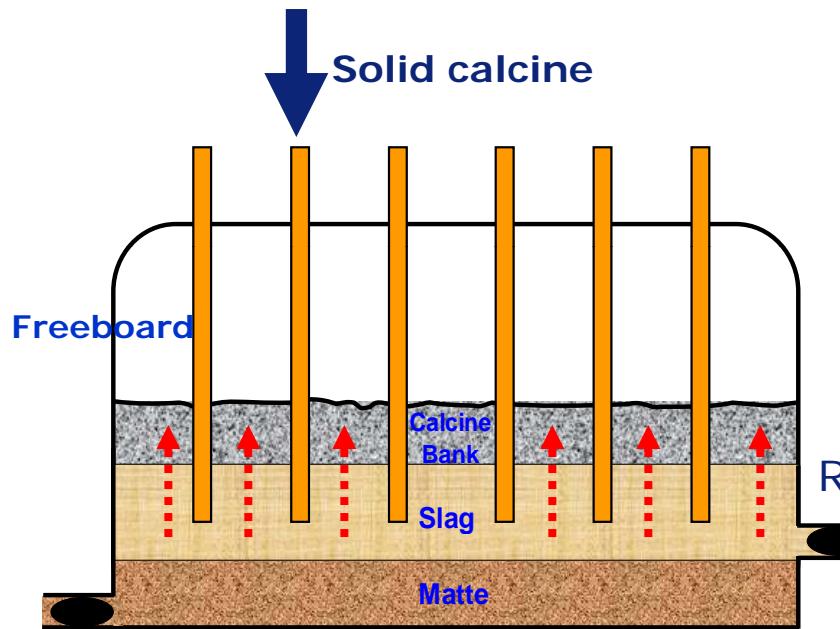


Applying principles of thermo-chemistry

- **FACTSAGE**
- **METSIM**

Understanding of a complex process mechanism in a vessel such as Electric Furnace.

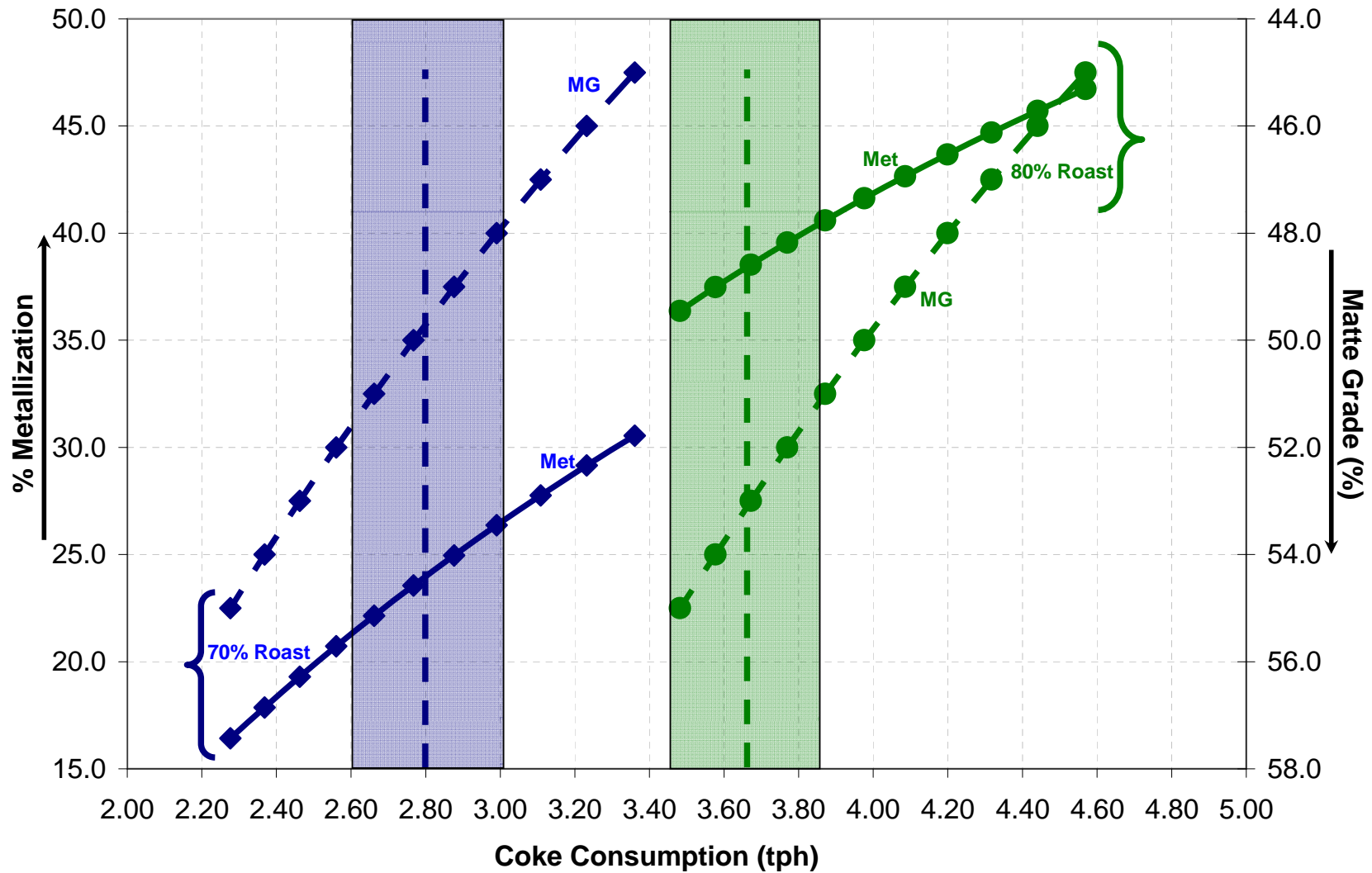
Process Mechanism: Electric Furnace



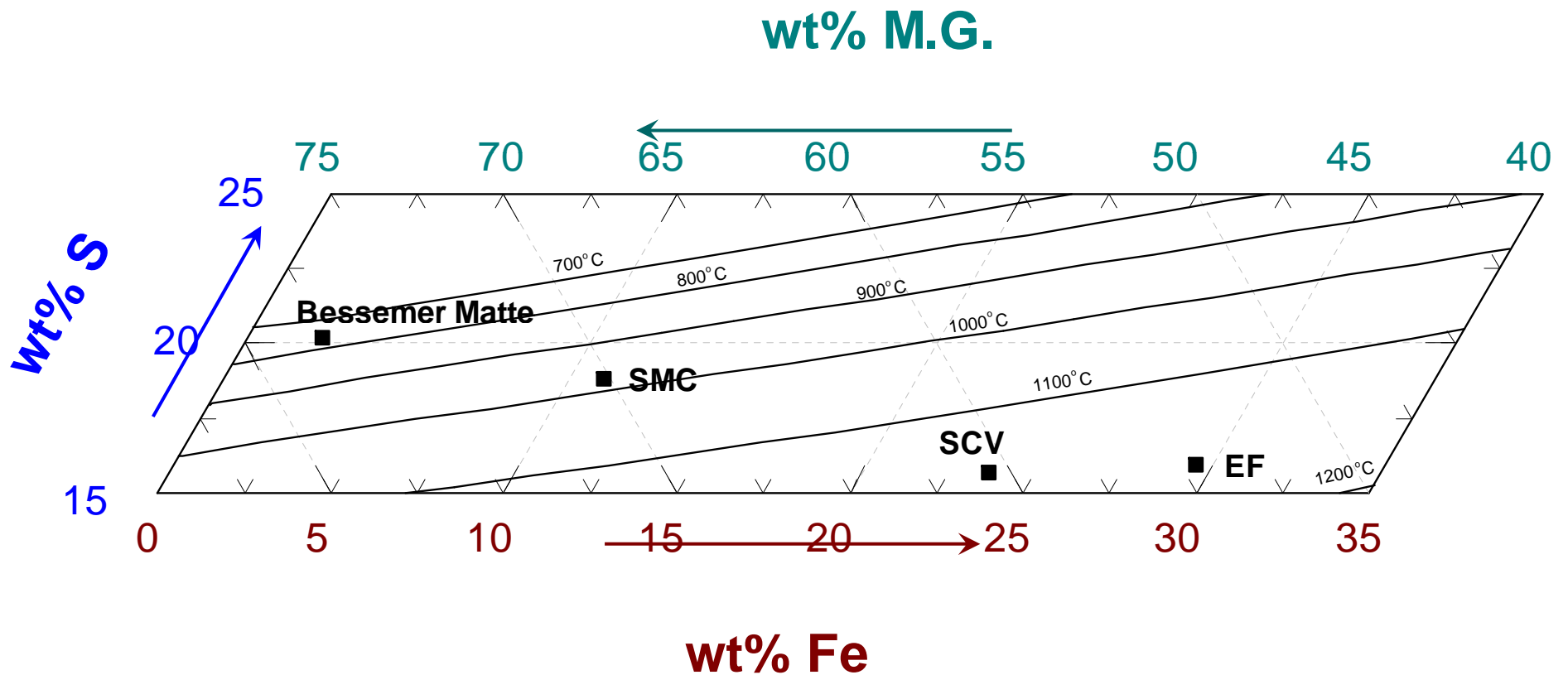
Various equilibriums within EF

- Troubleshooting
- Optimized operation
- Equipment design

Defining Optimum Operating Windows



Mapping of Matte Temperature



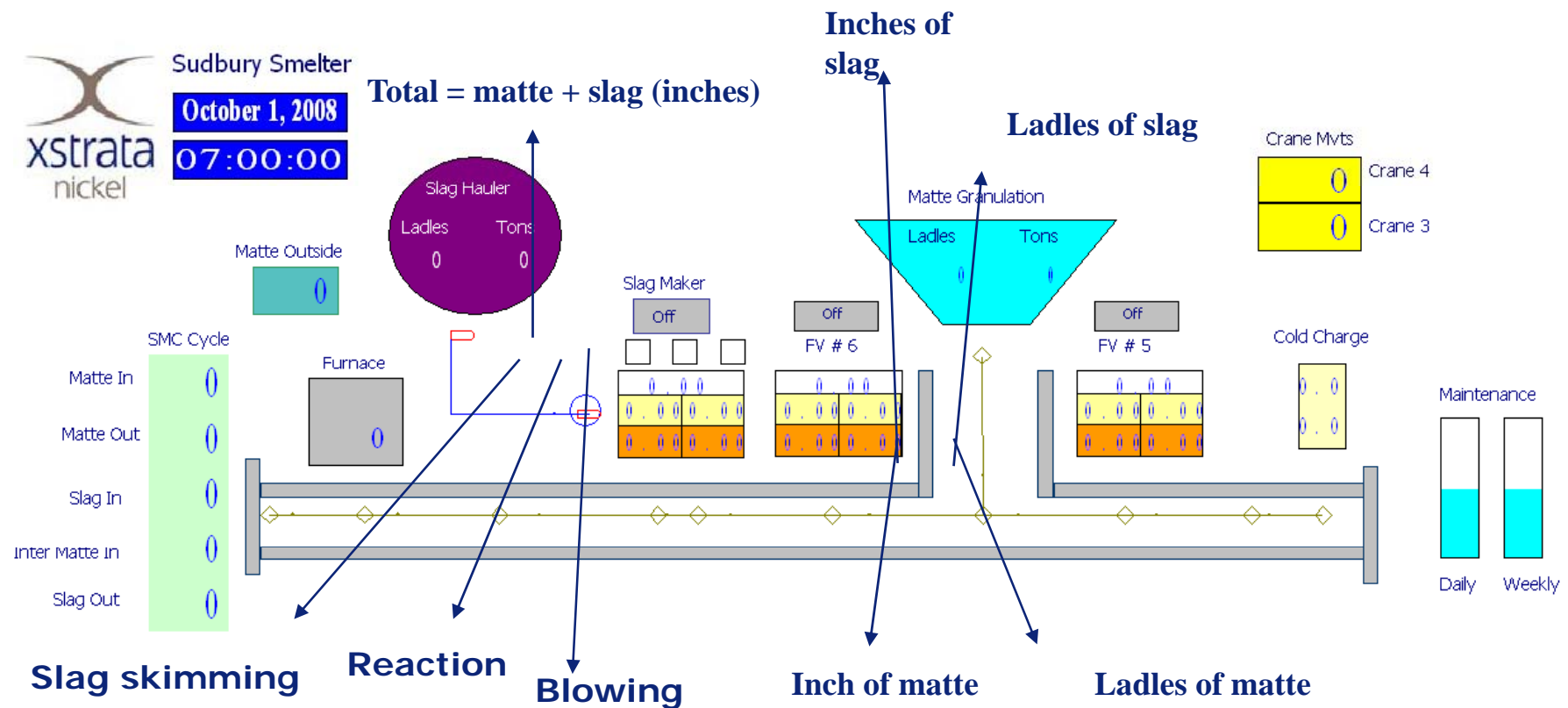
Discrete event modelling

Analysis of the flowsheet from a **logistics** perspective considers:

- Ladle size
- Crane capacity, travel time
- Availability constraints
- Equipment utilisation
- Scheduling- rebuilds etc.
- Input from METSIM and plant data

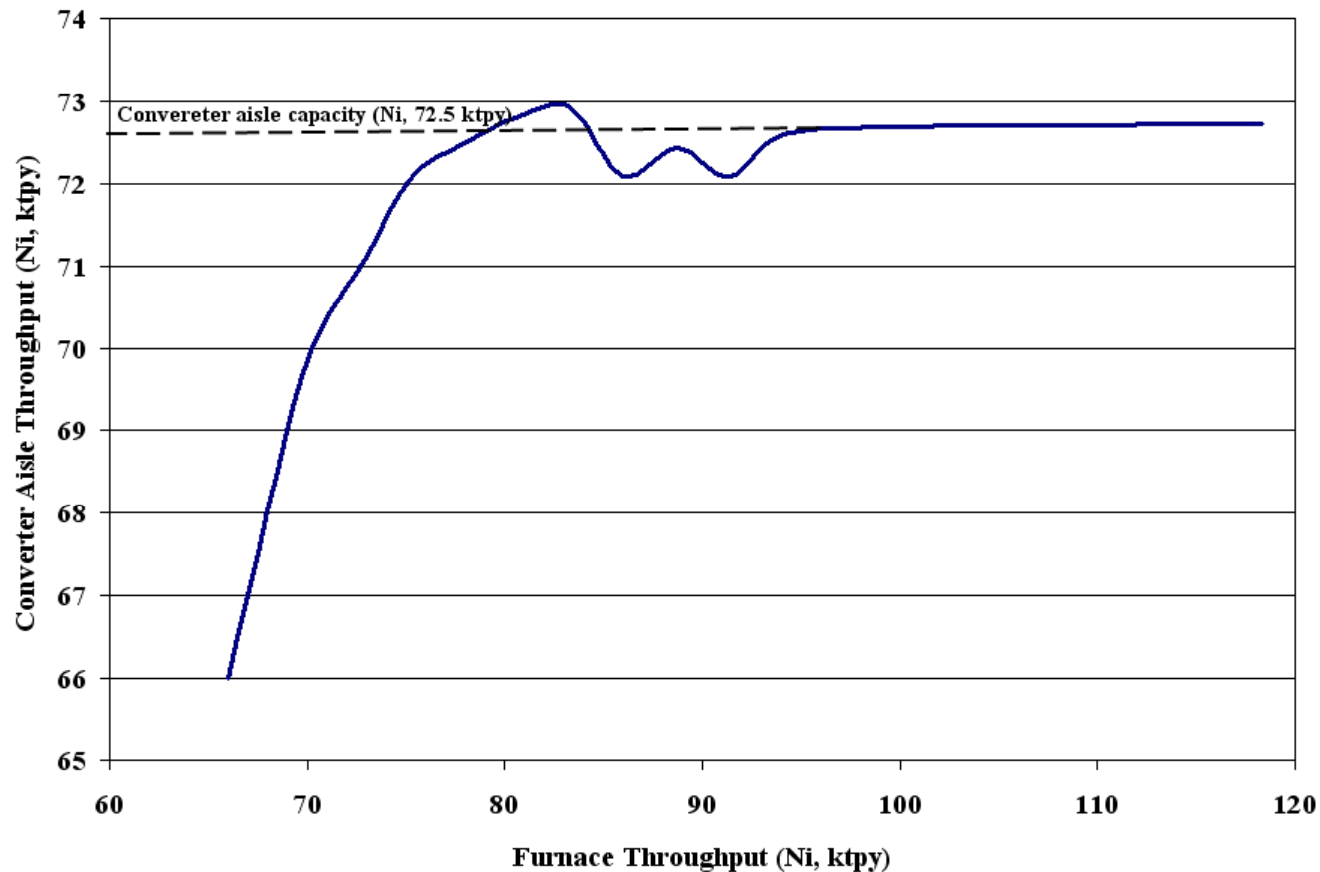
- Computes plant capacity for various scenarios and operating conditions

Discrete Event Modeling: Arena



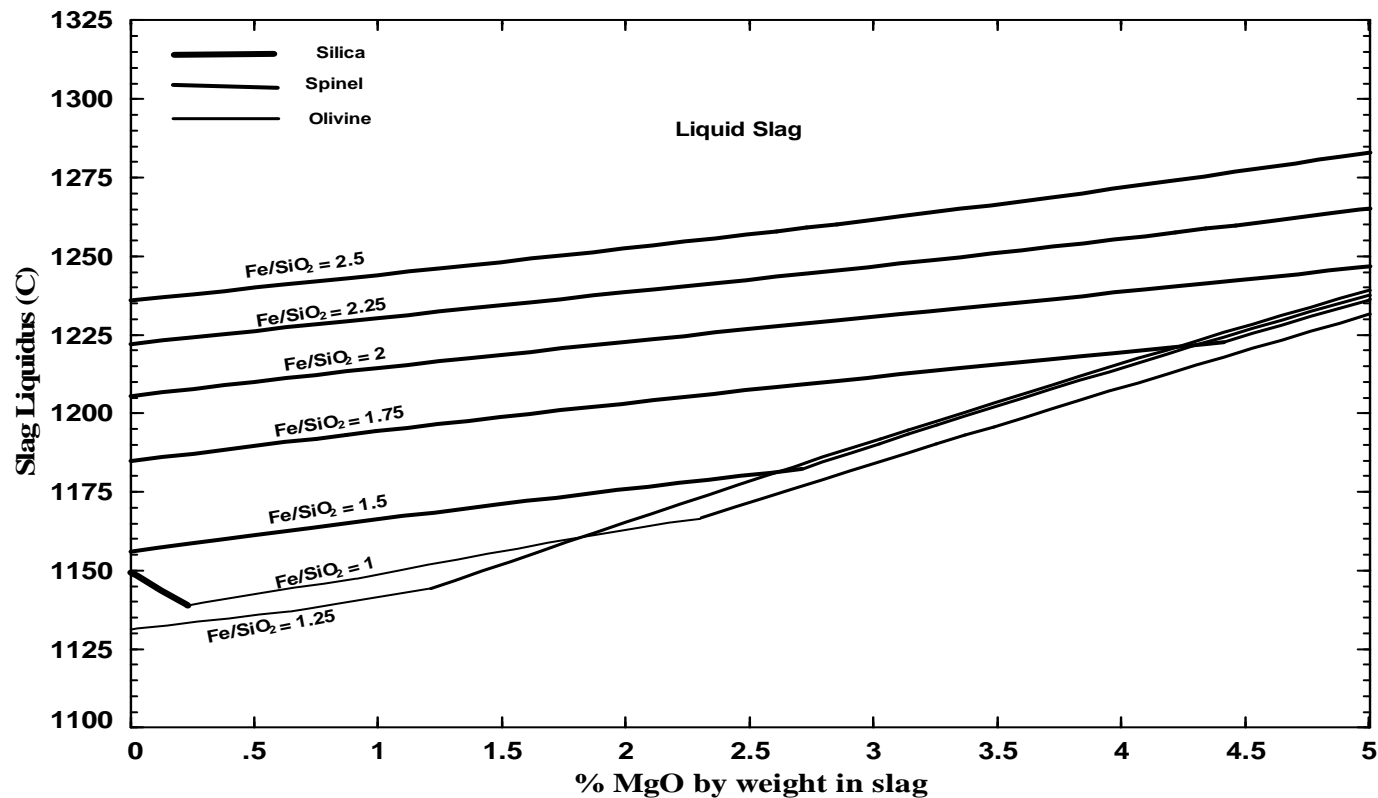
Converter Aisle Capacity: ARENA

- Cumulative Capacity of an Assembly
- De-bottlenecking

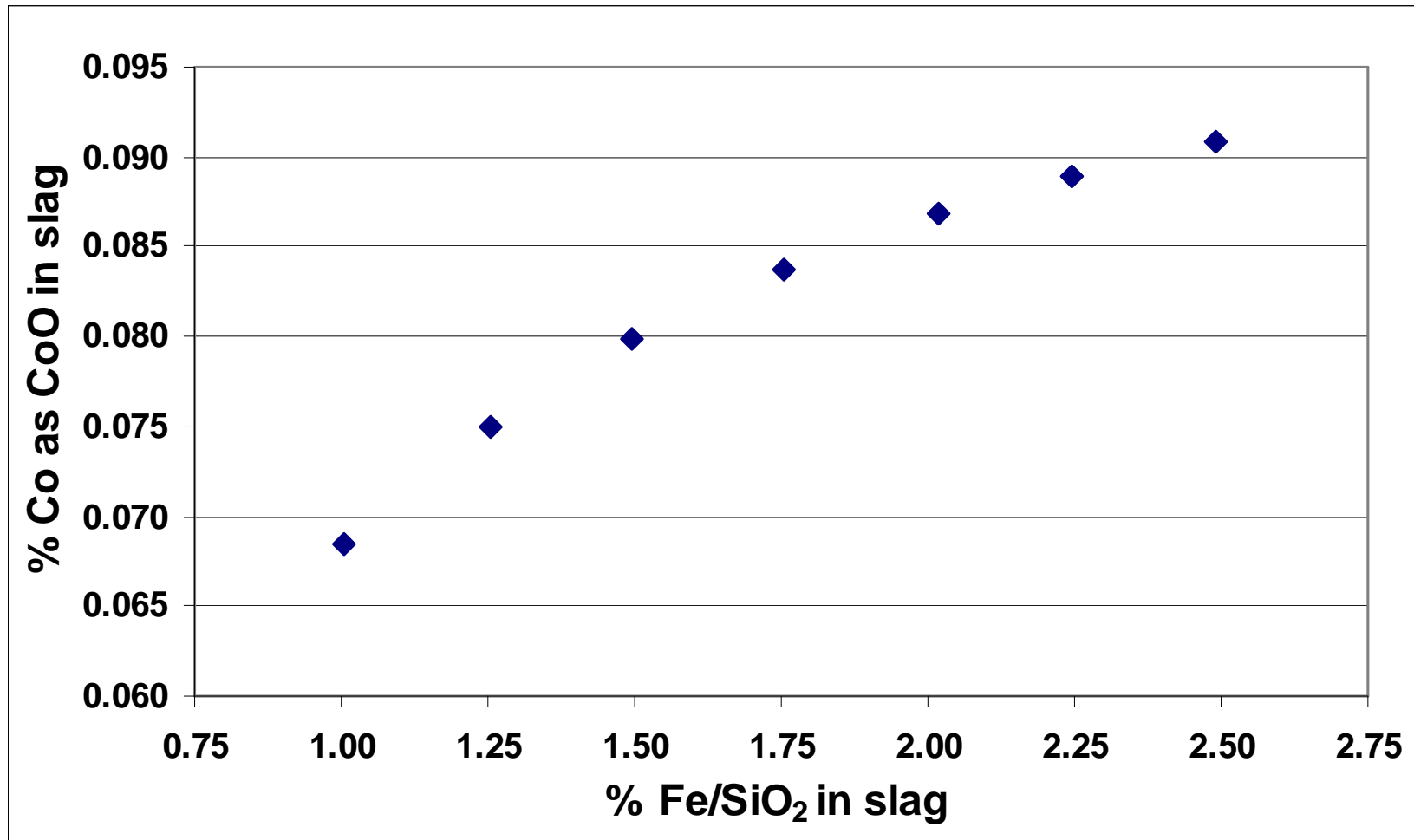


Mapping of Liquidus Temperature: FACTSAGE

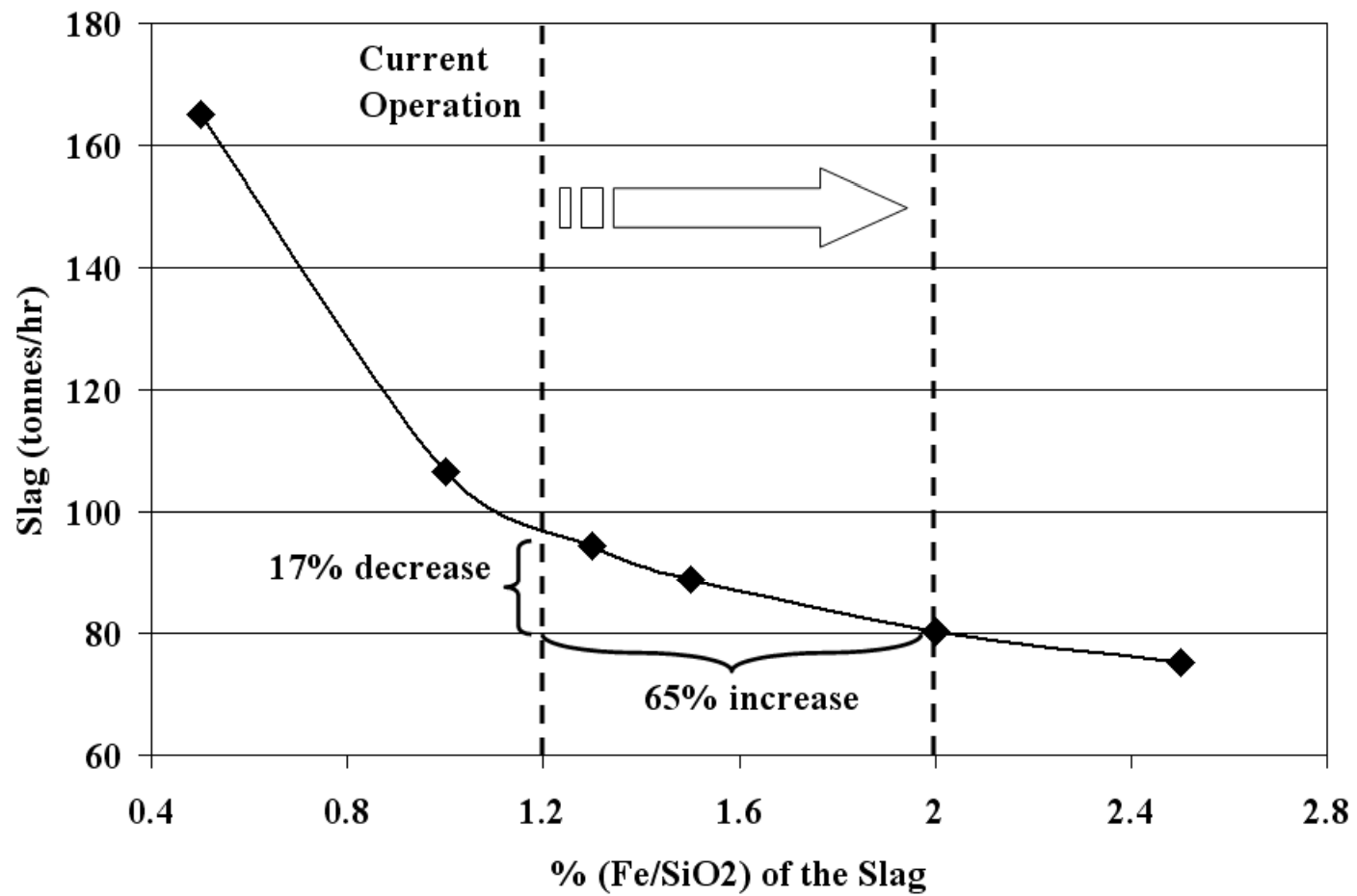
- Feed variability has impact on slag liquidus hence super heat available
- Slag losses are linked to viscosity and liquidus temperature



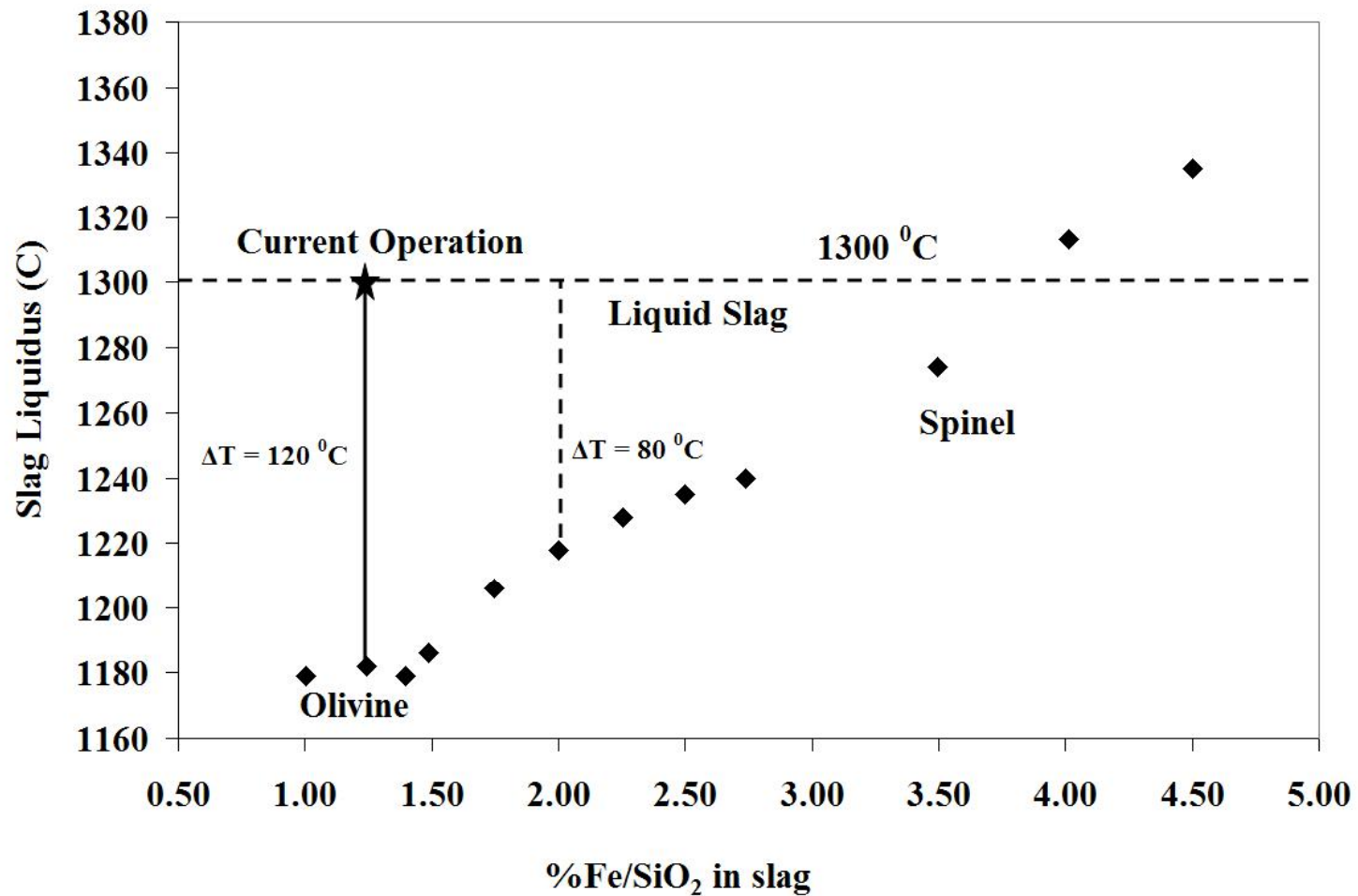
Dissolved Metal Losses: FACTSAGE



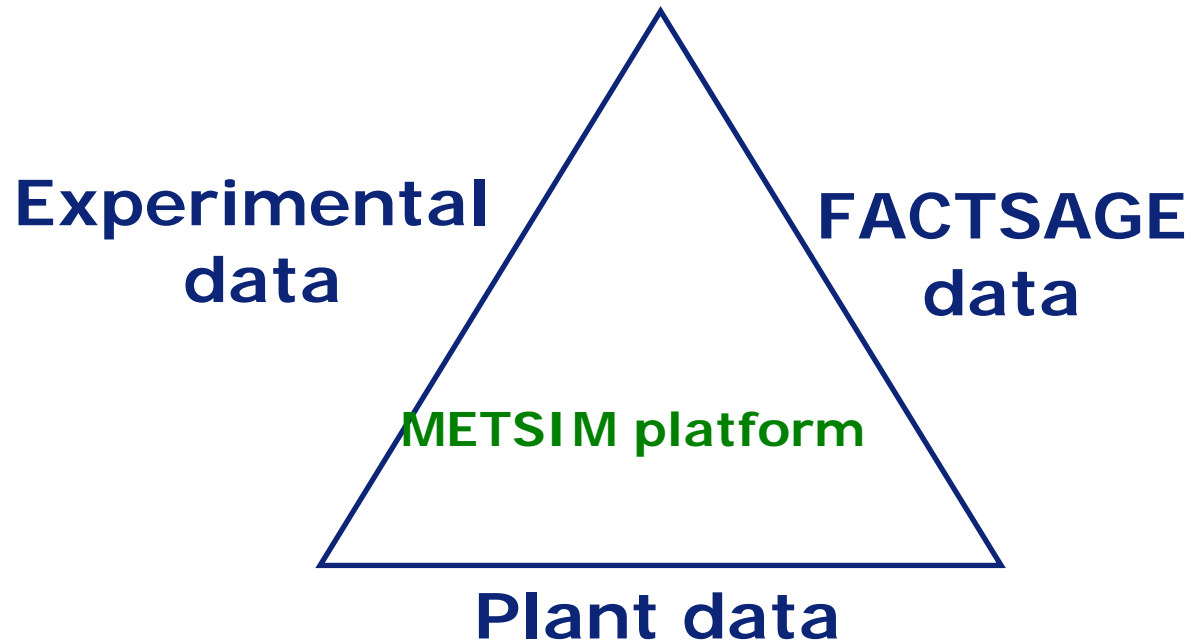
Reducing Slag Volume



Slag Superheat with Changing Fe/SiO₂ ratio

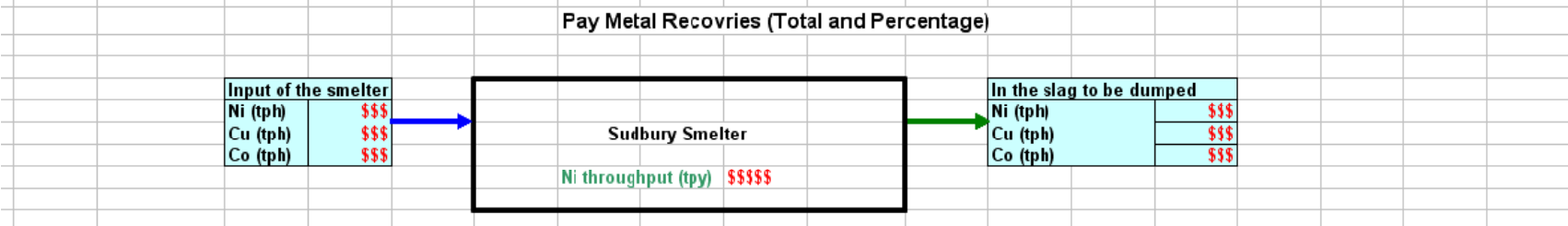
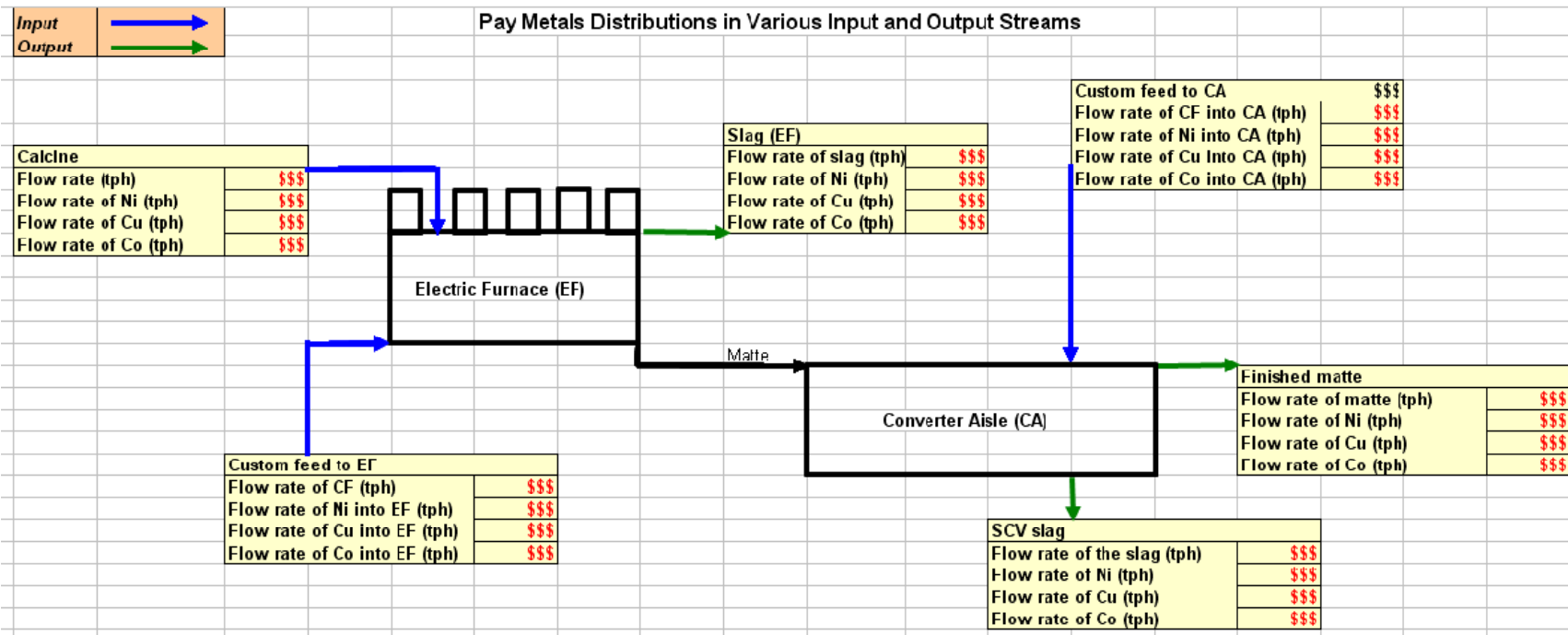


Combined Flowsheet Modeling



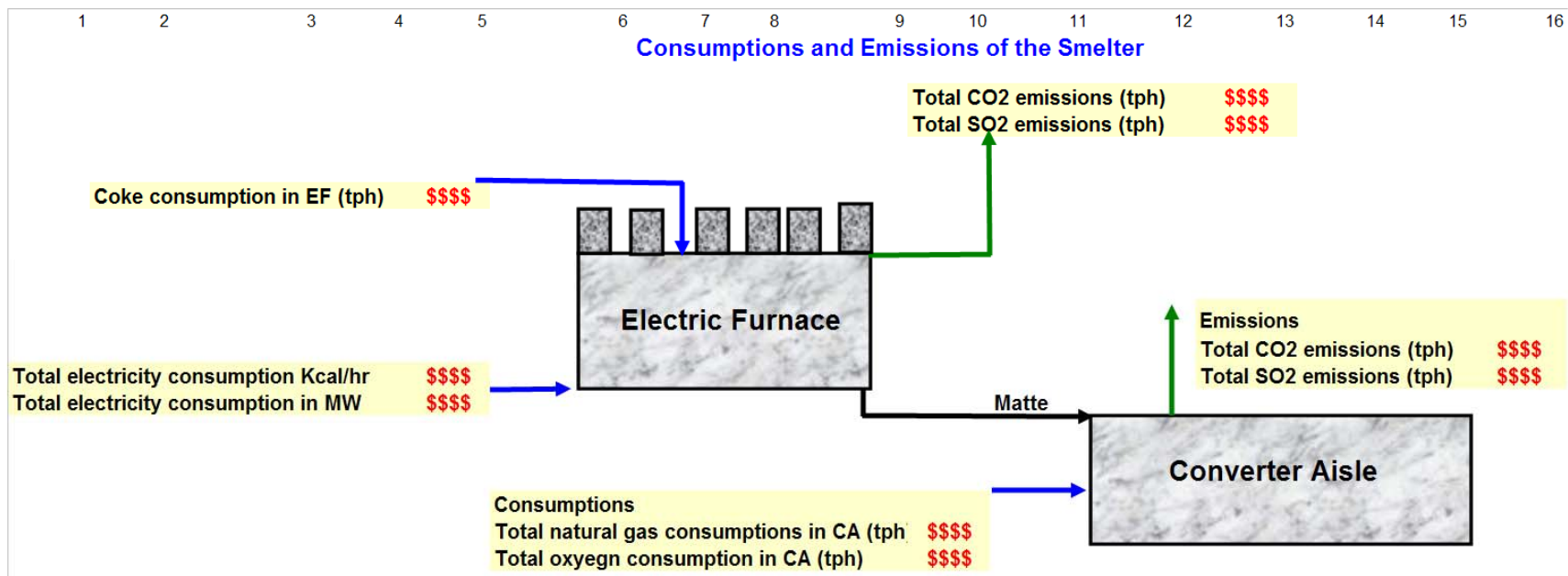
- No need for the user to be expert in performing thermo-chemical calculations
- Unlike FACTSAGE, reaction kinetics can be indirectly taken into account
- Validation with existing plant data and FACTSAGE data
- Reliable, accurate and robust tool for flowsheet evaluations
- Uses Excel as the platform

Plant Recovery: Different Cases



Emissions and Consumption

- Various feeds
- Process changes e.g. roasting, matte grade, metallization etc.
- In situation like a vessel is down in converter aisle
- Plant performances, flexibility for custom feed, slag management, emissions etc.



Evaluating Future Options

Various Capacity and Emission Control options were evaluated using process models:

- **Isa smelting**
- **Isa converting**
- **DC furnace**
- **Reductive roaster**
- **High Roast**
- **Controlling Furnace Atmosphere**
- **High Roast + Control Furnace Atmosphere**

Important plant performance parameters were compared for different cases

Flowsheet Optimisation

- Lowering the slag volume
- Potential for improved overall metal recoveries
- Enhanced custom feed treatment capacity at the plant
- Enhanced revenues
- Controlled emissions

*Process model is connected with an **economic model** to calculate CAPEX and OPEX requirements/ forecasts*

Feasibility Study

Comparing different flowsheets from different perspectives:

- **Economic**
- **Technical**
- **Environmental**

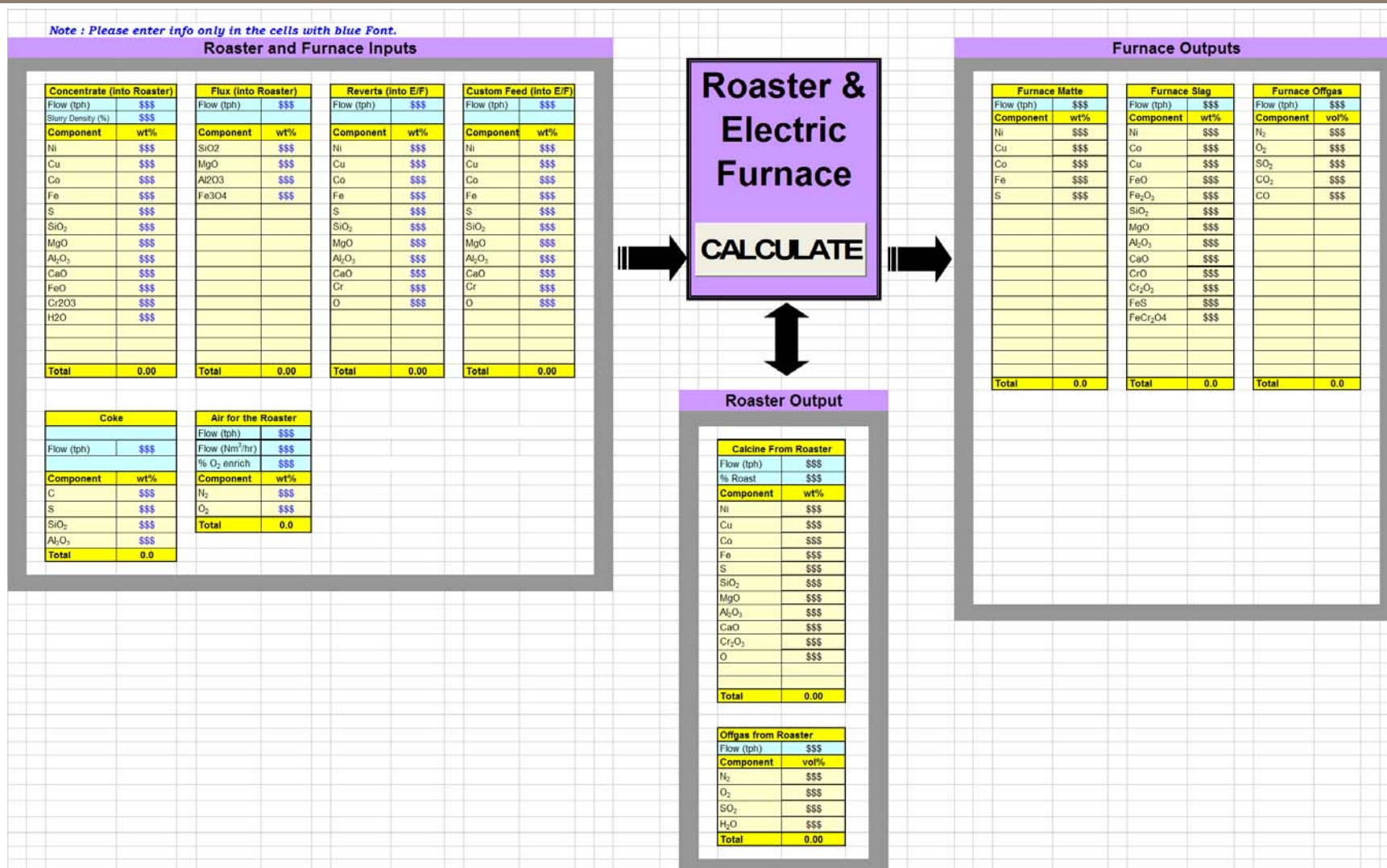
This helps the client in selecting viable options for piloting and identifying revenue generating opportunities.

Operational Support: CHEMSHEET



- **Uses FACTSAGE database and thermo-chemistry but.....**
- **No FACTSAGE license & installation is needed**
- **Built on simple Excel platform**
- **Results are based on reliable data**
- **Provides operators with an online tool**
- **Reduces plant variability**
- **Easy to use**

Example of a CHEMSHEET Model



Summary

- Various modeling tools play an important role in supporting plant operations and their long term objectives
- Modeling tools need to be reliable and robust based on sound engineering principles and plant and laboratory data and be capable of validation.
- Working in conjunction, these integrated models reduce the time taken on investigating dead ends and highlight areas where piloting should focus

Thank you. Questions?

