



## Level 2/3 control system PSImetals of PSI

Ira Vollenberg, PSI Metals  
DissTec Webinar, 18.10.2017

## PSI – Process Control & Information Systems



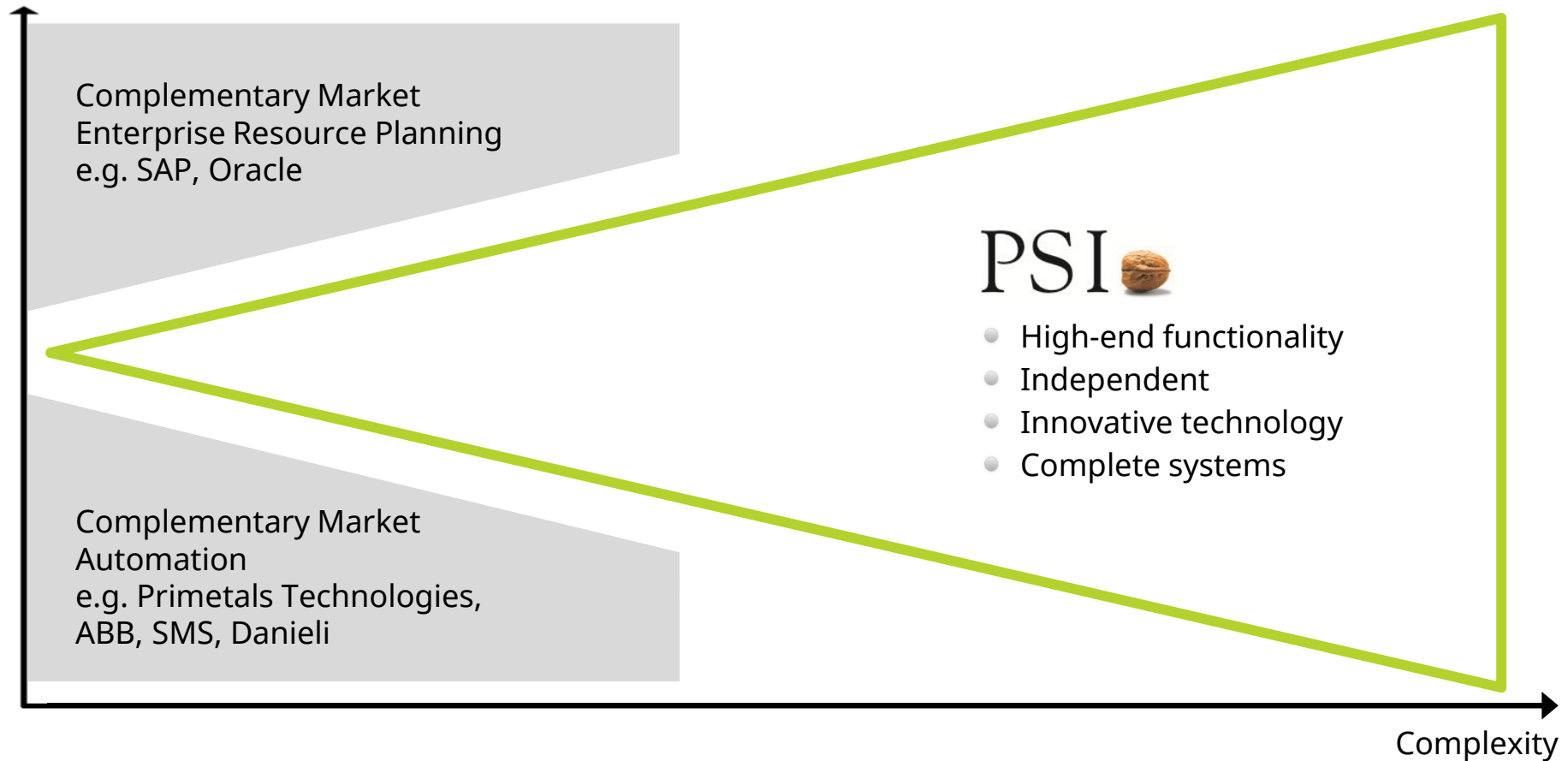
PSI is a leading supplier of process control software for utilities and industry.

# PSI Segments & Vertical Markets – For Total Integration of Your Value Chain

| Energy Management    |   | Production Management |  | Infrastructure Management |   |
|----------------------|---|-----------------------|--|---------------------------|---|
| Gas/Oil              |    | Metals                |    | Traffic                   |    |
| Electrical Energy    |   | Assembling            |   | Public Transport          |   |
| Energy Trading/Sales |  | Logistics             |  | Safety                    |  |

## High End Position Between ERP & Automation

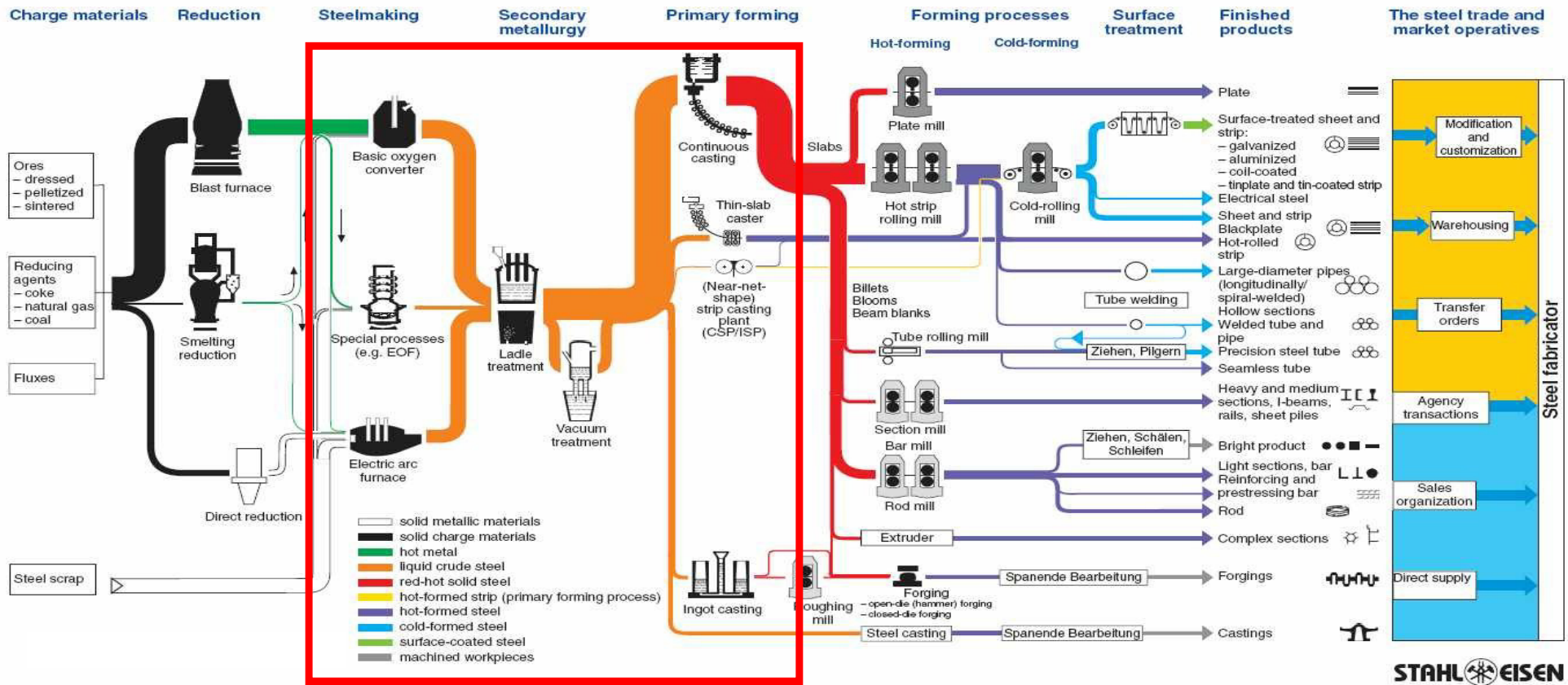
Software Levels





# PSImetals Production & Quality for Melt Shops: From Ore to Steel

## From ore to steel



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## Melt Shop - Which Improvements are Possible?



# Digitalization of Your Liquid Production



Heat Order



Heat Scheduling



Scrap Yard &  
Crane Control



Ladle  
Management



Production  
Tracking



Process Automation  
Models



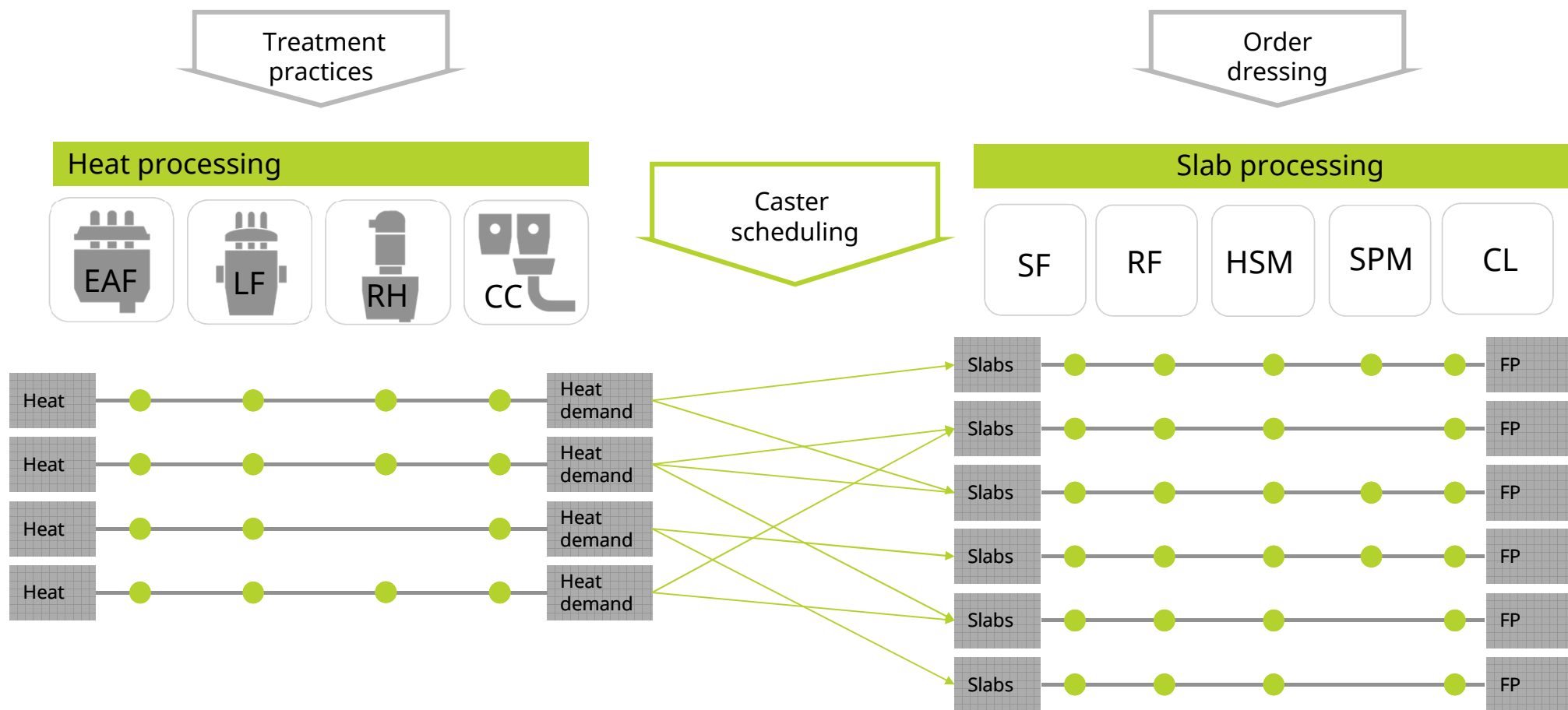
Deviation  
Management



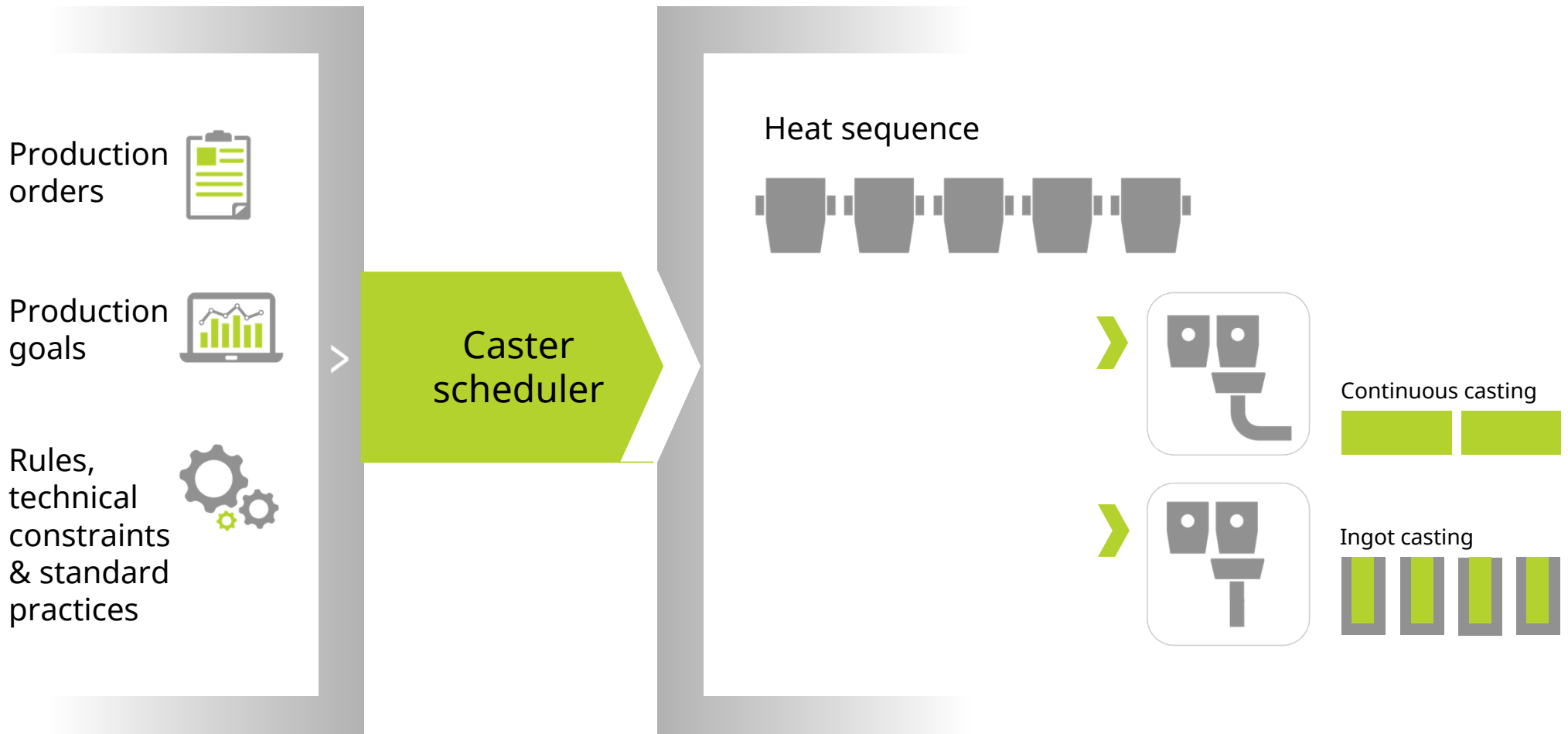
Heat Release

# Caster Scheduler

## From Slab Demand to Heat Orders



# Planning of Heat Sequences: Caster Scheduler



## Digitalization of Your Liquid Production



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Heat Release

# Schedule Execution Management From Heat Planning to Raw Material Instructions

CC1 Line Schedules (P2851)

Edit View ? Filter

Production Planning Completed

Line sequence header

Autofill Create Modify Cut Paste Join ValidatePG Approve Activate Interrupt Continue UndoActivate UndoApprove Reject Cancel

| Line | PgId        | PgKind             | PGState    | TargStart       | Remark | SetupTime | ValidCode | ValidationStatus |
|------|-------------|--------------------|------------|-----------------|--------|-----------|-----------|------------------|
| CC1  | N0000000411 | Production program | processing | 4/2/16 12:00 AM |        | 0 min     | OK        | Ok               |
| CC1  | N0000000412 | Production program | released   | 4/2/16 4:01 AM  |        | 90 min    | OK        | Ok               |
| CC1  | N0000000413 | Production program | released   | 4/2/16 9:29 AM  |        | 90 min    |           | Out-of-date      |

Input material

Split Create Add Remove CutHeat CutTundish Paste Modify Reassign CalcHeatWeight ChargeCalc(Std) ChargeCalc(Opt)

| Local Id | POId   | PoStpId | PgRowState | PgRowName | Remark | Weight | Steelgrade | SeqNo |
|----------|--------|---------|------------|-----------|--------|--------|------------|-------|
| H00005   | N541_0 | 4       | processing |           |        | 191 t  | 17340      | 0     |
| H00006   | N541_1 | 4       | preparing  |           |        | 210 t  | 17340      | 0     |
| H00007   | N541_2 | 4       | preparing  |           |        | 197 t  | 17340      | 0     |
| P00004   | N541_3 | 4       | released   |           |        | 194 t  | 17340      | 0     |

Output material

Create Remove Change Reassign Cut Paste

| LfdN... | PoTgt             | PoStpId... | Weight | Width      | Thickness  | Length | Steelgrade | OrdR... | OrdR... |
|---------|-------------------|------------|--------|------------|------------|--------|------------|---------|---------|
| 1       | MVF100351/010/010 | 20         | 24 t   | 2030.00 mm | 220.000 mm | 6.79 m | 17340_0    | 1       |         |
| 5       | MVF102715/010/010 | 20         | 19 t   | 2030.00 mm | 220.000 mm | 5.31 m | 17340_0    | 1       |         |
| 2       | MVF103857/010/010 | 20         | 24 t   | 2030.00 mm | 220.000 mm | 6.79 m | 17340_0    | 1       |         |
| 6       | MVF102491/010/010 | 20         | 24 t   | 2030.00 mm | 220.000 mm | 6.79 m | 17340_0    | 1       |         |
| 3       | MVF101838/010/010 | 20         | 19 t   | 2030.00 mm | 220.000 mm | 5.31 m | 17340_0    | 1       |         |
| 7       | MVF101837/010/010 | 20         | 19 t   | 2030.00 mm | 220.000 mm | 5.31 m | 17340_0    | 1       |         |

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- Heat sequence management
  - Take over of casting sequences (continuous casting) or
  - Heat sequences (ingot casting) from planning
- Charge & alloy optimization
- Ladle usage planning
  - Considering availability in OHS
  - Checking usage-constraints and
  - Generating usage-suggestions
- Online heat scheduling (OHS)
  - Exact time and capacity planning of the lines
  - Considering malfunctions and down times
  - Showing conflicts
  - Simulation

# Planning all Production Steps in Melt Shop: Online Heat Scheduler

Casting Sequences



Production steps in melt shop



Actual situation

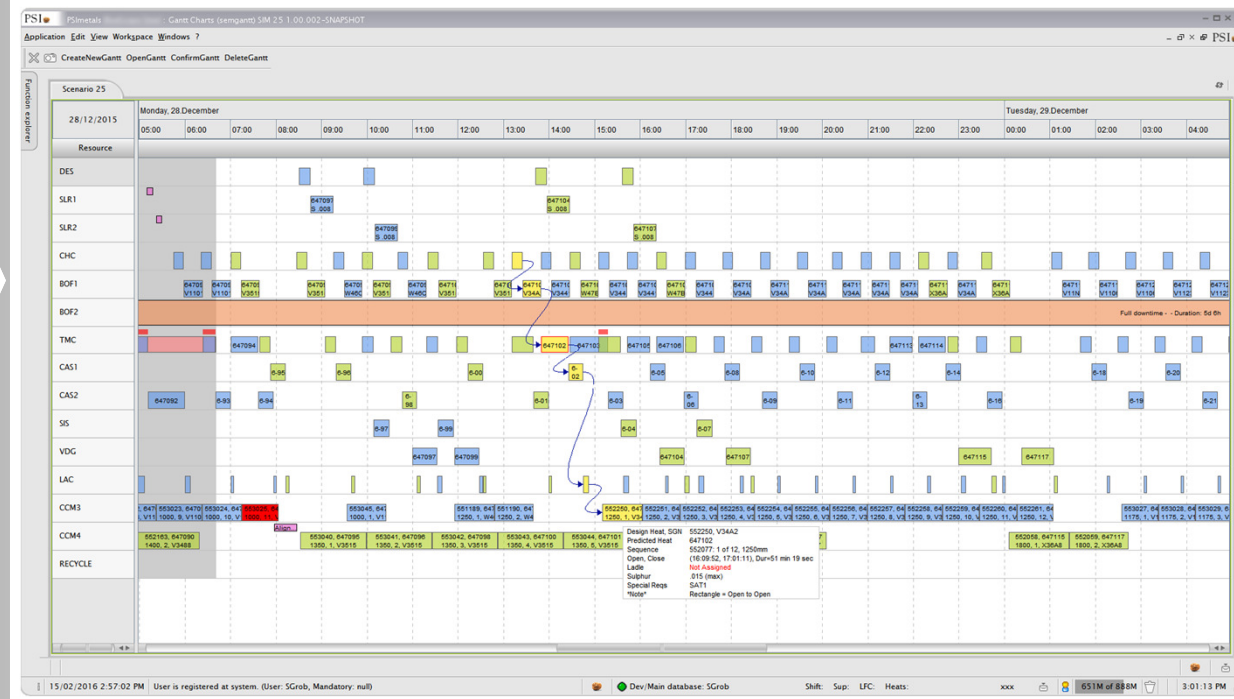


Delays, break downs



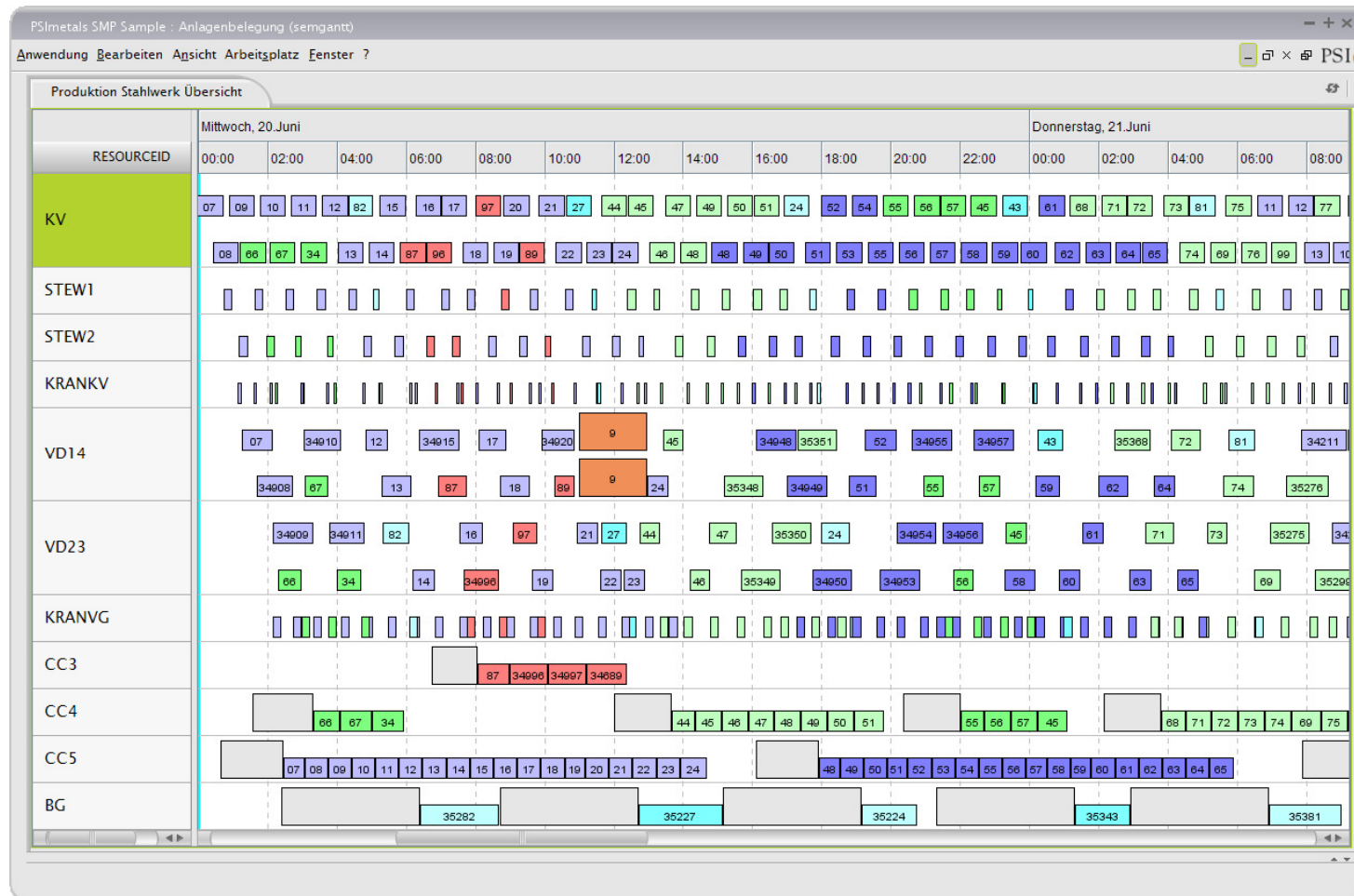
Online heat scheduler

- Planning of bottleneck facilities
- Production forecast



# Online Heat Scheduler

## Line Downtime (Vacuum Degasser): 2h Between 10am und 2pm



## Digitalization of Your Liquid Production



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Crane Control



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Process Automation  
Models



Deviation  
Management

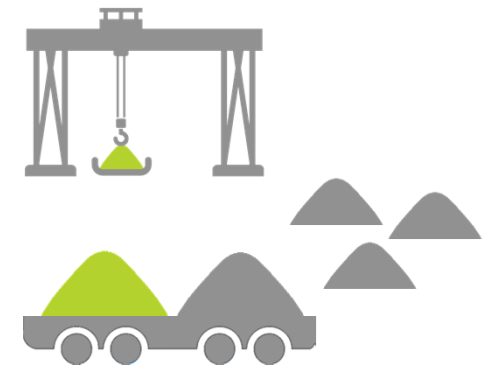


Heat Release

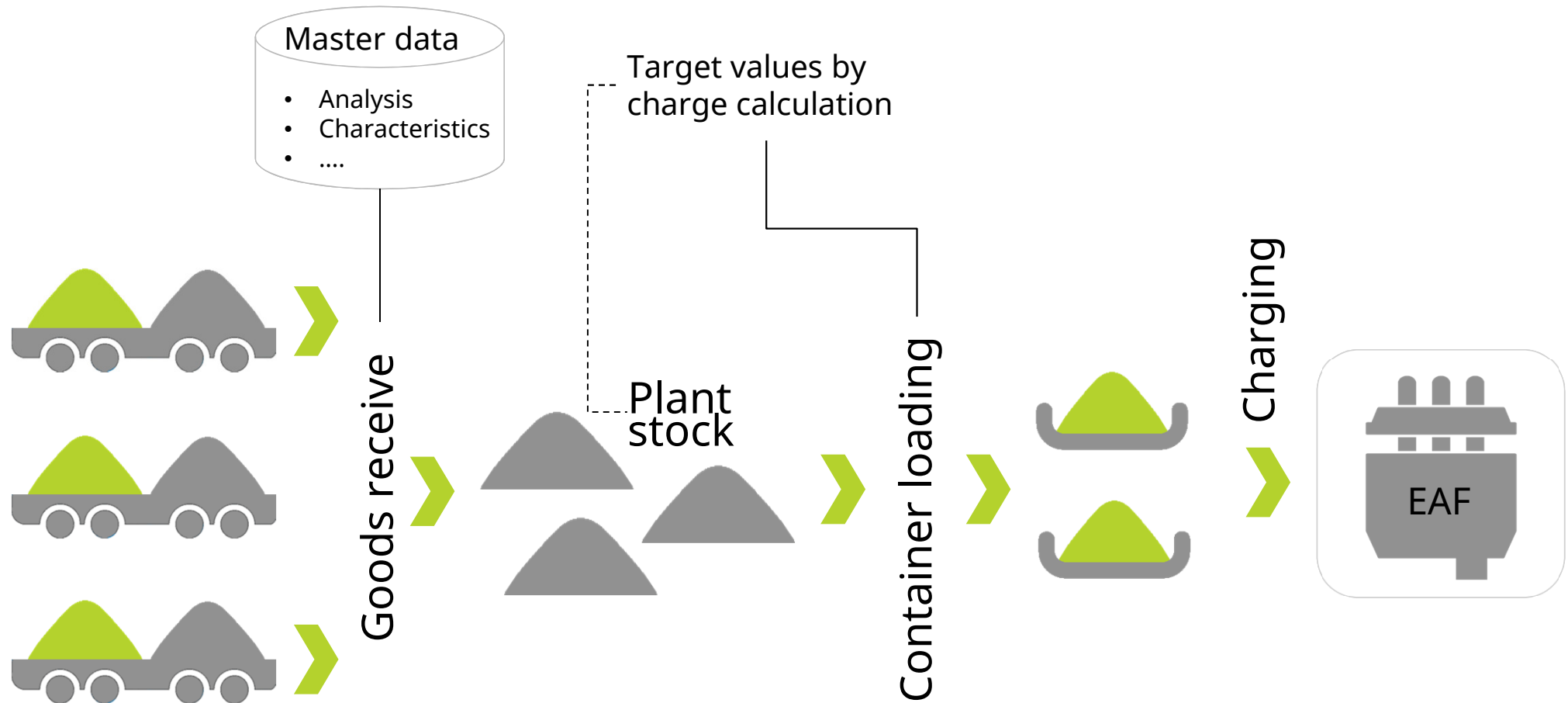
# Scrap Yard Management

## From Load Planning to the prepared Baskets

- Material & stock management considers:
  - Master data: analyses, prices, attributes, ...
  - Current inventories: analyses, deliveries, stock positions, ...
  - Various material types: scraps, refractories, blocks, ...
  - Yard areas: scrap boxes, scrap containers, ...
  - Means of transport: trucks, wagons, cranes, ...
- Alloy and charge calculation
- Preparation of next heat at the scrap yard with special crane dialogs
- Chute/basket loading and management
  - Scrap composition within chute/basket
  - Analysis
- Management and tracking of single material supplies and its analysis
- Scrap disposition: forecast & management of future scrap demand



## Handling of Raw Material Data



# Alloy and Charge Calculation (ACM)

## Optimization of scrap input and alloy additions

- Can be based on standard burden calculations
- Takes into account:
  - Material composition (scrap analysis , alloy analysis)
  - Target analysis of actual production step (e.g. EAF) or process step (e.g. fine alloying)
  - Target heat weight (mass balance); allow or prohibition of reducer if required
  - Material restrictions: weight, analysis, material, material class (based on attributes, min-/max-amounts, reliability of analysis, etc.)
  - Material availability and accessibility in stock
  - Material additions in following treatment steps
  - Linear constraints and target key values (e.g. carbon equivalent)
  - Melting losses (production lines, material, elements)
- Determines solution with minimal costs
- Keeps unrequested elements on a low level



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Heat Release

# Equipment Management

Equipment Management Interface

Equipment Table:

| Eq type     | Equip name   | Gr.Name | Coveragetype | Status code | Workflow status | Workflow su... | Supplier |
|-------------|--------------|---------|--------------|-------------|-----------------|----------------|----------|
| Backup Roll | Backup Roll1 |         |              | used        | used            | used           |          |
| Backup Roll | Backup Roll2 |         |              | free        | free            | free           |          |
| Backup Roll | Backup Roll3 |         |              | used        | used            | used           |          |
| Backup Roll | Backup Roll4 |         |              | free        | free            | free           |          |
| Backup Roll | Backup Roll5 |         |              | free        | free            | free           |          |
| BCC         | BCC1         |         |              | free        | free            | free           |          |
| CC          | CC1          |         |              | free        | free            | free           |          |
| CC          | CC2          |         |              | free        | free            | free           |          |
| EAf         | EAf1         |         |              | free        | free            | free           |          |
| EAf         | EAf2         |         |              | used        | used            | used           |          |
| LADLE       | Ladle1       |         |              | used        | used            | used           |          |
| LADLE       | Ladle2       |         |              | used        | used            | used           |          |
| LADLE       | Ladle3       |         |              | free        | free            | free           |          |

Equipment Graphic: Ladle3 (free)

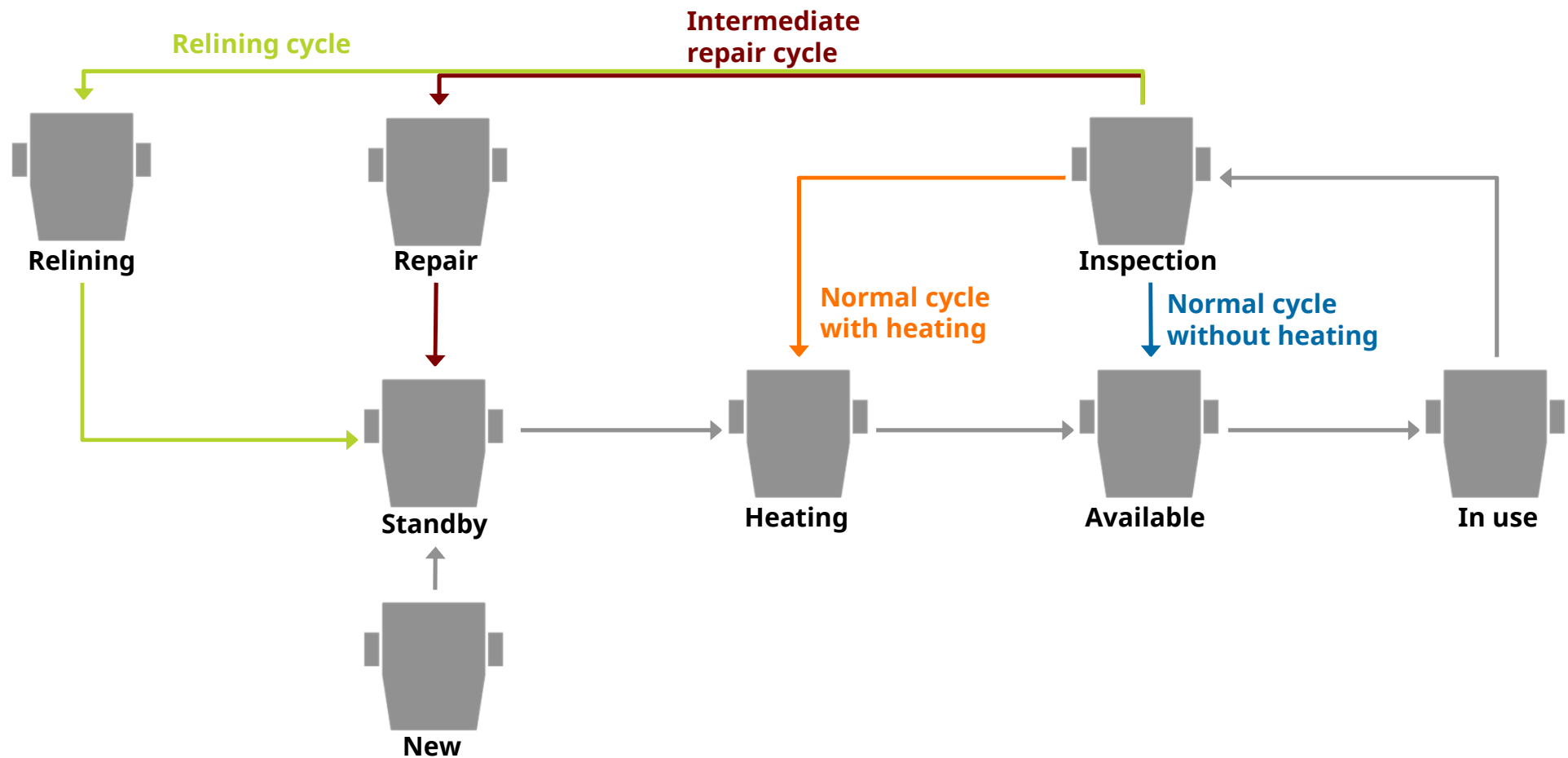
Equipment History Table:

| Event     | Status code | Workflow status | Workflow substatus | Reason   | Supplier | Supplyti |
|-----------|-------------|-----------------|--------------------|----------|----------|----------|
| EQDATA    | free        | free            | free               |          |          |          |
| EQCOUNT   | free        | free            | free               |          |          |          |
| EQHEATING | free        | free            | free               |          |          |          |
| EQHEATING | free        | free            | free               |          |          |          |
| EQHEATING | free        | free            | free               |          |          |          |
| EQHEATING | free        | free            | free               |          |          |          |
| EQREPAIR  | free        | free            | free               | Reason 1 |          |          |
| EQREPAIR  | free        | free            | free               | R2       |          |          |
| EQREPAIR  | free        | free            | free               | R2       |          |          |
| EQCOUNT   | free        | free            | free               |          |          |          |

Equipment parameter Table:

| Param name                 | Value  | Unit | OrdNo |
|----------------------------|--------|------|-------|
| ID last heat               |        |      | 1     |
| thermal State              | heated |      | 2     |
| Refractories               | RefXX  |      |       |
| Relining Temp.             |        |      |       |
| Temperature                | 800    |      |       |
| Spraying Y/N               | Y      |      |       |
| ID Argon brick             | 66     |      |       |
| Id Slide Plate             | 78     |      |       |
| Supplier                   | Ref1   |      |       |
| Id Relining                |        |      |       |
| Duration thermal Treatm... |        | min  |       |

## Equipment Lifecycle: Ladle Management



## Digitalization of Your Liquid Production



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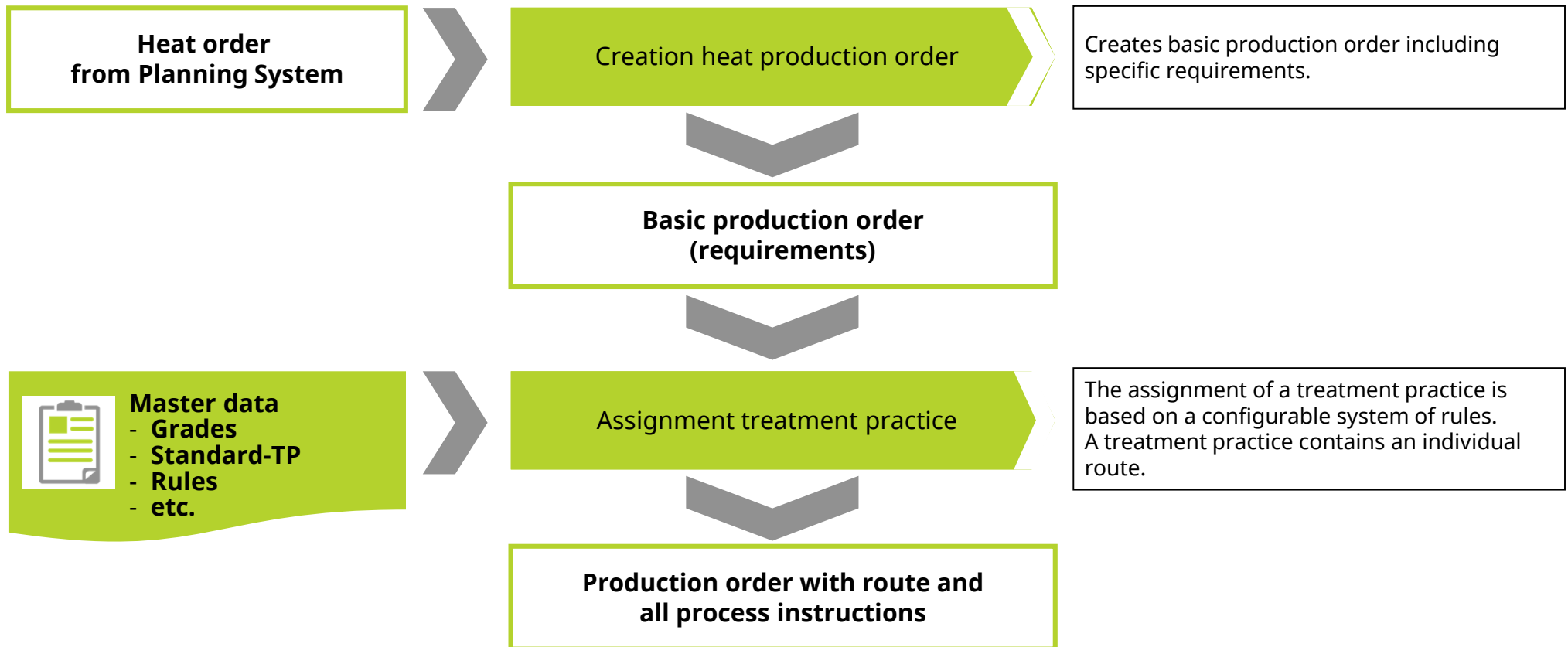


Deviation  
Management

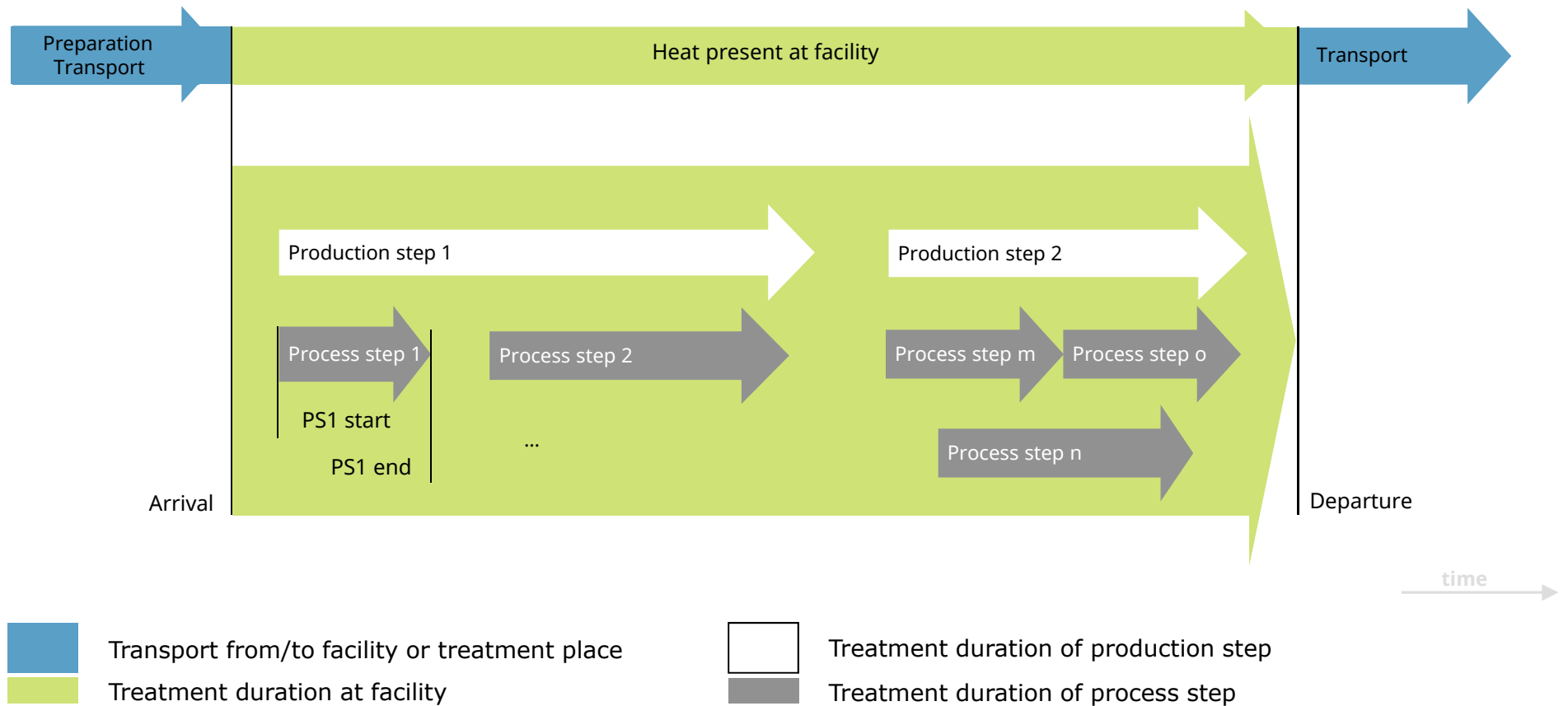


Heat Release

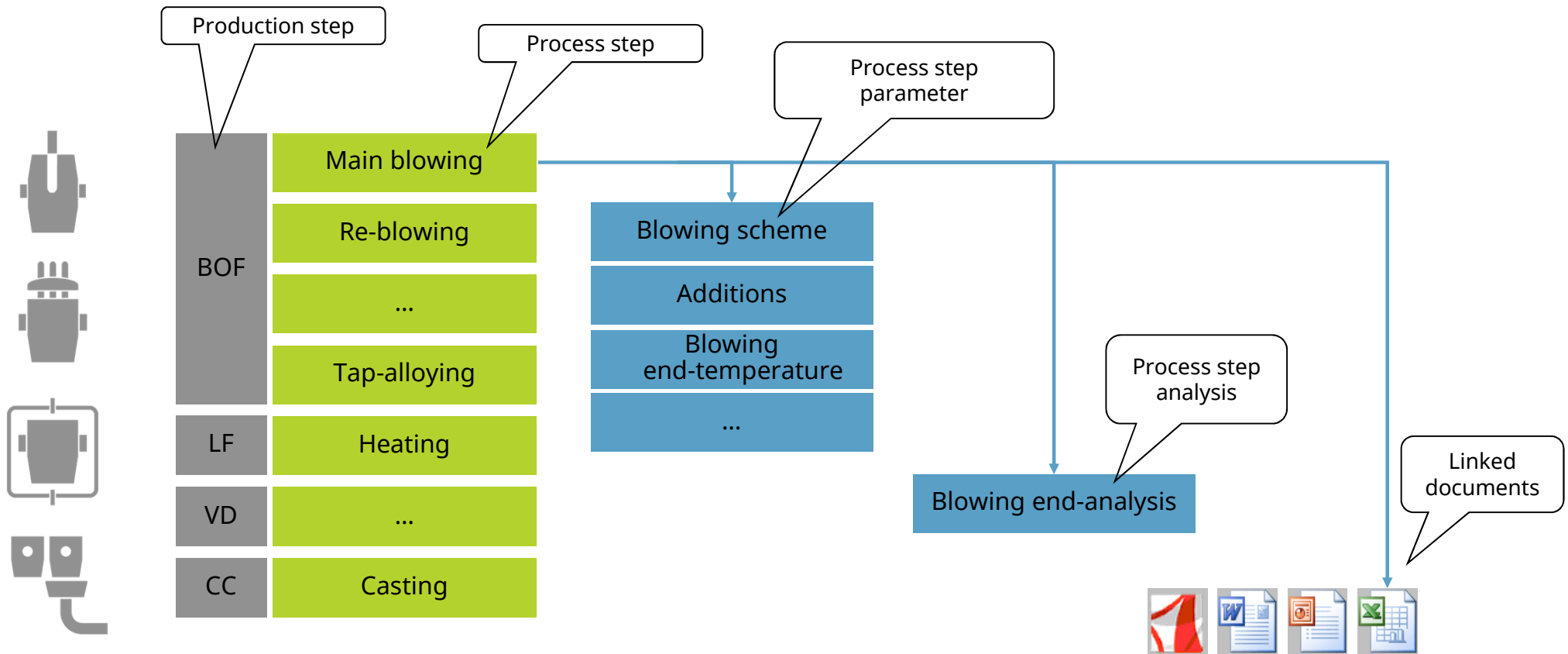
## Heat Production Order Extension with Treatment Practice



# Production Tracking: Concept

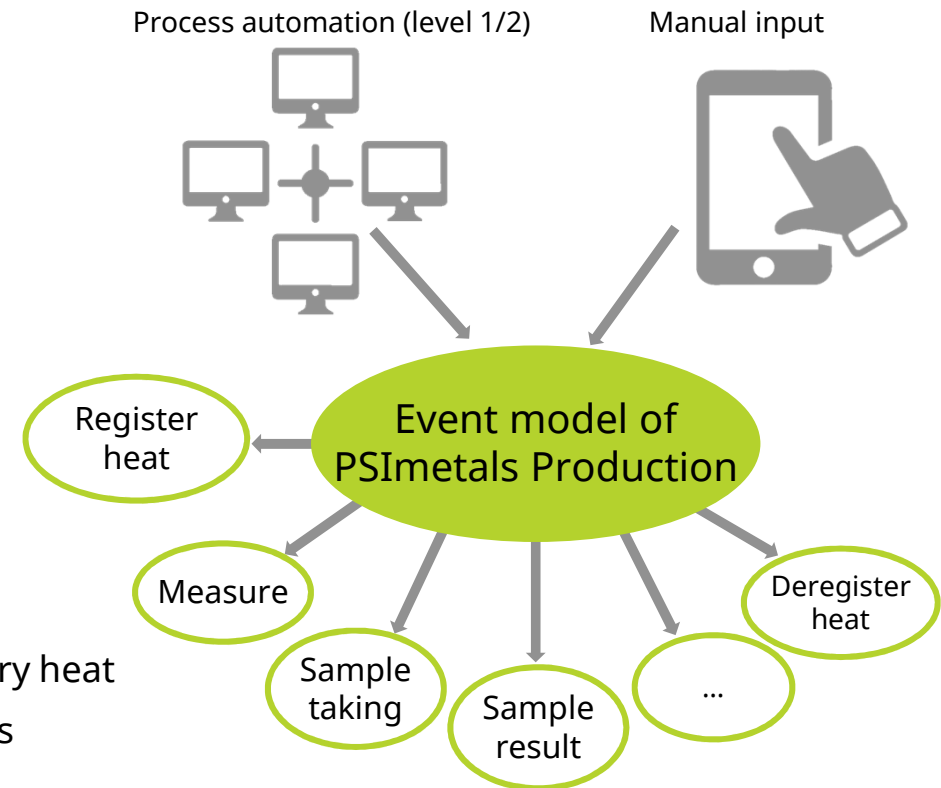


# Treatment Practice Example for Converter Steel Plant



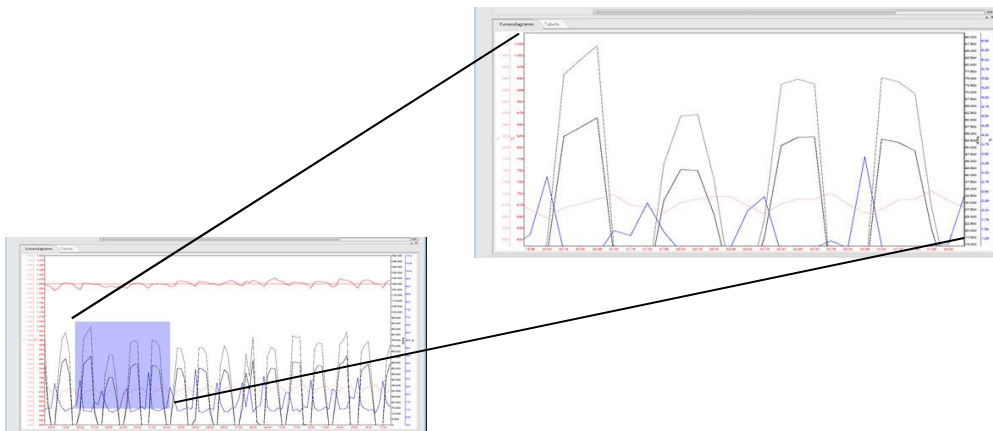
# Production Tracking for Seamless Recording of all Operating Data

- Tracking of operation data
  - Register/Deregister heat at facility
  - Additions
  - Measurements (temperature, Celox, ...)
  - Ladle assignment
  - Sample taking
  - ....
- Mapping on treatment practices
  - Graphical visualization of process step status
  - Storage and assignment of detailed process data for every heat
  - Target-actual comparison and initiation of re-work orders



# Production Monitoring: Process Value Management and Visualisation

- Continuous Measurement Support
- Basic data collection and visualisation
- Easy Configuration of Diagrams
- Automatic calculation of new process values based on measured and computed values
- Hierarchical data compression



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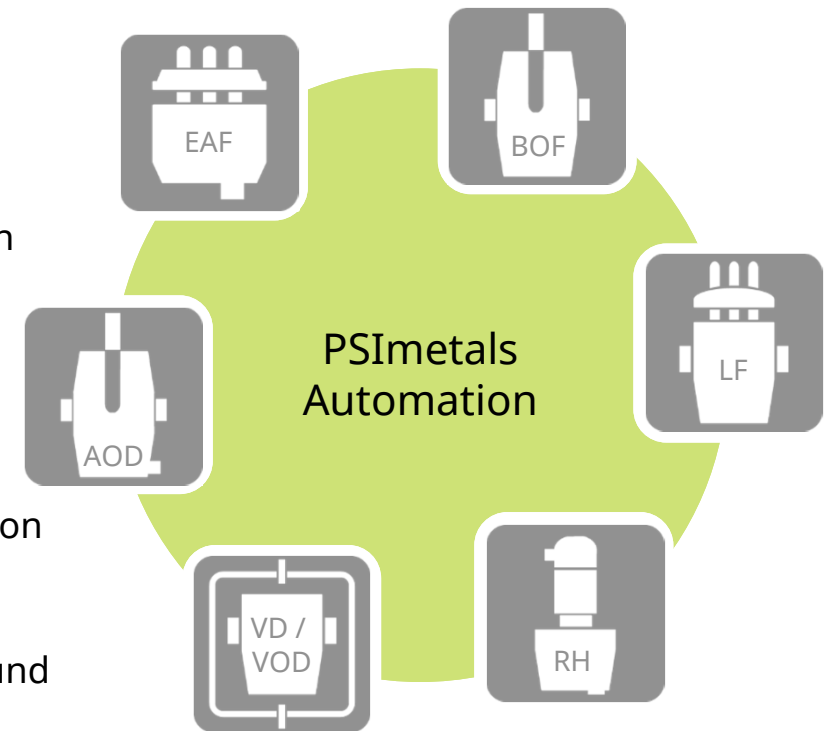
Deviation  
Management



Heat Release

# Model-based Process Control

- Online-Process control based on energy and mass balances
- dynamic heat-status-calculation (temperature, mass, analysis)
- Automatic regulation of electrical and chemical energy consumption connected with congestion control
- Automatic regulation of continuous material additions (DRI, HBI, slag former)
- Calculation of Charging-, Alloying-, De-Oxidation- and De-Sulfurization Materials as well as Slag Conditioner
- Online-Process Control for Carbon-Reduction, Nitrogen-Reduction und De-Sulfurization
- Automatic regulation of Oxygen charging for decarburization



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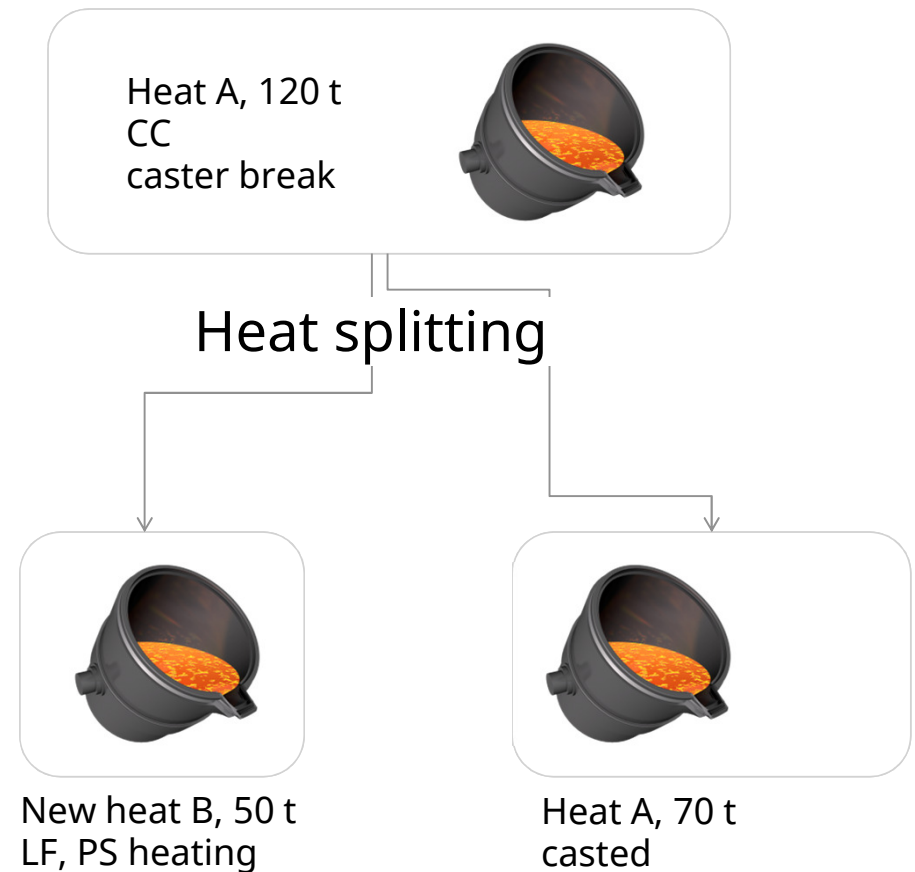
Deviation  
Management



Heat Release

# Deviation Management

- Start/stop/repeat of process steps
- Activate and de-activate of production steps and process steps
- Modification of process step sequence
- Modification of heat sequence
- Re-assignment of a heat to another order (downgrading)
- Caster break
- Dilution
- **Dynamic Re-routing until the very last minute**



# Deviation Management: Dynamic Routing

PSImetals Execution : Station Monitor LF2 5.13.000

Application Edit View Workspace Windows ? Layout

Function explorer

CyclicRefresh Home SelectHeat HeatLogon HeatLogoff Addition LadleAssignment HydriisMeasurement **CeloxMeasurement** AnalysisSample

Line **LF2** Heat number H00008 Prod order Id N549\_0 Grade 17340

Weight 26000 Target output weight 189863 kg Temp 1550 Ladle

Treatment Practice Analysis history Production Message Temperature Material Consumption

Start End Active Init All

Treatment Practice

- ★ EAF
  - ✓ Charging
  - ✓ Melting
  - ✓ Sampling
  - ✗ Tapping
- ★ LF
  - TempMeasurement
  - Heating
  - TempControl
- ★ CC
  - Sampling
  - Casting

Parameter

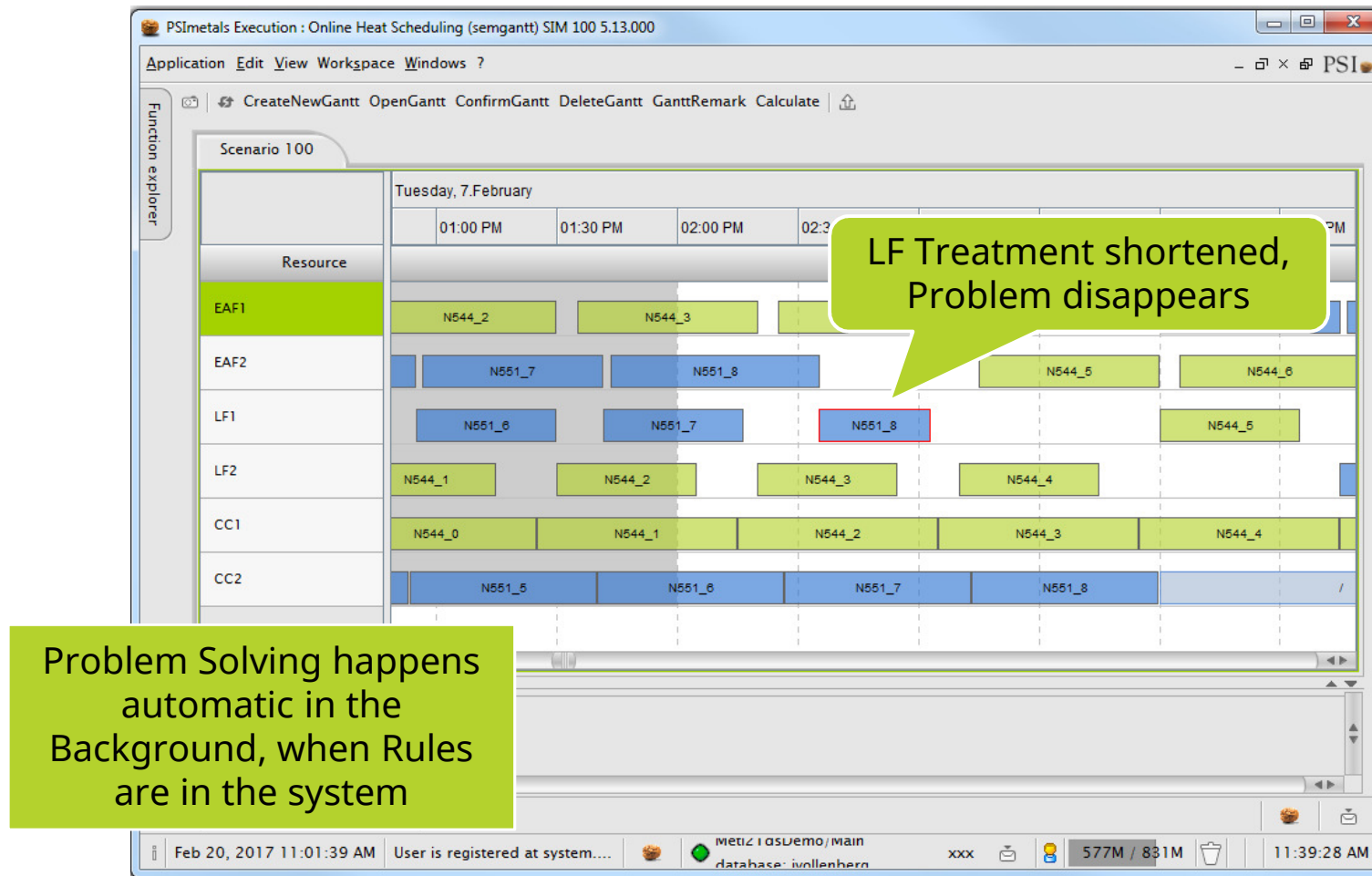
| Parameter        | Min  | Aim  | Max  | Act  | FID   |            |
|------------------|------|------|------|------|-------|------------|
| NumBaskets       |      | 1    |      |      |       | use only 1 |
| ScrapMenu        |      |      |      |      | SM-Cr | use menu   |
| TotalScrapWeight |      | 48   |      |      |       | max. 48 t  |
| Lime             |      | 1920 |      |      | lime  | use 1920   |
| MeltingDuration  |      | 110  |      |      |       | 110 min r  |
| Rate             |      | 10   |      |      |       | use transf |
| SamplingProce... |      |      |      |      |       | use equip  |
| OvenSump         |      | 2    |      |      |       | remaining  |
| Temperature      | 1571 | 1576 | 1581 | 1550 |       | temperatu  |
| DeltaTemp        |      | -26  |      |      |       | temperatu  |
| PowerRate        |      | 2    |      |      |       | use power  |
| HeatingDuration  |      | 2.6  |      |      |       | 2.6 min p  |
| Temperature      | 1571 | 1576 | 1581 |      |       | temperatu  |
| SamplingProce... |      |      |      |      |       | use equip  |

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Feb 14, 2017 11:22:58 AM User is registered at system. (User...)

metiz1asDemo/main database: xxx 465M / 884M 2:01:30 PM

## OHS Scenario: Delay at Caster CC2



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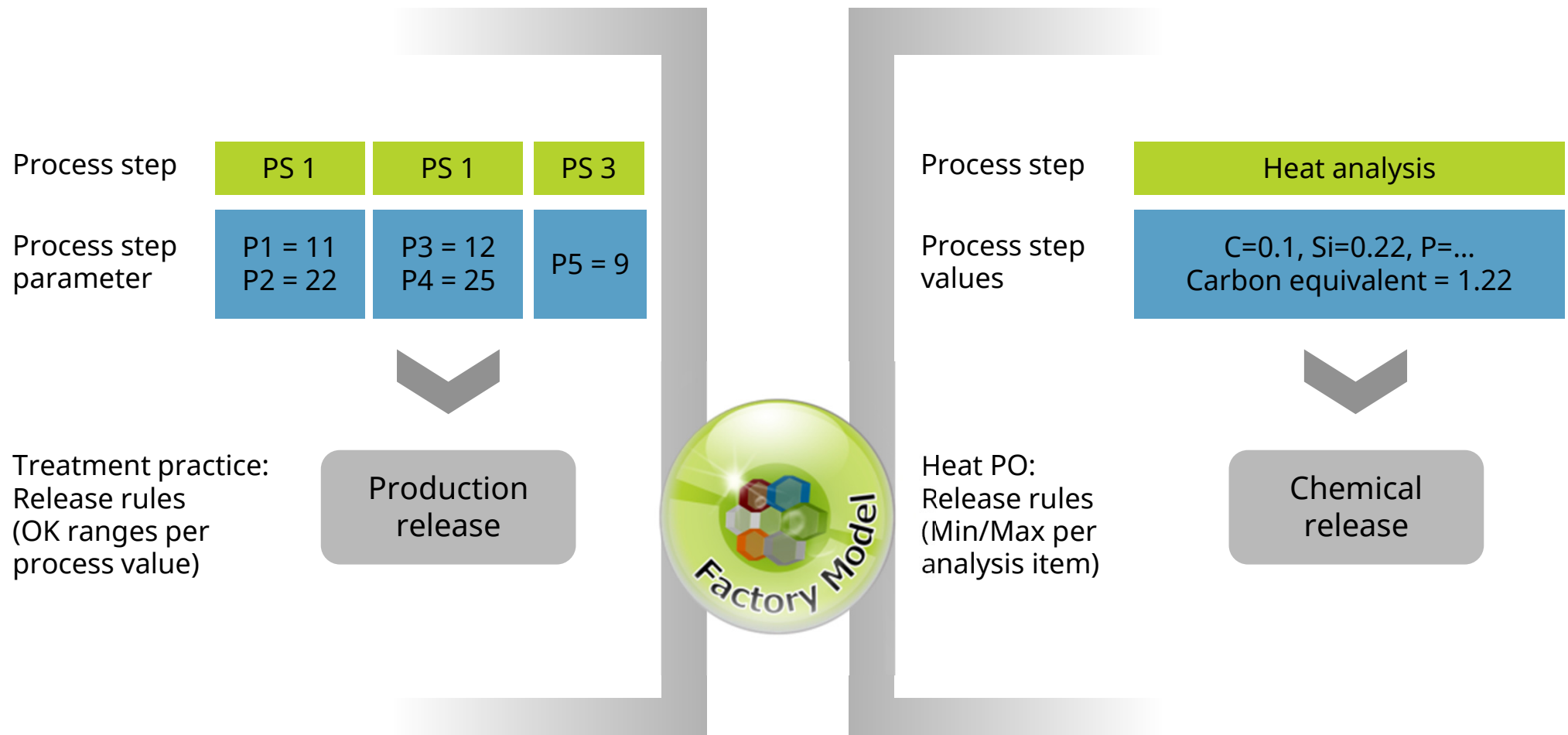


Deviation  
Management



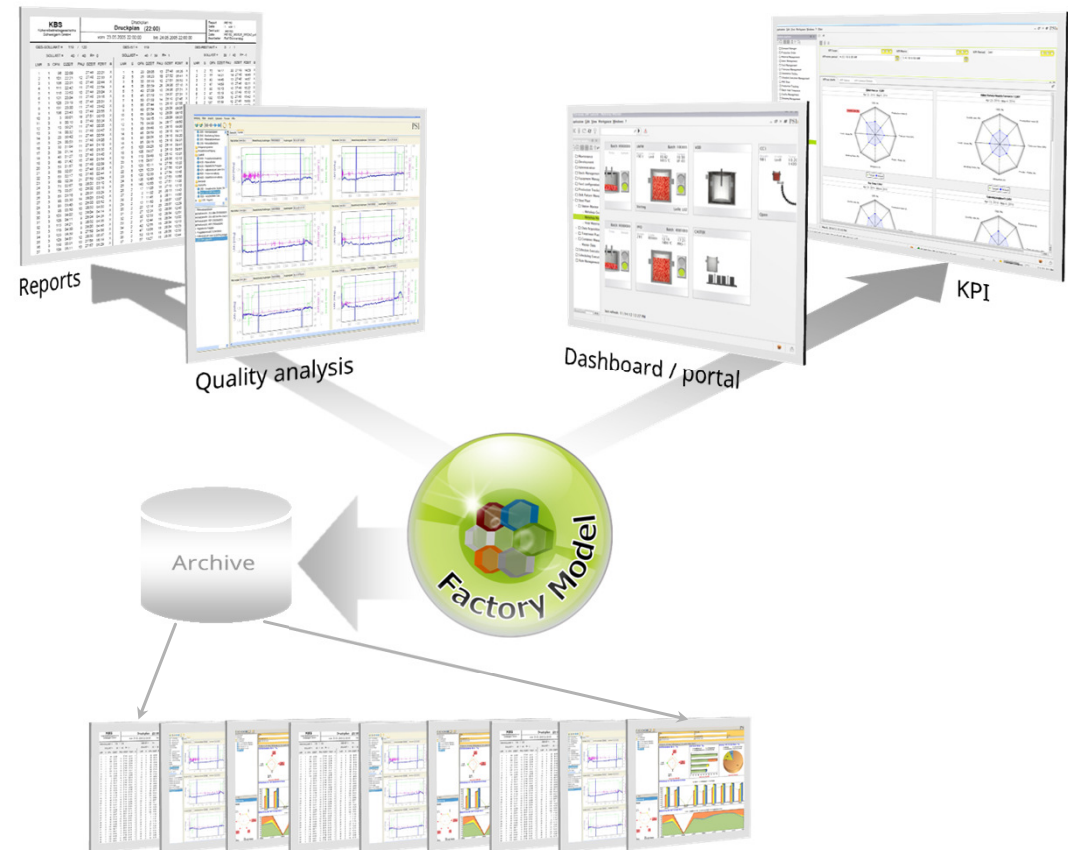
Heat Release

## Production Release & Chemical Release



# Production Monitoring with PSImetals

- Real-time analytics with Factory Model
  - Current figures
  - Target figures
  - Forecast data
- Separate archive database with identic structure for
  - Historical analyses
  - Extensive analyses
  - Integration of further data bases



Thank you for your attention!



# Questions?

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