

GUROBI DAYS 2023

INTEGRATED PRODUCTION PLANNING

With Optimization



**SALZGITTER
DIGITAL SOLUTIONS**

A Member of the Salzgitter Group

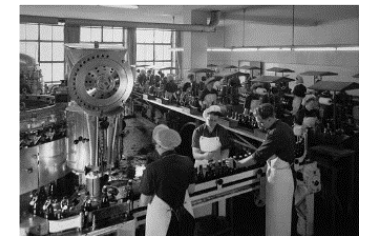
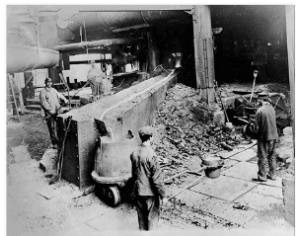
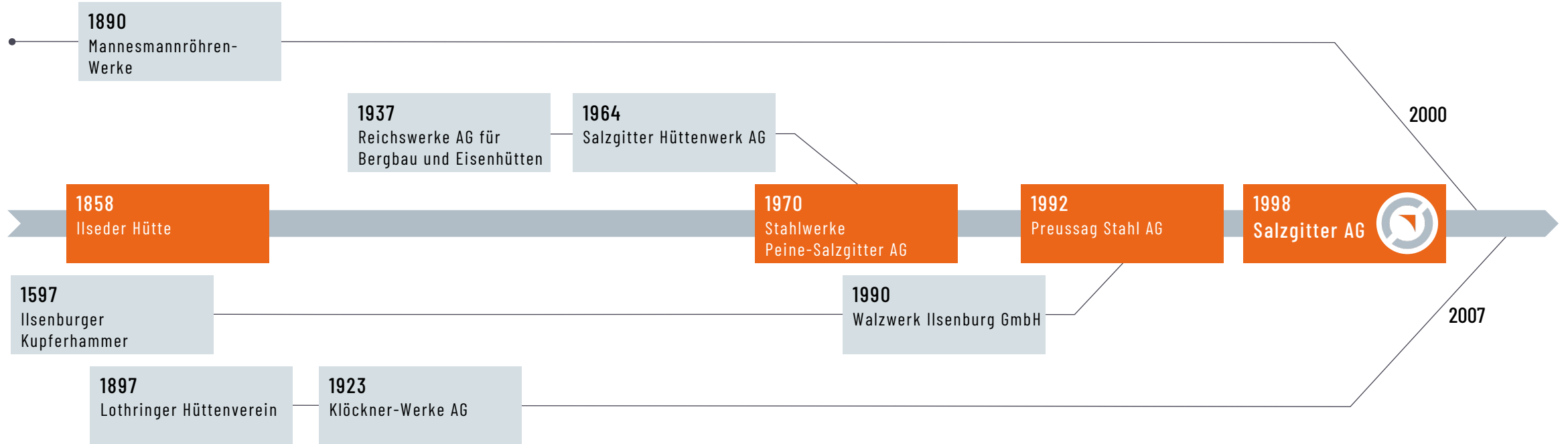


AGENDA

- 01 Salzgitter Group / Salzgitter Digital Solutions GmbH
- 02 moreRules Decisionbox
- 03 Integrated Production Planning
- 04 Lessons Learned
- 05 Questions & Answers

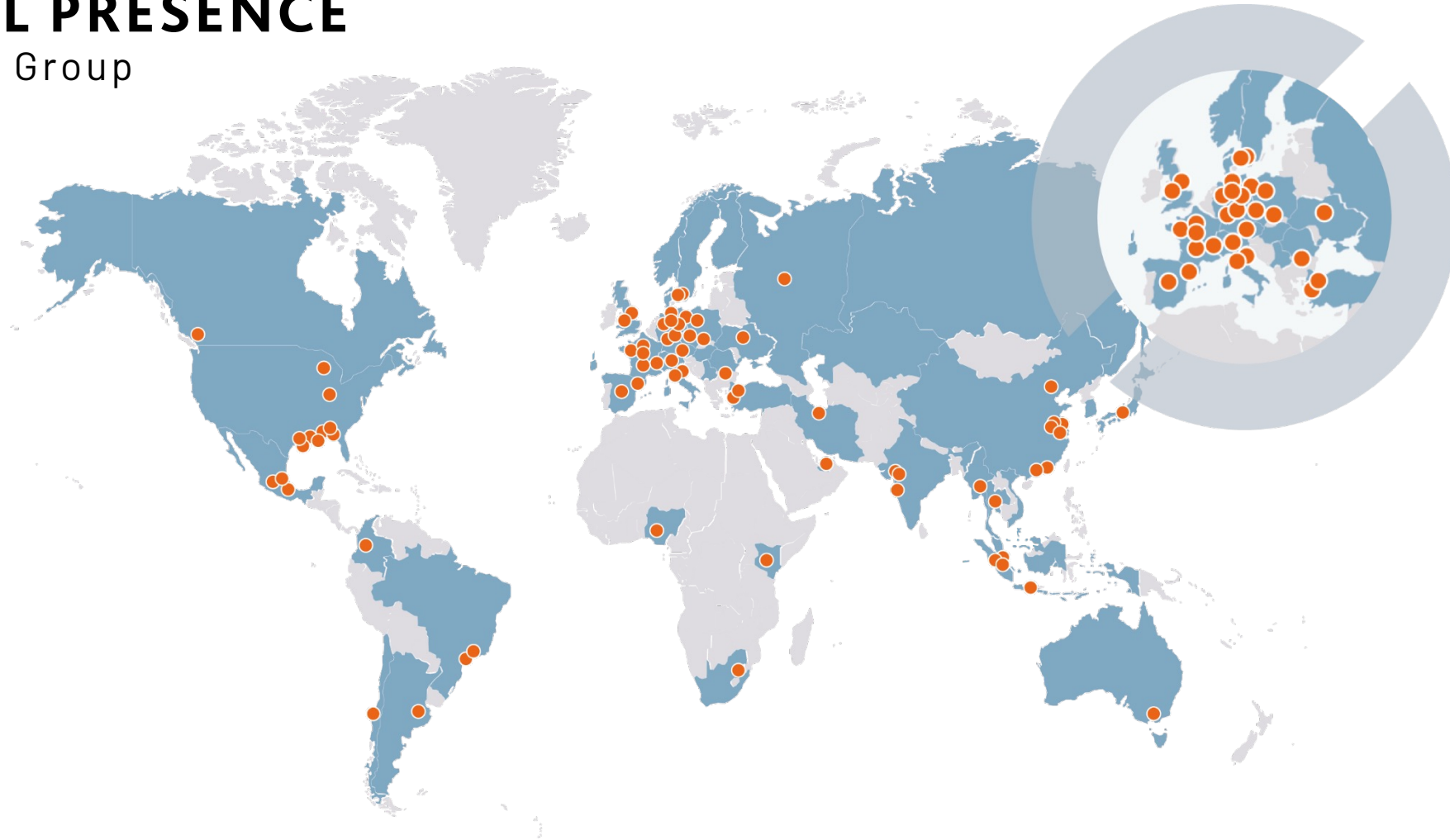
01 YOUNG YET WITH GREAT TRADITION

Salzgitter Group



01 GLOBAL PRESENCE

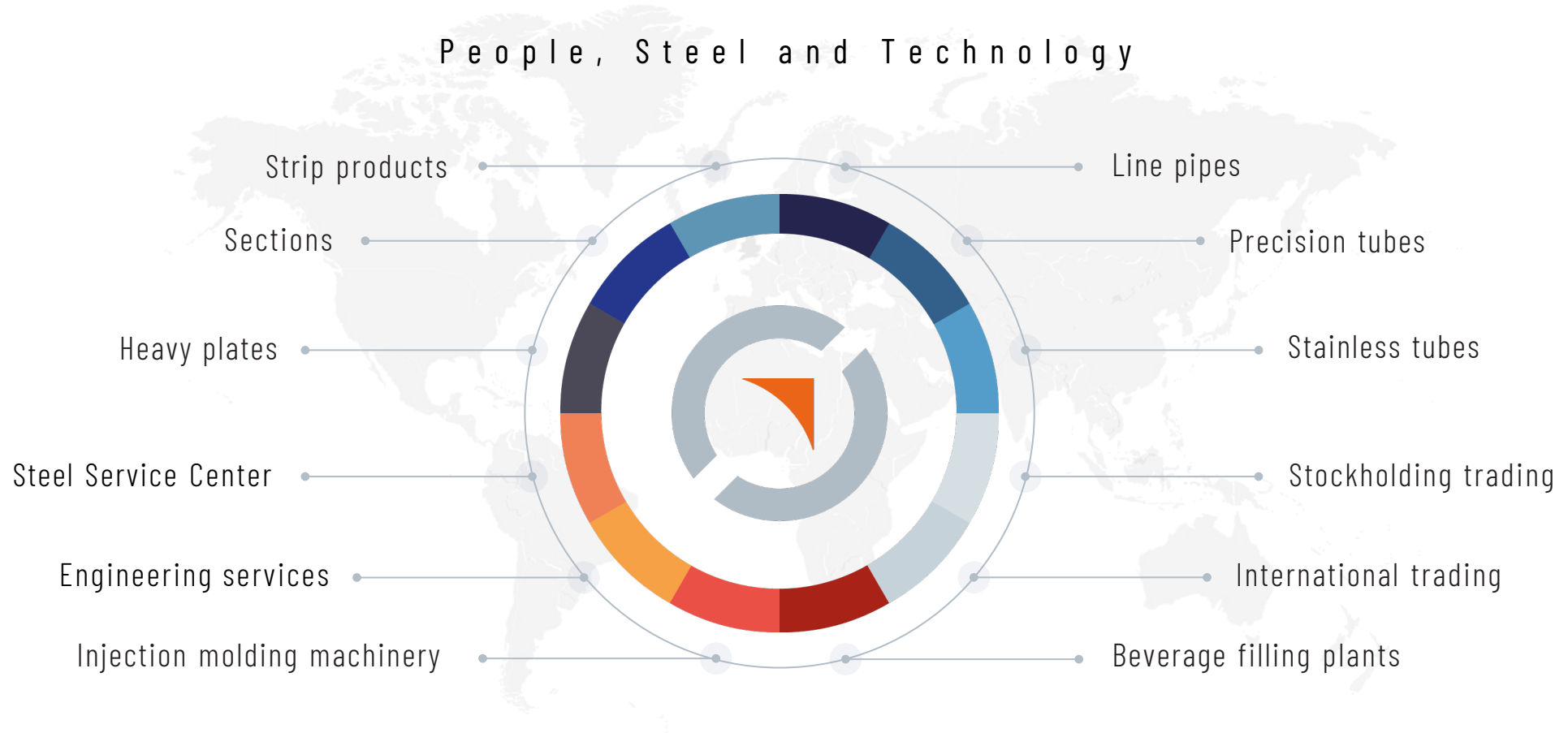
Salzgitter Group



Crude steel production 2022: 6.1 million tons; trading volume: 3.6 million tons;
Among the top 3 producers of beverage filling and packaging machinery

01 DIVERSIFIED PRODUCT PORTFOLIO

Salzgitter Group



01 GROUP STRUCTURE AND KEY DATA FY 2022

Salzgitter Group

Salzgitter Group

External Sales cons.: € 12.5 billion / **EBT:** € 1.2 billion / **Employees:** 22,622

Steel Production

/ **External Sales:** € 4.3 billion
/ **Employees:** 7,369
/ **EBT:** € 791 million



Steel Processing

/ **External Sales:** € 2.1 billion
/ **Employees:** 5,341
/ **EBT:** € 86 million



Trading

/ **External Sales:** € 4.6 billion
/ **Employees:** 1,975
/ **EBT:** € 243 million



Technology

/ **External Sales:** € 1.4 billion
/ **Employees:** 5,329
/ **EBT:** € 48 million



All data about employees as per 12/31

01 GROUP STRUCTURE

Salzgitter Group

Salzgitter Group

Salzgitter Mannesmann / Salzgitter Klöckner-Werke

Steel Production Business Unit	Steel Processing Business Unit	Trading Business Unit	Technology Business Unit	Industrial Participations / Consolidation	
Salzgitter Flachstahl	Mannesmann Precision Tubes	Salzgitter Mannesmann Handel Gruppe	KHS	Verkehrsbetriebe Peine-Salzgitter	
Peiner Träger	Mannesmann Line Pipe	Universal Eisen und Stahl	Klöckner Desma Elastomertechnik	Salzgitter Digital Solutions	
DEUMU Deutsche Erz- und Metall-Union	Mannesmann Stainless Tubes		DESMA Schuhmaschinen	TELCAT MULTICOM	
Salzgitter Mannesmann Stahlservice	Mannesmann Grossrohr			Salzgitter Automotive Engineering	
Salzgitter Europlatten	Ilseburger Grobblech			Salzgitter Hydroforming	
	Salzgitter Mannesmann Grobblech			Salzgitter Business Service	
	Hüttenwerke Krupp Mannesmann	30%		Salzgitter Mannesmann Forschung	
	EUROPIPE	50%		Glückauf Immobilien	
	Borusan Mannesmann	23%		Aurubis	29,99%
				Hansaport	51%

As of January 2023, simplified display

01 SALZGITTER DIGITAL SOLUTIONS

Salzgitter Group

INDUSTRIAL PARTICIPATION

- / Integration of business processes into one uniform IT-solution
- / Reflect the entire workflow
- / Proven practical know-how thanks to decades of cooperation



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02 MORERULES DECISIONBOX

Salzgitter Digital Solutions



more Rules



Business Rules

IBM Operational Decision Management



Mathematical Optimization

Gurobi

02 MORERULES DECISIONBOX

Salzgitter Digital Solutions



more Rules

- / single point-of-truth for business logic
- / separation of application- and business-logic
- / if-then conditions
- / table-like structure
- / customers can change on their own

Business Rules

IBM Operational Decision Management

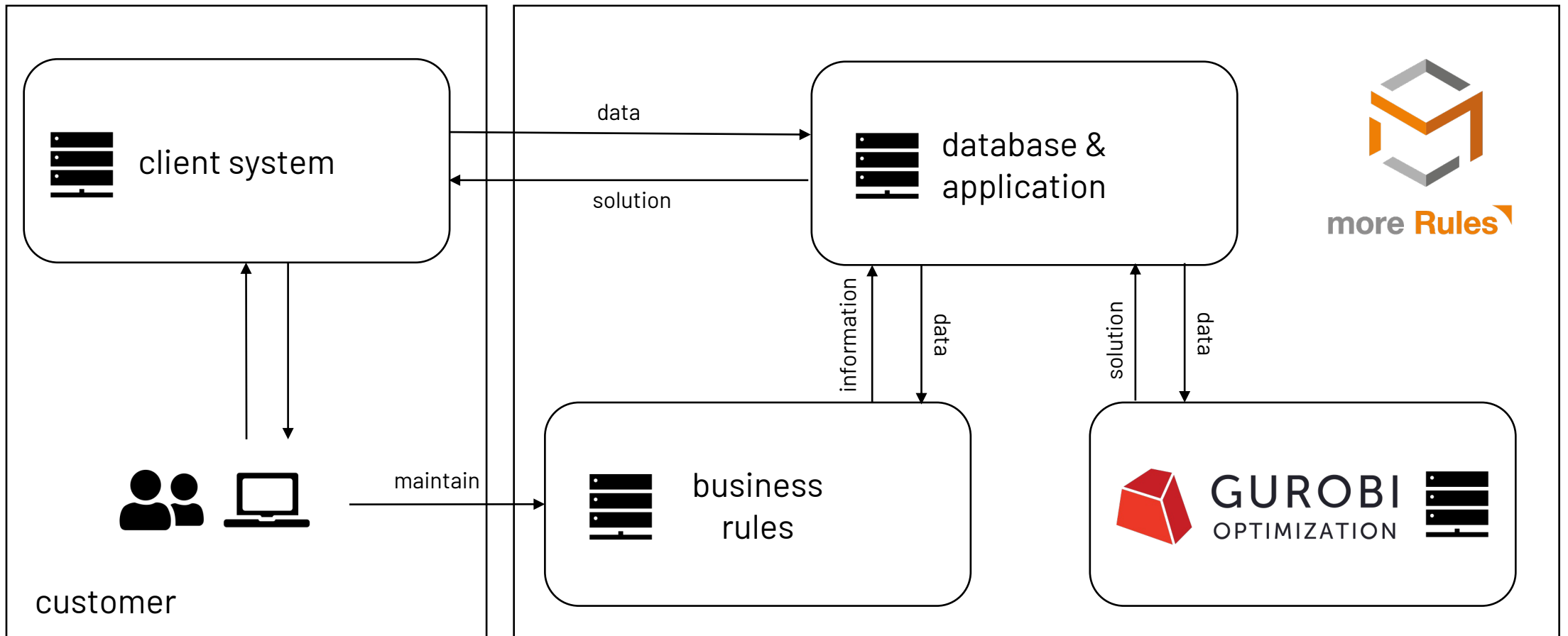
- / complex problems
- / identify (globally) best solution
- / multicriterial objectives

Mathematical Optimization

Gurobi

02 MORERULES DECISIONBOX

Salzgitter Digital Solutions





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03 INTEGRATED PRODUCTION PLANNING

Typical planning problems

SEQUENCING

/ In which order should these pieces be processed optimally?

/ How can we make sure the machine/plant can process this order?



(MULTIPLE) KNAPSACK

/ Which pieces should be combined to save energy/time etc.?

/ How can we minimize the number of necessary machines?

/ How can we make sure the plant can handle the combinations?



03 INTEGRATED PRODUCTION PLANNING

With Optimization

VISION OF THE NEW TOOL



03 INTEGRATED PRODUCTION PLANNING

With Optimization

POSH = P(lanning), O(optimization) & S(mart) H(euristics)



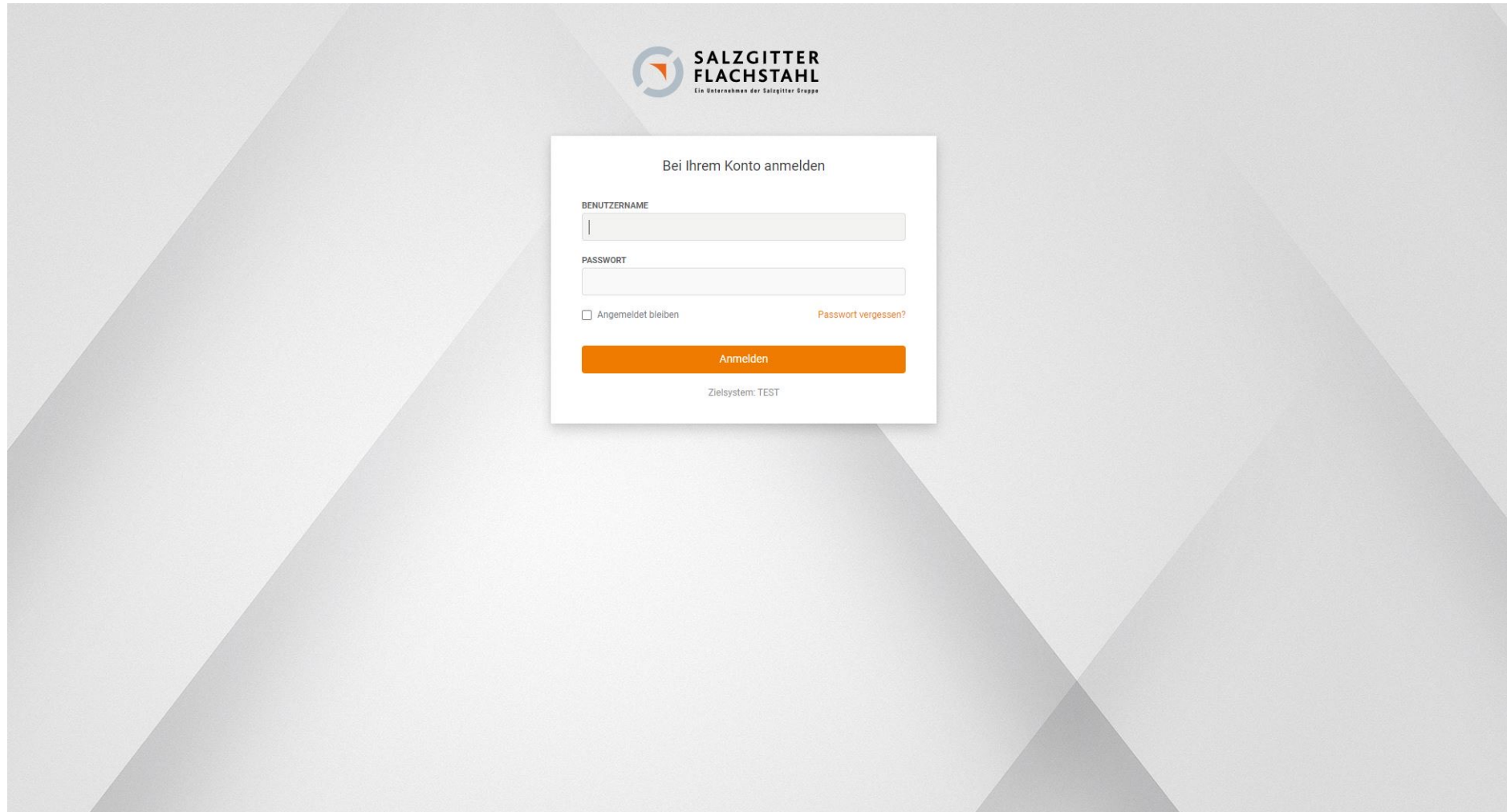
03 INTEGRATED PRODUCTION PLANNING

With Optimization



03 INTEGRATED PRODUCTION PLANNING

With Optimization



03 INTEGRATED PRODUCTION PLANNING

With Optimization

The screenshot displays a web-based production planning application. On the left is a navigation sidebar with menu items: Startseite, Auftragskomplettierung, Analyse, Programmbildung, Programmübersicht, Anlagenbuch, Stammdaten, Allgemeine Informationen, Anlagen, Arbeitsvorgänge, and Einstellungen. The main area shows a grid of planning cards for plant 'ANLAGE: GLU'. A dropdown menu is open over the 'GLU' card, listing options: FV1, FV2, FV3, GLU (highlighted), KB2, SBE, TAN, and WBB. Other cards include 'Planung Auftragskomplettierung', 'Notizen Anlagenbuch', 'Planun Progr', and 'Einstellungen'. The bottom of the screen features a 'Datenbereitstellung' section with a table of data sync jobs.

Job Name	Startzeitpunkt	Laufzeit
Delta-Sync	08.09.2023 08:13:12	01:16
ASS Apo R3	08.09.2023 05:05:12	02:11
ASS VMI	08.09.2023 07:06:08	00:13
ASS TKB	-	-

Toolbar with icons for save, undo, redo, and other functions. Includes a warning icon and a red box highlighting a play button and a download button.

ID: 420100493 | - gurobi_days (Status: in Bearbeitung / Optimierungsstatus: nicht optimiert)
Anweisung enthält schwere Restriktionverletzung

Table with columns: Flg, Opt Anl FV, AG Notiz, Stück Notiz, Stück Pro, Auftrag, Verbraucher kurz, Stückident, Feld, Verk Artikel, Güte Soll, Güte Ist, WG 34, G..., RTF, QS, QS Spr, Dicke Soll, Dicke Ist, Breite Soll, Breite Ist, Bes... Breite, Besä... KZ, Zink Ges, W, Rau heit, Öl Sorte, Chrom KZ, Ob fl, Ob kl, Flg Anl, Cb V, Coilblock Bez, S. Ist, S. M., AnwText1, Gew Ist, Länge Ist, CAD Soll, C... S..., Prio Anl, NA-Typ, Kum Gew, Kum Lauf, Restriktions prüfung, Sync Status, Sync Nachricht, Prod Artikel Soll.

Context menu with options: Entfernen, Ersetzen, Einfügen, Programzeile bearbeiten, Coilaufbau, Stücke zusammenhalten, Zum Anfang verschieben, Zum Ende verschieben, Notiz Arbeitsgang bearbeiten, Notiz Stück bearbeiten, Filter Übergangsstück, Zelleninhalt kopieren, Export.

Pre-Planning | Anweisung dialog box. Title: Pre-Planning | Anweisung. Content: Optimierung für Anweisung undefined | FV1 starten? LAUFZEIT AUSWÄHLEN (Mittel dropdown), KPI-BERECHNUNG (toggle), ABBRECHEN, BESTÄTIGEN.

Table with columns: Gew Ist, Länge Ist, CAD Soll, C... S..., P... Anl, NA-Typ, Kum Gew, Kum Lauf, Restriktions prüfung, Sync Status, Sync Nachricht, Prod Artikel Soll. Includes summary statistics: 24 Aufträge, 30 Stücke, 749 t Tonnage, 59 km Länge, 12:28 Laufzeit, 28.09.2023 00 Produktionsdatum.



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04 LESSONS LEARNED

Challenges and Achievements

/ Challenges:

- / delta sync
- / different needs for each special field
- / optimization goals hard to identify
- / acceptance of optimization itself

/ Achievements:

- / central tool
- / easy to roll out for new plants
- / business logic and planning know how conserved





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05 QUESTIONS & ANSWERS

Contact

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