

Fresh Look on the Casting Industry

Dr. Wolfgang Hiller (CEO)

Buderus Guss Corp., Breidenbach - Germany



www.buderus-guss.de

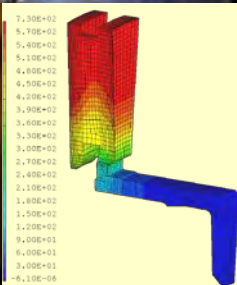


- Introduction
 - Buderus Guss GmbH
- Industry Trends
 - Price-/Cost Pressure
 - Global Footprint
 - Connectivity
 - Environment
 - Electro Mobility
- Summary

Outside Casting Industry: Several Prejudices



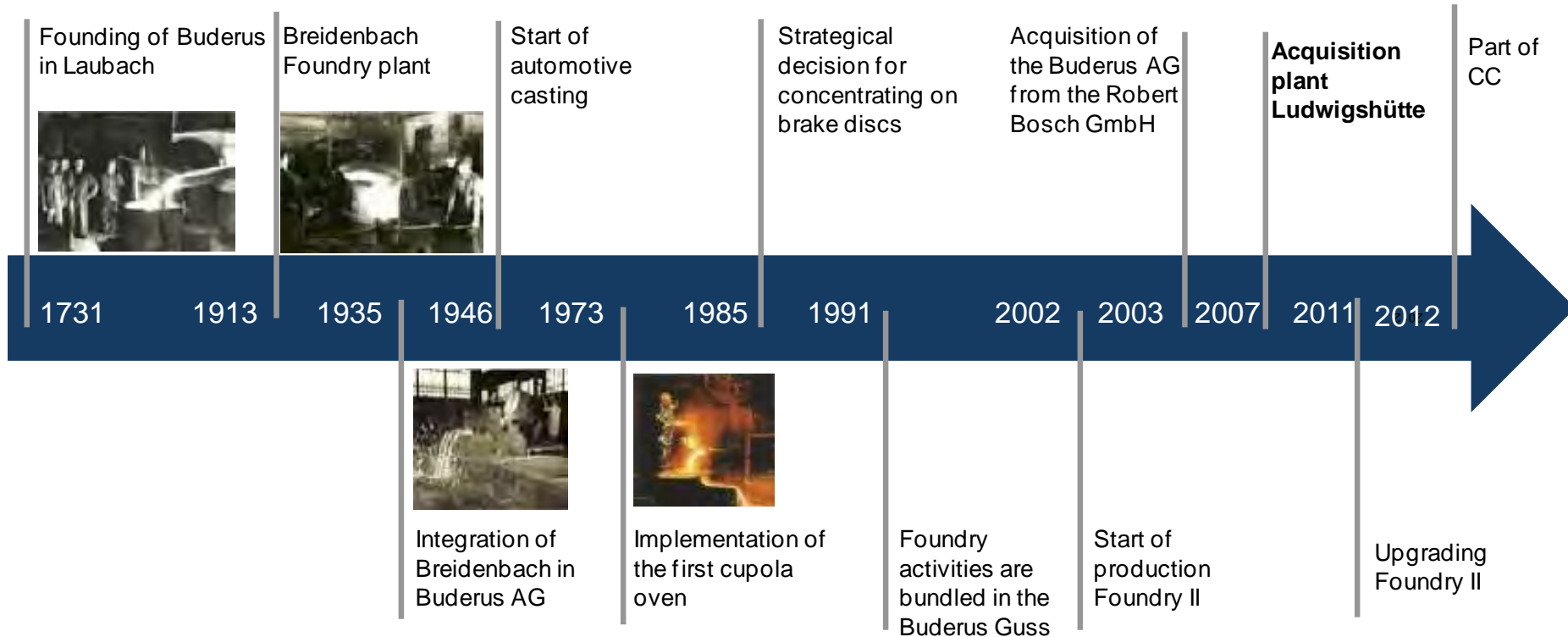
Fascinating casting industry:



- Casting is the most important manufacturing technology today and in the future for production of metal-based near net shape components!
- From physics/chemistry point of view: Basis processes are not well understood!
- OEM-casting product market: Core competence only with few companies!

Key historic milestones

→ Historical development of foundry competencies...



... over the last century

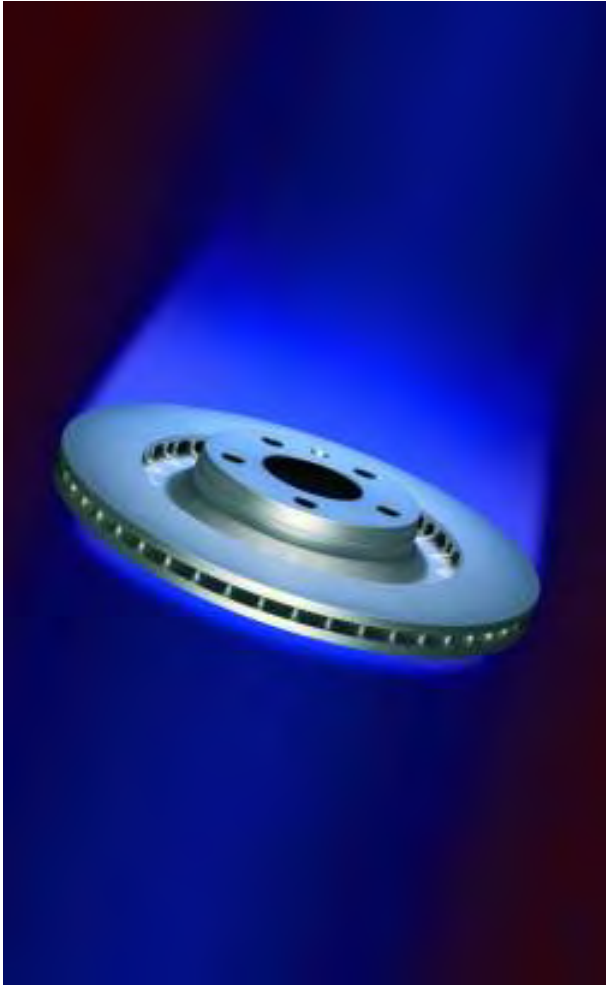
Long history/experience → Promising Future!



Das Werk Breidenbach 1915



Buderus Guss facts 1(2)



- Foundry is focused on brake discs
- Market Leader for OEM passenger car brake discs in Europe
- Process technology leader
- Success Factor: Automation
 - Full automatic, vertical moulding lines
 - Cores are placed automatically in moulds
 - Full automatic machining lines
 - Inline control: Parts are measured automatically
 - Automatic (Optical) Inspection

Buderus Guss facts 2(2)



- All relevant surface treatments possible
- Coating: Application of zinc dust, Geomet coating (silver), Senotherm (black) and new materials
- Longterm engineering experience with grey cast iron materials and brake disc design
- Independent brand Buderus; lean standalone company organization
- Innovative products:
 - Light weight rotors
 - New coatings



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Industry Trends: Watch them carefully!

Price-/cost pressure



- Process technologies
- Automation
- Production chain
- Lightweight

Environment



- CO₂-Reduction
- Energy management
- Efficiency
- Particle emission

Electro Mobility



- Innovation (new vehicle concepts)
- Lightweight
- Product Life Time

Global Footprint



- Request to quote/deliver globally
- Investments
- Partnerships
- Joint Ventures
- Innovation

Connectivity



- Industry 4.0
- Traceability

Casting products as Commodity?

Commodities

- Standardized product
- Prod. processes standard competence
- Interchangeable with other competitor goods of the same type on short notice
- Applicable for different fields of use
- No differentiation by features or quality
- Information about producer irrelevant for market success

OE-Brake disc

- OE-tailored product (material/coating/cooling technology); engineering today covered/led by OEM due to complexity & safety relevance of the product!
- Core competence of few companies.
- Release time constants by OEM 2-3 years (for the few companies)!
- Developed for specific applications
- Strong differentiation by performance, features and quality
- Producer and brand important for acceptance on the market

OE-brake discs are complex customer tailored products based on the core competence of few companies => no commodities !

Price-/Cost-Pressure 1(2)



Automation

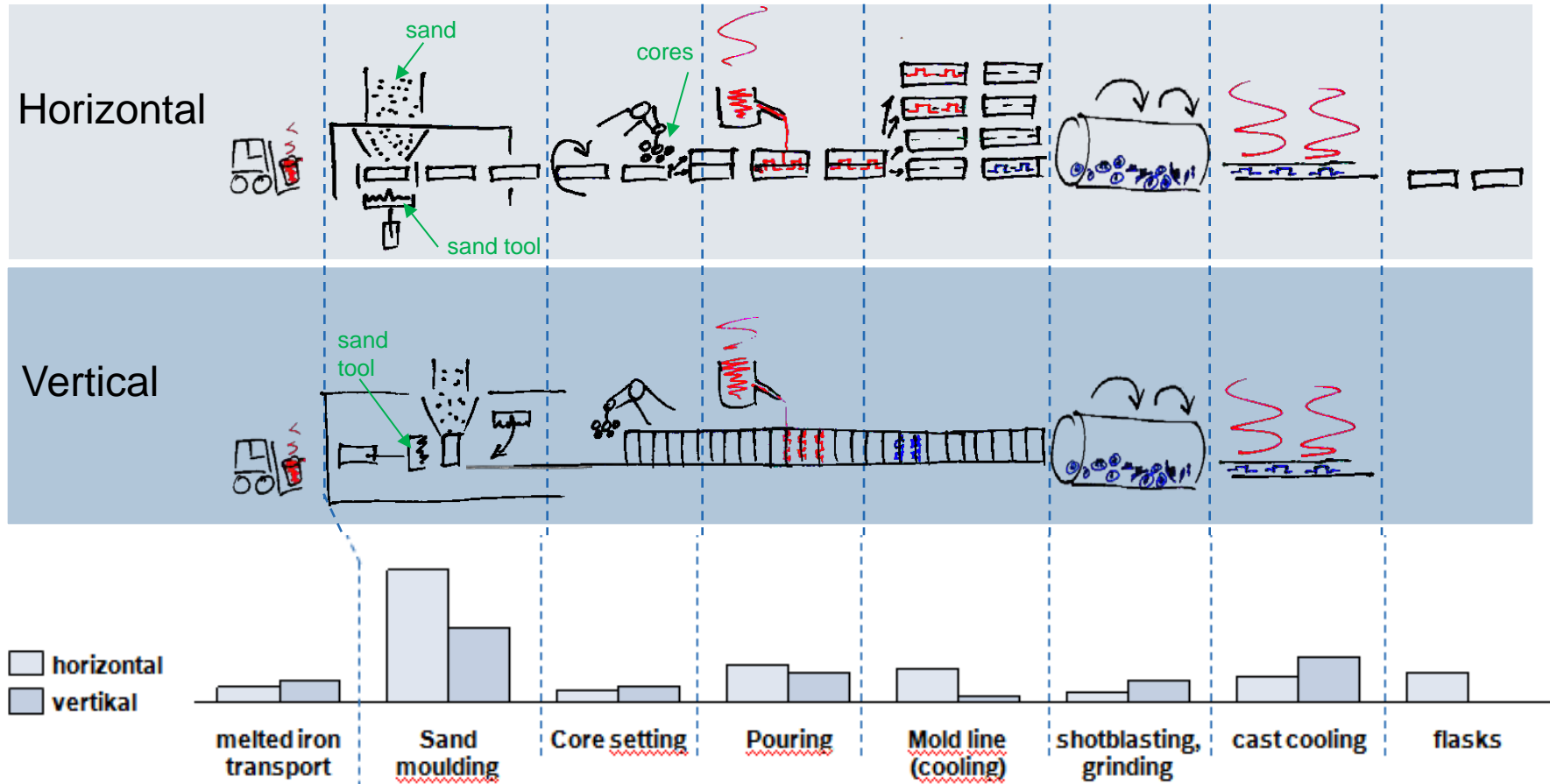
- Focus on productivity
- Automated coldbox core production/ coldbox handling
- Automatic Inspection
- Automated liquid metal transportation
- Innovative gripper technologies
- Connectivity (Industry 4.0)



Processes

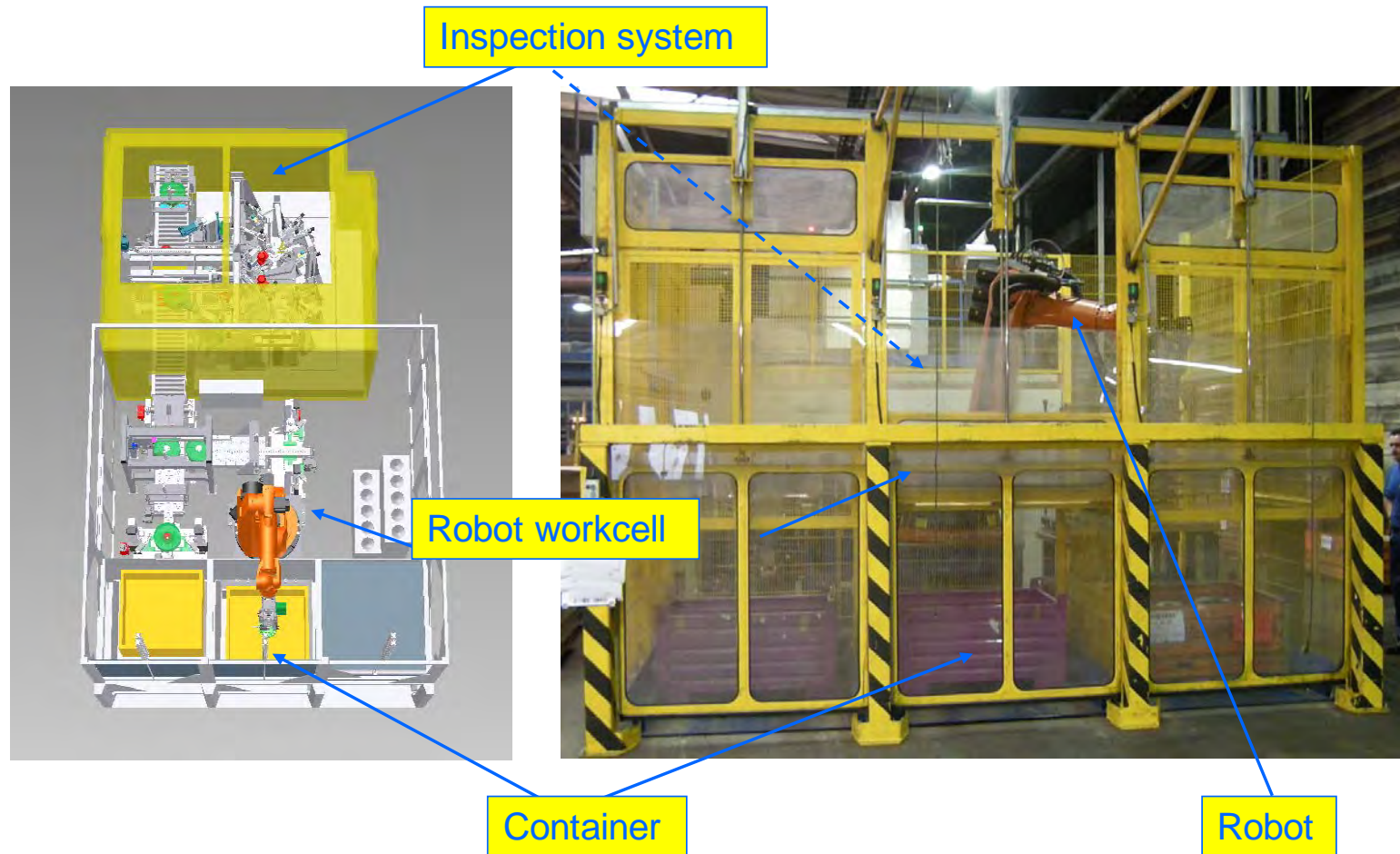
- Improve basic understanding of production processes
- Deep-dive of cost analysis of all process-steps!
- Stabilization of manufacturing processes/ robustness!?
- Introduction of Toyota Production System (BPS)
- Technologies:
 - Molding process technologies
e.g. vertical vs. horizontal → new alternatives / search fields
 - Hydraulic vs. electronic motion control
 - Inspection technologies

Cost analysis of production process e.g. molding:



Product specific analysis depending on several parameters → surprising results!

Testing procedures: Automatic Optical Inspection (AOI)



BGG-Automatic Optical Inspection

Price-/Cost-Pressure 2(2)



Location: LowCostLocation ⇔ HighCostLocation

- Global footprint
- Manufacturing-/engineering in low cost locations
- Establishing partnerships/joint ventures
- Political environment!?

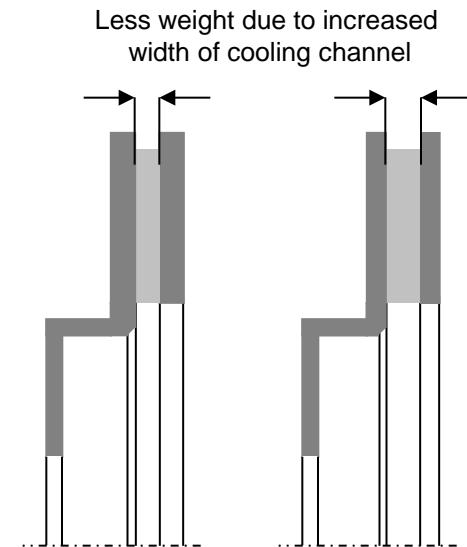
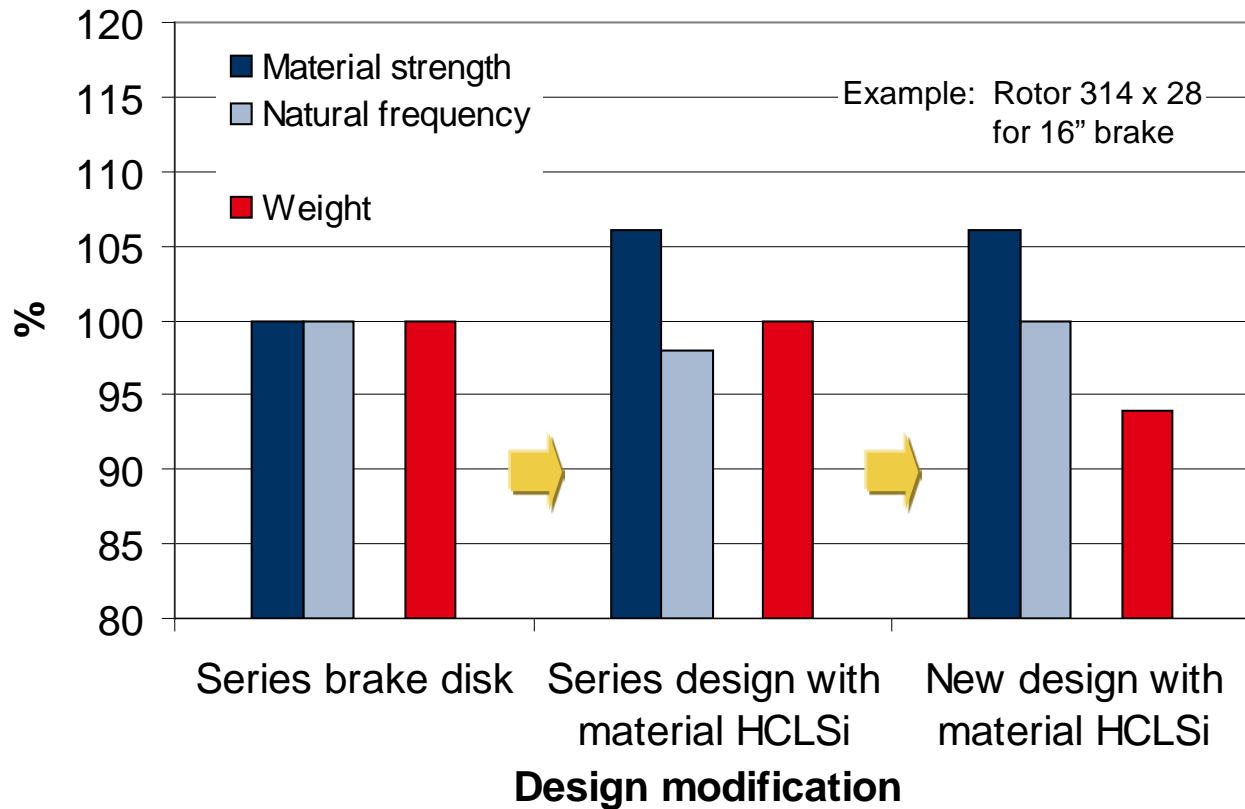
Lightweight technologies

- Metallurgy:
 - ⇒ New material standards e.g. higher tensile strength
 - ⇒ new design with regard to lower weight possible
- Substituting
 - casted parts by materials with lower specific weight e.g. Aluminum/Steel etc.
 - ⇒ Combination of diff. manufacturing technologies
- Coating ⇒ reducing thickness of casted metals

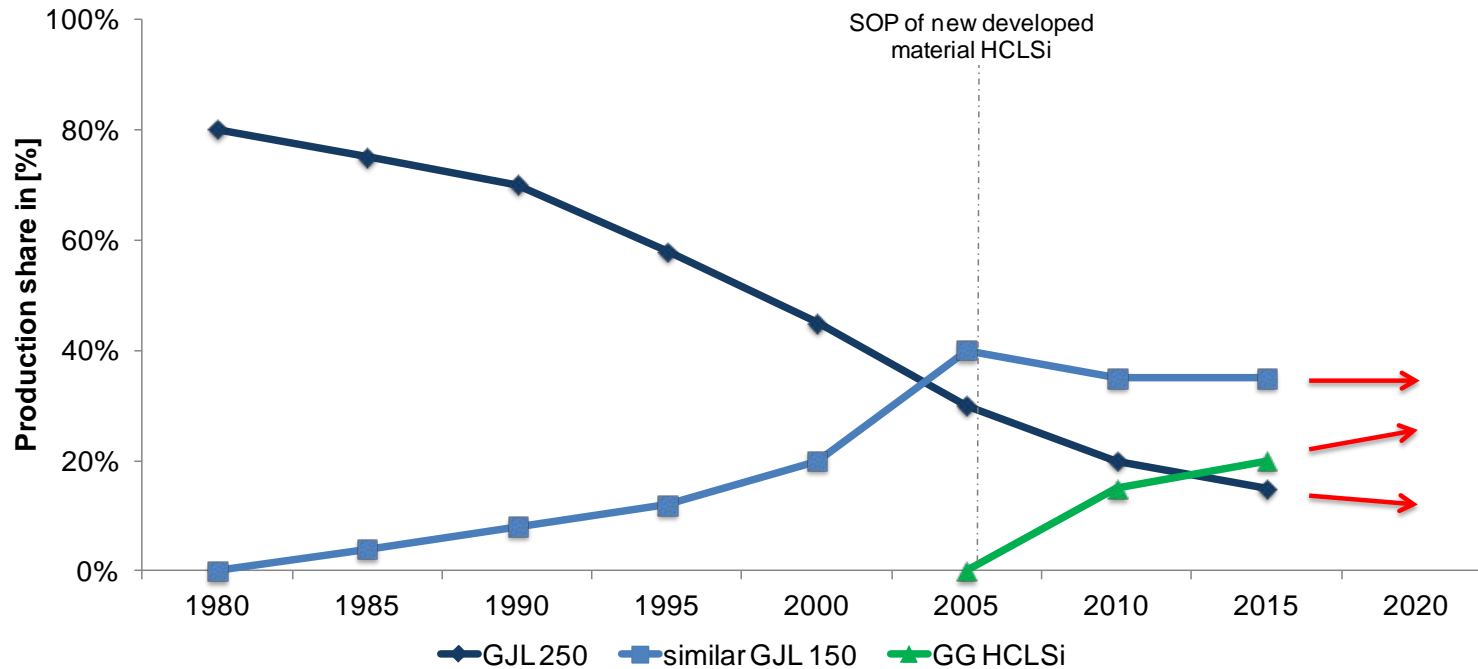


Weight saving by new material standard HCLSi

- By the development of the material HCLSi a higher strength can be achieved
- This allows for wider cooling channels and significant weight reduction
- Natural frequency can be kept within specified limits



Gain of market share by HCLSi



New material meets customer requirements and market trends:

- Increasing share of ventilated brake discs
- Trend towards high carbon materials
- Increasing share of larger brakes/brake discs (16" ->18"/19")

• Two material market standards established by BGG.

Environment



Energy management

- Iron Casting – The Green Technology !
Iron Casting foundries are role model for the recycling industry!
- New ISO 50001 for Energy Management Systems!
- Energy costs
- Furnaces: MFO`s / cupola furnace



Impact of industrial product pollution

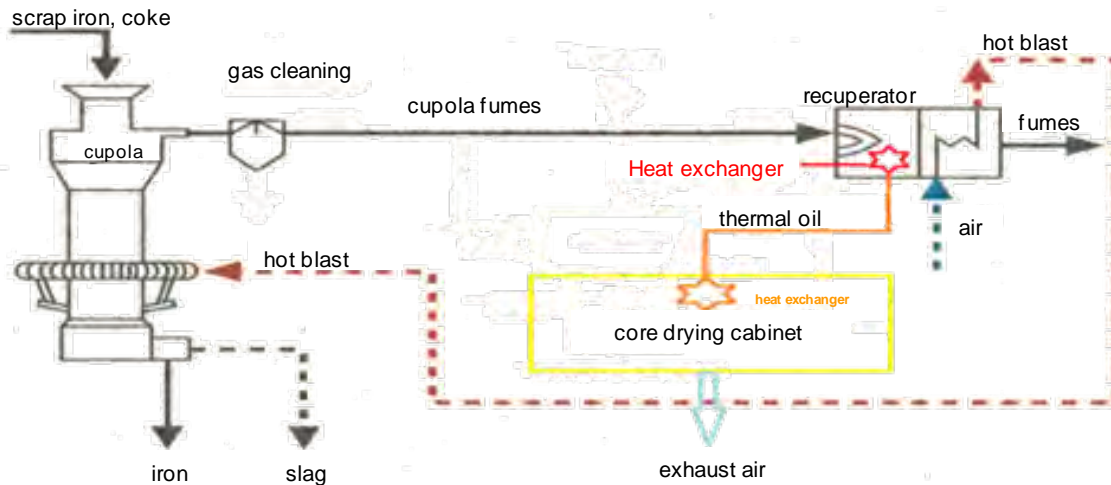
- Emission → e.g. new filter technologies
- CO₂ reduction:
 - Product: Lightweight, product lifecycle
 - Plant: Value stream orientation
e.g. heat recovery system
- Reduction of product related pollution e.g. brake dust
- Improvement of facility/product lifetime

Iron Casting - The green technology:

Iron Casting foundries are role model for the recycling industry!

Buderus was the first casting company in Europe passing the ISO 50001, Energy Management Systems!

Operation of a Core Drying Furnace by Waste Heat Recovery of the Cupola



Average rate of domestic gas use of conventional furnaces:
360.000 m³ = 13.000€/a

Proposed rate of domestic gas use waste heat recovery furnaces:
200.000 m³ = 6.900€/a

Savings: 160.000m³ = 6.000€/a = 100 tCO₂/a

Partly usage of anthracite coke in hot blast cupola

The foundry coke should be placed partly by anthracite coke. Compared to foundry coke, anthracite has a lower carbon content as well as a slower dissolving in the cupola furnace. The advantage of that is the reduced emission of carbon dioxide.

Target is to use 10% anthracite coke to cut down carbon dioxide by 280 tons.

Innovative surface treatment/coatings

Lifetime

- Disc lifetime
- Pad lifetime



- No corrosion on friction surface
- No brake dust
- No surface scratches

Durability

- Stable coefficient of friction
- No cracks after endurance tests

Electrification

- No corrosion even if brake is not used
- Weight reduction

Global Footprint



Supplying products in different regions

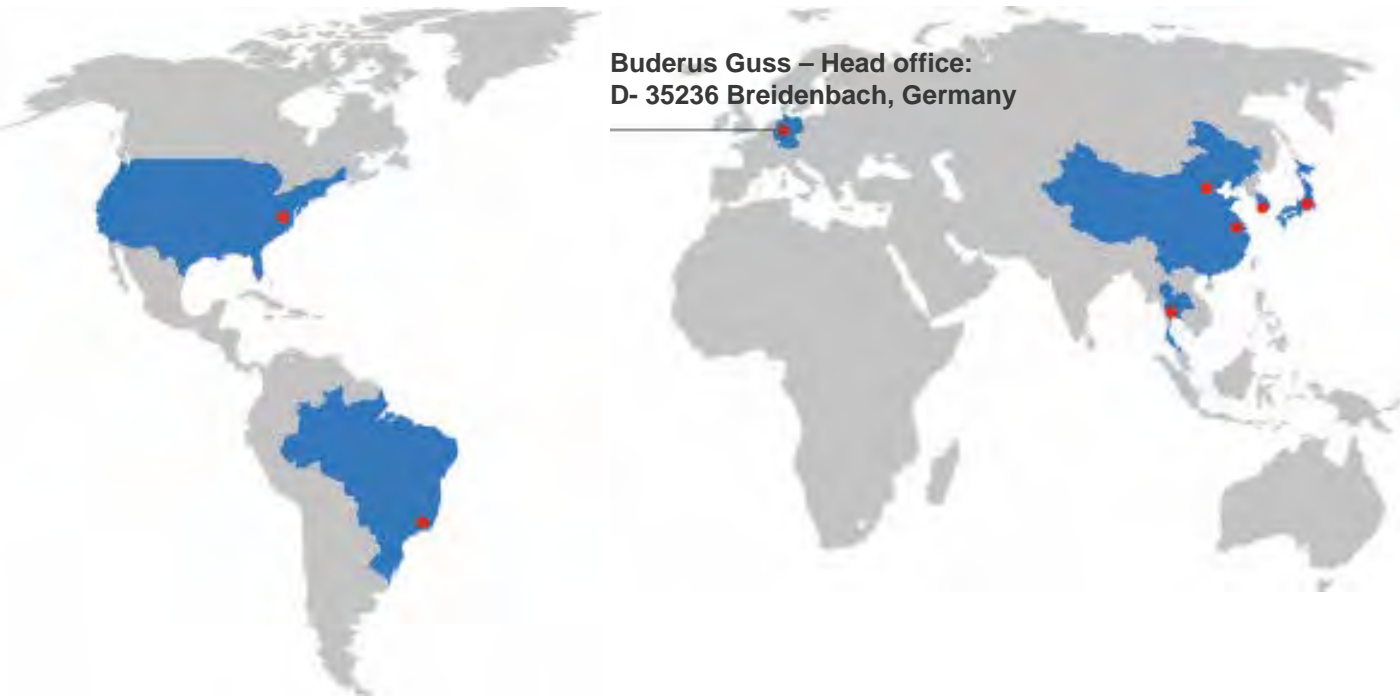
- Investments: Complete or part of the value chain (melting/molding/machining/coating)
- Cooperation with regional/local companies
 - Partnerships e.g. project/ customer related
 - Joint ventures
- Purchasing local for local

Challenges



- Flexible manufacturing processes
- Regional market adjusted product design
- Task sharing/responsibilities (RASIC)
- Local casting industry competences
- Availability of energy-resources

Global Footprint: Offices



Representatives in cooperation
with Huppert Engineering

Asia /Pacific

China (Shanghai und Beijing)
Mr. Zhenguao Ma

Japan (Tokio)
Mr. Toshiyuki Kuwabara

South Korea (Seoul)
Mr. Hojin Park

ASEAN

Thailand (Rayong)
Mr. Mongkol Artipanu

NAFTA

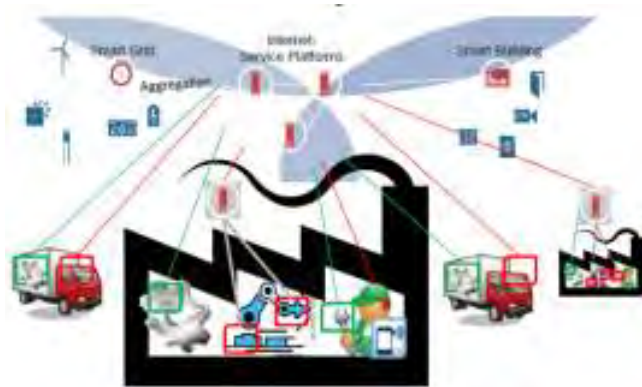
USA (Detroit)
Mr. Joe Groedel

LAM

Brazil (Sao Paulo)
Mrs. Silvia Richieri

Buderus Guss is an international automotive supplier with global offices for development and manufacturing of brake discs for passenger cars.

Connectivity



Industry 4.0

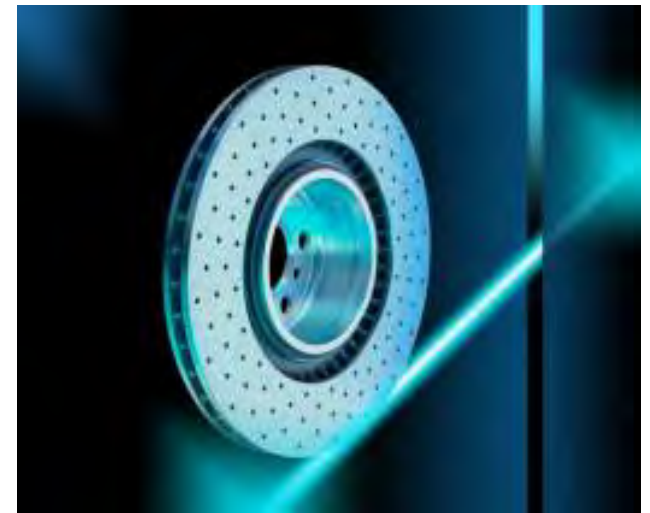
- Interconnecting customer and supplier, products and manufacturing processes, ...
- Data collection → data mining → data allocation
- Preventive maintenance / pre-warning systems

Challenges for casting industry

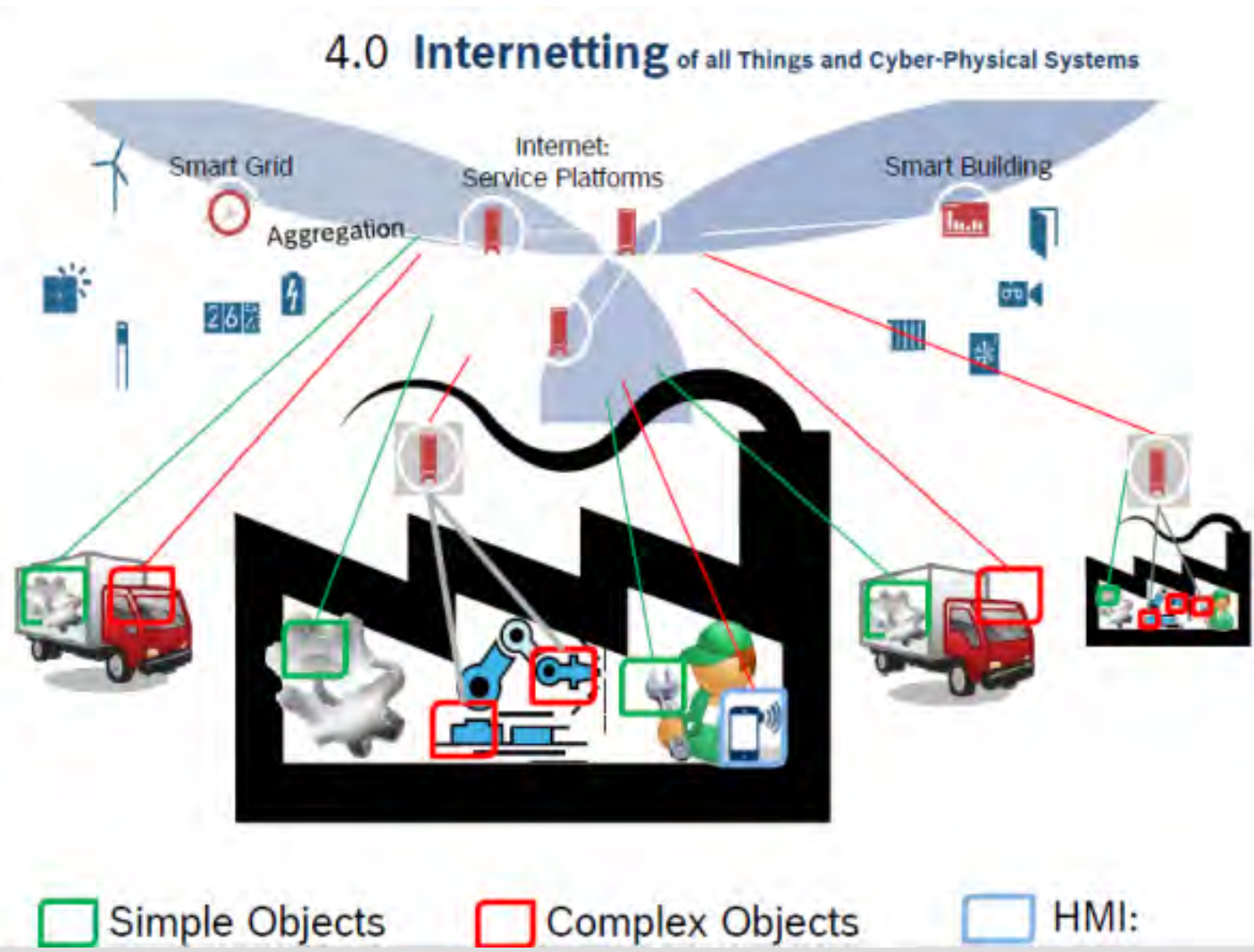
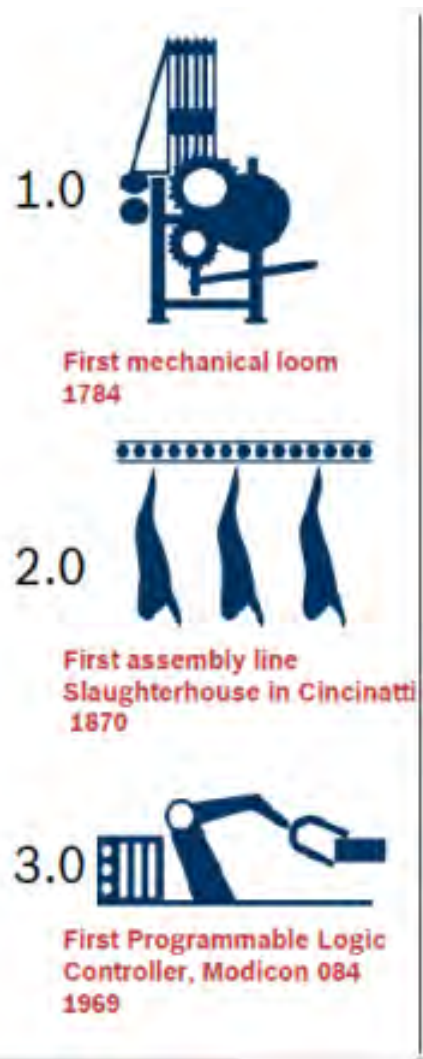
- Combine different cultures/competences:
 - Casting
 - Electronic
 - Software/Internet
- Introducing known sensor technologies (e.g. RFID)
- New sensor technologies
- ...



Innovation path
to intelligent casting products



Industry 4.0 – Are we ready?



Foundry 4.0 - Dealing with big data on the shopfloor



Summary

- ***Most important manufacturing technology today and in the future for production of metal-based near net shape components!***
→ ***Fascinating!***
- ***Basic processes are not well understood:***
→ ***Huge potential for improvements and innovations!***
- ***Industry trends: Watch them carefully!***
↓
- ***Industry 4.0 Are we ready?***



Thank you!

