
HAVE AN EYE ON OUR
melting&casting
INTECO
technologies
INTECO at a glance
CONTINUOUS CASTING TECHNOLOGY

Content

- Company Presentation
- Product Portfolio
- Key Technological Equipment
- Technological Packages

FAMILY BUSINESS

INTECO

1973

2022

Good to know…

1973 › Founded as **IN**ternational **TE**chnical **CO**nsulting

› 400 employees worldwide

› Headoffices in Bruck/Mur, AUSTRIA

› Global presence: 10 subsidiaries

› Turnover of 80 – 100 Mio. $ / year

Location

In the heart of the Austrian steel region with a tradition in steel dating back to the middle ages

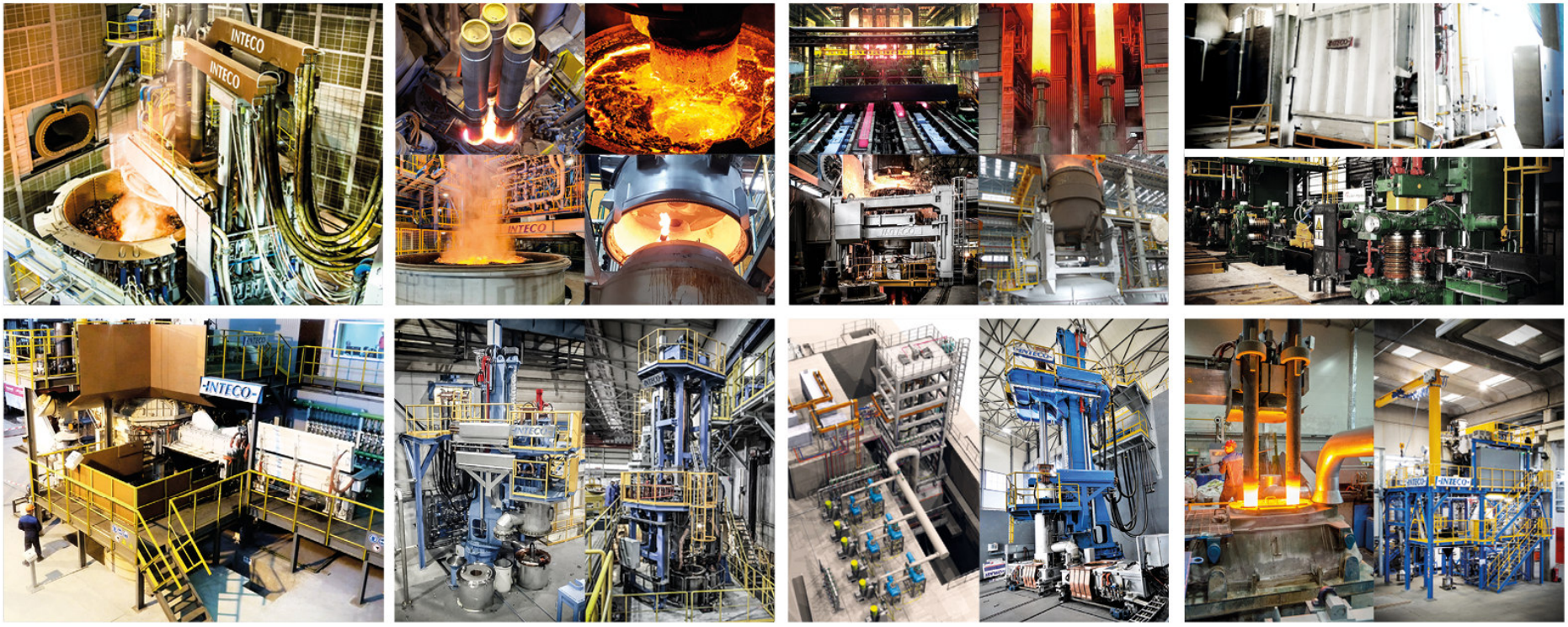
„We are a world leading technology and equipment supplier for the steelmaking and related industry.“

Tradition is built over years

From a consulting company to a holistic partner for any kind of steel projects – new, revamp or modernization

IMAS (INTECO Metals Application Suite)

PROCESS KNOW-HOW & CONSULTING



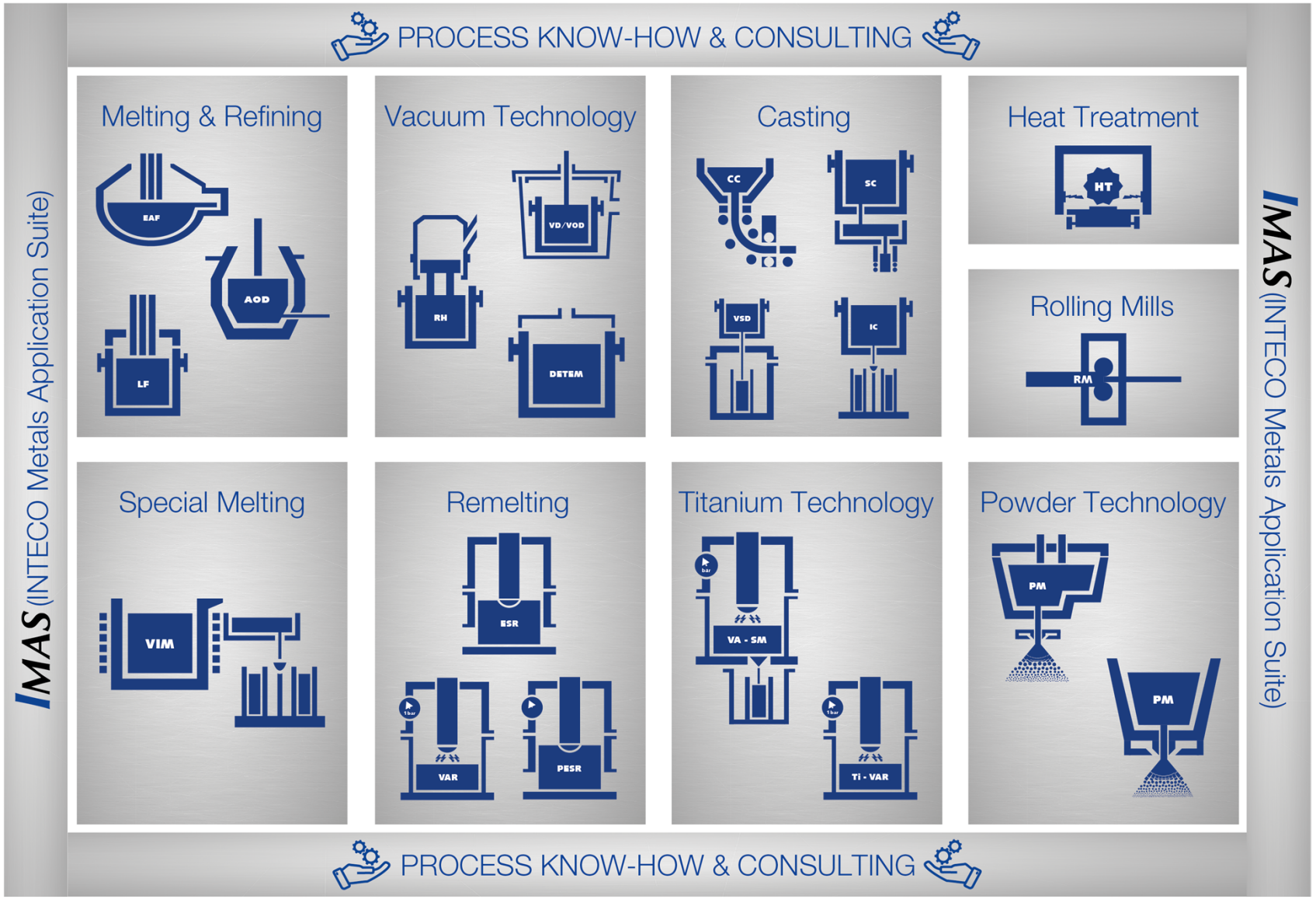
PROCESS KNOW-HOW & CONSULTING

IMAS (INTECO Metals Application Suite)

Leadership in metallurgical process technology and equipment for ***melting, refining, casting, atomization*** *and* ***solidification*** *of*

- *High Performance Steels*
- *Super-Alloys*
- *Titanium*

INTECO´s PRODUCT PORTFOLIO



HISTORY

1988

2009

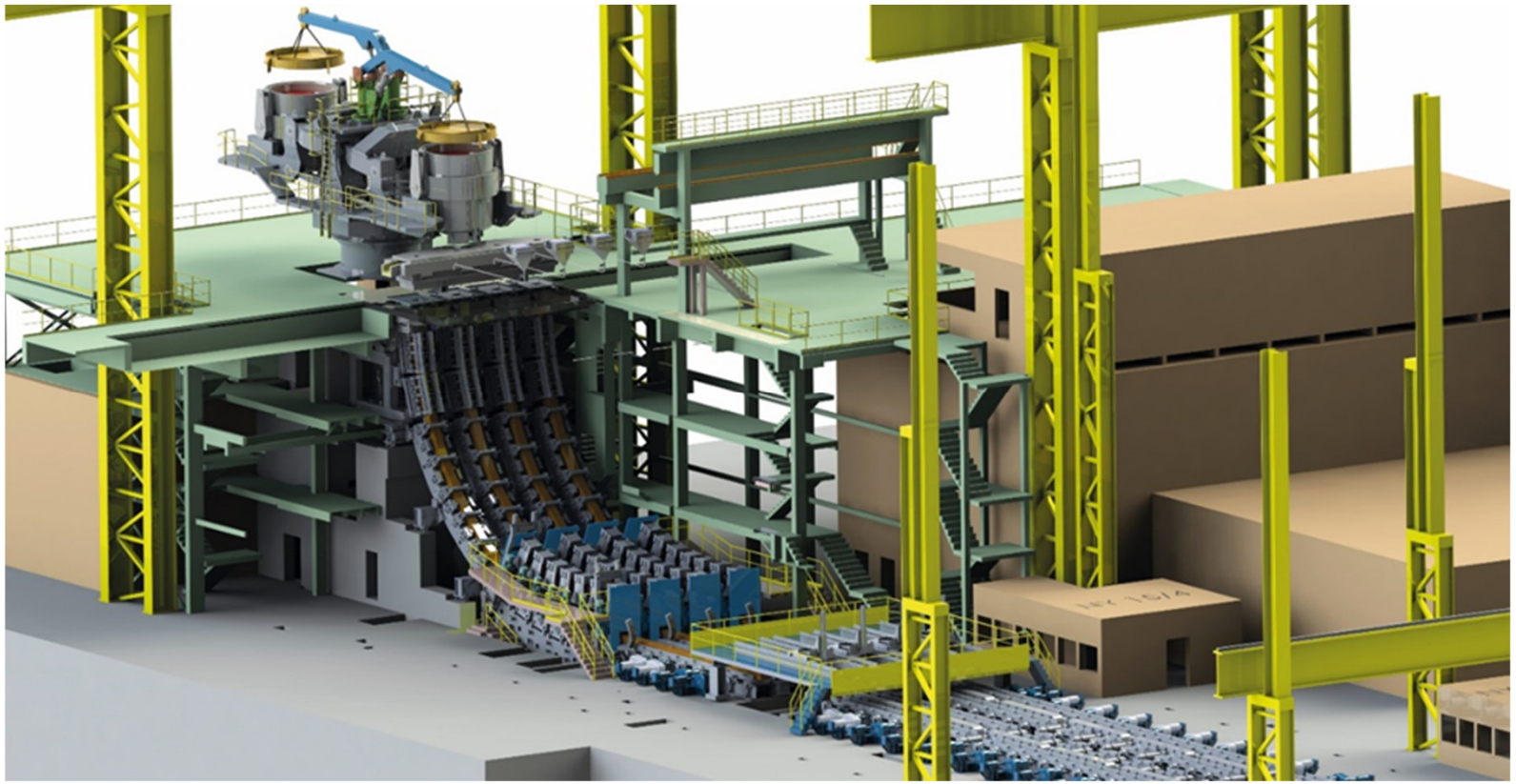
2023 more than 35 years experience in CC

Content

- Company Presentation
- Product Portfolio CCM
- Key Design Features
- Technological Packages
- Slab Casters

Product Portfolio CCM

- **Bloom & Billet Casters**
- Slab Casters
- Beam-Blank Casters
- Horizontal Casters
- VCC
- Segment Casters



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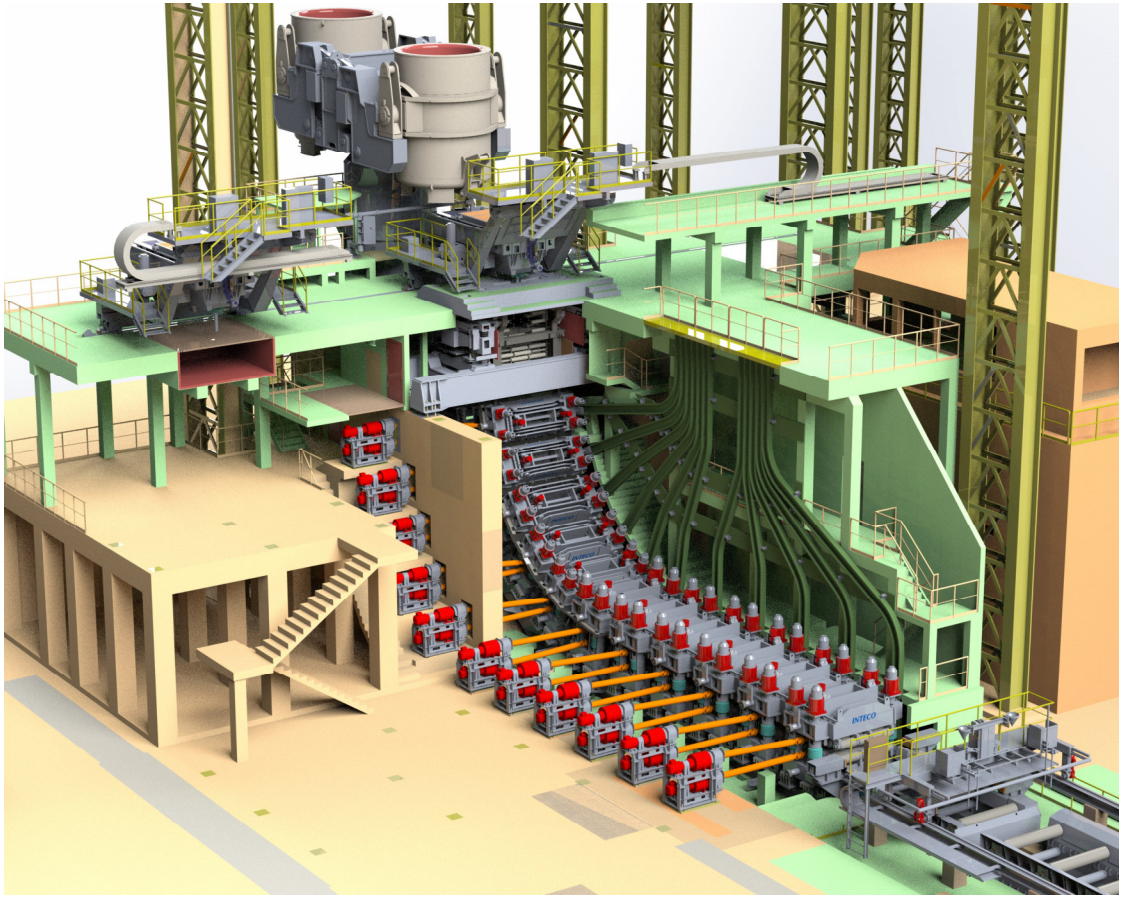

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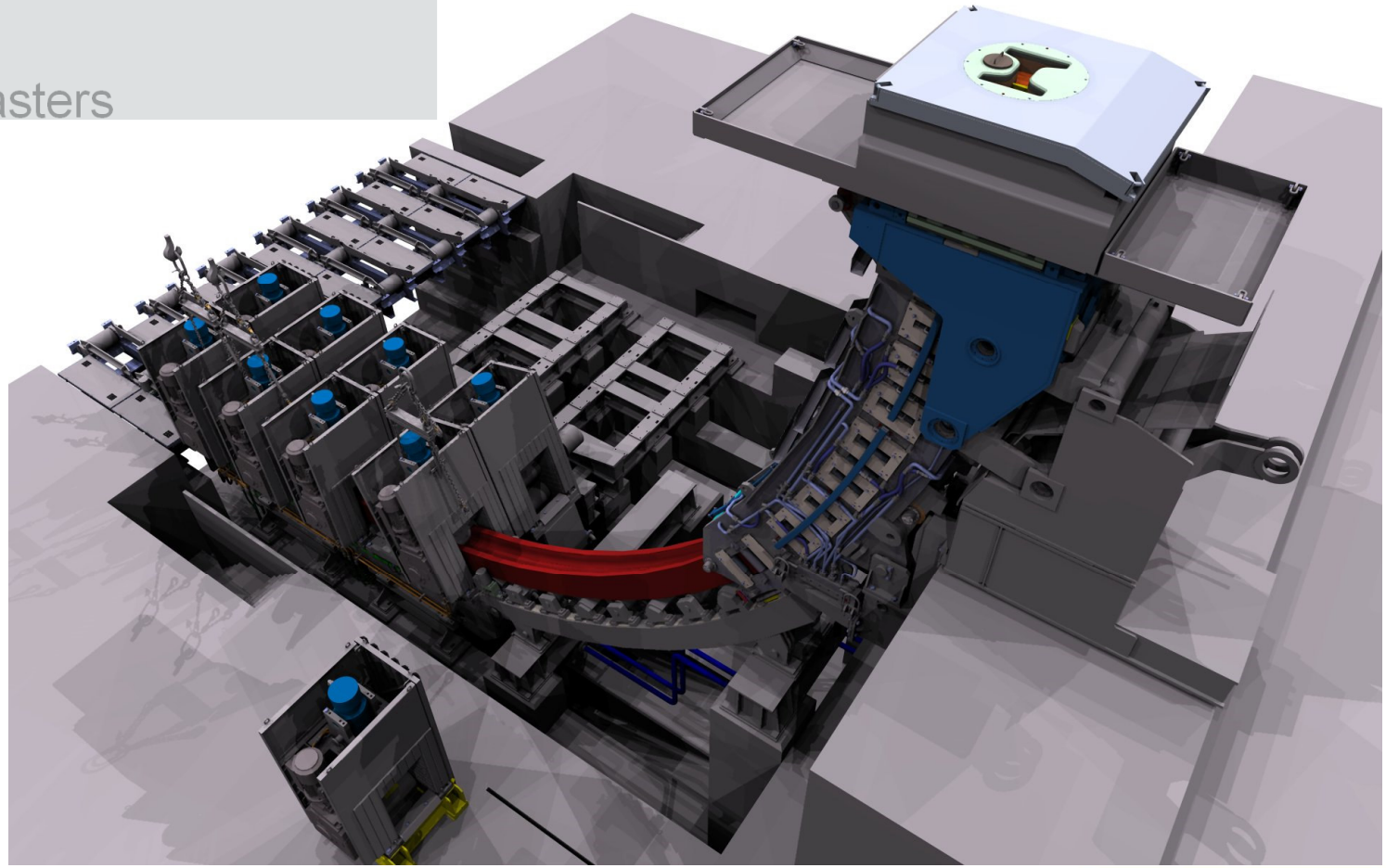

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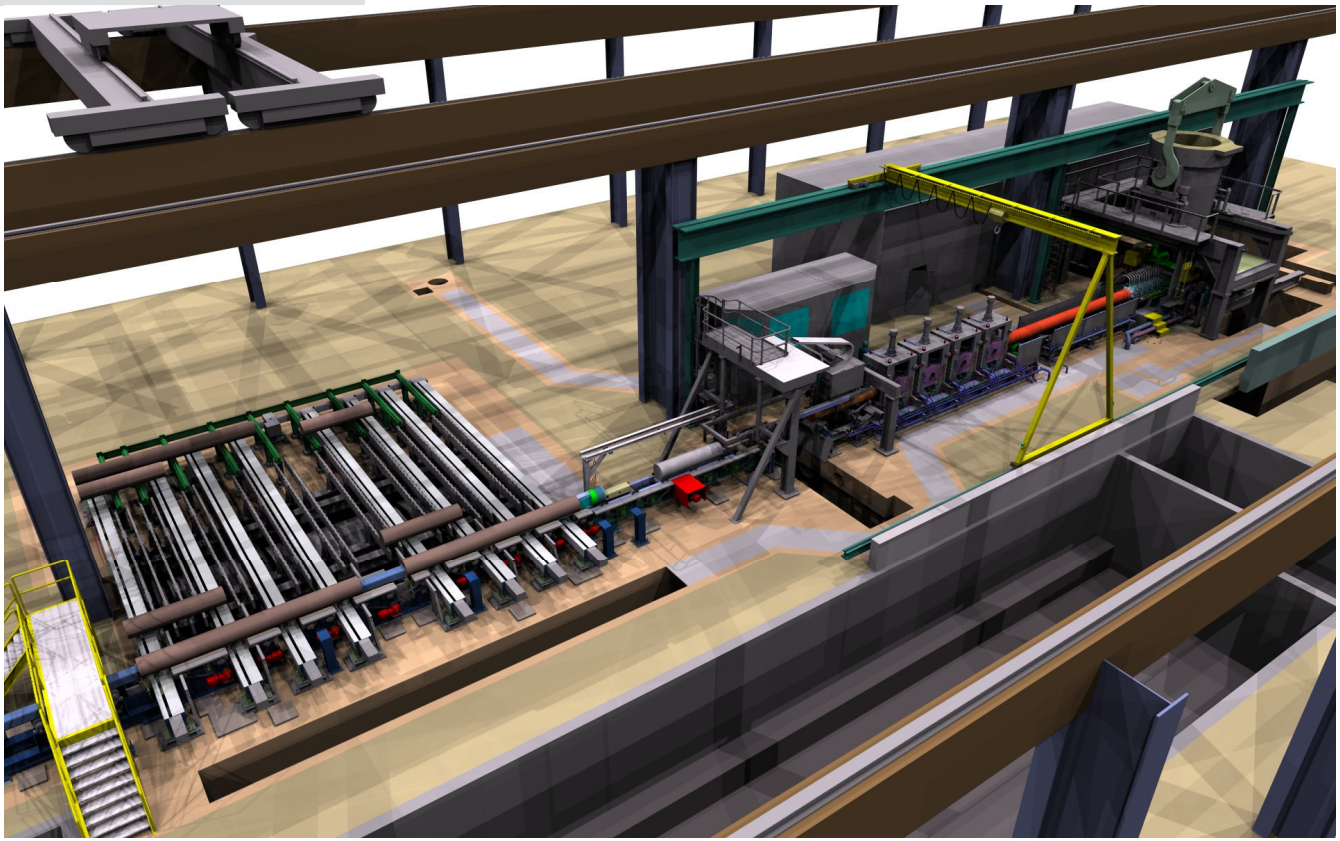

Product Portfolio CCM

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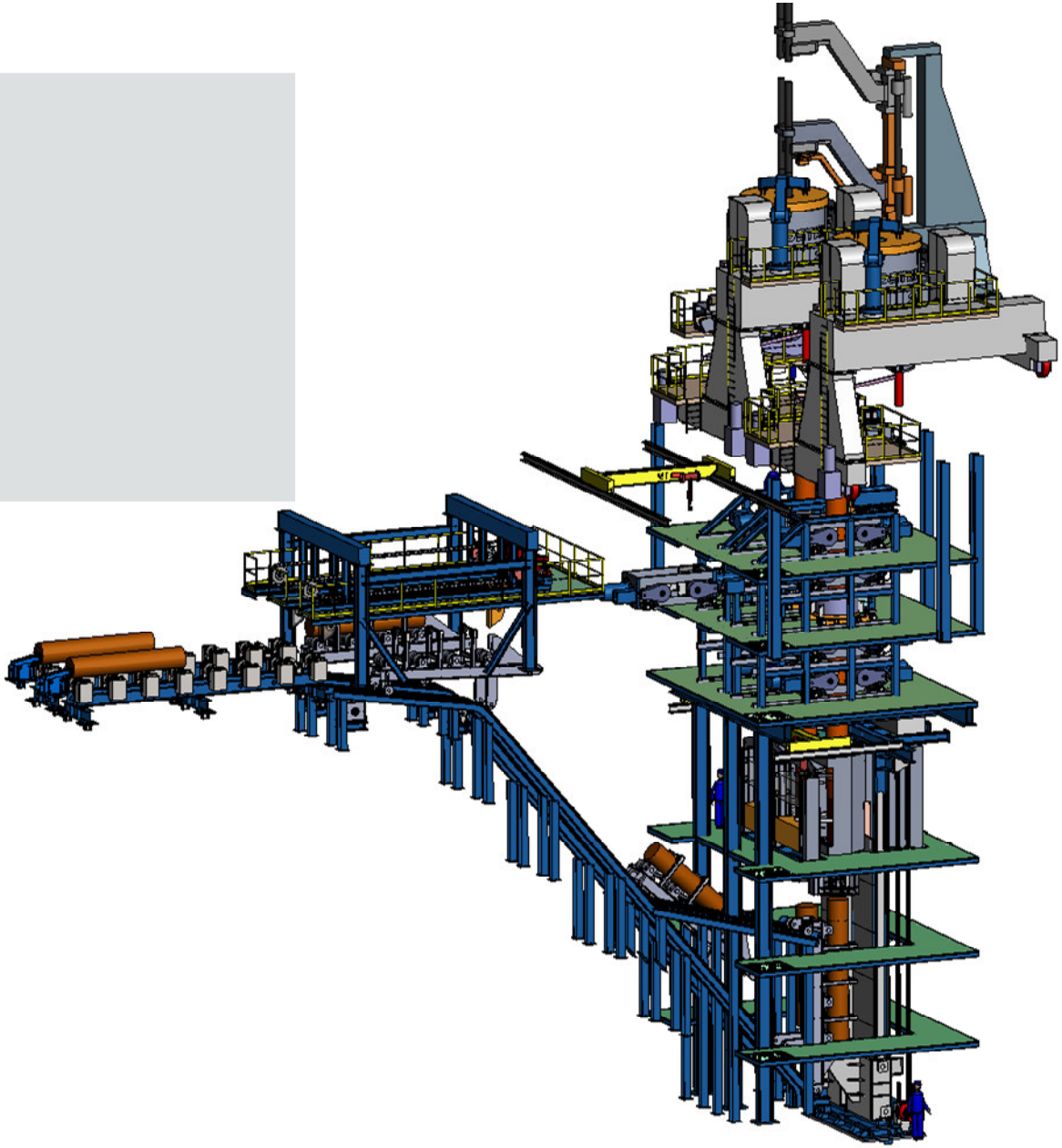
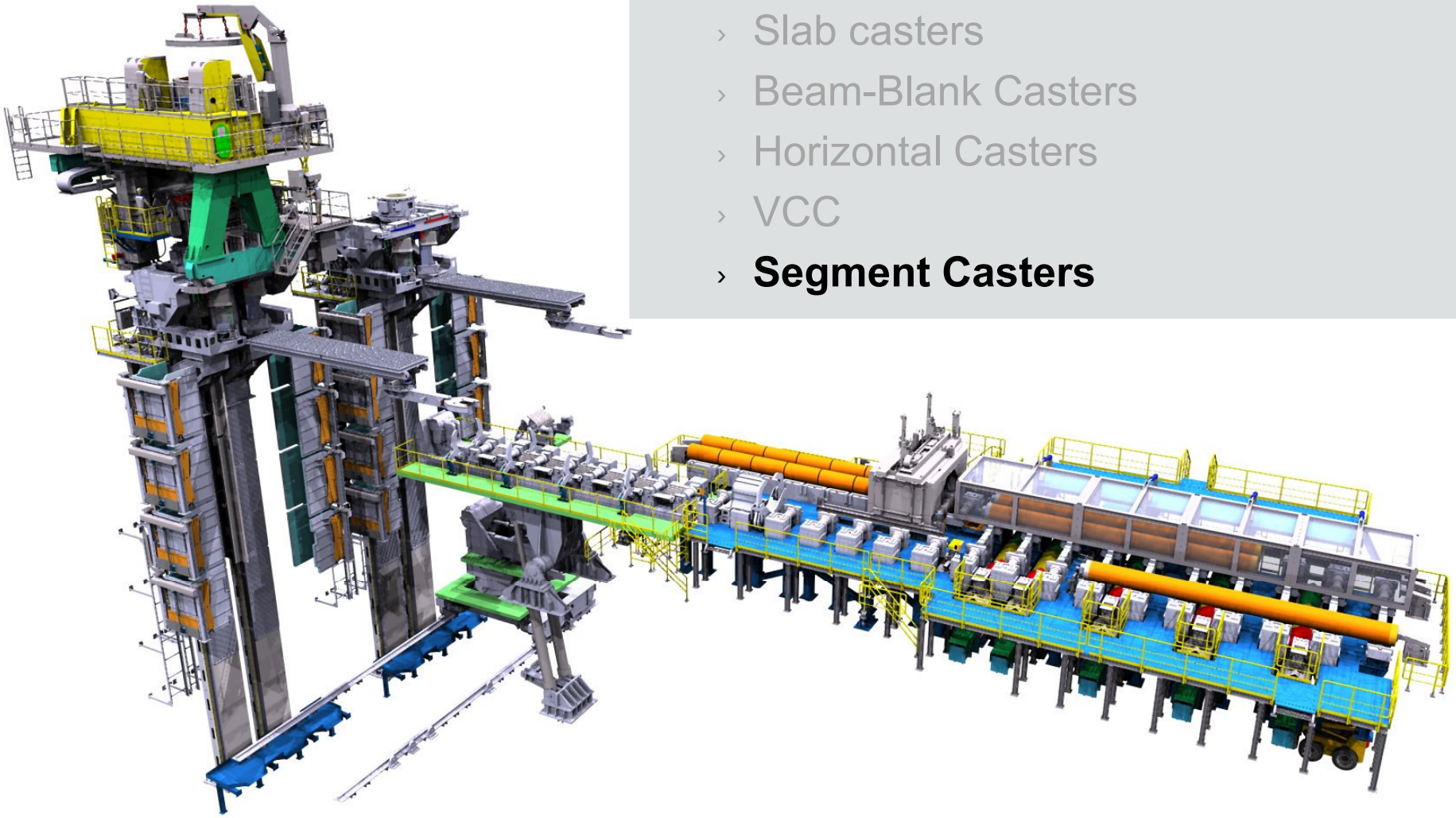


Product Portfolio CCM

INTECO

- Bloom & Billet Casters
- Slab casters
- Beam-Blank Casters
- Horizontal Casters
- VCC
- **Segment Casters**

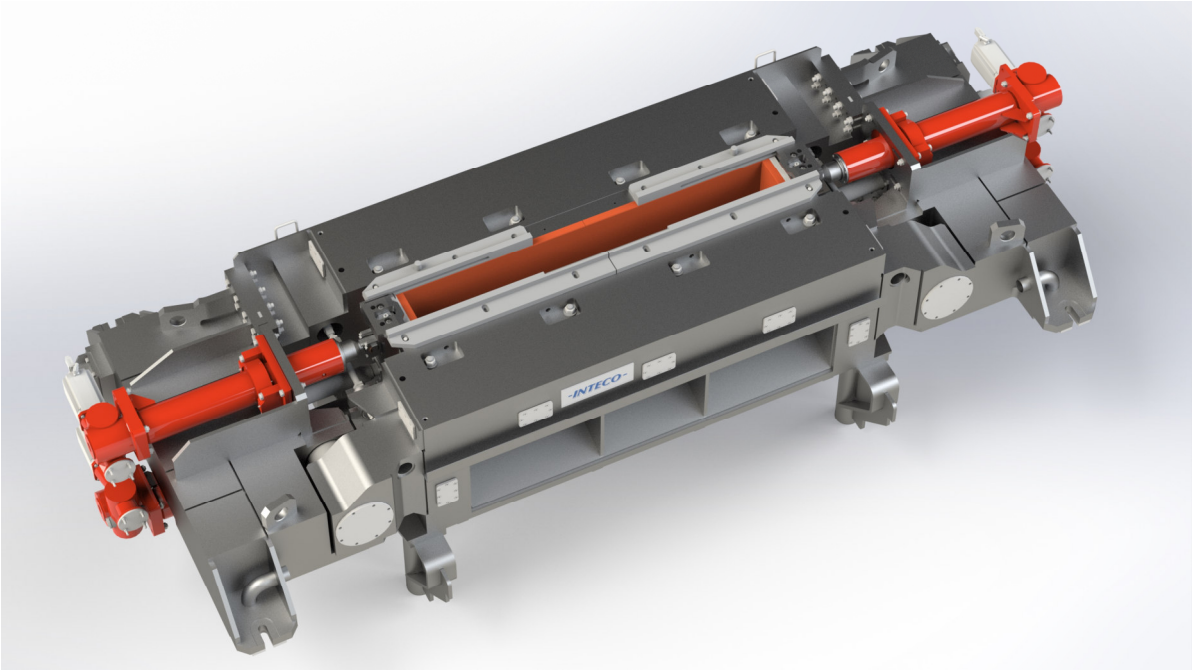


Content

- Company presentation
- Product portfolio CCM
- Key Design Features
- Technological packages
- Slab Casters

Key Design Features

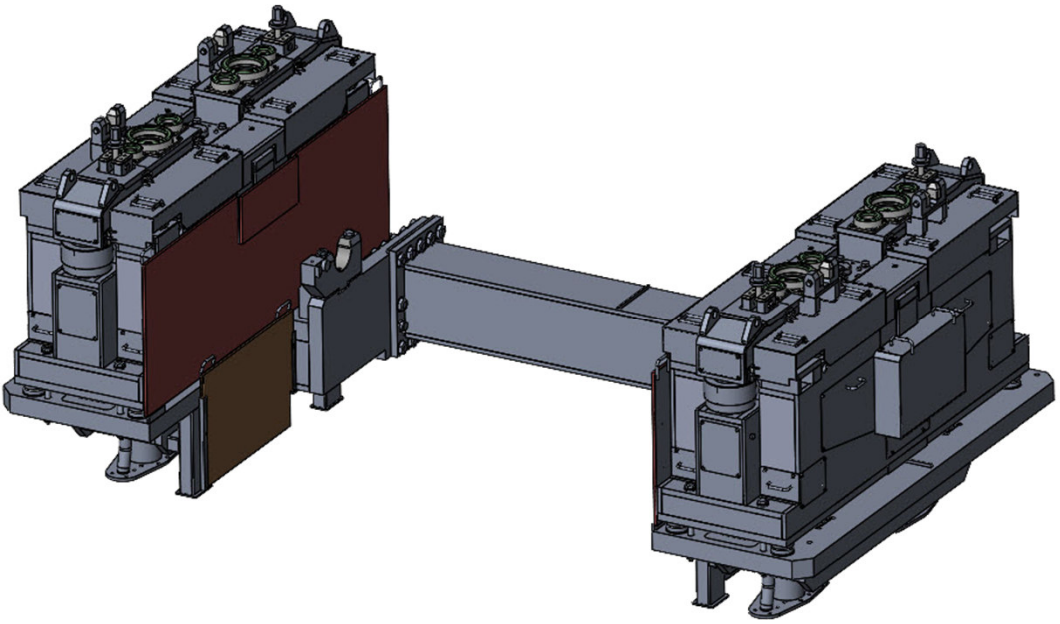
Mould Design – Mould for flat products



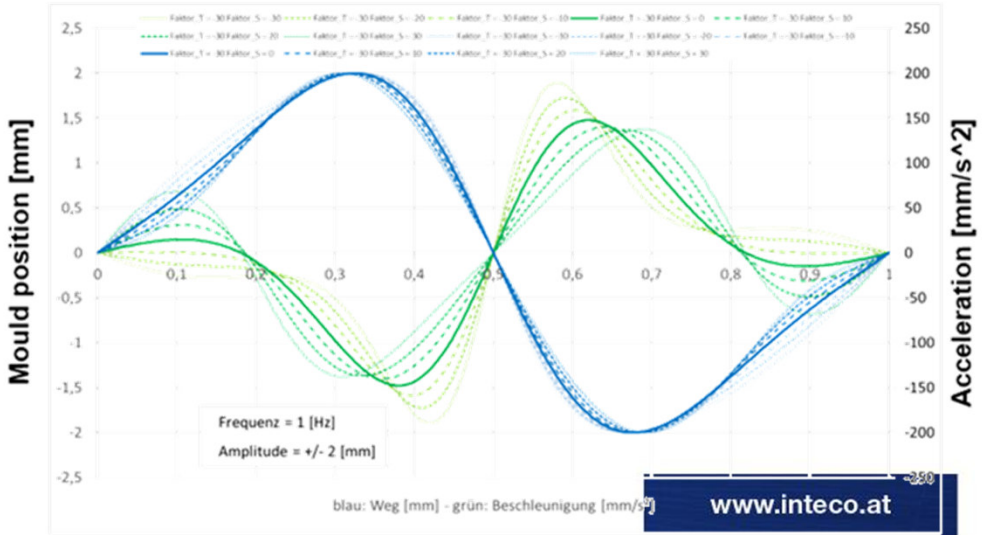
- Frame design with quick exchangeable copper plates
- Automatic connections for water
- On-line mould width adjustment electromechanic or hydraulic
- Thermcouples for breakout prevention system
- Predisposition for M-EMS installation

Key Design Features

Oscillator– flat product

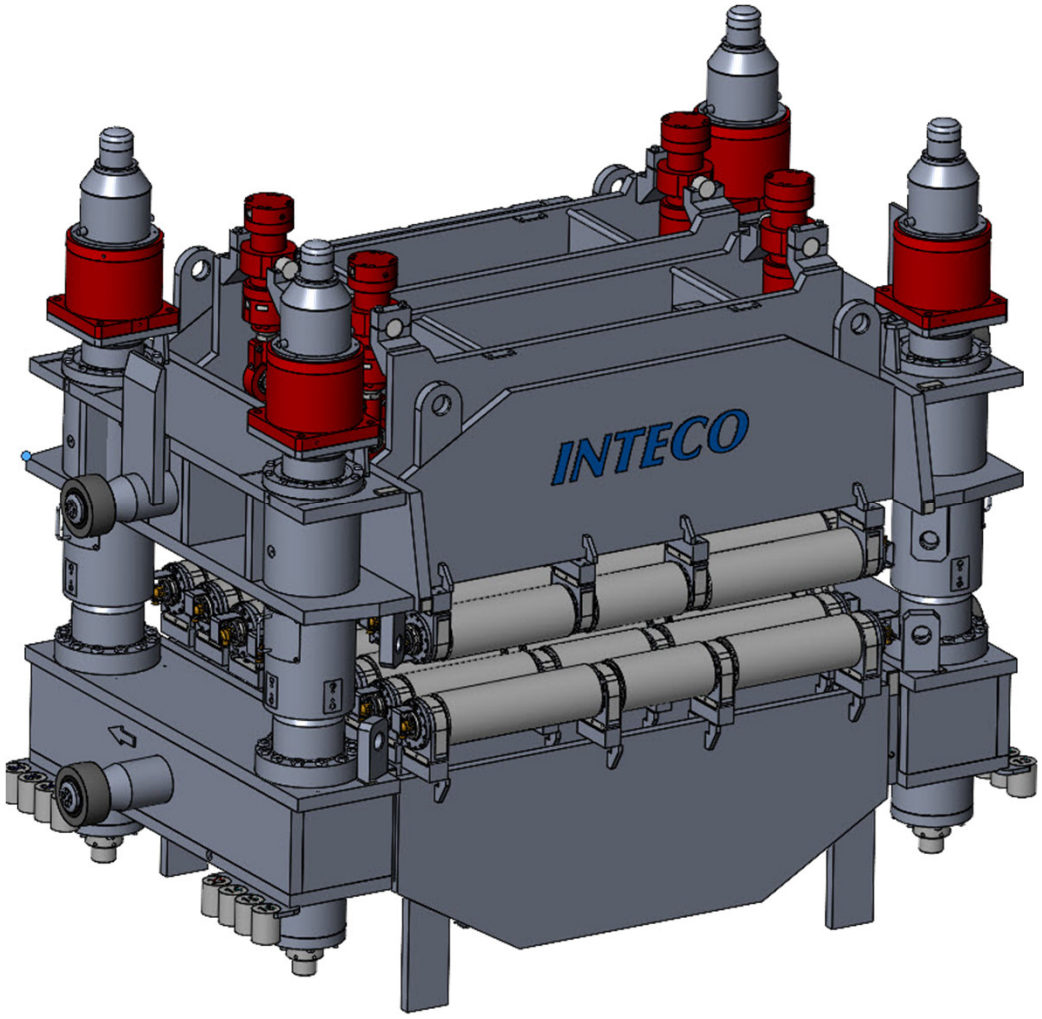


- Tandem oscillator
  - Leaf-spring guidance
  - Weight compensation
  - Possibility of variation of stroke, frequency, use of non symmetric shape thanks to hydraulic cylinder o servodrive



Key Design Features

Containment section – flat products

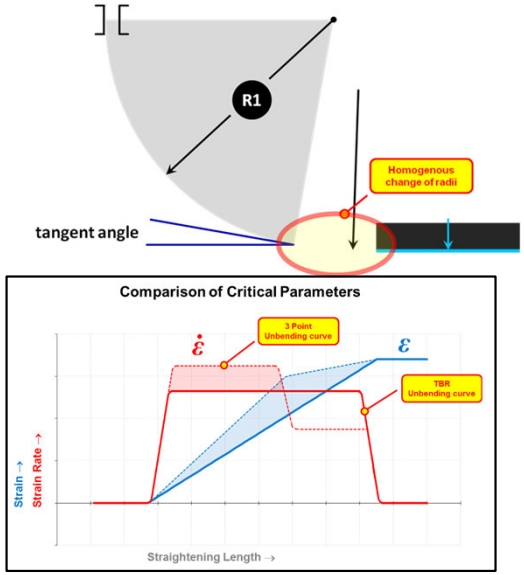


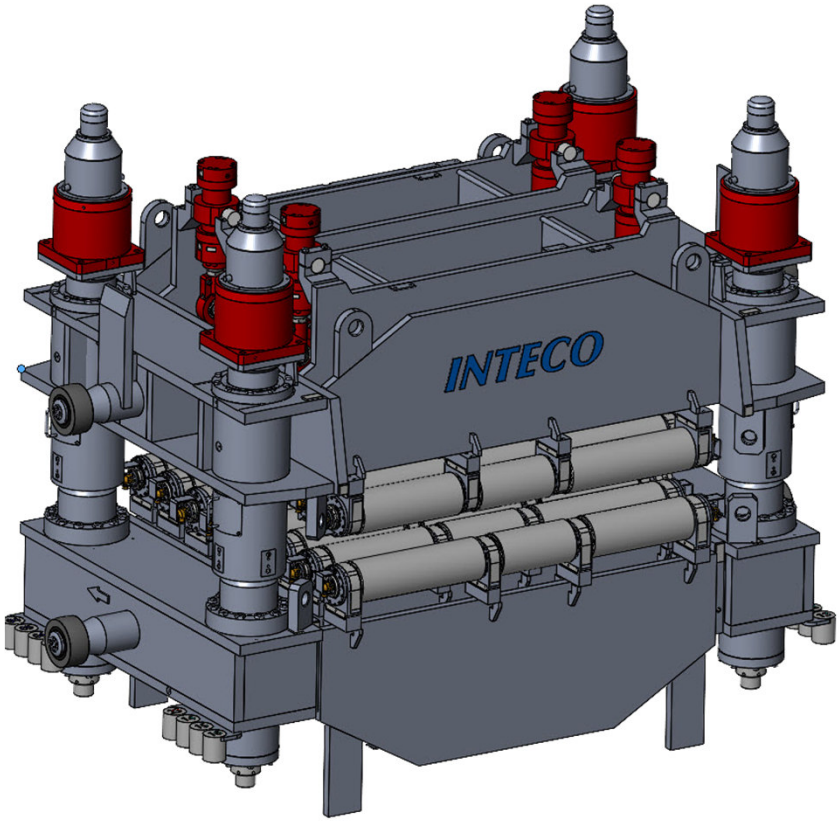
- Rigid frame design to minimize deflection
- Tight roll pitch for minimization of bulging
- Split rolls internally cooled
  - Shaft cooling
  - Peripherical cooling for dry casting
- Driven rolls with independent cylinders
- Position control for soft reduction with on board solenoid valves or servo – valves
- Bending/Straightening with continuous curve

Key Design Features

Widthrawal / straighteining unit

- **Withdrawal / Straightening unit**
  - Continuous straightening curve
  - Soft reduction





Content

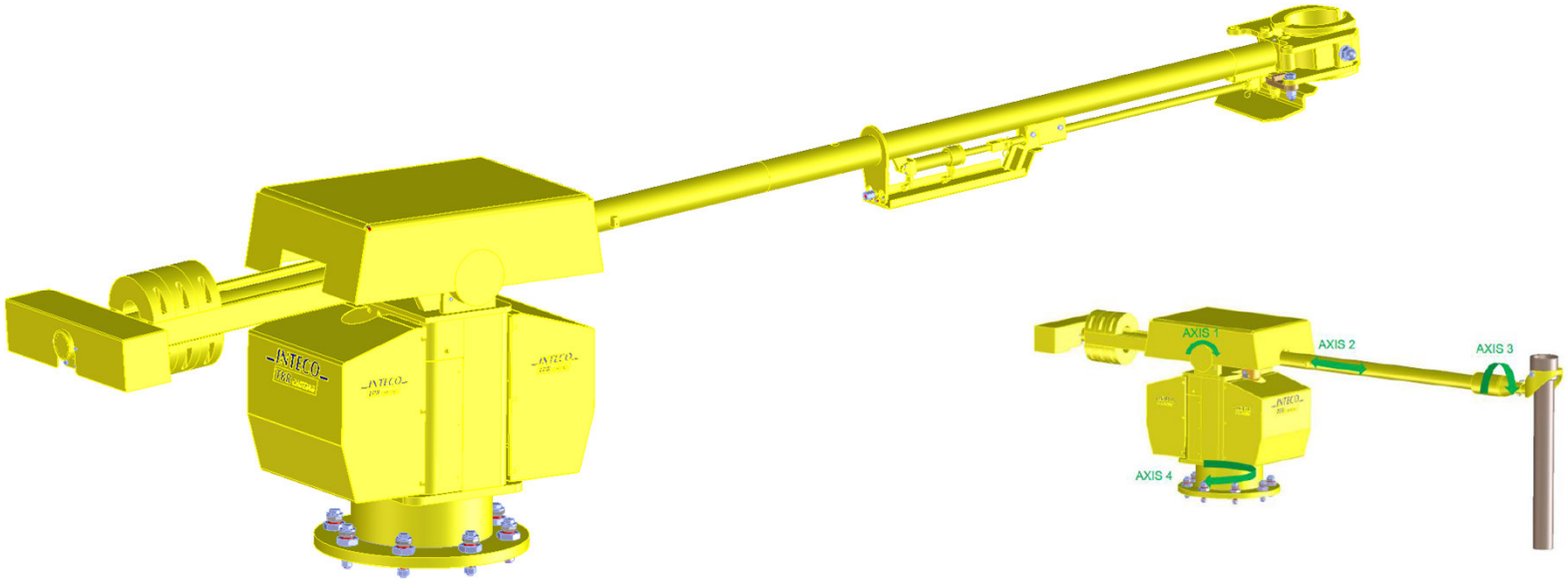
Technological packages

No-man-around casting floor solution

The semi-automatic ladle shroud manipulator provides a reliable attachment of the ladle shroud on the lower nozzle of the ladle slide gate.

Main features

- Increased operator safety
- Easy attachment, even in case of large and heavy ladle shrouds amid tight space conditions
- Faster attachment of ladle shroud
- Stand alone unit located on platform



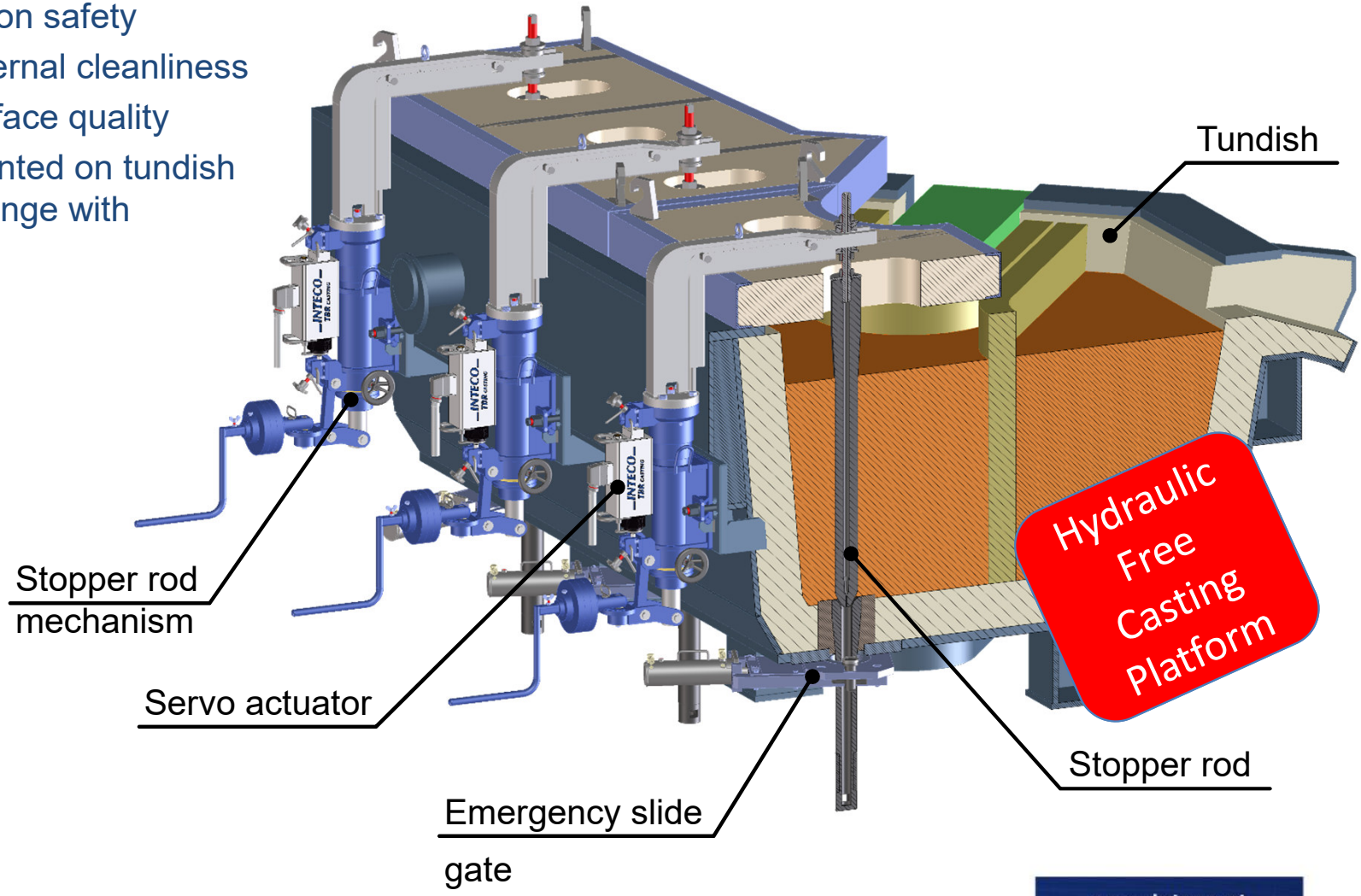
Technological Packages

Mould Level Control System- MLM

INTECO

Main features

- Increased process stability
- High production safety
- Increased internal cleanliness
- Improved surface quality
- Actuator mounted on tundish car (no exchange with tundish)



Technological packages

Stopper Control System – Mould Level Master (MLM)

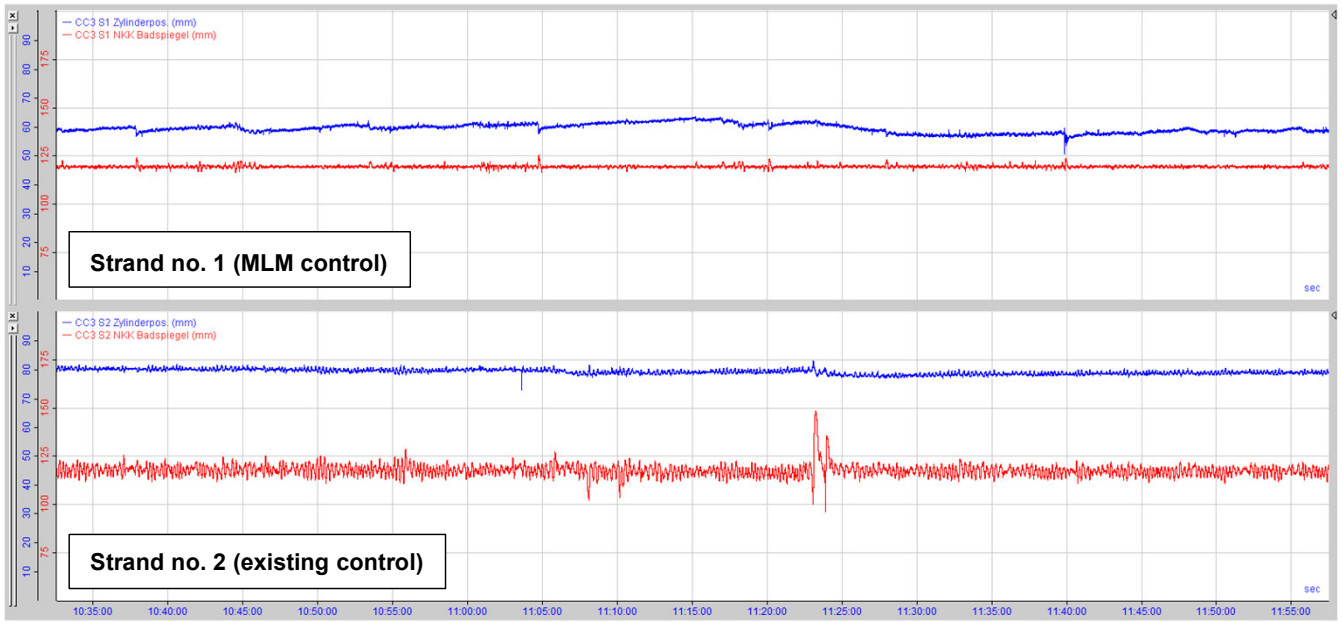
Mould Level Master (MLM)

INTECO mould level control system with superior mould level stability.

MAIN FEATURES

- Mould level accuracy ≤ **+/- 1.5 mm** during standard casting conditions
- Automatic start of cast
- Automatic overflow / break-out protection
- Anti-Clogging Master
- SEN/SES Wear Master for enhanced refractory lifetime and sequence length
- Improved surface quality

Reference Installation
INTECO MLM vs existing system



Mould Level Position
Stopper Position

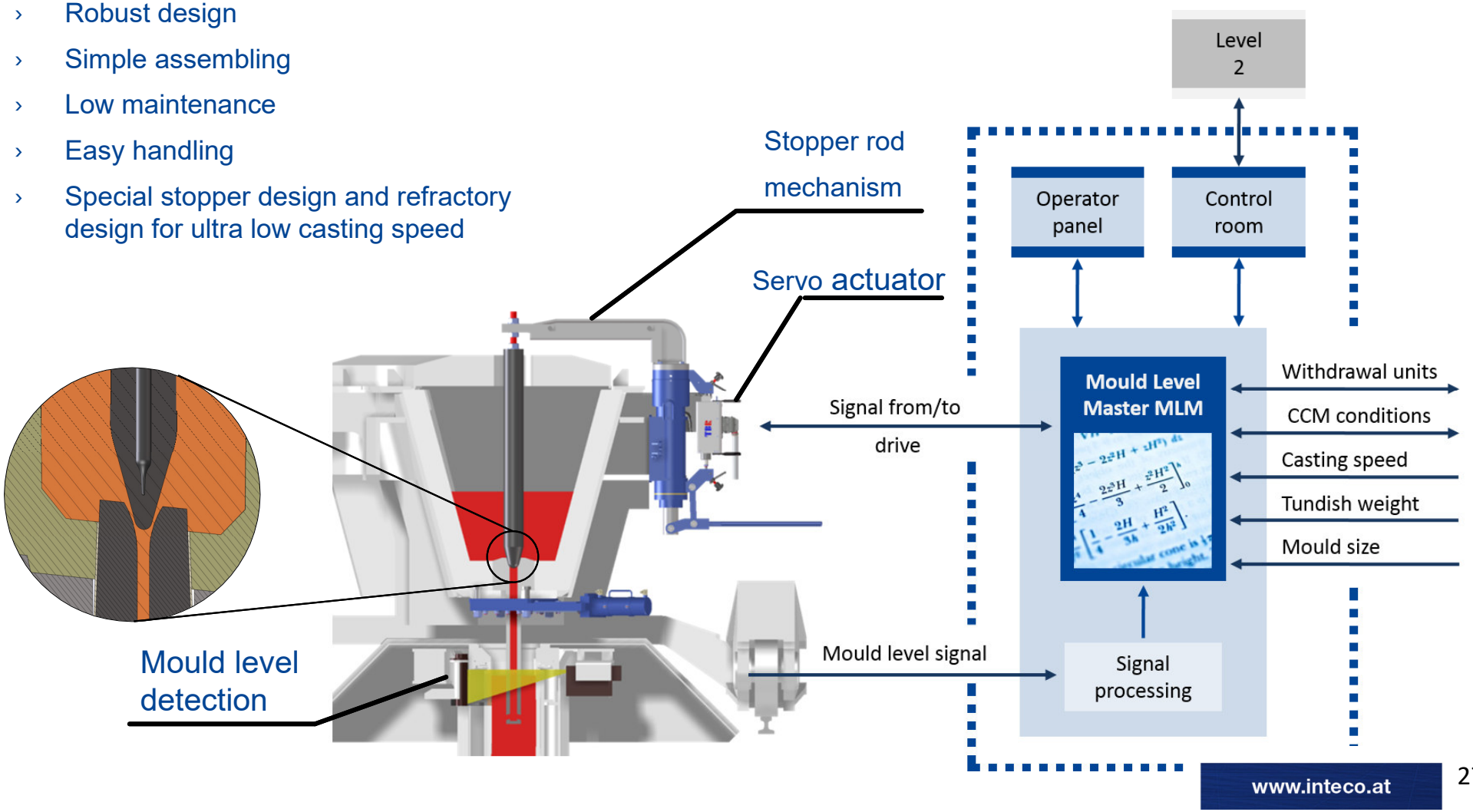
Technological packages

Stopper Control System – Mould Level Master (MLM)

Stopper Control System

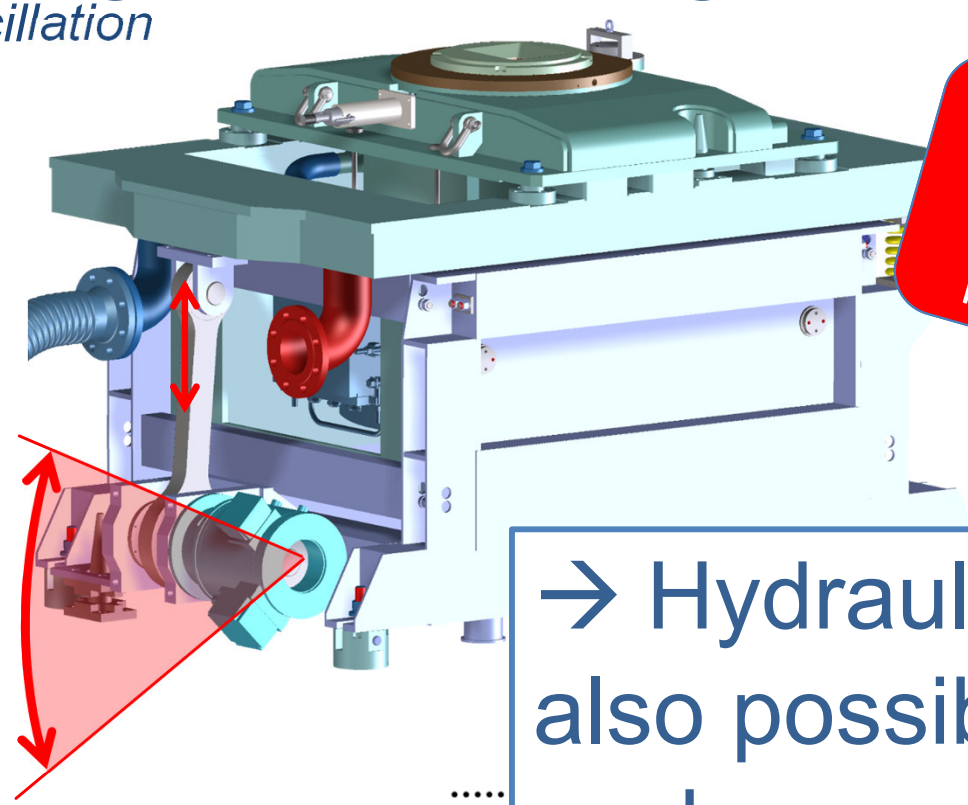
MAIN FEATURES

- Robust design
- Simple assembling
- Low maintenance
- Easy handling
- Special stopper design and refractory design for ultra low casting speed

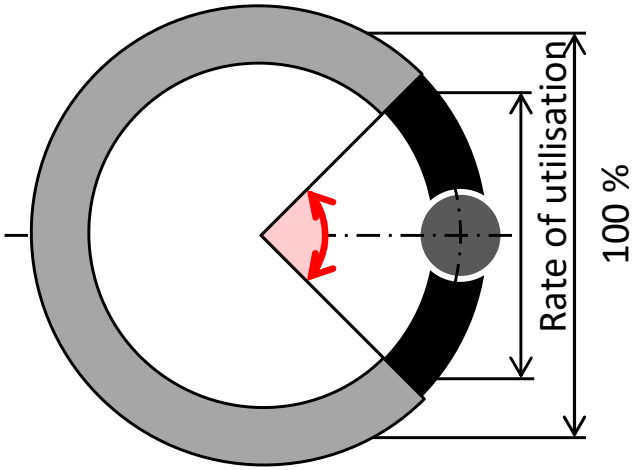


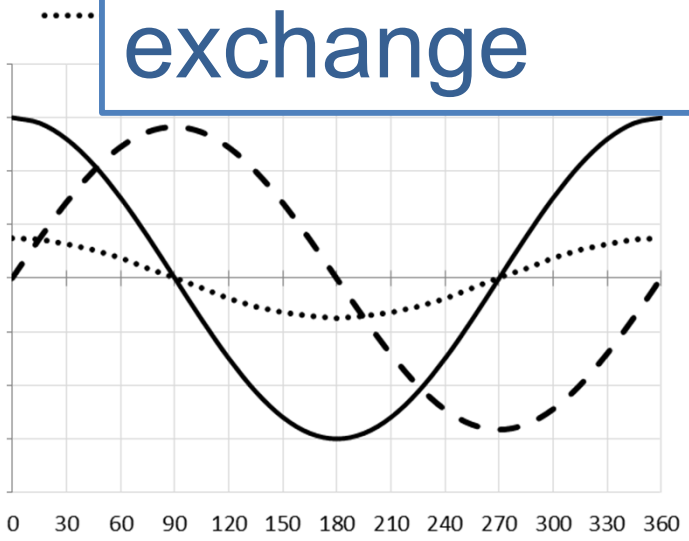
Technological packages

Servo-Drive Oscillation



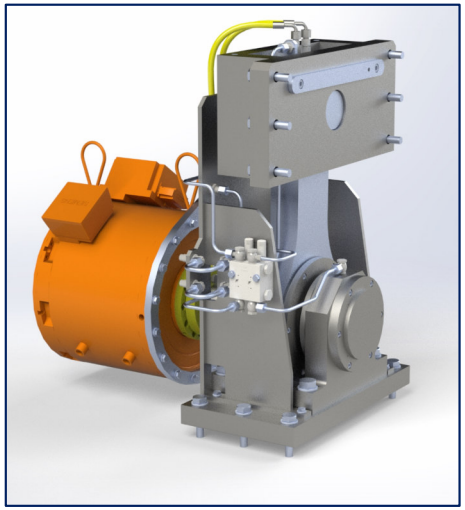
→ Hydraulic Oscillator also possible, easy exchange

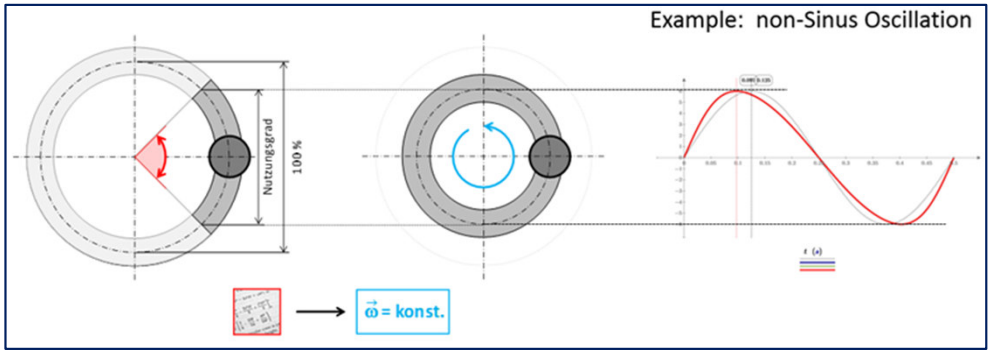


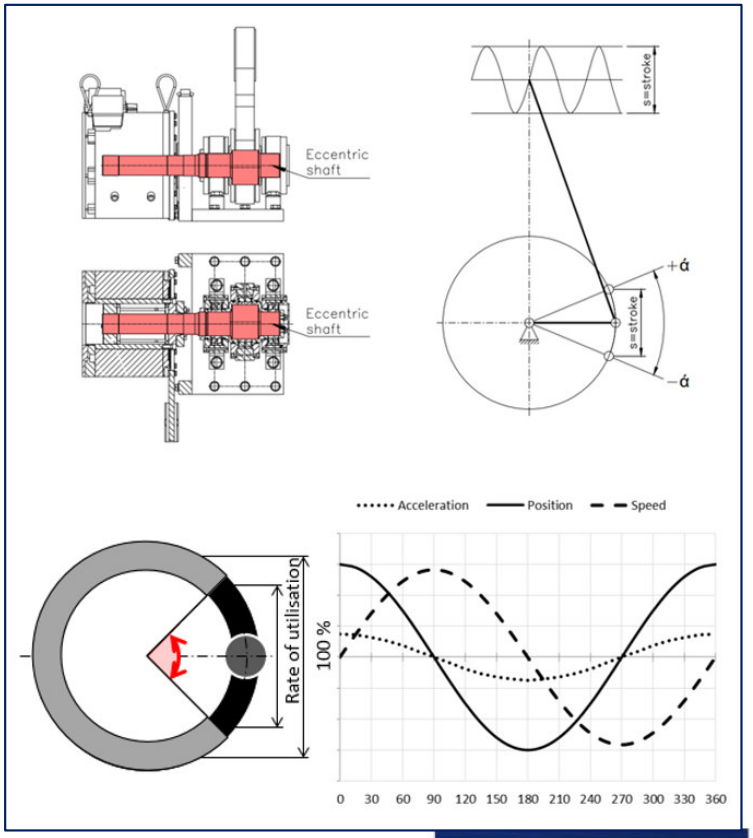


Technological packages

Servo-Drive Oscillation





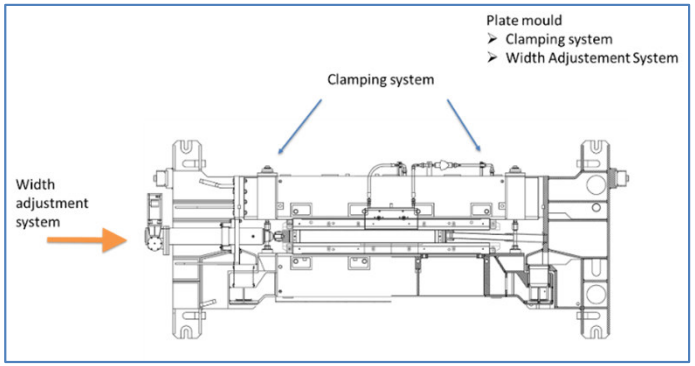


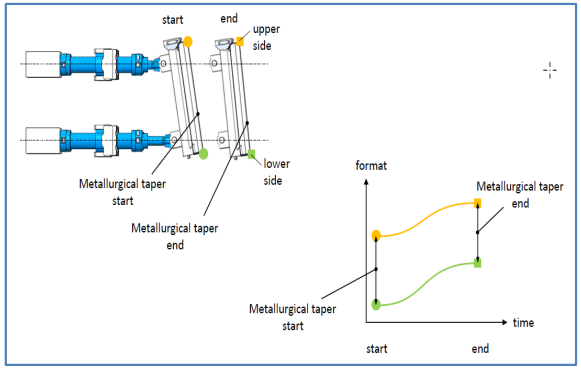
- **NO HYDRAULICS**
  - **No leakages**
  - **No risk of valve failure due to contaminated hydraulic oil**
- Brushless and maintenance free / low maintenance
- Direct drive
- Low mass, low inertia, high dynamics
- Suitable for various type of oscillation frames
- **In-line adjustment of stroke, frequency, and oscillation curve:**

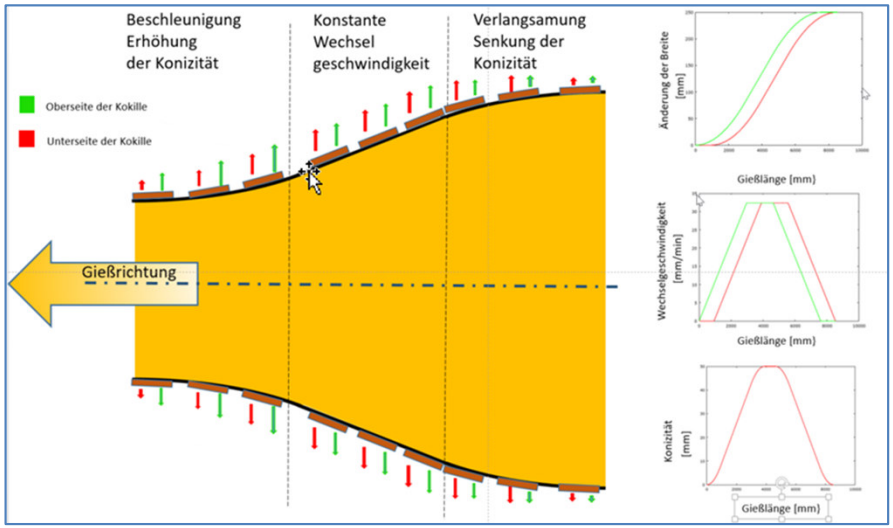
Technological packages

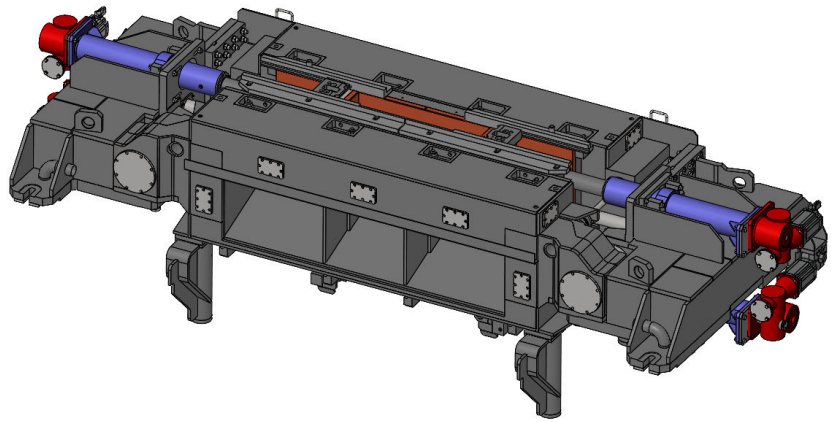
Mould Width Adjustment

During a hot adjustment a dedicated algorithms is used to move the narrow sides avoiding the creation of excessive gap or compression between the narrow plates themselves and the slab, avoiding risks of breakouts and minimizing the transition length





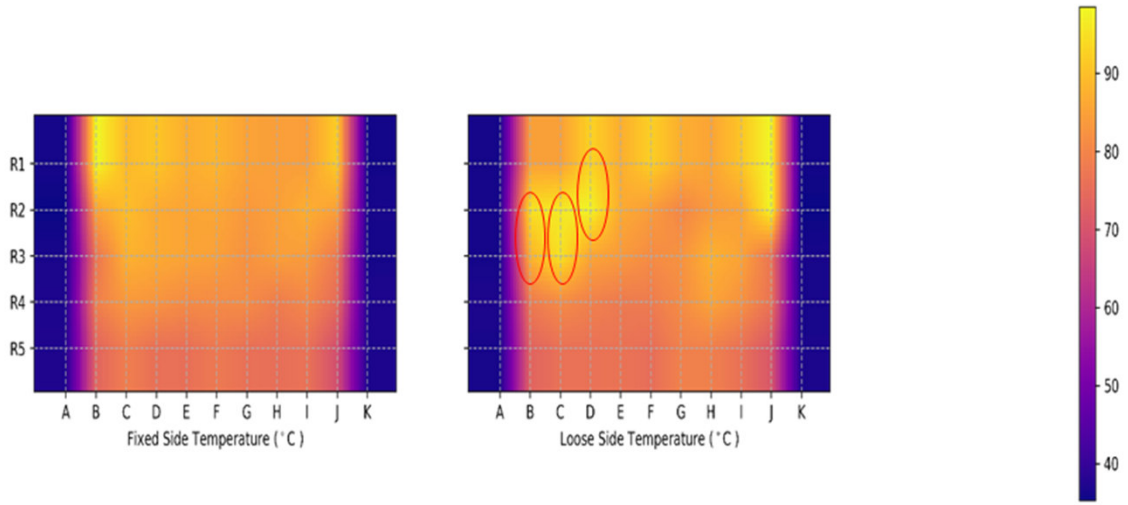




Technological packages

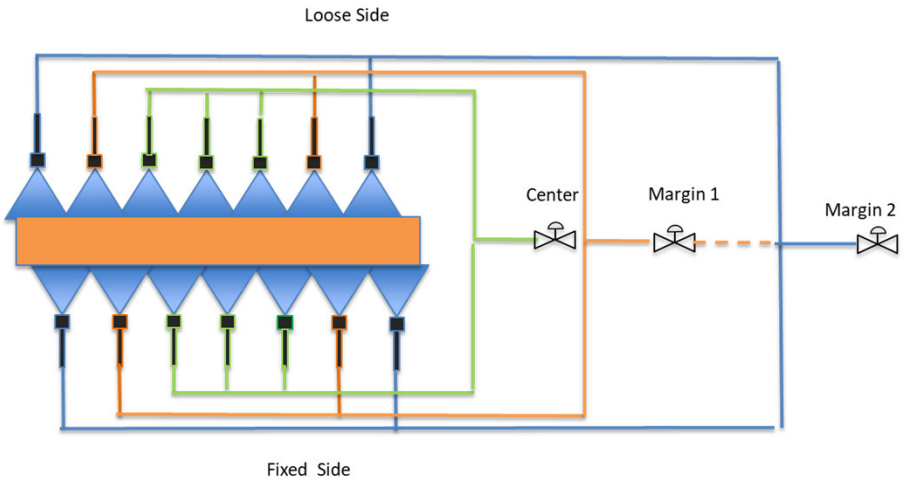
Breakout Prevention system

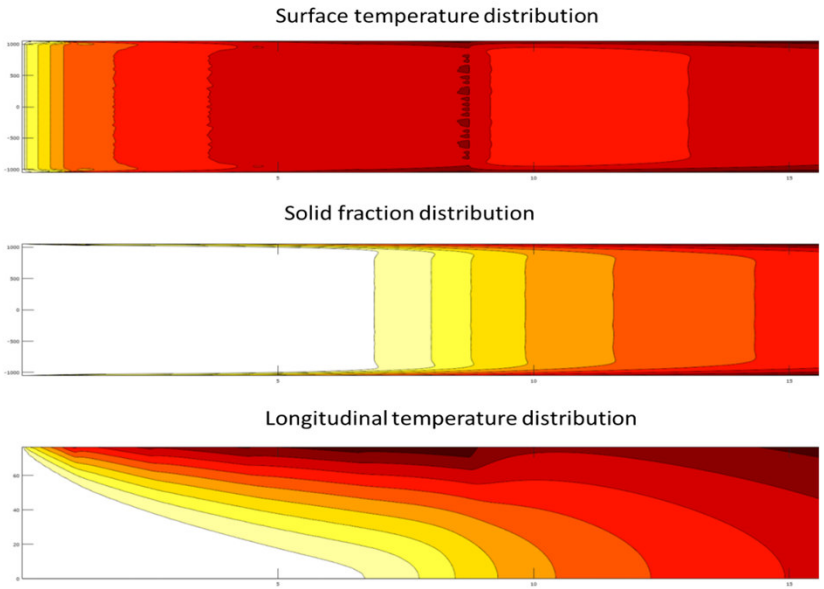
Most of the grades cast can be considered critical form the mould behavior point of view. A thermocouple based thermal map will be installed integrated with a dedicated software to prevent breakouts and detect preventively possible anomalies. The system uses classical algorithms integrated with an AI based system



Technological Features

Secondary cooling control – flat products

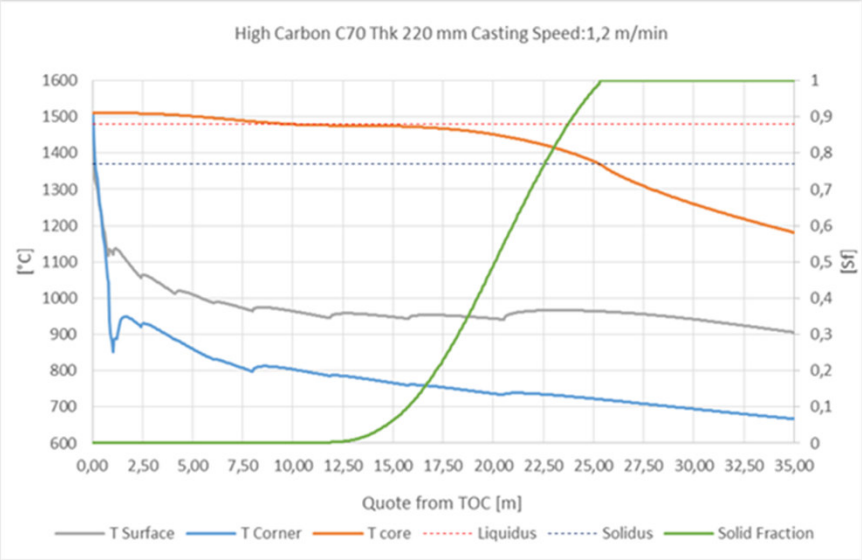


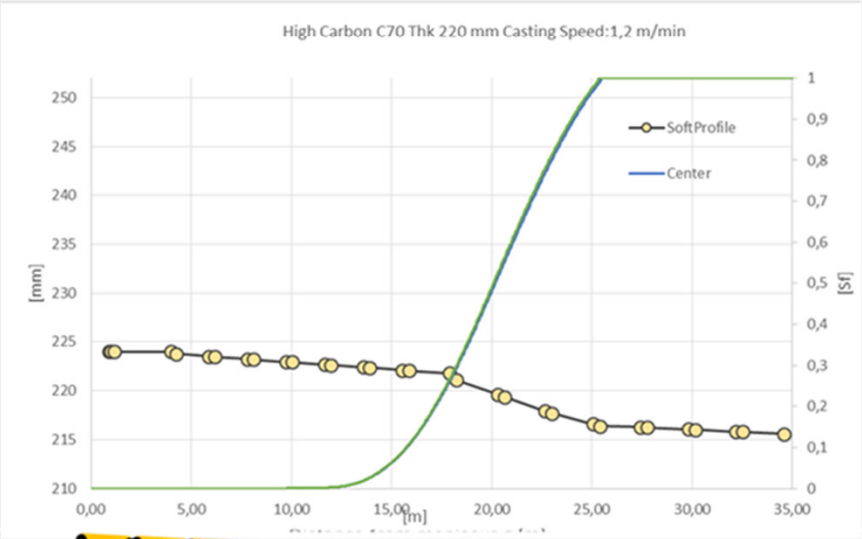


Most of the steel grades can be considered crack sensitive, therefore a secondary cooling with “width control” is the chosen solution in order to have the optimal control of edges’ temperature having a uniform solidification profile across the slab width

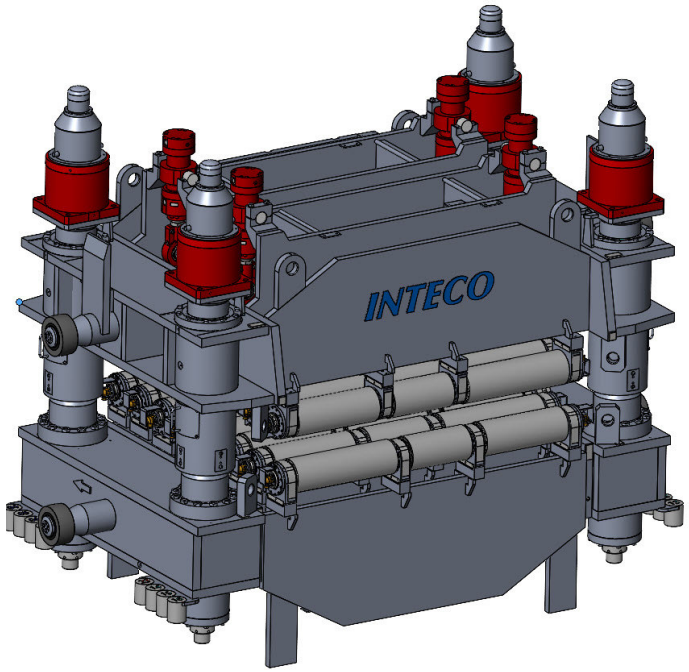
Technological packages

Soft reduction



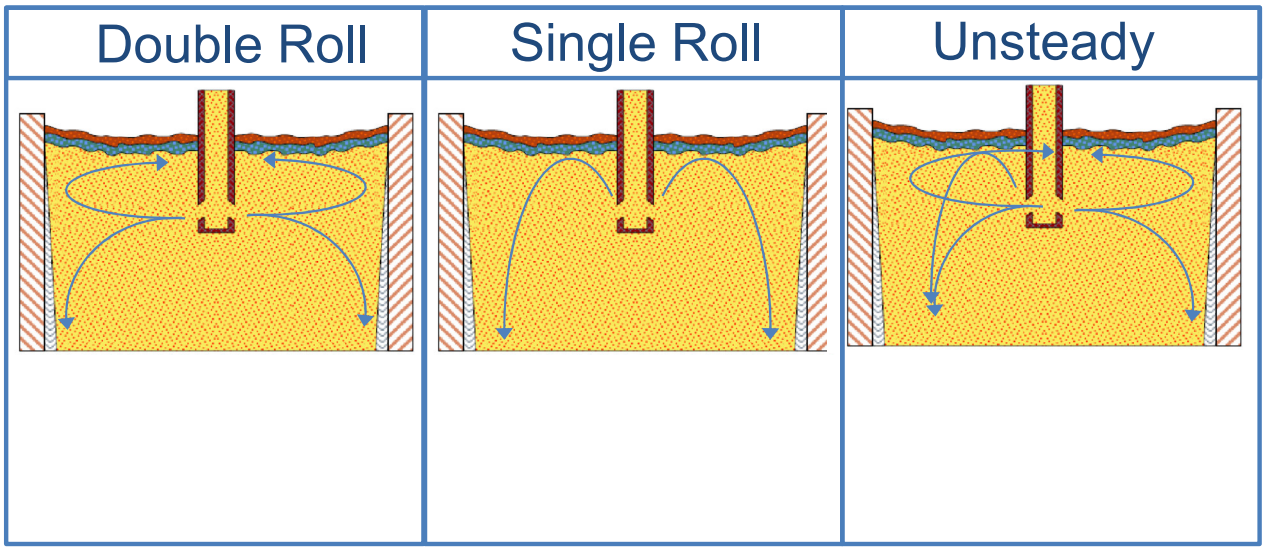


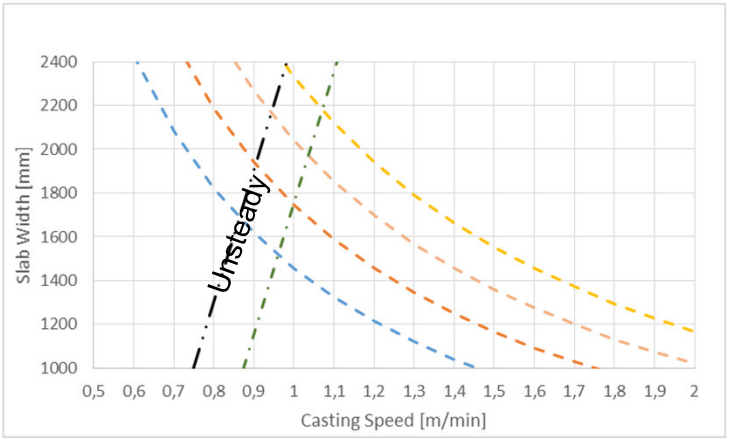
The shrinkage due to the liquid – solid transformation and to the higher thermal gradient at the liquid pool end respect to the surface causes suction of such enriched liquid and formation of segregation. The soft reduction is a technique that applies a thickness reduction to compensate this phenomenon. During casting an optimal profile is dynamically applied between two values of the solid fraction at the centerline.



Technological Features

M-EMS – Flat products





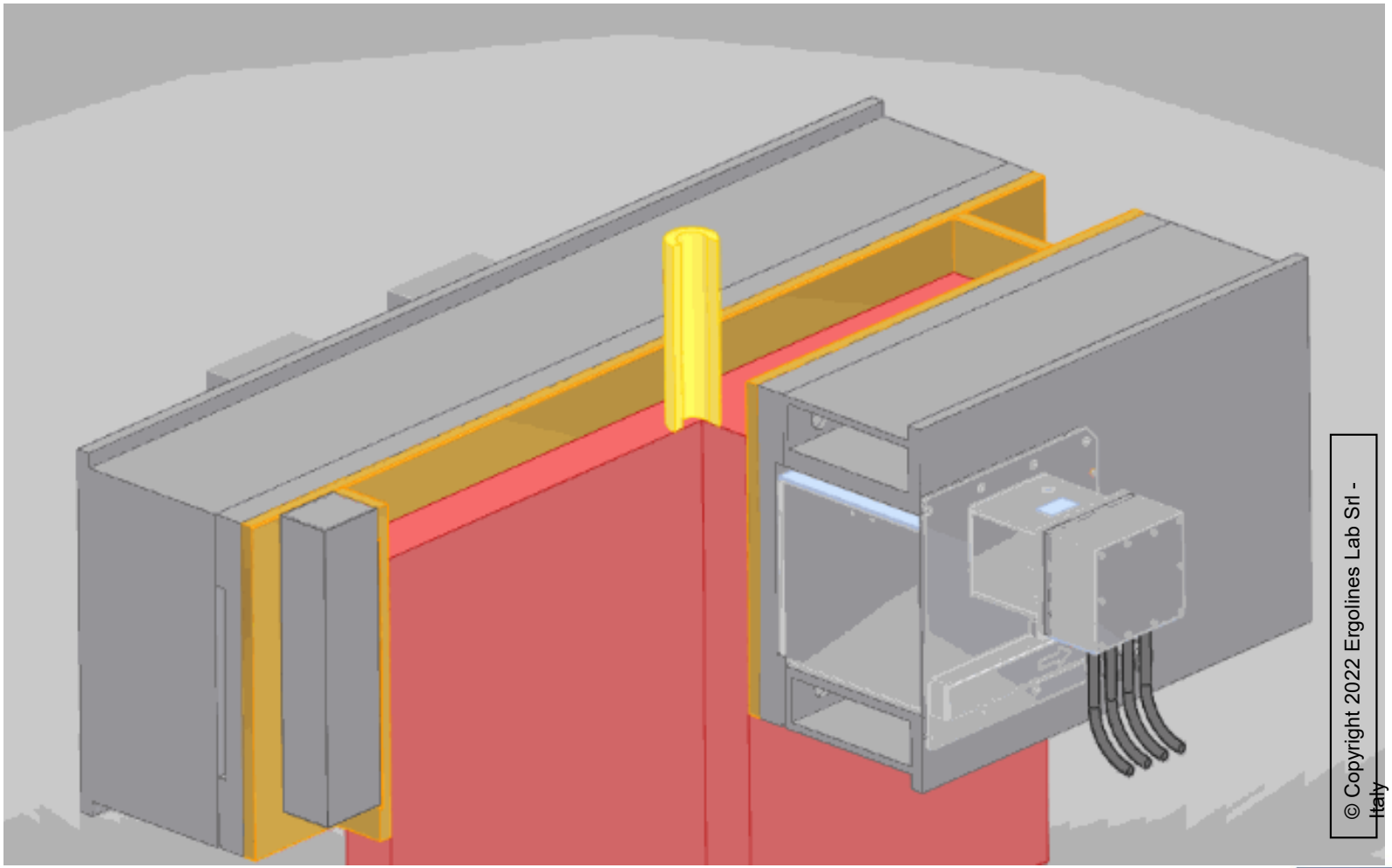
Flow type		Condition	Effects	Problems
Double Roll	Strong	High throughput/speed	High meniscus wave, uneven slag distribution	Entrapment,sticking,transverse cracks
	Normal	Moderate sub-meniscus velocity	Even slag distribution	Optimal condition
	Weak	Low sub meniscus velocity	Cold meniscus, hook formation	Al inclusions
Single Roll		Low casting speed,High Ar	Uneven powder distribution, deep argon flow into slab	Entrapment , longitudinal cracks
Unstable		Clogging	Vortexes, uneven powder distribution	Entrapment, longitudinal cracks

Technological Features

M-EMS – Flat products

INTECO

- **4 linear stirrers, 2 on each wide side**

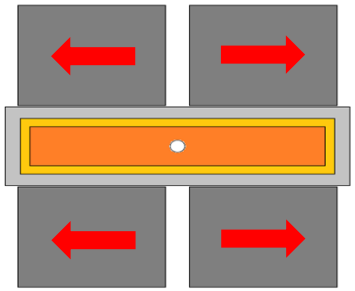


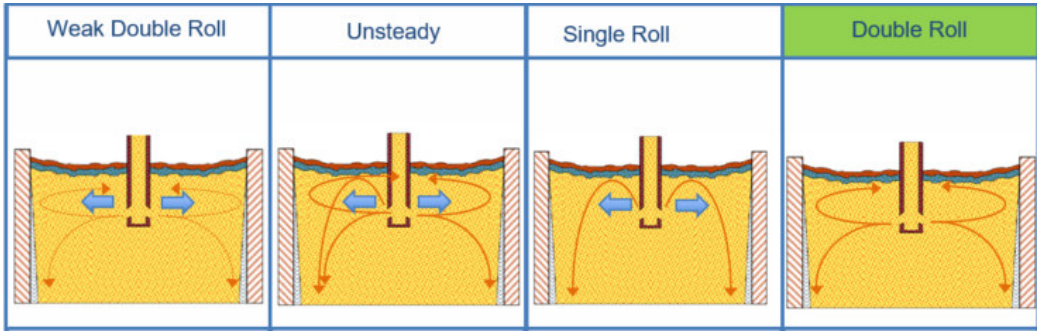
Technological Features

M-EMS – flat products

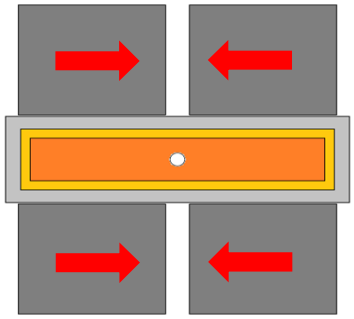
INTECO

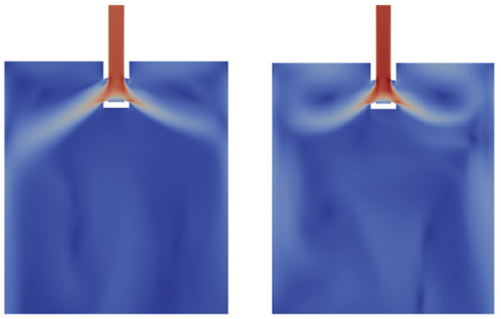
- **The M-EMS works as :**
  - Accelarator for “weak” flow condition





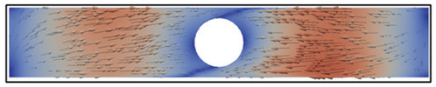
  - Brake for “strong” flow condition





Vertical slice without stirrers

Vertical slice with stirrers



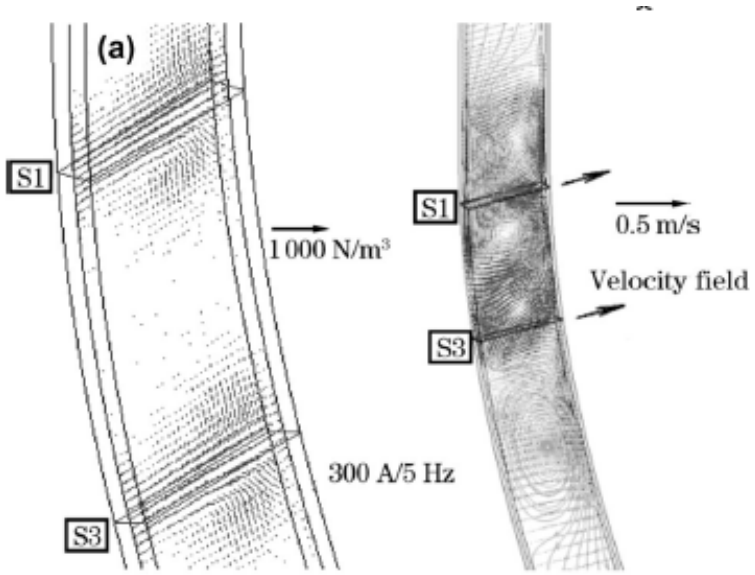
Meniscus velocity analysis.

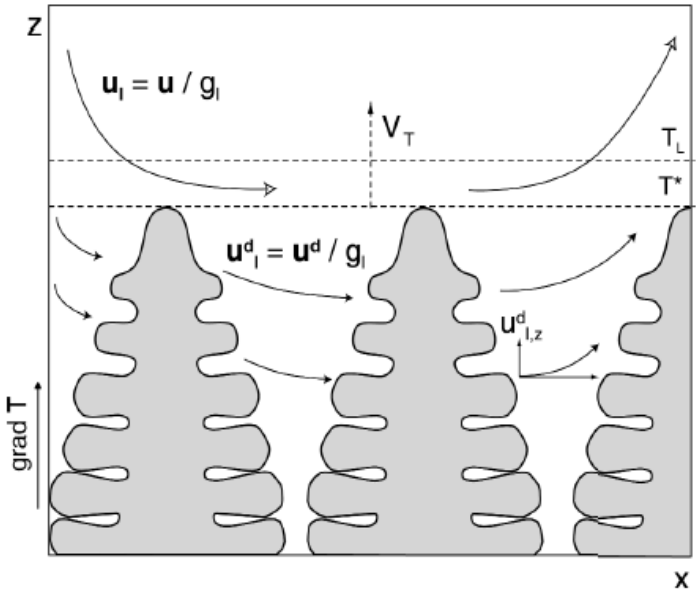
Technological Features

S-EMS /F-EMS– Flat products

INTECO

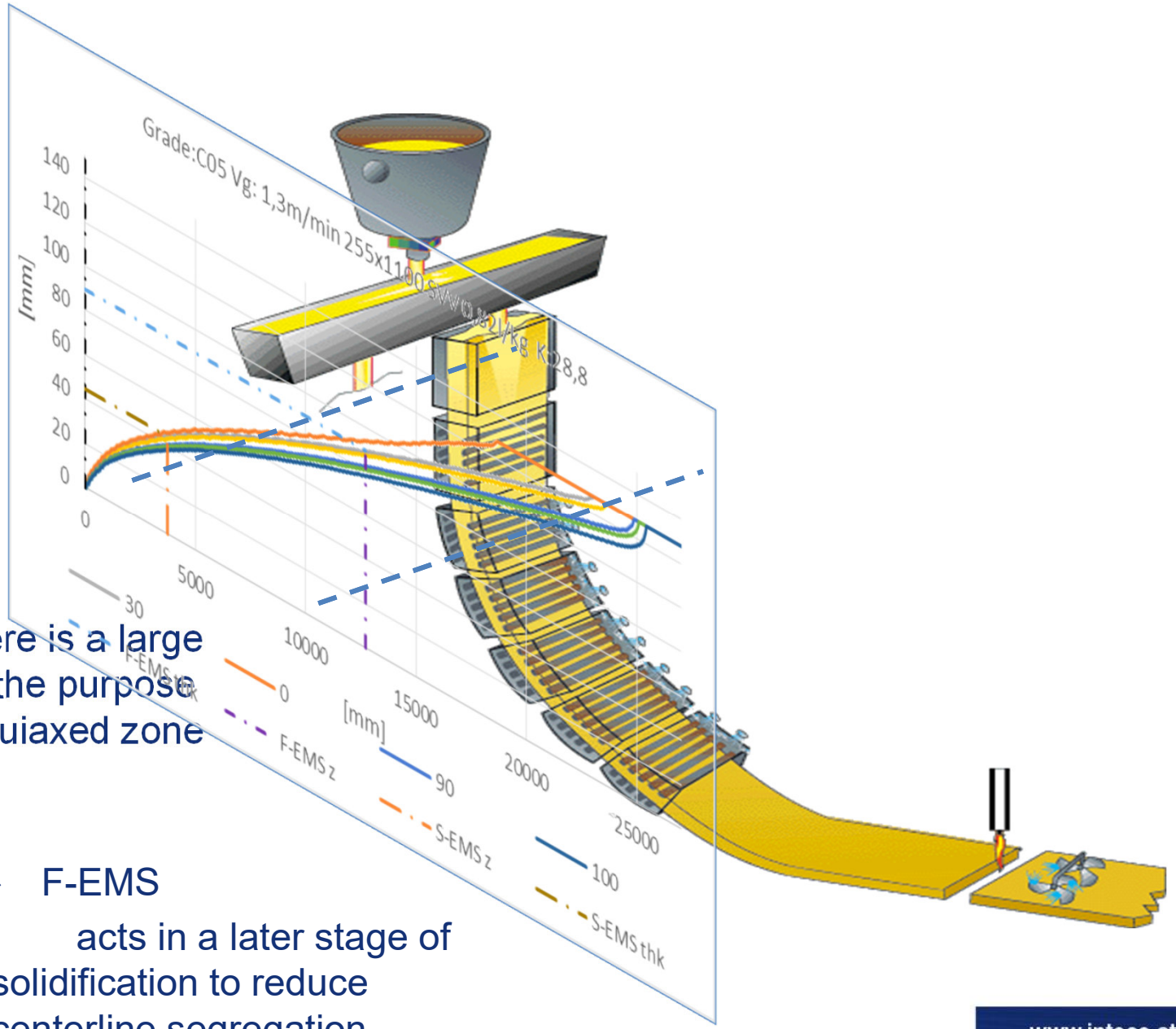
- The EMS acts on the liquid steel in the slab during solidification process with these actions :
  - Superheat removal through temperature omogeinization
  - Reduction of columnar growth and increase of equiaxial zone





Technologica Features

S-EMS /F-EMS– Flat products



› S- EMS

acts where there is a large liquid fraction, with the purpose to create a large equiaxed zone

› F-EMS

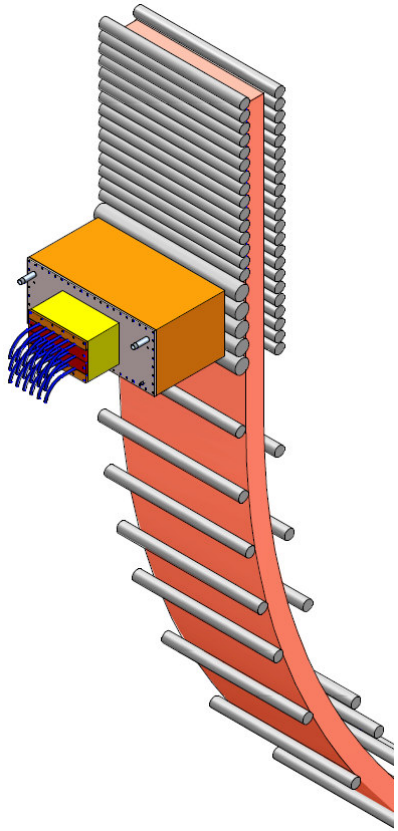
acts in a later stage of solidification to reduce centerline segregation

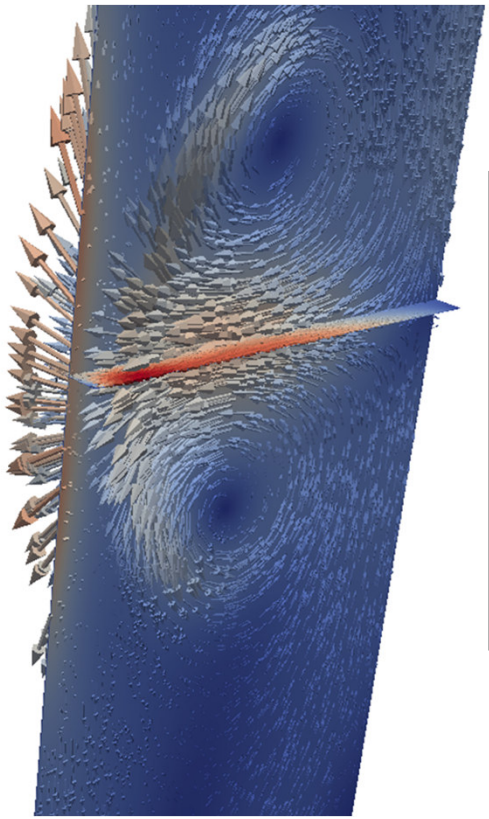
Technological Features

S-EMS /F-EMS– Flat products

INTECO

› Box type stirrer for equiaxial zone increase





Automation

Introduction

Industrial production of high performance materials requires precise tracking and transparency of all production steps to ensure highest reproducibility for high-demanding industries such
as the aerospace industry. Starting from the very beginning with simple manual data logging in excel sheets or printed melt logs the first basic database systems (Level 2 systems) were developed. As the requirements on data storage and the amount of data continuously increased over the years, the potential of these systems was already on the limit.

Modern production management systems require vertical and horizontal integration of all production processes and shall cover not only process tracking and reporting but also include planning and optimization tools for the entire production route which are necessary to meet customer and end-user specific requirements.

INTECO as a world leading supplier for specialized production technologies offers a powerful process and production management solution called *"INTECO Metals Application Suite (IMAS)"*. IMAS was developed to combine several levels of automation and is intended to close the gap between machine data (Level 1) and the enterprise IT landscape (Level 4). State-of-the-art software development combined with the process know-how of INTECO are the fundamentals of IMAS.

IMAS INTECO Metals Application Suite

Our Technology – Your Advantage

› Quality improvement due to standardized and centralized know-how
› Modular design
› Online production monitoring and supervision
› Data processing and analysis for continuous know-how improvement
› Seamless integration into any existing IT landscape
› Low to high operator guidance
› Highest availability and reliability due to modular state-of-the-art software development
› Easy-to-use operation interface dedicated to office and pulpit operations
› Production reporting from detailed melt report to monthly recaps
› Business intelligence integration for advanced analytics

Automation

Process and Technology

INTECO Metals Application Suite (IMAS) was designed as a flexible framework in contrast
to a single developed application. It is designed to cover all special metallurgical processes under one roof, which makes IMAS to an holistic application suite.

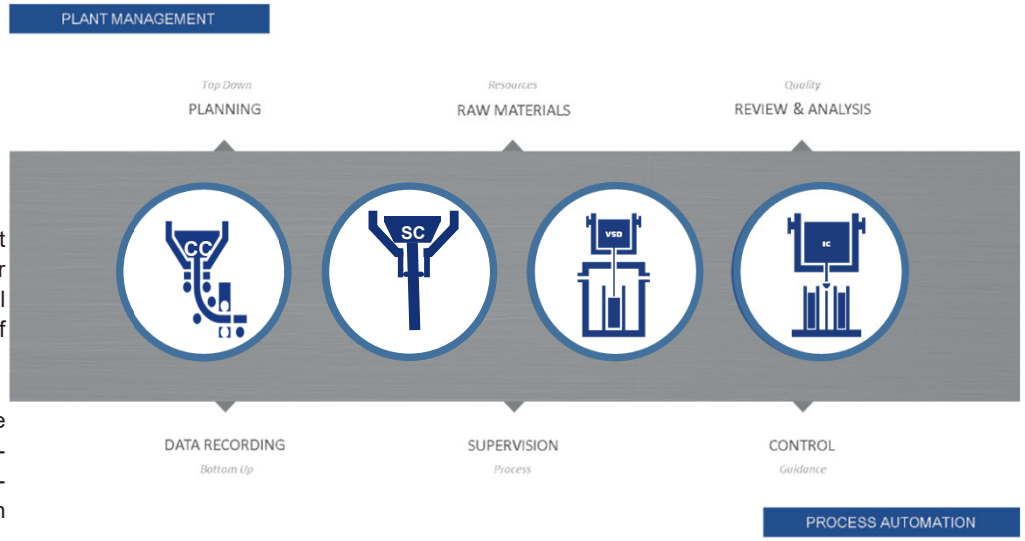
The integrated automation concept of INTECO covers the following functionalities:

(1) Plant Management and Supervisory Functionalities

On top of all processes within the production plant is the superior plant management application. The plant management unites all the process automation apps under one roof. The major responsibilities are the overall production planning, raw material distribu- tion as well as review and analyses to close the cycle at the end of production.

(2) Shop floor Integration for Production and Auxiliary Equipment

These modules are responsible for data recording, supervision and control. The process automation apps are designed for operators at the pulpit to provide bottom-up process guidance, allowing operation personnel to observe all recorded sensor-data in real-time. Moreover, IMAS provides instant information and alarms, based on which the operators can control and steer the process just-in-time.



In order to achieve highest flexibility together with a maximum in reliability, IMAS was developed based on the latest tech- nology and developments with respect to its software architecture, fulfilling all requirements for Industry 4.0. The latest generation of IMAS breaks with old software paradigms like monolithic applications or client/server infrastructure. Instead, the IMAS framework follows the microservice concept to ensure scalability in modern steel shops. By the use of Microsoft® technology stack and C# as development language, a consistent and state-of-the-art software architecture and develop- ment framework is ensured. The distributed architecture of the latest IMAS generation allows not only to cover all individual customer specific processes, but also to interact bi-directional with any existing IT landscape in an extremely flexible way. Whatever ERP/Level 4 system is in place, a dedicated communication agent will do the job.

IMAS does not only care about real-time operational data, it also provides comprehensive archiving functionality and long- term storage of any process related data. Current researches in big data and machine learning will further improve ope- rator guidance and processes with advanced analytics. Researches in deep learning technology, also known as artificial intelligence, will make IMAS capable of decision recommending or even making.

Level 2

IMAS INTECO Metals Applica

CCM Application

Mathematical models

Content

- Company Presentation
- Product Portfolio CCM
- Key Design Features
- Technological Packages
- Slab Casters

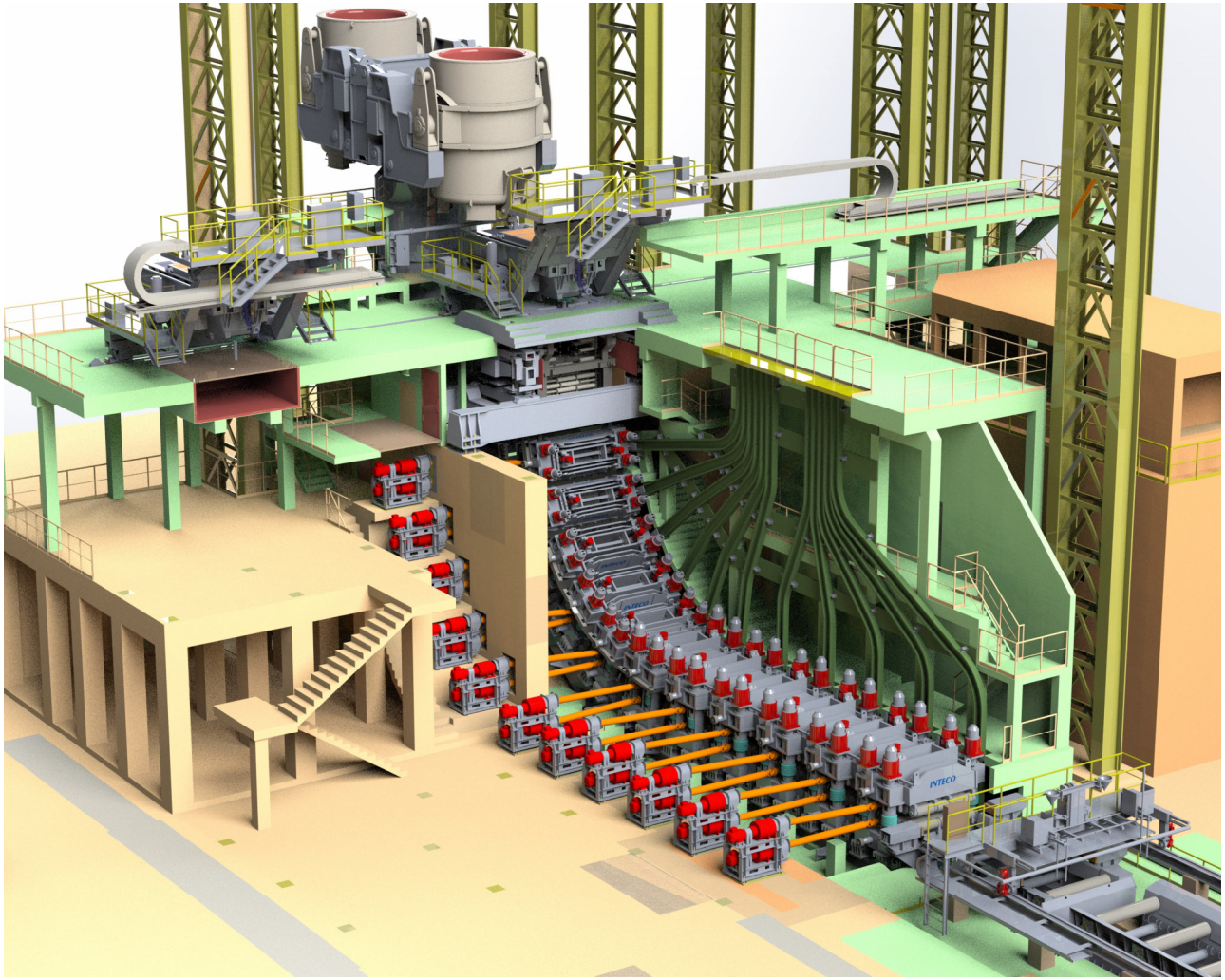
Slab caster

- Custom: Confidential
- Yearly production : 1,2 MTPY

- Steel grades
  - Ultra low carbon
  - Low carbon grades
  - HSLA grades
  - Construction steel grades
  - Pipeline steel grades

- Machine type: Vertical curved
- Radius : 8 m
- Thickness: 130-220- 250mm
- Width 1000 – 2500 mm
- Ladle size: 155

- Main features
  - Mould level Master
  - Hydraulic oscillator
  - On – line width adjustment
  - Breakout prevention system
  - Width controlled secondary cooling
  - Dynamic soft reduction



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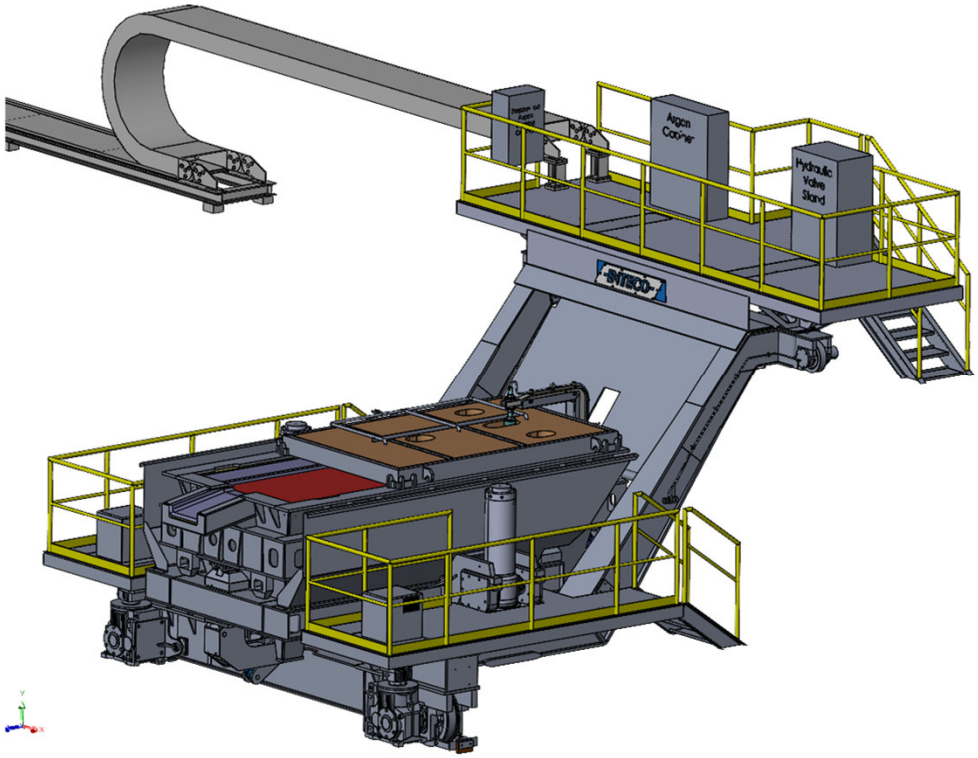
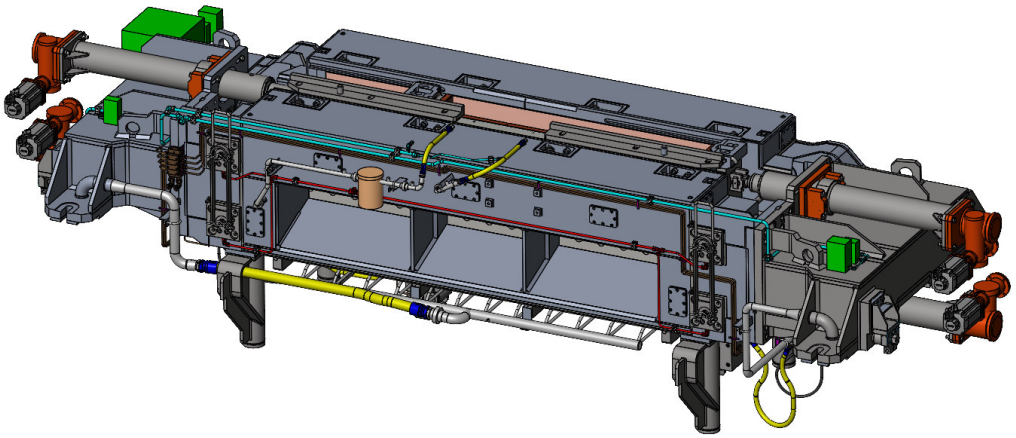


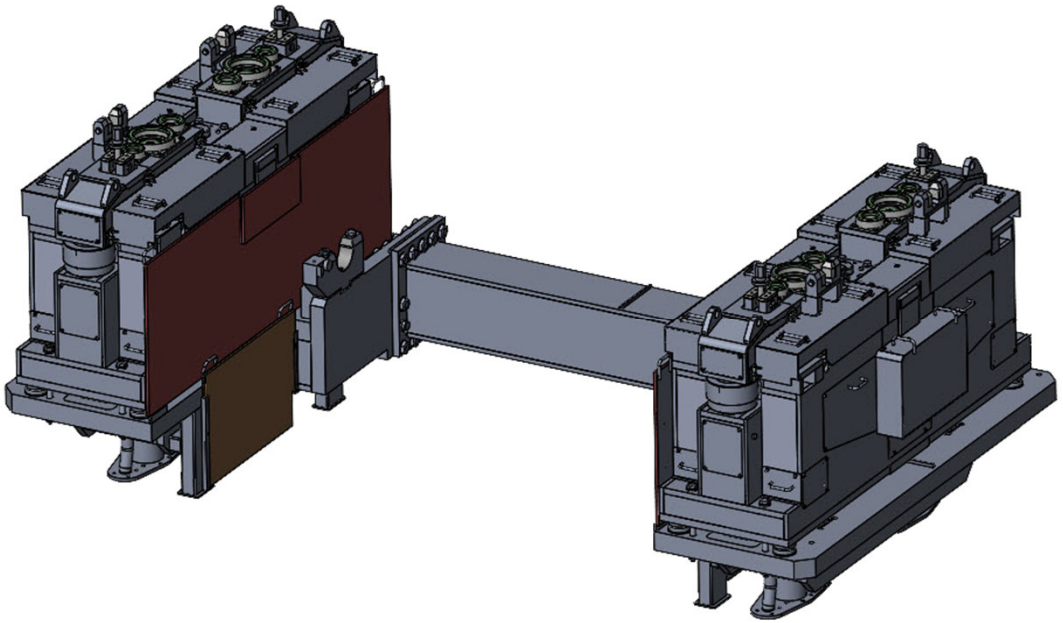
Main Data	
Type	Semi – gantry
Tundish capacity	~ 40 t
Lifting lowering	Hydraulic
Centering	Hydraulic
Weighing system	4 weighing cells
Travelling drives	Electromechanic(Hydraulic)
Temperature measurement	Continuous
Flow control	Stopper rod / SES/Quick exchange mechanism

Mould



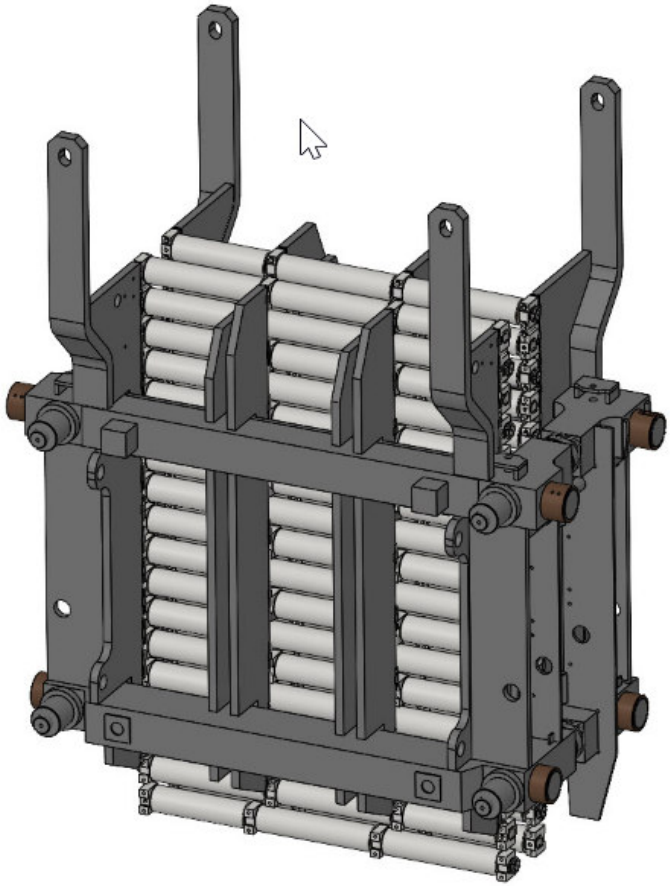
Main Data	
Design	Mould frame type with straight copper plates, quick connection for water,
Copper plates	Cooling : channels Length : 900 mm Material:CuCrZr Coating:Nickel
Width Adjustment	On-line Electromechanic (Hydraulic)
Breakout prevention	Thermocouples based
Level detection system	Eddy current ledge type

Oscillator



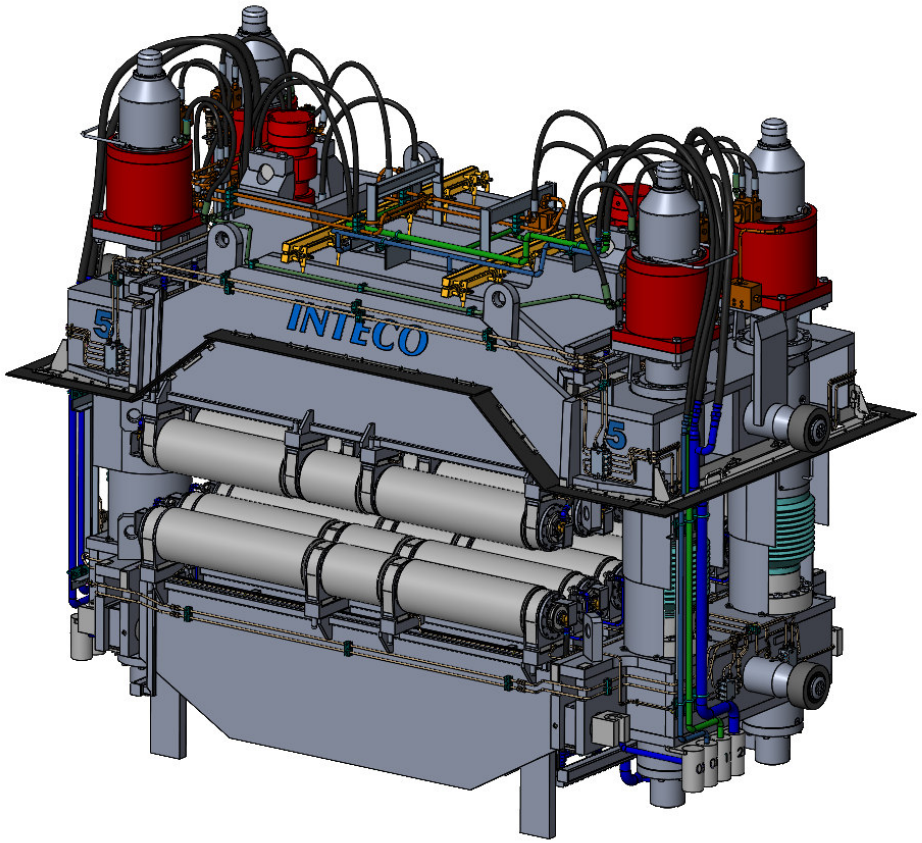
Main Data	
Design	Tandem oscillator with weight compensation, and guiding springs, with variable stroke, sinusoidal symmetric and asymmetric waveforms,
Drive System	Servodrive

Containment - Bender



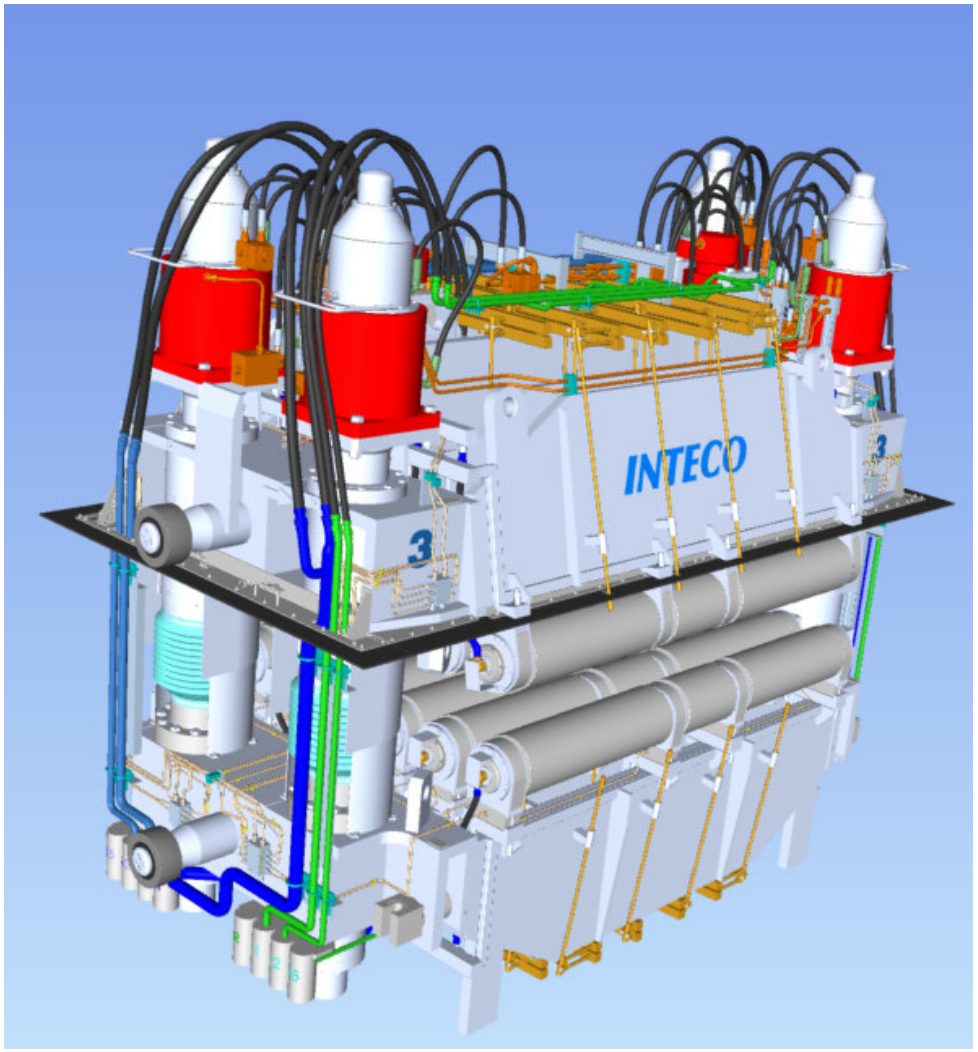
Main Data	
Design	The bender supports and bends the hot strand below the mould, bending it to the casting radius with a continuous bending curve. It consists of two rigid frames designed to minimize deflection and support the rolls on both inner and outer radii
Roll type	Sleeve split roll
Secondary cooling	Air mist, 2 zones, with 3 width independent control

Containment – Bow segments



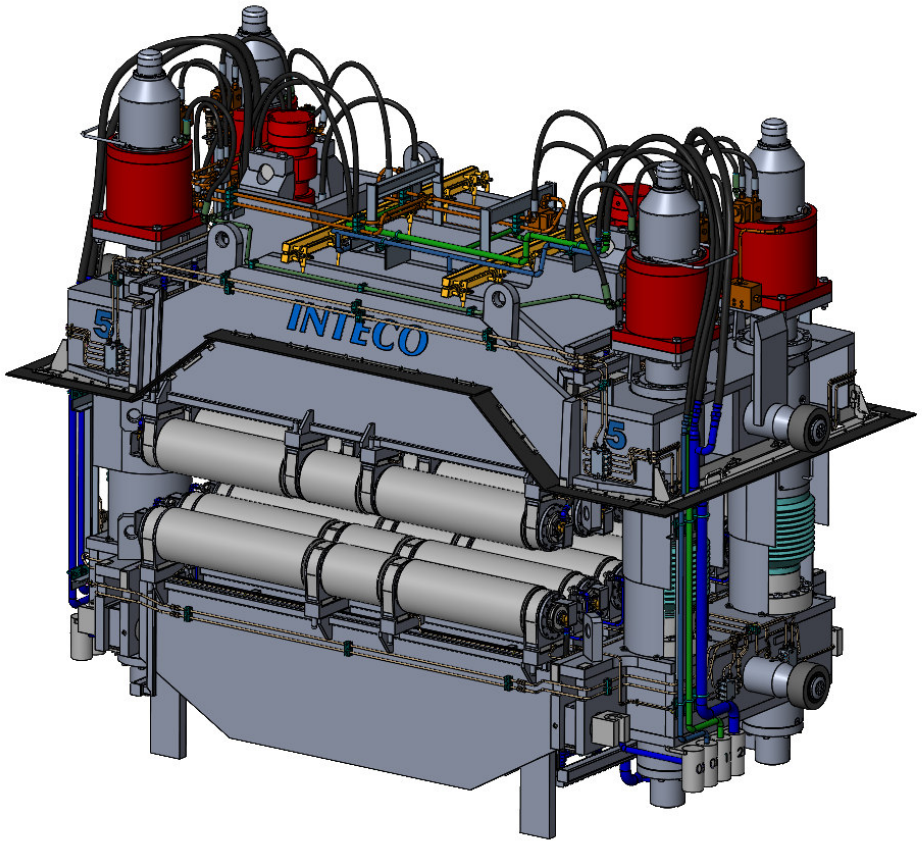
Main Data	
Design	Bow segments support the slab during solidification and enable soft reduction. Each unit has a fixed lower and movable upper frame with hydraulic cylinders, allowing quick removal, storage, and interchangeability. Position is controlled via transducers and servo valves.In order to allow the as tight as possible roller pitch in the bow are installed two segment types.
Roll type	Internally cooled split rolls Idle rolls : 6 pairs Driven roll : 1 pair Roll cooling: shaft cooling
Position control	By hydraulic cylinder and linear transducer.
Secondary cooling	Air mist, with 3 width independent control

Containment – Straightening



Main Data	
Design	The straightener segments support the slab during solidification and enable soft reduction and unbend it according a continuous curve. Each unit has a fixed lower and movable upper frame with hydraulic cylinders, allowing quick removal, storage, and interchangeability. Position is controlled via transducers and servo valves.
Roll type	Internally cooled split rolls Idle rolls : 6 pairs Driven roll : 1 pair Roll cooling: shaft cooling
Position control	By hydraulic cylinder and position transducer. For soft reduction.
Secondary cooling	Air mist, with 3 width independent control

Containment – Horizontal



Main Data	
Design	Horizontal segments support the slab during solidification and enable soft reduction. Each unit has a fixed lower and movable upper frame with hydraulic cylinders, allowing quick removal, storage, and interchangeability. Position is controlled via transducers and servo valves.,
Roll type	Internally cooled split rolls Idle rolls : 6 pairs Driven roll : 1 pair Roll cooling: shaft/peripherical cooling
Position control	By hydraulic cylinder with on board valves and position transducer.
Secondary cooling	Air mist external roller cooling

Slab caster revamping

General

INTECO

- Customer : confidential
- Project description

Products‘ quality improvement

- S-EMS

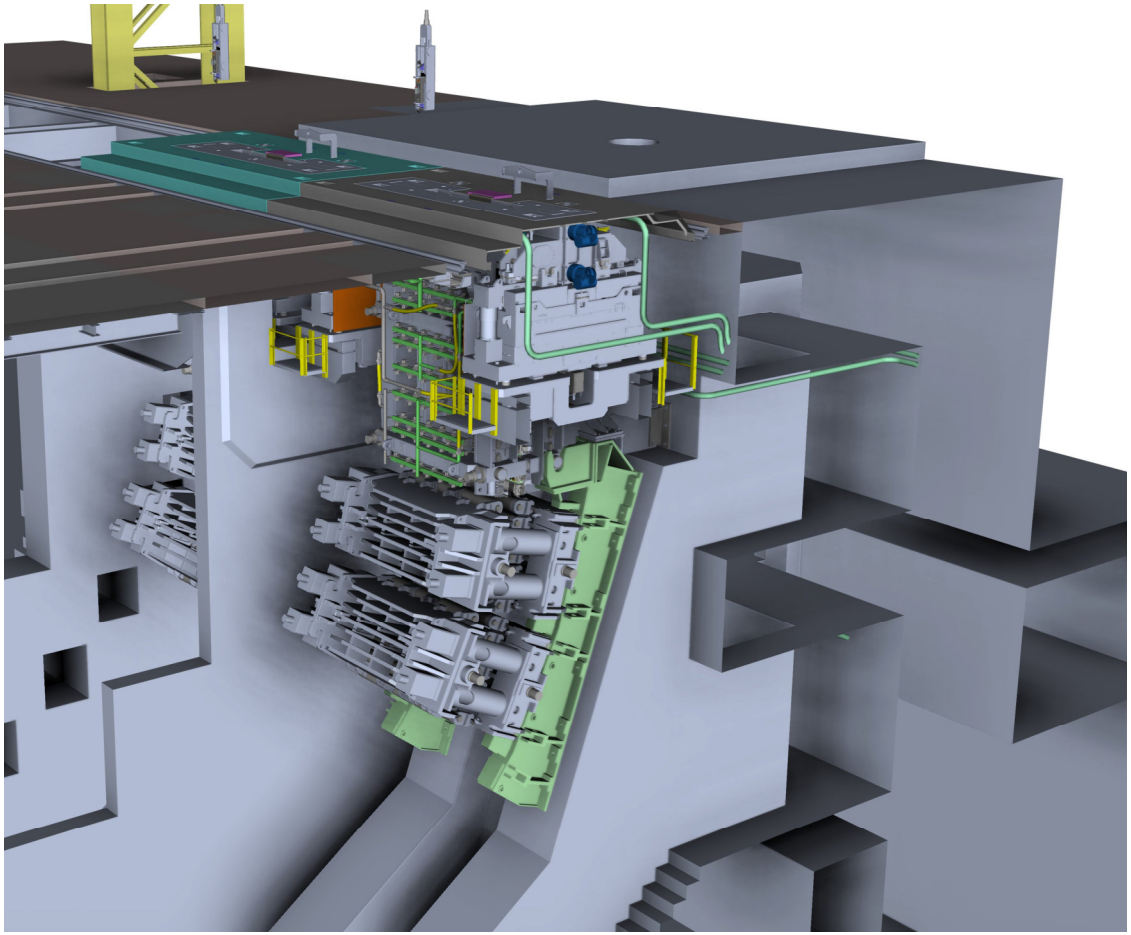
  Improvement of internal quality especially for Si grades

- M-EMS

  Improvement of surface quality, reduction of inclusions

- Soft reduction revamping

  updgrade of existing system

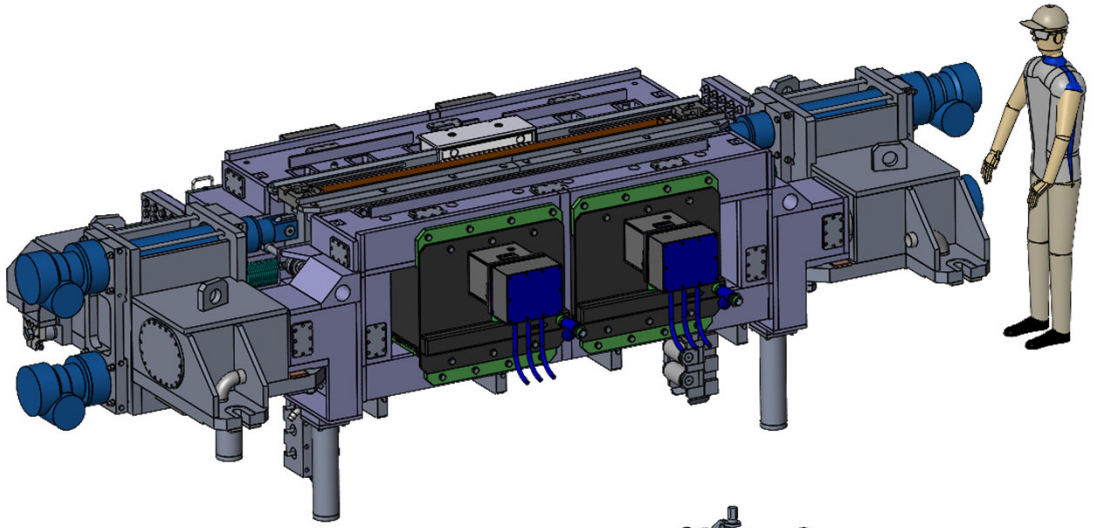


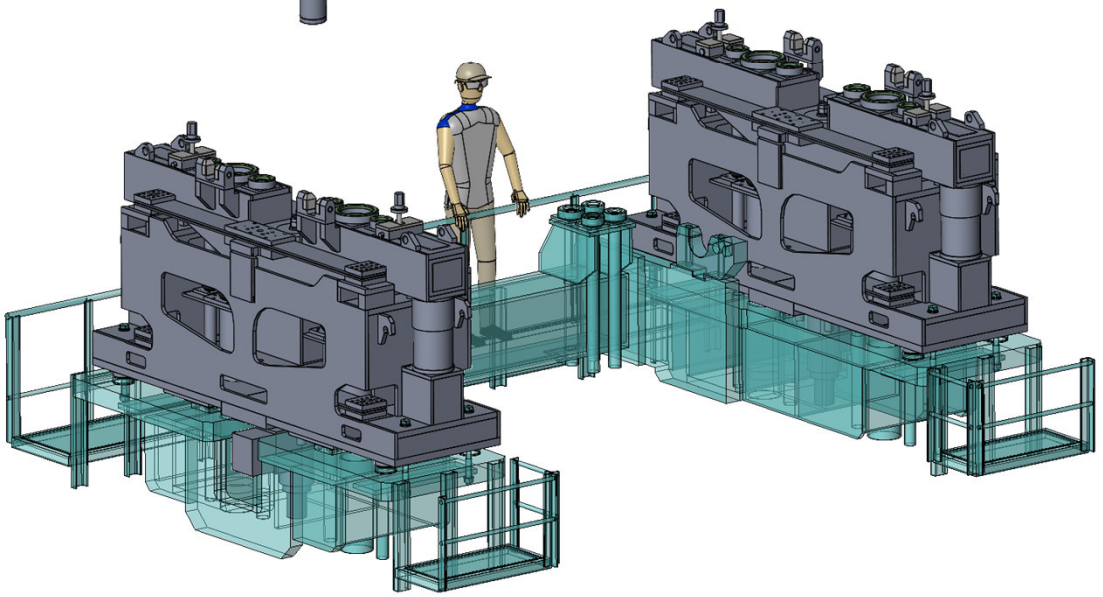
CCM Data			
Type of machine			Vertical Bending
Strands		[n°]	2
Radius		[mm]	9500
Slab thickness		[mm]	200/220/250/300
Slab width		[mm]	900-2000

Slab caster revamping

M-EMS

- Supply of :
- M-EMS
- Mould level control
- Mould modification for EMS installation
- New oscillator



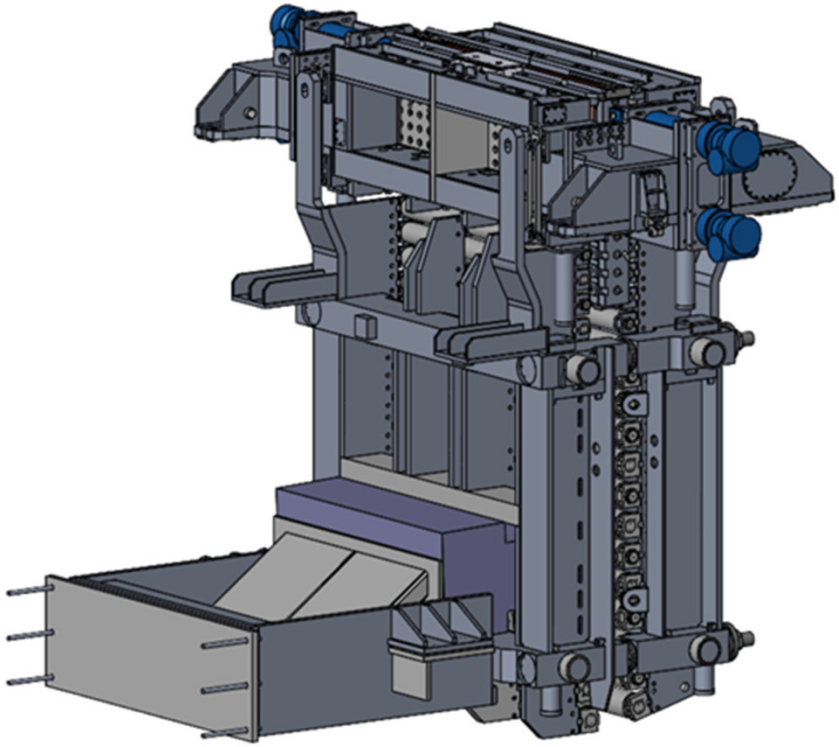


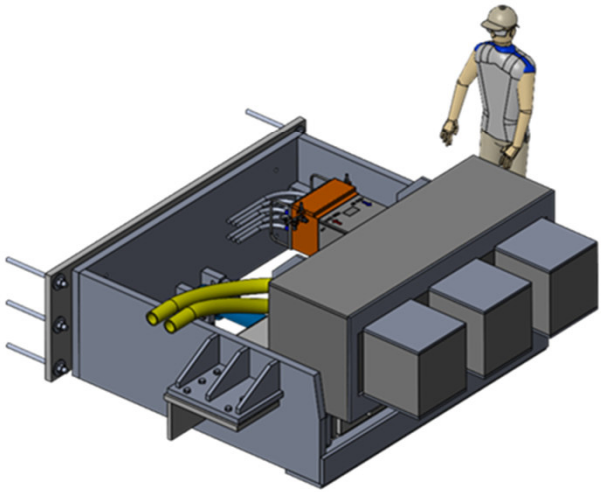
Slab caster revamping

S-EMS

INTECO

- Supply of :
- S-EMS
- Segment 0 modification
- Stirrer manipulator





World Class Customers

Customers for Life

Tradition can be built on new business relastionships


THANK YOU !
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