ProserviceTech

INNOVATION IN FOUNDRY PROCESS

ITACA

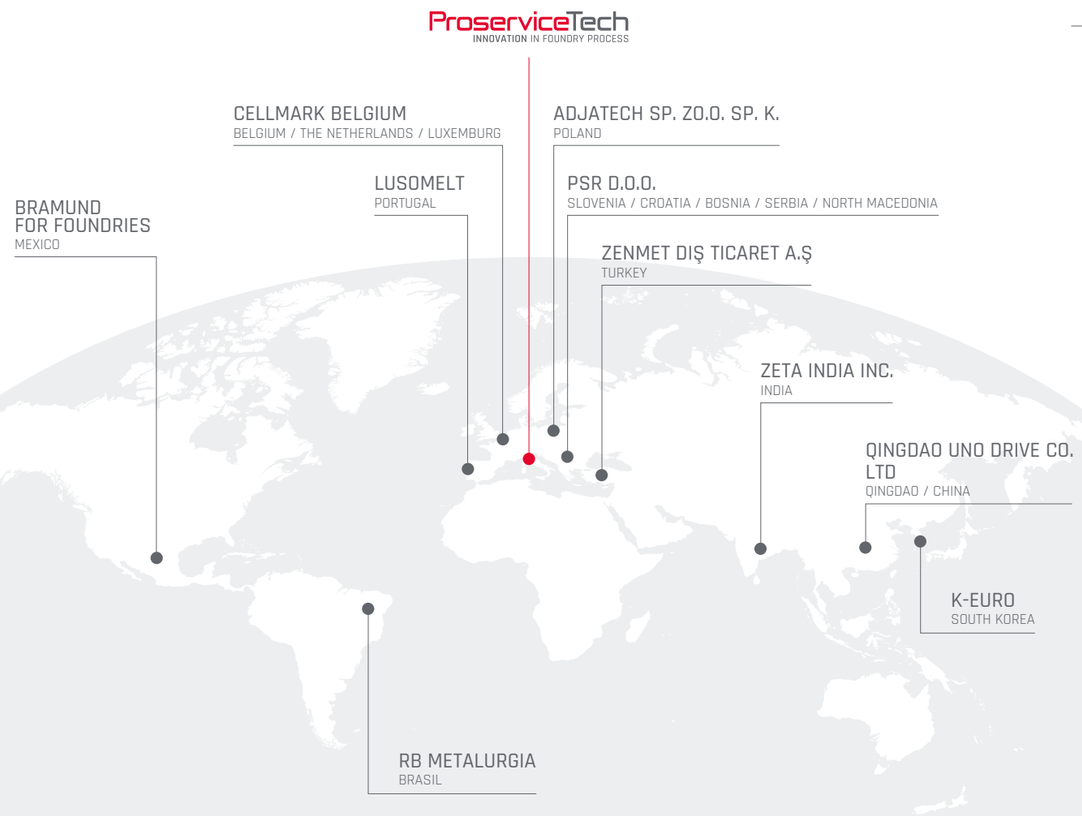
ITACA | DYNAMIC DOSING & CONTROL

PROSERVICE TECHNOLOGY

ABOUT

After the foundation in 2002 **ProserviceTech** quickly established a reputation in the market for its technical innovation for cast iron foundries. In just a few years **ProserviceTech** had become a reference point for many world foundries.
For the last 15 years our innovations have helped the industry to improve the quality of their castings and strive to maximize productivity & stabilize processes.
With its highly integrated & customized solutions **ProserviceTech** aims to be the obvious partner for the foundry of tomorrow. Our goal is to share our foundry know-how and to inspire a future generation of foundrymen.

AGENT & PARTNERSHIP



INTRODUCTION

MELTSHOP

In cast iron production process, there are different aspects to consider, each one with its own variances. Some of them can be controlled, like equipment and raw materials, others cannot, for example human intervention and process methods.

It's clear that, in order to reach a good process stability, allowing for a reliable casting quality, it's necessary to act on different aspects:

- **Operator's Control;**
- **Data Integration;**
- **Dynamic approach to the process;**
- **Traceability.**

In a generic process incorporating various phases, the variability in the final product is the sum of the variabilities introduced in each phase. For simplicity, by splitting the foundry process in just two stages (preparation of the base iron and treatments in ladle), the variability in the final iron will depend on the sum of the variation introduced by the in ladle treatment and the variation from the base iron.
As a consequence, a high variation in the base iron will lead to an even higher variation in the final iron. Please note that it is much more difficult and more costly to neutralize the variation in the second phase of the process.
For this reason, any intervention to decrease the variation during the first stage of the process, also reduces the variation in the final iron, thereby producing the iron at reasonable cost and consistently within specification.

Hence, the starting point of the automated and integrated solution must be with the melting phase.

The control of the melting operations is a fundamental part of the cast iron production process.

COST-EFFECTIVE

ITACA | Charge

ITACA Charge is an active system that allows to manage and optimize the charging process of melting furnaces. When connected to an existing charge equipment (i.e. magnet charge crane), it can be turned into a semiautomatic or fully automatic charging system.
ITACA Charge is an active component of the ITACA family of products. It can be fully integrated with ITACA MeltDeck and ITACA Hybrid systems.

ITACA CHARGE MAIN FEATURES

- Database of recipes and materials are the core of the control philosophy
- Times optimization (acceleration/deceleration at load and unload, depending on the weight of the material and its shape)
- Paths optimization (minimizing the distance)
- Improves the efficiency of the magnet: leaves the material, if necessary, and try a new load rather than deliver the load
- Uses the magnet as a scanner to identify the most performing areas of each bunker
- Avoids operator mistakes. Each material is linked with a pick-up bunker and so to a specific set of rules within working
- Divides the charge car into 3 unloading zones and assigns each material to a specific area, in order to maximize the efficiency of the induction
- Automatically recalculates the recipe in case of mistake (or intentional choices) on type and/or quantity of released material
- Optimizes corrective materials in order to reach physical-chemical targets
- ITACA Charge ensures total traceability of charge materials, times, power and energy for each batch

/ MELTSHOP

In **ITACA Charge** everything starts from the layout settings where all the positions of stocking and dosing (bunkers, dosing systems, scales, charge cars, etc.) are identified and codified.

Then, the database of the charge materials is created. To each material are associated:

- **A description**
- **One or more positions of dosing and stocking (i.e. bunker 6, silo 3, etc.)**
- **Addition step (i.e. charging, trimming, etc.)**
- **Physical properties (density, granulometry, min size, cost, etc.)**
- **Chemistry**
- **Yields**
- **Max amount that can be added**

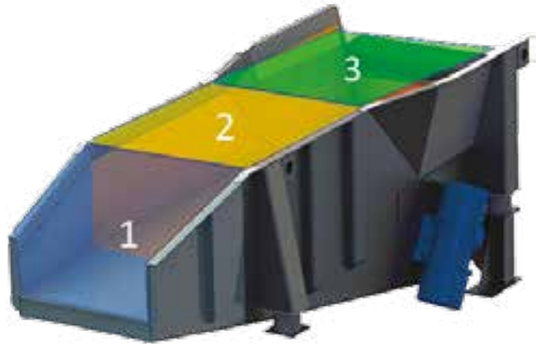
A specific remark is focused on the function of yield that can be simple percentages (i.e. Carbon contained in pig iron 1, if added in the charging phase, has a yield of 95%), complex functions (i.e. IF Carbon target is between 3.2 and 3.4 AND IF addition step is "charging" THEN yield is 94%; IF ... etc.) or functions deriving from the auto-learning algorithms (deep learning).
Clearly, the same material can have different behaviors, if added in different phases (i.e. the yield of the graphite added in furnace is different from that one of the same material added in ladle). There are no limits to the number of materials that can be added/modified. The database can be improved whenever, by adding/modifying elements, yields, physical parameters and % quantities. Each material is stocked in a specific position of which it is possible to know even the space coordinates (x, y, z) to move dosing machines or machines for the handling like the charging cranes, in a semi-automatic or completely automatic mode.
Once that the materials database is created, it is possible to create the recipes database.

For **ITACA Charge**, the recipe is a loading procedure where the operator selects materials and quantities, decides if the charge will be in one or more steps (in this case, each step will be defined and a compensation algorithm will balance some eventual mistakes made in the previous steps, in order to reach the final target). The recipe is also a working sequence for the charge crane or for its pilot. More working sequences can come from other sources (other melting furnaces in charge or in trimming) and be managed contemporarily. In fact, **ITACA Charge** will manage the queue list by assigning a higher or lower priority, following the settings defined by the high level users.

ITACA Charge

ITACA Charge manages also an eventual liquid heel or some "variable" and "sudden" charge materials like residual iron in furnaces and/or pouring ladles.
Even in this case, the system will automatically compensate the remaining charge materials, in order to point to the physical-chemical target that was previously set.

Also eventual charge cars can be divided in 3 loading areas, in order to distribute the materials, to maximize the induction.



The cycle starts with the selection of the recipe by the operator on a **ITACA Active Display**, on a ITACA MeltDeck unit, or on a PC owned by the foundry.
At the selection of the recipe will correspond the creation of a heat-code that will be the container for all the information (chemical analysis, thermal analysis, temperatures, times, energy, power, LECO, charge materials, correctives, trimming materials, etc.) associated to the specific furnace.

ITACA Charge splits the recipe in a charging program that is sent to the charging crane and to the dosing machines (or to some specific displays, in case of manual dosing) and manages the queue list of the charging and trimming operations, in order to optimize the operations granting the adherence with the procedure and with the established priorities. For each operation, **ITACA Charge** manages the start, acceleration, path, speed, deceleration of the charge crane, and decides if it is convenient (or not) to bring the material to the destination or to try with another taking.

ITACA Charge can also register a "map" for each bunker, identifying the areas of each bunker where the taking is more efficient. In the down times, (and only in case of automatic charging crane) **ITACA Charge** can use the crane to homogenize the distribution of the material in the different bunkers.

/ MELTSHOP

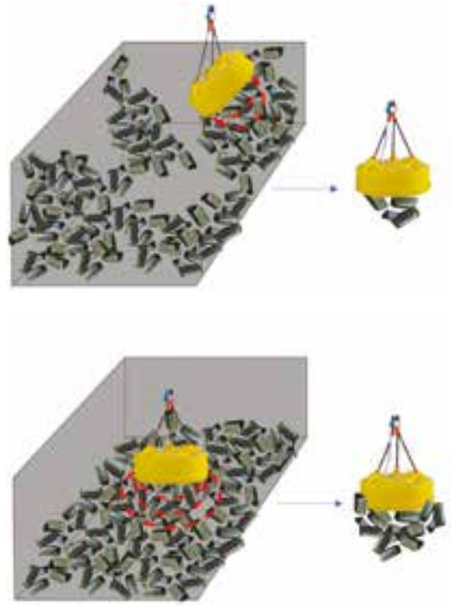
Once that the materials are charged into the charge cars, **ITACA Charge** calculates the exact amount of Fe-alloys, additives, dopants, perlitizers to be added, in order to reach the physical-chemical targets.

These amounts are calculated on the basis of the real amounts of the charged materials, and not just following a rigid recipe.

During the melting, also other parameters can be registered and used as power, energy, temperature and time.

When the iron is ready to be checked (trimming), the control procedure of ITACA MeltDeck will be applied (see the dedicated paragraph).

Clearly, the main goals of **ITACA Charge** are to reduce and optimize the charging and melting time, and to minimize the variance of the liquid iron in the way that the need of trimming is lower, too.



ORTRANDER EISENHUTTE:

Thanks to ITACA Charge, 4 more heats per day ensuring additional 6000 tons capability per year.

COST-EFFECTIVE

ITACA | Meltdeck

- Real time metallurgical quality control
- Time-based procedures for operators
- Control on operators' behavior
- Automatic Correction Module
- User friendly interface
- Spectrometer Connection
- Alarms in case of substandard metallurgical quality
- Connection with automatic alloy dosing plants

DOUBLE CUP ACQUISITION SYSTEM AND DATA INTEGRATION

Thermal analysis was not only developed to estimate the CEq, C and Si.
ITACA MeltDeck, compared to other market solutions, takes advantage of two different types of acquisition:
- Tellurium acquisition, to calculate the CEq, C and Si;
- Generic acquisition, for the evaluation of the nucleative status of the iron and the correct position within the Fe-C phase diagram.

The metallurgical status of the iron is not only based on chemistry, but mainly on solidification behavior.

HINT

/ MELTSHOP

Thermal analysis is just a small part of **ITACA MeltDeck**: the integration with melting temperature and spectrometer allows to maintain control of every single melting parameter.
Our principle combines chemical and thermal analyses, temperatures and data from melting furnaces to fully evaluate the condition inside of the iron in the furnace and the right approach for the correction process.

To limit the human intervention with data handling, the association between **ITACA MeltDeck** and other analysis systems can be completely automated: data imported from any kind of source (txt, cvs, and xls) or through the creation of unique barcodes and QR codes, all within the main interface of the system, replacing the old notes on paper.

Charging/Alloying material (FeSi - FeMn - Graphite Pig iron...)

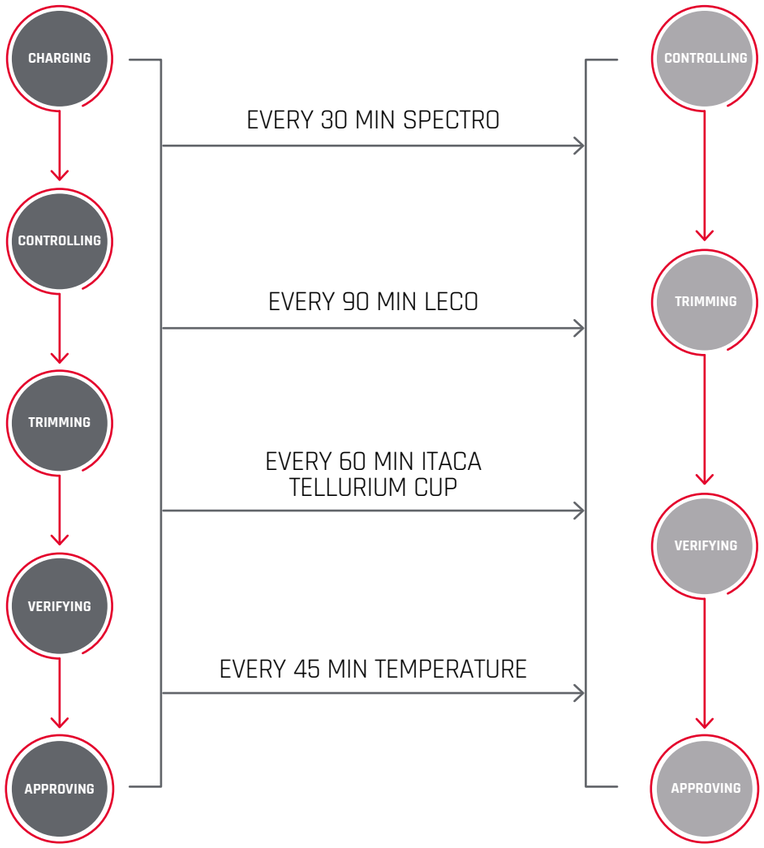
- Type of material/bunker
- Amount for each material
- Recovery functions
- Position in charge car

Charge crane control

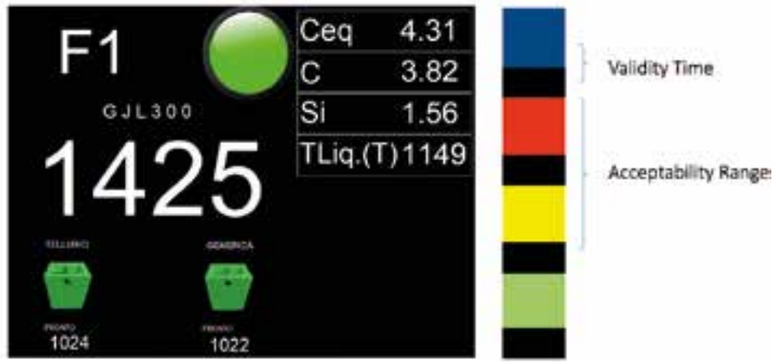
CORRECTION RECIPLE		
5.7	KG	Graphite
8.4	KG	FeSi
4.3	KG	FeMn
	Etc.	

TIME-BASED PROCEDURES AND AUTOMATIC CORRECTION MODULE

Controlling the operator's behaviour is one of the most important targets that a foundry can reach when utilizing **ITACA MeltDeck**.
The system works by means of guided procedures, with well defined ranges for each type of alloy which the foundry produces.
Each procedure is performed within a set of parameters, with its own ranges and validity time. When the time expires, the operators will be immediately alerted to repeat the acquisition of the data for the next incoming iron.



With the Correction module included in **ITACA MeltDeck**, it is possible to consistently attain the process targets and the physical targets required for the castings in production. **ITACA MeltDeck** calculates the correction for ALL the parameters based on the cast iron thermal analysis and chemical analysis and displays it to the operator.
The correction can be performed directly into the ladle, or into another conventional vessel for corrections in the furnace.



ZANARDI FOUNDRY:

5 minutes reduction on calculation and addition of the materials inside the furnace, data saved inside the main database.

COST-EFFECTIVE

CONNECTION WITH AUTOMATIC DOSING SYSTEM

However, the operations of weighing and alloy additions are usually two steps which lack traceability control. To counteract this aspect and maintain the concept of control of operator's behaviour, **ITACA MeltDeck** can be easily connected with ITACA Scale, ITACA Stream XL or ITACA Optidose for semi-automatic or automatic material additions.

ITACA SCALE

The recipe suggested by **ITACA MeltDeck** Correction module is displayed in the main interface of ITACA Scale.
The operator just needs to follow the instructions displayed on the screen.
All the data (correction calculated by **ITACA MeltDeck**, material weighed by the operator and the final confirmation) are saved to the database and are displayed in the Analysis Module for deeper analyses like material yield, trimming operation costs, etc.

COMPARISON WITH OTHER SYSTEMS

	ITACA MELTDECK	OTHER SYSTEMS
Acquisition Channels (Max)	20 (10 furnaces at the same time)	4
CEq, C and Si from tellurium cup	Y	Y
Guided Time-based Procedures	Y	NO
Data Traceability	Y	NO (not all)
Solidification evaluation	Y	NO (not all)
Automatic Correction module (considering also thermal parameters)	Y	NO
Analysis Module	Y	NO (not all)
Integration with Spectrometer	Y	NO (not all)
Buzzer and Lamps signalling for operators	Y	NO (not all)
Connection with automatic dosing machines like ITACA Optidose, ITACA Stream XL and ITACA Scale	Y	NO
Interaction with pouring line (ITACA X)	Y	NO
Temperature integration	Y	NO

ITACA Opti Dose

- Automatic Control of the alloy additions into the furnace or ladle
- Connection with ITACA MeltDeck for automatic calculation of the amount of material to be added
- Data Traceability
- Alarm in case of malfunction
- High precision and speed without operator intervention
- Simpler material inventory
- Minimal material handling
- Optimized use of alloys with different charges mix
- Flexible batches
- Accurate addition and simultaneous material handling

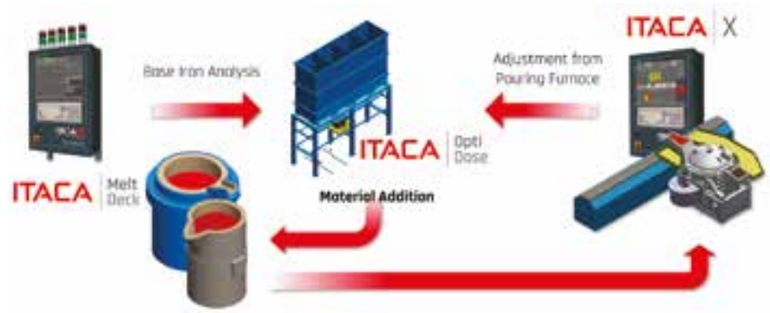
The base iron correction recommended by ITACA MeltDeck can be made in a fully automated way, with even greater accuracy.
ITACA OptiDose alloy dosing system standardizes the process with minimal interference and assures higher traceability levels.

The dosing system can be customized to the following specific conditions for each foundry: cycle time, number of dosing materials, hopper capacity, production capacity requirements, specific delivery time requests and foundry layout.
The machine can be equipped with various engineering solutions such as: a belt conveying system, hoppers with dedicated load cells or screw conveyor system. All these factors are taken into considerations during design phase for each unique system.

/ MELTSHOP

ITACA OptiDose is designed to work in two different arrangements:
- Performing corrections within the furnace. In this case, the system will be equipped with larger hoppers, an automatic transport system, utilizing bucket elevator (on a monorail) to collect the material from under the hoppers and to load it into the furnace skips;
- Performing corrections within the ladle. The system releases the material directly into the ladle before or during tapping operation from the furnace. The system will be equipped with hoppers and the alloy conveyance systems, optimized to suit the ladle volume.

Especially in this second option, the correction is not only calculated following the results of ITACA MeltDeck and spectrometer, but the core of the simplex receives feedback also from ITACA X, the system dedicated to final iron, giving information on the final casting requirements, such as pearlite promoter elements (Cu, Mn and Sn), variation of carbon and silicon contents, nucleation level (acting, in this case, on preconditioner materials) and information about the magnesium treatment for nodularization (during ductile iron production, so quantity of FeSiMg and steel cover for the ladle and to restore eventual loss of Mg in pouring furnace).



STAND ALONE VERSION	INTEGRATED VERSION (IN ADDITION)
• Customized solution following foundry needs • Automatic dosing cycle following the preloaded recipe • Reduction of dosing time	• With ITACA MeltDeck: correction recipe received directly from Correction module, following chemical and physical iron properties • All data saved inside ITACA MeltDeck database for deeper traceability • With ITACA X: calculation made considering the particular request from pouring line

ITACA | Stream XL

- Control of the additions in the ladle during tapping
- Control of the addition of inoculant during No Bake pouring
- Connection with ITACA MeltDeck or ITACA X for automatic calculation of the amount of material to be added
- Data Traceability
- Alarm in case of malfunction
- Possibility of remote control
- Flowrate up to 300 g/s

Many foundries rely on preconditioning of their base iron, but this process also lacks of traceability and is rarely related to the quality of the poured iron.

ITACA Stream XL is designed to automate this process.
Through integration with ITACA MeltDeck, pre-inoculation can be a function of the nucleation status of the iron.
Pre-inoculation will only be added as and when required, and with the correct amount so as to ensure a good and consistent metallurgical status.

WILLIAM-LEE FOUNDRY:

Preconditioning automatically made with ± 0.1% precision on two different tapping positions.

TECHNICAL SOLUTION

/ MELTSHOP

The size of the In-stream inoculation hoppers are adapted to each process.
The density of the material, minimized hopper recharge time, material yield, and other specific conditions in the foundry will affect this configuration.
Especially in this second option, the correction is not only calculated following the results of ITACA MeltDeck and spectrometer, but the core of the simplex receives feedback also from ITACA X, the system dedicated to final iron, giving information on the final casting requirements, such as pearlite promoter elements (Cu, Mn and Sn), variation of carbon and silicon contents, nucleation level (acting, this case, on preconditioner materials) and information about the magnesium treatment for nodularization (during ductile iron production, so quantity of FeSiMg and steel cover for the ladle and to restore eventual loss of Mg in pouring furnace).

STAND ALONE VERSION	INTEGRATED VERSION (IN ADDITION)
• Customized solution to meet the foundries exact unique requirements. • Manual or automated mode. The level of automation is to be defined by agreement between the foundry and ProserviceTech.	• Integrated feedback between melt shop and pouring line, regarding iron quality for inoculation purposes. • Data saved in the ITACA database for deeper analysis.

INTRODUCTION

LADLE TRANSPORTATION AND TREATMENT

The cast iron production process is not just performed by the melting and pouring phases. The most important step to determine the rhythm of any foundry is probably the molten metal handling and treatment, the connection "ring" or "circuit" between the melting furnaces and the pouring line.
Excluding the addition of preconditioning materials, already explained in the melt shop section, in this stage of the process the focus is on the nodularization treatment of the iron.

It is well known that there are many kinds of treatments that a foundry can use to transform the grey iron into ductile iron:

- **Sandwich (Tundish);**
- **In-Mould;**
- **Cored Wire.**

All of them have a different impact on the process time, types of material used, and all with differing yields and costs.

Based on the foundry process and material granulometry, ProserviceTech has found different solutions to ensure the most consistent precision of the ladle treatment.
ITACA Stream XL, ITACA OptiDose and ITACA Wire have been developed through the years to perform the calculation of the material and its addition completely automatic, minimizing the effect of the human intervention (data handling, Mg calculation and timing of the addition) and thereby increasing the safety aspects.
ITACA LTS (Ladle Transportation) then allows to optimize the transportation timing and also to improve the safety for the operators, with automatic or semi-automatic solutions.

Ladle handling and treatments often are the bottle neck on the production pace.

COST-EFFECTIVE

ITACA | Stream XL

- Precise control of the addition of the FeSiMg and covering materials of the ladle before tapping (Sandwich/Tundish treatment)
- Complete Automatic or Semi-Automatic modes
- Connection with ITACA MeltDeck, ITACA X and spectrometer for automatic calculation of the exact amount of material to be added
- Data Traceability
- Alarm in case of malfunctioning
- Possibility of remote control
- Customized following the foundry needs

/ TREATMENT

Except for the addition of preconditioning or recarburizer material during the tapping operation as described in the melt shop section, **ITACA Stream XL** is also suitable for the addition of nodularization material. When this is used in a powder form of up to 6 mm in grain size, a constant precision of ±0.1% is repeatedly attainable.

The materials as FeSiMg and cover (steel chips or FeSi), are contained in customized hoppers, dosed via screw conveyor system and load cells, installed onto the hoppers, then delivered by automatic or semi-automatic mode.

After positioning the delivery point, in accordance with the foundry layout, repeatability can easily be attained by the machine, treatment after treatment.
The timing of the calculation, position of the material within the ladle and waiting time before the tapping operation, all strongly affect the yield of the nodularization process. **ITACA Stream XL**, when connected to ITACA MeltDeck and ITACA X, can guide the operators with the correct dosing amount and time.

Are you producing ductile iron with in-mould treatment?
No Problem! **ITACA Stream XL** can easily be installed at the pouring line to deliver the material into the moulds. The pipe of **ITACA Stream XL** can be customized to reach different and complicated delivery points.

Timing of the addition is a key factorfor nodularization treatment. Longer is the time of the material inside the ladle, lower will be the process yield.

COST-EFFECTIVE

ITACA Opti Dose

- Automated control for the addition of FeSiMg and cover materials into the ladle before tapping (Sandwich/Tundish treatment)
- Connection with ITACA MeltDeck, ITACA X and foundry spectrometer for automatic calculation of the amount of material to be added
- Data Traceability
- Alarm in case of malfunction
- High precision and speed, without any operator involvement
- Minimal handling of material

ITACA OptiDose dosing system is designed to make the additions of the materials into the ladle, automatically and precisely. The calculation and delivery of nodularizing materials become the most important step of ductile iron production process.
The system is completely customized to comply with the customer's requirements, such as used material size, quantity of material to be added, hoppers capacity (related to material consumption) and, of course, foundry layout.
Utilizing this information, the system can be equipped with different dosing systems:
- Vibrating channels;
- Belt conveyor system;
- Moving cart;
- Moving arm.

/ TREATMENT

With all the movements fully automated or semi-automated, **ITACA OptiDose** is designed to deliver the correct quantity of material, taking into account both the base and final iron properties, such as the Sulfur content of base iron, residual Sulfur and Magnesium content of final iron, the quantity of iron to be treated and, if known, the quantity of iron in the pouring furnace. All these parameters are considered for a more precise calculation.

No manual intervention is required: the machine is designed to deliver the material in a completely automatic process (or semi-automatic, with remote control), always at the same point within the ladle and in the same sequence, to deliver a perfect coverage.
The feedback loop from the final iron allows for small corrections to be done in the subsequent ladle when the target is not completely reached, or when the pouring line has an unexpected stoppage to restore eventual fading of residual Magnesium.
All the data are saved in the internal database for greater traceability and post-production analysis, in order to check material consumption, yields and costs.

CASE STUDY:

ITACA Optidose dosing system integrated with ITACA Systems and ITACA LTS for complete automated process.

TECHNICAL SOLUTION

ITACA | Wire

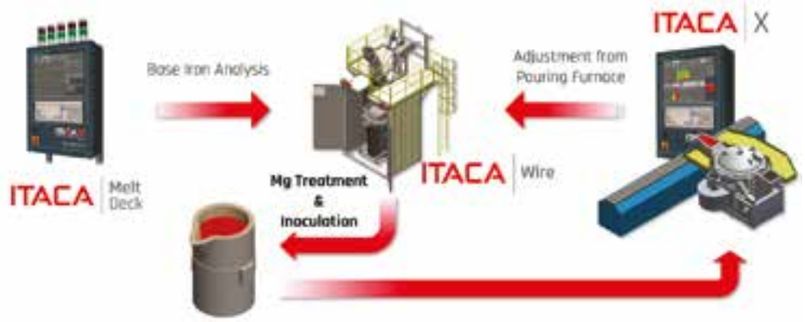
- Completely enclosed cabin for nodularization treatment with Cored Wire injection
- Recommended when ladle capacity is greater than 700 Kg
- Total flexibility during batch and continuous production
- Completely automatic or semi-automatic working mode
- For any foundries producing ductile iron
- Optimization of Mg treatment through:
  - Data integration: Spectrometer, iron temperature, iron weight, ITACA process control systems (if present), to perform the calculation of the addition immediately after all the data are received by the system;
  - No manual handling of data: all the data sources can be directly connected to the system;
- Reduced cost per treatment: by only considering the lower material consumption, the payback of the investment is usually less than 12 months;
- Improved stability on final iron: the same target is reached every time with dynamic process correction logic.

/ TREATMENT

ITACA Wire is the most advanced and complete solution for Mg cored wire treatment and post-treatment inoculation: both operations can be made in the same station, saving time and simplifying the process.

ITACA Wire gives a unique option to control the treatment process based on:
- Final Mg residual and weight of the iron in the pouring furnace;
- Actual iron quantity, utilizing an integrated load cell (optional);
- Temperature of the iron just before the treatment;
- Initial and final Sulfur levels;
- Retroactive loop function for the calculation of the treatment yield.

With the dynamic calculation, the optimal amount of wire is calculated for each treatment. The calculation is based on several metallurgical factors, known to have a strong influence. The information is supplied in real time, using the integration within the complete ITACA system (Optional) and the spectrometer.



With the Dynamic control of the cored wire, each individual treatment is not targeted to achieve a constant Mg level in each ladle (known as static treatment), but to balance the Mg content in the pouring furnace.

In normal production ITACA Wire is designed to operate in Semi-automatic mode using the dynamic calculation, but if required the system can also be operated in manual mode, with full control of the treatment process.

HINT

/ TREATMENT

Every single process parameter is checked by PLC system for all the different sources:

PARAMETER	SOURCE
· S% in base iron	ITACA MeltDeck/Spectro
· Mg% in Base iron	ITACA MeltDeck/Spectro
· Temperature in ladle prior to treatment	ITACA Wire
· Weight to be treated	ITACA Wire
· Cored wire composition details	ITACA Wire
· Desired Target Mg% in final iron	ITACA X/ITACA Wire
· S % in final iron	ITACA X/Spectro
· Mg % in the pouring furnace (if present)	ITACA X/Spectro
· Iron weight in pouring furnace (if present)	ITACA X/ITACA Wire

The new generation of **ITACA Wire** is developed to maximize Mg recovery and production economics in every single detail:

- Increased distance between the feed wheels to enhance the straightening capacity;
- Automatic cleaning of feed wheels for steel fragments;
- Management of pulling force of idle wheels;
- Installation of wire straighteners to remove even small traces of curves and helicoids from the wire, granting a vertical injection into the ladle;
- Automatic clamping with spring loaded ladle cover, controlled by pneumatic actuators.

ACTION	SANDWICH	IN-MOULD	ITACA WIRE
Mg Calculation	Before tapping (manual)	Based on mould weight	After tapping (automatic)
T (°C) effect	NO	NO	Calculated
Iron weight	After treatment	Mould weight	Before calculation (+ feedback from Pouring line)
ITACA Integration ITACA	NO	NO	Total
Reaction place	Melting furnaces	Mould	Cabin treatment (placed near pouring line)
Data Traceability	NO	NO	Total
Retroactive Feedback Loop from Pouring	NO	NO	Automatic

Each individual treatment is saved into the database and it can be traced and becomes available in the ERP system.

LUITPOLDHUTTE FOUNDRY:

Automatic solution providing 3 tons of treated iron every 3 minutes.

TECHNICAL SOLUTION

/ TREATMENT

The feedback from the pouring lines allows the foundry to verify if the treated iron is in compliance with the quality standards, in terms of nucleation status, compactness of the matrix and tendency to form carbides, and to modify the treatment for the next ladle, if required.

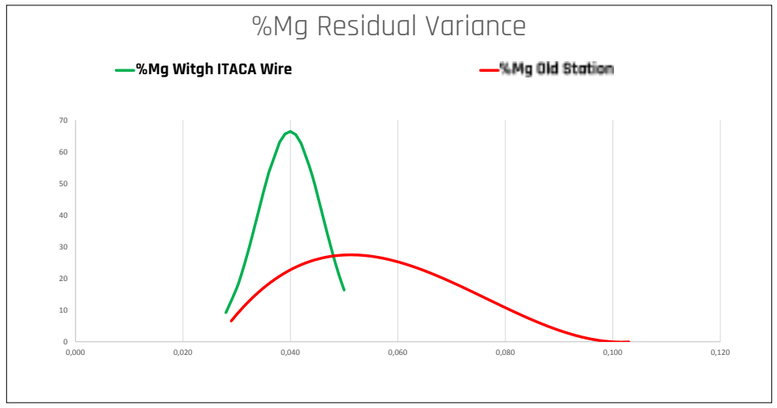
Furthermore, ITACA Wire station has the following advanced features:

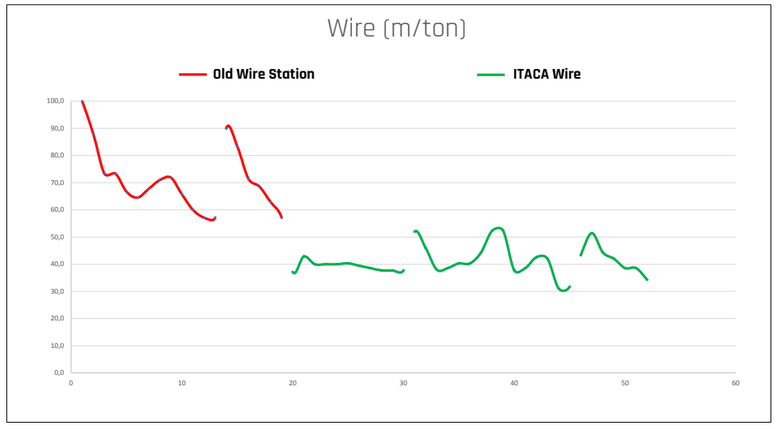
- **Cored wire breakage - when the cored wire station detects a broken wire, it alerts the operator to stop the operation;**
- **Compensation for the ladle refractory consumption, by inserting a function on the feeder;**
- **Speed compensation: when the wire feed speed decreases, the amount of the cored wire dosing time will increase to compensate for the lower yield;**
- **Variable speed: accounting for the variation of the iron temperature (before the treatment), ITACA Wire automatically adjusts, not only the quality of wire to be injected, but also the injection speed;**
- **If the level of nucleation is low, the wire quantity will be increased and vice versa. However, a minimum value and maximum range values can be set;**
- **In case of communication failure with other systems, the system will wait for a manual input, or otherwise will perform the default amount of wire;**
- **Sealing between ladle and lid: the lid is designed following the geometry of the ladle. Strong steel springs and pneumatic actuator always allow for a good seal, preventing iron sprues during the wire treatment;**
- **Fume extraction system: through the optimization of the suction system, it is possible to improve the yield of the process, thereby minimizing the fumes emitted from the ladle.**

A consequential aspect of the cored wire technology is that it may create an increase in the cycle time, so creating a bottle neck for the entire duration of the production process.
For this reason, in evaluating the delicate step of the transition between sandwich process to cored wire, it is very important to consult with the experts of the foundry process, since the solution is very often not simple and may involve different stages of the process.

Unexpected surprises are not acceptable. Utilizing this method, it will be possible to achieve a **payback period of one year or less**, based solely on the reduced consumption of treatment material.

STAND ALONE VERSION	INTEGRATED VERSION (IN ADDITION)
• Customized solution following the foundry needs • Connection with Spetrometer for chemical analysis (optional, if possible) • Temperature acquisition (option) • Automatic length calculation • Automatic yield calculation • Feeder for post treatment inoculation (Option)	• With ITACA X: automatic import of Mg target values from ITACA Database • Feedback from meltshop and pouring line regarding iron quality for inoculation process • Data saved inside the ITACA database for deeper analysis





ITACA | LTS

- Automatic or semi-automatic molten iron transportation
- Ladles for molten metal handling or treatment
- Completely customer-oriented project
- No need of isolated areas because of the operator presence
- Ability to define fixed position for tapping, treatment, pouring and maintenance
- High level of safety systems to prevent the ladle from falling down
- Simplification of all ladle logistics
- No incorrect orientation or interference with other equipment
- Faster transfer operations to minimize cycle time
- Programmable and flexible ladle paths
- Operator independent movement
- Safer working environment

/ TREATMENT

The transport of the molten metal has always been one the trickiest and most hazardous operation of the process. Starting from this simple truth, ProserviceTech has developed many automatic ladle transportation systems which are not only an improvement of the traditional methods, but at the same time they are a method to optimize the foundry logistics, while the overall process can be integrated and supervised by ITACA process control systems.

Paths between tapping and emptying areas, for example from the melting furnaces to the pouring furnaces, can be programmed and automated with high level of precision and repeatability.

Traditional conveying systems of molten metal consist of manual loading, unloading and transport operations from the melting area to the pouring area. ProserviceTech customizes and manufactures automatic handling systems with unique solution for the customers, accounting for their movement requirements, hoisting and tilting of the ladle:

- Monorail aerial systems;
- Crane systems;
- Moving floor kart systems.

CASE STUDY:

Complete Monorail loop of 135 m length serving melting area, ITACA OptiDose and pouring line.

TECHNICAL SOLUTION

Safety First!
All the solutions are designed to guarantee the safest working conditions for the operators: fully automatic solution within defined area, or remote-controlled by operator. In case of aerial transportation, the design can be very complicated, but... No problem! The structure is equipped with all the required safety systems to meet the requirements.

- Specific design to allow the complete furnace tilting during tapping
- Tilting center corresponding to the pouring spout
- Robust steel structure to counteract stresses during ladle tilting;
- Complete Safety system:
  - Carrier Anti-fall system
  - Pulley anti-fall system
  - Hydraulic Brake on lifting drum
  - Rotating and lifting systems controlled by PLC encoders
  - Mechanical limit on rotation with shock absorption system
  - Limit switches for lifting pulley
  - Protection covers on pulleys
  - Protection on ladle shaft
  - Load cells
  - ETC on gearmotors

The system continuously monitors and controls the position of the ladle, step by step, and can be connected to new or existing dosing machine as ITACA OptiDose, ITACA Stream XL and ITACA Wire.

But not only!
Since **ProserviceTech** offers complete solutions for foundry process, our advanced foundry ladles cannot be forgotten.
Based on the knowledge of metallurgical production process and the great experience in foundry process optimization, it is possible to provide customized ladles of any size and shape, in accordance with the final purpose and the foundry requirements.

Ladles are designed and engineered to work with:
- Cranes;
- Forklifts;
- Movable karts;
- Combination between all the previous methods;
- Designed to be moved with all **ITACA LTS** systems.

ProserviceTech manufactures a complete range of advanced and customizable ladles for:
- Geared Crane Ladles;
- Motorized Geared Ladles;
- Treatment ladles;
- Transport and pouring ladles.

ITACA | LTS

The main focus is put again on safety. None of the motorized gearbox rotates the hand wheel when in action, in order to prevent any accidents.
The movement is managed by frequency converters: it is possible to operate with fast rotation speed for discharging the ladle into a furnace, or with very slow tilting speed when used to pour the moulds.

The operators can easily control the tilting of the ladle by remote control: if necessary, they can shift the ladle to "manual" mode, simply operating via a lever system and vice versa.

The main features of **ProserviceTech** ladles are:

- Compliance with EN 1247 & EN ISO 3834
- Gearboxes are designed by **ProserviceTech**
- Finite Element Analysis (FEM) is performed on all gearboxes and ladles
- Extremely robust design
- Gearboxes are not reversible and firmly hold the ladle at any desired angle
- The ladle shafts are bolted to the shell and are interchangeable

Odlewnia Zeliwa Srem

No. 3 motorized ladles (5, 10 and 15 tons) for Iron nodularization by ITACA Wire and pouring at NoBake line.

TECHNICAL SOLUTION

THE POURING PROCESS:
TOTAL CONTROL OF THE FINAL IRON

INTRODUCTION

Many foundries are looking for new methods to drive their process and to minimize the variations, and thereby to maximize the productivity.
This requires a broader approach, which involves the integration of all the information created by the different plants involved in the cast iron production.

The majority of the casting defects are not related just to the metallurgical quality of the iron: sand properties (compactibility, humidity, cohesion, temperature), casting geometry and mould design, inoculation level, pouring temperature, cores properties, all these factors contribute to the final result. For instance, sand humidity and high pouring temperature can lead to pinhole defect, as well as low compactibility and high recalescence can lead to mould deformation.

So, why shouldn't you control all the different steps of the production?
The concept of "Total Control" refers, precisely, to this: integration of all the available data to have a complete picture of the pouring process.
ITACA X can be linked to any existing plant, like sand preparation plant, pouring devices, temperature measurement systems, automatic dosing machines, and receive input from technical department. The connection with ITACA Vision, ITACA Stream, ITACA Pyro and ITACA Wire LI allows then to create an integrated ITACA network, introducing the concept of dynamic micro-correction, in order to stabilize the quality of the iron and to minimize the waste of material.

The combined effect of greater control, traceability, less scrap or rework goes hand in hand with greater focus on sustainability and will help to reduce the environmental impact of your foundry.

HINT

ITACA | X

ITACA X is the latest generation of process control system of the final iron on pouring line or pouring area, for quality conscious iron foundries.
ITACA X monitors the status of the final iron with thermal analysis and other process data by comparing the current conditions to the requirements of each individual casting. The analysis can be adapted on the basis of geometrical features and historical defects of a casting.

The system has been developed following the needs of the foundries:

- **Specific module dedicated to the technical office, Casting Designer, where all the castings and their specification can be detailed for the production;**
- **User friendly interface dedicated to the acquisition module of ITACA, that immediately gives an overview of the process status, through the integration of all the data coming from different plants in the foundry;**
- **Completely dedicated module for the quality department, Quality Check, designed to the introduction of results deriving from all the main quality tests usually made in foundry.**

/ THE POURING PROCESS

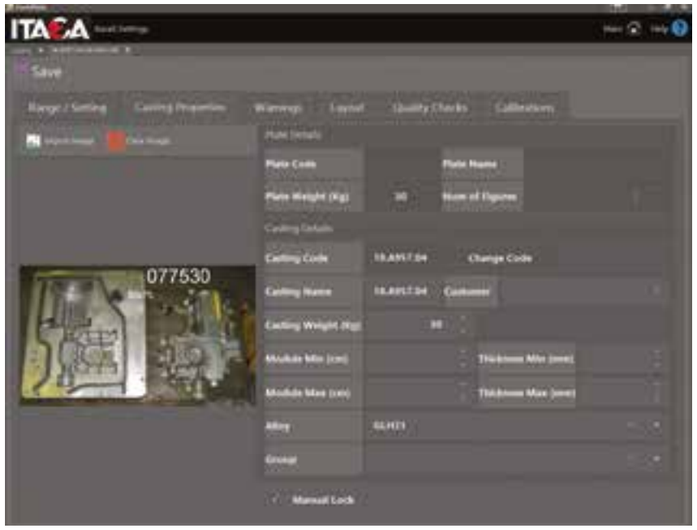
The purpose of **ITACA X** is to be a platform of knowledge, for a better precision in foundry process. The focus of the system is not only on the iron quality in the pouring furnace or ladle, but mainly on the quality of the final casting.

ITACA X utilizes the state-of-art PROFINET technology to communicate with other systems and allows real time data from PLCs. This makes this process control system more capable to communicate with any connected system and to use its data to control the process:

- Base iron properties;
- Chemical composition
- Iron temperature;
- Sand properties;
- Cores parameters;
- Moulding and Pouring parameters;
- Casting features from technical office;
- Feedback from quality department;
- ITACA Vision (if present), a system that analyzes the in-stream inoculation process through a camera;
- ITACA Stream (if present), an inoculation device designed for dynamic control of the in-stream inoculation process;
- ITACA Scale (if present), a system engineered to provide accurate and traceable final additions to the base iron;
- ITACA Pyro (if present), a system developed to improve the accuracy of temperature measurement mould by mould.

As an example, **ITACA X** can communicate with a moulding machine: thereby, it knows which pattern is being moulded, and it can adapt the metallurgical evaluation for a specific casting without any action by the operators. All data are collected to provide a global picture of the process.

Casting Designer module allows the technical office to set all the process control parameters, for all the sources and their ranges, for the casting properties such as plate weight, pictures, casting weight, thickness, thermal module and alloy.



TOTAL PROCESS CONTROL: WARNING MODULE

Besides being an online prediction of main defects and mechanical properties, already present in the previous version of ITACA, the combination of all the process data (cast iron thermal analysis, chemical composition, pouring temperature, sand properties, casting properties, etc.) is used to extensively analyze the production in real time, via the Warning Module.

What is a "warning"?
It is an alarm related to the production process, that takes into consideration one or more parameters set from the settings, and their boundary conditions derived from all data sources present in the foundry.

As example, "Mold Deformation" can be connected to High Graphite Expansion (thermal analysis parameter) or Low Sand Compactibility (sand property). Or "Cold Junction" defect can be related to high Liquidus Temperature (thermal analysis parameter) or to Low Pouring Temperature (process parameter).

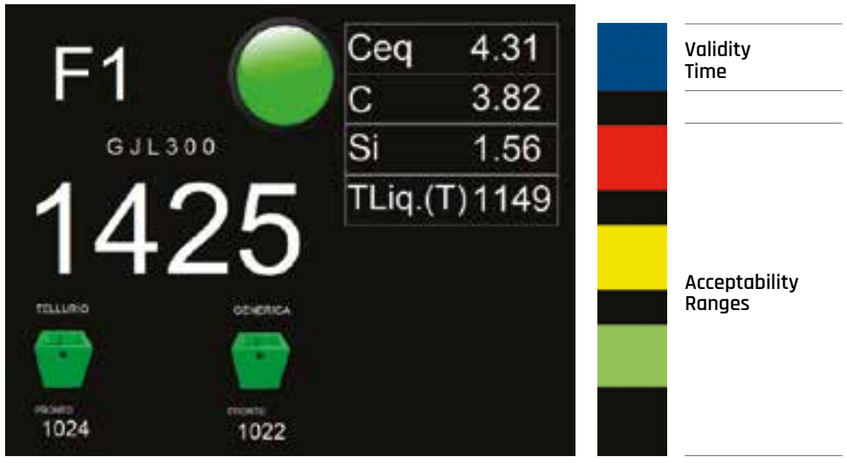
All the warnings are established according to foundry requirements and processes.
The graphical interface has been developed in close cooperation with many foundries, and it makes even simpler to recognize the information required to control the process: the operators have an immediate feedback from the system on the defects or problems that can affect the casting, and quickly take the right corrective action.

The analysis can be adapted on the basis of geometrical features and historical defects of a casting. As an example, a heavy casting produced in ductile iron usually has a minor risk of cementite, but has a much higher tendency to graphite flotation problems.
For a thin walled gray cast iron, the opposite situation could be more probable.

Thanks to the dynamic displays and their lamps tower, it is possible to have a fast overview of the complete metallurgy and to understand, just walking around the foundry, if there is a parameter close or out of validity time and required to be measured again, or if there is even one parameter out of the target introduced at page 7.
They are commonly used also to share useful information between separate departments (sand /metallurgical/ quality labs, melting shop, pouring area, etc.,).

They are quoted as optional items for each melting/holding furnace or pouring line.

For each dynamic display, it is included:
- Industrial panel HMI with a colour display and Ethernet connection;
- IP65 rated metal protection box;
- Programming and configuration;
- Lamps tower.



/ THE POURING PROCESS

DEEPER ANALYSIS AND TRACEABILITY

ITACA X Analysis is a key ingredient in our Smart Foundry concept where it plays an important role in the integration, continuous control, traceability and knowledge transfer. The Analysis module permits to share the production process information through the different foundry departments. The interactive method of data filtering is useful to study the behaviour of alloys or castings for different type of analyses.

Three different kinds of analyses are possible:

- Trends – presentation of parameters tendencies;
- Data Viewer - to recall the curves and filtering them into function of time, day/days of week, casting, batch and process state;
- Curve Comparison - to compare all the cooling curves and all the cooling speeds.

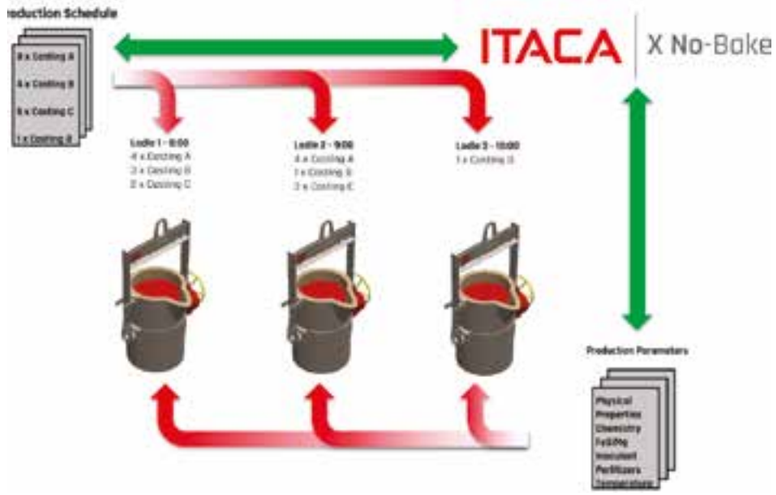
The interfaces of **ITACA X** Analysis have been designed for different kinds of user:

- Operators: trend of parameters control, associated with different sources of information (spectrometer, LECO, thermal analysis, sand properties, moulding line, pouring furnaces/ladle);
- Engineers/supervisors: comparison with a high level of detail, analysis of alarms and events;
- CEO/top managers: consolidated and extremely graphic analysis.

ITACA X continuously communicates with ITACA MeltDeck and other ITACA equipment, in a closed feedback loop. All the data are used to modify the correction of the next ladle, to ensure that the final iron is poured with near constant conditions and providing full traceability.

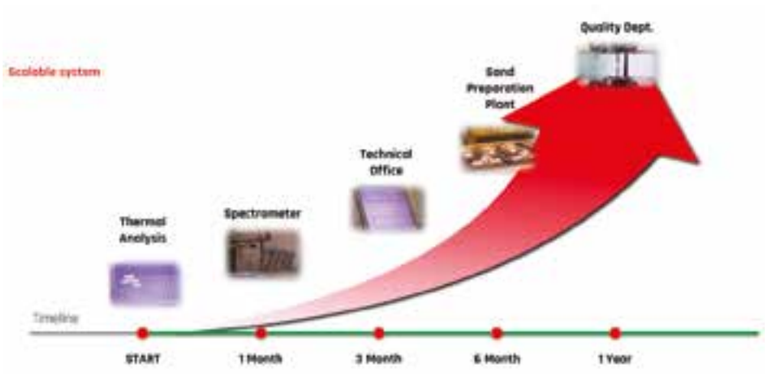
ITACA X FOR NO BAKE LINE

For the No bake process, we have developed a specific section of **ITACA X**. The main difference in comparison with a green-sand moulding process is the need to start the thermo-chemical analysis before knowing which moulds and castings will be poured with the analysed iron.
With **ITACA X** – No bake, it is possible to start the analysis and then in a second step, the results can be associated to the casting code really poured, starting from a complete list or from a daily production program.
ITACA X – No bake guarantees the total traceability, associating the data of the analyses to each single casting. Like **ITACA X** for moulding lines, also **ITACA X** – No bake can send Warnings and define Actions to be taken before pouring the castings, in case you know which castings you are going to pour. This knowledge is ensured by the information crossing that comes from sand and physical properties, temperatures, materials for corrections and chemical analysis.



ADVANCED STATISTICAL REPORTS & DATA MINING

The combined process data (cast iron thermal analysis, chemical composition, pouring temperature, sand properties, etc.) is an important source of information. It can be transformed into knowledge, providing a greater understanding of unexplained events.
A concept known as Data Mining. In combination with advanced statistical evaluations, in **ITACA X** becomes a powerful tool to understand the process.



An important area of integration is to provide detailed information for the casting process simulation systems. As a direct proof of this, we have participated in a project for the "On-line prediction of ductile iron mechanical properties using a shared software interface between **ITACA X** and MAGMASOFT®". The target of the project is to validate the thermo-physical properties used in the casting process simulation systems, and to improve the prediction of defects with cast iron thermal analysis.
It is ensured that the process quality is not only deriving from preciseness, because it meets also the requirements of the casting to be produced, and even the unnecessary waste and inefficiencies in the process can be eliminated.
Ultimately, it will lead to lower production costs and to an increase of the foundries competiveness.
The combined effect of greater control, traceability, less scrap or rework, goes hand in hand with a greater focus on sustainability, and will help to reduce the environmental impact of your foundry.

SOLVE YOUR NUCLEATION DEFECTS THROUGH A BETTER CONTROL OF IN-STREAM INOCULATION PROCESS

1 THE LATE INOCULATION IS CRUCIAL

We start clarifying some points:
Often, late inoculation is used like a patch in the process to solve anomalies previously created and restoring acceptable nucleation levels for the production of a specific casting. It is a weapon to reduce the variance.

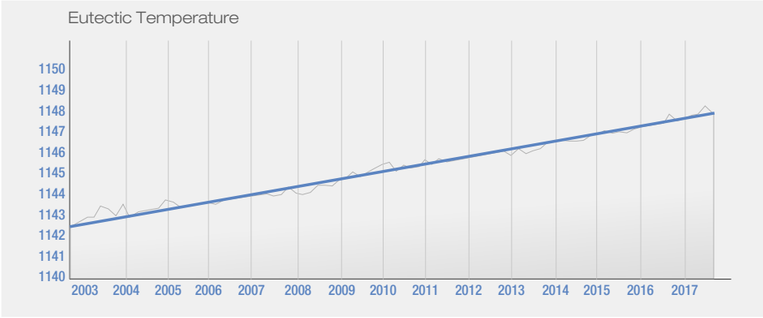
Charge material, holding time in melting and pouring furnaces, Mg-treatment, pearlitizers ...Everything contributes to deteriorate the nucleation, causing various consequences on the defects: cementite, shrinkages, porosity, graphite degeneration.
In our experience, there are lots of foundries with "white iron" (or with very low levels of nucleation) on the pouring channels of the furnaces or in pouring ladles.
When we add 0.1% of this "magic powder", problems completely (or almost) disappear.
This phenomenon emphasizes in case of big capacity ladles or pouring furnaces, because of the longer holding time. Thus, late inoculation is decisive, mandatory for a good casting, but usually foundrymen use it just to counteract under inoculation. Unfortunately, this is not the correct way. During last years, inoculants performances increased a lot, introducing new kinds of problems.
More often over inoculation is becoming an actual and real problem, very difficult to be identified for those foundries that think the inoculation only as a means to solve cementite and shrinkage problems and improve the nodule count.
What about micro shrinkages? Porosity under feeder neck? And degenerated graphite?
Many of our customers are facing these problems and often solve them by modifying the feeding system or increasing the size of the risers. But these measures are often useless and expensive, without solving the real cause. It's another gold patch!

2 IT IS NOT POSSIBLE TO MEASURE THE EFFECT OF LATE INOCULATION WITH SPECTROMETER

Measuring is always the first step in a decision-making process that leads to the definition of the most effective control system. So, given that that late inoculation is decisive, how do you measure it?
The spectrometer is inadequate. We can say that the estimation of nucleation is not part of its competence. You can prove it by yourself, detecting the chemical composition

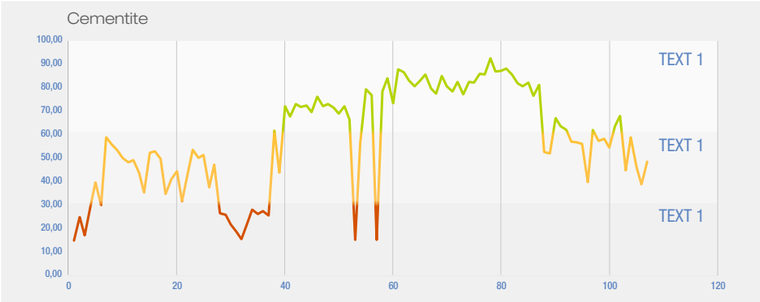
before and after in- stream inoculation (around 0.1%). The only important change concerns Silicon (probably 0.02%?). The spectrometer gives the same results for both not inoculated and inoculated iron, but actually they have a "little" difference, the first one produces scraps, the second one produces good castings.
Even if we suppose to consider the variation of Silicon as a criterion to check the efficiency of late inoculation (and however this does not make sense, because with the same percentage of Silicon, inoculants have very different behaviours!), to estimate the difference we need 2 samples: one before and one after inoculation. In most cases, it is an operation impossible to achieve with an adequate level of consistency, due to dosing problems and dissolution of the inoculant in the spoon.
Thermal analysis is the only way to correctly measure the nucleation level and the efficiency of the inoculant quickly and consistently. However, this opens a new chapter partially outside our purpose, thus we will just focus on some key points related to late inoculation problem.

- **Under-cooling Method**
  It is outdated, because it can't identify and manage high eutectic temperatures or Carbon saturation conditions (very common situation in the last years).



- **There is a big difference between "suggesting" and "controlling"**
  It is very simple to show a number on a screen, but using it to control an automatic dosing machine is a really different thing. That's why in our ITACA systems the word "software" is forbidden.

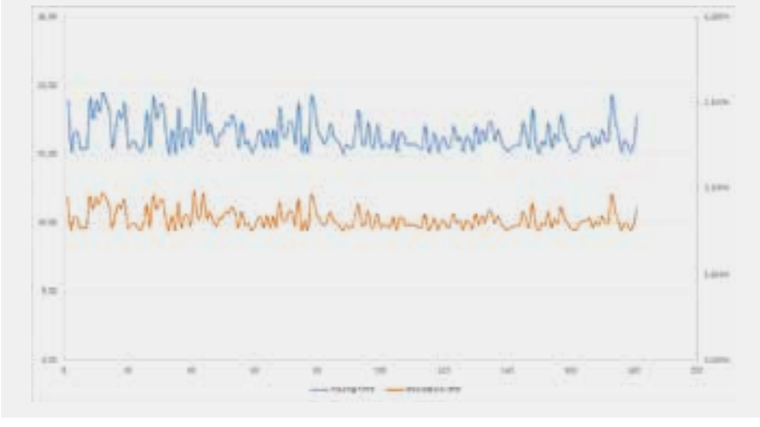
- **Late inoculation control**
  The nucleation analysis is one of the focal points, but it represents only a relatively small section inside ITACA.
  The graph shows how in a modern foundry the nucleation of the cast iron evolves just before the late inoculation. The variance is significant, but the action will be blind and consequently static, without a suitable system of evaluation and control.
  It is well known that there are a lot of variance causes, before late inoculation: charge material, holding time in melting and pouring furnaces, Mg-treatments, pearlite promoter elements, pouring temperature, etc.). Nevertheless, even in a so dynamic contest, foundries normally react with a static approach, trying to stabilize their process (golden patches).



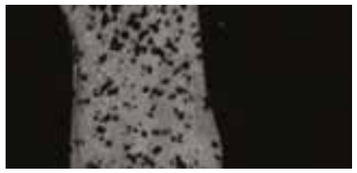
3 IT IS NECESSARY TO REDEFINE THE CONTROL PARAMETERS OF LATE INOCULATION

For most foundries, the benchmark is the "inoculant flowrate" of in-stream inoculation device (obviously taking for granted that the inoculator has already been calibrated and is calibrable!).
Advanced foundries usually use different kinds of flowrate, according to the iron flow and to the needs of castings or castings families. Actually, there are at least four variance sources that are often unknown.

Pouring time
Working with a constant flowrate, as the pouring time increases, the amount of inoculant introduced into the mould will increase, especially if the inoculant pipe guides the inoculant directly to the inlet point and not to the stream. Variations of pouring time, compared to the default pouring time, are very frequent and related to iron fluidity (Fe-C diagram real position, pouring temperature, iron oxidation level), mould design, stopper status and pouring control system.



The mismatch
Mismatch between inoculant pipe and iron stream. Almost no one consider the importance of this stage, giving the responsibility to check the alignment (normally hammering) only to the operator. It is a mystery to understand how the operator can manually align the pipe with a perfect precision. We remind you that the misalignment does not depend only on inoculation device, but more often is related to presence of slag on the nozzle, incorrect position of stopper/nozzle, stopper deformation, etc..
This is a daily problem which normally does not correspond to any kind of alarm.



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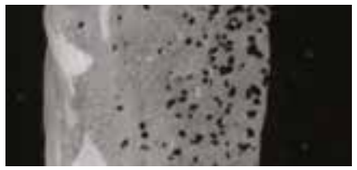

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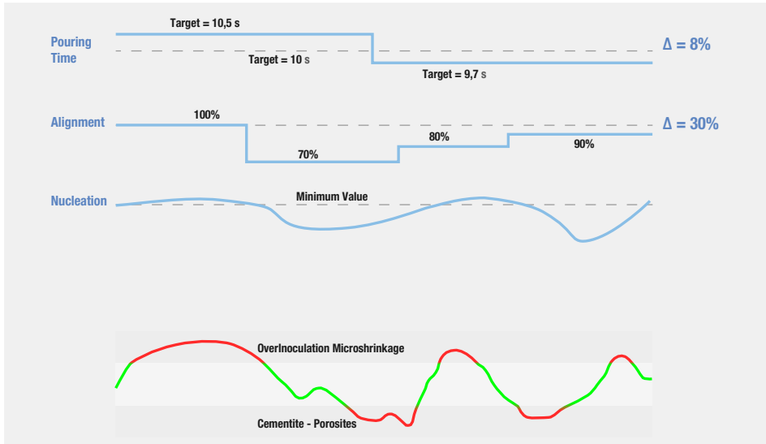
The iron nucleation
The iron nucleation level before the late inoculation. It is the problem we have analysed in the previous paragraphs.

The geometry of the inoculant pipe
Do you still think that your late inoculation is really under control?
We disagree at all with companies that have developed new generation inoculators by introducing load cells to measure the weight of the inoculant. It is possible that there is a slight increase in the accuracy of inserted inoculation amount (0.5%?).
Our ITACA Stream guarantees an accuracy of ±1% as long as you use an inoculant produced by a reliable company that guarantees an acceptable granulometric stability.
However, if this did not happen, the precision introduced by the load cell would really be the last problem! One second more on 10 seconds of pouring time means a 10% error; the misalignment, according to our experiences with the ITACA Vision system in Italy, Germany, Spain, produces errors of more than 30%. Very often up to 70%. In this condition, the measurement of the weight of the inoculant seems to be a golden patch.

4 THE DYNAMIC APPROACH IS FUNDAMENTAL: MACHINES AND CONTROL SYSTEMS HAVE TO OPERATE IN PERFECT SYMBIOSIS

Previously, we have talked about source of variance ignored in the foundry production process:
- Nucleation
- Pouring time
- Mismatch between inoculant pipe and iron stream.

The very interesting thing is that these parameters are completely independent one from each other. We can compare them as three different storms in the ocean, with a different intensity but that act at the same time. The consequence is unpredictability.



5 PROSERVICETECH SOLUTION IS ITACA PRODUCTION AND DOSING SYSTEM, a new concept in which dosing machines and control systems can operate independently but, when they are connected one to each other, they are governed by a unique system, aimed at minimizing the process variance by a continuous and dynamic control logic.
About in-stream inoculation there are 4 fundamental systems:

ITACA X	It is the key component. It supervises the level of nucleation of the cast iron interacting with the other components.
ITACA Stream	It is the dosing machine for in-stream inoculatoin process.
ITACA Vision	It is the visual monitoring and control system of in-stream process.
ITACA Wire LI	It is the wire inoculation device, specifically designed to work on the furnace chanbnel and pouring ladle.

ITACA | Stream

ITACA Stream is our system for in-stream late inoculation and it has been developed together with European foundries, to add a controlled amount of inoculant into the iron flow during the pouring of the mould.

It can be easily placed near all the automatic pouring systems (by furnace or ladle).
ITACA Stream is a product of ITACA Production and dosing system family and can be interfaced with all other ITACA equipment to maximize the control on the iron quality.

ITACA Stream is engineered for a non-stop use during production:
- **Connection with pouring devices for synchronization with stopper;**
- **Connection with foundry database for inoculation level;**
- **Connection with ITACA X for dynamic inoculation process control.**

ITACA STREAM FEATURES

ITACA Stream is a screw driver inoculator device with unique characteristics:
- Two versions, single screw or dual system, equipped with two hoppers and two independent dosing systems, with 1 rotating pipe;
- Dosing group removable without tools in less than 60 seconds. In this way, it is possible to minimize the maintenance time;
- Torque control on electric motors (rotation and dosing system) to prevent the gearbox in case of impediment;
- Screw designed to minimize pulsations and wear, maximizing its life;
- Optical fiber sensor to check the passage of inoculant inside **ITACA Stream**;
- Insensitive to electromagnetic noises;
- Removable hoppers (22 lt or 50 lt) by "Switch Inoculant Switch" system;

/ THE POURING PROCESS

- A choice of only two different screws with a wider range of flowrates. The first screw for low flowrate, usable from 0.5 g/s and 30 g/s. The second screw for higher flowrate, from 12 g/s and 82 g/s. in case of dual version, the maximum reachable flowrate is higher than 160 g/s;
- Automatic cooling system and continuous monitoring and controlling of internal temperature of ITACA Stream;
- Pneumatic system to control the main connection valve between the hopper and the dosing system: it is very important to avoid losses of inoculant during the tilting of the pouring unit during or during the change of inoculant type with "Quick Inoculant Switch";
- Dynamic control of air pressure as function of the flowrate;
- Venturi system to eject the inoculant;
- Fast reaction time to minimize the delays;
- Born to communicate with hundreds of COM protocols already on board;
- ITACA Active 10" display;
- Very high accuracy.

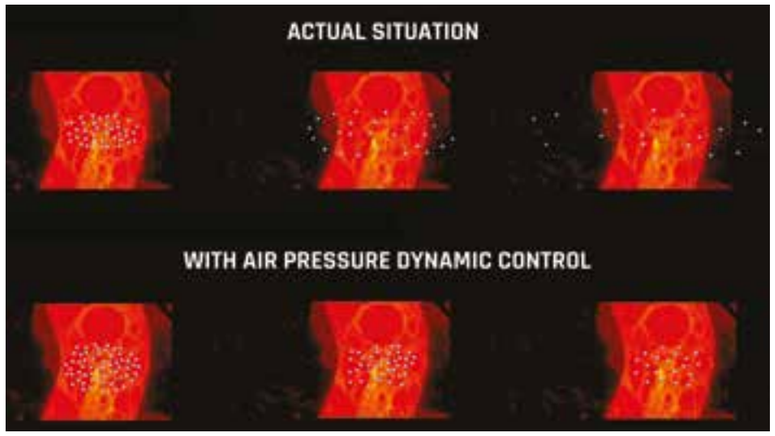
SOME FUNCTIONS DESERVE A DEEPER ANALYSIS.

Besides dosing precision (±1%), the machine is also equipped with a second stepper motor dedicated to pipe rotation.
The rotating can be moved in manual or automatic mode (with ITACA Vision) to follow the iron flow, keeping the alignment constant. Every step of the motor makes the pipe moving 0.038 mm (considering 1 m pipe). This is precision!
ITACA Stream can be connected to existing automatic pouring systems, automatically managing the inoculant flowrate in function of the pouring time (compared to the default one). Even if there are variances in the pouring time, **ITACA Stream** will always keep the same amount of inoculant in every single mould. In fact, the most important parameter is the target amount of inoculant actually provided, not the flowrate.
ITACA Stream can work with different inoculants that can have a different calibration curve. Just select the new inoculant on the control display or from the PC and replace the hopper with the one containing the new inoculant.
By the "Quick Inoculant Switch" system, this operation is really fast, taking just few seconds. The hopper, even if completely full, will not lose inoculant.
We have designed the control software of **ITACA Stream** according to the most modern standards.
It can easily be interfaced with other equipment (moulding line, pouring furnace/ladle, database, etc.) and its graphic interface is user friendly.
Another absolute innovation of **ITACA Stream** consists of the dynamic control of the inoculant dispersion pattern. This option can be installed also on existing **ITACA Stream** systems already installed in foundry.

ITACA | Stream

/ THE POURING PROCESS

ITACA Stream adapts the air pressure inside the shot "gun" in function of the flowrate and the inoculant type (grain roundness, granulometric distribution, specific weight), in order to always ensure a constant dispersion pattern.



Actual situation: lowering inoculation flowrate but keeping constant the air pressure, the dispersion pattern will be wider;
With air pressure dynamic control: **ITACA Stream** automatically modifies the air pressure, according to the used flowrate.

This solution grants a constant and reliable inoculation and it is possible to monitor the geometry of dispersion pattern to highline eventual anomalies, if ITACA Vision is installed.

ITACA STREAM DUAL FEATURES

The "Dual" version is a new concept of inoculator device, developed for those foundries with specific needs concerning the inoculation. In addition to all the features previously described, **ITACA Stream** Dual allows maximum flexibility on the production process:

- Two independent hoppers with two independent dosing groups;
- Fast switch (form one mould to the next one) from first to second dosing group, for fast change of inoculant type. Very important if the foundry wants to use a normal inoculant and, in special conditions, a powerful one (i.e. in case of long stops or for specific castings/alloys);
- Possibility to use 2 inoculants at the same time: a mix of 2 inoculants in or same percentage or the same inoculant in a potentially double amount.
  In this case, ITACA Stream can potentially reach the incredible flowrate of 164g/s!

ITACA Stream can be installed as a stand alone unit, ensuring important advantages compared to a traditional machine, but the best performances are reached when it is connected to ITACA Vision and ITACA X.
When **ITACA Stream** and ITACA Vision work together, the inaccuracy related to misalignment instantly disappears. The pipe will always be perfectly centred with the iron flow.

Inoculant hit point trend (8 hours on Disa Plant) analysed with ITACA Vision

Inoculant hit point trend (10 hours on Disa plant) with ITACA Stream and ITACA Vision

When **ITACA Stream** is connected with ITACA X, this last one takes the control, dynamically dosing the inoculant (amount of inoculant) in function of the real nucleative status of the molten iron and of the acceptability ranges established for the casting actually in production.

ITACA | Stream

/ THE POURING PROCESS

ITACA STREAM TECHNICAL SPECIFICATION

	SMALL COCHLEA	BIG COCHLEA
TARE	Max. 115 Kg	Max. 115 Kg
INOCULATION RANGES (g/s)	0.5 – 18 g/sec (Reduction ratio 1/20) 0.9 – 35 g/sec (Reduction ratio 1/10)	15 – 80 g/sec
INLET AIR PRESSURE	6 - 8 bar	6 - 8 bar
INOC. PIPE DIAMETER	14 - 16 mm	16 - 18 mm
INOC. PIPE ROTATION (OPTIONAL)	± 6°	± 6°
INOC. GRANULOMETRY	0.1 – 1.6 mm	0.1 – 1.6 mm
MAX WORKING TEMPERATURE	60°C	60°C
POWER SUPPLY (V)	110 /230 V	110 /230 V
FREQUENCY (Hz)	50/60 Hz	50/60 Hz
HOPPER VOLUME	22 L (50 L on request)	22 L (50 L on request)

- Siemens PLC system installed in external metal box;
- 10" touch screen display with software, running in manual or automatic mode;
- Dosing unit provided with 1 brushless motor for dosing screw, 1 stepper motor for pipe rotation (if present);
- Automatic cooling system;
- Removable hopper 22 or 50 liters;
- 5 mt connection cable provided with high temperature protection.

KEY BENEFITS

- **FLEXIBILITY**: ITACA Stream In-stream inoculation system is equipped with two tanks: one in production and one ready to be replaced.
- **HIGH EFFICIENCY**: Optimal distribution and uniform inoculant for each casting, and continuous monitoring of the process.
- **SIZE**: Small sizes, adaptable to areas where space is restricted.
- **COMPATIBILITY**: Compatible with both modern and older pouring systems.
- **COMMUNICATION**: Communicates with PLC's via PROFINET to receive the required information (like the stopper movements).
- **SAND CONTAMINATION**: Prevents the sand contamination during operation and change of inoculant.
- **MAINTENANCE**: The automatic cleaning system removes the remaining inoculant in the feeding system when switching to the next tank. Pressurized unit to avoid dust and small particles of inoculant inside.
- **SAFETY**: Improved working conditions, thanks to the automated dosing.
- **INTEGRATION**: Combined and integrated with ITACA X. When the nucleation status of the iron is estimated, the amount of required inoculant can be automatically derived from cast iron thermal analysis.

STAND ALONE VERSION	INTEGRATED VERSION (IN ADDITION)
• Material dosing precision ± 0,1% • Manual Pipe rotation (Optional) • Removable Hopper (22/50 L) • Variable flowrate based on pouring time (signal from stopper required) keeping constant the amount of inoculant • Up to 10000 different calibrations • Connection to foundry casting database (optional) • Fast maintenance dosing	• With ITACA Vision: Automatic pipe rotation • Analysis module with video and results mould by mould • With ITACA X: modification of inoculation level based on nucleation of final iron • All data saved inside ITACA X database for deeper process analysis

ITACA Vision

Not only the metallurgical quality of the iron is considered for the inoculation process, but is important also the quality of the flow during the pouring phase.
ITACA Vision is a tool to monitor and control the in-stream inoculation process.
A motorized camera "reads", up to 30 times per second, the inoculant particles on the iron flow measuring size and position for each particle.

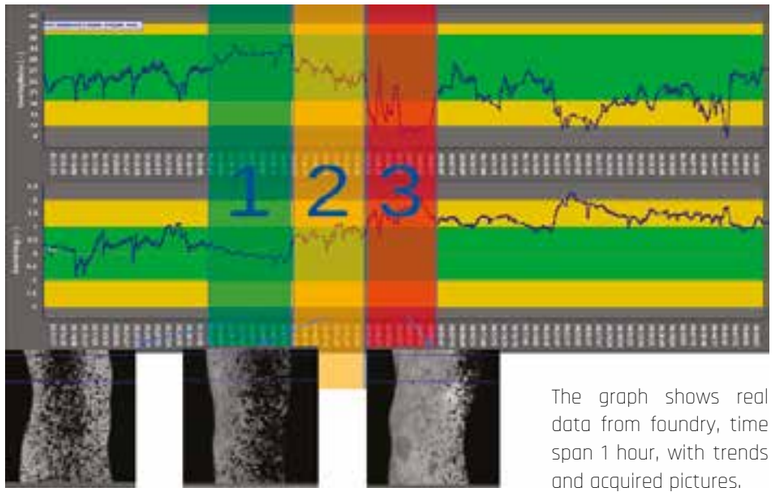
1 It calculates the real amount of inoculant present on the iron flow. For every single pouring, **ITACA Vision** calculates, frame by frame up to 10 frames/second, the amount of inoculant actually inserted into the iron stream. This means that you can check whenever you want (even after many years) the distribution of the inoculant on the iron flow. Was the inoculant present or not? Was the quantity enough? Was the distribution homogeneous? Was the pipe aligned with the iron flow? Was the inoculant flow correctly synchronized? You can easily have an answer to all these questions.

2 In its latest version, **ITACA Vision** is also able to "read" and measure the inoculant that is going out of the stream, drastically improving the calculation of the real amount of inoculant efficiently entering in the stream. **ITACA Vision** is also able to measure the dispersion pattern of the inoculant, checking if it is correct, in function of the inoculant properties and the flowrate defined by the foundry.

/ THE POURING PROCESS

3 It checks the "turbulence index" of the iron up to 30 times per second.

4 It calculates the misalignment that can be caused by slag on the nozzle of stopper wear. If ITACA Stream is connected with **ITACA Vision**, the inoculation pipe will always be kept perfectly aligned to the iron flow in a totally automatic way. You can forget about spot cementite problem or microporosities caused by over-inoculation.



The graph shows real data from foundry, time span 1 hour, with trends and acquired pictures.

5 It measures the synchronization delay during the opening phase in 0.1 second. Which is the time delay, in terms of 1/10 second, between the first iron and the first inoculant? This is a very useful information to synchronize the stopper and the in-stream inoculation devices. It is very difficult to calculate it "by eye", because the first moved particles are the thin powder led by the compressed air. Unfortunately, this fine powder is not useful to improve metallurgical quality of the iron and sometimes it does not reach the iron surface, throwed away from the convection generated by hot air.

/ THE POURING PROCESS

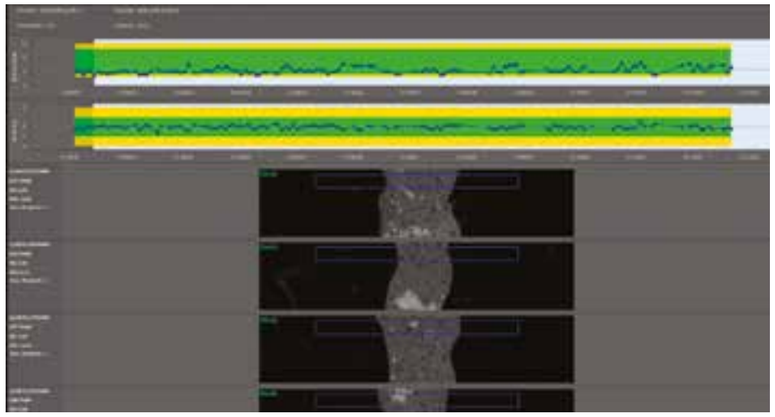
6 It measures the early closing of the inoculant flow, compared to the closing of the stopper, in 1/10 second. The goal is to avoid unnecessary waste of inoculants and sand contamination.

7 In each single acquisition, **ITACA Vision** evaluates possible "pulsations" of the inoculant and it checks that there are no inoculation "holes" that could cause problems especially in case of multi-castings moulds.

8 Everything is clearly and intuitively reported. In **ITACA Vision** Analysis module, every frame is saved for future needs. Inoculation will no longer be a mystery to anyone.

9 Focus and zoom can be adjusted directly from the console. It is therefore never necessary to let the people get close to the liquid metal or stop the system for calibration operations.

10 **ITACA Vision** has its own internal database that contains all the control ranges for each casting. When it is connected to the pouring devices, ITACA Vision automatically changes the working ranges according to the casting in production.



11 **ITACA Vision** can be synchronized with other equipment based on PLC, database, csv file.

12

STAND ALONE VERSION	INTEGRATED VERSION (IN ADDITION)
• Analysis of misalignment, overlay ratio and stopper synchronization • All data saved into the database, with results and video for each mould • Deep analysis module	• With ITACA Stream: automatic pipe rotation on the inoculator device • With ITACA X: all data saved inside ITACA X database for deeper process analysis, warning module and casting code • Autobatch function (change of pattern plate) when connected to ITACA

To prevent any problems related to in-stream inoculation, ITACA Vision can send a signal to stop the pouring line in case of malfunctioning.

TECHNICAL SOLUTION

ITACA | Wire LI

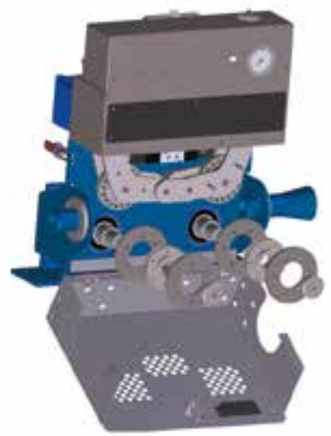
Is the in-stream inoculation enough to restore the right nucleation level of the iron?
In our experience, lots of foundries have "white" iron inside pouring devices. Moreover, some castings could require a higher inoculation level because of thin parts, sometimes affected by inexplicable cementite defects in some castings inside the mould, even after in-stream inoculation.
In this case, the introduction of a new control logic of two-steps inoculation is necessary. **ITACA Wire LI** is especially engineered to help the nucleation inside the pouring basin, before late inoculation.

Taking advantages from the total integration and evaluating the iron quality for the casting in production, ITACA X can decide to split the inoculation process between ITACA Stream and ITACA Wire LI, in order to:

- **Optimize the inoculant consumption, working on the correct timing of the addition;**
- **Improve the mechanical properties, such as hardness and tensile strength;**
- **Reduce the scrap rate in the final casting.**

/ THE POURING PROCESS

ITACA WIRE LI Technical specification



- Siemens PLC system installed in external metal box;
- 10" touch screen display with software, running in manual or automatic mode;
- Dosing unit provided with 2 driving wheels and 2 idle wheels;
- 5 mt connection cable provided with high temperature protection.

DOSING UNIT WEIGHT	100 Kg
INLET AIR PRESSURE	0.5 – 8 bar
CORED WIRE DIAMETER	- 13 mm
MOTOR POWER	0.5 KW
POWER SUPPLY	400 V 50/60 Hz

STAND ALONE VERSION	INTEGRATED VERSION (IN ADDITION)
• High precision wire injection (±0,1%) • Variable injection speed based on pouring flowrate • Possible connection with foundry database • Automatic start and stop (connection with stopper required) • Up to 150 calibration	• With ITACA X: modification of inoculation level based on nucleation of final iron • With ITACA X + ITACA Stream: possibility to split final inoculation to improve addition yield • All data saved inside ITACA X database for deeper process analysis

ITACA | Pyro

- Continuous temperature measurement, one value per mould
- Reading/ Recording temperature for each mould: no loss of information about temperature
- Saving and analysis of historical data;
- Casting Logic: possibility to set different working ranges for different castings in production;
- Integrated automatic calibration system;
- Possibility of Integration with other machines (moulding line, ITACA, ...): a range for each casting is automatically set taking information from the other machines.

The metallurgical process has various factors that can compromise the casting's quality and cause different defects. The pouring temperature is one of these key factors.
Its monitoring and its control allows to minimize some defects like cold junction, sintering, cementite.
ITACA Pyro has been developed to help foundries in continuously monitoring the iron temperature during the pouring phase.
The continuous measurement is important because the foundry has to understand what is happening mould by mould, and not to have a rough idea averaged on a batch or on a shorter or longer time basis.

/ THE POURING PROCESS

The most common system for the monitoring of the temperature is the dip probe, that is universally considered to be an accurate system. Unfortunately, the system thermocouple plus acquisition hardware is a source of variance. There can be even differences of 10°C between 2 measurements taken on the same liquid metal, because of the operator behaviour, immersion time, immersion depth.
ITACA Pyro minimizes the operator interference and automatically updates the current temperature range for a specific alloy or casting (option when connected to ITACA X or pouring devices). Only when the calibration of the emissivity is required, it will request an action from the operator and will automatically verify the current emissivity value, against the temperature measurement by an immersion probe.

HOW DOES IT WORK?

For each alloy, casting family or single casting, it is possible to associate a range of acceptability for the pouring time. During the production, mould by mould, **ITACA Pyro** will verify the temperature measurement alerting the operator by a visual (or acoustic) signal, in case it goes out of range. In addition to the acceptability ranges, it is possible to set the frequency of calibration: **ITACA Pyro** will alert the operator when a new acquisition with dip probe is required, automatically calibrating the emissivity of the pyrometer.
Each acquisition is then saved into the database, making all the data available for any further analysis.

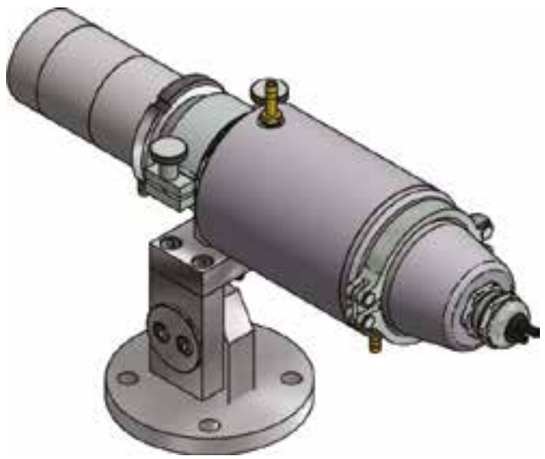
ITACA | Pyro

ITACA Pyro has been engineered in the same environment of ITACA family and its function can be integrated as an important source into the comprehensive metallurgical control system ITACA X. Combining it with other sources of information such as thermal analysis, chemical analysis, sand properties etc., the system allows the clearest monitoring of the metallurgical process.

ITACA PYRO MAIN FEATURES

STAND ALONE VERSION	INTEGRATED VERSION (IN ADDITION)
· Continuous temperature measurement mould by mould · Possibility to define different temperature ranges · Autocalibration mode (when connected to dip probe)	· With ITACA X: working ranges defined in ITACA automatically transmitted to ITACA Pyro · Association in warning module for possible defects · Association into ITACA database for deeper analysis

ITACA PYRO TECHNICAL SPECIFICATION



- Optical Pyrometer designed to measure the temperature of liquid iron;
- Temperature range: 650° - 1700°C;
- Maintenance-free, wear-free;
- Optics with rectangular target spot ensures reliable temperature data even when pour stream position varies;
- Dual wavelength technique yields accurate readings despite smoke or dust in the sight path;
- Sighting options: integrated camera connected to external monitor (coaxial cable);
- Easy and safety set-up;
- High temperature proof metallic case;
- Air cooling and lens-cleaning system;
- Software installed on a desktop PC;
- Predisposition for connection to ITACA X;
- Remote assistance.

ITACA | Quality Check

The quality control is the final production step, just before the castings leave the foundry. The purpose is to verify that all the requirements, given by the final customers, are achieved. Then, how is it possible to connect all the results given by these tests, to the prediction made by **ITACA** system at the production site? **ITACA QualityCheck** is the module dedicated to quality department, especially designed to be connected with **ITACA** Central database. The logic of the system works in two different steps:

1 ANALYSIS OF THE CASTING BATCH

Because of the direct connection to ITACA X database, **ITACA QualityCheck** shows to the operators the production status of the batch they have to analyse. The main screen displays all the alarms related to each specific casting, suggesting which are the main kind of defects that can affect the production batch.

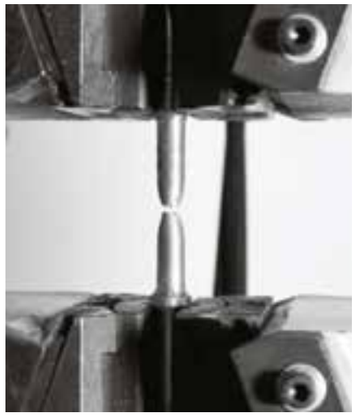
ITACA | Quality Check

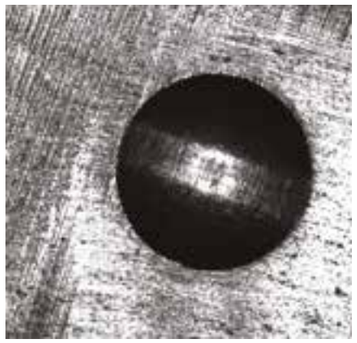
/ THE POURING PROCESS

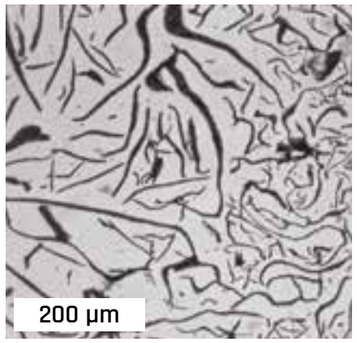
2 INPUT OF QUALITY TESTS

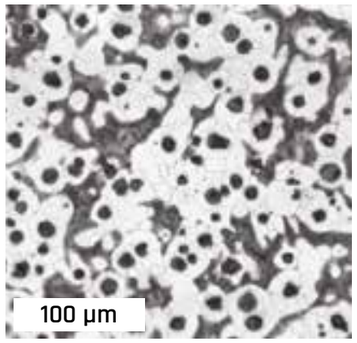
In addition to the visualization of the acquired parameters of production, it allows the insertion of real quality check results, such as:

- Insertion of results from quality tests, such as:
  - Mechanical Properties;
  - Visual checks;
  - Hardness test;
  - Videos;
  - Penetrant Liquids;
  - Micrographies;
  - X-ray;
  - Ultrasound.
- Connection with SAP/ERP system:
  In this way it is possible to have an history of the casting behaviour, making all the data traceable and available also in production, and it helps the foundryman to easily make the correlation between the results of production process parameters with the real defects found at quality department.









Thus, ITACA Quality Check plays an important role in integration, continuous control, traceability and knowledge transfer.

NEVER ALONE: ITACA CARE

Since 2002 our focus has been to improve processes within the foundries. Over the years we have gathered both knowledge and experience in a wide range of disciplines, that we share with the foundry industry.
Our resources for Technical support of our customers are focused on strong local presence by our partners and backed by international experts. We have seven metallurgical engineers and eight IT engineers and a fully equipped metallurgical laboratory in our premises in Italy.

All our customers with support agreements have access to **ProserviceTech** Assistance Centre and to ITACA Care (a service dedicated to ITACA users).
ITACA Care is included for the first year after the purchase of all our systems, which gives you access to the following:

- **Support by phone;**
- **Remote assistance;**
- **Calibration of hardware if required, via remote connection;**
- **Annual software updates;**

This is a modern tool which affords real time knowledge of the status at our customers. Through the ProserviceTech Assistance Centre and ITACA Care, our engineers can access to our customers systems and quickly solve issues, regardless of their location.

ITACA | Quality Check

/ THE POURING PROCESS

ITACA Care service provides a specific amount of hours that can be used, according to the customer needs, for the following activities:

- Technical assistance on hardware and software;
- Process and metallurgical consultancy: the hours included in the maintenance agreement can be used to involve ProserviceTech engineers on process evaluation and analyses, taking advantages from knowledge, experience and dexterity on software usage;
- Cooling curves analysis;
- New algorithms development;
- Software customization: continuous development and improvement on software and its interfaces allow the customer to interact with the development of algorithms and other parts of the software, in case of specific customization customer oriented.

The development of **ITACA** has been possible because of the close cooperation that ProserviceTech has with all its customers.

DEVELOPMENTS MADE ON ITACA systems, starting from ITACA8 presentation

06/2011: Presentation of ITACA MeltDeck and ITACA8;

11/2011: Development of connection with spectrometer;

09/2012: Development of "Procedure" module for ITACA MeltDeck;

07/2013: Development of "Broken Sample" algorithm for thermocouple failure detection;

08/2014: Development of "Correction" module for ITACA MeltDeck;

11/2014: Development of "Perlitizer Calculation" module for final iron;

02/2015: Development of "Multi-Ladle Correction" module;

04/2015: Development of "My-ITACA" (system for remote view with portable systems inside the foundry);

06/2015: Presentation of ITACA X;

01/2016: Algorithms development for Hi Carbon and Ni-Hard alloys;

08/2016: Software implementation for connection with automatic dosing machines;

02/2017: Improvement on ITACA remote display with "Input" module, to control ITACA systems;

06/2017: Introduction of QR code module creator, for an easy data traceability and spectrometer correlation;

11/2017: Development of new analysis module in ITACA system: Data Viewer, Data Trend, Curve Comparison;

06/2018: Development of ITACA Charge;

11/2018: Development of "Acknowledge" system for operators input tracking;

02/2019: Development of CGI production algorithms.

THE BOTTOM LINE

Ensuring the process quality is not only "good", but meets the requirements of the castings to be produced, eliminating the unnecessary material waste and process inefficiencies. In other words, it will lead to lower production costs, increasing the foundries competitiveness.
The combined effect of greater control, traceability, less scrap or rework has a greater focus on sustainability and will help the environmental impact of your foundry.

FOUNDRIES HAVING CHOSEN ITACA

AFC
ORTRANDER Guss um Guss
SANDFITS
SABI GROUP FOUNDRY MACHINING
pgo
Wm Lee
VDC A VDP COMPANY
fagorederlangroup
TRAKYA DÖKÜM
FONDERIA ZARDO
LH Luitpoldhütte
DRAXTON Mobility inspired

ITACA QUALITY CHECK
ProserviceTech INNOVATION IN FOUNDRY PROCESS

ITACA | DYNAMIC DOSING & CONTROL

made by **palazzinacreativa.it**

ProserviceTech
INNOVATION IN FOUNDRY PROCESS

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