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TÜYAP Fair, Convention & Congress Center, İstanbul
8. Uluslararası Döküm Kongresi / 8th International Foundry Congress by TUDOKSAD Academy
In conjuction with Ankiros / Annofer / Turkcast fairs

«Vaka Çalışması: Proses Kontrol Çözümleri İle Çekinti Hatalarını Önleme»

«Case Study: Shrinkage Reduction Strategy»

Nicola Segreto
(ProService Srl, Italy)

4.Oturum: Döküm Teknolojileri Kalıp

4th Session: Moulding Technologies

Oturum Başkanı/Session Chairman: Bülent Şirin (Componenta Dökümcülük Tic. San. A.Ş.)

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innovation in foundry process control

Strategy for reducing shrinkage defects in automotive castings

Mr. Nicola Segreto
ProService Srl, Italy

Background

Ortrander Eisenhütte GmbH

Production of

Grey iron
Ductile iron
Compacted graphite iron (CGI)

Within

Automotive, cookware and oven parts

Annual production ~35 000 MT

Background

4 x 6 MT induction furnaces

3 x DISAMATIC moulding lines

Cored wire treatment process

Automatic pouring system

Stream inoculation

Integrated Process control

Background

Historical micro porosity on CGI automotive castings (pressure plate)

High scrap rates (~18 %) on certain parts, others low (< 2%)

Strategy implemented to reduced defects involving:

- **Integrated process control with Thermal Analysis**
- **Trial based approach finding optimal working range**
- **Procedure for maintaining optimal process window**

Why is Thermal Analysis important?

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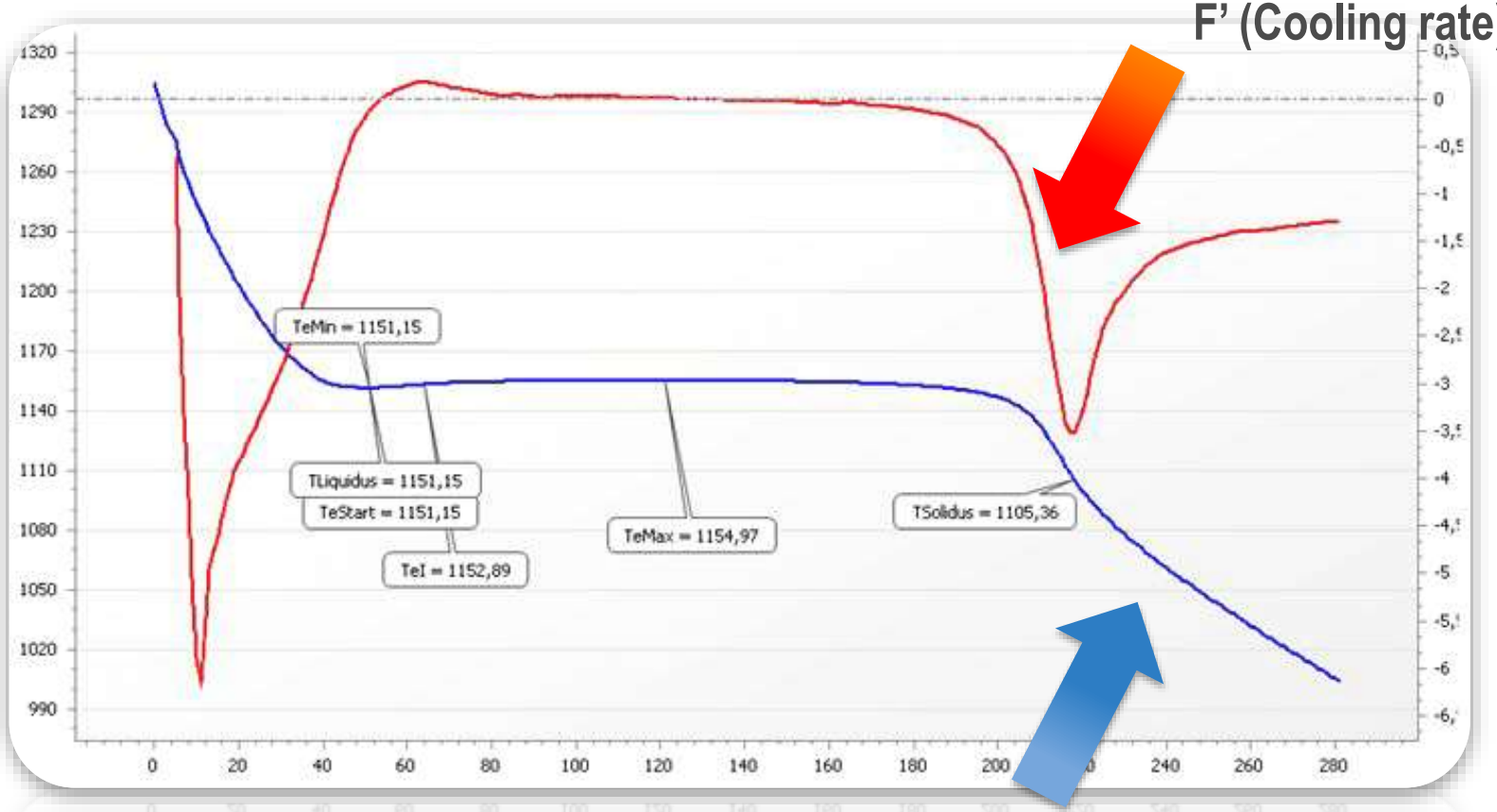
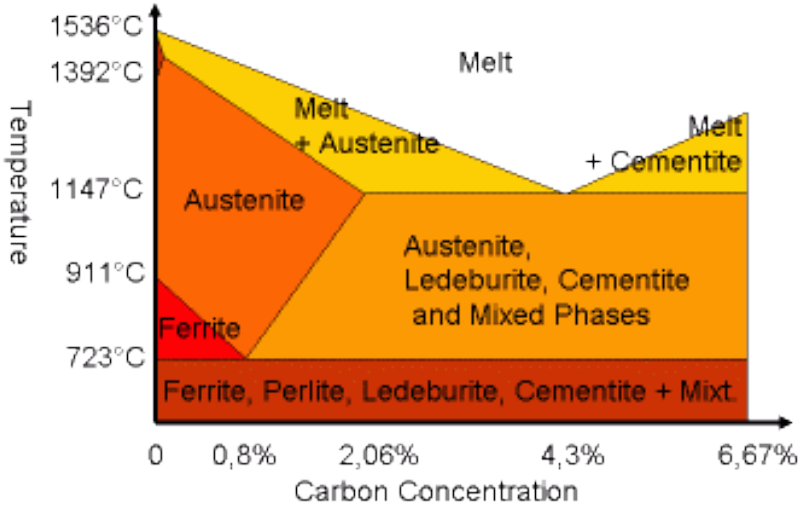
Red Curve:
F' (Cooling rate)



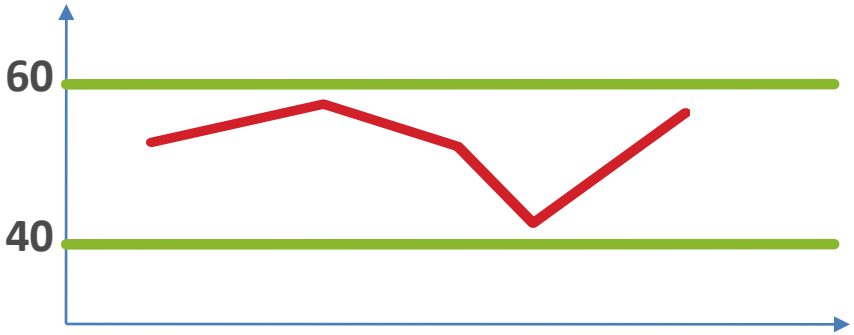
Blue Curve:
F (Temperature)

Position on Fe-C diagram, HEH



Eutectic as a segment … not a point!

All eutectic irons,
but with **different metallurgical behaviors**

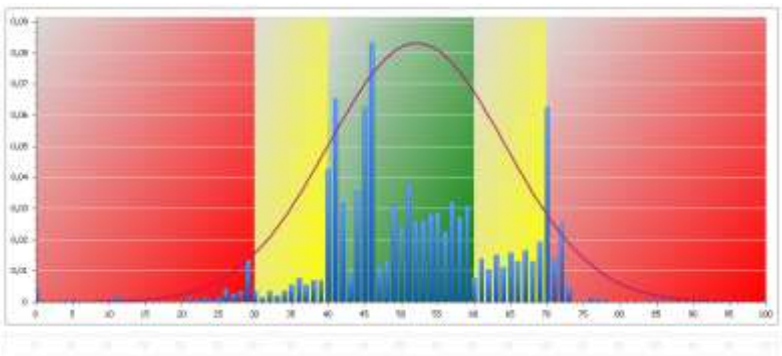


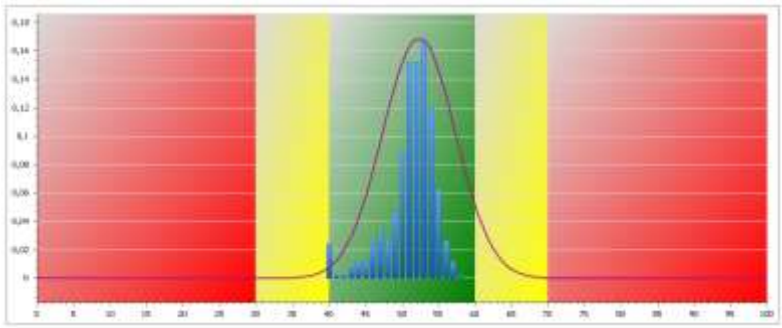
Position on Fe-C diagram, HEH

The starting point for optimization
is a stable process.

How to determine if the process
is stable?

Process analysis applied for HEH





Typical process variation for traditional process control vs Integrated process control

Stable process?

The alloy was operated in the eutectic segment in the base iron

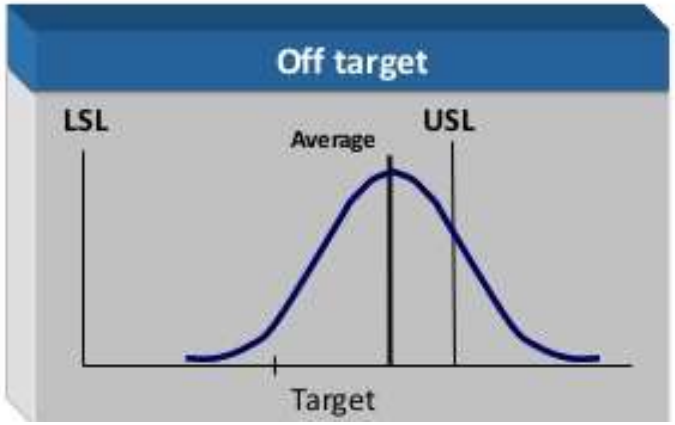
High stability in chemical & thermal parameters

Generally high Recalesence

Nucleation levels good

But even a **CAPABLE** process can be **OFF TARGET** and is thereby not optimal

Incapable process



Capable but Off target

Trial based approach

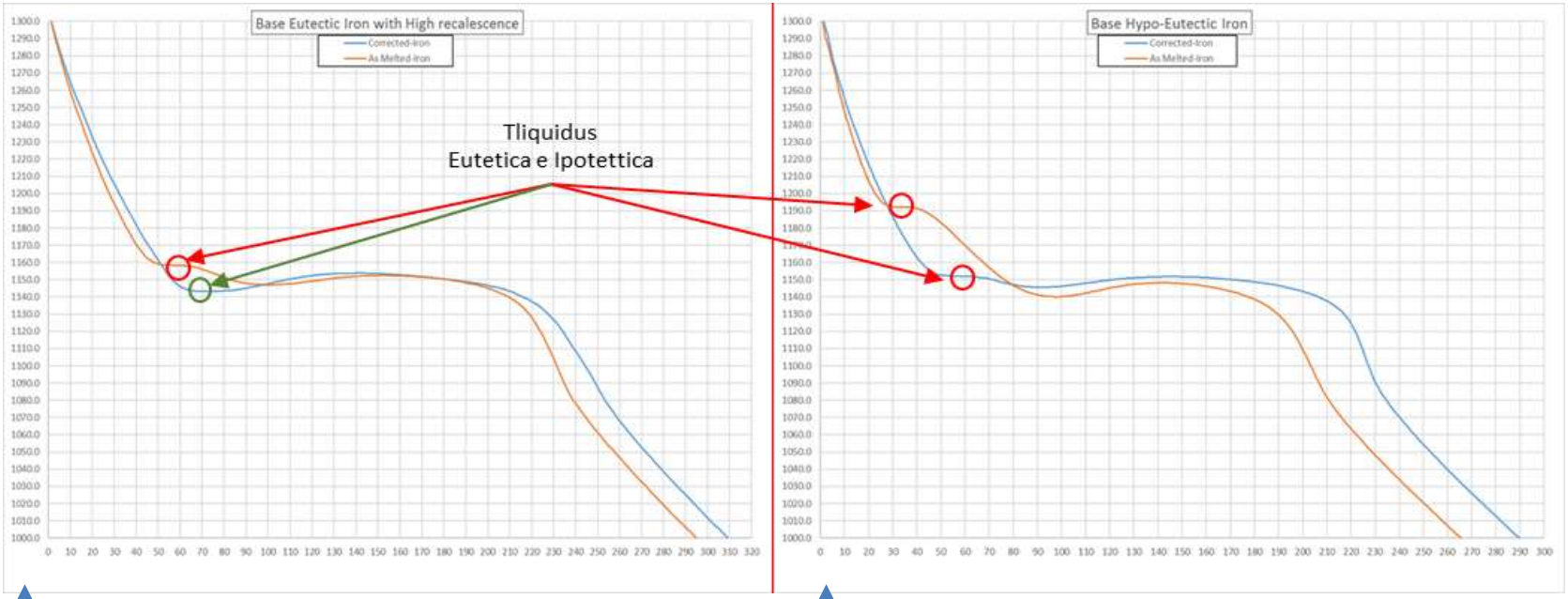
Good process control but wrong **PROCESS TARGET** for the particular casting caused the shrinkage defect

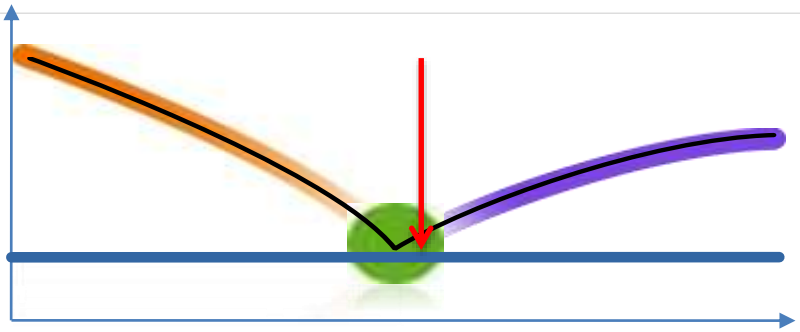
Experience led to the reduction of **HEH** (position on phase diagram) in order to modify solidification behaviour and find optimal working range

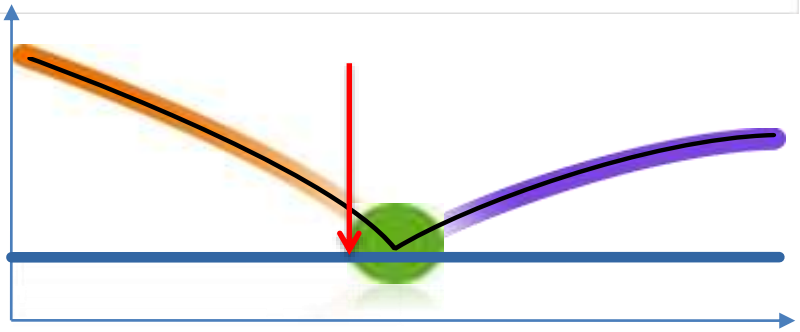
Eutectic -> Slightly Hypo eutectic in the base iron

Trial based approach

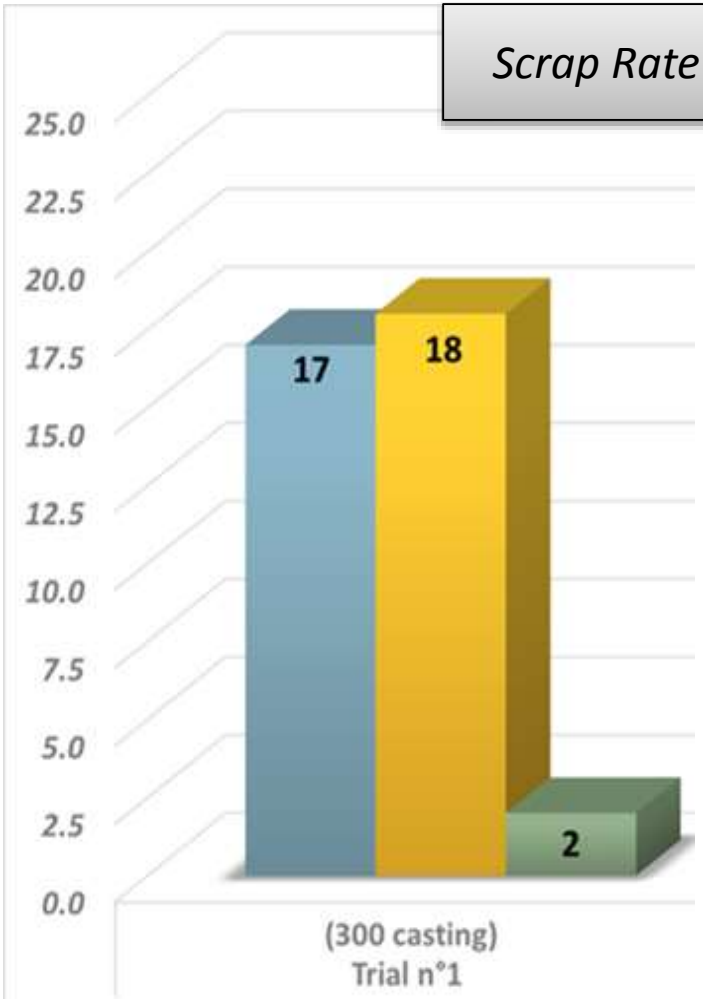
Transition from Eutectic to Slight Hypoeutectic solidification







Trial based approach



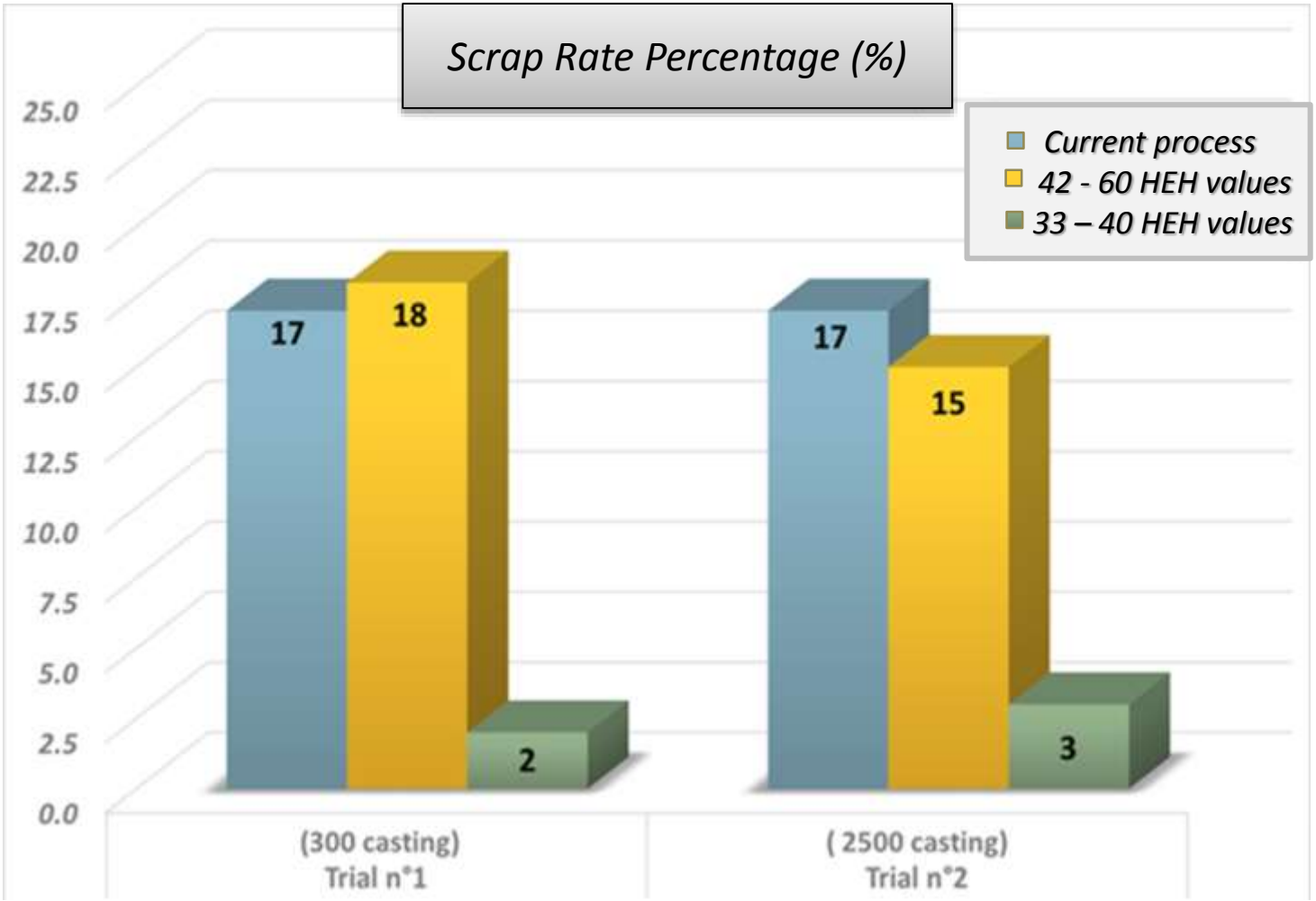
Trials conducted to move the process and to modify the solidification on small small series in two steps

Significant reduction of defects found in one area

Trial expanded to larger volumes

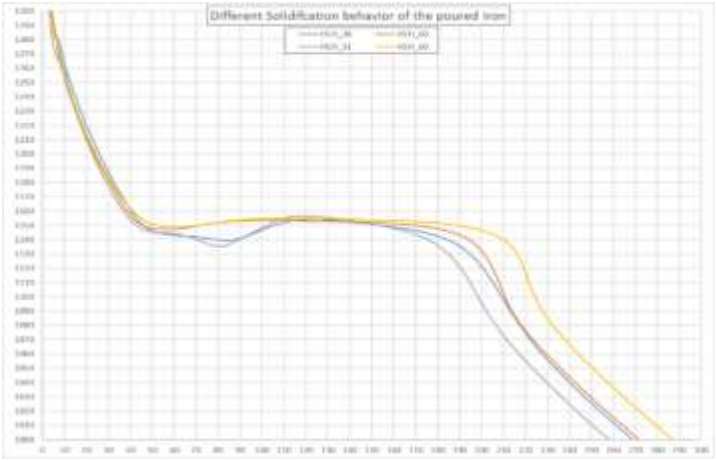
- *Current process*
- *42 - 60 HEH values*
- *33 – 40 HEH values*

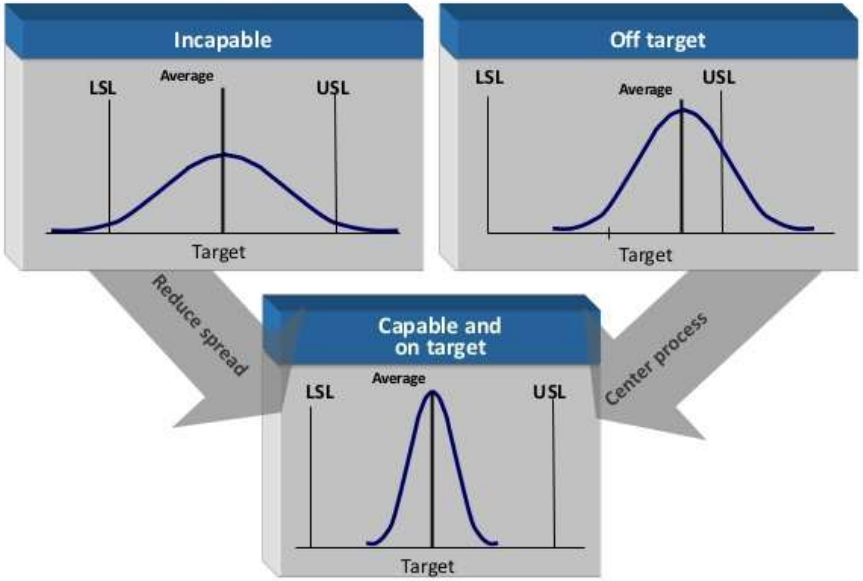
Trial based approach



Results of trial

Trial at large volumes confirmed the **correct working range** had been found for the current casting





Furthermore the integrated process controll allowed operation in a narrow range as both **CAPABLE** and **ON TARGET**

Optimal working range

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Repeated for similar castings

Three significant ranges were found for final iron

Note there is **not one unique solution** for all castings

Implemented in the process control logic as Procedures

Fe-C Diagram Position	GJV/GJS			HEH Values
	Mod. A	Mod.B	Mod.C	
Hypo				<40
Low Eutectic				40 to 50
High Eutectic				50 to 60
Hyper				> 60

Red	High defect risk range
Yellow	Medium defect risk range
Green	Target working range

Process control - Procedures

Procedures with the required specification guide the operators

Process control - Control logic

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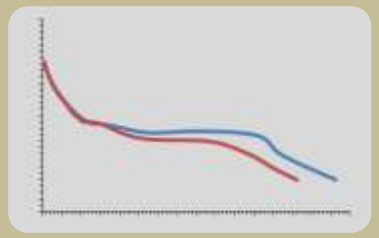
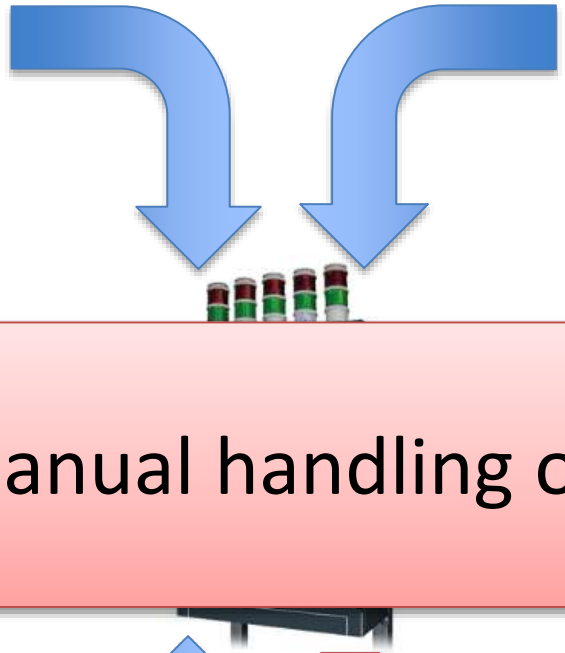


Thermal Analysis



Process Targets

Chemical An

aterials
raphite etc)

No manual handling of data!

Weight in furnace

Output: Correction recipie

5.7 kg Graphite
8.4 kg FeSi
4.3 kg FeMn
Etc.

Process control - Output

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Integrated process analysis transferred into simple actions with full traceability

Output: Correction recipie

5.7 kg Graphite
8.4 kg FeSi
4.3 kg FeMn
Etc.

So, why is integration and automation important?

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Standardized working behaviour

Full control of the process

Reduced operator influence

Reliable process data

Ensures traceability

Gives us a foundry the tools to reduce defecs and optimize the process!

Our target

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Our ambition is to turn your foundry into a **Smart Foundry**

ProServiceTech

innovation in foundry process control

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