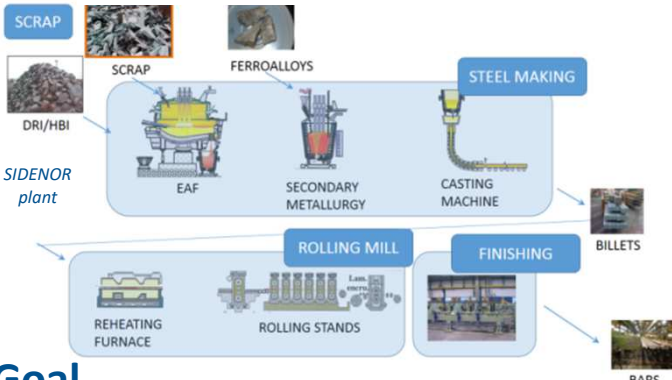


COCOP Steel Pilot case

Steel making process



Goal

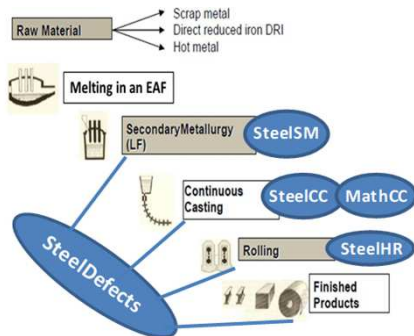
The aim is to develop a steel manufacturing plant-wide monitoring and advisory tool in order to reduce the surface defects in micro-alloyed steels in as-rolled state, assuring a good performance of the related sub-processes (secondary metallurgy (SM), continuous casting (CC) and hot rolling (HR))

Use Cases

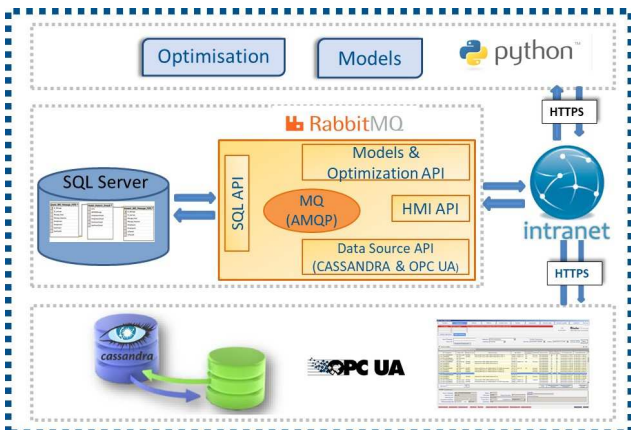
Name	Goal
SM Planning optimisation	Provide optimal values of the SM parameters to minimise final defects and get a good castability index
CC Planning optimisation	Provide optimal values of the CC parameters to minimise final defects and achieve a good temperature of the billet before the straightener
HR planning optimisation	Provide optimal values of the re-heating furnace & HR parameters to minimize final defects and get a good temperature of the billet during the hot rolling
On-line alarm tool in SM	Alarm system when the prediction for the number of defects and/or the castability index are not good
On-line alarm tool in CC	Alarm system when: i) predicted defects on final product, ii) temperature of the billet before the straightening is not good, iii) the thickness evolution at the output of the mould is not good to avoid a break-out, or iv) there are differences between target and real parameters
Off-line tool for defect prediction	To predict defects on final product after continuous casting based on real process data of the SM and CC
Off-line tool for validation & consult of defect prediction	To compare the defect predictions based on real process data with the real performance (validation of the tool) and to allow analysing which would have been the best process parameters to avoid them (process improvement)

Models

- Model **SteelSM**: data based model to predict the castability index of a heat after the SM process, a critical parameter regarding steel quality
- Model **SteelCC**: data based model to predict the temperature of the billet before the straightener during the CC process
- Model **MathCC**: mathematical model to predict the thermal and solidification evolution along the CC process
- Model **SteelHR**: data based model to predict the temperature difference between the head and tail of the billet before the continuous rolling mill
- Model **SteelDefects**: to predict the surface defects generation in the final product. It is defined by the parameters of the three sub-processes (SM, CC and HR) with the greatest influence on the occurrence of such defects



Architecture



Coordinating Optimisation

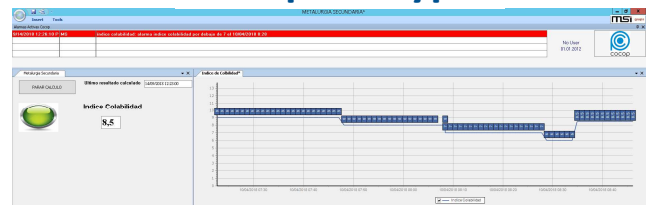
The goal is to find the best combination of values for the key defect-related parameters that minimise the generation of surface defects in the final product assuring a good performance of each sub-process

Coordination Layer to assure a good global performance

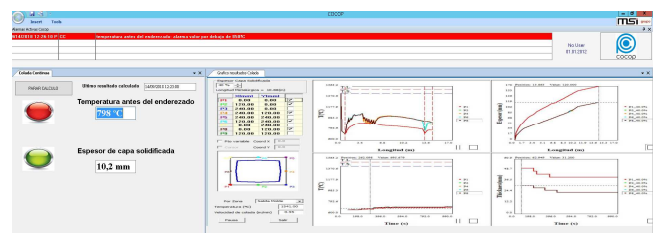
- Use model **SteelDefect** in order to get the optimal values of the key defect-related parameters for each sub-process that minimise the defects
- Optimize the parameters of each sub-process (using the models **SteelSM**, **SteelCC** and **SteelHR**) to obtain a good performance, considering as constraint the optimal values of the key defect-related parameters

Model SteelSM (data based model)	Model SteelCC (data based model)	Model SteelHR (data based model)
Optimisation: Maximise the castability index	Optimisation: Minimise the difference between the target and real temperature of the billet before the straightener	Optimisation: Minimise the <i>billet head-tail temperature difference</i> before the continuous rolling mill
Model SteelDefects (data based model) Optimisation: minimise the number of surface defects		

First prototypes



On-line alarm tool in secondary metallurgy



On-line alarm tool in continuous casting process