

**ANN(Artificial Neural Network) based Smart Factory System for Continuous Casting**

*On-line Prediction of Qualities and Origins of Defects*

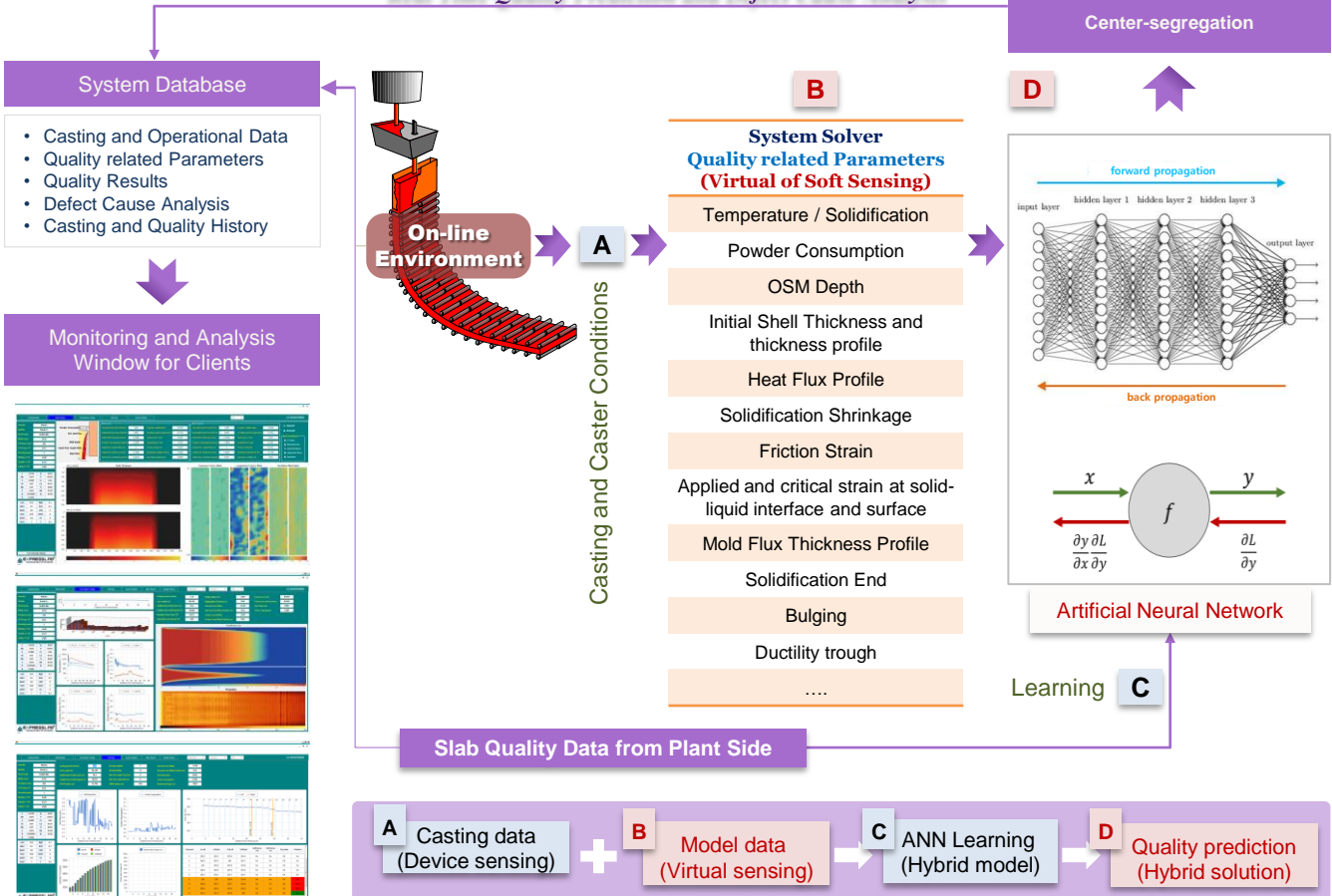
**CC-EYE** offers a function of advanced on-line monitoring of quality related parameters, cracks, and central segregation during continuous casting. It may predict surface crack very accurately using the feature parameters from the system and artificial neural network. It also gives on-line prediction of the origins of defects and casting abnormalities, and it is easy to check whether these problems are solved. Eventually, the basic framework for Smart Factory System for continuous casting can be constructed.

**ANN based Expert System for Continuous Casting**

- Predicting Qualities by Artificial Neural Network Learning Model
- Real time Check of Casting Conditions & Quality Index
- Check History of Casting Conditions & Quality Index
- Scarfing/Grinding Decision Guide
- Finding Cause of Defect and Solution Guide
- Data Management of Casting Information and results

Quality Prediction
Internal Crack
Surface Crack (Transverse, Transverse Corner, Longitudinal, Longitudinal Corner)
Center-segregation

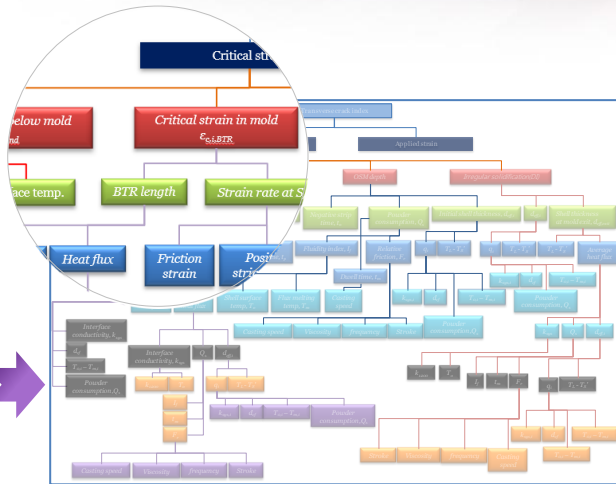
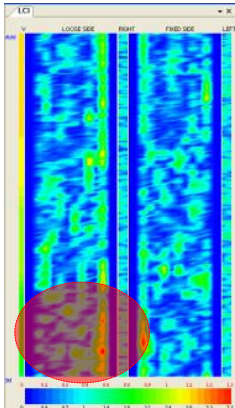
*Real Time Quality Prediction and Defect Cause Analysis*



**Right Solution of Smart Factory for Continuous Casting!**

## Cause Analysis and Reporting

### Quality Index



### Casting/Quality Parameters Check

- Checking Min/Max values
- Checking normal range or not
- Checking abnormal variation

#### Casting parameters

TC temp., heat flux, casting speed, mold level, stroke, frequency, powder, SEN flow, N/Z flow, SEN depth, mold friction, mold cooling water flow, 2ndary cooling water flow, cooling water dT, roll gap, cylinder force, etc.

#### Quality parameters

powder consumption, OSM depth, level fluctuation, initial shell thickness, irregular solidification, initial heat flux, heat flux variation, shrinkage, surface crack initiation, bulging, S/R matching, ductility trough with temp. etc.

### Cause Analysis

- Summary of abnormal parameters
- Finding main parameter of the problem
- Evaluating parameter change effect

#### Quality Index

internal crack, transverse crack, corner crack, longitudinal crack, center segregation

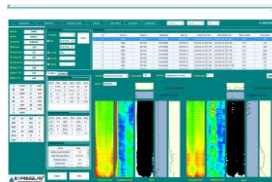
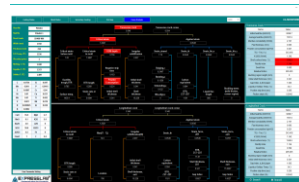
### Reporting

- Systematic reporting based on slab position
- Guidance for precise scarfing/grinding decision

### Advanced Monitoring

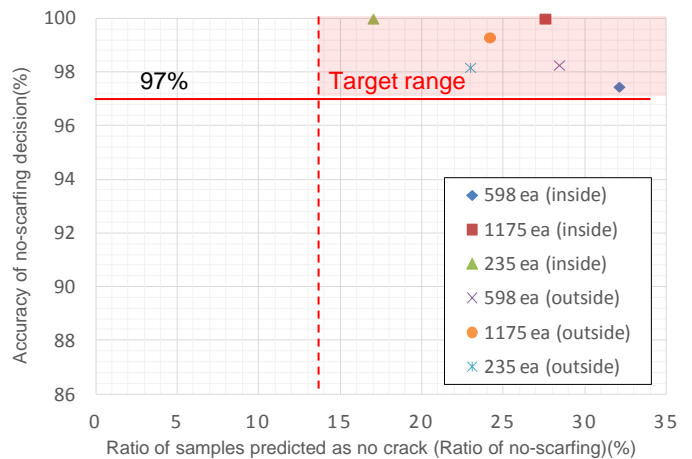


### Cause Analysis



## Benefits

- Maintaining optimum casting condition by constant real-time monitoring of slab qualities and casting condition
  - basic platform for defect-free slab casting and highly efficient casting operation
- Expected profit from minimizing the defect ratio of each steel grade
- Reducing the required time for problem solving
- Reducing the cost for trial and error by drawing optimum casting condition through carrying out off-line simulation before new steel grade production
- Reducing the cost of scarfing loss by predicting surface crack for precise scarfing decision



No-scarfing decision by predicting surface corner crack in slab

## Requirements

- System server : HP DL380 or higher
- Database S/W : Oracle or MS-SQL
- Network : TCP/IP networking with Level2 and Level3 system
- Client PC : Desktop or Notebook PC
- Operating system : Windows Server (32/64 bit)
- Can be changed by
  - situation of inventories at ordering time
  - user requirements

