

IISCO STEEL PLANT, SAIL, BURNPUR



Presenter Details





Academic Profile

• B.Tech (Computer Science & Engg.) NIT-Delhi

Ravi Shanker

- Pandey
 Senior Manager (Computer & Automation)
- IISCO Steel Plant, Burnpur
- Steel Authority India Limited
- 10+ Years of Experience
- 20+ Papers
- 12 Copyrights (5 Granted + 7 Under Process)
- 2 Patents (Under Process)

RESEARCH INTERESTS

- Emerging Technologies in iron making
- Process Modeling
- Industry 4.0 & its role in steel manufacturing
- Carbon footprint reduction
- Green Steel

AREAS OF EXPERTISE

- Process Automation
- Blast Furnace Technologies
- Process Modeling
- Digital Transformation
- Industry 4.0
- Computer Programming

AWARDS & ACHIEVEMENTS

- SAIL-Corporate Excellence Awards 2021 under **Innovation Architect for Digital Transformation** Work in Iron making at SAIL-ISP
- Winner of Director's Cup for Young manager.
- CEO Excellence Award Winner
- Consecutive 7 years Jawahar Lal Nehru Team Award Winner.
- IIM ATM Best Oral Presentation Winner



Digital Twin: Introduction



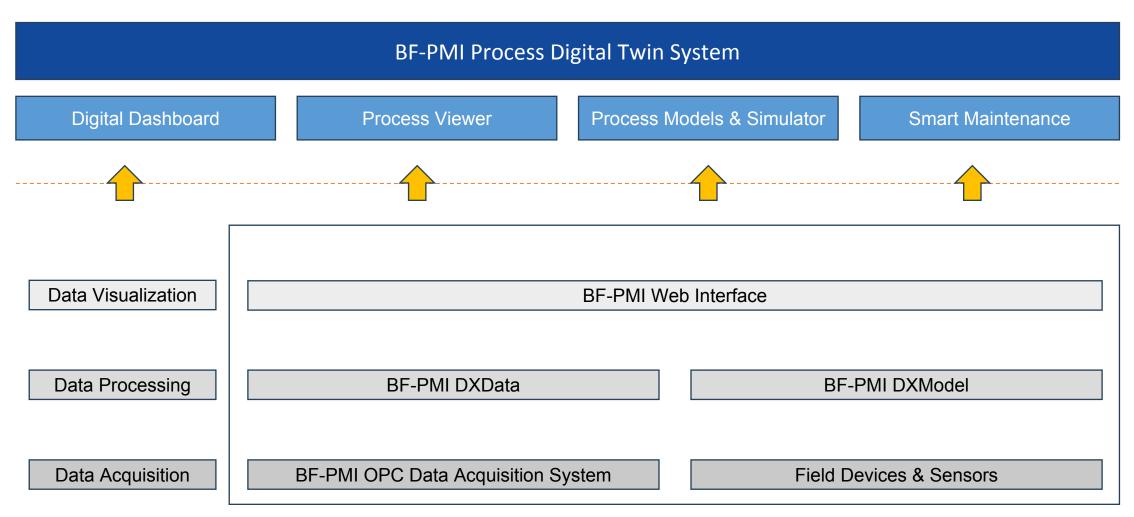
- A digital twin is a virtual representation that serves as the real-time digital counterpart of a physical object or process.
- Type of Digital Twins:-
 - ✓ Component Digital Twin
 - ✔ Asset Digital Twin
 - ✓ System Digital Twin
 - ✔ Process Digital Twin

At **Kalyani Furnace (BF-5)** of ISP, our dedicated in-house team has developed and implemented a sophisticated Digital Twin system called as the "Blast Furnace Process Monitoring Interface" (BFPMI). This advanced system offers a comprehensive and integrated view of the entire blast furnace process. It features an enriched dashboard, an intuitive process viewer, and in-house implemented process models and simulators, all designed to improve operational efficiency and aid in decision-making.











BF-PMI: Digital Dashboards



Digital Dashboards

- Comprehensive Overview: Provides a real-time snapshot of complete furnace operations through a single-page interface.
- Data Consolidation: Integrates data from multiple modules, presenting it in an intuitive and visually appealing format.
- Key Parameters Highlighted: Displays essential process, production, techno-economic, and quality metrics in one centralized location with enriching graphics.
- Enhanced Monitoring: With integrated dashboard for both Process & Quality it facilitates easy monitoring for concern personnel, enabling quick decision-making.





BF-PMI: Process Viewer



Process Viewers

- ✓ Detailed Performance Tracking: It provides detailed tracking of various Process through single point interface to monitor performance of various units within the blast furnace.
- ✓ Comprehensive Coverage: Incorporates detailed tracking of critical areas such as the furnace proper, stock house, cast house, stoves, SGP, GCP, CDI etc.
- Real-Time Insights: System provides real-time insight in different units of BF through BF-PMI-DXData module by taking feedback from various models and metallurgical calculations module.
- ✓ Systematic Alerts: Delivers timely notifications regarding various process events or anomalies, enhancing response efficiency.

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			(A) ISP	BF-PMI DIGITAL DASHEGARD	DASH BOARD HO	WE - THERMAL - U		TS TRENDS CEWMS		
			ISP	RIASTI						
	FURNACE TOP			BEASIL			OPERATIO		RADAR & PRO	
Top Pressure		2.32 [Kg/cm2]	Blast Pressure		3.74 [Kg/cr		Delta Pressure	1.42 [Kg/om2]	Stock Level[1]	-1.58
Top Temp.		118 °C	Blast Volume		6102 (Nm3/r		BCY	8427.43 [Nm3/min]	Stock Leve(2)	-1.58
Eta CO		46.2	Blast Temp		1175.1 '0		RAFT	2091.1 °C	Mech. SLI	-1.48
C0[%]		24	O2 Flow		10012.4 (m)		O2 Enrichment	2.1%	Stockrod Avg.	-1.55
C05[%]		20.6	Blast Energy		15339.14 [Kg.)		Tuyere Velocity	290.86 [m/sec]	PW	0.93
N2[%]		52.3	Blast Humidity		17.6 (g/Nm		Throat Gas Speed	0.93 (m/sec)	CWI	1.05
H2[%]		42	Top Gas Volume		9217.17 [Nm3	liming	Furnace Gas Speed	2.37 [m/ses]	Total Spray	-12,87
	CHARGE DATA			PERMEABILI	TY INDEX		HEATLOAD		STOCK HOUSE BUNK	
Charge No		20	Upper K		0.57		S2-R2 Heatload	10486	Pushing Coke Level	66.72 %
Charge Time		10-2024 12:14:28	Upper K[%]		23.35		B2-S1 Heatload	3577	Yard Coke Level	74.27 %
Charge Speed [1 /5 / 10]		13.9 / 13.4 [Min/CH]	Niddle K		0.39		H1-B1 Heatload	2507	Sinter Level	70.24 %
Ore Base 112.29 [Ton]			Middle K[%]		15.88		Horizn. Heatload	837	Small Sinter Level	63.31 %
Charge Volume 117.28 [m3]			Lower K		1.48		Body Heatload	14963	Additives Level	41.97 %
O/C Ratio		3.94	Lower K[%]		63.66		Total Heatload	16570	Ore Lump Level	80.67 %
Burden Level		1.4	Total K		2.44 [100]	%]	Raceway Length	2.29 (Mtr)	CDI Rate	44.1 TorvHr
	Skin & Stack Average			Skin & H	earth		Zonal Heatload &	Tao Hole Data	Above Burden	Probe
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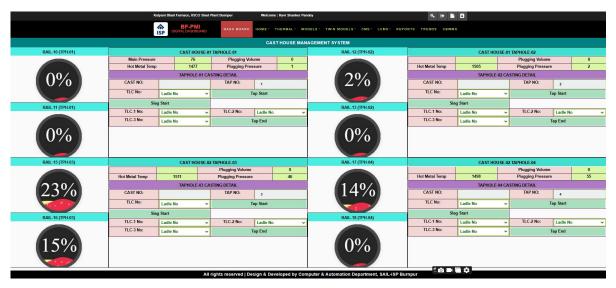


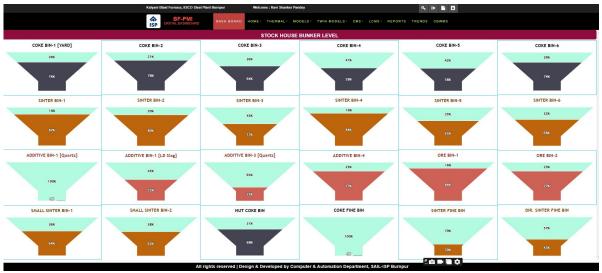
BF-PMI: Process Viewer



Process Viewers

- Cast House Management: The System connected with HM_Liquid Level Tracking Model helps in efficient casting practices by generating detailed casting reports and further connected with ladle management system to ensure cast-wise hot metal linking with SMS.
- Raw Material Tracking: The System track the movement of raw material in/outside the blast furnace. It tracks input material of Coke from COB, Iron Ore Additives from RMHS & Sinter from Sinter plant. As well as batch-wise charging material and fines generation in BF-5







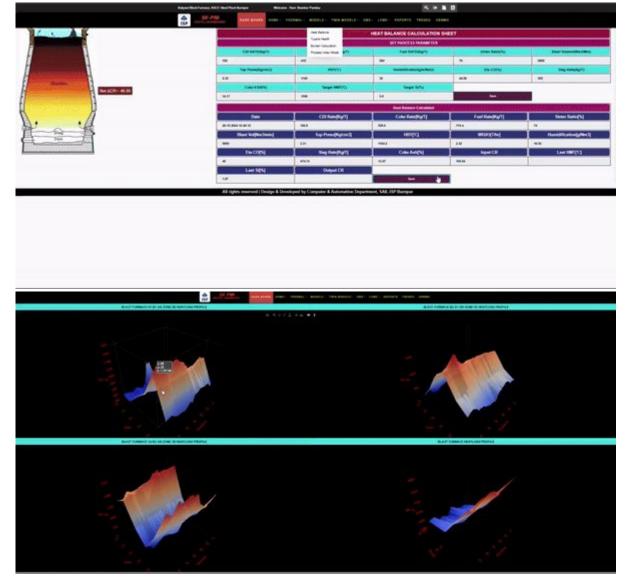
BF-PMI: Process Models



Process Models

The BF-PMI System includes 11 In-house developed process models. The Models implemented in-house have been done based on the research and detailed study of the data and various process behaviours observed in operation of large blast furnace.

- 1. Operational Index Model
- 2. Burden Calculation Model
- 3. Burden Distribution Model
- 4. Shaft Track Model
- 5. Heat (Energy) Balance Model
- 6. Stave Condition Monitoring Model
- 7. Heat Flux & Raceway Model
- 8. Tuyere Health Management Model
- 9. Cohesive Zone Prediction Model
- **10.** Hearth Management Model (DCI)
- 11. Hearth Liquid Level Model.

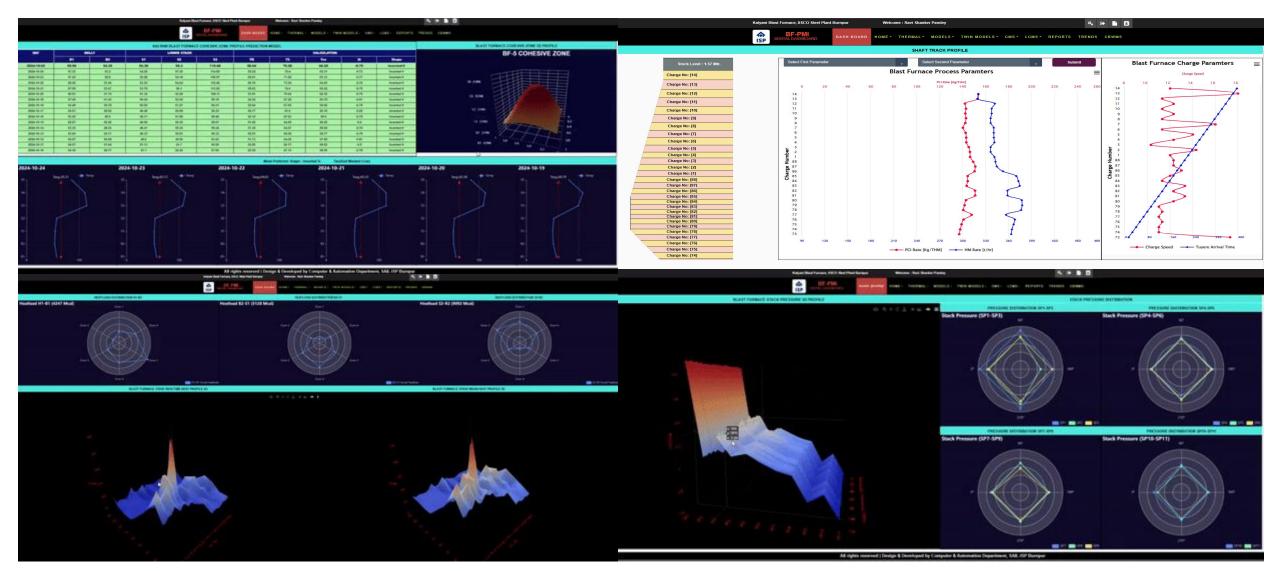






BF-PMI: Process Models (Snaps)





BF-PMI: Process Simulator



- **Purpose**: To enable scenario testing and performance optimization without impacting production. The System Incorporates 14 controllable process parameters for comprehensive analysis.
- Methodology: By analyzing over three years of process and quality data, we utilized an AI-based Data Correlation Model to establish the relationships between the operator-controlled parameters and their direct impact on the overall process.

• Benefits:

Great Place To Work。

Certified

Process Simulator

- ✓ Techno-Economic Analysis: Offers insights into techno-economic impacts of different scenarios.
- Productivity Metrics: Measures productivity variations under different conditions.
- ✓ Mathematical Calculations: Conducts various calculations to identify potential issues.
- ✔ Corrective Actions: Facilitates timely interventions to optimize furnace performance.

	LSP	1						
			Blast Furnace Pr	ocess Simulator				
	Blast Famace Simulation Param	aters)		Blast Furnace Process Simulation Result				
Parameter Norme	Simulation Value	Prev Simulation	Current Volue	Result Paranter None	Resulted Result	Actual Value	Deviation	
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One % in Burean	Tage Card Street	15	15	Fuel Rate	BOT 28 Kg/THM	\$45.28 Kg/THM	44	
Pellet % in Burden	Tage 5.10 P		0%	Production Rate	228.11 Texator	202.42 Tenter	* 6.69	
COI Flow	Target CD FIL	e Tenter	42.8 Ton/W	Productivity	1.19	1.05	+6.84	
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Blast Pressure	Sept there is	# (Highwood)	Sa parad	Top Dan Volume	\$124.35 pan lower(REDARK Democracy		
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Sileon in HM	Target Marcell	45.	0.44%	Raceway Longth	2.12 Mater	2.12 Meter	- 8	
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	a Kapan	Died Farmers, \$1600 Stand Pr	el Remper - Melanne : Ravi Stanler Paulog							
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Raft	2216.45	-0	Personal	2004117		Saul 1	Metalli	10		
Blast Pressure	2.60	Katon ^a Katon ^a	1.19	1.14		1.16	4.73			
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IISCO STEEL PLANT, SAIL,



BF-PMI: Smart Maintenance



Condition Monitoring & Life Cycle Management

Comprehensive Monitoring: Integrates all critical equipment onto a single platform for real-time asset health assessment.

Alert Generation: Automatic alerts for each piece of equipment based on deviations in key performance parameters. Alerts are sent via Telegram for immediate notification of abnormalities.

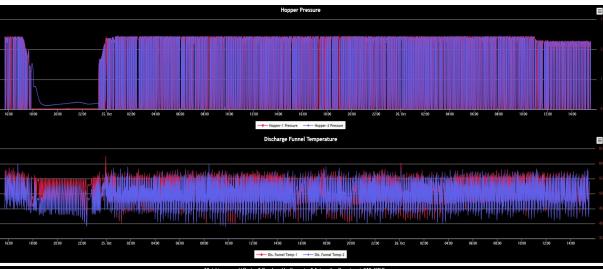
Maintenance Logs: Digital documentation of maintenance, cleaning, and inspection records for all critical equipment.

Access to Documentation: Digital access to SOPs, SMPs, and key equipment drawings, including recent modifications and maintenance updates.

Data-Driven Insights:: Utilizes data to detect potential failures and conduct predictive analysis for proactive maintenance.

Alert System for Lifecycle Exceedance: Generates alerts when equipment lifecycle limits are approached or replacement is required.





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BF-PMI: Reports & Graphical Trends

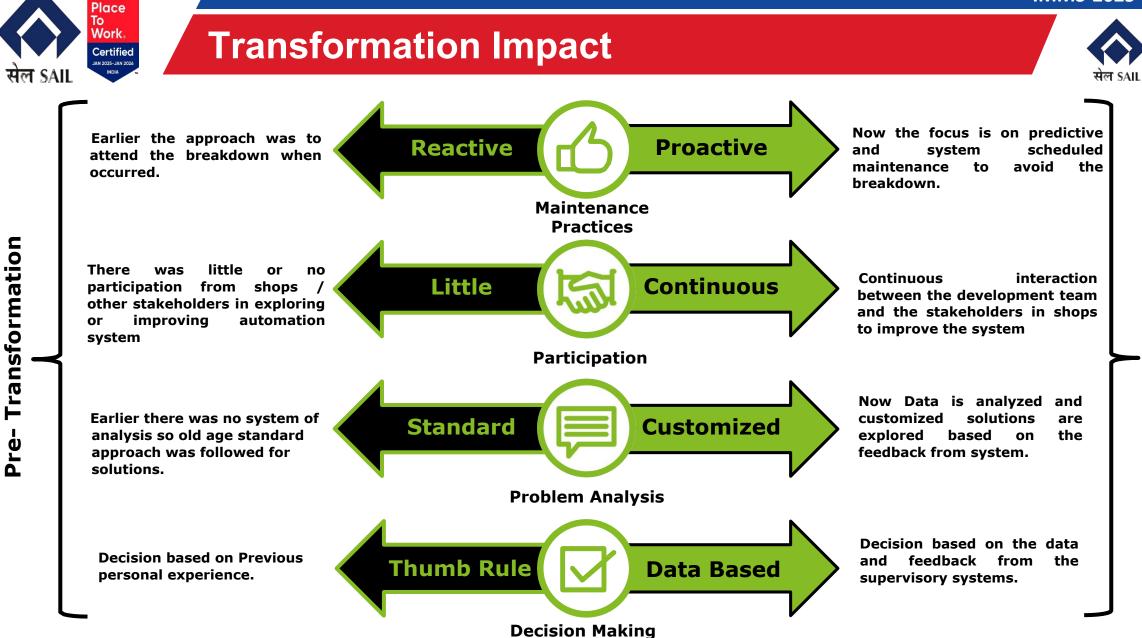


Reports & Graphical Trends

- **Reports**: Over 20+ reports available, including batch-wise, cast-wise, shift-wise, and day-wise, covering process, production, quality, maintenance, and consumption.
- Graphical Trends:
 - ✓ Parameter Monitoring: Over 1,800 parameters tracked, providing comprehensive insights.
 - Frequency of Data Collection:Data collected at intervals ranging from 1 second to 2 minutes, depending on criticality.
 - Access and Duration: Accessible via the web / Mobile App for historical data spanning 6 months to 3 years.







IISCO STEEL PLANT, SAIL,

Great

Post

Transformation

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THANK YOU

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