



**Table 1 — CSR - TDE-LF™ Implementation Levels**

TDE-LF™ can be deployed at three progressive implementation levels, depending on the customer’s objectives, available data and desired degree of plant integration.

**Integration level:**

● Full live integration ○ Partial / advisory integration — No live plant connection required

Version	Main purpose	Typical use	Plant integration	Expected output
<b>Offline Simulator</b>	Process study and scenario evaluation	What-if analysis, ladle treatment studies, alloying practice comparison, thermal assessment, slag/refractory interaction review, training, benchmarking	— No live plant connection required	Simulated treatment trends, thermal and metallurgical analysis, comparison of refining strategies, preliminary lining-related interpretation
<b>DSS / Advisory Mode</b>	Decision support during ladle treatment	Operator guidance, temperature and chemistry adjustment support, alloying review, slag practice interpretation, refractory consumption review, process monitoring	○ Historical, exported or semi-live plant data	Recommendations, warnings, process interpretation, support for treatment decisions, refractory-related advisory support where data quality is sufficient
<b>Online Digital Twin</b>	Real-time synchronized process representation	Live monitoring, predictive supervision, treatment tracking, digital twin deployment	● Integrated with live plant signals and automation architecture	Real-time tracking, predicted process evolution, dynamic advisory output, synchronized digital process view, ladle thermal and lining condition support

Each level corresponds to a different operational scope, from offline engineering analysis to real-time synchronized process intelligence.