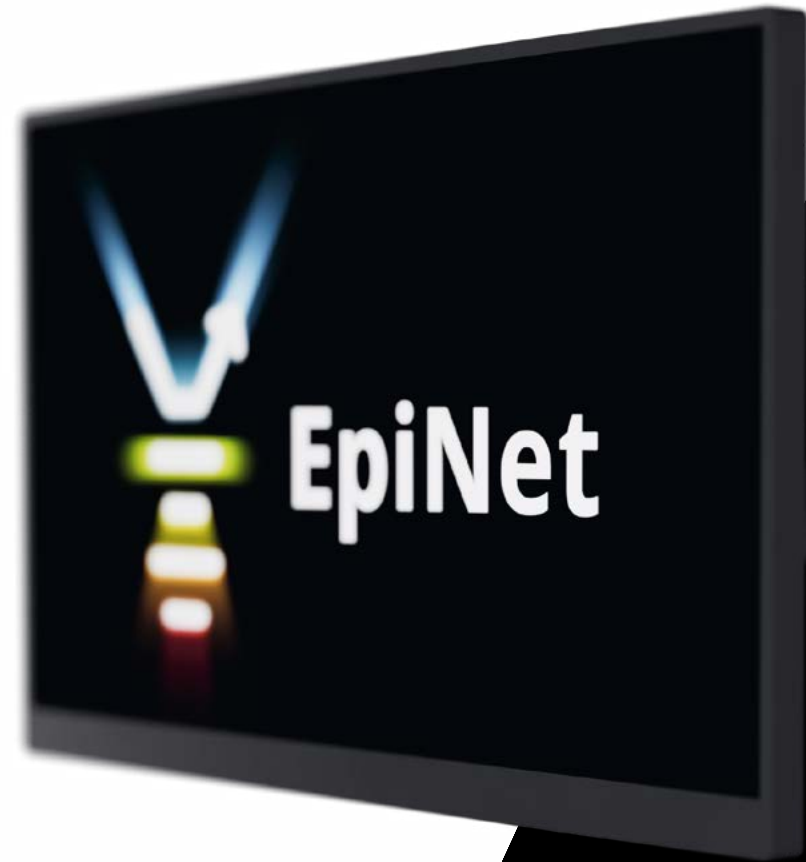
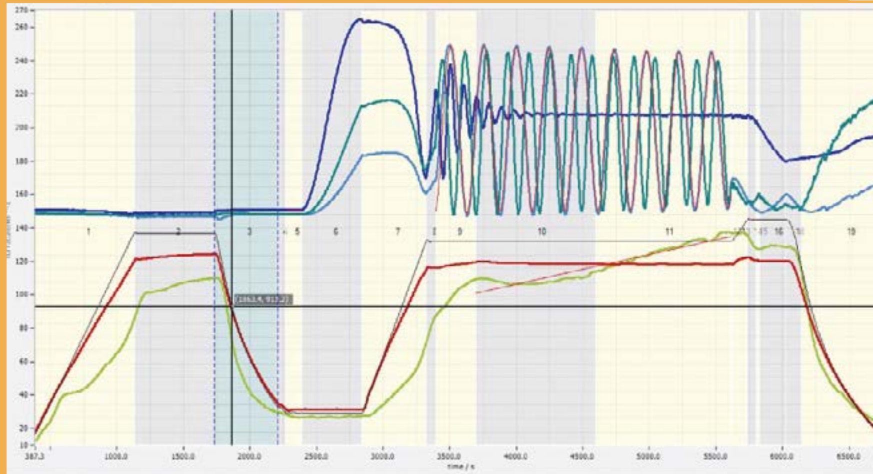
EpiNet® features and licences

In-situ monitoring control software



EpiNet® – Improve yield, save costs!



EpiNet® software enables control, analysis and optimization of epitaxial processes in the production and development of LEDs, laser diodes, VCSELs, HEMT, HBT and other electronic and optoelectronic devices.

The software unlocks key details of wafer behavior during growth.
For enhanced run-to-run control and statistical process control, these key figures are used to improve yield and maximize process capacity.

EpiNet® 2024 can be seamlessly integrated into automated fab workflow, with user-customizable integration options, ranging from plain-text files to sophisticated live SECS / GEM integration.

Customer Benefits

- In-situ process control with ex-situ accuracy, even for very thin layers
- Robust control of complex production processes, even on operator level
- Fast in-spec / out-of-spec heads-up indication for stop or go decisions
- High-level automation saves operator time, eliminates error sources and facilitates sophisticated in-situ control easy without increased training loads
- Sophisticated data analysis

Measurements

- Time-resolved, wafer-resolved, zone-resolved in-situ measurements of:
    - Emissivity-corrected pyrometry
    - Multi-wavelength reflectometry
    - Wafer curvature including asphericity measurements
- Multi-pocket mode
- Window coating tracking (Alpha history)
- Wafer backside emissivity correction

Licensing Options

- Basic / OEM package for basic operation and data analysis
- Premium package for advanced analysis and process understanding
- Additional licences for specific features

For more information about licence options, kindly contact sales@laytec.de.

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EpiNet® Features and Modules

Feature/ Module	Explanation	EpiNet 2017 Basic	EpiNet 2017 Premium	EpiNet 2022 Basic	EpiNet 2022 Premium	EpiNet 2024 Basic	EpiNet 2024 Premium
Measurement Options							
Measurement Module	Allows for data acquisition with LayTec hardware and replays of raw measurement data for service purposes.	✓	✓	✓	✓	✓	✓
MultiPocket recognition	Evaluation of MultiPocket configurations for best possible SNR.	✓	✓	✓	✓	✓	✓
Replay	Replay of a RawDataDump for service purposes.		✓		✓		✓
ARS Mode [2]	Two or more curvature measurements across a wafer are evaluated for a better SNR (gas turbulances) and a higher resulation. specially for very low bows (InAlP/InP)	✓	✓	✓	✓	✓	✓
RunTypes	RunType are set of descriptions for the current run (susceptor layout, substrate material, measurement zone definition,...). which can be easily selected and are visually accurate	✓	✓	✓	✓	✓	✓
Automatic Reflection Correction	A special RunType flag. The best reflecting wafer is chosen for normalization.			✓	✓	✓	✓
EpiGuard: Pre-Run Check	A custom pre-run analysis is triggered to provide information on the susceptor and load condition prior to a run.				✓		✓
Wobble Correction	Correction for instable carrier situations (MBE)			✓	✓	✓	✓
Support for two emissivity corrected temperatures	Full support for two TrueTemperatures like 810nm and 950nm.			✓	✓	✓	✓
Support for non-normal incidence measurements	In case of non-normal incidence situations, reflectance normalization and analyses will account for the incidence angle.			✓	✓	✓	✓
In-situ Window Offset Calibration	The Window Offset Calibration usually done during maintenance is now marker triggered for in-situ use.			✓	✓	✓	✓
Gamma Calibration corrects residual oscillations	In-run calibration and correction to account for residual oscillations in TrueTemperature			✓	✓	✓	✓

1 Measurement License needed 2 Additional license needed

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EpiNet® Features and Modules

Feature/ Module	Explanation	EpiNet 2017 Basic	EpiNet 2017 Premium	EpiNet 2022 Basic	EpiNet 2022 Premium	EpiNet 2024 Basic	EpiNet 2024 Premium
Interfaces							
Standard TCP/IP Package [1]	Standard interface to AIXACT®	✓	✓	✓	✓	✓	✓
Premium TCP/IP Features [1]	Selection of RunType prior to run via Aixact recipe (Step Code based RunType loader) and further possibilities to control EpiNet®.		✓		✓		✓
SECS/GEM [2]	Connect EpiNet® via SECS/GEM to transfere data and results, control like Start/ Stop is generelly possible.	✓	✓	✓	✓	✓	✓
MODBUS Interface [2]	Connect to MODBUS based infrastructure to send data and status reports.	✓	✓	✓	✓	✓	✓
SNMP Interface [2]	Interface to povide current and past run data using the well known SNMP protocol for visualisation across all reactors.			✓	✓	✓	✓
Hardware Interfaces							
NI-DAQ	NI-DAQ 6025 Device Compatibility.	✓	✓	✓	✓		
NI-IMAQ	NI-IMAQ 1427/28 Device Compatibility.	✓	✓	✓	✓	✓	✓
Temperature current output	Hardware based temperature (ECP) output for direct reactor feed-in.		✓	✓	✓	✓	✓
SDAQ	Data acquisition card to replace the NI-DAQ in 2018.		✓	✓	✓	✓	✓
VCSEL Add-on [3]	Integration of spectral metrology for VCSEL-growth monitoring.		✓	✓	✓	✓	✓
Inside Pyro 400 [3]	Metrology system for UV pyrometry.		✓	✓	✓	✓	✓
Base Unit	Data acquisition card for all data combined, replacement for SDAQ and NI-IMAQ starting in 2024.					✓	✓

1 Measurement License needed 2 Additional license needed 3 requires additional hardware

EpiNet® Features and Modules

Feature/ Module	Explanation	EpiNet 2017 Basic	EpiNet 2017 Premium	EpiNet 2022 Basic	EpiNet 2022 Premium	EpiNet 2024 Basic	EpiNet 2024 Premium
Display							
Transient View	Graphical representation of transients (signal / time) of measured data.	✓	✓	✓	✓	✓	✓
Color Plot View	Signals over position (line scans) and ofer time are shown in a color coded 2D plot.	✓	✓	✓	✓	✓	✓
EpiGuard®: PocketGuard	Visual representation of in-spec/out-of-spec information of analyses recipes and its results displayed as a virtual susceptor.		✓		✓		✓
EpiGuard®: Wafer-to-Wafer View	Visual representation of in-spec/out-of-spec information of analyses results in a polar plot.		✓		✓		✓
Enhanced Marker and RunState Display	Visualisation of set markers and other usefull informations.			✓	✓	✓	✓
Enhanced alpha History	More usefull values around the alpha normalization.			✓	✓	✓	✓

Feature/ Module	Explanation	EpiNet 2017 Basic	EpiNet 2017 Premium	EpiNet 2022 Basic	EpiNet 2022 Premium	EpiNet 2024 Basic	EpiNet 2024 Premium
Administration and data storage							
Legacy EpiNet® 1.10 data	ASCII file export for measurement data (transients).	✓	✓	✓	✓	✓	✓
Full run export	Export of all relevant run data (transients, linescans, configuration).	✓	✓	✓	✓	✓	✓
SQL Server 2014	Full version of MS SQL server 2014 for measurement data, configuration, results, analyses storage.	✓	✓	✓	✓	✓	✓
SQL jobs	Maintenance jobs to delete obsolete data and manage space.	✓	✓	✓	✓	✓	✓
Run Management within EpiNet®-Display	Runs can be exported and deleted within EpiNet®-Display without the need to use the Management Console.			✓	✓	✓	✓
Monitoring Process [4]	Monitoring tool to manage various software modules. Can be used as an auto starter and restarter for all kinds of software.					✓	✓
IF-Epi User Interface [4]	Interface to configure and test the hardware interface functions such as temperature current output.					✓	✓
SQL Server 2022	2022 version of MS SQL server.					✓	✓
Dongle Free License [2]	Option to use network licenses for office versions of EpiNet®.					✓	✓

2 Additional license needed   4 only available in base unit software module

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EpiNet® Features and Modules

Feature/ Module	Explanation	EpiNet 2017 Basic	EpiNet 2017 Premium	EpiNet 2022 Basic	EpiNet 2022 Premium	EpiNet 2024 Basic	EpiNet 2024 Premium
Analysis extras							
Automatic post run analyses	A predefined analyses recipe is executed after the run has ended. A results file is generated and saved for later evaluation.		✓		✓		✓
Automatic post step analyses	A predefined analyses recipe linked to the RunType is executed after a certain step and the value is display during the run, if used with in-spec/ out-of-spec limits it will return easy to interpret traffic light status of the run.		✓		✓		✓
In-spec/out-of-spec values	An analyses result is compared to predefined borders and a color-coded result is displayed.		✓		✓		✓
Analyses Sets	Analysis Sets provide an easy way of storing and applying predefined analyses and a quick creation large analysis recipes.			✓	✓	✓	✓
Analyses							
1 Basic Maths | Data Processing	Filters (adj. average, median, slope correction, multiplication,...) will be applied to selected data and a new dataline is created that can be used for further evaluation.	✓	✓	✓	✓	✓	✓
1 Basic Maths | Slope	Provides the slope of a dataline like the curvature in respect of growth time.		✓		✓		✓
1 Basic Maths | Statistics	Minimum, maximum, average, and standard deviation of selected data.		✓		✓		✓
2 Re-Calibration | ReflectanceCorrection Layer	The selected reflectance data is corrected for a specific layer material and a new data line is created for subsequent usage.		✓		✓		✓
2 Re-Calibration | ReflectanceCorrection Substrate	The selected reflectance data is corrected for a specific substrate material and a new data line is created for subsequent usage.		✓		✓		✓
2 Re-Calibration | Reflectance DSP to SSP Conversion	The selected reflectance data is corrected to compensate the backside reflection of a DSP substrate. A new data line is created for subsequent usage.						✓
2 Re-Calibration | Temperature Correction	Numeric analyses to correct TrueTemperature residual oscillations.			✓	✓		✓

EpiNet® Features and Modules

Feature/ Module	Explanation	EpiNet 2017 Basic	EpiNet 2017 Premium	EpiNet 2022 Basic	EpiNet 2022 Premium	EpiNet 2024 Basic	EpiNet 2024 Premium
Analyses							
3 Growth Rate | MultiWL Growthrate Fit	Several wavelengths are taken into account to provide a better calculation of growth rate for a given layer.		✓		✓		✓
3 Growth Rate | NKR adv Virtual Layer Fit	This fit is based on the legacy „NKR Virtual Layer Fit“ and will calculate faster providing better fit results.		✓		✓		✓
3 Growth Rate | Oscillation-based Growth rate	A damped sine fit is used to determine the oscillation frequency of the reflectance data; based on the fit result, the growth rate is calculated for the optical properties taken from the database of the selected layer material at the measured temperature.			✓	✓	✓	✓
4 Growth Rate with Re-Calibration | MultiWL Growthrate Fit with Reflection Correction	Several wavelengths are taken into account to provide a better calculation of growth rate for a given layer.				✓		✓
4 Growth Rate with Re-Calibration | NKR Fit on calibration-Layer-corrected reflectance	A prior layer is used as reflectance basis - the next layer is corrected and used for growth rate evaluation.				✓		✓
4 Growth Rate with Re-Calibration | NKR Fit on substrate-corrected reflectance	A substrate step is used as reflectance basis - the next layer is corrected and used for growth rate evaluation.				✓		✓
5 Multi-Layer | 1-3-Layer R Fit on Fully Absorbing Layer	This analysis performs a reflectance correction first and then fits the growth rates of up to three very thin subsequent layers.				✓		✓
5 Multi-Layer | DBR-Graded R Fit on Virtual Layer	This analysis fits the growth rates of two alternating materials. It can be used with an arbitrary number of layer pairs.				✓		✓
5 Multi-Layer | DBR-R Fit on Substrate	As a first step, this analysis performs a reflectance correction on the reflectance transient, using a substrate or absorbing layer step. It can be used with an arbitrary number of layer pairs grown directly on a substrate or absorbing layer.				✓		✓
5 Multi-Layer | DBR-R Fit on Layer	This analysis can be used with an arbitrary number of alternating layer pairs of composition A and B of a ternary material with intermediate gradient layers.				✓		✓
6 Composition | MultiWL Composition Fit	Several wavelengths are taken into account to provide a better calculation of the composition for a given layer.				✓		✓

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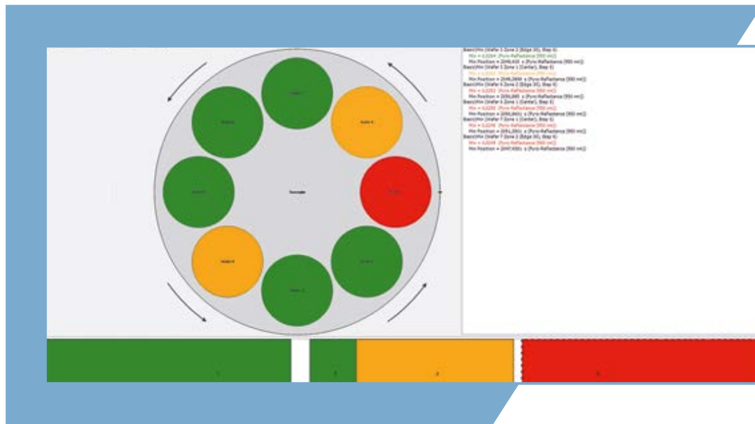
EpiNet® Features and Modules

Feature/ Module	Explanation	EpiNet 2017 Basic	EpiNet 2017 Premium	EpiNet 2022 Basic	EpiNet 2022 Premium	EpiNet 2024 Basic	EpiNet 2024 Premium
Analyses							
7 Dispersion | NKR Fit on Fully Absorbing Layer	This analysis can be used for the determination of n and k of a layer grown directly on a well-known substrate or fully absorbing layer. The temperature should be constant.						✓
7 Dispersion | NKR Fit on Layer	This analysis can be used for the determination of n and k of a layer grown directly on a well-known absorbing layer. The temperature should be constant.						✓
(Spectral) Band Edge Detection [3]	Algorithem to extract the band edge position from spectral data.				✓		✓
(Spectral) Temperatur based on Band Edge [3]	The band edge position is used to calculate surface temperature.				✓		✓
Material dispersions - legacy „ltec“ [5]	Standard LayTec material dispersion databases mostly based on simulated data.						
Advanced material dispersions - ddx	Advanced material databases are derived from in-situ and ex-situ measured materials to provide enhanced fit results and better consistency upon wafelengths.						

3 requires additional hardware   5 AlInGaP, InN, Si3N4 are not included



Operator view: PocketGuard (part of EpiGuard package)

- Single-glance overview of all monitored wafers during run
- Customer can easily set up procedures for corrective actions based on PocketGuard information
- Operator display can color-coded to rapitly draw attention to developing issues based on user-defined in-spec / out-of-spec criteria
- Wafers visualized as they are positioned on the susceptor
- In-spec / out-of-spec criteria can be set for all LayTec analysis features

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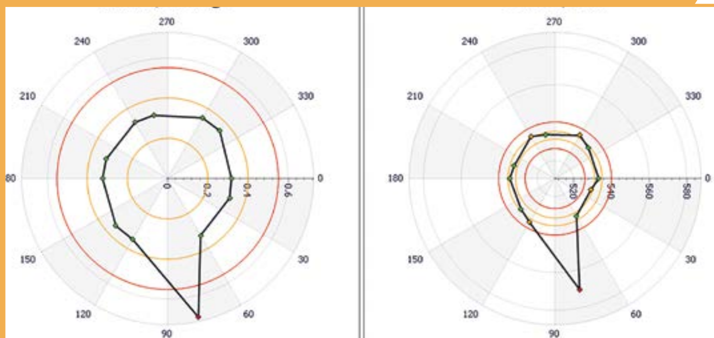
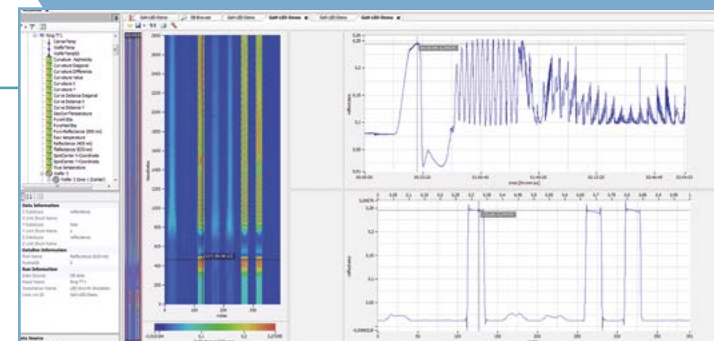


Wafer-to-Wafer view for post-run analysis

- Analysis results for all wafers displayed in separate web charts (polar charts)
- Easy comparison of wafers for run homogeneity check
- Fast detection of outliers – identifies wafer zones that are out of specification (red circle) or control (yellow circles) tolerance

Color plots and line scans

- Color plots (left): time and space-resolved measurements for quick fingerprinting and visualization
- Line scans (below right) show wafer homogeneity during growth
- Time-resolved transients (top right) provide the basis for detailed analysis of growth performance (see Transient view below)



Wafer-to-Wafer view for post-run analysis

- Complex data comparison of critical process parameters down to single data points across zones, wafers and runs
- Transients can be segmented manually or automatically into growth steps
- Automated analyses of any step to extract process information from raw data (e.g., composition, growth rate etc.)
- Pre-configuration of analyses algorithms as recipes for repeated or automated use

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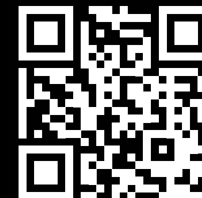

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