

NOVA

Optimization of Scatterometry for Integrated Metrology

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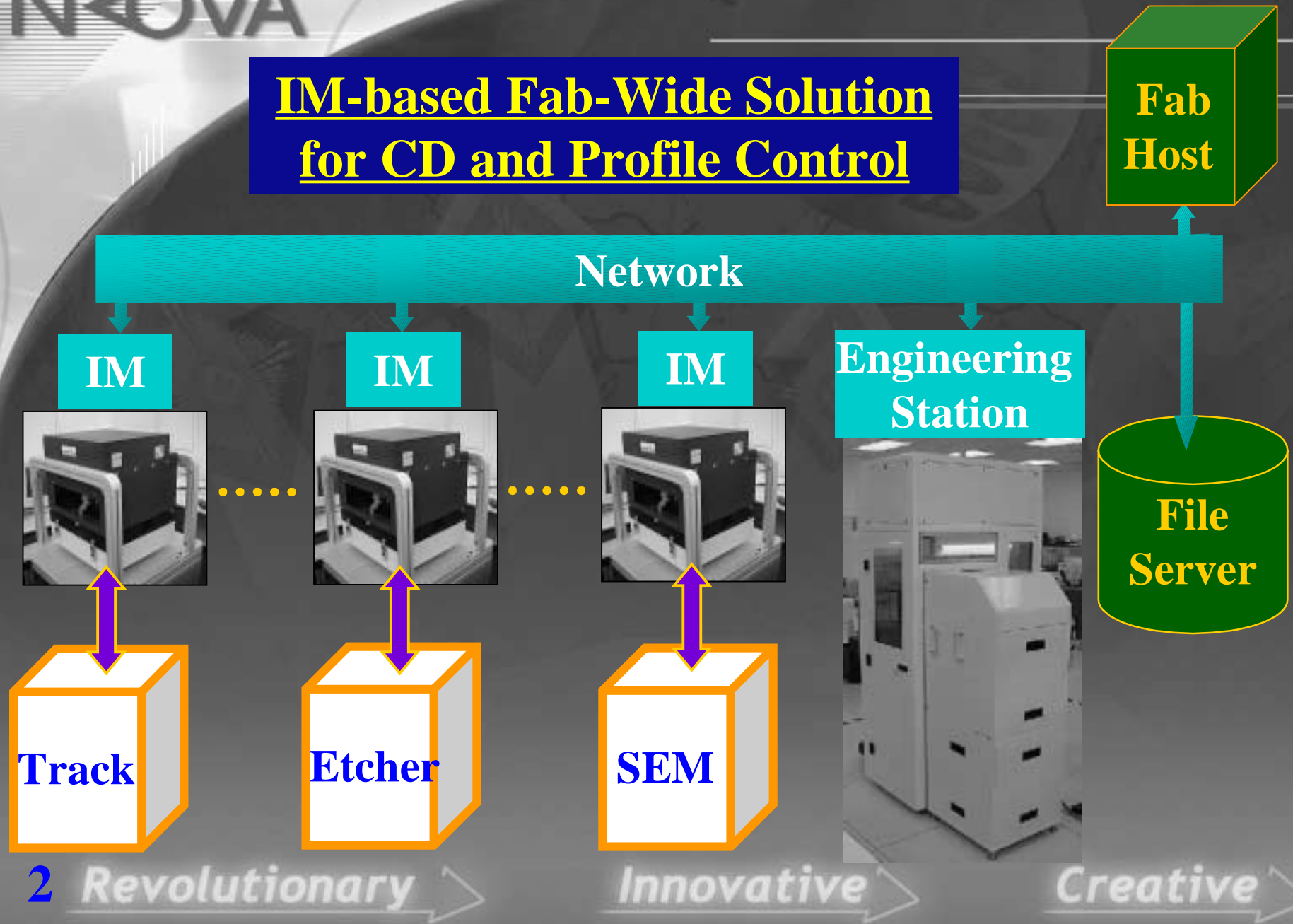
Nova Measuring Instruments

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IM-based Fab-Wide Solution for CD and Profile Control



Fab-Wide Solution - Main Aspects

- **Optimized IM tools**
- **Data Interpretation / Analysis**
- **Engineering Station (ES)**
- **Integration with Process Tools**
- **Network: Recipe Proliferation, Host Communication,...**
- **Process Control Solutions**
- **Support model – SW and HR**

Design Requirements for an Integrated Scatterometry Tool:

- High measurement quality (ITRS)
- Small footprint/volume for internal integration
- Robustness – low sensitivity to environment
- High throughput
- Small spot size
- High reliability & Serviceability
- 200/300 bridge tool

Method Comparison

	<i>Spectrophotometry</i>	<i>Polarized Spectrophotometry</i>	<i>Ellipsometry</i>
<i>Profile Information</i>	-	+ / ++ (*)	++
<i>Repeatability</i>	-	+	++
<i>Robustness</i>	+	+	-
<i>Spot Size</i>	+	+	-
<i>TPT</i>	++	++ / + (*)	-
<i>Footprint</i>	+	+	-
<i>Complexity & Cost</i>	++	+	-

(*) Depending on # of polarizations measured

Optimized Integrated Measuring System – Main Characteristics:

- **Reflectometry:**
Robust measurement technique, suitable for integration
- **Polarized light:**
**Enables precise modeling and accurate interpretation
using 1 or more independent measurements**
- **DUV:**
High sensitivity required for sub 100nm features
- **Low incidence angle :**
**Small footprint, small spot size, good penetration into
high aspect ratio features**

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Data Analysis:

Two Approaches to Data Interpretation:

- **Libraries Approach:**

Fit using pre-calculated library of spectra

- **Direct Fitting Approach:**

Fit using real time calculated spectra

Fitting Methods - Comparison

	Libraries	Direct Fit
Setup Time	Long	Short
Limitations	Setup time increases with application complexity	Application complexity limited by computation power
	Flexibility is limited	Danger of getting wrong solution (local minimum)

Optimal Solution = Combination

- **A Possible combination:**
 - Direct Fitting & Library Building on ES
 - for **Engineering/R&D** mode
 - Library-based interpretation on IM tools
 - for **Production** mode
- **Optimal Combination depends on:**
 - Fab type (R&D/Production/Foundry)
 - Number & type of systems in Fab
 - Application support model

Engineering Station (S/A)

- Strong recipe/library creation capabilities
- Fast response time for Engineering/R&D mode
- Identical measuring unit in IM and ES -
Recipe transportability
- High-end automation



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Application Support

- User-friendly SW tools for the Process Engineer
- Field Service Application Support
- Second-line support from Metrology Experts

Conclusions

- **IM tool needs to be optimized for it's role in the overall picture**
- **Engineering Station as a complementary part of the product offering**
- **Combination of RT & Libraries according to need/mode of operation**
- **Strong application support**