IEUVI Resist TWG: More Moore update

European Projects

EXTREME ULTRAVIOLET LITHOGRAPHY

MEDEA+ projects

“Label of approval”

Funding by national governments

Typically targeting industry needs

Office in Paris

Projects: e.g. ExCite, ...

IST (Information Society) projects

Direct sponsorship

Funding by EU

Typically targeting research

Office in Brussels

Projects: e.g. More Moore …

Courtesy of K. van Verdeven

More Moore main features

1. Type of project : IST Project (EU funding)

2. Duration: 3 Years (starting January 2004)

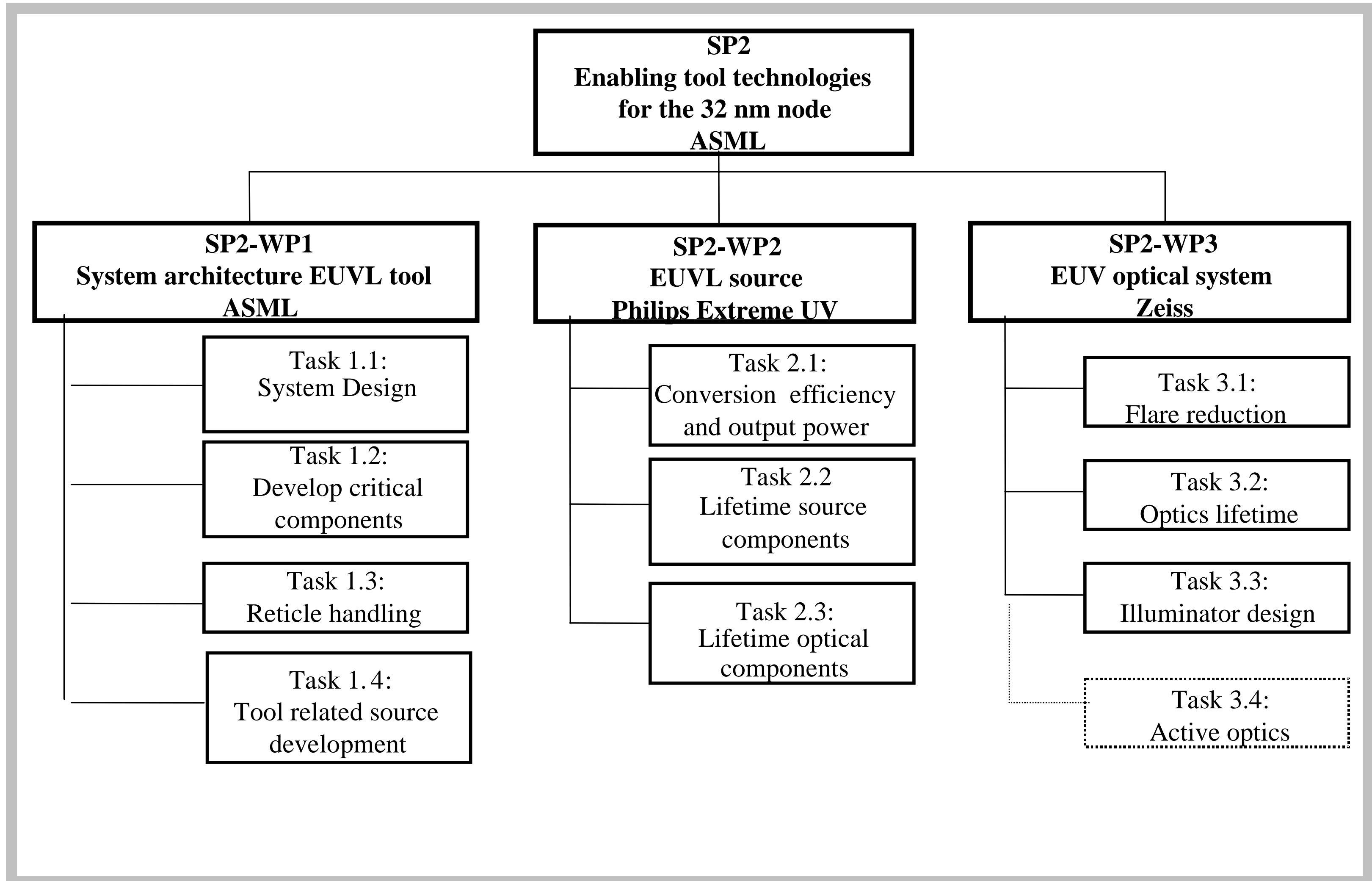
3. Man Power: 310M/Y, 26 partners

4. Structured in 3 Sub-Projects
   - ✓ SP1: Management, dissemination, training
   - ✓ SP2: Enabling tool technologies for the 32 nm node
   - ✓ SP3: Innovative technologies for 22 nm node and beyond

Courtesy of K. van Verdeven

EUVL EXTREME ULTRAVIOLET LITHOGRAPHY

SP2-Work packages structure



EUV roadmap

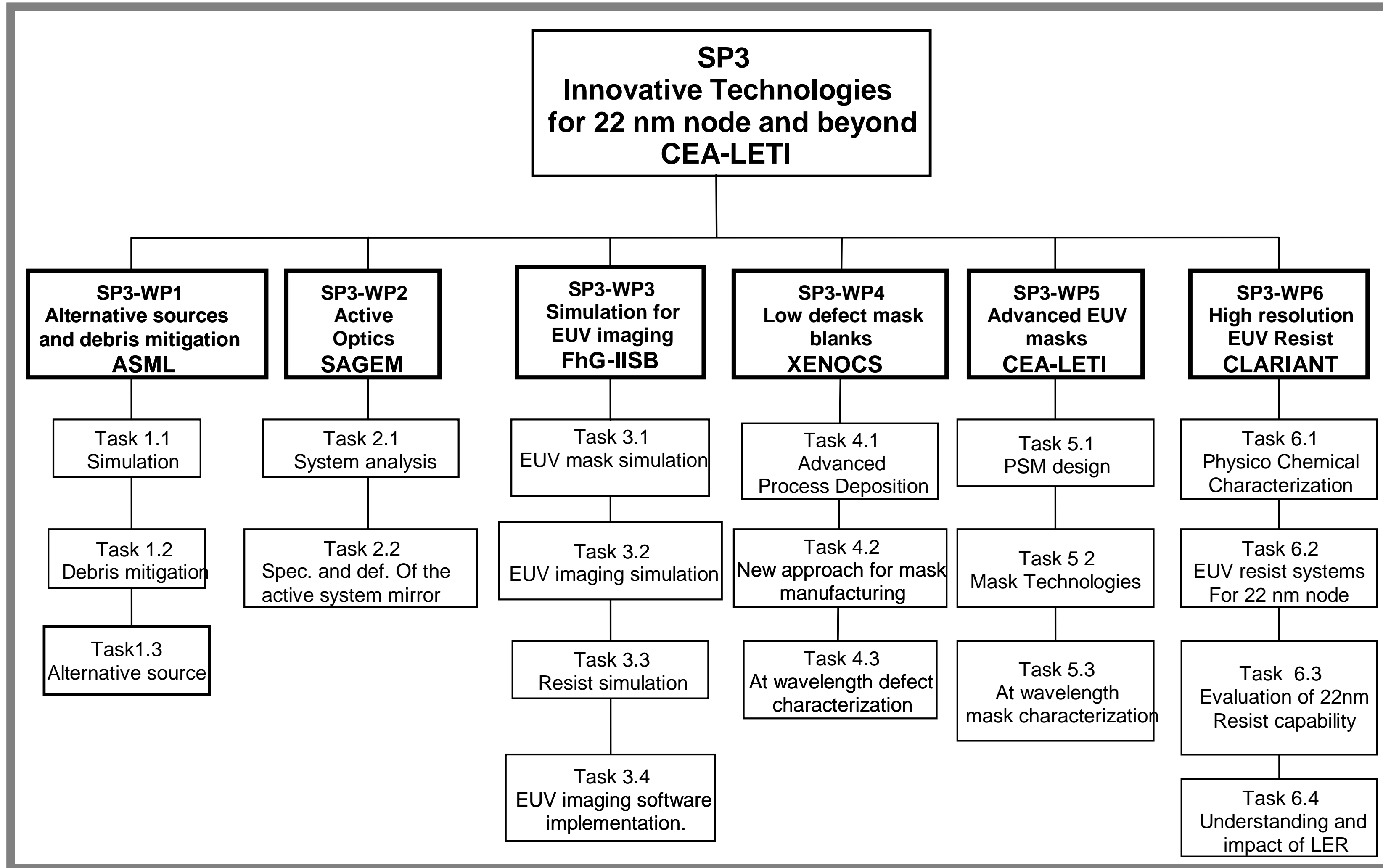
	Process development tool		Production
NA Range	0.15 to 0.25		0.15 to 0.25
Imaging - Dense Lines	50 nm ->40 nm		32 nm
- Isolated Lines	40 nm ->30 nm		18 nm
- iso/dense contacts	65 nm ->55 nm		40 nm
Overlay	12 nm		6 nm
Throughput	10 WPH		>80 WPH

Notes:
CDU = 10 % Resolution
Throughput is at 300mm, 16mm x 32mm, 125 shots, 5mj/cm^{-2}

Currently building two Alpha Demo tools for process development that will go to research centers end 2005 and early 2006.

Pilot production tools are likely to be in late 2008 / early 2009 but will depend on market pull and success of 193 immersion.

SP3-Work packages structure



EXTREME ULTRAVIOLET LITHOGRAPHY

Specific objectives for the WP6

Objectives High resolution and low LER EUV resist

1. Characterize and understand the limiting parameters of CAR resist for high resolution

2. Evaluate the resolution limit of existing resist.

3. Understand the formation of line Edge roughness and evaluate the impacts on device / propose LER quantification methods.

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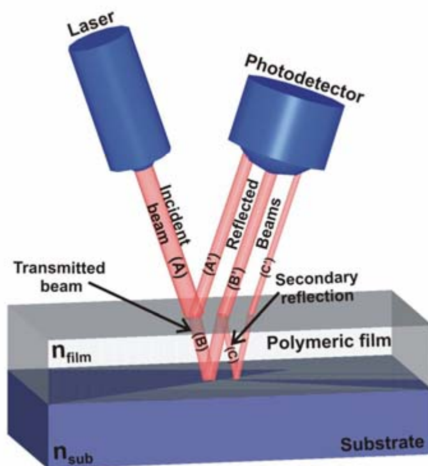
Characterization of ultra thin resist films

✓Bulk and thin films properties measurement by:
- •Phase modulation ellipsometry (CNRS)
- •Interferometry (IMEL)

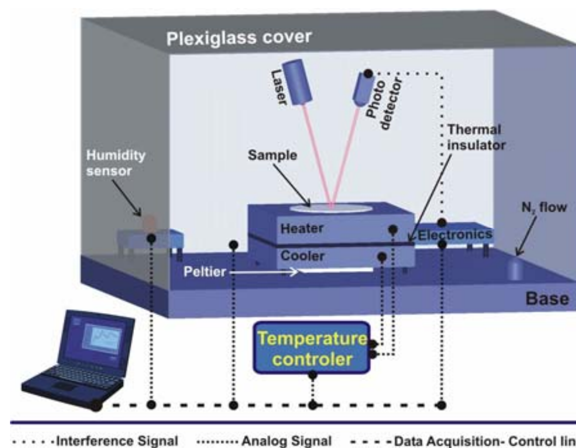
✓Software development for modeling spin coating and soft bake (CNRS)

✓Outgassing set up and studies (Elettra)

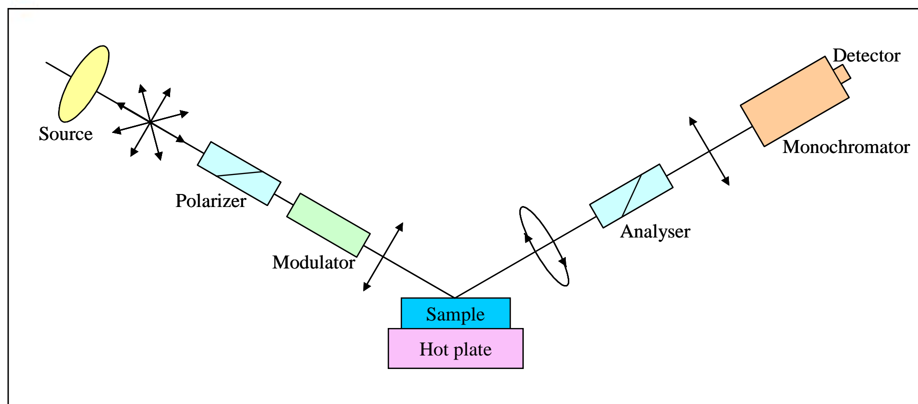
Characterization of ultra thin resist films



OPTI principle of operation



OPTI apparatus

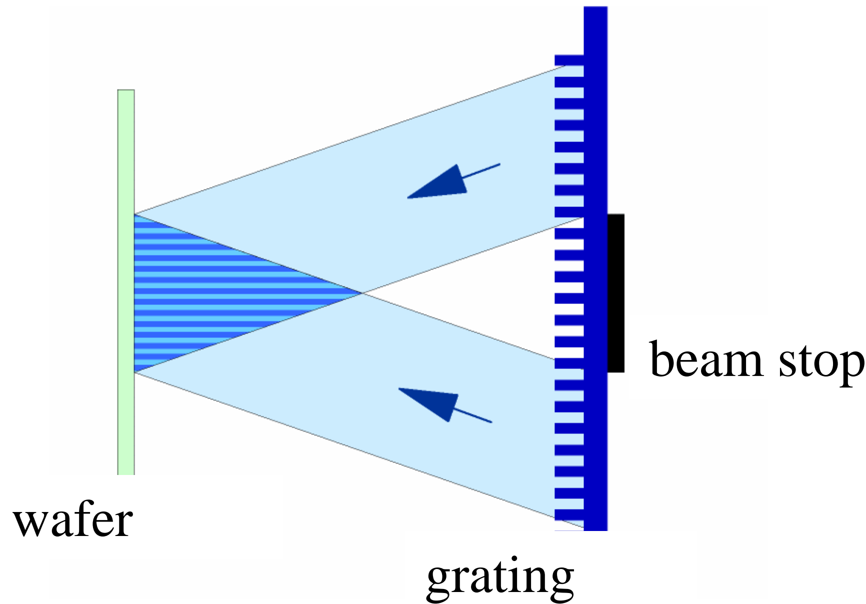


Principle of a phase modulation ellipsometer

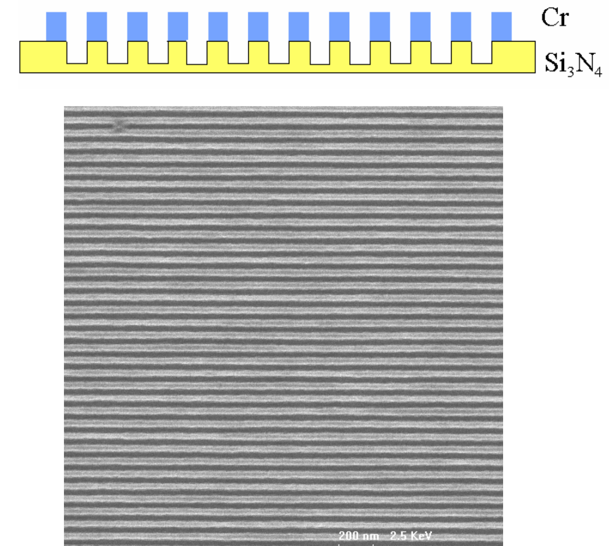
Modulation ellipsometer (Jobin-Yvon)

Evaluate the resolution limit of existing resist

EUV Interferometric Lithography at PSI



• Interference Lithography set-up (2 beam interference)

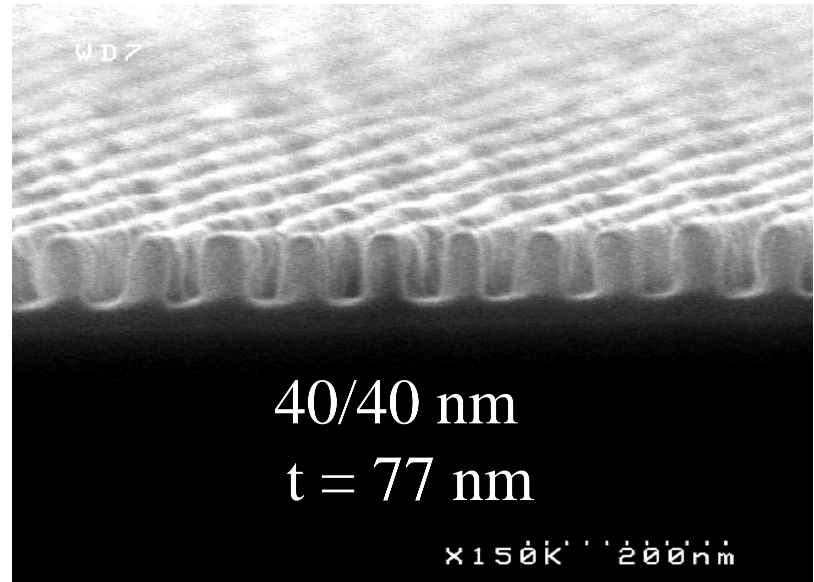


80 nm pitch grating written with EBL at CEA-Leti

Evaluate the resolution limit of existing resist

EUV Interferometric Lithography at PSI

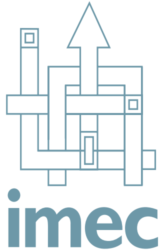
XP9947W Diluted 33%

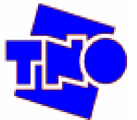


- New Mask M157
- dose=26 mJ/cm^2 (at mask level)
- t_{dev} = 20s
- LER (top)=5.5nm ± 1

- This is about the maximum thickness that can be used to avoid pattern collapse

Understanding and impact of LER/ quantification methods





- ✓Method of measuring LER
- ✓Protocol of LER/LWR measurements
- ✓Molecular weight effect on LER
- ✓Low energy scattering impact
- ✓Simulation of processing effect on LER
- ✓Impact on devices