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# The European Research Programms MEDEA+ and more Moore

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**SEMATECH EUV Source Workshop 2004**

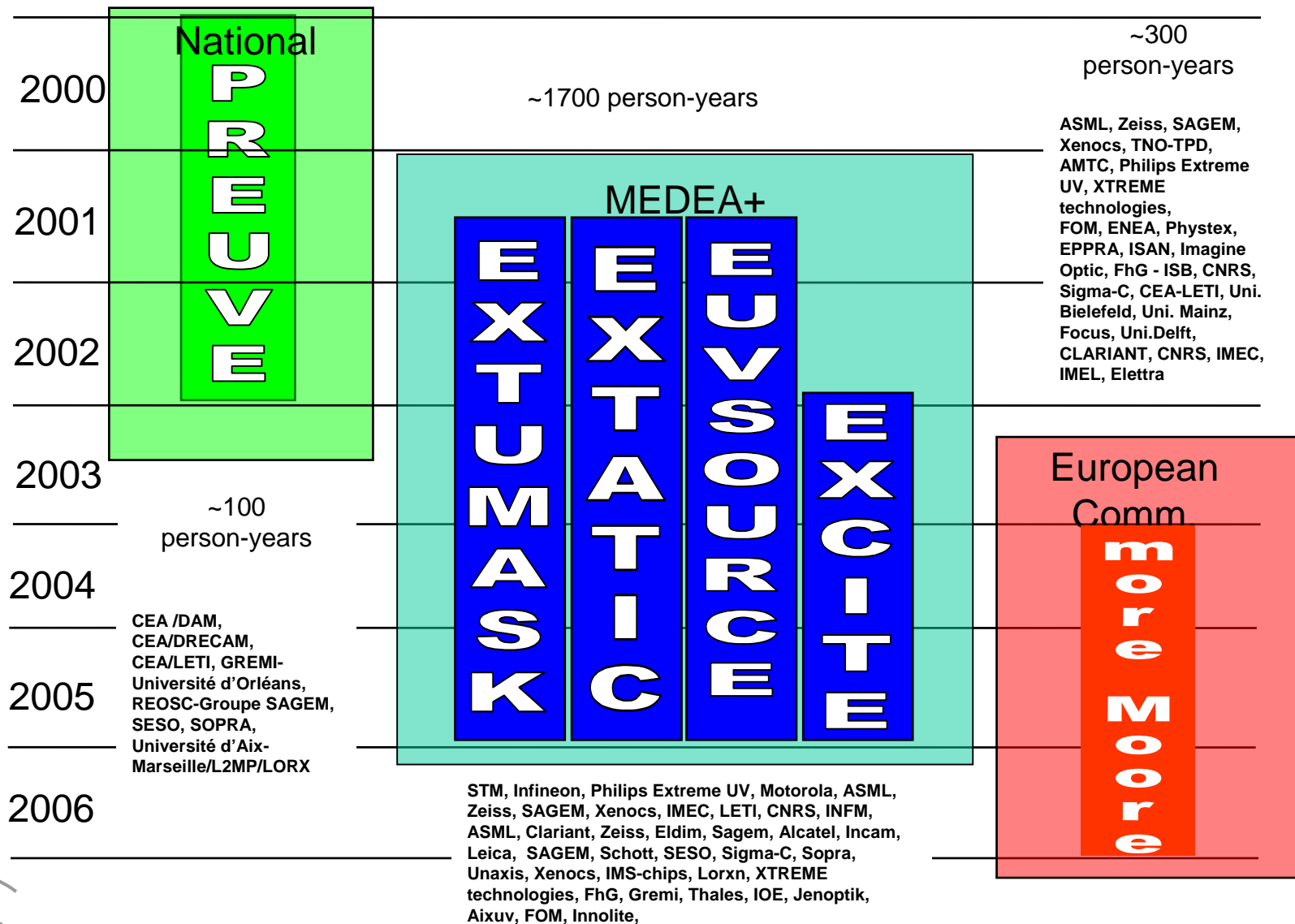
Santa Clara, CA, USA

# Commercial EUVL source requirements\*

| Attribute   | 2009 Commercial Tool         |
|---|------------------------------|
| Central wavelength (nm)   | 13.5                         |
| Clean EUV power in 2% BW (W) delivered to intermediate focus    | 115                          |
| Source cleanliness after IF                                     | >30,000 hrs                  |
| Etendue of source output (mm <sup>2</sup> sr)                   | 1 – 3.3 (max.)               |
| Max. solid angle to illuminator (sr)                            | 0.03 – 0.2                   |
| Repetition Rate (kHz)   | 7-10                         |
| Integrated energy stability pulses at 6 kHz and nom. scan speed | ±0.3% 3 $\sigma$ , 50 pulses |

\* Based on consensus of ASML, Canon, Nikon modified Feb. 2003

# European EUV programs

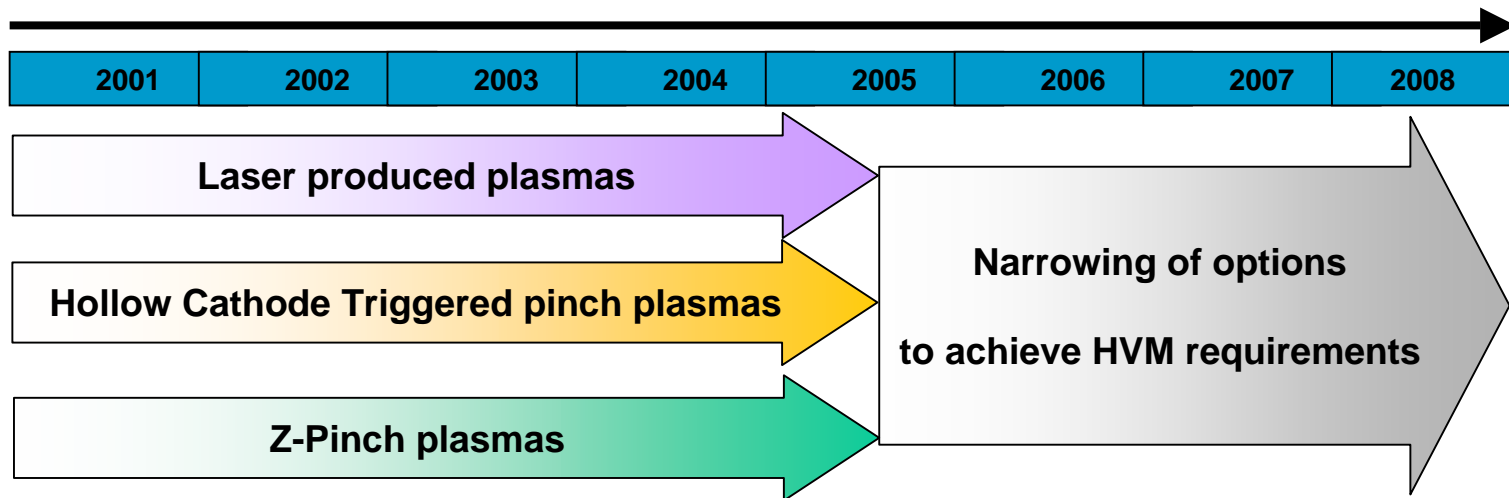


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# MEDEA+ Project T405: Goals of the project

## Goals of the project T405 „EUV source development“

- Enabling technologies for the beta-tool EUV source
- Basic research for technology decision
- Narrowing the options for the high volume manufacturing source



*Walt Trybula (Intl. Sematech), SEMATECH Lithography Forum,  
Jan 29, 2004, Los Angeles, CA, USA:*

**„We narrowed the options (for next generation lithography)  
from 4 to 11, so we did a good work.“**

# MEDEA+ Results: High power source development

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## Main highlights within MEDEA+ in 2003

- Delivery of MET sources to EXITECH
- Delivery of alpha-tool sources to ASML
- EUV power of  $>100 \text{ W}/2\pi\text{sr}$  (GDPP)
- Repetition rates up to 7 kHz (GDPP)
- Source component lifetimes exceed 200 Mio. Pulses (GDPP)
- Optics lifetime 100 Mio. pulses (GDPP)
- Tin experiments successful (GDPP)
- Laser power 1300 W (LPP)
- Repetition rates up to 25 kHz (LPP)
- Optics lifetime 10 Mio. Pulses (LPP)

# MEDEA+ GDPP: XTREME's XTS 13-35 for the microstepper

- XTS 13-35 from XTREME technologies for the EXITECH EUV Microstepper:
  - EUV sources with 35 W in  $2\pi$  sr at 1000 Hz delivered and under integration
  - Optics lifetime (10 % Reflectivity decrease) with debris filter > 100 million pulses,
- Equipped with debris mitigation and integrated with collector optics from Zeiss, GER.
- Use for process development at International SEMATECH, USA.



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# MEDEA+ GDPP: Philips EUV source for the alpha-tool

- HCT-Pinch source from Philips EUV for the ASML alpha-tool:
  - EUV sources with 10 W in the intermediate focus at 7000 Hz delivered and under integration
  - Component lifetime > 200 million pulses,
- Integrated with collector optics from ZEISS, GER.



# MEDEA+ LPP: XTREME technologies

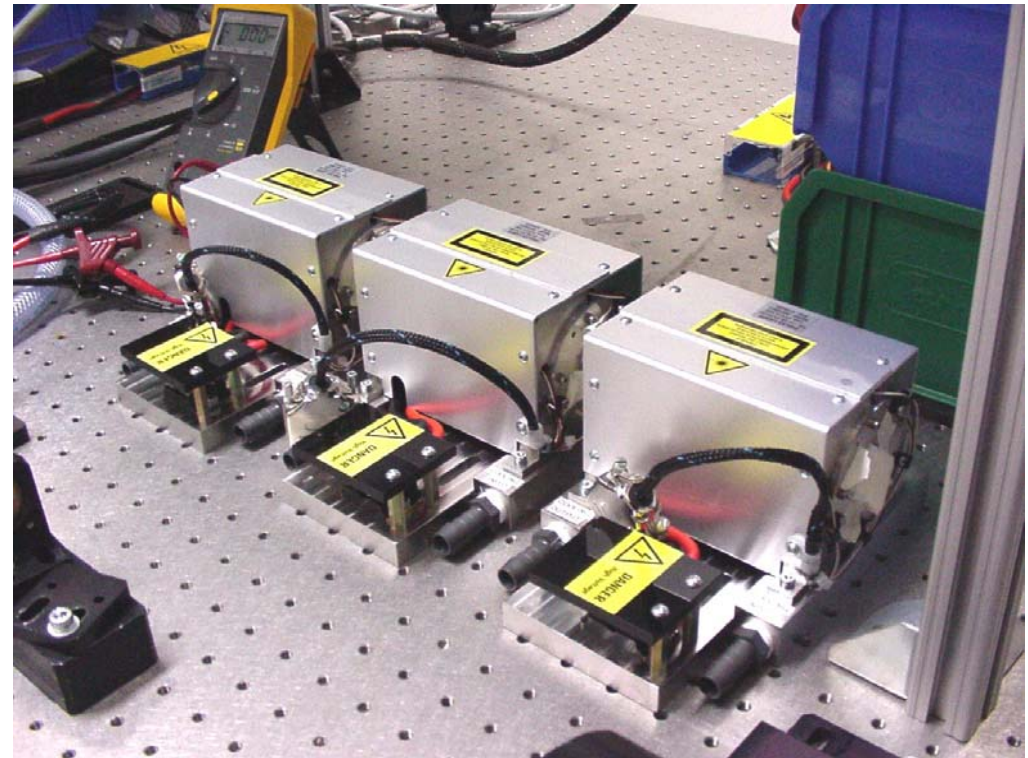
- Laser with 500 W power integrated to liquid Xenon target
- Laser system upgraded to 1300 W power
- Repetition rates up to 10 kHz



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# MEDEA+ LPP: Alcatel / CEA / THALES

- Laser power 550 W
- Repetition rates up to 25 kHz
- Liquid Xenon target



# MEDEA+ Metrology tools: JENOPTIK Mikrotechnik

- Laboratory calibration station installed
- Versatile metrology tools realized
  - Mini energy monitor
  - Spectrograph
  - Broadband detector
  - Debris monitor

