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# **EUV Source Modeling Workshop Summary**

**Hilton Hotel, Antwerp, Belgium**

**September 28, 2003**

## *Workshop Co-chairs*

Vivek Bakshi – International

John Gillaspay – NIST

Bryan Rice – Intel

# Workshop Details

- **Purpose: Provide a forum for modelers to detail the capabilities of their models and for suppliers to show how they use models and what additional capabilities they require.**
- **Nine modeling presentations:**
  - 5 talks by modelers describing technical details of models
  - 4 talks by suppliers describing how models are used
- **75+ attendees for this technical conference**
- **2+ hours of discussion and questions**

# Summary

- **Modeling (sub-models) used for:**
  - Magnetohydrodynamics (Pinch)
  - Coupling of electric circuit to plasma
  - Atomic ionization (Sn, Xe; Lines and UTA)
  - Radiation transport (opacity)
  - Electrode cooling/heating, erosion
  - Gas flow dynamics
  - Optical (collection efficiency)
- **Use cases:**
  - “Pragmatic approach”: Portable; enables tight coupling of modeling and engineering; quick but less accurate
  - “Gold-plated solution”: useful for strategy, fundamental limit determination, better understanding/benchmarking

# Summary of Key Results

- **Atomic data results:**
  - Still disagreement over optimum plasma temperature (highly source-dependent)
  - States not adjacent to 10+ may contribute significantly (under the right circumstances)
  - Configuration Interaction (CI) must be included to obtain physical results
- **Sn debris might be more tractable if mass limited targets are used (all Sn atoms are ions)**
- **Diagnostics needed:**
  - Laser interferometry to determine electron  $\rho$ , P, T
  - Ion type and energy (debris mitigation)

# Summary of Key Results

- **Modeling of Sn is expected to be harder than Xe due to atomic structure/opacity of Sn**
  - Request made for more/better Sn data
  - More funding needed to support Sn modeling
- **Predictions for ultimate conversion efficiencies of Xe and Sn vary widely:**
  - Xe: 2% to 4.5%
  - Sn: 4% to 7.5% ← Predictions for LPP configuration
  - Generally, prediction is that Sn is ~2x better than Xe
  - Generally, experimental values are much lower (~1% for Xe, ~2+% for Sn)

# Conclusions

- **Succeeded in bringing modelers and suppliers together.**
- **Both communities have a clearer picture of how the other functions and what is needed by the other.**
- **Lots of discussions; hopefully, many new relationships formed**
- **Grade?**
  - The jury is still out.... A+ if we get an HVM source by 2007!