

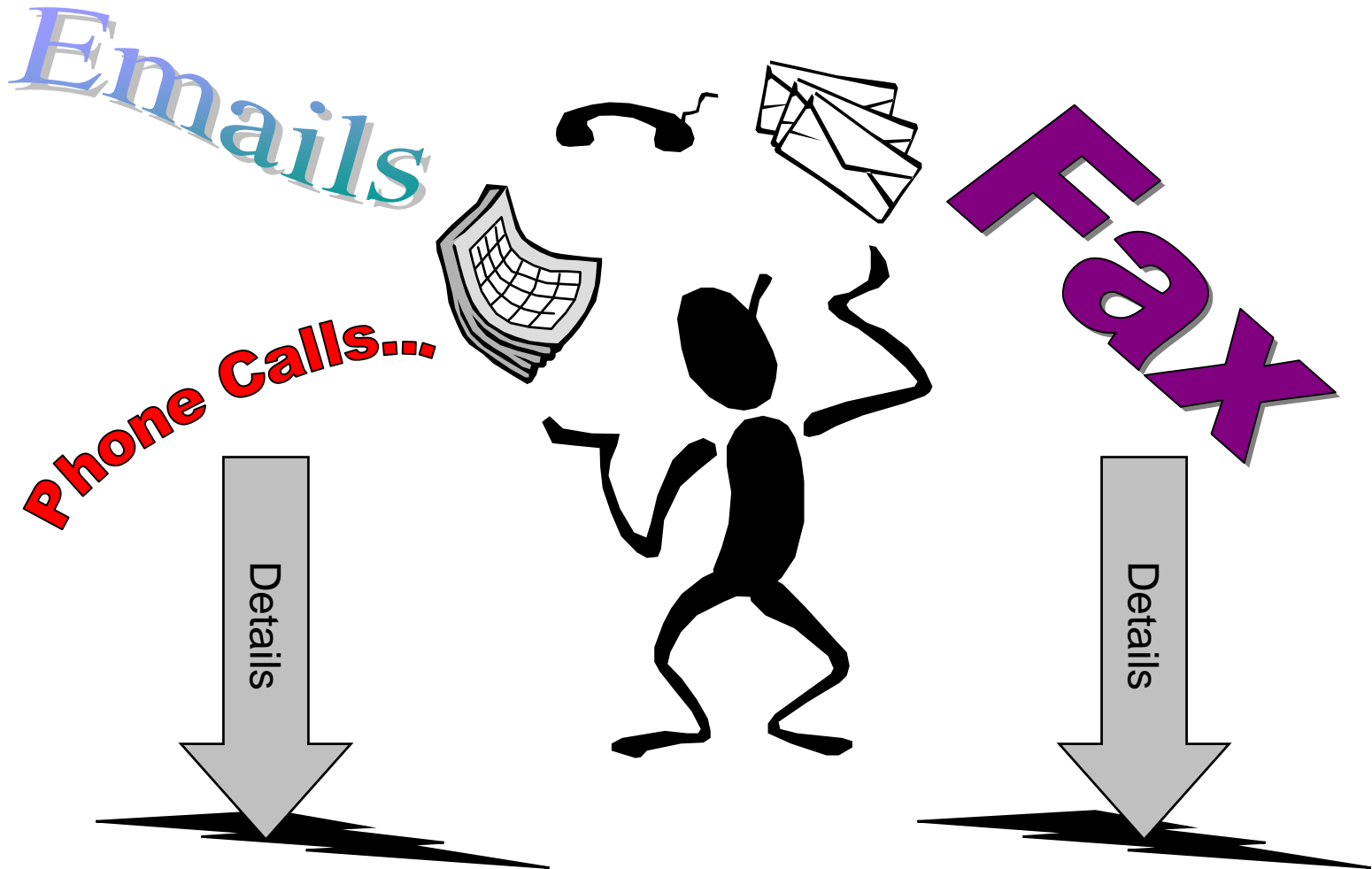
# **Proposed Modifications to SEMI P-10 for EUV Masks**

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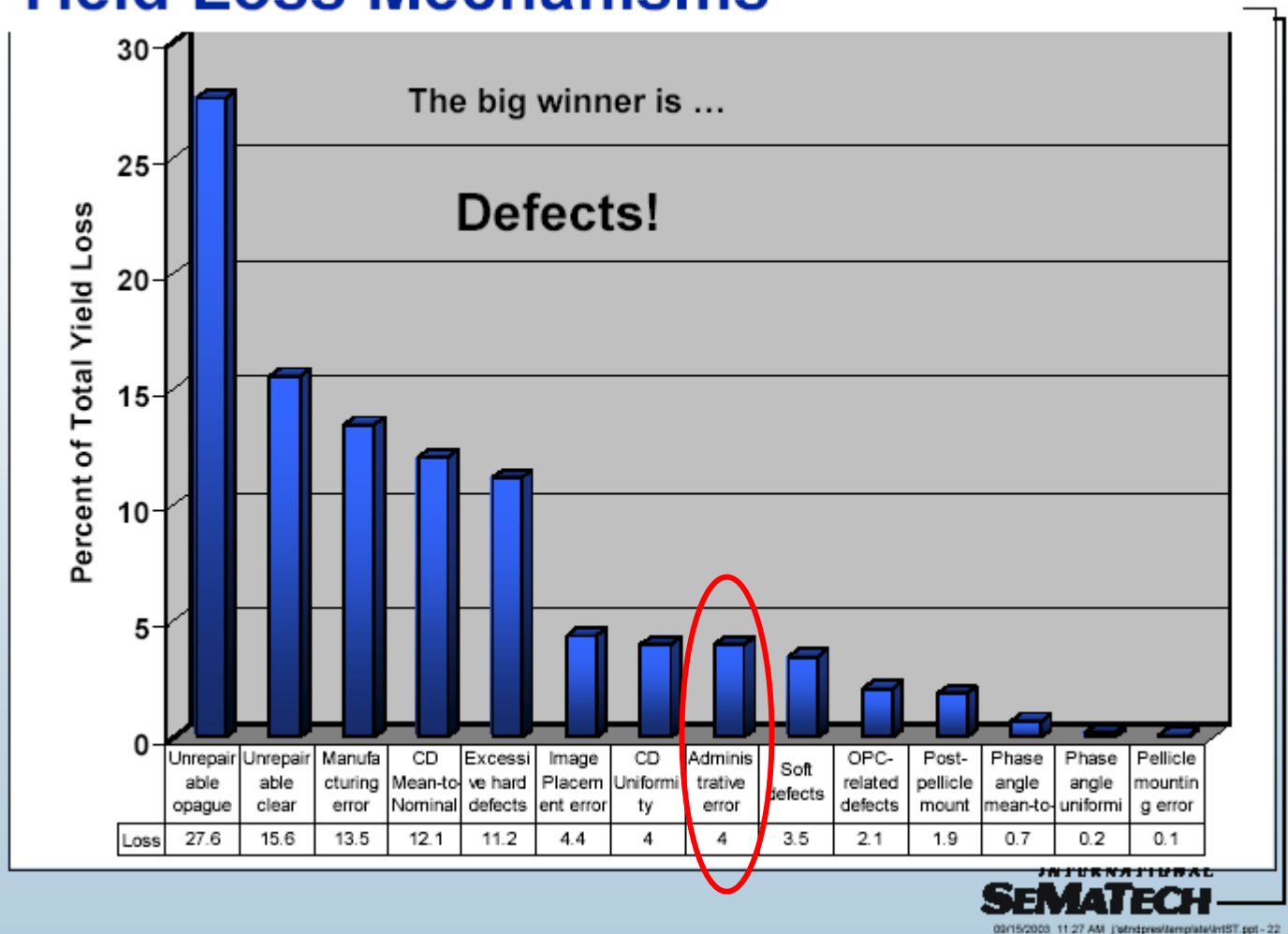
**Chairman of SEMI EUV Mask Task Force**

# Current Ordering Methods

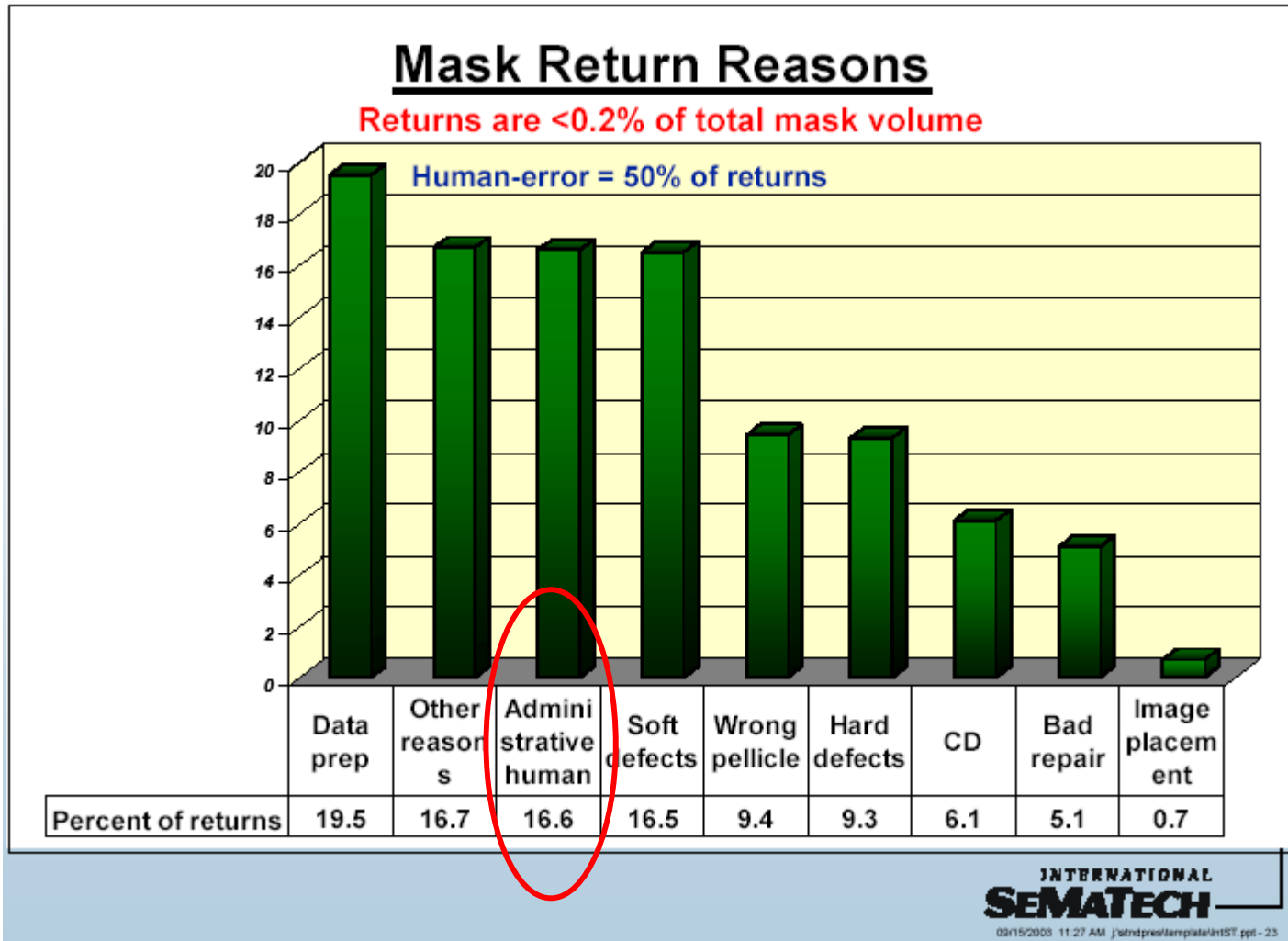


# Administrative errors account for 4% of mask yield loss

## Yield Loss Mechanisms



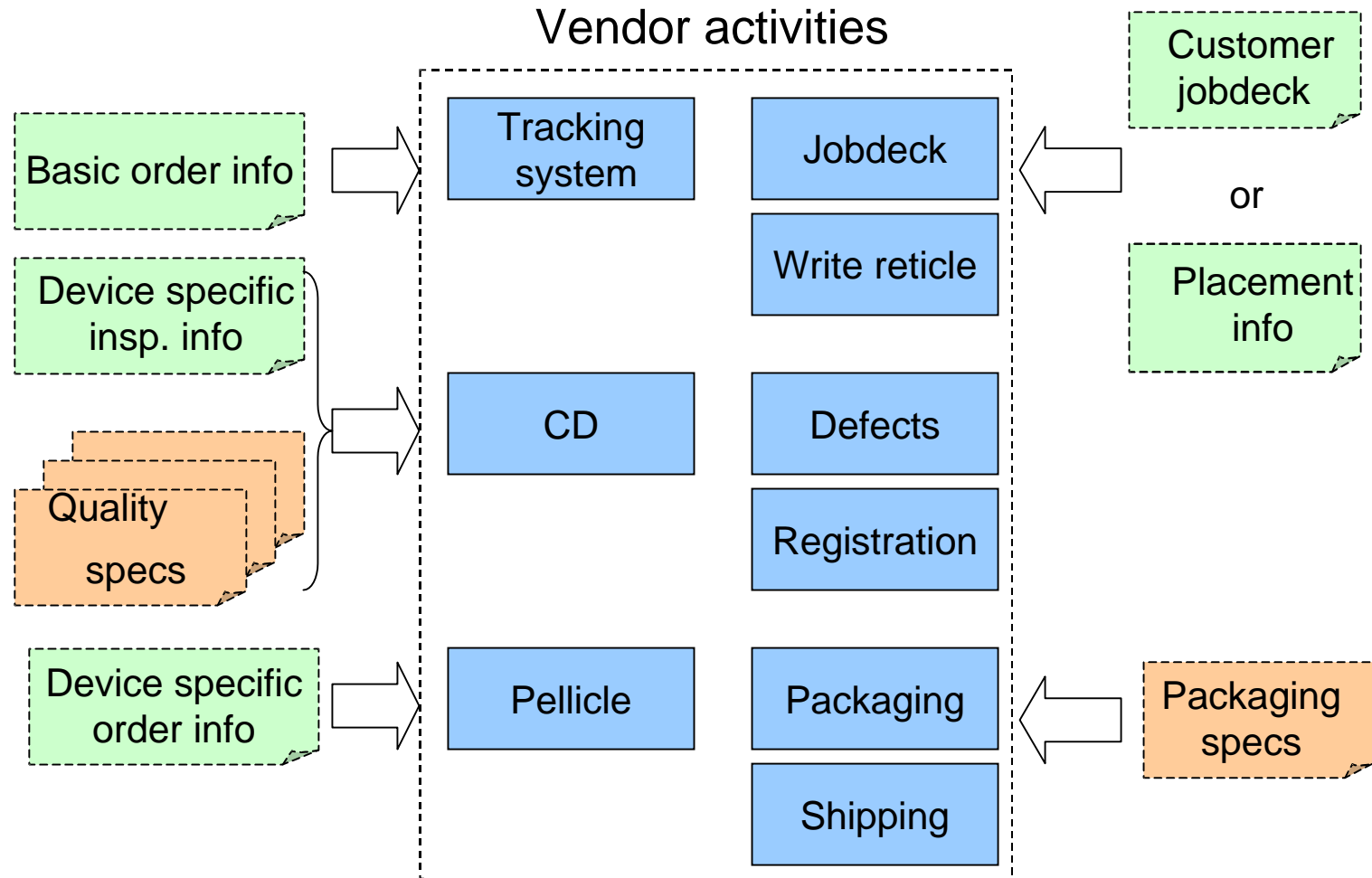
# Reason For Returns



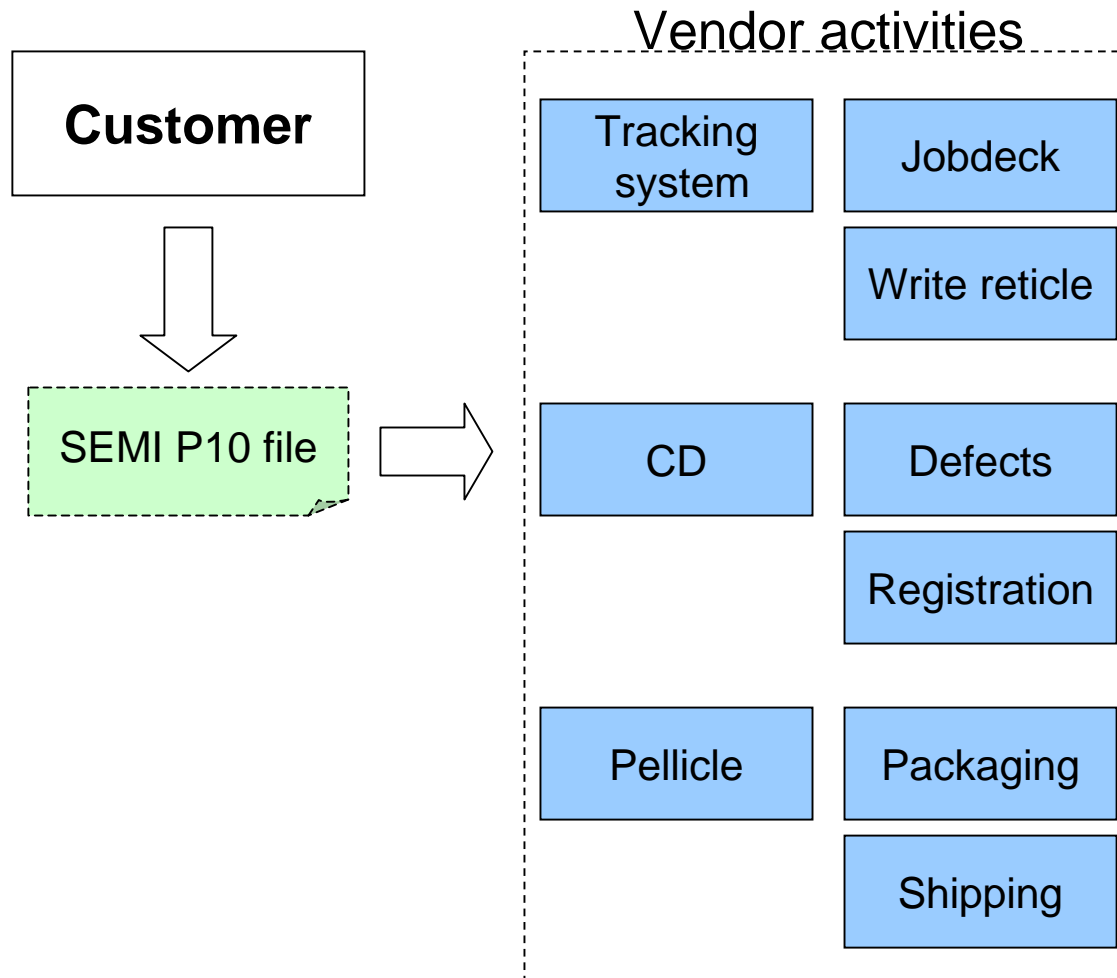
# What is SEMI P10?

- **“Specification Of Data Structures For Photomask Orders”**
- **A precisely defined syntax for transferring mask data between mask customer and mask suppliers**
  - **Two structures**
    - **Mask orders (customer to supplier)**
    - **Mask results (status and measurements from supplier to customer)**
  - **Specific limitations and conventions**
  - **Specifically defined terminology**
    - **Currently 613 distinct keywords**
  - **Examples of P10 order files**

# Typical Reticle Order System



# Order System with SEMI P10



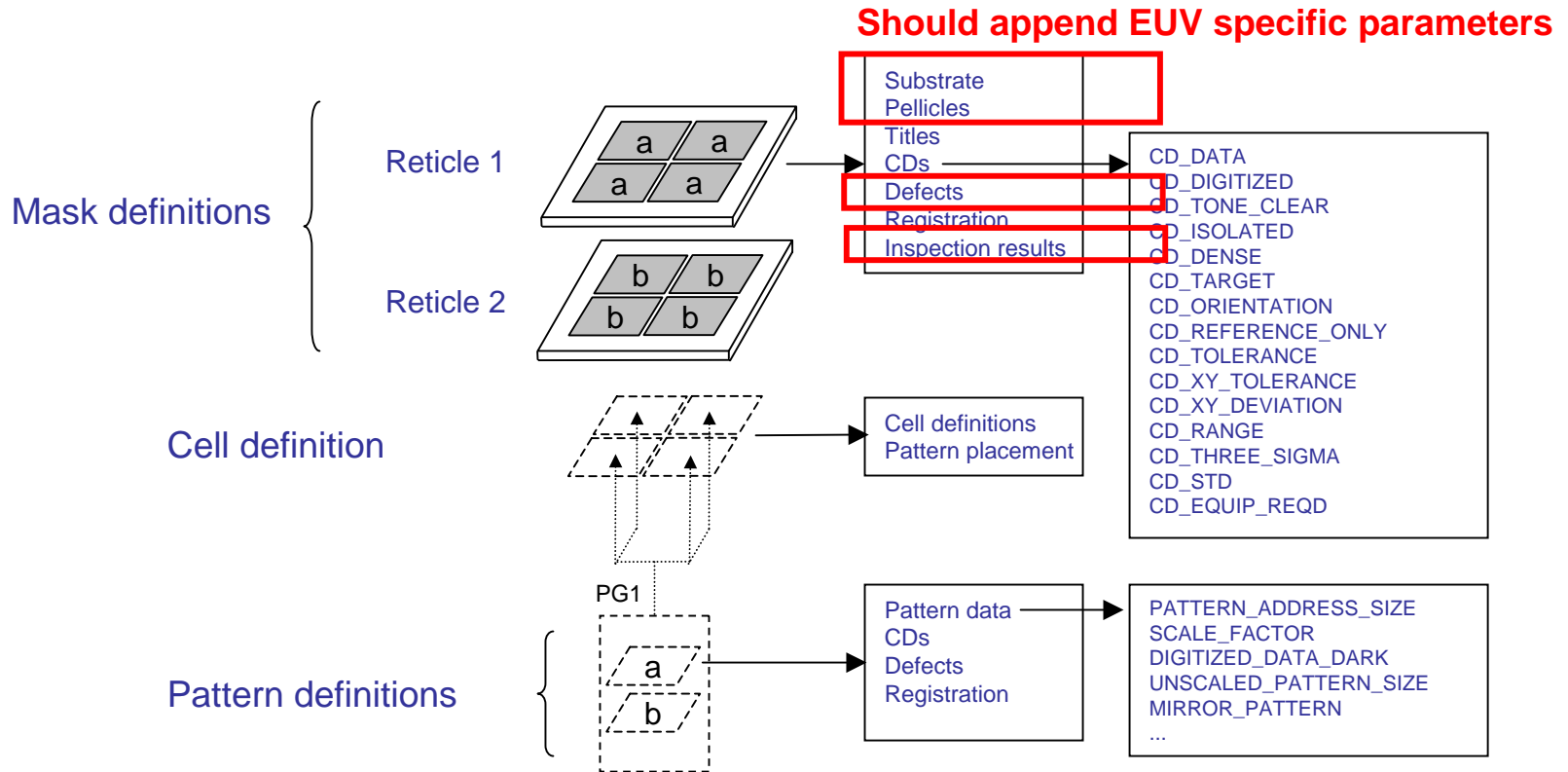
# SEMI P10 Structure

- The data model is influenced by concepts from GDSII and MEBES jobdeck format
- Hierarchy is used to organize data and manage complexity
- Key elements

Should append EUV specific parameters

- ***Mask definition*** - usually one for each physical substrate
- ***Pattern definition*** - individual pattern file details
- ***Pattern group*** - collection of pattern definitions, the basic unit of pattern placement
- ***Cell definition*** - contains *Pattern group* placements and/or placements of other *Cell definitions*
- ***Mask group*** - collection of reticles with common pattern layout
- Multiple ***mask groups*** used for mix and match

# P10 Keyword Level



# Relationship model for EUV mask requirements

## Supplier (mask blank supplier)

Responsible for verifying that the mask blank meets the requirements listed in the standard to the satisfaction of the user. Responsible for acquiring substrates that meet SEMI P37.

User/supplier negotiation for purposes of P-38

## User (mask patterning facility)

Orders mask blanks from the mask blank supplier, Responsible for communicating patterning process and end user needs to the mask blank supplier

(Should be guided by SEMI P10)

## End user (using exposure tool)

Communicates mask performance and durability requirements to mask patterning facility. Some requirements are provided by the exposure tool supplier.

## Exposure tool supplier

Defines some aspects of mask performance to end user to meet error budgets for exposure tool performance

# Proposed SEMI P-10 elements for EUV masks

*Proposed  
priority*

- **Substrate**

- ① • **Mask blank attributes need to be specified by party ordering patterned mask**
  - Selected items from Table 2 in SEMI P38

- **Pellicles**

- ② • **Requirements for mask protection from defects might be appropriate**

- **CDs**

- ② • **May be sidewall slope requirement**

- **Defects**

- ② • **May be EUV-specific requirements regarding printability or location (buffer vs. absorber)**

# **Proposed items to be included in substrate parameter list in SEMI P-10 for EUV masks**

- **Defect quality area**
- **Flatness**
- **Material composition of multilayers**
- **Composition of capping layers on the multilayer stack**
- **Multilayer stack mean median reflected wavelength**
- **Multilayer stack mean peak reflectivity**
- **Multilayer stack peak reflectivity uniformity**
- **Absorber stack material composition**
- **Optical properties of absorber stack**
- **Electrical resistance measured between the surface of the absorber stack and the backside of the mask blank**

## Contacts for SEMI P-10 questions

- **Wes Erck, [wes.erck@sbcglobal.net](mailto:wes.erck@sbcglobal.net)**
- **Article in MICRO Magazine, June 2002, "Streamlining the front-end reticle fabrication process by improving mask ordering" by Edward Suttle, Charles Croke, and James Morrison, Photronics, at <http://www.micromagazine.com/archive/02/06/suttle.html>.**