Definition of Process Parameters Needed for MBPC:

Report from SEMI
Equipment Control Systems Task Force

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Overview

- Equipment Control Systems (ECS) Task Force
  - Chartered to develop standards to enable APC in *current* environments
  - Championed addition to GEM standard to specify mechanism actuation of process program parameters to support MBPC
- Current Efforts: Create standards to enable Model Based Process Control
  - *Proposal*: Define tunable parameters for each process???
  - *Resolution*: Focus on standardizing support of fundamental quality parameters
    - Define tunable parameters that actuate quality parameters

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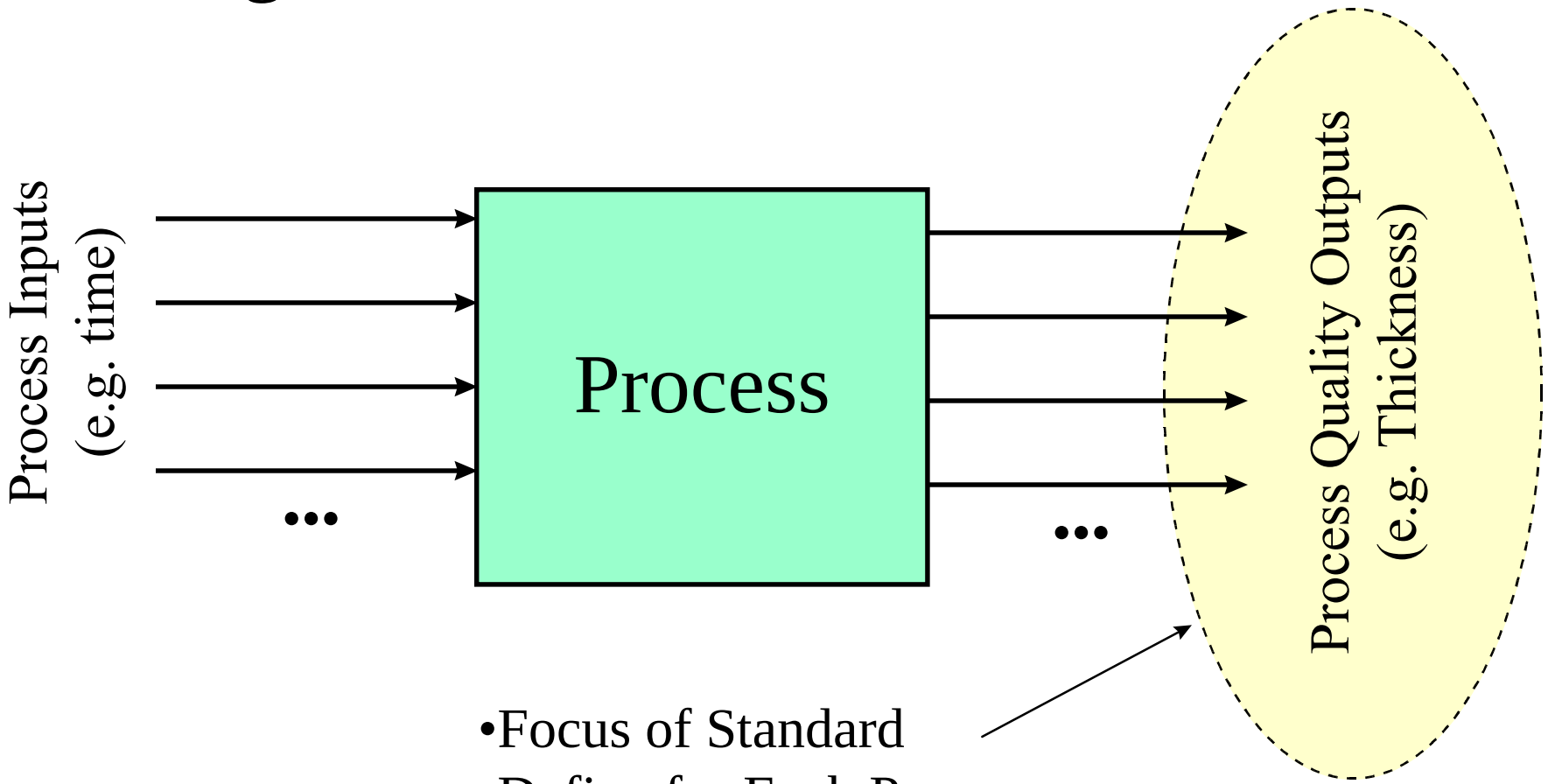
Figure 1: MBPC Control Problem



- Focus of Standard
- Define for Each Process
- Must be Tunable Run-to-run

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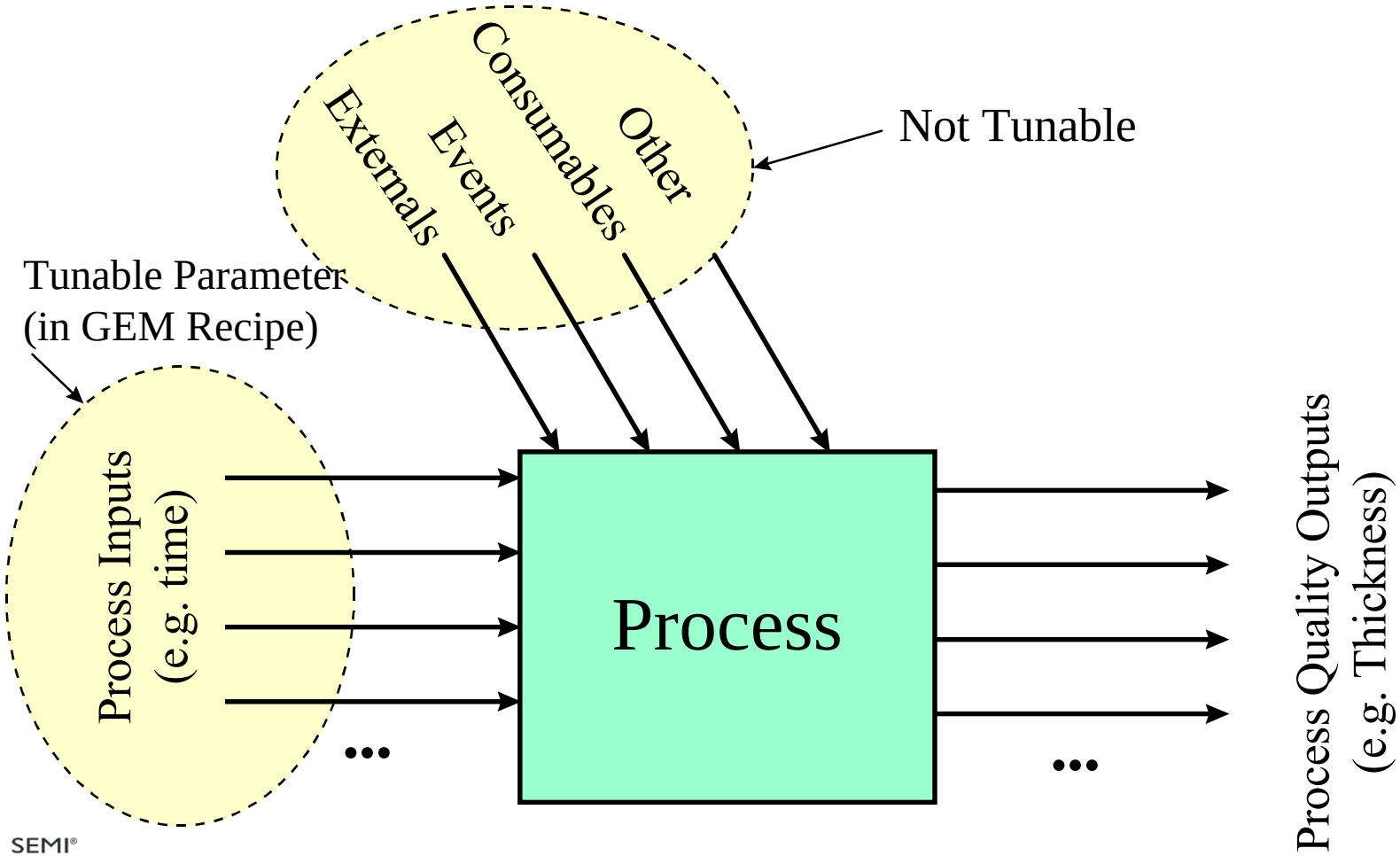
Figure 2: Defining a Tunable Parm.



Approach to the Standard

- For Each Process Define Quality Parameters
  - E.g., CMP == Thickness and Center-to-edge non-uniformity
- Conformance to Standard Would Require
  - For each quality metric for the tool type, a set of input parameters must be identified that will actuate these quality metrics
  - There must be a capability to actuate these parameters individually, in a R2R fashion, according to the GEM application note or other SEMI standard

Example R2R Variables to Change (Not to be Standardized)

Proposed Quality Parameter Tunable Run-to-run (to be Standardized

Key:
Required (bold)
Desired
Optional (italics)

Litho:
- Exposure
  - CD problems:
    - **focus (first)**
    - Dose
  - Overlay
    - lots of possibilities but mechanical in nature
      - **Delta X and Delta Y**
- Track
  - Apply
    - **spin speed (first)**
    - chill plate temp
    - photoresist temp
    - acceleration
    - exhaust
    - environmental temp
  - Bake
    - **time**
    - **temp**
  - Develop
    - **flow (first)**
    - spin speed
    - arm speed

Litho:

CD

Alignment (X and Y)

Defect Analysis
Uniformity
Thickness

Very Preliminary

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Example R2R Variables to Change (Not to be Standardized)

- CMP
  - **polish time (first)**
    - *Individual head control preferred*
  - carrier speed
  - table / platen speed
  - back pressure
  - *downforce*

- Vapor Phase Epitaxy / Furnaces
  - **time**
  - temperature
    - *Individual zone control preferred*
  - dopant level
  -
  -

Proposed Quality Parameter Tunable Run-to-run (to be Standardized

Key:
Required (bold)
Desired
Optional (italics)

CMP

Thickness

Uniformity

Rate (secondary ?)

Vapor Phase Epitaxy / Furnaces

Thickness

Resistivity

Resistivity Uniformity

Rate (secondary?)

Very Preliminary

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Action Plan

- Gather Input from Users, OEMs and Solution Providers as to *Primary* Quality Metrics
- Develop Standard Document Structure so That Above Parameters Can Be Easily Entered Into the Standard
- Pursue Standardization
  - Ballot for voting at winter meetings (March 2002)
  - Next meeting: Tuesday, Oct. 16th, Austin (SEMICON/SW)
    - Main focus: Defining quality parameters for each process

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Equipment Control System (ECS) Task Force

Minutes: Semicon West

Attendees:

John Pace (co-chair)	IBM / SEMATECH	John.pace@sematech.org
James Moyne (co-chair	Brooks Automation	james.moyne@brooks.com
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