# SMT2020

# Semiconductor Manufacturing Testbed

# General Data specification

**Release 1.0 - 03/2020**

# 1. Introduction

The purpose of this document is to describe the data of the Semiconductor Manufacturing Testbed 2020 (SMT2020) in a simulation tool-independent manner. SMT2020 in its final version will include several fab models, among them a High Mix – Low Volume model (dataset 1) and a Low Mix – High Volume fab (dataset 2). The file of each dataset contains seven different types of tables. A summary of the purpose of all the tables is given next.

| Table | Description |
|---|---|
| Toolgroups | Information on all tool groups, their characteristics, and dispatching. |
| PM | Information on preventive maintenance (PM) for all tools including the related probability distributions. |
| Breakdown | Information on tool breakdowns for all tools including the related probability distributions. |
| Route_Product_i | Information on all routes (process flows) where the route of each product is located in a separate table. |
| Lotrelease | Information on all products, lot types, and the release (probability) distributions. |
| Setups | Additional information on setups. |
| Transport | Information on transportation times. |

In addition, the table “Setup_Matrix_Implant_Gas” gives an overview of the setups und their time concerning all process steps for particular Implant tool sets.

# 2. Description of the tables

Each table will be described in some detail in this section. A brief description of each column will be provided.

## 2.1 Toolgroups

| Column | Description |
|---|---|
| AREA | Name of the manufacturing area, a single area includes typically several tool groups. |
| TOOLGROUP | Name of the tool group. |
| NUMBER OF TOOLS | Number of tools of the tool group. |

| | |
|---|---|
| CASCADINGTOOL | Information whether the tools are cascading tools or not. |
| BATCHINGTOOL | Information whether the tools are batching tools or not. |
| BATCHCRITERION | Criterion to form batches from wafers. |
| BATCHING UNIT | Unit for the batch size (here wafers). |
| LOADINGTIME | Time for loading a lot/batch on the tool. |
| LT UNITS | Time units for loading. |
| UNLOADINGTIME | Time for unloading a lot/batch on the tool. |
| ULT UNITS | Time units for unloading. |
| TOOLGROUPLOCATION | Location of the tool group within the factory. |
| DISPATCHING | Used dispatching strategy considering Ranking 1 - 3.<br>1) The superhotlot strategy prefers superhotlots, a tool for the next step will be reserved for a certain period of time.<br>2) The setupavoidance rule ensures a prescribed number of lots in a run for the setups of the implant_gas setup group. |
| Ranking 1 | Lots with a higher priority are chosen first. |
| Ranking 2 | Given lots with the same priority: The lot with the least required setup time is the tie-breaker. |
| Ranking 3 | Given lots with the same priority and the same setup time: First come first serve (FIFO) (dataset 1) or Critical Ratio (dataset 2) are the tie-breakers. |
| TOOL WAKE UP Ranking | Tool with the smallest required setup time is the tie-breaker if there is more than one idle tool (standby). |

## 2.2 PM

| Column | Description |
|---|---|
| PM EVENT NAME | Name of a defined PM probability distribution. |
| PM EVENT VALID FOR TYPE | Definition for which tools the PM event is valid, e.g. for all tools of an area or a tool group. |
| TYPE NAME | Name of the specific area or tool group for which the PM event is valid. |

| | |
|---|---|
| PMTYPE | Type of the PM, i.e. time-based or counter-based. |
| MTBeforePM | Mean time before a PM (MTBPM) or the number of processed wafers for a tool (constant distribution). |
| MTBPM UNITS | Time units or number of wafers for MTBPM. |
| TTR DISTRIBUTION | Distribution of the time to repair (TTR) (PM duration), here continuous uniform. |
| MEAN | Value of the first parameter (mean) of the distribution. |
| OFFSET | Value of the second parameter (offset) of the distribution. |
| TTR UNITS | Time units for TTR (TTR). |
| FIRST ONE AT DISTRIBUTION | Distribution of the first PM for the tools of a tool group.<br>The constant distribution means that the first PM for the tools of a tool set are evenly distributed based on the FOA value.<br>For example, a FOA value of 80 days with 4 tools lead to PMs at the following days: 20, 40, 60, and 80. |
| FOA | The first one at (FOA) value refers to a time for time-based PMs and to a number of wafers for counter-based PMs. |
| FOA UNITS | Time units or number of wafers for FOA. |

## 2.3 Breakdown

| Column | Description |
|---|---|
| DOWN EVENT NAME | Name of a defined down distribution. |
| DOWN EVENT VALID FOR TYPE | Definition for which tools the down event is valid, e.g. for all tools of an area. |
| TYPE NAME | Name of the specific area for which the down event is valid. |
| DOWNTYPE | Type of the tool breakdown, i.e. time-based. |
| TTF DISTRIBUTION | Distribution of the time to failure (TTF), here exponential. |
| MTTF | Mean TTF (MTTF). |
| MTTF UNITS | Time units for MTTF. |

| | |
|---|---|
| TTR DISTRIBUTION | Distribution of the time to repair (TTR), here exponential. |
| MTTR | Mean TTR (MTTR). |
| MTTR UNITS | Time units for MTTR. |
| FIRST ONE AT DISTRIBUTION | Distribution of the first TTF for the tools of an area, here exponential. |
| FOA | The first one at (FOA) value (MTTF). |
| FOA UNITS | Time units for FOA. |

## 2.4 Route Product_i

| Column | Description |
|---|---|
| ROUTE | Name of the route. |
| STEP | Name of the process step, here a number. |
| STEP DESCRIPTION | Original name of the process step. |
| AREA | Name of the manufacturing area. |
| TOOLGROUP | Name of the tool group. |
| PROCESSING UNIT | Processing unit, i.e. wafer/lot/batch. |
| PROCESSING TIME DISTRIBUTION | Probability distribution of the processing time per processing unit, here continuous uniform. |
| MEAN | Value of the first parameter (mean) of the distribution. |
| OFFSET | Value of the second parameter (offset) of the distribution. |
| PT UNITS | Time units for processing time. |
| CASCADING INTERVALL | Time between two consecutive finished wafers or lots on a cascading tool. |
| C Units | Time units for cascading interval. |
| BATCH MINIMUM | Minimum number of wafers to build a batch. |
| BATCH MAXIMUM | Maximum number of wafers to build a batch. |

| | |
|---|---|
| SETUP | Name of the required setup for the process step. |
| WHEN | Information whether the setup will be always executed or only if the tool does not have already this setup, i.e., a setup is needed. |
| SETUP DISTRIBUTION | Distribution of the setup times. |
| SETUP TIME | Setup time for constant distribution or mean setup time for uniform distribution. |
| OFFSET | Value of the second parameter (offset) in case of uniform distributed setup times. |
| ST UNITS | Time units for setup time. |
| STEP FOR LTL DEDICATION | Step name/number where exactly the same tool must be used for processing (for lot-to-lens dedications). |
| REWORK PROBABILITY in % | Probability to be sent for rework. |
| R UNIT | Unit to be sent for rework. |
| STEP FOR REWORK | Step name/number destination for rework. |
| PROCESSING PROBABILITY in % (Sampling) | Probability that a lot will be inspected. |
| STEP FOR CRITICAL QUEUE TIME | Name of the step until its beginning a critical queue time is valid. |
| CQT | Critical queue time (CQT) from the end of the current step (process on tool) until the begin of the step defined in the previous line (process on tool). |
| CQT UNITS | Time units for critical queue time (CQT). |

## 2.5 Lotrelease

| Column | Description |
|---|---|
| PRODUCT NAME | Name of the product. |
| ROUTE NAME | Name of the corresponding route of the product. |
| LOT NAME/TYPE | Name or the type of a lot. |
| PRIORITY | Priority of the lot type, lots with a higher priority are preferred (Ranking 1). |

| | |
|---|---|
| SUPERHOTLOT | Information whether the lot type is superhotlot or not, information for the superhotlot rule to reserve a tool for the next step. |
| WAFERS PER LOT | Number of wafers per lot. |
| START DATE | Release date of the first lot. |
| RELEASE DISTRIBUTION | Distribution of the time interval between lot starts, here constant. |
| RELEASE INTERVAL | Mean of the time interval between lot starts. |
| R UNITS | Time units of the interval between lot starts. |
| LOTS PER RELEASE | Number of lots started each time interval. |
| DUE DATE | Due date of the first lot. |

## 2.6 Setups

| Column | Description |
|---|---|
| SETUP GROUP NAME | Name of a setup group. |
| CURRENT SETUP | Name of the current setup. |
| NEW SETUP | Name of the new setup. |
| SETUP TIME | Setup time (constant distribution). |
| ST UNITS | Time units for setup time. |
| MINIMAL RUN LENGTH | Minimum number of processed lots required after a tool has changed its setup (before a new setup), enforced by the setupavoidance rule. |

## 2.7 Transport

| Column | Description |
|---|---|
| FROM LOCATION | Transportation starting point (location of the tool group). |
| TO LOCATION | Transportation ending point (location of the tool group). |
| TRANSPORTTIME DISTRIBUTION | Probability distribution of the transport time, here continuous uniform. |

| | |
|---|---|
| MEAN | Value of the first parameter (mean) of the distribution. |
| OFFSET | Value of the second parameter (offset) of the distribution. |
| TT UNITS | Time units for transportation time. |