Lithography Equipment Analysis Assumptions

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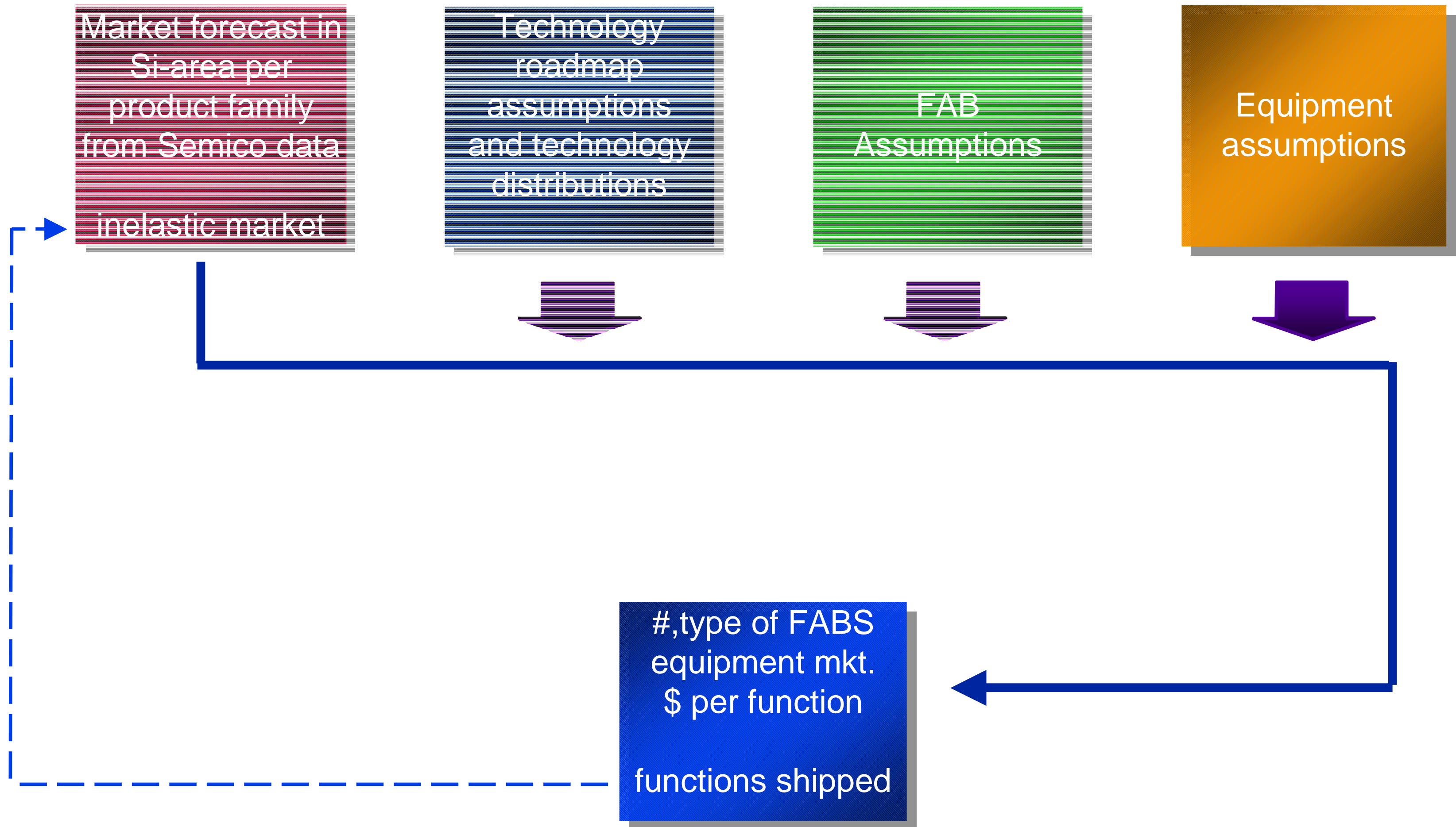
Presentation Overview



Assumptions- Equipment Speed

200mm Litho tools – number of fields per wafer

- 25mm x 25mm die size has 37 steps per wafer
- 22mm x 22mm die size has 45 steps per wafer
- 20mm x 20mm die size has 57 steps per wafer

200mm Litho tools – Throughput (planned)

- 25mm x 25mm die size – 62.7 wafers per hour
- 22mm x 22mm die size – 59.6 wafers per hour
- 20mm x 20mm die size – 52.3 wafers per hour

300mm Litho tools – 60% of 200mm Throughput

Equipment Efficiency – Scenario #1

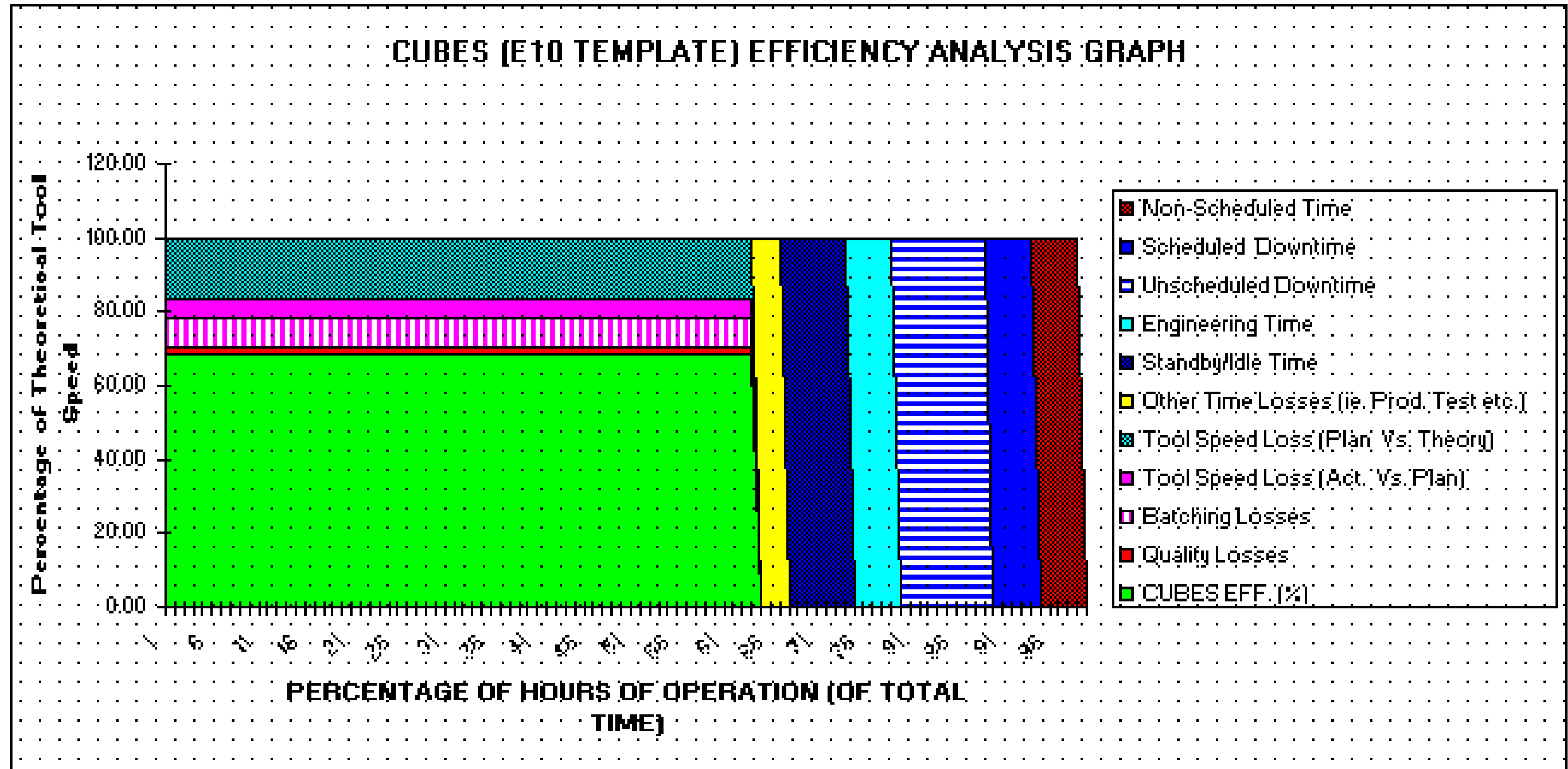
CUBES v. 2.51 BETA (E10 TEMPLATE) EFFICIENCY ANALYSIS TOOL #######

TOOL:	TOOL 1	SUPPLIER:	MODEL:
TOOL ID:		SOURCE DATA DATE:	
BATCHSIZE:	5	SOURCE DATA FROM:	

SUMMARIZED INPUTS		INPUT CHECKS	SUMMARIZED OUTPUTS		CUBES EFFICIENCY (%)		THRUPUT
			Actual Production		45.48		4791
					OVERALL EFFECT (%)	INDIVIDUAL EFFECT (%)	THRUPUT INCREASE ANALYSIS IN UNITS
Theoretical Tool Speed (UPH)	62.7		Speed Efficiency (%)	68.22			
Total Time	168		Time Efficiency(%)	66.67			
Plan Tool Speed (UPH)	52.3	TRUE	Tool Speed Loss (Plan Vs. Theory)		11.06	16.59	
Actual Tool Speed (UPH) ***	49	TRUE	Tool Speed Loss (Act. Vs. Plan)		3.51	6.31	323
Average Batch Size (% Full)	90	TRUE	Batching Losses		5.21	10.00	532
Quality Losses (% Loss)	3	TRUE	Quality Losses		1.41	3.00	148
Other Time Losses (ie. Prod. Test etc.)	4.00	TRUE	Other Time Losses (ie. Prod. Test etc.)		2.38	3.45	171
Standby / Idle Time	12.00	TRUE	Standby/ Idle Time		7.14	9.38	513
Engineering Time	8.00	TRUE	Engineering Time		4.76	5.88	342
Unscheduled Downtime	16.00	TRUE	Unscheduled Downtime		9.52	10.53	684
Scheduled Downtime	8.00	TRUE	Scheduled Downtime		4.76	5.00	342
Non-Scheduled Time	8.00	TRUE	Non-Scheduled Time		4.76	4.76	342

Based on CUBES developed by John Konopka, Ph.D.

Equipment Efficiency – Scenario #1



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Summary of Daily Tool Throughput

- **200mm Tools (in wafers per 24 hours)**

	Effective TPT	AltPSM TPT
– ITRS Roadmap [C]	998	600
– 2 year cycle [B]	684	410

- **300mm Tools – 60% Throughput de-rating**

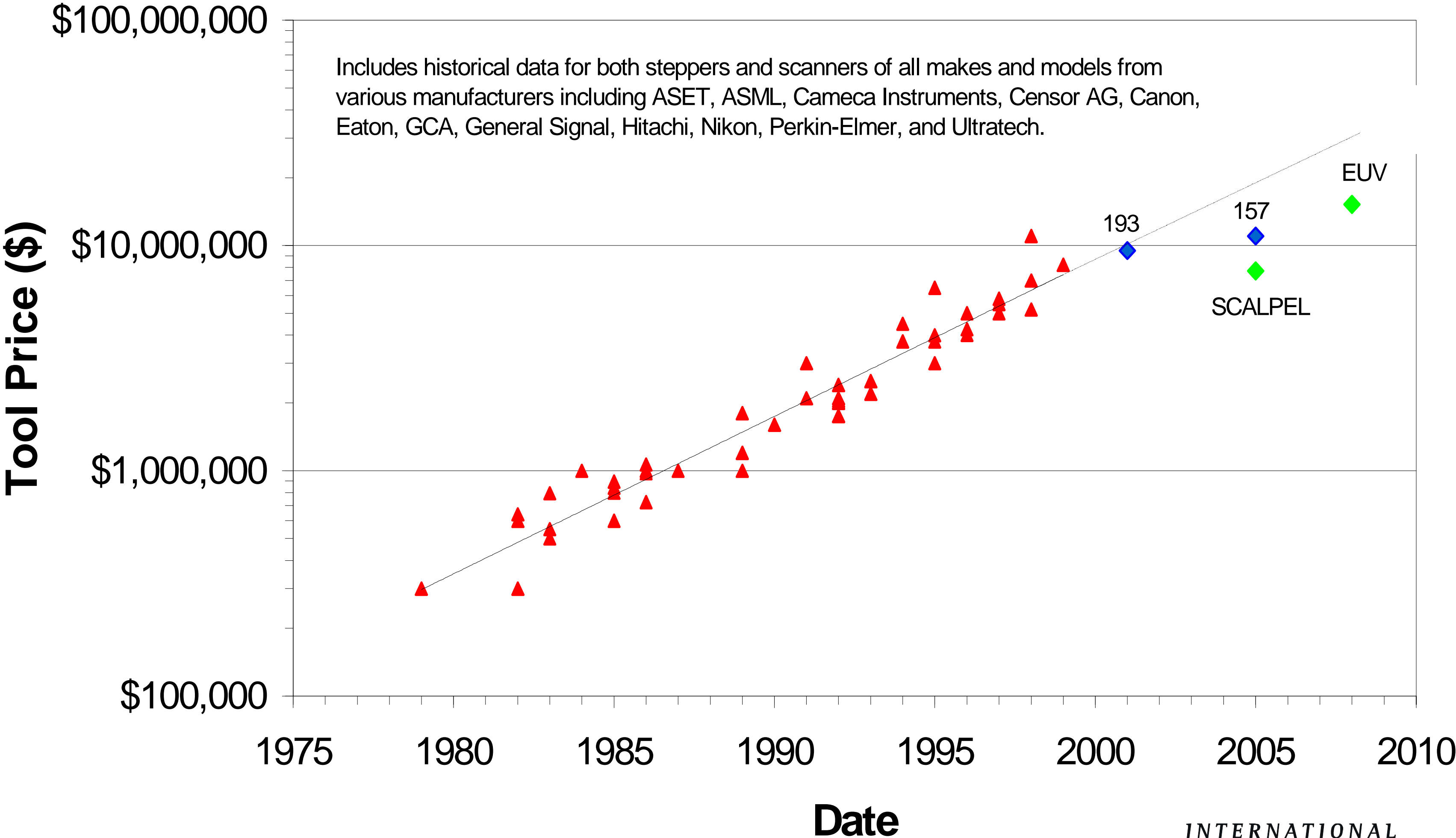
	Effective TPT	AltPSM TPT
– ITRS Roadmap [C]	600	360
– 2 year cycle [B]	410	247

AtlPSM consists of Blocking Mask and PSM.

Throughput Conclusions

- Manufacturer quoted equipment throughput is based on minimum number of fields per wafer and is otherwise optimized to provide the most favorable picture of operating conditions.
- Equipment claims do not consider availability or scheduling constraints in advertised throughput values.
- Static Modeling efforts must de-rate actual throughput to reflect "real" world experience. (Without de-rating, a Fab for devices with 19 levels would require 12 steppers – actual is 27 or 28.)

Exposure Tool Price vs. Time for Various Manufacturers



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Stepper Projection Scenarios

	130nm	100(90)nm	70(65)nm
Throughput (wph)			
– ITRS Roadmap [C]	25/15	25/15	25/15
– 2 year scenario [B]	17/10	17/10	17/10
		(binary mask /double phase shift mask)	
Tool Cost ($M)			
– ITRS Roadmap [C]	8/11	11/14	14
– 2 year scenario [B]	8/12	11/15	15
	(248nm/193nm)	(193nm/157nm)	(157nm)

Throughputs are a function of accelerated tool wavelength introduction.
Tool costs are a function of wavelength introduction.

Conclusions

- **There is a penalty in stepper equipment cost due to acceleration of technology – 10% for each year of shortening**
- **Stepper throughput will change slightly due to technology acceleration - < 5%**
- **Other cost contributors, i.e., masks, resists, etc., will increase due to technology acceleration**
  - These changes, which are anticipated to be small, are not modeled in today's presentations

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