

Complex Machine Performance Testing

Business Justification

To meet demand for objects on a 3-year forecasting schedule, the Complex Machine manufacturing system will need to decrease manufacturing time. Additionally, over the last few months we have noticed an increase in variability of time spent in the pipeline, and need to investigate the cause of the variability. To that end, performance tests were executed and recorded for the Complex Machine manufacturing system by Quality Assurance over three manufacturing cycles.

Testing Process

This table illustrates the required confidence levels and sample sizes for different testing tasks. To verify our process is working, we will complete 25-50 test runs each week. For changes to the process, a sample size of 75-100 is required with a higher confidence level.

Frequency	Confidence level	Sample size	Notes
Low	90%	25	<ul style="list-style-type: none">• Minimum tolerable sample size for weekly checks• Run this holiday weeks
High	95%	50	<ul style="list-style-type: none">• Desired sample size for weekly checks• Run this every normal 7-day week
Medium	97%	75	<ul style="list-style-type: none">• Minimum sample size required for small processing changes• No more than twice per month
Low	97%	100	<ul style="list-style-type: none">• Required sample size for process changes• Once per month

This monthly report examines potential process changes (highlighted in yellow above). To consider changes to machinery and process, a 97% confidence level is required. Our testing process is built for and looks for at least one of the following quality/cost benefits.

- Reduced manufacturing time
 - Definition: A total system reduction of at least 5 milliseconds
- Increased system maintainability
- Increased system stability
- Increased employee safety and satisfaction

Results

Here are the results from 100 test runs of manufacturing objects. The average time spent manufacturing one object is 66.797 seconds, which is nearly 3 seconds faster than the last test. Based on outside analysis, the Pre-processing and Machine B steps might see the largest reduction of time through parallelization with other steps.

	Setup	Pre-processing	Machine A	Machine B	Machine C	Validation
Minimum	1,301	3,447	11,776	15,212	23,087	378
Average	3,339	4,502	18,505	16,110	27,890	451
Maximum	6,002	4,998	29,004	17,019	28,921	521
Total	33,390	45,020	185,050	161,100	278,900	4,510

This figure shows the results from from 100 test runs of manufacturing objects. Notice the extreme variability in Machine A. The variability in Setup and Machin C is not as prominent.

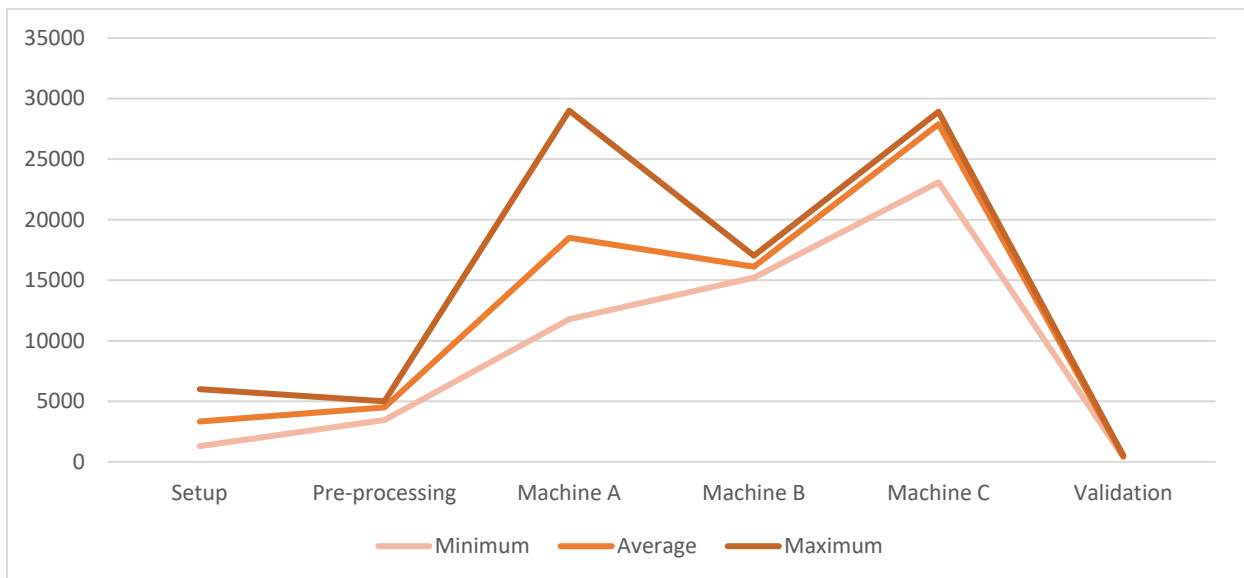


Figure-1: Results are in milliseconds

Conclusion

Based on our analysis, we have two main recommendations. Even though most of the time is spent in Machine C, our recommendation is to focus on parallelization of Machine B with Machine A. We expect to see a 6-7,000 millisecond reduction in time spent. To reduce the variability in the system, our recommendation is to optimize the parameters for Machine A toward consistency.