Thickness Measurement Rate in a CMP Environment

In-situ optical measurement in CMP is done through a window in the platter. The measurement time interval is limited because of the rotation. It is frequently desirable to make multiple measurements within one rotation to sample points in the different locations on the wafer.
Thickness measurement includes two steps: data acquisition and data analysis.

Data acquisition time is limited by the signal strength: shorter integration time decreases the signal strength. The minimum integration time in the Ariel spectrometer is 10 µs, but a typical integration time in a CMP environment is ~5 ms due to slurry and window contamination.
Signal strength can be increased by ~2-3x, if necessary, through light-source changes and reflectance-probe optimization.

	Time	Conditions
Minimum integration time	10 µs	Shortest possible time
Typical integration time	~ 1-2 ms	On Si
Typical integration time	~ 5 ms	On Si in a CMP environment

Table 1. Integration time / data acquisition summary

Data Analysis
Thin films (<1 µm) and thick films (>1 µm) are analyzed differently.

Film thickness	Calculation / data analysis time
<1 µm	< 100 ms
>1 µm	<10 ms

Table 2. Data analysis time depends on the film thickness range

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Maximizing Acquisition Rate

Data acquisition and data analysis can be separated. Data acquisition can proceed at the maximum rate allowed by the signal strength, while data analysis runs separately on a calculation server.

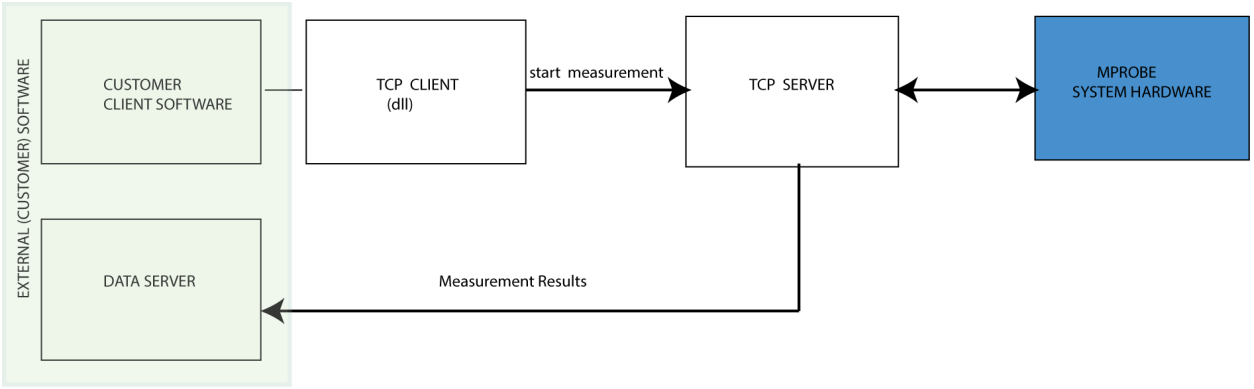


Fig.1 Data acquisition and Data analysis are separated internally in TCP server and only measurement results (e.g. thickness) are sent to the DataServer

Calculation / data analysis speed

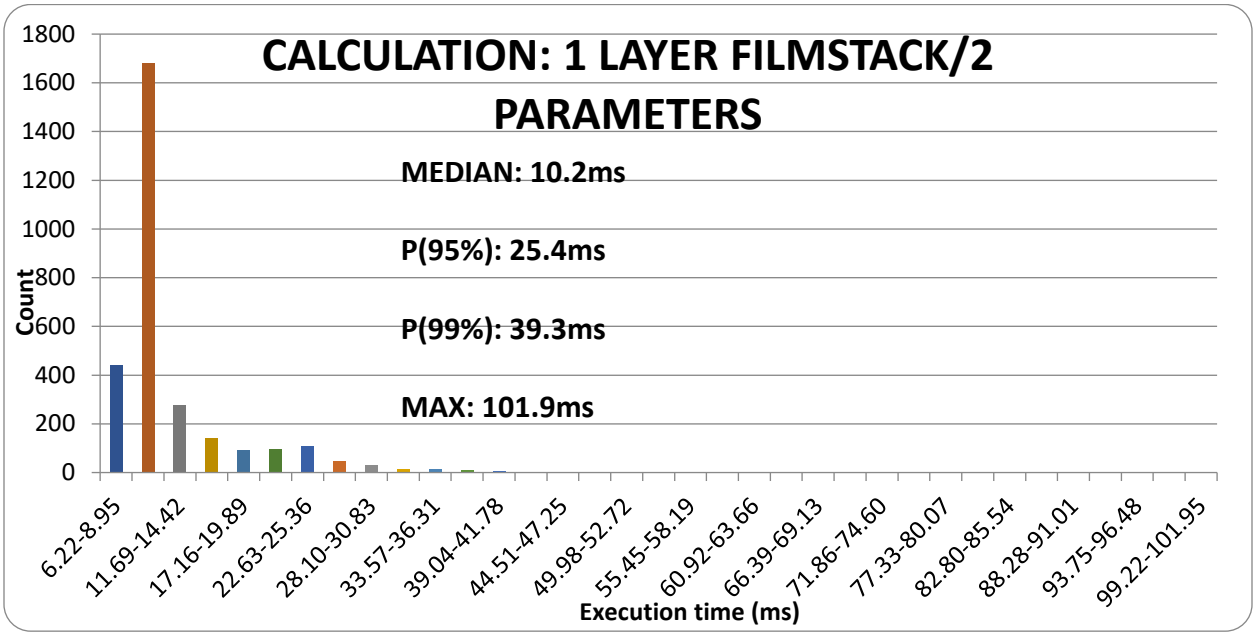


Fig. 2 Thin film (<100 nm): one-layer film stack, 2 calculated parameters

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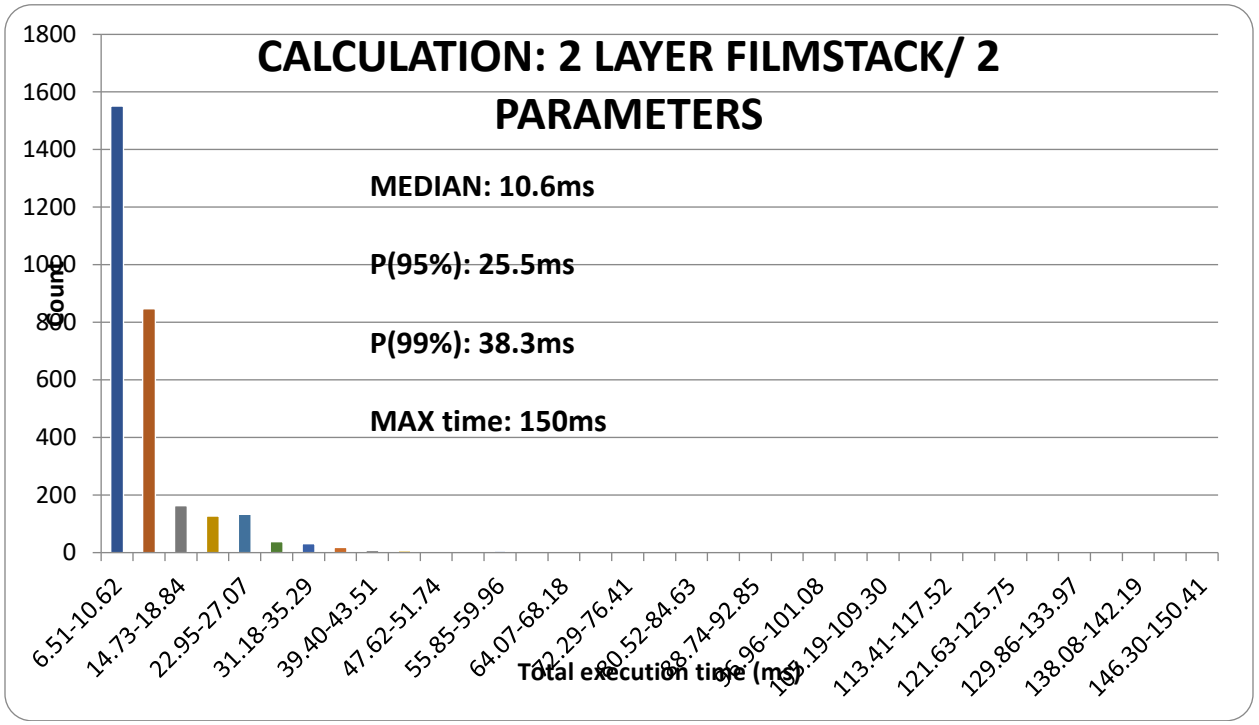


Fig. 3 Thin film (>100 nm): two-layer film stack, 2 calculated parameters

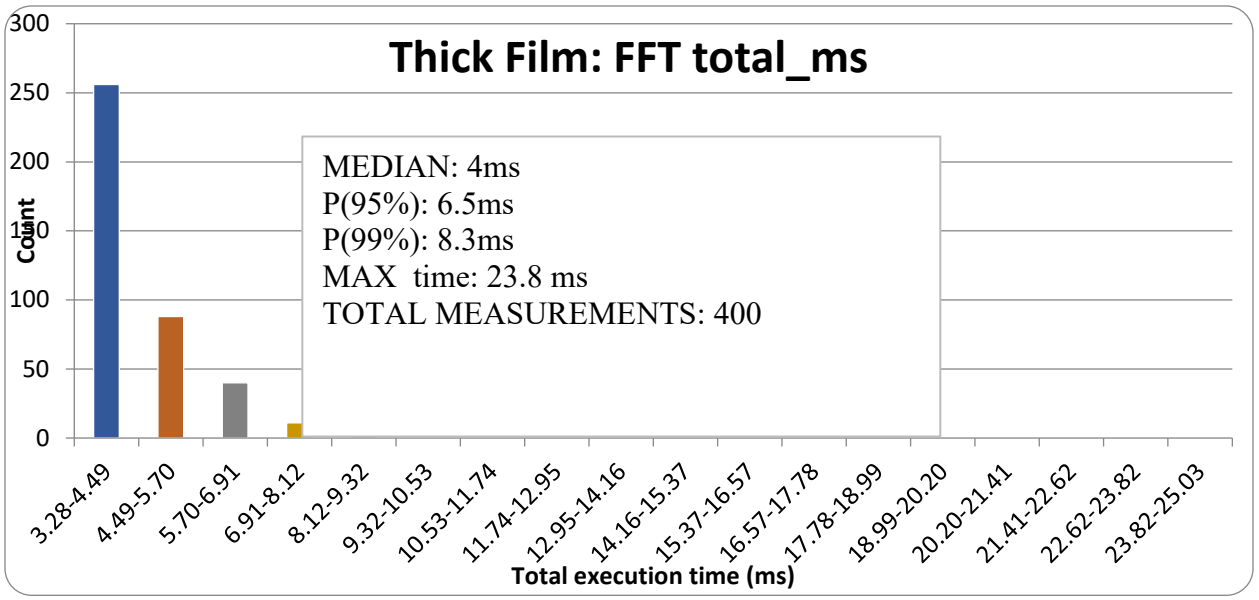


Fig. 5 Thick film (>1 µm)

Testing platform:
Windows 11; CPU: AMD Ryzen 9 5950X 16-Core Processor, 3.4 GHz, 16 cores
RAM: 64 GB

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