

# **Fastrack NPIs from Fixture Design and Development to Mass Production**

PathWave Manufacturing Analytics (PMA)

## Organization

- Server board contract manufacturer (CM)
- OEM working with global CMs

## Challenges

- Lengthy NPI rollout cycle (3 months before mass production)
- Difficulty achieving minimum CPK value of 1.33
- Manual ICT measurement extraction and analysis
- Extended system downtime due to debugging without data

## Solutions

- PathWave Manufacturing Analytics (PMA)

## Results

- Reduced NPI rollout time to 3 weeks with test flexibility
- Provided global visibility to OEMs across CMs
- Implemented a unified platform for complete NPI oversight and change tracking
- Achieved 95% FPY, up from 80%, ensuring project quality
- Lowered retest rate by 5%
- Used advanced AI & ML for early fixture and equipment issue detection

## Background

Due to rapid technological advancements coupled with frequent new product releases from businesses, manufacturers are pushed to continuously introduce new product initiatives (NPIs) in their production lines for mass production. Taking new NPIs into production involves working with multiple vendors, resulting in longer lead times and limiting the number of NPIs that can be rolled out in a year. Any improvement to reduce lead times can help launch new products to market in a shorter time frame, hence positively contributing to the top-line revenue.

In this case study, we highlight how artificial intelligence (AI) & machine learning (ML)-based Keysight software application PathWave Manufacturing Analytics helped its customers fast-track the NPIs cycle and reduced long lead time from designing the fixture to taking it for mass production.

# The Challenge

## Iterative process with a lack of visibility

Keysight engaged with a server board contract manufacturer in Asia Pacific who is facing a challenge in scaling up NPI rollouts as the overall cycle took around three months before getting into mass production. One of the primary reasons was the fine-tuning of tests to achieve a minimum process capability index (CPK) value of 1.33. CPK scores are one of the aspects of manufacturing that showcase the process's stability. The higher the CPK scores, the better the yield quality produced.

Fine-tuning the CPK for new fixtures involved collaborating with the fixture house to identify and address tests with low CPK values iteratively. This process required redesigning fixtures and programs. Multiple builds are completed before a product reaches the mass production stage. During each build, in-circuit test (ICT) measurements are manually extracted, computed, and analyzed to improve the subsequent build's first-pass yield (FPY). These manual processes are tedious, time-consuming, and prone to human error. Additionally, debugging without data led to extended system downtime on the production floor during test fine-tuning.

## The Solution

Contract manufacturer adopted PathWave Manufacturing Analytics (PMA) to assist in quickly identifying the CPK scores of their new fixtures. PMA was adopted as early as during the design phases in collaboration with Fixture Design House and extended the usage further during the “improvement phase” of their fixtures. Then, PMA was used to monitor and improve their quality and yield during mass production in real time.

This also helped overcome another significant challenge: the lack of visibility for Original Equipment Manufacturers (OEMs). Adopting PMA across the entire process allows OEMs to identify bottlenecks quickly. Additionally, OEMs can compare new product introductions (NPIs) across different sites and implement benchmarks.

Overall, the NPI journey followed by manufacturers can be broken into 3 phases:

### Design phase

During the design phase, the Fixture House develops a golden board and performs 30 controlled tests. Based on the measurements from the golden board, the fixture or program is improved before being shipped to the manufacturer.

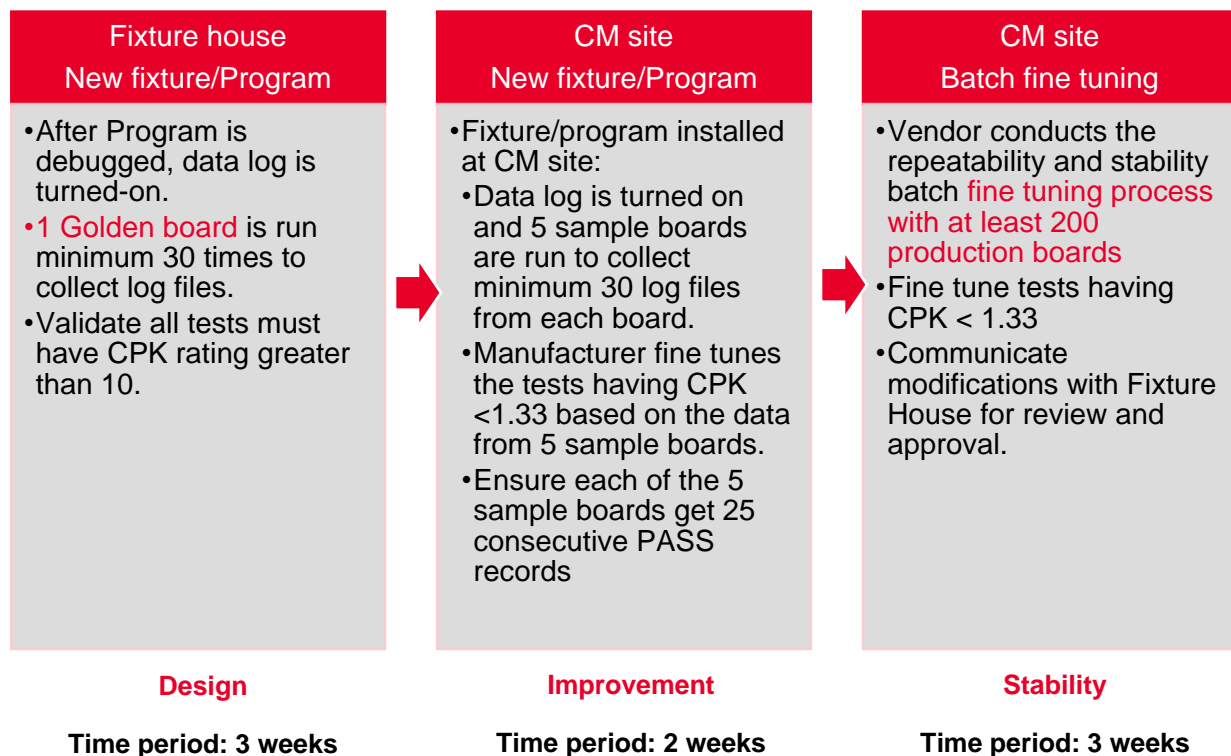
## Improvement phase

The contract manufacturer receives the fixture for the project's first run. At this stage, they increased the number of controlled tests and tested five different boards to obtain at least thirty log files from each board. The CPK score is set to a minimum expected value of 1.33, and the program must achieve at least twenty-five consecutive passes to qualify for the next phase, known as the stability phase. Most tests fail at this stage and are referred to the fixture house for improvement. This iterative process can take multiple rounds before achieving the correct program.

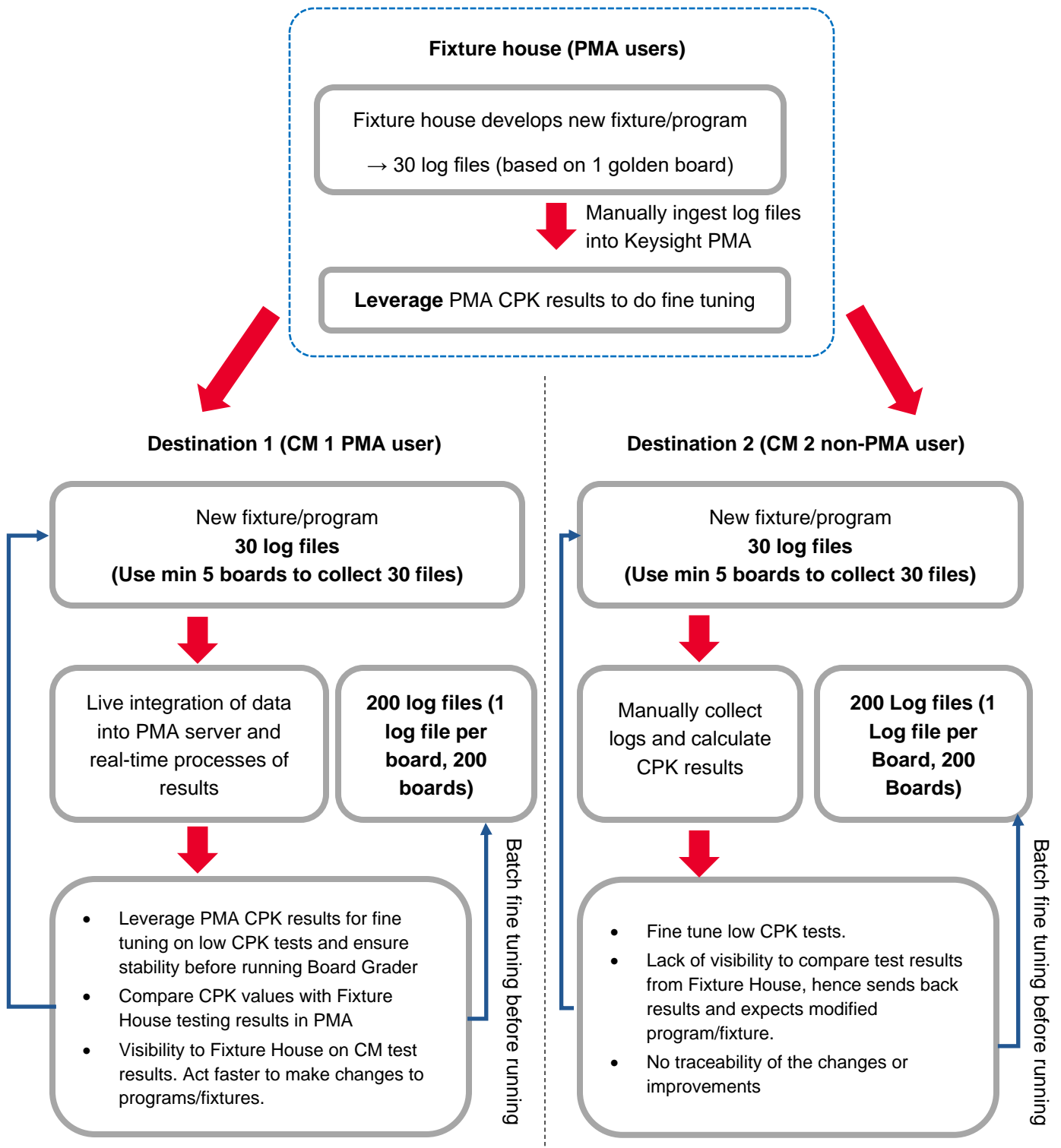
## Stability phase

The boards are tested in real-time scenarios after the program passes the improvement phase. A minimum of two hundred production boards are measured in real-time using the minimum CPK benchmark (1.33) to ensure the program is stable and qualifies for mass production. Test engineers conduct further analyses, such as anomalies and probe issues, to achieve the defined production standards.

## Typical flow for New Fixture/Program Buyoff



## PathWave Analytics As-a-Service for new fixture/program buyoff



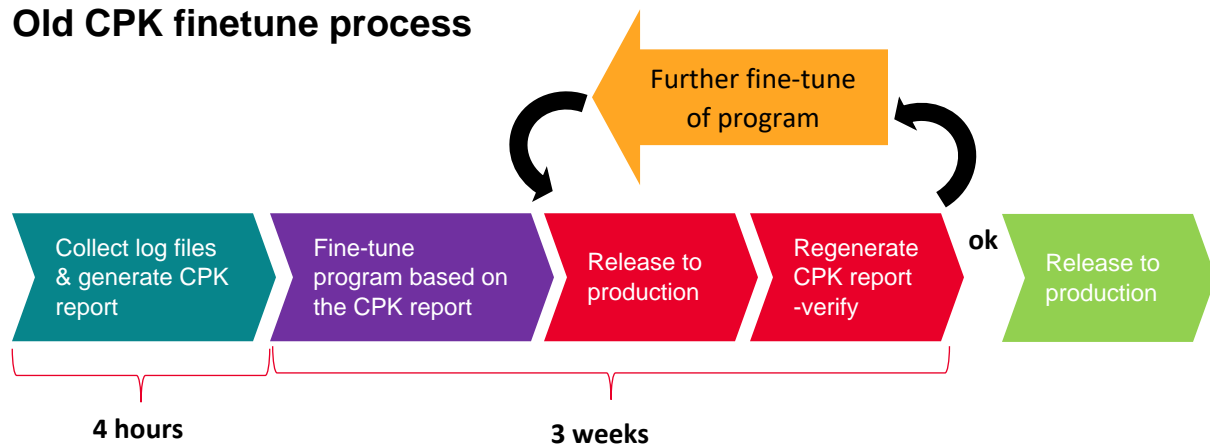
# Solution Details

Since most of the fixture houses do not have the option to integrate their testers into PMA, our team provides a utility for manually uploading the files during the design and improvement phase. The key value provided by PMA is improving the quality of the fixture by using analytics and providing feedback on CPK metrics to the fixture house during the design and improvement phase. This helps the fixture house to test the fixtures multiple times before shipping them to the manufacturer.

When the manufacturer receives the fixture/program, they can integrate PMA to get real-time insights on the controlled tests. From PMA insights, manufacturers can iteratively improve specific tests with low CPK values. During the mass production phase, the PMA solution provides real-time alerts and ML-based analysis like degradation & anomalies that can help to flag issues that are more difficult to discover by humans, thereby helping contract manufacturers maintain high first pass yield and reduce wastages.

## Speed up NPI delivery and buyoff

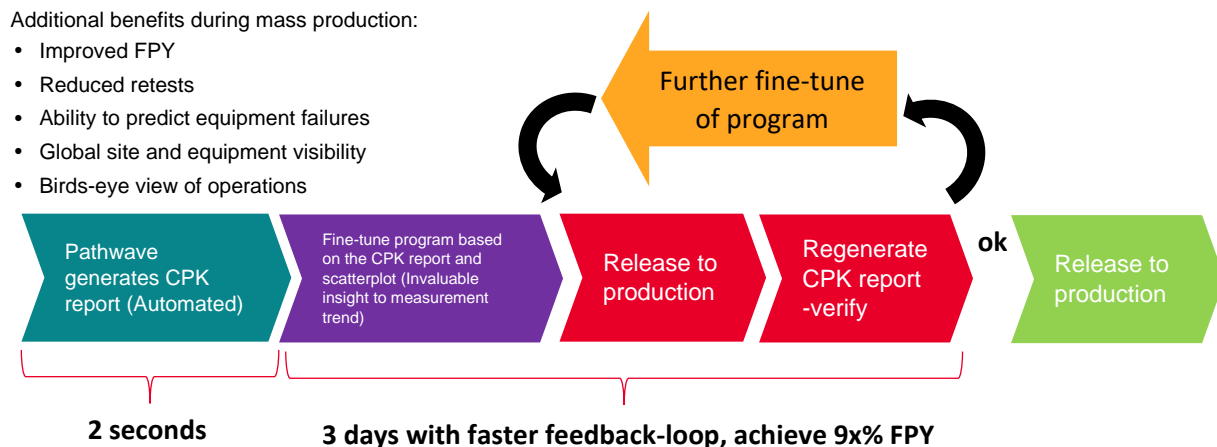
### Old CPK finetune process



### New CPK finetune process

Additional benefits during mass production:

- Improved FPY
- Reduced retests
- Ability to predict equipment failures
- Global site and equipment visibility
- Birds-eye view of operations



# The Results

Adopting PMA has helped the customer significantly improve their NPI rollout process. The customer has successfully reduced the NPI rollout cycle from two months to three weeks, all while maintaining the flexibility to fine-tune tests as needed.

Furthermore, the PMA has provided global visibility to OEMs across different Contract Manufacturers (CMs), offering a comprehensive birds-eye view of the entire rollout process and facilitating real-time tracking of changes. This enhanced visibility has improved project and program quality assurance, with the First Pass Yield (FPY) rates increasing substantially from 80% to an impressive 95%.

Moreover, the advanced Artificial Intelligence (AI) and Machine Learning (ML) models within the PMA have allowed for proactive identification and forecasting of fixture and equipment failures, further enhancing project efficiency and reliability. The PMA has also targeted a 5% reduction in retest rates, contributing to overall cost savings and operational efficiency. Through integrating these initiatives, the customer has experienced streamlined NPI cycles and heightened confidence in the success of their rollout projects.

## In summary, the customer was able to:

- Reduced NPI rollout cycle from **2 months to 3 weeks** while enabling test fine-tuning
- Provided **global visibility** to OEMs across different CMs
- Implemented a single platform for a **birds-eye view** of the complete NPI rollout process and change tracking
- Improved project/program quality assurance, achieving a **high FPY** of 95% from 80%
- Decreased retest rate by 5%
- Utilized advanced AI & ML models to **identify and forecast** fixture and equipment failures proactively

# Conclusion

In conclusion, Keysight's PMA has transformed the NPI rollout process for this server board contract manufacturer. The adoption of PMA reduced the rollout cycle from 2 months to 3 weeks, enabling efficient test fine-tuning and accelerating time-to-market. PMA provided global visibility to OEMs across CMs, improving project quality with a 95% FPY rate. Advanced AI & ML models within PMA reduced retest rates by 5% and enhanced operational efficiency, highlighting PMA's transformative impact on streamlining NPI cycles and ensuring project success.

## For more information

For more insights on how to accelerate your NPI rollout with PMA, please visit  
<https://www.keysight.com/us/en/product/PM2288A/pathwave-manufacturing-analytics.html>



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Published in USA, July 4, 2024, 3124-1411.EN