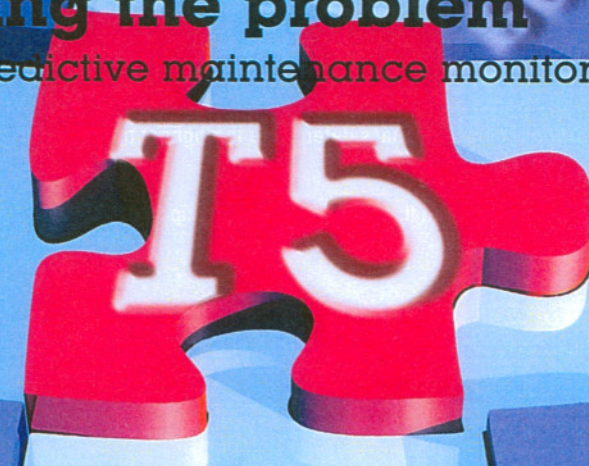


Finding the problem

T5 on predictive maintenance monitoring



EUV Lithography
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Predictive Fault Fixing

Semiconductor manufacturing grows ever more complex and manufacturing companies seek innovative methods to improve yields and reduce downtimes for the myriad of tools required to produce a functioning device. All of the larger process tools depend on a variety of sub-components to sustain the highest level of functionality. **T5 Process Solutions** of Ireland discuss a monitoring system that informs a fab manager of potential problems that would normally cause tool downtime.

T5 Process Solutions Limited (T5) is a start up company that was formed by Joe Temple in 2004. Temple has 20+ years of Test & Measurement experience at HP and Agilent Technologies and saw an emerging business opportunity in the management of subsystems used in semiconductor and related manufacturing industries. He is now Managing Director & Sales Manager of T5.

The company was developed through an Irish national initiative called the International Enterprise Development Program sponsored by both Enterprise Ireland and the European Union. The driving force behind T5's business vision is technology innovation that gathers data from a designed catch-all adaptor to remotely monitor and learn the optimum performance beat of customers' processes. This technology will alert and advise customers to take corrective action prior to failures that result in downtime.

There was a time when the industry only had to rely on continued device shrinking to follow the maxim of Moore's Law and reap the financial benefits. As the industry has moved to, and beyond, the edge of optical lithography, the required shrinkage does not necessitate the expected price reduction. To maintain competitiveness and reliability, manufacturers need to squeeze every ounce of productivity out a fab. Every level of design and production is looked upon as a potential yield enhancer. This is just as true with the component parts that support the major process tools. These component parts, like pumps, vacuums and chillers are a vital part of the process jigsaw.

T5 aims to provide manufacturers with a predictive tool for these sub component pieces to avoid costly downtimes when problems occur. The reality is that if a pump or a chiller malfunctions then a tool has to stop production.

As well as develop technological know how through the incubation programme, Temple also

built a strong management team that could develop this niche business into a global concern. He enlisted international research leader and industry

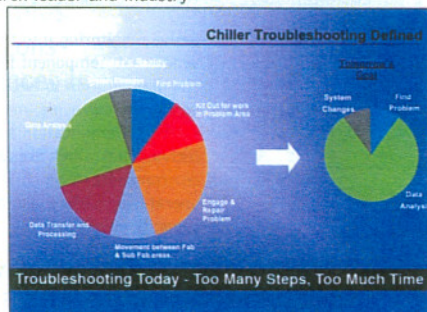
expert Enda Fallon as Lead Technologist at Athlone Institute of Technology. Former General Manager, European Systems Manufacturing of Intel Leixlip in Ireland, Bill Riley as the company's Industry Advisor & Director. Kevin Sweeney was appointed the new Operations Director.

Sweeney is the former General Manager of HP and Agilent Technologies where Temple used to work.

The company is 80% focused on Research and Development. The main facility is based in Athlone, County Westmeath, Ireland with another office based in Naas, County Kildare, Ireland. The initial work has been well received with T5 being recognised for its innovation potential in 2005 by Enterprise Ireland as a "High Potential Start Up" company and the resultant investment from the award. This furthered the company's ambitions and potential of delivering measurable cost reduction benefits to high technology manufacturers of up to 50% reduction in downtime and associated costs while facilitating the maximum uptime of the production tools thereby managing the levels of scrap associated with chiller flow, temperature and resistivity settings.

No Downtime equals more money

Major process equipment/tools are typically under some form of 'on-line', 'hard-wired', computer control. However the ancillary equipment which supports these processes, such as Thermo-monitor units (TCUs), vacuum-pumps, and gas-pumps, have been perceived by industry as below





the threshold that warrant continuous on-line monitoring and control.

Current industry feedback confirms that, as global competition is pressurizing margins and forcing more refined cost analysis, it has become clear that the several hundred units of ancillary equipment used by a facility are a major contributor to down-time and operating costs. The unique value of T5's solution is the ability to bring predictive, pro-

active monitoring into the highly diverse multi-vendor sub component facilities space. Providing a singular solution to all the potential sub component vendors will provide immediate cost benefit. Using robust communication and pervasive measurement technologies which are adapted to the challenging environments in which the ancillary equipment operates provides manufacturers with a monitoring capacity unheard of.

Technology know how

Today's reality is that sub fab equipment in many cases and in particular the chiller case have been designed for technologies that are not current and have not followed the demands set by Moore's Law. This results in critical services performing at their edge. The Remote Intelligent Monitoring System (RIMS) from T5 is designed to reduce the number of steps required in managing and maintaining sub-fab equipment uptime and performance that directly impacts tool output. A unique profile is defined for each chiller based on an algorithm with inputs from pump, compressor, condenser and flow rate signatures along with temperature and resistivity data.

T5 TRIMS Basic Predictor will provide the right mix of reliable sensors and automated analysis techniques to detect faults before they result in costly consequential damage to both the chillers own performance and that of the process that the chiller is hooked up with. The system has the ability of detecting impending mechanical and electrical failures in these processes at the early stages of fault development. Because of its continuously monitoring feature, abnormal operations in equipment are traced. Particular attention is given to defining a profile for chillers and sub-fab equipment based on flow, temperature, resistivity and current and voltage signatures for pumps and motors and compressors.

Thermal beginnings

T5's technology platform name is Remote Integrated Management System (RIMS) and is firstly being developed to manage Thermo ancillary services provided by Thermo Control Units (TCUs). The first product variant will be TRIMS (Thermo RIMS) which will provide remote management and remote diagnostic evaluation of TCUs.

TRIMS will be deployed using its own network which will permit the online management and monitor of TCUs. In contrast with existing fault detection systems, T5's technology identifies fault patterns before the actual fault occurs. Thus, T5's technology provides for predictive maintenance of TCUs and eliminates the need for unscheduled downtime associated with the occurrence of a fault. The predictive maintenance will significantly reduce the service and support costs of TCUs - while the elimination of TCU downtime and the reduction of wafer scrap could save an average-sized wafer fab millions a year.

The current management of chiller performance is provided by highly skilled maintenance engineers who use a combination of alarms provided from the production tool and visible inspection methods carried out on a regular basis. This is a reactive process that can range from downtime of 5 hours in a good week to up to 40 hours in a bad week. Current solutions involve an "all hands on deck" approach to remove a failed chiller from a live process and replace it with a spare unit. The failed chiller is brought to a sick bay and a combination of local and external service functions are employed to repair the unit which will be soak tested before being classified OK to re-enter the production system.

The TRIMS solution provides a site wide management solution for the chiller element offering advanced warning of potential chiller failure thus allowing personnel to be proactive in their efforts to keep uptime to a maximum. The TRIMS project is driven by commercial demands from industry to have tighter view of heat budgets and the need to cut costs, reduce scrap and improve uptime in an industry that has very high value throughput and high levels of leading edge technology requirements.

