

Designing for cost-effective Chinese manufacture

Case Study: Gene Analysis System (2009)



Introduction

A pioneer in genetic analysis, Affymetrix (NASDAQ: AFFX) introduced highly parallel genetic assays to the marketplace by commercialising the first DNA microarray in the late 1980s. Today the company remains at the forefront of technological and scientific innovation. Researchers around the world use Affymetrix technologies to better understand the role that genes play in disease, the effectiveness and safety of therapies, and many other biological factors that affect human well-being. Affymetrix technology has been used to make groundbreaking discoveries to help the scientific and medical communities investigate conditions such as infertility, HIV, cancer, diabetes, malaria, Parkinson's disease, and many others.

Products like their GeneTitan scanner lead the industry in terms of quality and speed, but Affymetrix wanted to bring their technology to more users in the research community - users with limited budgets, no access to microarray scanners, or those in price sensitive markets. Their solution was to develop a new desktop instrument, based on the proven GeneTitan platform, but specifically aimed at lower throughput labs with limited capital equipment budgets.

Brief

As part of their R&D work on this product, the company's engineers took elements of the GeneTitan scanner and adapted them to suit the smaller format. Many electro-mechanical features such as the sampling head needed considerable change, and this design work was also done using their own technical resources. The result was a basic test-bed prototype that allowed them to conduct trials and decide the way forward. It performed well enough for them to agree the next step - refinement for market. In early 2009 Affymetrix began the search for a good product design consultancy to help them, and given the cost sensitivity of this unit, they looked to Asian consultancies in particular. We were approached and briefed on their many requirements: minimal size footprint, improved functionality, better usability, more desirable styling, and crucially design for lowest-cost highest-quality Chinese manufacture. Our compelling track record in all these areas finally won us the job.

Activity

For this important project we assigned 2 teams totalling 8 industrial designers, 2 mechanical engineers, 1 production engineer and 1 project manager. We worked closely with Affy's China based project manager who was leading the project, but meetings were held with their NPD staff visiting from the US. Our first task was to closely observe how the existing prototype was used, and its operating environment. The general format of a front loading unit was sound, but the way the cover hinged open meant it took up far too much space. We also learnt that the bio-chip inside the sampling area was very light sensitive, with tests often aborted when the cover is accidentally or prematurely opened. The test procedure was also sensitive to knocks and vibration, so these were clearly areas we needed to resolve.

Our teams explored a number of ideas offering improvements in ease of operation, integration with its surroundings, motion mechanisms, structural design, assembly, safety and styling. Presenting them as photo-realistic renderings

allowed our customer to understand the concepts fully, and therefore decide which one to proceed with. We then continued to develop this in full and precise engineering detail. Our solution for the hinged cover used a 4-bar linkage mechanism, allowing it to open as fully as before but in half the height. To provide a tamper-safe lock during operation we used a mini solenoid latch, automatically releasing the cover on completion of a test cycle. And to balance the problem of light transmission on the sample with the need to see the sampling inside, we simply applied a deeper opacity tint to the plastic. Finally to resolve the problem of vibration, we created our own self-levelling rubber foot with damping.

All our work during this technical stage focused around optimising the design for lowest cost, but without compromising on quality and functionality. 3D e-drawings allowed Affymetrix to inspect our final design from every angle, view moving parts in motion, and explode it to reveal the sub-assemblies inside. We often refer to this as a 'virtual prototype'. Of course we did then build a fully functional production quality prototype for us all to evaluate and test, and ultimately it's this 'real' physical product that the customer is most keen to see. Following some minor adjustments revealed by their testing, Affy approved the design and instructed us to begin planning volume production with their newly licensed device manufacturer in China. Our production engineer worked closely with them to ensure our design and specifications were implemented correctly, and to oversee the commissioning of new mould tooling. By September 2009 the new tooling was complete, supply chain was in place, assembly line and test procedures defined, and sample units were signed off.

Results

PER Design successfully completed this multi-stage re-development project in only 4 months, followed by a further 2 months to ready the production facility in China. Such a tight time-frame was critical for the client, and certainly our local manufacturing expertise helped make this possible. On the 3rd June 2009, Affymetrix's CEO Kevin M. King proudly rang the NASDAQ bell on Wall Street. They also took the opportunity to unveil this ground-breaking new product (called GeneAtlas) to the media, confirming that sales would commence in early 2010. Finally, in November 2009 our design for the GeneAtlas won us a Red Star Design Award - one of the most highly prized accolades in the Chinese design calendar.

Here's what our customer had to say about working with PER Design:

“At the beginning of our cooperation, I was actually wondering whether PER Design was able to finish this project smoothly and efficiently according to our demanding plan, given the relative sophistication of the work and time differences between all parties. But the final outcome proved me wrong. PER Design completed their excellent work before the contracted deadline, helping greatly in the timely promotion of our new GeneAtlas product. I think if we need to choose a design partner in future, PER Design will be one of our best choices.”

Mrs. Ren Chen
Affymetrix Project Manager



Affy's prototype



4-bar linkage



Affy board on Wall Street

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