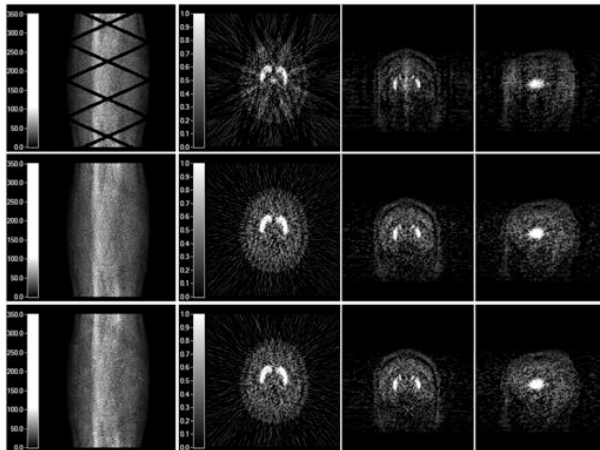




# WINNING THE MEDICAL RESEARCH RUN WITH TECHILA



Picture 1: Gap-filling for PET sinogram

The only way to map brain functions is imaging. Brain imaging is an essential tool if we want to do dementia research or if we want to understand how a medicine really works.

Brain imaging is done using positron emission tomography (PET). PET is a nuclear medicine imaging technique, which produces a three-dimensional image or picture of functional processes in the body.

If we can take a sharp image, we will have clear visibility of the process happening inside the brain. High quality imaging delivers our research a great competitive edge. It will speed up our research dramatically and it will launch our results to a whole new level.

Currently, Medical Research has accepted radical compromises in the quality of imaging. This has happened because of time-pressure and the cost of computing power required in biological and medical image reconstruction. The running competition between research groups is becoming increasingly faster. The competition has come to a point where scientists have had to acknowledge that a team who are ready to accept compromises will not be able to win.

## Challenge

The measurement process included in PET introduces a great amount of noise to the image. Noise reduces the quality of the image and it has to be cancelled before using the image.

The current way of noise cancellation is widely based on average values. When talking to leading scientists, it becomes obvious that this method is far from optimal. The reason why scientists accept this is due to the lack of a better solution. All scientists confirm that if a more advanced noise reduction method would be available, that could provide a great competitive edge to their research.

One of the concepts proposed to improve the quality of PET imaging is an application of stochastic models for noise cancellation. Some of the leading international positron emission tomography research groups have tested the stochastic measurement noise reduction in their work. These tests have proven the validity of the concept.

When testing the stochastic image enhancement models in live research environment, it was noticed that a model, which is able to adapt to noise and biological variance, will require very high computing capacity. If done on a personal workstation, one image enhancement run will take several weeks. During the run, this workstation is virtually unavailable for any other use. In practice, this means that stochastic image enhancement models are not feasible in daily work on personal workstations.

If a research group wants to use the competitive edge delivered by high quality imaging, they will need access to High Performance Computing (HPC) resources. In most cases, acquiring a dedicated HPC unit will have a total cost of ownership, which will not fit in the budget. Buying a HPC together with other groups may result in conflicting interests in administration and allocation of resources. Buying HPC resources from a services provider is a good solution for a one-off calculation need, but it is not an agile or cost-efficient solution for recurring needs.

The PET research group who tested stochastic noise cancellation summarized the challenge using Albert



## For more information:

[www.techila.fi/downloads.html](http://www.techila.fi/downloads.html)

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Einstein's words: "The solutions to the problems we face today cannot be solved on the same level of thinking we were at when we created them."

## Solution

The PET research group works in one of the leading universities in Europe. The university campus has 15 000 people working on it. Almost every person has a personal computer. Based on the IT department statistics, around 4 000 workstations are constantly connected to the University Research Intranet.

An IEEE study has showed that workstations have an average CPU idleness of 97,9%. This means that majority of the desktop capacity remains unused. In modern PC world terms, the unutilized computing capacity in the existing University Research Intranet infrastructure equals to 1060 server blades. According to a Gartner study, the value of this is up to 5 700 000 EUR.

Techila Technologies delivered a Techila GRID solution to the Medical Research organization. Techila GRID is a software solution designed and developed by Techila Technologies. It takes unutilized PC capacity into use. In the first phase of the rollout project, Techila was installed on 400 workstation clients in participating units and supporting functions.

Techila allowed the PET research group to take the stochastic calculations and securely distribute them across the research Intranet for background processing. Techila gave the research scientists an access to the computing capacity they needed in medical image reconstruction on demand without having to invest on high-maintenance HTPC system.

Techila rollout was done in co-operation between Techila Technologies, IT administration and the PET research group. The rollout took one business day and Techila availability has more than 100 years of uninterrupted CPU time since.

The Techila rollout had no impact the daily work of workstation users in university organization. The solution was installed invisible to the user, maintaining the operational efficiency of the organization unaffected.

## Benefits

### Improved accuracy:

The Techila rollout propelled the medical image reconstruction accuracy available to the PET research group to an incredible level. Noise-cancelled imaging enabled the scientist to follow a tracer entering the brain cells in real time. This delivered a dramatic improvement to the accuracy of research results and delivered an unforeseen detailed control over the experiments.

### Improved efficiency:

After the Techila solution rollout, scientists are now able to take PET images and process them real-time. Instead of accepting an expensive HPC hardware investment, the Techila Technologies gives them more at a cost of less than 20%. PET technique combined with a fast Techila-based noise cancellation system enables fast assessment of results and repeating the imaging immediately, as needed.

As a result of the improved and environmentally aware computing capacity delivered by Techila, the university research has now been able to unleash their scientific capacity. The improved algorithm processing allows doing the work iteratively. This agility has built a platform for exciting new scientific innovations and rapid validation. The research groups working in the university are now able to publish stunning results, and win the scientific run in dementia and medical research against their competitors.

## ECAT High Resolution Research Tomograph

Picture 1 data acquired by the ECAT High Resolution Research Tomograph (HRRT, CTI PET Systems, Knoxville, TN, USA), located at Turku PET Centre.