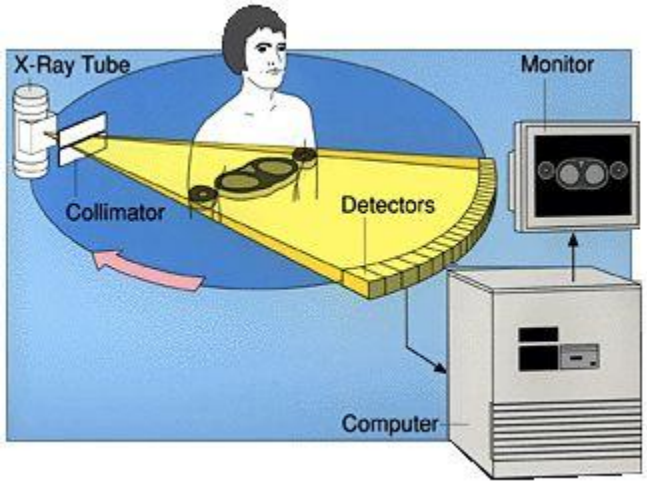
Steve Johnson on Imaging (1975 paper) PhL 4.19.07

Company name was Techniscan. See notes below.

p 56: **Xrays** are good, but lots of issues like blurring, point x-ray source, angles, overlapping stuff. In 1917 **Radon** showed how to reconstruct something from all its projections. Tomography is different. The xray source and the receiver rotate together, there is always one plane through the body parallel to the film plane.

p 57: A good way to go is to solve the **2D slice problem**, then just integrate the slices to get a 3D image. If you had a point x-ray source, at each position you get a "line" of data. [In a CT scanner, the x-ray is a point source, the receiver is a banana shape set of detectors that record a line at each instant of rotation. The data from the detectors is called a **profile**, and you might get 700 of these per revolution.]



D

p 58: In the above picture, imagine a single body point in the slice, a pea. For each of several angles of the rotation, the shadow of the pea appears in different detectors. You could know exactly which rays go through the pea, and you could add up all their detector results to get a sum. This might tell you want you want to know, the **summation method**. A film streak method shown page 60 was done in Russia, you can see the results of the reconstruction are not great.

p 59: Summation method has problems. Hospitals already have scanners, what is the best way to use their data to reconstruct images? **ART** is one method, but description here does little for me. I think it is to guess the image, see what it would show in the detectors, then modify it. Ie, a forward method that you iterate.

p 60: Mention of the **convolution method** and the **Fourier method**. The British EMI scanner of **Hounsfield** went to the Mayo in **1973.**

p 61: Describing this early machine used for brains. At each degree position, you have 160 detectors so you get 160 "ray sums). Unit then rotates 1 degree and you get another 160 rays sums (I guess these are

the profiles of the above web site). Took 5 minutes to go half circle. You then have 28,800 ray sums. Image was reconstructed (of a slice) in 5 minutes and put on an 80 pixel square screen.

List of companies in the scanner business.

The graphic here shows the **ART method idea**. You guess a 2D pattern, see what its ray sums would look like, compare this to your scan data (one set of ray sums shown as a graph), then modify the source data and compute new ray sums. Again, the forward method. A **relaxation** method of sorts.

Scanner is non-invasive, can detect tumors.

p 64: Picture shows the EMI scanner. At each position, it really would scan a single source/detector across a line (it says linear traverse). So it would do this traverse at each position. Then you get a set of straight line sums, not diverging ones as suggested by the above picture.

p 65: The **beating heart problem**, an early version of cardiac MRI is described, a dog heart.

Picture here shows brain scan versus a dissection, but picture quality no good.

p 66: All pictures. Top shows the **ART3** ray sums method for heart, bottom shows the beating heart.

p 67: Would be nice to have real time on moving heart, but you would need a lot of sources at once.

Prospects: quality not as good as a normal Xray, computing time is a problem.

The ending pages of this paper are gone!

Notes from Feb 13 2007 Phone Call from Steve

Mentions his **two-phase SBIR**, preliminary and build. They built **7** machines, **no FDA yet**, none sold due to insufficient resolution, need to double in all dimensions so need 8x.

Frank Stenger at the U does sync functions to solve PDEs somehow. Faster convergence. e^{-N}
Some **BYU physics prof** doing QM wave equations. Lots of hardware people. Computation big issue. Lots of A/D channels to bring in the data from the receiver arrays.

Steve Johnson Patent (2003)

I perused this thing, the print is very dense, lots of typos and repeated text. Mention of **marching methods** and **parabolic methods**, discussion of the physical apparatus, lots of stuff in here. There are specific references to papers for the algorithms used. Enough for now.

Notes from Steve Phone call today. April 19, 2007 about 11AM

Wants to have a meeting May 21,22 (Lee dental 10 AM May 21). He has **SPIR 2.8 mil**, combine with company cash from investors, how best to use? Steve wants to build a **better scanner**, faster CPUs, **double system resolution**. Current system takes 2 hours to compute stuff. They use **32-bit FP**. Mention of Xilinx chips to do this maybe. Improved system might take a whole day of computation.

Mentions flash group in his building, making fast large memory, 10^6 burns limit though.

Wants to **upgrade to four rows**, not one row. This gives more range (diversity) of Δk vector, so you are sampling more of the $f(\Delta k)$ scattering function. But then he says 32 columns and 3072 total sensors in new array, time MUX'd into some A/D's. They now have 1024 elements as.

They use **non-linear inverse scattering method** of some sort. Difficult, getting into time domain. Ray **bending** and **stretching**. **Adjoint** of the forward. [Jim points out that, unlike x-rays, sound waves bend a lot, causing interpretation confusion.]

Their basic method has been the inverse scattering which is really the Saxon method. But hand machines always do reflection method.

Gives names of various people involved. **Jim Greenleaf** of the **Mayo**. **Mike Andre** from **UCSD**. **Dick Anderson** retired business type.

I asked about recent bad news on mammo results, Steve clarified this well. The **R2 system** does not buy you anything (**Second Radiologist** software).

Wants me to talk with him and **Frank Setenzik**, his historic designer guy. CPCI cards.

Talked about **micelles** which can release cancer drugs on ultrasound pulses. Some biology department lady involved.

Comments on the **intelligent design** debate and the 60 sequential steps, I mentioned my 10^{40} experiments.

His patent did mention **time of flight** as a way to get data. Perhaps just time short pulses. **Absorption and time delay** (phase) both measured on a given ray.

Notes on second phone call Steve and Frank S on Thurs April 19

- Getting **FDA approval** is a problem for them. You file a **510k**. Not only must your product be safe, but it must also be equivalent or better than a previous device (a **predicate**). They have filed for separate 510k approval on their transmission and reflection methods. But there is no previous device for their transmission method (while current hand devices to reflection), so harder to get approved on transmission.

To sell a product, you need the first level of approval called **Pre Market Approval** or **PMA**. For this, your product has to be superior to past ones I think he said.

I mentioned the room of FDA people at OEC, they told me OEC/GE lost approval and C-arm shipments have been stopped for over a year. I emailed Curt on this. He confirmed it! More than a year.

Comment that some clinical work done at UCSD.

- **Resolution Now is:**

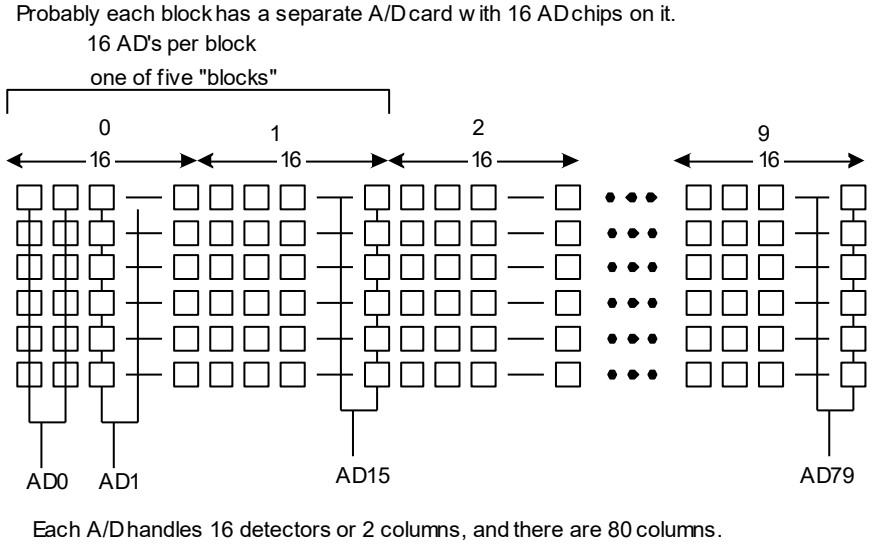
	Transmission	Reflection
	V = 3-5 mm	2 mm
	H = 1.5-2 mms	0.5 mm

They want to half both transmission numbers. This is the main goal of their 2.8 mil SBIR grant which is from NCI (started 1937) within NIH.

Their hardware budget is about 1.0 M from this 2.8, and of that it will cost 150K to make a new set of T and R modules, then maybe another 70K if they need to make a second copy.

- The current **transmitter** is a single "bar" piezo device which is horizontal. In the new design, they want to have four bars stacked vertically, but only one will transmit at a time. This will get them more diversity I guess they call it, more angular information. [If they use one at a time and combine all results, it is as if they had four receiver arrays covering more k-space, I think that is the idea. Cheaper to make four transmitters rather than be able to move the receiver array relative to the rigid wheel?]

• The current **receiver** is I think 6 rows with 160 detectors in each row, for 960 total. For data acquisition, the 960 are arranged in 5 blocks of 192 each and 5*192 = 960. For each block of 192 = 32*6 detectors, there are 16 A/D converters, and each of these somehow time-multiplexes 16 input channels, so each block has the ability to handle 16*16 = 256 detectors, but only 192 of these are used for that purpose. In my picture, each A/D handles two columns or 12 transducers (not 16)Perhaps other info is on the other channels. Thus, there are 80 AD converters. Here is what I think they are doing in their receiver array, where each square is a detector. [960/32 = 30]



Each A/D handles 16 detectors or 2 columns, and there are 80 columns.

If the audio were 5 MHz, you would need to sample at 10 MHz at least for Nyquist. Their A/Ds are 33 MHz at 14 bits, so probably they must somehow sequentially scan through the detectors in a block, downloading the date sequentially maybe 2 or 3 at a time. Maybe this happens when the system rotates to a new position. I imagine the detectors integrate signal amplitude, this is very unclear to me, but at least I see the physical picture here.

The new receiver is going to have 3072 detectors in "32 Columns", said Steve. I think this is really going to be 256 columns by 12 rows in the sense of my picture above, so doubling number of rows, and nearly doubling the number of columns. Perhaps each set of 8 columns is called a Column in this new organization, so you would then have 256/8 = 32 Columns.

I would guess the transmitter bar transmits a sine wave plane wave pulse of some duration. During this pulse, I would guess each detector records lots of samples, so the sample stream recorded has phase information as well as amplitude information. If the pulse is at 5 MHz, the detectors would operate at perhaps 10 MHz or more. A 1 ms burst of sine wave would then have 5000 samples at 5 MHz, so perhaps 10,000 samples. The idea would be to store these locally in a RAM and then download them later.

• For a transmission method, you have separate T and R modules. For reflection, the R stuff is built into the T module, so you have a single T/R module.

• When you make a slice, you do 180 positions (now) of 2 degrees each. They collect about 1 GB of data per slice, so that would be 1024/180 = 5.7 MB per position. If there are 960 detectors then you are collecting about 5.7*1024/960 = 6.08 KB per transducer. If each sample is 14 bits, then each detector is

recording 6.08*1024*8/14 = 3557 samples. This is on the order of magnitude of my estimate above. They might be detecting 360 samples at each of 10 frequencies, or 3600 samples at one frequency.

- Complete scan is maybe 30 slices at 1 GB each, so 30 GB per boob. This data is sent off to a "cluster" on a SAN which has 7 Pentium M nodes and takes maybe 5 hours to run the image algorithm on all the data to get a 3D picture.

- It takes 10 minutes to collect 30 slices, so takes 20 seconds per slice (per rotation), and 20,000/180 = 111 ms/position. This time includes mechanical rotation time. At each position they have to unload 6 MB of data, so data rate has to be at least 60 MB/sec, but they have 80*33 MHz of bandwidth so should not be a problem.

- In new system, with four transmitter bars I guess they will have 4 times more data maybe (or maybe that is because 3072/960 = 3.2 since more detectors), and computation goes from 2.5 to 10 hours. In the new system, they will get 4x more data, so 120 GB/boob.

- The company only has 15 people. They might make a half-array with 1500 sensors.

- At 5 MHz, water wavelength of sound is about $\lambda = vT = v/f$ = 1500 m/sec * 1/5000000 m which is 1500/5000 mm = about 1/3 mm. Twenty waves would be about 7 mm. I use 1500 m/sec as sound speed in water from the web. At 1 MHz get 1500/1,000,000 = 1500,000 mm/1,000,000 = 1500/1000 = 1.5 mm. Steve says 20 waves/boob so maybe wave = 5 mm so 20 waves = 10 cm implying maybe only 300 KHz sound frequency. Numbers seem off here but OK. Maybe he meant there were 20 2π extra phase shifts in the boob relative to a water path due to phase shift.

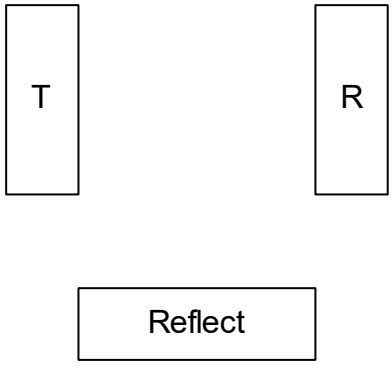
- They need to use low-f scan data to quickly make a zeroth order guess at the image, then iterate forward on that with higher and higher scan frequency data.

- In reflection method, if you move a dot by 1 mm, the reflection path moves by 2 mm, whereas in transmission the path change is 1 mm, so get better resolution in reflection. But, reflection does not give an accurate image because it has nothing to reflect off in uniform areas (lipid drop interior). I think their reflection method is more like a radar method.

- Current uses 7 CPUs, using 4-core CPUs can have 32 CPUs going at once.

Notes on Visit 4/25/07 to Techniscan (four hours in the evening)

Visit was 4 hours long, 6:30 to 10:30 PM. I first had a little walking tour. Saw an opened up prototype of the product. The T and R elements are sealed in a fancy aluminum U-shaped rotating assembly. I was surprised at the small height of the R array. Both T and R are about 1" high and 6" wide. I was thinking that you would want more vertical information, but maybe that is not needed in the slice tomography method. Later I saw another machine that had a third "head" which was for the reflectance method scan. This third sits relative to the two transmission method heads as follows:



At present, no one has worked on the **"reflection algorithm"** needed for the reflectance method, the theory group has too much load already to do this work. This group needs more help.

I was shown a **"ribbon of 32 coax cables"** (very small cables) that carry the signal from the rotating head assembly to the computer section of the product. Each row of the receiver has 5*32 = 160 transducers and I think each row is read one at a time, so maybe 5 transducers are read into each cable somehow (MUX'd), the matching members of each block. I guess the reading process then cycles through the six rows, I think that is what Frank said. The pulse is a **"chirp"** which is a sliding frequency thing, so that is how they do the frequency diversity. So maybe they do 6 chirps at each position, one to each row.

In any event, I then saw a large **RAID array** which stores the data, a flat drawer affair with maybe 12 small drives visible at the edge. The RAID used is that which gives **max bandwidth**. Then each side of the **rolling cart** has a small rack frame with vertically mounted boards which are the computation nodes. All data is moved around the frame with little **optical fibers**. A special board makes the database appear in some desired manner to each computing card. They had room for extra computing cards in this "cluster" arrangement, that is to say, blank slots.

At this point, we discussed what I thought was the **oddness** of carrying all this computing power around with the medical cart, I think Steve agreed. The reason is that floor space is expensive in hospitals and they don't want more things rolling around than they need. The CEO is a medical products marketing guy who provides the information here. I was imagining you would burn a DVD somehow with your 30 GB and just take it to a separate computer room for overnight processing, would have to be a BlueRay said Steve correctly. Or it could just be a removable drive, I was thinking. The problem here is that during the scan, you cannot use the computing power for processing earlier scans? Or you cannot change the ratio between compute engines and scanning platforms. I like the idea of a general computer room that does different kinds of processing in the hospital, but that would require too much vendor cooperation I suspect. Steve noted all the floor space needed in an MRI room, archiving, computing, the machine, etc.

After this talk with Frank and Steve, we walked over to the prototype that has the third reflectance method head on it. There we saw the **fake breasts** which have some odd name which contain tumor like pellets that they use to test the scanner. I asked about **simulation of the whole product**, Steve seemed to say they could do that and that results were not perfect because their algorithm does not handle "mass density", it only handles Young Modulus density which is what ultrasound sees.

At this point I asked **how tumors differ from other tissue**. Steve said they had books with data on this, and one difference is **larger nuclei** and perhaps more **mass density**. Some women are too large for the machine hole.

In a **mammogram**, they do maybe 2 or 3 x-rays with plates at different angles, so the entire screen is those 3 x-rays. Each one shows integration of all depth. **Session** takes maybe 10 + 10 minutes each year,

that is one of the screening requirements, visit must be quick and painless if possible. Their scanner takes about 10 minutes per breast, or 20 seconds per slice, which is deemed acceptable.

Steve said they want their scanner to be the **primary screening machine**, not a secondary machine after someone gets a suspicious mammogram.

We were by this time in the little room viewing the pictures. They present the data in a manner similar I think to MRI. At the same time you see **axial, coronal and sagittal slices** in three windows, and you can step through the slices. Obviously the non-axial slices are reconstructions of some sort from the raw slice data. Steve described how there are **12 milk gland systems like grapes** that feed to the front nipple opening, and you see milk ducts in the picture. They showed a picture where cancer in two grapes connected by a duct were all cancerous, at least they were white in the image. Steve said that then a tumor is between 1/**2 and 1 cm diameter**, it can be removed by surgery, but larger than 1 cm has usually already metastasized, so they need to see the smaller stuff.

Steve explained the words sensitivity and specificity. If you can cleanly detect all tumors and none escape the image, you have good **sensitivity**. But tumors can be cancerous or benign. If you can tell perfectly which ones are cancerous, you have great **specificity**. That is what they need to have.

Steve then talked about the fact that the ultrasound wavelength is maybe 1 mm = 1000 μ, but the cell size as I know is 10 μ, so really you only see **statistical clumps** of cells with ultrasound. He likened this to the fact that a laser beam reflects on clumps of molecules (dust particles) and causes speckle. You have a problem determining the nature of the underlying cells from the clump-scattering data. So when they talk about doubling their resolution, they are talking about seeing smaller clumps of cells.

The **algorithm group** (see later) produces **FORTRAN code** and this is the code that runs in the cluster to analyze the data. It uses an Intel compiler. We talked about profiling the code and coding up pieces in assembly language. When we talked on this subject, I was thinking that someone was porting the code from FORTRAN to C, but not so. I have never thought FORTRAN was an efficient compiler, but I know little really. It is the language used by academic people like Jim. They have just started doing some **profiling** but have not cranked hard on this stuff. [Bad code could lead to more I/O load where their bottleneck now lies.]

Steve brought up their computing speed problem and how they need 30x improvement and I explained what Xilinx chips do: adds, multiplies, memory, all spread out. But Frank rained hard on this subject, saying that the computation was all completely I/O bound by moving data to and from memory. He said that a Xilinx chip has lower bandwidth to a DRAM than does a Pentium type chip, which is doubtless true. I asked about the **partitioning issue**, but only then realized that each slice represents for them a separate computing problem, so they certainly can use the cluster in that sense, each CPU using separate data. But they do have 3D reconstruction that uses all the data or more of it. I guess this is something I could look at with Frank, to see the exact numbers of the bandwidth critical paths. They do some Xilinx work I think, maybe on the **acquisition boards**, I did not see that stuff. They never asked me for non-disclosure forms, so I guess that shows trust. Steve knows Jeff Davis and Patty and RIM did lots of PR work for Steve in the last few years. Steve did not know that Patty left.

Steve's history. A Mormon from Utah, Steven A. Johnson. He is currently an Adjust Faculty member at the U's **Biomedical Engineering** department, also known as **Bioengineering**. So I guess that does not mean "biological engineering" in general. Web says bioengineering is either medical or farming related, I wonder where solar energy bacteria systems would fit in?

Steve's official address on his web page is odd, Northgate 800N and 350W ? This seems to be the home of some medical related companies.

Education

Utah State University, B.S., Physics // an Aggie!
Stanford University, M.S., Physics
Stanford University, Ph.D., Physics

Patents

5 issued (ultrasonic medical diagnosis); 2 issued (ultrasonic flow meter, two-phase flow meter); 5 issued (solar energy, low-temperature distillation).

Has name on 101 papers, some with the two theory employees (more below), but last one 1999.

So I think this confirms Steve's Utah origins. I think after his PhD he want to the **Mayo** in Minnesota and worked there for a while, but was unhappy because he was not getting married. He came to SLC in 1980 and married "late" (age 45) his **violinist wife** who plays in the symphony. In our discussion, he always made a point of pointing who was and was not married, and how many children they had. Steve has **one son** age 21 who is doing some kind of LDS service mission in SLC and does not seem interested in following the footsteps, dropped out maybe after 2 years of college, an obvious source of discomfort for the father.

Steve **never got tenure** at the U because, he said, he was too busy running his large research group and did not teach enough courses. His grants were 200K, while other people were only doing 100K. I thought this was a bit strange. It could be more his visionary persona.

The Algorithm Group. Jim Ball did work for 2 years, but "did not work out", This group now consists of four people, two are employees and two are not. The Adjunct Faculty list is quite long, and Wiskin is on the list and is listed as a T cofounder.

1. Dave **Borap** was a Boise star, got his PhD, did basis functions E&M work.

2. Jim **Wisken** (Canadian) has a math PhD 1991 from the U, knows acoustic scattering, Adjunct Assistant Prof in BioE. Many of his papers are with Borap and others. He has done some molecular biology modeling, maybe a good guy to know for other reasons. His papers are saturated with scattering theory and math, just they guy you would want at Technoscan.

I suspect both these guys were postdocs in Bioengineering at the U.

3. Manuel **Berondo** in BYU Physics, consults only for last 2 years , age 55-60. Does quantum chemisty, Hartree Fock and such, teaches math methods, E&M, mechanics. Non Mormon, 2 daughters, remarried.

4. Frank **Stenger**, Appled Math, at the U professor in School of Computing in Merrill. Has stock. Connected to famous guy Calvin Wilcox who died but did sonar work. Frank I think goes back a long way with Steve.

He is the primary developer of a new area of computation, called **Sinc Methods**. This is a close to optimally efficient, and self contained, family of methods of computation, which enables the computer solutions to hitherto difficult or impossible to solve problems.

He has recently authored a **565-page text,** *Numerical Methods Based on Sinc and Analytic Functions,* which was published by Springer-Verlag, in 1993. For further information, click here (\$75)

He has also co-authored a 349-page text, with *M. Kowalski* and *K. Sikorski* , entitled *Selected Topics in Approximation and Computation,* which was published by Oxford in 1995. The authors were awarded "First Prize" for the best scientific work in Poland in 1995. For further information, click here

The 304--page text entitled *Sinc Methods for Quadrature and Differential Equations* , by J. Lund and K. Bowers, which was published by SIAM in 1992 is an excellent exposition on this subject, especially for beginners. For further information, click here.

I think Frank has a contract to do something the blocks him from consulting for Techniscan, so Steve bought his CD + M code for $1K. Frank is about to retire and is doing a house in Vancouver and does not have the time he once had to work for T. (I think this is the Vancouver guy).

5. (potential). **Dilip Goshroy**, an Indian genius who wants to do his own thing, writes his own papers, PhD in laser physics, wrote some books, no position for him at the U, worked off grants only. Steve wants to hire him as an algorithm simulation guy, keep him focused on a real problem.

So these are the guys that come up with the FORTRAN code that runs on the product. I imagine it is pretty fancy stuff. The simulation of the product issue is unclear to me, to what extent is it doable?

Management. They are very "flat", 2 of 15 with Barry a ME.

The CEO is **Dave Robinson** of SLC, a Baptist, who Steve feels has let the company to some dead end paths. I think he is the guy who knows how to get medical products into the marketplace, and whose main job is getting money (funding). He has to keep "the investors" happy, whoever they are. Company is privately held so far (I think), most workers have some stock including Frank S and Steve J.

The COO is **Barry Hanover** whom I met at OEC a few years ago. He has a Mechanical Engineering background.

The SBIR grant supports 90 days backfunding and should get final routine approval in 3 weeks, they are already spending the money said Steve.

Here is a little article:

A group of bioengineers and mathematicians from the U hopes a new method of analyzing lumps in breasts will reduce the number of unnecessary tumor removal surgeries.

The Ultrasound CT is a diagnostic machine for breast cancer and has the potential to determine whether or not a mass of tissue is cancerous.

Barbara Richards, a voluntary participant in the testing at St. Mark's Hospital, said, "I have regular mammograms, and if it were me, I would have every test done before having surgery. This is just another test."

The machine gives more detailed information about the physiology, or the bulk tissue, and the anatomy of the breast than traditional mammogram methods, according to David Robinson, president and CEO of Techniscan, the company that founded Ultrasound CT.

"The computer-aided detection potentially finds abnormalities for the radiologists and provides more certainty beyond a normal ultrasound," said Robinson.

Rather than relying on breast compression, women lie on a table and place their breast through an opening into a cylinder filled with body-temperature water. The process takes half an hour and produces a three-dimensional image of the breast.

The machine uses inverse scattering to make tomographical images of the breast. The machine sends ultrasound waves through more than 180 locations of the submerged breast. The algorithms create images that will potentially tell whether the lump is

malignant or benign.

"The procedure was pain-free and relaxing, I was almost asleep. It was nice," said Richards.

Robinson explained that the equipment's intent is to give a higher level of confidence of the quantitative measure of a lump in the tissue.

More than 80 percent of removed tumors are benign, according to the American Cancer Society. Women involved with those surgeries sometimes leave the hospital with scarred, dimpled or differently sized breasts.

One hundred fifty mammogram patients recently participated in a trial run of the equipment at St. Mark's Hospital.Hanover said women reacted positively to the CT at the hospital and hopes to have the approval of the FDA by early next year.

The original **founders** of inverse scattering studied at the U and include: Steve **Johnson**, James **Whiskin**, David **Borup** and **Mike Berggren**.

Frank Setenzik started in 2003 after working at some supercomputer company formerly Alta.

"Mr. Setinsek designed several **Alpha-based**, single-board computers, which power the **supercomputer cluster** that constitutes the Japanese government's supercomputer. Comprising 250 nodes, it is the fastest 250-processor-node computer in the world. Mr. Setinsek was group manager-Systems for **Leeds & Northrup** and hardware design engineer with **Evans & Sutherland** where he designed parallel processing systems and custom ASICs for the Simulation Division. He helped to form **Alta Technology, a Linux clustering company** that specialized in making distributed processing supercomputers. Mr. Setinsek was **Alta's Vice President of Engineering and served on Alta's Board of Directors. "**

Unfortunately I told Frank I never heard of Alta, he said it has some new name now that I don't remember and cannot find. I guess someone bought the thing, he was VP Engineering there it says above.

So other people at the company are:

Wendy Dunn, controller
Karlene Calatran, clinical interface (did work with St. Mark's hospital trials).
Lady 3, works for Karlene on clinical stuff

David Beria, quality
David Smith, software and I/O control. (data ack software is in C++).

Martin Keymeyer, general purpose electronics guy
Maria Keymeyer is his wife and also works for the company

Mike Beggran works half-time, physics and code and grants. He was with Steve at the Mayo.

Scott Olsen, PhD, does PCB and FPGA work, know Born approximation, a practical guy

So now lets try to assemble a complete list of the employees:

1 Steve Johnson, visionary founder
2 Dave Borap, algorithms
3 Jim Wisken, algorithms

4 Dave Robinson, CEO get money
5 Barry Hanover, COO and mech engineer, amazing memory guy
6 Wendy Dunn, controller
7 Karlene Calatran, clinical
8 Lady #3, clinical
9 David Beria, quality (probably a required job slot for FDA)
10 David Smith, software
11 Frank Setenzik, architecture
12 Martin Keymeyer, electronics
13 Maria Keymeyerm, his wife
14 Mike Beggran, half time founder, physics, grants, was at Mayo
15 Scott Olsen, PCB and FPGA work

// at this point **Word crashed**, I had to recover the above text from several different files. So I just made a full backup copy.

So there are the 15 people, as Steve claimed. In addition, they have Frank and Manuel from U and BYU.

So what would I do for this company, said Steve. He has in mind some "general philosopher". I told him I could probably understand all the scattering and math stuff, as well as the electronics stuff. I will just lie low and resume my biology and see what happens next with them. I certainly did get more of their picture on this long visit. I must have notes on earlier visits, but cannot find them, I recall Steve talking to Jeff and I about the angel funding and such things.

Steve started this thing in 1984 so it has been 23 years so far!!!! Still no shipping product, ouch! Although he has done Mayo and bioengineering, he did not seem to know about codons.

Steve Johnson's Phone Call of Friday May 4, 2007

Once again, after I have invested the time to review all of the above stuff, Steve called to say that Techniscan does not want me involved. I was thrilled, did not like this amorphous cloud of dim responsibility hanging over me. He sounded apologetic, saying that he tried to get me on that design review committee, but probably no one else wanted someone they did not even know. So now I can quit worrying about the May 21/22 meeting dates when Lee is here. He said in very quick passing that he got my email and was sorry to be so slow in getting back to me. He did not say one word about my huge DNA document, nada! He offered as much as Frank liked me and would have enjoyed working with me (a consolation award in Steve's mind), and I reciprocated the same about Frank.

In retrospect, I can easily imagine what happened. They have a small budget, they are all on the treadmill with ownership and years at risk, and Steve wants to go hire a consultant to be a "philosopher" for the group, someone nobody knows and who has no experience at all in their product field. I know exactly what I would think if I were in the group!

It is fun actually to spend a few hours now and again seeing how they are doing, and I am sure I will hear from Steve in another 3 years or so. So: case closed for now, and I can continue on my Watson program. [Sarah talked to Watson a while ago about her lice.] [Jim had good things to say about Borap I think.]