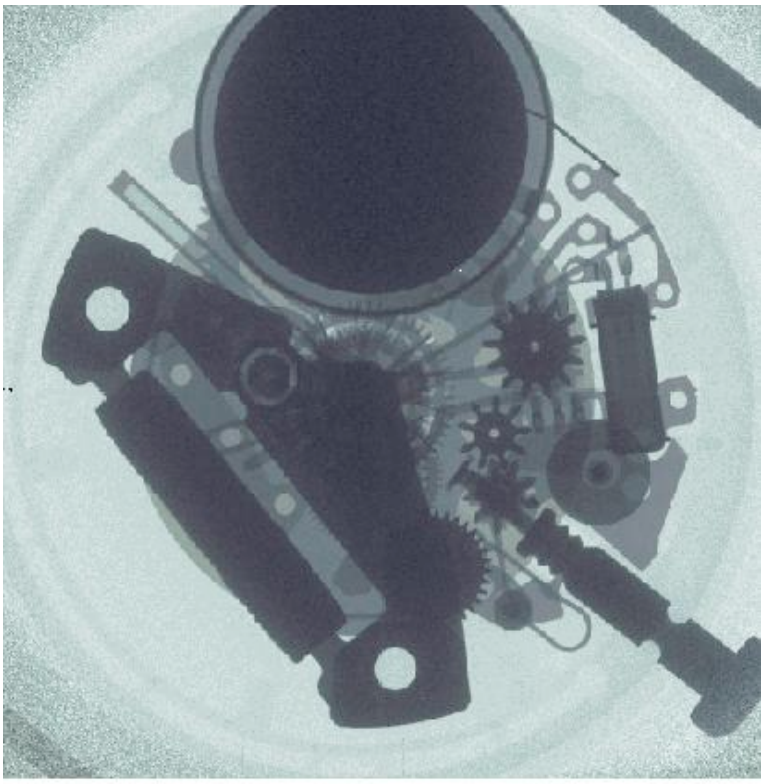
NTNU SCREENIG WEEK

MEDIPIX – FOR THE EDUCATIONAL MARKED



9-13 OKT 2009

CERN -GENEVA

GROUP 1: TRULS BRATAAS, STINE ASPLI, CHRISTIAN SKOGLUND, KNUT WIEN

This report is a result of the MoU between NTNU School of Entrepreneurship (NSE) and the Knowledge & Technology Transfer (KTT) department at CERN. The report is a study of the technological opportunities and commercial potential of a technology from CERN, and was created by the students of NSE during the NSE Screening Week 2009 at CERN. In addition to this report, the students held a presentation on the same topic.

The technology was presented to the students monday November 9th, with a deadline Thursday, November 12th. The presentation was held the following Friday.

Executive summary:

CERN research facility in Geneva has their main focus on elementary physics research. In this process many products are developed that might be used in other areas than what they were originally intended for. The Medipix is a result of such activity. It is an image sensor for nuclear energy that has proven to be of interest in many applications. CERN has an interest in reaching as many people as possible with their technology. On the search for areas of applications for Medipix, they identified that it might be interesting for teachers in physics to use this device in their education so that the students will get a better understanding of nuclear physics, and consequently be more interested in the field.

The product can visualize the cosmic radiation being around us in real time, and it can show the energy that radiates from nuclear sources close to the sensor. The product will consist of an USB device containing the image chip, and a software that processes the signal and show the picture of the protons and electrons passing the sensor.

The product is today produced and assembled inn house at CERN in quite small quanta, which results in currently very high prices on the Medipix chips.

The marked consists of tree major interested parties. The educational equipment manufacturers, the distributors of equipment, and the schools who are using the equipment. There are a few major manufacturers world wide, as well as many local companies in different countries. Because of the difference between every school in every country, the distributors often operate quite locally. But they play a vital role in the value chain. And the manufacturers are dependent on them in order to know the needs in the marked. The needs are created by what the students are supposed to learn. Learning physics is a difficult ting, and therefor lab experiments is a nice way of visualizing physical laws and phenomena.

Manufacturers have good network relations with distributors, which will be crucial in order to introduce a new product to the market.

The few large manufacturers of equipment are the ones that might be interesting in buying the Medipix chip. They will be happy for getting new products into their portfolio that they can sell with profit. They are however very sensitive on the price. They have to be able to by the chips they need from someone, saying they don't have money to invest in a huge batch production alone or together with others.

The economic potential in the marked is obviously quite large, having all schools and universities in the world as potential customers. Calculations from the Swedish marked show that Swedish schools every year buy physics equipment for EUR 5 million, though a smaller percentage is for nuclear physics.

We have seen a clear potential for this technology in the marked of education. We have identified that the most adequate way to get the product from cern to the classrom is by selling licenses to the manufacturers of educational equipment, but to do this the price will have to be extremely much lower than what it is today. KTT will have to find an interested investor to produce the chip and sell it to manufacturers. We do not think that there is any room for ES to take a part in the further work as a startup company.

1 MedipixEDU

1.1 Background

CERN started developing the Medipix chips in the 1990s in collaboration with three institutes. It was developed to meet the need of noise-free single photon counting in the Large Hadron Collider at CERN.

CERN is interested in implementing their technology for as many people as possible, especially throughout CERN European member states. This is part of fulfilling CERNs marketing and idealistic purposes.

In the search for applications where the Medipix technology might be used as a public accessed product, the CERN Knowledge and Technology Transfer (KTT) has identified industrial possibilities for the Medipix 2 chip[1] in the educational marked.

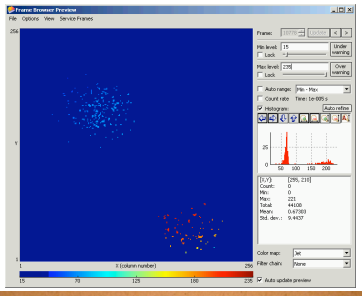
The reason for this report is thus to better understand how the marked of education works, and how Medipix might be sold for educational purposes. MedipixEDU is a name this group has given the product only for the convenience of this report.

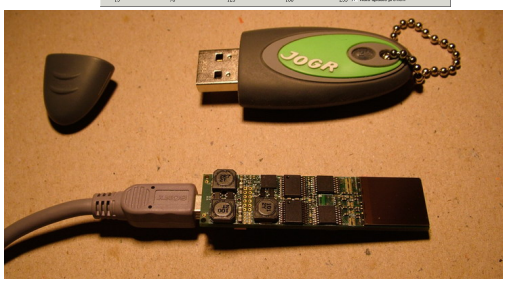
1.2 Problem description

Experiments are a well known method used to better understand the physical phenomena's in the world. Physical laboratories have all sorts of equipments to visualize the world of physics. In nuclear physics however, there is little user-friendly equipment available. MedipixEDU is a perfect product to supplement the education in this field of elementary physics.

1.3 Technology

The MedipixEDU is a digital and visual GM counter developed in the 90's and later packaged in the form of a USB memory stick in both size and design. It contains a Medipix 2 chip that registers ionizing radiation in an active area of 2 cm^2.





There are two types of ionizing radiation: particle radiation and electromagnetic radiation. Particle radiation is alpha[2] and beta particles[3] carrying energy because of their high velocity motion. Gamma rays are photons existing of only energy and without mass[4].

1 http://medipix.web.CERN.ch/MEDIPIX/Medipix2/indexMPIX2.html

2 http://en.wikipedia.org/wiki/Alpha_particle

3 http://en.wikipedia.org/wiki/Beta_particle

4 http://en.wikipedia.org/wiki/Gamma_ray

When ionizing radiation interacts with the Medipix chip, energy is transferred to electrons. The electrons are registered directly as digital signals and visualized real-time on the computer screen. The MedipixEDU registers specific levels of energy by adjusting upper and lower thresholds and can also measure intensity and identify type of incoming radiation.

1.4 IPR

The Medipix sensor chip is a patented technology owned by CERN.

1.5 Alternative uses

MedpixEDU can be used in other scientific subjects such as:

- In biology experiments students could monitor occurrence of radioactivity in animal meat.
- In geology students could monitor level of radioactive intensity in rock minerals.

The MedipixEDU chip could be used as a small x-ray machine for bugs and other soft tissue organisms. But strict regulation for usage and storage of radioactive material in classrooms[5] exclude all use of strong external radiation needed for this kind of experiments.

2.6 Status today

CERN uses approximately 200 Medipix chips a year internally in the organization. IBM produces wafers for the Medipix chips and delivers the chips to CERN for soldering and final assembly.

Physicists at CERN are currently testing the Medipix 2 in the form of a USB stick for usage in the educational market.

The Medipix technology is developing by CERN in collaboration with others research facilities in Europe. This next version of the Medipix chip has four connectable sides, more accurate photon detection along the boundaries and will be more expensive. The medipix 3 has been delayed for a couple of months, and is today under final testing and verification.

2.7 Scalability

Chips can for now be bought through CERN. The company who buys the production license of MedipixEDU will buy chips directly from a supplier like IBM. The production cost will be greatly reduced with production of large quanta of the chip.

5 http://www.naturfag.no/_naturfag/artikkel/vis.html?tid=17097&within_tid=16915

3 Market

High school teachers that have seen Medipix have uttered an interest for using this product for educational purposes. Unfortunately the steps from CERN to all the physics laboratories in the world are quite complex.

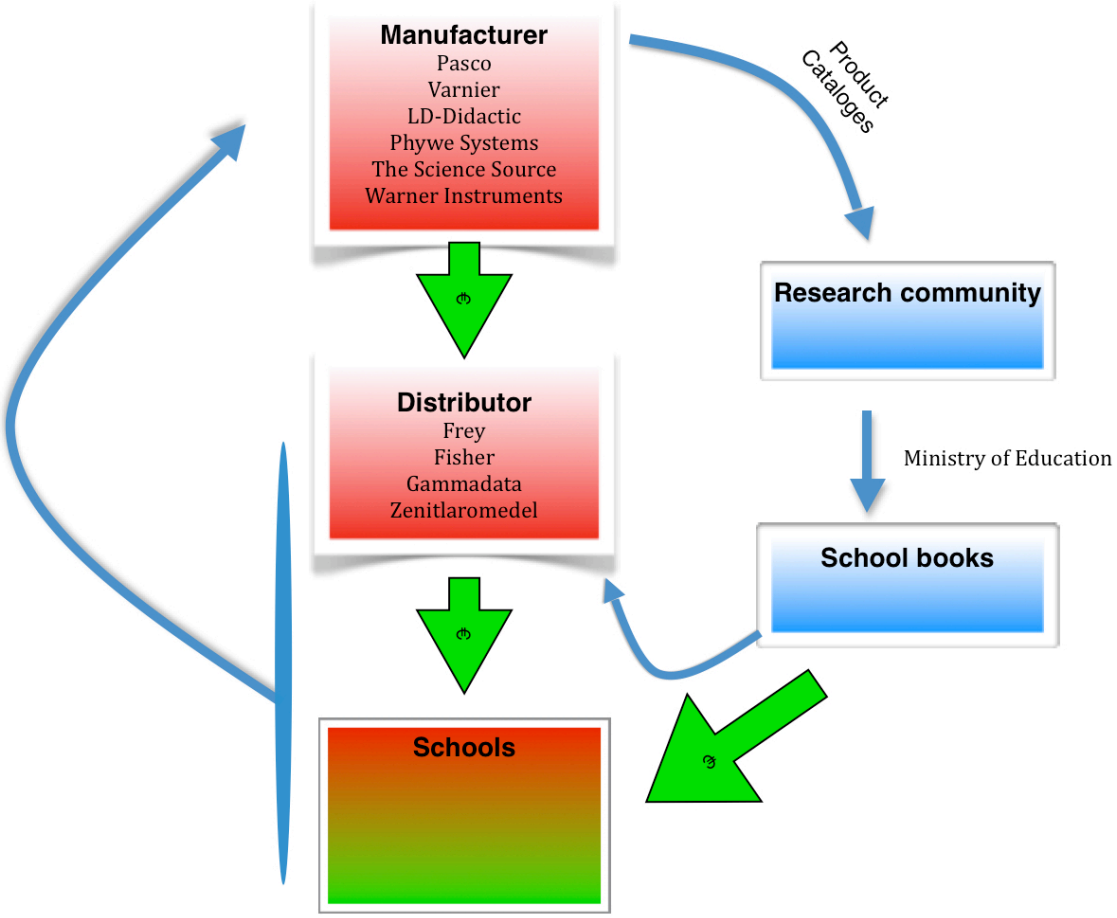


Figure : The large arrows show the flow of equipment and money. The slim arrows show the flow of the influential forces.

3.1 Decision process for buying new equipment

MedipixEDU is new and interesting, but not a must-have in order to learn physics. MedipixEDU has a curiosity value for a few hours every semester. There are lots of other equipment that is more important for a school than MedipixEDU.

This is not saying that it might not be extremely interesting for an enormous amount of students. But it will not be one of the first products a school will buy for their laboratory. A school has a very limited budget when it comes to educational

equipment. Thus they firstly buy what they are obliged to have in order to give a course to their students.

In Western Europe the curriculum is decided at national level. A group set by the government usually decides the curriculum, and thus they also set the premises of mandatory experiments. The educational books are then written on these premises. This governmental group has an influence on what equipments the schools end up buying, but the equipment available in the marked also influence the governmental groups.

"The best way to reaches the teachers and physicists in these educational groups is to get one of the big producers of physics educational equipment to front our product" says Anna Hess in Zenit AB who is a big distributor of school material in Sweden. She has first hand experience from these governmental educational groups, and she assures that the people in this governmental committees does background research of all interesting products from the major producer of educational equipment.

The educational marked is pushed very hard on prices. Since there is no economic value creation from using educational equipment, the reasons for buying is somewhat different than in other markets. This marked is driven on the premises of educational profit from the equipment. The importance is how much more the students learn because of the equipment.

3.2 Value chain

The figure illustrates that there are tree major parties in the value chain of educational equipment. The manufacturers, the distributors and the users.

There are four major manufacturers of educational equipment in the world. There are also some major companies producing certain equipment types, like dataloggers. In addition there are many local manufacturers in countries around the world. Some of these smaller companies also act as distributors for product they do not produce themselves. Some companies also produce equipment for use in both education and commercial businesses.

The local distributors play a vital role in this value chain. That is because of the complexity in the amount of manufacturers and because of the need to know the end users in the different countries. Different demands and wishes from schools in the various countries, as well as laws and rules of import, makes it absolutely necessary for the manufacturers to rely on the distributors to sell their product.

High schools usually buy equipment from the local distributors. Universities and colleges buy equipment other distributors, though the manufacturers might be the same.

3.3 Entry barriers

The barriers for a new product into the marked:

- Very slow decision process. Both internally in schools, but also in the development and adaption of new curriculum. (As described above)
- Extremely price sensitive marked. Small budgets and many different equipments competing for the same money.
- Life cycle of products is very long. Few products will thus be sold every year. A school buys the same equipment type very seldom. A lab product is expected to last from 10 to 20 years. Digital equipment from 5-10 years. (Verier)

3.4 User segmentation

-Users of the product can be segmented into the different levels of education. From kindergartens to University to PHD level.

At what level of education this product is interesting will depend on the curriculum at the different levels. In Western Europe and USA, the curriculum of nuclear physics is at the last year of high schools or the first years of college and university.

-Private or public schools is a third segmentation.

The budget for educational equipment is often very different between public schools and private schools. The decision taking process also differs.

3.5 Competitors and substitutes

The most obvious substitute is not to do this kind of experiment, but learn this theory through books, videos and lectures.

The only product that visually shows radiation in real time today is a cloud chamber[6]. These products are very illustrative and also very cheep, but they are fully analogue, do not provide an easy setup and they are not portable. MedipixEDU is distinguished form this solutions because it is digital, easy to sett up and portable.

	Price	**Advantage**	**Disadvantage**
GM-Counter	700€	• Audiovisual presentation of radiation • Portable • Easy to use	• Analogue • Old technology • Expensive
Cloud Chamber	150€	• Highly illustrative • Cheep	• Analogue • Difficult setup • Stationary • Time consuming

6 http://kptnaturfag.no/filbibliotek/Forsoktips/video/taakekammer

3.6 Customers

The customers of MedipixEDU will be the manufacturers of educational equipment. The customer value of this product is having more products to sell and earn money from. They have to evolve and develop just like any other company.

The manufacturers the group has contacted this week has all shown an overwhelming interest in learning more about the Medipix technology, as it would be something new in their product portfolio.

The purchasing criteria's are quite a few:

- The most important is that the pricing is low enough.
- The manufacturers must be able to buy what they need when they need it. They do not have the money necessary to invest in huge batch production.
- That the product is something new that they don't have today.
- That it might replace some of the equipment they sell today.
- It has to bring value to their customers, being the end users discusses earlier.

"Having such a device within PHYWE's portfolio would be more than nice." Dr. Ludolf von Alvensleben

Manufacturer	Where
Pasco	USA
Varnier	USA
LD-Didactic	Germany
Phywe Systems	Germany
The Science Source	USA
Warner Instruments	USA

4 Organization

4.1 specialist environment

The Medipix 2 collaboration consist of 17 institutes in Europe and USA. This means over 70 registered persons working within the collaboration.

The Medipix was originally developed at CERN for use in the LHC. Today CERN is developing the Medipix technology together with leading technological institutes world wide[7].

4.2 Formal rights

The formal rights to medipix belong to CERN Knowledge and Technology Transfer. Today CERN is licensing out the technology exclusively to medical imaging and spectronomy. It is possible to license the technology for educational applications.

7 http://medipix.web.CERN.ch/MEDIPIX/Medipix3/PeopleMP3.htm

4.3 Business model

The technology will be licensed out to a company already manufacturing teaching equipment. They will adapt the product for educational purposes and create a teaching framework around it. To license such a technology you will have to pay a flat fee to gain membership in the developing consortium and then pay royalties for the product.

Licensing has been chosen as the most likely business model because the technology has already been licensed out. A chip reseller will therefore not get exclusivity on the production of the chip.

4.4 Role of NTNU School of entrepreneurship

The nature of licensing makes it hard for NTNU School of Entrepreneurship to participate in this project.

5 Economy

5.1 Economic potetial

According to Zenit AB, which is one of the major distributors of school material in Sweden, high-schools use in average 30 000 - 40 000 SEK on physics equipment every year. There are 7880 schools in Sweden[8], and approximately 1/5 of those are high schools.

Number of high-schools in Sweden	1500	
Average physics equipment budget pr year pr school.	35000	SEK
	3500	€
Total spendings on physics equipment	5250000	€

Indications show that Swedish schools have an average budget for science equipment relative to the European countries. This estimation founds the conclusion that the superior financial criteria for MedipixEDU are present.

5.2 Price Secitivity

Teachers and distributors have indicated that schools usually buy 8 units per school to equip one laboratory used by a class of 30 students. The teachers and distributors estimate that schools are willing to pay approximately € 500-800 per unit with great educational value.

If the device turns out to be more expensive it might be an option to sell one unit as a teacher demo device.

8 http://www.adressleverantoren.se/Produkter/Sveriges_skolor/Sveriges_skolor.htm

Research show that educational distributors have a gross margin close to 50%. Meeting the customers willingness to pay for the MedipixEDU, the estimation show that the Medipix chip can be sold to the manufactures for no more than 50-100€.

5.2 Capital need

Development

The chips are currently being used in production environment and further development is not necessary. Future costs in developing the product are therefore zero. The product investments will be covered through the licensing terms.

Comersializing

The medipix chip manufacturing requires production of huge batches in order to reduce the cost of the product to an acceptable level. A rough price estimate fon producing only one chip is EUR 1000 a piece, but producing a batch of 20000 the price is EUR 50-100 a piece. The production cost of 20000 chips is EUR 1-2 millions.

6 Our opinion:

After working with this project it is obvious that MedipixEDU is not about moneymaking. MedipixEDU is about giving knowledge and technology to the educational system, and increase the quantity of produced Medipix chips. We have received several indications from manufacturers that this is a very good time to introduce this product into the educational marked, and 100% of the manufactures have shown great interest for this product.

However, we believe that this project it is a pure licensing case that has to be done by CERN Technology Transfer.

So, if you want to work with MedipixEDU, go to www.CERN.ch/jobs and apply for a position within the CERN Technology Transfer. We believe it have a big chance to succeed.

"Your call came at a very opportune time"

- Bob Schmedicke, Designer @ The Science Source

Appendix

CERN KTT follow up

Manufacturers that has shown great interests for MedipixEDU technology. Read contact log and follow up:

1:
Bob Schmedicke, The Sience Source
+1 207-8326 344
bobs@thesiencesource.com

2:
Gerard Ezcurra , Vernier
+1 941-3491 000
info@vernier-intl.com

3:
Joachim Prince, LD-didactics
+49 2233604299
hprinz@ld-didactics.de

4:
Ludolf von Alvensleben, Phywe
Germany
Tel.: +49 (0) 551 604-215
Mobil: +49 (0) 151 14 806 215
Fax: +49 (0) 551 / 604 107
mail: LvA@phywe.de

II Contactlog

Date	Contact info	Contact	Information	References
10.11	Universitetet of Bergen Writer of School Physics books V/Egil Lillestøl 55580000	Truls	Interesting! Sure it can be used in high schools, but think it must be combined with a radioactive source for x-ray functions to be perfect for university! Perfect for demonstration of cosmic radiation, alfa, beta and gamma rays. Show which radiation penetrates skin and other materials. 1mm 2mm 3mm 4mm 5mm osv. Show that we have radiation all around, all the time, and it is not dangerous! Right time according to nuclear power plant. Knowledge about nuclear power and the future of it. It is very very strict with the use of external sources in schools! Must be very week. But it would be extremely nice if we could have several x-ray machines in the lab! Need many sets, so cant be to expensive. One lab have 10-20 units at the university. Also a nice place to test this out since professors can handle radioactive material with care. Norway is on the rock bottom when it comes to how much money is granted for this kind of equipment.	Carl Angell - fysisk institutt på UNI Oslo! Phone: 2285 6443 Leader of the physic society in Norway.
10.11	Utdannings-direktoratet	Stine	Approx 100000 NOK/ 18000 CHF per student in Norway (private and public). The Counties decides and orders the science equipment.	
10.11	Gunvor Thomassen 0047 73866227 The County of Sør-Trøndelag	Stine	"Rammetilskudd?" for number of students. It does not matter which course the students takes.	Siv Heidi Ruud
10.11	Siv Heidi Ruud 0047 73866265 The County of Sør-Trøndelag	Stine	Should not be more expensive to teach science than history: the schools makes the decisions internally. The County does not order educational equipment, the schools does. 5/24 of the Counties in Norway orders for the schools.	KPT-naturfag Catalogs Frode Øren
10.11	Frode Øren 004773925169 Physics teacher at Byåsen high school in Trondheim, and Leader for the Physics network for high schools in	Stine	Every high school in Norway has a budget of approx 100000 NOK/18000 CHF to use on science equipment. The school decides the purchases independent of each other and the county. Mainly, the software is purchased by the County of Sør-Trøndelag and delivered to the schools, but this will yield for all school starting next years budget. Three physics courses in high school: 1st year for all students, optional for 2nd and 3. grade. Every course uses geiger counters, the students i 1st	Eivind Åmot Gammadata KPT VWR Pasco.com udir.np

	the County of Sør-Trøndelag		year has a 2h course in using the software. Udir has overview for teaching goals. See KPT standards online. Students can do experiments with radio active isotops themselves, not just the teacher. Except one experiment: isotops with half-lives 15 minutes.	
1100	Arve Stokke 71 58 89 00 KPTnaturfag.no stokke@kptnaturfag.no	Knut	KPT is a distributor of sience equipment for the norwegian school sector. They are selling equipment to all levels of education. From kindergardens to universities. They are buying equipment from lots of different supplyers and producers. They by whatever they think the schools need. Buy telling the teachers about new products they try to create a need in the market. They have some major competitors in norway. ribikon komet naturfag håland hamre vwr Some of their supplyers: risøy - danmark fredriksen - danmark	
	DANMARK Frederiksværk Gymnasium v/ Jonny Simonsen	Truls	In Danmark there are several small business that sell school equipment. But there are a cople of big distrubuturs. They are: Dear Sir As I promised on the phone I send you some names of firms we buy material by. Skolebutik, 2760 Måløv; Scandidact, 3490 Kvistgård; Unimenco, 3400 Hillerød, many regards	http://www. american- pictures.com/ dansk/ show/ gymnasieadresser .htm
	Erik Duhs Nilsen Area Sales Manager Norway Gammadata 0047 33096330	Stine	Gammadata Norway has delivered science equipment to approx 100 primary & low secondary schools in Norway. Gammadata delivers equipment to 70% of Norwegian high schools (350 total: delivers to ca 250 schools) , and almost everybody buys a GM Counter. Cost: 5000 NOK/ 900 CHF, including USB cable. The GM Counter can be connected to a computer by USB. A range of 65 different measurement products connectable to USB and computer, to be used in physics, biology and chemistry. Multi measurement equipment for use in biology. Additional software from DataStudio: free version or a (eternal) school license (cost 5000 NOK / 900 CHF), most high schools buy the license. Software and equipment in 14 different languages, including Norwegian. The software offers graphs, diagrams, digital reports. Gammadata is the Norwegian (and Swedish, Finish) distributers for Pasco: american producer of educational science equipment (John Wayne and Dave Stogner). Also providers of software: Spark View, icon based. Pasco is a world wide supplier.	Impo (Danmark) Pasco (USA): -John Wayne (wayne@pasco.com) -Dave Stogner (stogner@pasco.com) Motic (Hong Kong) Crocodile Clips phywe.com

			Norway has not a good marked for educational equipment. Norwegian schools use between 5000-50000 on eq. Product they are buying varies from 5000 NOK /900 CHF to 15000 NOK / 2700 CHF. Products with cost 30000 NOK/ 3600 CHF sold approx every 2nd year. After "Kunnskapsløftet": more digitalization and the County gives the schools more money to spend. Recommended experiment for every student: Cesium-Barium Isotop and GM counter. Germany and GB spends more on it. Producer in Germany: Phywe. A lot of the very old equipment i Norwegian labs comes from this producer. Very expensive equipment, mainly German schools buys it.	
	Glenn Ghose Komet naturfag Telefon: 32 87 86 46 Telefax: 3287 75 89 Epost: komet@online.no Internett: www.kometnaturfag.no	Knut	distributor of equipment in norway. Three main factors that influence what is being bought in schools. Plans, books and the understanding of what is standard in a lab. A product like this is probably not "standard" in a way that every school needs this. Standard in the way that it is directly into the target plan for the education. If not in the target plan, then the marked is much smaller because only the ones with special interests will buy this. The marked is very price sensitive. A GM counter is today sold to end user at around 6000 NOK each. It should probably be sold as a part of a product range. Komet is the main distributor in norway of the vernier.com equipment. They are quite large world wide on these kind of equipment. Komet has an average price gross margin of about 50%.	Vernier.com Florida Gerard Ezcurra 19413491000
	SWEDEN: Sandvikens Gymnas Science and Technology Division Tel:026-24 13 54	Truls	There are more small contractors now then before. Just a few years ago there were only IMPO, Gammadata and some others. Now schools buy from small contractors like - Alega (http://www.alega.se/) - Zagito - Zenit (http://www.zenitlaromedel.se/) This school get 80 000 SEK/11 770CHF every year to buy this kind of equipment for the physics division alone.	Zenit 0523-37900 Alega 0511-10411
	SWEDEN: Anna Hess Zenit laromedel Distributor of school matrerial in Sweden Alega 0511-10411	Truls	They make some product self, but mostly import. The products thye sell are influenced from the curriculum that is sett for the contry you are in. In Sweden there are a group of "six" teachers/profesors who deside what the curriculum will be. They can deside to include a whole new subject if they find it informative! Now you send students on a rollorcoster ride with a acelerometer and a gforce messurement! this is called Animated physics, and it is getting more and more populare! http://www.phywe-systeme.com/ is a high quality producer of this kind of physics products. They deliver Cloud chambers witch might be the	Ludulf Won Abelsleden @ Phywe

			closest to our sulution. Phywe deliver their product world wide and a agreement to use their nettwork would make it much easier to enter the curruculum in the different countries. In sweden the average amount a school use on equipment for their physic classes are 30 000 - 40 000SEK / 4500-6000CHF every year. She thinks the price must be around 5000-8000SEK pr. unit. A lab class usualy buys 8 units for one lab! Might also be a posibility to sell one as a teacher demo.... It is very strickt when it comes to radioactive material in classes!	
	SWEDEN: Alegra.se Distributor of school matrerial in Sweden	Truls	Only three people working there. They import product from Kina, and deside what they need to import from the content of the schoolbooks. Two are former techers so they know what they need!	
	Terri Polani (800) 772-8700 x 212 9167863800 Pasco, Europe Technical Sales Rep polani@pasco.com	Stine	Requested an email to take it upwards in the system.	
	Ludolf Won Abelsled 215 Phywe-systeme.com Telephone: +49 (0) 551 604-0 Fax: +49 (0) 551 604-107 Internet: www.phywe.com E-mail: info@phywe.com Service: service@phye.com	Knut	He is one of the engineers in the company, He found the idea interesting, but he wanted an email so he could get a better understanding of the technology. He said that entering the educational marked with a new devise is a very slow process. The end users are very slow adapters, and the needs of the customers change very slowly. It will take at least tree years from entrance until there is a reasonable sale of products. The sale will depend on the price and the educational power of the product. It will have to be revolutionary in order to be adopted fast. Schools firstly buy product that is of main curriculum interest, and thereafter things that is of more curiosity-interest. They prefer produce the product themselves. But they also buy allot of products from external suppliers. They have a development department of about 20 people. Se E-mail conversation.	Send email

	Henning Huuse	Knut +	Medipix webside with lots of publications. Everything is open information. Remember the context of this student project. That this is not an official request from Cern. Cern has an interest in getting this product out to as many people as possible, not to make as much money as possible. Cern has an industry R&D research license that they sell to industry for 25000 euro. This involves software and hardware to test on. Information is basically all open. Other licenses has to be dealt with later by cern TTO. There are licenses for medical and spectronomy today, but they are quite specialiced, and for certain purposes.	
	Frey Scientific	Truls	Frey is a distributor. Their chief buyer was not present.	
	klingereducational .com	cms	They are a distributor. They buy their products from ld-didactic.com	LD-Didactic Oda +492233604188 Miss veronica.
	Fisher purchase sectore http://www.fishersci.com	truls	Fisher is a big distributor that sells products from different manufactures. When it comes to nuclear science they use The Science Source. ”education is a big and important part of Fischers turnover” Got contact information to to sentral marketing persons! Follow this two to get an estimate of the american marked! ----- Hi Truls, I sourced 2 names that might be of more assistance to you. Dave Gribben- marketing director for education	BOB - Bob bobs@thescienceso urce.com 2078326344

			david.gribben@thermofisher.com tel#630-259-4752 Josh Burchacki-marketing manager for education joshua.burchacki@thermofisher.com tel#800-955-1177 x1364765 It was a pleasure speaking with you, I do hope this takes you in the right direction. Have a nice day!	
	Impo			
	MANUFACTURE Bob S thesciencesource.com/ 2078326344	Truls	Generaly they buy components like the Medipix and make the product that the klients want. They dont normaly buy exlucive patents to produce the most advansed compenents. Bob work with the Nuclare physics products, and design the Geiger Counter they sell. He now works with a "cloud tube" where you may see radiation, and think this tecnology sounds interisting. I´ll send him a mail with more questions:	waiting for answer on email!
	ProLab 1-800-556-5226			
	LD-didactics Joachim Prince +492233604299 hprinz@ld-didactics.de		Joachim Prince found this technology very interesting, and understood well what this was about. He very much whanted to be informed about the product. He was very open for looking into the possibility of having this as a part of their products. He said that this probably only would apply to the last year of high school, or university level. LD- didactics will probably whant to develope the software themselfe.	
11.10	Egil Lillestøl leader of the physics federation and professor at University of Oslo	Truls	three distrubutors in Norway: - Ktp naturfag - Komet naturfag - Gammadsata	

			same forming of the curriculum as in Sweden	
	Komet naturfag	Truls	four big manufacturers worldwide - Pasco - LD didactic (formor labelt) - Phywe - Warner he thinks a co-operation with some of Warners existing products would be the best way to get this product out to the schools	
	Ludolf von Alvensleben Phywe Germany Tel.: +49 (0) 551 604-215 Mobil: +49 (0) 151 14 806 215 Fax: +49 (0) 551 / 604 107 mail to: LvA@phywe.de	Knut	Mail corespondance with Ludolf in PHYWE. Read from bottom and upp.. Dimension of the active surface 1,4*1,4 cm Se document Max counting rate /Dead Time 20 frame pr sek - 256*256 pixel - se dokument Energy range and resolution - Price and availability this depends on the amount of articles. But it is not sheep. Exclusivity for the educational market It is not lisences for the educational marked yet. So it is open to use in most educational situations. Getting an exclusive lisence will be a mather of negotiations with Cern. Knut <image001.jpg> Den 11. nov. 2009 kl. 15.17 skrev Alvensleben, Ludolf v.: Dear Knut, sounds quite interesting. When I understand it right the unit has a capability to detect single e.g. x-ray photons, give the energy of this photon, and the position of incidence on the device. In other words it can replace a Geiger Müller counting tube, an X-ray energy detector and includes the spacial resolution of the incoming x-ray photon. Having such a device within PHYWE's portfolio would be more than nice.	

			Some first questions come up Dimension of the active surface Max counting rate /Dead Time Energy range and resolution Price and availability Exclusivity for the educational market We are certainly in the position to produce a USB stick device within our facilities. The question comes up, if this makes sense as you already have it ready or are you not willing to make it yourself? Our Company (PHYWE Systeme GmbH & Co. KG) is developping, manufacturing selling worldwide educational equipment for Physics Chemistry , Biology an Applied Sciences. Please have a look on our Internet page I like to focus your interest on our X-ray unit (09058-99) the X-ray enery detector (09058-30) and the relative accessories. You ask for a market potential. This is definetely a difficult question, which I would like to discuss on the phone. Mit besten Grüßen / With best regards PHYWE Systeme GmbH & Co. KG Dr. Ludolf von Alvensleben Product Marketing Physics Robert-Bosch-Breite 10 D - 37079 Göttingen / Germany Tel.: +49 (0) 551 604-215 Mobil: +49 (0) 151 14 806 215 Fax: +49 (0) 551 / 604 107 mail to: LvA@phywe.de www.phywe.de <http://www.phywe.de> USt-ID: DE 2313775 34 Von: Knut Wien [mailto:knutwien@gmail.com] Gesendet: Mittwoch, 11. November 2009 10:19 An: Alvensleben, Ludolf v.; lwa@phywe.de Betreff: Cern product Hei Ludolf, thank you for the informing conversation yesterday. I hope I can make everything clearer through this mail. We are doing an intensive marked research this week, so we are trying to get an as good as possible understanding of the potential and interest in the marked for the new product that is developed in Cern Geneva. The product is today basically a nuclear image sensor chip that can be used in lots of various ways. The product we are working with is an USB device that has the chip installed. Together with software this gives a perfect picture of any radioactive signals passing it. It can be used to understand everything from background radiation to visualize stronger sources of radiation.	

			Take a look at this webpage to read basically everything about the technology of medpix and in this case medpix 2. http://medipix.web.cern.ch/MEDIPIX/index.html It is in use in different situations today, but not in the field of education. Cern has an interest in getting this out to as many people as possible, and thus they would like students in many levels to be able to learn from this product. It is grate if you can take a look at the webpage and call med back if you find this interesting, or have more questions. I also have some other questions that I would be very happy if you could help me out with. In order to better understand the potential in this product we need to get an approximate understanding of the marked size. The absolute best is if you could tell me how much turnover it is in the worldwide marked of educational equipment for nuclear physics. This might be difficult, but maybe you could tell me your approximate marked share on this. And maybe how much turnover and/ or numbers of parts this represents. We need this rough estimate in order to present this to the Cern board. The price of every device will depend on the numbers of products. It will need many work hours for Cern, so they need to know if it is of any interest at all, or if they price themselves out of the marked. It would also be nice to know if you think you can produce the interface yourself, or if you think you need a supplier who produces the USB stick for you. Best Regards Knut Wien Cell: 0047 97137185 knutwien@gmail.com	
	Simen Malmin 0047 97570453 Balter Medical	Stine	He is currently working at the Technology Transfer connected to the University of Bergen in Norway. Balter Medical has developed a handheld detector for skin cancer developing in moles. The detector is based on UV and infrared rays transmitted from the detector and reflected at a few millimeters depth in the skin. An algorithm uses the reflection from three angles to create an image that visualizes the skins condition: mole cancer or not. Red light better than blue light. Smaller wavelength has a higher intensity and gives a better resolution. Their product is the size of a large mobile telephone, and cost a couple of thousands NOK to produce in a small scale. A 3D-scanner costs approx 300 000 NOK / 54 000 CHF.	Will send an email with names of potential product developers and producers for the Balter Medical product.
	Simen Malmin 0047 97570453 Balter Medical Simen.Malmin@be	Stine	Hei Stine, Under har du en link til Balter og våre nærmeste konkurrenter: www.baltermedical.com	

	rgento.no		www.scibase.com www.eosciences.com Var det slik at dere skulle finne aplikasjoner for skole og utdanning? Her har du en liste over selskap vi vurderte å bruke til å utvikle den kommersielle prototypen til scanneren. Sanmina er det eneste av disse som også kunne ha masseprodusert enheten. Hotswap PAJ Prevas Epsilon Semcon Sanmina Helbling Xsense Mvh, Simen	
	Hamar katedraskole v/ Hilde Turmo and Svein Erik Knudsen KPT 91101626	TRULS	Information on how much radiation that is aloved in schools in norway! www.naturfag.no - sikkerhet på lab radioktive kilder! kpt - svein erik knutsen The borders are desided from the norwegian institutt for radiation in a cllaberation with Natrufag.no Anders Isness is the main person in Natrufag. say hi from Svens Erik	Anders Isness @ www.natrurfag.no
	Bob Schmedicke The Science Source 2078326344 bobs@thesiencesource.com	Truls	Hi Bob, Thank you for taking the time to talk to me on the phone earlier today. We are four students from the Norwegian University of Science and Technology in Trondheim (http://www.ntnu.no/english), who are currently working with The European Organization for Nuclear Research (CERN) located in Geneva, Switzerland. The main goal for our project is discovering the marked possibilities for Medipix (developed here at CERN). Pleace take a minutte to read about the technology on the link below: http://medipix.web.cern.ch/MEDIPIX/Medipix2/indexMPIX2.html This is not a formal request from either CERN nor us, but a market survey for our student project to find out if we can deliverer this technology to the educational marked. Our questions: Would Medipix be an interesting product for The Sience Source(TSS)? Why or why not? Do TSS buy products from a producer or does TSS design and produce the products? Do TSS have a licensed agreement with technological	

			organizations/companies? Where are your main markets? Who are your main competitors? And where are they located? Approximately how many schools do TSS provide with educational scientific equipment? Hope to hear from you :) Mvh / Best regards Truls Brataas Norges Teknisk-Naturvitenskapelige Universitet Institutt for Produktutvikling og Produksjon Norwegian University of Science and Technology CERN-Technology transfer ---------- ANSWER: Dear Truls, Thank you for your call and email. Your English is excellent, by the way. You needn't have worried. Please allow us to address your questions: -- Would Medipix be an interesting product for The Sience Source(TSS)? Why or why not? Your call came at a very opportune time. We have been considering the development of a number of projects for our Daedalon brand that could utilize this exact technology. We have expertise in vacuum technologies, precision field generation, and particle sources, and believe that a market exists for an educational mass spectrometer, gamma spectrometer, and Stern-Gerlach apparatus, which would all use related componentry. We have been attracted to the didactic simplicity of Faraday cups and amplifiers, but Medipix and Timepix could drastically improve these products. So yes, Medipix would be very interesting to us. -- Do TSS buy products from a producer or does TSS design and produce the products? In general, we design our products. On occasion, we pursue promising projects that are presented to us by educators or researchers. We manufacture the final product. We prefer to have manufacturing control over as much of a product as possible. However, as I mentioned on the phone, some componentry is sourced. That is, when it is most cost-effective for us to purchase a component instead of manufacture it, we do so. Oftentimes these are components that are outside of our capabilities to manufacture. Chips such as Medipix would fall in this category. -- Do TSS have a licensed agreement with technological organizations/companies?	

			Our license agreements are usually with universities or individual experts to produce specific designs on a royalty basis. We do not generally acquire licenses to incorporate componentry into apparatus, but prefer to simply purchase those components from the manufacturer. We are open to any mutually beneficial agreements, however. --Where are your main markets? Daedalon's main markets are university physics educators and researcher, as well advanced high school educators. While we have particular expertise in the US market, we have customers globally. TSS's broader product line includes elementary, middle, and high school science. --Who are your main competitors? And where are they located? Daedalon's main domestic competitor is Pasco, in California. There are relatively few domestic manufacturers. Overseas competition is primarily from a number of European manufacturers. --Approximately how many schools do TSS provide with educational scientific equipment? Daedalon provides equipment to hundreds of universities and high schools, in dozens of countries. The broader TSS line has thousands of customers worldwide. I hope that answers your questions. If you have any others, please feel free to call or email. I look forward to the possibility of working with you and your colleagues. Best regards, Bob Schmedicke	
	Rafael balabriga & emanuel Dr. Erik H.M. Heijne	Group	For xray usage cadmium 129 can be used, it radiates a couple of megabequerel. But the problem with natural sources is that they don't only radiate photons and they radiate in all directions. This causes the image taken of an object to be blurry (natural blurring). There is one company that sells xrayequipment to schools and universities, but I don't remember the name. To get help from cern with developing the product for educational purposes you have to market the product to cern management so they allocate resources for the educational project.They may do it because the product promotes cern to schools. One person you can talk with is Becky Parton/Parker. She is working on the lucid project. To sell xray to schools you have to sell a shielded enclosure with the	

			sensor and xray source to meet regulatory decisions on radiation. The energy level captured by this device is 5-40KV It is not possible to photograph remote radioactive sources due to the fact that photons are not travelling far, and that you will have to use a camera obscura principal with a small pinhole to record the radiation. It will therefore take a day to take one picture. --- The trick to make money on this for educational purposes is to make huge quantums of the product. If you produce 20000stk the end price might get down to 1000eur, but 200eur is a lot for schools in Holland. In Holland the budget for this stuff is 100eur. Producers are not going to finance anything. They have to be able to by equipment quite cheep. Microelectronics has to be made lots of. User electronics has to be made in about millions. Cern itself is not using large quanta of chips, the largest quanta was 1000 chips for the cms project. For 120000chf you get membership + a few chips, and you can then order more. If you buy a couple of hundred chips you will need to establish a system for production, and this makes it more expensive to buy 100s than 1000s. So it is important to sell a large quantum. Micro electronics is a quite riski business. It is only possible if you make a large quanta. 20 000 pieces is an absolut minimum in order to be able to get it inexpensive enough.	
	23301200 23301336 Trine Norman The norwgian departpent for education	Truls	Trine is the person who has the number on how many students who are enrolling in physics (Fysikk-2) in norway	
	Naturfag.no	Truls	The values for the quantities that are alowed to emit in norwegian schools. http://www.naturfag.no/_naturfag/artikkel/vis.html?tid=17097&within_tid=16915	
	Vernier.com Florida Gerard Ezcurra 19413491000	Knut	Dataloggin, lab using more modern tools - collecting computers trough info@vernier-intl.com 28 years ago 138 contries, very much standard in the world, vernier is one of the most open systems, software are open arcitecture. They are here to serve	

			nuclear regulations for students. Several experiments. GM tubes. Build upp equipment, lifesycle is about 7-10 years. Budgetary. Warant for 5 years. 4 major - small competitors in the local companies. US- Two in the US, 55-60 % All of them are private markets, so nok largest company in the world, data collections, Datalogger. Variable voltage output. USB signal, Rilis Brand new product, small simpel gas cronograf. They do not usually like to be an investment	