Zacks Small-Cap Research

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Zecotek Photonics (V.ZMS)

V.ZMS: Hamamatsu Revenue Still Delayed But Expect Acceleration With Finalized Agreement

Current Recommendation	**Outperform**
Prior Recommendation	N/A
Date of Last Change	10/02/2013
Current Price (12/04/2014)	$0.32
Target Price	**$2.00**

OUTLOOK

Zecotek is the only company in the world to own all key elements for a high performance PET scanner. Technology is protected by large patent portfolio. ZMS.V is well positioned to capitalize on growth of PET market. Their LFS scintillation crystals look to be superior to any other crystals on the market and with PET scanner performance tied to performance of crystals, demand for LFS crystals could be substantial. Major distributor just signed and initial orders received. Crystals also to be used in high profile Large Hadron Collider. ZMS.V is plaintiff in lawsuit claiming patent infringement - potential award could be substantial and provides potential add'l upside value.

SUMMARY DATA

52-Week High	**$0.97**
52-Week Low	**$0.26**
One-Year Return (%)	**-57**
Beta	**N/A**
Average Daily Volume (sh)	**240,117**
Shares Outstanding (mil)	**107**
Market Capitalization ($mil)	**34**
Short Interest Ratio (days)	**N/A**
Institutional Ownership (%)	**N/A**
Insider Ownership (%)	**N/A**
Annual Cash Dividend	**N/A**
Dividend Yield (%)	**N/A**
5-Yr. Historical Growth Rates	
Sales (%)	**N/A**
Earnings Per Share (%)	**N/A**
Dividend (%)	**N/A**
P/E using TTM EPS	**N/A**
P/E using 2014 Estimate	**N/A**
P/E using 2015 Estimate	**N/A**
Zacks Rank	**N/A**

Risk Level	**N/A**
Type of Stock	**Large-Growth**
Industry	**Med Products**

ZACKS ESTIMATES

Revenue
(in '000 of $)

	Q1 (Oct)	Q2 (Jan)	Q3 (Apr)	Q4 (Jul)	Year (Jul)
2014	8 A	41 A	14 A	23 A	87 A
2015	34 E	68 E	340 E	681 E	1123 E
2016					3998 E
2017					8772 E

Earnings per Share

	Q1 (Oct)	Q2 (Jan)	Q3 (Apr)	Q4 (Jul)	Year (Jul)
2014	-$0.01 A	-$0.02 A	-$0.02 A	-$0.04 A	-$0.09 A
2015	-$0.02 E	-$0.01 E	-$0.01 E	-$0.01 E	-$0.05 E
2016					-$0.03 E
2017					$0.02 E

Zacks Projected EPS Growth Rate - Next 5 Years % **N/A**

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WHAT'S NEW…

Fiscal Q4 2014 Financials: *Hamamatsu revenue still delayed yet look for uptick in 1H 2015…*

Zecotek filed their financials for their fiscal 2014 fourth quarter. Revenue remains insignificant and representative of delays in recognizing revenue from the $2 million in Hamamatsu orders. Zecotek has acknowledged as much and notes that delays in orders from PET OEMs due to necessary engineering changes to their scanner components has been the reason for the insignificant revenue to-date. And while the delay has been a real disappointment, it has no relation to the quality of or interest in the crystals. We continue to see no reason to believe that order shipments related to this initial Hamamatsu order or to CERN-related experiments, including the Hadron Collider rebuild, will not materialize over the near-term. In fact ZMS announced earlier this week that CERN provided positive feedback on their assessment of the crystals, placed additional orders and expects that the contract should be finalized early next year. The indication being that order flow should accelerate in the coming months.

In addition, new potential opportunities continue to materialize which could spark even greater demand for the LFS crystals over the long-term. This includes an initial shipment in November of a $500k order of crystals to the NIITFA Automation Research Centre for Technical Physics (in Russia) related to the development of a PET scanner. As we have noted in our ongoing coverage of Zecotek, new PET scanner development is a huge potential opportunity for the company. This includes scanners that are upgrading from legacy photo multiplier tubes as well as development of scanners by manufacturers outside of the "big 3" (GE, Siemens, Philips), particularly those in emerging markets where PET scanner market growth is expected to be particularly robust.

And Zecotek's distribution partner, Hamamatsu, is also looking to enter the space with a PET scanner of its own. While Hamamatsu is likely loath to compete head-on with its OEM PET customers with a traditional scanner, the company has announced that they are developing a PET scanner specific for the brain. Given ZMS's close relationship and Hamamatsu's high regard for the company's crystals, we think it is possible Hamamatsu could look to Zecotek to supply crystals for its brain scanner, which could provide a multi-million dollar supply agreement opportunity. Based on certain communications and particular insight we think news flow on additional opportunities, which possibly could include supply agreements with PET manufacturers, will pick up over the coming weeks.

Q4 revenue was $23k, compared to our $52k estimate. Again, we think LFS crystals revenue related to the CERN agreement, as well as the NIIFTA relationship, should spark a greater revenue rate in the coming months. This is reflected in our updated model.

Q4 net income and EPS were ($4.0) million and ($0.04). Net loss was considerably higher than Q3 2014 (yoy) and Q4 2013 (sequential, ex collaboration costs) as a result of significant spend in the most recent period on the lawsuit with St. Gobain and Philips. While the company has not released much in the way of recent information regarding the ongoing lawsuit, the tight-lipped nature is common with litigation proceedings and we continue to believe Zecotek's holds a position of strength given the precedents.

The company exited the quarter with $615k in cash and equivalents. Subsequent to quarter end the company closed on the sale of 8.01 million shares (with 100% warrant coverage) @ $0.35/share for gross proceeds of $2.8 million.

We are maintaining our Outperform rating and $2.00/share price target. We continue to think the shares remain highly undervalued with the delay in recognition of the Hamamatsu order putting downward pressure on the stock price and offering an attractive entry point. We think near-term news flow and steeping revenue rate will provide a catalyst to the share price.

Additional LFS Crystals Sought By CERN, Supply Agreement About Finalized

Zecotek recently announced that a new configuration of their LFS crystals was requested by CERN for their Compact Muon Solenoid (CMS) experiment. The crystals will be tested as part of the Large Hadron Collider rebuild. Per Dr. Michael Arenton, Senior Research Scientist with CERN, "We are pleased with the performance of Zecotek's new LFS-3 configuration using plates geometry and we are confident that it will pass all the prerequisites needed for the new electromagnetic calorimeter part of CERN's LHC and CMS upgrades."

Following the initial announcement in late July that CERN had requested LFS crystals for this new experiment, ZMS announced that CERN will be installing the crystals in the Large Hadron Collider. This is the final validation

stage by CERN before the organization would fully adopt the crystals for their experiments. Then in early December Zecotek announced that CERN provided positive feedback on their assessment of the crystals, placed additional orders and expects that the contract should be finalized early next year. We view this as an indication that order flow should accelerate in the coming months.

We also view CERN's continued and growing interest in ZMS's LFS crystals as validation of the quality and performance of the crystals. Upon full adoption, we would expect this to present a meaningful revenue opportunity for ZMS.

Markman Hearing - Court Rules In Favor of ZMS
On May 14th the U.S. District Court of Ohio ruled in favor of Zecotek by adopting interpretations of certain patent language that is key to its lawsuit against Saint-Gobain and Philips. The Markman hearing allows the judge in a patent infringement case to examine evidence from both parties and to determine the interpretation of the language of the patent in question. A ruling in ZMS's favor in the Markman hearing was critical as it now allows the lawsuit to go forward.

As a reminder, in February 2012 Zecotek announced that they brought a lawsuit against Saint-Gobain Corporation and Philips alleging infringement of Zecotek's patent (7,132,060) covering the substances and chemical formulations to grow their LFS crystals. Zecotek was granted the patent in November 2006. See this link on the U.S Patent and Trademark office website for the full description and claims of the patent: http://1.usa.gov/1bcxsYP.

The lawsuit, which was originally filed in U.S. Federal District Court in Los Angeles and is now being heard in the U.S. District Court in Ohio, claims that Saint-Gobain's currently commercialized LYSO (lutetium yttrium orthosilicate) crystals infringe Zecotek's patent and that Philips is also liable because they use these Saint-Gobain crystals in their commercialized PET scanners. BOET, the manufacturer of ZMS's LFS crystals is co-plaintiff in the lawsuit.

Timing for conclusion of the lawsuit is a complete unknown. We believe that it's still possible that the two sides could settle prior to trial. And if it does go to trial, it's possible that it could be drawn out for sometime given the potential for appeals by either side. Clearly the lawsuit will be of significant interest to investors as the outcome could, if in Zecotek's favor, could provide significant upside value to the company.

We also note that Philips, which holds significant share of the OEM PET market, is a potential future customer for Zecotek's products - LFS crystals, MAPD, IDM, and potentially future products. While complete speculation on our part, we think there may be an interest for both Zecotek and Philips to come to terms of an agreement and settle the lawsuit in exchange for (at the very least) to allow for good relations and potentially enter into a supply/purchase agreement.

Either way, it's a clear positive development that the Markman hearing went in Zecotek's favor as this gives the company the upper hand and affords them the option to go to trial, or if desired, to seek some sort of settlement with the defendants.

Recent Operational Highlights Focused on 3D Technology
As Zecotek is in the midst of initial roll-out of their scintillation crystals and related imaging products, they have also made substantive progress towards moving their 3D technology closer to commercialization.

The company recently announced that they have been in discussions with major electronics companies to develop an OLED/LED-based, flat screen, glasses-free, 3D HD television. Then in July ZMS announced that they signed a letter of intent for Aquarius, Russia's largest computer company, to acquire 20% of Zecotek Display Systems for $7 million. This investment is expected to be used to complete the commercialization of two patented 3D displays. These displays are for flat screen and large screen formats and also for use with a 3D printer.

Relative to the other recent progress on moving the Display business forward, Zecotek's CEO noted in a recent press release that, "We have overcome the main technical barriers required to meet the consumer preference for flat screen form factors and HD picture quality with available OLED/LED flat screen display technologies."

In March 2014 Zecotek filed two patents with the U.S. Patent Office related to front and rear-projection auto-stereoscopic 3D display, allowing for 3D visualization (on both front projection and rear projection systems) without the need for special glasses. Also in March the company announced that it was awarded a patent in

Korea related to its glasses-free 3D technology. With many of the major display manufacturers located in Korea, this is potentially a step-forward for Zecotek towards a collaboration agreement in development of a glasses-free 3D display product.

While it is still unclear how soon commercialization of the 3D display technology for the consumer market may materialize, we view the recent developments as materially positive and the progress more rapid than we had previously anticipated.

Zecotek is also moving forward on other fronts related to its 3D technology. This includes their 3D projection technology which they see applicable for applications where flat screens are not particularly important. This is mainly the non-consumer markets including for applications such as advertising and large venue displays. Of particular utility could be for 3D printing applications for commercial use.

In the last several months Zecotek announced that they are now designing a 3D interface platform between 3D printers and their 3D display technology as well as developing their own 3D printer. The interface would allow someone to see a 3D image of an object prior to actually printing it on a 3D printer. The user would be able to view the object from all angles and make any desired adjustments before they printed it, affording time, cost and materials savings. Relative to a 3D printer, Zecotek is working with their long-time contracting partner LT-Pyrkal (Armenia) in designing a compact, high speed and more efficient printer than the 3D printers currently on the market. While the design is still in the early stages, Zecotek continues to make progress and in late May 2014 they completed the initial design for a 3D processing module. In July ZMS announced that they and LT-Pyrkal had made meaningful progress with development of the 3D printer and which would begin assembly and testing.

With the rapid growth in popularity of 3D printing, this could be another high-potential opportunity for Zecotek's 3D display technology. The company envisions initially subcontracting production of the 3D display units for the 3D printer application and then potentially partnering for wider distribution.

While we still do not model a contribution from the display-related businesses (consumer or commercial related markets), we believe the recent progress could provide a greater chance of upside to our outlook. We will be monitoring ongoing developments and update our model if and when appropriate.

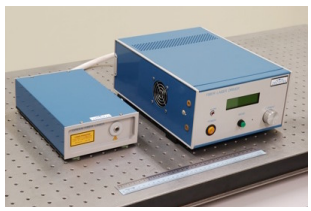
BACKGROUND

Three Operating Businesses, Current Main Focus is Imaging Systems
The company has three operating businesses; Zecotek Imaging, which develops high resolution imaging products and components for the medical field (includes LFS crystals, the company's current focus), Zecotek Lasers, laser systems for the medical and industrial fields, and Zecotek Display, the company's proprietary display technology which provides 3-D viewing without glasses and is aimed at the medical, industrial and consumer markets.



- **Zecotek Display Systems (ZDS)** is focused on a proprietary 3-D technology which provides unique, multi-dimensional viewing without requiring glasses. The display allows viewers sitting at different angles to see separate views. Zecotek completed system development and has a 32-inch pre-production model which they are exhibiting for demonstration. The system is not currently in production. Potential end markets include medical, video gaming, graphic design, and military, among others. We think the display systems business has significant potential given the huge and various markets interested in high quality 3-D technology and the unmet demand due to the fact that most currently commercialized technologies require glasses, which consumers find an annoyance. We had just recently viewed the business as sort of a back-burner opportunity as Zecotek focused on their LFS crystals and their MAPD but recent developments in the display business, including a July 2014 announcement that they signed a letter of intent for Aquarius, Russia's largest computer company, to acquire 20% of Zecotek Display Systems for $7 million, now have us believing Zecotek's display systems business may have more near-term potential than we had previously thought. This investment is expected to be used to complete the commercialization of two patented 3D displays. These displays are for flat screen and large screen formats and also for use with a 3D printer.

- **Zecotek Laser Systems (ZLS)** develops lasers and laser components for applications in the medical and industrial sectors as well as for research purposes. The company develops two main types of lasers; visible fiber lasers (VFL) and thin film lasers.



Their VFL lasers cover wavelengths in the green, blue and red spectral ranges and are manufactured using the company's proprietary fiber optical technology. Zecotek notes certain advantages of their lasers including; high beam quality and stability, compact design and high efficiency, adjustment-free operation, no water cooling, wavelength output in most of the visible spectrum, and broad continuous wavelength tuneability. The tuneability within wide spectral ranges, along with relatively lower cost compared to conventional lasers are specifically noteworthy benefits. Their VFL lasers are sold to various industries and for a variety of applications, these include; medical (DNA sequencing, flow cytometry, ophthalmology, dermatology, urology), printing, material processing (laser writing, lithography), and research (spectrsocopy, fluorescent analysis), among others. Zecotek's VFL lasers are currently used by the National Cancer Institute, a division of the U.S. National Institutes of Health (NIH).

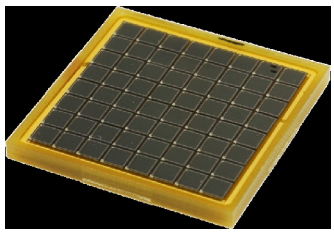
Zecotek's thin film lasers are still under development. The company has previously noted that it was partnered with the Advanced Materials and Process Engineering Lab at the University of British Columbia in development of thin film waveguide structures for the next generation of diode-pumped solid-state (DPSS) lasers.

Most recently however, in early 2014 Zecotek noted in its Q2 2014 quarterly filing that it is revising the Laser Systems' technology portfolio, restructuring the business and now focusing on "ready technologies geared to cater for the ever expanding security market demands." What this means in terms of near-term projects, product development or product commercialization is unclear – however, we think it may indicate that the company will look to incorporate its laser technology into products with more broad-based applications. However, similar to the Display Systems segment, we still do not model any contribution from the Lasers Systems business as product development is still in too early of a stage to reasonably estimate financial contribution from these segments.

- **Zecotek Imaging Systems (ZIS)** develops and manufactures components for advanced imaging products, mainly for the medical industry, including PET and MRI scanners. The ZIS business is where most of Zecotek's current attention remains focused and includes their LFS scintillation crystals, MAPD, and integrated PET/MRI assemblies. As the products from the ZIS business, most importantly the LFS scintillation crystals, aggregate the majority of Zecotek's near-term opportunity, this is where we dedicate most of our discussion. In 2009

Zecotek received the Frost and Sullivan award for "Best Enabling Technology" for its MAPD and LFS scintillation materials.

The main components of PET scanners which have to do with capturing the images are crystals and photo-detectors. During a PET procedure a patient is injected with an imaging agent. As the agent decays it emits a positron, and eventually produces photons, which are detected by scintillation crystals. These crystals create a burst of light which are then captured by the photo detectors which multiply the signal, allowing for it to be detected. Millions of these events can occur in a single scan which are then reconstructed with computer algorithms to produce single images. The majority of PET scanners sold today also have CT capability which provides for enhanced resolution and greater localization of lesions, which is particularly desirable for oncology applications. Hybrid PET/MRI scanners, which provide even better visualization of soft tissue and have lower radiation than PET/CT, have recently evolved as a major area of growth for PET manufacturers with Siemens introducing the first fully-integrated PET/MRI scanner in the U.S. in 2011.



Zecotek's **MAPD** have been developed to replace photo multiplier tubes, which are the most commonly used photo detector in PET scanners and gamma cameras. Photo multipliers are a type of vacuum tube, but unlike most vacuum tubes, photo multipliers are not obsolete. Photo multiplier tubes are very sensitive detectors of light with high gain, low noise and very fast response, which has made them ideal for applications such as in advanced medical imaging cameras. They do have some drawbacks, however, including they are relatively large, expensive, and require very high voltage. Another meaningful disadvantage is that strong magnetic fields can impede the performance of photo multiplier tubes. Therefore a combination PET/MRI machine can not easily be constructed using photo multiplier tubes as MRI (magnetic resonance imaging) produces strong magnetic fields. Zecotek and the University of Washington have collaborated in designs for a PET/MRI scanner using the company's newest generation MAPD's.

Zecotek's MAPD have been developed to have all the benefits of photo multiplier tubes (high sensitivity, high gain, low noise, fast response) without the drawbacks. Zecotek's MAPD uses relatively low voltage and the solid-state design makes them much more compact than photo multiplier tubes. It also is not affected by magnetic fields. Zecotek's MAPD target markets encompass all those currently served by photo multiplier tubes which, along with medical technology, includes high energy physics, astronomy, pharmaceutical research, security, defense, and environmental monitoring.

Due to the drawbacks of PMT and advantages of solid-state photo detectors, PET manufacturers have a significant interest in building their scanners with this better technology. The initial solid-state detectors were built with technologies called silicon photo multipliers (SiPM) and multi-pixel photon counters (MPPC), technologies which were invented and patented by scientists who now work for Zecotek. Zecotek improved on these technologies which resulted in the MAPD technology. The MAPD overcomes certain limitations of SiPM and improves overall performance. PMT suppliers have moved towards offering PET manufacturers solid-state technology but in the form of SiPM and MPPC. Zecotek believes their MAPD technology is the optimum solution for the PET manufacturers as well as high-energy physics such as calorimeters and part of the Large Hadron Collider machine in CERN. Zecotek has authored a white paper on their MAPD which references studies that have been conducted which have shown the high performance of their MAPD technology.

Hamamatsu Photonics, which Zecotek recently signed a distribution agreement with (discussed below), is the world's largest supplier of PET photo detectors.



SOURCE: hamamatsu.com

Hamamatsu's capabilities extend much further than just manufacturing and distribution, however. The company is deeply engaged in PET-related research and development as well, which also extends into the relationship with Zecotek. Zecotek has several variants of MAPDs and the two companies will collaborate on improvements of Zecotek's photo detectors and modules with Hamamatsu in the lead role. Hamamatsu will also largely be responsible for funding joint R&D and product development. Both companies will retain ownership of their patents and IP.

Hamamatsu is very much on the cutting edge of medical imaging technology innovation and founded the Hamamatsu Medical Imaging Center (picture) where they conduct medical imaging and conduct R&D and clinical trials. Hamamatsu has developed their own photo detectors which are used in TOF-PET/CT scanners.

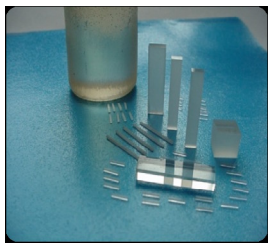
Therefore, Zecotek's agreement with Hamamatsu which includes collaborative efforts on product innovations is much more compelling than just from a distribution standpoint, particularly given Zecotek's large and potentially very appealing patent portfolio.

MAPD Used by CERN…

Zecotek notes that their MAPD has undergone testing by a number of institutions including the European Organization for Nuclear Research (CERN), a world-renowned institution run by 20 European member states which (per CERN website) uses "the world's largest and most complex scientific instruments to study the basic constituents of matter - the fundamental particles." CERN has used Zecotek's MAPD photo detectors in several projects and experiments over the last few years all with positive results. CERN has chosen Zecotek's MAPD as an alternative to photo multiplier tubes. The most recent project, dubbed COMPASS, was announced in December 2012 whereby Zecotek's MAPD-3N (i.e. - the third generation MAPD) photo detector is being used in an electromagnetic calorimeter at CERN's Super Proton Synchroton accelerator in Switzerland. Given the strict criteria set by CERN engineers relative to selection of photo detectors, the fact that CERN continues to come to Zecotek for their MAPD for use in their experiments is a clear vote of confidence in the technology. And as CERN is a world leader in scientific research, this vote of confidence carries potentially significant influence and one which commercial manufacturer's of PET systems and other instruments may likely heed. And as we discuss below, CERN is also using Zecotek's LFS crystals in a revolution experiment to clarify the existence of the Higgs Boson.

Zecotek initially partnered with the National NanoFab Center (NNFC), a South Korean nanotechnology company, to manufacture their MAPD photo detectors for the commercial market. In December 2012 Zecotek announced that NNFC has completed the major steps towards upgrading their MAPD to current industry standards and indicated they were close to being able to deliver initial commercial units. With the recently penned agreement with Hamamatsu, manufacturing of the MAPD will now transfer over to Hamamatsu. This transfer to Hamamatsu is now ongoing. Zecotek and Hamamatsu will be jointly involved in selecting the versions of MAPDs that will be suitable for CERN and those for commercial production.

LFS Scintillation Crystals



Scintillation means flash of light or luminescence. Scintillation materials are designed to absorb the energy of an incoming particle and then re-emit the energy as light. In applications that use scintillation materials, the more light produced by the material, the better. The company's proprietary and patented LFS scintillation crystals have been designed to provide for certain critical advantages over other commonly used scintillation crystals including high light yields and ultra fast decay times. As the performance of PET cameras is directly effected by the properties of the scintillation crystals used in the scanner, higher light yields and faster decay times means better quality pictures. Important to understand is that there can be significant performance differences between makes and models of PET scanners and the most important link in the components of a scanner that dictate performance is the quality and performance of the crystals. The crystals typically account for about one-third of the total cost of a scanner (PET/CT scanners can cost as much as $2 million) and each scanner requires as many as 30k of these crystals.

The desired properties of scintillators include high light output, high density, high atomic number, short decay time, fast speed, low cost, and hardness, with high light output and short decay time among the most important characteristics. Today, the three most commonly used scintillation materials in PET and gamma cameras are bismuth germanate (BGO), lutetium oxyorthosilicate (LSO) and gadolinium oxyorthosilicate (GSO). BGO has been the most widely used material in legacy PET scanners but since the discovery of LSO, which has certain advantages over BGO, LSO (and LYSO, a related material) has become the scintillation material of choice for new PET scanners (since ~2005).

High light output and short decay time (decay time is a measure of how long until a crystal emits light after absorption of a photon) were not a common combination in scintillation crystals until LSO was discovered, which performs relatively well (compared to BGO and GSO) on both measures. Another scintillation material, NaI(Tl), has very high light output but low density and a low atomic number, which means it is relatively inefficient at absorbing photons (i.e. - low stopping power). Despite the shortcomings of NaI(Tl), it has been the dominant scintillator material for more than 50 years and remains the material of choice in single-photon emission computed tomography (SPECT)[1]. Meanwhile LSO seems to have combined the best of BGO (i.e. -

[1] Saeterstol, Jostein. Characterization of Scintillation Crystals for Positron Emission Tomography. University of Bergen. June 2010

high density and atomic number) and NaI(Tl) (i.e. - high light yield) which has recently made it the scintillation material of choice for the major PET manufacturers.

LFS's Advantages Trump Competition…

The performance of Zecotek's LFS scintillation crystals, however, looks to even trump that of LSO. With a very high light yield (up to twice that of LSO, although slightly less than NaI(IT)), comparable density and atomic number to LSO (and much higher than NaI(Tl)), and the fastest decay times of all the common scintillation materials, Zecotek's scintillators appear to be the most competitive and highest performance material. In addition to superior performance over competing scintillation materials, Zecotek's LFS crystals are also lower cost. And with the photo detector and scintillation material typically accounting for approximately 60% - 65% of a PET scanner's cost, lower cost and better performing scintillation crystals are significant advantages.

Below is a chart from a white paper authored by Zecotek comparing the characteristics of each scinitillation material. We have verified the performances listed in this chart for the competing materials to other published data in the public domain which agree with Zecotek's findings. The LFS data was taken from trials performed by the University of Washington, CERN, and the Institute for Theoretical and Experimental Physics) Moscow, Russia.

LFS scintillation crystals: Industry product comparison

Parameter \ Crystal*	Tl:NaI	BGO	LSO	GSO	LYSO	LFS-3	LFS-7	LFS-8
Density, g/cm^3	3.67	7.13	7.4	6.71	7.1	**7.35**	**7.4**	**7.4**
Effective at. number	51	74	66	57	66	**64**	**64**	**64**
Attenuation length, cm	2.6	1.11	1.14	1.38	1.12	**1.15**	**1.12**	**1.14**
Decay constant, ns	230	300	40	30–60	41	**25–33**	**30–35**	**12–25**
Max emission, nm	415	480	420	430	420	**425**	**412–416**	**422**
Light yield (NaI:Tl=100%)	100	7–12	40–75	20	70–80	**80–85**	**80–85**	**80–85**
Refractive index	1.85	2.15	1.82	1.85	1.81	**1.81**	**1.81**	**1.81**
Energy resolution ^{137}Cs, %	8	12–14	10–14	9.5	8.0	**8**	**8**	**7**
Absorbed γ-ray irradiation dose, rad (rad. hardness, %/cm)†	10 (?)	10^{2-3} (?)	10^{8} (7)	10^{8-9} (6)	10^{8} (7)	**10^{8} (2)**	**10^{8} (7)**	**10^{8} (7)**
Hygroscopicity	strong	No	No	No	No	**No**	**No**	**No**
Hardness, Moh	2	4.5	5.8	5.7	5.8	**5.8**	**5.8**	**5.8**
Cleavage	(100)	none	none	(100)	none	**none**	**none**	**none**
Boule size, mm	Ø400x600	Ø100x250	Ø75x200	Ø75x150	Ø75x150	**Ø90x250**	**Ø90x250**	**Ø50x200**

* The chemical composition of the competing crystals: BGO — $Bi_4Ge_3O_{12}$, LSO — $Ce:Lu_2SiO_5$, GSO — $Ce:Gd_2SiO_5$; LYSO — $Ce:Lu_{1.8}Y_{0.2}SiO_5$.

† Induced optical transmission loss after exposure to radiation is a more realistic and quantifiable measure of the radiation hardness than the absorbed radiation dose.

SOURCE:Zecotek

Similar to the OEM PET manufacturer market, the market for medical imaging crystals is largely highly concentrated between only a few major suppliers. In general BGO crystals are not considered competitive in terms of performance to LYSO and LSO crystals. Zecotek's LFS crystals would compete against LYSO and LSO crystals, the major manufacturers of which are Saint-Gobain and Crystal Photonics. A third manufacturer, CTI Molecular Imaging, had been a long-term JV of Siemens' and was eventually acquired by the PET OEM in 2005, which afforded Siemens the ability to source their crystals through their wholly-owned supply chain.

LFS Crystals Validation Supported By Use In High Profile Experiments…

The LFS crystals have been used in trials since 2007 including by The Paul Sherrer Institute (Switzerland) in a PET program focused on increasing performance of PET scanners, Shinshu University (Japan) in trials for their next-gen PET imaging program focused on improving resolution of 3-D imaging in cancer, and trials by the

University of Washington and CERN. The various studies over the recent years have aided in the validation of the performance of the LFS crystals.

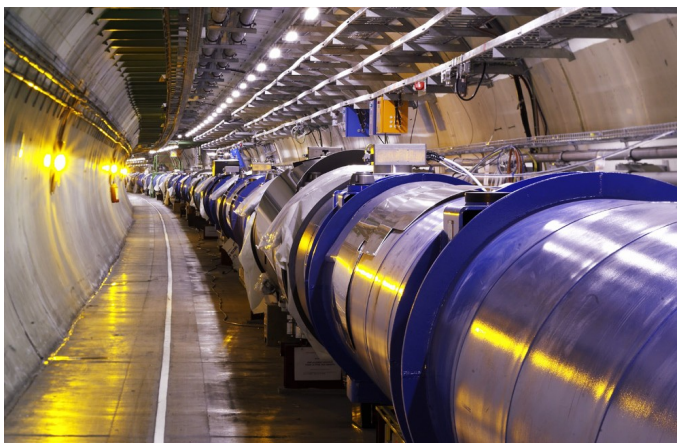
Employment of the crystals has since evolved to the late stages of validation and is now at a point where they are being utilized as components in scanners and other instruments. This includes being used in development of a new PET system by NuCare Medical Systems, a South Korean nuclear imaging company and in a trial PET scanning device by a (undisclosed) Japanese OEM PET manufacturer. And most recently, in November 2014 Zecotek announced an initial shipment of a $500k order of the crystals to the NIITFA Automation Research Centre for Technical Physics (in Russia) related to the development of a PET scanner.

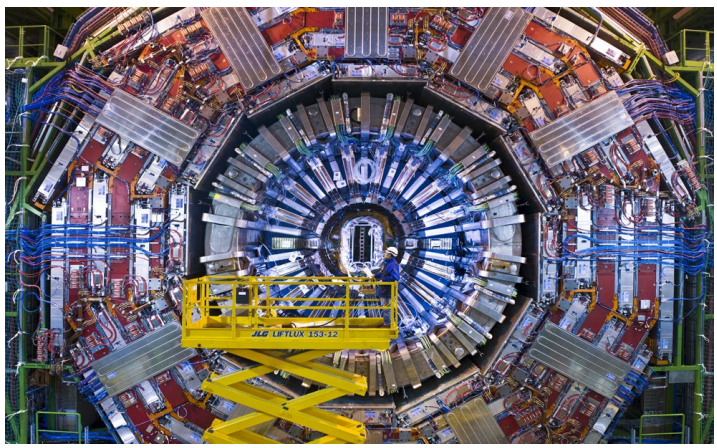
Scientific applications of the LFS crystals has also evolved beyond just validation of the material and moved to utilization of the crystals for scientific discovery purposes. In May 2013 Zecotek announced that CERN will be using the LFS crystal material in experiments to clarify the existence of Higgs boson - which is considered a very high-profile project in scientific communities.

Higgs boson is an elementary particle and discovery of it would confirm the Standard Model of particle physics - which in the field of physics would be considered a monumental accomplishment - in fact the Large Hadron Collider (built by CERN from 1998 - 2008), the most powerful particle accelerator ever built, was constructed largely to prove or disprove the existence of Higgs boson.

In March 2013 CERN physicists announced that the Large Hadron Collider had tentatively confirmed the existence of Higgs boson. Formal confirmation still needs to be made through additional experiments, however. The Large Hadron Collider is now being rebuilt in order to be able to operate at higher temperatures. The rebuilding process is expected to take about two years with experiments expected to resume in early 2015. Higher temperatures will require extremely hard crystals - which is one of the reasons that CERN has chosen Zecotek's LFS crystals. Zecotek's LFS-8 crystals will be used by CERN. Zecotek's MAPD may also be used by CERN. Zecotek has been now working with CERN to determine the optimum size configurations to be used in the Higgs boson confirmation experiments. Use by CERN in this project should provide significant validation of the properties and performance of the LFS crystals and almost certainly provide Zecotek and Hamamatsu with a valuable and very credible marketing message to the commercial marketplace (Zecotek's LFS-3 crystals will be sold commercially and used in the MAPD product).

Large Hadron Collider





SOURCE: boston.com

Zecotek recently announced that a new configuration of their LFS crystals was requested by CERN for their Compact Muon Solenoid (CMS) experiment. The crystals will be tested as part of the Large Hadron Collider rebuild. Per Dr. Michael Arenton, Senior Research Scientist with CERN, "We are pleased with the performance of Zecotek's new LFS-3 configuration using plates geometry and we are confident that it will pass all the prerequisites needed for the new electromagnetic calorimeter part of CERN's LHC and CMS upgrades."

Following the initial announcement in late July 2014 that CERN had requested LFS crystals for this new experiment, ZMS announced that CERN will be installing the crystals in the Large Hadron Collider. This is the final validation stage by CERN before the organization would fully adopt the crystals for their experiments. Then in early December Zecotek announced that CERN provided positive feedback on their assessment of the crystals,

placed additional orders and expects that the contract should be finalized early next year. We view this as an indication that order flow should accelerate in the coming months.

We view CERN's continued and growing interest in ZMS's LFS crystals as validation of the quality and performance of the crystals. Upon full adoption, we would expect this to present a meaningful revenue opportunity for ZMS.

The other potentially very valuable benefit to Zecotek is that the Collider rebuild may require significant quantities of crystals and photo detectors. While it's too early to speculate on specific quantities that CERN may order from Zecotek, we think that it's reasonable that it could be in the several million dollars to potentially tens of millions of dollars worth of product.

Now On The Cusp of Full Commercialization…

The next link in the chain of evolution of the LFS crystals is expected to be full-blown commercialization. In mid-July 2013 Zecotek announced a partnership with Hamamatsu Photonics to commercialize the company's imaging products including their photo detectors, LFS crystals and integrator detector modules. Tokyo-based Hamamatsu has approximately $1 billion in annual sales, is the leading supplier of optoelectronic components used in PET scanners and counts major OEM PET manufacturers as customers, including Philips and GE. Hamamatsu also has a long-standing relationship with CERN - in fact we think the relationship between Zecotek and Hamamatsu may have been facilitated by an introduction through CERN.

Under this exclusive commercialization and joint development agreement, Hamamatsu will handle marketing and distribution of most of Zecotek's imaging products including their LFS crystals and solid-state MAPD photo detectors. Hamamatsu will also manufacture the MAPD and IDM products. Zecotek received its first order from Hamamatsu in late July 2013. We view the relationship with Hamamatsu as a significant positive development for Zecotek as while Zecotek had already established compelling products (particularly the LFS crystals), substantial distribution and customer relationships (particularly with the PET OEM's) had been the missing piece of the puzzle until now. Hamamatsu also brings R&D and product development resources and will largely be funding these activities for ongoing improvement of Zecotek's existing products as well as potentially bringing new products to market. Hamamatsu's relationships, marketing muscle and distribution reach should be an ideal fit for Zecotek's products. Hamamatsu has an aggregate of $2M of orders for Zecotek's LFS scintillation crystals which are slated for use in third party PET scanners as well as for in-house use by Hamamatsu.

But while we think this relationship with Hamamatsu is a major positive for Zecotek, revenue from this distribution agreement has so far been somewhat of a disappointment. Despite $2.0M worth of orders placed by Hamamatsu since July 2013, Zecotek has recorded just $103k in revenue since that time through the end of the most recent reporting period (July 31, 2014).

In September 2014 ZMS provided an explanation for the delay, noting that the expected end-user customers (mostly OEM PET manufacturers) have been making design upgrades and changes but that ZMS and these potential customers have been working together to finalize the designs so as to facilitate crystal shipments. And while the delay has been a real disappointment, it has no relation to the quality of or interest in the crystals. We continue to see no reason to believe that order shipments related to this initial Hamamatsu order or to CERN-related experiments, including the Hadron Collider rebuild, will not materialize over the near-term.

Integrated Detector Module

Zecotek is also working on an Integrated Detector Module (IDM) which combines their LFS crystals, an array of their MAPD photo detectors and a readout system into a single assembly for use in PET and gamma scanners. The IDM allows PET manufacturers to forego having to purchase the three components separately. The components of the IDM represent approximately 75% of the total cost of a PET scanner.

Given that the IDM has the potential to reduce the cost of building a PET scanner with potentially less maintenance required (compared to separate components), this offers a much more affordable option for less well-heeled manufacturers, particularly those that service lower-income markets. Zecotek envisions the initial market for their IDM as small PET manufacturers in emerging countries.

In January 2013 the company announced that they had completed the design concept of the IDM. The IDM will also be manufactured by Hamamatsu, which will also be directly involved in ongoing R&D related to ongoing improvements of the product. The IDM has already been validated in prototyped machines. Additional functionality and added value will be incorporated into the IDM including a data acquisition board. The next

step prior to commercialization will be to optimize components to reduce input costs and to facilitate full-scale production and manufacturing. Hamamatsu continues to work to optimize the design of the IDM that will use Zecotek's crystals. Upon completion, we would expect to see shipments of the LFS crystals (and related revenue) to Hamamatsu accelerate.

Patent Portfolio

Zecotek has a large patent portfolio, covering all of the company's major products including lasers, displays, LFS crystals, photo detectors, and other PET component technologies. Zecotek is the only company to own all key elements for a high-end PET scanner. As of April 2014 Zecotek owned or controlled over 50 patents.

While the carrying value of the patent portfolio is relatively minimal, the true tangible value could be substantial, particular relative to ZMS.V's current book and market values of about ($1.4) million and $65 million, respectively. Insight into the value of the '060 patent covering the LFS crystals may be unearthed at the conclusion of the ongoing lawsuit (below) - the value of this patent alone could potentially dwarf current market value of the company.

Zecotek is looking to monetize their patent portfolio in several ways. One is developing and commercializing products built from their IP. The other - although not a strategic move - is defending their patents in court and seeking damages. The third is through a recent relationship with Intellectual Ventures, a leading IP firm involved in patent strategy and monetization - which includes patent purchasing, licensing, building and partnering.

Below is Zecotek's patent portfolio from their most recent public filings;

Key Technology	Patent/App. No	Date Filed	Jurisdiction	Status
Visible fibre lasers	12/182,951	30-07-08	PCT, US, CA	Pending
	2006119198	02-06-06	RU	Granted
Solid-state lasers	12/851,427	05-08-10	PCT, US	Pending
	12/881,033	13-09-10	US	Pending
3D displays	7,944,465	27-02-06	US, CA, AU	Granted
	13/108,249	16-05-11	US	Pending
	11/769,672	27-06-07	US	Granted
	PCT/IB2007/003309	07-11-07	PCT, CN, EA, EP, IN, JP, KR	Pending
	201070065	07-11-07	EA	N. of Allowance
	EP 2177041	07-11-07	EP	Granted
	61/586,809	01-15-12	US	Pending
	13/546,877	11-07-12	US	Pending
LFS scintillation crystals	7,132,060	21-07-05	US	Granted
	2242545	04-11-03	RU	Granted
	PCT/RU2004/000094	12-03-04	PCT, AU, CA, CN, EA, DE, FR, GB, IN, JP, NL	Granted
	1493/KOLNP/2006	12-03-04	IN	Pending
Semiconductor photo-detectors (MAPD)	2316848	01-06-06	RU	Granted
	PCT/RU2007/000287	31-05-07	PCT, AU, CA, EP, IN, JP, KR, MY	Pending
	200808979-9	31-05-07	SG	Granted
	200780024920.5	31-05-07	CN	N. of Allowance
	12/034,603	20-02-08	US	Pending
	13/609,136	10-09-12	US	Pending
PET imaging technologies	7,956,331	27-10-08	US	Granted
	13/232,944	14-09-11	PCT, US	Pending
	PCT/US2009/062108*	26-10-09	PCT	Pending
	12/544,174*	19-08-09	US	Pending
	8,003,948 B2*	03-11-08	US	Granted
	PCT/US2008/082273*	03-11-08	PCT, AU, CA, EP, JP, KR, CN, EA, IN	Pending
	PCT/US2009/061600*	22-10-09	PCT, US	Pending
	13/125,962*	10/26/2009	US	Granted

* Zecotek, as principal financier and development partner of imaging components with the University of Washington, has the exclusive license rights for improved data-processing electronics for new generation PET scanning devices.

Zecotek vs. Saint-Gobain / Philips lawsuit

Zecotek Believes They Have Strong Case in LFS Crystals Patent Infringement Lawsuit…
In February 2012 Zecotek announced that they brought a lawsuit against Saint-Gobain Corporation and Philips alleging infringement of Zecotek's patent (7,132,060) covering the substances and chemical formulations to grow their LFS crystals. Zecotek was granted the patent in November 2006. See this link on the U.S Patent and Trademark office website for the full description and claims of the patent: http://1.usa.gov/1bcxsYP.

The lawsuit, which was originally filed in U.S. Federal District Court in Los Angeles and is now being heard in the U.S. District Court in Ohio, claims that Saint-Gobain's currently commercialized LYSO (lutetium yttrium orthosilicate) crystals infringe Zecotek's patent and that Philips is also liable because they use these Saint-Gobain crystals in their commercialized PET scanners. BOET is co-plaintiff with Zecotek in the lawsuit. Zecotek has retained the law firms of Graybeal Jackson LLP and Godfrey LLP to represent them. Zecotek is in good hands with both firms highly respected and having significant patent law experience. In July 2013 Susman Godfrey, for the fourth straight year, was named the nation's number one (~17k law firm associates were surveyed) litigation boutique in Vault's annual Practice Area Rankings.

In early July 2013 a Markman hearing was held. The Markman hearing allows the judge in a patent infringement case to examine evidence from both parties and to determine the interpretation of the language of the patent in question.

On May 14th the U.S. District Court of Ohio ruled in favor of Zecotek in the Markman hearing by adopting interpretations of certain patent language that is key to the lawsuit against Saint-Gobain and Philips. This ruling in ZMS's favor was critical and a clear positive development as this gives the company the upper hand and affords them the option to go to trial, or if desired, to seek some sort of settlement with the defendants.

Similar Lawsuits Could Offer Insight…
Zecotek's action is not the first crystals related patent infringement lawsuit. In fact, crystals-related patent lawsuits have become almost commonplace. There is an ongoing lawsuit brought by Crystal Photonics, Inc. (CPI), developer of LYSO crystals, against Siemens Medical. The suit claims that Siemens infringed on a patent issued to CPI in 2006 ("Method of Enhancing Performance of Cerium Doped Lutetium Orthosilicate Crystals and Crystals Produced Thereby") to enhance the performance of Siemens' LSO crystals which were incorporated into various products (including PET scanners) that the company sold. CPI argues the Siemens used CPI's patented technique of exposing crystals to oxygen diffusing treatments to improve their crystals which thereby improved the performance of the Siemens products. CPI is seeking an undisclosed amount of damages ("adequate to compensate CPI for Siemens Medical's acts of infringement, such damages to be determined by a jury"). Similar to Zecotek's lawsuit against St. Gobain, CPI is also claiming willful infringement which, if the court agrees, provides for the potential of trebling of damages.

Another lawsuit similar to Zecotek's was that of Siemens brought against St. Gobain in 2007 in U.S. District Court in Delaware. In that action Siemens claimed that St. Gobain infringed on their scintillator crystal detector patent ("Lutetium Orthosilicate Single Crystal Scintillator Detector"). The patent was filed in 1989. Siemens manufactured LSO crystals covered by this patent which used only the element lutetium and had relatively superior performance properties (high light output, fast decay time, etc.) to other crystals on the market at the time. Siemens claimed that St. Gobain infringed on the patent by manufacturing their LYSO crystals which also used lutetium but substituted 10% of the lutetium with another element, yttrium (10% Y LYSO crystals), in an effort to avoid patent infringement. St. Gobain's 10% Y LYSO crystals were used in two specific Philips PET scanners models ("Gemini TF" and "Gemini Raptor"). "TF" stands for "time-of-flight" which is a technology used in high-end scanners which provides for much better resolution.

Siemens admitted evidence at the trial which showed a large similarity in scintillation properties of the two crystals. The jury ruled that St. Gobain's 10% Y LYSO crystals violated the doctrine of equivalents as the performance achieved substantially the same result as Siemens' crystals. St. Gobain argued that Siemens had not demonstrated clear and convincing evidence of equivalence of the two crystals and, given that St. Gobain's crystals are patented (and therefore it's not obvious that they were equivalent to Siemens' crystals), Siemens should be required to do so. The court disagreed. Clear and convincing evidence is a higher burden or proof than preponderance of the evidence, the latter which is typical practice.

The jury ruled in favor of Siemens on the issue of equivalence and awarded them $52.3 million in lost profits damages. Siemens had also sought willful infringement which the jury did not grant. The amount of lost profits damages was calculated based on the number of PET scanners sold that used the 10% Y LYSO crystals prior to the expiration of the patent (October 2008) as well as related lost service contracts. The jury award was

based on 79 scanners (at ~$580k per scanner) plus 28 service contracts (at ~$344k per contract) for scanners located in the U.S. less $3 million. In post trial motions the court ruled that Siemens did not provide sufficient evidence that 79 scanners were sold with the infringing crystals and reduced the award to $44.9 million, representing 61 scanners. The court noted that while there was evidence that 79 scanners were manufactured with these crystals, there was only sufficient proof that 61 had been sold prior to the expiration of the patent.

St. Gobain appealed in federal court but the verdict was upheld. The appeals court ruled in February 2011 and also asked the trial court to consider additional damages for the 18 scanners that were not part of the award given that manufacturing these scanners (whether they were sold or not) infringed the patent. The Federal Appeals Court concluded that, " The district court's judgment entered in favor of Siemens is affirmed. However, we vacate the damages award and remand for the court to consider a reasonable royalty for the additional 18 infringing scanners, to be added to the $44,937,545 in lost profits for the 61 scanners that were sold." The case eventually went to the U.S. Supreme Court which upheld the federal appeals court decision. In November 2012 The district court made a final judgment of $51.6 million.

Key for the plaintiff to claim lost profits damages was to support the supposition that had their patent not been infringed upon, that it would have made the sales that St. Gobain did make. The Federal Circuit uses a four-factor test, called the Panduit test, which the plaintiff must demonstrate in order to prove lost profits. This encompasses 1) demand for the patented product 2) absence of acceptable non-infringing substitutes 3) manufacturing and marketing capability to exploit the demand and 4) the amount of the profit it would have made.

The dearth of PET manufacturers (market largely consists of only Siemens, GE and Philips), the fact that the performance of crystals is a key factor in demand of PET scanners, that Siemens' crystals were considered superior to crystals used in GE scanners (which use BGO crystals), and that Philips was only able to compete in the "high-end" PET scanner market due to the use of the 10% Y LYSO crystals was deemed sufficient support for passing the Panduit test. Key for Siemens was to demonstrate to the court that this was really a two supplier market for high end PET scanners - Siemens and Philips and since GE only sold lower performance scanners, that they did not compete in the same space and therefore theirs were not an acceptable alternative to the high end scanners.

Potential Implications for Zecotek's Lawsuit…

Assuming the case goes to trial, we think it is reasonable to assume Zecotek will cite the Siemens case as a precedent. St. Gobain is the defendant in both lawsuits and Philips is accused of using the crystals in their Gemini scanners in both suits. There are also some other obvious and significant similarities between the Siemens vs. St Gobain lawsuit and Zecotek's lawsuit against St. Gobain. Both claim that a crystals-related patent was infringed upon and that these crystals were used in PET scanners which were then sold. The crystals named in both lawsuits are St. Gobain's "PreLude 420" crystals (the Zecotek suit notes the infringing crystals are not limited to the PreLude 420 crystals). The crystals in both lawsuits both fit into the high-end category, both may be considered the highest performing at their particular and respective times and were used in Philips' "Gemini TF" and/or "Gemini Raptor" scanners (the Zecotek suit notes that use of the infringing crystals is not limited to these scanners). There still is only three major PET scanner manufacturers and the quality of the crystals used in PET scanners remains perhaps the most important characteristic of the quality of the scanner. Perhaps these also provide a reasonable position for Zecotek's claim to pass the Panduit test, assuming it is applied. In addition, both lawsuits claim willful infringement by the defendant.

While all the details of the lawsuit have not been made public, it is probably reasonable to assume Zecotek will take a similar position as did Siemens in regard to calculating damages. There is no publicly available information on the number of scanners sold that use the PreLude 420 crystals - and Zecotek's lawsuit implies they may believe St. Gobain has manufactured other crystals that infringe on their patent. An article written by AlphaEdge in March 2012 related to the Zecotek lawsuit estimates the number of scanners sold using the infringed crystals since the granting of Zecotek's patent in November 2006 at about 300. AlphaEdge basis their estimate on a June 2011 Philips press release which cited that 260 of its Gemini scanners were sold since 2006 and adds an estimated 40 scanners to this to account for those sold after the June 2011 press release (up to the March 2012 publication of AlphaEdge's article). We think that that's not an unreasonable estimate.

Another not unreasonable estimate methodology is to use some of the testimony from the Siemens lawsuit. The number of scanners sold that used the infringing crystals was not known. Records showed 49 sales through May 2008 - to come to the 61 number, St. Gobain's damages expert extrapolated, based on past performance, to estimate the total number that was sold through September 2008 (the extrapolation averages 3 scanners sold per month). If we use a 3 scanner/month average to estimate the number of scanners that may

have infringed Zecotek's patent from November 2006 to the present, this equals approximately 243 - in the ballpark with AlphaEdge's estimate (which through the current date would now be slightly higher than 300). In addition, Siemens' damages were eventually based on 79 scanners, 18 more than allegedly sold, as the appeals court ruled that just manufacturing the scanners infringed the patent. As such, it would not be unreasonable to assume that Zecotek would have a fair argument to claim similar infringement - potentially meaning the 243 number is low.

Assuming a per scanner basis is used to calculate damages, the other part of the equation to figure the damages is the per scanner loss of profit. In the Siemens case this was approximately $653k ($51.6MM / 79 scanners) per scanner. Zecotek's case is different however, as instead of lost profits from scanners, it is based on lost profits on the crystals - the margin from which, on a per scanner basis, may be significantly different than for each scanner.

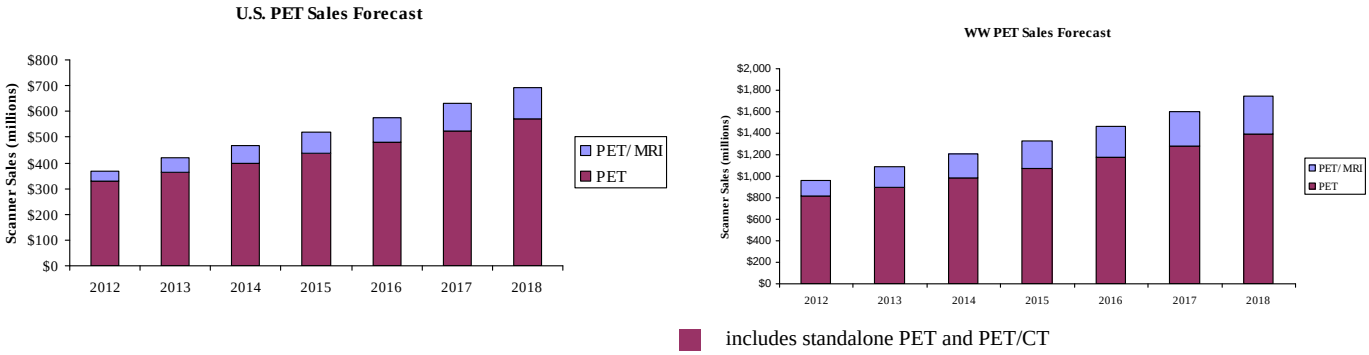
Timing for conclusion of the lawsuit is a complete unknown. It's still possible that the two sides could settle prior to trial. And if it does go to trial, it's possible that it could be drawn out for sometime given the potential for appeals by either side. Clearly the lawsuit will be of significant interest to investors as the outcome could, if in Zecotek's favor, could provide significant upside value to the company.

We also note that Philips, which holds significant share of the OEM PET market, is a potential future customer for Zecotek's products - LFS crystals, MAPD, IDM, and potentially future products. While complete speculation on our part, we think there may be an interest for both Zecotek and Philips to come to terms of an agreement and settle the lawsuit in exchange for (at the very least) to allow for good relations and potentially enter into a supply/purchase agreement.

MARKETS

PET Systems Growth Fueled By Areas Zecotek Expects To Exploit…

In January 2012 Bio-Tech Systems Inc. a healthcare market research firm specializing in medical imaging, published a report on forecasted growth of PET systems sales in both the U.S. and internationally[2]. The report noted that while U.S. sales volumes had been declining from about 2005 through 2009 due largely to uncertainties over reimbursement, that sales have since picked up. Worldwide, Bio-Tech estimates PET scanner sales to grow at a CAGR of just over 10% from 2012 to 2018 with much of this driven by increasing demand for hybrid PET/MRI machines, which they forecast to grow at a CAGR of 16% worldwide and 21% in the U.S.



Bio-Tech Systems forecasts total U.S. PET and PET/MRI scanner sales to increase from about $368 million in 2012 to $690 million in 2018. Worldwide, they project this to go from $962 million in 2012 to $1.75 billion in 2018. Of particular interest, in relation to Zecotek, is that Bio-Tech Systems expects much of this forecasted growth to be fueled by increasing demand for higher resolution imaging, burgeoning interest in PET/MRI systems, and lower priced scanners with higher-end imaging capabilities. All of these are the sectors of the market that Zecotek expects to exploit. The competitive advantages of their LFS crystals (very high performance at potentially more competitive prices) and MAPD photo detectors (lower price, equal to or better performance than PMT and legacy solid-state detectors, and can be used with PET/MRI) potentially put them in

[2] Burns, M. Report 340:Market For PET Radiopharmaceuticals and PET Imaging. Bio-Tech Systems Inc. Dec 10, 2010.

an ideal position relative to where the bulk of the market growth is expected to come from over the next several years.

Visiongain, another life sciences market research firm, also recently published a report on the nuclear medicine industry. The authors of the report, titled, "Nuclear Medicine Imaging Devices: Global Market Prospects 2012-2022", note that developed markets such as the U.S. and U.K. are already highly saturated and growth in these markets will mostly come from upgrading stand-alone PET and SPECT systems with hybrid units (i.e. - with adding CT or MRI). This again, suggests potentially increasing demand for the likes of Zecotek's MAPD photo detector which, unlike PMT's, can be used side-by-side with MRI.

Visiongain also expects emerging markets such as China and India to offer more opportunity for growth due to the relative lack of nuclear medicine facilities and increased healthcare spending in those parts of the world. Visiongain notes that healthcare investment in emerging countries is expected to double over the next seven years. Zecotek has noted that they have a particularly strong focus in emerging markets. Emerging markets are the initial territories that they expect to target with their IDM product and the company has plans to identify and work with a strategic partner in India to manufacture PET scanners incorporating their components.

The high cost of the scanners from the major OEM's have largely precluded significant purchases from many of the emerging countries. This, however, offers a real potential opportunity for Zecotek as these developing countries, which largely have nationalized healthcare systems, are now looking to manufacture their own PET machines. With Zecotek owning all the major technology necessary to build a PET scanner and with lower-cost components, demand from emerging markets could be a real boon for the company.

Medical Imaging Market Dominated By "Big 3"…
The general medical imaging market is dominated by three manufacturers; GE, Siemens and Philips with approximate market share of 22%, 20% and 17%, respectively. Other players (market share) include Toshiba (9%), Hitachi (4%) and Shimadzu (2%).

Siemens and Philips have been the pioneers in advancements in PET/MRI scanners and in development of high-end scanners in general. Siemens, following its acquisition of CTI Molecular Imaging in 2005, sources its crystals through its internal supply chain and as such, there may be limited opportunity for Zecotek to sell crystals to Siemens, at least in the near-term. As Philips is named as co-defendant in Zecotek's lawsuit against St. Gobain, we do not see a likely customer relationship until the conclusion of the lawsuit or, potentially, earlier in the event Zecotek and Philips agree to a settlement. GE's scanners still use BGO crystals, which may be considered inferior to LSO (used by Siemens) and LYSO (used by Philips). As such, GE may be highly interested in upgrading to higher performing crystals and, therefore, we view GE as a likely near-term customer for ZMS's crystals. GE and potentially the other smaller PET OEM's (combined which accounts for ~40% of the total market), would therefore be Zecotek's major target customers for their LFS crystals in the near-term.

With the crystals and photo detector of a PET scanner each accounting for approximately one-third of the cost of the machine and estimating that Zecotek's target market encompasses roughly 40% of the PET OEMs, we estimate the size of their current total market at about $290 million and estimated to grow to approximately $470 million in 2018. While not an enormous market size, it's important to keep in mind that the PET component and OEM markets are highly concentrated which provides for the potential for Zecotek to acquire significant market share in short-order, particularly if their components are considered higher performance and at least (or more) cost competitive than other suppliers'. And with Zecotek being the only company in the world to own all key elements (i.e. - scintillation crystals, solid-state MAPD photo detectors, and a data acquisition board and readout system) for a high performance PET scanner, just a small initial foothold into the PET OEM supply chain could potentially quickly turn into large and very valuable supply agreements over the long term.

Other Markets Offer Future Opportunity, Particularly For Their 3D Technology…
And while the PET component market is Zecotek's near-term focus, their other products target other customers, industries and applications which would significantly expand the size of their overall end markets. As an example 3-D imaging for the consumer market has massive appeal and an enormous potential market size (maybe as many as 1 billion potential customers) - the market has barely been penetrated, however, given that most currently commercialized 3-D technologies require glasses, which consumers find an annoyance. Zecotek also believes their technology could be ideal for the 3D printer market. These products are in earlier stages of development, however, and may not be substantially advanced until the company has reasonable resources to do so.

We do note, however, that Zecotek has made recent progress in moving its display-related business closer towards eventual commercialization. The company recently penned a letter of intent for Aquarius, Russia's largest computer company, to acquire 20% of Zecotek Display Systems for $7 million. This investment is expected to be used to complete the commercialization of two patented 3D displays. These displays are for flat screen and large screen formats and also for use with a 3D printer.

Additional developments related to progress in the Display business include that Zecotek's CEO noted in their recent press release that, "We have overcome the main technical barriers required to meet the consumer preference for flat screen form factors and HD picture quality with available OLED/LED flat screen display technologies. Renewed discussions are now in progress and we feel confident about reaching a mutually rewarding business arrangement."

In March 2014 Zecotek filed two patents with the U.S. Patent Office related to front and rear-projection auto-stereoscopic 3D display, allowing for 3D visualization (on both front projection and rear projection systems) without the need for special glasses. Then in March the company announced that it was awarded a patent in Korea related to its glasses-free 3D technology. With many of the major display manufacturers located in Korea, this is potentially a step-forward for Zecotek towards a collaboration agreement in development of a glasses-free 3D display product.

While it is still unclear how soon commercialization of the 3D display technology for the consumer market may materialize, we view the recent developments as materially positive and the progress more rapid than we had previously anticipated.

Zecotek is also moving forward on other fronts related to its 3D technology. This includes their 3D projection technology which they see applicable for applications where flat screens are not particularly important. This is mainly the non-consumer markets including for applications such as advertising and large venue displays. Of particular utility could be for 3D printing applications for commercial use.

In the last several months Zecotek announced that they are now designing a 3D interface platform between 3D printers and their 3D display technology as well as developing their own 3D printer. The interface would allow someone to see a 3D image of an object prior to actually printing it on a 3D printer. The user would be able to view the object from all angles and make any desired adjustments before they printed it, affording time, cost and materials savings. Relative to a 3D printer, Zecotek is working with their long-time contracting partner LT-Pyrkal (Armenia) in designing a compact, high speed and more efficient printer than the 3D printers currently on the market. While the design is still in the early stages, Zecotek continues to make progress and in late May 2014 they completed the initial design for a 3D processing module. In July ZMS announced that they and LT-Pyrkal had made meaningful progress with development of the 3D printer and which would begin assembly and testing.

With the rapid growth in popularity of 3D printing, this could be another high-potential opportunity for Zecotek's 3D display technology. The company envisions initially subcontracting production of the 3D display units for the 3D printer application and then potentially partnering for wider distribution.

And Zecotek may also now be looking to revive their Laser Systems business. While the company has not provided much in the way of details, in the Q2 2014 quarterly filing they noted that they are “revising this division’s technology portfolio and re-structuring its business activities. Management is opting for ready technologies geared to cater for the ever expanding security market demands.” What this means in terms of near-term projects, product development or product commercialization is unclear – however, we think it may indicate that the company will look to incorporate its laser technology into products with more broad-based applications.

But while we still do not model a contribution from the Display or Lasers-related businesses (consumer or commercial related markets), we believe the recent progress could provide a greater chance of upside to our outlook. We will be monitoring ongoing developments and update our model if appropriate.

FINANCIALS

Balance Sheet / Cash Flow
As of the most recent reporting period (ending 7/31/2014) the company had $615M in cash and equivalents. Subsequent to quarter end the company closed on the sale of 8.01 million shares (with 100% warrant coverage)

@ $0.35/share for gross proceeds of $2.8 million. In addition, assuming the deal with Aquarius is consummated, this could potentially infuse additional significant cash.

Recent Financial Performance

Zecotek has generated immaterial revenue since inception through their most recent reporting period. The company recently noted that they have started shipments of their crystals to Hamamatsu related to integration into the new IDM modules which will be sold to third party PET OEMs. We have made some revisions to our model to reflect the delayed recognition (relative to prior expectations) of the recent Hamamatsu orders. We think the shipments will accelerate as the design of these new IDM's using Zecotek's crystals is finalized – which Hamamatsu continues to work to complete.

Zecotek generated net losses averaging approximately $5 million/year in fiscal 2011 and 2012. Net loss, excluding a $3.0 million non-cash share compensation expense (related to the joint collaboration agreement with IDMC) was approximately $4.0 million in fiscal 2013. While sales to date have underperformed our estimates, we continue to expect financial performance, including revenue, net loss and cash flow to significantly improve, initially catalyzed by the LFS crystals.

DCF values ZMS.V @ $2.00/share

We have made some updates to our model to reflect the delay in orders from Hamamatsu, which we think also introduces additional risk - which is reflected in the increase to our discount rate. We look for revenue of $87k generated in 2014 to grow to $1.1 million in 2015 and $4 million in fiscal 2016. As indicated earlier our current model only reflects commercial PET scanner related sales and does not incorporate any contribution from CERN related revenue - this will be updated if and when appropriate. We have also not included any contribution from Zecotek's other business lines - which is also subject to being updated, if and when warranted.

We use a 7.5% discount rate, up from 6% prior to the delayed orders which reflects what we think is appropriately greater risk. Our terminal growth rate remains at 2%. Based on our revised DCF model inputs, ZMS.V is valued at approximately $2.00/share. We are maintaining our Outperform rating.

FINANCIAL MODEL

Zecotek Photonics Inc.

	2014 A	Q1E	Q2E	Q3E	Q4E	2015 E	2016 E	2017 E	2018 E
Total Revenues	$86.6	$34.0	$68.1	$340.4	$680.9	$1,123.4	$3,998.4	$8,772.0	$16,707.6
YOY Growth	*118.5%*	*317.4%*	*64.6%*	*2283.3%*	*2894.1%*	*1198.0%*	*255.9%*	*119.4%*	*90.5%*
SG&A	$6,857.3	$1,527.0	$1,257.0	$1,241.0	$1,418.0	$5,443.0	$5,622.0	$5,438.6	$7,351.3
% SG&A	*7922.7%*	*4485.6%*	*1846.2%*	*364.5%*	*208.3%*	*484.5%*	*140.6%*	*62.0%*	*44.0%*
R&D	$1,682.4	$387.0	$325.0	$368.0	$401.0	$1,481.0	$1,388.0	$1,344.0	$1,657.0
% R&D	*1943.8%*	*1136.8%*	*477.3%*	*108.1%*	*58.9%*	*131.8%*	*34.7%*	*15.3%*	*9.9%*
Collaboration costs	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0
Operating Income	($8,453.1)	($1,880.0)	($1,513.9)	($1,268.6)	($1,138.2)	($5,800.6)	($3,011.6)	$1,989.4	$7,699.3
Operating Margin		-	-	-	-	*-516.3%*	*-75.3%*	*22.7%*	*46.1%*
Total Other Income (Expense)	($203.0)	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0
Pre-Tax Income	($8,656.2)	($1,880.0)	($1,513.9)	($1,268.6)	($1,138.2)	($5,800.6)	($3,011.6)	$1,989.4	$7,699.3
Tax expense (benefit)	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0
Tax Rate	*0.0%*	*0.0%*	*0.0%*	*0.0%*	*0.0%*	*0.0%*	*0.0%*	*0.0%*	*0.0%*
Net Income	($8,656.2)	($1,880.0)	($1,513.9)	($1,268.6)	($1,138.2)	($5,800.6)	($3,011.6)	$1,989.4	$7,699.3
YOY Growth	*23.0%*	*79.7%*	*-9.3%*	*-35.7%*	*-71.3%*	*-33.0%*	*-48.1%*	*-166.1%*	*287.0%*
Net Margin		-	-	-	-	*-516.3%*	*-75.3%*	*22.7%*	*46.1%*
EPS	($0.09)	($0.02)	($0.01)	($0.01)	($0.01)	($0.05)	($0.03)	$0.02	$0.07
YOY Growth	*-0.8%*	*52.8%*	*-23.1%*	*-42.7%*	*-75.2%*	*-42.1%*	*-49.5%*	*-164.8%*	*278.9%*
Diluted Shares O/S	92,331	102,100	108,000	108,400	109,220	106,930	110,000	112,100	114,500

Brian Marckx, CFA

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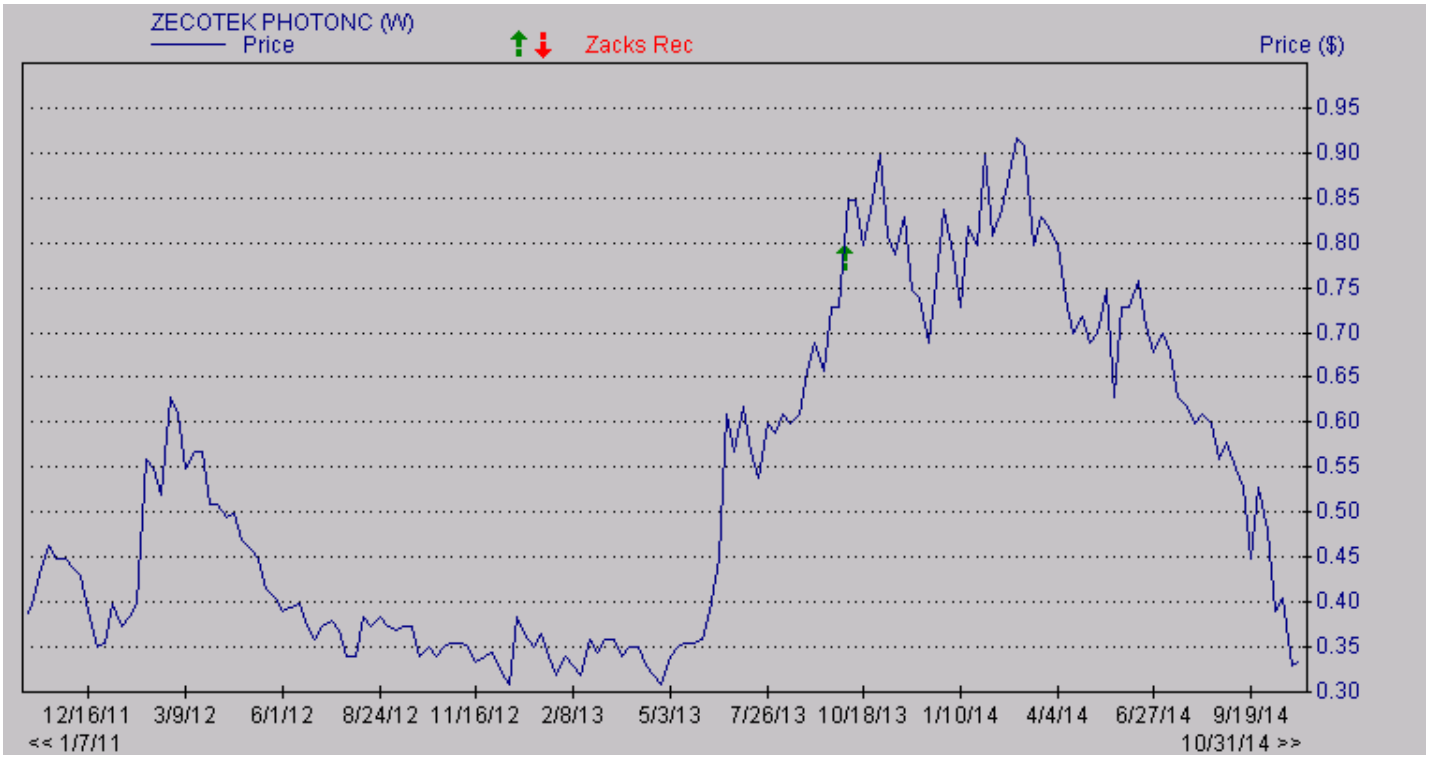

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