Optomechanix

April-June 2018

Technical journal of OMiD, Opto-Mechanical Institute of Design

Participating country falgs at Analytica 2018

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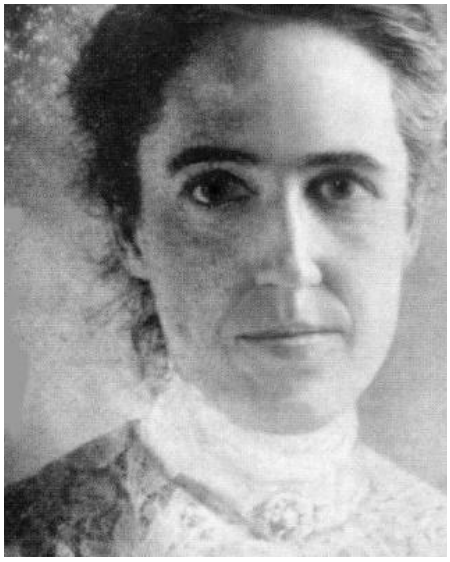
OSA The Optical Society | 100 Since 1916

Member of OSA
Optical Society of America

OMD Opto Mechanical Institute of Design

SPIE.

Member of SPIE
The international Society for Optical Engineering



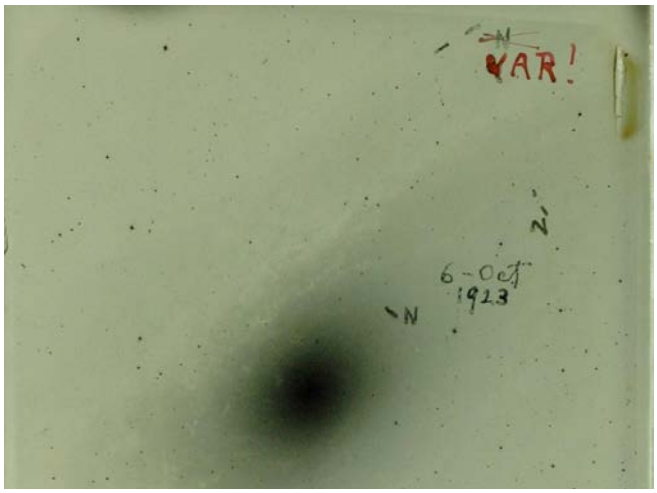
This issue Dedicated to:

Henrietta Leavit (1868-1921) was an American astronomer, who discovered the relation between the luminosity and period of Cephied variable stars at Hrward College Observatory in 1914. This showed a simple relation between the brighness of variable stars, and their pulsating periods.

As soon as the constructon of 2.5 meter Mount Willson observatory was completed, Edwin Hubble used the luminosity-period relation to find the distance of M32 Andromeda galaxy (our closest neighbor) to determine its distance. By measuring the distances of more distant galaxies, together, with spectral shifts first measured by Vestor Slipher at Lowel observatory, he determined that the universe is expanding.

Swedish Academy od Siences tried to nominate her for Nobel prize in 1924, only to learn she had died of cancer 3 years earlier.

“She had the happy faculty of appreciating all that was worthy and lovable in others, and was posessed of a nature so full of sunshine that, all of life became beautiful and full of meaning”, by her colleage, Solon Bailey



Actual negative taken by Edwin Hubble with 2.5 m Mount Willson to find variable star in Andromeda Galaxy M31

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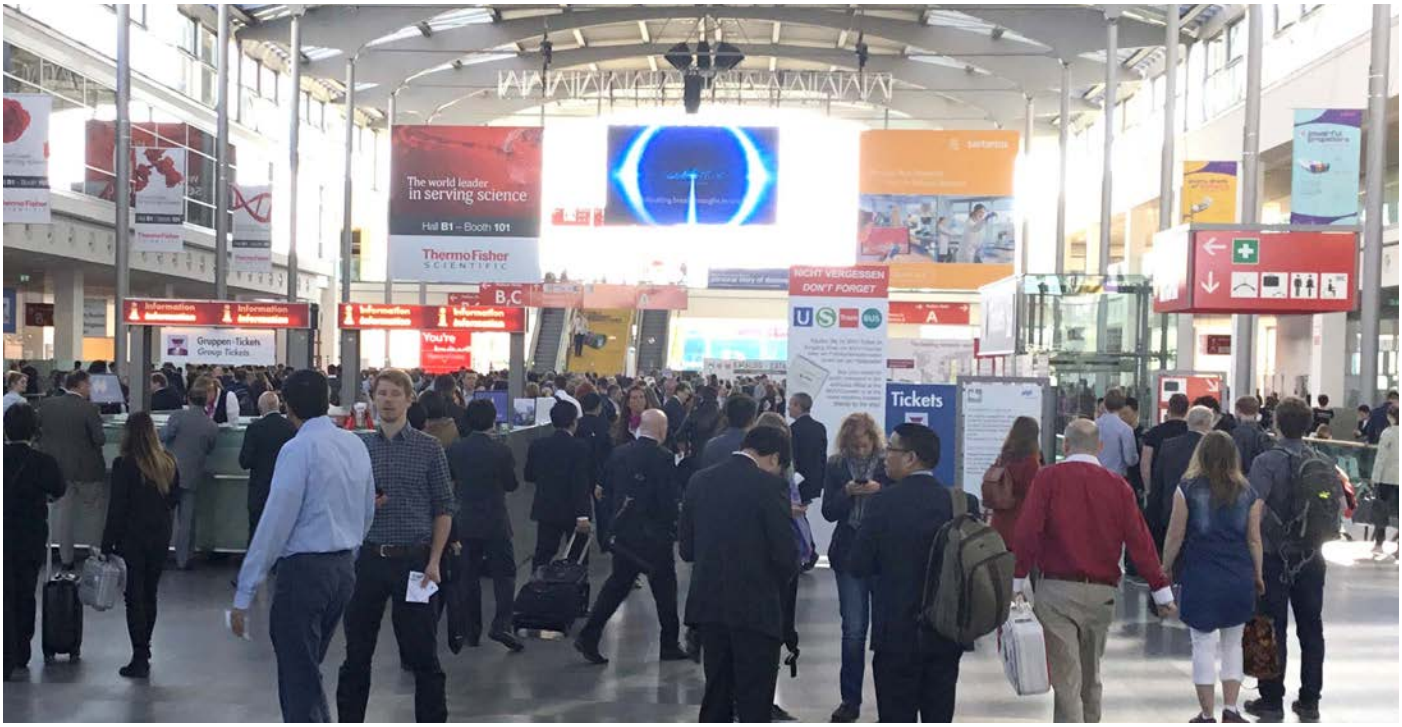
Optomechanix is a quarterly journal of Opto-Mechanical Institute of Design (OMiD), with technical articles for practical, hands-on opto-mechanical engineers. This magazine is privately founded.

Cover page photo: Zeiss Z2m Upright microscope
Inside page photo: Participating country falgs at Analytica 2018

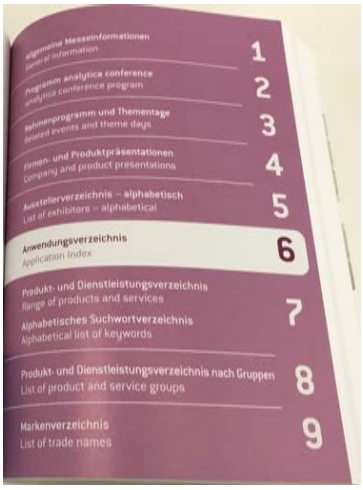
Attending Analytica Show 2018 (April 10-13)

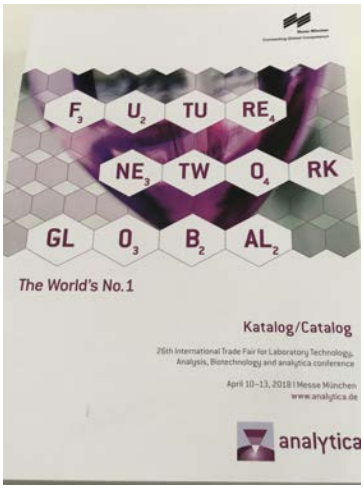
This was my first visit to Analytica show, but I felt so much at home having attended the laser show for so many years at Messe Munchen. There were four shows going on at the same time all related to the laboratory technology, biotechnology, analysis, and diagnostics. My main interest was, of course, optomechanics, and specially microscopy. The main concentration of optical instruments were at hall A2, and only a few companies at A3. This is where my own booth was also situated. The 26th Analytica show had a recordbreaking 1,164 exhibitors from 49 countries, and 35,800 visitors of which 40 percent had come from abroad. People from Germany, Austria, Switzerland, Italy, and China were top visitors. There were 2,074 participants in technical conference sessions. The conference had an increased participation in evey way since the 2016 event.



Entrance hall to the show was packed with visitors. I had never seen a bigger show with so many qualified attendees.

To avoid $65 euros entry fee, a huge number of visitors had received free invitation tickets to attend the show.





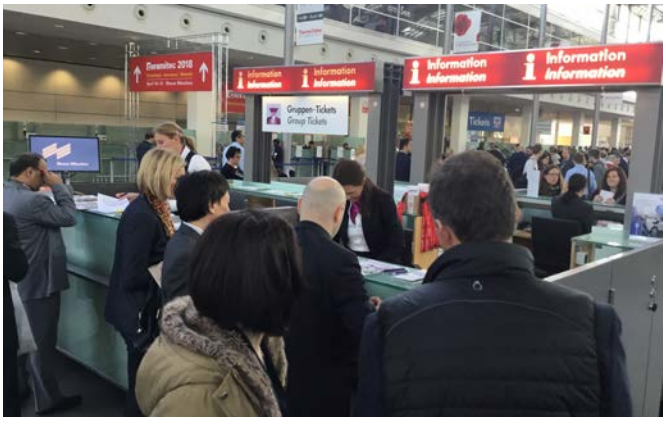
Many small companies who exhibit at the show, specially those who come from abroad, pre-order their booth layout, and carry in their display items to their booth. If the total value of carry-on items exceeds 1,000 euros, you need to have a customs declaration form filled out to be able to pass through customs. For 1,300 Euros worth of goods ($2,000), the fees are as follows: 100 euros to prepare the forms, and 350 Euros (27%) for duties, and import taxes. After the show, you'll needed to go back to the preparer's office so they could fill out yet another form for additional 50 euros to declare you are taking the items out of Germany to get a refund.

In principle, nobody at Messe Munchen knows about these customs laws, and don't know where to send you to resolve it. If you would like to avoid this problem, either reduce the value of your items below 1,000 euros so you could fill out the paperwork yourself at customs, or if it's above the 1000 Euros limit, this is one of the customs brokerage offices that could help you prepare the declaration forms: Mr. Bujar Shehaj, email: info@hszollagentur.de Another option would be to buy Carnet ATA forms that are valid for 3 years if you think you'll exhibit a lot in Germany.

Ali Afshari, CEO, OMiD

The entery to the show was mainly from the nearby subway station. This was the entrance for one of four shows.

Taxi line up in front of Messe Munchen, and scheduled busses were avilable during the four days of the show.



You could pick up a free copy of show guide (above this page) at the information center to search for ehibitors.

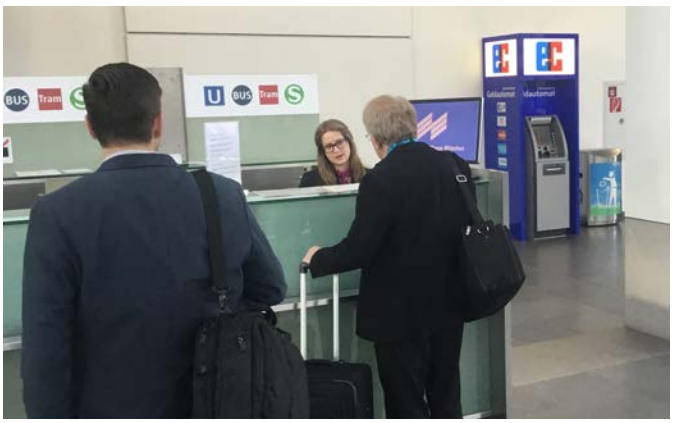
Around 15 publications were available for pick up during the show, mostly in German. I picked up 4 in English.

Every day, there were live instructional presentations at the show about the latest lab accessories and trends.

These high quality numerically adjustable pippets go for 220 euros each. Chinese version price is 20 for six pack.

This exhibitor served visitors liquid nitrogen chilled icecream with a booha-haha mad scientist style fun demonstration.

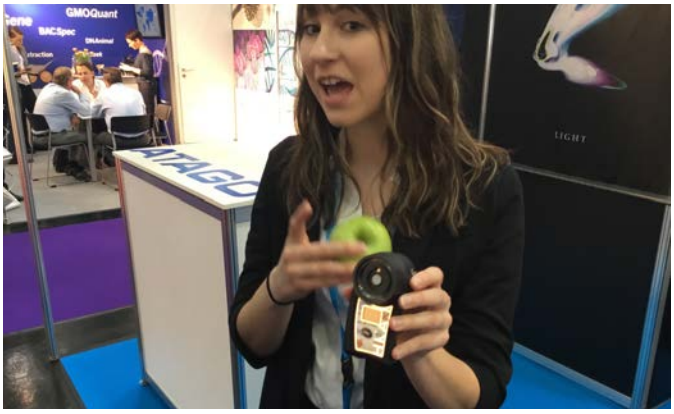
Lufthansa private counter allowed luggage check-in for all star alliance flights during the last two days of the show, and boarding passes were also issued. The only rule was the check-in time was less than 24 hours before the flight. The customer treatment was like first class ticket.



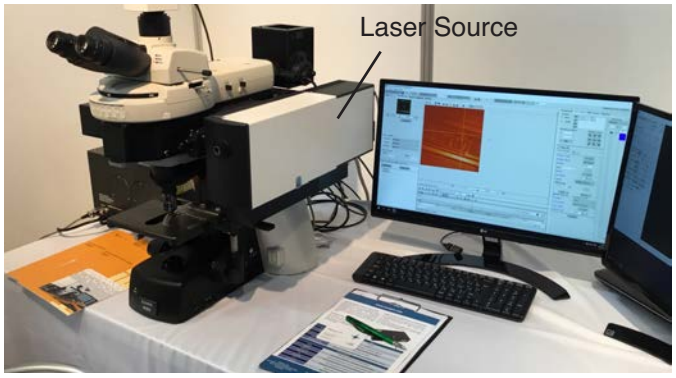
Left, the help counter at the show sold train, and bus tickets, and gave departure times, subway maps, and directions for show attendees. The ATM machine shown on the back is located at the airports, and at the Messe munchen is to dispense cash with any valid ATM card. The exchange rate on these machines are fair, but your bank will charge you an exchange fee when withdrawing from your account.

The current exchange for dollar was 0.6699 at the airport but it was much better rate in downtown Munich for 0.73.

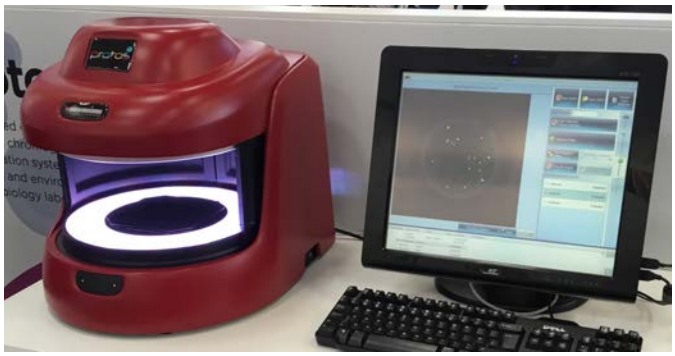
The best new Products at the show (Contact us for description or email errors)



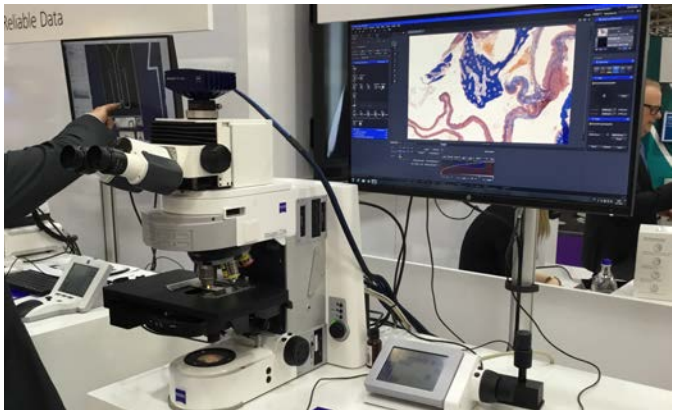
1.This apple sweetness tester utilizes LEDs to measure its interaction inside an apple to measure its sweetness. The Japanese made handheld device is pressed against an apple, and gives instant answers. Email: moriguchi@atago.net

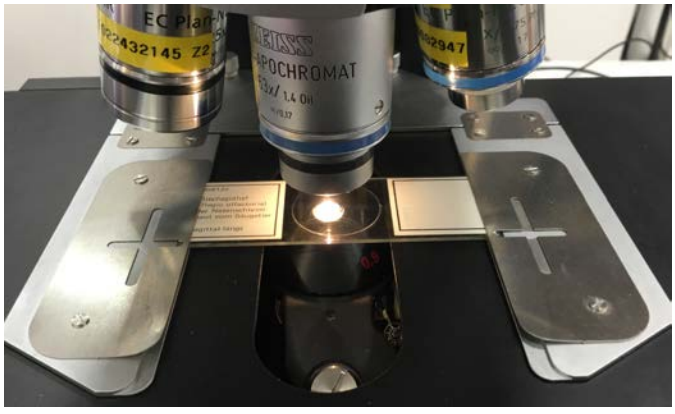


2. This slim miscoscope body design (left) is a wide range IR microsocpe (IROS) by Ostec. The microscope features all reflected optics for its wide spectral range. Right, Confocal Raman microscope. Email: pribora.v@ostec-group.ru

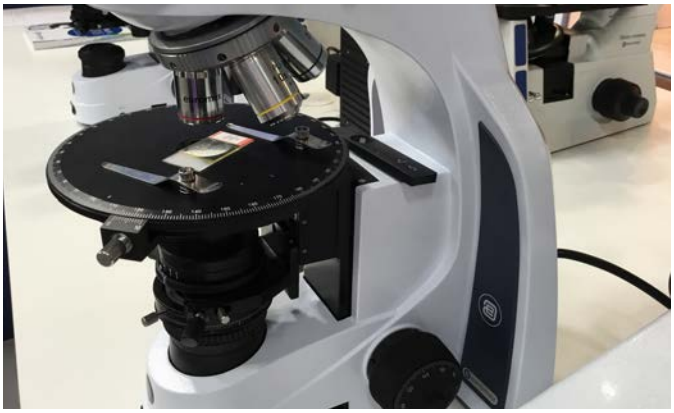


3. Peri dish observation station by Synoptics. Simple but very useful idea that allows image capture, measurement, and visulization of petri dishes with viewing comfort, and image enhancement. Email: jayne.arthur@synoptics.co.uk

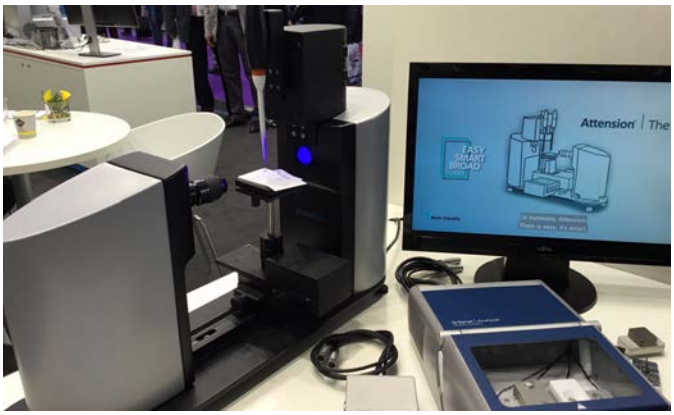




4. Zeiss microscope (cover page) with height adjustable ergonomic viewfinder. Its foot print design follows T- shaped Axiotron series microscopes. Right, a flexture design to secure microscope slides. Email: andreas.bolzer@zeiss.com

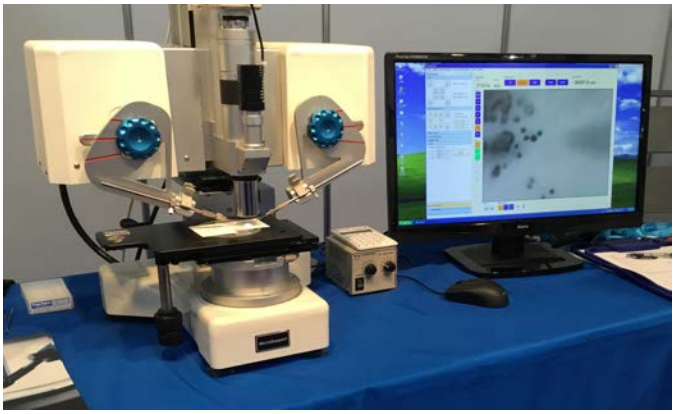


5. From Netherlands: The body shape of euromex microsocpes serve as fitting space for power supply board behind the microscope body. The rear body design also offers protection for their focusing knobs. Email: info@euromex.com



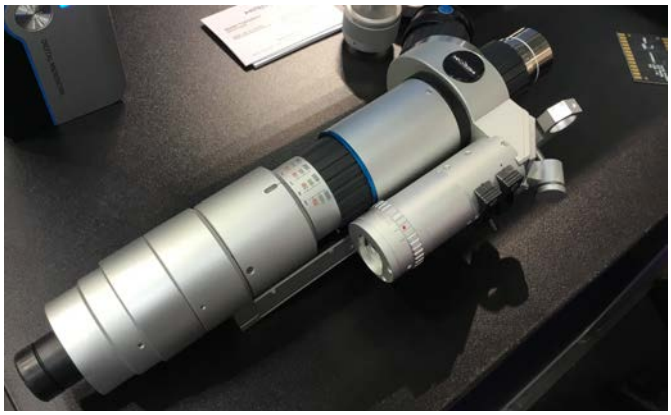
6. Bench-top contact angle measurement setup by Biolin Scientific. Email: jyrki.korpela@biolinscientific.com

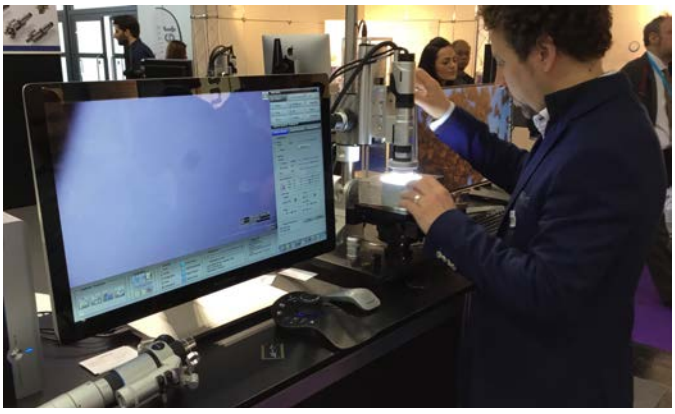
5. Manufacturers always look for a unique form so it will stand out, and will provide better product identification.



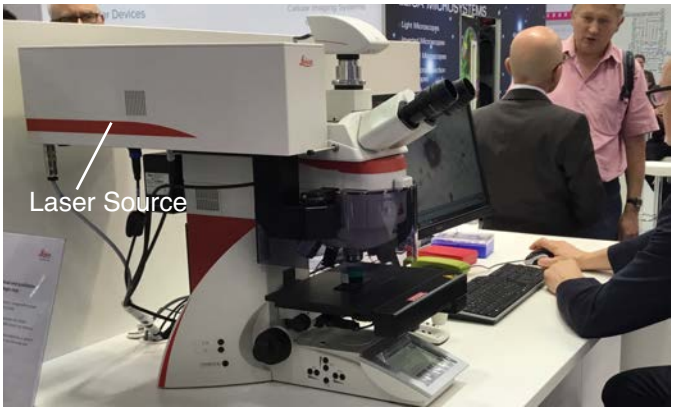
8. Unique Axis Pro sampling microscope with mouse controlled probe manipulation: r.asaka@microsupport.co.jp

7. Hobria's Xplora series Raman microscope and multi wavelength laser confocal imaging: ingo.reese@horiba.com

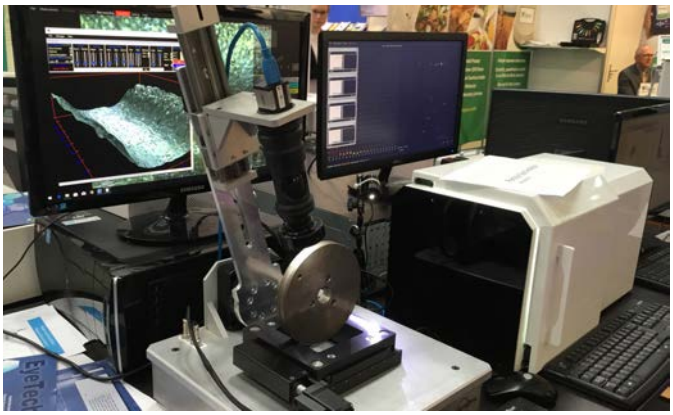


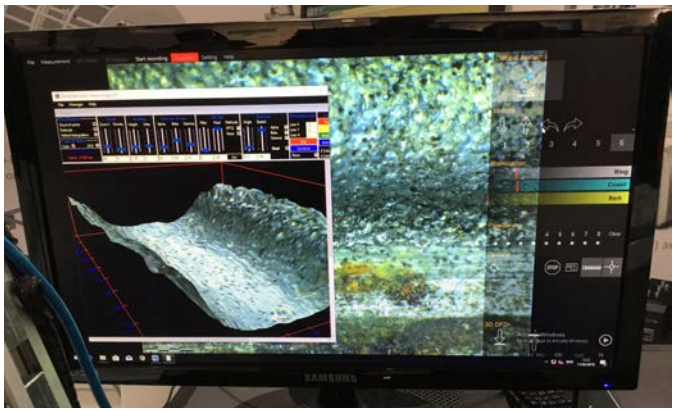


10. Digital microscopes by Hirox utilize their own in-house designed lenses for maximum resolution, and increased depth of field. Their close focus lenses (left) utilize side illumination via in-line beamsplitter. Email: emilien@hirox-europe.com

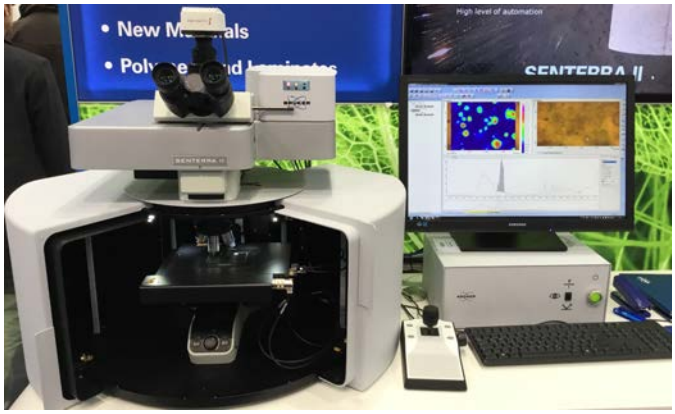


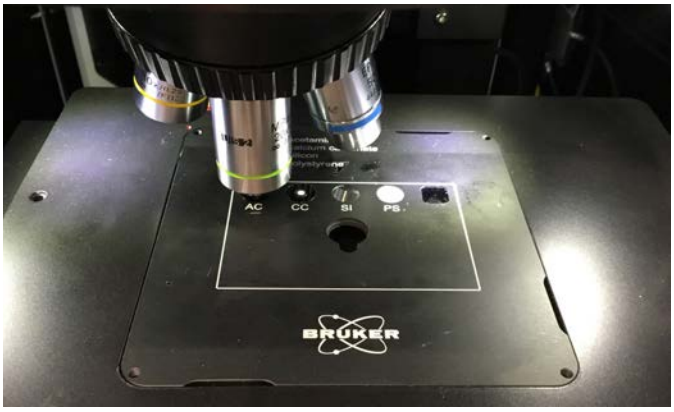
11. Leica microscopes with focusing stage automation, and motorized turret feature heavy rear end body design. The detachable X-Y stage allows its interchange with motorized stages. Email: marika.sosnowski@leica-microsystems.com





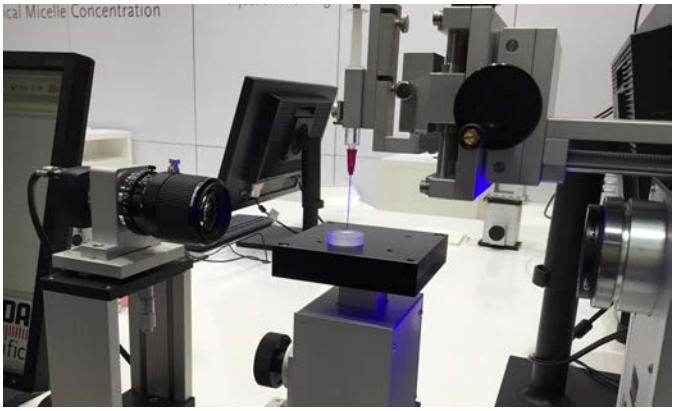
12. 3D digital microsopy by compact MicrOptic allows reconfiguration of its body components to make custom systems. This configuration reveals the surface roughness around a machined disc. Email: havanlieshout@microptik.eu



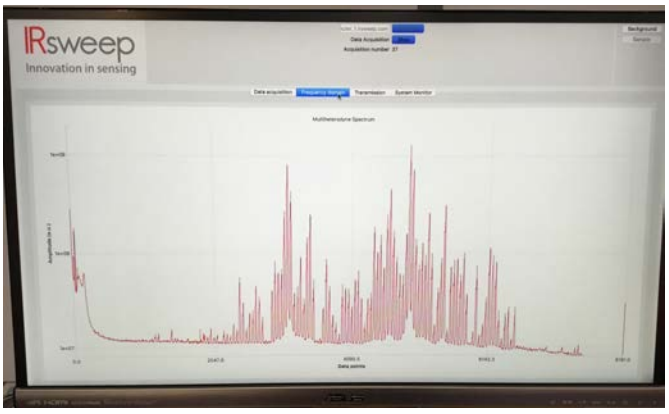


13. Bruker Raman microscope offers complete spectral data not affected by fluoresence by choosing the appropriate excitation line. The challege of swing door is maintaining a solid microscope platform: jurgen.sainwatzki@bruker.com

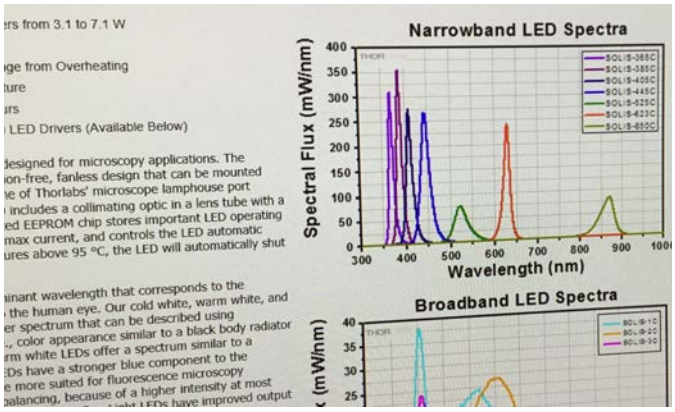
13. Two desk top analyzer workstations by Bruker offer menu driven rear mounted touch display (left), and monitor/ instrument door closure combination (right) to save desk top space. Email: jurgen.sainwatzki@bruker.com



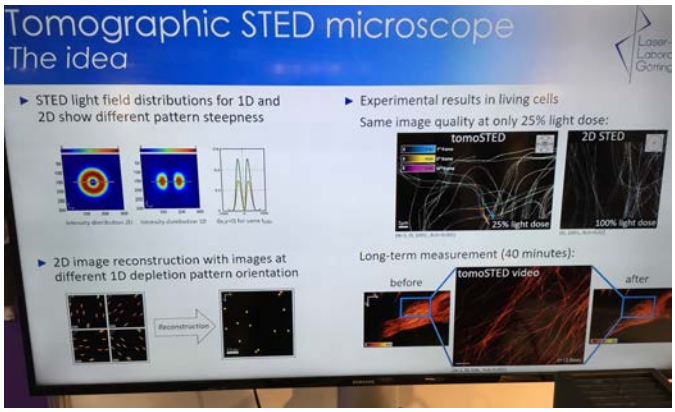
14. Contact angle measurement is handled easilly with this modular system, and its computer user interface by Lauda Scientific. The software calculates the contact angle of a drop on the surface. Email: ulf.reinhardt@lauda-scientific.de



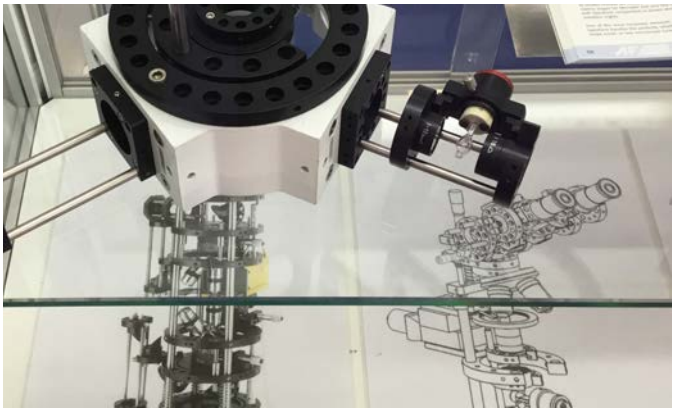
15.The IR cell utilizes a cylindrical muti-pass cell to combine the long optical path in a small detection volume for increased measurement sensitivity, and eliminates bulky cells for laser abs. spectroscopy. markus.geiser@irsweep.com



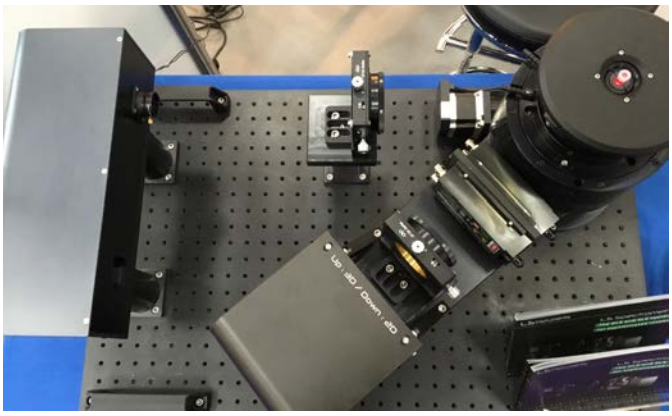
16. Thorlabs SOLIS narrowband LED light source for flourescence microscopy is capable of outputting from UV to near IR. Various models with center wavelenghts: 365, 385, 405, 445, 525, 623, and 850 nm: shallwig@thorlabs.com

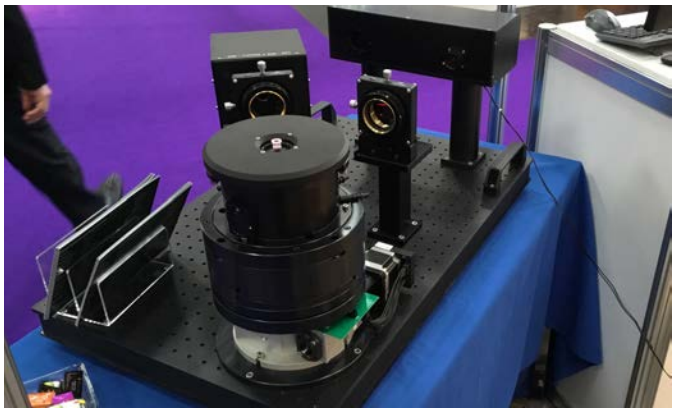


17. The tomographic or Stimulated Emission Depletion Microscopy (STED) produces images below the optical diffraction limit by using a phase plate to produce doughnut shape pulse. Watch online interview with **Stefan Hell** on youtube. The purpose of binocular head swinging vertical (left) is to be out of the way in a lab space: kareem.soliman@llg-ev.de

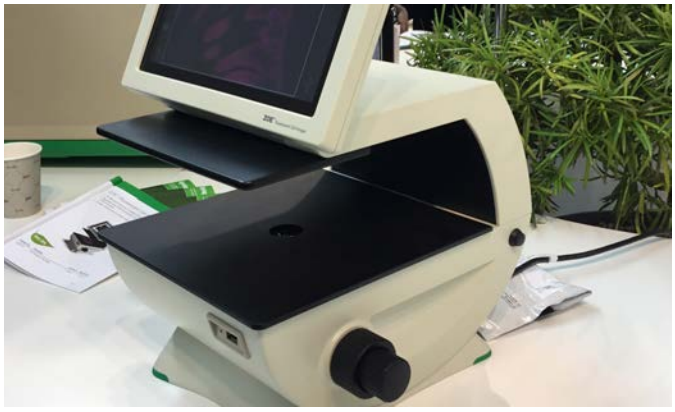


Modular microscopy at Optoform booth: Both mechanical cage system and electrical contacts are combined (right) to create flexible embeded microscopes without wires hanging around the assembly: optoform.com

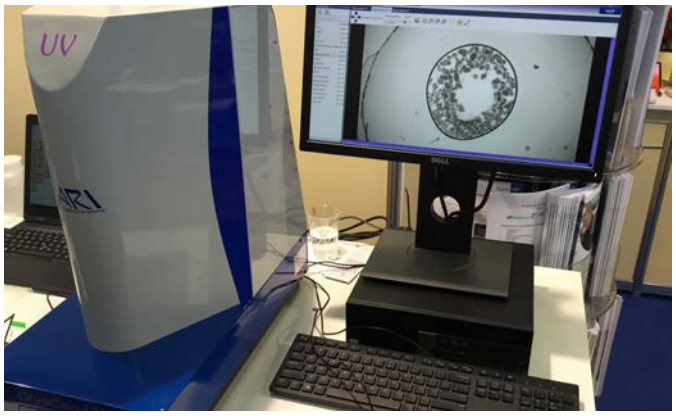


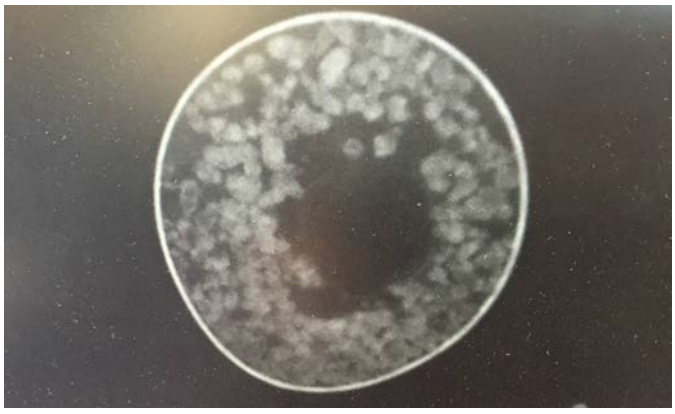


18. Dynamic light scattering technique (DLS) uses laser beam to measure size of nano particles while they move within a solution due to brownian motion, causing the intensity of scattered light to fluctuate. danil.gaudino@lsinstruments.ch

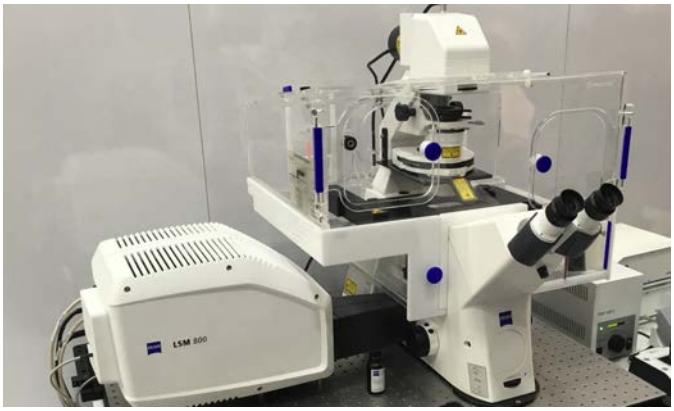


19. Compact fluorescent cell imager allows visualising cells in the desktop. It utilises brightfield and three fluorescent cahnnels to display a wide range of fluorophores. It features touch screen controls: nanette_schlatermund@bio-rad.com

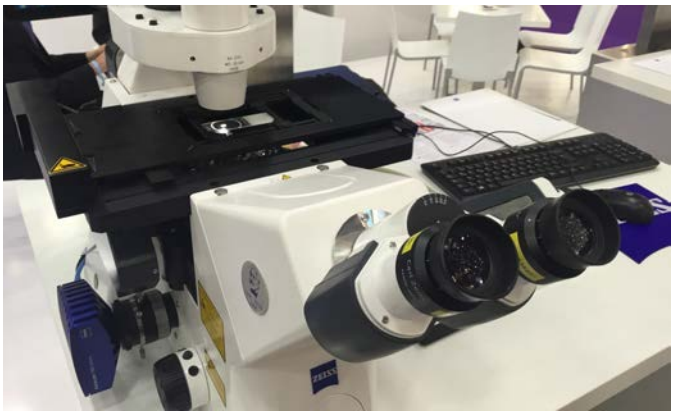


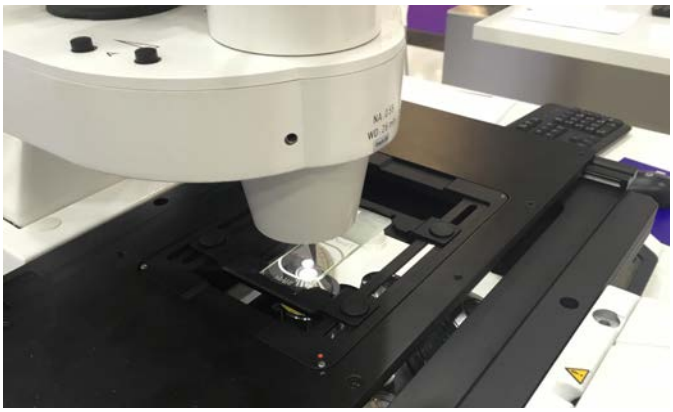


20. Changing the illumination from visible (left) to UV light (right) in this microscope arrangement reveals comparative details for protein crystallization imaging, with options for working with fluorescence. Email: info@dunnlab.de

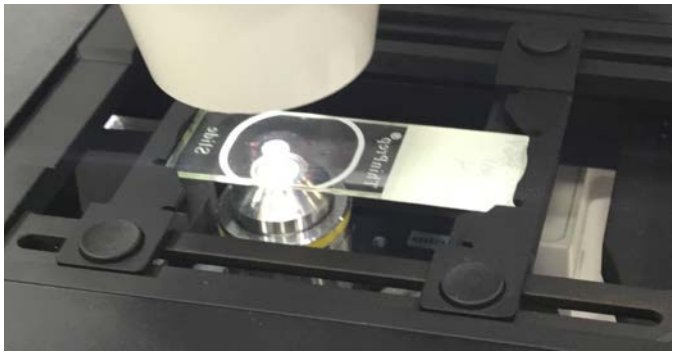


23. The basic Zeiss inverted microscope design (left) with added LSM 800 galvo scanning module (right) is mechanically challenging. Although both units are sitting on an optical table, their optical alignment requires slight mid floating point.



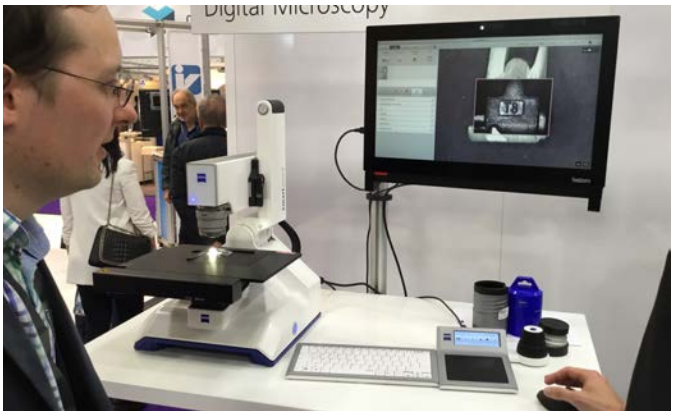


Zeiss opto-mechanical design combines solid diecast Aluminium housing with white powder coated finish and blue Zeiss logo. How Zeiss acheives alignment between these modular parts is pure mastery in optical engineering.



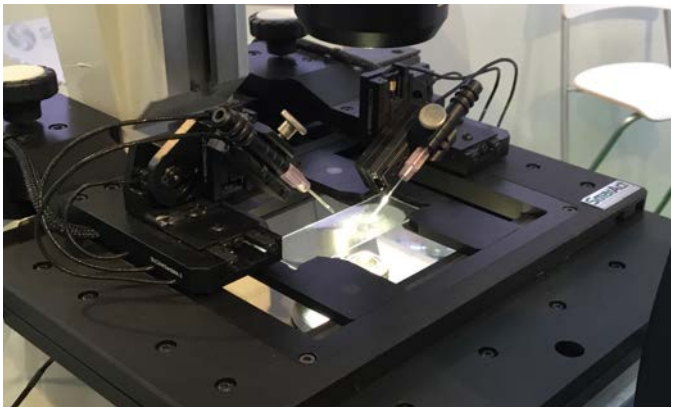
Email: andreas.bolzer@zeiss.com

Modular specimen platform that would accept standard rectangular microsocpes slides, and circular petri dish containing bacterial growth, etc. Various new touches in ergonomic control of the microscope movements, next to the keyboard.



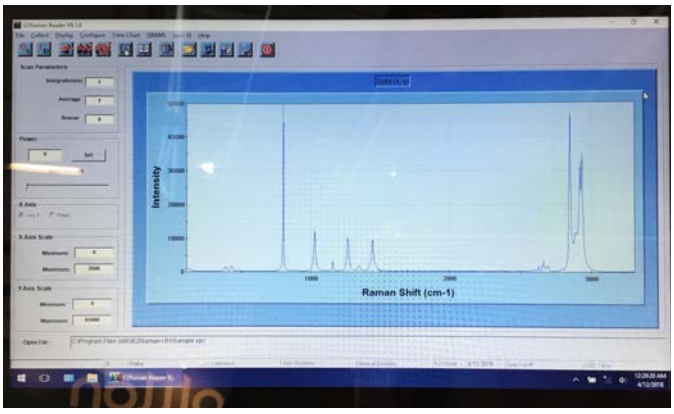
Versatile viewing of 3D objects with this Zeiss system, with adjustable angular viewing possibilities. The vertical mono rail (left) allows vertical positioning while the swivel joint (rear view, right) allows angular adjustment for oblique viewing.

24. Microscopes by Optika feature Italian ergonomic design. The T-shape microscope body contains the power supply board to drive the light source for the microsope. Email: andrea.barbarisi@optikamicroscopes.com

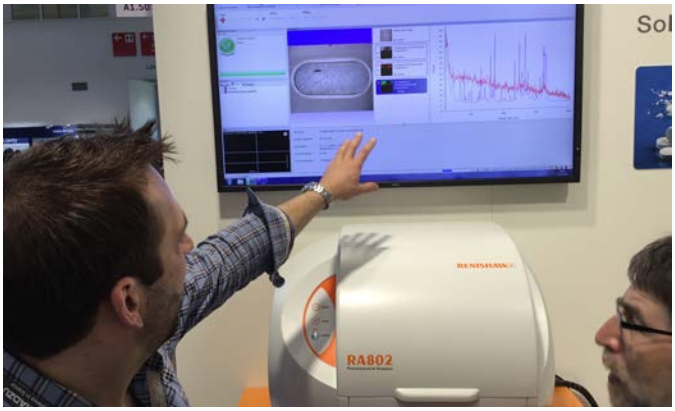


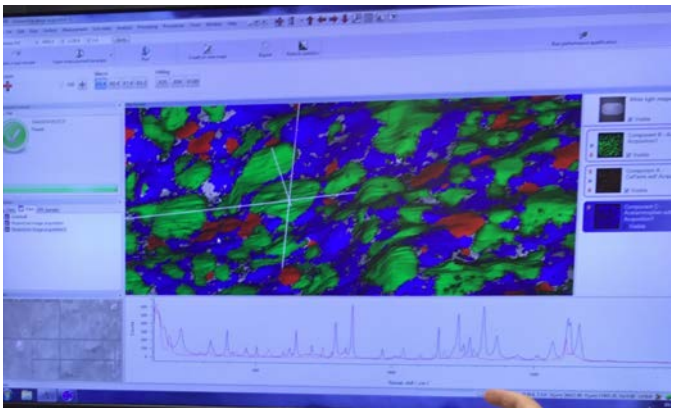
26. Precision nano positioners (left), and probes (right) by SmarAct provide nanometer resolution. SmarAct also provides a wide rabge of micro-grippers with force feedback. Email: weigel-jech@smaract.com

27. Well designed modular accessories for Metrohm Raman viewing device: The finely machined anodized Aluminium accessories fit together as if they are made of injection molded plastic. Email: nicolas.ruehl@metrohm.com

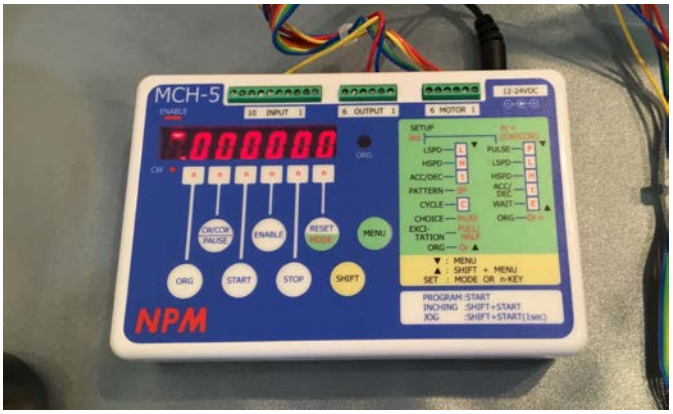


28. Soliton Raman microscope uses back illuminated CCD sensor, and dual 532 nm, and 785 nm laser. Its compact/portable package can be mounted on various microscope brands. Email: w.wagner@soliton-gmbh.de



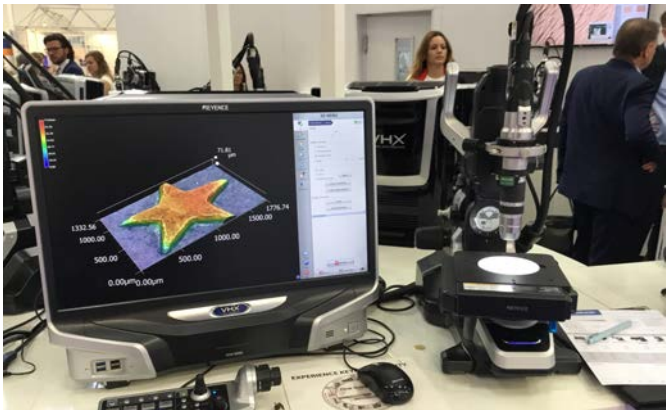


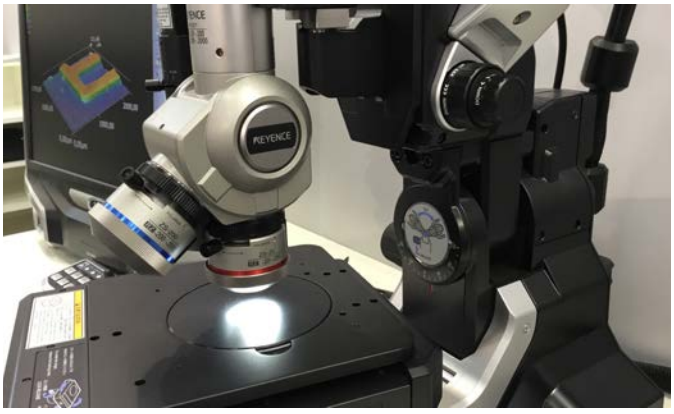
29. Above-left, Rainshaw's Raman microscope in standard package. Right, their RA802 pill examination machine displays a cross sectional slice of the pill, and its inner contents. With cool easy to use cleaver tool (lower left), the pill is first sliced in half. The distribution of pill contents are displayed (above-right), and thanks to image processing software, their comparative cross sectional distribution are measured (lower right). Email: riccardo.tagliapietra@renishaw,com



31. Takasago electro-mechanical modules for the pharmasutical engineers to control liquid flow with isolation valves, pinch valves, slider valves, and liquid pumps having outstanding inertness. Email: f-wintzenrieth@takasago-elec.co.jp

32. The most visible company at the show was Labechnage Group with their large/colorful hand bags that were carried around the show by the majority of the attendees. They sell used equipment. Email: hubert.sauter@labexchange.com



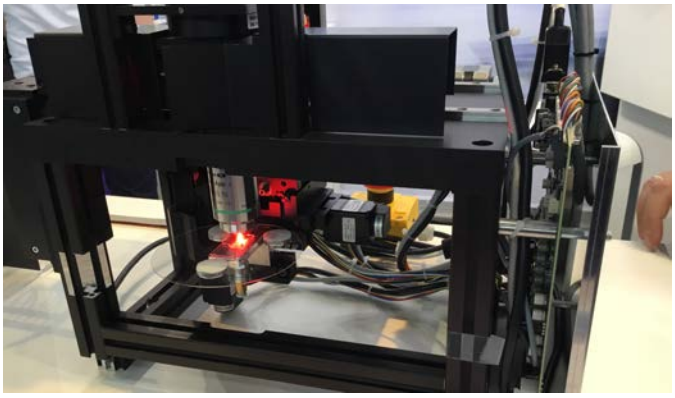


33. Keyence inspection system has inner metal supports covered with high quality plastics. Plastics are not my favorable material for their dust collecting electrostatics, perhaps suitable in clean room environments: marketing@keyence.de

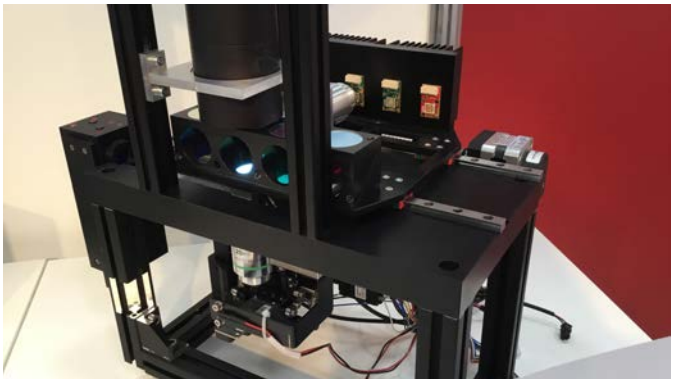
34. AHF is mainly a disributor of microscopy filters, and components in Germany. On diplay were various lamp sources, including the new X-Cite LED lamp (right), and fluorescence filter sets. Email: info@ahf.de

38. UK based, The West Group supplies plastic valves, tubing, inline filters, and solenoid flow control for the optomechanical, and biotech design engineer. The parts are precision injection molded plastic. Email: pwest@westgroup.co.uk

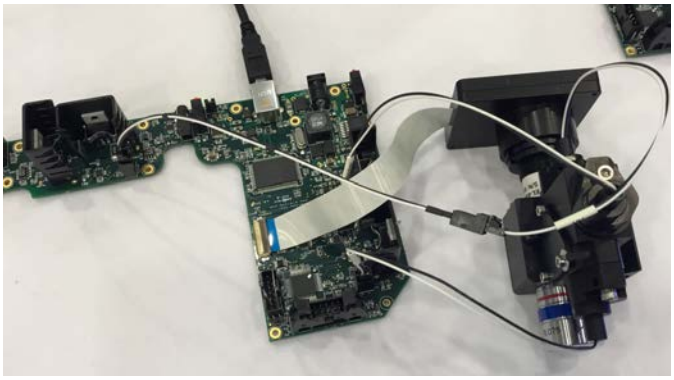
40. Monarc offers various biotech kits such as these DNA gel extraction kits given away at BioLabs booth. The kit contains collection tubes, clean up collumns, DNA Dissolving Buffer, Wash buffer, and Elution buffer. Email: kropat@neb.com



41. Volpi AG, Email: gentiana.buzhala@volpi-group.ch

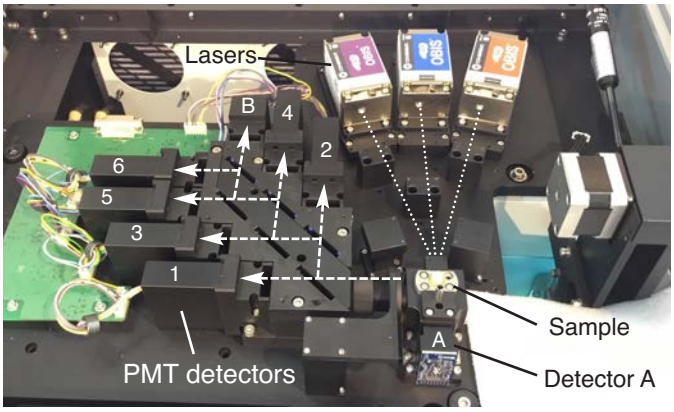


43. HSE-AG, Email: mariana.dittmann@hseag.com

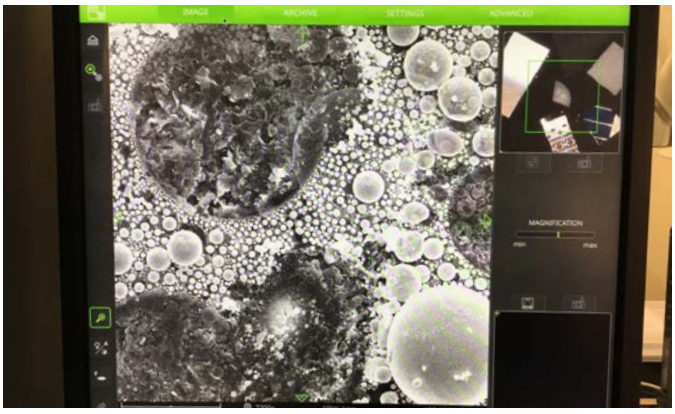


74 (Photonics West). Ethaluma: eweiner@ethaluma.com

Elaborate four wavelength Fluorescent miscoscopy arrangement (left) consists of a motorized stage that translates the four filter cubes and four sensitive detectors. This looks too costly compared to recent innovations with multipass filters that work with three LED laser sources/no moving parts (right). The question is can this new lower cost idea really work?

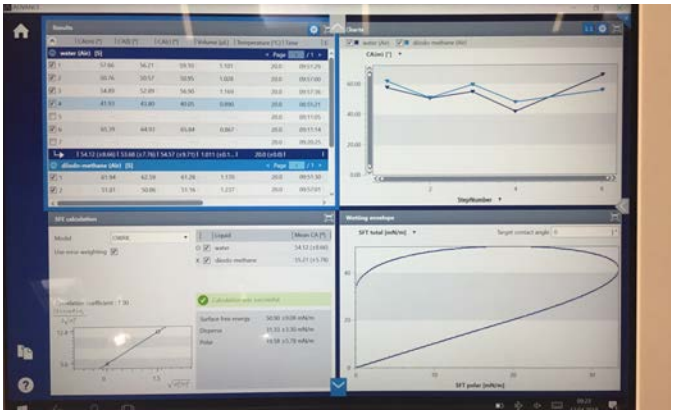


42. Complex beam layout in this flow Cytometer at OLS booth contains six PMT arrangement, two other detectors, and three laser sources to identify and analyse specific sub-populations of cells. Email: info@ols-bio.de

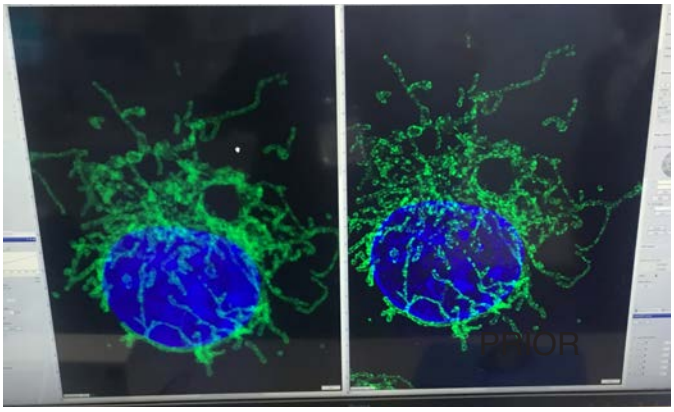


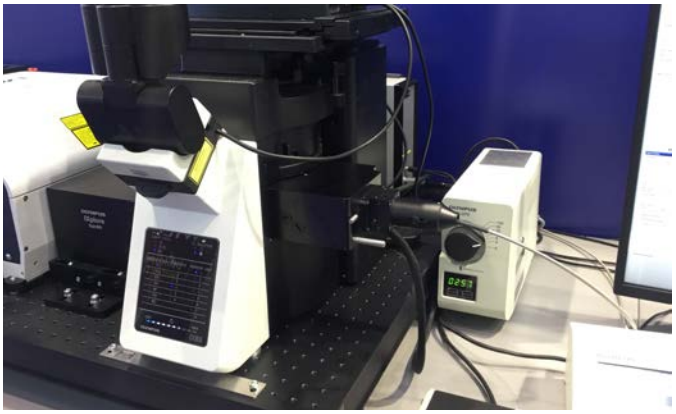
45. This high performance table top SEM by Phenom World, costs 50-100K euros. It features fully integrated elemental analysis, smooth sample navigation at up to 150,000X magnification. www.phenom-world.com

46. Vision inspection microscopes utilize reflex optics for viewing comfort. Reflex optics reduces weight just as in large astronomical telescopes. The binocular 3D viewing can be adjusted like normal scopes. Email: summer@visioneng.de

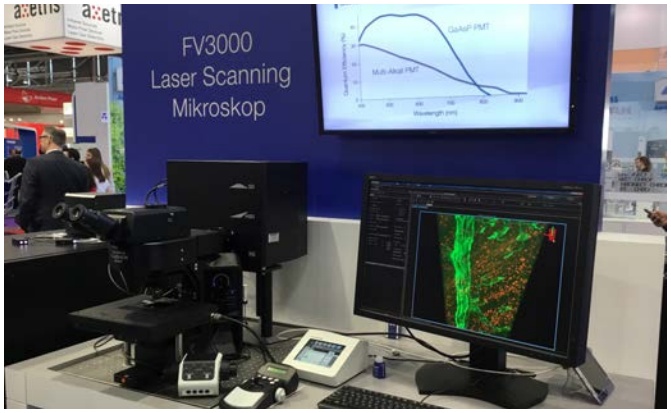


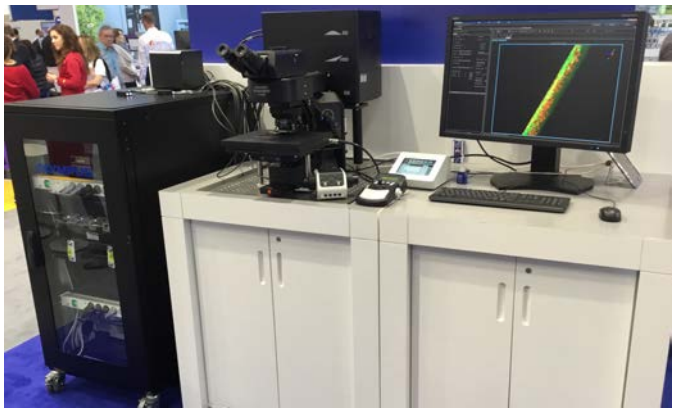
47. Contact angle measurement (by a liquid drop) is accomplished by this compact mobile analyzer for inspection in automobile parts, curved surfaces, and surface free energy measurements made by Kruss. Email: d.frese@kruss.de



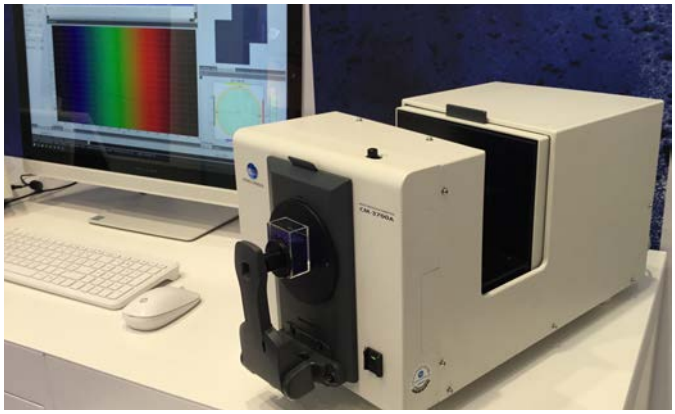


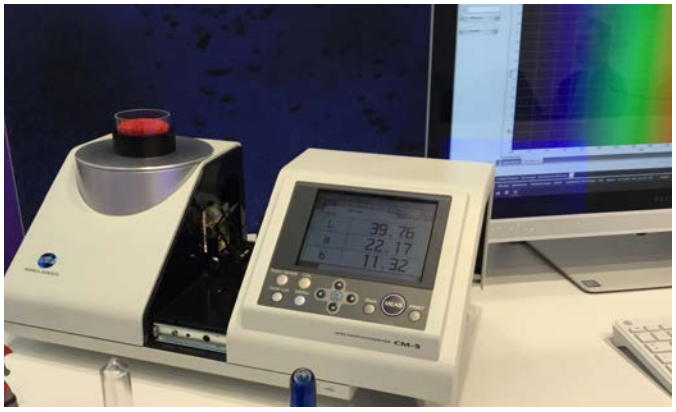
48. Olympus inverted Spinning Disk microscope claims to deliver 120 nm resolution (above right) compared with 280 nm limit of traditional microsocpes. It utilizes Yokogava CSU-Wi 4000 rpm Nipkov disk with six light sources: 405, 488, 551, 640, 515, and 445 nm, and IXplore spinSR for image enhancement. Email: bjorn.sieberer@olympus.de



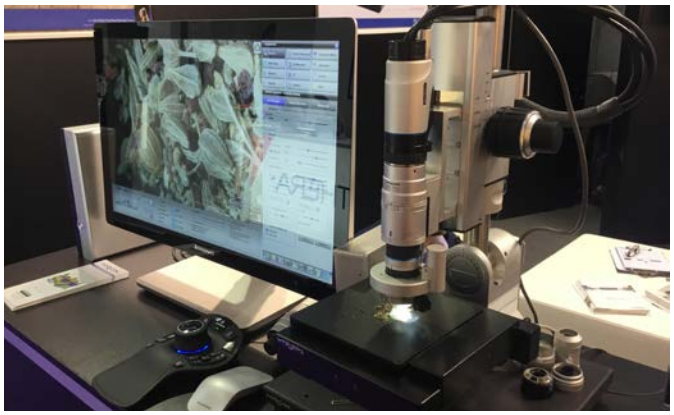


48. Olympus FV 3000 Single Photon Confocal Laser Scanning microscope uses Bicolle SD PMT detectors, highly sensitive HSD detector, Resonant, and Hyprid galvos for fast image scanning. The huge cabinets of these microscopes allows the workstation to be placed in a separate room for cooling. Email: bjorn.sieberer@olympus.de

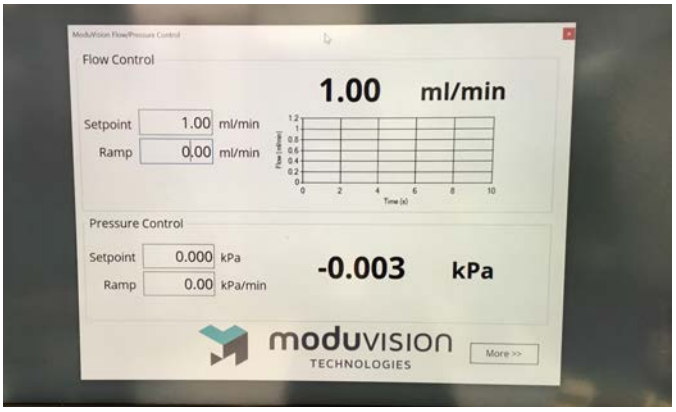




49. Minolta color measurement instruments can measure ransmission and absorbtion wavelengths. The sliding door on these instruments are cleverly designed to light trap externaneous light: hannes.kernreiter@seu.konicaminolta.eu



50. Hirox high resolution optics utilizes in line illumination, and rotating mirro 360 view of the sample with long depth of field. They offer interchangeable optical heads plus variable angle support column. Email: emilien@hirox-europe.com

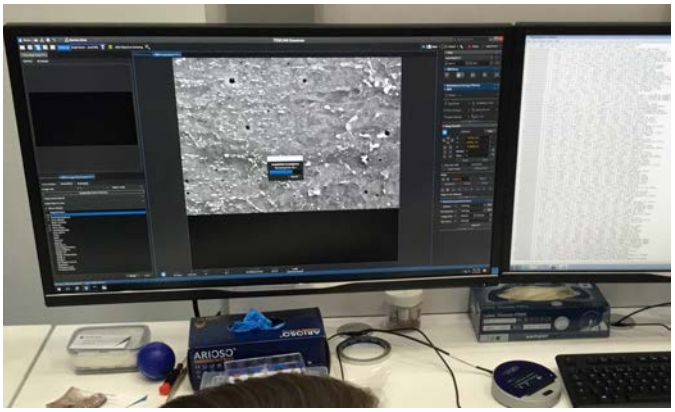


51. Moduvision analytica 2-channel flow, and pressure controller card with user interface software, controls both gas pressure, and flow from an input source, and displays the measured result on PC screen. Email: gvdb@moduvision.com

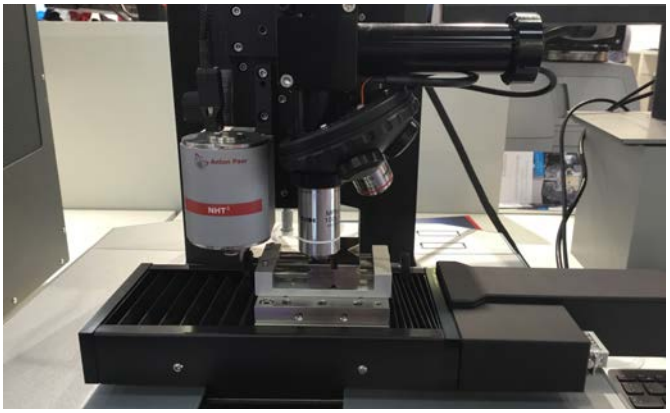
52, RGB Photonics miniturized integrated Spectrometers with USB interface, and light sources are ideal for OEM and table top instrumentation by optomechanics design engineer. Email: dimitri.engel@rgb-photonics.com

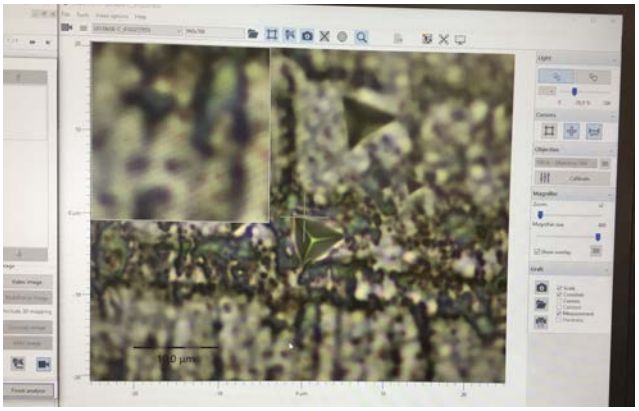
53. Visitron Systems GmbH offers compact version of spinning disc microscope shown on 48: hwurm@visitron.de

64. Nikon had many of their microscopes, and objectives on display: www.nikon instruments.com

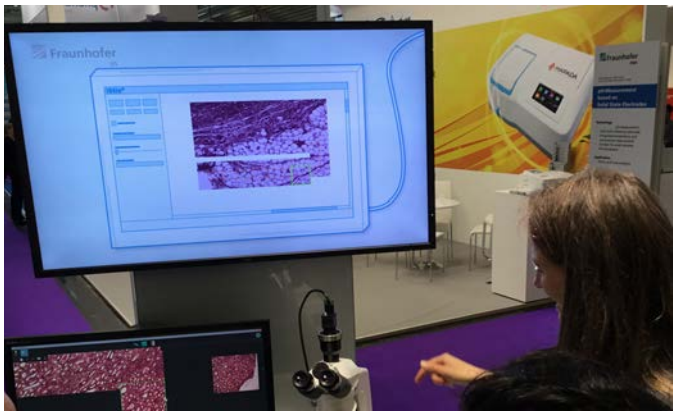


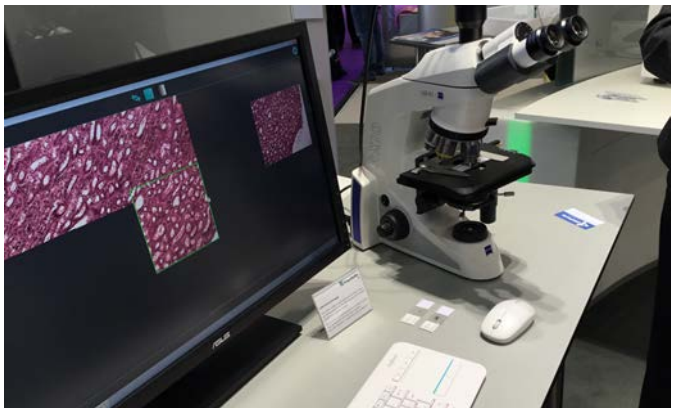
54. Tescan brightbeam SEM column technology utilizes combined electrostatic-magnetic objectives. There is a potential tube at the center of electron beam column that keeps electrons at a higher energy level: tom.jaepel@tescan.de



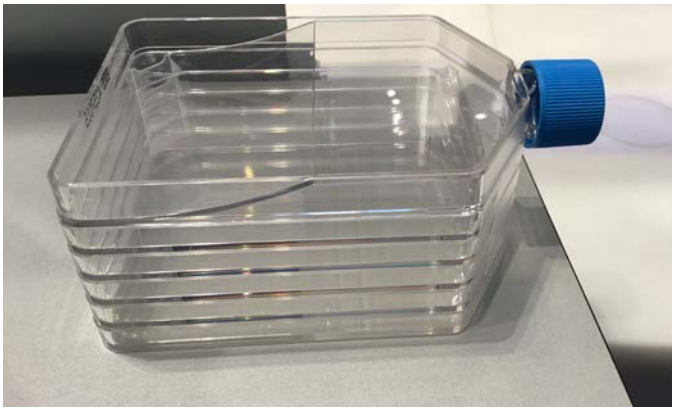


55. Anton Paar micro surface roughness tester uses a diamond tip microscopic marking device, motorized translation stage to transport the sample below a microscope for image analysis, and measurement: paul.pavlov@anton-paar.com

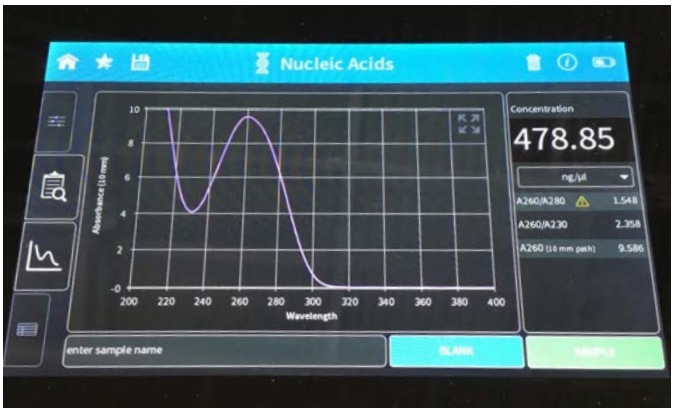




56. Franhufer research group is liescensing their manual X-Y panaromic image capture software to convert it to a product. Olympus BX3M microscopes use this technique in their MIA image capture scheme: michaela.benz@iis.fraunhofer.de



57. Another Franhufer idea for liescensing is this BF/ Phase Contrast microscope to scan multilayer cell culture flasks. Obviously, there is a light source, and imaging optics like an inverted microscope. harald.peter@izi-bb.fraunhofer.de



61. IMPLEN desk top microvolume spectroscope has 7” touch pannel user interface to measure down to 0.3 micro liter sample volumes. The 200-900 nm photometry curve is instantly displaed (right). Email: msahiri@implen.de

Conversations with God

For every trip I make, it's the learning experience by meeting interesting people that drives me to travel around the world. On this trip, I had encountered some customs issues that forced me take the train back to the airport, but on the way back, it was worth all the trouble. A lady named Helga was sitting in front of me, and she started the conversation by asking: "Excuse me, which country did you fly from?" I explained to her that I had arrived the day before, but had to come back to resolve some customs issues. That's how the conversation began, and we ended up talking about out personal life experiences, and how ignorant most people are that haven't traveled to see the world, but just judge everyone the way the news channels show it.

Helga started talking about this book that had touched her life: "Conversations with God", by Neil Donald Welsh. She said on that book, he asks God: "Who am I?" God says you are one of my children with so many qualities that I have given you. The next day he asks God again: "Who am I?" This time God says: "You are like a candle, but your light can not be seen in the sun. If you wish to see yourself, you need to go to a dark land, and there, you will be able to see who you are." This short passage that she said from the book kindled such a deep connection between us that I forgot I was in a train, surrounded by strangers.

Helga said that one day, she felt she needed to test her faith in God. What she did was she decided not to set the alarm clock to wake up on time in the morning to catch her flight. Instead, she asked God to wake her up! She said after making that commitment, I went to sleep, and God woke me up exactly when I had asked him to. She said on my next flight, and any other important occasions, I asked God the same thing, and God never broke his commitment. I now have faith in God that he really listens to me, and he hears me. She said once she was traveling with one of her in-laws, and she said she'll set the clock because she didn't believe in any of that stuff. She said I asked God to wake me up 5 minutes before her alarm goes off, and I did wake up exactly five minutes before her alarm went off.

I told her about a similar story mentioned in Movlana Jallaludin Rumi's book: The Masnavi. The story is about a man who reads a verse in Holly Koran: Who do you think is feeding the birds that fly above you in the skies? I am your only provider, so rely only on me. The man decides to test his faith, and tells God if you really mean this, I'll go sit somewhere to see if you will really feed me. So he goes a stranded land in the desert, and he sits, and waits. By accident, the next day, a caravan was passing by, and someone spots a man stranded in desert from their remote spot. When they go to him, he bites his teeth together so they can't feed him. They say: "Poor fellow, he has starved so much that his teeth are locked together!" So they bring a dull knife, and force open his teeth to feed him.

Helga said she was born in Germany but after age 4, his parents moved to America. After she got married, she moved back to live in Germany with her husband. She has stayed in many countries, and believes people with whatever faith that they have around the world want to live in peace, and there is truth in every religion. It is our job to spread the truth, and bring people closer together to live with love, and in harmony. Meanwhile, I noticed the facial expressions of a near by passenger, and how he couldn't believe us speaking to each other as if we'd known each other for years..

Unfortunately, our conversation was cut short after my train station was announced: "Istbanhof". We ended up standing up to say good by, and gave each other a warm hug. When I got back to my apartment, I told my wife about the book over the internet, and by the time I returned to Iran, she had bought, and had already read through half of the book. In my last article: "How to succeed in your product the romantic way", I had mentioned that God's words are not in just holly scriptures, they are written every where. While reading this book, I found that to be so true. Tonight, my wife asked me to read a passage of the book to put her to sleep, and that one passage was so mind opening to us.

For people who are seekers in life, I think books like this say that you are not alone. Life is really beautiful to those who seek beauty in it, and take its problems as opportunities. Because they had held my bag at customs, I had to get there so early in the morning to catch my flight, and at 5 a.m. in Munich airport, guess what I heard: The song of sparrows! I had heard them everywhere except at the airport before. We still live in the middle of nature, and in between trees, rocks, and rivers no matter how much we alter it. Our soul will not be in peace without them.

Yes, I got up five minutes before my alarm went off.

Munchen Museum

The Munchen museum is probably the most well known science museum in the world. It contains so much in it that it would take a first time visitor a week to fully see everything that's on display. I have visited the museum many times already, and I still haven't been able to finish seeing its opto-mechanical instruments.

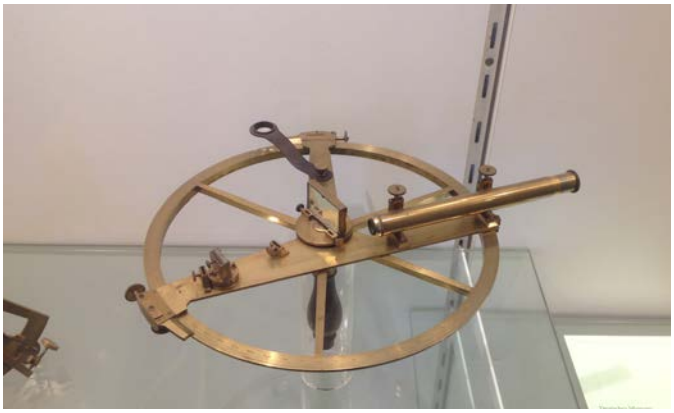
Museums are sacred places. Ever since I established my own museum, I feel so entangled with the efforts of others who have worked so hard to make that dream a reality. A museum for me, is as big as the whole world because it has so much respect, and admiration for what it secures within its walls. It's a place of full trust to preserve the past.

For more information, visit www.dutches-museum.de

The huge museum property which is as big as a full scale university campus is a visitation site by itself. There are two telescope domes (both a solar telescope, and a 20" astronomical telescope), plus a rather large planetarium dome.

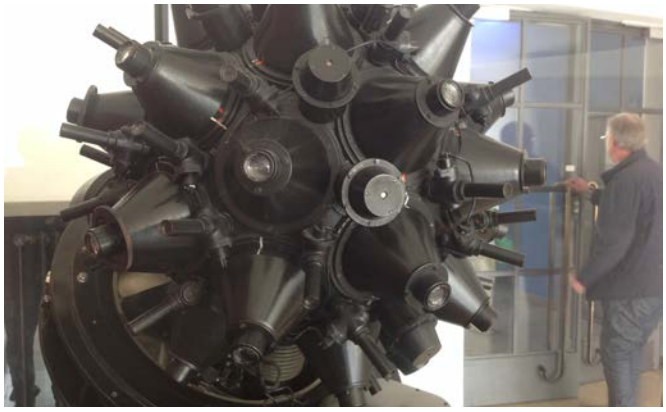
Dutches Museum has a science bookstore filled with science toys, and books but unfortunately most of them are German. The two most valuable books you could purchase are the Museum Collections book, and the Noano/Biotechnology book.

The optical glass types show cases as many glass types that are utilized in most optical designs, each cut in prism form for studying their dispersion properties. 1 meter telescope mirror (right) is shown with counter balance weights.

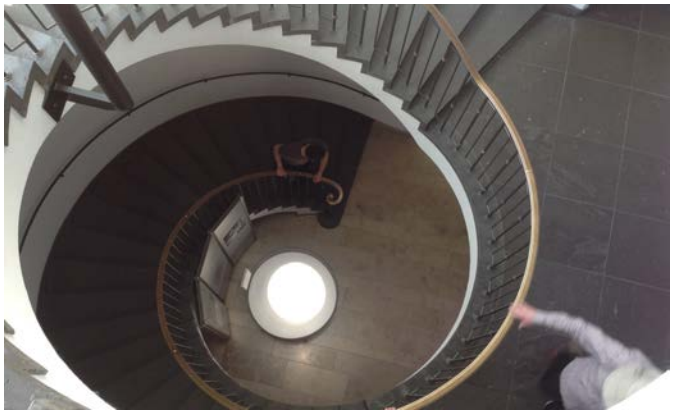


An early theodolite made of brass utilizes first surface mirrors, a Galilean telescope, and graduated angular scale.

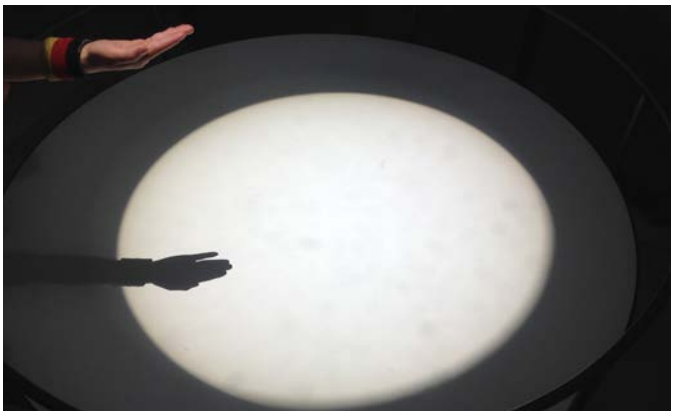
A late 1800's brass telescope with rear focusing knob to adjust main objective position via a long lead screw rod.



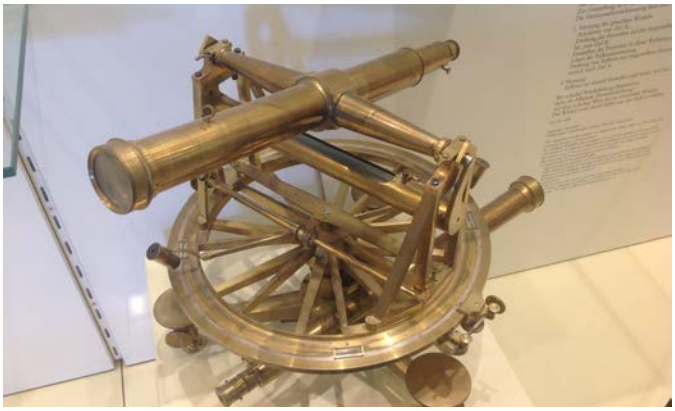
Zeiss developed this Mark I planetarium in 1923. It was the world's first projection planetarium.



The 2 meter projection screen is ideal for watching the sun during an eclipse, while visitors fill the spiral stairs.



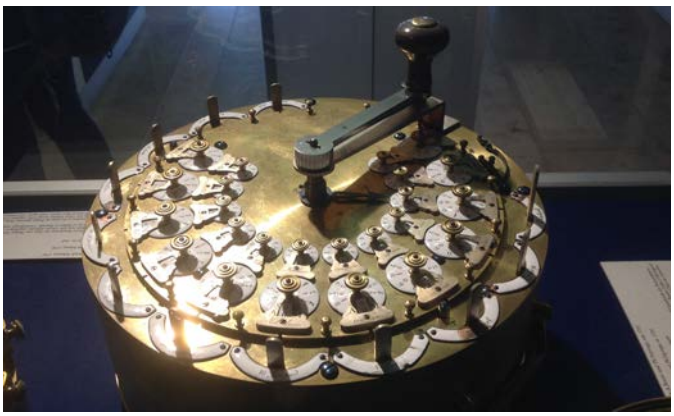
The sun telescope is beautifully designed to blend with the architecture. There is an automatic tracker mirror on top, and a lens projection system utilizing Spindler & Hoyer's Macrobench system. The image is projected on screen below.

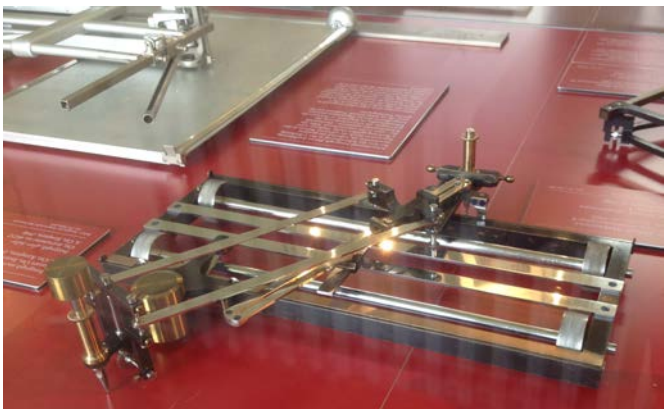


Two types of equilateral telescopes utilized for early clock accuracy. A star was centered in its reticule, and after 24 hours, the star had to reappear on the same spot (actually minus 4 minutes due to the earth's rotation around the sun).

The microscope museum displays hundreds of different microscope types, and accessories, and they are the most fascinating part of the optics museum. Also on display are various Electron Microscopes/AFM with demonstratin classes.

The time keeping section displays watchmaking tools like a vintage gear cutter (left), and the lathe to make other parts of the watch. Then various watch escapement mechanisms are on dsiplay. Right, a ship clock made by Lange Sohne.





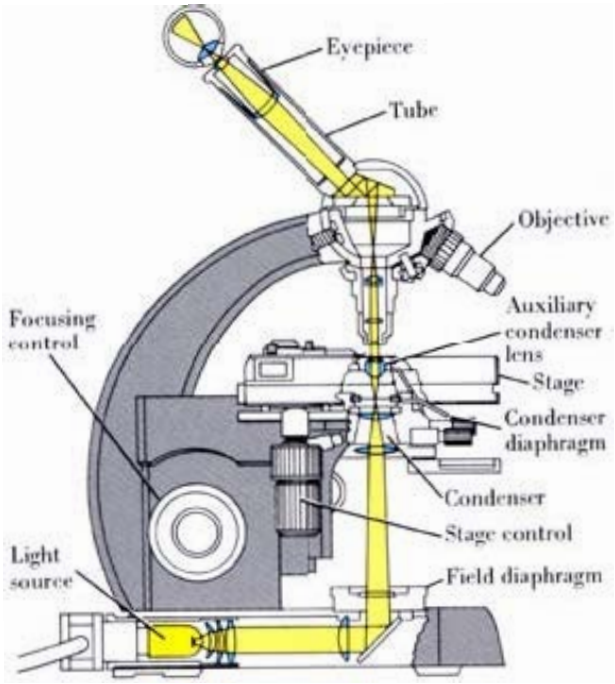
Two types of mechanical calulators shown are part of computer technology section of the museum. The early slide rules are shown with more complex mechanical calculators, then from the first computers to the full sized croy computer.

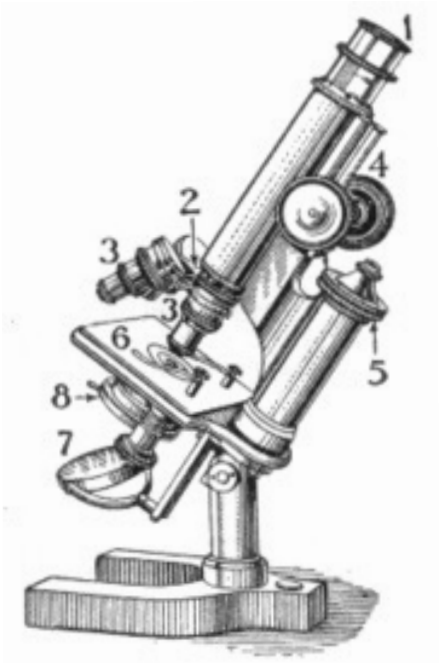
Designing the next concept for Optoform Cage Sysem Part 1

By Ali Afshari

Whenever it comes to designing a microscope, a designer usually thinks of its traditional look: A microscope needs a turret in order to change magnification. It needs a viewing eyepiece, and a light source to illuminate the sample, and it needs a precision stage to position the sample, plus a versatile focusing device to focus the sample at both low, and high magnifications. Then there are more sophisticated viewing heads to allow ergonomic viewing habits, and an alternate light path for image capture.

New trends in optical engineering, and software development is starting to change all that but the microscope hardware has remained to be application specific for, i.e., upright Bright-Field technique, inverted, confocal, Epi-luminescent, fluorescent, single photon, etc. I have always looked for a universal design to be able to do them all utilizing the same components more like children's lego blocks. When I invented Optoform back 25 years ago, I had this in mind. Recently, I was wondering in spite of all my efforts to make Optoform flexible, I really haven't taken that extra step to make it the product I originally had in mind. The reason aws because I have focused most of my attention to expand its applications to cover too many applications.





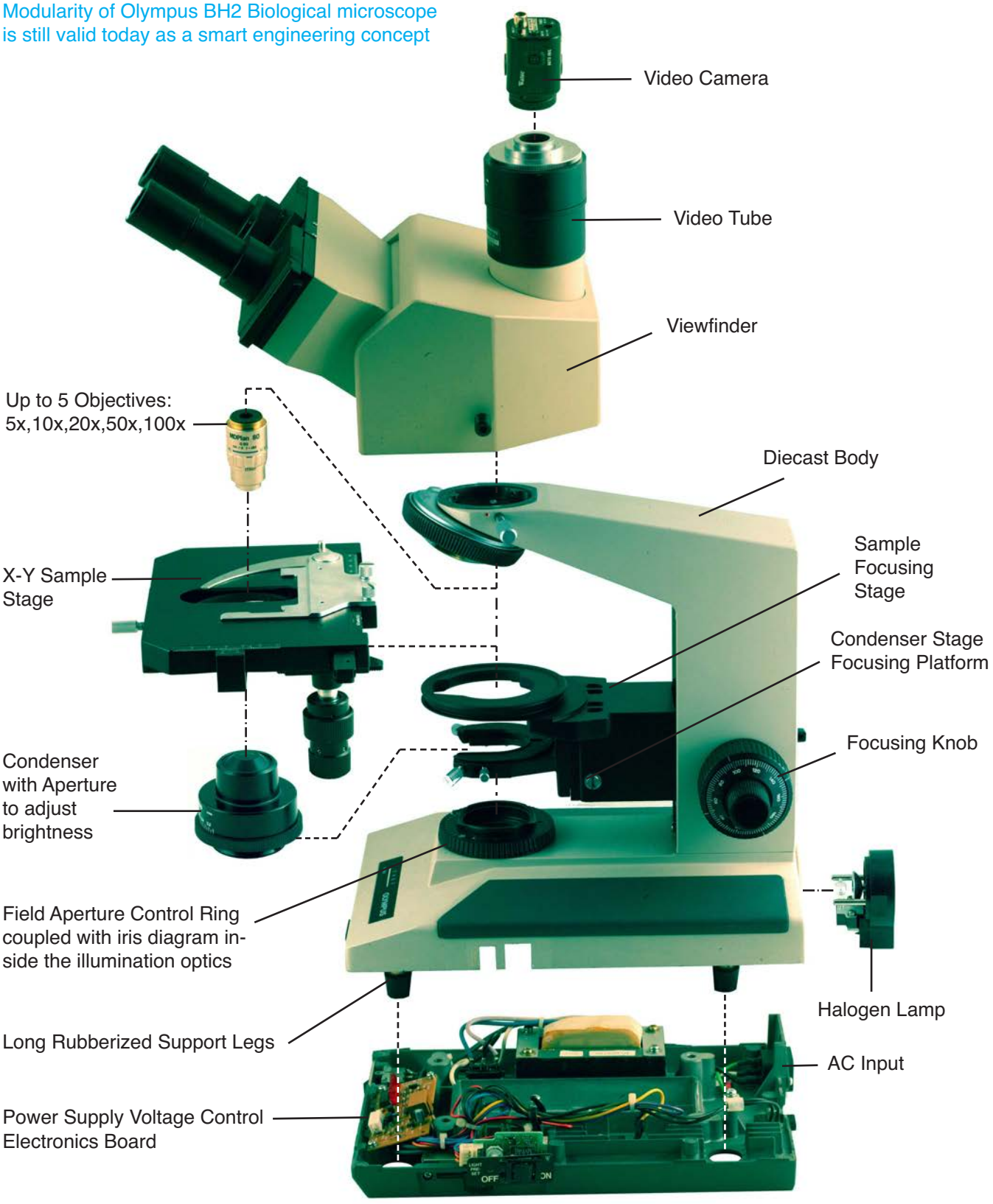
The vintage versus the modern microscope

So I decided to let go of everything else, and focus my efforts to microscopy. Microscopes have so much optomechanics squeezed in such a small volume that if Optoform could handle this task in a modular, and versatile way, then it could setup almost everything else. From seeing microscopy setups, and other documentation aleady available for Optoform (Optomechanics Guide 1 published in 2007), one could extract their own ideas to do most biomedical applications, interferometry, spectroscopy, etc.

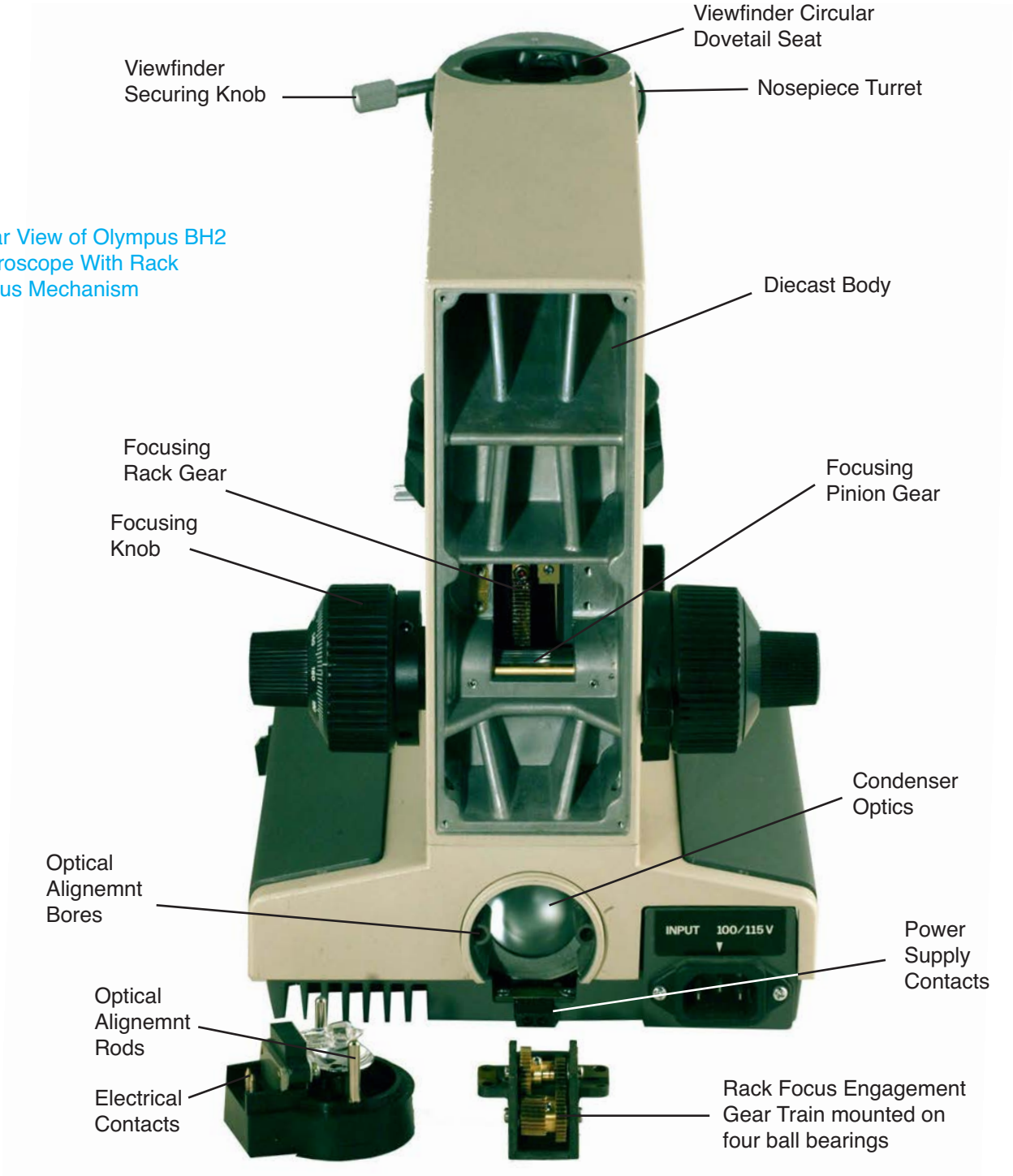
While selling microscopes, I have seen two types of customers; Those who would just turn on their microscope, and start using it, and those who keep tinkering with it to see if they could improve its image quality. You could usually tell who has been using a microscope by seeing whether the optics is kept clean or not. For those who want to participate in constant image improvement, I think an Optoform microscope would be the ideal instrument. But no matter who the end user, a fully integrated microscope is necessary. People want a self holding, all built-in instrument that may be removed from a work bench just like an ordinary microscope.

What's considered today as versatile microscopy tools looks like anything but a microscope. So let's first review a good design. I'll pick a microscope like Olympus BH2 (opposite page) for our study so we could first learn to appreciate what a good design looks like. Opto-mechanix is really an art. The way this 30 year old microscope has been put together is so smart, and has stayed valid through time. The Olympus concept was to design all the essential parts even the power supply electronics to be modular. This allowed each module to be separately assembled, and tested but eventually all the pieces were put together, and shipped as one unit.

Modularity of Olympus BH2 Biological microscope is still valid today as a smart engineering concept



I have been going through so many shows, and have seen so many designs and shapes come and go but this classical shape of microscope has always been people's choice. Why is this shape so successful? The reason is proper placement of the viewing eyepiece (up front), and placement of support column, and focusing knob (on the back side), and the Halogen lamp to allow the illumination optics to lay flat at the base. The old fashioned transformer-type power supply surrounding the illumination optics (above), also gives the microscope the right balance by putting most of the weight at the base. Note the microscope legs actually pass through the power supply assembly to land on the floor.



Rear View of Olympus BH2 microscope With Rack Focus Mechanism

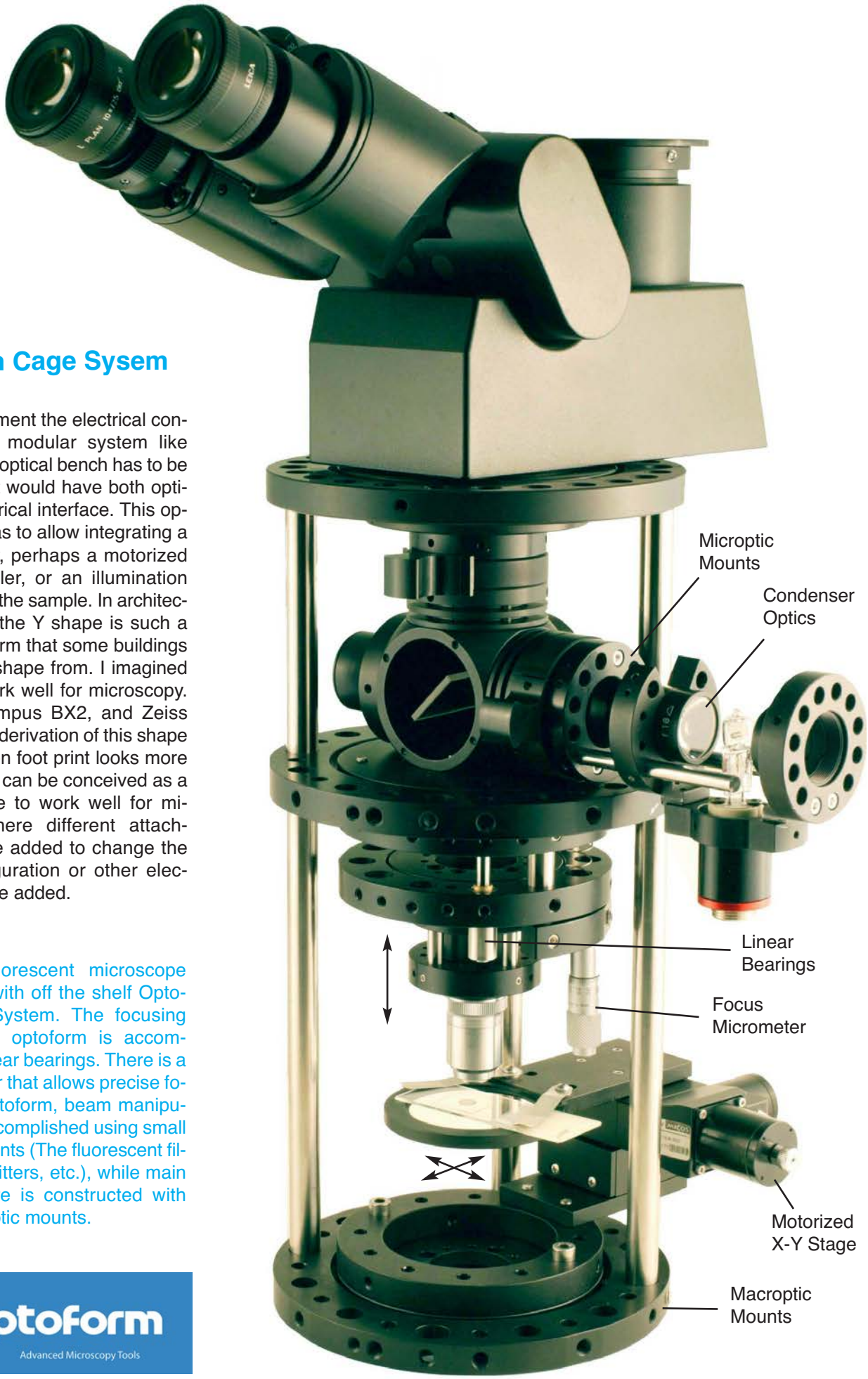
The last thing I would like to discuss is the focusing mechanism in this microscope, and most importantly, the Halogen lamp housing. Olympus, much like Nikon, Leica, and Zeiss, likes to play with gears. If you think backwards, the rack, and pinion is basically geared down to reach the fine focusing knob. This way, the weight of the stage will never be heavy enough to rotate the focusing knob, and everything will stay locked after focusing. The very good engineering approach is to mount these gears on four ball bearings to achieve super smooth focusing movement. I know both Zeiss, and Leica have been using the right grease in their instruments. Japanese manufacturers have a long history of doing it the right way but China just doesn't seem to want to let go of their sticky gue grease (that you would avoid when getting near trees), and has been using it in their student grade microscopes for past 40 years.

But what's so special about the Halogen lamp holder? Not that what I am about to say about the new Optoform concept has originated from this, but now that I look at it, I see it's the same idea. There are two alignment rods that mount the Halogen lamp housing to the back of microscope (see above) while there are two more electrical contacts that connects it to the power supply. This is what we'll be discussing next because we have just added electrical contacts in the same manner to our Optoform cage system. But first lets take a look at what an Optoform microscope looks like.

Optoform Cage Sysem

Now to implement the electrical contacts onto a modular system like Optoform, an optical bench has to be designed that would have both optical, and electrical interface. This optical bench has to allow integrating a power supply, perhaps a motorized stage controller, or an illumination path beneath the sample. In architectural design, the Y shape is such a meaningful form that some buildings borrow their shape from. I imagined this might work well for microscopy. Actually, Olympus BX2, and Zeiss are already a derivation of this shape (Zeiss Axiotron foot print looks more like a T). This can be conceived as a modular base to work well for microscopy, where different attachments can be added to change the optical configuration or other electronics may be added.

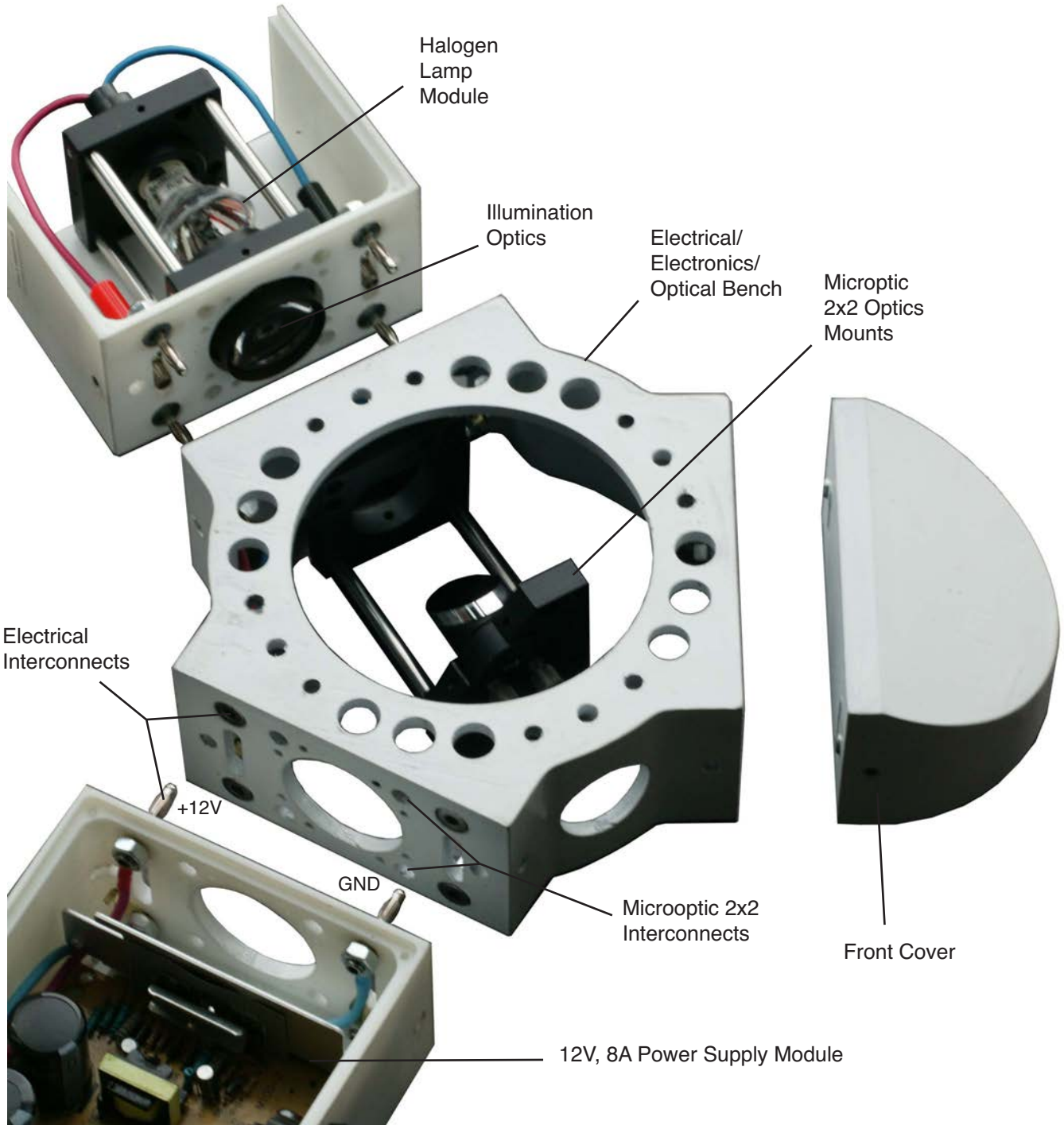
Right, a Fluorescent microscope constructed with off the shelf Optoform Cage System. The focusing translation in optoform is accomplished by linear bearings. There is a lift micrometer that allows precise focusing. In Optoform, beam manipulations are accomplished using small Microptic mounts (The fluorescent filters, beamsplitters, etc.), while main body structure is constructed with larger Macroptic mounts.



Optoform's new logo to reflect new vision

So what we added to Optoform were four electrical lugs that would transfer power between separate modules. This is easier said than done but it basically eliminates wires, and is a means for connecting modules together. In principle, Optoform has a huge range of accessories to construct optical setups, but it would need a new series of attachments to be added specifically for microscopy. The advantage would be obvious: A microscope that can be upgraded to take different forms, while other available microscopes do not allow these fundamental changes.

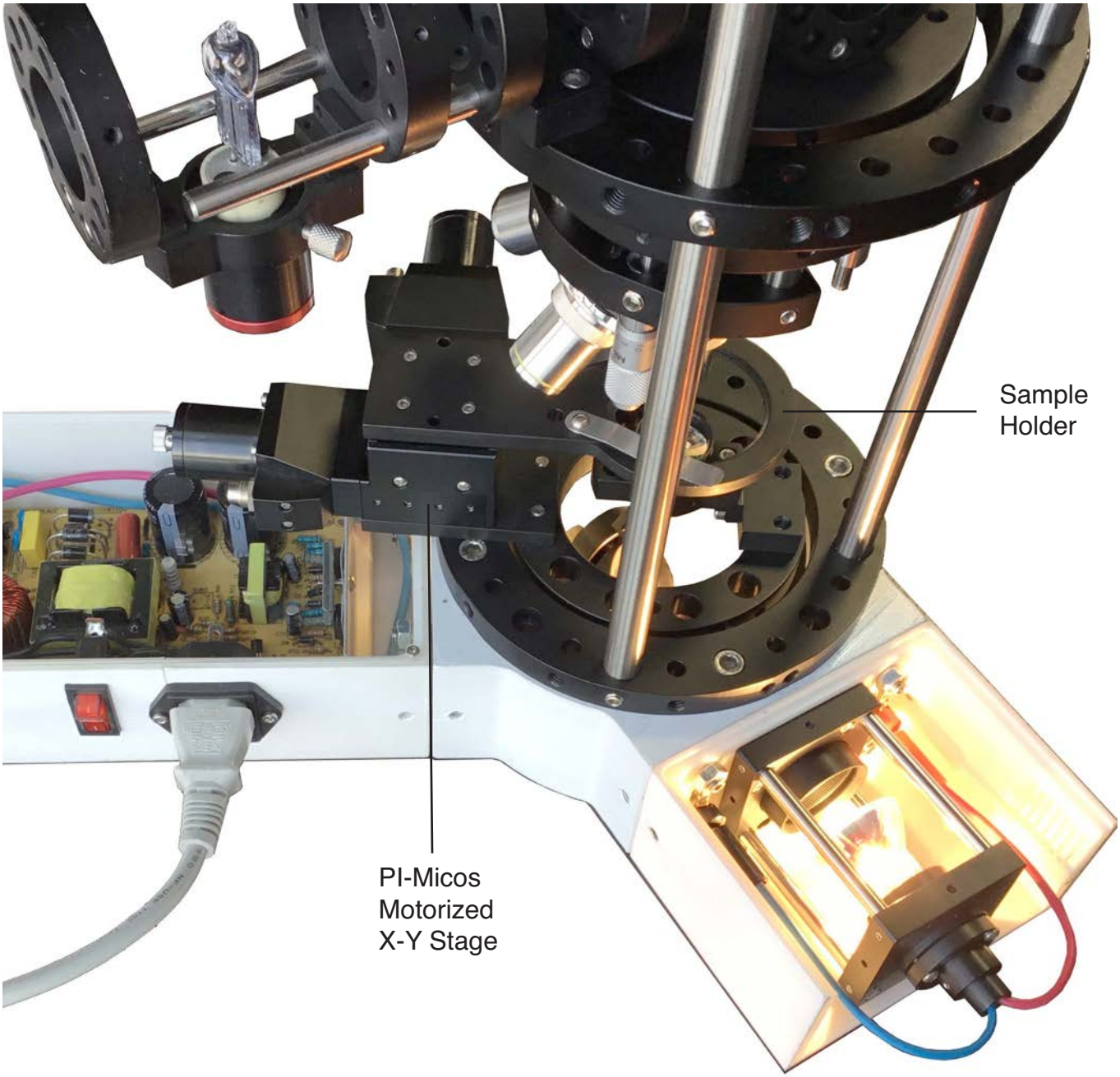
While documenting Optoform applications for many years, I have seen very few endusers who would just follow the instructions on the user's guide. Most people like to tinker with it so they could figure it out on their own. When an M&A was signed with Edmund optics to sell it, I was asked to train their staff the know how to produce them. At that time, they weren't interested in learning design details but when they began producing it, they couldn't take their hands off of its design, and started changing the specs without knowing the consequences. I think this had to do with the nature of this system that when people start using it, they would want to do it their way. Unfortunately, these design changes lacked farsightedness. They anodized the mounts glossy to make them look prettier, and they also increased the outer dimensions of the mounts not realizing they would no longer fit inside 2" tubing.



New Optoform Concept reveals modular optical+electrical interconnects for design flexibility

The first crucial part in microscopy is really about high quality illumination. The next important part is the imaging optics. Proper illumination would improve the optical quality of the imaging path in a microscope. This is especially true about confocal, and a scanning microcopy. I have seen two same objectives being used to improve image quality: One objective above the sample for imaging, and the same quality objective below the sample for illumination. This is how important the illumination role is in microscopy. Constructing such a setup is easy with Optoform. Place two separate turrets above, and below the sample, while the focusing translation stage lies in between.

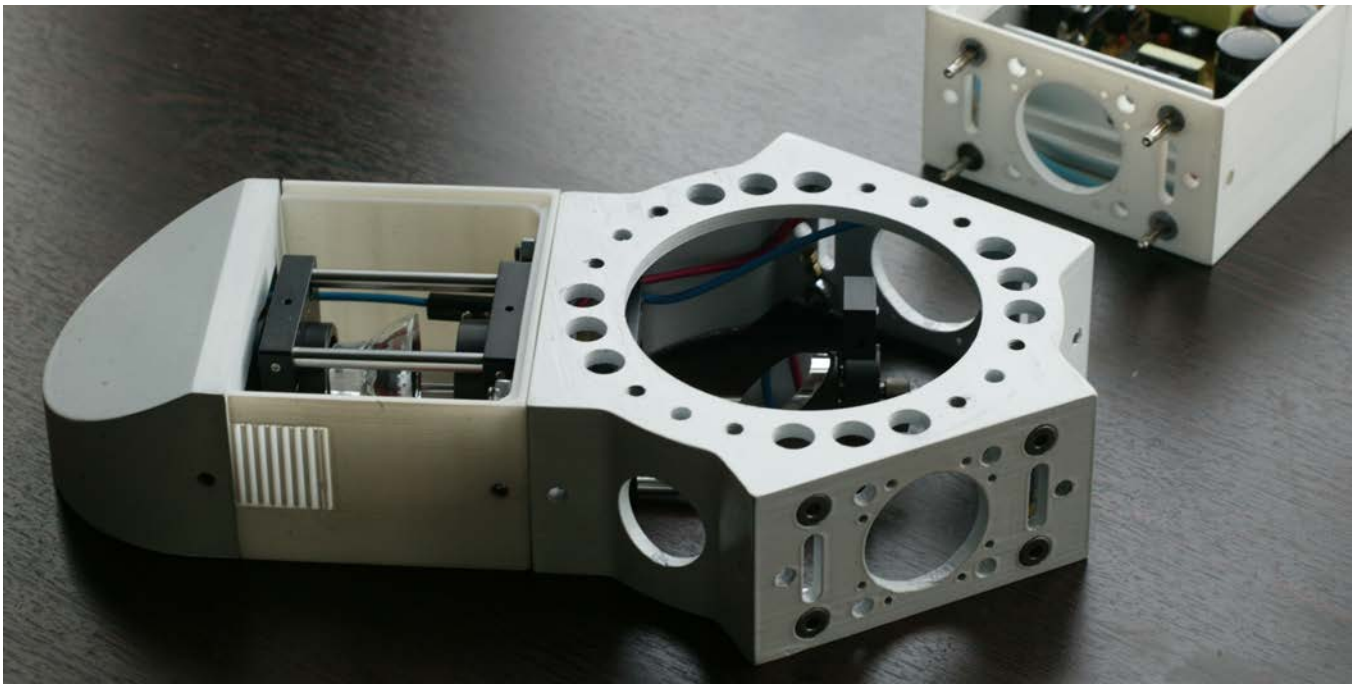
The last crucial part in microscopy is its image sensor, and imaging software. We find it our responsibility to provide the leading edge software to achieve the best final result. This is what the current trend is in microscopy is. It's old fashioned to develop software just for large workstations, and bundle it with a microscope with so much cabling behind a console. Now is the age of iPads, and tablets, and publishing it on the web. I personally hate cables, and would do anything to avoid them. Having taken all these steps, the last part would be to reduce noise in the system. This would become an issue when the imaging cables are placed adjascent to motion control or power supply cables.



Modular microscope built with off the shelf Optoform components, optional motorized stages, and auto focus unit. With modern software routines, this arrangement is being programmed to perform auto search, and image capture of cancer cell in biological sampless, and DNA research.

Optoform is now being utilized at various universities to scan biological samples, and it's also in use in DNA research labs. I think Microscopy gives Optoform a rich playground that it had long needed to show its intended mounting possibilities. The Y shaped base can house all the necessary electronics, and optics layout options. It also increases the stability of the entire assembly to support its vertical structure containing various configurations, such as image capture, and scanning heads, etc. Furthermore, because it is supported by an optics bench, it can be hard-mounted directly on optical tables.

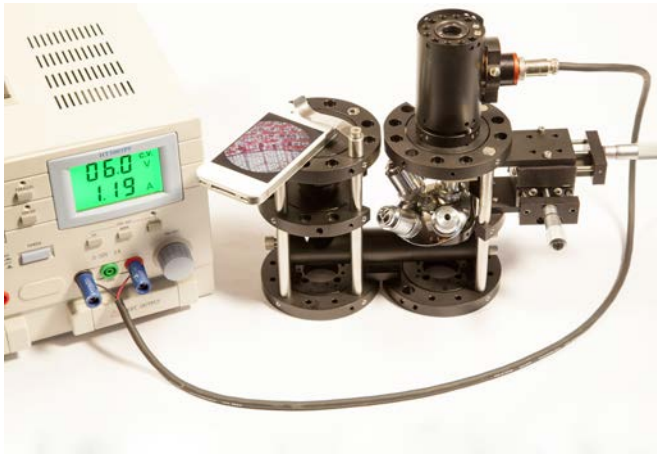
Designing the interchangeable optical becnch blocks for Optoform.

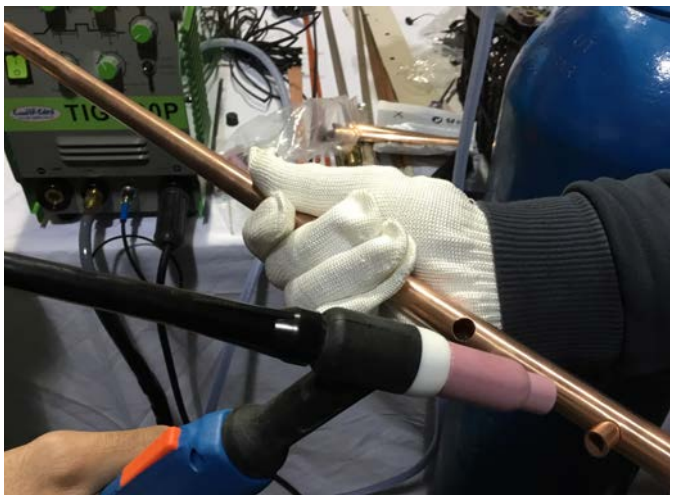


As final note here, although this article introduced some basic ideas to handle the electrical connections, we'll be displaying a new Optoform concept at Photonics West 2019.

We are currently looking for reliable vendors to manufacture Optoform, and distributors in Europe. I have had 18 yeas of experience in producing Opoform parts in US, and it's a real challenge. These are high precision parts that require up-to-date CNC lathes with live tooling, and routine checking with a CMM machine to make sure all the crucial dimensions stay within tolerance.

Various microscope designs constructed with Optoform Cage System.





FabLab group had this spaghetti lamp project that they utilized some of our metal cutting tools to fabricate. This crazy design consists of so 90 brass tubes that are first computer designed, then cut in size, and welded together to form the skeleton of a 3D cube. There are 180 light bulbs, and a complex web of soldering joints that if there is a single short, the entire lamp housing has to be disassembled again to find fix it.

Top right, the joints are being welded together. Above, each brass tube is cut to length, and machined to have the right angle to be tangent to the inner surface of an imaginary cube. Each tube is wired, and then all the connecting wires pass through tube joints so there are no wires exposed. When the final product is lit (right), it has a mesmerizing affect.

Restoration of Lenzkorich 1882 alarm clock for OMiD museum was both challenging, and fun. The internal pendulum is unique to this watch. All the mechanical parts are precision made with hard brass, and steel. This clock was made in Germany by Lenzkorich watch factory in .... Look it up in Wiki

Events Calendar

January 2018

Photonics West, Bios

US, San Francisco 01/27-02/01

February

Photonics Russia

Russia, 2/27-3/02

March

Photonics China / OFC

Shanghai, 3/14-16 /San Diego 03/13-15

April

Analytica

Munich, Germany, 4/ 10-13

May

CLEO

US, San Jose Convention 5/15-17

June

July

Inustrial Export Russia

Yekateringburg, 07/10-12

August

Photonics San Diego

US, San Diego 8/21-23

China Optoelectronic Expo

China, Shenzhen 9/5-8

September

Photonics India

India, Bangalore 9/26-28

October

November

Medica Trade Fair

Germany, Dusseldorf 11/12-15

December