

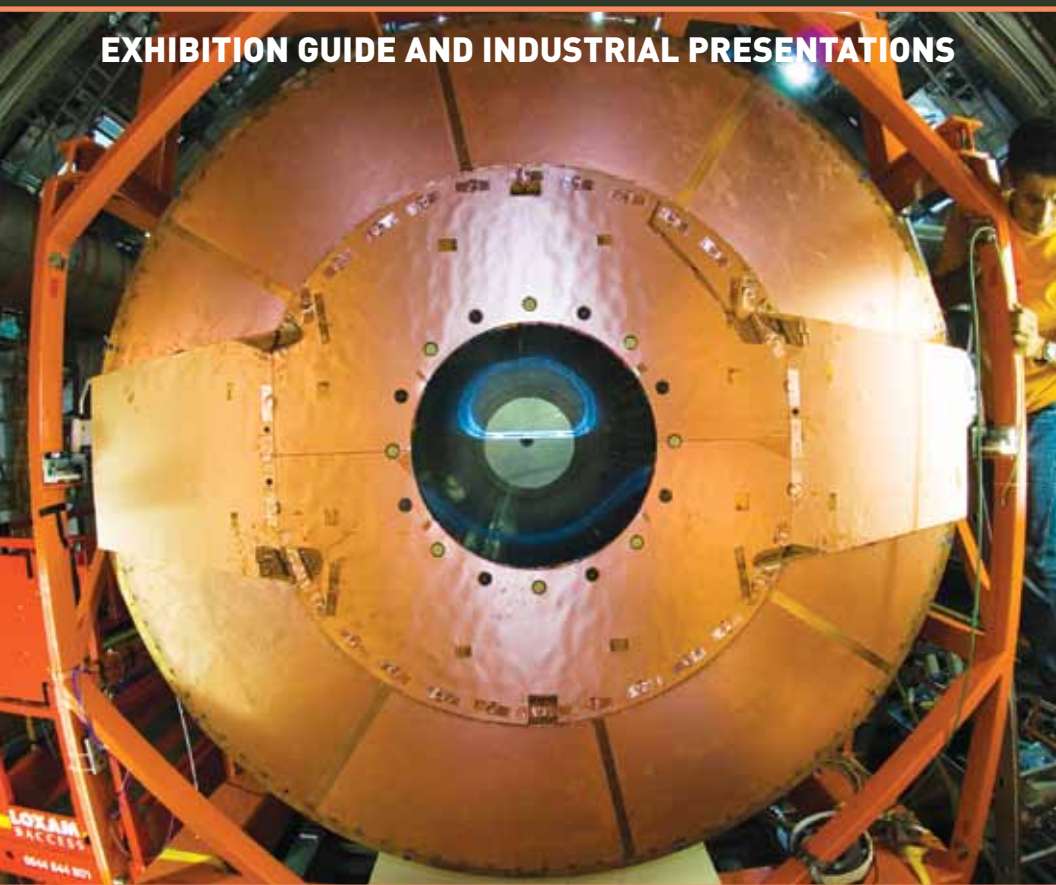
IEEE Nuclear and Plasma Sciences Society

2019 IEEE Nuclear Science Symposium (NSS) and Medical Imaging Conference (MIC)

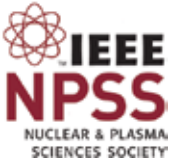
26th International Symposium on Room-Temperature X-Ray
and Gamma-ray Detectors

Saturday 26 October to Saturday 2 November
Manchester Central Convention Complex, Manchester, UK

EXHIBITION GUIDE AND INDUSTRIAL PRESENTATIONS



CONFERENCE WEB SITE: <https://nssmic.ieee.org/2019/>



2019 IEEE NSS-MIC Exhibition Guide

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2019 IEEE NSS-MIC

Nuclear Science Symposium (NSS) & Medical Imaging Conference (MIC) 26th International Symposium on Room-Temperature X-Ray and Gamma-ray Detectors

LOCATION

**Manchester Central Convention Centre
Manchester, United Kingdom**

EXHIBITION HOURS

Tuesday, October 29

Exhibit Open for Attendees: Noon – 7:30 PM

Refreshment Break: Mid-Afternoon

Exhibitor Reception: Starting at 6:00PM

Wednesday, October 30

Exhibit Open for Attendees: 9:00 AM – 6:00 PM

Refreshment Breaks: Mid-Morning & Mid-Afternoon

Thursday, October 31

Exhibit Open for Attendees: 9:00 AM – 4:00 PM

Refreshment Breaks: Mid-Morning & Mid-Afternoon

Exhibition Closes at 4:00 PM

2019 IEEE NSS-MIC EXHIBITORS

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EXHIBITORS

Booth#

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EXHIBITOR PRESENTATION SCHEDULE

All Exhibitor Presentations will take place in Exchange 11

Wednesday 30 October, 2019

- | | |
|-------|---|
| 9:30 | Integrated Circuits and Systems for Radiation Detection and Imaging |
| 10:20 | Silicon Drift Detector for Ultra-Fast Count Rate Processing |
| 10:38 | Readout solutions for SiPM based detection systems |
| 10:56 | NDL SiPMs and Its Potential Applications |
| 11:14 | Recent developments in photomultipliers and associated electronics |
| 11:32 | Readout solutions for SiPM arrays |
| 13:58 | Recent Developments of MPPC at Hamamatsu (Part 1) |
| 14:16 | Recent Developments of MPPC at Hamamatsu (Part 2) |
| 14:52 | SciCompiler: Open-FPGA Configurable DAQ systems |
| 16:18 | 3D-IC Technology for Pixel Detectors & Sensor Devices |
-

EXHIBITORS

Acrorad Co., Ltd.

Booth # 305

**1-11-1 Osaki
Shinagawa-ku, 1410032
Japan
+81-3-34937621
www.acrorad.co.jp**

Acrorad is a company manufacturing CdTe single crystals, CdTe detectors, and devices consistently. Though CdTe has been recognized for its outstanding characteristics as a radiation detector for over 30 years, it was very difficult to manufacture high quality CdTe crystals and detectors for stable supply. After more than 20 years of research activity, Acrorad has successfully developed our own technology to realize 4-inch diameter single crystal by Traveling Heater Method (THM) which enables us to produce the highest quality CdTe radiation detectors in large volume. We exhibit not only the CdTe single crystal itself but also applied products based on this technology such as X-ray and Gamma-ray imagers.

ADVACAM

Booth # 116

**Tietotie 3
Espoo, 02150
Finland
+358-414-313212
www.advacam.com**

ADVACAM s.r.o. designs, manufactures and provides material resolving x-ray imaging detectors based on Medipix photon counting technology. ADVACAM Oy provides silicon sensor manufacturing, solder wafer bumping and flip chip bonding services. In the exhibition ADVACAM will be representing its newest developments in Energy Dispersive X-Ray Diffraction and spectral Non-Destructive Testing X-ray imaging applications. The AdvaPIX and MiniPIX TPX3 detectors are able to provide fast and high energy XRD sample analysis using polychromatic industrial X-ray sources. The WidePIX MPX3 detectors enable high resolution material discriminating static or fast scanning X-ray imaging with signal to noise ratio up to 800 and scanning speeds up to few meters per second.

Alpha Spectra, Inc.**Booth # 606**

**715 Arrowest Ct.
Grand Junction, CO 81505
United States
+1-970-2434477
www.alphaspectra.com**

Alpha Spectra, Inc. Scintillation Detectors for Gamma Detection: First, thanks to the many customers around the world that use our products. The growth of our company has been a result of your repeat business. We are proud of the many different designs that we have made over the three decades that we have been manufacturing scintillation detectors for gamma detection. Our story is given in much more detail on the new website that we recently launched. We hope that you take a moment and review our new website at www.alphaspectra.com. Stop by our booth and we will tell you more about the scintillation materials that we work with and the many designs that we ship worldwide. Alpha Spectra, Inc. since 1986.

AMETEK (GB) Limited**Booth # 309**

**Spectrum House, 1 Millars Business Centre, Fishponds Close
Wokingham RG41 2TZ
United Kingdom
+44-865-4832124
www.ametek.com**

AMETEK ORTEC is an industry leader in the design and manufacture of ionizing radiation detectors, nuclear instrumentation, analysis software, and integrated systems. ORTEC's technologies, superior products, and services are instrumental in the analysis of radioisotopic identification and measurement.

AMPTEK Inc.**Booth # 110**

**14 DeAngelo Drive
Bedford, MA 01730
United States
+1-781-2752242
www.amptek.com**

Amptek brings you the highest performing detectors available and in the format you need. Our family of detectors have lower noise, lower leakage current, better charge collection, and uniformity from detector to detector. This results in superior peak-to-background, peak-to-tail, resolution and a more Gaussian spectrum. See our newest line of ultra-high performance FAST SDD[®], large area FAST SDD[®], improved SDD and our newest Si-PIN detectors. Also, CdTe detectors available with Graphite Windows. Amptek scintillation detectors are used world-wide in nuclear plant monitoring and homeland security applications. For over 40 years, Amptek has defined the true state-of-the-art.

ARALE LAB**Booth # 203**

**Rm636, Korea University R&D Center, Anamro145, Sungbuk
Seoul 02841
Korea
+82-02-9291711
www.aralelab.com**

ARALE laboratory develops various cutting edge technologies in the field of radiation imaging. Developed systems include: Radiation detectors for national security and clinical and preclinical diagnostic nuclear medicine imaging systems for national healthcare. Additionally, software algorithms for high quality imaging tools are boldly explored! Radiation Monitoring: Radiation surveillance system, based on VPTM technology, monitors nuclear terrors and disasters more effectively. It optimizes the performance parameters of surveillance systems for each radioactive condition in real-time. You are able to zoom-in and trace the target through the remote control room. Compact Gamma Camera: Hand-held and light weight gamma ray imaging camera based on a silicon photomultiplier, high resolution scintillator, high speed ADC, SoC-FPGA based data acquisition circuit and target specific collimator. The compactness, powerful performance

and flexible architecture of this device help researchers easily develop their own applications at a faster pace. Medical Imaging Systems: High resolution clinical and preclinical nuclear medicine imaging systems, such as gamma camera and single photon emission computed tomography (SPECT) are under development. Most of the state-of-art radiation imaging technologies are combined to create the first commercialized clinical SPECT that made in Korea.

Avago Technologies GmbH, a Broadcom Inc. Company **Booth # 115**

Wernerwerkstr. 2, c/o Monika Riederer
Regensburg 93049
Germany
49-941-2978-4152
www.broadcom.com

For more information please email: thomas.lichtenegger@broadcom.com
Broadcom Inc. is a leading designer, developer and global supplier of a broad range of analog and digital semiconductor solutions. We combine global scale, engineering depth, broad portfolio diversity, superior execution and operational focus to deliver leading edge products so our customers can build and grow successful businesses today and in the future. Broadcom has entered the field of specialized optical sensors for weak light detection. The main technology of this sensor family is the Silicon Photomultiplier (SiPM). The Broadcom NUV-HD SiPM products show excellent features: a very high PDE in the blue UV combined with a small SPAD pitch of 30 μm , a very uniform and stable breakdown voltage and a very compact and reliable chip-size package (CSP) with TSV. Two different CSP form factors have been released to the market: 3.9mm x 3.9mm and 6mm x 6mm. End of 2019 there will be the release of the 3mm x 3mm CSP. The NUV-HD technology is optimized for PET and radiation applications. Combined with the ASIC capabilities Broadcom is able to provide sensor solutions with optimized readout electronics to reach highest performance with low power dissipation. Broadcom is also working on various R&D topics aimed at enhancing the current technology platform and extending the sensitivity to the near-infrared region.

Baltic Scientific Instruments**Booth # 609**

**Ramulu str. 3
Riga 1005
Latvia
+371-6-7383942
www.bsi.lv/en**

The NitroSPEC the world's smallest liquid nitrogen cooled Spectrometer which is based on High Purity Germanium (HPGe) semiconductor detectors. The NitroSPEC is providing the complete range of functions and features which are offered by regular laboratory Spectrometer based on HPGe detectors but in a really miniature composition of all major components.

Beijing High Energy New Technology Co., Ltd. Booth # 409

**RM302,Chongxin Creative Building, No.18 Shixing East
Street,Shijingshan District
Beijing 100043
China
+86-010-13810515953
www.hent.cc**

Beijing High Energy New Technology Co.,ltd (for short HENT) specializes in R&D for Nuclear technology application and product commercialization. HENT was founded in 1988, as the subsidiary holding shares by Institute of High Energy Physics Chinese Academy of Sciences and Golden Horse Group. With the goal of building nuclear technology incubation platform and productization base, and relying on the strong scientific research ability of IHEP and human resources, By means of technology innovation and system integration, HENT is a new high-tech enterprise dedicating in R&D, production, promotion, sales, service and training that transforms the achievements of science and technology and high-tech new product development on the basis of the existing advanced technology and provides the nuclear detection industry solutions.

Berkeley Nucleonics Corp**Booth # 512**

***2955 Kerner Blvd., Ste D
San Rafael, CA 94901
United States
+1-415-4539955
www.berkeleynucleonics.com***

Berkeley Nucleonics (BNC Corp) is a recognized leader in nuclear instrumentation. We manufacture signal sources and radiation detection systems. For R&D applications, we offer NIM Pulsers, Benchtop Pulse/Delay Generators with low jitter, deep memory Arbitrary Waveform Generators, High Voltage and Optical Pulsers. We also offer isotope identification technology in RIIDs, Backpacks and Vehicle/Portals. For custom solutions, we offer digital MCA electronics and custom scintillators. Our femtosecond timing designs with ultra-fast risetimes are used in High Energy Physics, Nuclear R&D and Aerospace / Laser applications. Founded in 1963, BNC continues to offer leading products, services and accredited training. www.berkeleynucleonics.com

BIC Technology Ltd**Booth # 211**

***Ringtail Court
Burscough I4081b
United Kingdom
+44-0151-3212073
www.bictechnology.co.uk***

Atomtex is a leading world supplier of radiation detection equipment. With continuous R&D and comprehensive calibration laboratory facilities, Atomtex are able to offer the best solutions for radiological measurements. BIC Technology (UK) have been working with Atomtex for 15 years helping to distribute products & advise on market needs.

BRIGHTSPEC NV/SA**Booth # 516*****Waterfront Researchpark, Galileilaan 15 (Darwin)******NIEL 2845******Belgium*****+32-8449586****www.brightspec.be**

BRIGHTSPEC' is a relatively new company producing nuclear and X-ray (XRF) instrumentation. The company has innovative solutions for scintillation-based gamma-ray spectrometry with its tube-based, compact DSP-based MCAs line: bMCA. It should be highlighted, as well, its products for high-resolution X-ray spectroscopy, including bAXIL, a very complete and comprehensive spectrum analysis software. The company also design advance software for the gamma-ray and x-ray spectrometry and related applications. BRIGHTSPEC provides solutions and/or instrument designs and software for the OEM market as well.

C&A Corporation**Booth # 306*****6-6-40 Aza-Aoba, Aramaki,******Sendai 9808579******Japan*****+81-22-3938285****www.c-and-a.jp**

C&A Corporation Booth #306: C&A Corporation was founded in 2012 as a spin-off venture company from Tohoku University, with more than 15 years of experience in bulk single crystals grown from the melt. GAGG, which has the highest light yield among the oxide scintillators. GFAG, which has the highest light yield with fast decay time. HR-GAGG, which has the highest energy resolution among the oxide scintillators. La-GPS, which keeps high light yield, fast decay time and high energy resolution up to high temperature. Eu:SrI₂ and CeBr₃, which has high light yield, high energy resolution. It will be provided in hermetically sealed canister. m-PD furnace, which is the powerful tool for materials screening. It allows us to grow one composition within half a day.

CAEN SpA**Booth # 601*****Via Vetraria 11******Viareggio 55049******Italy*****+390-0584-388398****www.caentech.com**

CAEN SpA is acknowledged as the only company in the world providing a complete range of High/Low Voltage Power Supply systems and Front-End/Data Acquisition modules which meet IEEE Standards for Nuclear and Particle Physics. Extensive Research and Development capabilities allowed CAEN S.p.A. to play an important long-term role in this field. CAEN activities have always been at the forefront of technology, thanks to years of intensive collaborations with the most important Research Centers of the world. CAEN products appeal to a wide range of customers including engineers, scientists and technical professionals who all trust them to achieve their goals faster and more effectively. Strong of the experience in the physics research world CAEN instruments are today used in many advanced industrial applications. Today CAEN is looking far ahead, and its roadmap includes the development of instruments not only for research but for real life applications like Environmental Monitoring, Homeland Security, etc.. A new series of instruments and electronics for the growing SiPM detectors and the digital Spectroscopy have been introduced to satisfy the need of a growing users' community. Products: Modular Pulse Processing Electronics, Waveform Digitizers, Digital Spectroscopy, Electronics for SiPM, Power Supplies, Digital Detector Emulators, Educational Kits Applications: High Energy Physics, Astrophysics, Neutrino Physics, Dark Matter Investigation, Nuclear Physics, Material Science, Medical Applications, Homeland Security, Industrial Applications

CapeSym, Inc.**Booth # 604**

**6 Huron Dr, Suite 1B
NATICK, MA 01760
United States
+1-508-6537100
www.capesym.com**

CapeSym provides radiation detection instruments as well as detectors for OEMs. The flagship RIIDs and detector modules are based on ScintiClear - a new high-performance SrI2(Eu)-based gamma-sensitive scintillator crystals as well as dual-mode isotopically enriched elpasolite scintillators, TlBr semiconductors, and composite materials. RadSolver RIID has excellent energy resolution across the entire energy range, high stopping power, and free of internal activity. It heralds a new era in rapid and accurate identification of complex isotope mixtures in small volumes and shielded containment. RadSolver is a rugged RIID with state-of-the-art nuclide identification software, approved by the IAEA community and widely used in demanding environments all over the world.

CLEAR PULSE CO.,LTD.**Booth # 216**

**6-25-17
Ota-ku 143-0024
Japan
+81-3-37550045
www.clearpulse.co.jp/indexEng.html**

CLEAR PULSE Co., Ltd. is established in 1971. Our products include originally developed spectrum stabilizer, digital rate meter, PC based PHA as the first model in Japan. CLEAR PULSE Co., Ltd. has been enhancing the corporate policy to provide state of the art custom order products to the customers. CLEAR PULSE Co., Ltd. also has been supplying unique AEC NIM Bin series products including standard Bin & PS, low noise charge sensitive preamplifiers including custom made hybrid IC based multi-channel preamplifiers and main-amplifiers. Traditionally CLEAR PULSE 's collaborators are national & public organizations (mostly universities and institutes) for physics and radiation

measurement & control. Our main products are as follows. NIM modules. NIM Bin & PSs, ADCs, Multi-channel amplifiers, Pulse shaping amplifiers, Scaler timers, HV power supplies, NIM blank modules, etc. Physics & radiation measurement instruments. Front-end and Readout electronics for 64 channel and more SiPM and MAPMT. The probes including CdTe/CdZnTe/TlBr/GAGG/SrI2(Eu)/CsI(Tl) with optimized preamplifier. Low Noise Charge-sensitive preamplifiers, Multi-input PHAs, Environmental radiation monitors, Gamma Camera for hot spot finder, Balloon installed cosmic-ray measurement systems, Car-borne/Hand-borne radiation survey systems, Ionization chambers.

Crytur, spol. s r.o.

Booth # 410

Na Lukách 2283

Turnov 51101

Czechia

+420-481-319511

www.crytur.cz/

CRYTUR is one of the world leaders in crystal manufacturing and processing with a strong focus on proprietary research and customised solutions. During the past decades, CRYTUR has gained worldwide recognition as a provider of integrated crystal-based hi-tech solutions for science and industry. Our expertise in precise manufacturing combines deep knowledge and know-how based on more than 70 years of tradition with innovative and modern production technologies. We have a strong focus on niche applications and client specific projects built on high expertise and close cooperation in research and development. Synthetic crystals are the key component of unique solutions provided by CRYTUR. Production portfolio covers laser rods, components and modules, precise detectors for electron microscopy, ionizing radiation detectors, high-resolution imaging systems, light convertors for LEDs or durable protection for temperature sensors.

ET Enterprises Ltd**Booth # 406**

***45 Riverside Way,
Uxbridge UB8 2YF
United Kingdom
+44-01895-200880
www.et-enterprises.com/***

ET Enterprises Ltd is a leading manufacturer of photomultipliers and associated electronic products with over 60 years of experience in photomultipliers and electronics design. We offer a wide choice of high-quality photomultiplier tubes with detection areas of 13mm to 280mm covering spectral ranges of 110nm to 900nm. Our newest range of photomultipliers include high quantum efficiency (QE) photomultipliers with QE up to 35%. We also have a new compact range of photomultipliers which are ideal for scintillation applications. We will be demonstrating our new Multi Channel Analyser products at the IEEE 2019.

Eljen Technology**Booth # 502**

***1300 W Broadway
Sweetwater, TX 79556
United States
+1-325-2354276
www.eljentechnology.com***

Eljen Technology is one of the world leaders in the development and manufacturer of organic plastic scintillation material encompassing cast plastic and liquid scintillators as well as reflective paints, and glues. We have grown to over 60 employees and ship our products worldwide. We have been providing scintillators and assemblies to research and commercial customers worldwide since 1997. Visit our booth for a new catalog of our products and see new developments in organic scintillators. The latest development is our Li6 Loaded PSD Plastic Scintillator (EJ-270) and our ${}^6\text{LiF}/\text{ZnS}$ Thermal Neutron detector (EJ-426).

EPIC Crystal Co.,Ltd**Booth # 315**

***Rm 807, Building 4#, ZhongXin Square
Huaqiao Town, Kunshan City 215332
China
+86-512-5013-5884
www.epic-crystal.com/***

Founded in 2005, Epic Crystal was dedicated to developing and manufacturing scintillation crystals based in Shanghai, China, included the main CsI(Tl), NaI(Tl), GAGG(ce), LYSO(ce), BGO and CdWO₄, within the areas of radiation detection, nuclear medical imaging, security inspection, high energy physics, geological exploration and other relevant field. We are able to provide scintillators in customized design, like the single crystals, linear or 2 dimensional array. We, at EPIC Crystal, are dedicating to serving our clients with CARE and PRIDE.

Field Viewers Ltd Inc**Booth # 112**

***321 Tally Ho Drive
Vernon Hills, NJ 60061
United States
+1-631-9431631
www.fieldviewers.com/***

FIELD VIEWERS mission is to revolutionize the radiation detection market place. Our current product distribution include ASICs suitable for CZT, CdZnTe, Si and gas filled detector readouts for variety of applications.

FLIR Detection**Booth # 111**

**100 Midland Road
Knoxville, TN 37830
United States
+1-865-2283054
www.flir.com/threat-detection/**

FLIR identiFINDER R-Series products help emergency responders detect, locate and identify radioactive materials. We offer a complete line of handheld systems ranging from small belt-worn spectroscopic pagers to large highly sensitive devices capable of rapidly locating and precisely identifying radioactive material.

H3D, Inc.**Booth # 204**

**812 Avis Dr.
ANN ARBOR, MI 48108
United States
+1-734-6616416
<https://h3dgamma.com/>**

H3D® offers the world's highest-performance imaging spectrometers. Quickly identifying and localizing gamma-ray sources with a single measurement, H3D is revolutionizing how measurements are performed. + Fast startup + Compact and lightweight + Industry-leading energy resolution + Highly efficient imaging + User-friendly interface + Cost effective. Customer focused: H3D exists to serve customer needs. With 11 highly trained PhDs and extensive experience in detector applications, we make understanding customer applications and building solutions our highest priority. Available to customers 24/7, we stand by our products. Applications: Offering imaging spectrometers, spectrometers, hand-held directional RIIDs, and specialty systems, H3D has something for almost any application. Read more about our most popular applications below. Nuclear Power & Waste: H3D instruments help find, characterize, and clean up contamination. With our instruments purchased by 60% of US nuclear power plants, our customers find them useful. See a list of the top

16 applications. The H series and P series of instruments are most useful for imaging applications. The S series and P100S are good choices for process monitoring or isotopic quantification. Security: Imagine a handheld detector with energy resolution near HPGe, but weighing five pounds and able to startup in minutes. This is the A400. H3D also offers instruments developed with DOD DTRA; contact us for more information about these products. Environmental: When more efficiency is required, H400 provides over three times the efficiency of H100, while still being able to image source distributions. Medical: H3D developed a proton-therapy imaging system, J6400, in support of an NIH effort. Additionally, the H420 can be used for radiation protection in medical facilities. Specialty Systems: H3D offers custom systems and modular detectors for other applications or integration into other products. Contact us to discuss the details of your application.

Hamamatsu Photonics UK Limited

Booth # 401

***2 Howard Court 10 Tewin Road
Welwyn Garden City, Hertfordshire AL7 1BW
United Kingdom***

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www.hamamatsu.com

Hamamatsu Photonics is a world-leading manufacturer of optoelectronic components and systems. The Company's corporate philosophy stresses the advancement of photonics through extensive research and yields products that are regarded as state-of-the-art. Our products are designed to cover the entire optical spectrum and provide solutions for a wide variety of applications including analytical, consumer, industrial and medical instrumentation. Developments in Nuclear science and Medical imaging continue to be made by Hamamatsu Photonics, with products such as PET Modules, MPPC, MPPC arrays and VUV PMTs. We look forward to seeing you at booth 401/402 where our experts will be happy to discuss any product or application needs you may have.

Hangzhou Yong Hee Photonics Co.,Ltd**Booth # 611**

**39,Xiang Yuan Road,Gong Shu District,
Hangzhou 310011
China
+86-571-88095310
www.lphotonics.com/**

Hangzhou Yong Hee Photonics Co.,Ltd was founded in 2001, we are devoted to manufacture and development of scintillation crystals and array: NaI(Tl), CsI(Tl), BGO, LYSO(Ce), Ce:YAG, Ce:YAP, CdWO₄, Ce:GAGG, Ce:LuAG, Pr:LuAG etc., scintillation detectors: NaI(Tl) detector, CsI(Tl) detector, LaBr₃ detector, Plastic detector, radiation monitoring systems and industrial solutions. We have gone through 18 years and owned a good team and advanced instruments. We are being widely involved in nuclear medical imaging, nuclear radiation detection, high energy physics, food safety testing, oil well survey, cargo safety inspection, aerospace etc.

Hellma Materials GmbH**Booth # 215**

**Moritz-von-Rohr-Strasse 1
Jena 07745
Germany
+49-3641-2877227
www.hellma.com**

Hellma Materials provides high-tech optical crystals and inorganic scintillators. CeBr₃ is the cutting edge scintillation material which is regularly available up to 4 inch in diameter and 6 inch in length. It combines high light yield, high energy resolution and very low internal radioactivity. Based on its outstanding properties Hellma Materials CeBr₃ enables high-end instrumentation for security, medicine and geophysics. In addition to CeBr₃ Hellma Materials provides BaF₂ and CaF₂:Eu for special applications. Recently Hellma added LBC:Ce to its portfolio. This crystal provides excellent energy resolution supplemented by very good scintillation properties at low energies.

Hilger Crystals**Booth # 505*****521 Great Road, Suite 1******Littleton, MA 01460******United States*****978-540-0161****www.hilger-crystals.co.uk**

Radiation Monitoring Devices (RMD) is renowned for its world-class research and development in the fields of radiation detection and imaging, nuclear instrumentation, and non-destructive test equipment. Hilger Crystals is recognized for its excellence in manufacturing synthetic crystals for custom-developed scintillators and imaging arrays - on time and to incredibly demanding specifications. Both RMD and Hilger Crystals are part Dynasil Corporation, a leader in scintillation materials as well as optical coatings and components serving the photonics industry. Learn more about how both companies serve the security, defence, and medical industries at Booth 505 and at <https://www.dynasil.com/>.

Hitachi High Tech Science Americas**Booth # 209*****20770 Nordhoff Street******Chatsworth, CA 91311******United States*****+1-818-2800745****www.hitachi-hightech.com/**

Hitachi High Tech Science America Inc. designs and manufactures the Vortex line of Silicon Drift Detectors (SDDs) for applications ranging from benchtop instrumentation to the most demanding synchrotron spectroscopy and mapping installations. We work closely with end-users on design customization. R&D is a major part of HHT-US's capabilities with the recent introduction of the Vortex ME-7 SDD and also the 2mm thick SDD sensor which extends the capabilities of the Vortex SDD to higher energies.

innoRIID GmbH**Booth # 212**

***Merowinger Platz 1A
Duesseldorf 40225
Germany
+49-2182-823626
www.innoriid.eu/***

Founded in 2014 by Peter Henke, innoRIID is a European small technology enterprise delivering professional products and expert engineering services in the field of radiation detection. Our staff has longstanding expertise in the fields of radiation detection, software engineering and algorithms. innoRIID's main product is the RADEAGLE, a handheld radio-isotope identification device (RIID), which is sold world-wide. This handheld product is based on a series of innoRIID electronical components and software programs that can be modularly combined in different ways. Therefore we also offer customised solutions for the installation and utilization of nuclear detection equipment. We have already deployed such solutions in the academia, health + medical and industrial sectors. To foster the commercial success of our company, we actively contribute to international research projects in the field of radiation detection. Our engagements are focused on research and pilot projects of the US government and the European Horizon2020 programme.

Inrad Optics, Inc**Booth # 511**

***181 Legrand Avenue
Northvale, NJ 07647
United States
+1-201-767-1910
www.inradoptics.com***

Inrad Optics award winning Scintinel (TM) stilbene scintillation crystals for fast neutron detection provide excellent discrimination between neutron and gamma radiation. Scintinel's unique properties make it an ideal candidate for next generation radiation detection equipment for homeland security, nuclear nonproliferation, and neutron detection at nuclear facilities. This high quality crystal scintillator is easily integrated to photomultipliers for a wide range of imaging and sensing configurations. Scintinel (TM) is available from 5mm cubes to five inch diameter cylinders.

Integrated Detector Electronics AS (IDEAS) Booth # 616

Gjerdrums vei 19

Oslo 0484

Norway

+47-900-50265

ideas.no/

IDEAS - Integrated Detector Electronics AS – develops integrated circuits for radiation detection and imaging applications. The company was founded in 1992 with strong background in applied physics, radiation detector instrumentation and electrical engineering. The headquarter is located near Oslo, Norway. The products are application specific integrated circuits (ASICs) for many types of radiation detectors, which are applied in medical imaging, industrial scanning, nuclear science and astrophysics. The circuits can be delivered in any quantity to commercial and scientific customers worldwide. The ASIC designs feature low-noise and low-power amplifiers for the readout of, for example, CZT/CdTe/TlBr, silicon, PMTs/MCPs and APDs/SiPMs/MPPCs. Depending on the requirements, the circuits can be self-triggering, and they can provide fully digital data of the pulse heights, the addresses, and trigger time. For space applications, the circuits can be designed radiation hardened against latch-up and single-event upset. Recent ASIC designs for new technologies support spectroscopic photon counting, dose monitoring, continuous waveform sampling, cryogenic operations, and infrared focal-plane arrays.

iseg Spezialelektronik GmbH**Booth # 302**

***Bautzner Landstr. 23
Radeberg / Rossendorf 01454
Germany
+49-351-269960
www.wiener-d.com***

iseg Spezialelektronik GmbH: Bautzner Landstr. 23 D-01454 Radeberg / OT Rossendorf Germany Phone: +49 351 26 996 0 Contact email: sales@iseg-hv.de Website: www.iseg-hv.com iseg Spezialelektronik GmbH, founded in 1998, and W-IE-NE-R Power Electronics GmbH, founded in 1958, are two very well known and experienced companies in the physics community, often tasked with demanding assignments to create the best possible power supplies for various nuclear and high energy physics detector setups. To be able to offer the most versatile and easy to use products to efficiently supply front end electronics and particle detectors, the two companies decided to team up their development experience. The result of the cooperation is the “Modular Multichannel System”, a modular Low Voltage/High Voltage power supply system easily adaptable to numerous applications in state-of-the-art physics experiments. In addition to that, the companies iseg Spezialelektronik GmbH and W-IE-NE-R Power Electronics GmbH are specialized in standard and customized equipment for Nuclear Physics Experiments and offer the most versatile and highest available specification and quality series of for example multi and single channel High- and Low Voltage Power Supplies, MTCA.4 Power Supplies, NIM-, VME- and CAMAC-Crates as well as Read-Out Electronics such as Preamplifiers, ADC, TDC and Digital Pulse Processors via partner companies. A combined 81 years of experience in small, middle and large scale Physics Experiments worldwide make these two companies the partner of choice for a variety of challenging requirements. The quality and longevity of the products will guarantee a long trouble free runtime of Experiments. www.iseg-hv.com www.wiener-d.com

KETEK GmbH**Booth # 102**

***Hofer Str. 3
Munich 81737
Germany
+49-160-8804111
www.ketek.net***

KETEK Silicon Photomultipliers (SiPM) for optical spectroscopy and ultralow level light detection. KETEK is a leading manufacturer of Silicon Photomultipliers (SiPM), introducing the new WB-Series with next generation chip and package design, allowing economic production of compact and scalable detector arrays at low costs.

kinheng crystal material (Shanghai) Co., Ltd**Booth # 506**

***Room 605, wanda plaza, lane 4995, Gonghexin Rd,
Shanghai 200435
China
+86-21-63063530
www.kinheng-crystal.com/***

Kinheng provided series scintillators including CsI(Tl), CsI(Na), NaI(Tl), GAGG:Ce, LuAG:Ce, LuAG:Pr, BGO, LYSO & Array for Nuclear radiation detection, medical imaging, Security inspection, Oil logging, High energy physics and University education etc. Kinheng supplies customization solutions for users.

Kromek Group plc**Booth # 415**

***NETPark, Thomas Wright Way
Sedgefield TS21 3FD
United Kingdom
+44-1740-626070
www.kromek.com***

Kromek Group plc provides design and high-volume supply of both hardware and software of CZT and scintillation radiation detector components and finished products for the medical OEM, civil nuclear and security sectors. We manufacture in both the UK and the US, supplying worldwide through direct sales and a network of distributors and resellers. Our product offering ranges from x-ray and gamma ray detector sub-assemblies for OEMs to end user radiation detector products ready to go straight out of the box.

labZY, LLC**Booth # 105**

17F BISBEE CT
SANTA FE, NM 87508
United States
+1-505-9200045
www.labzy.com

labZY (www.labzy.com) provides high-performance radiation measurement devices in exceptionally small enclosures. Based on more than 25 years of research and development, we provide real-time, low-noise digital pulse processors and pulse-height analyzers. The nanoMCA(-II) family of 16k channel MCAs offers low-power operation with unmatched low-noise performance. The high counting rate nanoPSD is a real-time digital scintillation spectrometer with embedded pulse-shape analyzer/discriminator. Liquid scintillation counting applications can greatly benefit from our ultrafast nanoTDCR triple-to-double coincidence ratio counting device. The nanoXRS is a highly integrated X-ray spectrometer using a thermoelectrically cooled Silicon Drift Detector. Visit us at booth #105.

Mediso/Bartec Technologies**Booth # 412**

Laborc u.3.
Budapest 1037
Hungary
+36-1-3993046
www.mediso.com

Mediso have been working in the field of nuclear and molecular medicine since 1990 with a profile of development, manufacturing, sales and servicing of multi-modality in-vivo imaging systems. The company offers complete solutions from hardware design to evaluation and quantification software, both for clinical patient care and high-level life science research into all animal models in between rodents and primates. Besides the unique triple-modality clinical SPECT-CT-PET hybrid AnyScan[®] system, Mediso launched the world's first pre-clinical integrated PET-MRI and SPECT-MRI cameras as members of the nanoScan[®] high-end small animal imager family, consisting of SPECT, PET, CT and MRI modalities. Mediso runs successfully two complex clinical diagnostic, research and educational centres and offers clinical and evaluation software trainings for the international medical community.

Micron Semiconductor Ltd**Booth # 109**

***Marlins, Middleway, Kingston Gorse
Littlehampton BN16 1SB
United Kingdom
+44-1903-755252
www.micronsemiconductor.co.uk***

Supplier of Silicon & Diamond Detectors to the Physics & Space Community offering multi strip single-sided and double-sided, ac- or dc-coupled, with or without polysilicon resistor or punch through Foxfet biasing. Total depletion thickness from 15 μ m to 2000 μ m. in 4 inch and 6-inch silicon technology. Cern's LHC-b VELO is now operating successfully post inversion after several years of running in the pre-inversion condition utilising both oxygenated N on N and N-P designs with excess of 2000 channels indicating the superb high reliability of the Micron products in a hostile high radiation environment of LHC now in its post Higgs discovery phase. High Energy Physics has moved to single side P-type silicon in 150 μ m, 200 μ m and 250 μ m for pixels and strips, exception being the KEK Super-Belle and most Nuclear Physics and Heavy Ion Physics and Medical Imaging for Proton Therapy, that favours double sided silicon detectors in 6 inch technology with active area 100mm x 100mm , TTT series offers 14 designs on offer, TTT14, although TTT2 is the most popular DC DSSD 128 strips / side and AC coupled TTT9 with 1024 strips.

Mirion Technologies**Booth # 101**

***800 RESEARCH PKWY
MERIDEN, CT 06450
United States
+1-203-6392620
www.canberra.com***

Our organization is comprised of over 1800 talented professionals, passionate about delivering world class products, services, and solutions in the world of radiation detection, protection and measurement. In partnership with our customers in nuclear power plants, military and civil defense agencies, hospitals, universities, national labs, and other specialized industries, Mirion Technologies strives to deliver cutting edge products and services that constantly evolve based on the changing needs of our customers. Combining state-of-the-art technology with exceptional customer service, Mirion Technologies is dedicated to providing an unmatched experience in radiation detection and instrumentation.

Nalu Scientific, LLC**Booth # 612**

2800 Woodlawn Dr. Ste #240
Honolulu, HI 96822
United States
+1-808-3439204
www.naluscientific.com

Nalu Scientific is a startup company in Honolulu, HI, specializing in fast readout electronics for medium to large size experiments. We are developing System-on-Chip front-end electronics based on our full waveform sampling analog to digital converters. Our SoCs have built-in calibration and feature extraction logic and are low power and fabricated in low cost CMOS technology. Our planned product line-up includes: 1. SiREAD - 64 channel waveform sampling readout chip for SiPMs 2. ASoC - high performance SoC for data acquisition 3. AARDVARC - 6-10 GSa/s waveform sampling SoC for precision timing. We will also showcase previous versions of the products and DAQ boards which are currently in operation.

Novel Device Laboratory**Booth # 405**

Xinwai Street No19, Hai Dian District
Beijing 100875
China
+86-10-62207419
www.noveldicelab.com

NDL (Novel Device Laboratory) provides products of epitaxial-quenching-resistor silicon photomultipliers (EQR SiPMs) and related modules, which feature high detection efficiency, large dynamic range, fast response and cost-effective. EQR SiPM employs intrinsic epitaxial layer to form the quenching resistors, using a continuous cap resistive layer as an anode to connect all the APD cells, that allows large micro cell density while retaining adequate photon detection efficiency; easy to implement ultra-high resolved position-sensitive SiPMs with charge division mechanism. NDL products are suitable to the fields of high energy physics, safety & security, nuclear medical imaging (PET, SPECT, CT) and biological fluorescence detection, etc.

Nuclear Instruments

Booth # 605

via Lecco 16

Lambrugo 22045

Italy

+390-340-3032250

www.nuclearinstruments.eu

Nuclear Instruments is a provider of innovative solutions for the nuclear physics world, focusing on emerging technologies for scientific research, industrial process and security. In collaboration with CAEN, Nuclear Instruments displays several SiPM based solutions. Among these, the new I-spector is a cost-effective, fully integrated SiPM-based radiation detector. It squeezes a SiPM array coupled to a scintillator, high voltage, MCA, Ethernet and LORA communication in the same size of a single PMT, offering a smaller, safer and fully integrated solution. The high-resolution MCA and TDC features make I-spector the best solution both for large experiments and for the industrial world. Moreover, the integrated peak identification and cloud-based alarm monitoring system, coupled with LORA communication, enable I-spector to operate as a stand-alone system for environment monitoring and homeland security. SiPM-based solution catalogue also includes several readout and bias solutions, such as a readout system based on a 64 simultaneous sampling channels, a 128 channels modular readout system based on WeeROC ASICs, digitally controlled 20-85V bias module with programmable temperature compensation. Innovative solutions are not only limited on the hardware side. We thought that we could do some innovation also on the software side. SciCompiler is the future way to design your next experiments: imagine programming FPGAs in the same way of building a readout system for an experiment using NIM modules. This is only a small part of what you can do with SciCompiler. Nuclear Instruments can be your next hardware and software design partner for your ideas.

Nuclear Shields B.V.**Booth # 510**

**Akkervoortweg 5
Vortum-Mullem 5827AP
Netherlands
+31-485-561140
www.nuclear-shields.com**

Improve your image quality. Nuclear Shields is a manufacturer of lead and tungsten collimators based in the Netherlands with more than 40 years of experience. Our lead and tungsten collimators and anti-scatter grids are used in gamma cameras, baggage scanners, and more. We also produce radiation shielding, such as detector shielding boxes and custom lead parts with adhesive backing to easily lead line your equipment. Our production facility is designed to meet the requirements of serial production and one-off custom projects. Lines of communication are short due to our small team of sales and engineering personnel, making it easy to discuss projects and create solutions quickly.

NUVIA**Booth # 404**

**280 AVENUE NAPOLEON BONAPARTE
RUEIL-MALMAISON 92500
France
+33-1-47765497
<http://www.nuvia.co.uk>**

NUVIA, subsidiary of world-leading VINCI Group, is an international company that operates on highly regulated and sensitive industrial sites. Thanks to its solid expertise and historical experience in ambitious international nuclear projects, NUVIA is a key partner for highly demanding industries that place regulatory requirements and safety at the top of their priorities. NUVIA is recognized designer and supplier of sophisticated nuclear measurement & monitoring instruments, radiation detection systems for homeland security, environment and high energy physics, and a software developer for multiple applications.

ON Semiconductor Limited**Booth # 201**

**2nd & 4th Floor Greenwood House, London Road
Bracknell, Berkshire RG12 2AA
United Kingdom
+32-15-446356
<https://www.onsemi.com>**

ON Semiconductor (Nasdaq: ON) is driving energy efficient innovations, empowering customers to reduce global energy use. The company is a leading supplier of semiconductor-based solutions, offering a comprehensive portfolio of energy efficient connectivity, sensing, power management, analog, logic, timing, discrete, and custom devices. The company's products help engineers solve their unique design challenges in automotive, communications, computing, consumer, industrial, medical and aerospace/defense applications. ON Semiconductor operates a responsive, reliable, world-class supply chain and quality program, and a network of manufacturing facilities, sales offices and design centers in key markets throughout North America, Europe, and the Asia Pacific regions.

Oxide Corporation**Booth # 615**

**1747-1 Mukawa
Hokuto 408-0302
Japan
+1-914-4286317
www.opt-oxide.com**

Booth number: 615 OXIDE provides LGSO single crystals for PET. LGSO which emits light by radiation incidence as a scintillation material is mass-produced by OXIDE's highly sophisticated technology of crystal growth with high melting point. Besides LGSO, OXIDE developed other scintillation crystals such as GSO, SrI₂ (Eu) and GPS. These scintillation crystals are well accepted for wide arena of industrial and academic applications, contributing to the field of healthcare and environmental cares. OXIDE can offer crystals for radiation detector and photonics industry. The ability to implement a wide range of growth methods allow us to select the most suitable method.

PETsys Electronics**Booth # 316**

***Taguspark, Ed. Tecnologia I, 24
Porto Salvo 2740-257
Portugal
+351-933-191460
www.petsyselectronics.com***

We are displaying the current version of our Evaluation Kit (eKit). It's intended for customers to evaluate the performance of our ASIC in a close to "plug and play" solution, in a setup that provides the necessary dark and cooled environment. Flyers will also be available.

Photek Ltd**Booth # 610**

***26 Castleham Road
St Leonards On Sea TN38 9NS
United Kingdom
+44-1424-850555
www.photek.co.uk/***

Photek is a specialist manufacturer and global supplier of vacuum based tubes and camera systems for photon detection. We manufacture Image Intensifiers, Solar Blind Detectors, Photomultipliers, Streak Tubes and a range of associated electronics and Camera Systems. We have a comprehensive range of products for most photon detection applications and work with our customers to design bespoke solutions where these are required.

Polymer Assembly Technology, Inc.**Booth # 303**

6581 BELDING RD NE, STE 102
Rockford, NC 49341-9625
United States
+1-919-6096577
www.polymerassemblytech.com

Polymer Assembly Technology (PAT) provides prototype and low-volume flip chip assembly of high-density pixel imaging devices and temperature sensitive II-VI and III-V group materials, including: optical, radiation, and bio-medical sensors, and optical/polymer-MEMS. PAT offers a low-temperature hybridization alternative to Indium Bump Bonding with electrically conductive and non-conductive polymer inks that can be stencil-printed and cured at temperatures as low as 70°C. Single sensors and detectors are assembled directly to ASIC readout chips, or in 2x2 arrays on PCB or ceramic substrates. PAT performs all gold stud bumping of ASIC chip and wire bonding in-house.

Rohde & Schwarz GmbH & Co.KG**Booth # 311**

Mühldorfstraße 15
München 81671
Germany
+49-89-412912749
www.rohde-schwarz.com

With over 80 years of business experience, you can rely on Rohde & Schwarz excellence in high-energy RF signal generation, signal amplification and state-of-the-art test and measurement solutions. With more than 70 subsidiaries and local representations worldwide, Rohde & Schwarz has built up long-lasting relationships within the global research community. Driven by our own curiosity for technical innovation and research development, we are constantly expanding this relationship network – offering our expertise and cutting-edge solutions to our partners. And our global presence and widespread service and support network is a decisive benefit when providing local expertise and on-site support. Our global reach and technical expertise makes us a reliable partner in today's international programs and worldwide projects. Whether your challenge lies in | Elementary particle research | Particle therapy applications | Material characterization or in providing service in fields such as | High-energy particle acceleration | Precise beam forming and monitoring | Reliable and safe particle storage Rohde & Schwarz is your reliable long-term partner with proven solutions to address all of these highly sophisticated requirements. Learn more and visit us at booth 311.

Saint-Gobain Crystals**Booth # 301**

**17900 Great Lakes Parkway
Hiram 44234
United States
+1-440-8345615
www.detectors.saint-gobain.com**

Saint-Gobain Crystals provides radiation detection solutions with superior resolution, gamma-neutron detection and advanced photo-sensor integration. These products are used in a variety of applications including medical imaging, health physics, homeland security, industrial sensing, oil exploration, research applications. Offering a range of scintillation materials: Neutron-Gamma dual detection materials such as CLLB and NaI(TL+Li), high density LYSO with 36ns decay time and LaBr₃(Ce+Sr) with FWHM 2.2% at 662 KeV, in addition to traditional inorganic [NaI(Tl), LaBr, BGO, CsI, CdWO₄] and organic scintillators (Solid BC-408) and fibers technology. We have production facilities and/or sales offices in the USA, France, India, China and Japan. <https://www.crystals.saint-gobain.com/>

Scintacor**Booth # 106**

**125 Cowley Road Cambridge Commercial Park
Cambridge CB40DL
United Kingdom
+44-1424-444883
www.scintacor.com**

Scintacor team will be delighted to greet you at booth 106. Do not hesitate to contact us at sales@scintacor.com or, by telephone at +44 (0)1223 223 060, to arrange a meeting: Scintacor has a long and established history in the manufacture of large area scintillators. Our experience in the design and manufacture of high-performance X-ray phosphor screens (based on Gadolinium oxysulphide, also known as GOS, Gadox Gd₂O₂S) and neutron detection screens (based on Lithium-6) has established relationships with global system integrators, developing a range of products that are used across broad range of applications. Our structured microcolumnar thallium doped caesium iodide (CsI:TI) is extensively used in the most demanding X-ray imaging applications for its superior performance compared to single crystal scintillators.

Scintitech/AMCRYS**Booth # 304**

**1000 Mt. Laurel Circle
Shirley 01464
United States
+1-978-4250800
www.scintitech.com**

From crystal growth to complete nuclear electronic system package manufacturing makes ScintiTech/Amcrys a unique supplier on today's market. Vast variety of NaI(Tl), CsI(Tl) and CsI(Na), ZnSe, CeBr₃, SrI₂:Eu and other scintillation materials and detectors with integrated readout units are in production line for fast delivery as well as customized products according individual specifications. ScintiTech first in the World utilizes 3D printed housing for some type of detectors and assemblies.

Scionix Holland BV**Booth # 504**

**Regulierenring 5
Bunnik 3981LA
Netherlands
+31-30-6570312
www.scionix.nl**

SCIONIX Holland B.V. is a company specialized in the design and manufacture of instruments for the detection of Nuclear Radiation based on the principle of scintillation. The company was established in 1992. Besides a wide range of standard scintillation detectors we supply an extensive variety of tailor-made scintillation detectors to the specifications of the end-user. The main fields in which we are active are Science, Medicine and Industry. Some other areas are Environmental Physics, Nuclear- and High-Energy Physics, Space Research, Medical applications and Security. Keywords in our business model are High Quality and Flexibility with the aim to develop and maintain long lasting relationship with our customers.

Shanghai Project Imp.& Exp. Co., Ltd.**Booth # 411**

**Room 1678 Qijian Building No. 439 Yishan Road
Shanghai 200030
China
+86-21-61531866**

Shanghai Project Crystal Co., Ltd. Room 1678 Qijian Building No. 439 Yishan Road Shanghai 200030, China Telephone: +86-21-61531868 Contact email: sales@pjtelect.com Website: www.pjtelect.com Shanghai Project Imp. & Exp Co., Ltd. (Shanghai Project Crystal Co., Ltd.) was founded in 2008. We are mainly devoted to researching and manufacturing all kinds of scintillation crystals. Our company owns eleven sets of furnaces to grow the scintillation crystals and can meet customers' requests. After nearly ten years of operation, our company has a number of professional production staff and sales team who can give you professional technical support and high quality guarantee. Our products are exported to Europe, America, Southeast Asia and other foreign markets. Our products are praised foreign customers. The main products we will show at the exhibition include LYSO(Ce) crystal, BGO crystal, CsI(Tl) crystal, CsI(Na) crystal, NaI(Tl) crystal, LaBr3(Ce) crystal, Ce:GAGG crystal, plastic scintillator, scintillation crystal arrays and scintillation detectors. All the products are mainly applied to Gamma-ray and X-ray detectors in areas such as PET/SPECT, Nuclear medicine, Nuclear physics ,high energy physics, security scanner, radiation detector and spectroscopy instrument. We warmly welcome all experts and professors to visit our booth#411 and discuss your needs. We are looking forward to meeting all of you at our booth. Thank you so much!

Shanghai SICCAS High Technology Corporation**Booth # 103**

**1295 Dingxi Road
shanghai 200050
China
+86-21-52412901
www.siccas.com**

Established in 1987, Shanghai SICCAS High Technology Corporation is a research-based enterprise wholly invested by Shanghai Institute of Ceramics, Chinese Academy of Sciences (SICCAS). The main products cover varies inorganic non-metallic materials including artificial crystals, structural ceramics, functional ceramics, special coatings and related components. SICCAS, thanks to the tremendous R&D support from Shanghai Institute of Ceramics, has developed various industrial customers worldwide. Through innovation and commercializing lab-technology, SICCAS is able to supply quality products to benefit our customers and greatly committed to meeting the high expectations of our business partners, shareholders, investors, regional communities, and all other stakeholders.

Sichuan Tianle Photonics.Co., Ltd.**Booth # 515**

**#70 Li xing zhi jia, Keji Road, Economic Development
Zone,Chongzhou
Chengdu 611230
China
+86-28-82228986
www.tianlephotonics.com**

Tianle Photonics has a full production capacity of producing and manufacturing all the scintillation crystals/materials and providing our customers with plates, columns, and arrays. We have our own lab to test the scintillation properties and to make sure our products all at the same king quality. We offer professional solutions for scintillation crystal growth, surface treatment and array assembly. We're a company that dedicate to LSO/LYSO scintillator crystal growth and crystal array assembly.

SINTEF AS Minalab**Booth # 104**

***Guastadalleen 23C
OSLO 0373
Norway
+47-982-45162
www.sintef.no***

SINTEF MiNaLab is a leading supplier and pioneer of advanced silicon radiation sensors. The department owns a clean room with state-of-the-art fabrication facilities and a complete silicon processing line with capability of processing complex devices and fine line features down to around 1 μm . The general cleanroom area is of class 1000 where mini environments for sensitive processes are as low as class 10. Our key services are design, prototyping and production of custom design radiation sensors including single- and double- sided strip sensors, pixel sensors, and silicon drift diodes (SDDs) with thicknesses from 10 μm up to 2 mm. On our R&D front, the combination of SINTEF's pioneering radiation detector technology and expertise in Micro- Electromechanical systems (MEMS) has facilitated a series of cutting-edge detectors with 3-dimensional structures, including edgeless sensors, micro-dosimeters that mimic the radiobiological effectiveness on cellular level, and radiation hard sensors that survive the intense flux at the Large Hadron Collider. We pride ourselves of our edgeless sensor technology that has recently reached manufacturing maturity. Other recent research activities include investigation of novel materials such as silicon carbide and nanomaterials like graphene.

Suzhou JT Crystal Technology Co., Ltd.**Booth # 403**

***No 19, Dongcang road
Taicang 215400
China
+86-512-82778036
www.jtcrystaltech.com/en***

Suzhou JT Crystal Technology Co., Ltd. engage to produce superior quality scintillation materials for both Medical and high energy physics PET imaging market since 2012. Lu1.8Y0.2SiO5:Ce and Ce:YSO crystals are ideal generation scintillator crystals which have the advantages of high light output and density,

quick decay time, excellent energy resolution and fast time resolution. These properties make Lu_{1.8}Y_{0.2}SiO₅:Ce and Ce:YSO an ideal material for detection applications in nuclear physics and nuclear medicine, which require higher improved timing resolution and superior energy resolution. Suzhou JT Crystal Technology Co., Ltd. also provide services for crystal cutting, lapping, polishing, processing, and array assembling service according to customer's require. Suzhou JT Crystal Technology Co., Ltd. hold the "Innovative" and "Responsible" operation ideology, and keep providing the high quality Scintillation products and the best service to the customers.

TechnoAP Co., Ltd.**Booth # 501**

2976-15 Mawatari
Hitachinaka 312-0012
Japan
+81-29-350-8011
www.techno-ap.com

TechnoAP Co., Ltd is a leading manufacturer of devices for the radiation measurements, as well as x-rays, gamma rays and neutron detection. We mainly developed unique modules, DPP (Digital Pulse Processor) that provides superior usability by offering a wider energy range, higher throughput and better stability in various applications. TechnoAP Co., is established in 2000. We have over 15 years experience in nuclear physics and industrial market in Japan.

Teledyne Signal Processing Devices Sweden AB Booth # 205

Teknikringen 6
Linköping 583 30
Sweden
+46-72-0162032
www.spdevices.com

Teledyne SP Devices designs and manufactures world-leading modular data acquisition and signal generation instruments. Our products utilize patented calibration logic, the latest data converters, and state-of-the-art FPGA technology resulting in an unrivaled combination of high sampling rate and resolution. Products are available with a range of application-specific features and embedded, real-time signal processing.

Tohoku-MicroTec Co., Ltd (T-Micro)**Booth # 210*****T-Biz-203, 6-6-40 Aza-Aoba, Aramaki, Aoba-ku, Sendai
Sendai 980-8579******Japan*****+81-22-3986264****www.t-microtec.com**

Tohoku-MicroTec (T-Micro) is the unique and advanced 3D/2.5D IC process and MEMS process-oriented Foundry. We provide cutting-edge 3D-IC R&D Prototyping and Pilot / Low-Volume Production Service. (1) State-of-the-art technologies From chip to 12 inch 3D process engineering lines and advanced technology platforms - 3D design / layout / mask making - 3D-IC Processing (Form TSVs, Bump, Redistribution layer and bonding) (2) 3D stacking LSIs prototype manufacturing service - Prototyping of proof of concepts using commercial/customized 2D chips - Die-level 3D hetero-integration with backside TSV technology (3) Support your small-volume, special customized 3D productions - Base-line process set-up for the pilot production - Facilitate your product development (4) 2.5D interposer R&D foundry and pilot production service - Large area interposer - Interposer with passive devices.

Wolfmet**Booth # 503*****M&I Materials Ltd, Hibernia Way, Trafford Park
Manchester M32 0ZD******United Kingdom*****+44-161-8645506****www.wolfmet.com**

Wolfmet is a brand of M&I Materials, an international company headquartered in the UK with offices in the USA, India, China and UAE. Serving more than 60 countries across the globe, M&I Materials is the driving force behind a portfolio of successful brands in addition to Wolfmet, including Midel, Metrosil and Apiezon. From a 13,000m² purpose built factory and headquarters in Manchester, UK, Wolfmet's technical experts and multi-lingual commercial team provides unparalleled support to customers across a range of scientific and industrial sectors.

XGLab S.R.L.**Booth # 509**

***Via Conte Rosso 23
Milano
Italy
+390-02-49660460
www.xglab.it***

XGLab is a leading provider of innovative readout electronics for radiation detectors and instrumentation for X- and Gamma-ray application. The strong focus on Research and Development and the numerous active collaborations with research institutions, synchrotrons and academies makes XGLab the best partner for high quality and technology based product innovation. The main areas of expertise of XGLab are: • ASIC and Electronic Design • Digital Pulse Processors • Radiation Detection Solutions • Instrumentation Design and Customization • X-ray Spectrometers. In August of 2017, XGLab became part of Bruker Nano Analytics (BNA), a division of the Bruker Corporation and a global leader in scientific instruments and solutions for life sciences and materials research, as well as industrial process and quality control. XGLab is headquartered in Milan, Italy.

XIA LLC**Booth # 206**

***31057 Genstar Road
Hayward, NJ 94544
United States
+1-609-2791547
www.xia.com***

XIA LLC develops and sells advanced digital pulse processors and data acquisition systems for gamma-ray and x-ray detectors and related instruments with applications in research, industry and homeland security. Our core technology of high-performance digital pulse processors is available in flexible stand-alone instruments, dedicated embedded configurations, and large multi-channel installations. Our products range from compact, low power cards for handheld instrumentation to rack mounted multi-channel arrays for high rate spectroscopy in the Mcps range and above. XIA also offers a separate product range for ultra-low background alpha counting. Please visit us at booth #206.

Yasu Medical Imaging Technology Co., Ltd. Booth # 312

628 Yoshiji**Yasu-shi 520-2413****Japan****+81-77-5845300****www.ymitech.com**

Yasu Medical Imaging Technology Co. Ltd. YMIT, located in Yasu city, Japan, develops and produces high performance scintillators which convert x-rays into visible light. These are utilized in a wide range of areas from Medical Imaging to Nondestructive Testing across the globe, YMIT's advanced technique to attach and deposit high performance scintillators directly to sensors significantly contributes to lower doses of radiation and less noise. Our mission is to remain at the forefront of technology innovation and revolutionise Digital Imaging. YMIT Tokyo branch office : +81-3-6441-2530 Contact : Ms. Midori Iimura,, email: iimura@ymitech.com

EXHIBITOR PRESENTATIONS

Location: Hanover A-B, Hyatt Regency Atlanta

Wednesday 30 October, 2019

9:30 **Integrated Circuits and Systems for Radiation Detection and Imaging**

Presenters: D. Meier, Integrated Detector Electronics AS (IDEAS), Oslo, Norway

We will present our latest ROIC/ASICs and detector systems: low-noise amplifiers, PMT and SiPM readout for spectroscopy and energy binned counting (SIPHRA and APOCAT ASICs), focal-plane array readout (NIRCA for earth observation and astronomy) and infrared ROICs. We also show latest results from gamma cameras and spectrometers.

IDEAS designs readout integrated circuits (ROIC) and detector systems. We develop new products based on our ROICs and application specific integrated circuits (ASICs). We have designed integrated circuits for scientists and engineers working at ESA, NASA, JAXA, CAS, ISRO, ESS, ESO, CERN, DESY, INFN, GSI, JINR, KEK, etc. We also work on commercial products with partners and companies in radiation detection and imaging technologies, for example, infrared cameras. We are specialized in analog and digital (mixed-signal design) designing in full-custom CMOS with various foundries.

10:20 **Silicon Drift Detector for Ultra-Fast Count Rate Processing**

Presenters: S. Barkan, V. D. Saveliev, E. Tikhomirov, Y. - N. Wang, M. Zhang, E. V. Damron, D. Redfern, Hitachi High-Technologies Science America, Inc., Chatsworth, California, United States of America

Hitachi High-Technologies Science America, Inc. (HHS-US) is a manufacturer of Silicon Drift Detectors (SDDs) for various applications. We are very well known in the synchrotron community as the supplier of single and multi-element SDDs. Multi-element SDD systems with good energy resolution at very high count rates and are capable of collecting quality spectra and x-ray images in a short time are recently at work in several synchrotron facilities. We have developed several multi-element SDDs which, when combined with advanced Digital Pulse Processors (DPPs), produce spectroscopic systems for high-flux chemical analysis and high quality x-ray mapping. Some of the multi-element SDD products in use are: a 3-element focal design ("Vortex ME3"), a 4-element SDD ("Vortex ME4"), and a 7-element SDD ("Vortex ME7"). In 2018 we completed

the development of a 7-element SDD (the Vortex ME7). Each element of the 7-element SDD has a 50 mm² effective area for a total area of 350 mm². The 7 elements are designed to have the best “packing factor” to minimize dead space and to locate the elements as close as possible to the center. The snout diameter of the Vortex ME7 is only 1.5” (38.1 mm). The ME7 resolution (FWHM - Full Width Half Maximum) performance of a manganese (Mn) sample (5.9 keV) is 270 eV at 5 Mcps and 450 eV at 7 Mcps per channel. This performance was measured with an advanced digital pulse processor (DPP). Resolution at low count rate (at 100 Kcps) is better than 140 eV for all elements combined. Each element of the 7-element SDD array is a 50 mm² effective area for a total area of 350 mm². There is no additional cooling, for the entire spectrometer, beyond the built-in TEC (Thermo-Electric Cooler). Application results of the new multi-element SDD products including the ME7 will be presented at the conference.

10:38 Readout solutions for SiPM based detection systems

Presenters: A. Abba, F. Caponio, C. Alberto, Nuclear Instruments, Lambrugo, Italy

In last two years SiPM detectors performance in terms of noise and sensibility have been improved and become a valid alternative to PMT. Nuclear Instruments developed an innovative detection system based on SiPM coupled with scintillator that can fully replace a PMT detector: it includes bias, preamplifier, shaper, MCA, wireless LORA, ethernet, USB communication and a TDC for event time stamping; all these features in less than the size of a PMT with a power consumption of two watts. The long range communication and the low power make it suitable for environmental monitoring solutions.

One of the most common issue with SiPMs is that they change their gain with the temperature. We develop a compact HV bias module that uses a lookup table to compensate in realtime the bias voltage in order to keep constant the gain. In large area detection system or in device used in surgery there is no space to collocate a temperature sensor close to SiPM. We are developing a new method that uses the SiPM detector itself as a temperature sensor in order to make the temperature measurement exactly inside the device without the needed of external detector.

In order to readout SiPM matrix for imaging purpose, Nuclear Instruments (in collaboration with CAEN and WeeROC) developed two new programmable platforms. The first solution uses, Petiroc and Citiroc ASIC and it designed for scientific experiments with very high density of channels. The second system directly samples the SiPM signal, channel by channel, dumping waveforms from each channel, calculating the spectrum and the image, event by event, in realtime.

Due to the large number of application where these two systems can be used, it was impossible to develop a single firmware that could be simply configure in order to make it suitable for every solution. Nuclear Instruments developed a new software called SciCompiler that, starting from a graphical block diagram, it automatically generates the firmware for the readout system.

10:56 NDL SiPMs and Its Potential Applications

Presenters: D. Han, Y. Peng, K. Liang, R. Yang, Beijing Normal University, Novel Device Laboratory, Beijing, China

In the past ~10 years, NDL (Novel Device Laboratory, Beijing) has developed a novel SiPM technology, i.e., a SiPM with epitaxial quenching resistors (EQR). It has small micro APD cells, large micro cell density, high fill factor, simple fabrication technology and cost-effective. It is benefit to achieve large dynamic range while retaining high photon detection efficiency (PDE). On the other hand, EQR-SiPM features a cap resistive layer (CRL) to connect all the micro APD cells, thus is easy to implement for charge division mechanism and realize a position sensitive (PS) SiPM.

In this talk, the author will present the latest development of NDL EQR-SiPMs as well as their unique potential applications in HEP (high energy physics) calorimeters, ultra-high resolving scintillation imaging and so on.

11:14 Recent developments in photomultipliers and associated electronics

Presenters: T. Gomes, ET Enterprises Ltd, Uxbridge, United Kingdom

ET Enterprises Ltd is a leading manufacturer of photomultipliers and associated electronic products with over 60 years of experience in photomultipliers and electronics design. We offer a wide choice of high- quality photomultiplier tubes with detection areas of 13mm to 280mm covering spectral ranges of 110nm to 900nm. Our newest

range of photomultipliers include high quantum efficiency (QE) photomultipliers with QEs up to 35%. We also have a new compact range of photomultipliers which are ideal for scintillation applications.

ET Enterprises specialises in electronics development for photomultipliers. Our high voltage power supply range consist of active transistor based high voltage power supplies and those embracing the direct CW based power supplies that have ultra-low power consumption. Our signal conditioning electronics for fast transient signals, photon counting and analogue applications include amplifiers, amplifier discriminators and counter timers. These devices come in a fully integrated detector module form.

This year we are releasing a new MCA (Multi-Channel Analyser) Base and a MCA module, especially designed for spectroscopy applications. The MCA base is specifically designed for gamma ray spectroscopy applications with NaI(Tl) scintillation detectors. It consists of a high voltage power supply and a preamplifier and uses powerful digital signal processing to provide a multichannel analyser with a USB connection. Our MCA module is a portable spectrum analyser which comes with three input channels for studying single photo-electron response of photomultipliers, gamma ray spectroscopy applications with NaI(Tl) scintillation detectors and plastic scintillation detectors. Both analysers come with open source windows application software which allows rapid integration into user's radiation detection systems.

11:32 Readout solutions for SiPM arrays.

Presenters: R. Bugalho, L. Ferramacho, C. Leong, Petsys Electronics S>A, Oeiras, Portugal, T. Niknejad, LIP, Lisbon, Portugal, J. C. Da Silva, R. Silva, M. Silveira, Petsys Electronics S>A, Oeiras, Portugal, S. Tavernier, VUB, Physics, Brussel, Belgium, Petsys Electronics S>A, Oeiras, Portugal, J. Varela, LIP, Lisbon, Portugal, Petsys Electronics S>A, Oeiras, Portugal

PETsys electronics S.A. is a spin- off company from CERN concentrating on providing readout solutions for applications reading of a large number of SiPM photo-sensor pixels and where a high data rate and excellent time resolution is required. The readout is based on the TOFPET2 ASIC. This is a low power ASIC with 64 channels optimized for reading SiPMs for Time Of Flight PET applications. Typical application are in medical imaging and in basic physics experiments.

The performance characteristics of the ASIC will be presented, and overview of the readout solution will be given, together with a brief discussion of the possible applications. Further developments of the ASIC will also be discussed.

13:58 Recent Developments of MPPC at Hamamatsu (Part 1)

Presenters: K. Yamamoto Hamamatsu Photonics K.K., Solid State Division, Hamamatsu City, Japan

More than 10 years have passed since Hamamatsu started developing the MPPC, which is a part of the SiPM family. The most important feature is its photon counting capability due to its high gain and low noise, but the MPPC has many additional features such as compact size, low operation voltage, robustness, high detection efficiency, and immunity to magnetic fields. Over the years, various types of MPPC technology and devices have been developed for specific applications such as academic research, medical, precise measurement, and industrial. Our most successful developments include the MPPC coupled with a scintillator for HEP and for TOF-PET for cancer detection. Recent developments resulted in covering different wavelength regions such as VUV, VIS, and NIR, to make the MPPC suitable for a wider field of applications. Recently, the demand for NIR-enhanced MPPCs has become very popular in distance measurement applications in the automotive industry. In addition to developing the detectors, Hamamatsu has also developed ASIC, power supplies, and modules using these components to make it easy for customers to design their systems. In this presentation, we will discuss new devices that we call "Hybrid MPPC SPAD." In these new devices, the 1D or 2D MPPCs are connected, to especially design photon-counting ASICs through wire bonding or bump bonding. We also recently developed the 2D InGaAs MPPC with ASIC, which is an infrared-sensitive SPAD. Some of our modules will be introduced in this presentation.

14:16 Recent Developments of MPPC at Hamamatsu (Part 2)

Presenters: K. Yamamoto, Hamamatsu Photonics K.K., Solid State Division, Hamamatsu City, Japan

More than 10 years have passed since Hamamatsu started developing the MPPC, which is a part of the SiPM family. The most important feature is its photon counting capability due to its high gain and low noise, but the MPPC has many additional features such as compact size, low operation voltage, robustness, high detection efficiency, and immunity to magnetic fields. Over the years, various types of MPPC technology and devices have been developed for specific applications such as academic research, medical, precise measurement, and industrial. Our most successful developments include the MPPC coupled with a scintillator for HEP

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14:52 SciCompiler: Open-FPGA Configurable DAQ systems

Presenters: A. Abba1, E. Caponio, A. Cusimano, Nuclear Instruments, Lambrugo, Italy

The increasing use of programmable logic devices in trigger and data acquisition systems shows the need to have general purpose platforms and technicians dedicated to the firmware development. The advantage of employing programmable logic devices with respect to standard logic modules (like NIM logic modules) is remarkable: a single programmable logic device includes the potentiality of hundreds of thousands of standard logic modules. For the technicians, who usually work with standard logic modules, the use of specific languages like VHDL or Verilog for the firmware development could represent a limitation in the spread of these powerful devices. In this presentation, we show an innovative method to simplify the firmware development. The method is based on a graphical programming interface consisting of ip-cores developed ad-hoc for nuclear physics applications. As an example, any trigger logic could be implemented by connecting specific blocks in the graphical interface, as easily as physically connecting NIM modules in a rack. The SCI-COMPILER (Scientific Compiler) software allows to develop both purely digital applications, exploiting blocks like scaler, counter, pattern matching, logic analyzer and state machine, and analog processing applications, such as custom multichannel analyzer using charge integration, trapezoidal filter, spectrum and oscilloscope blocks. In addition, the SCI-COMPILER software provides the functionality to read and test the ASICs, enabling the user to develop a sequencer for the ASIC

control, to acquire data using digital or analog signals and the I2C or SPI programming. The SCI-COMPILER software focuses the attention only on the functional blocks of the application to be implemented and does not require a deep knowledge of the device in use, enabling the employment of programmable logic devices also to users who are not experts in firmware development.

16:18 Tohoku-MicroTec Co.: 3D-IC Technology for Pixel Detectors & Sensor Devices

Presenters: M. Motoyoshi, Tohoku-MicroTec Co., Ltd (T-Micro), HQ, Sendai, Germany

Large-scale integration (LSI) technology has been widely applied in two dimensions over the past four decades and now moves into the era of sub-10-nm node. To maintain the scaling trend, new transistors with three-dimensional (3D) structures, new materials, and new processes have been introduced. From the economic viewpoint, the development and manufacturing cost of systems on chip has skyrocketed. A 3D-IC is an effective solution for reducing the manufacturing costs of advanced 2D LSI while ensuring equivalent device performance and functionalities. This technology allows for a new device architecture of stacked detectors/sensor devices with a small dead sensor area and facilitates hyper-parallel data processing. Currently, many methods to realize 3D-LSI devices have been developed by focusing on the unit processes of 3D-IC technology: (1) through-silicon via (TSV) formation, (2) bump formation, (3) wafer thinning, (4) chip/wafer alignment, and (5) chip/wafer bonding. However, these unit processes are incompatible in terms of various device and process requirements such as process temperature, device structure, TSV and bump dimensions, yield, reliability, and supply chain. We focus on applying this technology to real circuit test devices, namely, pixel detectors or stacked sensor devices with a compound semiconductor sensor device and silicon readout (RO) integrated circuit. The simplest structure of 3D-pixel detectors and stacked sensors is the two-tile face-to-face stacked device with a fine-pitch μ -bump bonding. This requires bump formation, wafer thinning, chip/wafer alignment with small alignment error, and chip/wafer bonding techniques with the adequate temperature and pressure. In my presentation, recent 3D-IC technology and market trend are introduced. And also the two types of Au micro-bump technologies apply to pixel detector/sensor are presented.

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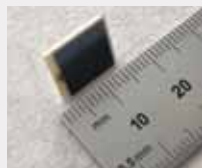
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