2021

Taiwan Instrument Research Institute

儀科中心110年報

ANNUAL REPORT

110 年儀科中心年報
TIRI Annual Report 2021

目錄 Contents

主任的話
Words from Director General

回顧 110 年，全球仍籠罩在新型冠狀病毒 (COVID-19) 不斷變種的疫情下，國內雖受國際疫情影響，但在全體國人共同努力下，疫情漸趨穩定。儀科中心亦配合政府政策，嚴守防疫規定，並搭配線上溝通軟體與平台，對外仍維持順暢的溝通與交流，且與國際標竿研究單位比利時微電子研究中心 (imec) 完成國內首創之高光譜核心技術發展，共同發表國際重要光電領域的期刊論文，持續強化國際科技與交流之研究能量。同時，配合國家政策推動下世代前瞻關鍵儀器設備之自主研發與應用，完成國內第一套學術用二維材料沉積設備，打造學術界團隊二維材料共同專用研發平台，協助學研界加值整合半導體領域研究成果，樹立國內外之技術指標。

儀科中心完備的跨領域整合之儀器科技研發服務平台，扮演學研團隊的關鍵合夥人，與國內外近 70 所大學院校及研究單位、450 位教授及研究團隊密切合作，提供理、醫、工、生 (農)、文等最廣領域之服務，共同合作研發多項尖端科學研究所需之客製特規儀器設備，協助進行前瞻科學研究；並以全球領先之「次埃解析度 (sub-Å) 原子結構研究與應用」研發服務平台 (點解析度為台灣第一、世界第三的 0.78 Å)，提供國際學術界與產業界全新的視野，以了解先進材料結構與性質之間的連結，支援國內頂尖大學研究團隊，榮獲國研院「110 年度研發服務平台亮點成果獎」特優獎；更與學界共同執行多項科技部重要專案，包括跨 7 校 7 團隊的「A 世代半導體計畫」，支援學研界下世代半導體製程與設備之需求、跨 8 校 9 團隊的「發展智慧製造及半導體先進製程資安實測場域計畫」，協助學界打造物聯網資安場域，深耕我國資安實力、跨 6 校 9 團隊的「智慧微塵感測器技術服務平台計畫」，協助學界發展微小化與低功耗特性之智慧微塵感測器，加速感測器國產化之進程。

本中心積極鏈結學、研、產各界之生醫、半導體、光電等之技術能量，與中央大學合作協助其進駐廠商進化光學公司，共同研發第三代半導體核心材料的矽基氮化鎵晶圓磊晶技術，成功應用於大面積 8 吋矽晶圓，技術全球第一，將帶領台灣半導體供應鏈邁進一個新里程碑。並聯手國內頂尖大學與醫院合作開發創新醫材，包括：與花蓮慈濟醫院合作開發「智慧藥箱」，解決偏遠地區病患取藥不易，且藥品配給後常發生病患忘記用藥

與用藥時間等問題；與臺灣大學共同合作開發「免萃取式農藥殘留快速偵測系統」，三十秒內就能偵測農藥超標之農產品，大幅提升農作物的農藥殘留篩檢效率；與陽明交通大學合作開發「人工下顎與植體骨仿生結構」，提高植牙相容性及骨癒合率，共三案榮獲第 18 屆國家新創獎，研發成果落實社會。

除此之外，醫材認證一站式服務平台在防疫上不遺餘力，積極輔導廠商投入防疫行列，其中輔導矽基分子公司開發新冠病毒快速檢測晶片，為國內首套核酸檢測快篩晶片，擁有不需要經過 PCR 放大的超高靈敏度，僅需 3 分鐘即可完成判讀，且準確度與核酸檢測相同，已於年底順利通過「緊急使用授權 (Emergency Use Authorization, EUA)」審查，可作為提升早期快速檢測能量的第一道防線，擴大國內快篩量能；另協助台灣醫學影像公司「胸腔 X 光輔助診斷系統」順利取得歐盟 CE 上市許可及 ISO 13485 認證，並獲 TFDA 專案製造核准，於國內疫情肆虐之際，以 AI 系統用於新冠肺炎輔助診斷，協助國內醫療第一線人員抗疫；並配合政府新南向政策鏈結東南亞國家，延續與泰國國家發展局 (NSTDA) 下 BIOTEC-IBST 實驗室合作，進行「肺癌檢測技術開發」計畫，並擴大合作面向至 COVID-19 快篩臨床應用，深化國際夥伴合作關係；且順利完成新加坡國立大學團隊所開發之客製化 3D 列印骨板安全與功效性驗證，有助於打入國際醫材測試驗證供應鏈。

展望未來，儀科中心將持續聚焦於「前瞻光學」、「先進真空」與「智慧生醫」專業領域，精進核心與關鍵技術素養，深切了解學界對於研究上的獨特需求，以儀器科技核心能量力挺學界開創前瞻的學術研究成果。並積極研發「台灣第一」、「國際領先」的下世代半導體製程與設備、尖端國防與太空酬載系統及防疫相關儀器，在解決科學探索之實作過程中，培育兼具科學素養與產業需求的跨領域創新儀器技術人才，建構台灣學界與產業儀器設備自主化的能量，橋接學界研發創意與產業需求，帶動國內創新發展與提升世人的生活品質。

In 2021, Taiwan's society and people's livelihood remained rather stable under the joint efforts of all citizens while the rest of the world was impacted by the COVID-19 pandemic. Taiwan Instrument Research Institute (TIRI) strictly followed the domestic epidemic prevention and control regulations and adopted online communication software and platforms to maintain communications with the world. TIRI has cooperated with the Interuniversity Microelectronics Center (imec), a benchmark international research institute, in developing the first specific hyperspectral technology in Taiwan and has co-published academic articles in the field of optoelectronics. TIRI has continuously enhanced our research capacity to connect to the globe on science and technology. In line with government policy priorities, TIRI executed to promote the cutting-edge R&D and applications of critical instruments for the next generation. We built up Taiwan's first 2D material deposition equipment and a joint R&D platform for academic teams. This platform allows the academic and research community to integrate their researches related to semiconductors and to establish technical standards domestically and internationally.

TIRI plays an important role as the key partner of academic teams providing the complete, interdisciplinary, and integrated instrument technology R&D services. We cooperate closely with 450 professors and research teams from nearly 70 domestic and international universities and research institutes, providing services in domains, including science, healthcare, engineering, agriculture, and art. We also develop customized and specialized instruments to assist in cutting-edge scientific research. The world-leading "**Sub-Å Atomic Structure Research and Applications" R&D Service Platform** (0.78 Å point resolution, the first in Taiwan and the third in the world) provided a new perspective for the global academic community and industry to understand the link between the structures and properties of advanced materials and supported the research teams from top universities. The platform was awarded the High Distinction Award of the NARLabs R&D Service Platform Achievement Award in 2021. In addition, TIRI has collaborated with the academia on a number of important projects of the Ministry of Science and Technology. Those projects included the "**Å-generation Semiconductors Project**" across 7 schools and 7 teams to support the needs of the next-generation semiconductor processes and equipment, the "**IoT Information Security Development Project**

for Intelligent Manufacturing and Semiconductor Processing Testing Field" across 8 schools and 9 teams to assist the academic community in building an information security field for the Internet of Things (IoT) and deepening Taiwan's information security strength, and the "**Smart Dust Sensor Technology and Development Service Platform Project**" across 6 schools and 9 teams to assist the academic community in developing smart dust sensors with miniaturization and low power consumption, thus accelerating the process of sensor localization.

TIRI has actively linked the capabilities of the academia, research, and industry from the fields of biotechnology, semiconductors, and optoelectronics. We assisted the Microluce Co. Ltd., a business incubator from the National Central University. Through cooperation in developing the third generation of silicon-based GaN wafer epitaxial technology for core semiconductor materials, the company has successfully applied the technology onto large area 8-inch silicon wafers. This technology ranks first in the world and will lead Taiwan's semiconductor supply chain to a new milestone. TIRI also collaborated with top universities and hospitals in Taiwan to develop innovative medical devices, including the "**Smart Medical Kit**" with Hualien Tzu Chi Hospital to solve the problems of medication accessibility and reminder for patients in remote areas, the "**Extraction-free Rapid Detection System for Pesticide Residue**" with National Taiwan University to detect pesticide residues above the standard in 30 seconds and greatly improve the efficiency of pesticide residue screening of crops, and the "**Artificial Jaw and Implant Bone Bionic Structure**" with National Yang Ming Chiao Tung University to improve the compatibility and bone healing rate of dental implants. The three projects were awarded the 18th National Innovation Award - Clinical Innovation Award, greatly benefitting the society.

The One-stop Medical Devices Service Platform has spared no effort in pandemic prevention, actively guiding manufacturers to participate in such prevention. In particular, it has supported Molsentech to develop a COVID-19 rapid test chip, which is the first rapid screening chip for nucleic acid detection in

Taiwan. It has high sensitivity without PCR amplification and can be read in just three minutes with the same accuracy as the nucleic acid detection. The chip has successfully passed the "Emergency Use Authorization (EUA)" review at the end of the year and is expected to be used as the first line to improve early rapid detection energy and to expand the capacity of fast screening in Taiwan. The platform also assisted a Taiwan medical imaging company in the "Chest X-ray Assisted Diagnosis System" to obtain the EU permit for CE listing and ISO 13485 certification, as well as TFDA project manufacturing approval, using the AI system for COVID-19 assisted diagnosis to help Taiwan's first-line medical personnel fight against COVID-19. In line with the government's New Southbound Policy to strengthen relationships with Southeast Asian countries, the platform continued to collaborate with the BIOTEC-IBST laboratory under the National Science and Technology Development Agency (NSTDA) in Thailand on the project of "**Technology Development for Lung Cancer Detection**" and extended the cooperation to clinical applications of COVID-19 rapid screening, deepening the international partnership. In addition, the platform has completed the safety and efficacy validation of the customized 3D printed bone plate developed by a team from the National University of Singapore, contributing to the entry into the international testing and validation supply chain of medical materials.

In the future TIRI will continue to focus on the areas of "**cutting-edge optics**", "**advanced vacuum technology**", and "**intelligent biotechnology**", refining our core and dominant technologies and grasping the unique demands for academia research. We will actively develop "**No.1 in Taiwan**" and "**world-leading**" next-generation semiconductor equipment, cutting-edge national defense, spaceborne remote sensing systems, and anti-epidemic related instruments. During the process of practical scientific explorations, we will also cultivate interdisciplinary and innovative professionals for instrumentation who can meet the industrial requirement. Most importantly, we will provide assistance to academia and industry for the localization capability of instruments and equipment, bridge academic R&D creativity and industrial needs to drive Taiwan's innovation and development, and then improve the quality of life.

主任 Director General

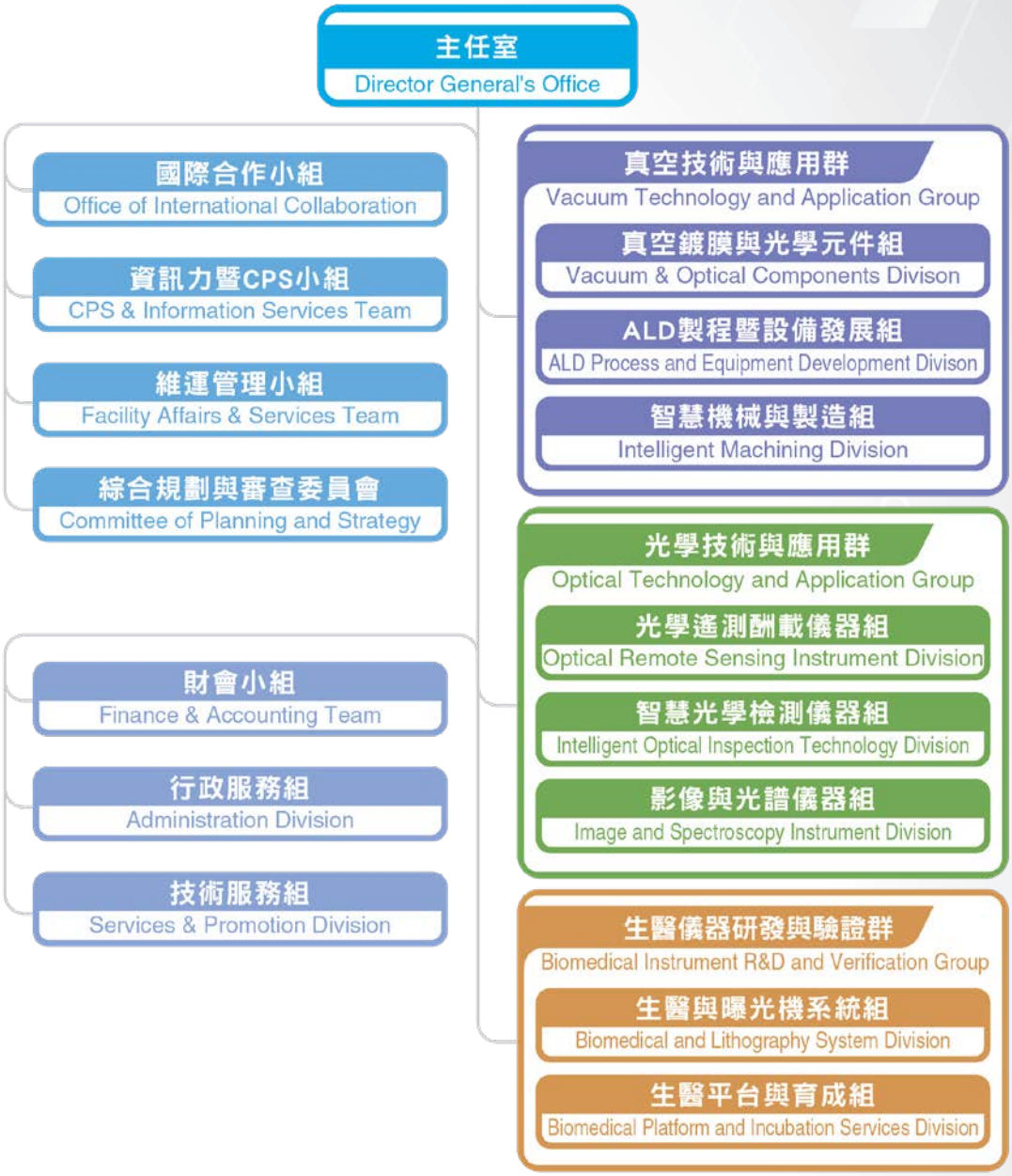
楊燿州

Taiwan Instrument Research Institute

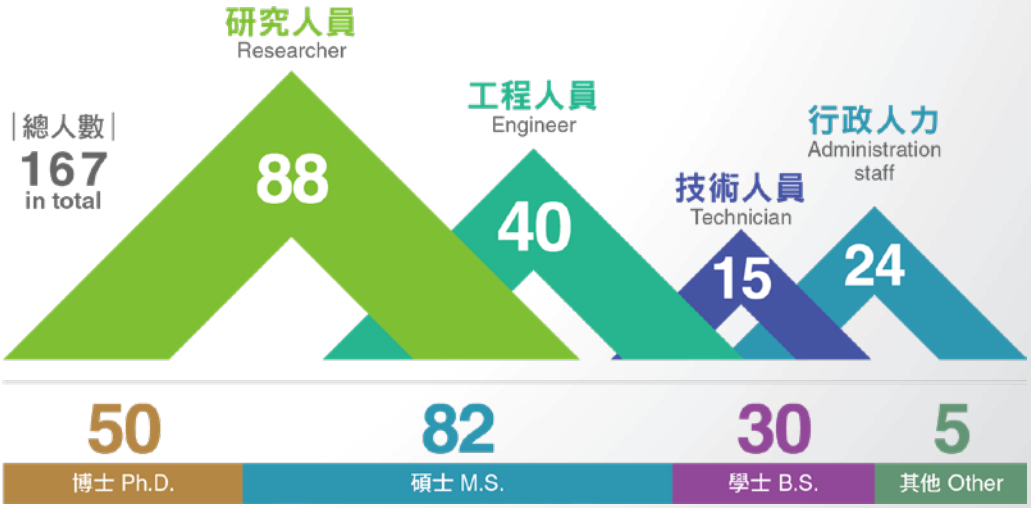
基本概況

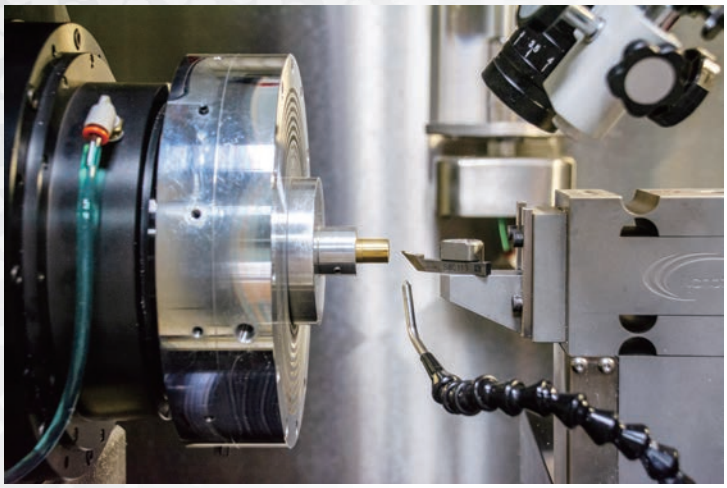
Overview of TIRI

組織架構 Organization Chart



人力配置 Deployment of Manpower





核心設施 Core Facilities

(1) 精密光機工程 Precision Opto-mechanical Engineering

超過 45 年精密光學製造技術，提供精密光機元件及系統設計製作服務，為國內唯一可提供大口徑非球面鏡面加工的單位。

Having accumulated 45 years of experience in precision optics and machining, TIRI provides precision opto-mechanical device and system design & manufacturing services. We are the only organization that can provide fabricating services for meter-scale aspheric optics in Taiwan. Our core facilities include:

- 超精密鑽石車削輪磨機 Single Point Diamond Turning, SPDT
- 大口徑 CNC 拋光與檢測設備 Meter-scale CNC Polishing and Inspection
- 磁流體拋光機 Magnetorheological Finishing, MRF
- 非球面拼接式干涉儀 Aspheric Stitching Interferometric Inspection, ASI
- 超高精度三次元輪廓機 Ultrahigh Accurate 3-D Profilometer, UA3P
- 車削定心機 Turning Centering Machine
- 鏡面自由曲面超精密加工機 Freeform Ultra Precision Machining System

(2) 真空技術 & 薄膜製程 Vacuum Technology & Thin Film Process

儀科中心為國內真空技術發源地，專注於先進薄膜製程技術與系統開發，以及真空系統檢校技術並建置 ALD/ALE 聯合實驗室，提供先進真空系統開發、薄膜製程發展及檢校服務平台。

TIRI is the origin of domestic vacuum technology and builds the ALD/ALE Joint Laboratory. TIRI provides advanced vacuum system development, thin-film process development, and inspection/ calibration service platforms; our major core facilities include:

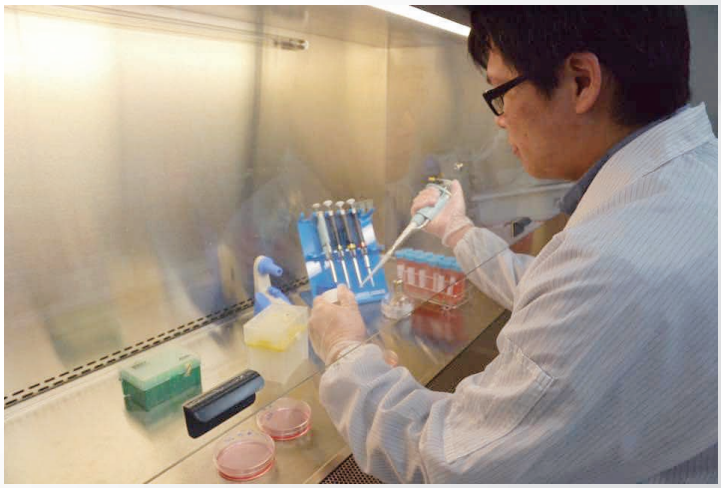
- 電漿輔助原子層沉積系統 Plasma-Enhanced Atomic Layer Deposition, PE-ALD
- 金屬有機化學氣相沉積系統 Metal Organic Chemical Vapor Deposition, MOCVD
- 深紫外波段光學鍍膜系統 Deep UV Optical Coating System
- 大口徑鏡片鍍膜系統 Meter-scale Optical Coating System
- 脈衝雷射蒸鍍系統 Pulsed Laser Deposition, PLD
- 高功率脈衝磁控濺射系統 High Power Impulse Magnetron Sputtering, HiPIMS
- 離子源輔助磁控濺射系統 Magnetron Sputtering with Ion-assisted Deposition
- 離子束輔助電子槍蒸鍍系統 E-gun with Ion-assisted Deposition
- 像差修正掃描穿透式電子顯微鏡 Aberration Corrected Scanning Transmission Electron Microscope, STEM

(3) 生醫科技研發環境建置 Medical Device Testing & Verification Laboratories

儀科中心於新竹生醫園區建置及維運共通核心實驗室、產品檢測驗證實驗室，並提供醫療器材法規加值、管理系統整合，輔導品質系統建置、輔導申請產品上市許可 (歐盟、美國等國家) 等軟體服務，主要核心設施包括以下：

TIRI has established and kept maintaining the Medical Device Testing & Verification Laboratories in Hsinchu Biomedical Science Park, which conforms to international medical device regulations. The laboratories provide one-stop shop services to accelerate the medical product launch. The major core facilities include:

- ▲金屬材料原型打樣系統 Metallic Material Additive Manufacture System
- ▲生醫複合材料打樣系統 Polymer Material Additive Manufacture System
- ▲生物力學材料試驗機 Biomechanics Material Testing Machine
- ▲生物晶片表面改質系統 Biochip Surface Modification System
- ▲生物分子交互作用分析系統 Bio-molecular Interaction Analysis System
- ▲高分子醫療輔具原型打樣系統 Polymer Material Additive Manufacture System
- ▲C-arm X 造影系統 Medical C-arm X-ray Imaging System
- ▲3T 磁振造影系統 3-Tesla Medical Magnetic Resonance Imaging system
- ▲128 切電腦斷層掃描系統 128-slice Medical Computed Tomography Imaging System



核心價值與營運策略 TIRI Core Values and Business Model

儀科中心是國內唯一可針對學術界各領域，開發建置前瞻研究所需之客製特殊儀器設備的單位，長期專注在儀器技術平台的發展與應用，著重核心設施的維運與核心技術的精進，以作為支援學術研究的堅實後盾，建構台灣學界與產業儀器設備自主化的能量與契機。

TIRI is the only organization in Taiwan that can target all fields of academia and develop customized special instruments needed for cutting-edge research. It has been dedicated in the development and applications of instrument technology, the maintenance and operations of core facilities, and the refinement of core technologies. As a solid backing to support academic research, it offers an opportunity for the self-development of domestic instrument in the academia and industry.

儀科中心核心價值與營運策略
TIRI Core Values and Business Strategy

營運策略 Business Strategy

- **學術研究之關鍵合夥人**
  Key Partner for Academic Research
- **科研成果之最佳推廣者**
  Best Promoter for R&D Achievements

核心價值 Core Values

尖端儀器的研發
R&D of advanced instruments

- 國防太空
  National space defense
- Å世代半導體
  Å semiconductor
- 綠能 / 新農業
  Green energy/ New agriculture
- 智慧製造
  Smart manufacturing
- 精準醫療
  Precision medicine

最廣領域的服務
Services in all domains

- 藝術 Art
- 農 Agriculture
- 理 Science
- 工 Engineering
- 醫 Medicine

關鍵技術 Key Technologies

先進真空
Advanced Vacuum Technology

- 前瞻半導體製程驗證
  Advanced semiconductor processing
- 原子級設備研發
  R&D of atomic level equipment
- 先進材料開發
  Advanced material development

前瞻光學
Cutting-edge Optics

- 精密光電檢測儀器
  Precise photonic inspection instrument
- 高光譜遙測技術
  Hyperspectral remote sensing technology
- 先進封裝曝光設備
  Advanced lithography stepper

智慧生醫
Intelligent Biotechnology

- 醫材研發加速器
  Medical device accelerator
- 上市取證輔導
  Consultancy in FDA approval
- 生醫光電儀器開發
  Biomedical photonic & biophotonics instruments

主要服務面向 Main Services

- ▲執行重大政策任務 Executing crucial policy tasks (Government)
- ▲支援重要學術計畫 Supporting major academic projects (Academia)
- ▲新技術 (產業) 商品化 Commercializing novel technologies (Industry)
- ▲推動科普教育 Boosting science populariztion education (Talent Cultivation)

政府部門 Government

- 推動自研自製高階儀器設備在地化發展
  Striving for domestically self-developed and self-fabricated advanced instruments and facilities
- 發展衛星酬載遙測技術
  Developing satellite remote sensing technology
- 支援「臺灣精準健康戰略產業發展」方案
  Supporting the biomedical program under the "Five-Plus-Two Innovative Industries Plan"
- 支援建立災防預警系統
  Supporting the establishment of the disaster prevention and warning system
- 協助精準農業發展
  Assisting the development of precision agriculture

學術界 Academia

- 參與產學合作計畫、深耕計畫
  Participating in industry-university cooperation program and enhancement projects
- 支援學研計畫原型製作
  Supporting the prototyping of research programs
- 生醫團隊育成輔導及重點產業高階人才培育與就業計畫
  Cultivating and guiding biomedical teams, and carrying out the project of "Rebuild After PhD's Industrial Skill & Expertise (RAISE)"
- 共同合作研發前瞻研究所需之儀器科技與特用儀器系統
  Jointly researching and developing instruments, technologies, and special instrument systems for prospective research

TIRI

人才培育 Talent Cultivation

- 舉辦儀器相關學生競賽
  Organizing instrument-related student competitions
- 儀器技術人才培育及科普教育
  Fostering talents in instrument technology and launching science popularization education
- 出版科儀新知、儀科中心電子報
  Publishing "Instrument Today" and "TIRI eNEWS" for news, activities and instrument knowledge
- 參與國內外光電、真空技術相關學術研討會
  Participating in domestic and international seminars on photonics and vacuum technologies

產業界 Industry

- 客製化光電及真空儀器系統及關鍵元組件開發
  Developing customized photonics and vacuum instrument system, as well as its critical components
- 提供精密光學元件設計製作及薄膜製程服務
  Providing the service of precision optical component design and production, as well as thin film processing
- 協助建立線上光學檢測及量測系統
  Assisting the establishment of the automatic optical inspection system in production lines
- 一站式醫材法規、測試、驗證服務
  Providing one-stop service related to medical device laws, testing, and verification
- 導入智慧製造管理流程
  Introducing the smart manufacturing management process

Taiwan Instrument Research Institute

亮點成果與大事紀要

Notable Achievements & Milestones in 2021

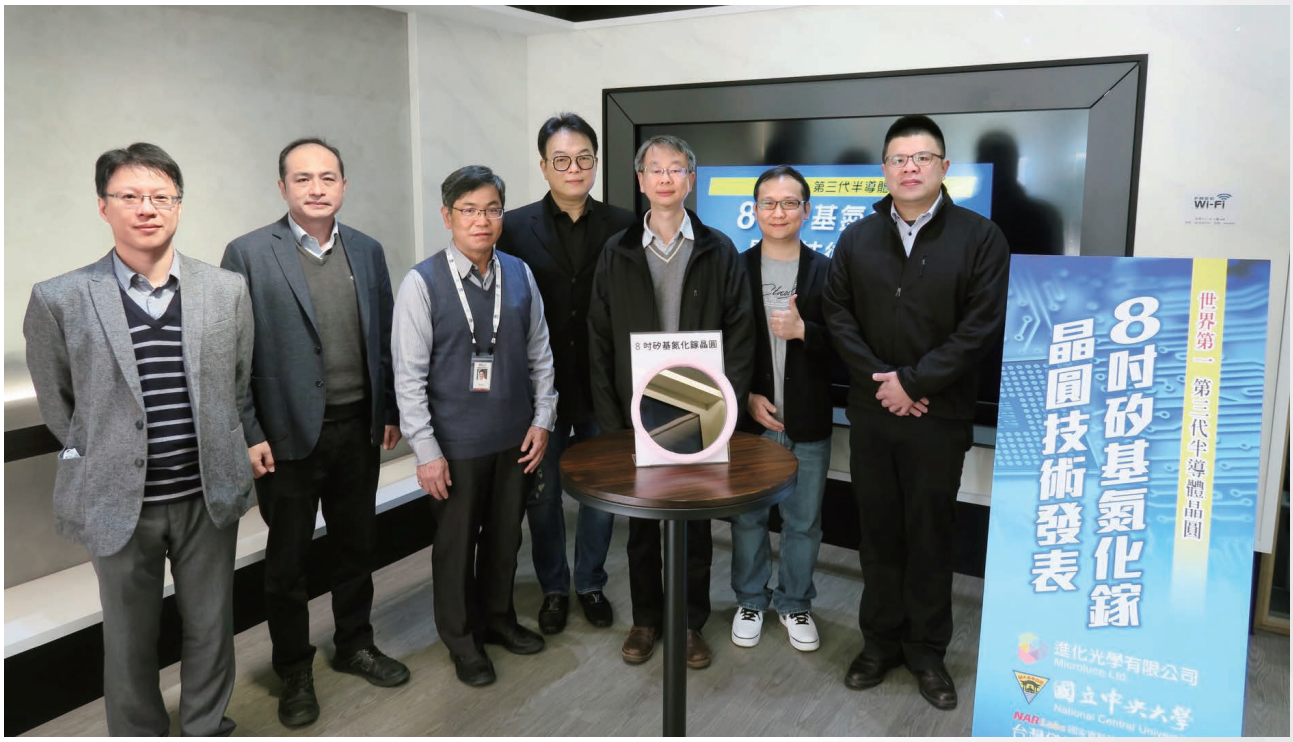
2021 / 01 / 20

突破第三代半導體晶圓技術，8 吋矽基氮化鎵晶圓磊晶技術獨步全球

A Breakthrough in Third-Generation Semiconductor Wafer Technology - Unique 8-inch Silicon-based GaN Wafer Epitaxy Technology in the World

儀科中心與國立中央大學陳昇暉教授合作，攜手中央大學育成培育企業「進化光學有限公司」，共同研發第三代半導體核心材料的矽基氮化鎵晶圓磊晶技術，成功應用於大面積 8 吋矽晶圓。本技術利用低溫磊晶技術能夠快速生成 8 至 12 吋的矽基氮化鎵晶圓，透過物理動能的薄膜沉積技術，薄膜均勻性比氣流式的 MOCVD 磊晶技術還要好，晶圓面積的元件利用率可高達 9 成以上，大幅降低晶圓生產成本，為全球首創技術，將帶領臺灣半導體供應鏈邁向一個新里程碑。

TIRI cooperates with Professor Sheng-Hui Chen from National Central University and Microluce, Ltd., a company from the University's incubation center, to develop the wafer epitaxy technology of silicon-based GaN, a third generation semiconductor material, and successfully applies it to large-area 8-inch silicon wafers. The low-temperature epitaxy technology is adopted to rapidly produce silicon-based GaN wafers in size of 8 to 12 inches. Through the thin film deposition technique with physical kinetic energy, it has better film uniformity than that of the gas-flow MOCVD epitaxy technology and gains over 90% utilization rate of the wafer area. It is a pioneering technology in the world that significantly reduces wafer production costs and will lead Taiwan's semiconductor supply chain to a new milestone.



儀科中心與國立中央大學以及進化光學有限公司共同發表全球首創 8 吋矽基氮化鎵晶圓技術。
TIRI collaborates with National Central University and Microluce, Ltd. to hold the press conference on the world's first "Unique 8-inch Silicon-based GaN Wafer Epitaxy Technology".

2021 / 03 / 06

風和日「力」 再生能源大挑戰 ，「國研盃智慧機械競賽」培育高階跨領域研發人才

Renewable Energy Challenge - Harvesting the Sun and Wind

NARLabs Smart Machinery Competition to Foster High-level Interdisciplinary R&D Talents

儀科中心已連續七年協同美國機械工程師學會 (ASME) 台灣分會舉辦「國研盃智慧機械競賽」學生競賽，分為設計競賽及演講競賽，並由 ASME 訂定設計競賽主題，競賽題目多元且務實，藉此引導學生對機械技術進行創意發想及功能整合，並提升學生國際視野。110 年設計競賽題目為「風和日『力』機器人耐力賽」(Harvesting the Sun and Wind)，參賽隊伍必須使用大會提供的一個 3A 充電電池，打造一組限用風力或太陽能充電之機器人，本次競賽除考驗機器人的移動速度與負重能力，以及學生的機械設計與操作外，更需要研究風力或太陽能的轉換效能。設計競賽最終由國立清華大學團隊分獲冠、亞軍；演講競賽則由國立臺灣大學同學奪冠。

For the seventh year in a row, TIRI and the American Society of Mechanical Engineers (ASME) Taiwan Section organize the “NARLabs Smart Machinery Competition” for students. The competition is divided into a design competition and a presentation competition under a theme set by ASME. The competition topics are diverse and practical to stimulate students' creative thinking and functional integration of mechanical technology, thus enhancing their international perspective. In 2021 the topic for the design competition is “Harvesting the Sun and Wind”, in which participating teams must use a 3A rechargeable battery provided by ASME to build a group of robots that can only be charged by wind or solar energy. In addition to the speed and weight capacity of the robots and the mechanical design and operation of the students, the competition also involves a study of the conversion efficiency of wind or solar energy. Two teams from National Tsing Hua University win the first and second places in the design competition respectively, and a National Taiwan University student wins the presentation competition.

藉由「國研盃智慧機械競賽」吸引更多年輕學子投入儀器設備設計與製造領域，加速推動我國產業設備自主化。

“NARLabs Smart Machinery Competition” is held to attract more young students to the field of instrument design and manufacturing, accelerating the self-development of Taiwan’s industrial equipment.

2021 / 04 / 12

國研醫材創價聯盟與臺大醫院新竹臺大分院交流會成果豐碩

Fruitful Exchanges between NARLabs Medical Device Alliance and National Taiwan University Hospital (NTUH) Hsin-Chu Branch

由儀科中心與臺大醫院新竹臺大分院主辦，科技部新竹科學園區管理局、科技部中部科學園區管理局、科技部南部科學園區管理局共同協辦的國研醫材創價聯盟廠商交流會，邀請儀科中心輔導之新創醫材廠商與新竹臺大分院各科室醫生進行案例分享及深度交流，一同就臨床需求與技術優化議題討論。後續儀科中心、新竹臺大分院及竹科管理局三方簽署合作備忘錄，藉此增進新竹生醫園區產官學研交流，促進園區生醫產業發展。

The Manufacturer Communications of NARLabs Medical Device Alliance is hosted by TIRI and NTUH Hsin-Chu Branch and co-organized by the Hsinchu Science Park Bureau, Central Taiwan Science Park Bureau, and Southern Taiwan Science Park Bureau. The start-up medical device manufacturers under the guidance of TIRI, are invited to share cases, exchange ideas, and discuss the clinical needs and technical optimization with doctors from various departments of NTUH Hsin-Chu Branch. Subsequently, TIRI, NTUH Hsin-Chu Branch, and the Hsinchu Science Park Bureau sign a MOU to promote the development of the biomedical industry in Hsinchu Biomedical Science Park, thereby enhancing exchanges among industry, government, academia, and research.

臺大醫院新竹臺大分院與國研醫材創價聯盟廠商交流會就案例討論臨床需求，更加貼近生醫產業應用面。
NTUH Hsin-Chu Branch and NARLabs Medical Device Alliance discuss clinical needs based on cases at the manufacturer communications to make them more relevant to the application of the biomedical industry.

2021 / 05 / 07

實踐學界創想，「智慧機械· 永續創新」展現智慧機械技術整合成果

"Intelligent Machinery- Sustainable Innovation" Showcases the Integration of Intelligent Machinery Technology by Practicing Academic Innovative Concepts

儀科中心執行之智慧機械主題式專案計畫於「科技部智慧機械永續創新成果展」展出，共計 29 個學界計畫團隊參與。本次成果展從感測器元件研發，智慧機械用控制器、機器人至產業製造應用所需的資安技術，完整勾勒出智慧機械上、中、下游技術整合脈絡；透過國研院轄下研究中心協同合作的技術服務平台，學界創新構想得以跨領域整合、產學合作及法人加值等方式，協助其提升技術研發能量與產業應用鏈結。

TIRI's projects on intelligent machinery are exhibited at the “Intelligent Machinery - Sustainable Innovation Showcase” of the Ministry of Science and Technology (MOST), in which 29 academic project teams participate. From sensor component development, intelligent machinery controllers, and robotics to the information security technology required for industrial manufacturing applications, this showcase outlines the complete upstream, midstream, and downstream technology integration of intelligent machinery. Through the collaborative technology service platform of the research institutes under NARLabs, the functions of interdisciplinary integration, academia-industry collaboration, and corporate value-added can be applied to the academic innovative concepts in enhancing research team's technology and connection with industrial applications.

左圖：科技部智慧機械永續創新成果展開幕合影，展現 29 個學研團隊在 5 個專案計畫下之研發成果；右圖：科技部工程司李志鵬司長 (右二) 在儀科中心楊燿州主任 (右三) 陪同下聆聽學研團隊成果說明。

Left: Group photo at the opening of the Intelligent Machinery - Sustainable Innovation Showcase of MOST, displaying the R&D achievements of 29 research teams under five projects. Right: Director General Chih-Peng Li of Engineering and Technologies Department, MOST (second from the right) is accompanied by Director General Yao-Joe Joseph Yang of TIRI (third from the right) to listen to the presentation of a research team.

2021 / 06 / 23

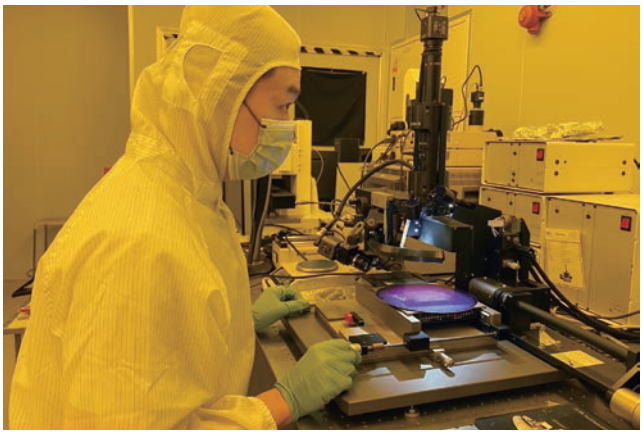
創價醫材加速器平台積極輔導廠商投入防疫行列，加速快篩產品上市

Medical Device Service Platform Actively Assists Manufacturers to Participate in Pandemic Prevention and Accelerates the Launch of Rapid Testing Products

儀科中心建置創價醫材加速器平台，積極輔導廠商投入防疫行列。其中矽基分子電測科技公司開發的新冠病毒快速檢測晶片，透過儀科中心矽晶片微流道異質整合封裝技術與安規驗證協助，完成高雄榮民總醫院臨床試驗，於 110 年底取得我國衛福部食藥署緊急使用授權 (TFDA / EUA)，預計 111 年 2 月上市銷售。臺灣尖端先進生技醫藥公司與世延生醫公司聯手開發的抗體快篩產品，經由儀科中心的技術優化協助，完成長庚醫院臨床試驗，該產品只需 15 － 20 分鐘即可完成判讀，可作為提升早期快速檢測能量的第一道防線，強化國內快篩量能。儀科中心輔導臺灣醫學影像公司研發之胸腔 X 光輔助診斷系統，加速通過歐盟認證，並已獲得首筆百萬以上訂單。該系統是以 AI 系統判讀胸部 X 光片，可應用於新冠肺炎的診斷，為全球防疫共盡心力。

TIRI’s Medical Device Service Platform actively supports manufacturers to help prevent the pandemic. In particular, Molsentech's COVID-19 rapid test chip has completed clinical trials at the Kaohsiung Veterans General Hospital with the support of TIRI's heterogeneous integration of microfluidic channels packaging technology and licensing assistance. At the end of 2021, the chip obtained Emergency Use Authorization (TFDA/EUA) from the Food and Drug Administration (Taiwan) and is expected to go on sale in February 2022. Taiwan Advance Bio-pharmaceutical Inc. and S&T Biomed jointly develop an antibody rapid testing

product, and under TIRI's technology assistance, they complete clinical trials at Chang Gung Memorial Hospital. The product takes only 15-20 minutes to interpret and can serve as the first line to improve the early rapid testing capability and to enhance the capacity of rapid testing in Taiwan. The Chest X-ray Assisted Diagnosis System, developed by Taiwan Medical Imaging Co., Ltd. with the support of TIRI, is quickly certified by European Union and has already received its first order of over one million NT dollars. It is an AI system for the interpretation of chest X-rays, which can be applied to the diagnosis of COVID-19, contributing to global pandemic prevention.



左圖：透過儀科中心的生醫晶片製程服務以提供精準大健康生醫晶片製作能量；右圖：儀科中心提供一站式醫材加速器服務，輔導新創醫材團隊投入防疫行列。
Left: TIRI's biomedical chip manufacturing services provide the capacity to produce accurate biomedical chips for health. Right: TIRI offers one-stop medical device accelerating services to help start-up teams devote themselves to preventing the pandemic.

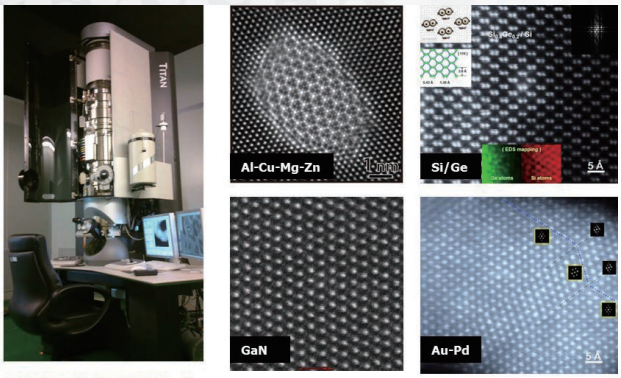
2021 / 08 / 30

國際領先「次埃解析度原子結構研發服務平台」榮獲國研院「110 年度研發服務平台亮點成果獎」特優獎
International Leading Sub-Å Atomic Structure Research and Applications R&D Service Platform Wins the High Distinction Award of 2021 NARLabs R&D Service Platform Achievement Award

儀科中心建置之「次埃解析度 (sub-Å) 原子結構研究與應用」研發服務平台，提供臺灣大學團隊研究先進半導體元件及材料結構分析，獲得優異成果，榮獲國研院「110 年度研發服務平台亮點成果獎」特優獎，該平台建立全球最完整的航太級鋁合金之原子級析出物相變態顯微結構演化機制，並首創「原子解析度三維顯微結構」分析技術，提供國際學術界與產業界全新的視野以了解先進材料之結構與性質之間的連結。

The Sub-Å Atomic Structure Research and Applications R&D Service Platform established by TIRI assists the team from National Taiwan University in studying structural analyses of advanced semiconductor components and materials. The team achieves excellent results and is honored with the High Distinction Award of 2021 NARLabs R&D Service Platform Achievement Award. The platform has established the world's most complete atomic microstructure evolution mechanism of the precipitation phase transformation in aerospace-grade aluminum alloys and pioneered Taiwan's atomic-resolution 3D electron tomography analysis technology, thus opening up new horizons in international academia and industry for investigating the connections between the structure and properties of advanced materials.

亮點成果與大事紀要 Notable Achievements & Milestones in 2021



TIRI-HRSTEM Lab.

國內首創「原子解析度三維顯微結構」分析技術，提供國內外學者進行下世代二維材料與量子點半導體元件原子結構與成分分析。

The pioneering atomic-resolution 3D electron tomography analysis technology in Taiwan supports domestic and international scholars with atomic structures and composition analyses of next-generation 2D materials and quantum dot semiconductor components.

左起臺大材料系鍾采甫博士後研究員、臺大材料系楊哲人特聘教授、國研院院長吳光鐘、儀科中心楊燿州主任共同出席頒獎典禮。

From the left, Postdoctoral Researcher Tsai-Fu Chung, Professor Jer-Ren Yang of the Department of Science and Engineering of National Taiwan University, President Kuang-Chong Wu of NARLabs, and Director General Yao-Joe Joseph Yang of TIRI jointly participate in the award ceremony.

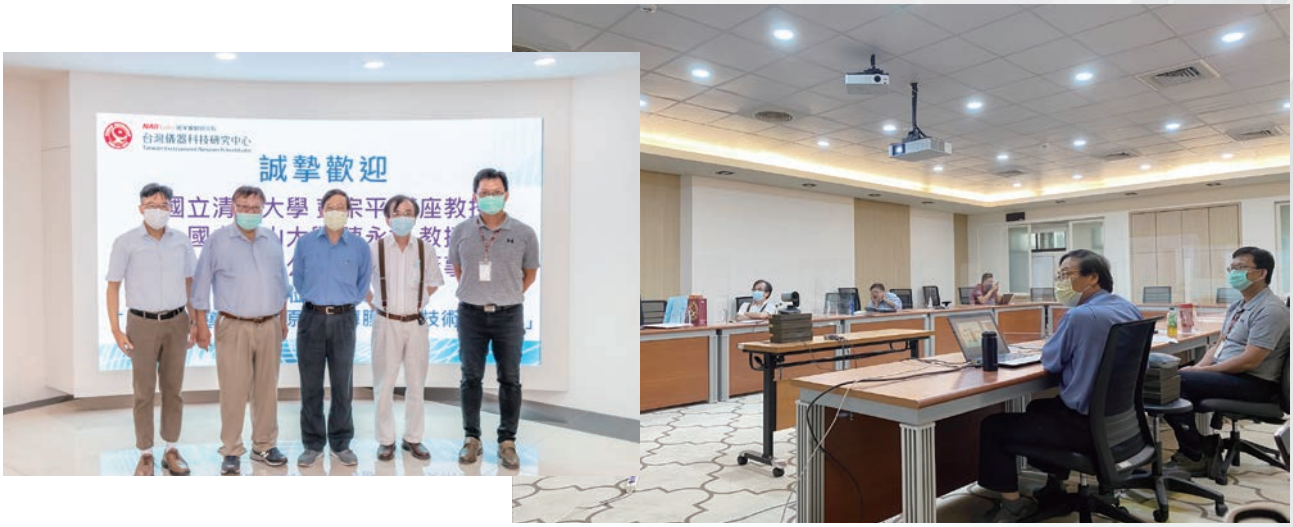
2021 / 09 / 23

「2021 半導體設備原子級薄膜製程技術交流會」深化國內半導體設備與製程技術交流

The 2021 ALD/ALE Equipment Development Workshop Deepens the Exchange of Semiconductor Equipment Technology in Taiwan

「2021 半導體設備原子級薄膜製程技術交流會」邀請清華大學彭宗平講座教授、中山大學陳永松教授、中央大學郭倩丞副教授、明志科技大學陳政營助理教授及儀科中心陳維鈞副研究員擔任主講者，與國內原子級薄膜製程技術專家學者一同與會。因應防疫措施，本次會議滾動調整為視訊會議方式舉辦，達 150 人同時上線，透過線上會議與會者能隨時發問，主講者也能即時反饋，達到良好的交流互動，深化國內半導體製程設備技術。

2021 ALD/ALE Equipment Development Workshop invites Chair Professor Tsong-Pyng Perng from National Tsing Hua University, Professor Yung-Sung Chen from National Sun Yat-Sen University, Associate Professor Chien-Cheng Kuo from National Central University, Assistant Professor Cheng-Ying Chen from Ming Chi University of Technology, and Associate Researcher Wei-Chun Chen from TIRI as presenters to attend the workshop with experts and scholars in atomic-level thin-film process technology in Taiwan. In response to the pandemic prevention measures, this virtual workshop attracts up to 150 participants getting online at the same time. Through the webinar, presenters can give real-time feedback whenever participants raise questions, resulting in good communication and interactions.



左圖：「2021 半導體設備原子級薄膜製程技術交流會」邀請國內知名教授擔任主講者；右圖：以線上視訊會議舉辦，達到線上即時互動效果。
Left: 2021 ALD/ALE Equipment Development Workshop invites renowned professors as presenters. Right: Webinar for real-time communication

2021 / 10 / 02

第 13 屆「國研盃 *i*-ONE 儀器科技創新獎」，產學研攜手持續推動儀器創新實作之人才培育

The 13th "NARLabs *i*-ONE Instrument Technology Innovation Competition" Promotes Talent Cultivation for Instrument Innovation through Industry-Academia-Research Collaboration

「國研盃 *i*-ONE 儀器科技創新獎」創設迄今已逾十載，培育科研人才不遺餘力，歷年來超過 300 組優秀作品報名參賽，第 13 屆「國研盃 *i*-ONE 儀器科技創新獎」分別由清華大學及雲林縣私立揚子高級中學團隊獲得專上組及中學獎首獎得主。值得一提的是 106 年第 9 屆「國研盃 *i*-ONE 國際儀器科技創新獎」中學組首獎作品「球型輪胎原型機：球型感應馬達」，挖掘出相當優秀、具創新與實作的中學生顏伯勳與李尚融，現已將創意付諸產品並創立張量科技公司，這項成果經過幾年的改進，預計 111 年和 SpaceX 合作夥伴、波蘭衛星商 SatRevolution 一起搭著 SpaceX 的火箭上太空進行驗證，彰顯了「國研盃 *i*-ONE 儀器科技創新獎」對於培養儀器科技尖端人才的宗旨與成效。

The "NARLabs *i*-ONE Instrument Technology Innovation Competition" has been founded for more than a decade and has devoted to training scientific talents. Over the years, 300 pieces of outstanding works in total have signed up for the competition. Teams from National Tsing Hua University and Yang-Tze High School are awarded first prize in the college group and high school group in the 13th "NARLabs *i*-ONE Instrument Technology Innovation Competition". In particular, the first prize of the 9th "NARLabs *i*-ONE Instrument Technology Innovation Competition" for the high school group in 2017, "A Prototype Machine for Spherical Wheel: Spherical Induction Motor", was awarded to Po-Hsun Yen and Shang-Jung Lee, who are outstanding, innovative, and realistic students. They put this idea into product form and found Tensor Tech Co., Ltd. The product, which has been improved over the years, is expected to be verified in space with SpaceX partner SatRevolution, a Polish satellite company, on a SpaceX rocket in 2022. The students' achievements demonstrate the aim and effectiveness of the "NARLabs *i*-ONE Instrument Technology Innovation Competition" in incubating cutting-edge talents in instrumentation technology.

左圖：第 13 屆「國研盃 *i*-ONE 儀器科技創新獎」，打造下世代尖端儀器自製人才；右圖：清華大學王偉中教授指導之學生團隊榮獲專上組首獎。

Left: The 13th "NARLabs *i*-ONE Instrument Technology Innovation Competition" fosters the next generation of talents for developing cutting-edge instruments. Right: Students supervised by Professor Wei-Chung Wang of National Tsing Hua University win the first prize in the college group.

2021 / 11 / 05

2021 亞洲生技大展，「儀」起接力守護臺灣

TIRI and its Coached Teams Show Achievements for the Pandemic Prevention at BIO Asia-Taiwan 2021

儀科中心透過亞洲生技大展，展出許多實力堅強的醫材加速器成果，幫助國家提升競爭力。在科技部科研產業化平台逾 70 項產學合作，儀科中心輔導新創團隊，同步展現防疫科技與豐碩醫材技術研發成果，完整體現臺灣生醫冠軍隊的豐沛量能。因應全球防疫趨勢，儀科中心攜手輔導團隊以核酸檢測快篩晶片、抗體檢測快篩試劑、新冠病毒老藥新用平台、肺炎影像 AI 輔助判讀系統、植入式醫材等成果廣獲好評。

At BIO Asia-Taiwan, TIRI displays several strong achievements through the medical device accelerator to improve Taiwan's competitiveness. With over 70 academia-industry cooperation projects of MOST, TIRI guides start-up teams and displays the R&D results of pandemic prevention technology and rich medical devices, while fully demonstrating the abundant capacity of Taiwan's biomedical champion teams. In response to the global trend of pandemic prevention, TIRI, together with its coached teams, has been widely praised for its nucleic acid test chip, antibody rapid testing reagents, a platform for the new use of old drugs for the COVID-19 virus, AI-assisted interpretation system for pneumonia images, and implantable medical devices.

2021 亞洲生技大展儀科中心攜手輔導團隊打造後疫新世代

At the 2021 BIO Asia-Taiwan, TIRI partners with its coached team to create a new generation of post pandemic.

2021 / 12 / 22

儀科中心支援學研團隊創新技術開發，榮獲第 18 屆國家新創獎多項獎項肯定

TIRI Supports Academic and Research Teams in Innovative Technology Development, Recognized by the 18th National Innovation Award - Clinical Innovation Award

儀科中心建構跨領域整合的儀器科技研發服務平台，協助學研團隊開發具有創新優勢及市場價值之創新技術，多項技術榮獲第 18 屆國家新創獎肯定。儀科中心與臺灣大學及清華大學團隊合作，開發「免萃取式農藥殘留快速偵測系統」只要 30 秒以內就能偵測農藥超標之農產品，不需專業人員繁瑣萃取步驟，避免取樣偏差，大幅提升農作物的農藥殘留篩檢效率；儀科中心協助花蓮慈濟醫院開發「模組化遠距健康照護系統 — 智慧藥箱」，解決偏遠地區病患取藥不易，且藥品配給後常發生病患忘記用藥與用藥時間等問題；國立陽明交通大學醫工系開發「人工下顎與植體骨仿生結構」，儀科中心協助完成下顎區段植入物之設計模擬與雛型品 3D 列印打樣製作，可縮短術後復原期及提高植入物之相容性與骨癒合率，現已導入 GMP 廠進行製程量產測試。

TIRI has established an interdisciplinary and integrated platform for R&D services in instrumentation technology, assisting academic and research teams to develop innovative and marketable technologies, with several technologies being recognized by the 18th National Innovation Award - Clinical Innovation Award. TIRI, in collaboration with a team from National Taiwan University and National Tsing Hua University, has developed the “Extraction-free Rapid Detection System for Pesticide Residue” to detect pesticide residues above the standard in agricultural products within 30 seconds. The innovation can eliminate the tedious extraction steps by professionals, avoid sampling deviations, and greatly improve the efficiency of pesticide residue screening on crops. TIRI assists Hualien Tzu Chi Hospital in developing the “Modular Remote Health Care System - Smart Medicine Kit” to solve the problems of medicine accessibility and reminder for patients in remote areas. TIRI also cooperates with the Department of Biomedical Engineering of National Yang Ming Chiao Tung University to develop “Artificial Jaw and Implant Bone Bionic Structure” and assists in the design simulation and 3D printing of the prototype of the mandibular implant, which can shorten the post-operative recovery time and improve the compatibility and bone healing rate of the implant. It has been introduced to the GMP plant for mass production testing.

與台大及清大團隊共同研製「免萃取式農藥殘留快速偵測系統」，榮獲第 18 屆國家新創獎－學研新創獎肯定。

The "Extraction-free Rapid Detection System for Pesticide Residue" developed with teams from National Taiwan University and National Tsing Hua University is recognized by the academy-research innovation prize of the 18th National Innovation Award - Clinical Innovation Award.

2021 / 12 / 28

2021 臺灣國際半導體展儀科中心展現自研自製先進製程設備及客製光學鏡頭服務成果
TIRI Shows Self-developed Advanced Equipment Achievements and Total Solution Services for Optics at SEMICON Taiwan 2021

儀科中心長期配合國家政策擴展研發能量，推動高階關鍵儀器設備及元組件之自主研發與應用，藉由本次半導體展，展現儀科中心在半導體前瞻設備上自研自製的研發能量與成果，當中包含了結合國內學研技術共同合作開發客製化的特殊應用光學鏡頭、高光譜顯微技術以及先進半導體製程設備；在科技部前瞻計畫支持下，近期開發半導體臨場檢測設備，首創叢集式 *in-situ* 製程量測，可在製程階段提供臨場量檢測數據，提供產學研界進行半導體新穎材料製程研發時的依據，提升製程良率與可靠度，以及提供國內外半導體製造業 ALD/ALE 製程設備測試與開發驗證的服務平台，同步於 12 月 29 日技術論壇發表「國研院先進半導體設備與製程技術」相關研發成果。

TIRI has a long history of expanding its R&D capabilities in line with national policies to promote independent R&D and applications of high-level key instruments and components. Through this exhibition, TIRI has showcased its R&D capabilities and achievements in the self-development of advanced semiconductor equipment, including customized optic lenses for special applications, hyperspectral microscopy, and advanced semiconductor process equipment, developed in collaboration with domestic academia. With MOST projects' supports, it has recently developed a semiconductor *in-situ* testing device. This is the first trial that can provide *in-situ* testing data at the process stage by clustered *in-situ* measurement, provide a basis for the academia, industry, and research community to develop novel semiconductor materials, improve process yields and reliability, and offer a service platform for domestic and international semiconductor manufacturing in ALD/ALE process equipment testing and development verification. The results of the “Advanced Semiconductor Equipment and Process Technology of NARLabs” has been published in the technical forum at Seminar of NARLabs' Advanced Semiconductor Equipment & Process Technology (NARLabs 2021 ASEPT Seminar) on December 29.

左圖：於「2021 臺灣國際半導體展」展示半導體產業高階儀器設備自主研發成果與客製服務績效；右圖：「國研院先進半導體設備與製程技術」技術論壇。
Left: TIRI's R&D achievements in the self-development of advanced instruments and customization services for the semiconductor industry are showcased at SEMICON Taiwan 2021. Right: The technical forum at “NARLabs 2021 ASEPT Seminar”

110 年獲獎記錄 Awards in 2021

活動 Event	參賽作品 Participating Work	獲獎項目 Award
第 18 屆國家新創獎 18th National Innovation Award	模組化遠距健康照護系統 – 智慧藥箱 Modular Remote Health Care System - Smart Medicine Kit	臨床新創 – 創新醫護服務 (與花蓮慈濟醫院團隊共同榮獲) Clinical Innovation Award-Innovative Healthcare Services (awarded with the team of Hualien Tzu Chi Hospital)
	免萃取式農藥殘留快速偵測系統 Extraction-free Rapid Detection System for Pesticide Residue	學研新創獎 (與國立臺灣大學、國立清華大學團隊共同榮獲) Academic Research Innovation Award (awarded with the team of National Taiwan University and National Tsing Hua University)
	人工下顎與植體骨仿生結構 Artificial Jaw and Implant Bone Bionic Structure	學研新創獎 (與國立陽明交通大學團隊共同榮獲) Academic Research Innovation Award (awarded with the team of National Yang Ming Chiao Tung University)
	自動化快速檢測乳癌 Automated Rapid Testing of Breast Cancer	學研新創獎 (輔導臺北醫學大學團隊獲獎) Academic Research Innovation Award (the team of Taipei Medical University coached by TIRI)
中華民國計量工程學會 Chinese Metrology Society	原子級科學與工程技術發展 Atomic-level Science and Engineering Development	第 16 屆計量科技研發創意獎 Innovation Award for Metrology Technology R&D of the 16th Session
2021 未來科技獎 2021 Future Tech Awards	「轉移奈米結構的方法及具有奈米結構的裝置」技術 Method of Transferring Nanostructures and Device Having the Nanostructures	2021 未來科技獎 2021 Future Tech Awards

亮點成果與大事紀要 Notable Achievements & Milestones in 2021

活動 Event	參賽作品 Participating Work	獲獎項目 Award
110 年「第一屆國家實驗研究院研發服務平台亮點成果獎」 2021 "The 1st NARLabs R&D Service Platform Achievement Award"	「次埃解析度原子結構研究與應用研發服務平台」服務團隊成果 Sub-Å Atomic Structure Research and Applications R&D Service Platform	特優獎 High Distinction Award
	「鏈結產學技術加值服務平台」服務團隊成果 TIRI's Value-Added Service Platform for Industry-Academia Technology Linkage	佳作 Honorable Mention Award
110 年「第十五屆國家實驗研究院傑出科技貢獻獎」 2021 "The 15st NARLabs Outstanding Scientific and Technological Contribution Award"	第三代前瞻半導體材料製程與設備 Third-generation Semiconductor Material Processes and Equipment	「學術研究」優等獎 Merit Award in Academic Research
	前瞻超穎材料製程新技術 Novel Technologies for the Metamaterials Process	「學術研究」佳作 Honorable Mention in Academic Research

左圖：「轉移奈米結構的方法及具有奈米結構的裝置」技術榮獲未來科技獎；右圖：與花蓮慈濟醫院共同開發之「智慧藥箱」榮獲國家新創獎。

Left: "Method of Transferring Nanostructures and Device Having the Nanostructures" is honored with 2021 Future Tech Award. Right: "Smart Medicine Kit" jointly developed with Hualien Tzu Chi Hospital receives the 18th National Innovation Award – Clinical Innovation Award.

Taiwan Instrument Research Institute

儀器科技發展

Development of Instrument Technology

支援前瞻學術研究
Supporting Cutting-edge Academic Research

儀科中心積極建構跨領域整合的儀器科技研發服務平台，是國內唯一可提供學術界客製化開發特殊關鍵模組與儀器設備的單位，滿足各領域進行前瞻研究與實驗的特殊需求，期能促進科學上的新發現。

TIRI actively builds interdisciplinary and integrates R&D service platforms for instrumentation technology. It is the only institution in Taiwan that can provide customized development of key modules and instruments to meet the specific needs of cutting-edge research and experimentations in various fields and to facilitate new scientific discoveries.

大面積二維材料製程 / 設備開發與服務平台
Development of Fabrication and Equipment for Large-scale 2D Material

臺灣第一套學研用硫氣態源二維材料沉積系統
Taiwan's first sulfurous gas 2D material deposition system for academic research

儀科中心所建構之「硫氣態源二維材料沉積系統」以氣態 H_2S 為反應性氣體，可長成高品質之二硫屬化物的二維材料，提供國內學研團隊做為開發大面積、高純度的二維材料沉積技術之前期研究使用之平台。

TIRI develops "Sulfur Gas Source Two-dimensional Material Deposition Equipment" which uses gaseous H_2S as the reactive gas to grow high-quality 2D transition-metal dichalcogenide. It also provides domestic academic and research teams as a R&D platform for preliminary research of the large-area, high-purity 2D material deposition technology.

重要規格 System specifications

- 工作壓力 Working pressure: 1-100 Torr
- 加熱溫度 Heating temperature < 1,000 °C
- 加熱區 Heating zone < 30 cm
- 具自動 PID 演算單段溫度控制系統
  Single-stage temperature control system with a PID controllers

次埃解析度原子結構研究與應用研發平台
Sub-Å Atomic Structure Research and Applications R&D Service Platform

國內首創「原子解析度三維顯微結構」分析技術
Pioneering Taiwan's "atomic-resolution 3D electron tomography" analysis technology

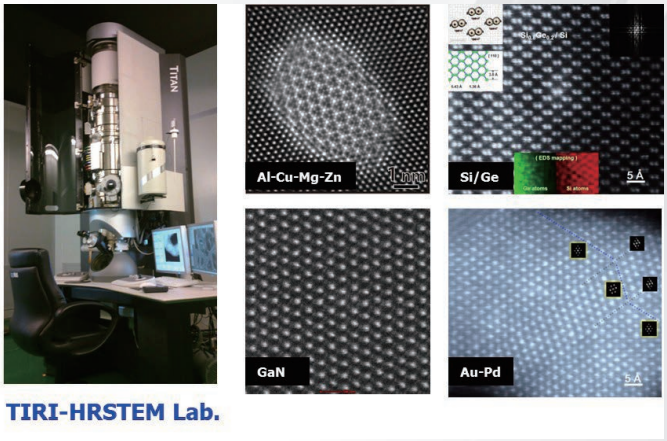
次埃解析度原子結構研究與應用研發服務平台配備「原子解析度像差修正掃描穿透式電子顯微鏡」，點解析度為目前國內最高的 0.78 Å，並建立國內首創的「原子解析度三維顯微結構」分析技術，提供國際學術界與產業界全新的視野，以了解先進材料之結構與性質之間的連結。

“Sub-Å Atomic Structure Research and Applications” R&D service platform, which is equipped with the “Atomic Resolution Aberration-Corrected Scanning Transmission Electron Microscope” with a resolution of 0.78 Å, the highest in Taiwan. The Taiwan's pioneering “atomic-resolution 3D electron tomography” analysis technology provides a new perspective for international academia and industry to understand the link

between the structure and properties of advanced materials.

重要規格 System specifications

- X-FEG 高亮度電子槍 X-FEG high-brightness electron gun
- 三組聚光電磁透鏡 Three sets of concentrating electromagnetic lenses
- DCOR 像差修正器 DCOR aberration corrector (球面像差spherical aberration < 1 m)
- TEM 解析度 TEM resolution 0.24 nm ; STEM 解析度 STEM resolution 0.78 Å
- 能量分散光譜儀 Energy-dispersive X-ray spectroscopy (EDS)，能量解析度energy resolution 136 eV。



高光譜顯微影像分析研發服務平台
Hyperspectral Microscopic Imaging Analysis and R&D Service Platform

探究微米尺度微觀世界
Exploring the microscopic world on a micron scale

儀科中心深耕高光譜影像技術多年，近年來推動高光譜技術與顯微系統之整合，開發高光譜顯微影像分析研發服務平台，不僅具備微米尺度定位顯微取像功能，更具有光譜影像定量分析之特點，可測量樣品重要物理參數，如穿透率、反射率與吸收率等，且可提供產學研各界應用於微奈米材料、光電元件與生物組織的顯微影像分析研究。

TIRI has been dedicated to the hyperspectral imaging technology for more than decades and recently has applied it on microscopes, developing the “Hyperspectral Microscopic Imaging System”. Different from the general hyperspectral imaging mostly applied on qualitative data analysis, our system not only has the functions of micron-scale positioning and microscopic imaging, but also has the characteristics of spectral quantitative analysis, which can measure important spectral parameters of samples, such as transmittance, reflectance, and absorptance. This technology is widely used in microscopic image analysis of nano-micro materials and biological tissues.

重要規格 System specifications

- 波長範圍 Wavelength range: 470-900 nm
- 光譜為 150 波段 Spectrum in the 150 band
- 高光譜影像像素 Hyperspectral image pixels: 3,600 (X)×2,048 (Y)

複合式電漿原子層蝕刻 / 沉積系統
Hybrid PEALE/ALD System

學研客製化鍍膜與蝕刻製程實驗裝置
Customized atomic layer etching/deposition system

複合式原子層電漿鍍膜系統結合原子層蝕刻功能，專為小尺寸試片與探針製鍍超薄奈米結構，具備高密度表面絕緣保護膜製鍍品質，並可應用於生物試片與原子解析度三維重構試片製鍍，幫助學研節省研發期間前驅物材料的浪費。

The hybrid atomic layer plasma coating system leverages the atomic layer etching function to coat small-size specimens and probes with ultra-thin nanostructures, under a coating quality of high-density surface insulation protection film. It can be applied to the coating of biological specimens and atomic resolution 3D reconstructed specimens, helping to save precursor material waste for academic research during R&D.

重要規格 System specifications

- 製程反應腔全周採用氧化鋁以維持製程穩定 Alumina oxide is used around the entire circumference of the process reaction chamber to maintain process stability.
- 4 吋晶片載座操作溫度 Operating temperature of the 4-inch chip carrier : 350-400 °C
- 感應耦合電漿 Inductively coupled plasma (ICP) 300 W
- MFC 流量控制模組 MFC flow control module
- 模組式儀控箱，輕鬆升級與檢修 Modular instrument control box is easy to upgrade and fix.

促進重點產業發展
Promoting the Development of Key Industries

儀科中心長期因應國家政策擴展研發能量，推動高階關鍵儀器設備及元組件之自主研發與應用，配合政府六大核心戰略產業發展重點，以加速我國產業升級轉型，讓臺灣成為未來全球經濟的關鍵力量。

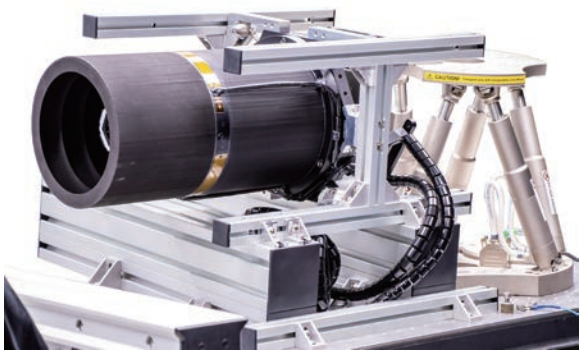
TIRI has been expanding its research and development capability in response to national policies for a long time, boosting research, development and applications of high-end key instruments and components. In line with government's "six core strategic industries" development priorities, TIRI targets to accelerate Taiwan's industrial upgrading and transformation, making Taiwan a key force in the future global economy.

反射式望遠鏡光機系統
Optical-mechanical System of Reflective Telescope

客製化光學遙測取像系統
Design and development of opto-mechanical system for customized optical remote sensing telescope

藉由福衛五號光機系統發展計畫，儀科中心建立高精度望遠鏡光機系統的設計、製作、組裝調校與量測等技術能量。此「反射式望遠鏡光機系統」的研製為採用 Ritchey-Chretien 光學系統架構設計，並使用極低熱膨脹特性材料來製作鏡片與機構等組件，例如 Zerodur, Fused Silica, CFRP, Invar 等來製作高精度的光機系統。本系統可應用於高空機載及衛星之光學遙測取像應用。

Based on the development project of opto-mechanical system for FORMOSAT-5 satellite, TIRI has established the technologies of design, manufacturing, assembly, tuning and measurement for high-precision opto-mechanical system of telescope. The opto-mechanical system of reflective telescope is designed with Ritchey-Chretien optical system architecture. The lenses and structures of the high-precision opto-mechanical system are fabricated with the materials of extremely low thermal expansion, such as Zerodur, Fused Silica, CFRP and Invar. The system can be applied to the image acquisition for airborne-based and satellite-based optical remote sensing system.



重要規格 System specifications

- 通光口徑 Clear aperture: 132 mm
- 瞬時視場角 IFOV: 9.0 μrad
- 視角 FOV: ±1.87°
- 光譜範圍 Spectral range: 450-900 nm
- 有效焦長 Effective focal length: 500 mm

複合式物理氣相沉積系統
Hybrid Physical Vapor Deposition (PVD) System

複合材料鍍製利器
The innovative driver for composite coating materials

濺鍍系統可在較低的溫度下製備高硬度及高堆積密度化合物薄膜，如氧化物、氮化物、硼化物、碳化物等；電子槍系統則能鍍製高沉積速率及高光學品質的金屬膜如金、銀、鋁等。儀科中心開發複合式濺鍍及電子槍鍍膜系統，此系統整合兩種鍍膜系統，可交錯鍍製金屬及化合物多層膜，提高鍍製效率。

The sputtering system can produce high-hardness and high-density compound films such as oxides, nitrides, borides, and carbides at lower temperatures, while the e-gun system can produce metal films with high deposition rates and high optical quality such as gold, silver, and aluminum. TIRI has developed a hybrid sputtering and e-gun evaporation system that integrates two methods for alternatively coating metal and compound multilayers to improve efficiency.

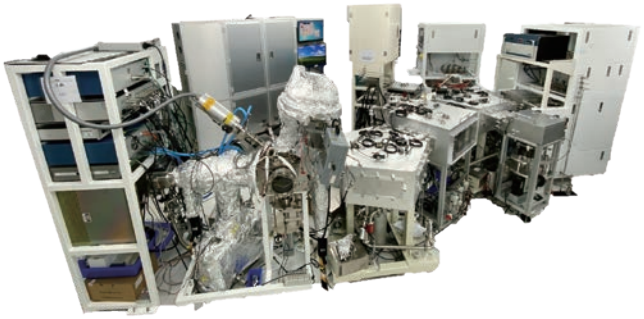
重要規格 System specifications

- 數位化的電控系統，自動化方式完成多層膜製鍍。
  Fully digital electronic control system with automatic multilayer coating
- 高真空系統，底壓 < 1E-6 Torr
  High vacuum system, base pressure < 1E-6 Torr
- 即時膜厚監控系統，監控頻率為每 1/10 秒可量測一次、鍍膜速率分辨率為 ±0.037 Å/S。
  Real-time thin-film thickness monitoring system with thickness and rate resolution is ±0.037 Å/S at 0.10 s measurement interval.

6 吋叢集式 ALD 暨臨場 XPS 檢測分析平台
6-inch Clustered ALD and *in-situ* XPS Testing and Analysis Platform

國內首創 ALD 製程與量測分析同步設備
Taiwan's pioneering simultaneous ALD process and measurement analysis equipment

儀科中心累積多年 ALD 相關設備及製程開發經驗與技術，建置叢集式 ALD 暨臨場 XPS 檢測分析平台，以叢集式技術整合製程與分析設備，避免樣品在傳遞過程中受大氣汙染，以及減少需額外製作保護層所增加的製程複雜度和成本。本平台可提供目前國內唯一 *in-situ* 製程分析服務，可應用於 FinFET/GAA 製程，並已與台積電和陽明交通大學等單位進行製程與分析打樣測試，未來將擴充 PEALE 等製程模組，進一步強化研發及服務能量。



TIRI has accumulated many years of experience and technology in ALD equipment and process development to build a clustered ALD and *in-situ* XPS analysis platform. It integrates analysis functions into the process, avoiding atmospheric contamination of samples during transfer, and reducing the process complexity and cost for additional protective layers. The platform provides the only *in-situ* process analysis service in Taiwan for FinFET/GAA processes and has been used for process and analysis sample testing with institutions such as tsmc and National Yang Ming Chiao Tung University. The system will be expanded with process modules such as PEALE to further enhance R&D and service capabilities.

重要規格 System specifications

- Oxide ALD 系統一套， 可提供 Al_2O_3、HfO_2、ZrO_2、Y_2O_3 製程。
  Oxide ALD system, available for the processes of Al_2O_3, HfO_2, ZrO_2, and Y_2O_3
- Nitride ALD 系統一套，可提供 AlN、TiN 製程。
  Nitride ALD system, available for the processes of AlN and TiN
- RTP 系統一套，可提供製程 800 ℃真空退火以及合成氣體 (FGA) 退火。
  RTP system, available for 800 °C vacuum annealing or forming gas annealing (FGA) process.
- *in-situ* XPS 分析儀一套，可提供製程臨場檢測。
  In-situ XPS analyzer, available for *in-situ* process analysis

智慧化鏡片膠合對心系統
Intelligent Lens Glue and Alignment System

提升臺灣精密光學元件製造產業競爭力
Enhancing the competitiveness of Taiwan's precise optical manufacturing industry

儀科中心自研自製用於生產半導體設備中的關鍵零組件之智慧化自動推給對心系統，由雷射整形模組產生對心用光源，膠合鏡片放置於旋轉對心系統上，光源經過透鏡量測其偏心量，依據偏心量推給鏡片，使膠合鏡片的相對偏心量逐步減少，直至 10 角秒以下。此系統能夠取代傳統人力的膠合對心製程，能提升對心精度、加快生產速度並提高生產良率。

TIRI has independently developed an intelligent automatic push-to-alignment system for the production of key components in semiconductor devices, in which the laser shaping module generates the light source for centering, the glued lens is placed on the rotating alignment system, the light source passes through the lens to measure its eccentricity and is pushed onto the lens according to the eccentricity, making the relative eccentricity of the glued lenses gradually drop to less than 10 arc seconds. This system replaces the traditional manual gluing and aligning process, improves centering accuracy, speeds up production, and enhances the yield.

重要規格 System specifications

- 設備對心解析度 Device centering resolution ≦ 1 arcsec
- 自動對心後膠合鏡片偏心量 Eccentricity of the glued lens after auto-centering ≦ 10 arcsec
- 自動對心推給次數 Automatic alignment counts ≦ 3 times

深化社會影響力
Deepening Social Influence

為有效擴散技術貢獻於社會，儀科中心致力針對社會民生需求，投入醫療、智慧節能、智慧農業與災害防救應用等提供多樣化的儀器系統創新開發。

To effectively diffuse technology and contribute to society, TIRI is committed to providing diversified instruments innovation and development for the needs of people's livelihoods, including medical treatment, intelligent energy conservation, intelligent agriculture, disaster prevention and rescue applications.

智能化能源管理暨分析系統
Intelligent Energy Management and Analysis System

有效掌握廠房溫溼度即時現況，實現智慧調控工廠
Real-time temperature and humidity control implementing the intelligent factory

儀科中心與輝瑞大藥廠合作，進行全方位之能源監測、分析、管理及最佳化節能控制。系統除可支援各式感測器及電錶外，更提供分析模型及智慧演算法，藉由操作設定點之即時優化調整、動態效率預測管理及生產效能分析，可大幅提升主要能耗設備之運維效率，提高節能成效，達成用能設備「自主優化」運轉，讓能源使用效率提升 3% ー 15% 實現環境品質、舒適及節能三贏之能源管理目標。

TIRI cooperates with Pfizer Inc. to conduct all-around analysis, management, and optimization of energy conservation control. It provides built-in analysis models and intelligent algorithms for various parameters of sensors and meters. Through real-time optimization

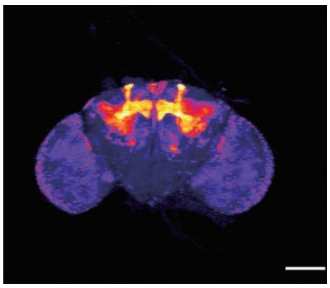
and adjustment of set points, dynamic operation efficiency prediction, and production efficiency analysis, the operations and maintenance of the major energy-consuming equipment can be greatly improved, and the energy-saving effect can be enhanced. The goal of "independent optimization" operation of energy-consuming equipment can be achieved, which can increase energy efficiency by 3%-15%.

重要規格 System specifications

- 透過資料探勘、K-means 分群方法與 Gap statistic 方法，對冰水主機資料進行預處理。
  Data mining, K-means clustering method, and Gap statistic method can be adopted to pre-process the chiller system data.
- 利用分群結果結合機器學習模型，有效提升模型之預測精準度，增加能源基線的可靠性。
  The clustering results are combined with the machine learning model to effectively improve its prediction accuracy and increase the reliability of the energy baseline.

動物腦波螢光積分模組
Bio-signal Integrating Fluorescence Signal Module

協助學研團隊探究腦科學
Assisting academic research teams to explore brain science



儀科中心協助台大物理團隊開發設計前端高速、微電流量測放大電路模組，以雷射陣列激發螢光訊號，進行每秒 500 個 200 um^3 立方體的掃描，應用於果蠅腦或動物神經訊號的成像。

TIRI supports the physics department from National Taiwan University in the development and design of a cutting-edge high-speed, micro-current measurement amplifier module that uses laser arrays to excite fluorescent signals at 500 scans per second of 200 um^3 cubes, which is applied to the imaging of Drosophila brains or neural signals in animals.

重要規格 System specifications

- 32 通道，每一通道 240 MHz 取樣頻率 32 channels, 240 MHz sampling frequency per channel
- 電流轉電壓轉換放大倍率 Current-to-voltage amplification: 15,000 V/A
- 最小量測電流 Minimum measured current: 0.2 uA

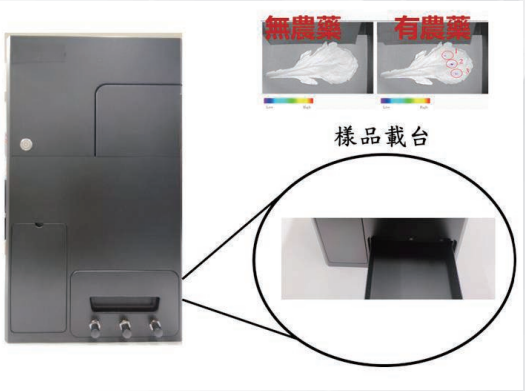
免萃取式農藥殘留快速偵測系統
Extraction-free Rapid Detection System for Pesticide Residue

邁向精準健康之新世代農業
Developing a new agriculture generation regarding precise health

本系統由儀科中心、國立臺灣大學及國立清華大學團隊共同合作開發，以螢光成像技術為基礎，透過蒐集大量農藥光譜資訊的大數據資料庫比對，無需專業人員繁瑣萃取步驟，即可同時大面積範圍分析多個樣本，30秒內偵測農藥超標之農產品，對食安作出的具體貢獻。

The system is developed by TIRI and the team from National Taiwan University and National Tsing Hua University. The system is based on fluorescence imaging and the big data database of pesticide spectral information to detect agricultural products with excessive pesticides in 30 seconds, avoiding tedious extraction steps by professionals and contributing to food safety.

重要規格 System specifications



- UV 波段光源激發光輸出及光源控制器
  Light output stimulated by UV-band light source
- 轉盤式濾波鏡組 Turntable filter: 700-850 nm
- 二級冷卻系統偵測農藥微弱螢光反應
  A secondary cooling system detects weak fluorescent responses to pesticides.
- 能檢測於葉菜類中有殘留超標之農藥種類
  Pesticide residues detected in leafy vegetables: Cyhalothrin, Cypermethrin, Deltamethrin, Chlorpyrifos, and Acetamiprid
- 以光學影像方式偵測，樣本不需破壞萃取。
  Detection by optical imaging with no destructive extraction of samples

模組化遠距健康照護系統－智慧藥箱
Modular Remote Health Care System - Smart Medicine Kit

輕鬆管理用藥的專屬智能小管家
Exclusive and smart butler for easy medication management

儀科中心與花蓮慈濟醫院共同合作開發智慧藥箱，以整合醫院資源為出發點，結合權限管制及物聯網 (IoT) 技術讓醫護人員分級使用病人的病歷與醫療資料，並友善地提醒病患用藥時間，可遠端即時確認用藥情況。此系統採取模組化概念，可依病患用藥量與人數靈活組裝，模組化藥盒可由合作醫院以物流配送至病患家中，造福偏鄉慢性病患者免於舟車勞頓之苦，改善偏鄉的醫療環境。

TIRI and Hualien Tzu Chi Hospital jointly developed a smart medicine kit that integrates hospital resources, combines access control and Internet of Things (IoT) technology to provide medical workers with hierarchical access to patient records and medical data and a friendly reminder to patients about the medication timing. The kit also supports the remote confirmation of medication in real-time. Modular medicine boxes are equipped according to the amount of medication and the number of patients and delivered by the partner hospitals to the patients' homes, thus benefiting rural patients with chronic diseases by avoiding long travel and improving the medical environment in the rural areas.

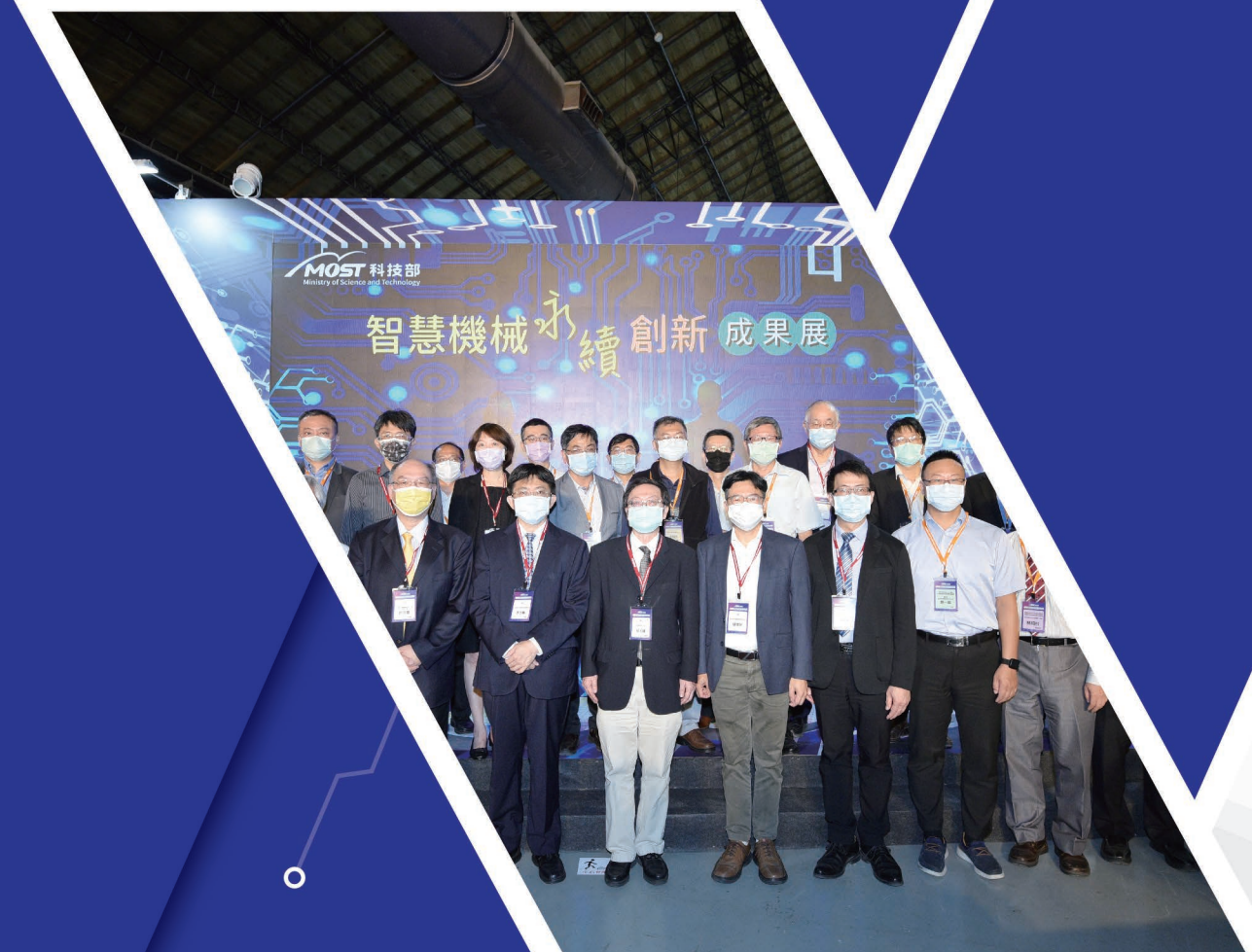
重要規格 System specifications

- 藥格空間 Medicine grid space: 1,000 × 8,000 × 100 mm (W × L × H)
- 權限管制：無線 (RFID) 登錄 100 枚以上；健保卡 100 枚以上。
  Permission control: 100 or more wireless (RFID) logins ; 100 or more health insurance cards
- 通報機制：每 30 分鐘提醒一次，共提醒 8 次 (4 小時)。
  Notification mechanism: 8 reminders every 30 minutes (4 hours)
- 軟體功能：吃藥時間設定、提醒設定、Line 推撥設定。
  Software functions: medication time setting, reminder setting, and LINE push setting
- 硬體效能：Linux、螢幕尺寸 10 吋、記憶容量 128 GB。
  Hardware performance: Linux, Hardware performance: Linux, 10-inch screen size and 128 GB. memory capacity

Taiwan Instrument Research Institute

任務導向研發

Mission-oriented Research & Development



推動前瞻基礎建設－「前瞻半導體製程臨場檢測設備研發」計畫

Striving for Forward-Looking Infrastructure Development Program — "Advanced Research Instrumentation Development Service Platform" Project

儀科中心以累積多年的光電儀器研製以及光機系統整合經驗，參與第一期 (106 － 107) 與第二期 (108 － 109) 前瞻基礎建設計畫中的「自研自製高階儀器設備與服務平台」整合型計畫，主要建立國內半導體製程設備自製能力；110 年參與前瞻第三期 (110 － 111)「建置半導體臨場檢測設備計畫」以及「下世代半導體技術開發與人才培育」，首創 *in-situ* 製程量測，可在製程階段提供臨場量檢測數據，協助國內半導體設備產業進入檢測設備自主開發，以及支援國內擴大半導體二維材料製程與設備跨領域半導體人才培育，吸引更多基礎科學物理、化學、數學領域人才加入半導體產業培育計畫，使國內廠商能佈局半導體檢測設備產業，落實整合國內半導體設備上中下游之技術，並將國內半導體設備能力再升級。

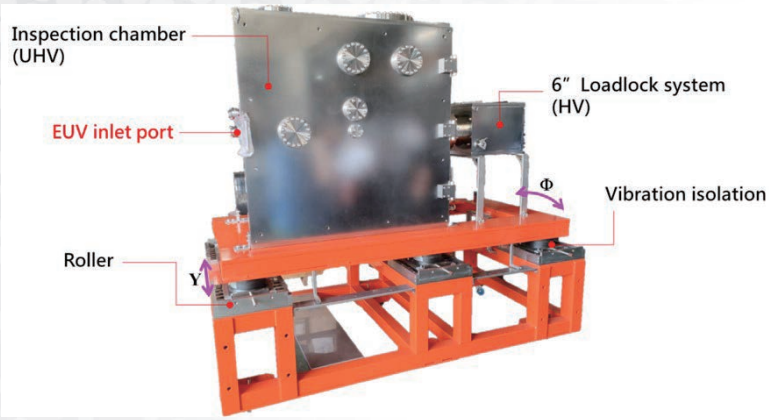
110 年主要成果如下：

- 建置拉曼光譜機邊量測模組與即時監控模組切換設計，除了可搭配大面積 CVD 製程即時分析外，亦可切換機邊檢測藉以提高支援二維材料檢測之機動性。
- 完成 EUV 材料組件缺陷分析技術與設備發展及整合各項檢測模組光路、進行檢測動作機構設計與腔體設計初步規劃，目標為建置可進行 EUV 光阻、光罩與反射率的多功能檢測平台。
- 開發大尺寸半導體二維材料製程系統，此系統可使用固態或氣態前驅物，同時透過模擬流場設計最佳化腔體，以達成大面積二維材料均勻成長；並指導清大、陽明交大及長庚大學等研究生一同參與系統開發，培育前瞻半導體設備高階人才。

With accumulated abundant experiences in the R&D and integration of opto-electro-mechanical systems, TIRI has participated in the integrated project of the "Advanced Research Instrumentation Development Service Platform" in Phase 1 (2017-2018) and Phase 2 (2019-2020) of "Forward-Looking Infrastructure Development Program", which focuses on developing Taiwan's independent production capability for semiconductor process equipment. In 2021, TIRI continues the projects of "development of *in-situ* inspection semiconductor equipment" and "next generation of semiconductor technology development and talent cultivation" in Phase 3 of the Program (2021-2022), initiating an *in-situ* measurement and providing data during the process stage. TIRI also assists in the self-development of inspection equipment in domestic semiconductor industry and supports the expansion of interdisciplinary talent cultivation for semiconductor 2D material processes and equipment in Taiwan. Therefore, more talents in the fields of basic science physics, chemistry, and mathematics can be attracted to join the incubation plan for the semiconductor industry, enabling domestic manufacturers to better plan the semiconductor inspection equipment industry. Thus, the domestic capabilities can be upgraded through the integration of upstream, midstream and downstream technologies.

The main achievements in 2021 are as follows:

- Designing a switching system for the Raman spectrometer side measurement module and the real-time monitoring module, which allows for real-time analysis of large-area CVD processes and switching between machine-side detection to increase the mobility for supporting 2D material detection.
- Completing the development of technology and equipment for the analysis of defects in EUV material components, integrating the optical path of each detection module, and carrying out the design of the detection mechanism and the preliminary planning of the cavity design, with the goal of building a multi-functional EUV detection platform for defects on photoresist, mask, and reflectance.
- Developing a 2D semiconductor material processing system for large wafer size, which can use solid or gaseous precursors, optimized the cavity by simulating the flow field design to achieve uniform growth of 2D materials on large wafer size. Supervising graduate students from National Tsing Hua University, National Yang Ming Chiao Tung University, and Chang Gung University to participate in the development of the system to cultivate advanced talent in cutting-edge semiconductor equipment.



左圖：EUV 微影元件檢測平台系統設計與建置；右圖：建置學研用研究型半導體二維材料製程系統。
Left: Design and establishment of the EUV detection platform for photolithography components
Right: Establishment of a 2D semiconductor material processing system for academic research

推動創價醫材加速器平台計畫
Boosting Medical Device Accelerator for Value Creation Project

儀科中心運用自身生醫科技核心實驗室研發能量與檢測驗證能力，提供研發團隊醫療器材開發輔導與檢測驗證一站式服務。藉由創價醫材加速器平台，加速研發團隊研究成果之轉譯與加值，並橫向連結北、中、南三大科學園區與工業局，加速新創及協助既有生醫廠商升級茁壯，提升生醫產業國際競爭力。

110 年主要成果如下：

- 本平台輔導 2 新創公司產品取得歐盟 CE 上市許可，包括鈦隼生物科技 (股) 公司之「腦部手術導航系統」，為國內首創之自動化腦部手術導航系統；以及台灣醫學影像 (股) 公司之「胸腔 X 光輔助偵測系統」，以 AI 系統用於新冠肺炎輔助偵測，協助國內醫療第一線人員抗疫，並促成該公司獲得歐盟首筆訂單。此外，促成 2 團隊成立新創公司、協助 2 新創公司通過人體試驗倫理委員會審查，加速研發成果進入臨床驗證。
- 因應全球 COVID-19 疫情肆虐，本平台積極輔導廠商投入防疫行列，善用科技幫助臺灣抗疫與防疫，其中輔導矽基分子電測科技 (股) 公司開發出世界首創的「新冠病毒快速檢測晶片」，協助產品安規驗證，於 2021 年底取得衛福部食藥署緊急使用授權 (TFDA EUA)。
- 發揮本平台鏈結產學技術加值服務能量，輔導世延生醫 (股) 公司與長庚大學、長庚醫院、奇美醫院等合作開發「口腔癌快篩診斷試劑產品」，並榮獲國研院「110 年度研發服務平台亮點成果獎」佳作，促成世延生醫總公司進駐竹科；另亦輔導世延生醫 (股) 公司與成功大學、成大醫院等合作開發「結合電刺激與紅外線之慢性傷口治療儀」，分公司進駐中科，達成跨園區及產學研醫緊密合作。
- 配合政府新南向政策鏈結東南亞國家，延續與泰國國家發展局 (NSTDA) 下 BIOTEC-IBST 實驗室合作，進行「肺癌檢測技術開發」計畫，並擴大合作面向至 COVID-19 快篩臨床應用，深化國際夥伴合作關係。並順利完成新加坡國立大學 (NUS) 研發團隊所開發之客製化 3D 列印骨板安全與功效性驗證，展現本平台於東南亞服務之量能與名聲，有助於打入國際醫材測試驗證供應鏈。

Given its own R&D advantages of biomedical core facilities, as well as testing and verification capabilities, TIRI provides a one-stop service for medical device R&D teams from prototype counseling to product testing and verification. Based on the medical device accelerator platform, TIRI assists the medical device R&D teams to accelerate the commercialization of their R&D results. It also horizontally connects Taiwan's three Science Parks with the Industrial Development Bureau, MOEA to speed up innovations, assists in the upgrade and growth of existing biomedical manufacturers, and enhances the international competitiveness of the biomedical industry.

The main achievements in 2021 are as follows:

儀科中心輔導長庚大學余兆松教授團隊開發「口腔癌檢測方法與免疫檢測試劑」，並成功技轉予世延生醫 (股) 公司，榮獲國研院「 110 年度研發服務平台亮點成果獎」佳作。

TIRI counsels Professor Jau-Song Yu's team at Chang Gung University to develop the oral cancer detection method and immune detection reagent. Both the method and reagent have completed the technology transfer to S&T Biomed Co., Ltd. and have been awarded with Honorable Mention of 2021 NARLabs R&D Service Platform Achievement Award.

- Coaching two start-up companies to obtain CE marking for their products, including the first autonomous neurosurgical navigation robot in Taiwan, "NaoTrac" of Brain Navi Biotechnology Co., Ltd., and the "Chest X-ray Aided Detection System" of Taiwan Medical Imaging Co., Ltd., which is an AI system to help Taiwan's frontline healthcare professionals triage COVID-19 suspected cases safely and rapidly. The platform has helped the company to obtain the first EU order. In addition, the platform faciliates the establishment of innovative companies by two teams and assists the two companies to pass the review of the Institutional Review Board, speeding up the clinical validation of R&D results.
- In response to the global COVID-19 pandemic, TIRI actively encourages manufacturers to help fight and prevent the pandemic in Taiwan with technology, including supporting the development of the world's first "COVID-19 rapid test chip" by Silicon-Based Molecular Sensoring Technology Co. Ltd. and assisting in the safety verification of the product. The product has received Emergency Use Authorization (EUA) from Taiwan Food and Drug Administration (TFDA) at the end of 2021.
- TIRI provides value-added services by linking academia-industry technologies for example; promoting S&T Biomed Co., Ltd., Chang Gung University, Chang Gung Memorial Hospital, and Chi Mei Medical Center to collaborate in the development of "Human OCBM-1 (Oral Cancer Salivary Biomarker) ELISA Kit", and being awarded with the Honorable Mention of 2021 NARLabs R&D Service Platform Achievement Award. In addition, TIRI facilitates S&T Biomed Co., Ltd. to set up the headquarters in the Hsinchu Science Park, and also assists S&T Biomed Co., Ltd. to work with Chang Gung University and National Cheng Kung University Hospital to develop a "chronic wound therapy device combining electrical stimulation and infrared light". The branch company of S&T Biomed Co., Ltd. has entered the Central Taiwan Science Park, achieving cross-park and close cooperation among industry, academia, research, and medicine.
- In line with the government's New Southbound Policy to strengthen relationships with Southeast Asian countries, the platform continues to collaborate with the BIOTEC-IBST laboratory of the National Science and Technology Development Agency (NSTDA) in Thailand on the project of "Technology Development for Lung Cancer Detection" and extends the cooperation to clinical applications of COVID-19 rapid testing, deepening the international partnership. In addition, the platform completes the safety and performance testing of the customized 3D printing bone plate developed by a team from the National University of Singapore, demonstrating its capability and reputation for services in Southeast Asia and contributing to the entry into the international testing and verification supply chain of medical devices.

推動發展智慧製造及半導體先進製程資安實測場域 專案計畫

Pressing ahead for IoT Information Security Development Project for Intelligent Manufacturing and Semiconductor Processing Testing Field Project

本計畫由儀科中心協同國家高速網路與計算中心及台灣半導體研究中心共同執行，結合具智慧製造 / 半導體與資訊安全專長之學研團隊跨領域合作，將所發展之先進製造技術融合資安技術落實於物聯網應用場域。透過產業資安標準落實、資安驗證場域建置、攻防演練等，整合學研資源強化智慧製造及半導體製程場域之資安防護能力，健全國內物聯網安全供應鏈，提升智慧製造、半導體、工業控制（工控）及資安等產業資安能量。

110 年主要成果如下：

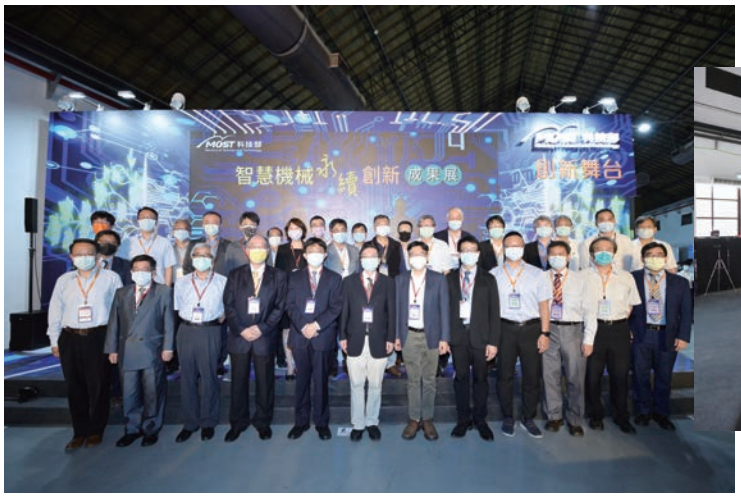
- 針對智慧製造與半導體先進製程之資安偵測防護技術開發，遴選學術界計畫團隊執行，鏈結學術、科技部法人機構與產業界，強化工控資安技術落實於實際產線中，藉以培育工控資安技術專業人才 (如 IEC 62443)，同時針對工控資安場域進行攻防演練，協助產業界提升物聯網及智慧製造暨半導體製程資訊安全。
- 針對八所學校團隊與儀科中心、半導體中心之場域進行資安測試演練，模擬駭客攻擊，以探索資安風險，產出公測報告提供給各團隊，讓團隊依結果改進，提升資安防護技術。
- 本計畫串接 8 個學研團隊、 3 個法人單位與 13 家廠商合作，培育科研人才 144 人 (博碩士 113 人)，並完成培育 IEC 62443 工控資安技術專業研究人力 30 名， IEC 62443 基礎培訓 67 名。期間完成期刊論文 30 篇、國內外研討會論文 13 篇、技術報告 2 篇、專利獲得 1 件、專利申請 13 件、產學合作 29 件，金額約 1,800 萬。
- 透過儀科中心航太級先進製造場域，將其網段區隔，以縱深防禦概念建置工控網路架構，工控場域內具有高精度多軸工具機、量測系統、機邊電腦、感測器等相關先進製造模組及系統，並透過國網中心長期監控工控場域網路，可供各計畫學研團隊以此場域為平台，驗證其開發之產品或技術模組。
- 配合科技部智慧機械 5 大專案計畫，於 110 年 5 月 7 日在臺北松山文創園區 1 號倉庫舉辦聯合成果展及實測考評。呈現團隊資安攻防技術之能量，藉以促成產學媒合，加速學界研發成果落實到產業應用。同時開放各機關學校與民眾報名參加，藉此推廣科普生活化，以滿足民眾終身學習的需求，提升全民科學素養。

This project is jointly implemented by TIRI, National Center for High-Performance Computing (NCHC), and Taiwan Semiconductor Research Institute (TSRI). It is a cross-disciplinary collaboration among academic research teams from fields of intelligent manufacturing, semiconductor, and information security to implement advanced manufacturing and information security technologies in IoT applications. Through the implementation of industrial information security standards, the establishment of validation fields for information security, and the offensive and defensive exercises, the academic research resources are integrated to strengthen the information security protection of intelligent manufacturing and semiconductor process fields, improve the security supply chain of Taiwan's IoT, and enhance the information security capabilities of intelligent manufacturing, semiconductor, industrial control, and information security industries.

The main achievements in 2021 are as follows:

- Regarding the development of information security detection and protection technologies for intelligent manufacturing and advanced semiconductor process, academic teams have been selected to carry out the project, connecting academia, corporate bodies of MOST and industry to strengthen the implementation of industrial control technologies for information security in actual production lines. It also cultivates professional talents in industrial control technologies for information security (e.g., IEC 62443) while conducting offensive and defensive exercises for the fields to assist the industry in enhancing the information security of IoT and intelligent manufacturing and semiconductor process.
- Eight university teams conduct information security drills in the test fields of TIRI and TSRI to simulate hacking attacks to explore the information security risks. It produces a public test report for the teams to improve their information security protection technologies based on the results.

- This project connects eight academic research teams, three legal entities, and 13 manufacturers to train 144 research elites (with 113 PhD and Master's degree holders) and trains 30 researchers specializing in IEC 62443 industrial control technology for information security and 67 IEC 62443 basic researchers. During this period, 30 journal papers, 13 papers from seminars outside Taiwan, two technical reports, one patent, 13 patent applications, and 29 academia-industry collaborations are completed, amounting to approximately NT$18 million.
- Through the aerospace-grade advanced manufacturing field of TIRI, the network segment is separated to build an industrial control network architecture with a deep defense concept. The industrial control field is equipped with high-precision multi-axis tooling machines, measurement systems, machine side computers, sensors, and other related advanced manufacturing modules and systems, and the network of the industrial control field is permanently monitored through NCHC. It can be used as a platform for academic research teams in the program to validate their developed products or technology modules.
- In conjunction with the five major projects on Intelligent Machinery of MOST, TIRI holds a joint achievement exhibition and evaluation on May 7, 2021 at the Warehouse 1 of Shongshan Cultural and Creative Park in Taipei, at which the capabilities of the teams' information security technologies were displayed, facilitating academia-industry cooperation and accelerating the application of academic R&D achievements to the industry. The exhibition is open to all institutions, schools, and the public to promote science and technology, fulfill people's passion for knowledge, and enhance the scientific literacy of all.



「發展先進製程資安攻防演練實測場域」計畫成果於「科技部智慧機械永續創新成果展」展出。

The achievements of the "IoT Information Security for Intelligent Manufacturing Field" project are exhibited at the "Intelligent Machinery - Sustainable Innovation Showcase" held by the Ministry of Science and Technology.

Taiwan Instrument Research Institute

國際合作

International Cooperation

儀科中心長期發展光學與真空技術，在國內已建立領先地位，為促成中心成為「國際級儀器科技研發整合卓越中心」，積極推動國際合作，儘管受到新型冠狀病毒肺炎 (COVID-19) 疫情影響，世界各國分別採取邊境管制及出入境後檢疫措施，儀科中心採以視訊、線上參與等非接觸模式與國際夥伴交流，維持與國際儀器科技社群交流與互動，以培育優秀儀器研發人才，提升儀科中心研究水準。

TIRI has been known as a pioneer and leading hub of vacuum and optics technology in Taiwan. Targeting to be an international integrated R&D instrument technology institute, TIRI is dedicated to promoting international collaboration. Despite the global border control and post-entry quarantine measures due to the impact of COVID-19 pandemic, TIRI this year continuously interacted with partners via teleconference and online communication. It has always been TIRI's pursuit to keep interaction with global instrumentation societies, cultivate excellent R&D talents, and advance its R&D level.

簽署合作備忘錄夥伴
Cooperative Memorandum of Understanding

國研院以推動國際化、打造世界級實驗室為宗旨，儀科中心積極向外推廣技術能量，與世界各國學、研、產單位接軌，提升國際知名度，儀科中心近年來與下列國際單位簽訂合作備忘錄：

One of the missions carried by NARLabs is to establish a global and world-class R&D service platform. TIRI actively promotes R&D capabilities to cooperate with industry, academia and research institutions in countries around the world to enhance its international visibility. TIRI currently has cooperative MOUs with the following units :

- 日本獨立行政法人理化學研究所
  RIKEN, Japan
- 捷克科學院物理研究所
  Institute of Physics, Academy of Sciences (FZU), Czech Republic
- 新加坡增材製造創新中心
  National Additive Manufacturing Innovation Cluster (NAMIC), Singapore
- 比利時微電子研究中心
  Interuniversity MicroElectronics Center (imec), Belgium
- 義大利薩尼奧大學
  Università degli Studi del Sannio, Italy
- 日本 Edgecross 聯盟
  Edgecross Consortium (ECC), Japan

國際頂尖研究機構合作計畫
International Research Cooperation Projects

儀科中心透過與國際學研單位專案委託及共同研究方式進行實質合作交流，合作議題整理如下表所列。

TIRI is conducting preliminary-stage commissioned projects and joint research with international academic and research units, and expects to establish a foundation for formal cooperation. The following is a summary of cooperative projects.

合作單位 Cooperating Unit	合作題目 Subject of Cooperation	年度 Year
日本獨立行政法人理化學研究所 RIKEN, Japan	● 近紅外波段寬頻可調變式超穎材料 ● 100 THz 寬頻多層式三維超穎材料之開發 Development of N-IR broadband, multi-layer, three-dimensional metamaterials	2014—2021

國際合作 International Cooperation

合作單位 Cooperating Unit	合作題目 Subject of Cooperation	年度 Year
捷克科學院物理研究所 Institute of Physics, Academy of Science (FZU), Czech Republic	● ALD 奈米疊層技術製備用於 NiTi 支架之高抗斷裂性 TiO_2/Pt 保護膜 Fracture-resistant TiO_2/Pt Composite protective coating on NiTi stent by ALD nanolamination ● ALD 沉積高覆蓋保護層用於提升 NiTi 合金支架生物相容性 Atomic layer deposited TiO_2 and Al_2O_3 coatings on NiTi alloy	2014—2021
比利時微電子研究中心 Interuniversity MicroElectronics Center (imec), Belgium	先進影像與光學應用技術 Advanced image and optics applications	2014—2021
義大利薩尼奧大學 Università degli Studi del Sannio, Italy	感測器資訊轉換器原型開發 Development of analog-to-information converter (AIC) prototype board	2017—2022
新加坡增材製造創新中心 National Additive Manufacturing Innovation Cluster (NAMIC), Singapore	生醫應用與積層製造技術發展 Biomedical applications and additive manufacturing technology	2018—2022
泰國國家科技院生技中心 BIOTEC-IBST of National Science and Technology Development Agency (NSTDA), Thailand	精準醫療之快速基因檢測 Rapid genetic testing for precision medicine	2019—2022

積層製造
Additive Manufacturing

列印樣品
Prototype printing

安全性檢測
Safety Testing

生物相容性及彎曲與疲勞測試
Biocompatibility, dynamic, & fatigue testing

功能性驗證
Efficacy Verification

蘭嶼豬骨板樣品植入手術
Bone plate of Lanyu pigs in implant surgery

儀科中心提供 3D 列印客製化骨板功能與安全驗證服務，打入新加坡醫材驗證與動物試驗國際供應鏈。
TIRI provides great reliability and quality services for customized 3D printing bone implants, successfully entering into the Singapore medical device industry and act as an trusted supplier in product verification and animal test field.

參與國際學研組織運作
Involvement in the International Academia and Research Organizations

為將技術能量推廣至國際，儀科中心積極利用受邀國際會議發表論文或演說機會，亦藉由成立儀器科技國際學會及組織學會活動的方式，提高儀科中心在儀器科技領域的知名度與領航地位。自 98 年成立國際電機電子工程師學會儀器工程與量測科技學會 (IEEE Instrumentation and Measurement Society, IMS) 中華民國臺北支會以來，積極耕耘學會活動；多次組織國內儀器科技領域專家學者代表團，前往參與學會之年度會議，以專文發表中心及臺灣儀器科技領域研發能量綜覽文章。同時，儀科中心每年受邀參加學會全球支會主席高峰會議 (IMS Chapter Chair Summit)，簡報臺灣當前儀器工程與量測科技之發展，有效拓展臺灣學者往後於全球推動儀器及量測科技發展及制定標準等方面之影響力。

In order to build up the global reputation of technical capability, TIRI takes advantage of every opportunity to publish papers and speech at the invited international conferences. In addition, TIRI has gradually established its reputation and leading position in the field of instrumentation technology through the strategy of initiating the international instrumentation technology society chapter and organizing society activities. In 2009, IEEE Instrumentation and Measurement Society (IMS) Taipei Section Chapter was established under the support of TIRI and domestic academia. Since then, TIRI has actively participated in the society activities to organize the delegation with domestic experts and scholars in the field to attend the annual flagship conference of the society, and published special issue about the R&D development and capabilities of TIRI and Taiwan. It is benefit to increase domestic scholars' influence on the promotion of instrumentation, measurement, standard formulation and so forth.

儀科中心積極參與國際儀器科技組織，以提升國際知名度與組織地位重要性，協助我國儀器專業躍升於國際舞台。儀科中心所參與的國際組織運作如下：

TIRI actively participates in international instrument technology organizations, and also hopes to enhance its own international visibility and status. Currently, TIRI participates in the following international organizations:

- 美國機械工程師學會台灣分會
  American Society of Mechanical Engineers (ASME) Taiwan Section
- IEEE 量測與儀器技術學會台北分會
  IEEE Instrumentation and Measurement Society (IMS) Taipei Chapter
- 實驗力學協會
  Society for Experimental Mechanics (SEM)
- 美國真空學會台灣分會
  American Vacuum Society (AVS) Taiwan Chapter
- 國際半導體產業協會台灣分會檢測與計量委員會
  SEMI Taiwan Inspection & Metrology Committee

建立台泰基因突變檢測技術國際合作模式，並於泰國國際醫療展線上展出
The international collaboration model on gene mutation detection technology between Taiwan and Thailand has established. Electrochemical LAMP diagnostic platform is demonstrated at the Health Tech Thailand 2021 online tradeshow.

電化學檢測平台
Electrochemical LAMP (Loop-mediated isothermal amplification) Diagnostic Platform

Taiwan Instrument Research Institute

技術服務

Technical Services

儀器系統開發及關鍵元組件委託研究與委製服務
Commissioned Research and Manufacturing Services for Advanced Instrument and Key Component

除了自主儀器技術的開發，儀科中心秉持支援學術研究、服務產業界為宗旨，提供真空、光學、光機相關儀器及關鍵零組件之委研、委製、校測等技術服務，110 年提供產學研各界檢測與委製服務累計共 1,925 件，接受各界委託，運用儀器科技協助進行前瞻研究並解決產業問題。

Not only have we constantly developed our own instrumentation technologies, but in compliance with our goal of supporting academic research and serving industry professionals, TIRI provides OEM and calibration services for vacuum equipment, optical system, and key components. In 2021 we provided a total of 1,925 testing and OEM services to enterprises, universities and research institutes. TIRI is commissioned by various industries to conduct foresight research and solve problems with its advantages in the field.

(1) 學界委託計畫 Commissioned Research Projects from Academia

支援學術前瞻研究，推動國家科技發展，透過長年與國內各大專院校的研發合作，儀科中心是台灣學術界的最佳盟友與幕後推手。110 年學界合約案件數眾多，僅列舉部分於下表。

Supporting academic research, promoting national technology development, and conducting long-term R&D cooperation with domestic universities have made TIRI the best ally and driving force for academia in Taiwan. There were a lot of projects for academia in 2021, only some of whom are listed below.

委託計畫 Project Title	合作對象 Partner
智慧機械感測器服務平台專案計畫 Intelligent Machinery Sensors Service Platform Project	國立清華大學、國立陽明交通大學、國立中山大學、國立彰化師範大學，4 校共計 5 個研究團隊共同參與計畫 5 research teams from 4 universities, including NTHU, NYCU, NSYSU, and NCUE, are joint in this project.
智慧微塵感測器技術服務平台專案計畫 Smart Dust Sensor Technology and Development Service Platform Project	國立臺灣大學、國立清華大學、國立陽明交通大學、國立臺灣科技大學、國立高雄科技大學、南臺科技大學，6 校共計 9 個研究團隊共同參與計畫 9 research teams from 9 universities, including NTU, NTHU, NYCU, NTUST, NKUST and STUST, join in this project.
發展智慧製造及半導體先進製程資安實測場域專案計畫 IoT Information Security Development Project for Intelligent Manufacturing and Semiconductor Processing Testing Field	國立臺灣大學、國立臺灣科技大學、國立臺北科技大學、國立成功大學、國立中興大學、國立中央大學、國立中正大學、國立虎尾科技大學，8 校共計 9 個研究團隊共同參與計畫 9 research teams from 8 universities, including NTU, NTUST, NTUT, NCKU, NCHU, NCU, NCU, NFU participate in this project.
攝影成像光學顯影輔助辨識系統 Identification System for Photographic and Optical Imaging	國立臺灣大學 National Taiwan University
客製化 Thermal ALD 設備 Customized Thermal ALD system	國立中央大學 National Central University

委託計畫 Project Title	合作對象 Partner
高真空 PVD 鍍膜系統 High Vacuum Physical Vapor Deposition (PVD) System	國立雲林科技大學 National Yunlin University of Science and Technology
適用於大樣本之客製化成像鏡筒 Customized Tube Lens for Large Samples	中央研究院 Academia Sinica

(2) 產業界委託計畫 Commissioned Research Projects from Industry

儀科中心以驅動儀器設備在地化為使命，積極擴散研發能量，鼓勵中心研發團隊解決產業界需求，透過橋接學界與業界，以產學合作方式，促使國家產業技術升級，並厚植及深根國內儀器技術。110 年產界合約案件數眾多，僅列舉部分於下表。

Aiming to localize the instrumentation technology, TIRI promotes its R&D capability actively and encourages its teams to respond to the industrial demands. Through industry-academia-research cooperation, TIRI is capable of bridging universities, institutes and industries, and thus promoting the domestic industry upgrading and instrumentation technology developing. There were a lot of industrial projects in 2021, only some of whom are listed below.

委託計畫 Project Title	合作產業類別 Type of Industry
微流體與生醫晶片整合技術 Technology of Integrating Micro Fluidic and Bio-medical Chip	電子零件產業及醫療生技產業 Electronic component industry & medical biotechnology industry
曝光機之光學元件開發製作 OEM of Lithography Stepper Optical Components	半導體製造業 Semiconductor fabrication industry
原子層沉積 / 蝕刻系統委製案 Atomic Layer Deposition/ Etching System OEM Project	半導體產業 Semiconductor industry
生醫產品開發及驗證 R&D and Verification Service of Bio-medical Products	醫療生技產業 Medical biotechnology industry
模組化遠距健康照護系統 – 智慧藥箱 Modular Telehealthcare System - Smart Medicine Kit	醫療院所 Medical institution
結合 AI 與多重感測器進行線上刀具狀態監測技術開發 The Development of On-line Tool Condition Monitoring System with Artificial Intelligent and Multi-sensors Fusion Algorithm	精密機械業 Precision Machinery

TAF 認證實驗室的校正與測試服務
TAF Certification Laboratories

儀科中心建置並持續維持 TAF 認證實驗室，提供真空標準的校正與光電檢校測試服務，服務對象包含產、官、學、研各界，每年提供逾百件認可校正報告服務。另外，生醫平台實驗室的電子醫療器材認證多達 19 項。

儀科中心所提供的 TAF 校正與測試服務項目詳列於儀科中心官網：https://www.tiri.narl.org.tw/Service/Taf，動態更新相關檢校項目。

TIRI has established and kept maintaining TAF Certification Laboratories to provide standard vacuum calibration, and optoelectronic inspection and testing services with more than 100 recognized calibration reports annually. In addition, there are as many as 19 electronic medical device certificates of biomedical platform laboratories. The TAF calibration and testing service items are shown on the TIRI website : https://www.tiri.narl.org.tw/Service/Taf.

人才培育
Talent Cultivation

儀科中心致力培育我國儀器研發高階人才，方式包括開放研究生參與研究計畫，及執行「重點產業高階人才培訓與就業計畫」，培訓博士級產業訓儲精英，進入企業實習機會，並媒合高階人才就業成功或創業，促成跨領域整合研究與培育儀器科技人才；舉辦學生儀器競賽、科普活動以及提供教學參訪行程等，落實科研教育向下扎根；以演講或短期訓練講座方式，積極參與學研界活動，以達知識擴散之目標。

同時透過開辦各種專業研訓課程與研討會，培育國家科研基礎人才的質與量，厚植高科技產業技術人才。110 年舉辦的研習班與研討會包括「真空技術研討會」、「半導體設備原子級薄膜製程技術交流會」、「半導體設備與製程技術種子教師系列研習課程」，以及開設多場重點產業高階人才培訓課程等。

TIRI has cultivated outstanding professional talents for domestic academia via various workshops and seminars, as well as cultivated research manpower required by high-tech industry such as "Rebuild After PhD's Industrial Skill & Expertise (RAISE) Project" in order to enhance the quality and quantity of talents as the foundation for scientific research of our country. There were many workshops and seminars organized in 2021, including "Workshop on Practical Vacuum Technology", "ALD/ALE Equipment Development Workshop", "Teacher Training Course for Semiconductor Manufacturing Process & Equipment", and courses related to cultivation of medical talents.

儀科中心開辦各種專業研訓課程與研討會，培育國家科研基礎人才。
TIRI has cultivated outstanding professional talents for domestic academia via various workshops and seminars.

110 年儀科中心年報
TIRI Annual Report 2021

發行所 Publishing House

國家實驗研究院台灣儀器科技研究中心｜ Taiwan Instrument Research Institute, NARLabs

發行人 Publisher

楊燿州｜ Dr. Yao-Joe Joseph Yang

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發行日 Publication Date

111 年 5 月｜ May, 2022

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