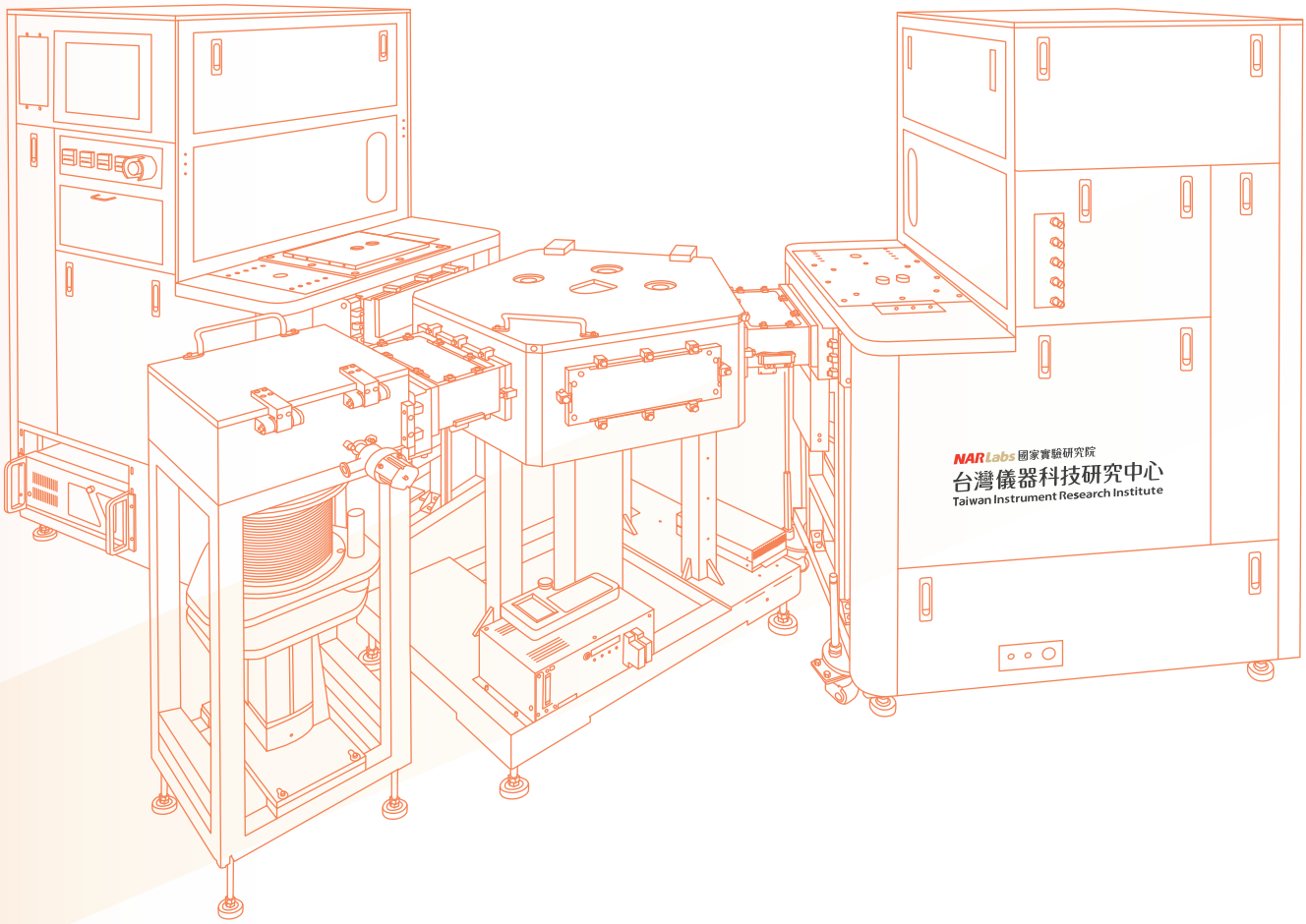
2022 ANNUAL REPORT

Taiwan Instrument Research Institute

儀科中心111年報



NARLabs 國家實驗研究院

台灣儀器科技研究中心

Taiwan Instrument Research Institute

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111年儀科中心年報

TIRI ANNUAL REPORT 2022

主任的話
Message from Director General

儀科中心成立近 50 年，爲執行國家任務，因應政策計畫，發展高解析遙測儀器、前瞻計畫下世代半導體製程與檢測等大型前瞻儀器設備的研發需求，自 2020 年開始籌劃成立研發大樓新建案，現克服疫情、缺工以及原物料上漲等種種困難，終於在 2022 年底啟動科研大樓的興建工程！將來新大樓興建完成後，有足夠之實驗室高度及空間容納精密儀器設備，儀科中心將更加完備跨領域整合的儀器科技研發平台，提升我國先進儀器設備自研自製能量，並且利用位於竹科的優勢，做爲與業界橋接的窗口，促成學界的應用研究與企業接軌，帶動國內產業創新發展。

儀科中心一直是學研團隊在進行前瞻研究時的關鍵合夥人，亦是臺灣唯一能提供學術界跨領域客製化前瞻儀器設備的研發機構，與國內外大學院校及研究單位之教授及研究團隊密切合作，提供理、工、醫、農、藝術等最廣領域之服務，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。本中心原子層沉積 (Atomic Layer Deposition, ALD) 聯合實驗室與台積電及陽明交通大學團隊共同開發高覆蓋性 ALD 製程，成功製作**有效氧化僅 1 奈米厚**之二維材料元件，以及研發環繞閘極 (Gate-all-around, GAA) 架構下奈米薄板二維材料電晶體，是超越摩爾定律發展相當關鍵的研究成果；本中心亦協助陽明交通大學及臺北醫學大學團隊**客製開發斜向濺鍍系統**研發創新材料，以奈米金屬塗層蜘蛛絲製作高靈敏度的光纖糖度感測器，未來可望應用於人體醫療植入物及日常醫療監測；另外，本中心與國際標竿研究單位 imec 合作國際領先的**高光譜顯微影像定量分析技術**，可應用於微奈米材料與生物組織顯微影像分析，在光電、前瞻顯示器及精準醫療領域皆具極大發展潛力，榮獲**第 17 屆計量科技研發創意獎**與**第 16 屆國家實驗研究院傑出科技貢獻獎技術類優等獎**。

儀科中心亦配合國家政策發展，推動下世代前瞻關鍵儀器設備之自主研發與應用，建構大面積二維材料製程 / 設備開發與服務平台，橫向整合數個學研單位並橋接學界研究成果導入產業應用，並培育下世代儀器技術高階研發人才；本中心也於 2022 年取得國際工控資安場域標準 (IEC 62443-2-4) 認證，爲台灣第一個通過 IEC 62443 資安場域驗證的法人機構，並與學界共同執行多項國科會重要智慧機械專案，協助學界進行智慧製造學理及 AI 技術驗證；同時，儀科中心的醫材認證一站式服務平台，積極輔導新創公司解決技術、驗證、法規、臨床的關卡，縮短新創醫材產品開發時程，**攜手矽基分子公司、中央研究院與高雄榮民總醫院，合作開發出世界首創的「新冠病毒核酸快速檢測晶片」**，已通過衛福部食藥署緊急使用 (Emergency Use Authorization, EUA) 授權並上市銷售，讓各界見證到國產新醫材的重大突破；另外透過平台輔導成立的世延生醫股份有限公司，於新竹生醫園區成立全球首家口腔癌檢測試劑工廠，與生技產業聚落鏈結，深耕在地；除此之外，儀科中心也與成功大學產學創新總中心共同簽署合作備忘錄，聚焦產學合作資源共享及團隊雛型品試製與驗證合作，將共同推動學界研發技術加值及加速新創團隊事業成立。

隨著全球新冠疫情獲得控制，儀科中心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；與泰國國家金屬材料中心及清華大學合作，透過整合電化學感測系統進行湄公河農藥與有機物偵測，深化國際夥伴合作關係；儀科中心長期與捷克科學院緊密合作，在雙方研究合作備忘錄之架構下以及國科會臺捷雙邊交流計畫之支持下，持續深入研究交流。

展望未來，儀科中心將持續聚焦於「前瞻光學」、「先進眞空」與「生醫光電」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。

Taiwan Instrument Research Institute (TIRI), established for nearly 50 years, has always been dedicated to fulfilling national objectives by developing high-resolution telemetry instruments that align with policy plans. TIRI proactively anticipates the R&D requirements for cutting-edge instruments and such as the next generation of semiconductor process and testing devices. Since 2020, TIRI has been strategizing the construction of a new R&D complex. Despite challenges like the COVID-19 pandemic, labor shortages, and escalating raw material costs, the construction project for the new facility was commenced in late 2022. Once the new building is completed, TIRI will be able to provide ample laboratory space to accommodate precision instruments and equipment. This will furnish TIRI with a better comprehensive, interdisciplinary and integrated service platform for instrument technology, further improving Taiwan's self-developed research and manufacturing capabilities. Leveraging its location within the Hsinchu Science Park, TIRI can more easily foster collaboration with industry partners and drive the convergence of academic applied research with enterprises to promote Taiwan's industrial innovation and development.

TIRI has long been the key partner for academic research teams, offering tailored instruments that cater to various academic disciplines. As the sole R&D institution in Taiwan capable of providing customized forward-looking instruments, TIRI collaborates closely with professors and research teams from domestic and international universities as well as research institutes to develop specialized instruments for cutting-edge scientific research, thus facilitating advancements in forward-looking scientific endeavors. Its services span a wide range of fields including science, engineering, healthcare, agriculture, and art. One notable achievement was the collaboration between TIRI, Taiwan Semiconductor Manufacturing (tsmc), and the National Yang Ming Chiao Tung University (NYCU) team in the development of a high-coverage Atomic Layer Deposition (ALD) process. This successful endeavor resulted in the creation of a two-dimensional material component with an **effective oxidation layer as small as 1 nm thick**. Additionally, a nano-thin-plate two-dimensional material transistor with a surrounding gate (GAA) structure was engineered, which is a key research achievement in More than Moore. These accomplishments represented significant breakthroughs in research. Furthermore, TIRI supported teams from NYCU and Taipei Medical University (TMU) in the development of an **oblique sputtering system** applied with innovative materials. A highly sensitive optical fiber sensor that utilized nano-metal to coat spider silk to measure sugar concentration was

successfully developed. This innovation holds promise for future applications in human medical implants and daily medical monitoring. In collaboration with Interuniversity Microelectronics Centre (imec), an internationally renowned research institution, TIRI offered **state-of-the-art hyperspectral microscopic image quantitative analysis technology**. This advanced technology finds applications in the analysis of micro-nano materials and biological tissues, with significant potential in fields such as optoelectronics, forward-looking displays, and precision medicine. This outstanding achievement mentioned above has received accolades such as **the 17th Innovation Award for Metrology Technology R&D from the Chinese Metrology Society** and **the 16th NARLabs Outstanding Scientific and Technological Contribution Awards.**

In alignment with national policies, TIRI actively promotes independent R&D as well as the applications of key instruments for the next generation. To achieve this, TIRI has established a large-scale platform for the development and service of two-dimensional material processes and equipment, horizontally integrating multiple academic research units and facilitating the transition of academic research achievements into practical industrial applications. In addition, TIRI focuses on nurturing high-level R&D talents in the field of instrument technology for the future. In 2022, certification in the international standard for industrial control information security (IEC 62443-2-4) was achieved. This notable accomplishment made TIRI the first legal entity of its kind in Taiwan to pass the IEC 62443 verification in the information security field. Collaborating with academic institutions, TIRI also played a significant role in several important projects related to intelligent machinery under the National Science and Technology Council (NSTC). These projects assisted academia in validating theories related to intelligent manufacturing and AI technology. Furthermore, TIRI's one-stop service platform for medical device certification actively supports startups in overcoming technical, verification, regulatory, and clinical obstacles. By reducing the time during new medical devices development, TIRI fastens their market entry. **Silicon Based Molecular Sensoring Technology CO., LTD. (Molsentech), Academia Sinica, Kaohsiung Veterans General Hospital (KSVGH) and TIRI have collaborated to develop the world's first "COVID-19 Rapid Test Chip" for COVID-19 nucleic acid**. This breakthrough product has received Emergency Use Authorization (EUA) authorization from Taiwan Food and Drug Administration (TFDA), and is now available for sale. It represented a significant advancement in domestic medical devices. Moreover, TIRI has played a pivotal role in the establishment of S&T BioMed CO., LTD., offering guidance and support in platform counseling. This initiative led to the establishment of the world's first factory for oral cancer detection reagents in the Hsinchu Biomedical Science Park. By fostering collaboration with the biotechnology industry, TIRI deepened its involvement in this field. Furthermore, TIRI signed a memorandum of cooperation with National Cheng Kung University (NCKU) Innovation Headquarters, focusing on resource sharing in industry-university collaboration and prototype trial-production and verification. Through this partnership, both entities aim to enhance the value of academic R&D technology and accelerate the initiation of new entrepreneurial ventures.

With the successful containment of the global COVID-19 pandemic, TIRI actively fostered connections with Southeast Asian countries in line with the government's New Southbound Policy. Under the fruitful partnership with the BIOTEC-IBST Laboratory of the National Science and Technology Development Agency (NSTDA) in Thailand, TIRI continued the project of

▲ Director General Handover and Inauguration Ceremony for TIRI

developing lung cancer detection technologies and expanded the bilateral cooperation to the clinical application of rapid COVID-19 screening. To strengthen the international collaboration, TIRI also joined forces with the National Metal and Materials Technology Center (MTEC) of NSTDA and National Tsing Hua University (NTHU). The collective efforts focused on integrating an electrochemical sensing system to detect pesticides and organic compounds in the Mekong River. TIRI not only addressed important environmental concerns but also fostered deepened international partnerships. On the other hand, the Czech Academy of Sciences was another longstanding collaborative partner. Operating within the framework of a research cooperation memorandum and with the support of the Taiwan-Czech bilateral exchange program facilitated by NSTC, TIRI continuously engages in profound research endeavors and promotes scholarly exchanges between the two institutions.

As looking forward to the future, TIRI remains dedicated to the professional domains of "**cutting-edge optics**", "**advanced vacuum technology**", and "**biomedical optoelectronics**". It has always been the major target to enhance the core technical competencies and key expertise, to deeply understand the specific needs of the academic community, and to support academia in generating groundbreaking research outcomes by harnessing the power of instrument technology. Moreover, TIRI will actively pursue to be the "**top one in Taiwan**" and "**front runner in the world**" in developing next-generation semiconductor processes and equipment as well as focusing on cutting-edge national defense, spaceborne remote sensing systems, and instruments related to pandemic prevention. Throughout the scientific exploration journey, TIRI recognizes the importance of cultivating interdisciplinary innovation in instrument and technical fields, devoted to nurturing talented individuals with scientific literacy and an understanding of industrial demands. Serving as a bridge from academic R&D creativity to industrial needs, it is the most significant prospect for TIRI to foster the independent capabilities of Taiwan's academic community and the industrial sector in the field, contributing more to the local innovative development and improve the quality of life worldwide.

主任 Director General | 潘正堂 Chen-Tang Pan

基本概況

Overview of TIRI

組織架構及人力配置
Organization Chart and Manpower Deployment

92	研究人員 Researcher	總人數 165 Total	博士 Ph.D.	46
35	工程人員 Engineer		碩士 M.S.	86
14	技術人員 Technician		學士 B.S.	28
24	行政人力 Administration staff		其他 Other	5

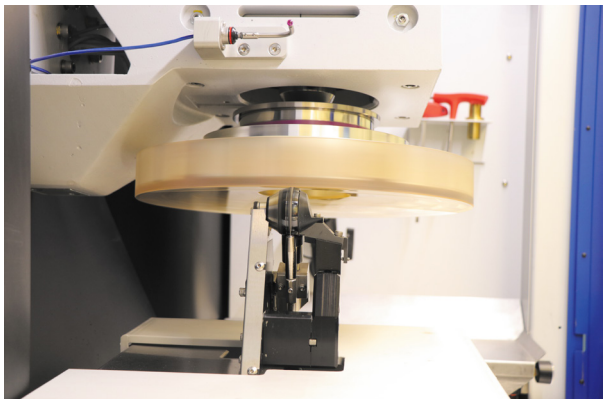
●●○ 核心設施 Core Facilities

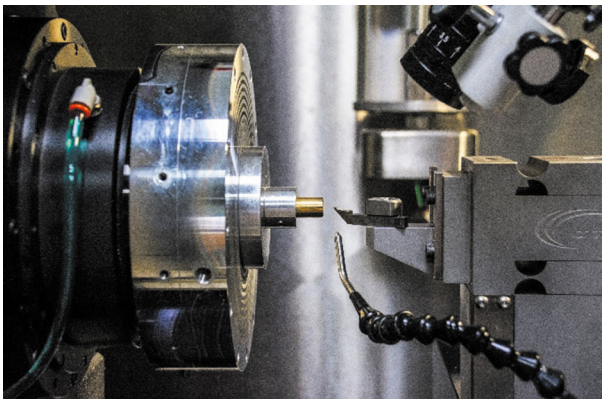
(1) 精密光機工程 Precision Opto-mechanical Engineering

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，爲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, which is the only organization that can provide fabricating service for meter-scale aspheric optics in Taiwan. Its 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) 眞空技術 & 薄膜製程 Vacuum Technology & Thin Film Process

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

As the origin of domestic vacuum technology, TIRI has been devoted to developing advanced vacuum system, thin-film process and inspection / calibration capabilities. TIRI has also established the ALD/ALE Joint Laboratory. The 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 service 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 Strategy

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，以作爲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 long focused on the development and application of instrument technology platforms, 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 Taiwan's academia and industry to develop autonomous instruments.

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

最廣領域的服務
Services in all domains

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

關鍵技術 Key Technologies

先進眞空 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

精密光機工程技術 Precise opto-mechanical technology
高光譜遙測技術 Hyperspectral remote sensing technology
尖端光電科學儀器 Advanced opto-electro instruments

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

產業界 Industry

- 客製化光電及眞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
- 導入資安及智慧製造管理流程
  Introducing the information security and smart manufacturing management process

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、眞空技術相關學術研討會
  Participating in domestic and international seminars on photonics and vacuum technologies

亮點成果
與大事紀要

Notable Achievements & Milestones in 2022

●○○ 2022/01/25

世界首創新冠病毒核酸快速檢測晶片 國產新醫材重大突破
Major Breakthrough in Domestic New Medical Devices: Development of the World's First COVID-19 Rapid Test Chip

儀科中心攜手矽基分子電測科技股份有限公司、中央研究院與高雄榮民總醫院，合作開發出世界首創的「新冠病毒核酸快速檢測晶片」，可於 20 分鐘內檢測體內病毒含量極低的感染初期或無症狀 COVID-19 患者，準確率達 95% 以上，已通過衛福部食藥署 EUA 授權並上市銷售。儀科中心積極輔導新創公司一次解決技術、驗證、法規、臨床的關卡外，並協助新創公司投入防疫行列，解決實務領域防疫需求，共同加速科技防疫產品實現，也讓各界見證到國產新醫材的重大突破。

TIRI has collaborated with Silicon Based Molecular Sensoring Technology (Molsentech) Co., Ltd., Academia Sinica, and Kaohsiung Veterans General Hospital to develop the world's first "COVID-19 Rapid Test Chip", which can quickly and accurately detect very low levels of the virus in patients at the early stages of infection or in asymptomatic COVID-19 patients, all in under 20 minutes. With an accuracy rate of over 95%, the test chip has obtained EUA authorization from the FDA of MOHW, and launched to the market. TIRI plays an active role in helping startups overcome technical, verification, regulatory, and clinical barriers, allowing them to contribute to pandemic prevention efforts and address practical needs. This collaborative effort has accelerated the development of scientific and technological pandemic prevention products and witnessed a major breakthrough in new domestic medical devices.

◀ 世界首創的「新冠病毒核酸快速檢測晶片」技術發表會
Group photo at the world's first "COVID-19 Rapid Test Chip" press conference

●●○ 2022/03/19

挑戰「順水推舟」機器人載水任務「國研盃智慧機械競賽」培育高階跨領域研發人才
"NARLabs Smart Machinery Competition" Fosters Interdisciplinary R&D Talents through Robot Water-Carrying Challenge

儀科中心協同美國機械工程師學會 (American Society of Mechanical Engineers, ASME) 臺灣分會舉辦「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。111 年設計競賽題目為「順水推舟」機器人載水任務 (H_2Go Revisited)，由南臺科技大學團隊拔得頭籌獲得冠軍、演講競賽則由國立清華大學學生奪冠。

TIRI and the American Society of Mechanical Engineers (ASME) Taiwan Section organize the NARLabs Smart Machinery Competition, consisting of both a design competition and an oral presentation competition. ASME determines the design competition's theme, which covers a variety of practical topics to encourage students to think creatively about mechanical technology and its functions, as well as to broaden their international perspective. The design competition focuses on the "H_2Go Revisited" robot water-carrying task for 2022, and the Southern Taiwan University of Science and Technology team wins the first place, while the student from National Tsing Hua University wins the oral presentation competition.

▲「國研盃智慧機械競賽」比賽現場與頒獎典禮大合照
On-site and group photos at “NARLabs Smart Machinery Competition”

••• 2022/05/16

「科技部智慧機械創新協作成果線上聯展」展現學研創新量能
"Online Exhibition of MOST Intelligent Machinery Innovation Collaboration" Showcases Academic Research Innovation Capabilities

儀科中心承辦「科技部智慧機械創新協作成果線上聯展」集結科技部三大智慧機械主題式專案計畫，共計 27 個學界計畫團隊參與線上聯展。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等相關技術，透過海報及影片內容展示，展現學界研發團隊之創新研發能量、國研院之技術加值服務，建構出符合國內產業技術需求之智慧機械創新生態圈。

TIRI hosts the “Online Exhibition of MOST Intelligent Machinery Innovation Collaboration” to showcase the thematic project accomplishments for Intelligent Machinery under the Ministry of Science and Technology (MOST) by bringing together 27 academic teams across three projects. From sensor component development, intelligent machinery controllers, and robotics to the information security technology required for industrial manufacturing applications, this online exhibition features posters and videos highlighting the innovative R&D efforts of academic teams and the technology value-added services provided by NARLabs, ultimately creating an intelligent machinery innovation ecosystem that meets the industrial technology needs of Taiwan.

◀ 科技部智慧機械創新協作成果線上聯展透過海報及影片內容展示，讓觀展者了解團隊計畫執行成果。
Visitors can learn about the accomplishments of the team plans through posters and videos at the online joint exhibition.

●○○ 2022/07/05

攜手國立公共資訊圖書館 推廣儀器科技科普知識
Collaborating with the “National Library of Public Information” to Popularize Instrument Science and Knowledge

儀科中心與國立公共資訊圖書館合作「提供光學解決方案的專家：創意實現夢工廠－台灣儀器科技研究中心」特展，共同推廣科普知識。包括讓民眾認識諾貝爾化學獎等級的光學鏡頭，以及一些少見又特殊的光學元件，還有應用非常多元的菲涅耳透鏡，更讓大小朋友透過多媒體互動機認識各式光學儀器結構。並介紹從玻璃胚料到光學元件一系列的製作工序，讓民眾了解臺灣自製高階科研鏡頭的研發能力。

TIRI partners with the National Library of Public Information for the "Experts Providing Optical Solutions: Dreamworks for Creative Realization - Taiwan Instrument Research Institute" special exhibition, for promoting popular science knowledge. The Nobel Prize-winning optical lenses in chemistry, rare optical components, and versatile Fresnel lenses are showcased on the exhibition. Through multimedia interactive machines, visitors of all ages can learn about the structures of different optical instruments and the manufacturing processes from glass blanks to optical components. The exhibition highlights Taiwan's capability to self-develop and produce high-level lenses for scientific researches.

▲「提供光學解決方案的專家：創意實現夢工廠－台灣儀器科技研究中心」特展
“Experts Providing Optical Solutions: Dreamworks for Creative Realization - Taiwan Instrument Research Institute" special exhibition

●●○ 2022/7/28

2022 亞洲生技大展 精準醫療新世代
BIO Asia-Taiwan 2022 Showcases the New Generation of Precision Medicine

儀科中心攜手 6 家新創團隊參加 BIO Asia-Taiwan 2022 亞洲生技大展，以「精準醫療新世代」爲主軸，展出創價醫材加速器所協助之技術升級成果，包括與成功大學、智遊科技共同合作的「智慧健促服務系統」、輔導精能醫學開發的「腕隧道止痛刺激器」、輔導博晟生醫開發的「軟骨修補系統」、輔導奇翼醫電開發的「必應健康系統」，以及與花蓮慈濟醫院合作開發與臨床試驗驗證的「智慧藥箱系統」等，呈現儀科中心所建構的跨域整合提供服務，推動精準醫療開發，加速產業進程的量能。

TIRI participates in BIO Asia-Taiwan 2022 with 6 start-up companies based on the "new generation of precision medicine" showcasing the technological advancements supported by TIRI's “Medical Device Accelerator”. Some of the exhibition highlights include the "intelligent health promotion service system" jointly developed with National Cheng Kung University (NCKU) and AI Free Tech, the "wrist tunnel pain-relieving stimulator" by GiMer Medical, the "cartilage repair system" by Biogend Therapeutics, the "bing health system" by Singular Wings Medical, and the "Smart Medicine Kit" developed in cooperation with Hualien Tzu Chi Hospital, which has undergone clinical trials. These demonstrations effectively show TIRI's capability to provide cross-domain services, drive the progress of precision medicine, and expedite industrial growth.

◀ 國科會吳政忠主委蒞臨「2022 亞洲生技大展國研院」現場視察
The Chairman Tsung-Tsong Wu of National Science and Technology Council (middle) visits the site of NARLabs at BIO Asia-Taiwan 2022.

●●● 2022/08/10

儀科中心與成大產創總中心簽訂合作備忘錄 將產學成果推向國際
TIRI and NCKU Innovation Headquarters Sign MOU to Promote Academic-industry Cooperation Achievements to Global

儀科中心與成功大學產學創新總中心 (成大產創總中心) 舉行「合作備忘錄簽署暨儀科中心成大辦公室揭牌儀式」，宣示雙方深化合作的決心，期盼雙方強強聯手，打造成大產創總中心培育新創團隊的新里程。透過儀科中心「創價醫材加速器平台」輔導學校團隊技術加值，幫助串聯醫療器材產業及醫院，一次解決生醫新創在技術、驗證、法規、臨床的關卡，降低研發成本及風險。未來在儀科中心與成大產創總中心的密切合作下，將扶植更多新創團隊，並加速商品化步伐，將台灣生醫產業進一步推向國際市場。

TIRI and NCKU Innovation headquarters join forces for the "Memorandum of Understanding (MoU) Signing and Opening Ceremony of TIRI at NCKU Office" to strengthen the collaboration and create new opportunities for cultivating innovative teams. Through TIRI's "Medical Device Accelerator Platform", technical guidance are provided to connect the medical device industry and hospitals, and to streamline the biomedical innovation process. The collaboration between TIRI and NCKU Innovation Headquarters aims to foster more startups, accelerate commercialization, and promote the biomedical industries in Taiwan to the global market.

▲ **合作備忘錄簽署儀式** Group photos at the MoU Signing Ceremony

●○○ 2022/09/13

國研醫材創價聯盟輔導有成　世延生醫全球首家口腔癌檢測試劑工廠開幕
S&T BIOMED Opens the World's First Oral Cancer Detection Reagent Factory Under the Guidance of NARLabs Medical Device Alliance

由儀科中心「國研醫材創價聯盟」服務平台所輔導成立的世延生醫股份有限公司於新竹生醫園區第二生技大樓舉行全球首家口腔癌檢測試劑工廠開幕典禮，未來新廠生產產線營運後，將有助解決全球口腔癌篩檢約 2.37 億人的龐大潛在需求量。其核心技術爲「非侵入式癌症生物標誌檢測平台」，現階段主力開發口腔癌生物標誌免疫檢測試劑產品。針對口腔癌新生物標誌 MMP-1，開發了「ELISA 檢測試劑套組」與「膠體金試紙型快速檢測盒」兩種體外檢測試劑產品，用以輔助診斷口腔癌。目前口腔癌篩檢或診斷尚無任何常規使用的分子診斷工具，世延生醫的產品將有助於實現早期診斷、早期治療，利於口腔癌防治。

S&T BioMed Co., Ltd., established with the support of TIRI's "NARLabs Medical Device Alliance" service platform, inaugurates the world's first factory for oral cancer detection reagents at the Hsinchu Biomedical Science Park's second biotechnology building. The factory's production line will cater to the huge potential demand for oral cancer screening, which is estimated to be around 237 million people worldwide. The core technology of the factory is a "non-invasive cancer biomarker detection platform", which mainly develops oral cancer biomarker immunoassay reagent products. S&T BioMed has developed two in-vitro detection reagent products for the new oral cancer biomarker MMP-1, namely, "ELISA detection reagent kit" and "colloidal gold test paper type rapid detection box", which aid in the diagnosis of oral cancer. Currently, there are no conventional molecular diagnostic tools for oral cancer screening or diagnosis. S&T BioMed's products will facilitate early diagnosis and early treatment, contributing to the prevention and treatment of oral cancer.

◀ 世延生醫全球首家口腔癌檢測試劑工廠開幕儀式
The opening ceremony of S&T BioMed, the first oral cancer detection reagent factory in the world

●●○ 2022/9/14

2022 臺灣國際半導體展 儀科中心展現自研自製研發服務績效
TIRI Showcases Self-developed R&D Services and Achievements at SEMICON Taiwan 2022

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，藉由國際半導體展，展現儀科中心在半導體前瞻設備及客製化的特殊應用光學鏡頭自研自製的研發能量與成果，並於 9 月 15 日半導體展創新技術發表會，舉辦「國研院先進半導體設備與製程技術」技術論壇，透過整合儀科中心核心設施與尖端科學儀器，鎖定下世代化合物半導體材料前瞻議題，發展半導體產業先進製程未來所需臨場檢測設備，提供產學研界賴以進行前瞻性之研發，現場發佈最新研發成果，藉此推廣相關技術服務。

TIRI has a long history of expanding the R&D capabilities in line with national policies to promote independent R&D and applications of high-level key instruments and components. During the SEMICON Taiwan 2022, TIRI showcases our R&D capabilities and achievements in the self-development of advanced semiconductor equipment, including customized optic lenses for special applications. Moreover, the Seminar of NARLabs' Advanced Semiconductor Equipment and Process Technology (NARLabs ASEPT Seminar) is held at the TechXPOT conference of the SEMICON on September 15. By integration of the core facilities and cutting-edge scientific instruments, TIRI aims to address the issues of the next generation compound semiconductor novel materials, develop *in-situ* testing devices for advanced process in the semiconductor industry, provide R&D services for industry, universities, and research institutions, and demonstrate the latest R&D achievements on-site to promote related technical services.

▲「2022 臺灣國際半導體展」中心攤位合照
Group photo at SEMICON Taiwan 2022

▲「國研院先進半導體設備與製程技術」創新技術發表會
The technical forum of " NARLabs ASEPT Seminar"

●●● 2022/09/27

「2022 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技術交流
"2022 ALD/ALE Equipment Development Workshop" Deepens the Technical Exchange of Semiconductor Equipment in Taiwan

儀科中心深耕原子級薄膜製程技術逾十年，連續四年舉辦「半導體設備原子級薄膜製程技術交流會」，邀請國內知名專家學者擔任主講者，講述最新技術、材料及相關應用，並同場加碼介紹儀科中心「次埃解析度 (Sub-Å) 原子結構研究與應用」研發服務平台，以國內首創「原子解析度三維顯微結構」分析技術，提供產學界進行半導體材料研發時全新的視野；現場亦同步展示儀科中心近期研發之 ALD Coupon Cluster 製程腔體及原子層蝕刻系統，藉此推廣原子級薄膜製程技術研發成果與技術，並增加與會人員的互動交流。

For over a decade, TIRI has been actively engaged in ALD/ALE technology, hosting the "ALD/ALE Equipment Development Workshop" for four consecutive years. During the event, ALD/ALE experts and scholars discuss the latest technologies, materials, and applications, while showcasing TIRI's R&D service platform, "Sub-angstrom Resolution (Sub-Å) Atomic Structure Research and Application". This platform features a unique "atomic resolution 3D electron tomography" analysis technology, providing a fresh perspective on semiconductor material R&D in Taiwan. Furthermore, the event exhibits TIRI's latest ALD Coupon Cluster process chamber and ALE system, promoting R&D achievements in ALD/ALE, and encourages interaction and communication among participants.

▲ **2022 半導體設備原子級薄膜製程技術交流會** 2022 ALD/ALE Equipment Development Workshop

●○○ 2022/10/01

第 14 屆「國研盃 *i*-ONE 儀器科技創新獎」產學研攜手推動儀器創新實作之培育扎根
The 14th "NARLabs *i*-ONE Instrument Technology Innovation Competition" Promotes Talent Cultivation for Instrument Innovation through Industry, Academia, and 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 14 屆「國研盃 *i*-ONE 儀器科技創新獎」分別由清華大學及嘉義高工團隊以「高速大體積光聲腦連結體顯微成像系統」及「多圖形自動鏟花機」獲得專上組及中學獎首獎。儀科中心將持續與夥伴廠商共同培育儀器自製的新世代科研人才，成為推動產業技術升級與鞏固國際競爭力的能量，並且提供跨領域儀器整合的平台，向下扎根培育對儀器科技有熱忱的人才，創造更大之社會效益。

For more than a decade, the "NARLabs *i*-ONE Instrument Technology Innovation Competition" has been a crucial platform for fostering research talents. Over 300 exceptional works have been submitted over the years. The 14th edition of the competition is won by the National Tsing Hua University and National Chia Yi Industrial Vocational High School teams, which secures the first prize in the college & above and high school categories, respectively. The winning projects are the "High Speed and Large Volume Photoacoustic Brain Connectome Micro-imaging System" and the "Development of an Automatic Scraping Machine for Multi-shape of Scraped Surface". TIRI will remain committed together with partners to encourage the young talents in self-developed instrument research, making them a potential force to drive Taiwan's technological advancement and international competiveness. Moreover, TIRI can provide interdisciplinary platforms related with instrument integration and then cultivate more passionate professional individuals, creating more significant social benefits.

▲ 第 14 屆「國研盃 *i*-ONE 儀器科技創新獎」頒獎典禮
Group photo at the 14th "NARLabs *i*-ONE Instrument Technology Innovation Competition" ceremony

▲ 嘉義高工團隊進行「多圖形自動鏟花機」作品解說
The team of National Chia-Yi Industrial Vocational High School demonstrates the work of "Development of an Automatic Scraping Machine for Multi-shape of Scraped Surface".

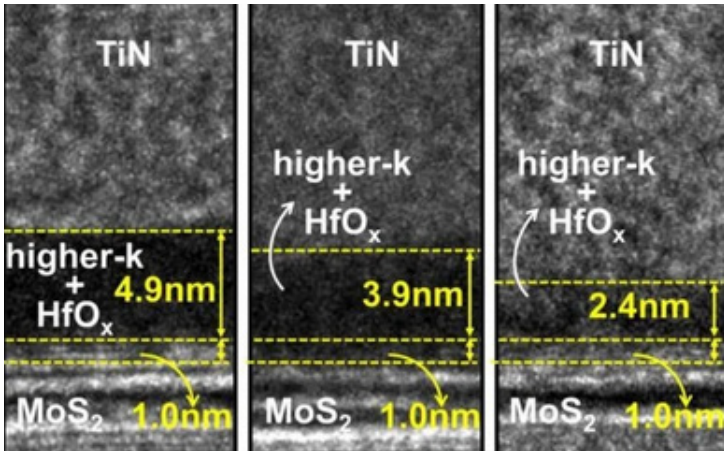
2022/10/18

原子層沉積技術加乘 協助二維材料研究創新突破
The Application of ALD Technology Facilitates the Innovation and Advancement of Research on Two-dimensional Materials

二維材料元件是超越摩爾定律發展關鍵，其中最大挑戰爲很難在二維材料表面沉積無孔洞介電層，台積電及陽明交通大學團隊與儀科中心 ALD 聯合實驗室共同開發高覆蓋性 ALD 製程，成功製作有效氧化僅 1 奈米厚之二維材料元件；同時，利用 ALD 技術極佳 3D 結構沉積覆蓋特性，開發環繞閘極 (GAA) 架構下奈米薄板二維材料電晶體，相關研究內容已發表於 2022 年 12 月國際電子元件大會 IEDM (IEEE International Electron Devices Meeting)。

Two-dimensional material components are the key to the development of More than Moore, but the main challenge is to deposit a pinhole-free dielectric layer onto the surface of such material. To tackle this challenge, a team consisting of Taiwan Semiconductor Manufacturing (tsmc), National Yang Ming Chiao Tung University (NYCU), and TIRI's joint laboratory of ALD collaborated to develop a high-coverage ALD process. This results in the successful development of a two-dimensional material component with an effective oxidation layer of only 1 nm thick. By leveraging the superior 3D structure deposition and covering characteristics of ALD technology,

a nano-thin-plate two-dimensional material transistor with a surrounding gate (GAA) structure is developed. This related research is published at the International Electron Device Meeting (IEDM) in December 2022.



◀ 原子層沉積技術協助二維材料研究創新突破
ALD is applied to two-dimensional materials research with an outstanding breakthrough.

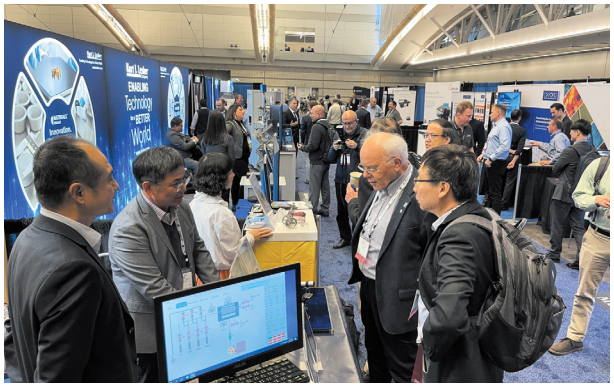
圖片來源：
"Nearly Ideal Subthreshold Swing in Monolayer MoS2 Top-Gate nFETs with Scaled EOT of 1 nm", T-E Lee and Y-C Su et al, tsmc/NYCU/TIRI

••• 2022/11/06

參與第 68 屆美國眞空學會國際會議暨展覽 接軌國際眞空領域
Connecting with the International Vacuum Field at the 68th American Vacuum Society International Symposium and Exhibition

第 68 屆美國眞空學會 (American Vacuum Society, AVS) 國際會議暨展覽於美國賓州匹茲堡的 David L. Lawrence Convention Center 舉行，期間亦參與學術研討會發表及儀器展示會，規模盛大，儀科中心除展示眞空領域的研發與客製服務成果外，並代表 AVS 臺灣分會參與 AVS CDG (Chapter/Division/Group) 核心組織會議，與國際各分會代表交換意見，深入國際眞空領域學術組織。

The 68th American Vacuum Society (AVS) International Symposium and Exhibition was held in David L. Lawrence Convention Center in Pittsburgh, Pennsylvania, USA. The event features academic seminars and instrument exhibitions on a large scale. TIRI not only showcases the R&D achievements and customized services in the vacuum field, but also represents AVS Taiwan Branch in the AVS CDG (Chapter/Division/Group) meeting, which provides an opportunity for TIRI to engage in discussions with representatives from international branches and deepen connections with international academic organizations in the vacuum field.



▲ 國際眞空領域專家學者蒞臨中心攤位交流
TIRI attends the AVS 68th International Symposium and Exhibition, and exchanges with international experts.

●○○ 2022/11/06

德國杜塞道夫醫療器材展 展現臺灣生醫量能！
Taiwan's Biomedical Capabilities Showcase at the MEDICA in Dusseldorf, Germany

國科會整合竹科、中科、南科三大科學園區於該展設立「臺灣智慧醫療創新館」(Taiwan Smart Health)，展示臺灣新創醫材團隊產品，儀科中心與目前合作或輔導的廠商團隊共有十家參加本次 MEDICA 展覽，其中有五個團隊在主題館展出，由儀科中心輔導的醫流體股份有限公司更入選此次大會 Start-up Competition Pitch and Award 賽會，爲世界各國選出 12 個新創公司之一。藉由展覽除了解目前產業與技術趨勢，更增加臺灣醫材研發能量之曝光機率，尋求國際拓銷的市場機會點與潛在的合作夥伴，吸引全球資金挹注，讓歐洲國際會展看見臺灣的生醫量能。

The National Science and Technology Council (NSTC) has integrated three major scientific parks: Hsinchu Science and Industrial Park, Central Taiwan Science Park, and Southern Taiwan Science Park to establish "Taiwan Smart Health" pavilion at this exhibition, showcasing the products of Taiwan's medical startups. Ten manufacturers, which TIRI is currently cooperating with, participate in this exhibition, with five teams exhibiting in the pavilion. Among these, MedFluid Co. Ltd., under the guidance program of TIRI, is selected as one of the 12 startups for the world's Start-up Competition Pitch and Award. This exhibition not only provides insight into current industry and technology trends but also increases the exposure of Taiwan's medical device R&D capabilities. It seeks market opportunities and potential partners for international marketing, attracts global investments, and showcases Taiwan's biomedical capacity at international exhibitions in Europe.

▲「臺灣智慧醫療創新館」參與單位及廠商合影
Group photo of participating units and manufacturers of Taiwan Smart Health

●●○ 2022/12/01

儀科跨域整合「醫」起躍升國際
TIRI's Cross-domain Integration in the Field of Medical Devices Reaches International Level

配合政府推動六大核心戰略產業推動方案及 5+2 產業創新基礎，由國科會主導，整合南科管理局、中科管理局、竹科管理局、儀科中心及經濟部工業局等生醫聚落發展量能建構跨部會平臺，共同推動「醫療器材產業加速新創與躍升國際推動計畫」，於臺灣醫療展 –「科學園區主題館」展示計畫成果。儀科中心建構跨域整合服務模式，展出創價醫材加速器所輔導的新創醫材廠商技術升級成果以及與產學研醫合作之 3D 列印展示，受到各界關注。

In collaboration with the government's initiative to promote programs of the Six Core Strategic Industries and the 5+2 Industrial Innovation Foundations, NTSC has integrated the capacity of biomedical settlements including the Southern Taiwan Science Park, Central Taiwan Science Park, Hsinchu Science and Industrial Park, TIRI, and Industrial Development Bureau to establish a cross-departmental platform. Together, the project of "Startup Acceleration and

International Promotions for the Medical Device Industry" is promoted and the achievements are showcased at the "Science Park Theme Pavilion" in Healthcare+ Expo Taiwan. TIRI has also established a cross-domain integrated service model, highlighting the technological advancements of startups under the guidance of TIRI's medical device accelerator, as well as the collaborative 3D printing implants and medical device prototypes involving industry, academia, research, and medicine. This has garnered widespread attention from various sectors.

▲ 臺灣醫療展 –「科學園區主題館」參與單位及廠商合影
Group photo of participating units and manufacturers of "Science Park Theme Pavilion" in Healthcare+ Expo Taiwan

••• 2022/12/12

儀科中心研發大樓 新建工程開工典禮
TIRI R&D Building New Construction Commences with Groundbreaking Ceremony

儀科中心成立近 50 年，是臺灣唯一能提供學術界理、工、醫、農、藝術等跨領域客製化前瞻儀器設備的研發機構，爲執行國家任務計畫，因應政策計畫需求發展高解析遙測儀器與前瞻計畫下世代半導體製程與檢測設備，自 2020 年成立大樓新建專案小組開始籌劃，克服疫情、缺工以及原物料上漲等種種困難，於 2022 年 12 月 12 日舉辦大樓新建工程開工典禮，由國研院林法正院長主持，並邀請竹科管理局王永壯局長等貴賓一同參與。預計在 2024 年 9 月完工，規劃爲地下 1 層到地上 4 層貫通之高層廠房，將增加約 700 坪的實驗室空間，以因應未來更大型、更前瞻儀器設備的研發需求。

Established almost 50 years ago, TIRI is the sole R&D institution in Taiwan offering customized and cutting-edge instruments for fields ranging from science, engineering, healthcare, agriculture to art. In compliance with the national programs, TIRI organized a team in 2020 to design a whole new complex to fulfill the R&D requirements for larger and more cutting-edge instruments and equipment in the future. Despite facing several challenges such as the pandemic as well as lack of manpower and materials, the groundbreaking ceremony of the new building project is successfully held on December 12, 2022. President of NARLabs, Faa-Jeng Lin, hosts the ceremony and Wayne Wang, Director of Hsinchu Science Park Bureau, is invited as a guest. The building is planned as a high-rise structure with one floor underground and four floors above ground. The laboratory space is increased by approximately 700 m^2 with an estimated completion date of September 2024.

▲ 研發大樓新建工程開工典禮 The groundbreaking ceremony of TIRI R&D complex

●○○ 2022/12/24

儀科中心支援學研團隊創新技術開發，榮獲第 19 屆國家新創精進獎肯定
TIRI Supports Academic and Research Team in Innovative Technology Development, Recognized by the 19th National Innovation and Improvement Award

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，相繼於 2021 年獲得第 18 屆國家新創獎，2022 年持續精進軟硬體更新及改善藥物配送流程，再度獲頒第 19 屆國家新創精進獎！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。

TIRI collaborates with Hualien Tzu Chi Hospital to develop the "Smart Medicine Kit", a modular telehealthcare system that addresses the issues of medication accessibility and adherence for patients in rural areas. The innovative solution won the 18th National Innovation Awards in 2021 and wins the 19th award again through continuous improvement of software & hardware updates and drug delivery processes. TIRI establishes a cross-domain integrated R&D service platform, which enables the research team to develop innovative technologies with market value and competitive advantage.

▲ 儀科中心與花蓮慈濟醫院共同獲獎肯定 TIRI and Hualien Tzu Chi Hospital win the prize together.

111 年獲獎記錄 Awards in 2022

儀科中心「高光譜顯微影像分析儀與技術發展」研究團隊榮獲中華民國計量工程學會所頒發的「第17 屆計量科技研發創意獎」肯定！

The R&D team of "Hyperspectral Microscopic Image Analyzer and Technology Development" wins the 17th Innovation Award for Metrology Technology R&D from the Chinese Metrology Society.

◀「高光譜顯微影像分析儀與技術發展」研究團隊出席頒獎典禮
The R&D team of "Hyperspectral Microscopic Image Analyzer and Technology Development" attends the ceremony.

儀科中心榮獲「第十六屆國家實驗研究院傑出科技貢獻獎」肯定，得獎名單如下：

The winner teams of the 16th NARLabs Outstanding Scientific and Technological Contribution Awards list below:

「技術發展」優等獎 —「高光譜顯微影像分析研發平台」
Excellent Award for "Technological Development" - Hyperspectral Microscopic Imaging System

研究團隊：
翁俊仁研究員、呂國豪專案佐理研究員、劉兆峰佐理研究員、翁精鋒副研究員、林郁欣副研究員、劉達人組長

Team Members:
Chun-Jen Weng, Guo-Hao Lu, Chao-Feng Liu, Jing-Feng Weng, Yu-Hsin Lin, and Da-Ren Liu

成果說明：儀科中心高光譜研究團隊致力於建構完整高光譜顯微影像分析研發平台，爲提供國內學者全球頂尖之研究平台，維運國家級儀器研究設施。其技術發展不僅具備微米尺度定位及顯微取像功能，更具有光譜影像定量分析之特點，有別與一般高光譜儀大多只能進行定性之應用分析，可測量樣品重要物理參數，如穿透率、反射率與吸收率等，可廣泛應用於微奈米材料與生物組織的顯微影像分析。

Results: This research team at TIRI is dedicated to establishing a comprehensive hyperspectral microscopic image analysis and research platform. This platform aims to provide domestic scholars with a world-class research environment while upholding national-level instrument research facilities. The technical advancements achieved by the team not only enable micron-scale positioning and microscopic imaging but also offer the capability for spectral quantitative analysis. In contrast to conventional hyperspectral instruments that primarily allow for qualitative application analysis, this hyperspectral instrument developed by the team goes beyond that. It allows for the measurement of crucial physical parameters of samples, including transmittance, reflectance, and absorptance. Consequently, it finds broad applications in microscopic image analysis of nano-micro materials and biological tissues.

「技術發展」優等獎 —「12 吋全自動叢集式原子層沉積設備開發」
Excellent Award for "Technological Development" - Development of 12-inch Cluster Atomic Layer Deposition Equipment

研究團隊：
陳建維助理研究員、余友軒助理工程師、柯志忠組長、周宗德專案助理研究員、林雨樵助理研究員、鄭至雅專案研究助理、張揚愉專案佐理研究員、張展源助理研究員

Team Members:
Daniel Chen, Yu-Hsuan Yu, Chi-Chung Kei, Tsung-Te Chou, Yu-Chiao Lin, Chi-Ya Cheng, Yang-Yu Jhang, and Chan-Yuen Chang

成果說明：該團隊與業界共同開發 12 吋量產型叢集式 ALD 設備及氧化鋁薄膜製程驗證，10 奈米厚度的氧化鋁薄膜均勻性 (uniformity) 大於 99%。相較於目前市面上量產型 ALD 設備，該機台設備擁有降低前驅物消耗量設計與相對高產出速度，並可依客戶端製程與產能需求加掛反應室，具備高度可擴充性；而氧化鋁薄膜製程也率先應用於 Mini-LED 及 Micro-LED 上作爲鈍化保護層，改善了 LED 發光效率與使用壽命。

Results: The team collaborates with industry partners to develop a 12-inch mass-produced cluster ALD equipment and conducts verification of the alumina film process. The team achieves exceptional results, with the alumina film exhibiting a thickness of 10 nm and a uniformity greater than 99%. In comparison to currently available mass-produced ALD equipment in the market, this equipment offers advantages such as reduced precursor consumption design and relatively high output speed. Additionally, it can be customized with a reaction chamber to meet the specific process and capacity requirements, making it highly scalable. Furthermore, the alumina film process pioneered by the team has been successfully applied as a passivation protection layer in Mini-LED and Micro-LED technology. This breakthrough significantly improves the luminous efficiency and service life of LEDs.

「科技服務」優等獎 —「次埃解析度 (sub-Å) 原子結構分析與應用」研發服務平台」
Excellent Award for "Technology Services" - Sub-Å Microstructure Investigation and Application in Materials

研究團隊：
蕭健男組長、陳峰志副主任、林建寶助理研究員、邱柏凱組長、林郁洧組長、蕭素淳助理技術師

Team Members:
Chien-Nan Hsiao, Fong Zhi Chen, Chien-Pao Lin, Po-Kai Chiu, Yu-Wei Lin, and Su-Chun Hsiao

成果說明：儀科中心自行設計建造符合該項儀器所需嚴格規範之實驗室環境，建構「次埃解析度原子結構研究與應用」研發服務平台，配備具有國內最新型電子光學 DCOR 像差修正器之「原子解析度像差修正掃描穿透式電子顯微鏡」，其點解析度可達目前國內最高之 0.78 Å。此研發服務平台提供學術界最先進之原子級顯微結構分析服務，支援國內外最頂尖之原子尺度學術研究與技術發展、並培育下世代科研人才。

Results: TIRI has successfully established its own laboratory environment, meticulously designed to meet the stringent requirements of advanced instruments. Within this framework, a state-of-the-art R&D service platform specializing in "sub-Å microstructure research and application" has been constructed. The centerpiece of this platform is an "atomic resolution aberration corrected scanning transmission electron microscope" equipped with domestic latest electro-optical DCOR aberration corrector. This cutting-edge instrument boasts the highest point resolution currently available in Taiwan, achieving an impressive 0.78 Å. It supports groundbreaking atomic-scale research and technological development both domestically and internationally, fostering the growth of the next generation of scientific research talents.

其他獎項 Awards in 2022

活動 Event	參賽作品 Participating Work	獲獎項目 Award
NYCU 創新創業競賽 NYCU Innovation and Entrepreneurship Competition	輔導陽明交通大學 – 針內超音波胸腔區域麻醉定位導引系統 Guidance Program for National Yang Ming Chiao Tung University- intraneedle ultrasound localization and guidance system for thoracic anesthesia	NYCU 創新創業競賽 NYCU Innovation and Entrepreneurship Competition
2022-1 FITI 創新創業激勵計畫 2022-1 From IP to IPO (FITI) Program	輔導中國醫藥大學附設醫院及國立中央大學 – Olproheal Biomimic 歐承健 Guidance Program for China Medical University Hospital and National Central University- Olproheal Biomimic	創業潛力獎 Entrepreneurship Potential Award
2022 未來科技獎 2022 Future Tech Award	輔導中國醫藥大學 – 精準性檢驗類風濕性關節炎之診斷套組 Guidance Program for China Medical University- diagnostic kit for rheumatoid arthritis with accuracy test	未來科技獎 2022 Future Tech Award

儀器科技發展

Development of Instrument Technology

●○○ 支援前瞻學術研究
Supporting Forward-looking 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 niche research and experimentations in various fields and to facilitate new scientific discoveries.

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

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」，點解析度爲目前國內最高的 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 novel 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)
- 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

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儀與技術發展，及高光譜顯微影像校正方法，具備微米尺度定位及顯微放大以及光譜定量之特點，可應用於微奈米材料與生物組織顯微影像分析，並在光電、前瞻顯示器及精準醫療領域皆具極大發展潛力，本平台於 2022 年榮獲「第 17 屆計量科技研發創意獎」。

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, the 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. The R&D team wins the 17th Creative Award of Metrology Technology R&D from the Chinese Metrology Society.

重要規格 System specifications

- 光譜範圍 Spectral range: 470-900 nm
- 光譜爲 150 波段 150 spectral bands
- 高光譜影像像素 Hyperspectral image pixels: 3,600 (X)×2,048 (Y)

客製斜向濺鍍系統
Customized Oblique Sputtering System

力助學研開發材料新應用
A new application of materials for research and development

儀科中心客製開發斜向濺鍍系統，協助陽明交通大學及臺北醫學大學團隊在固化的蜘蛛絲表面濺鍍一層薄薄的奈米金薄殼，以增加蜘蛛絲光纖對糖濃度的靈敏度，最後做成了一根直徑約略爲頭髮，肉眼可視的光纖感測器。其研究成果與研究團隊共同發表國際生醫光電領域重點 SCI 期刊 Biomedical Optics Express (IF>3.5)，並被獲選爲該刊物的編輯精選。

The customized oblique sputtering system developed by TIRI assists the teams of National Yang Ming Chiao Tung University and Taipei Medical University to create biosensor by turning spider silk into optical fiber. The process involves sputtering a thin nano-gold shell on the surface of solidified spider silk to increase the sensitivity of spider silk fiber to sugar concentration. A macroscopic optical fiber sensor with a diameter around the size of hair is created as a result. These research achievements are published in the international key SCI journal Biomedical Optics Express (IF>3.5) and selected as editorial selection.

重要規格 System specifications

- 使用 3 吋濺鍍槍設計，最多可擴增至 3 組。
  A 3-inch sputtering gun design with up to 3 modules
- 搭載 4 吋旋轉式機板載台。
  Using a 4-inch rotary board microscope carrier
- 可替換旋轉式夾具台，鍍製圓柱式樣品。
  A replaceable rotary fixture table for plating cylindrical samples
- PLC 搭配 Touch panel 製程控制系統具備全自動待機、自動抽氣、自動鍍膜等功能。
  When matched with the Touch panel process control system, the PLC is provided with the functions of automatic standby, automatic pumping, automatic coating, etc.

建構鼠腦 3D 高解析影像之大口徑顯微鏡頭
Large-diameter Microscope Lens for Constructing 3D High-Resolution Mouse Brain Images

揭開大腦神秘面紗
Shedding new light on brain functioning

儀科中心受中央研究院委託研製開發適用於層光螢光顯微鏡 之大口徑顯微鏡頭系統，其大範圍成像圈與高解析度可應用於高解析之大樣本取像，可一次取得鼠腦完整影像，改善一般顯微鏡成像範圍過於狹窄與拼接耗時等問題，可大幅提高老鼠腦部取像與研究的效能。

Entrusted by Academia Sinica, TIRI develops a large-diameter microscope lens system suitable for light sheet fluorescence microscopy. Its wide-range imaging circle and high resolution can be applied to take images of large samples with high resolution to obtain complete images of the mouse brain at one time. This can address the problems of a too-narrow imaging range and the time-consuming stitching of general microscopes. It boosts the efficiency of image-taking and research on the mouse brain.

重要規格 System specifications

- 無限共軛 Infinity-corrected conjugate
- 波長 Wavelength: 可見光 Visible light
- 油 / 水浸式 Oil/water immersion
- 數值孔徑 NA: 0.3
- 視場角 Field of view: ψ22 mm
- 工作距離 Working distance > 30 mm

●●○ 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，讓臺灣成爲未來全球經濟的關鍵力量。

TIRI has been expanding its R&D 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.

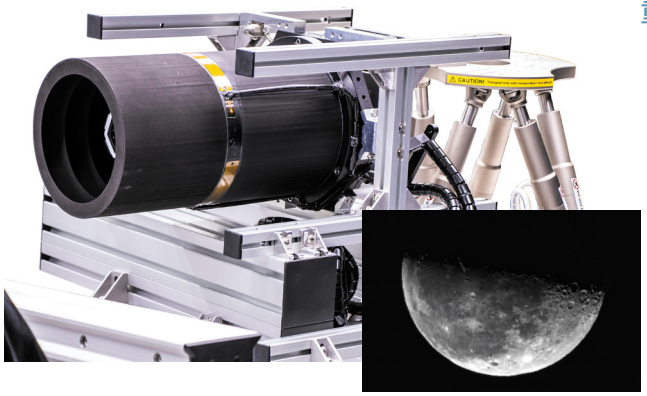
反射式望遠鏡光機系統
Optical-mechanical System of Reflective Telescope

客製化光學遙測取像規格設計
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」的研製爲採用 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, manufacture, assembly, tuning and measurement for high-precision opto-mechanical system of telescope. The opto-mechanical system of reflective telescope is adopted the design of Ritchey-Chretien optical system architecture. The lenses and structures are fabricated by using the materials with extremely low thermal expansion, such as Zerodur, Fused Silica, CFRP and Invar, in order to complete a high-precision opto-mechanical system. 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

◀ 對月球之實拍影像
Moon Image taken by the Telescope

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，透過數位電控方式整合兩種鍍膜系統，可交錯鍍製金屬及化合物多層膜，並以自動化製程控制，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.

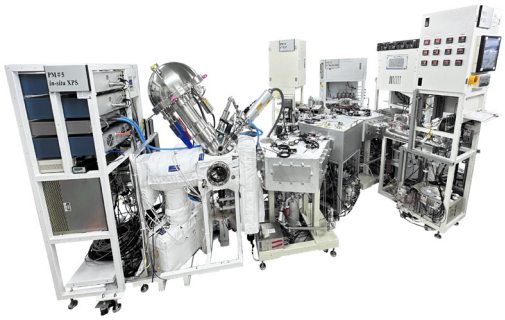
重要規格 System specifications

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

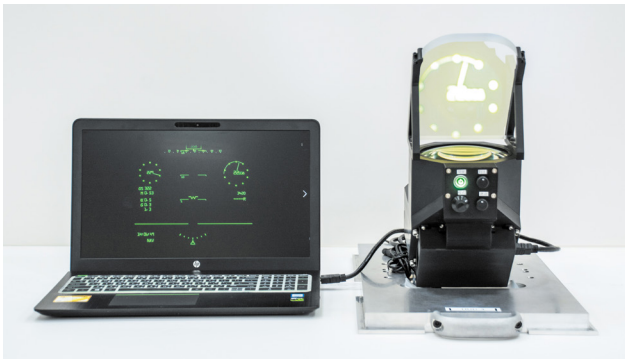
重要規格 System specifications

- 叢集式設計，最多可銜接 8 台製程或分析檢測模組。
  Cluster design, available for integrating with up to eight processes or analyses modules.
- Oxide ALD 系統一套，可提供製程：Al_2O_3、HfO_2、ZrO_2、Y_2O_3。
  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，可提供製程：AlN、TiN。
  Nitride ALD system, available for the processes of AlN and TiN.
- RTP 系統一套，可提供製程 800 °C真空退火以及合成氣體 (FGA) 退火。
  RTP system, available for 800 ° C vacuum annealing or 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.

抬頭顯示成像光學系統
Head Up Display

臺灣自研自製航空用關鍵裝置
Taiwan self-developed aviation key devices

抬頭顯示成像光學系統 (Head Up Display, HUD) 普遍運用在航空器上的飛行輔助儀器，飛行員不需低頭即可觀看飛機重要資訊，本系統配置高亮度圖像產生裝置，透過高亮度 LED 背光模組與成像投影鏡組，將外部輸入之圖像資訊投影至成像疊像鏡片上，並結合高增益微透鏡陣列擴散膜，大幅提升影像實際顯像區域的照明亮度，產生高輝度與高對比度之影像品質，並依客戶需求設計虛像投影鏡組，提升系統視角，並確保成像解析度，讓飛行員清楚觀看各項狀態參數。



Head Up Display (HUD) has been extensively applied to supplementary flight instruments in aircraft. Pilots can observe important information about the aircraft without looking down. This system is configured with a high-brightness picture generation unit (PGU). It projects input image signal onto the combiner lens by a high-brightness LED backlight module and an imaging projection lens set. The PGU enhances the illumination brightness of the display imaging area with the high gain micro-lens array of the diffusion film and generates high image quality of high brightness and contrast. Furthermore, the virtual image projection lens module is designed at the customer's request. This raises the system's angle of view and the imaging resolution so that pilots can get all state parameters of the aircraft clearly.

重要規格 System specifications

- 全系統尺寸 Overall system size: 150 mm × 370 mm × 410 mm
- 重量 Weight: 13 kg
- 顯示圖像具 26° (±5%) 視域角度
  The image displayed has a viewing angle of 26° (±5%).
- 複合玻璃具 70% (±5%) 透光度
  The composite glass has a light transmittance of 70% (±5%).
- 圖像解析度 Image resolution: 950 × 640
- 圖像更新率 Images frame rate: 60 Hz
- 可自動依據周遭環境光線強弱自動調整顯示亮度 0 - 3000 fL (±5%)
  The display brightness of 0 - 3000 fL (±5%) can be automatically regulated along with the intensity of ambient light.
- 可雙向傳輸 RS422 串列埠訊號
  Bidirectional RS422 signals transmission
- 可輸入 DVI 影像訊號
  DVI image signals input and output

基於雙光機裝置之自動光學對位系統
Automated Optical Registration System Based on Dual Opto-Mechanical Devices

提高點測機量測定位精準度
Raising the accuracy of measurement and positioning of the probing machine

儀科中心開發世界首創晶圓級氣體感測器點測機台，爲提高自動電性量測定位精準度，以兩組光機取像模組透過對位解算軟體計算，建立晶圓之座標系統與地圖 (wafer map)，以執行線陣列探針點測裝置之定位調校及感測器晶粒之電性點測，並連結原來的晶圓地圖屬性資料 (attributes)，達成晶圓級氣體感測器晶片的自動對位與操作功能。

TIRI has developed the world's first "wafer-level gas sensors probing machine". To increase the positioning accuracy of automatic electrical measurement, the coordinate system and the wafer map are established based on dual opto-mechanical devices. This is achieved through the

positioning software to perform the position adjustment for the linear arrayed probing device and the electrical measurement of the sensors. The derived datasets are linked to the original wafer map attribute data (attributes) to perform the automatic alignment and operational functions for the wafer-level gas sensors.

重要規格 System specifications

- 影像解析度 Image resolution: 5 μm/pixel
- 定位精度 Positioning accuracy: ±5 μm
- 雙光機取像裝置架構，分別對晶圓上的對位十字標及探針尖進行取像，以進行自動光學精密對位及自動取像行程規劃等功能。
  The structure of the dual opto-mechanical device acquires images for the alignment cross mark on the wafer and the tip of probes, respectively, in a bid to perform the functions of the automatic precisely optical alignment and the automatic imaging planning, etc.

••• 深化社會影響力
Deepening Social Influence

爲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
Smart Energy Management and Analysis System

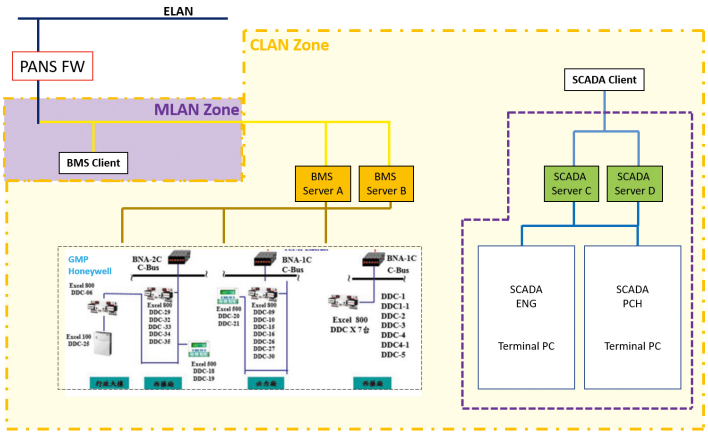
有效掌握廠房環境即時現況
Providing good command of the real-time status quo of the environment in factory buildings

儀科中心與國立臺灣大學機械系蔡孟勳教授長期合作，開發統計與機器學習等大數據分析方法，並將此成果推廣至產業界，已運用人工智慧物聯網相關技術，協助葛蘭素大藥廠建立廠房內環境監控設施，實行資料蒐集、整合與視覺化呈現，並於整合過程中確保資料傳遞之安全，協助其創造數位企業形象，以及提升競爭力。

TIRI has collaborated with Professor Meng-Shiun Tsai of the Department of Mechanical Engineering at the National Taiwan University to develop analysis methods of big data, e.g., statistics and machine learning. They also promote this achievement to the industrial circle. The related technologies of AIoT have been applied to assist GlaxoSmithKline Pharmaceutical Factory in establishing environmental monitoring facilities in factory buildings. The goal is to collect, integrate, and visualize data and guarantee the safety of data transmission during integration. It also assists in building the image of a digital enterprise and boosts its competitive edge.

重要規格 System specifications

- 透過資料探勘、K-means 分群方法與 Gap statistic 方法，對資料進行預處理。
  Data are pre-processed using data mining, K-means clustering, and Gap statistics.
- 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。
  The model's prediction accuracy is effectively raised by combining the clustering results with the machine learning model.



AI 技術演練線上資料庫
Cloud Database of AI Technical Drills

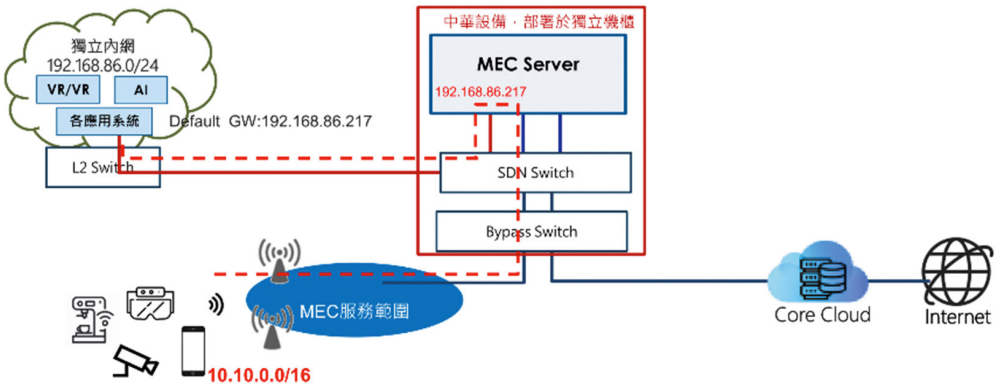
機械製造場域智慧化串接 5G 應用
5G application of smart tandem in the mechanical manufacturing field

利用 5G 高速、高頻寬的特性，將加工數據蒐集後傳輸至雲端資料庫，並以資料庫的高速運算能力進行資料分析與預測，之後傳輸至行動裝置顯示分析結果。持續優化使用者界面以提高使用者體驗，開發可提供使用者串接演算法之擴充 API 模組，以提升使用者自由度，吸引學界及產業界使用。

By adopting the 5G characteristics of high-speed and high-bandwidth, this AI cloud database collects the processing data, and transmit it to the cloud database. Then, the data is analyzed and predicted through the high-speed computing capability of the database. After that, it can transmit data to mobile devices to display the analysis results. The interface is continuously optimized in order to enhance user experience. An extended API module is developed to provide serial algorithms to enhance user freedom, attracting more academic and industrial customers.

重要規格 System specifications

- 雲端資料庫內建 AI 深度學習 CNN 及 SVR 模組，皆可達到準確度 90% 以上之預測性能。
  The cloud database has built-in modules of AI deep learning CNN (Convolutional Neural Network) and SVR (Support Vector Regression), which can achieve more than 90% accuracy in prediction performance.
- AI 落地驗證場域通過國際工控資安場域標準 (IEC 62443-2-4) 認證。
  The AI landing verification field has passed the certification of the international standards for the industrial control information security field (IEC 62443-2-4).



農用無人載具自動除草系統
Automatic Weeding System for Agricultural Application

智慧農業好幫手
A good helper in smart agriculture

儀科中心受花蓮農改場委託，以 AI 智能影像爲系統核心，開發農用無人載具自動除草系統，利用影像辨識技術，搭配機器手臂及無人車以自動化方式替代人工除草，精準拔除雜草，解決雜草於生長期間，搶奪作物之土壤養份的問題，目前系統設計可應用於大豆田、芝麻田等農地。

Entrusted by the Hualien District Agricultural Research and Extension Station, TIRI has developed an automatic weeding system for agricultural applications, with AI smart images at the core of the system. Leveraging the power of image recognition technology, this system, in conjunction with robotic arms and unmanned vehicles, automates the process of weed removal, accurately eliminating weeds, and addresses the issue of weeds depriving crops of soil nutrients during their growth. Currently, the system is designed for soybean and sesame fields.

重要規格 System specifications

- 32 通道，每一通道 240 MHz 取樣頻率。
  32 channels, each with a sampling frequency of 240 MHz.
- 電流轉電壓轉換放大倍率 Magnification of current-to-voltage conversion: 15,000 V/A
- 最小量測電流 Minimum measured current: 0.2 μA

螢光顯影人體血流動力學監測系統
ICG Image System for Hemodynamic Monitoring Based on Cycle Pulsation Effect

邁向精準健康新世代
Stepping into a new generation of precision and health

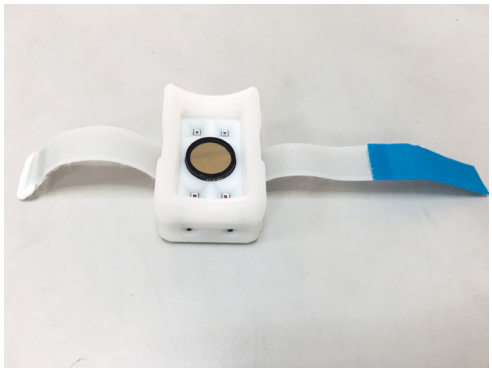
儀科中心與臺北醫學大學合作開發靛氰綠 (indocyanine green, ICG) 螢光顯影人體血流動力學監測系統，藉由靜脈注射 ICG 分析其血流螢光訊號，產生即時生理血流動力資訊，結合手機 APP 無線傳輸，可幫助醫師安全快速判斷病人病情，可望取代現有侵入性昂貴耗材的人體血流動力監測儀器。

In collaboration with Taipei Medical University, TIRI has developed an indocyanine green (ICG) image system for hemodynamic monitoring. Doctors are able to make an assessment quickly based on the real-time physiological hemodynamic information generated by analyzing blood flow fluorescence signal through intravenous ICG injection combined with the wireless transmission of the mobile APP. This is expected to replace the existing invasive and expensive human hemodynamic monitoring instruments.

重要規格 System specifications

- 尺寸 Size (L×W×H): 12 cm × 6 cm × 5 cm
- LED 光源 LED light source: near-infrared band (740 nm - 780 nm)
- 電壓範圍 Voltage range: 9 V - 12 V
- 螢光檢測範圍 Fluorescence detection range: 800 nm - 900 nm
- 系統偵測工作距離 Working distance of system detection: 3 - 5 cm

- 濾光片 Filter: 830 nm
- 光電二極體 Photodiode: Hamamatsu S3072
- 藍芽遠端控制 Bluetooth remote control



動物實驗用健康調節超廣域智慧燈具
Broad Spectrum Health-adjusting Lamps for Animal Experimentation

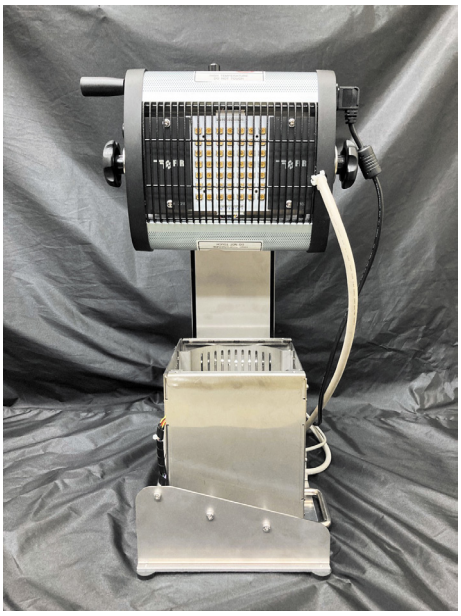
探究光照與免疫力強化關係
Exploring the relationship between illumination and immune enhancement

儀科中心協助高雄醫學大學開發動物實驗用之光照機，整合 UVB 及醫療級 FIR 光源用於維生素 D 生成之研究，透過燈具高度來調整光照範圍及光照功率，下方則放置具有智能溫控系統的動物實驗籠，避免活體動物因光照實驗過熱而傷亡，藉以探討光照對於免疫力強化效果，此智慧燈具正進行動物 IRB 實驗，將來可應用於新陳代謝及光照醫療領域。

TIRI assists Kaohsiung Medical University to develop the illuminator (lamp) for animal experiment purpose. The system is used to research vitamin D synthesis by integrating UVB and medical-grade FIR light sources. It regulates the illumination range and power through the height of the lamp. An animal experiment cage provided with a smart temperature control system is placed below to avoid the casualties of living animals due to the overheating. This experiment explores the effect of illumination on immunity enhancement. The smart lamp is undergoing IRB experiments on animals and can be applied to the fields of metabolism and phototherapy in the future.

重要規格 System specifications

- 光源 Light source: UVB-LED 308 nm,
  醫療級 medical-grade FIR 3 - 25 u
- 最大照度 Maximum illumination: UVB 500 (uW/cm^2) > 95% (均勻度 uniformity); FIR 8.9 (mW/cm^2) > 90% (均勻度 uniformity)
- 動物活動面積 Activity area of the animals: ψ150 mm × 200 mm
- 燈具垂直調整行程 Vertical adjustment stroke of lamps: 200 mm
- 溫控範圍：設定溫度 ±2°C (但無法低於環境溫度)
  Range of temperature control: set temperature ±2°C (It must be higher than ambient temperature.)



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 年開始執行前瞻基礎建設 - 數位建設 - 第三期 (110 － 114)「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。

111 年主要成果如下：

- 完成拉曼臨場檢測模組與二維材料製程相關檢測技術發展，該模組包含微距平台、雷射激發光源、檢測與取像探頭、光譜儀等，藉由即時量測可有效得到晶體資訊，並可獲得成長機制進一步優化元件製程。
- 完成多功能式極紫光 (extreme ultraviolet, EUV) 微影元件檢測平台之超高真空移動載台建置與光罩檢測模組製作，並將系統與同步輻射研究中心光束線進行銜接，調整光路透過光罩檢測模組初步取得光罩繞射影像，未來將可協助半導體相關廠商檢測光罩成像情形。
- 培育前瞻半導體設備高階人才，指導清華大學、陽明交通大學及長庚大學等研究生一同參與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。

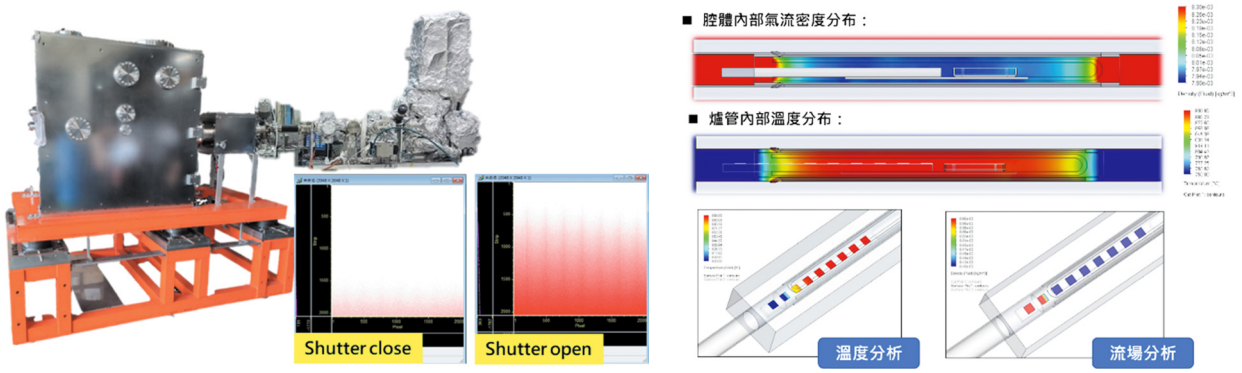
With accumulated abundant experiences in the R&D and integration of opto-electro-mechanical systems, TIRI has participated in the integrated project of the “Advanced Research Instrumentation Development Service Platform” in Phase 1 (2017-2018) and Phase 2 (2019-2020) of “Forward-Looking Infrastructure 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 (2021-2025), 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 for the year 2022 are briefed as follows:

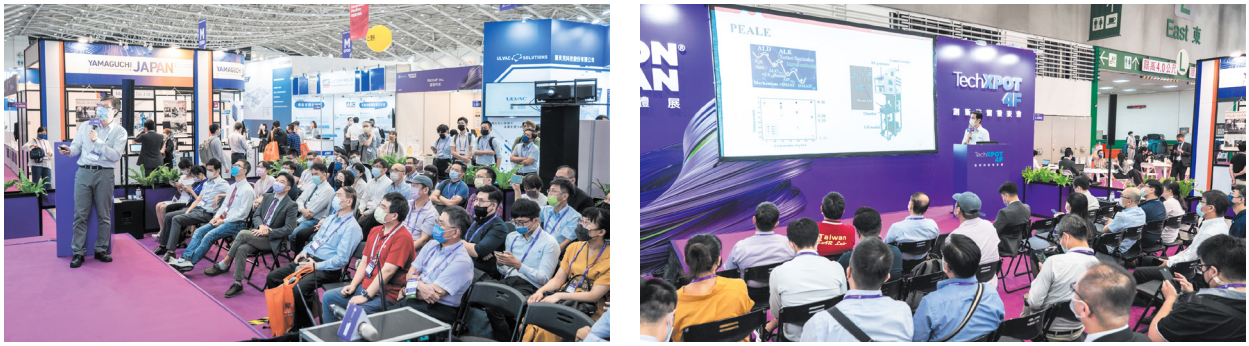
- The Raman module of detection technology for 2D material processing has been developed. The module includes a micrometer moving stage, laser-induced light source, detection and imaging probe, and spectrometer. This allows for the

effective acquisition of crystal information through real-time measurement, as well as the ability to acquire growth mechanisms to further optimize the component process.

- The team has completed the construction of an ultra-high vacuum moving stage and mask detection module for the lithography module detection platform of multifunctional Extreme ultraviolet (EUV). This system has been connected with the beam line of the National Synchrotron Radiation Research Center (NSRRC), and the optical path has been adjusted to take mask diffraction images through the mask detection module in real-time. In the future, this will aid semiconductor manufacturers in detecting mask imaging conditions.
- Graduate students are cultivated through this project and these students come from National Tsing Hua University, National Yang Ming Chiao Tung University, and Chang Gung University. They jointly work on the development of a large-scale semiconductor process system for 2D materials. By simulating the flow field to design an optimized chamber, the system can use solid or gaseous precursors to achieve uniform epitaxy growth of large-area 2D materials by stimulating the flow field.



▲ 左圖：EUV 微影元件檢測平台系統設計與建置，初步取得光罩繞射影像；右圖：培訓研究生模擬分析爐管中溫度與氣流分布狀況，研究二維材料最佳成長條件。
Left: The EUV lithography module detection platform system is designed and constructed to take mask diffraction images. Right: Graduate students are trained to simulate and analyze the temperature and airflow distribution conditions in the furnace tube, and to investigate the optimal growth conditions of 2D materials.



▲ 於 2022 臺灣國際半導體展辦理「國研院先進半導體設備與製程技術」技術論壇，展示計畫先期成果。
The early achievements of the project are published at the technical forum of “NARLabs 2022 ASEPT Seminar” in SEMICON Taiwan 2022.

推動創價醫材加速器平台計畫
Boosting Value-creation Medical Device Accelerator Platform 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。

111 年主要成果如下：

- 本平台輔導 3 家新創公司醫材產品成功取得海外上市許可，包括台智基因體 (股) 公司「次世代基因輔助檢測系統 (聽損基因分析)」取得歐盟 CE 認證，為協助醫師快速預測聽損基因變異相關潛在疾病之 AI 輔助基因檢測數據分析軟體；炳碩生醫 (股) 公司「脊椎微創手術機器人」取得美國 FDA 510 (k) 上市許可，為國內首個取得 FDA 上市許可的微創手術機器人產品；以及富伯生醫科技 (股) 公司「鏡像手復健機器人」取得馬來西亞 MDA 上市許可，並促成該公司接獲國際訂單，成功打入東南亞復健醫材市場。此外，輔導 3 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。
- 積極輔導廠商投入防疫行列，本中心與矽基分子公司、中央研究院以及高雄榮民總醫院，合作開發世界首創的「新冠病毒核酸快速檢測晶片」，通過衛福部食藥署 EUA 授權並上市銷售，加速科技防疫產品實現。
- 協助新創公司串聯產業鏈上中下游研發資源，促成世延生醫 (股) 公司與長庚大學、長庚醫院、奇美醫院等合作開發口腔癌 ELISA 檢測試劑套組與口腔癌快速檢測試片組，同時協助新創公司鏈結竹科、中科補助計畫資源，加速產品商品化，促使該公司全球首家口腔癌檢測試劑廠於新竹生醫園區落地生根。
- 配合政府新南向政策鏈結東南亞國家，延續與泰國國家科學院下之基因工程暨生物科技中心生醫工程與感測技術實驗室 (BIOTEC-IBST) 合作，持續進行肺癌基因檢測及新冠肺炎檢測開發，深化國際夥伴合作關係。

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 for the year 2022 are specifically as below:

- This platform facilitated 3 startups in obtaining overseas marketing licenses for their medical devices. TAIGenomics Co., Ltd.'s "Next Generation Gene-assisted Detection System (Hearing Loss Gene Analysis)" AI-assisted genomic analysis model, which has obtained CE certification in the EU, aids professionals in identifying underlying diseases associated with hearing loss gene variation quickly. Point Robotics MedTech Inc.'s "Kinguide Robotic-Assisted Surgical System" has obtained the FDA 510(k) marketing license in the U.S., making it the first minimally invasive surgery robot product in Taiwan to receive FDA marketing approval. Additionally, Rehabotics Medical Technology Corp.'s "wearable hand exoskeleton robotic device" has obtained the MDA marketing license in Malaysia, paving the

way for the company to receive international orders and successfully enter the rehabilitation medical device market in Southeast Asia. Moreover, this platform has assisted in setting up 3 startups and helped 2 startups pass the Institutional Review Board review, thus advancing research and development results to the clinical verification stage.

- The platform played an active role in guiding manufacturers to participate in epidemic prevention efforts. TIRI, together with Silicon-based Molecular Sensoring Technology Co. Ltd., Academia Sinica, and Kaohsiung Veterans General Hospital, had collaborated to develop the world's first Covid-19 Rapid Test Chip, which had received EUA from TFDA and launched to the market, contributing to the realization of scientific and technological products for epidemic prevention.
- This platform facilitated the connection of startups with R&D resources throughout the industrial chain, resulting in S&T BIOMED's collaboration with Chang Gung University, Chang Gung Memorial Hospital, and Chi Mei Hospital, to develop an ELISA detection reagent kit and rapid detection test set for oral cancer. Additionally, the platform linked startups with research grants from Hsinchu Science Park and Central Taiwan Science Park, promoting product commercialization and enabling the world's first factory for oral cancer detection reagents to be established in Hsinchu Biomedical Science Park.
- The platform facilitated collaboration with BIOTEC-IBST of the National Science and Technology Development Agency (NSTDA) in Thailand, in line with the government's New Southbound Policy, to launch the technology development of genetic rapid testing for lung cancer and COVID-19. The aim of this collaboration is to deepen international partnerships with Southeast Asian countries.

▲ 世界首創新冠病毒快速檢測晶片取得緊急使用授權記者會 World's first COVID-19 rapid test chip receives EUA" press conference

••• 建置智慧機械 AI 技術演練線上資料庫及 AI 落地驗證協作平台 Construction of Online Databases and Verification Platform for AI Intelligent Machine Technology

本計畫建置 AI 技術演練線上資料庫及 AI 落地驗證協作平台提供學研界研究與驗證用。AI 技術線上資料庫除蒐集儀科中心產線數據外，亦可收納各學研團隊或智慧機械相關計畫之去識別化實驗數據，進而建構不同製程、設備、感測器等多型態資料庫，提供團隊針對不同需求使用對應資料庫進行專業人員訓練或團隊所開發之 AI 辨識器。技術落地驗證協作平台則提供設計、製造、組裝以及檢測相關軟硬體環境，讓需要驗證 AI 產品或技術之學研團隊進行異地驗證，以增加產品或技術強健性。

111 年主要成果如下：

- 儀科中心提供學界智慧製造技術驗證場域，現已完成 AI 落地驗證場域通過國際工控資安場域標準認證，爲臺灣第一個通過 IEC 62443 資安場域驗證的法人機構，透過實際產線驗證後，協助學界進行智慧製造及 AI 技術驗證。
- 建置 AI 技術演練線上資料庫，蒐集場域工具機及機邊電腦至資料庫之資料流 (data flow)，並建立資料庫與 5G 訊號串接服務，可提供學研團隊下載產線數據進行 AI 演算法開發。此外，數據前處理後，使用雲端資料庫內建的 AI 深度學習 CNN 及 SVR 模組，皆可達到準確度 90% 以上之預測性能。
- AI 落地驗證協作平台提供智慧製造場域以便學研團隊進行產品測試，已將彰化師範大學曾立維教授團隊所開發之姿態感測器模組導入場域測試，透過感測器與設備間資料融合偵測設備加工狀態，藉此回饋改善團隊所開發的感測器模組效能；另將 AI 落地驗證協作平台研發之 AI 影像辨識技術輸出至漢翔航空工業，進行自動螺牙分類，成功加速 AI 影像辨識模型訓練並提升準確率。
- 目前平台累計培育 15 位研究生，進行先進製造、資安、AI 等先進技術研究；並舉辦 AI 雲端資料庫實作工作坊，辦理 AI 技術相關教育訓練，並使用智慧機械聯網刀具磨耗、表面粗糙度數據資料作爲範例進行實作訓練，共計 10 個國科會計畫團隊參加，協助國科會學研計畫團隊瞭解 AI 雲端資料庫功能及運用。

This project established an online AI technical training database and a collaboration platform for AI technology verification, aimed at facilitating research and development in academic and scientific communities. The online database not only collects TIRI's production line data but also de-identified experimental data from various academic research teams and intelligent machinery projects. This multi-type database, constructed by different processes, equipment, and sensors, is made available to teams for specialized training or for developing AI-based identifiers as per their requirements. The technology verification collaboration platform provided software and hardware environments related to design, manufacturing, assembly, and testing. Enabling academic research teams to verify AI products or technologies off-site, thereby increasing the robustness of their products or technologies.

The main achievements for the year 2022 are briefed as follows:

- TIRI has provided academia with an intelligent manufacturing technology verification field. This AI verification field has passed the certification of international standards of "Industrial communication networks - IT security for networks and systems" (IEC 62443-2-4). It is the first legal entity in Taiwan to pass the IEC 62443 cybersecurity field verification. This could assists the academia in verifying the theory of intelligent manufacturing and AI technology.
- An online database of AI technology was established, which collected data flows

from CNC machine and edge computers, and established serial connections between the database and 5G signals. This allows academic research teams to download production line data for AI algorithm development. Furthermore, AI deep learning CNN and SVR modules built in the cloud database can achieve prediction performance with an accuracy of over 90%.

- The AI verification collaboration platform provides the academic research team with a testing field for intelligent manufacturing products. The team of Professor Li-Wei Tseng from National Changhua University of Education tested their attitude sensor module in this field. By fusing data from the sensor and equipment, the processing status of the equipment is detected, and feedback to improve the performance of the sensor module. In addition, the AI image recognition technology developed in the collaboration platform is applied to Aerospace Industrial Development Corp. For automatic screw teeth classification, resulting in accelerated training of the AI image recognition model and improved accuracy.
- At present, a total of 15 postgraduate students have been trained to conduct cutting-edge research in areas such as advanced manufacturing, information security, and AI. TIRI holds AI cloud database practice workshops, AI technology-related training, and practical training using intelligent machine networking tool wear and surface roughness data as examples. A total of 10 National Science and Technology Council project teams have participated in these activities to gain insights into the functions and applications of AI cloud databases, thereby supporting their academic research.

▲ AI 雲端資料庫實作工作坊訓練課程實況
Scenarios of the training courses of the workshop on AI Cloud Database

國際合作

International Cooperation

儀科中心長期發展光學與眞空技術，在國內已建立領先地位，爲促成中心成爲「國際級儀器科技研發整合卓越中心」，積極推動國際合作，除派員參加國際研討會及展覽，參訪國際組織之外，同時並邀請國際知名學者及優秀人士至中心參訪，並以視訊、線上參與等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. To increase its global reputation, TIRI actively participates in international conferences / exhibitions and visits international organizations. Meanwhile, internationally renowned scholars and outstanding professionals are also invited to visit TIRI. This year TIRI continuously interacts 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、打造世界級實驗室爲宗旨，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:

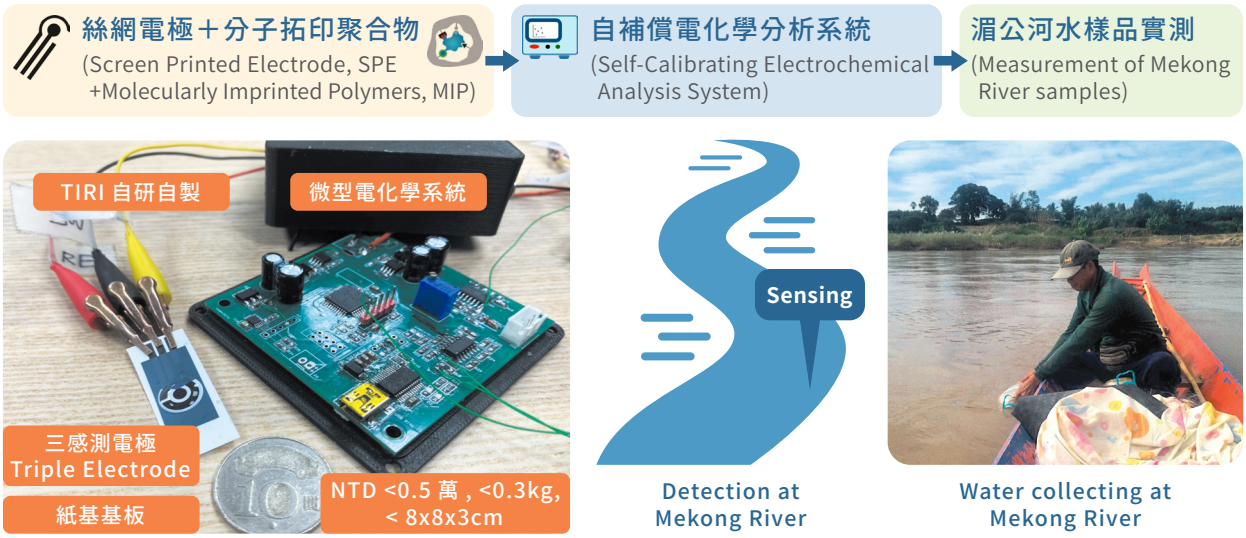
- 日本獨立行政法人理化學研究所
  RIKEN, Japan
- 捷克科學院物理研究所
  Institute of Physics, Academy of Sciences (FZU), Czech Republic
- 新加坡增材製造創新中心
  National Additive Manufacturing Innovation Cluster (NAMIC), Singapore
- 泰國國家科技院生技中心
  BIOTEC-IBST of National Science and Technology Development Agency (NSTDA), Thailand
- 泰國國家金屬與材料技術中心
  MTEC of National Science and Technology Development Agency (NSTDA), Thailand
- 義大利薩尼奧大學
  Università degli Studi del Sannio, Italy
- 美國 ALD 前驅物生產製造商
  RASIRC Incorporation, USA
- 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	(1) 近紅外波段寬頻可調變式超穎材料 (2) 100 THz 寬頻多層式三維超穎材料之開發 Development of Near-IR broadband, multi-layer, three-dimensional metamaterials	2014 | 2022
捷克科學院物理研究所 Institute of Physics, Academy of Science (FZU), Czech Republic	(1) 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 (2) 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 | 2022
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 NSTDA BIOTEC-IBST, Thailand	精準醫療之快速基因檢測 Rapid genetic testing for precision medicine	2019 | 2022
泰國國家金屬材料中心 NSTDA MTEC, Thailand	有機毒物感測器 Disposable electrodes for portable pesticide sensors (DEPPS)	2021 | 2022



▲ 與泰國國家金屬材料中心合作有機毒物感測器研發技術開發，完成自製可攜式微型電化學分析儀，成功辨識河川殘留有機磷農藥
TIRI collaborates with MTEC-NSTDA of Thailand to develop the technology of Disposable Electrodes for Portable Pesticide Sensors (DEPPS). The portable micro electrochemical analyzer has successfully identified the organophosphorus pesticide residues in Mekong River.

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

爲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，以及參與臺灣國際半導體展、美國眞空協會國際會議暨展覽會、及美國 SPIE 國際光電展等國際指標性展覽，展示核心技術與客製服務成果，提高國際能見度並爭取國際合作案。儀科中心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 participates in international exhibitions such as SEMICON Taiwan, AVS International Symposium and Exhibition, and SPIE Photonic West to display core technologies and customized services, improve international visibility and strive for international cooperation projects. Furthermore, 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列表如下：

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)
- 美國眞空學會台灣分會
  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

◀ AVS CDG 主席 Dr. Vincent Smentkowski 至儀科中心攤位參觀合影
Dr. Vincent Smentkowski, Chair of AVS CDG, visits TIRI's booth.

◀ 儀科中心代表 AVS 臺灣分會參加 AVS CDG 核心組織會議，與國際各分會代表交換會務意見，深入國際眞空領域學術組織。
Dr. Chien-Nan Hsiao, division director of TIRI, represents AVS Taiwan Chapter to attend AVS CDG meeting, engaging in the core society activities and interacting with main society faculties around the world.

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 Service 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、服務產業界爲宗旨，提供眞空、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，111 年提供產學研各界檢測與委製服務累計共 2,026 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 has TIRI constantly developed its own instrumentation technologies, but in compliance with the goal of supporting academic research and serving industry professionals, TIRI provides OEM and calibration services for vacuum equipment, optical system, and key components. In 2022 TIRI provides a total of 2,026 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夥伴與技術支援。111 年學界合約案件數衆多，僅列舉部分於下。

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 are a lot of projects for academia in 2022, only some of whom are listed below.

計畫名稱 Project Title	合作對象 Partner
A 世代半導體專案計畫 Angstrom Semiconductor Initiative Project	國立清華大學、國立陽明交通大學、國立中央大學、國立臺灣師範大學、長庚大學，5 校共計 6 個研究團隊共同參與計畫。 7 research teams from 5 universities, including NTHU, NYCU, NCU, NTNU, and CGU, are joint in this project.
智慧微塵感測器技術研發服務平台專案計畫 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 10 個研究團隊共同參與計畫。 10 research teams from 6 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、國立中正大學，6 校共計 8 個研究團隊共同參與計畫。 8 research teams from 6 universities, including NTU, NTUST, NTUT, NCKU, NCHU, and CCU participate in this project.
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爲使命，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。111 年產界合約案件數繁多，僅列舉部分於下。

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 are a lot of industrial projects in 2022, only some of whom are listed below.

- 微流體與生醫晶片整合技術 Technology of Integrating Micro Fluidic and Bio-medical Chip
- 精密光學元件開發製作 OEM of Precision Optical Components
- 原子層沉積 / 蝕刻系統委製案 Atomic Layer Deposition / Etching System OEM Project
- 生醫產品開發及驗證 R&D and Verification Service of Bio-medical Products
- 智慧急救藥櫃雛型製作 Prototyping for Smart First Aid Box
- 機匣螺牙插槽襯套 AOI 自動分類技術 AOI Automatic Sorting Technology for Helicoil Screw Thread Inserts

●●○ TAF 認證實驗室的校正與測試服務 ISO/IEC 17025 Calibration Laboratory

儀科中心建置並持續維持 TAF 認證實驗室，提供眞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 Accredited 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.

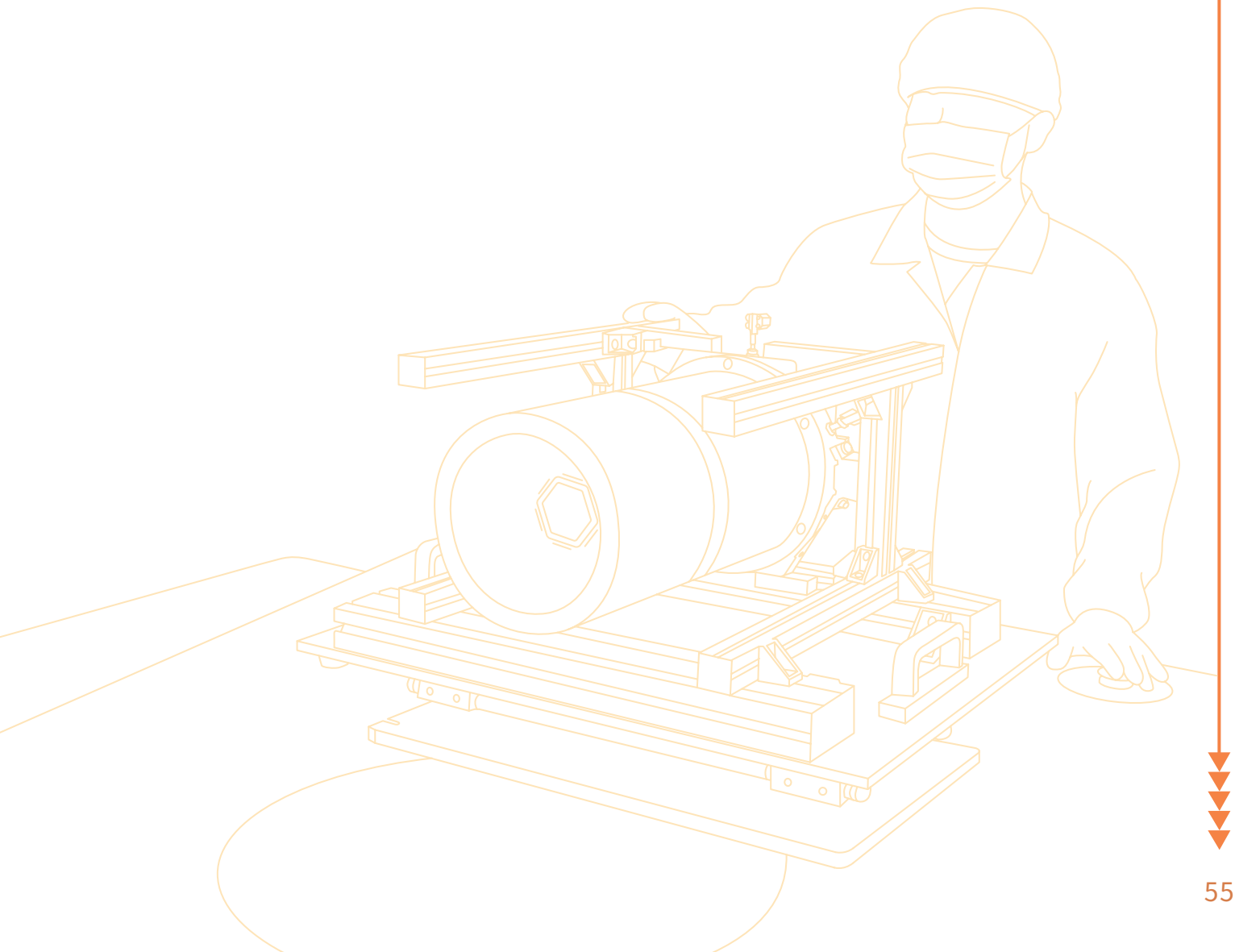
●●● 人才培育 Talent Cultivation

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。111 年舉辦的研習班與研討會包括「眞空技術研討會」、「儀器技術訓練」、「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, while cultivating 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 are many workshops and seminars organized in 2022, including “Workshop on Practical Vacuum Technology”, “Instrument Training Course”, “ALD/ALE Equipment Development Workshop”, and “Teacher Training Course for Semiconductor Manufacturing Process & Equipment”. And there are 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.



111年儀科中心年報
TIRI ANNUAL REPORT 2022

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

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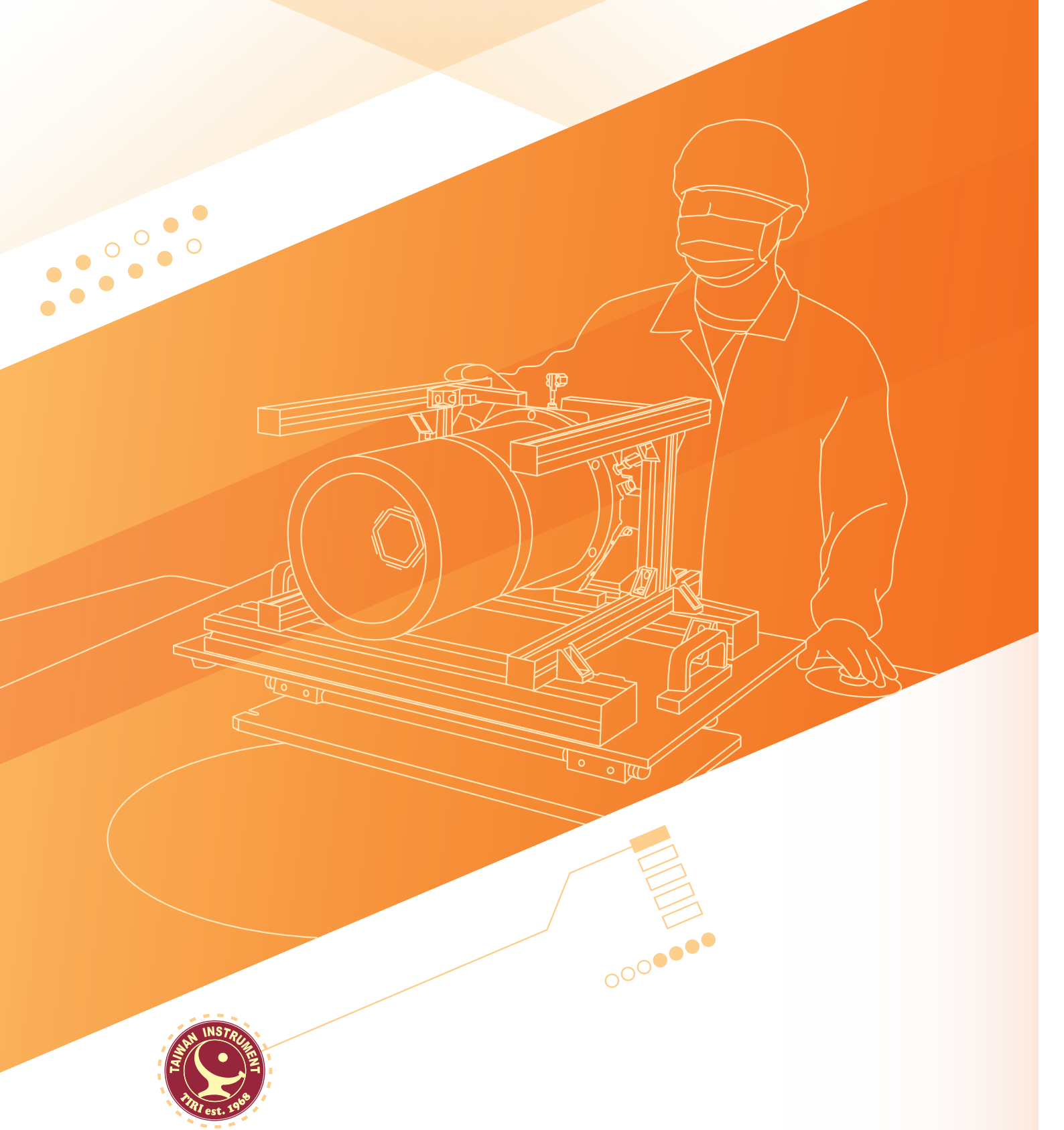
發行日 Publication Date

112 年 6 月｜ June, 2023



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