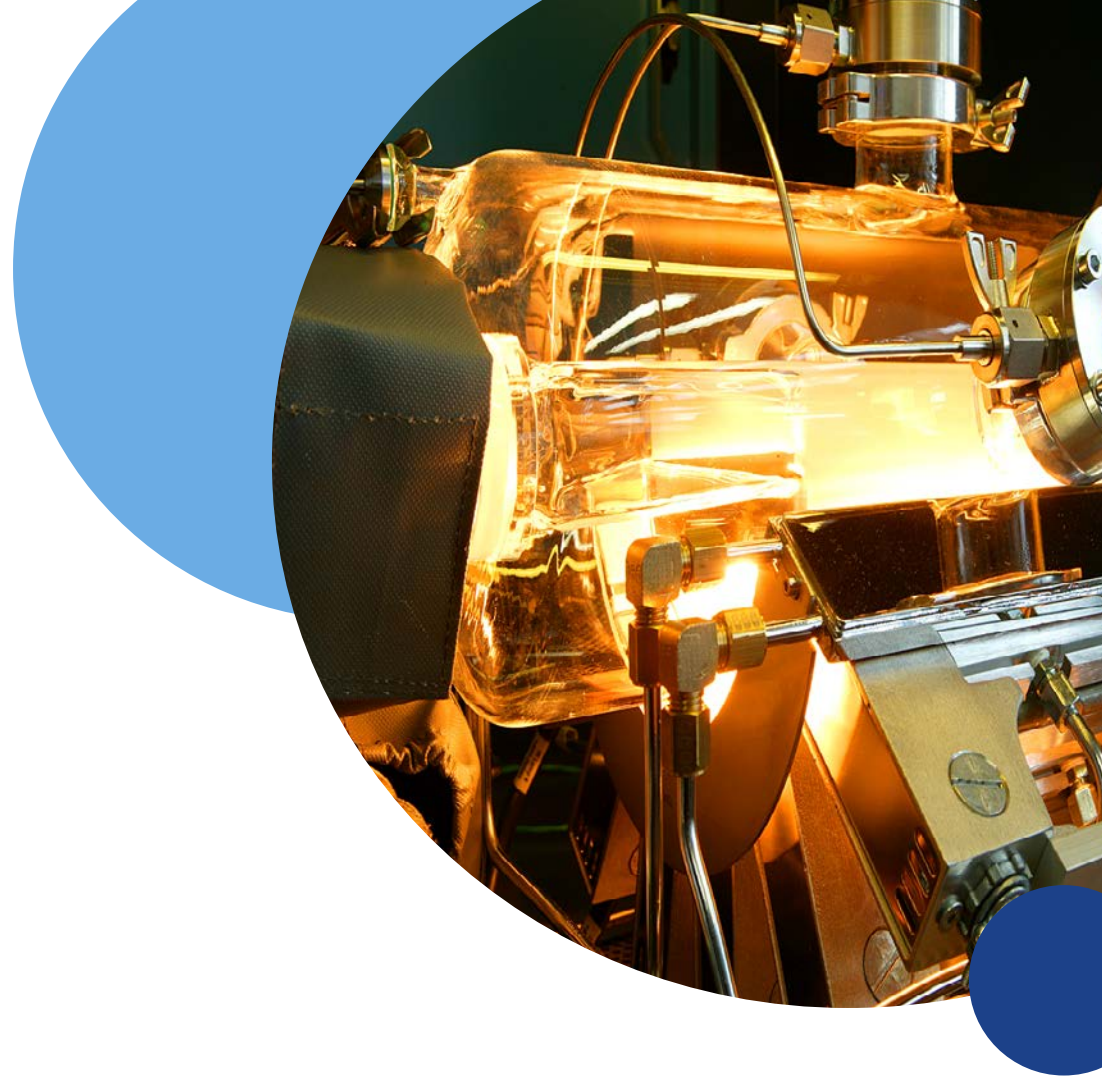


Tyndall National Institute Space Component Analysis

Finbarr Waldron
12th March 2019.



Tyndall National Institute



- Located in Cork, Ireland.
- Micro / Nano Electronics, Photonics & Microsystems
- Ireland's Largest Research Institute
- Excellence in Scientific & Engineering Research.

Tyndall in Numbers

€230m

Infrastructure
investment

500

researchers,
engineers
& support staff

271

peer-reviewed
publications in
2017

€36m

annual
income

85%

from
competitive
contracts

12

incubating
technology
spin-outs

30%

industry
project
funding

200

industry
partners
world-wide

>120

graduate
students
(MSc, PhD)

47%

of Ireland's
H2020 ICT
funding

50

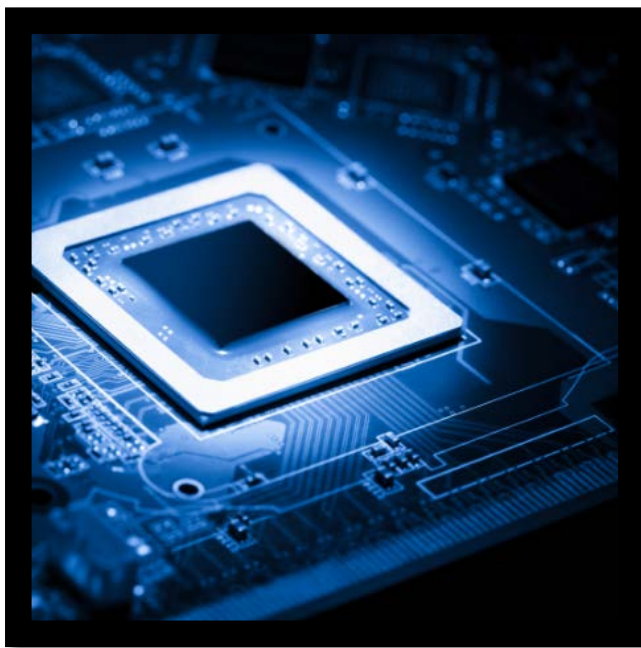
nationalities
on-site

20

industry
Researchers-
in-residence

Organisation – Tyndall Research Centres

Micro & Nano Systems (MNS)



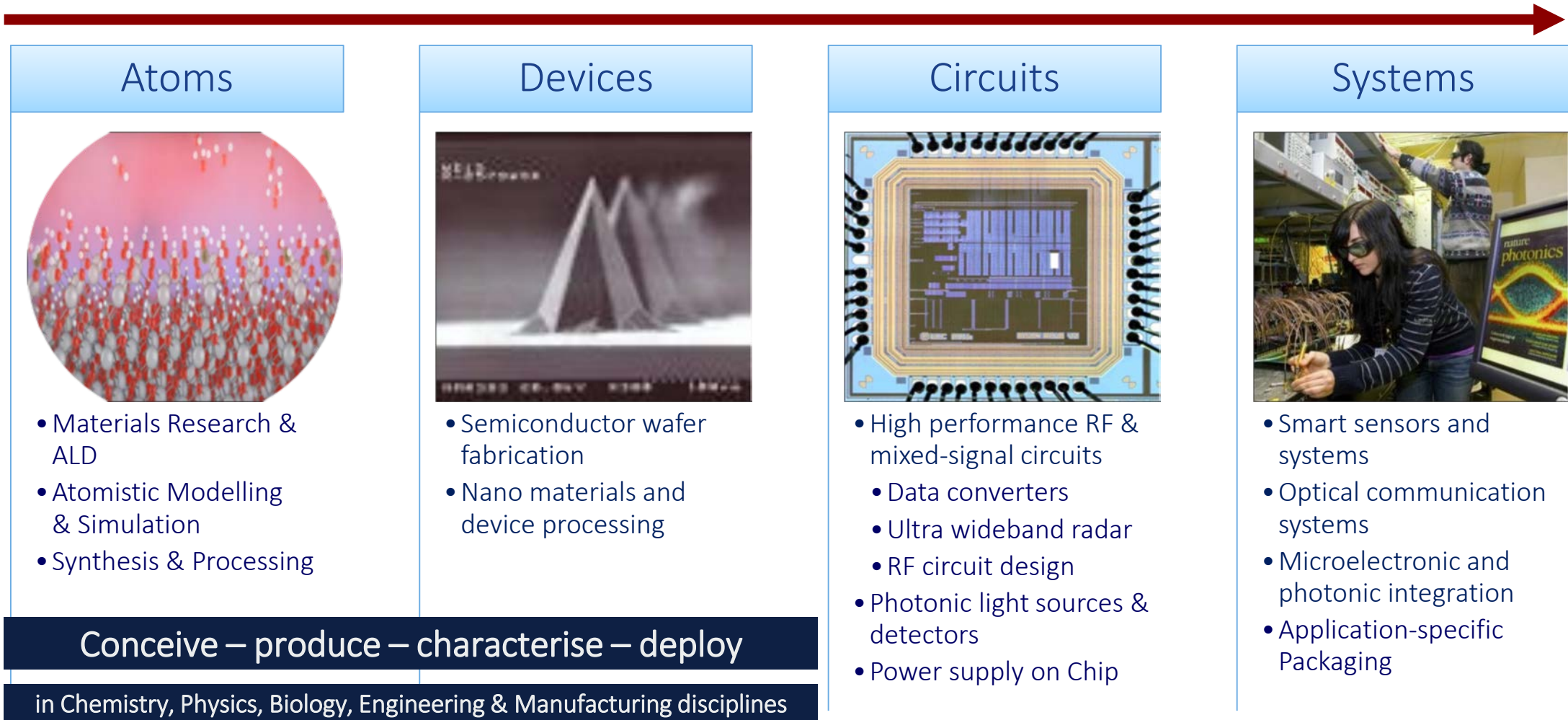
Photonics



Specialty Products & Services (SP&S)

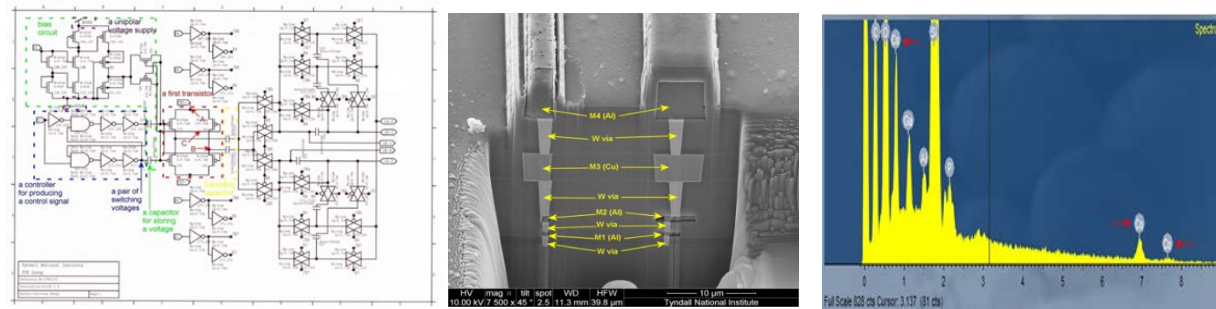
Highly-differentiated Research Approach

From atoms to systems



Tyndall - Key Laboratories & Facilities

- **Electronic Packaging & Reliability Analysis:**
 - Wire/die bond, flip-chip assembly, DPA, CA, Environmental testing, failure analysis, burn-in, shock & drop, X-ray analysis.
- **Electron Microscopy Analysis Facility:**
 - (EMAF) – SEM, TEM, FIB, EDAX analysis, cryo-stage enabled SEM for biological sample analysis
- **IC Design Technology Evaluation (DTE):**
 - CA, IC re-engineering, patent infringement, circuit design analysis, analogue, digital & mixed signal diagnostic measurements
- **Fabrication Facilities:**
 - Silicon CMOS, Compound Semiconductor MEMS, E-beam Lithography, MOVPE materials growth, Training Fab.



IC Circuit, Technology & Construction Analysis



Compound Semiconductor & MEMS Fabrication Facility

Tyndall – Reliability Test Laboratory

Activities:

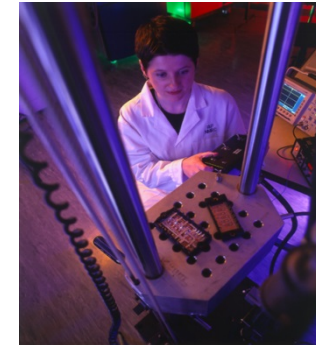
- Test programme design
- Commercial services
- Support to R&D projects

Facilities:

- Air-to-air thermal shock (X2).
- Temperature cycling (X3).
- Temperature / Humidity (X3).
- High/ Low temperature storage.
- Vacuum storage.
- LDS Shock & Vibration.
- Free Fall Shock Test.
- Salt Spray Test.
- Burn-in Tests
- Seal tests, PIND (hi-rel /space components)



Salt Spray



Mech. Shock



Vibration

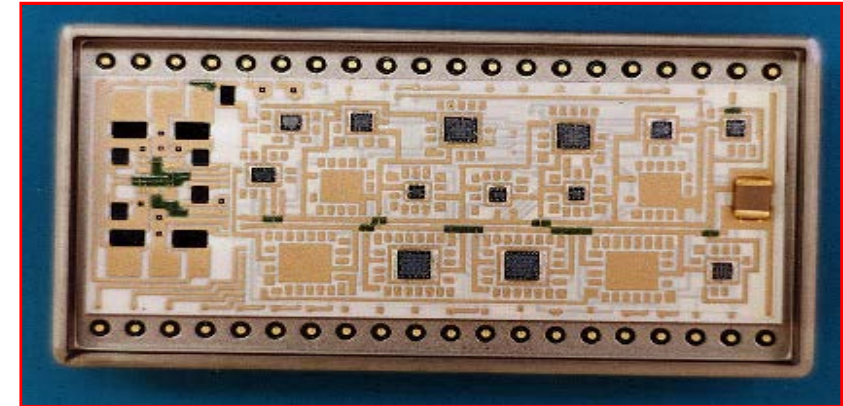


Thermal Shock, Temperature Cycling & Humidity Test

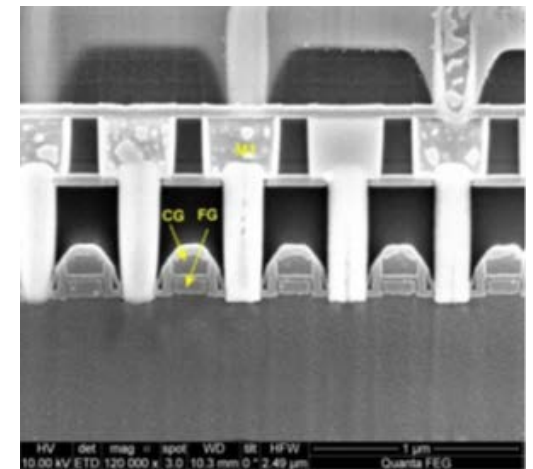


Tyndall – History of Space Activities

- Tyndall working with ESA since 1980's.
- MTSL (Microelectronics Technology Support Laboratory) - 1988.
- MTSL helped establish new test facilities at Tyndall:
 - *Reliability Test Laboratory.*
 - *Micro-packaging Analysis Facilities (component CA & DPA)*
 - *Integrated Circuit Test & Analysis.*
- Expansion of MTSL in 1991, 1993 & subsequent years.
- Renewal in 1993 & subsequent years (5-year contract).
- Tyndall awarded ISO 17025 Accreditation for Space Component DPA in 2018.
- Development of direct component DPA business with Space industry customers.



Hybrid Microcircuit DPA



CA of IC (FIB cross-section)

ISO17025 Accredited Space Component DPA



NSAI

Certificate of Registration of Quality Management System to I.S. EN ISO 9001:2015

Tyndall National Institute

Lee Maltings
Dyke Parade
Cork

NSAI certifies that the aforementioned company has been assessed and deemed to comply with the provisions of the standard referred to above in respect of:-

Research, development and innovation activities in the field of information communications and technology. (ICT).

Approved by:
Fergal O'Byrne
Head - Business Excellence, NSAI

Registration Number: 19.2673
Original Registration: 24 December 1997
Last amended on: 12 April 2018
Valid from: 12 April 2018
Remains valid to: 10 April 2021

This certificate remains valid on condition that the Approved Quality Management System is maintained in an adequate and efficacious manner. NSAI is a partner of IQNet - the international certification network (www.iqnet-certification.com)

All valid certifications are listed on NSAI's website - www.nsaai.ie. The continued validity of this certificate may be verified under "Certified Company Search"

NSAI (National Standards Authority of Ireland), 1 Swift Square, Northwood, Santry, Dublin 9, Ireland T +353 1 807 3800 E info@nsai.ie www.nsaai.ie

ISO 9001:2015 (Tyndall – All Activities)



Irish National Accreditation Board

Accreditation Certificate

University College Cork

Lee Maltings, Prospect Row, Dyke Parade, Cork, Cork

Testing Laboratory

Registration number: 372T

is accredited by the Irish National Accreditation Board (INAB) to undertake testing as detailed in the scope bearing the registration number detailed above, in conformity with ISO/IEC 17025:2005 2nd Edition
"General requirements for the competence of testing and calibration laboratories"
(This certificate must be read in conjunction with the publicly available scope of accreditation)

Date of award of accreditation: 13/06/2018
Date of last renewal of accreditation:
Expiry date of this certificate of accreditation: 13/06/2023

This accreditation shall remain in force until further notice subject to continuing conformity with the above standard, applicable EA/ILAC requirements and any further requirements specified by the Irish National Accreditation Board.

Manager: Dr Adrienne Duff Chairperson: Ms Ita Kinahan

Organisations are subject to annual surveillance and are re-assessed every five years. The renewal date on this certificate confirms the latest date of renewal of accreditation. To confirm the validity of this certificate, please contact the Irish National Accreditation Board.

INAB is a signatory of the European co-operation for Accreditation (EA) Multilateral Agreement (MLA) and the International Laboratory Accreditation Cooperation (ILAC) Mutual Recognition Arrangement for Testing.

The Metropolitan Building, James Joyce Street, Dublin 1, Ireland Tel: 1890 289 389. Int Tel: +353 1 614 7000. Email: inab@inab.ie Web: www.inab.ie

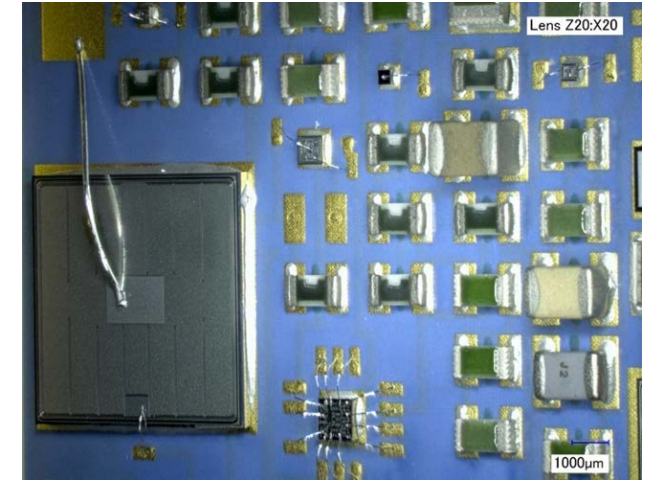
ISO 17025 (Tyndall – Space Component DPA)



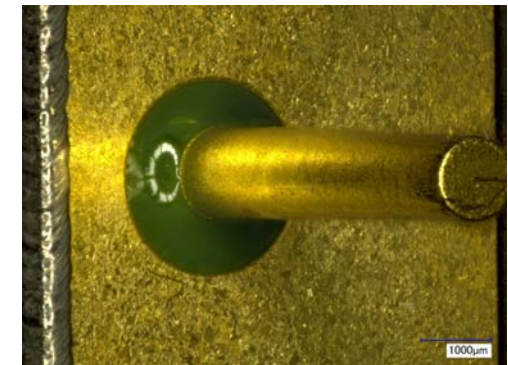
ISO17025 Accredited Space Component DPA

Scope of Accreditation

- External Visual Inspection - Mil-Std-883K, Method 2009.12
- Radiography - Mil-Std-883K, Method 2012.9
- Seal – Helium Fine Leak Test - Mil-Std-883H, Method 1014.13, Condition A1
- Seal – Perfluorocarbon Gross Leak Test - Mil-Std-883K, Method 1014.13, Cond C1
- PIND (Particle Impact Noise Detection) Test - Mil-Std-883K, Method 2020.9, Cond A
- Internal Visual & SEM Inspection – Mil-Std-883K, Method 2013.1
- Wire Bond Pull Strength Test – Mil-Std-883K, Method 2011.9
- Die Shear Strength Test – Mil-Std-883K, Method 2019.9



Internal Visual Inspection



External Visual Inspection

ISO17025 Accredited Space Component DPA

Equipment Highlights

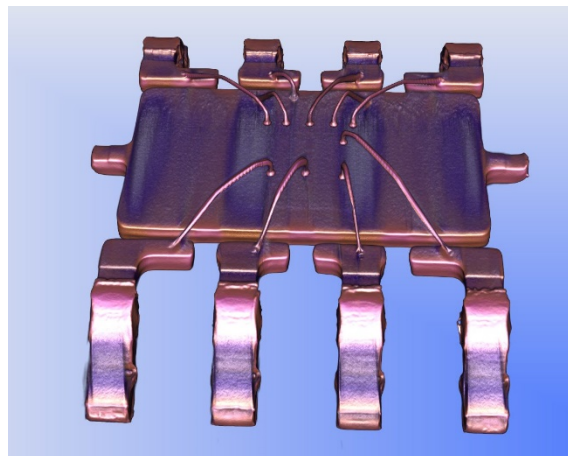
- Keyence VHX 2000 3D Optical Inspection system.
- Nordson-Dage Diamond II XD7600NT – X-ray & CT-Scan System
- PTI 4501A PIND Test system
- Leybold Phoenix L300i Helium Leak Detector
- Royce Microtesters (wire bond pull & die shear)
- FEI Nova 650 Nano SEM (EDS)



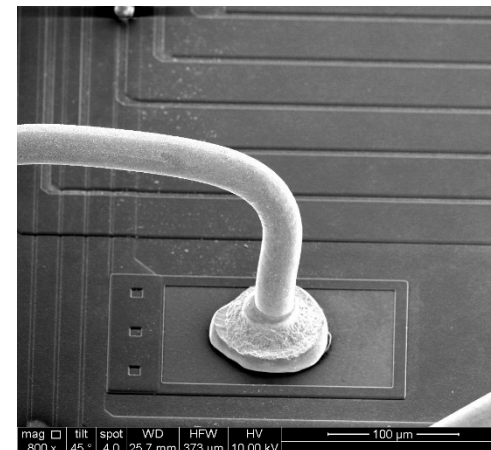
Nordson-Dage X-ray & CT-scan



3-D Optical Inspection System

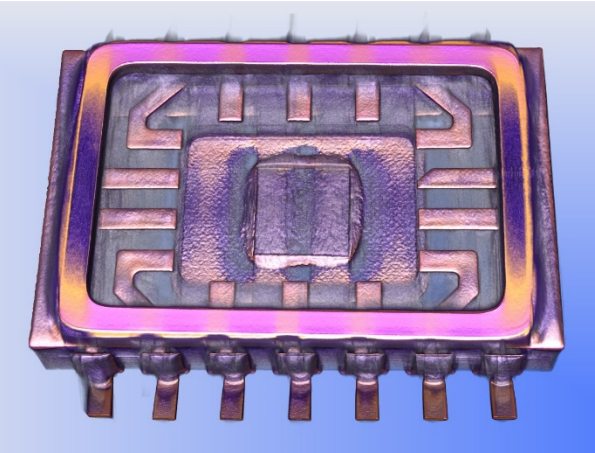


CT-Scan (Lead-frame Package)

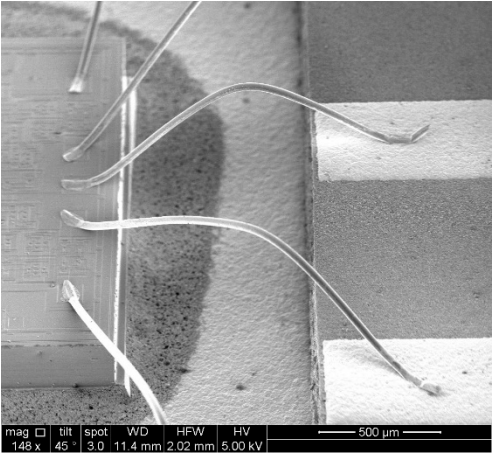


SEM Inspection of Wire Bonds

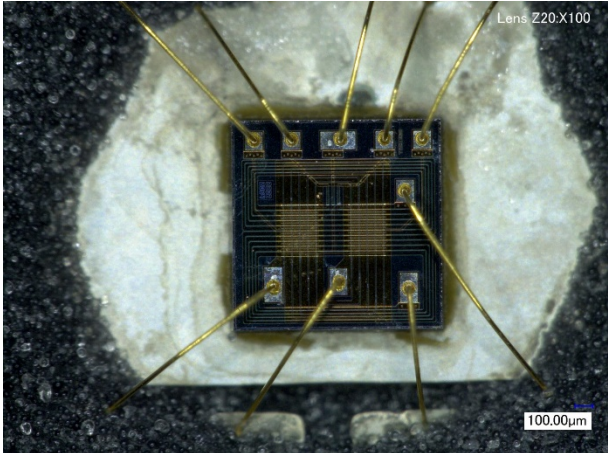
ISO17025 Accredited Space Component DPA - Examples



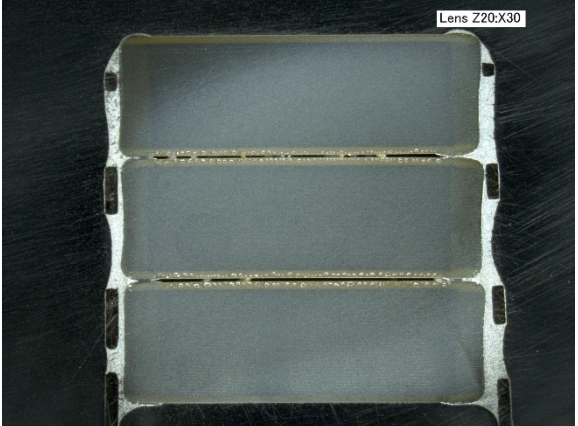
CT-scan of ceramic packaged device



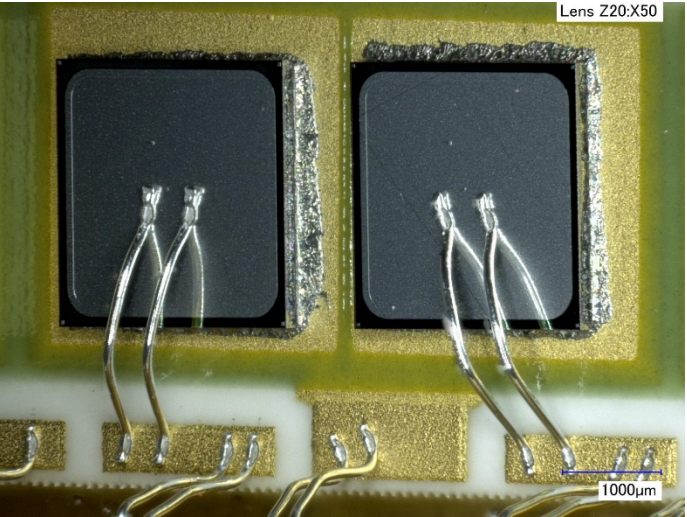
Al wedge / wedge bonds



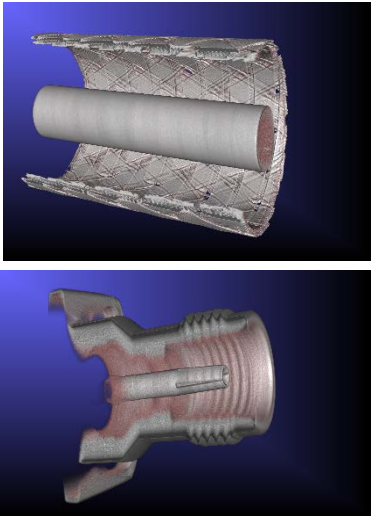
De-cap of plastic packaged device



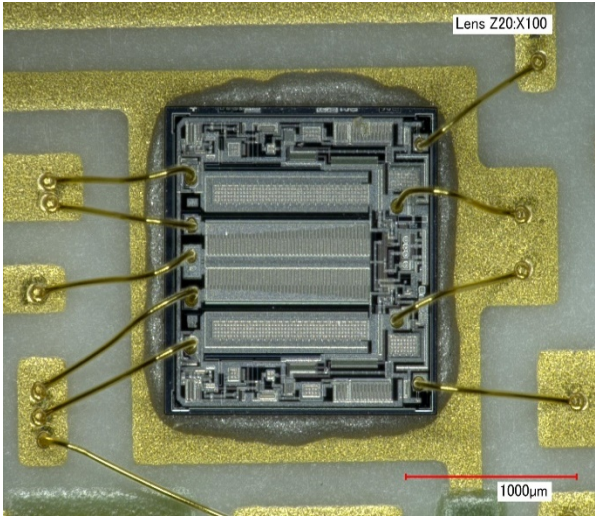
Capacitor stack micro-section



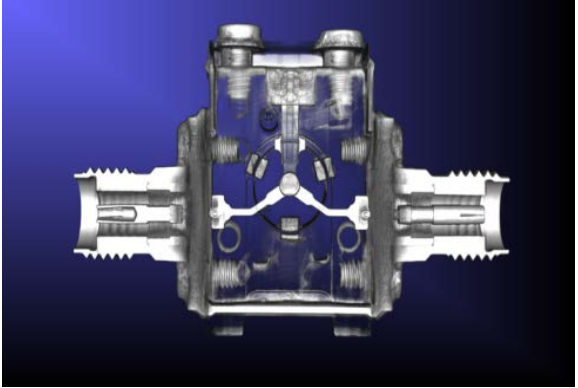
Inspection of power ICs in hybrid circuit



RF cable CA



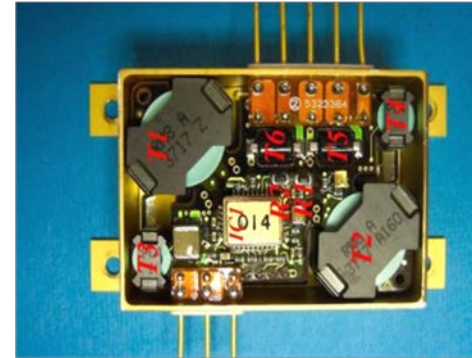
Control IC in hybrid component



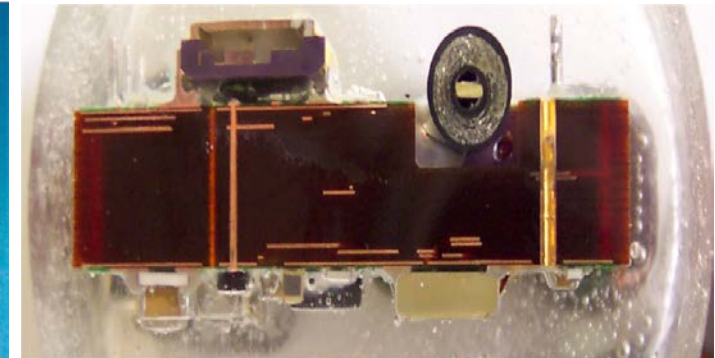
CT-scan of isolator component

Other Recent Space Component Activities

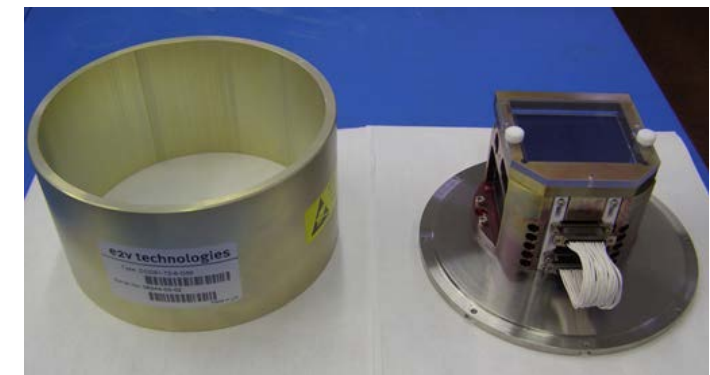
- Hybrid Microcircuit Construction Analysis.
- Microsystems Component Construction Analysis.
- CCD Construction Analysis.
- Schottky Diode Development.
- Reliability Evaluation of Novel DC-DC Converter Units.
- Thermal & Electrical Simulation of 3D SDRAM Modules.
- Supply of Si Test Structures.
- Characterisation & Supply of RADFET Dosimeters.
- Reverse Engineering of PWM devices.
- GaN Materials Investigations (MMIC).
- PoL DC-DC Converter Evaluation Programme.
- BME Capacitor Evaluation.



CA of point-of-load DC-DC converter (planar magnetics)



CA of relay in TO package



CA of camera unit (CCD)

Summary

- Comprehensive component DPA & CA services.
- Long history working with ESA / ESTEC.
- NDA to assure customer confidentiality.
- Competitive pricing.
- Quick turn-around.
- Tyndall-wide ISO 9001 Quality Management System.
- ISO17025 Accreditation – Space Component DPA.
- Happy to facilitate customer visits.



Dr. Franco Ongaro (ESTEC) visiting the Tyndall Component Analysis Laboratory in Nov. 2018. Pictured with Prof. William Scanlon (Tyndall CEO) & Mr. Finbarr Waldron.

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