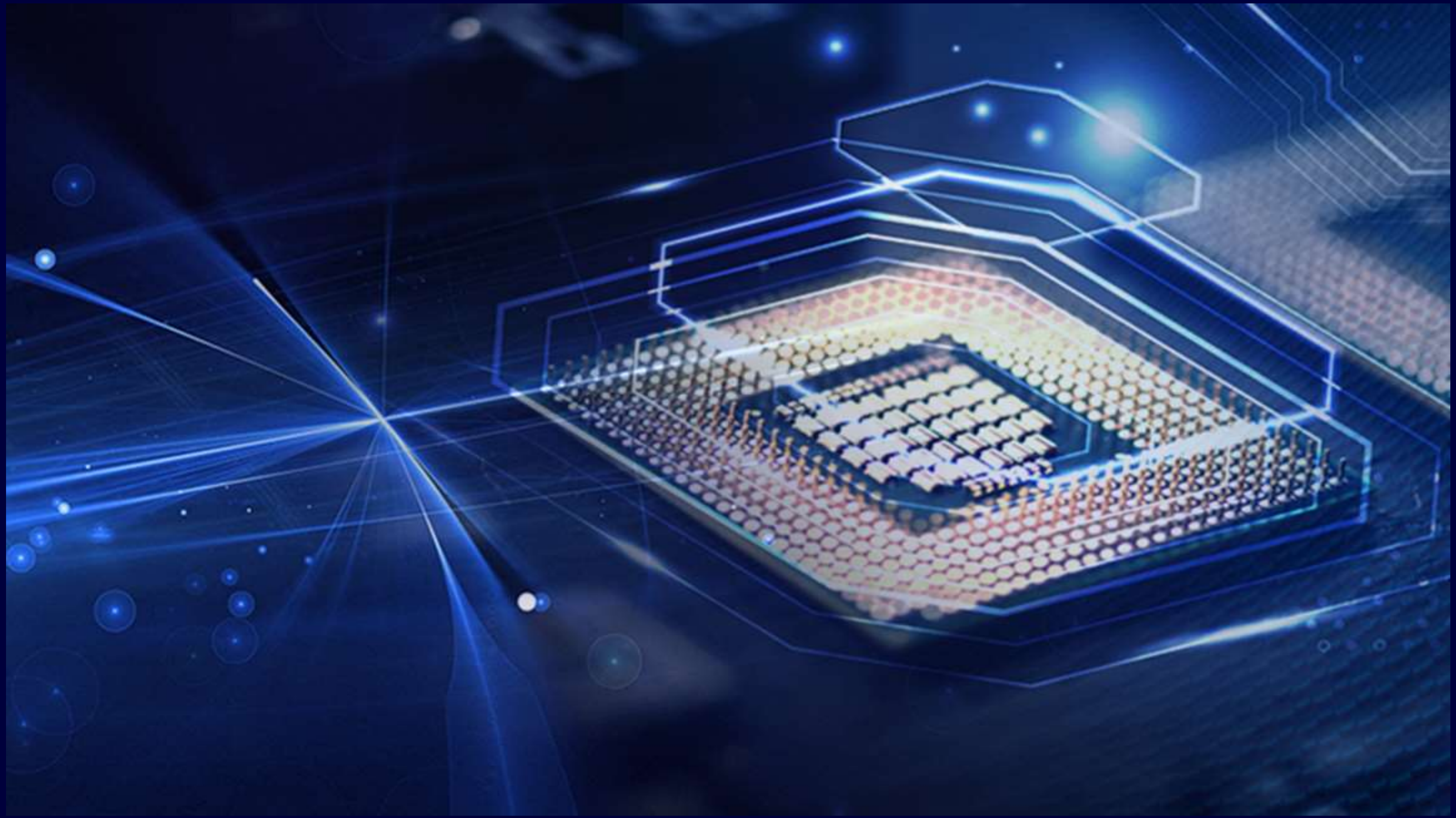
ALTER

ALTER FRANCE

Inspired by Knowledge



ALTER

TÜV NORD Group

Figures, data, facts

The TÜV NORD GROUP at a glance (2022's figures)

1,451.8

Million Euro sales

12.238

Employees worldwide

TÜVNORDGROUP

TÜVNORD · DMT · ALTER · TÜVIT

4

Core Brands
in the Industrial Services, Mobility, Training,
Engineering and Natural Resources, Aerospace
and IT business units

100

Active in 100 countries

82

Group Companies

TÜV NORD Group

Taken together, this is our expertise for your success.

Below Ground

On Ground

In space

With our knowledge, we stand for safety, independence and quality – everywhere and at all times. We look to the future and dedicate ourselves to making our clients even more successful in the connected world.

We protect lives, goods and natural resources. We achieve this by offering services in testing, inspection, certification, engineering and training.

ALTER Group

ALTER Group is a leading engineering company which provides reliable and agile solutions in engineering, procurement, **assembly, and test to many of the world's** most innovative technologies, such as semiconductors, electronic equipment and geospatial intelligence.

Our company is present in space, aeronautics, nuclear, automotive, medical and defence among many others.

ALTER Group

Figures, data, facts

TÜVNORDGROUP

- **Mobility** Intermodally linked transport
- **Industry** Safety for the digitalised industry
- **Energy & Resources** Driving forward the energy transition
- **Digital & Semiconductor** Essential technologies for a digital world
- **Certification** Certifications build trust
- **People & Empowerment** Empowering and strengthening people

115
Sales
in Million €

655
Employees
FTE average

38
Years
in the market

12
Sites
worldwide

8.000
M2
of laboratories

ALTER

ALTER Group

Figures, data, facts

NOVA

New Business Unit : Digital & Semiconductor

82
Million Euros Revenues

7
sites

470
Employees

>8500
M2 laboratories

36
Years in the market

ALTER

ALTER France

ALTER France at a glance

12
Millions euros Revenues

10%
of Revenues Invest

59
Employees

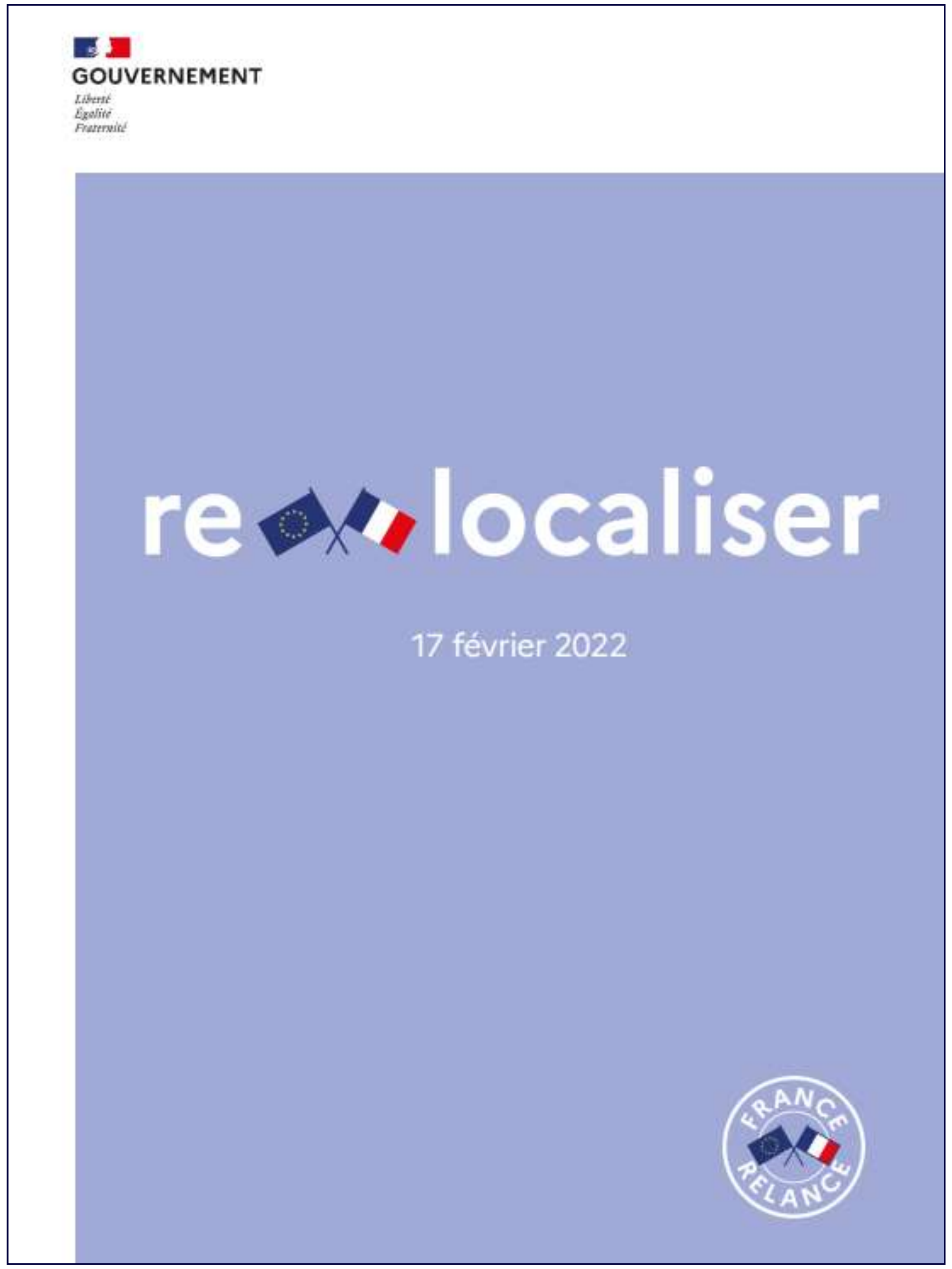
1600
M2 Laboratories

Alter France Qualification

- UNE-EN 9100:2018 (QM for Aerospace & Defense)
- UNE-EN-ISO 9001:2015 (QM Requirements)
- UNE-EN-ISO 14001:2015 (Environmental management systems)
- ISO 45001: 2018 (Health & Safety Mangement System)
- CNES SME Label (French industry base through their
  - Cutting-edge expertise,
  - Impressive ability to innovate,
  - Great agility

- French Fab SME Label

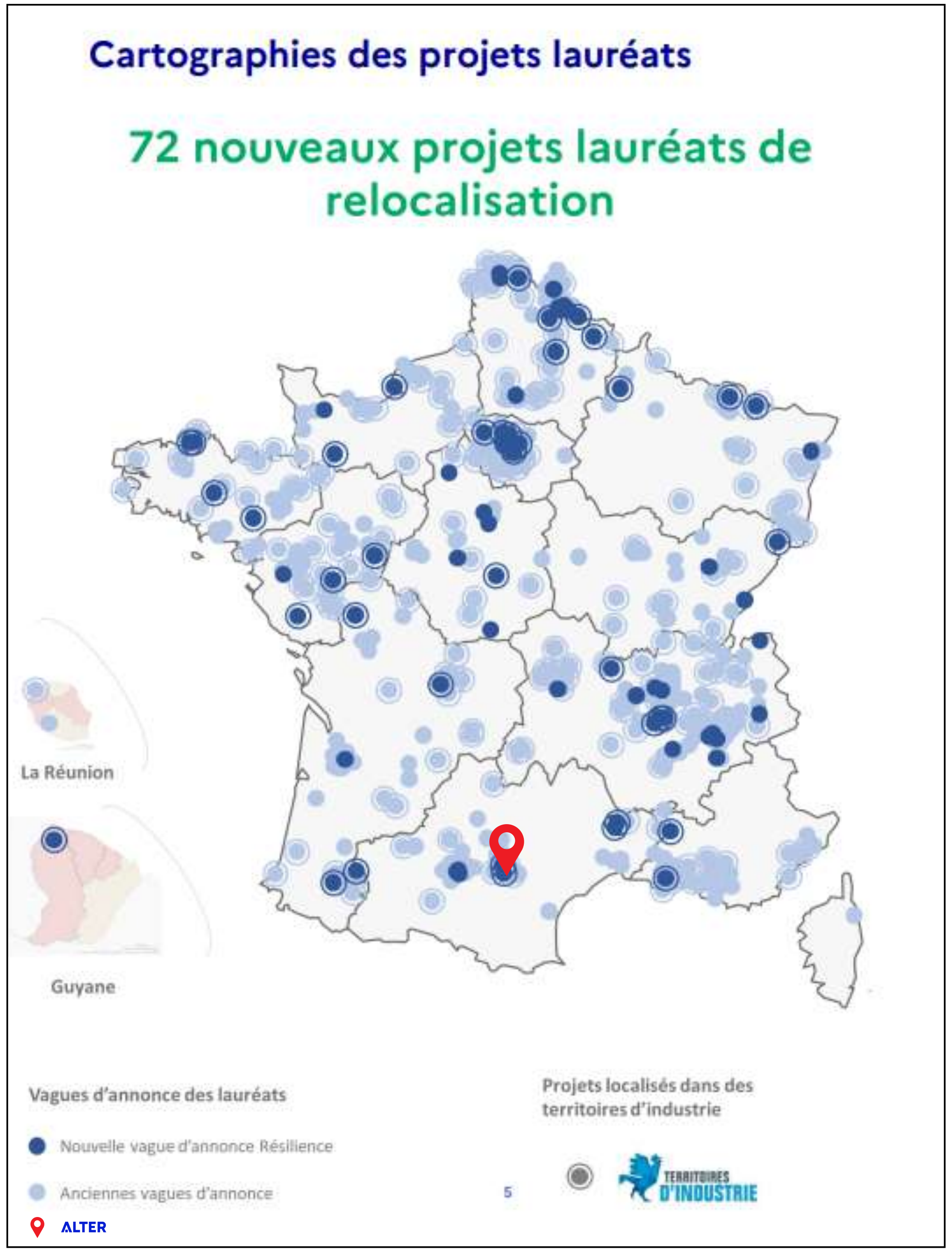
Alter France Investment



GOUVERNEMENT
Liberté
Égalité
Fraternité

relocaliser

17 février 2022



Cartographies des projets lauréats

72 nouveaux projets lauréats de relocalisation

Projet « TEST COMPOSANTS ELEC »

ALTER TECHNOLOGY TUV NORD FRANCE – PME

Ramonville-Saint-Agne (31) - Occitanie

Alter Technology est spécialisée dans l'évaluation, la qualification, le test et l'analyse physique et de défaillance des composants électroniques destinés à des applications de très haute fiabilité. L'objectif de son projet est de moderniser les moyens industriels de test des composants électroniques critiques, dont l'entreprise Alter Technology France est un acteur structurant dans la chaine de valeur (applications Spatiales, Aéronautique, Défense, etc…). Les objectifs sont de pouvoir tester les nouvelles technologies semi-conducteurs dites de rupture tel que le GaN Power ou RF et de gagner en compétitivité et réactivité pour la société et pour les clients français leaders sur leur marché à l'international.

Alter Technology specialises in the evaluation, qualification, testing and physical and failure analysis of electronic components intended for very high reliability applications. The aim of the project is to modernise the industrial test facilities for critical electronic components, for which Alter Technology France is a key player in the value chain (space, aerospace, defence applications, etc.). The objectives are to be able to test new breakthrough semiconductor technologies, such as such as GaN Power or RF, and to improve competitiveness and responsiveness for the company and for French customers who are leaders in their international markets.

Business sectors

Domain of Expertise

New Product Introduction

Yield Improvement

Electrical characterization

Failure Analysis

Qualification

Procurement

Reliability Testing

Technical Support

Technology Benchmarking

Technology Survey

Radiation Engineering & Testing

Customers - Space Market

ALTER

ZODIAC AEROSPACE
STEEL électronique
EREMS
LATMOS
Crisa AIRBUS DEFENCE & SPACE
RUAG Aerospace
SODERN
ST life.augmented
ABB
IAS
rakon
eutelsat
cnes
ANALOG DEVICES
TESAT SPACECOM
IAS
esa
CODECHAMP La solution Codeur Optique
3D plus
NASA JPL
KONGSBERG
AIRBUS DEFENCE & SPACE
ARQUIMEA
SAFRAN AEROSPACE · DEFENCE · SECURITY
ThalesAlenia Space
saft
AEROFLEX GAISLER
TELEDYNE e2v HIREL ELECTRONICS
TELEDYNE e2v Everywhereyoulook™

Customers - Aero / Auto / Indus Market

ST life.augmented

SAFRAN Snecma

SAFRAN Labinal Power Systems

SAFRAN Herakles

EXAGAN Accelerate Power Transition

SAFRAN AEROSPACE · DEFENCE · SECURITY

C-MAC MicroTechnology

BAE SYSTEMS

CODECHAMP La solution Codeur Optique

AIRBUS

TI Automotive

TRONICO

Valeo

ACTIA®

aPSI3D

OMMIC Innovating with III-V's

CNRS

MICROCHIP

AEROFLEX GAISLER COBHAM

cea

HEYDAY INTEGRATED CIRCUITS

ROLLS ROYCE

TELEDYNE e2v HIREL ELECTRONICS

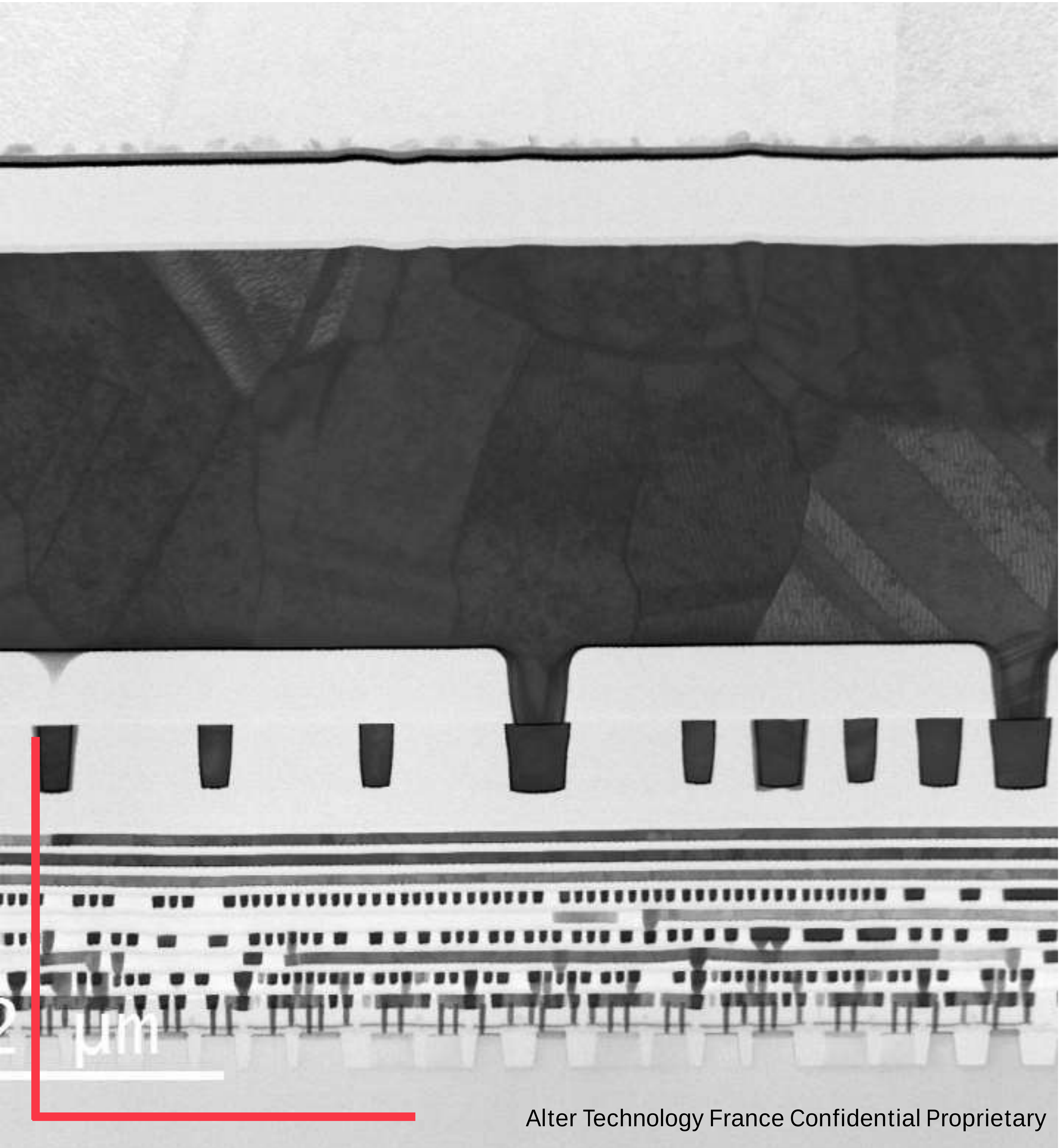
Company

ALTER is the leading provider of microelectronic and semiconductor services acting as the European OSAT in parts & system engineering, parts procurement, assembly, and testing for aerospace and harsh environment markets.

Our company develops and offers complete turn-key solutions covering all the backend engineering tests such as wafer probing, microelectronic and opto electronic assembly, parts qualification & reliability testing, final testing and technology analysis.

Outsourced Semiconductor Assembly & Test

ALTER France ensures efficient chip assembly & packaging, Electrical testing and assists in New Product Introduction (NPI) processes for seamless integration of new semiconductor products for diverse mission profiles and markets.



Technology Analysis

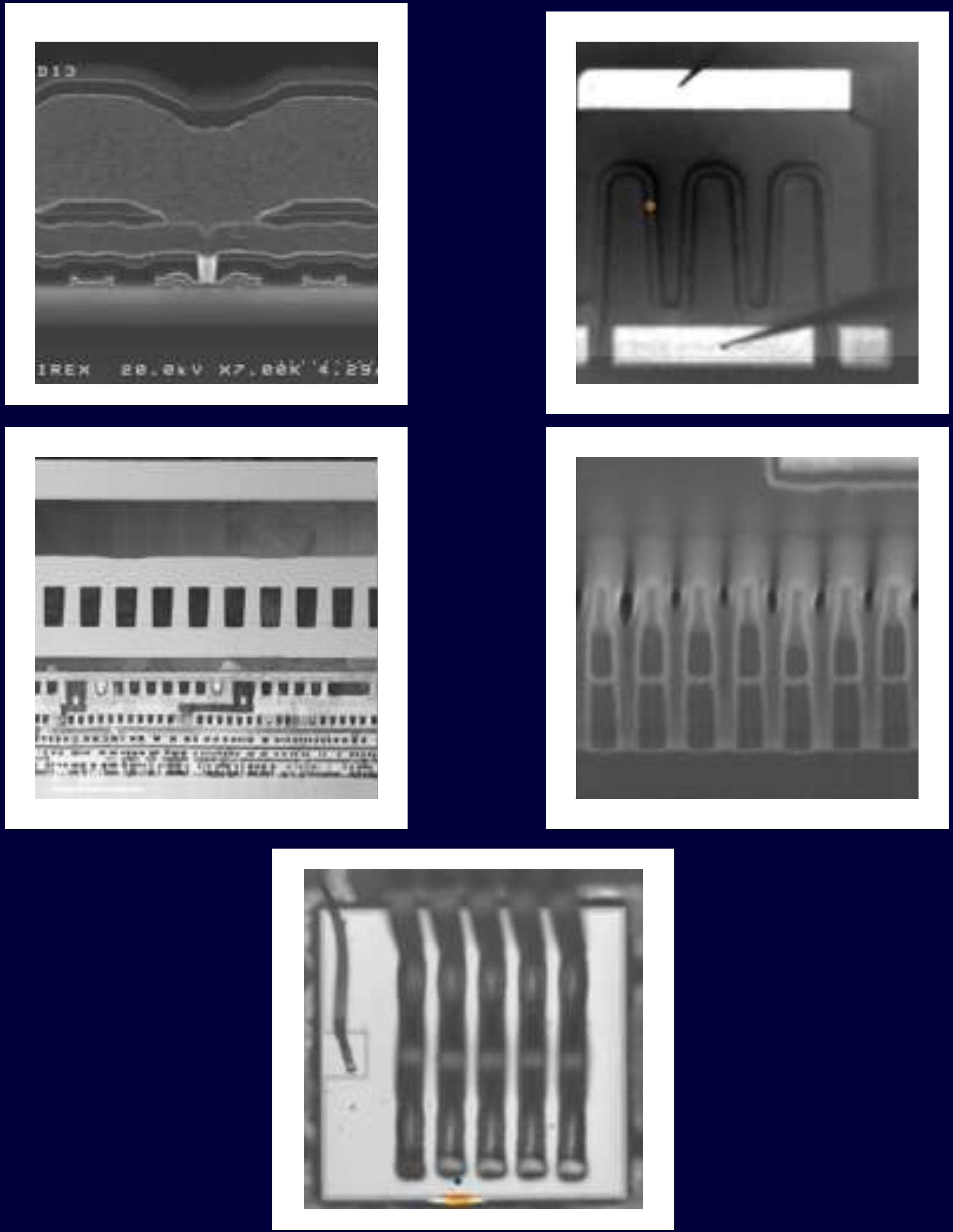
Our Technology Analysis Lab is in charge of performing deep-dive Analysis on product construction or product failure.

The laboratory mission is to identify potential weakness or root cause of malfunction on part or system.

Technology Analysis

LAT services: Technical expertise with appropriate tools is conducted on product families covering PCB domain to IC area in order to ensure the compliance to the Standards requirement and the State-Of-The-Art quality level.

- Construction analysis
- Reverse analysis
- Destructive Physical analysis
- Failure analysis



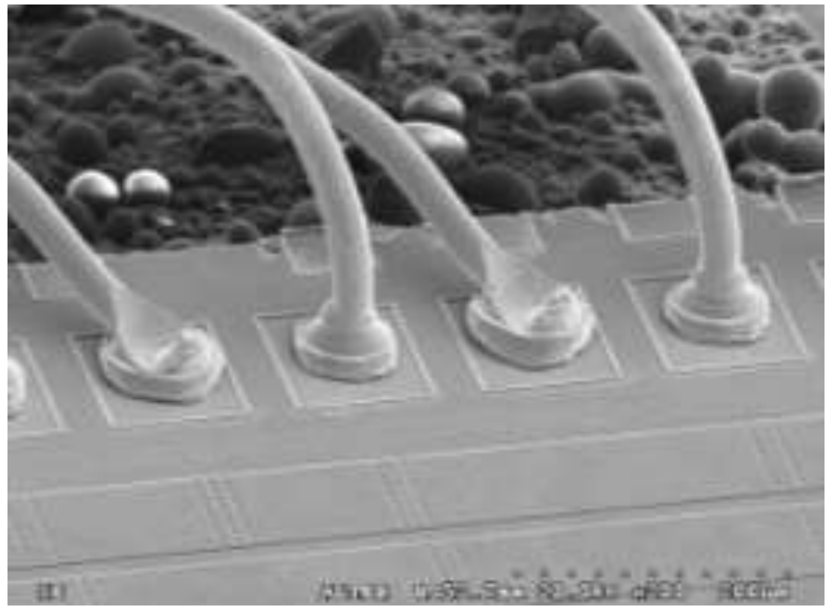
LAT Capability and Tools

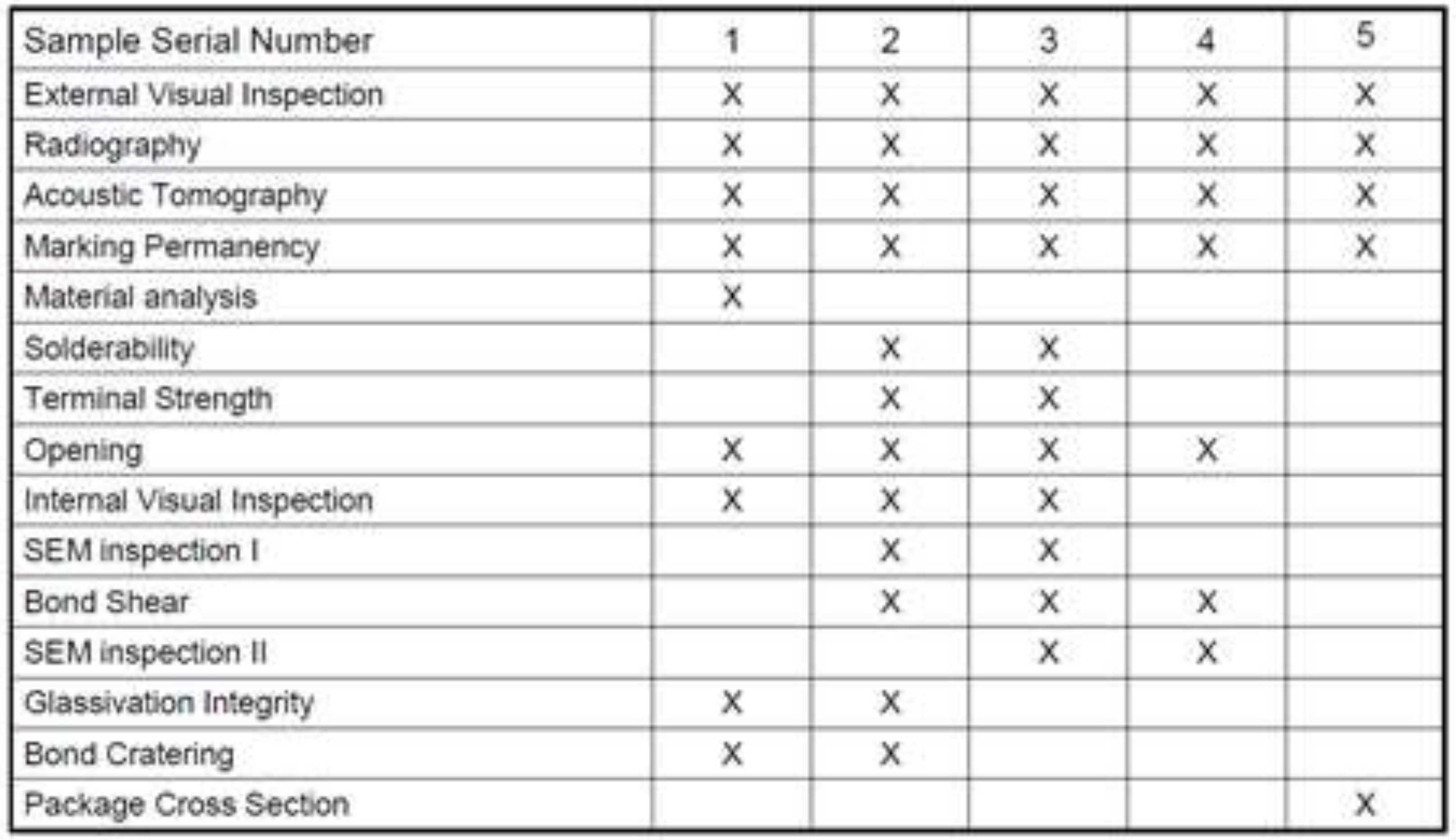
Destructive Physical Analysis (DPA)

DPA is routinely used by the aerospace industry in order to qualify electronic components to Class “S”. More and more commercial applications are using DPA screening to dramatically increase the reliability of their products in the field. Higher reliability electronic components are often required to operate for long periods of time. Orbiting satellites are good examples of this situation. Parts that meet the requirements for “space usage” are also used in applications where replacement is difficult and/or failure engenders great risk.

Specifications :

- MIL-STD-1580 MIL-STD-883MIL-STD-750 MIL-STD-202
- SSQ-25000
- ESCC, JEDEC, NASA

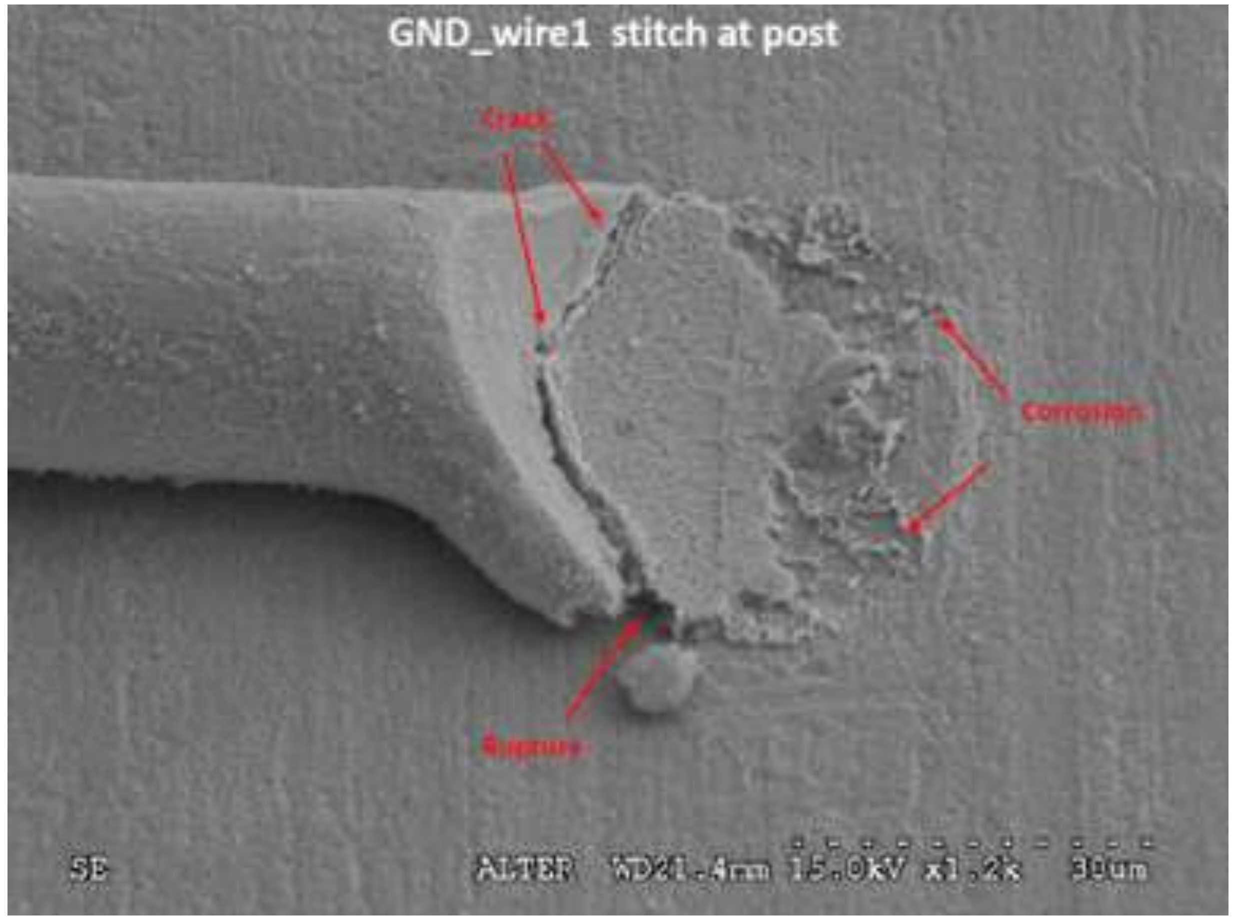


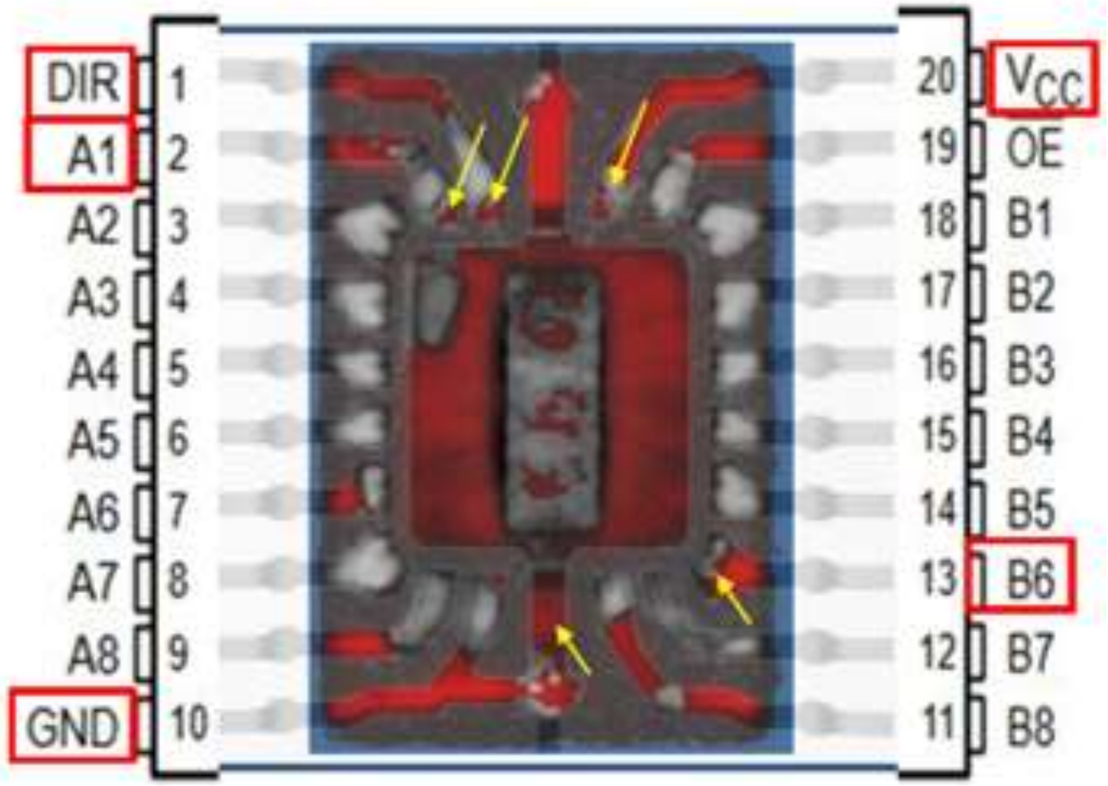


Sample Serial Number	1	2	3	4	5
External Visual Inspection	X	X	X	X	X
Radiography	X	X	X	X	X
Acoustic Tomography	X	X	X	X	X
Marking Permanency	X	X	X	X	X
Material analysis	X				
Solderability		X	X		
Terminal Strength		X	X		
Opening	X	X	X	X	
Internal Visual Inspection	X	X	X		
SEM inspection I		X	X		
Bond Shear		X	X	X	
SEM inspection II			X	X	
Glassivation Integrity	X	X			
Bond Cratering	X	X			
Package Cross Section					X

Failure Analysis (FA)

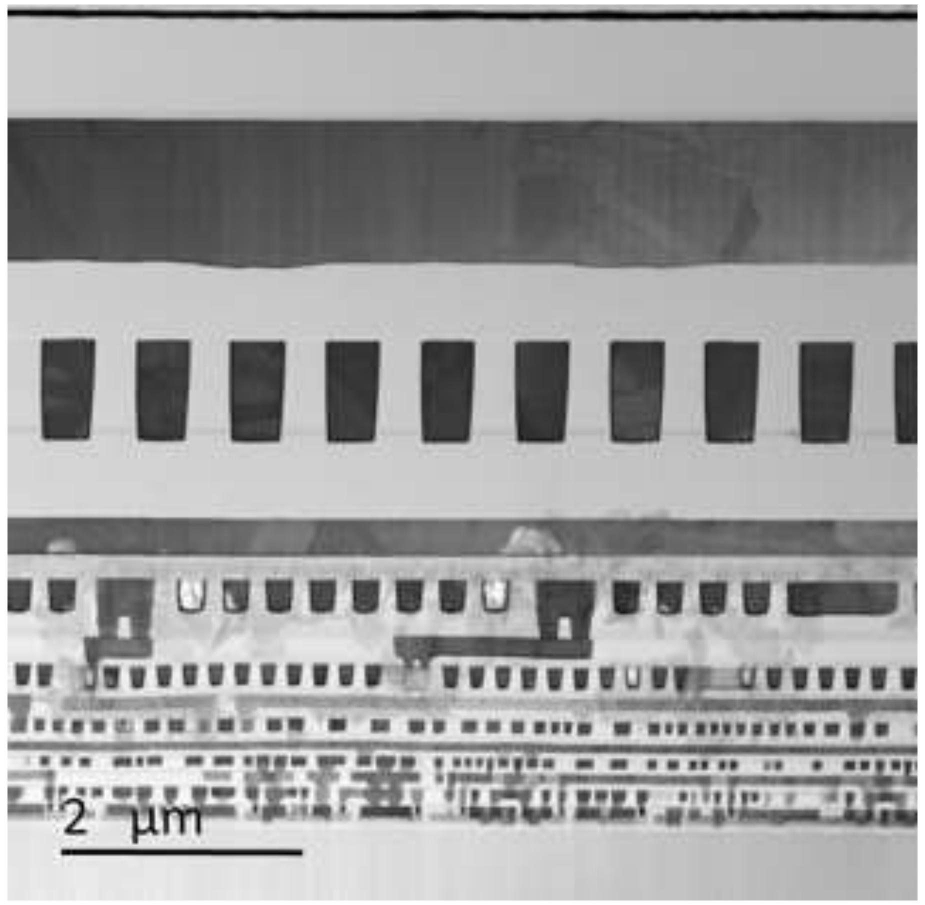
From non-destructing analysis to deep-dive physical analysis, our failure analysis approach answers to our customer with just-in-time commitment and technical demonstrations.

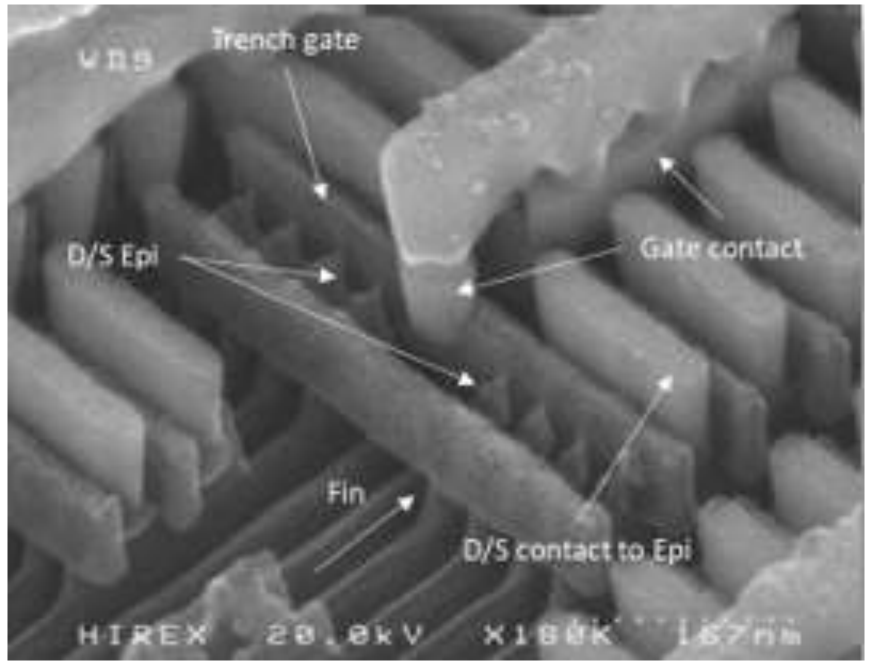


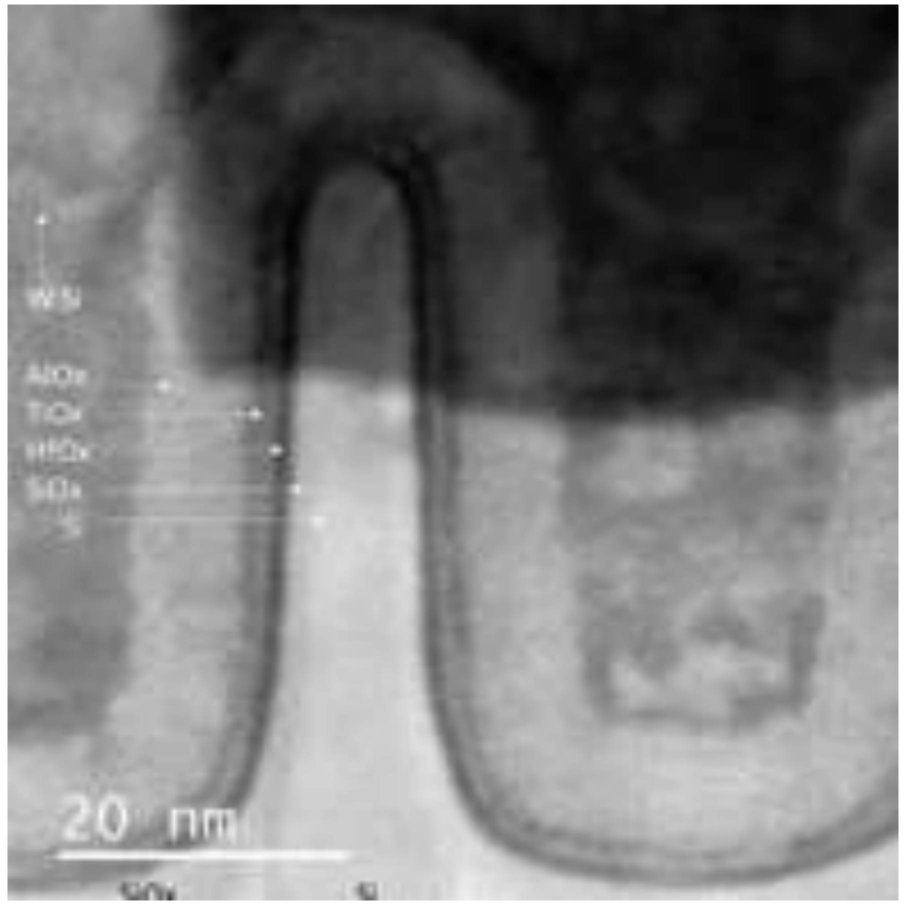


Reverse Construction Analysis

Deep dive characterization of FEOL and BEOL on XILINX ZYNQ 16nm Fin FET technology

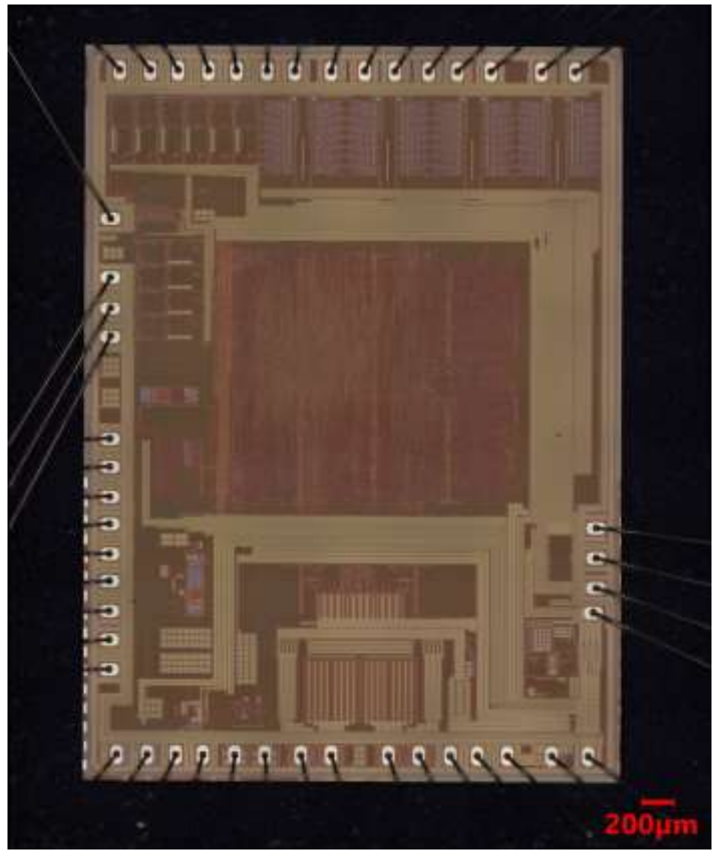


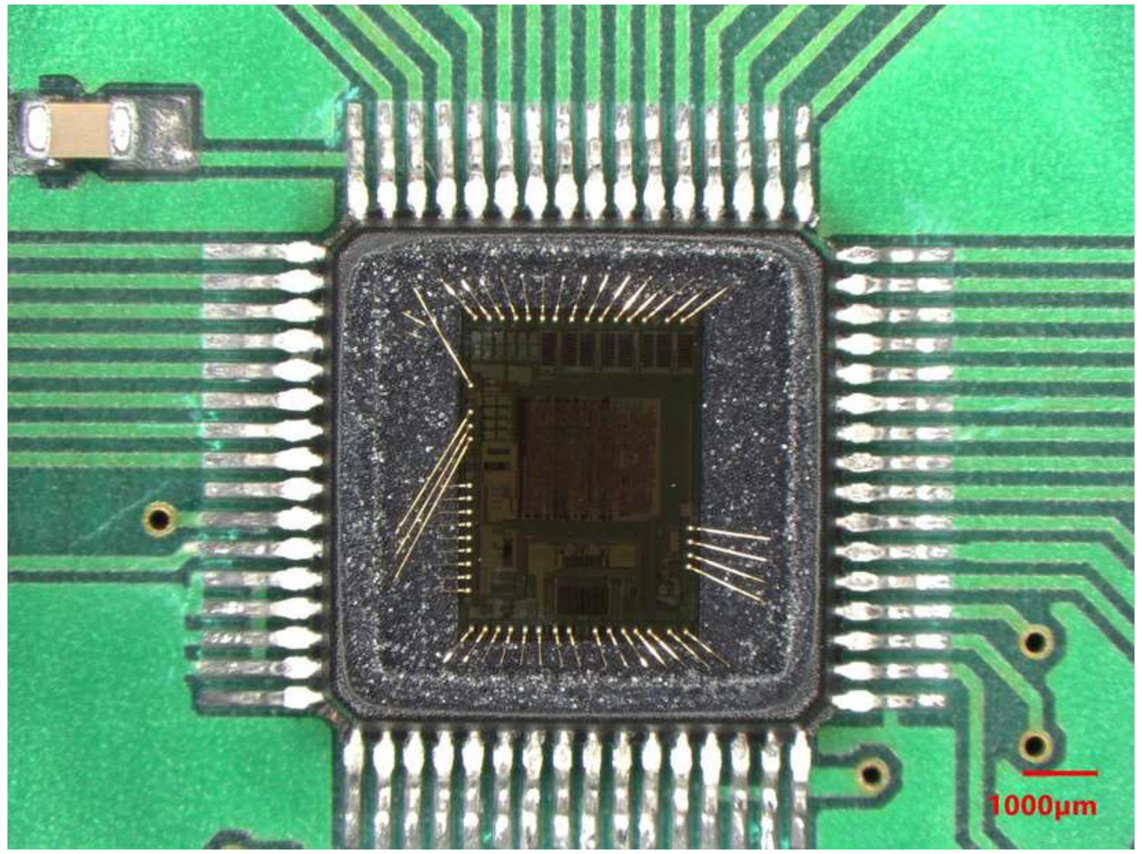


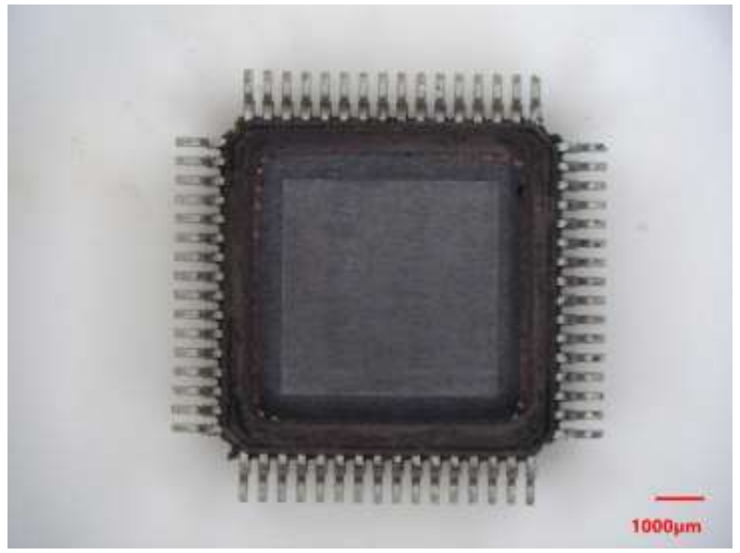


Sample Preparation

Sample preparation for radiation test with backside thinning or front side access on isolated part and on part-on-board. All specific requests are covered with innovative solutions.







Counterfeit

Alter Technology France provides a full suite of counterfeit semiconductor detection methods to assist our customer in making a determination regarding IC authenticity.

Authenticity detection can be performed according to company's specifications or based to industry standards such as SAE A6081, SAE AS5553 and IDEA-STD-1010B.

- External Visual Inspection
- Physical Dimension
- Marking Permanency
- X-Ray
- Environmental and Temperature Testing
- Internal Visual (De-cap)
- OEM Date Code Verification
- XRF Analysis
- Blacktop Test
- Burn-in/Qualification
- Solderability Testing

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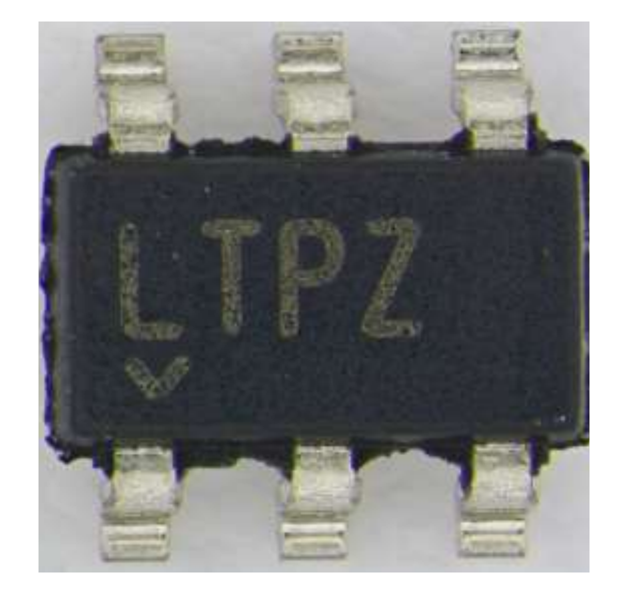
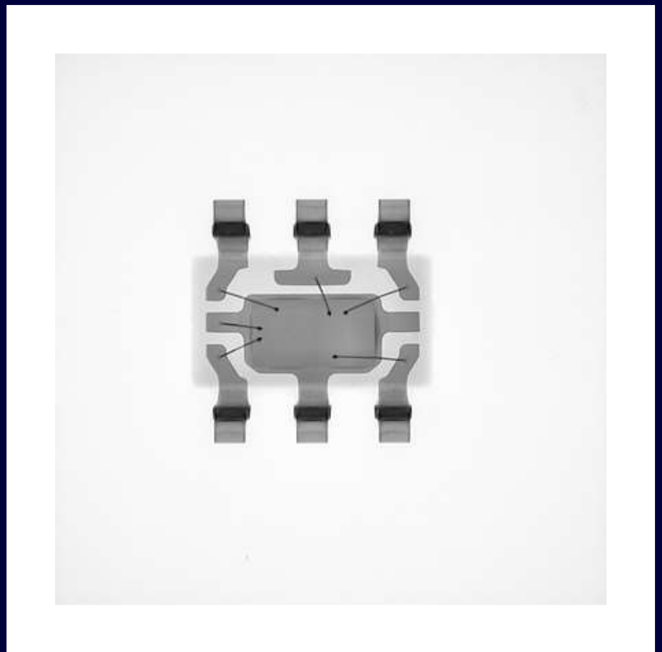
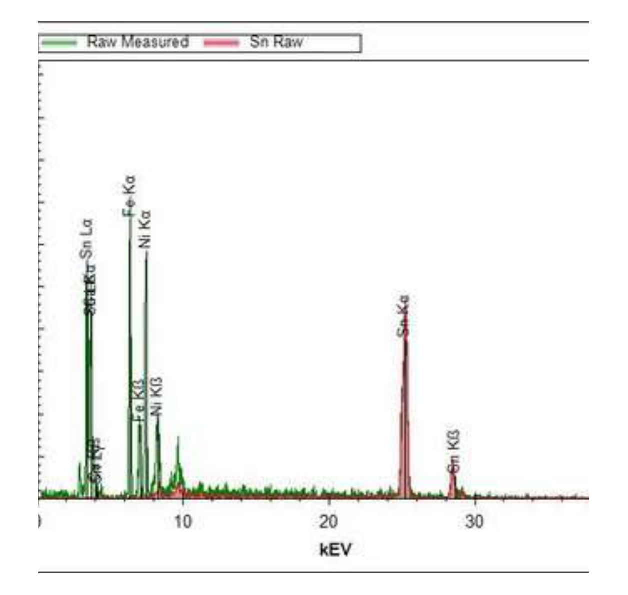
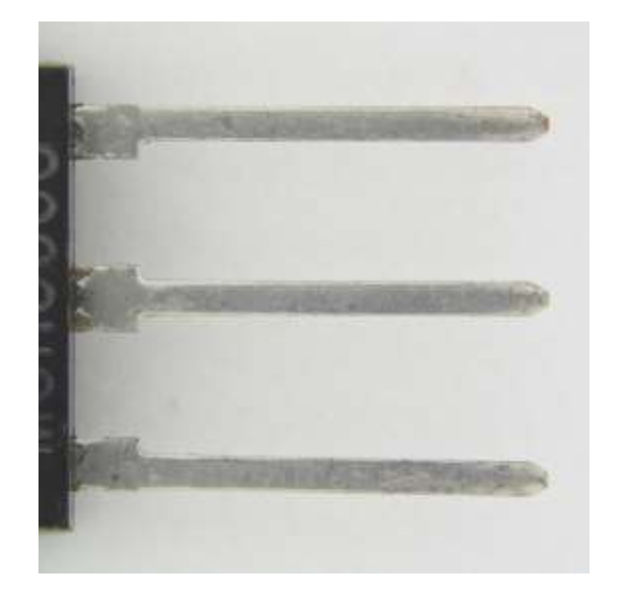
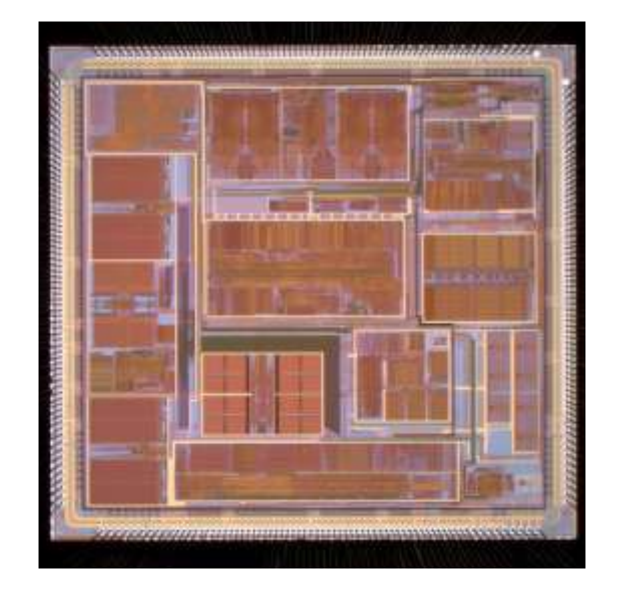
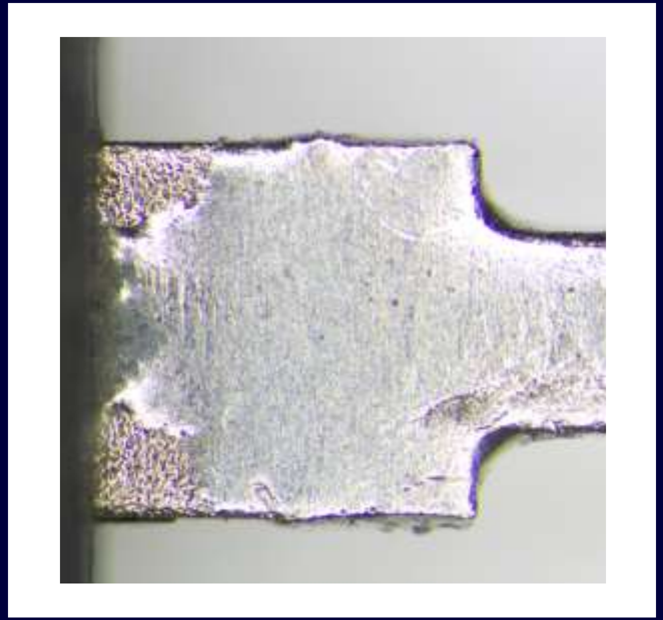












PCB and PCBA Monitoring

Alter Technology France performs a continuous monitoring of PCB/PCBA process quality by cross sectioning of samples.

Applicable Specifications :

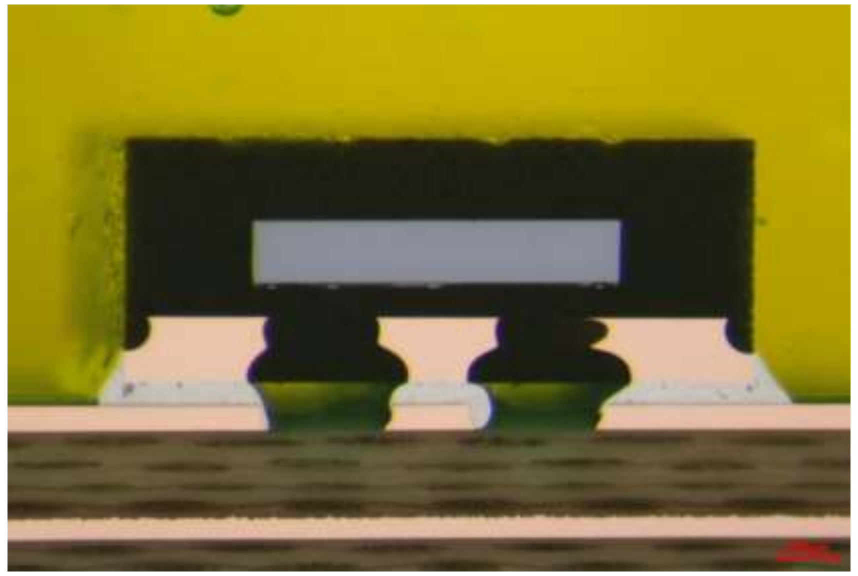
- IPC A 610 and IPC A 600
- ECSS-Q-ST-70-08C, ECSS-Q-ST-70-38C, ECSS-Q-ST-70-61C, ...
- Customer specification

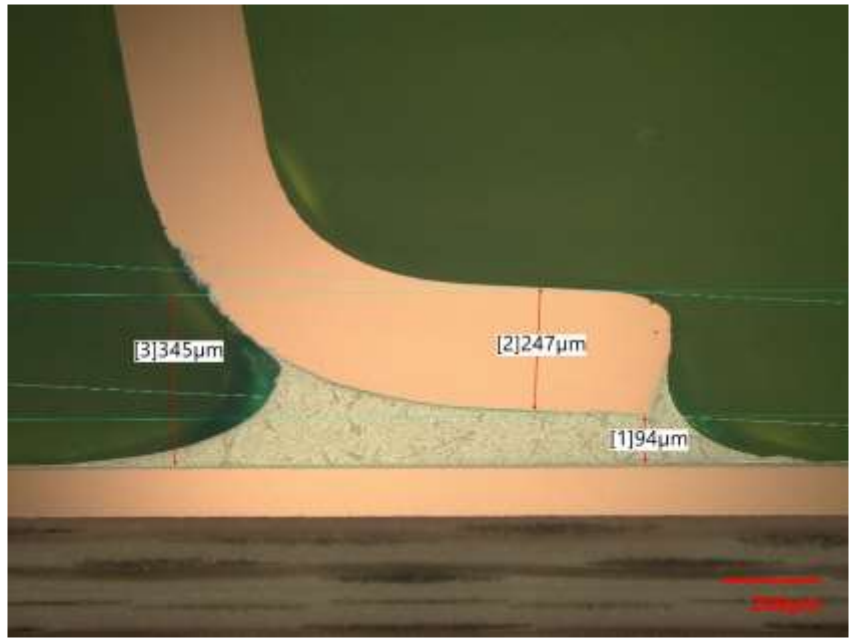
Lab capacity :

- 100 samples per week
- Three automatic polishers multi-sample
- Repeatable process
- Trained operators

Real time reporting :

- SharePoint on common cloud
- Virtual Lab cloud at Alter Technology





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Total semiconductor testing

Acting as an NPI (New product introduction) facility offering semiconductor Electrical testing, components qualification & characterization.

Alter Technology France’s electrical test services encompass both final test and probe. Certifying the semi-conductor product against their applications.

One Stop-shop

ALTER

Total semiconductor testing

- Electrical testing in temperature -90°C up to +300°C
- Wafer Electrical Testing (Probe) in temperature -40°C up to +200°C
- Reliability tests
  - Burn-In,
  - HTOL,
  - HTRB/HTGB,
  - IOL,
  - ELFR,
  - HAST,
  - THB etc.
- Mechanical & Environmental testing
  - Mechanical shock
  - Vibration (Sinus & Random)
  - Acceleration
  - Salt Spray
  - Temperature Cycling
  - Temperature shock
  - Extreme Temperature cycling -185°C up to +310°C
  - Thermal Vacuum
- FPGA & Programmable component Programming
  - Support all programmable logic families - FPGA, CPLD, PLD, etc.
  - Support all programmable logic manufacturers - Xilinx,
  - Intel/Altera, Actel/Microsemi, Lattice
  - Pin counts to 1000+
- Total dose COBALT 60 (TID) radiation and TNID (Displacement Damage)

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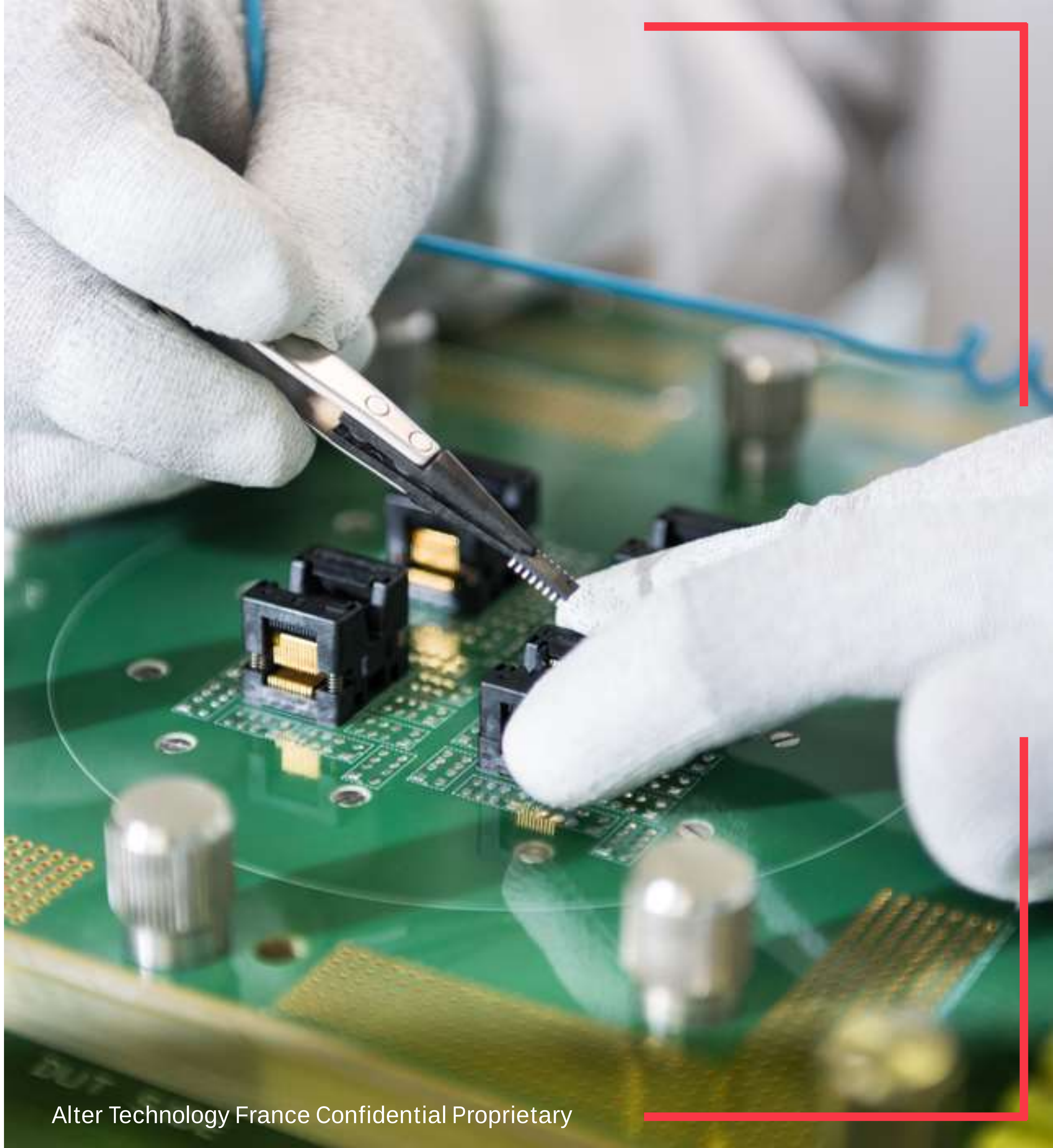
Wafer & Parts Testing

1. Electrical testing die, Wafer, Package & Module

2. Physical and Mechanical Testing

3. Electrical testing die, wafer, package & module



Wafer & Parts Testing

1 Probers

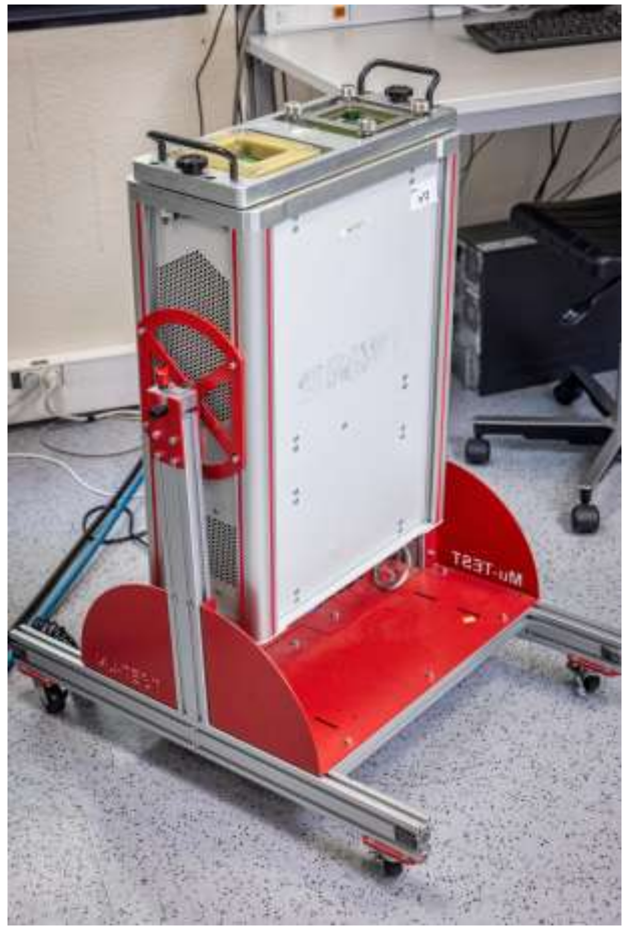
2 Gravity Handler

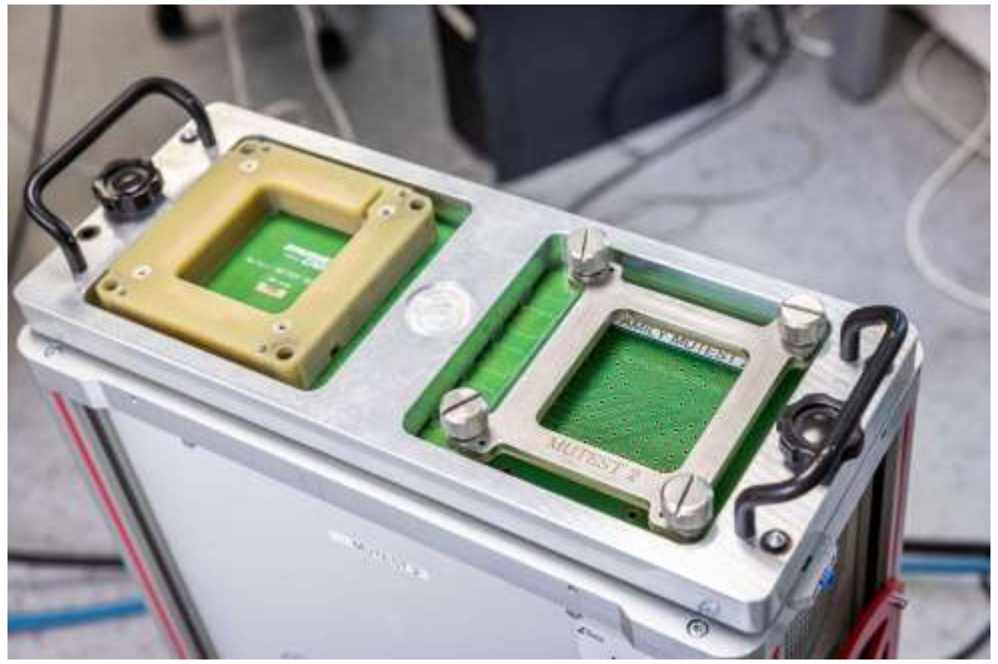
Wafer & Parts Testing

3 Pick & Place Esmo Tallos

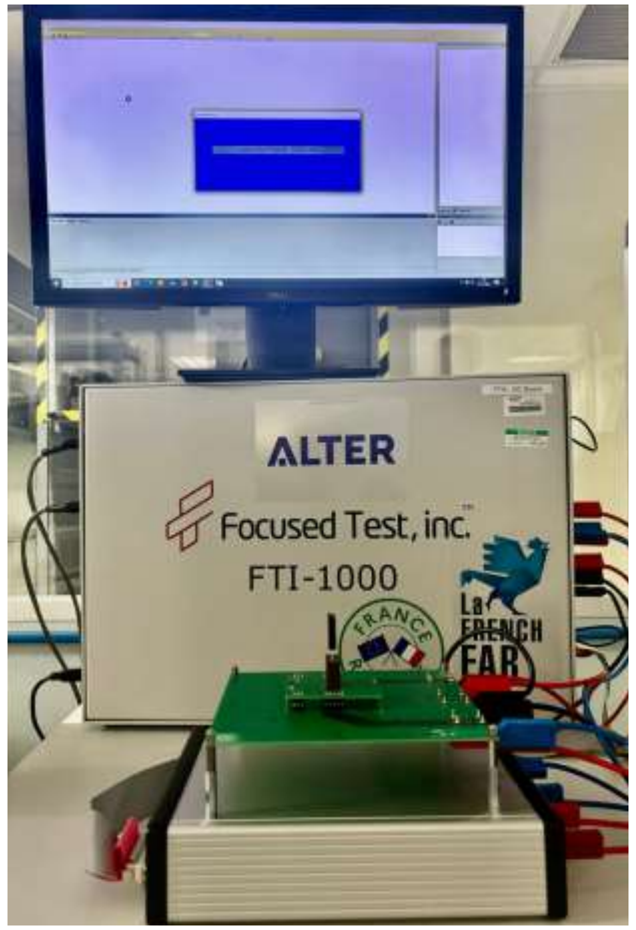
Electrical Testers

① Digital





② Power



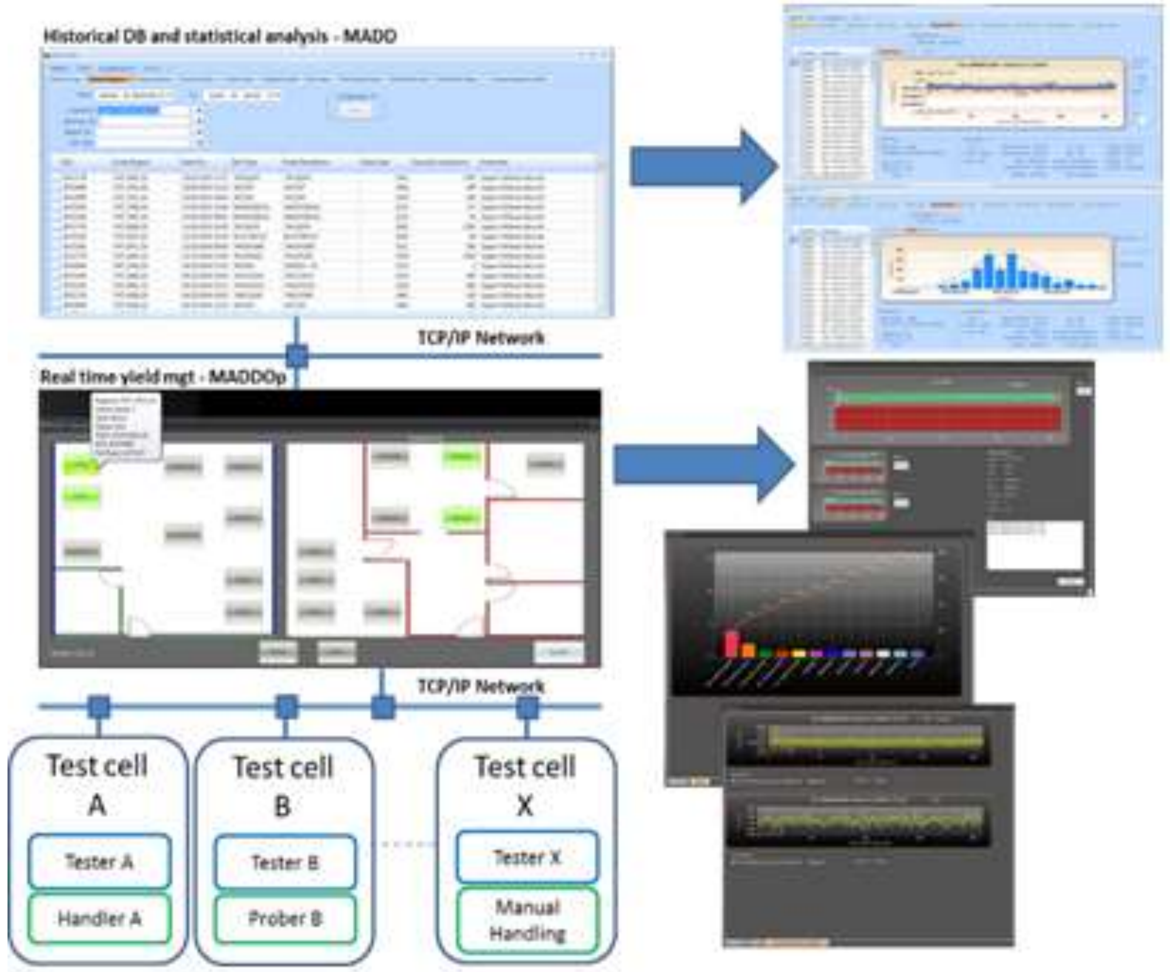
Environmental and Reliability Testing

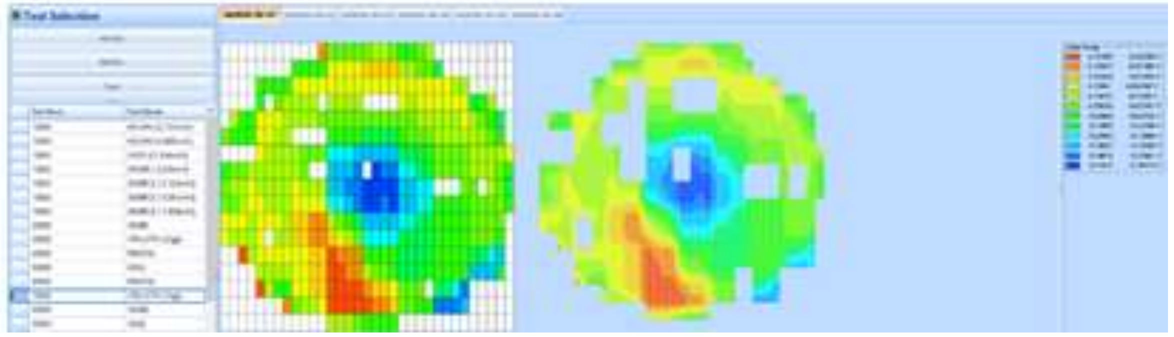
Fully equipped for product qualification to address MIL, ESCC, AEC-101 and JEDEC requirement

- Acceleration
- Autoclave
- Hast
- Damp Heat
- THB
- Burn-in life Test
- Intermittent Operating Life (IOL)
- Vibration (Sinus & Random)
- Mechanical Shock
- Thermal Cycling (+310°C to -185°C with 45°C/min Temperature Ramps
- Thermal Shock
- Salt Spray
- Thermal Vaccum chambers
  - Temperature Range -55°C up to +125°C
  - Pressure better than 10-5 mbars
  - In situ test monitoring

Total semiconductor testing

Historical database and Statistical tool analysis





- Test Program qualification
  - GR&R,
  - Precision / Tolerance.
- Per die or device trend plot and distribution analysis.
- Outlier detection based on sigma or Inter quartile computation.
- Tolerance Interval computation for device outside supplier range.
- Multisite testing
- site to site variation checking.
- Wafer map viewer and test analysis.

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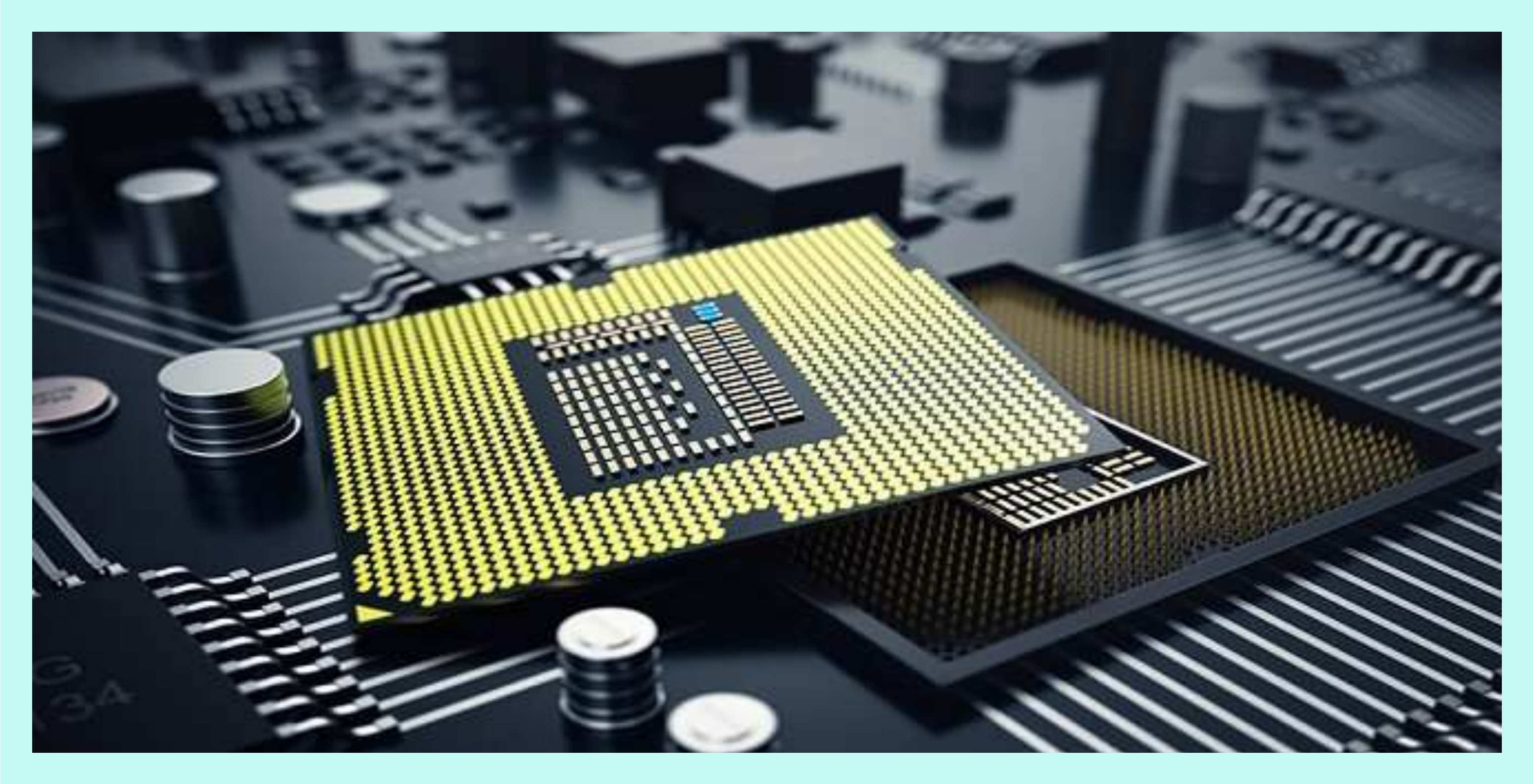
Packaging & Assembly

Electronic and Optoelectronic Components



Provides contact package design and precision assembly services for a wide range of optoelectronic, microelectronic and MEMS devices.

We offer end to end backend semiconductor manufacturing from wafer singulation to assembled product.

- Design for manufacture
- Wafer & die handling
- Die attach
- Wire bonding
- Optical alignment
- Hermetic sealing
- Electrical and optical test
- Fast-Turn, Prototype & Volume manufacturing

ISO 9001:2015 certified manufacturing in accordance with MIL-STD-883 and ESCC standards

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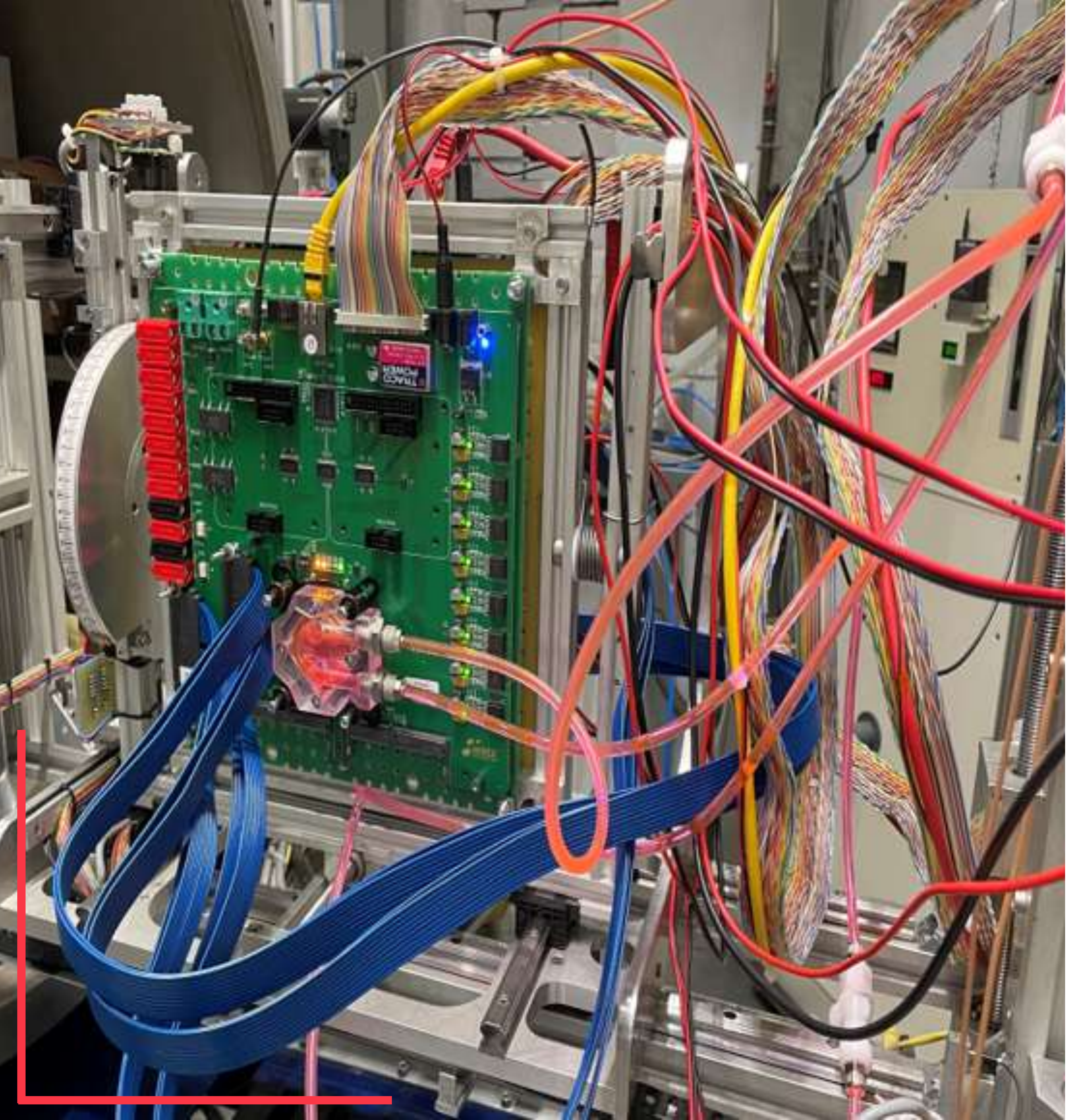

Radiations services

Engineering radiations involve using standard software tools and in-house software to quickly assess how semiconductor devices behave.

In addition to these activities, ALTER France conducts radiation testing on various semiconductor components, packages, modules and boards.

This testing assesses single event effects, total dose, and displacement damage by exposing them to heavy ions, protons, neutrons, and cobalt 60 irradiation or using laser and XRAY equipment.

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Radiations services

- Component technology and radiation hardness assessment
- Engineering Radiations Testing & Radiations characterization
- Sourcing & radiation qualification of electronic components
- Part sensitivity evaluation: SEE error
- SEE to COTS (Component Off The Shelves) prediction

Historical activities since 1993 :?
  - TID/TNID/SEE tests?
  - Thousands of test campaigns successfully conducted since 1993

Radiation engineering? :
  - Use of expert radiation simulation tools for shielding analysis
  - Internal Simulation software development in partnership with RadConsult

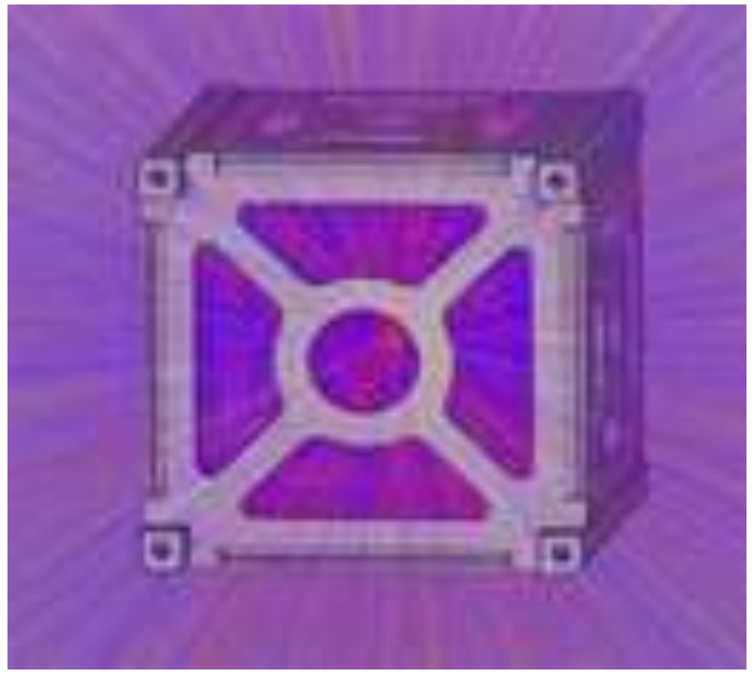
RAD CONSULT

RAD-E4SPACE

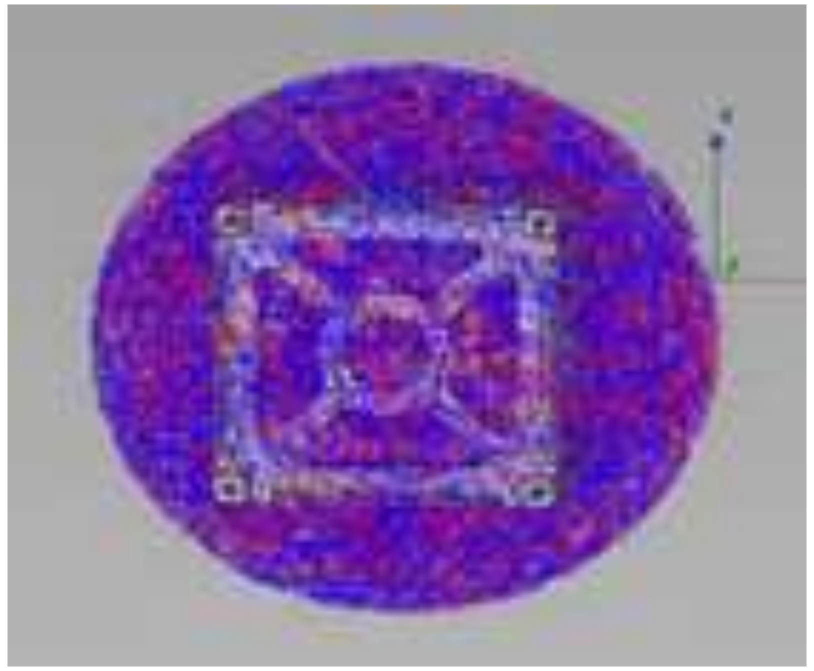
ALTER

Radiations services

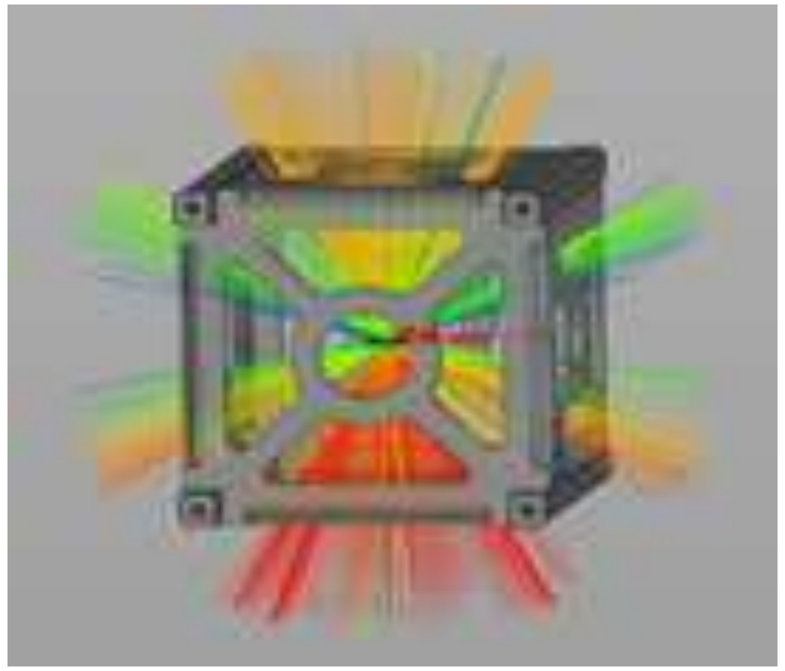
NOVICE & FASTRAD : TID and TNID calculations



RMC : accurate

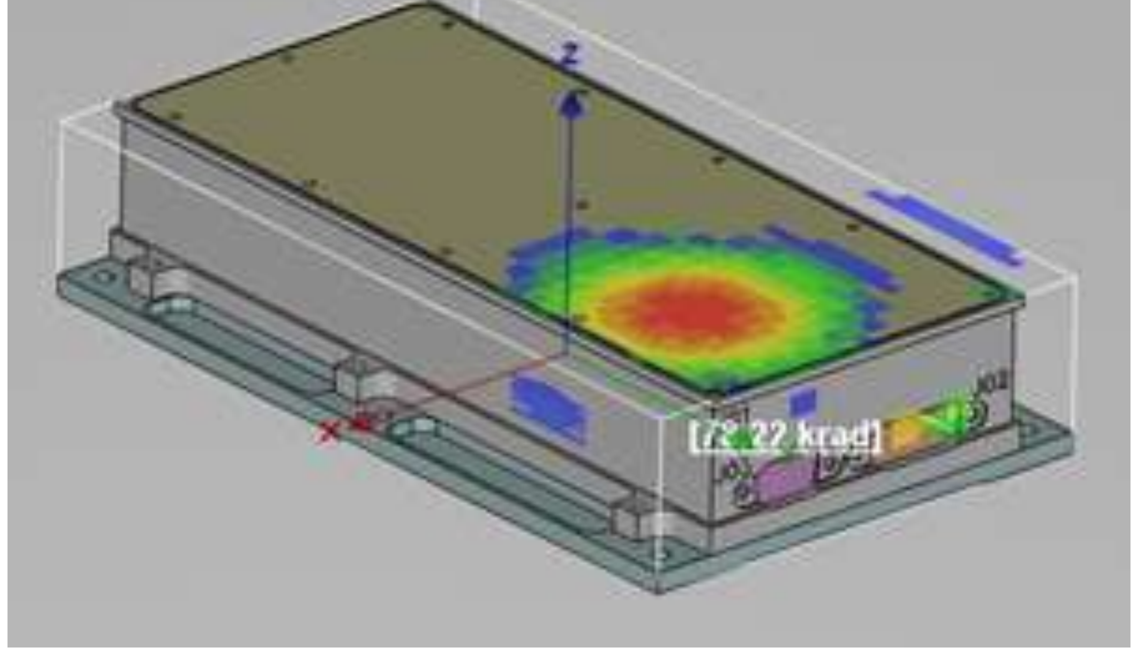


FMC : accurate

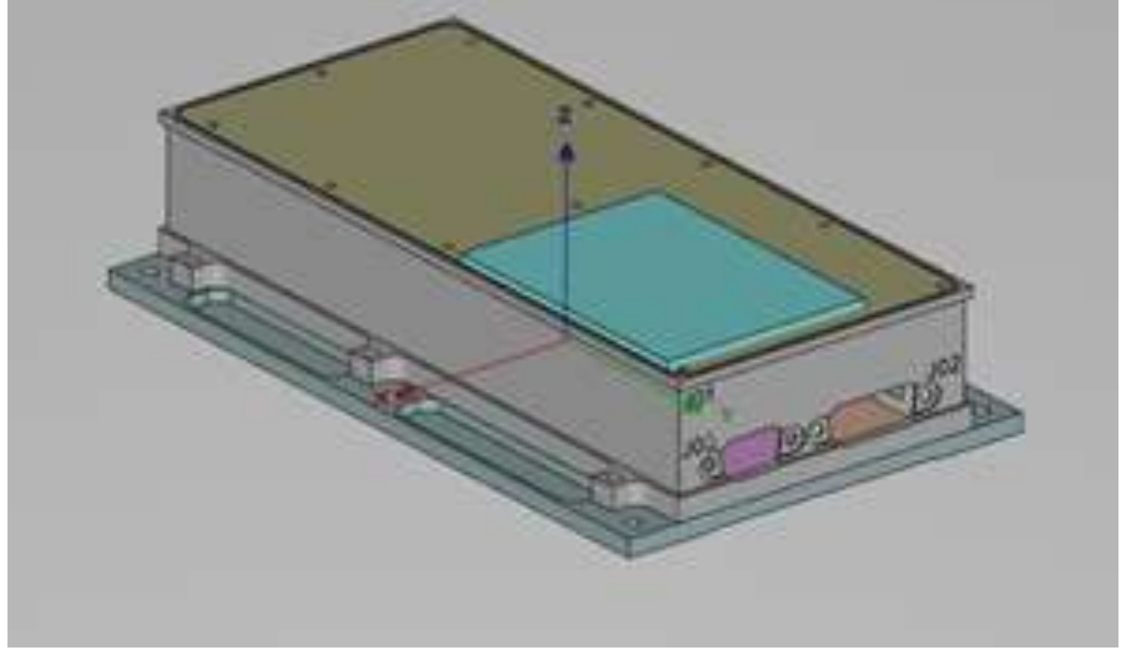


Ray-tracing : fast

Identify weak spots



Optimize shielding size and weight



Radiations services

OMERE : Define your environment & In orbit SER

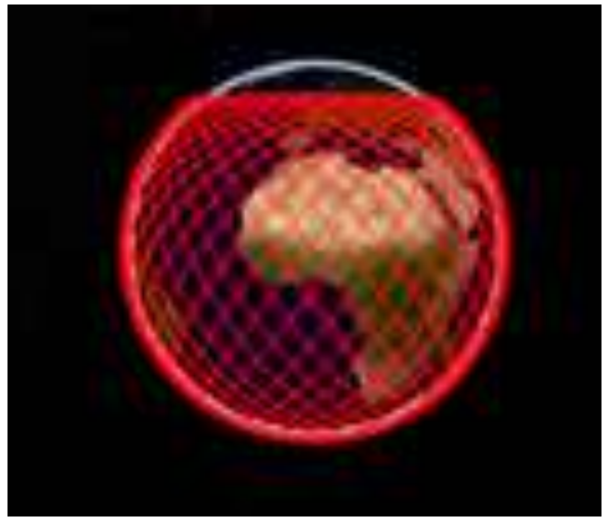
Define the orbit, the duration of the mission and models for:

- Trapped Particles
- Solar Particles
- Galactic Cosmic Rays

Weibull
+
Environment

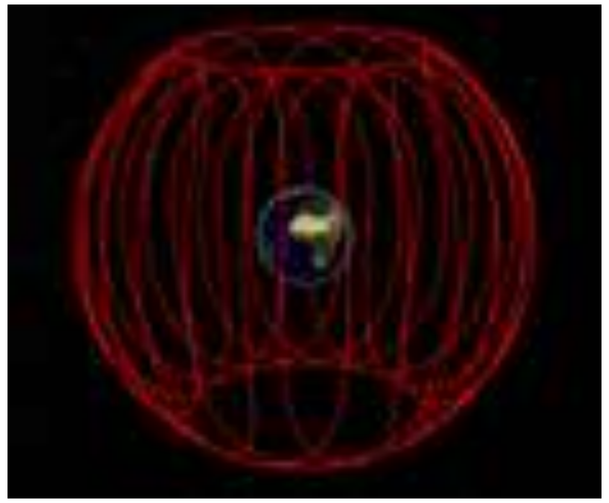
OUTPUT
Single Event Rate (SER)
Events / device / day

GEO stationary orbit



ISS

JASON-2

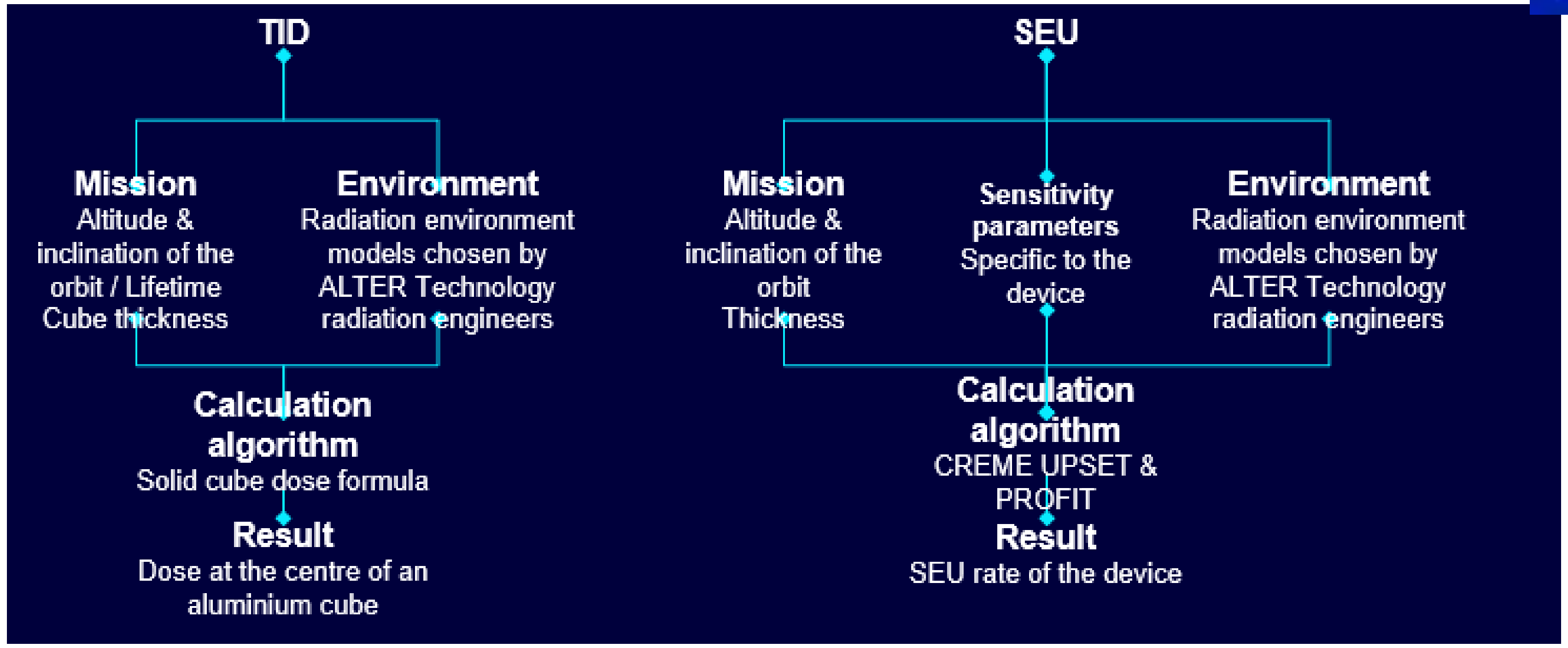


Galileo

Radiations services

Our tool

?Rad-E 4 Space, the first simulation software enabling quick & easy testing for anyone



TID

Mission
Altitude & inclination of the orbit / Lifetime
Cube thickness

Environment
Radiation environment models chosen by ALTER Technology radiation engineers

Calculation algorithm
Solid cube dose formula

Result
Dose at the centre of an aluminium cube

SEU

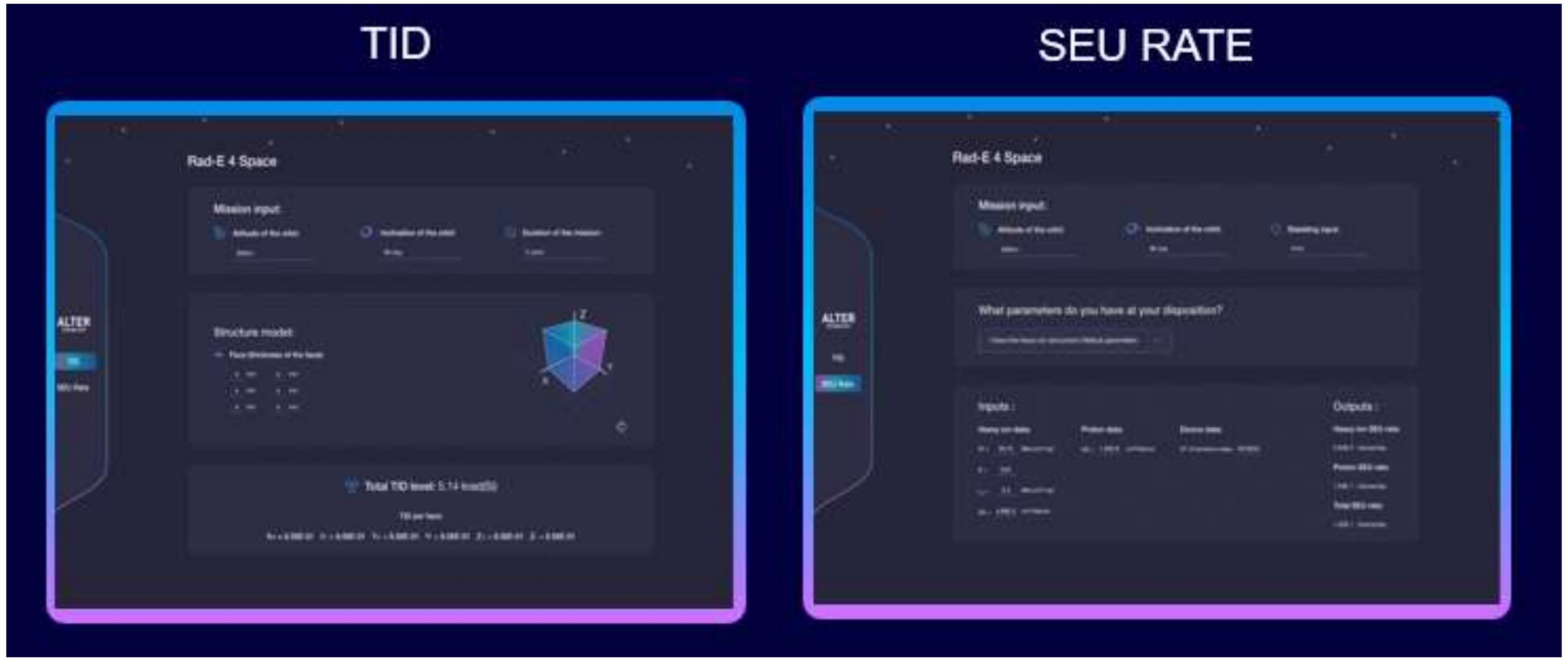
Mission
Altitude & inclination of the orbit
Thickness

Sensitivity parameters
Specific to the device

Environment
Radiation environment models chosen by ALTER Technology radiation engineers

Calculation algorithm
CREME UPSET & PROFIT

Result
SEU rate of the device

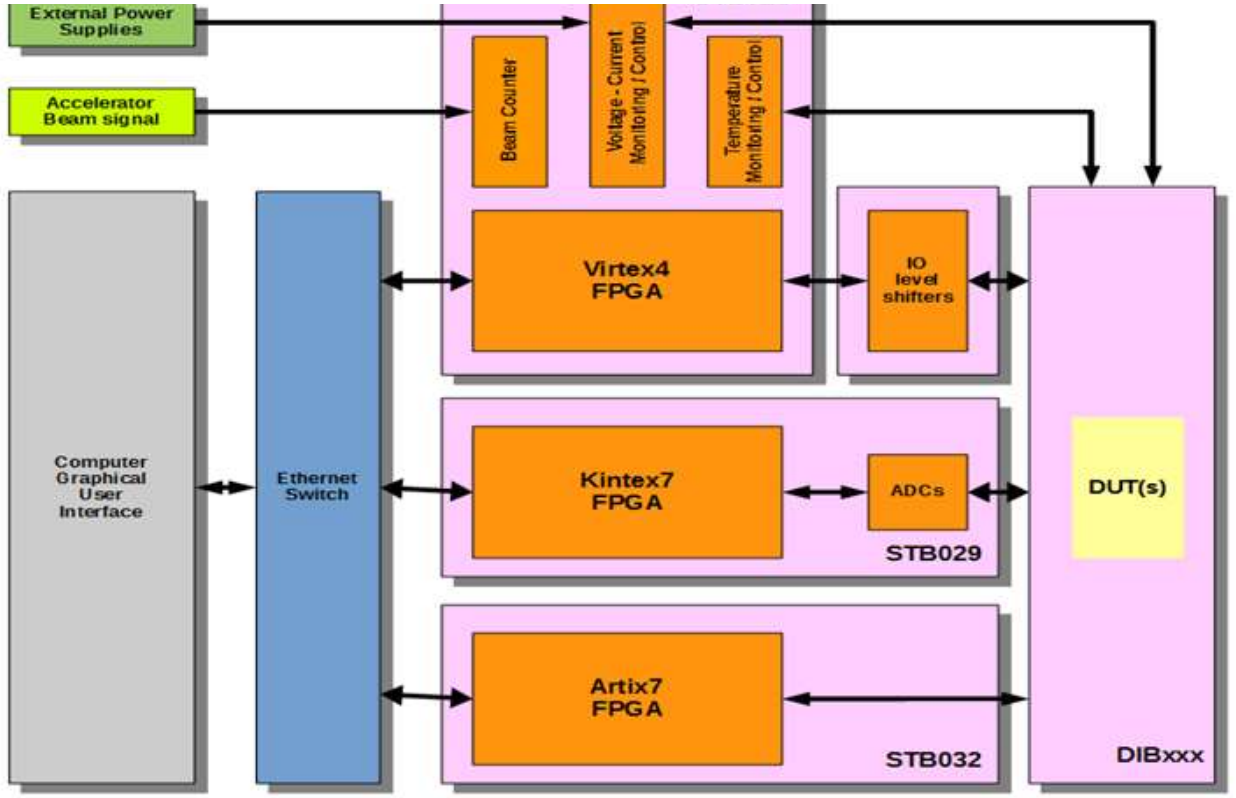


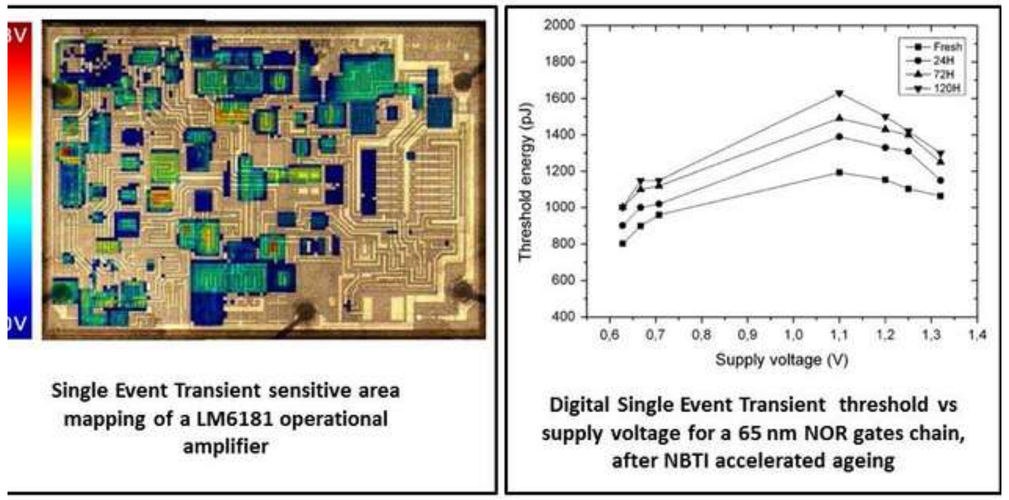
Radiations services

ALTER

Electronic component testing:

- Test bench development
- Test campaigns (SEE)
- Material testing and component/system radiation characterization





Single Event Transient sensitive area mapping of a LM6181 operational amplifier

Digital Single Event Transient threshold vs supply voltage for a 65 nm NOR gates chain, after NBTI accelerated ageing

Single Event Effect sensitivity Testing

University of Jyväskylä

UCL Université catholique de Louvain

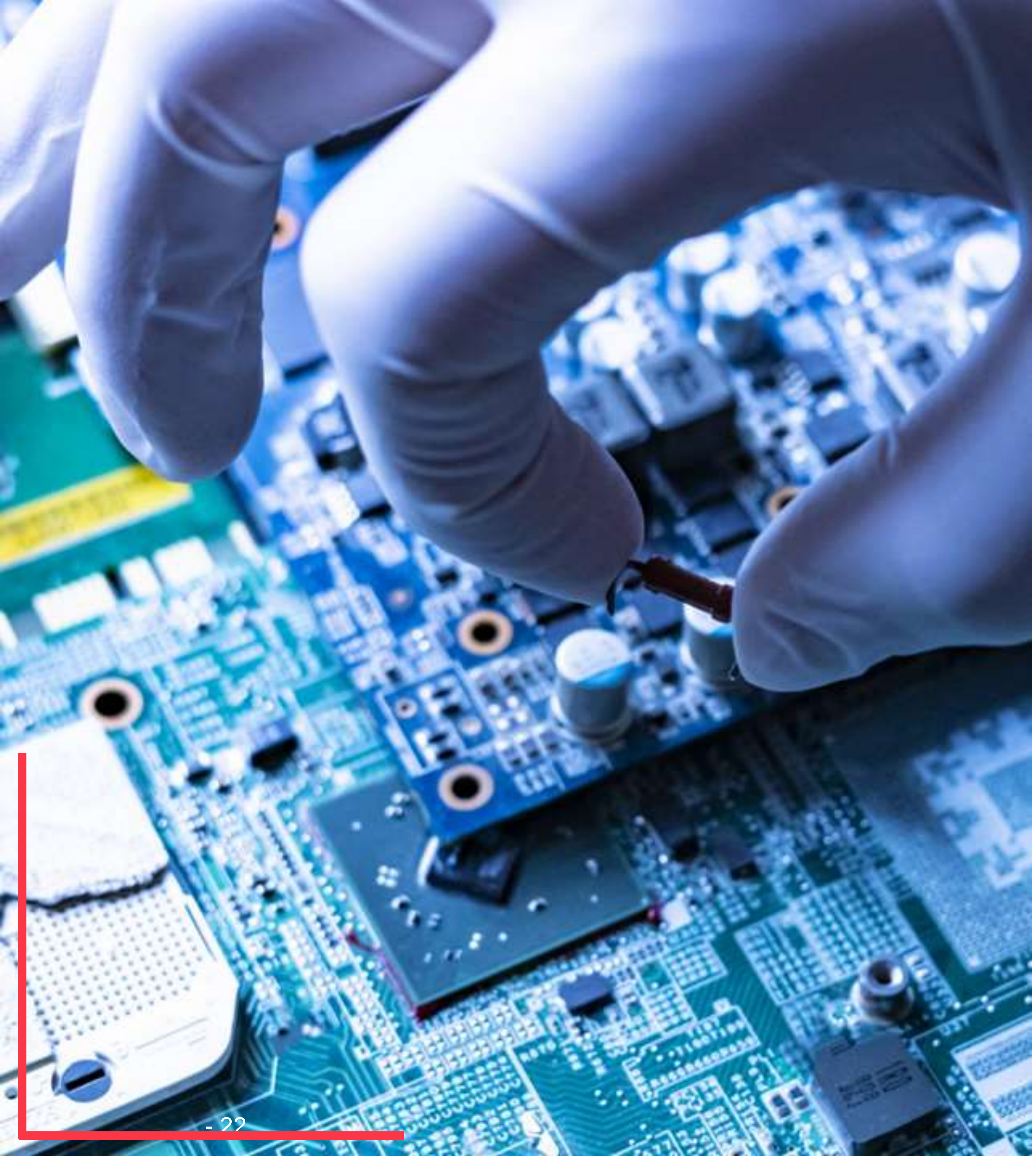
TRIUMF

KVI

PAUL SCHERRER INSTITUT PSI

Science & Technology Facilities Council ISIS Neutron and Muon Source

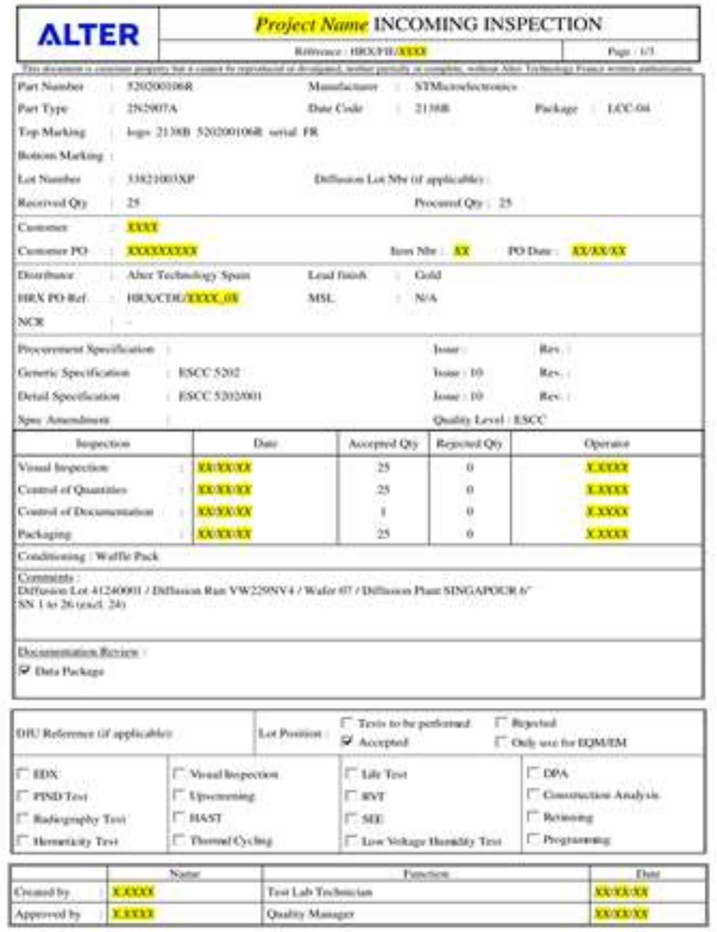
ims Laboratoire de l'Intégration du Matériau au Système



Procurement

- Ensure compliance with EEE part quality project requirements.
- Align test definitions with project mission.
- Organize meetings with manufacturers to guide design and select mission-compliant part references.
- Manage Outsourced Semiconductor Assembly & Test for obsolete parts and custom devices.
- Issue Part Approval Document (PAD) and procurement specifications.
- Conduct Parts Control Board (PCB) Meetings with end customer participation.
- Organize Equipment Radiation Control Board (ERCB) Meetings with end customer participation.
- Manage and optimize Declared Component List (DCL).
- Review alternatives to meet financial and lead time project requirements.

Procurement Service



ALTER | *Project Name* INCOMING INSPECTION
Reference : HRX/FIE/XXXX | Page : 1/3

Part Number : 520200106R Manufacturer : STMicroelectronics
Part Type : 2N2907A Date Code : 2138B Package : LCC-04
Top Marking : logo 2138B 520200106R serial FR
Bottom Marking :
Lot Number : 33821003XP Diffusion Lot Nbr (if applicable) :
Received Qty : 25 Procured Qty : 25

Customer : XXXX
Customer PO : XXXXXXXXX Item Nbr : XX PO Date : XX/XX/XX

Distributor : Alter Technology Spain Lead finish : Gold
HRX PO Ref : HRX/CDE/XXXX_0X MSL : N/A
NCR : -

Procurement Specification : Issue : Rev. :
Generic Specification : ESCC 5202 Issue : 10 Rev. :
Detail Specification : ESCC 5202/001 Issue : 10 Rev. :
Spec Amendment : Quality Level : ESCC

Inspection	Date	Accepted Qty	Rejected Qty	Operator
Visual Inspection :	XX/XX/XX	25	0	X.XXXX
Control of Quantities :	XX/XX/XX	25	0	X.XXXX
Control of Documentation :	XX/XX/XX	1	0	X.XXXX
Packaging :	XX/XX/XX	25	0	X.XXXX

Conditioning : Waffle Pack

Comments :
Diffusion Lot 41240001 / Diffusion Run VW229NV4 / Wafer 07 / Diffusion Plant SINGAPOUR 6"
SN 1 to 26 (excl. 24)

Documentation Review :
☑ Data Package

DIU Reference (if applicable) : Lot Position : ☐ Tests to be performed ☐ Rejected ☑ Accepted ☐ Only use for EQM/EM

☐ EDX
☐ PIND Test
☐ Radiography Test
☐ Hermeticity Test
☐ Visual Inspection
☐ Upscreening
☐ HAST
☐ Thermal Cycling
☐ Life Test
☐ RVT
☐ SEE
☐ Low Voltage Humidity Test
☐ DPA
☐ Construction Analysis
☐ Retinning
☐ Programming

	Name	Function	Date
Created by :	X.XXXX	Test Lab Technician	XX/XX/XX
Approved by :	X.XXXX	Quality Manager	XX/XX/XX

ALTER | *Project Name* INCOMING INSPECTION
Reference : HRX/FIE/XXXX | Page : 2/3

Label Picture :

STMicroelectronics
TYPE: 2N2907ARUBG 2N2907ARUBGF
Total Qty: 25
Bulk ID T1549J000001

High reliability parts
CP : 2N2907ARUBG
Marking : 520200106R FR
Date code : 2138B
Quantity : 25
SN from : 1 To : 26
Customer : ALTER/SPAIN
PO : 5020332
ST SO : 1031200440 ITEM : 0040

ST Lot : 33821003XP
CP : 2N2907ARUBG
Marking : 520200106R FR
Date code : 2138B
Quantity : 25
SN from : 1 To : 26
For traceability refer to joined mapping

Package Picture :

ALTER | *Project Name* INCOMING INSPECTION
Reference : HRX/FIE/XXXX | Page : 3/3

Manufacturer COC

Certificate of Conformance

To : ALTER/SPAIN

Required Certification to :

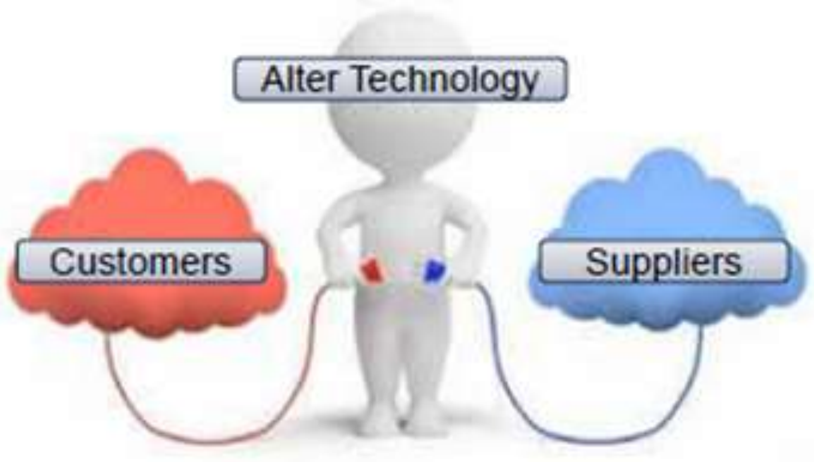
Serial Number :

Total Manufactured Quantity

Date Q.A. Manager Customer Approval (When requested)

Part procurement (HiRel and Commercial parts) only through manufacturers or official distributors.

- No specific portfolio allowing to procure all manufacturers
- End User Statement (EUS) management
- To identify procurement requirement (Single Lot Date Code; Date code restriction ...) including precap / Buyoff inspection management
- Non-Conformity Report (NCR) management
- Periodic reporting.



Incoming Inspection

- Incoming inspection report (documentation checking as CoC, data package, packing label ...). Documents shared through specific cloud (WIMI: access with login and password)
- Specific incoming inspection on request: electrical test, visual inspection with binocular, lead finish analysis
- Destructive Physical Analysis (DPA), Construction Analysis (CA), radiation test (TID, SEE, TNID), upscreening, Lot Acceptance Test (LAT), relifing ...

Storage and Shipment

Parts storage associated with specific software to manage / record traceability, labelling, packing list and storage location:

- Controlled area (temperature and humidity) for hermetic / Hirel parts
- Dedicated Long Period storage area (with dry cabinets <5%RH) for plastic package
- Protection against ESD risk during part handling

STORAGE

procurement leadtime securisationwith fixed price

(without manufacturer price increase)

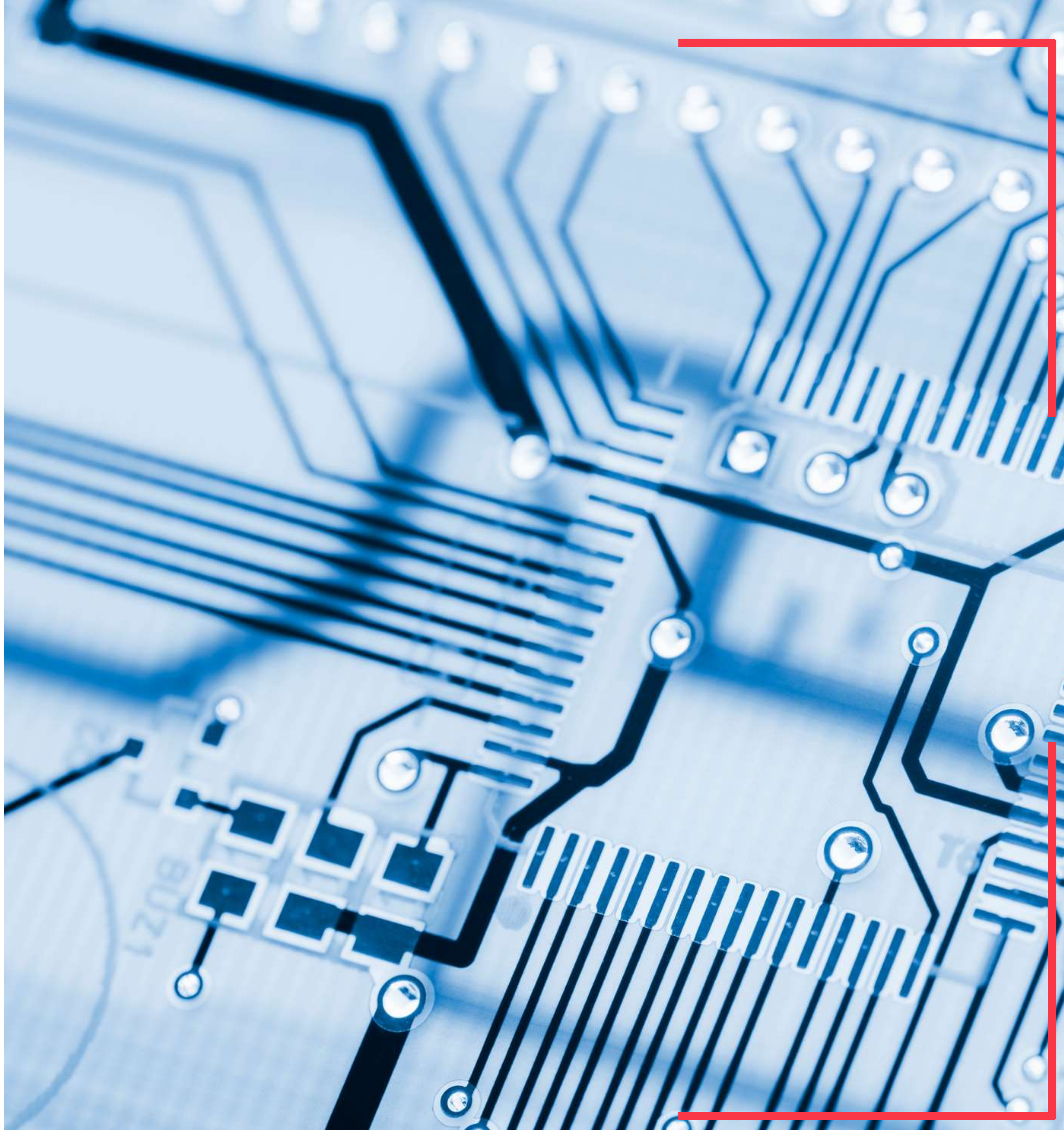
- Customized Kitting to optimize your reception
- Shipment with mechanical stress protection
- Dedicated Packing

EEE Part Engineering Consulting

Parts procurement through IDM (Integrated Die Manufacturer), distributor partners or in partnership with Alter Technology France group with traceability and testing services added involves the process of sourcing and acquiring semiconductor components for electronic devices while ensuring their authenticity, quality, and performance through traceability and testing.

This comprehensive approach helps mitigate the risks associated with counterfeit or substandard components and ensures that the acquired semiconductors meet the required specifications and standards.

ALTER



Thank You