



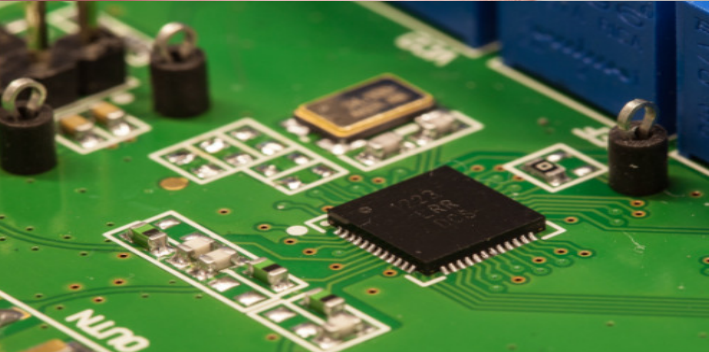
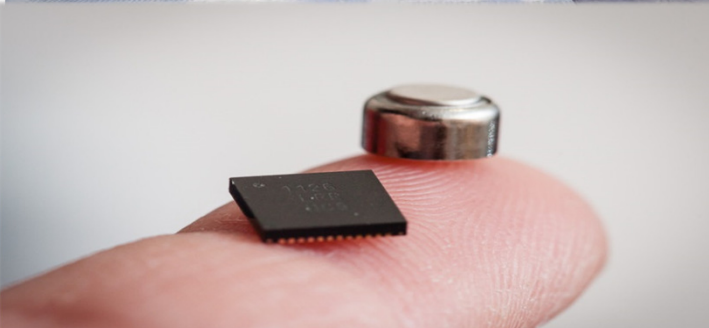
imecDARE

DARE MIXED SIGNAL PLATFORMS

IMEC'S RADIATION-HARDENING-BY-DESIGN SOLUTIONS

STEVEN.REDANT@IMEC.BE



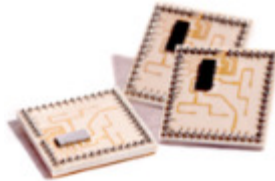


- ▶ Established in 1984
- ▶ Largest independent R&D institute in Europe
- ▶ Total 2014 revenue of 363M€
- ▶ > 2000 people

RESEARCH @ IMEC



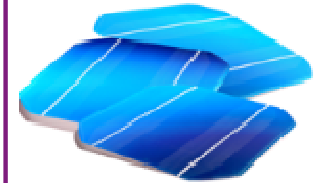
Human++
BAN
Life Sciences



PerSys
Low power
wireless
communication



Sensor systems
for industrial
applications



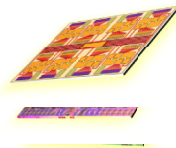
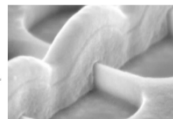
Energy
Photovoltaics
Power devices
LEDs

Core CMOS

Litho

Devices

Inter
connects

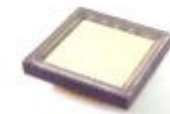


CMORE

MEMS, Sensor
Photonics



Organic electronics

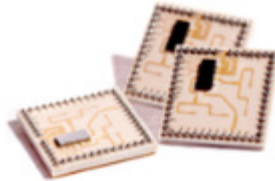


Imaging
Image sensors
& vision systems

IMEC IC-LINK: INDUSTRIAL ARM OF IMEC

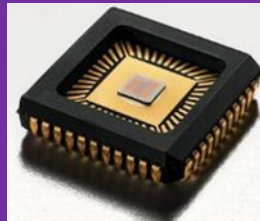


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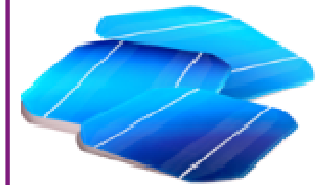


Green Radio
Low power
wireless
communication

**imec
IC-link**



**Sensor
systems**
for industrial
applications



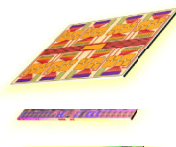
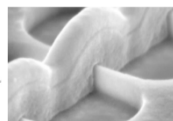
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CMORE

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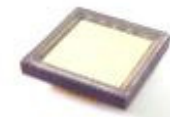


**Organic
electronics**

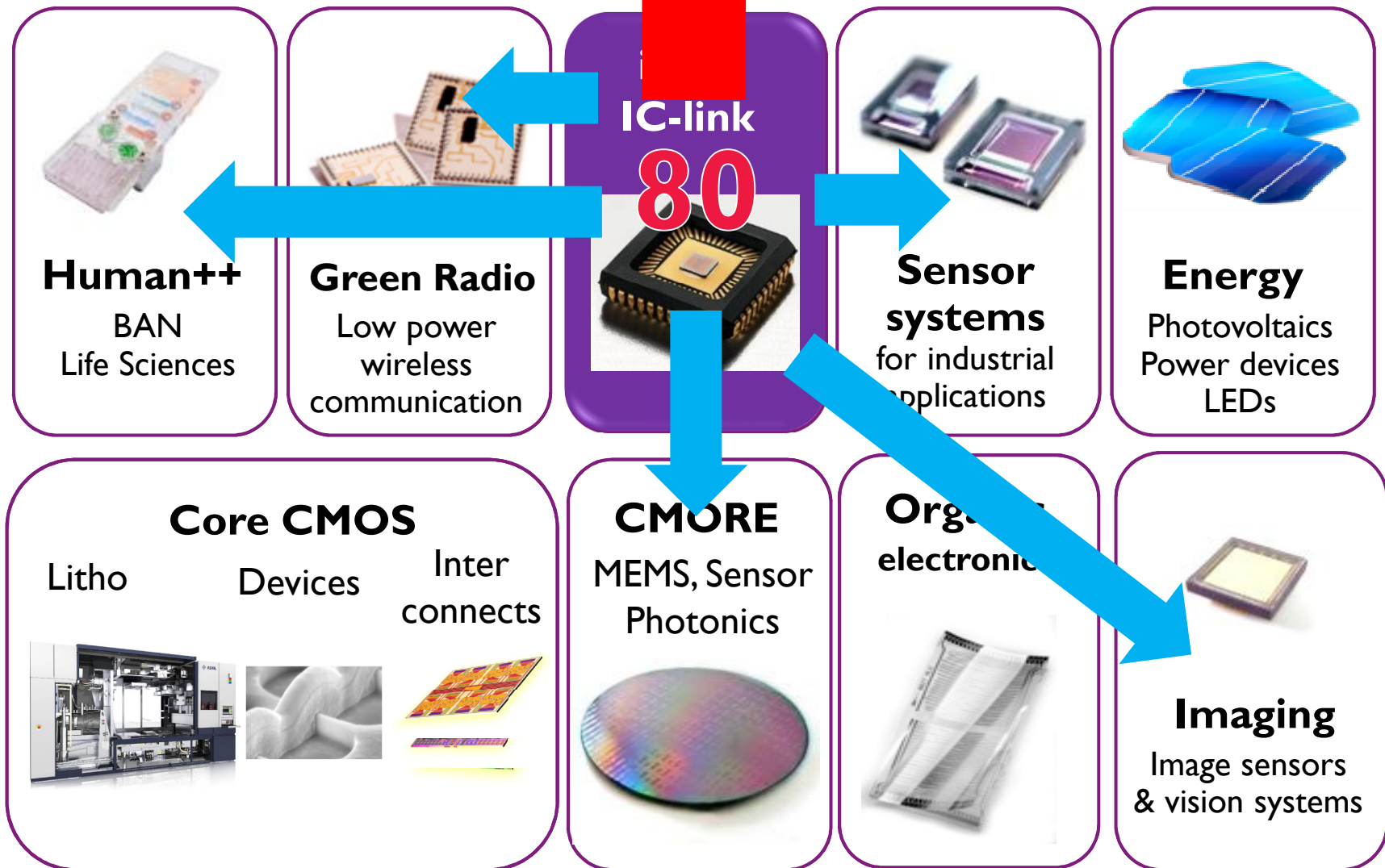


Imaging

Image sensors
& vision systems



IC-LINK: INTERNAL & EXTERNAL SERVICES



IMEC IC-LINK: A SERVICES UNIT

▶ ASIC services:

- MPW and assembly services to universities and companies
- Access to UMC, On Semi & XFAB for volume
- Access to TSMC technologies for prototyping and volume
 - VCA partnership with TSMC
- Full supply chain: Assembly, Test & Qualification



▶ Design services

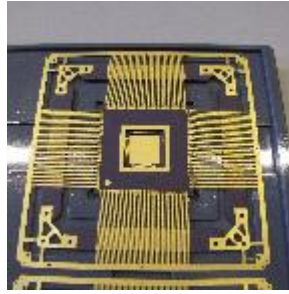
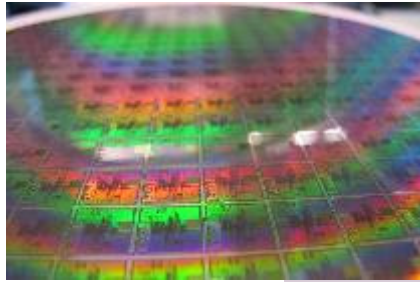
- Library creation & characterization
- RTL & netlist to GDS2
- Analog design & full custom layout (limited)
- Low power implementation methodologies

▶ PBA services, failure analysis, advanced packaging

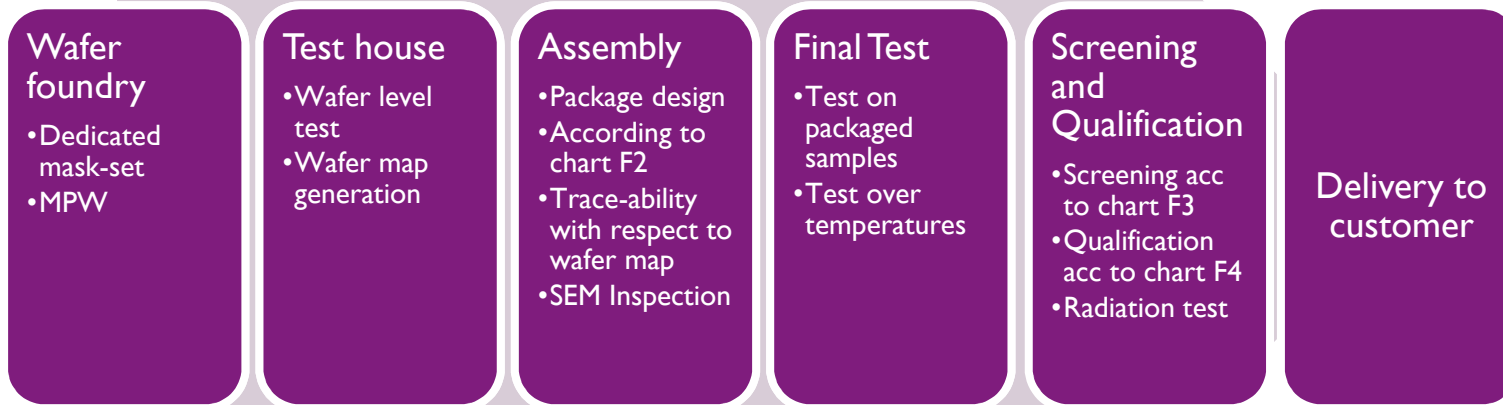
▶ >500 tapeouts per year



ASIC SUPPLY CHAIN FLOW



GDSII



Wafer foundry

- Dedicated mask-set
- MPW

Test house

- Wafer level test
- Wafer map generation

Assembly

- Package design
- According to chart F2
- Trace-ability with respect to wafer map
- SEM Inspection

Final Test

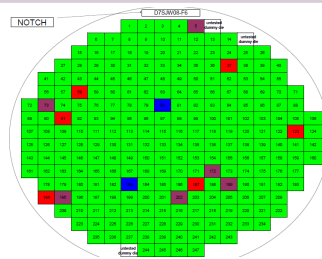
- Test on packaged samples
- Test over temperatures

Screening and Qualification

- Screening acc to chart F3
- Qualification acc to chart F4
- Radiation test

Delivery to customer

ASICs



FULL SERVICE - PARTNERS

Manufacturing     

Packaging     

Testing & qualification

- ▶ Manufacturing Test development
- ▶ Wafer probing & packaged tests
- ▶ Radiation testing & support
- ▶ Screening & Qualification
- ▶ Failure analysis

 THE NEW TESTING AGE





PCB quality support

 | 
IMO - IMOMEC
INSTITUUT VOOR MATERIAALONDERZOEK

RHBD & SPACE ASIC ACTIVITIES

Early 90ies

- ▶ Supporting CERN designers
- ▶ RhBD ESA projects with (then) MMS
- ▶ Designs: AGGA, LTMS, PDFE, FRACSYN etc.
- ▶ Fixed Function ASICs – RhBD proof of concept

In 2000 started DARE 180 UMC

Other imec Space activities

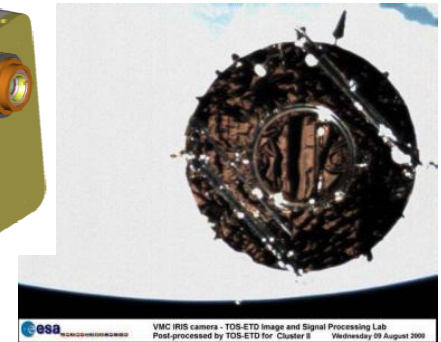
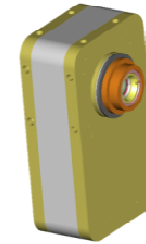
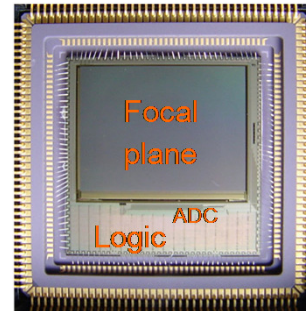
- ▶ GaN
- ▶ Imagers
- ▶ Solar Cells ...



SCIENTIFIC FLIGHT HARDWARE

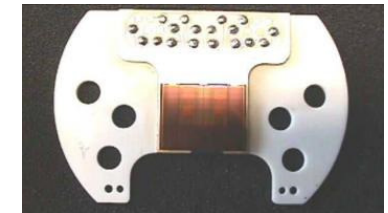
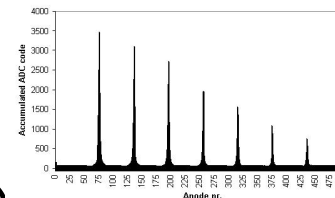
IRIS/VMC (~ 2000):

- ▶ On-chip camera for monitoring
- ▶ Flown on **ClusterII, XMM, ...**



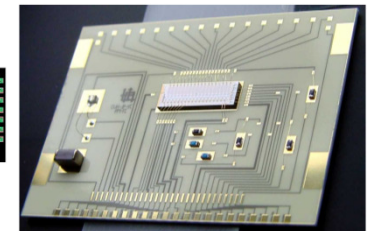
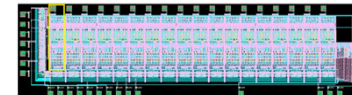
LEDA on **Rosetta** (2004):

- ▶ ROIC for electron spectrometer



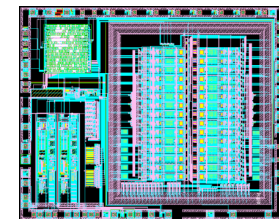
PACS instrument on **Herschel** (2009).

- ▶ 200 Cryogenic ROICs for a far-infrared detector array



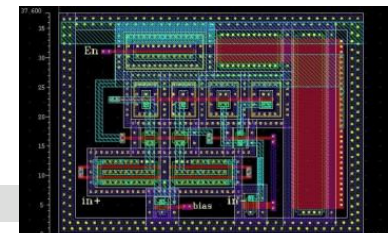
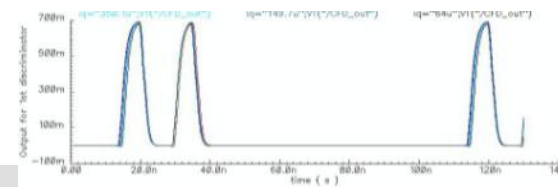
PDFE on NASA's **STEREO** (2006)

- ▶ SEPT instrument



PICAM for **BepiColombo** (~ 2014):

- ▶ ROIC for particle detectors

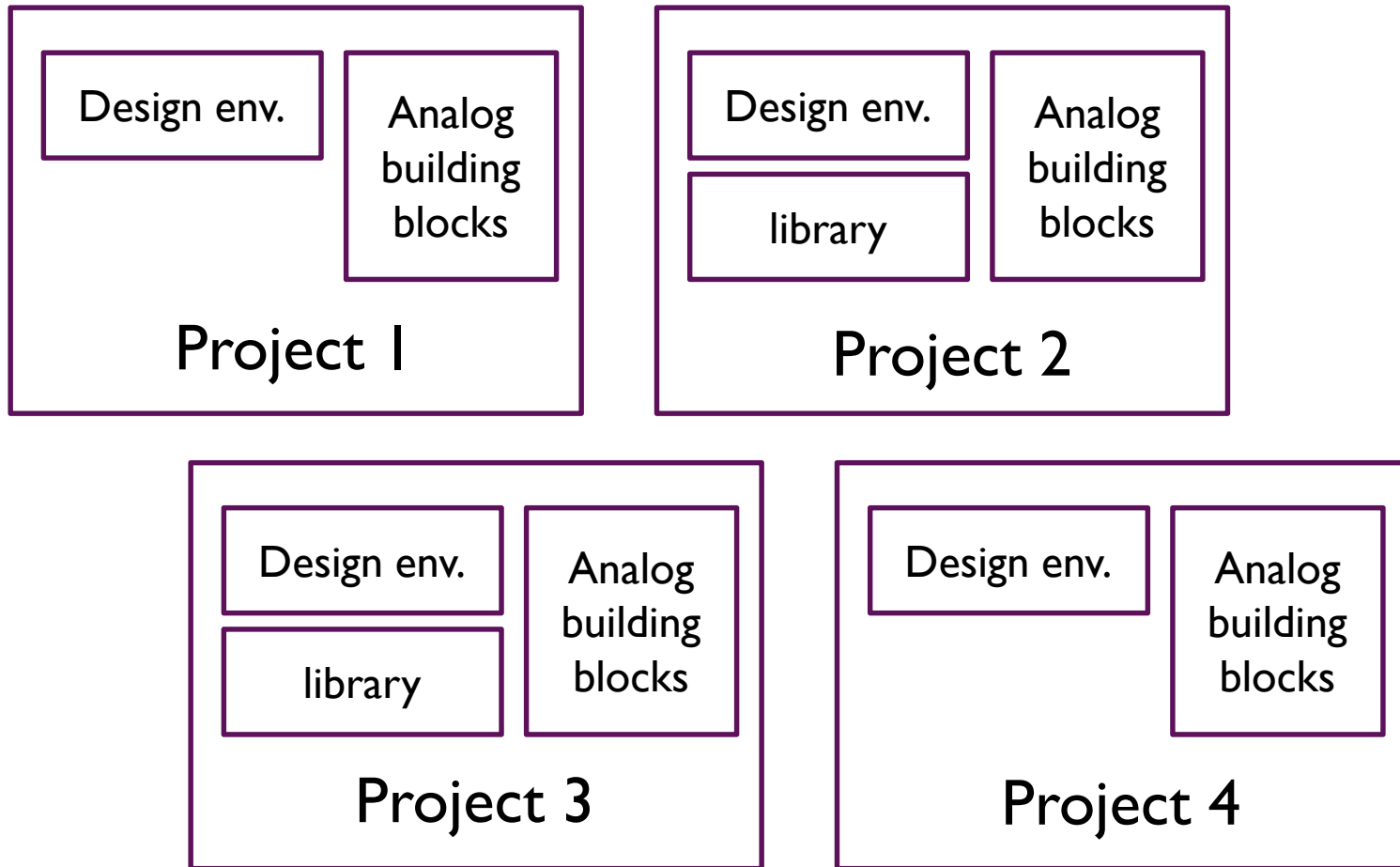


DURING THE 90IES...

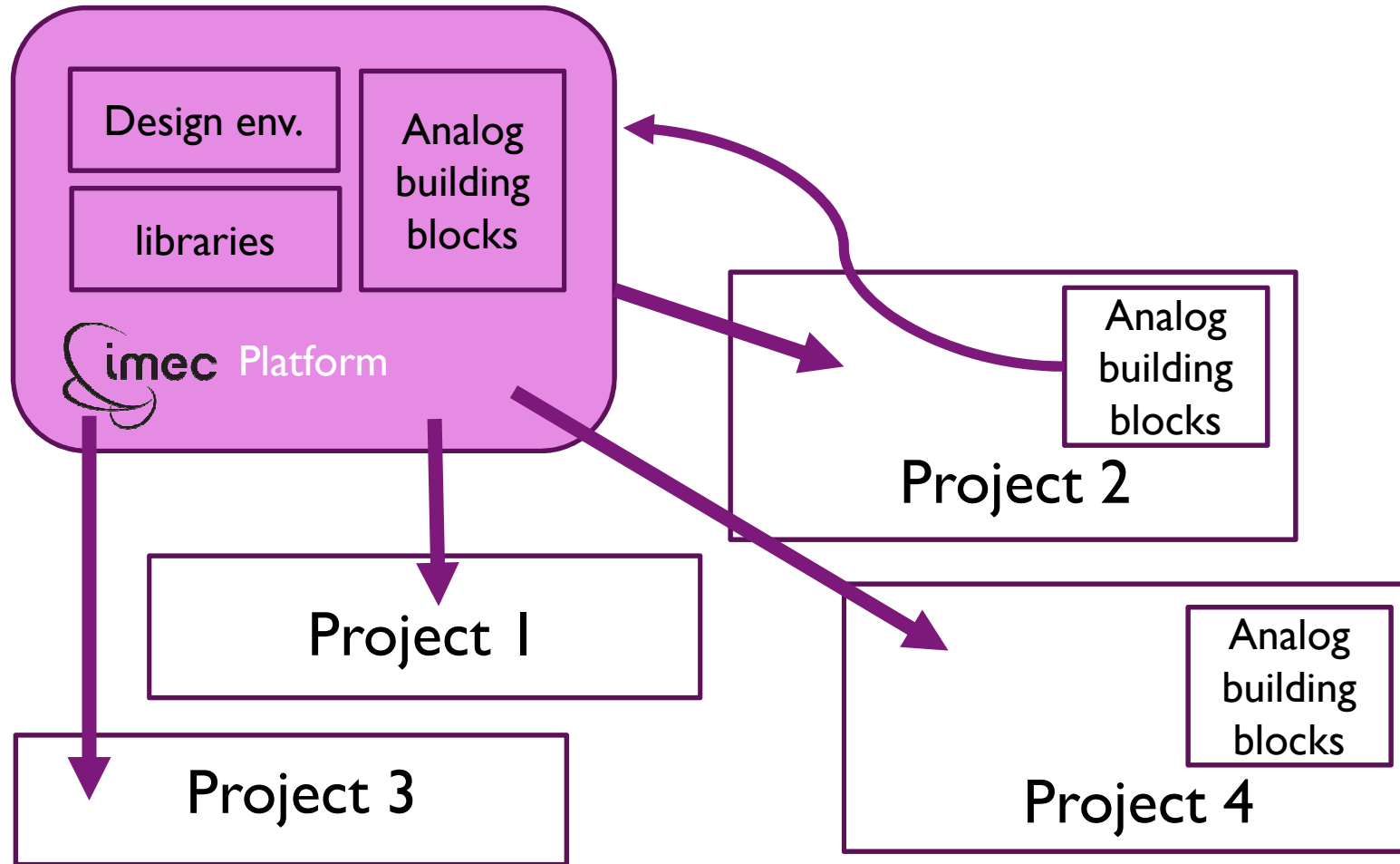
Radiation Hardened technologies leaving the market

- ▶ Too small volumes
- ▶ Too few projects
- ▶ Qualification effort

A SHIFT TO RHBD



DARE: A NEW PARADIGM...



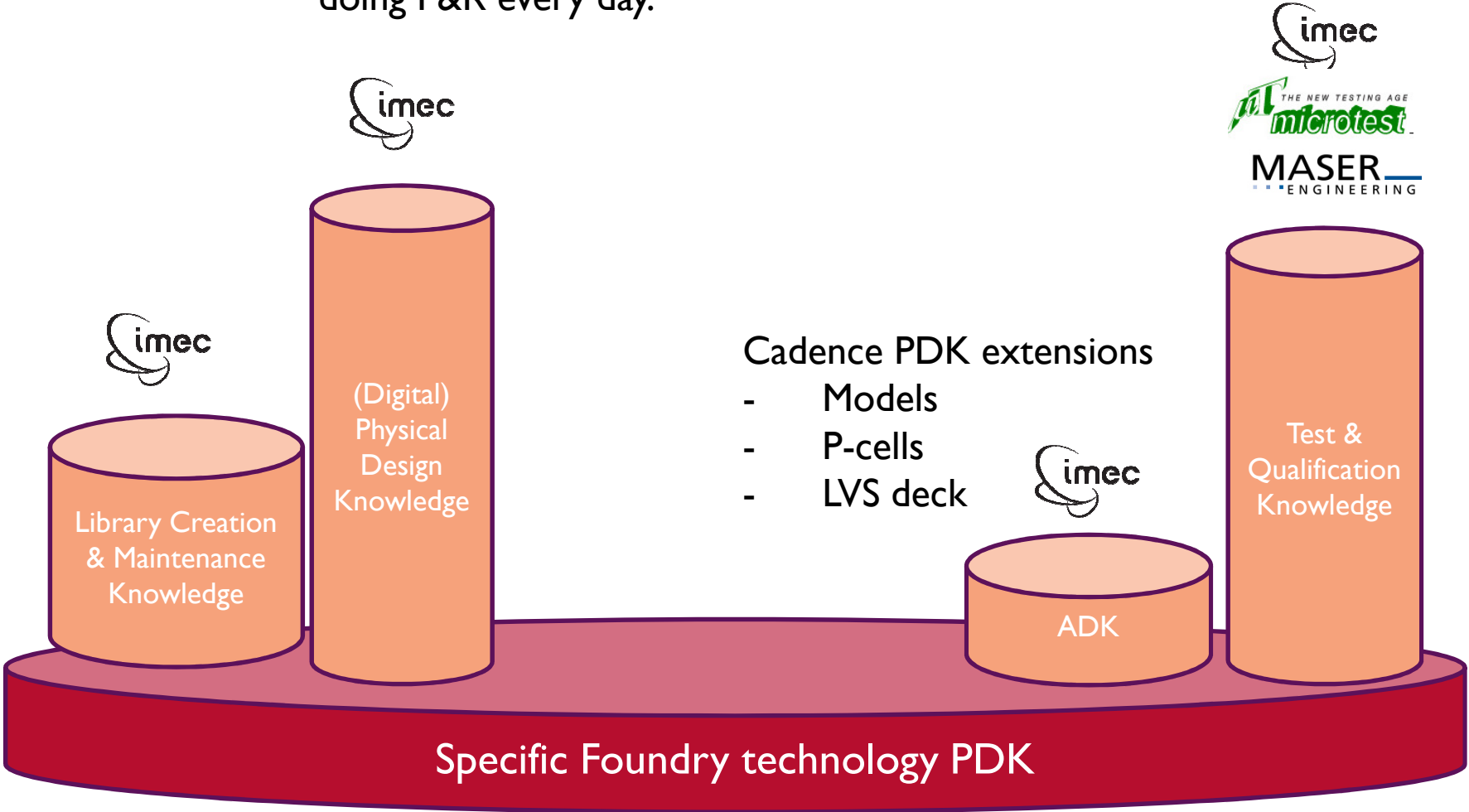
DARE PLATFORMS



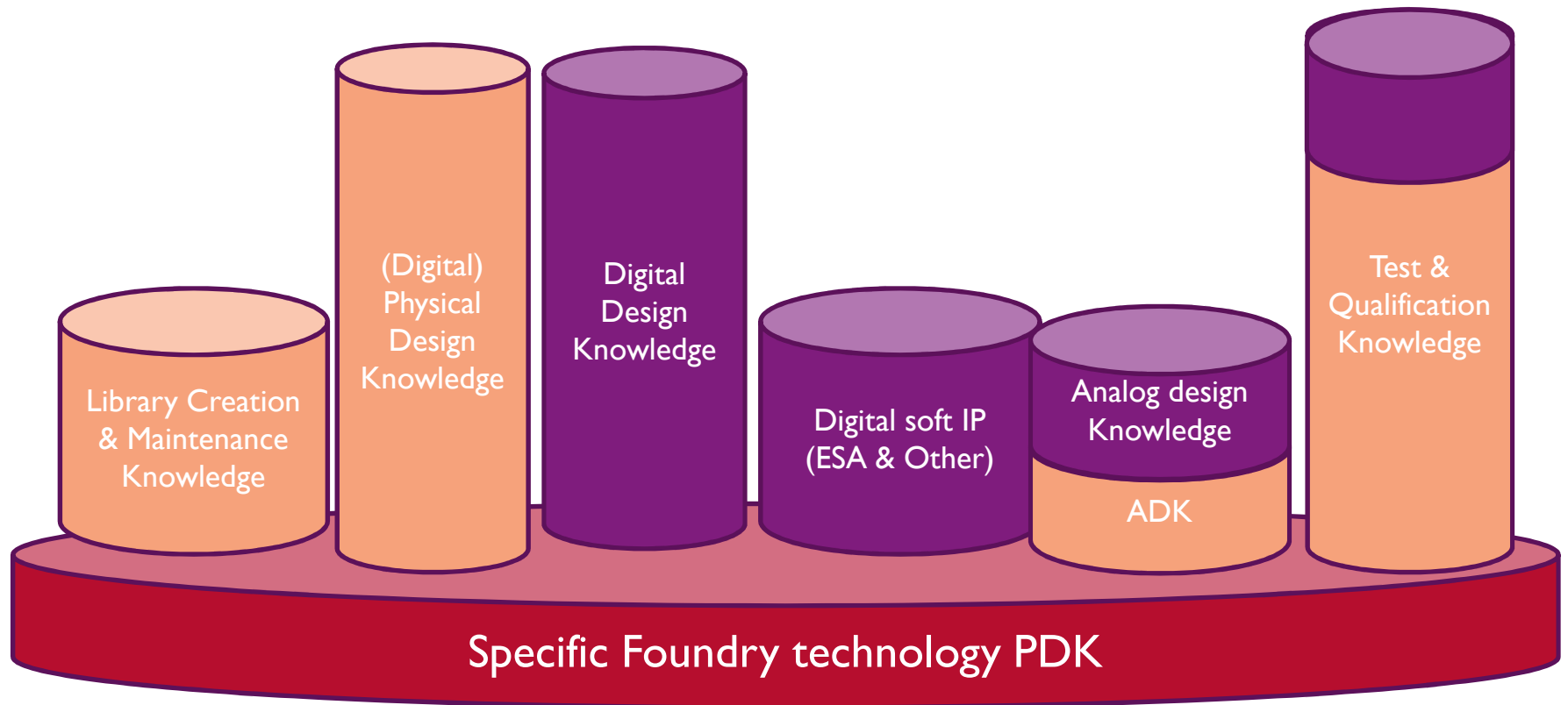
Specific Foundry technology PDK

BUILDING UPON CORE COMPETENCIES

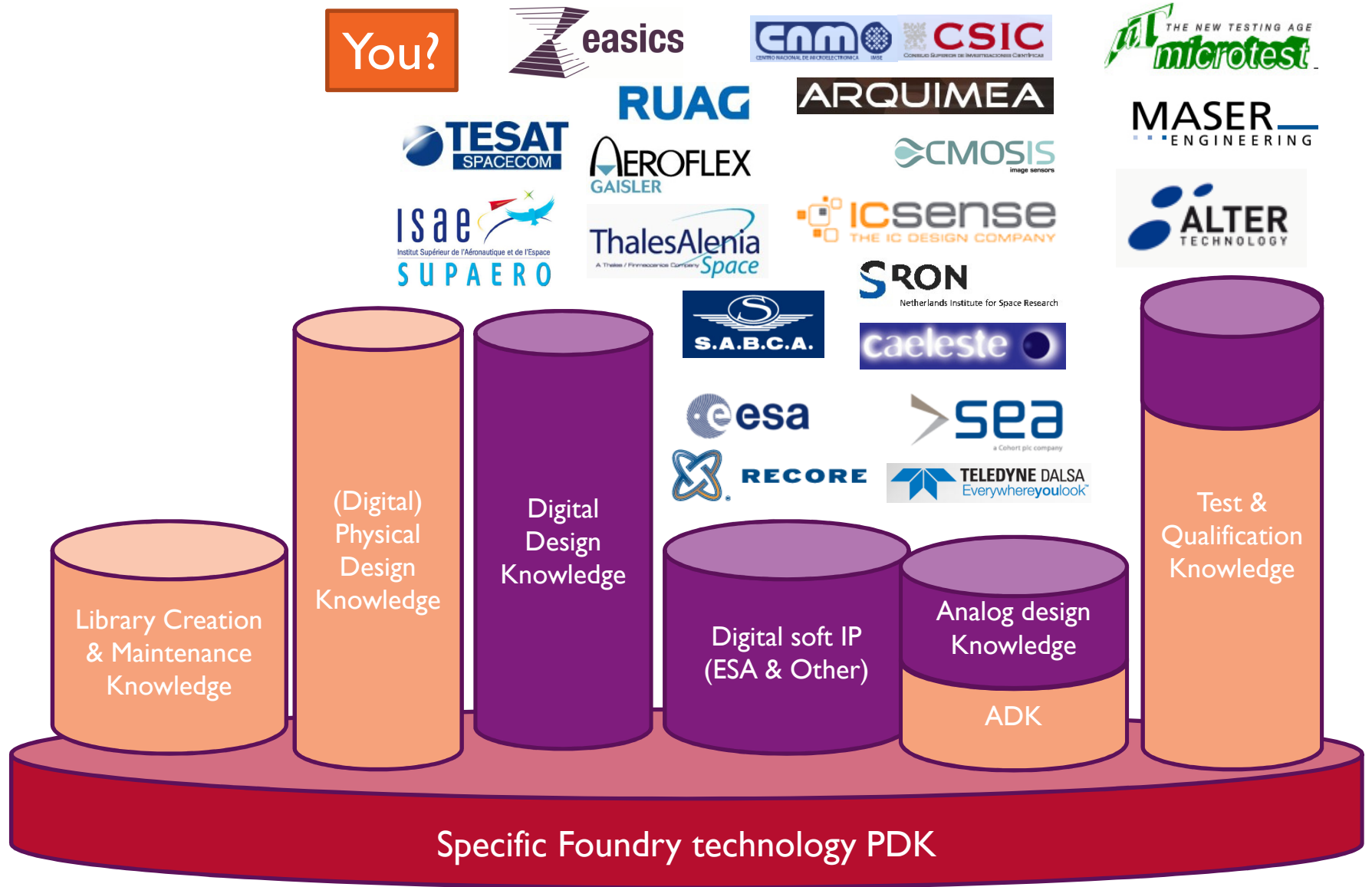
Very experienced digital layout team
doing P&R every day.



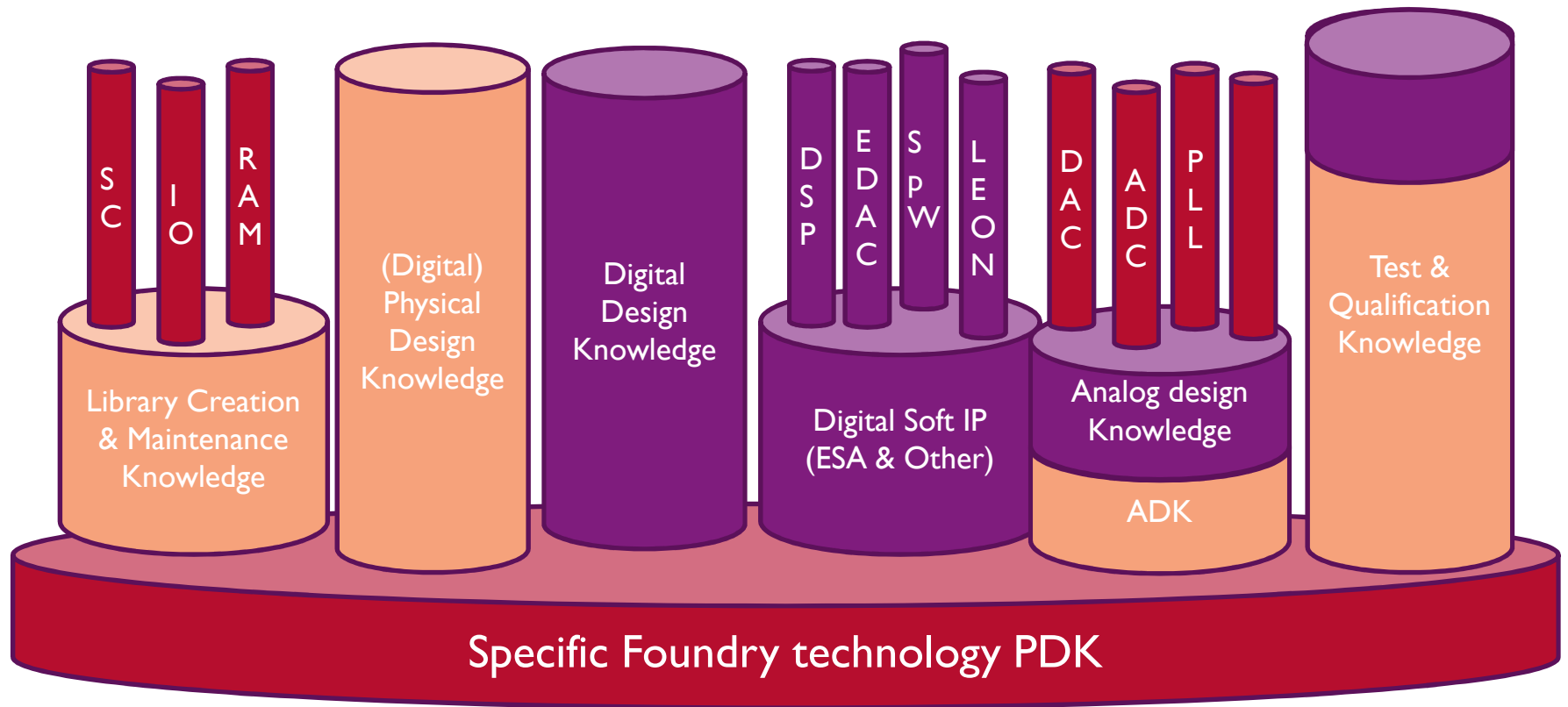
AND OTHER'S COMPETENCIES



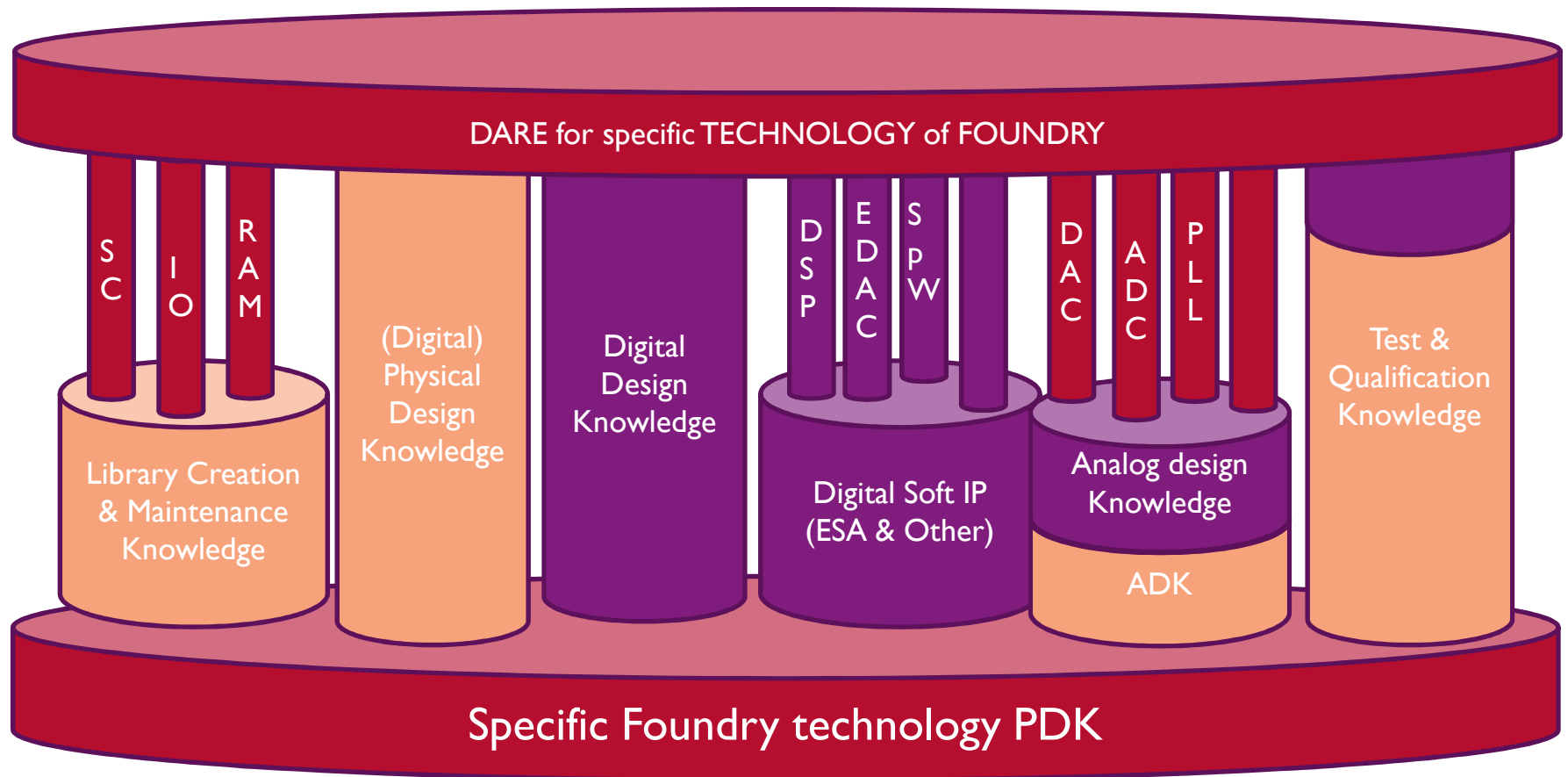
AND OTHER'S COMPETENCIES



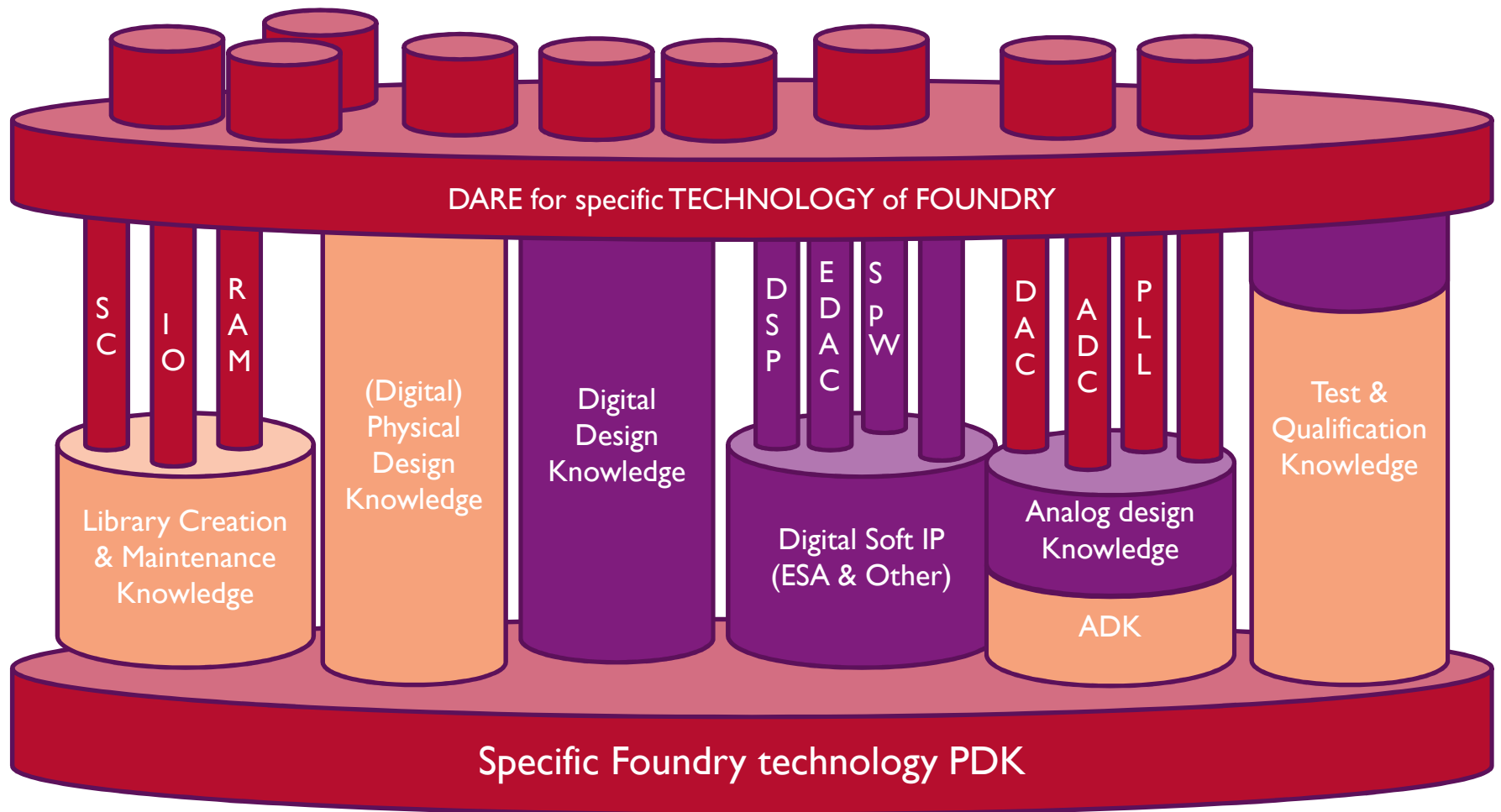
ALL PARTIES DO WHAT THEY DO BEST...



...TO BUILD RADIATION-HARDENED-BY-DESIGN PLATFORMS FOR MIXED SIGNAL DESIGN ...



...ON WHICH COMPONENTS CAN BE BUILT AND TESTED & QUALIFIED



THIS BRINGS...

Flexibility

- ▶ Cells, and analog blocks can be added to a platform by several parties (using ADK or not)
- ▶ Becoming then part of the platform
 - different business models possible
- ▶ Commercial MPW calendar

Maturity for RHBD solutions for everyone

- ▶ RHBD libraries and IP available to all (cf. commercial IP)
- ▶ **Legacy** build-up benefiting all

IP Re-use

- ▶ Saving money in MS design, test & qualification
- ▶ Lowering Risk and increasing speed of tapeout/results

AND ALSO ...

Knowledge Sharing

- ▶ Radiation data
- ▶ Design methods used

Centralization

- ▶ IP status & cost should be clear
- ▶ Allows for faster cost overview of a project
- ▶ Packaging solutions can be reused

Focus

- ▶ No/less duplication
- ▶ Emphasis on the new functionality

PLATFORMS @ DIFFERENT MATURITY

DARE UMC 180 – including CIS

- ▶ Well supported for mixed signal (core, I/O, RAM,s analog IP)

DARE UMC 90

- ▶ Small digital core & IO library (no RAM, no analog)

DARE XFAB 180 XH

- ▶ Core, I/O, RAM Libraries & analog IP ready
- ▶ First Silicon test chip design in 2015H2

DARE ON I3T80

- ▶ ADK ready
- ▶ Digital library in early stage

TSMC 130nm

- ▶ CERN RAM compiler

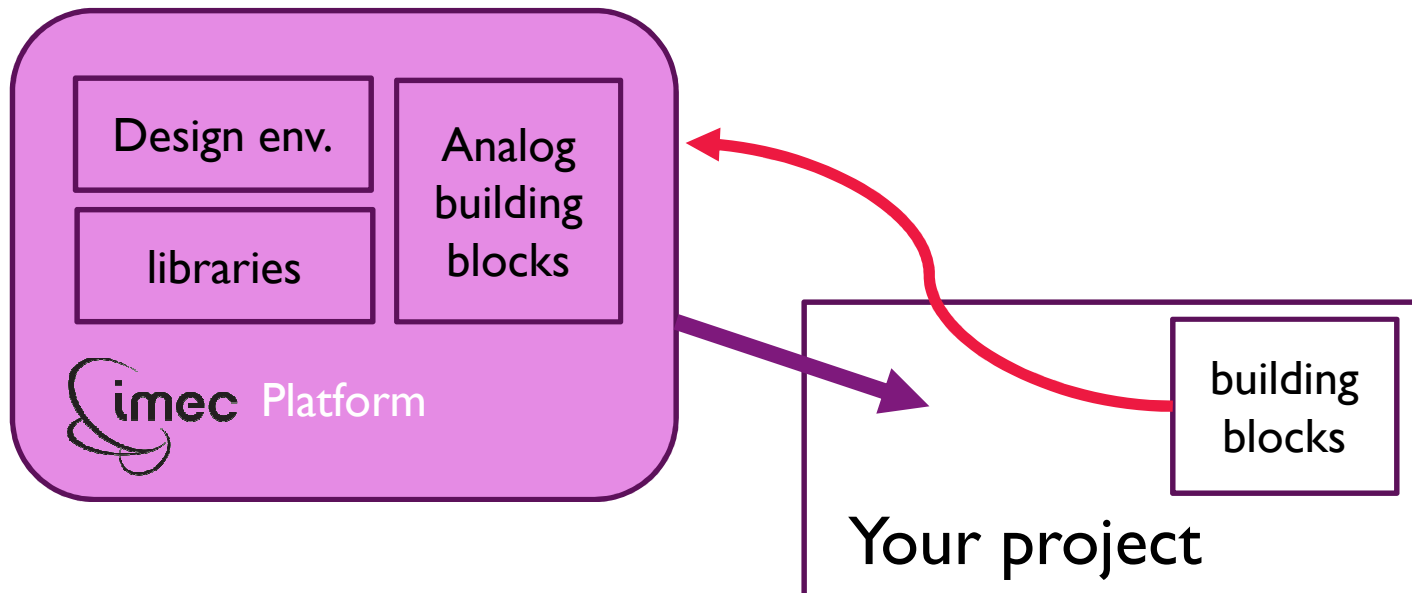
TSMC 65nm

- ▶ CERN RAM compilers
- ▶ Starting full library work soon

Do you have
Something interesting
to offer/contribute?

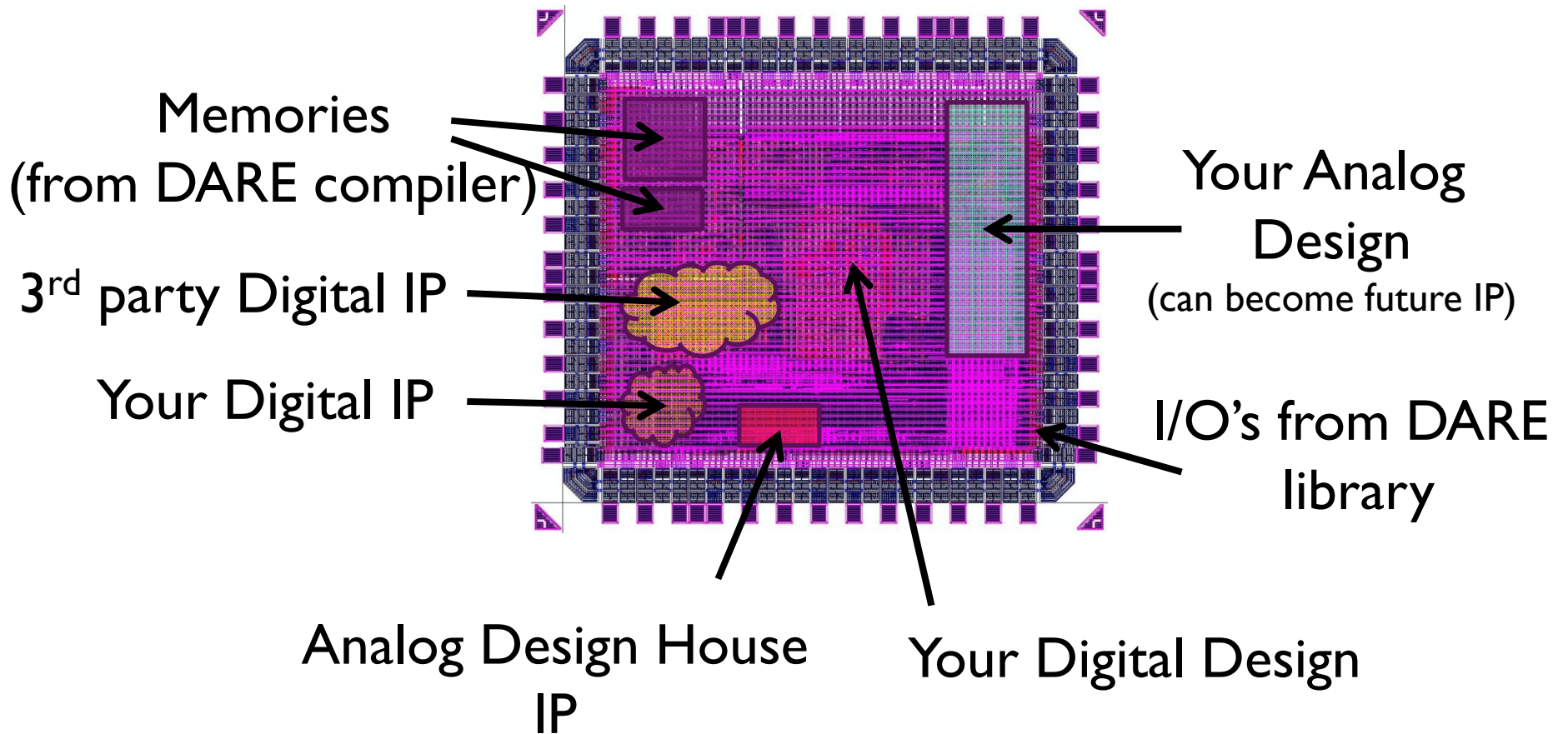


FOR EXAMPLE



CONCLUSION: DARE MS SOC PLATFORMS

Result of/ input to many projects



A platform can have several libraries/IP blocks in it



imecDARE

