The ESCC Components Technology Board Roadmap

Jean-Louis Cazaux, CTB Chairman

ESCCON, ESA-ESTEC, 13/03/2019

What is the CTB?

- **CTB: Component Technology Board**
- An ESCC body, subordinate to the SCSB *(Space Components Steering Board)*, along with PSWG *(Policy & Standard Working Group)* and MPTB *(Materials & Processes Technology Board)*
- Created in 2002 according to ESCC Charter 00000, Defined by ESCC 10400

*The CTB is charged with **the formulation of strategic programmes and work plans for technology research and development** in the area of **European EEE space components**.*

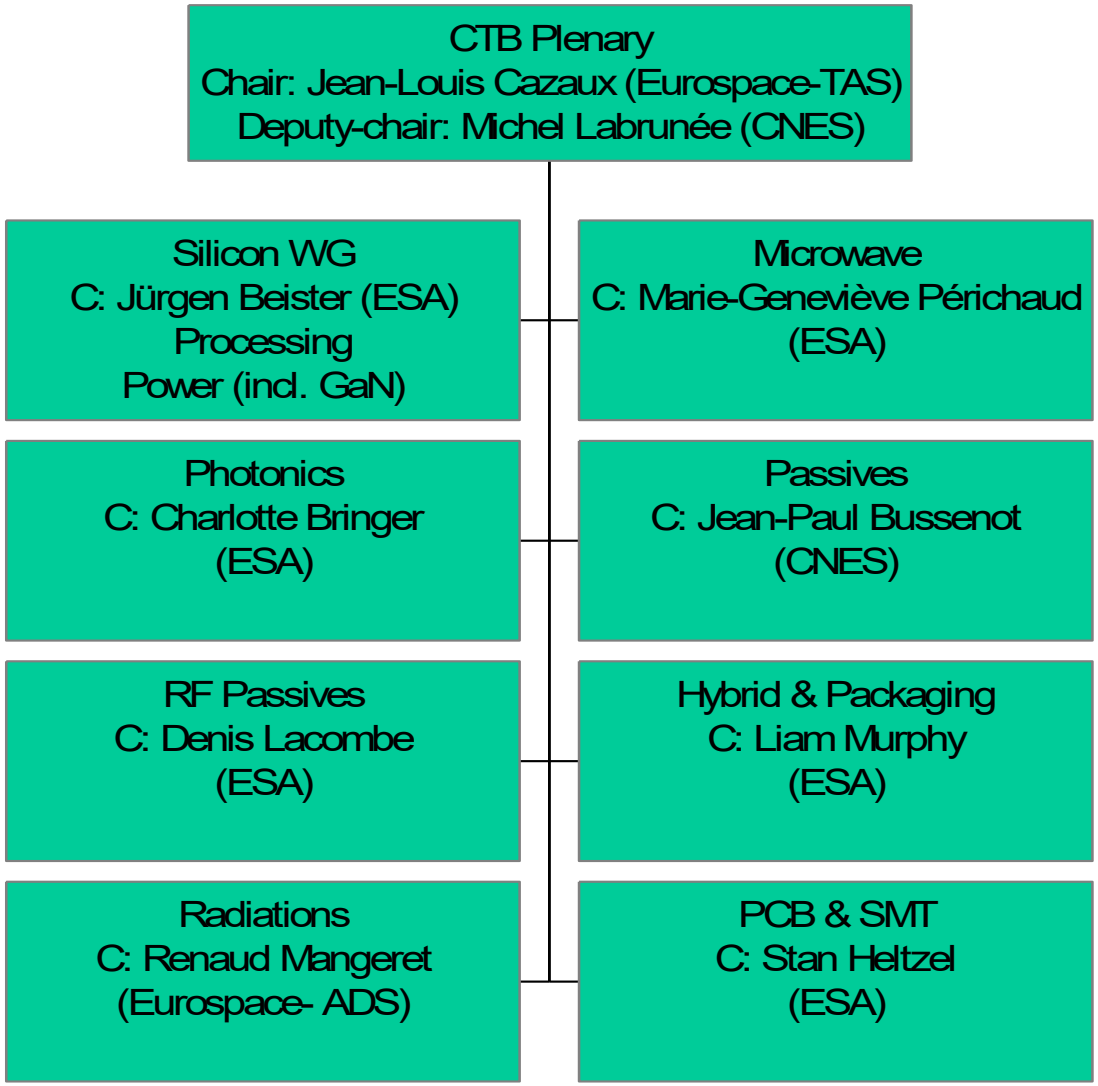
*It **harmonises** the collectively funded component research, development, evaluation, qualification, standardisation and quality assurance activities.*

Membership

- CTB Membership:
  - 1) Space Agencies: ESA + CNES, DLR, ASI (w/IMT), UKSA
  - 2) Equipement Manufacturers: through EUROSPACE >> Thales Alenia Space, Airbus D&S, ALTER, OHB, RUAG Space
  - 3) Component Suppliers:
    - a) Silicon (Microchip, ST);
    - b) Microwave (UMS);
    - c) Hybrids (Teledyne e2V, TAS-B);
    - d) Passives (Radiall)
  - + Permanent Observers: EC DG Grow, 3D+

CTB's Internal Organization

- **8 thematic Working Groups (WG) reporting to the "CTB Plenary"**
- In total, and as for today, CTB WGs involve about 200 individuals from 50 different organizations



CTB
Component Roadmaps 2019
v1.1

(20/02/2019)

Major needs for EEE parts: Two major trends

1. More flexible and reconfigurable satellites
2. Affordable solutions for the satellites of the so-called "New Space" move

>> also developed in STEPP - A project funded by the European Union

1) Enable increase flexibility for spacecraft and missions

- Increase level of digitalization
- Higher integration, towards heterogeneity (digital, analog mw, photonics)
- Higher frequency of operation, higher data rate
- Higher and better power handling
- Improved thermal dissipation options, in relation with higher integration and higher power handling
- Higher modularity, plug and play concept between units, mainly thanks to screwless interconnections

2) Design and production of less costly hardware

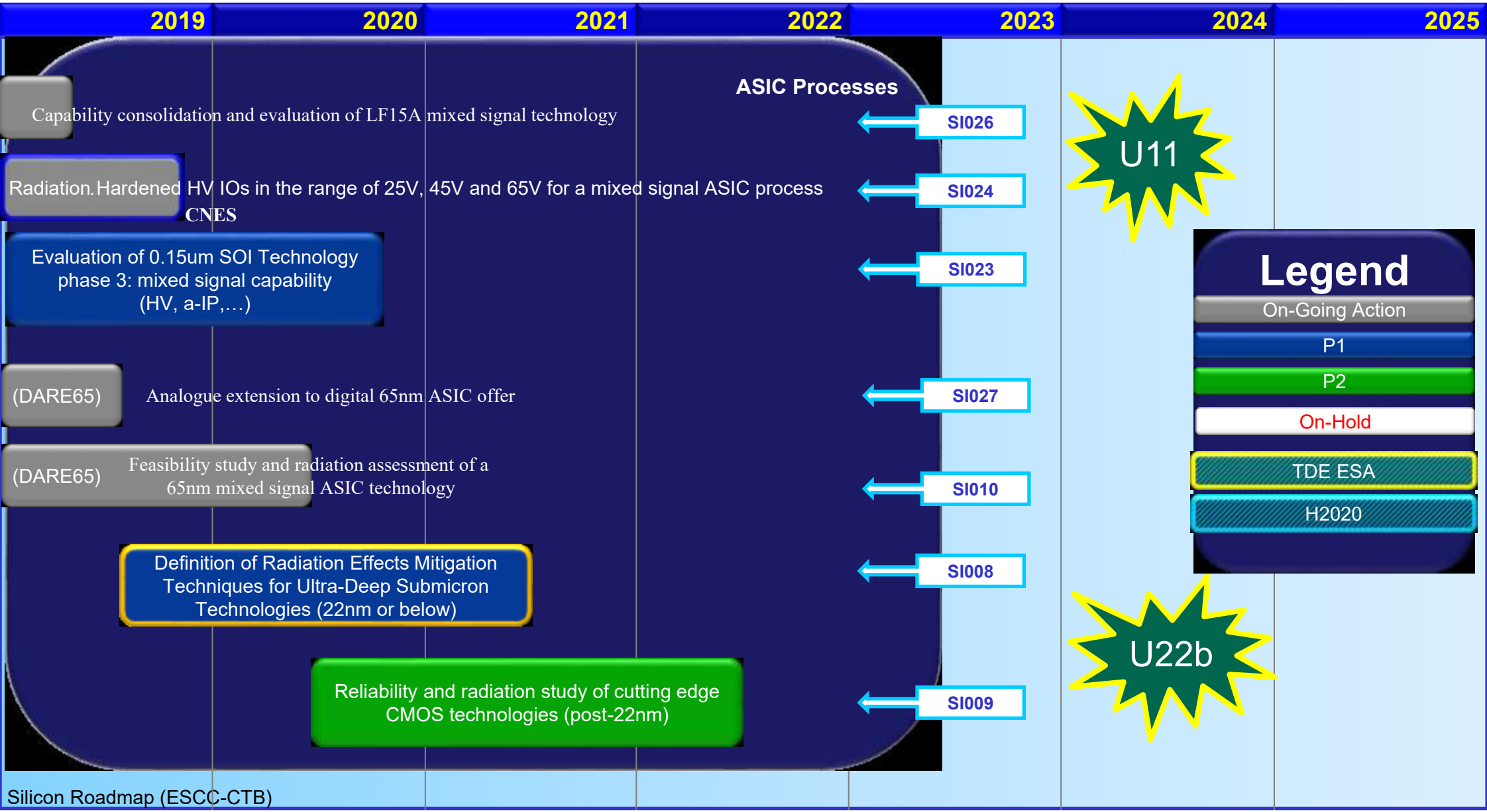
The reality of using COTS (Component Off The Shelves) or, better, “Mass Production Components” has been demonstrated by most integrators in the past and recent years.

That trend is growing in interest not only for economic reasons but also because it is a valid manner of increase reliability and sometimes to achieve better performance by accessing to optimised components.

- Increase the concept to families of component less concerned so far (passives, others, …)
- Address assembling conform to REACH and RoHS regulations (typically Pb-less)
- Radiation hardened die in commercial package
- Characterization of commercial technologies for radiation performance

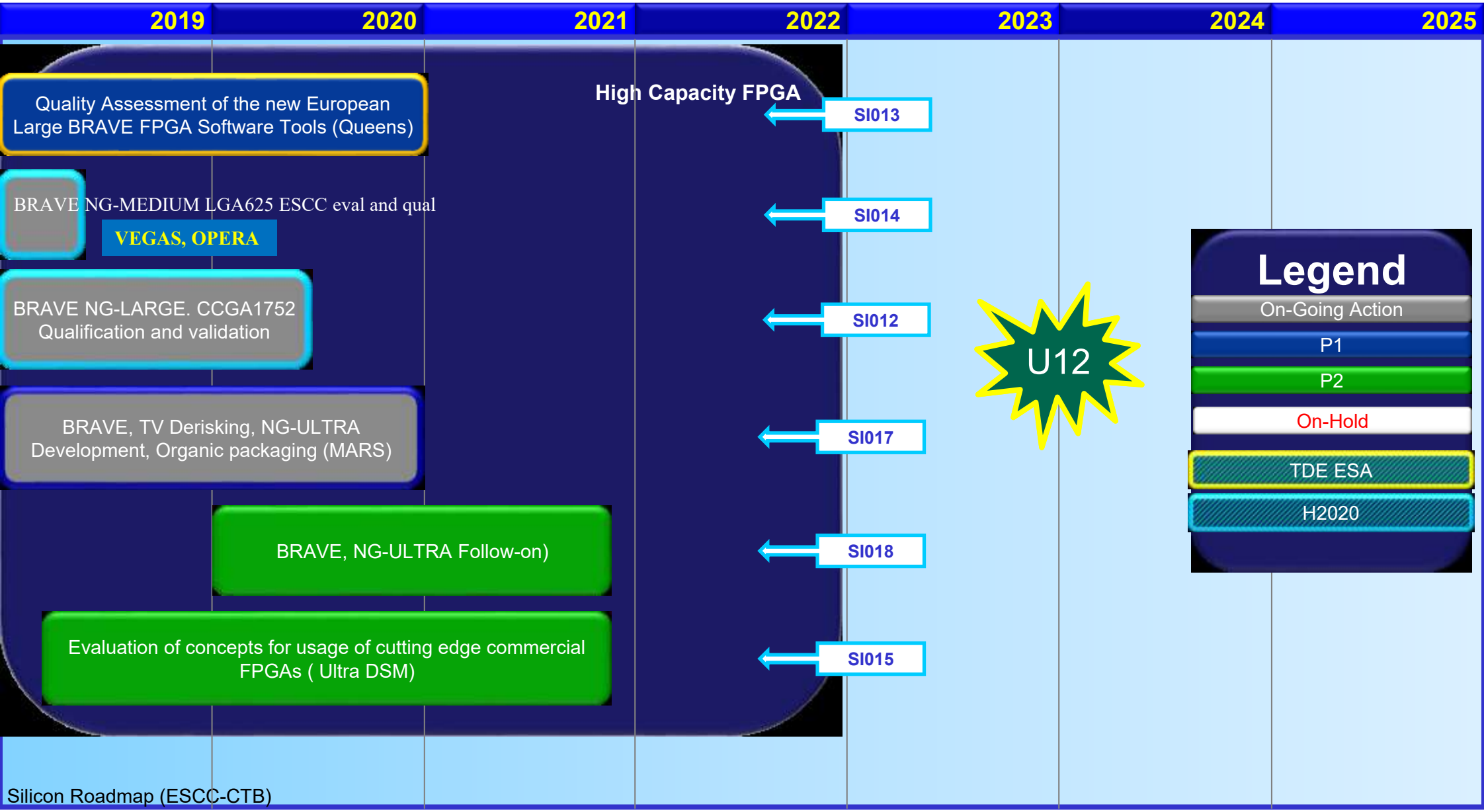
Processing & Power 1/5

ESCC / CTB
European Space Components Coordination
Components Technology Board



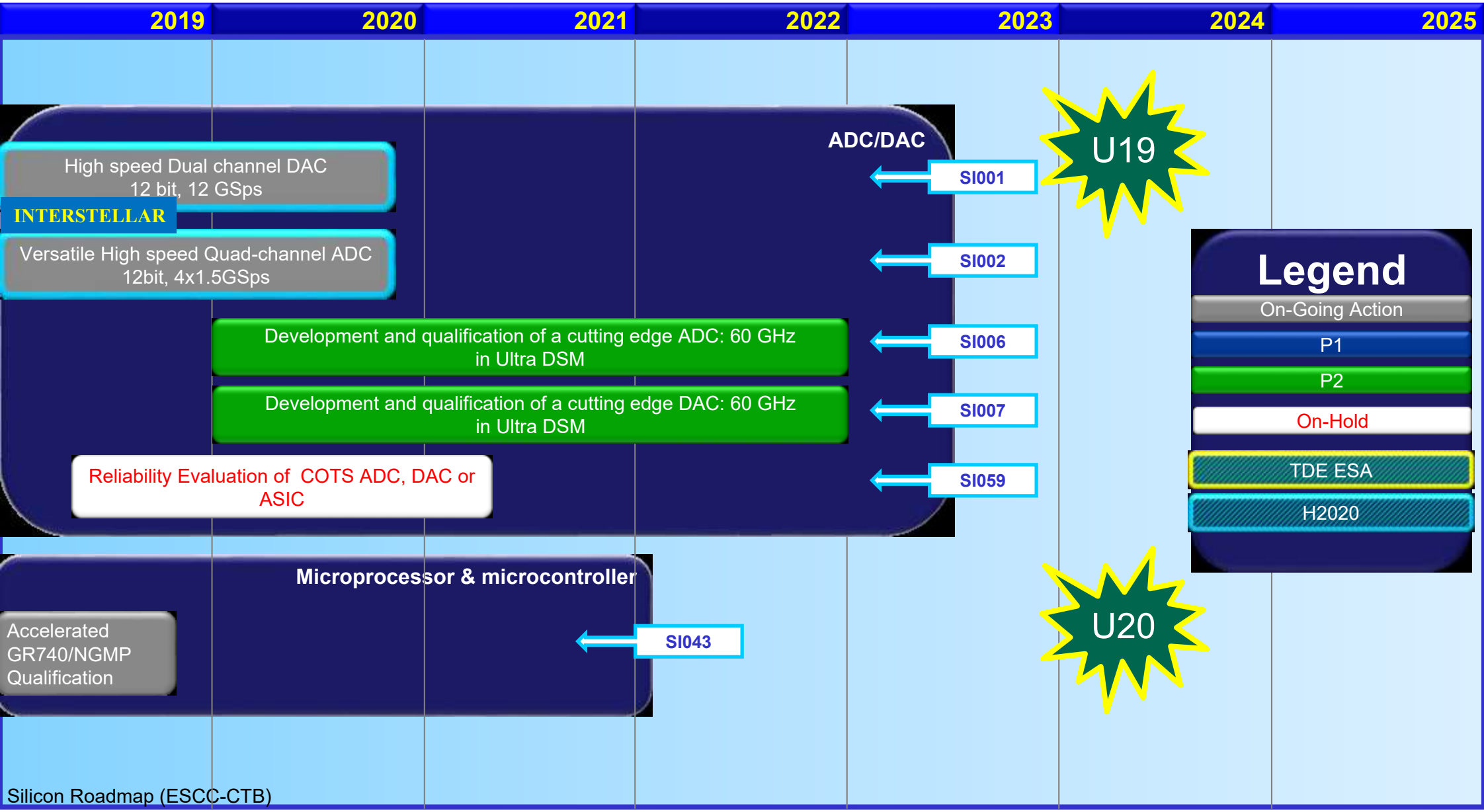
Disclaimer: The links with JTF domains (Uxx, Nxx) are given as an illustration of the thematic of the corresponding actions. It does not mean that these JTF domains are limited to those CTB actions only. It does not mean that these CTB actions are the priority elected by these JTF domains.

Processing & Power 2/5



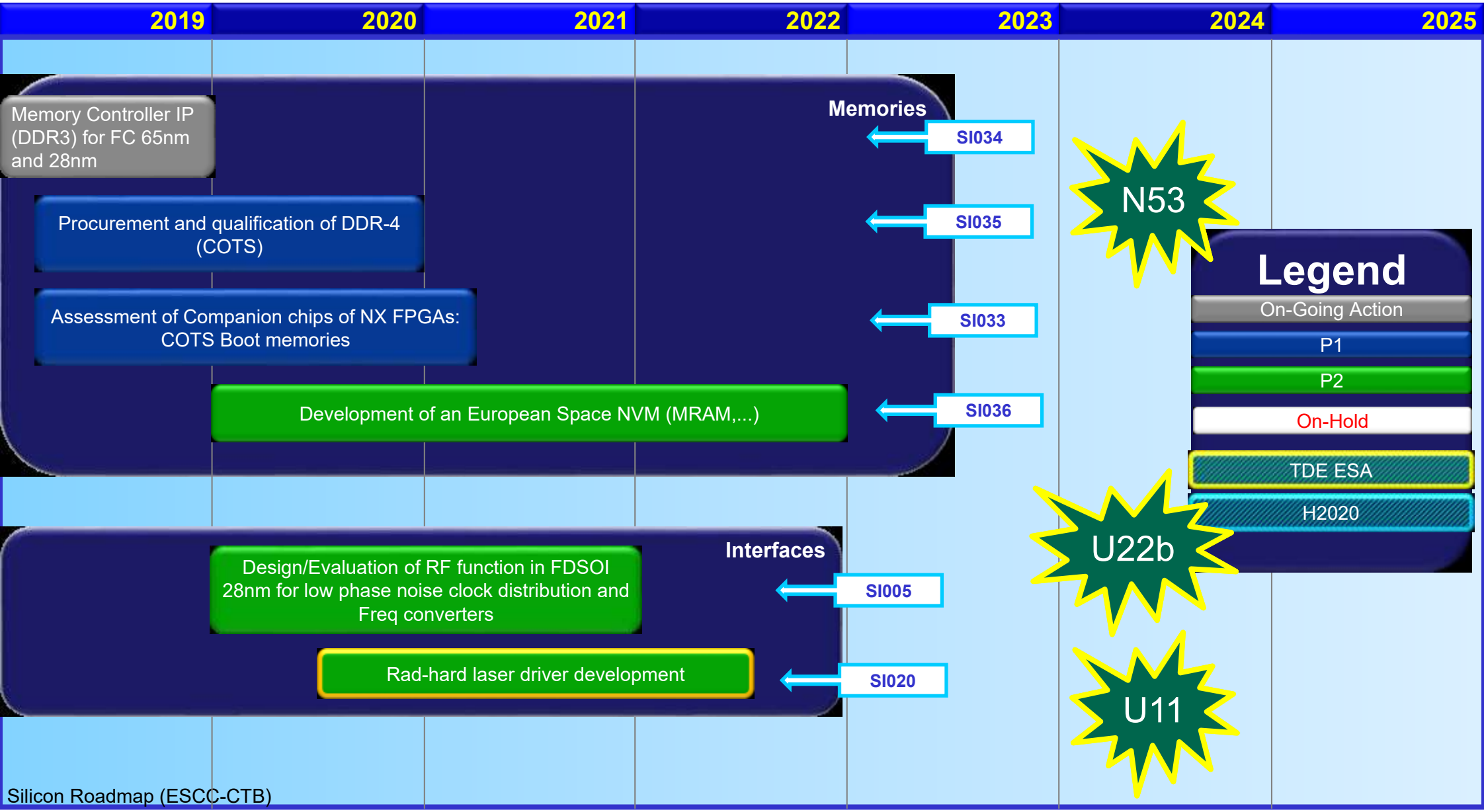
Disclaimer: The links with JTF domains (Uxx, Nxx) are given as an illustration of the thematic of the corresponding actions. It does not mean that these JTF domains are limited to those CTB actions only. It does not mean that these CTB actions are the priority elected by these JTF domains.

Processing & Power 3/5



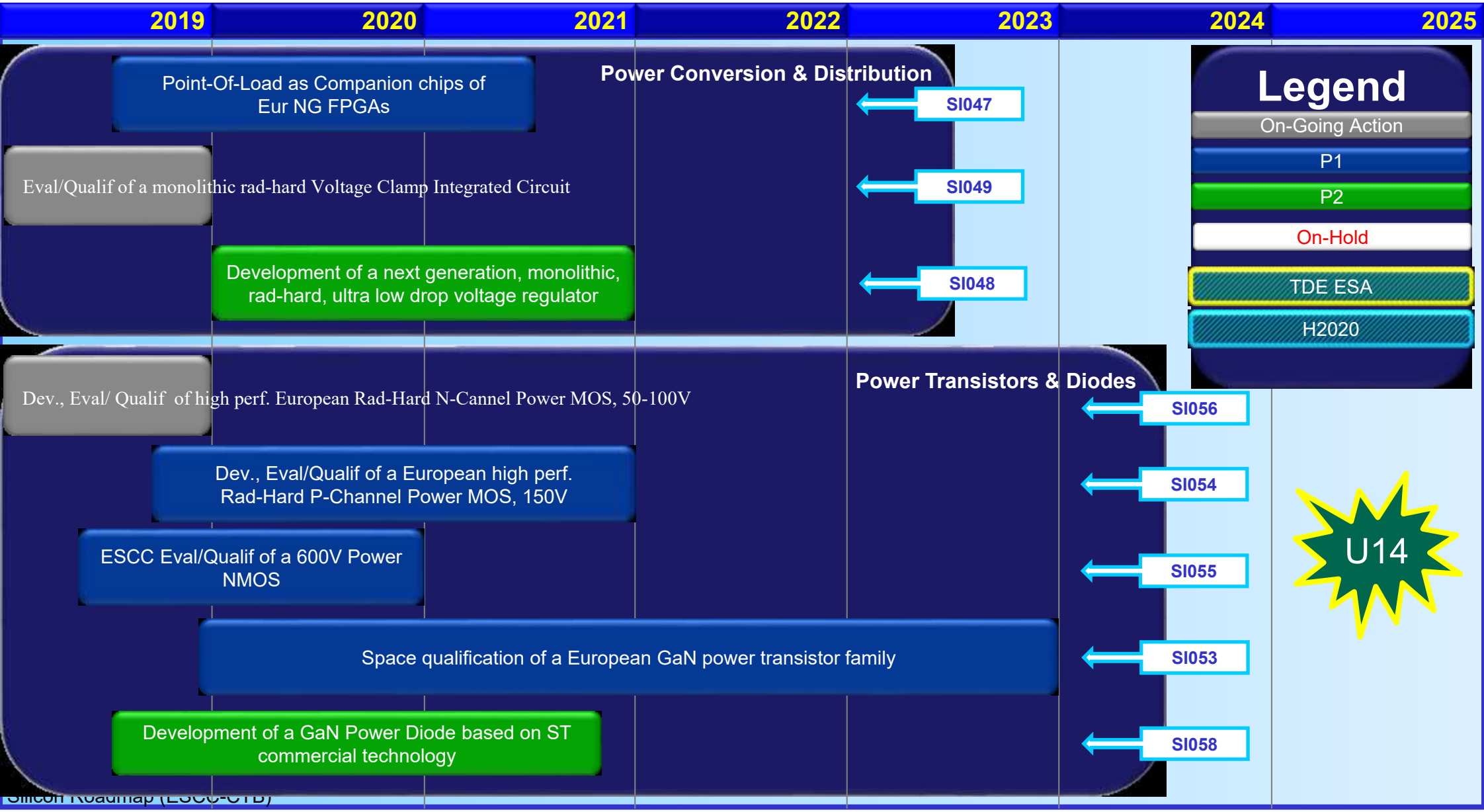
Disclaimer: The links with JTF domains (Uxx, Nxx) are given as an illustration of the thematic of the corresponding actions. It does not mean that these JTF domains are limited to those CTB actions only. It does not mean that these CTB actions are the priority elected by these JTF domains.

Processing & Power 4/5



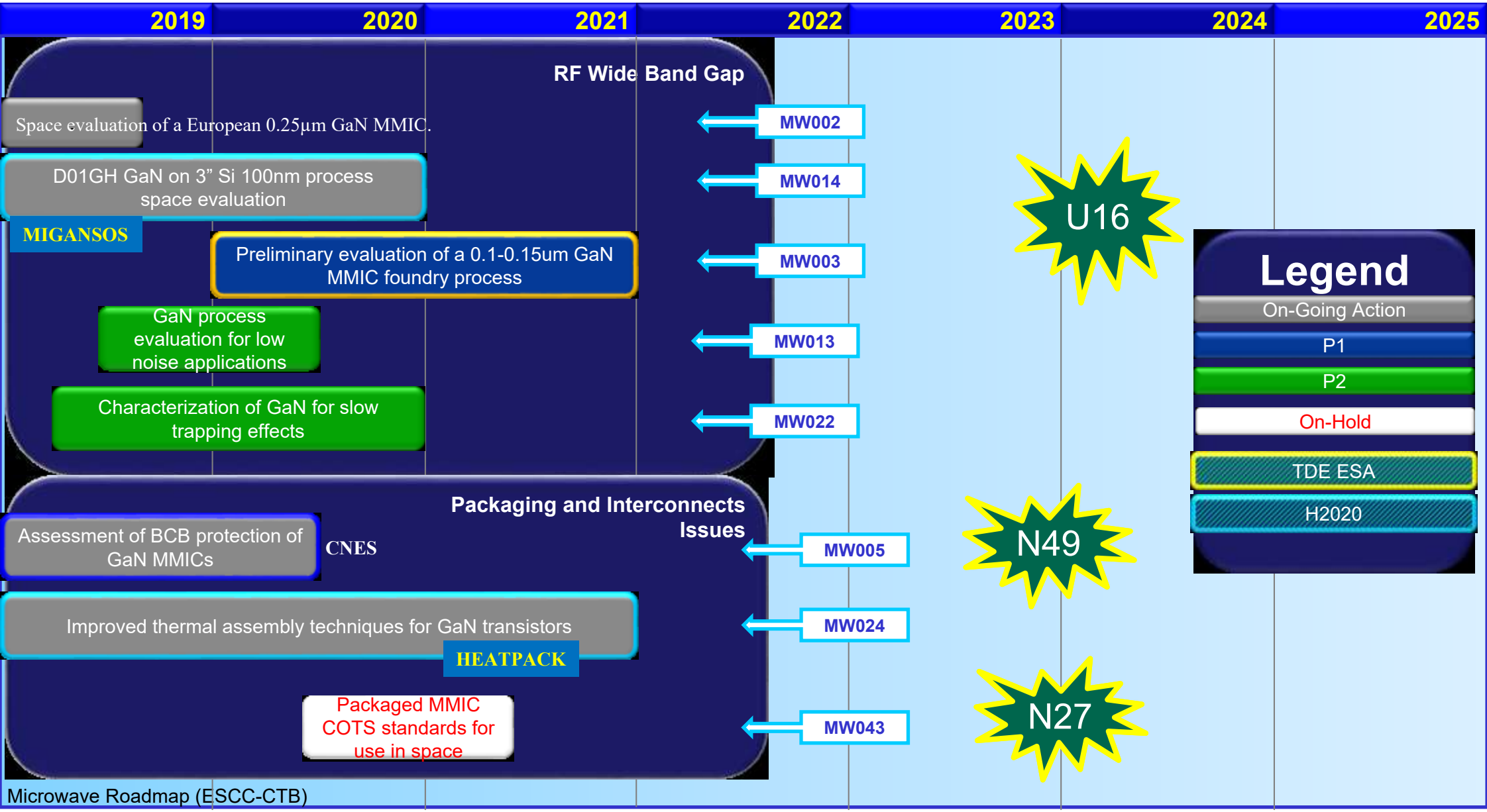
Disclaimer: The links with JTF domains (Uxx, Nxx) are given as an illustration of the thematic of the corresponding actions. It does not mean that these JTF domains are limited to those CTB actions only. It does not mean that these CTB actions are the priority elected by these JTF domains.

Processing & Power 5/5



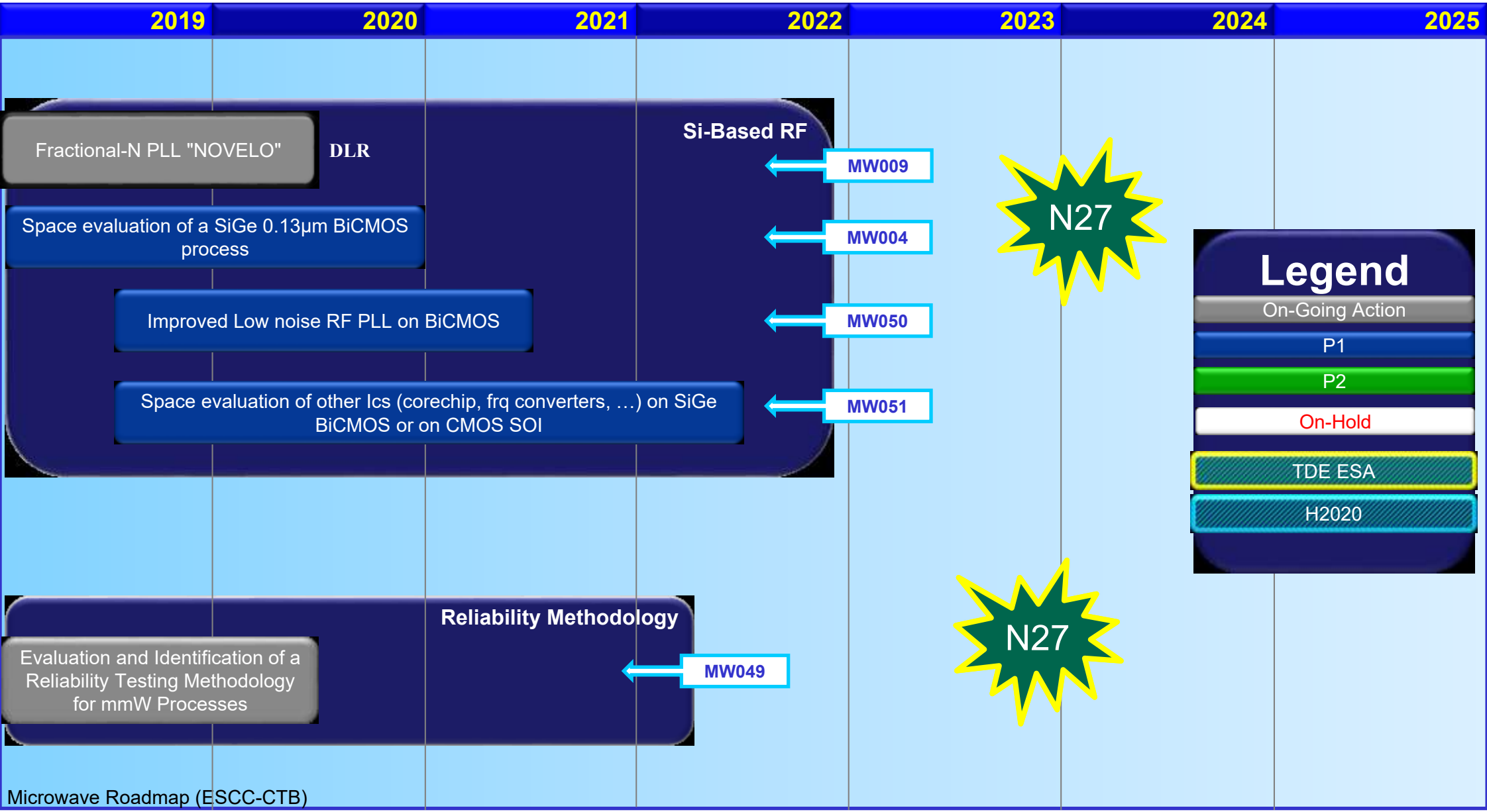
Disclaimer: The links with JTF domains (Uxx, Nxx) are given as an illustration of the thematic of the corresponding actions. It does not mean that these JTF domains are limited to those CTB actions only. It does not mean that these CTB actions are the priority elected by these JTF domains.

Microwave 1/2



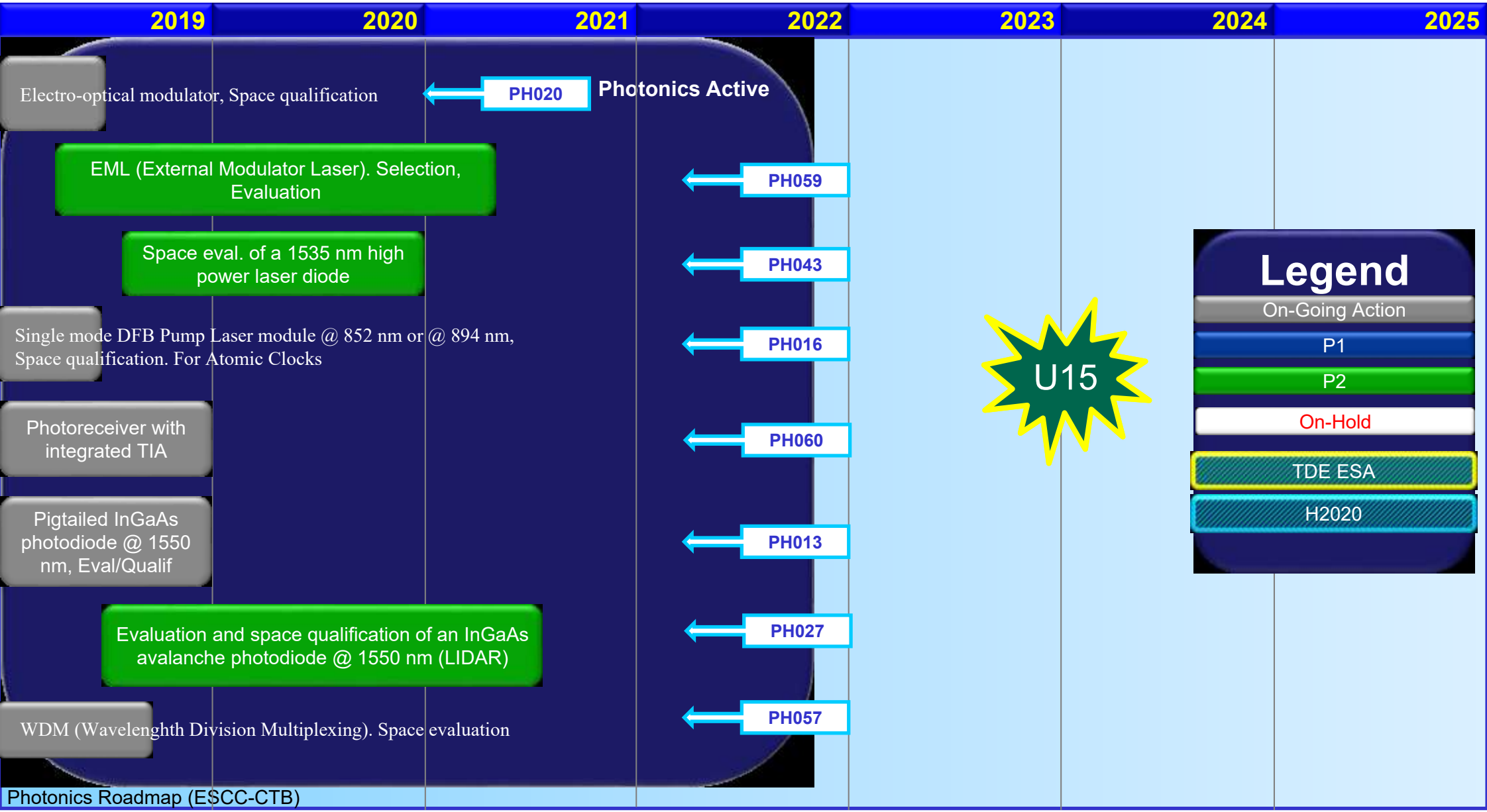
Disclaimer: The links with JTF domains (Uxx, Nxx) are given as an illustration of the thematic of the corresponding actions. It does not mean that these JTF domains are limited to those CTB actions only. It does not mean that these CTB actions are the priority elected by these JTF domains.

Microwave 2/2



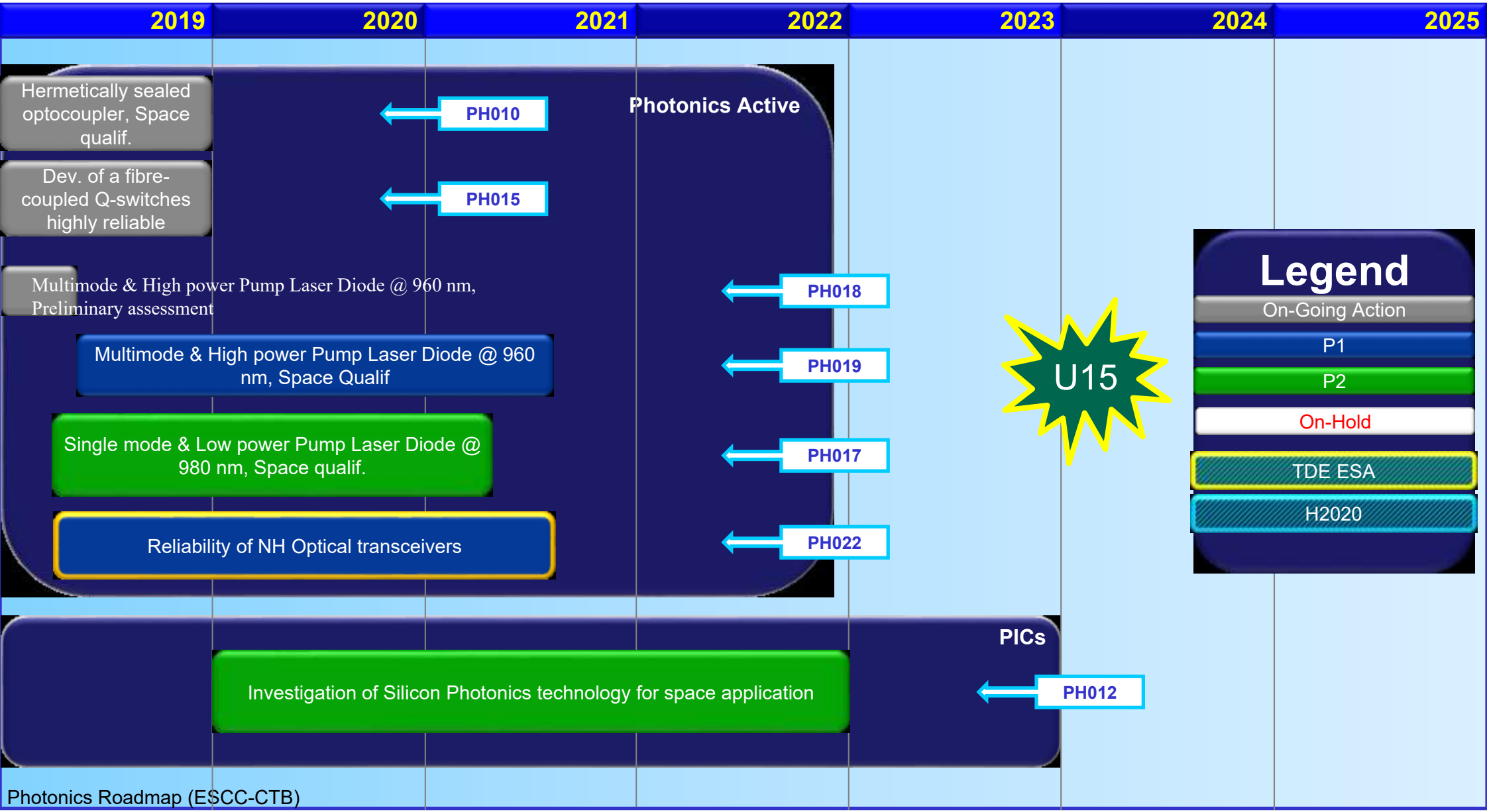
Disclaimer: The links with JTF domains (Uxx, Nxx) are given as an illustration of the thematic of the corresponding actions. It does not mean that these JTF domains are limited to those CTB actions only. It does not mean that these CTB actions are the priority elected by these JTF domains.

Photonics 1/3



Disclaimer: The links with JTF domains (Uxx, Nxx) are given as an illustration of the thematic of the corresponding actions. It does not mean that these JTF domains are limited to those CTB actions only. It does not mean that these CTB actions are the priority elected by these JTF domains.

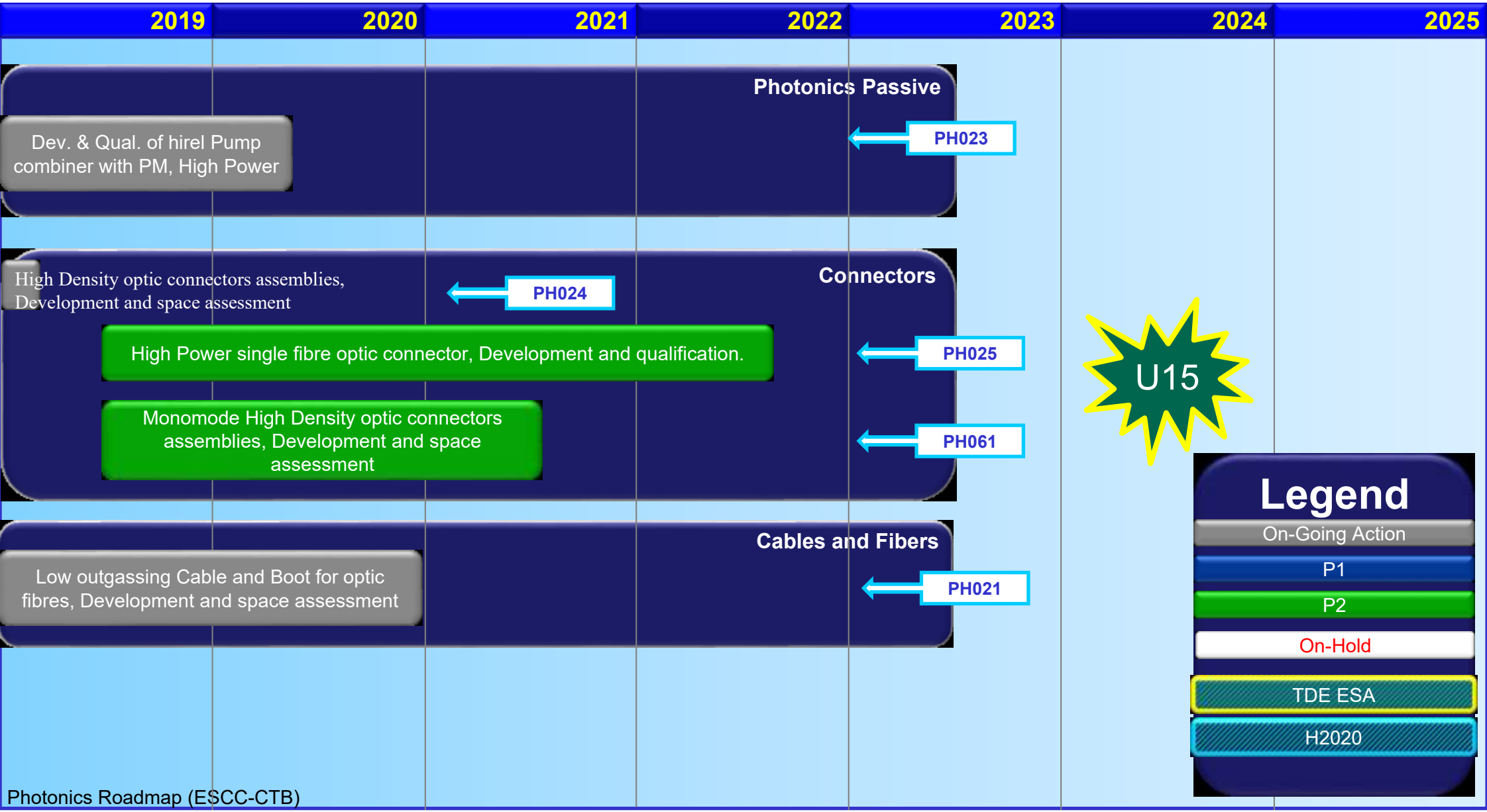
Photonics 2/3



Disclaimer: The links with JTF domains (Uxx, Nxx) are given as an illustration of the thematic of the corresponding actions. It does not mean that these JTF domains are limited to those CTB actions only. It does not mean that these CTB actions are the priority elected by these JTF domains.

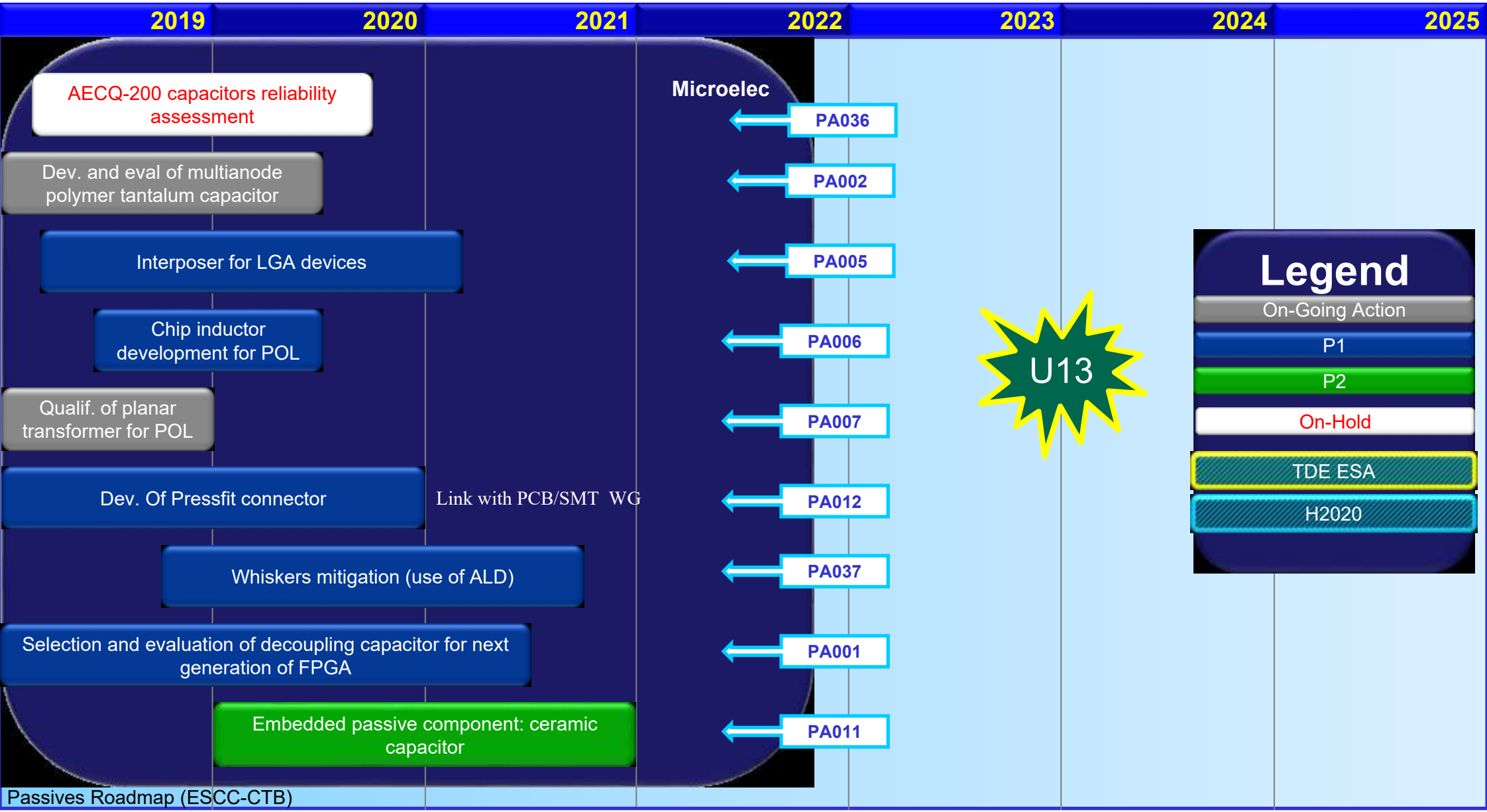
Photonics 3/3

ESCC / CTB
European Space Components Coordination
Components Technology Board



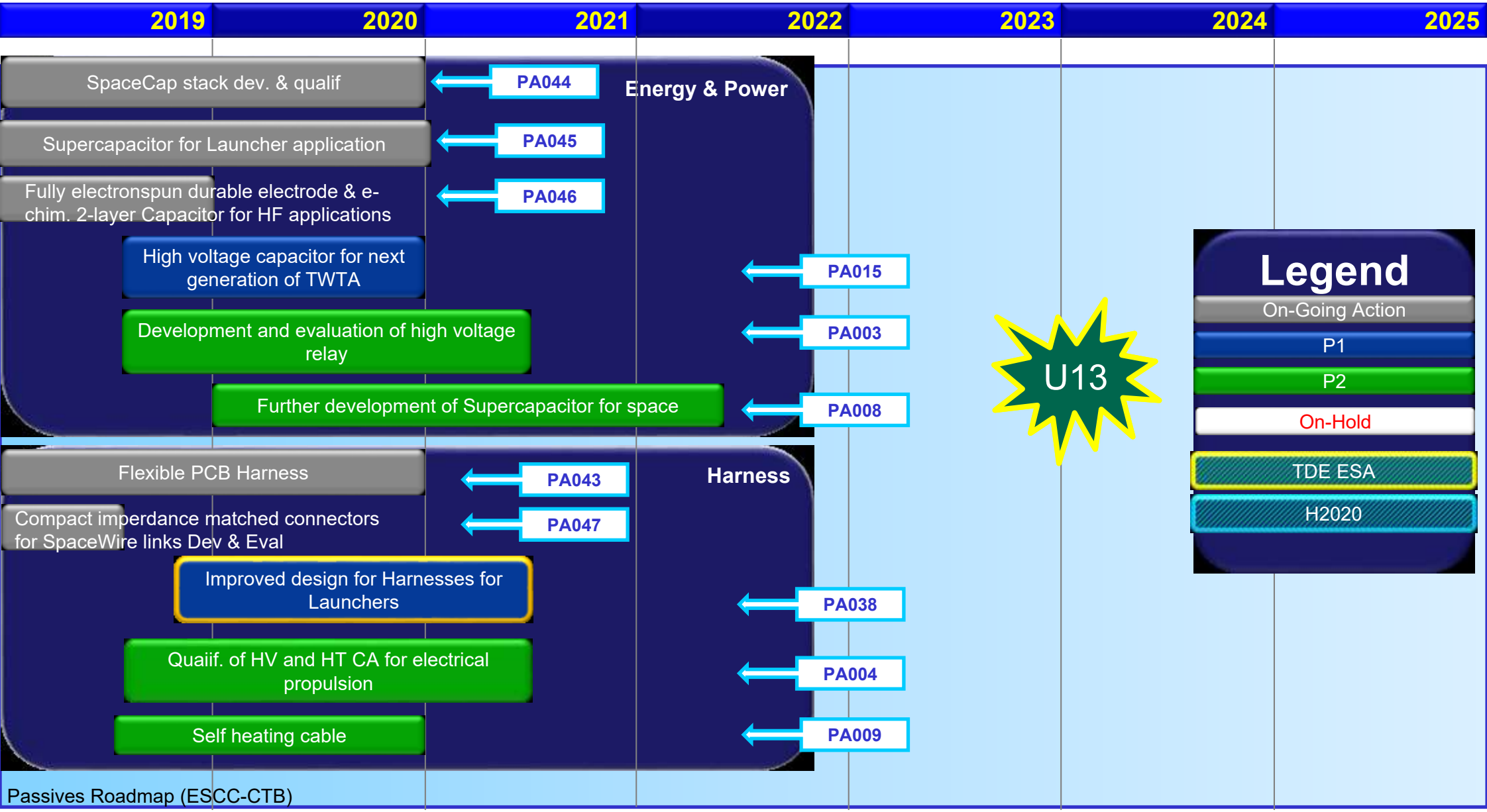
Disclaimer: The links with JTF domains (Uxx, Nxx) are given as an illustration of the thematic of the corresponding actions. It does not mean that these JTF domains are limited to those CTB actions only. It does not mean that these CTB actions are the priority elected by these JTF domains.

Passives 1/2



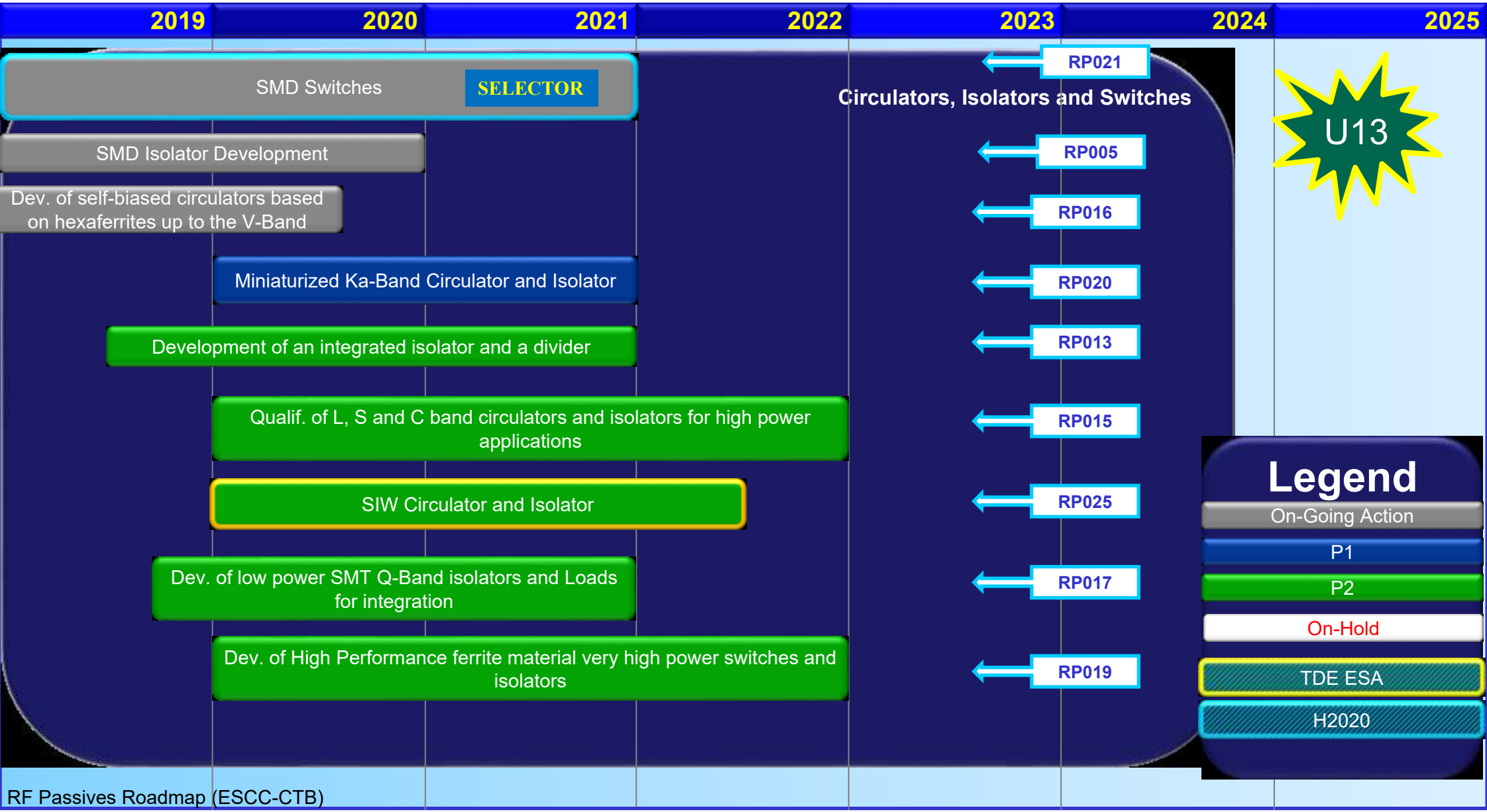
Disclaimer: The links with JTF domains (Uxx, Nxx) are given as an illustration of the thematic of the corresponding actions. It does not mean that these JTF domains are limited to those CTB actions only. It does not mean that these CTB actions are the priority elected by these JTF domains.

Passives 2/2



Disclaimer: The links with JTF domains (Uxx, Nxx) are given as an illustration of the thematic of the corresponding actions. It does not mean that these JTF domains are limited to those CTB actions only. It does not mean that these CTB actions are the priority elected by these JTF domains.

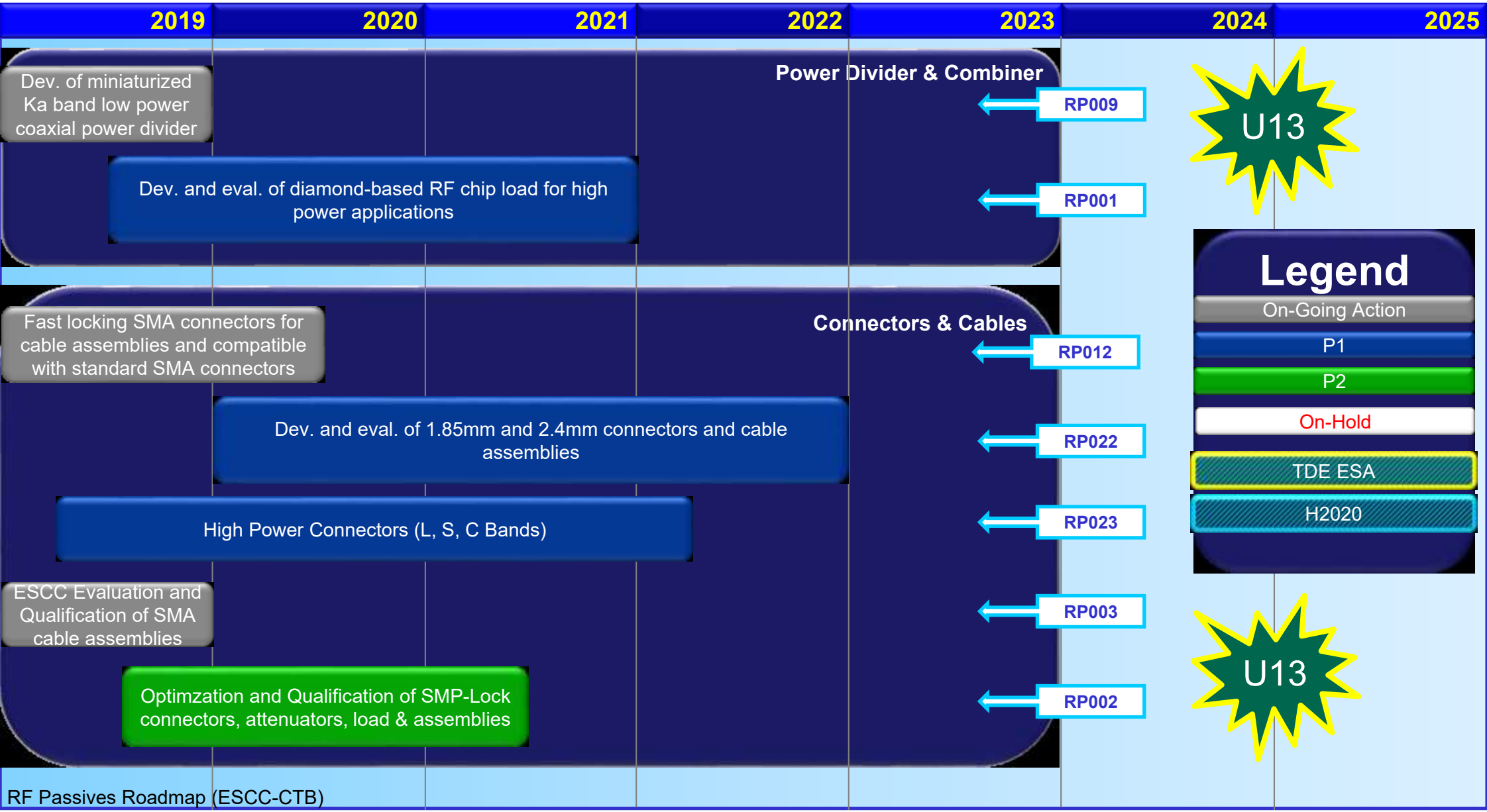
RF Passives 1/2



Disclaimer: The links with JTF domains (Uxx, Nxx) are given as an illustration of the thematic of the corresponding actions. It does not mean that these JTF domains are limited to those CTB actions only. It does not mean that these CTB actions are the priority elected by these JTF domains.

RF Passives 2/2

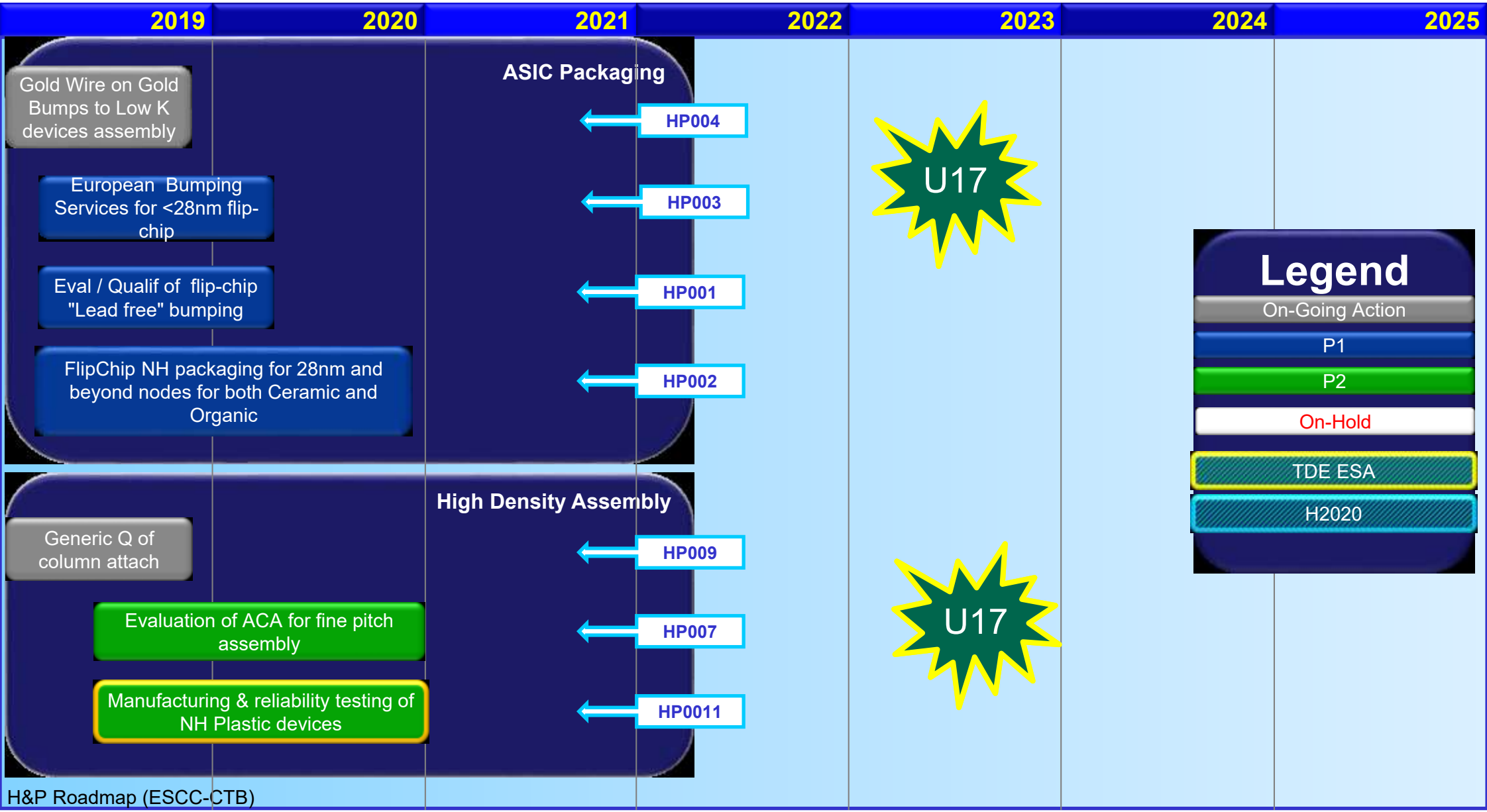
ESCC /CTB
European Space Components Coordination
Components Technology Board



Disclaimer: The links with JTF domains (Uxx, Nxx) are given as an illustration of the thematic of the corresponding actions. It does not mean that these JTF domains are limited to those CTB actions only. It does not mean that these CTB actions are the priority elected by these JTF domains.

ESCC / CTB Hybrids and Packaging 1/2

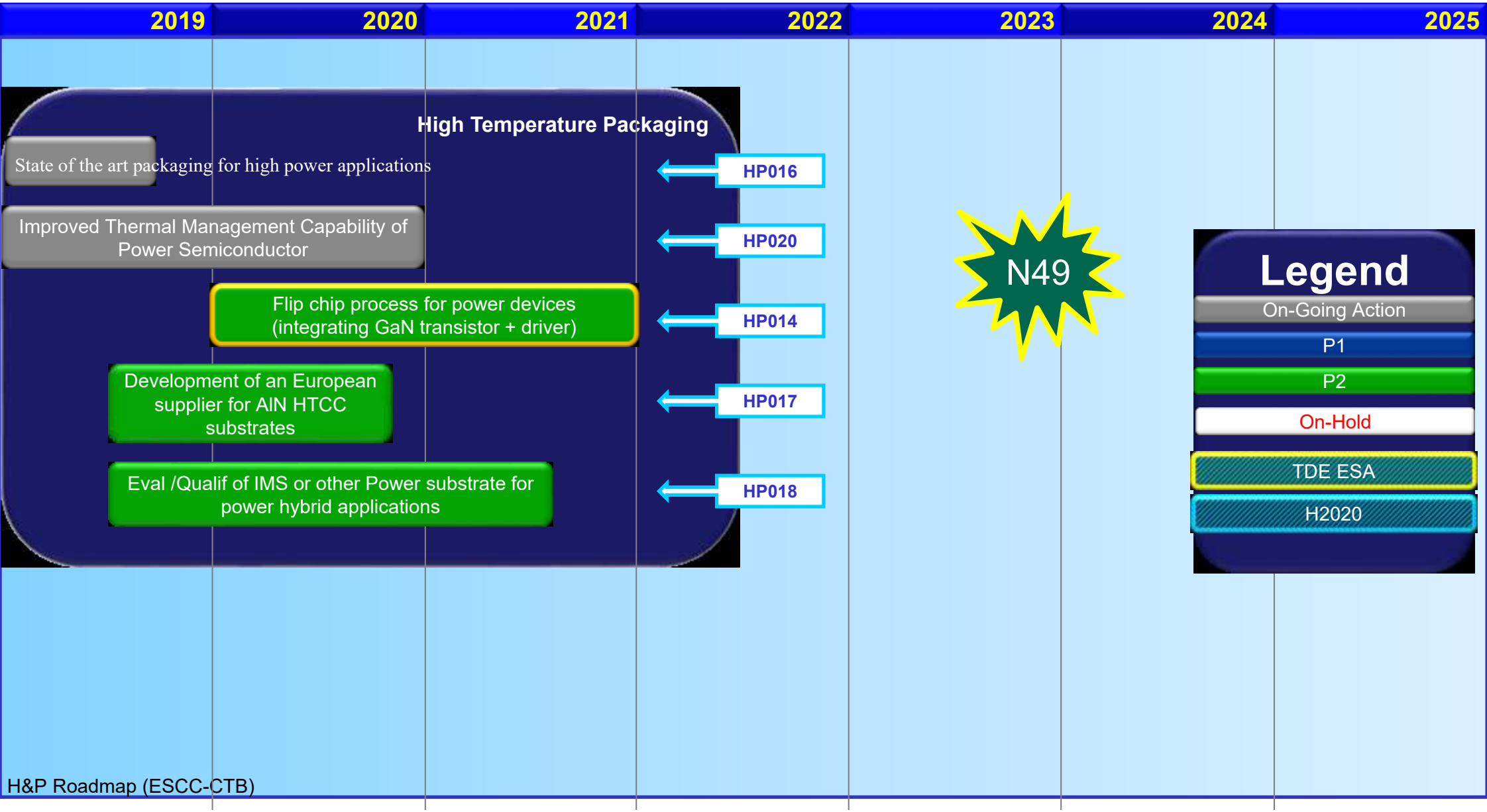
European Space Components Coordination — Components Technology Board



Disclaimer: The links with JTF domains (Uxx, Nxx) are given as an illustration of the thematic of the corresponding actions. It does not mean that these JTF domains are limited to those CTB actions only. It does not mean that these CTB actions are the priority elected by these JTF domains.

ESCC / CTB Hybrids and Packaging 2/2

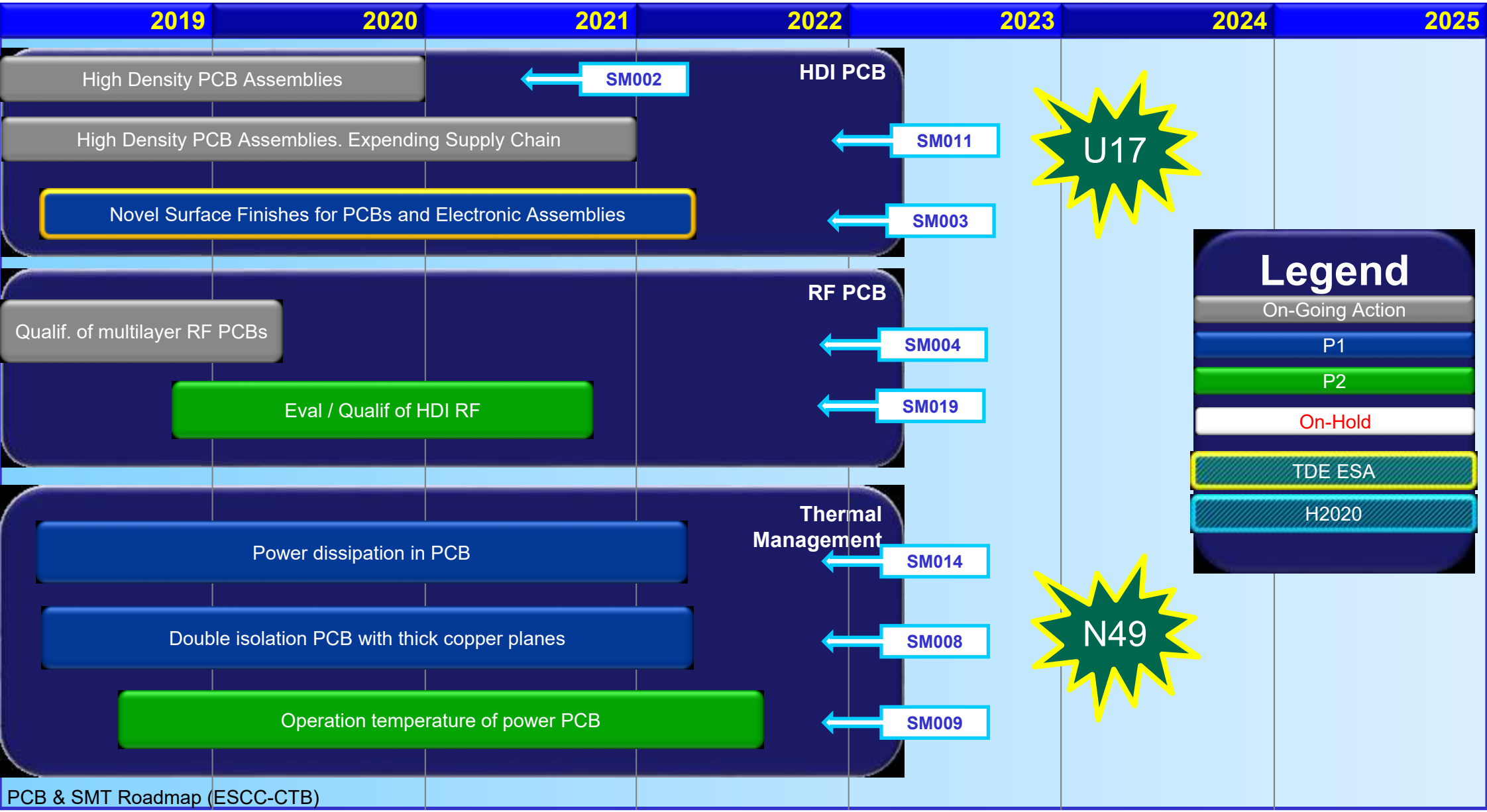
European Space Components Coordination — Components Technology Board



Disclaimer: The links with JTF domains (Uxx, Nxx) are given as an illustration of the thematic of the corresponding actions. It does not mean that these JTF domains are limited to those CTB actions only. It does not mean that these CTB actions are the priority elected by these JTF domains.

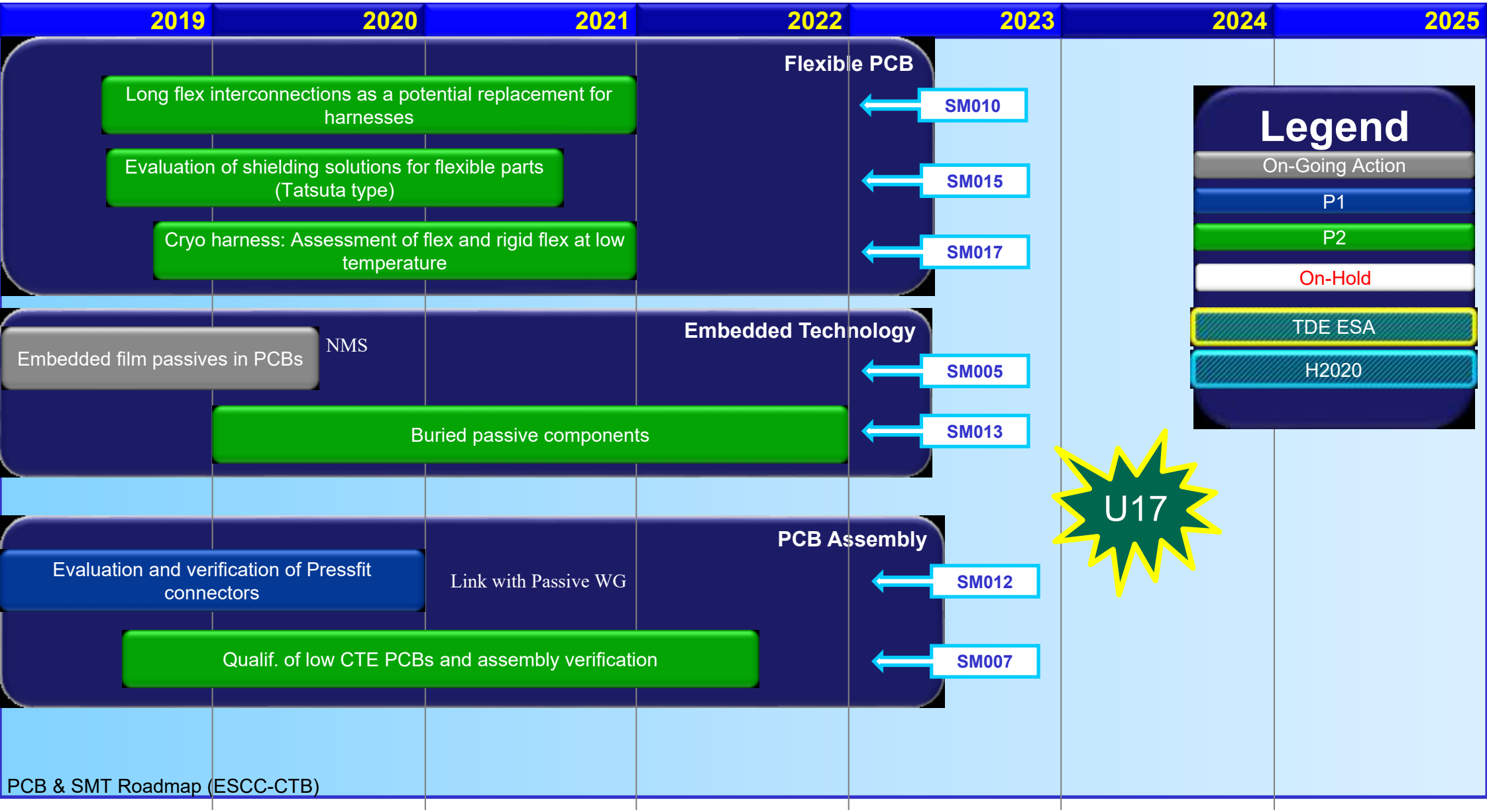
ESCC /CTB
European Space Components Coordination
Components Technology Board

PCB and SMT 1/2



Disclaimer: The links with JTF domains (Uxx, Nxx) are given as an illustration of the thematic of the corresponding actions. It does not mean that these JTF domains are limited to those CTB actions only. It does not mean that these CTB actions are the priority elected by these JTF domains.

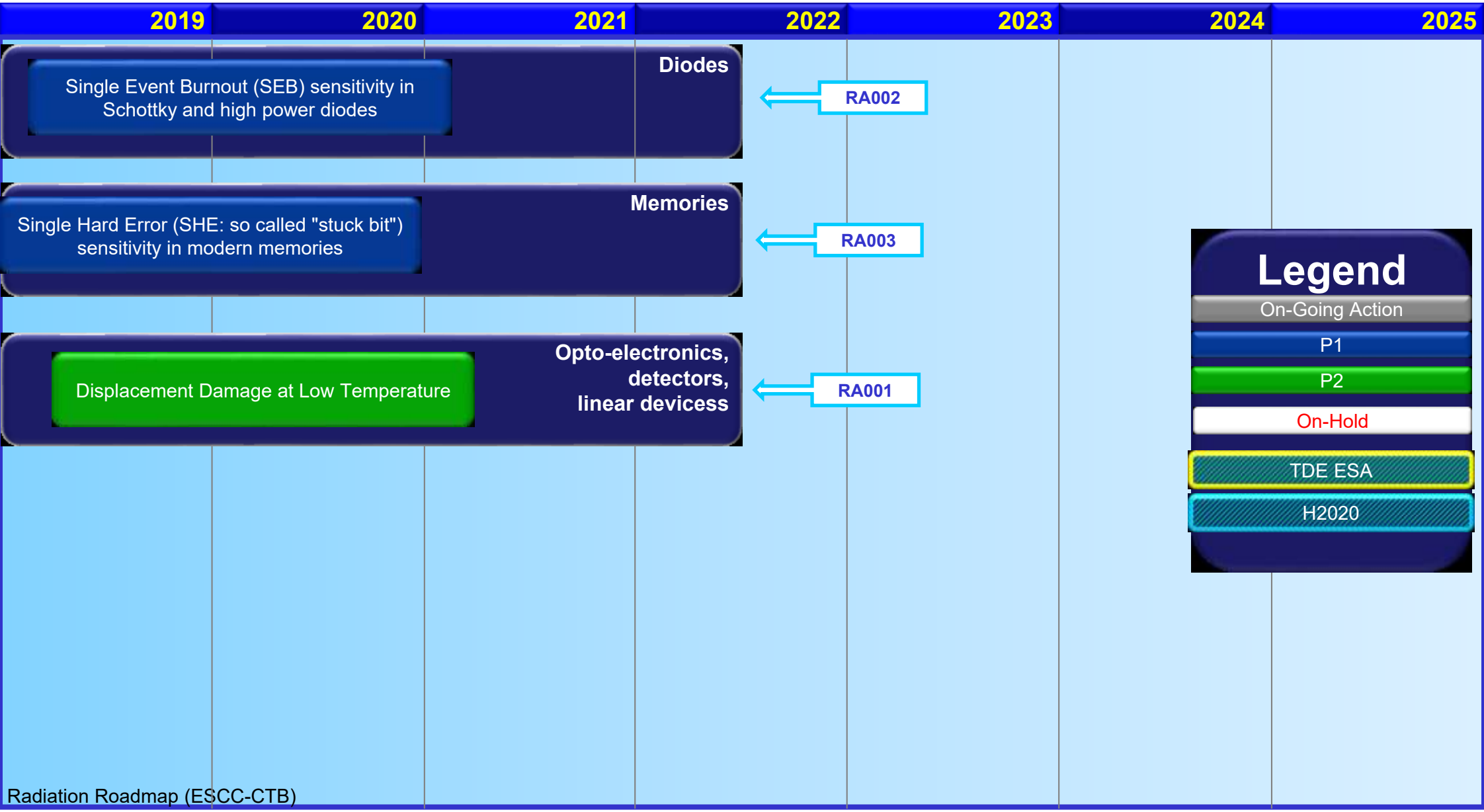
PCB and SMT 2/2



Disclaimer: The links with JTF domains (Uxx, Nxx) are given as an illustration of the thematic of the corresponding actions. It does not mean that these JTF domains are limited to those CTB actions only. It does not mean that these CTB actions are the priority elected by these JTF domains.

ESCC /CTB
European Space Components Coordination
Components Technology Board

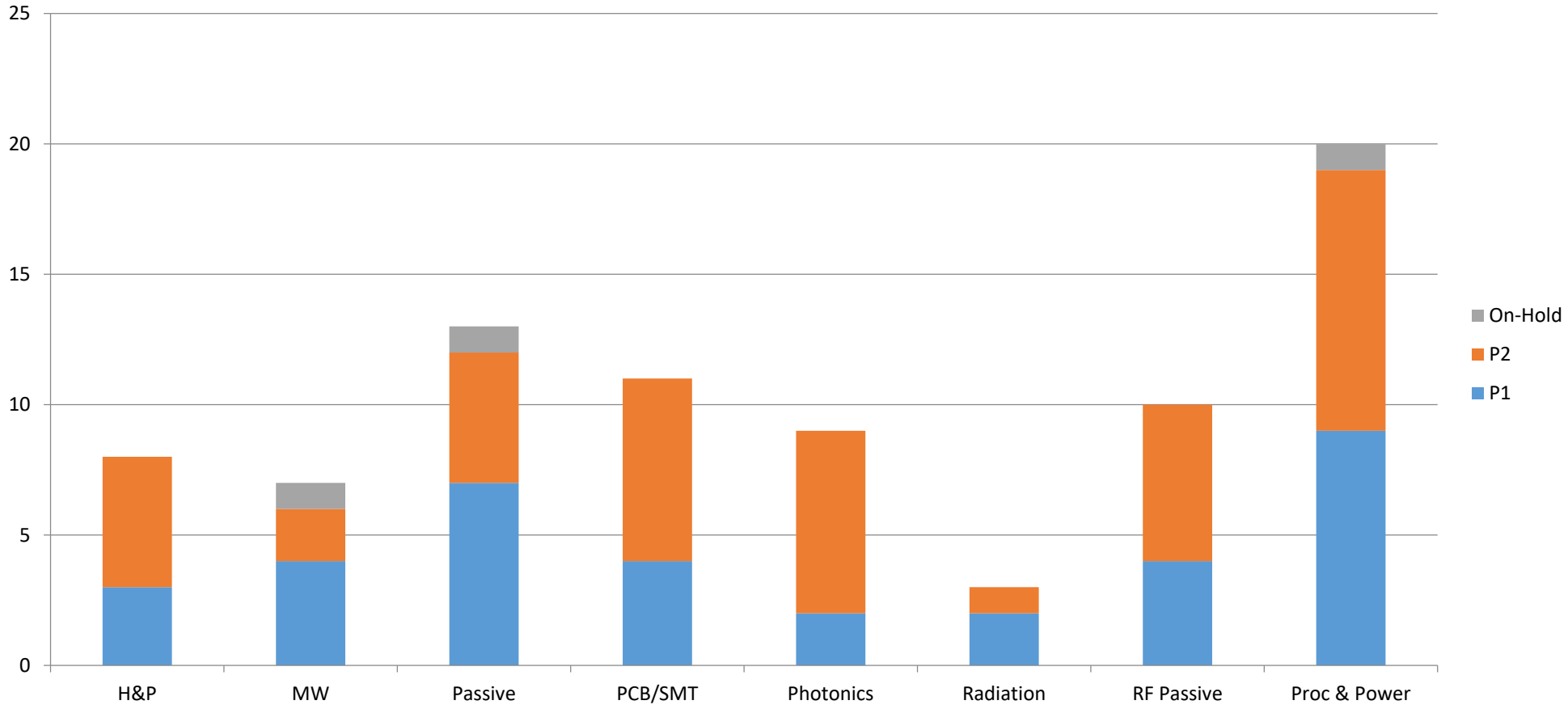
Radiation



Disclaimer: The links with JTF domains (Uxx, Nxx) are given as an illustration of the thematic of the corresponding actions. It does not mean that these JTF domains are limited to those CTB actions only. It does not mean that these CTB actions are the priority elected by these JTF domains.

Number of activities

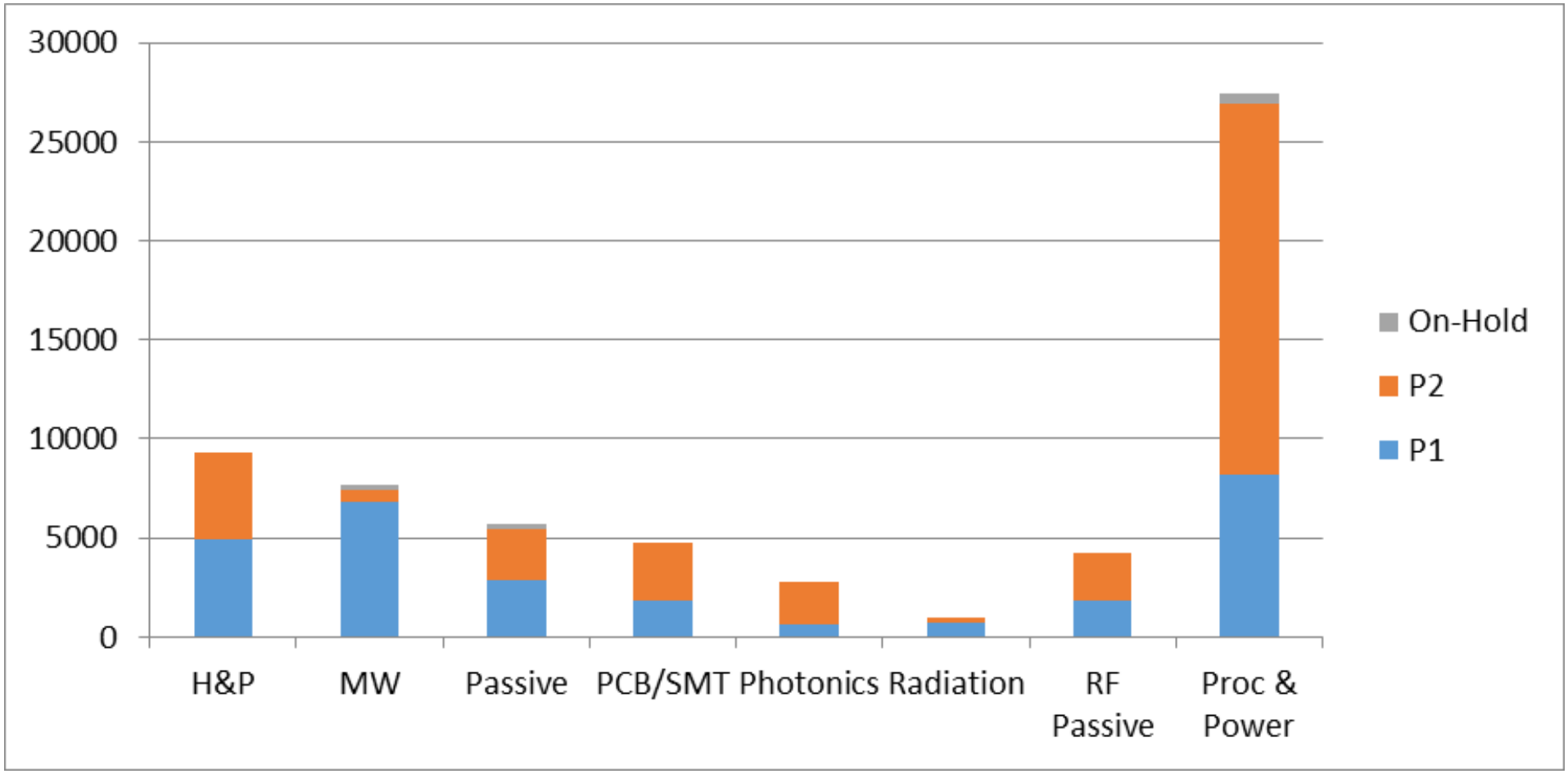
P1: 37
P2: 45
(+3 for On-Hold)



P3: 56
P4: 56
+ tbd: 27

Budget (k€)

P1: 27 720 / 4y
P2: 35 140 / 4y
(+1 000 On-Hold)



Technological Trends and Needs (1/2)

- Specific action on "**commercial components**" on-going at CTB: identified needs and priorities
- Ultra Deep Sub Micron digital technologies : sub-22nm transistor-based: investigation on radiation hardness of thinnest nodes (FinFET or FDSOI).
- Photonic components (for example laser diodes, photo-detectors, modulators, amplifiers, …) from first generation (to be space evaluated) to PICs
- Advanced PCBs: higher level of integration, high frequency / high data rate capability, embedded components for higher integration, improved power dissipation, photonic connection, …
- System-in-package for high integration combining and associating digital, microwave and photonic chips. This includes advanced concepts such as WLP (Wafer Level Packaging, Fan-in or Fan-out), 2.5D or 3D integration,
- Embedded FPGA and on-chip NVM
- Companion chips for UDSM: memories, passives

Technological Trends and Needs (2/2)

- Next generations of microwave power transistors : GaN for Ka, Q, V, W-bands, GaN on diamond
- RF/mW on Silicon (RF CMOS, BiCMOS SiGe, …)
- High pin count packages & package-less reliable assembly
- Active discrete power components for space. In particular, a power GaN supply chain in EU, would relieve an issue for European non-dependence.
- Advanced glues: high temperature, anisotropic
- 3D Additively manufactured parts, heterogeneous (metals, ceramics, organics) to improve or complement packages and boards
- Advanced materials (graphene-based, CNT-based, etc.) for ultimate thermal dissipation at the level of electronic circuits, boards or units.

Pb-free Transition

The ESCC SCSB is launching a joint task force consisting of MPTB and CTB members **on Pb-free transition**

Issues addressed (but not limited to):

- Lessons learnt from out of space sector?
- Tin-whisker mitigation and risk assessment
- Lead-free solders and assembly processes
- Accelerated tests for verification of Pb-free materials and processes and qualification of components
- Acceptance criteria for Pb-free materials, processes and components
- …

- Facilitator: Agustin Coello-Vera (REACHLaw)
- Contacts: Paavo Heiskanen (ESA, MPTB Chair), Jean-Louis Cazaux (Eurospace, CTB Chair)

A roadmap, to do what?

- ✓ The CTB Roadmap is a vision which is shared, agreed and approved by a very large professionnal community: all European agencies, industries and big component manufacturers
- ✓ It is updated every year
- ✓ It gives directions for the next 4-5 years
- ✓ It is an useful input for JTF (Joint Task Force ESA-EC-EDA) Harmonization, for H2020-SPACE program, for future ESA initiative (?), for decision makers…