



**Barcelona
Supercomputing
Center**

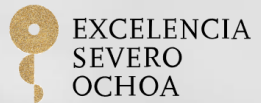
Centro Nacional de Supercomputación

HPC@BSC: from Code to Arch Series

LOCA initiatives: inter-departmental
collaboration as a key of success

Teresa Cervero

teresa.cervero@bsc.es



14/12/2023

BSC

 LOCA

1. Severo Ochoa (2023-2026) Summary

BSC's Strategic Plan 2023-2026

Vision: BSC is the world's leading research centre on the **Open HPC Stack and grand challenge applications**, providing a research environment that promotes inclusive and equitable career development, engages with society, and transfers knowledge and technology for a sustainable future

1 Leading the EU Exascale Open Stack and Applications

Apps	Climate	Personalised Medicine	Clean Energy
	Libraries and Platforms		
Stack	System Software		
	Co-designed Specialised Hardware		

- **Open HW/SW Exascale stack co-design team**
- **Engineers in residence** programme
- **International networking** with key institutions
- **AI MSCA Cofund**
- **Training actions** for LOCA community (BETC, Summer School, ...)

Key Actions in SO3

2 Gender and Diversity

Gender in Research

Gender in Careers

Networking

- **Female talent attraction** (top-ups, internships, ...)
- **Female talent retention** (mentoring, seminars, ...) and **leadership promotion**
- **Cultural change** management
- Include **gender perspective** in research

3 Skills Training

For Researchers, Students and Academia

For HPC Users

For Industry

- **Outgoing and incoming mobility calls**
- **EuroMaster4HPC**
- **BSC PhD mentoring and training programs, Doctoral Symposium, SORS**
- **Women in STEM** event
- **HPC Users/LOCA Training Courses**

4 Science with and for Society

HPC Ecosystem

Science Education

Science & Culture

- **HPC entrepreneurial community building**
- Launch an **on-line platform (2025)** for **networking** and accelerating services
- Creation and acceleration of **spin-offs**, maintenance of **BSC patent portfolio**
- Participation in **key events**

SO Executive committee

Eduard Ayguadé

PI

PMO

Eugene Griffiths



Leading the EU Exascale Open Stack and Apps

Teresa Cervero



Gender and Diversity

G&E: Maria Gracia
HHRR: Marc Gonzalez



Skills Training

Maria Ribera



Science with and for Society

TT: Anna Escoda
Outreach: Nuria Noriega

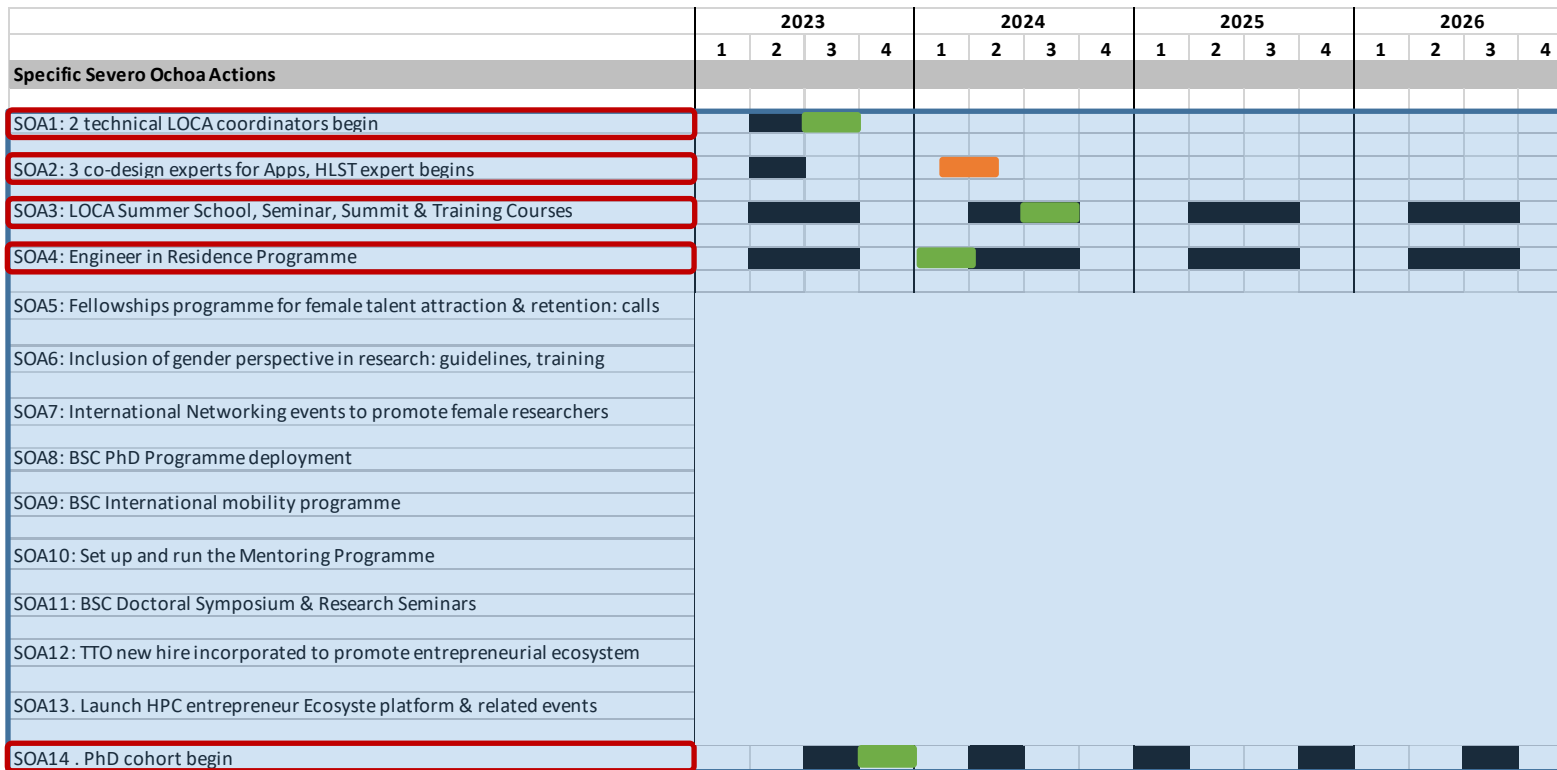
- Periodic meeting (later every 1,5 months)
 - Monitor actions by each SO unit
 - Revise milestones and indicators
 - Define action plans to achieve milestones and indicators

Milestones

The full **milestones for the 2023-26** period can be seen in the Gantt chart in the following slides. There are **46 lines entries in total**, and many have multiple milestones:

- **14 Specific SO actions**
- 14 on research outcomes
- 7 on external sources of funding
- 3 for recruiting and training (in addition to the many specific SO actions in this field)
- 3 related to tech transfer and communication (in addition to the specific SO actions in this field)
- 3 for Infrastructure
- 2 on organisational issues

Gantt Milestones & Actions



Gantt Milestones & Actions

	2023				2024				2025				2026			
	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
Research Output																
Annual publications analysis report					■				■				■			
RISC-V core and accelerator releases for SDV and tape-out	■		■		■		■		■		■		■		■	
New releases of BSC performance analysis/prediction tools			■				■				■				■	
Releases of BSC programming models and libraries for node and workflows			■				■				■				■	
Personalised medicine environment: data and simulations				■								■				■
Spanish language NLP platform releases			■				■		■		■				■	
Expansion of research Hospitals network			■						■			■				
Forecast enhancement using data assimilation and machine learning									■							
Climate forecast systems with realistic model processes														■		
Creation and improvement of operational services for key sectors							■									
Combustion platform releases				■				■				■				■
High-precision CFD platform releases			■				■				■				■	
Urban digital twin platform releases	■	■			■	■			■	■			■	■		

Gantt Milestones & Actions

	2023				2024				2025				2026			
	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
External Sources of Funding																
Renew strategic projects (IT & applications) with companies		■		■	■			■			■	■			■	
Renewal of EU funding for EPI and the CoEs			■	■							■					
BSC leading role in Framework Partnership on Open Software and Hardware						■										
Renewal air quality contracts with AEMET and Generalitat			■													
Start Destination Earth contracts				■												
Renewal Big national Natural Language Processing contract					■											
Host new ERC grantees			■				■				■				■	
Recruiting and Training																
Incorporation of new, full time, Gender Equality Officer		■														
Training on Horizon Europe (PROMOTHE project)	■	■	■													
EuroMaster4HPC master program: pilot, evaluation	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■

Gantt Milestones & Actions

	2023				2024				2025				2026			
	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
Technology Transfer and Communication																
5 New Spin-offs created				■				■				■				■
New Scientific culture unit created			■													
Launch of the new MareNostrum site opened to the public							■	■								
Infrastructure																
EuroHPC pre-Exascale machine begins production (MN5)				■												
150PB & 400PB data facilities in place				■				■								
Quantum computer installed, accessible to users				■												
Organisation																
Implementation of Improvements following Process Audit of support areas			■	■												
Group Leader/PI committee created																

Indicators

For a) **High impact scientific publications**, we include % Publications in Q1, aiming to increase the % in the first quartile to 80%. This is a good indicator to evaluate the quality of the scientific production, citations will also be taken into account.

For b) **Other outcomes** with high scientific, societal or economic impact we consider:

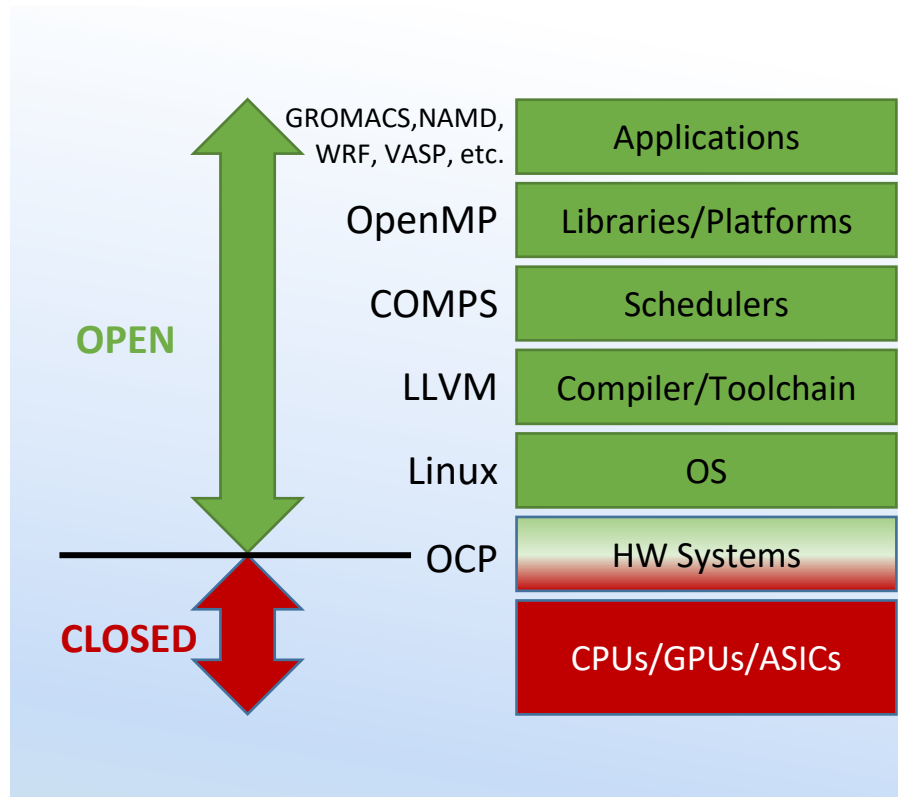
- i. the **number of BSC spin-offs in business**, as an indicator of the capacity of the centre to transfer IP generated from the research activities, which we expect to rise to sixteen by 2024;
- ii. the **RISC-V core and accelerator releases for SDV** (Software Development Vehicle) **and tape-outs**, as an indicator of the capacity to evolve the designs and turn them into real silicon, an important achievement in order to produce EU technology. The target is to have eight; and
- iii. The **number of applications included in the LOCA co-design programme**, the objective is to have 2 per applications department, so 6 in total.

For c) Talent attraction and retaining, pre-doctoral and postdoctoral training, we included an indicator concerning the number of **LOCA programme PhD students working on co-design**. We expect to have 46 **10** of them. We also include the number of **women scientists** hired through support from the Severo Ochoa **Gender programme**, where we expect to have 6 new hires.

For d) **External sources of funding**, either competitive or non-competitive, we included: 1) the number of important bilateral agreements with companies; and 2) an indicator of the return from the EU Framework Program, aiming at improving on the excellent results obtained so far. Both indicators reflect the capacity of the Centre to attract competitive funding to support the research activities and the transfer of technologies to companies.

2. LOCA Severo Ochoa (SO) overview

LOCA@BSC: Laboratory for Open Computer Architectures



LOCA Big Picture

- Mechanism to extend open-source ecosystem to include HW
 - Add HW expertise to BSC and European partners, leverage existing SW expertise
 - Intersection of academia and industry
 - Provide proven/usable open source HW
 - Open European HW ecosystem
 - Increase HW R&D in Europe
 - Catalyze HW R&D in ICT industry
 - Global HW R&D and training center

**International impact
(target: Europe)**



4. LOCA SO CO-DESIGN EU Exascale Open-Stack

BSC Board of Directors

Reports

SO Executive Committee

Reports SO actions

LOCA coordination
(Teresa Cervero)

Coordinate/promote



In coordination with:
 (*) SO/E&T
 (**) SO/G and SO/E&T



LOCA.SO

Co-design

- BSC applications/runtimes/architectures codesign
- BSC applications portability/performance study on LOCA architectures/accelerators
- Emerging Technologies Clusters portability/performance study

Op	LS	ES	CASE	CS
PhD cohort (FPI.SO)				

- Engineer in Residence program
- International networking

- LOCA/ACM Summer School and LOCA BETC course (*)
- LOCA Series:
 - HPC@BSC: from Code to Arch
 - Reading club
- Women in STEM event (**)

Sets scope

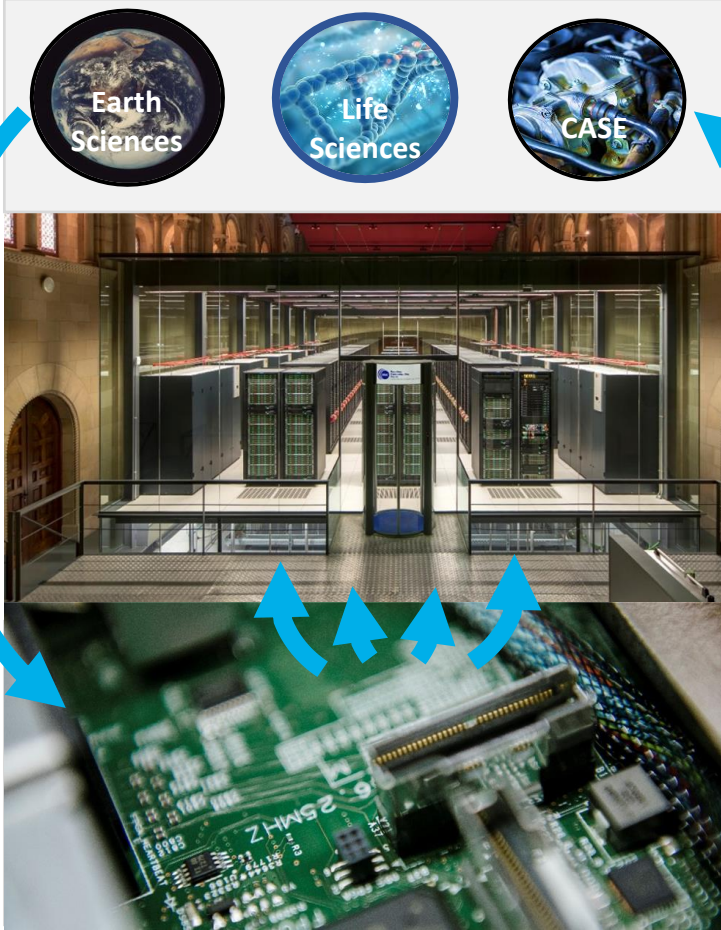
Contributes



BSC full stack: SO codesign cycle

SW
HW

Software/Hardware
Co-Design



HPC Applications

Specialization using
HW/SW Co-Design



European Laboratory for Open
Computer Architecture

HPC Hardware

BSC full stack: SO codesign cycle

SW
HW

Software/Hardware
Co-Design



HPC Applications

HPC services

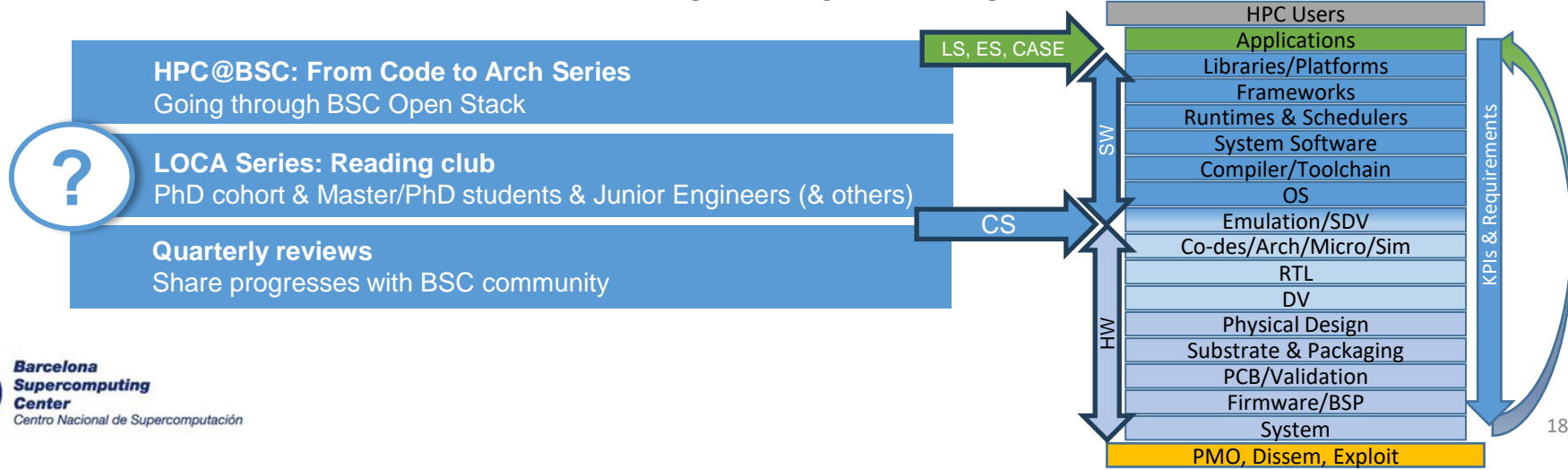


LOCA SO co-design

LOCA SO paves the way towards LOCA@BSC

Goals (I):

- **BSC@HPC-OHSw KNOWLEDGE:** Coordination, promotion, improvement
- **INTER-DEPARTMENTAL INTERESTS:** Combining, sharing, visibilizing interests & collaborations



LOCA SO co-design

LOCA SO paves the way towards LOCA@BSC

Goals (II):

- **TALENT:** Retaining and attracting talent

Engineering In Residence (EiR)

Learning from Experts and Sharing time with them

?

BSC EuroHPC Training Course (BETC)

Specific training on RISC-V@BSC

Women/All In STEM event

Promoting STEM careers (creating vocations & attract talent)

LOCA SO co-design

LOCA SO paves the way toward LOCA@BSC

Goals (III):

- **COMMUNICATION:** Improving communication & interactions
- **FOSTER R&D&I:** Improving research areas and developments visibility among departments
- **CONTACT POINTS:** well-identified pointers to contact with departments

Co-design activities

Departments' applications characterization & improving performance



Co-design plus

Make visible current inter-departmental collaborations

Departmental portfolio

Main research interests per group/department & contact point

Publications

International Workshops/Congress/Journals...



PhysiBoss



Alya

New Alya



IFS/NEMO

HERME/KAMP

LOCA SO co-design

LOCA SO paves the way towards LOCA@BSC

Goals:

- BSC@HPC-OHSw KNOWLEDGE: Co-design
- INTER-DEPARTMENTAL COLLABORATION: Co-design
- TALENT: Co-design
- COMMUNICATION: Co-design & interactions
- FOSTER: Co-design research areas and developments visibility among departments
- CONTACT POINTS: well-identified pointers to contact with departments

Internal impact
(precursor of DARE)

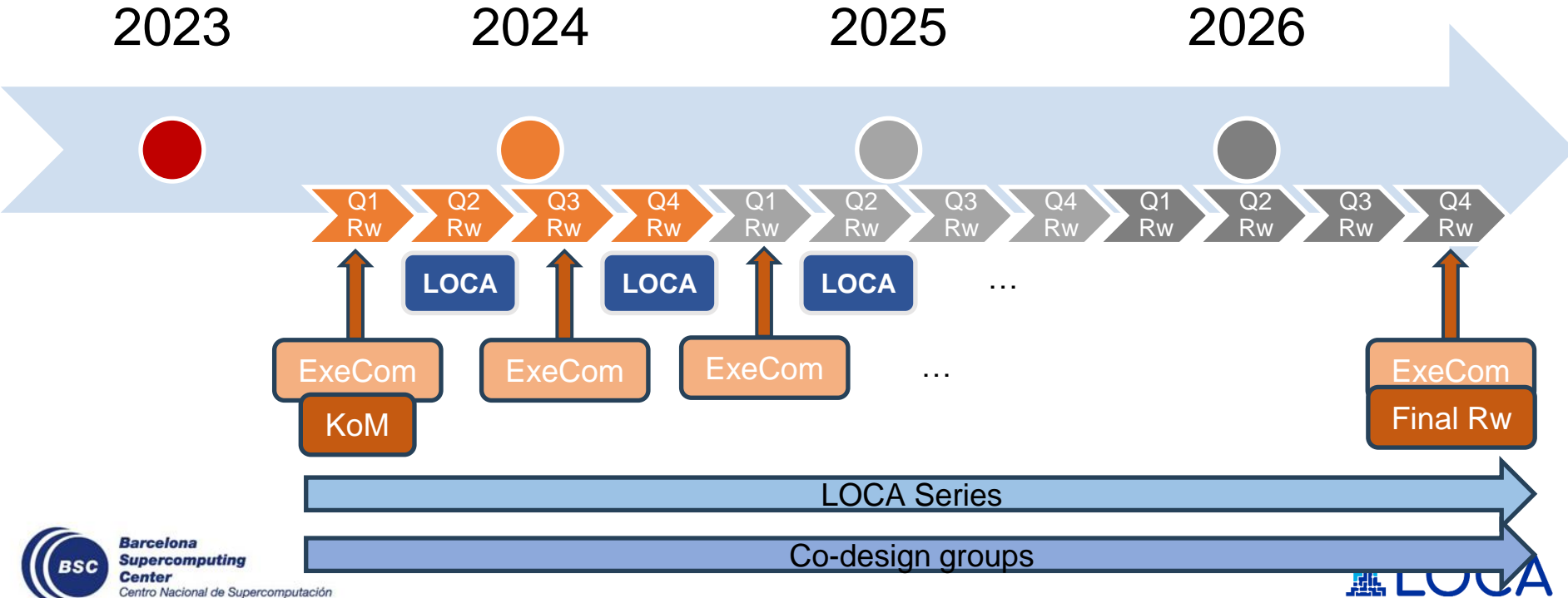
LOCA SO Co-design: Vehicle for common interests

- Evaluation of LS & ES & CASE applications
 - Deep characterization:
 - MN5
 - New architectures (based on RISC-V)
 - Software
 - Hardware
- Move codes forward
- Need of CS support
 - Knowing available tools/methodologies/flows
 - Working together with CS on improving app performance
 - Needs: Resources and support from CS
- Publications

Together we move faster and go further



LOCA SO Co-design: Workplan





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Thank you

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