

# Industrial Efforts for X-Band Accelerator Structure Fabrication

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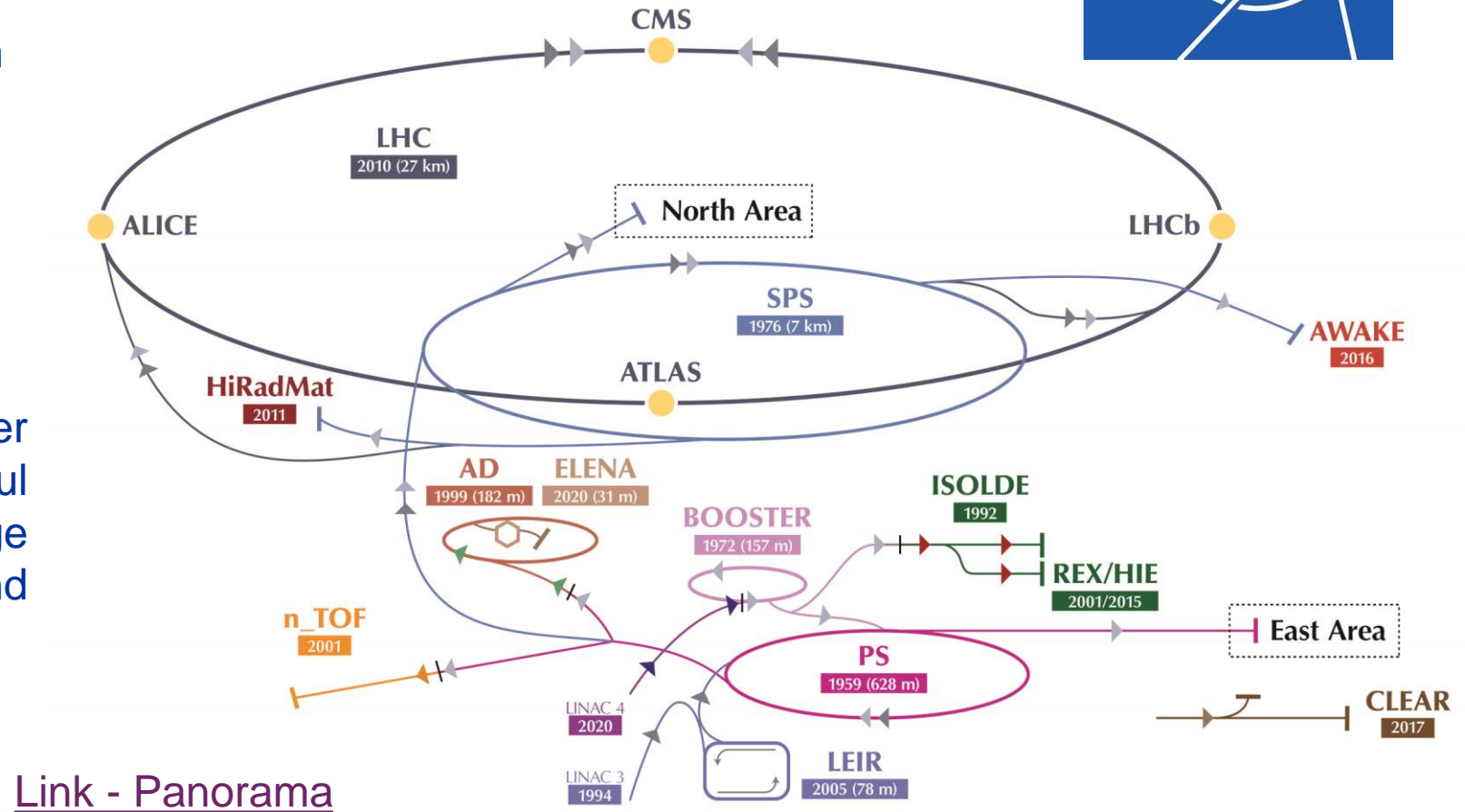
# CERN & CLIC



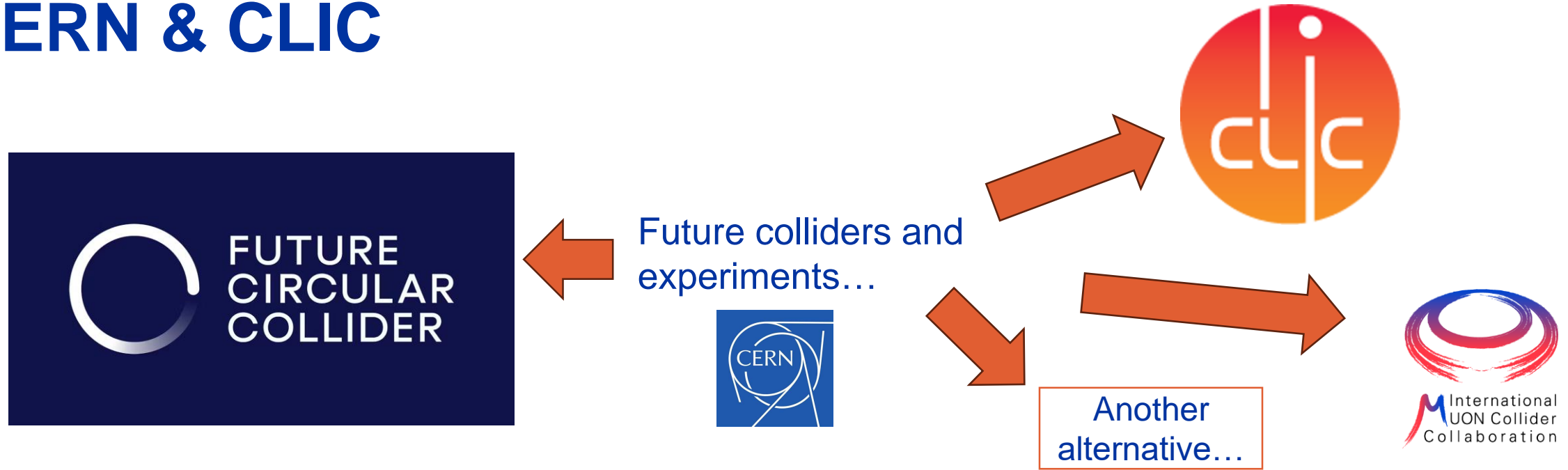
## CERN (European Organization for Nuclear Research)

- Established in 1954 as the leading laboratory for particle physics research in Europe.

- Home to the Large Hadron Collider (LHC), the world's most powerful particle accelerator among a huge grid of colliders, experiments and other accelerating machines



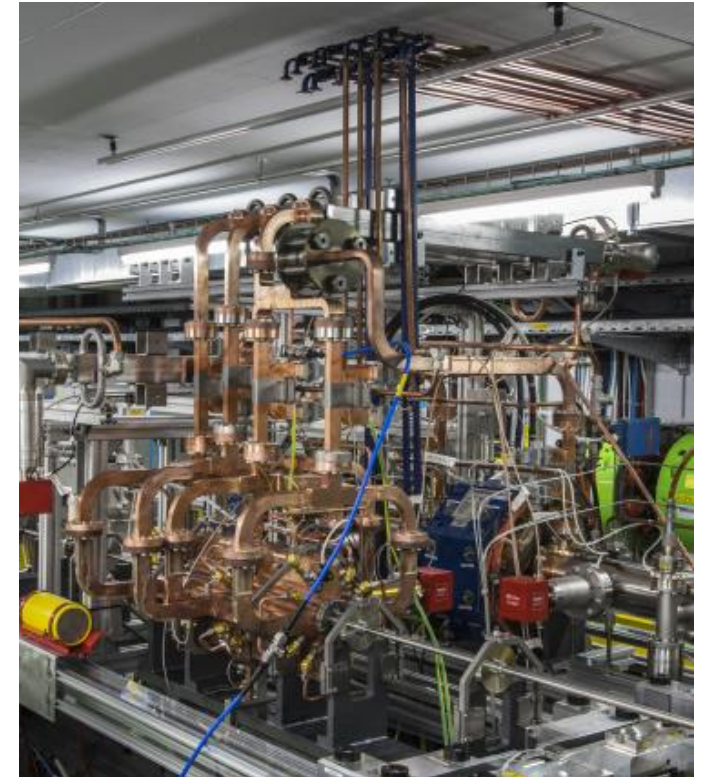
# CERN & CLIC



- Proposed future collider project at CERN aiming to explore beyond the energy frontier of the LHC.
- Development began in the 1980s as a conceptual design for a more compact and cost-effective collider.
- Gained significant momentum in last decade as a serious contender for the next major collider at CERN.

# CLIC Developments: Pushing Boundaries with Industry Collaboration

- CLIC's **ambitious** goals necessitate advancements beyond traditional accelerator technology.
- One key area of development is the exploration of **high-frequency** accelerator structures.
- CLIC investigated a range of frequencies, from 3 GHz to 30 GHz:
- Lower frequencies (3 GHz) offer easier high-gradient acceleration but require a longer, more expensive collider.
- Higher frequencies (30 GHz) enable a compact design but pose technical challenges in achieving the necessary accelerating gradients.
- Through collaboration with industry partners, CLIC ultimately selected 12 GHz as the optimal frequency.
- This choice **balances** the desired high-energy collisions with the feasibility of constructing and operating the collider.



<https://clic.cern/>



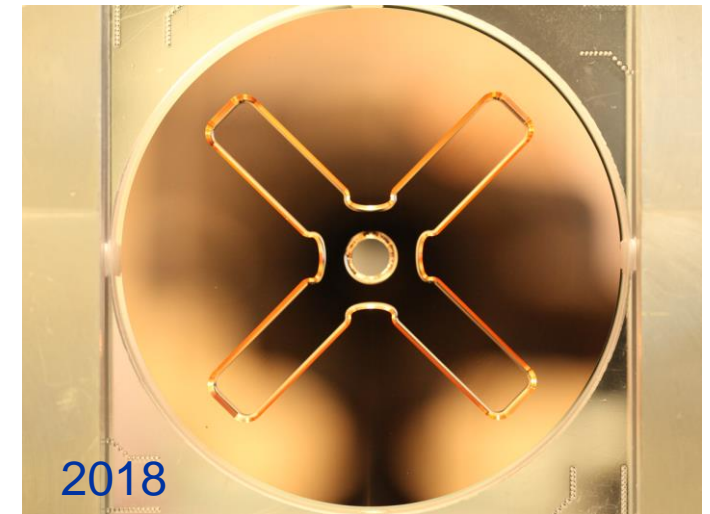
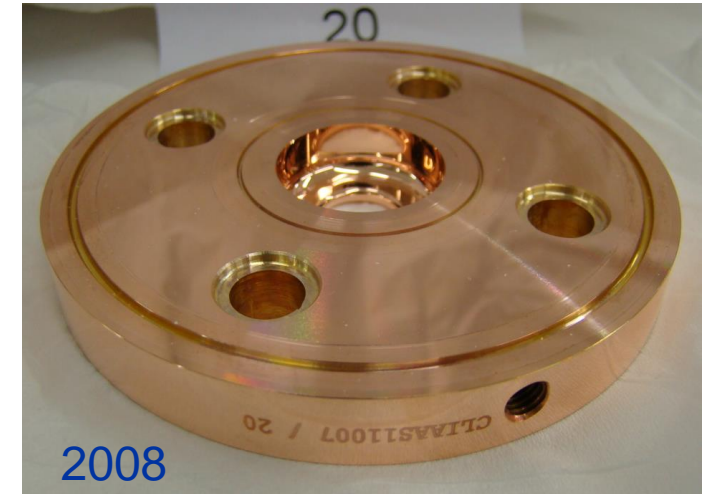
# CLIC Developments: Pushing Boundaries with Industry Collaboration

## ❑ Real-world Example:

- Collaboration on X-band structures has led to the **development of advanced fabrication techniques**, such as UP-machining and innovative brazing and alignment methods.
- These advancements are not only crucial for CLIC but also have broader applications in other accelerator technologies.

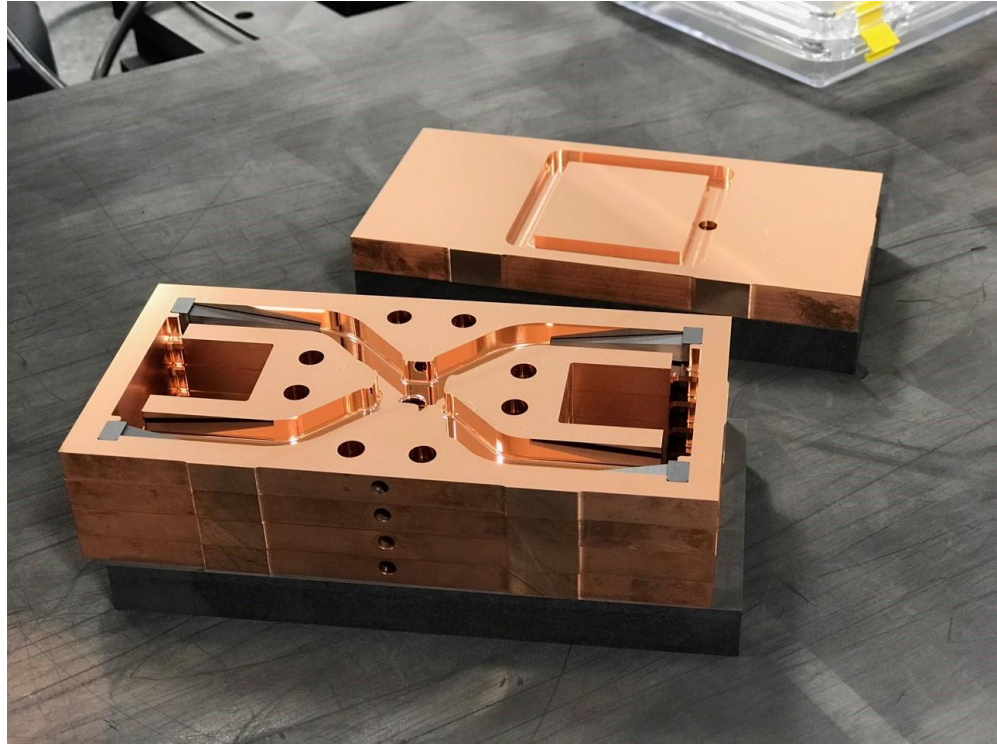
## ❑ Key Takeaways:

- Industry collaboration has been instrumental in overcoming the technical challenges of X-band technology.
- This collaborative approach enhance the innovation and benefits various scientific fields beyond particle physics.
- This collaboration has been done by qualification bids, challenging the suppliers to meet the requirements by a commercial price.



<https://clic.cern/>

# CLIC Developments: Pushing Boundaries with Industry Collaboration



# From Academia to Reality: Collaborative Projects - DEFT

DEEP ELECTRON FLASH THERAPY



Develop a next-generation medical linear accelerator for FLASH (FLash therapy with Advanced Synchrotron Head) therapy using a CLIC-based accelerator structure.

[More info](#)



# From Academia to Reality: Collaborative Projects - I.FAST



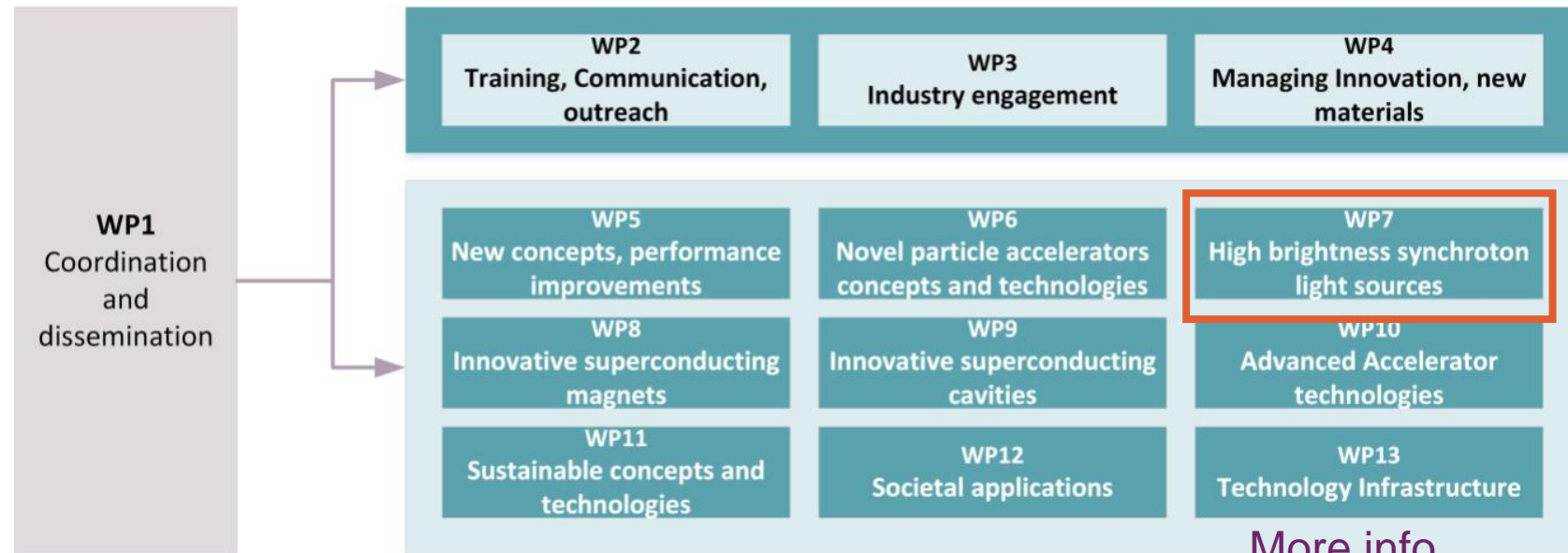
Innovation  
Fostering in  
Accelerator  
Science and  
Technology

A large-scale European Union project promoting advancements across the entire accelerator science and technology field.

Focuses on fostering collaboration between research institutions, universities, and industries.

WP7: High Brightness  
Accelerators for Light Sources:

A specific work package  
dedicated to X-band  
technology for light source  
applications.



[More info](#)

# From Academia to Reality: Collaborative Projects - Muhig

## MANUFACTURING IN THE UK FOR HIGH GRADIENT CAVITIES

- High-precision machining techniques for complex copper shapes.
- Innovative brazing methods to ensure robust and reliable structure joining.
- Advanced quality control procedures to guarantee tight tolerances.



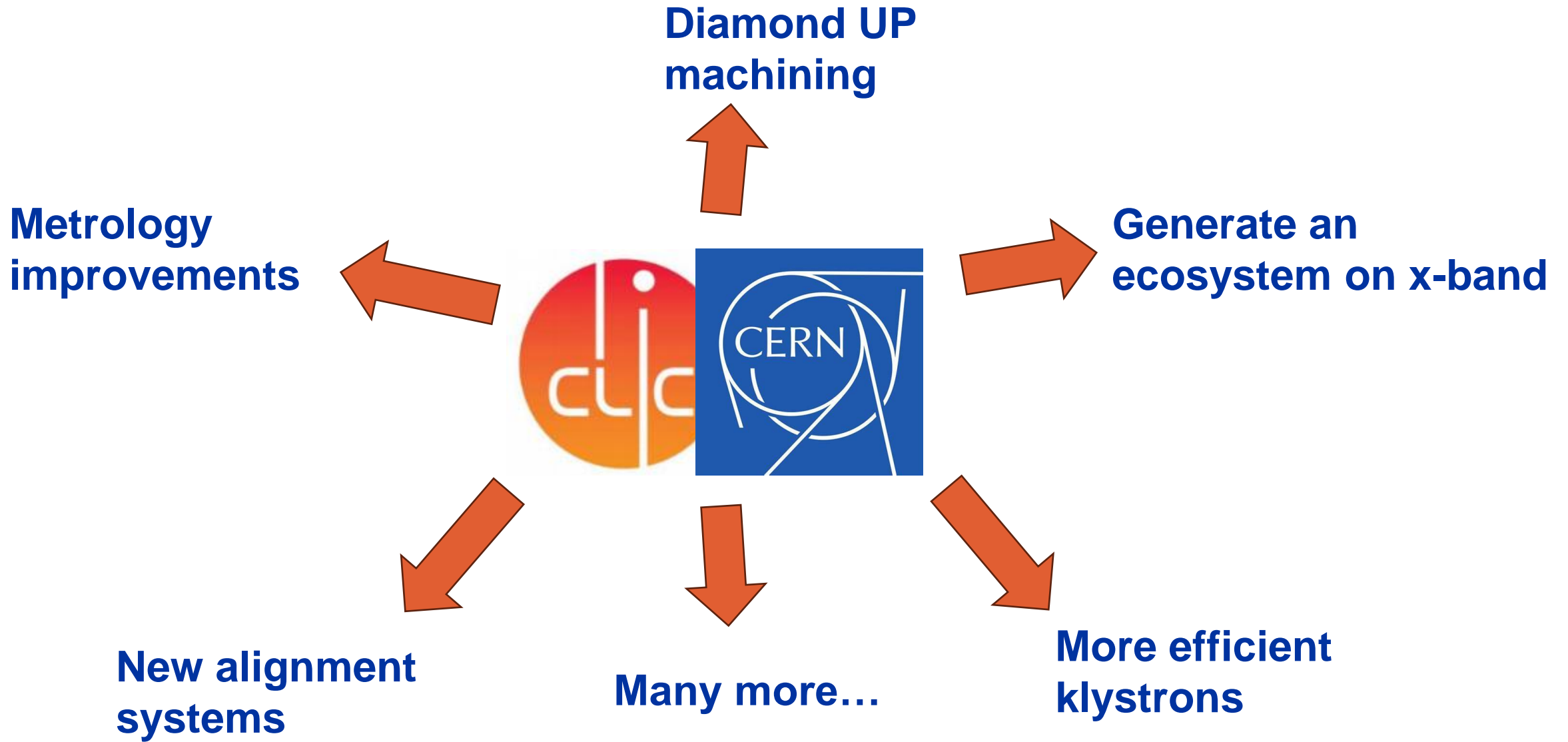
# From Academia to Reality: Collaborative Projects - EuPRAXIA

## EUROPEAN PLASMA RESEARCH ACCELERATOR WITH EXCELLENCE IN APPLICATIONS

EuPRAXIA is large-scale European project aiming to construct a next-generation research facility dedicated to plasma science. Inside this project X-band accelerators are potential candidates to drive particle beams.



<https://www.eupraxia-project.eu/home.html>





Band  
Prototypes  
Production

Thank you for your attention and do not hesitate to ask any question.

Thanks to Nuria Catalan Laseras and all the team for the help on the presentation and the pictures.