EN
Engineering

Case study: QUACO PCP

Isabel Bejar Alonso on behalf of the QUACO team

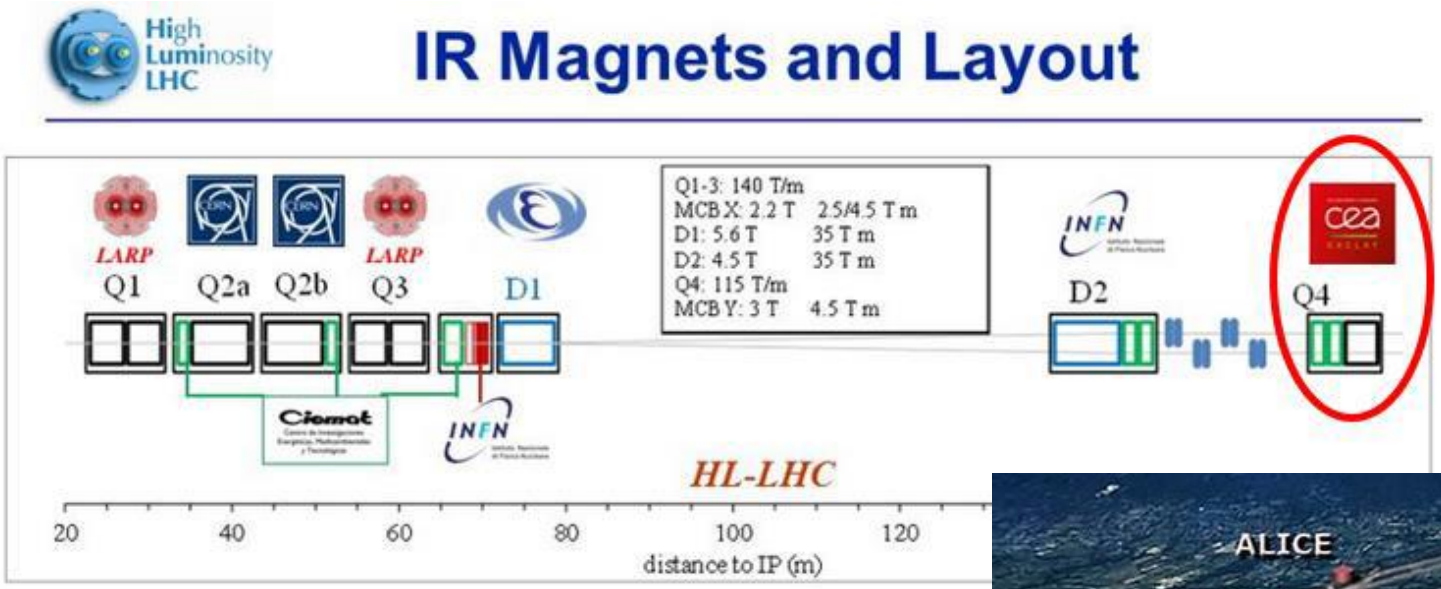
2026-04-23

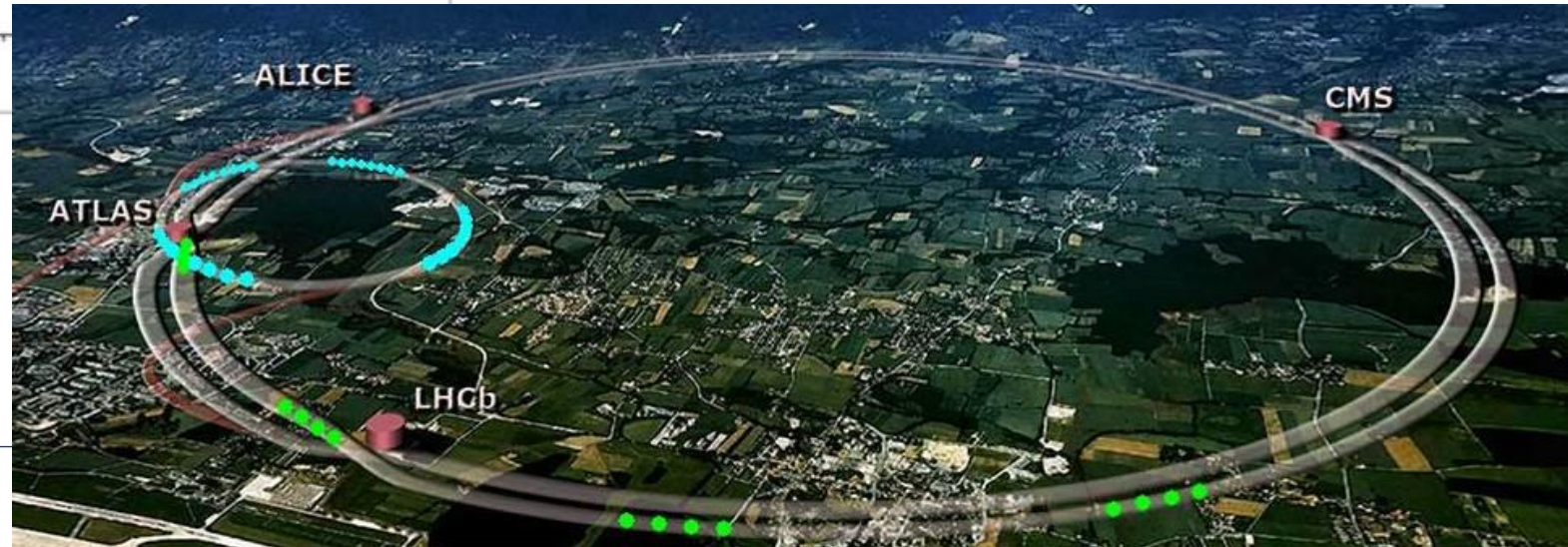
What QUACO aimed to solve and why PCP was chosen

HL-LHC

The problem

The scope of the QUACO project was to develop and procure 2 pilot superconductive quadrupole magnets valid for possible use in the frame of the HiLumi project, the Q4.





Why

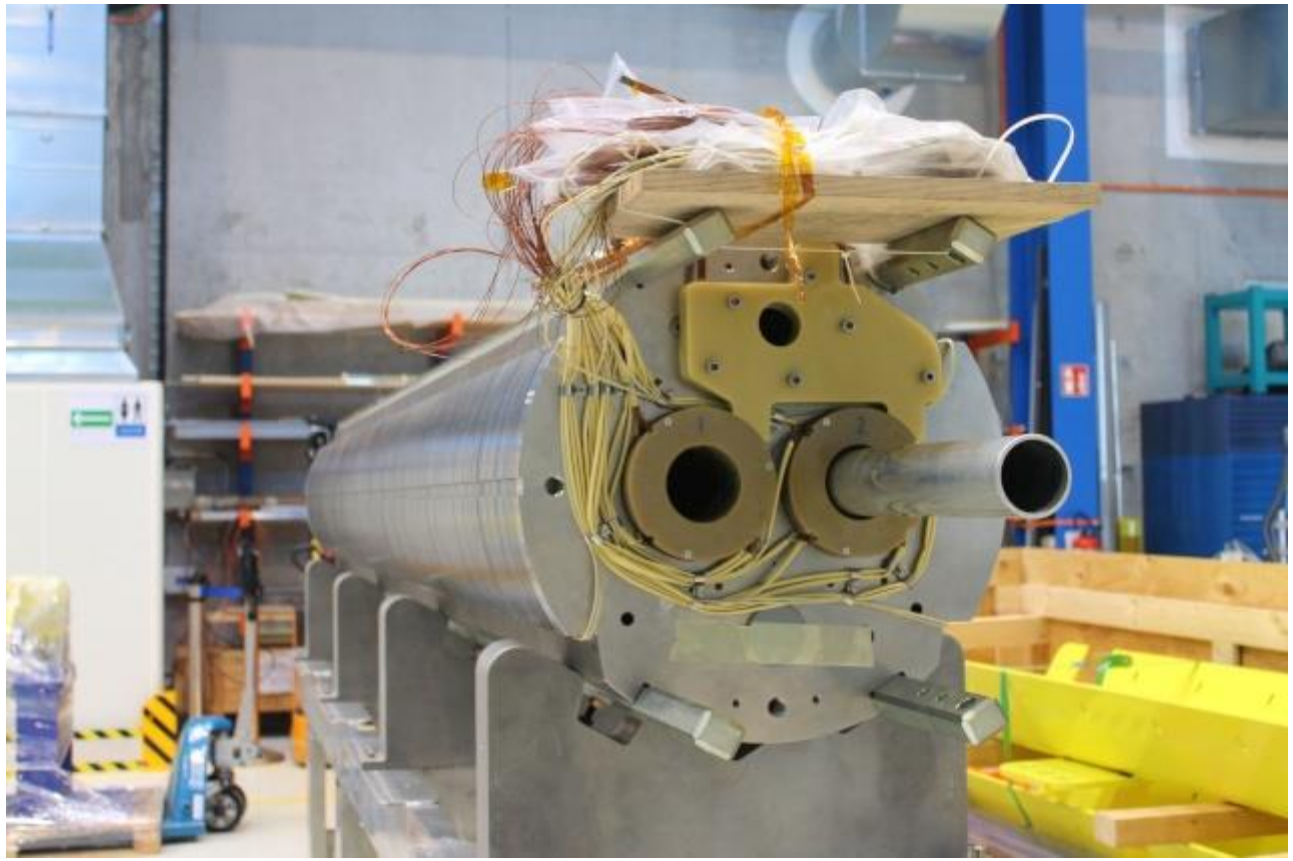
- **No off-the-shelf technology is ready to meet the challenge represented by HL-LHC needs. The most advanced solutions investigated are still at an immature level of development.**

- **A “conventional” tender instrument cannot address the purpose of the challenge. Indeed, the R&D effort is not matched by the potential large volume of advanced products to attract large companies. The technological risk is too high for small companies, and eventually, the market basis is very small.**

- **On the other side, the PCP instrument can serve the purpose of enlarging the market basis (by reducing financial barrier for SMEs), to attract SMEs (by sharing the technological risk of committing into difficult R&D), to mitigate risk of over or under specifications, by engaging industries at the early stage).**

QUACO – PCP INNOVATIVE MAGNETS

QUACO was the first Pre-Commercial Procurement (PCP) scheme adopted in the accelerator sector, entailing a gradual and collaborative approach to procurement in accelerator research and development. QUACO project paved the way for academia-industry partnerships by engaging small companies in complex and risky R&D projects, deploying an effective Technology Transfer methodology, from different laboratories to industry, therefore enlarging the European industrial capacity in the accelerator sector. Four companies were qualified for the first phase. The project delivered two 90-mm-aperture quadrupole magnet with a magnetic length of 3.67 metres and an operating gradient of 120 T/m at 1.9K



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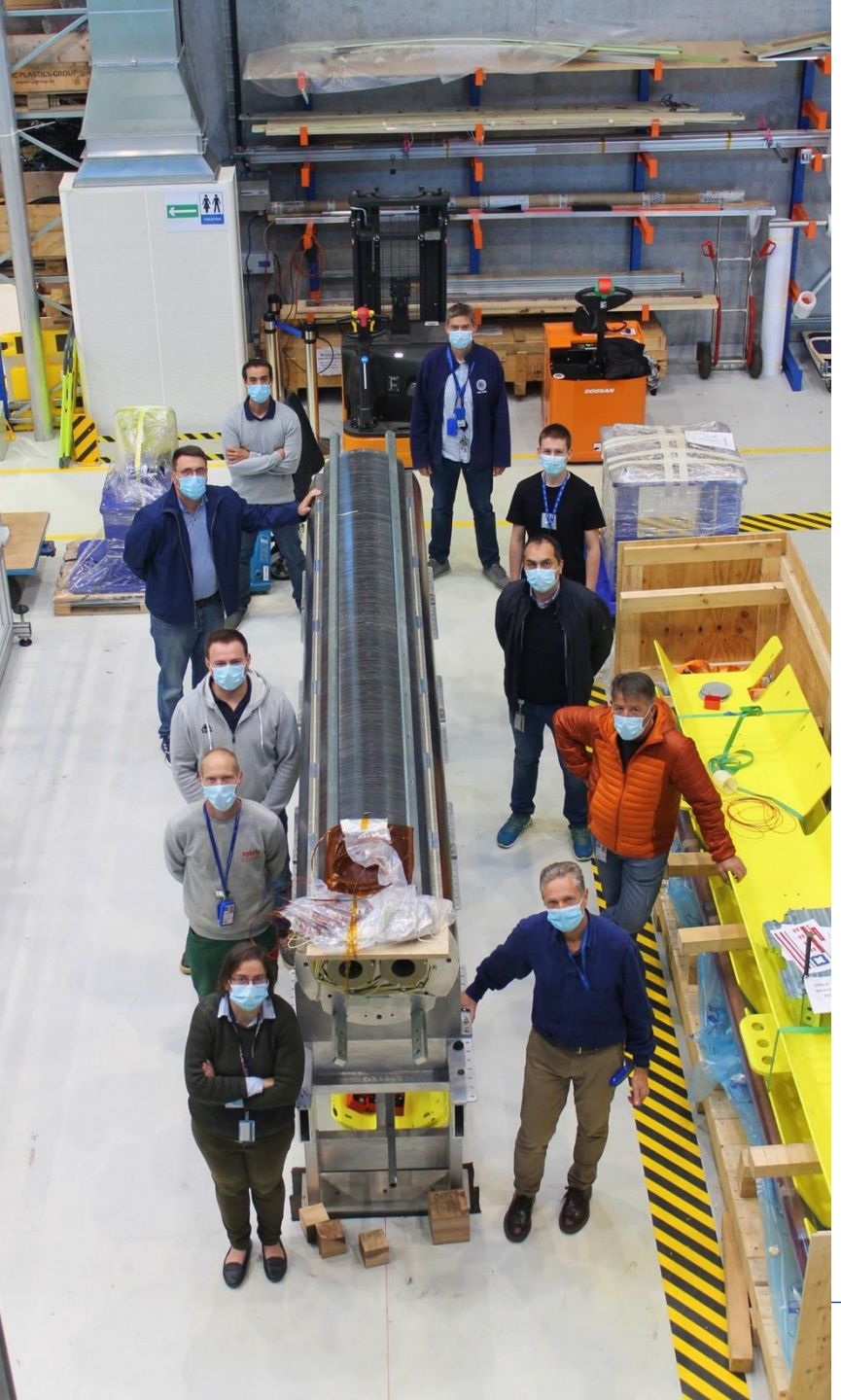
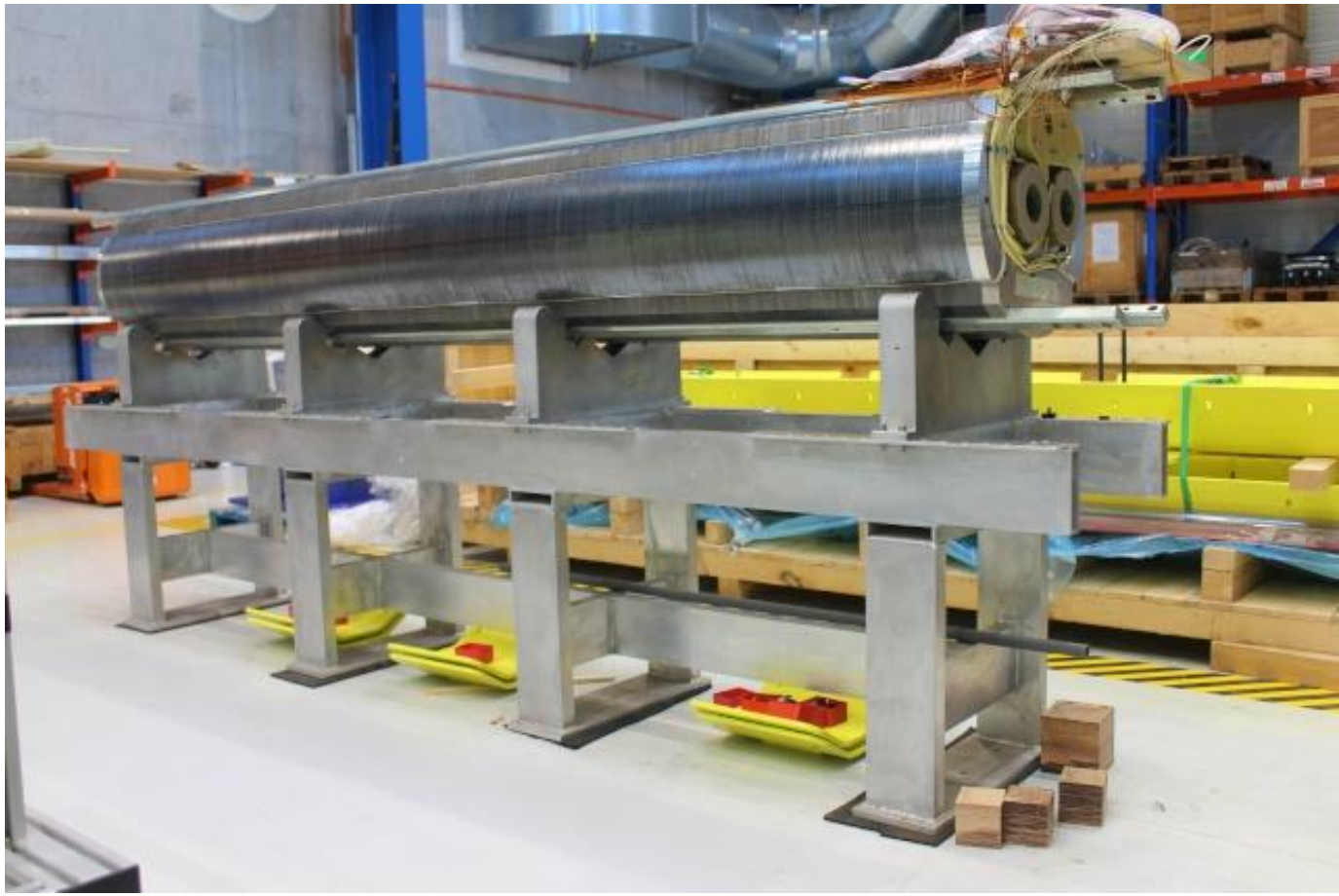
SIGMAPHI ACCELERATOR TECHNOLOGIES

ELYTT ENERGY

antec® Reliability is a must.

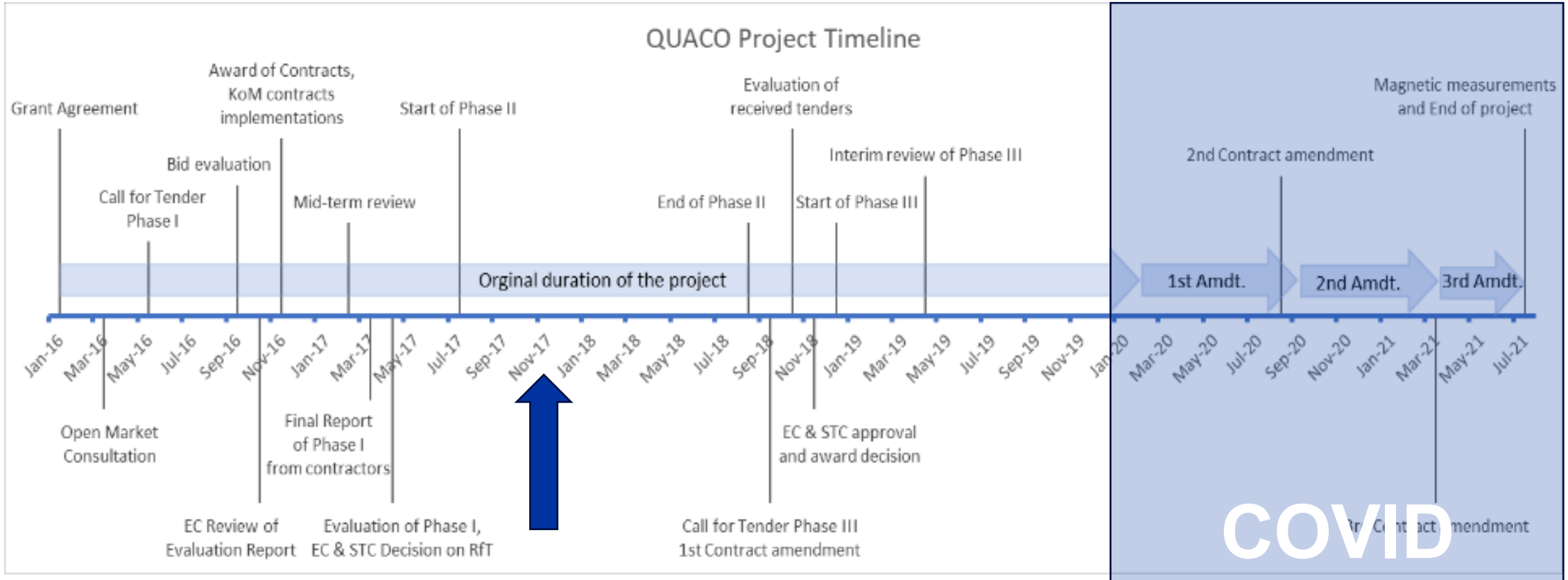


And the magnets!



And some circumstances

When the scope is descoped and when the world faces a major crisis



How was the PCP call structured, and how was it evaluated

Structure, Responsibility sharing and Little steps

Key elements

No	Name	Short name	Country	Project entry month[8]	Project exit month
1	EUROPEAN ORGANIZATION FOR NUCLEAR RESEARCH	CERN	Switzerland	1	48
2	COMMISSARIAT A L ENERGIE ATOMIQUE ET AUX ENERGIES ALTERNATIVES	CEA	France	1	48
3	CENTRO DE INVESTIGACIONES ENERGETICAS, MEDIOAMBIENTALES Y TECNOLOGICAS-CIEMAT	CIEMAT	Spain	1	48
4	NARODOWE CENTRUM BADAN JADROWYCH	NCBJ	Poland	1	48

Project Summary

Project 689359 (Quaco) - SIGNED (IN FORCE)

Responsible Unit:	RTD/B/04
Call:	H2020-INFRASUPP-2014-2015 submitted for H2(
Topic:	INFRASUPP-2-2015 - Innovative procurement pi
Type of Action:	COFUND-PCP
Duration:	48

Important Dates:

Entry into force of the Grant:	18/02/2016
Project Start Date:	01/03/2016
Project End Date:	29/02/2020

Amendment Information:

Number:	IP2
Reference:	AMD-689359-2
Type:	IP (Information Procedure)

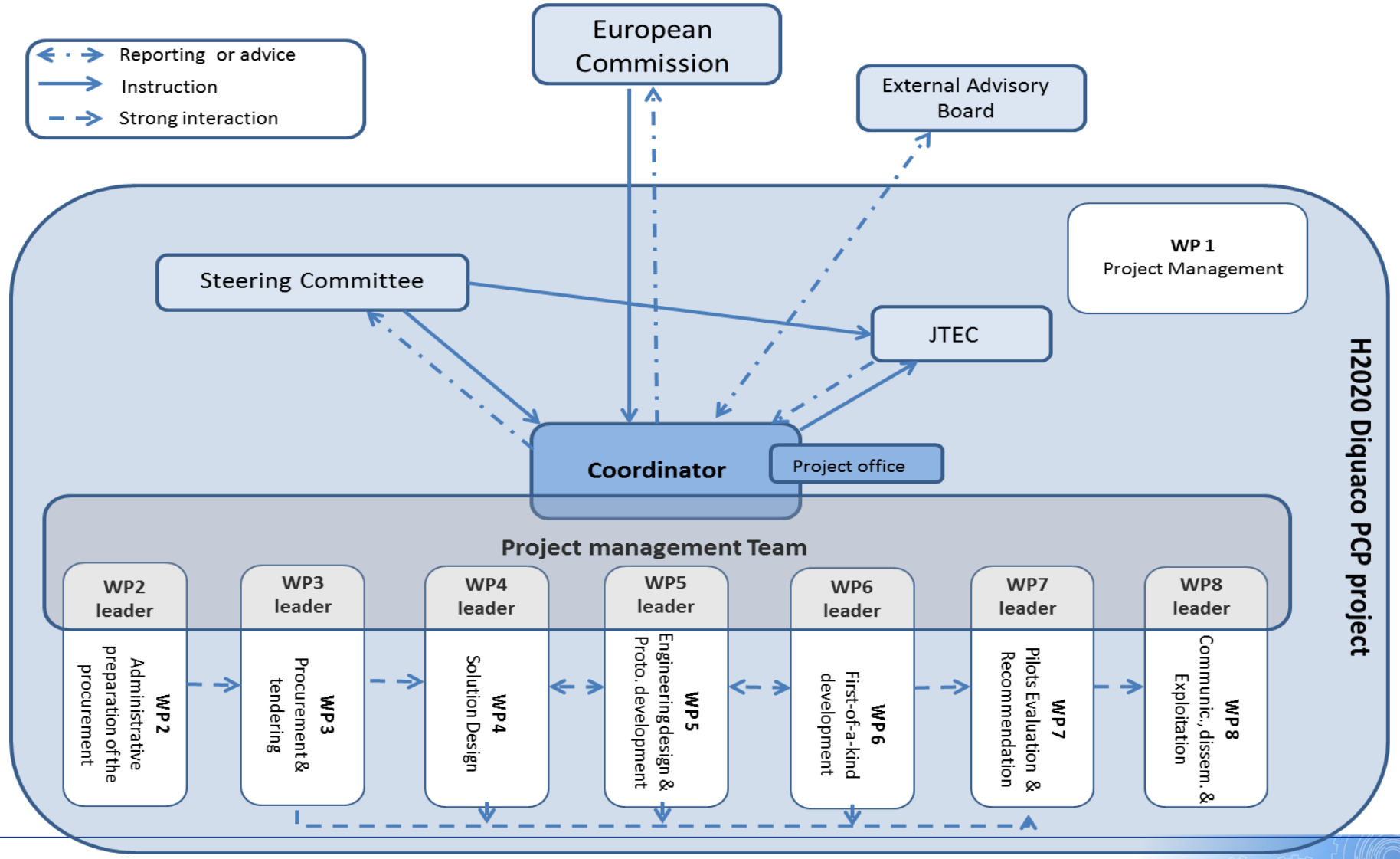
Budget Information:

Proposal overall costs :	6,647,891.25 €
Maximum grant amount after evaluation :	4,653,526.51 €
Total costs (including non-EU funded) :	6,647,891.25 €
Total Costs:	6,647,891.25 €
Maximum Grant Amount:	4,653,523.88 € 70.00 %

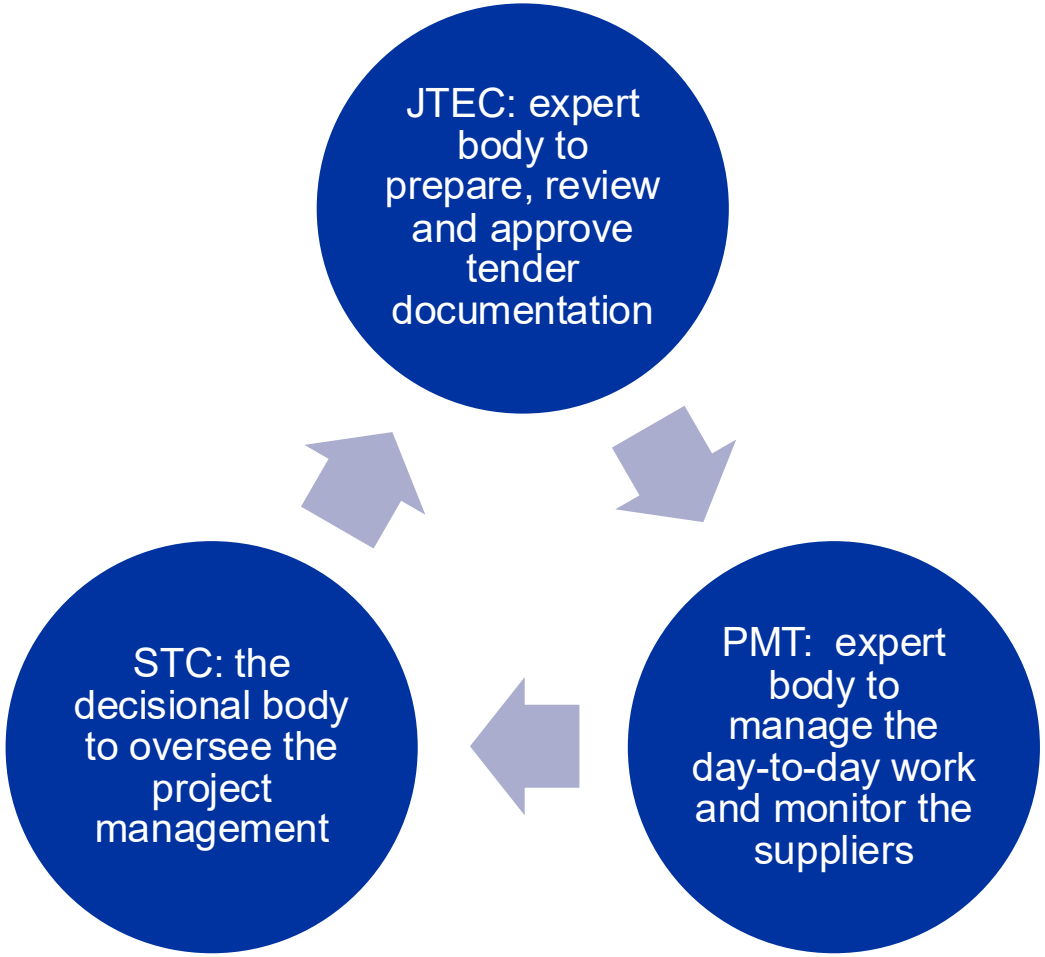
Officers:

Project Officer: Patricia POSTIGO MCLAUGHLIN (RTD/B/04)

QUACO Project Structure



Project organization



Governance

The Steering Committee (STC)

The Steering Committee is the highest decision-making body of the consortium.

It is composed of:

- one duly authorised representative at management level of each Party
- one additional duly authorised representative from CEA
- the HiLumi-LHC Project Leader
- the HiLumi WP3 leader
- one representative of the Lead Procurer's Finance and Procurement Department

STC members: J. Gajewski, S. Leray, J-M. Perez, L. Bottura, L. Rossi, E. Todesco, A. Unnervik, P. Vedrine

The STC shall meet at least twice per year and its meetings may be held in person, by teleconference or other telecommunication means.

In short approves tender documentation and evaluation reports as prepared by JTEC, authorize Lead Procurer to award contracts and make payments, decide on change in budgets, schedule, contract awards and contract amendments and on nominations of committees.

The Joint Tender Evaluation Committee (JTEC) – Tasks

The JTEC shall be responsible for the performance of the tendering process and shall make recommendations to the Steering Committee in this respect.
It is composed of technical experts and procurement experts, from all organizations.
The JTEC is chaired by the Project Coordinator.

- Review the tender documents, including the draft invitation to Tender, the draft Subcontracts, as prepared by the Lead Procurer in accordance with the laws applicable to it and the Specific PCP Requirements and submit to the STC all above documents for approval
- Evaluate under technical, administrative, including financial, aspects, the replies of the bidders to the invitation to tender for the PCP, against the criteria as established in the Invitation to Tender and in accordance with the Grant Agreement, the Specific PCP Requirements and the CERN Procurement Rules and recommend to the STC the selection of the Subcontractors on the basis of this evaluation
- Evaluate the activities performed by the Subcontractors during the Project phases, on the basis of the technical documentation prepared by the PMT
- Report regularly, via its chairperson, to the PMT and to the STC on the progress of the tender process.

The Project Management Team (PMT) - Tasks

The PMT shall, upon recommendation by its Project Coordinator:

- Prepare reports and recommendations for the STC on the progress, as well as on potential deviation from the original Project work plan
- Advise STC on ways to rearrange tasks / budgets
- Initiate meetings of specific working groups within the Work Packages,
- Support the Coordinator in preparing meetings with the Funding Authority and in preparing related data and deliverables, including the technical, procurement and quality documentation supporting the Deliverables
- Prepare the content and timing of press releases and joint publications by the consortium or proposed by the Funding Authority in accordance with the procedures of the Grant Agreement Article 29
- Coordinate the execution of all Work Packages
- Provide the relevant Project information to the relevant Parties
- Provide to the JTEC the supporting technical documentation on the results of the Subcontractors.

The core team

The WP coordinators and/or their deputies:

Isabel Bejar Alonso, Arnaud Pascal Foussat, Paweł Krawczyk, Marcello Losasso, Teresa Martinez de Alvaro , Lorcan Quain Solis, Simon Perraud, Etienne Rochepault, Damien Simon, Fernando Toral

Phase 1: Evaluation of the offers in 4 Steps

Step 1. General adminstrative compliance check

- Formal and procedural compliance check
- Content of the tender
- All the mandatory annexes are submitted
- Each submitted annex is signed by the authorised signatory
- Format

Step 2. Evaluation of the Administrative Section

- Admnistrative envelope
- Use Annex A,B,C
- Check of the Tender Submission Form (Annex A)
- Checkof the Exclusion Criteria (Annex B)
- Evaluation of the Selection Criteria with Pass or Fail: Technical (FS) and non-technical criteria (Rft) (Annex C)

Evaluation of the COMPANY

Step 3. Evaluation of the Technical Section

- Technical envelope
- Use Annex D and E
- Check the Compliance Criteria (RfT 3.4) (Annex D)
- Evaluation of the technical (FS) and non-technical Award Criteria (see RfT 3.5) (Annex E) (Technical Offer)

Evaluation of the submitted TENDER

Step 4. Evaluation of the Financial Section

- Financial envelope
- Use Annex F
- Evaluation of the Financial Offer (Annex F)

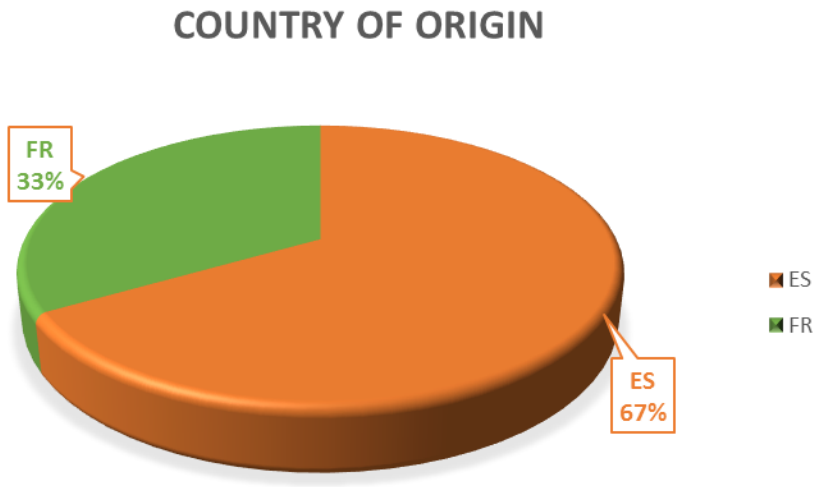
Evaluation of the Price

Award criteria Phase 1	Maximum Points
Phase 1	
1. Merit of the **top level manufacturing** plan.	**100**
A) Detailed description, split in tasks, how to **carry out the scope of the Tender** as described in the functional specification for the three Phases.	40
B) Detailed description of **key technical challenges** of the Solution Design and how these challenges will be addressed.	25
C) Describe the different **facilities and tools** that will be needed to develop and produce the MQYY	20
D) Describe the resources (manpower and tooling) **allocated to each task**. Describe the **work organization and supply chain (subcontracting plan)**.	15
2. Merit of the **technical capacity of the team** that will execute the contract.	**50**
A) Describe the **team (engineers, designers, technicians)** that will execute the work, develop, and produce the MQYY. - Demonstrate the **skills** of all team members and describe their **experience** in **manufacturing projects** which use relevant technologies for the MQYY such as: • Type of superconducting cable (NbTi, Nb3Sn, Rutherford CICC…) • Accelerator superconducting magnet (Magnetic design (Cos(Θ), block), aperture, magnetic length, energy, interfaces…) • Coil fabrication process (polymerization, vacuum impregnation…) • Other superconducting magnets (solenoid…) • Support structures assembly • Yoking experience (lamination, compression…) • Instrumentation and connectors implementation	40
B) Describe the experience of the team members in R&D projects carried out for the development of superconducting magnet and which led to: • scientific articles • the successfully execution of projects	10

3. Merit of the time schedule	**50**
A) Detail and demonstrate the consistency of **the technical schedule** for the execution of the contract, split into Phases (from Phase 1 till Phase 3). The schedule shall include all deliverables as detailed in the Functional Specification at section 2.2 and milestones.	35
B) Describe the main technical and project **risks, risk probabilities, impacts and opportunities** associated to the execution of the contract. Describe the key success criteria. Indicate the impact of each of them. Demonstrate how to mitigate the risks (schedule-wise) and how to exploit the opportunities identified.	15
4. Commercialisation approach and Impact	**20**
Submit a draft and simple commercialisation plan that explains the proposed approach to commercially exploit the results of the PCP and to bring a viable product or service to market.	20
5. Price	**80**
Submit a financial offer according to the Cost Breakdown (Annex F) and the section 3.6.4	80
TOTAL AWARDED POINTS max	**300**

Phase 2: Award Criteria

1. Merit of the technical plan, the technical solution and top level manufacturing plan. Weighting 145
2. Merit of the technical capacity of the team that will execute the contract. Weighting 50
3. Merit of the time schedule. Weighting 60
4. Commercialisation approach. Weighting 40
5. Price. Weighting 180



	Criteria 1. Merit of the technical plan, the technical solution and the top manufacturing plan.	Points
1 A)	Detailed description of how the tenderer intends to **carry out the scope of the Tender** as described in the functional specification for the second and third Phases: from engineering design to a first-of-a-kind manufacturing of a novel magnet including specific tooling. In case mock-ups are presented provide a detailed plan	**50.00**
1B)	Update the key technical challenges of the engineering detailed design features and how these will be addressed based on the outcome of the Final Technical Report for Phase 1. Detail how the proposed solution will take the minimum requirements into account and leave room for innovations. Describe the innovation aspects of the proposed solution in respect to the state-of-the-art.	**50.00**
1C)	Update the procurement and acquisition plan of tooling and coil components including the list of available tools and those that have to be procured, the timeline plan with expected installation and commissioning steps at the contractor's premises. Procurement path of the tooling (QUACO funds, other funds…) shall be provided	**30.00**
1D)	Update the resources (manpower and tooling) **allocated to each task** in the top level-manufacturing plan and in the phase 2 re-assessment. Describe the **work organization and supply chain**. Specify the configuration (e.g. consortium) and role of each consortium partner and sub-contractors	**15.00**
	Total Score	**145.00**
Criteria 2 Merit of the technical capacity of the team that will execute the contract		
2 A)	A) Describe the team (engineers, designers, technicians, purchaser, QA person…) that will be deployed to develop and produce the MQYY. Give the skills of all the team members and describe their experience in developing, manufacturing and using tooling for the fabrication of a superconducting magnet - Coil fabrication tooling (winding tooling, curing tooling) - Magnet assembly tooling	**50.00**
	Total Score	**50.00**
Criteria 3 Merit of the time schedule		
3 A)	Detail and consistency of the technical schedule for the execution of the contract, split in Phases, from phase 2 until Phase 3. Describe the project plan and detail the documentation flow that will be submitted to the Lead Procurer (deliverables, milestones, progress reports, surveys, witness visits, …)	**30.00**
3 B)	Update the main technical and project risks, risk probabilities, impacts and opportunities associated to the execution of the contract, that are the key success criteria. Indicate the impact (delays for example) of each of them. Detailed description of how to mitigate the risks and exploit the opportunities identified	**30.00**
	Total Score	**60.00**
Criteria 4 Commercialisation approach		
4	Submit an updated commercialisation plan that explains the proposed approach to commercially exploit the results of the PCP and to bring a viable product or service into the market. Estimate the time to market of the new magnets. Explain the underlying reasoning and major phases.	**40.00**
	Total Score	**40.00**
	Overall Total	**295.00**

Key lessons from each phase

What worked, what was challenging

QUACO Open Market consultation

Industry Readiness

8 companies were registered and participated in the event;

13 participants were connected via webcast;

11 CERN participants attended the event;

16 participants from companies attended the event;

7 participants from Consortium partners attended the event.

QUACO QUAdrupoleCOrrector

Home | QUACO in a nutshell | Acquisition Timeline | Events | Results | Contact

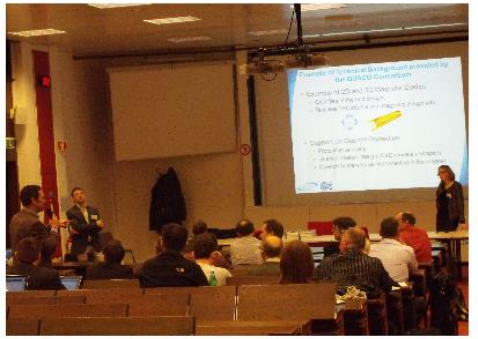
OPEN MARKET CONSULTATION

OMC QUACO - 30 Mar (CERN)

- Official Site
- Program

Open Market Consultation

The QUACO Open Market Consultation has been held at CERN on 30 March 2016. Leading companies in the field of magnet production attended this event organized by CERN and its partners (CEA, CIEMAT & NCBJ), the Consortium that is acting as a single buyer group in the QUACO Pre-commercial Procurement (QUACO PCP). The main aim of this event was to inform and prepare the companies for the upcoming call for tender that is foreseen in May 2016, as well as to gather feedback and suggestions from potential bidders.



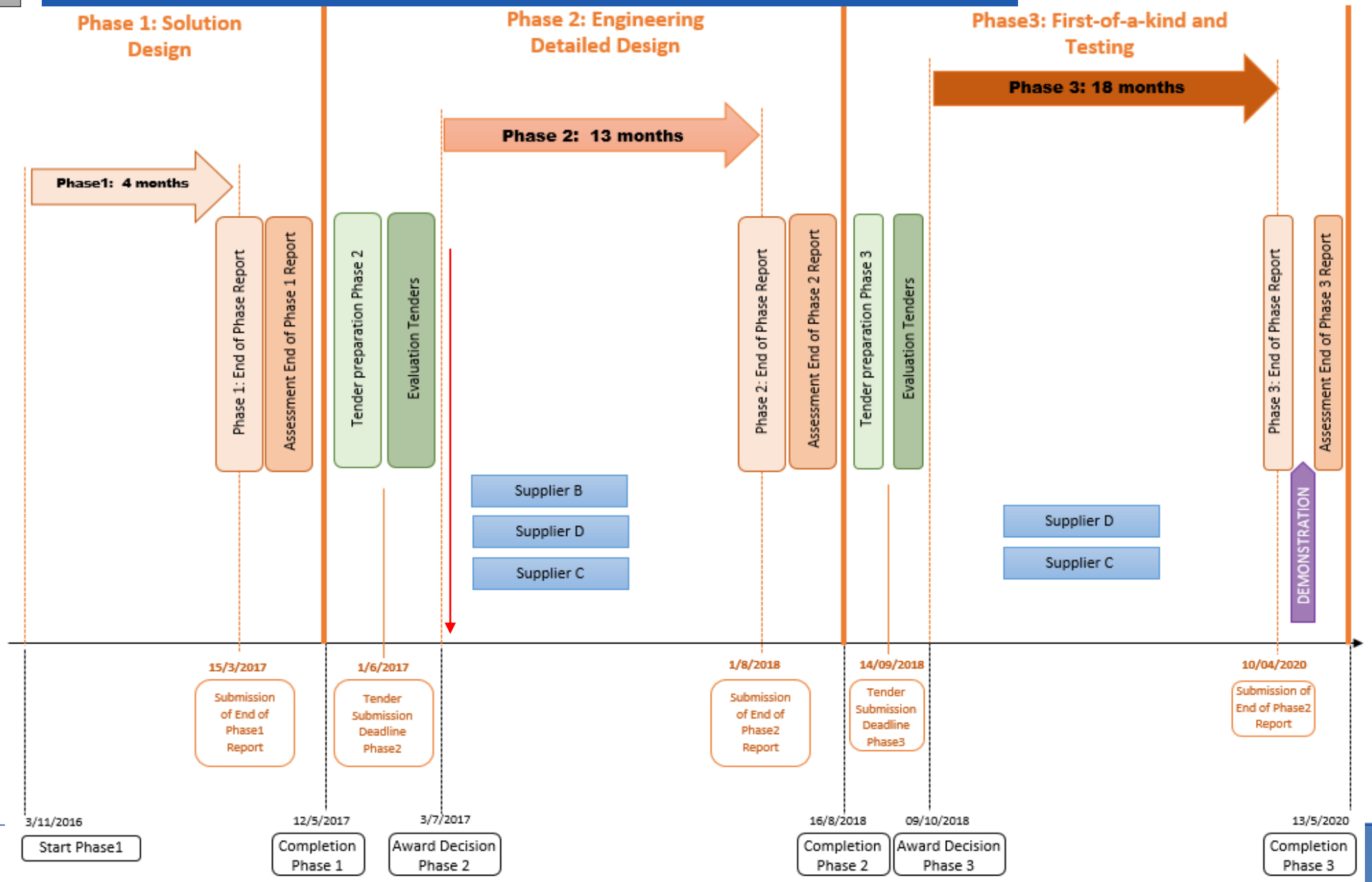
The morning session included a series of presentations that provided an overview of the QUACO project and the consortium, the pre-commercial procurement process, and the objectives of the procurement activity. The scope of the presentations went from technical aspects -current status of the Q4 magnet, its technical scope and requirements- to more legal and administrative matters, such as the legal and contractual framework in which the

4 answers

Pre-commercial Procurement

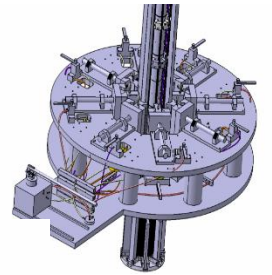
2. Pre-commercial Procurement

The Timing

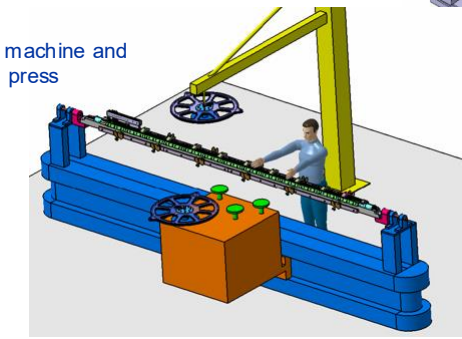


Tender Documents

- ✓Challenging exercise: major combined effort;
- ✓Functional Specs: high market knowledge and technical expertise at CERN;
- ✓Specification Committee;
- ✓Tooling for the manufacturing of the Q4 (Collaring Press, Curing press and Winding machine);
- ✓Specific CERN Safety requirements;
- ✓Consistency between tender documents.



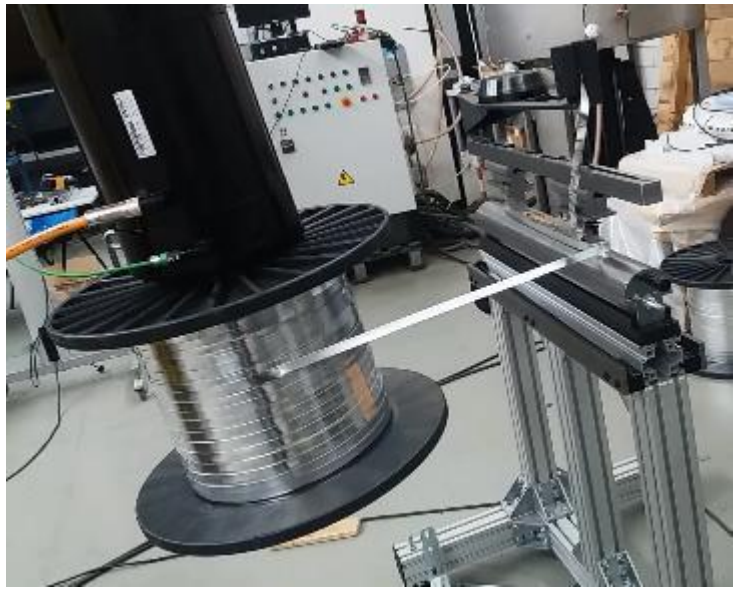
Winding machine and collaring press (Elytt)



Phase 2 results: ANTEC

By products

Robot winding test

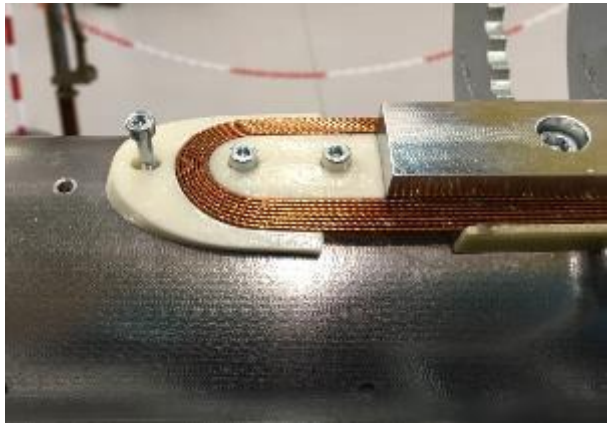


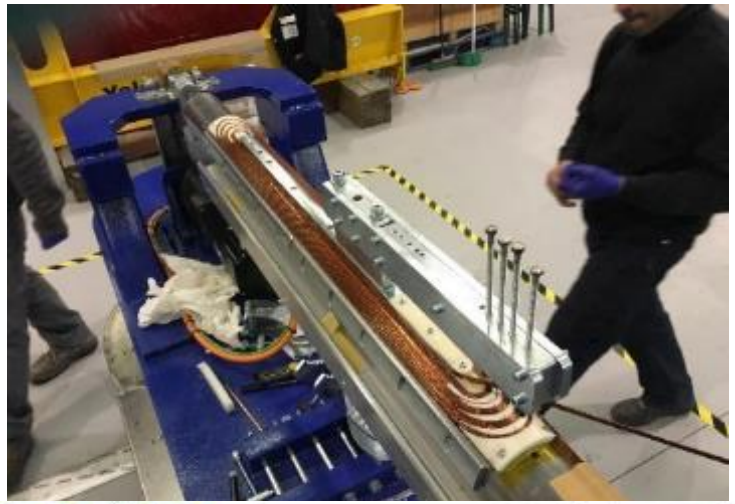
ANTEC (until end of phase 2) has provided innovation in winding automation process, and a very promising collaring processes.

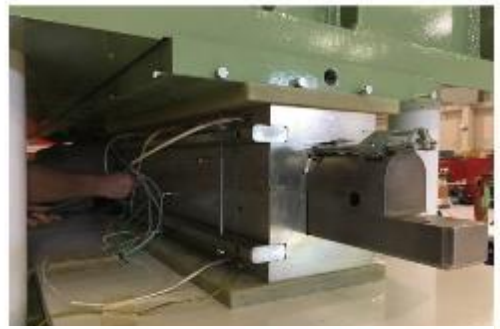
Yoke quadrant measurement

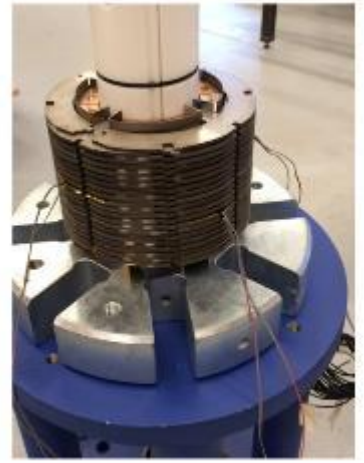
Phase 2 results: ELYTT

Building capacity



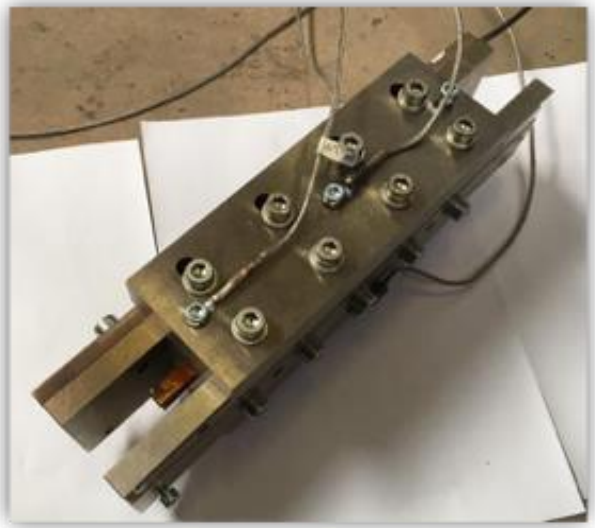






Mock-ups,
Winding, Collaring, polymerization tests

Phase 2 results: SigmaPhi



FEA analyses and prototypes manufactured during Phase 2, the feasibility and performance of this collaring solution
has been demonstrated and the design proposed by Sigmaphi is compliant with QUACO's technical specification.

Curing test, Collaring analysis

Key lessons and impact on procurement practice at CERN

Expected impact

QUACO was the first PCP project in the area of super conducting magnets. We acted to make it a « first-of-a-series » for this EC co-funded type of business.

Original targets:

- Make possible a progress from **R&D** of pilots magnets to **small series** production 👍 *achieved* small series production as a sequence of the Quaco project is now technically possible if and when requested. TRL is relatively high. (5-7)

- Broaden and **extend** the project for **similar** scope in the accelerator area 👍 *achieved* QUACO PCP example sets a benchmark in the market sector, enlarging opportunities in different technical areas.

- **Speed up** the technical background and the transfer of technology from national labs to industry 👍 *achieved* the PCP feature of risk sharing has facilitated dialogue with industries and transfer of know-how able to enhance and develop industries capabilities.

Lessons Learned from QUACO

- CERN is an adequate enviroment to launch PCP and PPI: innovation combined with high level of technical expertise;
- Procurement Directives and legal framework were new for CERN. EU regulation allows less flexible procurement approach;
- CERN members states versus EU member states;
- The tendering in Phases is well-appreciated by suppliers;
- PCP allow to reduce the risks as several suppliers are competing simultaneously in Phases;
- In Quaco smaller SMEs were attracted (get tooling and infrastructure) for the developments of MQYY magnets (vs. usual suspects);
- Trigger innovation from SMEs through an early engagement in the tendering process;
- The OMC and bidders conference are important in the whole PCP process (create credibility and trust between both the supplier and the Buyers Group, risk valuation through input of SMEs);

Lessons Learned from QUACO

- The obligation to publish the max. Budget for each Phase and for each contractor reduces the competition (small variation in the financial offers). The effect of price criterion is reduced to almost 0, except in Phase 1);
- Framework agreement and Work Order, no crucial legal point were raised until the award and the signature;
- Intellectual property remains a critical aspect of PCP;
- 50% of R&D-services is a difficult threshold to reach considering the expensive equipment and tooling to develop magnets;
- Building versus R&D-Service requirement;
- PCP increase “the team up together” beween Research Centers;

PCPs Mechanism

- Reduces strongly the financial risk for the company as the development costs are covered by the EU and the buyers group
- The multi phases allows progressive ramp up of resources
- Allows an easy transfer of knowledge and patents
- Development is driven by needs and by a first group of buyers
- A great opportunity for SMEs!!!!

Relevance for other BSOs considering PCP

From the companies point of view

Risks

Profits!

From the lab point of view

A lot of efforts

Without results

Tons of money

on the ....

How to make an unicorn

The instrument - PCP

A Pre-Commercial Procurement (PCP) is a phased approach for purchasing R&D services by procurers for the development of innovative products, services or processes by enterprises/research centres that are not yet available on the market.

One of the biggest advantages of PCP is the sharing of both opportunities and risks by both the public buyers and the private suppliers. It allows public purchasers to get innovative solutions to satisfy challenging needs, and support enterprises in their R&D.

Opportunities - Labs

- Several labs with the same needs joining supervision and contract follow-up efforts
- Having multi phases contacts that allows to step out if the development goes in the wrong direction
- Sharing of costs
- Critical mass
- Mitigate risk of over or under specifications by engaging industries at the early stage

Weakness - Labs

- Not always the labs have the same needs
- Shared supervision and contract follow-up can be complementary but also a mess
- Not everyone needs the same final product and some labs could prefer to step out too early
- What cost you less is sometimes not “appreciated” enough
- R&D is the core of a lab and you want to give this to industry

Opportunities - firms

- Sharing the technological risk of committing into difficult R&D.
- You are paid even if the result is not what was expected.
- The payment is based on the effort and the way the effort was handled
- With Multi phases, you can judge if you are ready to go to the new phase or not
- Not purely based on price
- Strong interaction and knowledge transfer

Steps to launch a PCP (buyers group)

Share your idea/need

Find partners

Get support to prepare your proposal

Find the budget that will not be covered by the EU

Write and submit your proposal.

Key factors

Define the state of the art: What do suppliers already have? What is under development in ongoing R&D projects? What are most advanced solutions already deployed or under development

Credibility of the proposed approach: Proposed approach/methodology to achieve the project objectives, Proposed lead procurer, buyers group, (third parties), (members sole participant)

Preparation phase: market consultation, development common specs & evaluation criteria

Implementation phase: scope procurement, expected output, duration, budget, approach for joint evaluation offers (external experts or not, draft evaluation criteria), monitoring progress suppliers

Expected impacts: Reducing fragmentation of demand for innovative solutions, Improving competitiveness and growth of companies via development of innovations, meeting needs of European and global procurement markets

Key factors

Measures to maximise impact: Demand side measures to encourage wide deployment of solutions, Plans to deploy and encourage other procurers to deploy solutions, Ways in procurement approach itself (e.g. KPIs) to maximise impact, IPR arrangement

Project plan: Work plan with work packages, deliverables, milestones (follow templates) Work Packages (foresee separate work packages for), Resources to be committed, How will consortium mobilise resources for project, cost of personnel

Consortium management: Preparation stage, Procurement/tendering stage, Contract implementation stage Management plan and decision making procedures, Organisational structure and decision making mechanisms governance, conflict resolution

Communication and dissemination: At the end of action: assessment of validation of solutions resulting from PCP/PPI + demonstration of solutions to Commission

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