IPNO and LAL Orsay experience on in-kind contribution to international project and projection into ESS

Sebastien Bousson

1st BrightnESS Best Practice Workshop, Bilbao, 14th November 2016

General Remarks

IPNO and LAL Orsay laboratories have participated to several accelerator collaborative projects (National, European, International), the most recent being LHC, SPIRAL-2, XFEL, FAIR… and now ESS.

Some of them were based on In-Kind contributions and both laboratories has gained some experience in contributing to projects under the framework of such collaboration model.

Collaborative project with in-kind contributions

- In-Kind contribution is a more and more frequent collaborative scheme to contribute to a project by sharing work and expenses among several partners.
- If the principle is very simple, the implementation itself is not and requires a perfect coordination between the project central team and the IK contributor
- If it is quite effective to set the financial contribution of a partner (or country) to a project and the general scope of work, it is not that natural from the technical management point of view and several aspects are sources of difficulties:

- Precise perimeter of the IK contribution
- Performances, specifications
- Interfaces management
- Responsibilities
- Intellectual property
- Planning
- …

General Remarks

Central team – IK Partner: not a customer – supplier relationship !!!

Several reasons for that:

- Our big scientific projects are always at the frontier of the technology: it makes it almost impossible to set a contribution with a contract covering all technical aspects because **part of its technological aspects are quite unknown** !
- For the same reason, equivalent contribution in a less collaborative but more commercial agreement would lead to an "increase cost" including an important cost safety margin, **making the whole project much more expensive than it should be** (financial risk covered equipment by equipment rather than all together)
- Sometimes the natural timing for each contribution (discussion on the scope, cost, schedule; agreement; IK contract signature; start of the work) **can not be fulfilled** and work start even before a complete discussion on the scope.

Performances - Specifications

Early definition and set of specifications & performances is a key to the success

- Obviously, they are the starting point for the design phase and drive the technical solutions to be chosen.
- Very often, a technical design report (TDR) is produced and is considered as the reference for the project. But inside a TDR the **level of design maturity** of each component or system **is very broad** (from only conceptual to full achievement).
- Design work will continue even during construction phase. Therefore it is of highest importance to **efficiently track the achieved design parameter of each sub-system**, and check if they fulfilled the specifications (if any).
- **Some parameter will become a specification,** (typically a system space envelope) and could not be easily changed later on (building dimensions, beam height…)

Technical responsibilities (1)

Responsibilities for the performance of an equipment (or system or component) should be clearly established.

- Only saying that "a partner is responsible for the performance of the system he is delivering to the project" **is not enough**.
  - Were the requirements clearly established and in due time ?
  - How performance is measured ?
  - What if a system shows a non-conformity with respect to a requirement : who decides rejection ?
- As a principle**, each system requirement should be "measurable"** and more than that, the way a performance is measured should be established and agreed on: test procedure should be defined
- A transfer of responsibilities at each step in a typical production chain (Industry -> IK partner 1 -> IK partner 2 for sub-system integration -> Project central team for final integration) **should each time be accompanied with acceptance procedure and specification checking**

Technical responsibilities (2)

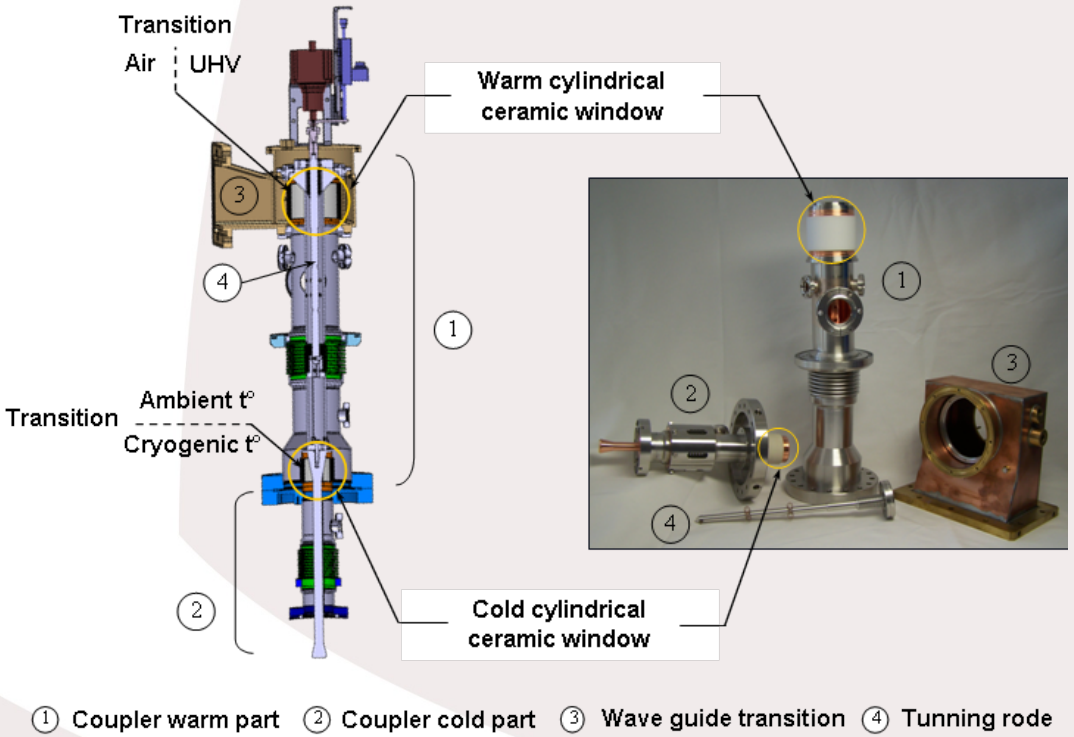
Unfortunately, during production, some components or systems are not going to fulfill all requirements

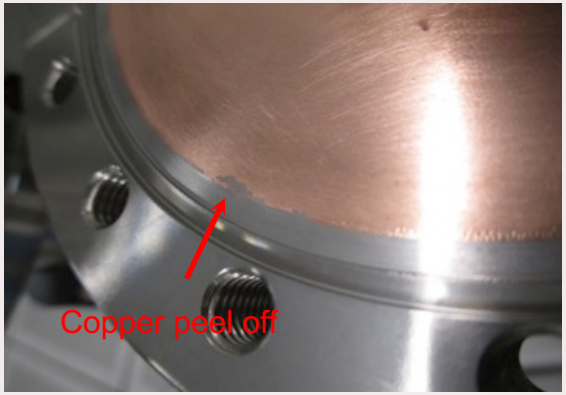
- Non conformities will appear, and better be prepared to handle them
  - THE RULE: **the sooner a non-conformity is discovered, the easier and less expensive it is to correct it** (if required)
  - If a non-conformity is factual (and should be recorded), its treatment might necessitate discussions and agreement between the IK partner and the central team (and sometimes other IK partners)
  - A non-conformity does not necessary means that the "faulty" component has to be rejected: some may be accepted because the impact is low (could be fixed outside the scope of the component) or without consequence (could be accommodated)
  - A clear procedure on non-conformity treatment decision should be established. A software tool is needed to track all these.

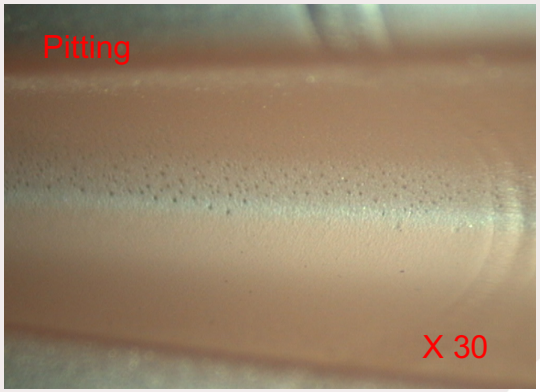
Technical responsibilities (3)

Example of series production of XFEL couplers (LAL Orsay)

IK Partner and central team (and industrial partner) agreed during production on the acceptance criteria on visual surface defect.







Interface Management

Setting up all interfaces within and in-kind project could be a very tedious task for everybody, but it is fundamental

- In-Kind contributions of each partner are set based on many factors like partner knowledge, capacity and competences; partner availability, national commitment to a project, available work packages,… In this decision, the technological logic of implementation is only partial -> the result is often **multiplication of interfaces**
- It is the role of the central team (integrator) to **manage interfaces to an appropriate level of details:** may be not the same level of details for each component or task in the project (ad-hoc set of interface documents)

Standardization (1)

Standardization of tools, procedures, material is definitively a key to the success of a collaborative project

Having standards software tools established is a concrete risk mitigation for technical errors during integration phase (CAD work, mechanical and electrical interface management).

- The central team has to define the software tools based on local knowhow and partners competences
- Impose these tools to each partner is counter-productive (more difficult to perform a design work with not well-known tools)
- If one or several partners use other tools, the central team (final integrator) should allocate sufficient resources to perform the interface work: **importance of the single point of truth.**

Standardization (2)

Standardization of tools, procedures, material is definitively a key to the success of a collaborative project

Choice of standard material may allow cost reduction, easy of maintenance and management of spare parts, but also facilitates the integration work and operation of the facility.

- If not properly addressed, standardization may lead to cost increase: for instance, taking the most demanding specification for a component in one particular use and make it a standard for all the project (ex: vacuum gauges for power couplers requires a fast response time which is not a mandatory requirement for the isolation vacuum in cryomodules)
- Standardization may lead also to planning slippage due to potential difficulties in component production if applying standards translate in mass production by a single vendor without appropriate capacity.
- Standard material should be applied wherever there is no good reasons (requirements, cost, design maturity) to go for another choice.

Conclusion

- IK contribution is efficient to reach an agreement in a project funding while gathering skills and knowhow from different teams for the project completion.
- But in terms of technical implementation, it adds difficulties because the result is mainly multiplication of interfaces and dilution of responsibilities.
- The central team, who is also the final integrator, has obviously a central role, also because each IK contract are between the project and the partner (not between partners).
- Success of such collaborative project is based on the existence, as soon as possible in the project life, of defined, existing, accessible, integrated and recognize tools for the engineering management of the project.

Conclusion

- Even if everything is documented and available in an super-efficient and super user-friendly database, do not sectored the partners by having electronic exchanges only, and create events for people to meet in persons and have live technical exchanges: PDR, CDR, TRR, SAR could be opportunities for people having interfaces with other systems to meet…

- And above all, the collaborative spirit of all partners should prevail, because due to the level of innovation in each of this scientific large scale project, it's almost impossible to have everything set and written in documents or contracts.