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I.FAST WP3

Industry related activities

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I.FAST WP3 "Industry engagement"

- WP3.1: [lead by M.M. (INFN)]: Explore and leverage the **potential and original contributions of industry** in I.FAST, particularly SMEs
- WP3.2 [lead by Djamschid Safi (DESY)] : Stimulate the **development of the Knowledge Transfer potential** in I.FAST activities and promote its exploitation
- WP3.3 [lead by Jose M. Perez (CIEMAT)] : **Extend the involvement** of industry, favoring early engagement in R&D activities
- Institutions involved: CEA, CERN, CIEMAT, DESY, INFN, UKRI

Summary

- **Initiatives** promoted by WP3 to foster the communication with Industry
- I.FAST II **Innovation Survey**
- **TT and Business exploitation** in I.FAST
- Report on "**Extended industry contributions to R&D activities**"
- The **special industry** session

Cryogenics workshop

- **proposed by the I.FAST Industry Advisory Board** in May '23
- one of the initiative that in I.FAST we have co-devised with industry
 - proposed by the **I.FAST Industry Advisory Board in May '23**
- organized by I.FAST WP3 with contributions from AIDA-INNOVA and LEAPS-INNOV
- goal was to present and discuss **ongoing technological developments in cryogenics for accelerators and related fields**
 - being pursued either in laboratories or in Industry
 - in particular to improve sustainability and efficiency.

Cryogenics workshop (I)

- Interesting presentations and discussions covering the most advanced developments as well as opportunities for industry:
- good participation:
 - 77 registered participants
 - of which 21 from industry
 - 2 from IHEP Beijing
- 1-to-1 meetings between Industry and RI representatives took place



Some highlights from the Workshop

- Several discussions were related to **efficiency**
- Use of **dry cooling** is promising but:
 - limitation of use, clearly not suited for big projects
- Improvement of efficiency in LHe production is still needed
 - still room on improving efficiency of compressors (-> centrifugal, Neon addition)
- **HTS** are expected to have a **big impact** also in efficiency
 - OK for many applications
 - still some way to go for using them in high field magnets for accelerators
 - surely promising for power transmission
- **LH2** looks interesting as a **cooling medium** and also for **energy transmission** (chemical + electrical) combined with HTS
 - improvements needed in storage and liquefying efficiency
- **He scarcity**
 - extraction from natural gas wells should be extended
 - improve storage in unused mines
 - limit the current waste
- Sustainability is not only efficiency but requires a global approach

Innovation survey

- Scientific Advisory Committee expressed some suggestions in May '23:
 - **I.FAST technologies should be critically assessed** with regards to a realistic pathway to identified markets and the time scales required.
 - For each technology, it would be good **to get idea of technology readiness level (TRL)** as not all developments seem to have the same level of market-readiness.
 - It was not always made clear enough **which developments are happening because of I.FAST**
- we decided to provide some feedback to the SAC by carrying out a new survey throughout I.FAST

First survey

- In the second half of 2021, a survey was carried out.
- Aimed at assessing the foreseen innovation outcome and TT potential of R&D activities supported by the I.FAST project.
- Out of the 28 tasks identified as suitable for participating in the survey, 61% provided a feedback.
- Results of the analysis carried out on the data collected were included in a report <https://zenodo.org/records/10419266>

I.FAST

Innovation Fostering in Accelerator Science and Technology
Horizon 2020 Research Infrastructures GA n° 101004730

NOTE-001

I.FAST Knowledge Transfer Report: Assessment of Innovation Potential and KT Opportunities in IFAST R&D Activities

[WP3]

ABSTRACT

This IFAST Knowledge Transfer Report contains the outcome of a survey carried out in the second half of 2021, as a combined effort of the IFAST Tasks 3.1: “Coordination and industrial partnership support” and Task 3.2: “Knowledge Transfer and Business Opportunities in Accelerator R&D”. The survey was aimed at assessing the innovation potential and the technology transfer opportunities of the IFAST R&D activities.

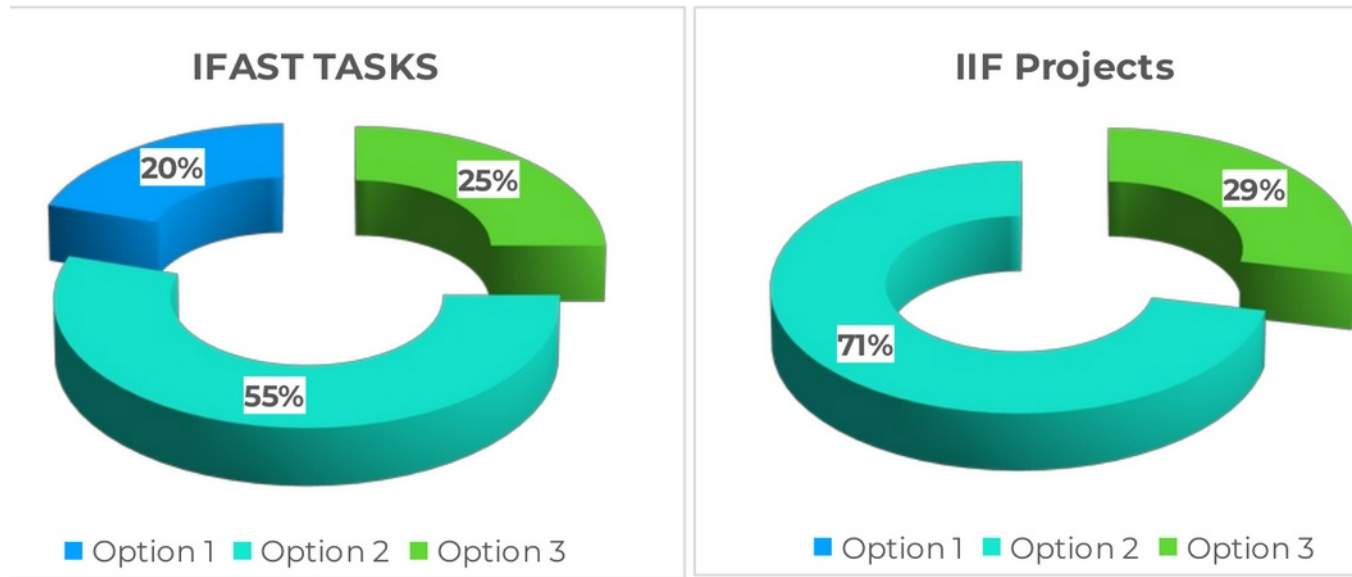
The KT report covers the general methodology and survey background, as well as the goals of the analysis and briefly discusses possible and planned next steps to be executed in the framework of the Task 3.2. This report represents the completion of the IFAST milestone MS09.

II Survey

- Extends the first survey by
 - including 10 new tasks that had not participated in the first survey;
 - including the new Internal Innovation Fund (IIF) projects started in 2024;
- Updates the assessments for the tasks involved with the first survey.
- Questionnaires were therefore distributed to the coordinators of
 - 24 task-related activities (10 new)
 - 8 new IIF projects.
- Feedback from
 - twenty activities (83 %)
 - seven out of eight IIF Projects (88%)
- Results of first preliminary analysis sent to SAC and discussed in the IAB

First question

What kind of innovation is it expected to be generated by your R&D activity?



- Option 1: ... **spillover to industrial partners is expected to be limited** ...
- Option 2: ... **significant innovation to industrial products and/or processes**
- Option 3: ... **industrial innovation is definitely an expected outcome.**

Time scale

What would be a possible timescale for the new derived products, processes or services to be market-ready?

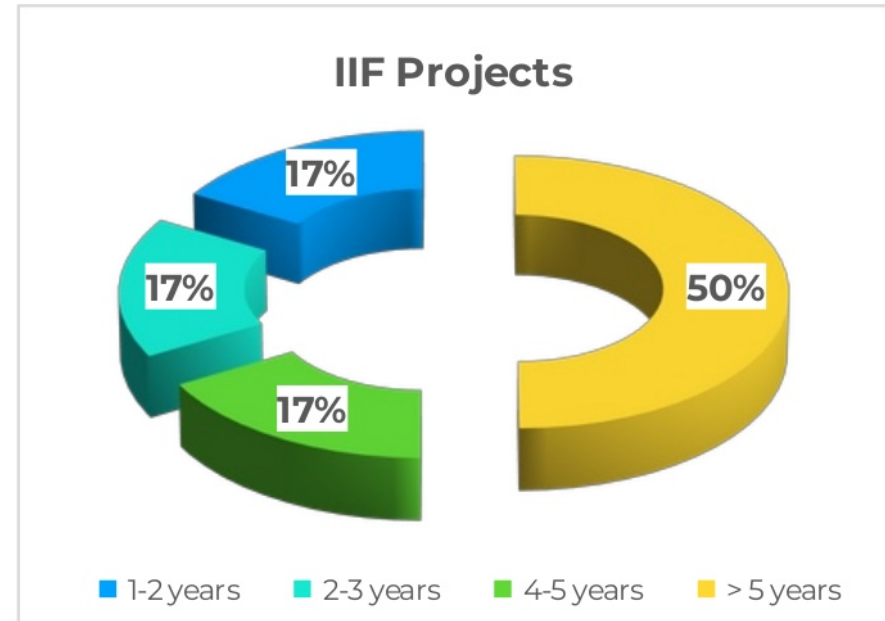
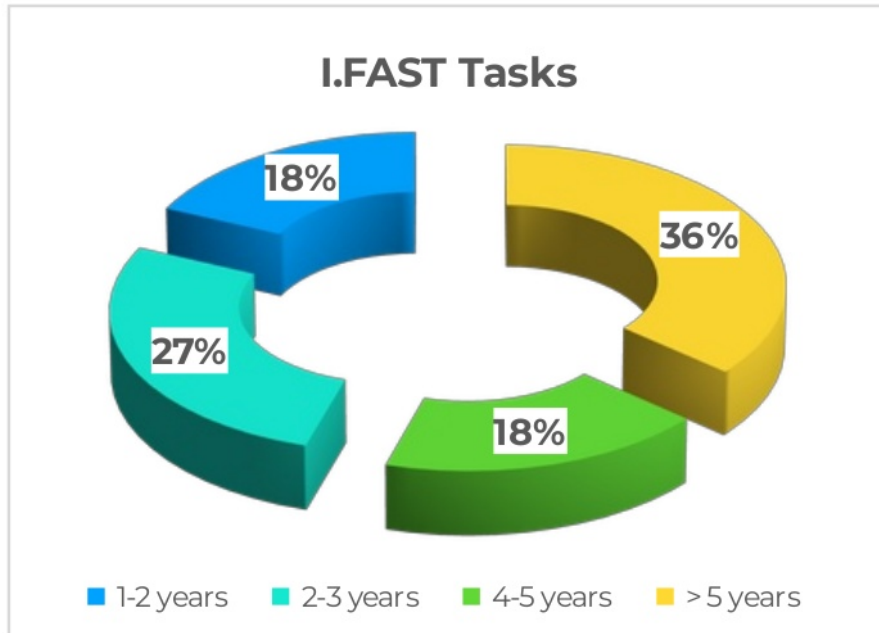
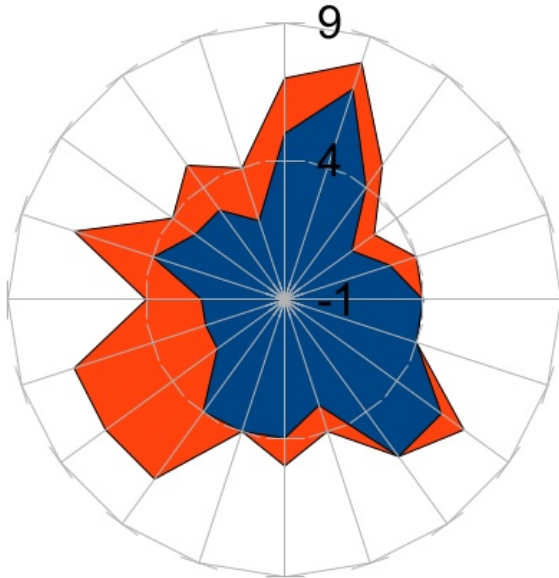


Figure: 2: Timescale for market-readiness

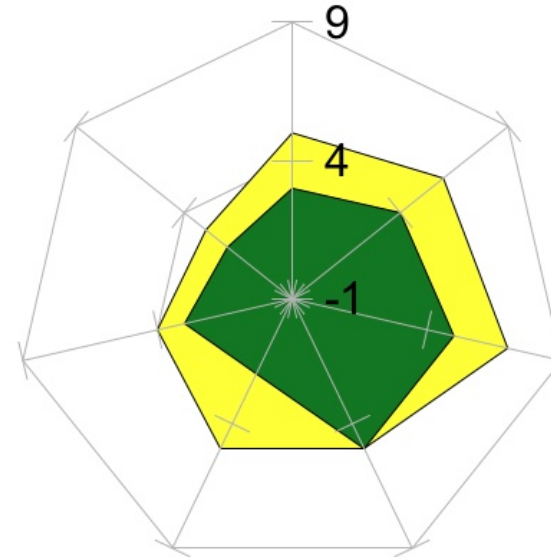
TRL evolution in I.FAST

I.FAST Tasks



- TRL at survey time
- TRL at the end

IIF projects



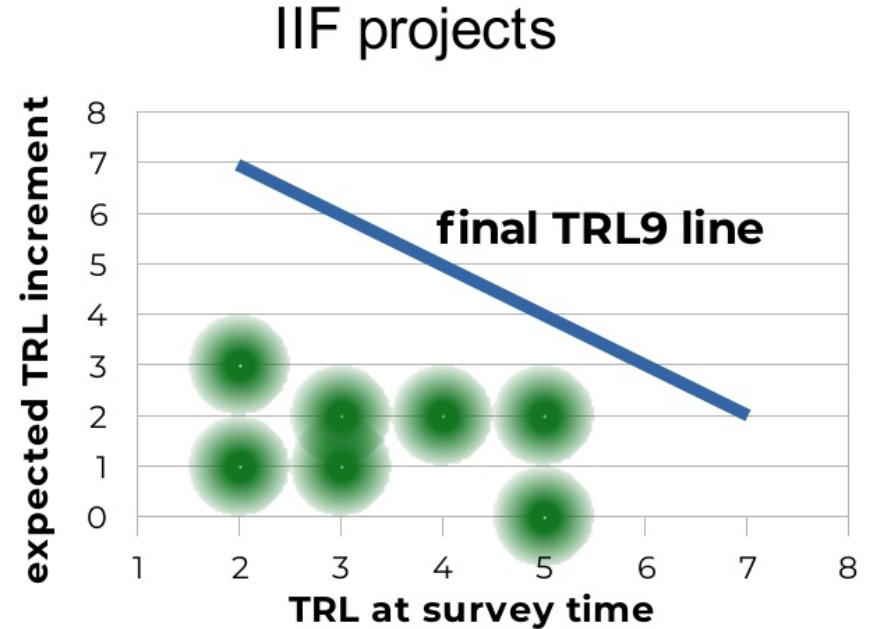
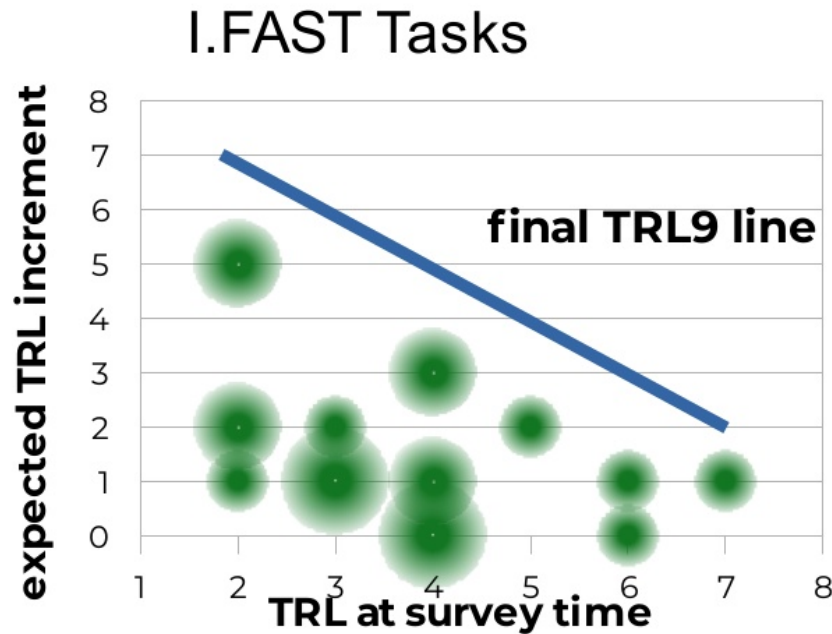
- TRL at survey time
- TRL at the end

For the tasks the **average final TRL is 5.3** and the average increment expected is **1.6**. For the IIF projects the average increment is the same, but the **final TRL is 5.0**. For comparison, in the previous survey that covered the foreseen evolution over the entire I.FAST timespan, the final TRL averaged across the tasks that provided their feedback was **5.4** with **an increment of 2.8**.

The TRL evolution (II)

-
- Two populations are clearly distinguishable in the left hand side plot: those with low TRL increment, that eventually reach a maximum TRL of 5 ("Technologies demonstrated, but not validated, in the environment") and those that have a TRL trajectory characterized by more ambitious TRL goals that lead to final values of 7 or even 8.

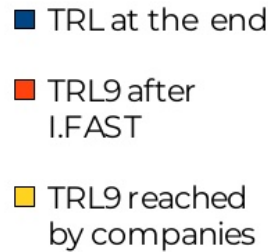
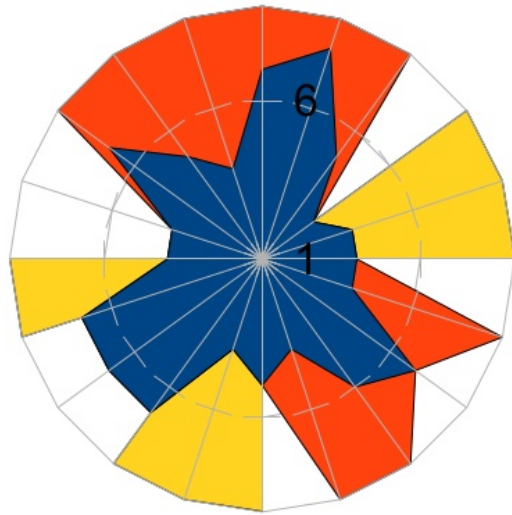
TRL evolution in I.FAST



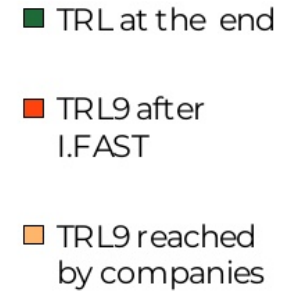
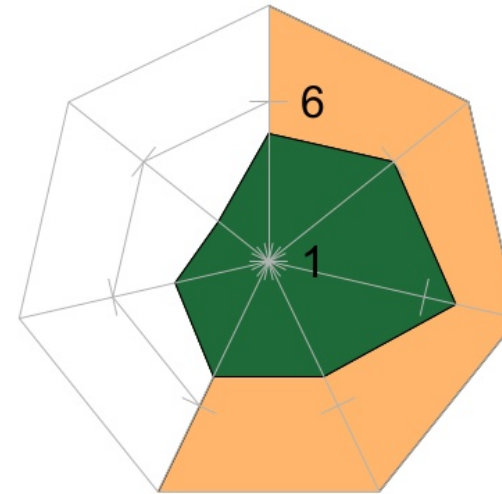
- Two populations are clearly distinguishable in the left hand side plot:
 - those with low TRL increment, that eventually reach a maximum TRL of 5 ("Technologies demonstrated, but not validated, in the environment")
 - those that have a TRL trajectory characterized by more ambitious TRL goals that lead to final values of 7 or even 8.

TRL beyond I.FAST

I.FAST Tasks



IIF projects



- The question was then raised as to whether efforts would be made to achieve TRL 9, whether this would be done with the main contribution of the group(s) currently engaged in development, or whether the task would be taken over by companies.

Are parts of the developments carried out also in contexts outside I.FAST?

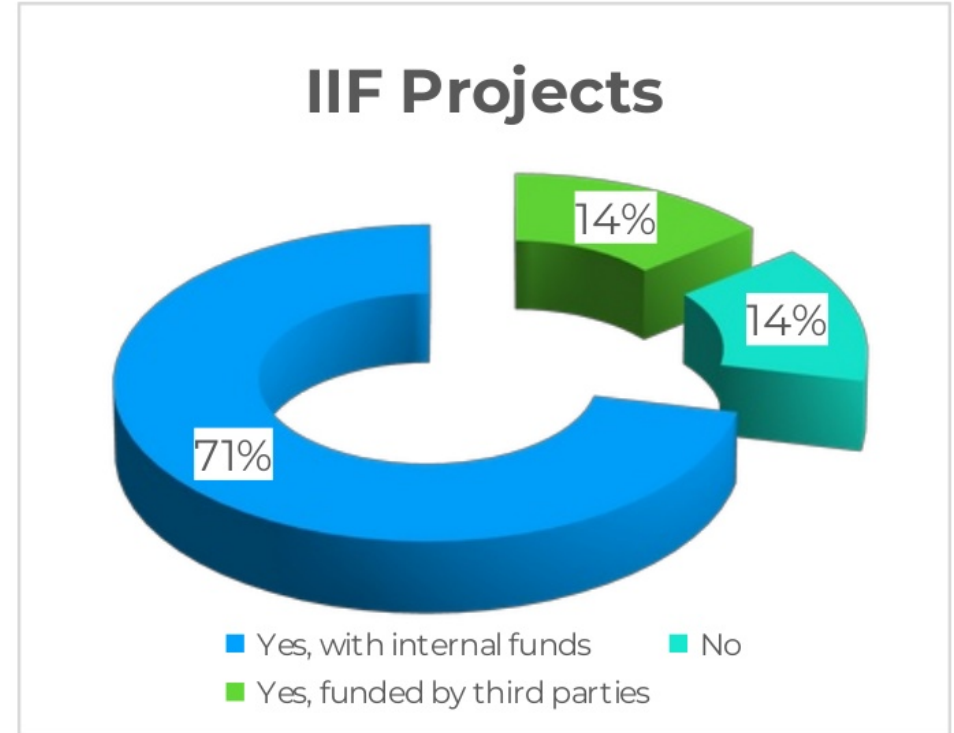


Figure: 6: Support beyond I.FAST

Are you aware of other groups working on the same or a similar topic?

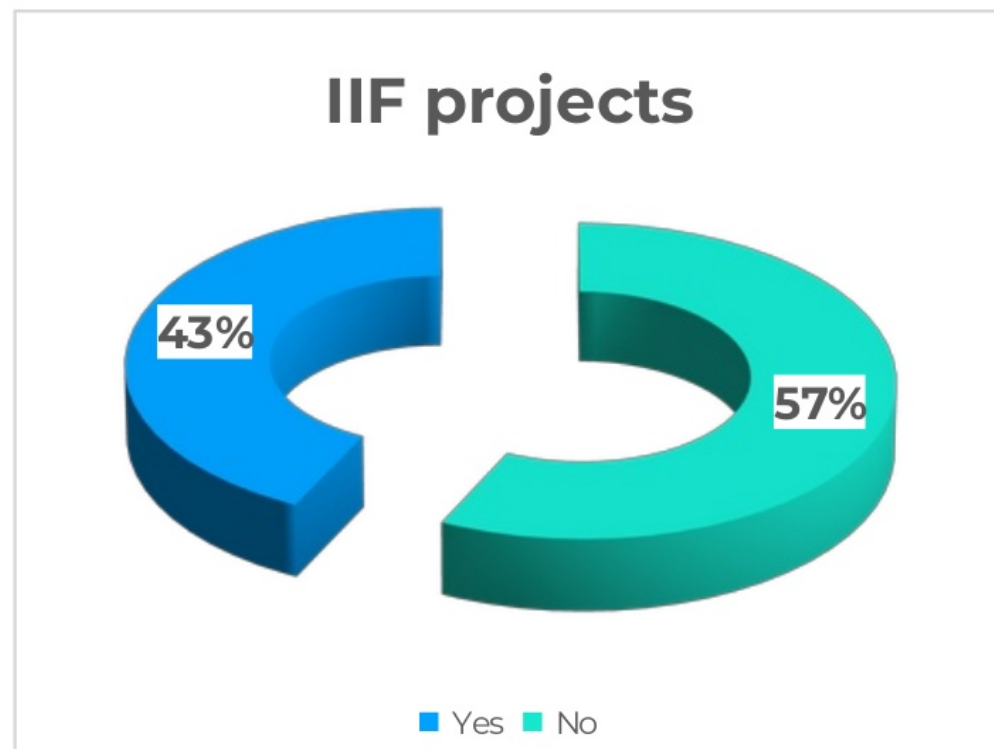


Figure: 7: Uniqueness of I.FAST activities.

Conclusions

- In general the self-assessment of the industrial **innovation potential of the R&D activities is encouraging**,
 - only in 20% of the cases the impact is considered to be not so significant
 - 25% of the activities are aimed at developing products or technologies that can find a market beyond the accelerator domain.
- With the more quantitative approach provided by the TRL assessments, it can be seen that
 - the R&D activities in I.FAST generally take longer than 4 years in order to reach a TRL higher than 7,
 - partly due to the fact that the initial TRL is low,
 - partly due to the rate of increase of the TRL, which is on average, less than 1 TRL/year.
- In the case of the IIF projects, the TRL is on average higher than for the tasks at the beginning of I.FAST (3.6 vs. 2.6), indicating that the **emphasis on innovation in the selection criteria has made a difference**.
- The analysis confirms the impression of the SAC that the R&D activities show a rather large diversity in their TRL trajectories, with **two populations clearly distinguishable**, characterized by a final TRL clustering at TRL7 and around TRL4.

I.FAST Task 3.2: Knowledge Transfer and Business Opportunities

- One of the task in I.FAST (WP3.2) is to foster Knowledge Transfer and Business opportunities in I.FAST accelerator R&D projects
- I.FAST projects are striving to achieve their R&D goals, mainly motivated by scientific interest
- Often overlooked is the potential to...
 - facilitate transfer of knowledge to industry
 - stimulate the build-up of added industrial value in terms of creating new IP, creating new market opportunities for existing companies, facilitating the creation of spin-offs, etc.
- One of the goals of the task is therefore to support the I.FAST beneficiaries in achieving an optimal exploitation of this potential

Ongoing efforts to support Knowledge Transfer and Business opportunities in I.FAST activities

- **Connection between WP3.2 and Luca Garolfi** (WP4, responsible for IIF projects) established, to jointly address the activities
- Discussions with IIF projects on their business cases:
 - contacted first half of the IIF projects,
 - first in-depth discussion
- **Individual meetings / interviews**, to get feedback on their approach, touching the following topics:
 - Business problem and value proposition
 - Primary application, users or customers
 - Alternative solutions
 - Path to market and commercialization approach
 - Anticipated impact pathways
- Support from WP3.2 in development of the business case will be provided when needed
- **Report on approach and first analysis** will be finalized by end of May (D3.2)

Access to IP Workshops to I.FAST community

- Based on the feedback in I.FAST Innovation and TT survey carried out within WP3, we share KTT related trainings between I.FAST, LEAPS-INNOV and AIDA-innova
- Most requested support of I.FAST activities were support with **assessment of commercial potentials** and **consulting regarding IP and licenses**
- Three workshops executed, with good participation of all projects
 - IPR Workshop on software with focus on copyright law
 - IPR Workshops on reading and understanding inventions and patents
 - Upcoming: Workshop on exploitation/utilization of research software

4th IP Seminar: Software IP Workshop

- Based on DESY SoftWert project: development and implementation of a methodological toolkit for the utilization of research software
- Online/Virtual only, 15 May 2024, 10:00 - 12:00 am
- Registration: <https://indico.desy.de/e/SoftWert> (please indicate „I.FAST“ in the „EU Project“ field)
- Content of the workshop:
 - In the times of digitalization, there are new opportunities but also challenges in software development and usage.
 - This workshop will give a basic overview about utilization of research software. Starting with the evaluation of the exploitation potential of research software, through clarification of the legal conditions, to the identification of suitable transfer paths and design of the respective business models, right up to the creation and negotiation of license agreements.
 - Target group are the researchers in the respective organizations working on software projects

WP3.3 task completed

- One important objective achieved in the past months was the completion of the WP3.3 activities
- The fundamental goal of the Task 3) was to **identify how the accelerator science and technology community can improve the effectiveness of industry-research institution collaboration at early stages.**
- Activities started in 2021 and included:
 - a large survey preformed with a series of 1-to-1 meetings with industry representatives (21) and Industrial Liaison Officers from 7 European countries
 - a few meeting with representatives of European RIs: CERN, DESY, INFN
 - a study by a consultancy firm to analyse how RIs are currently dealing with the contractual involvement of companies in projects where the deliverable are not already fully defined
 - a contribution to the creation of the Accelerator Sc&T Industry Permanent forum (AIPF)
 - an assessment, through the involvement of the AIPF, in ranking the relevance of possible actions for improvement
- **Final report was delivered** in March 2024



M. Morandin - 17 April 2024

IFAST

Accelerator Research and Innovation for European Science and Society

Horizon 2020 Research Infrastructures GA n° 101004730

DELIVERABLE DOCUMENT Report on extended industrial contribution in R&D activities

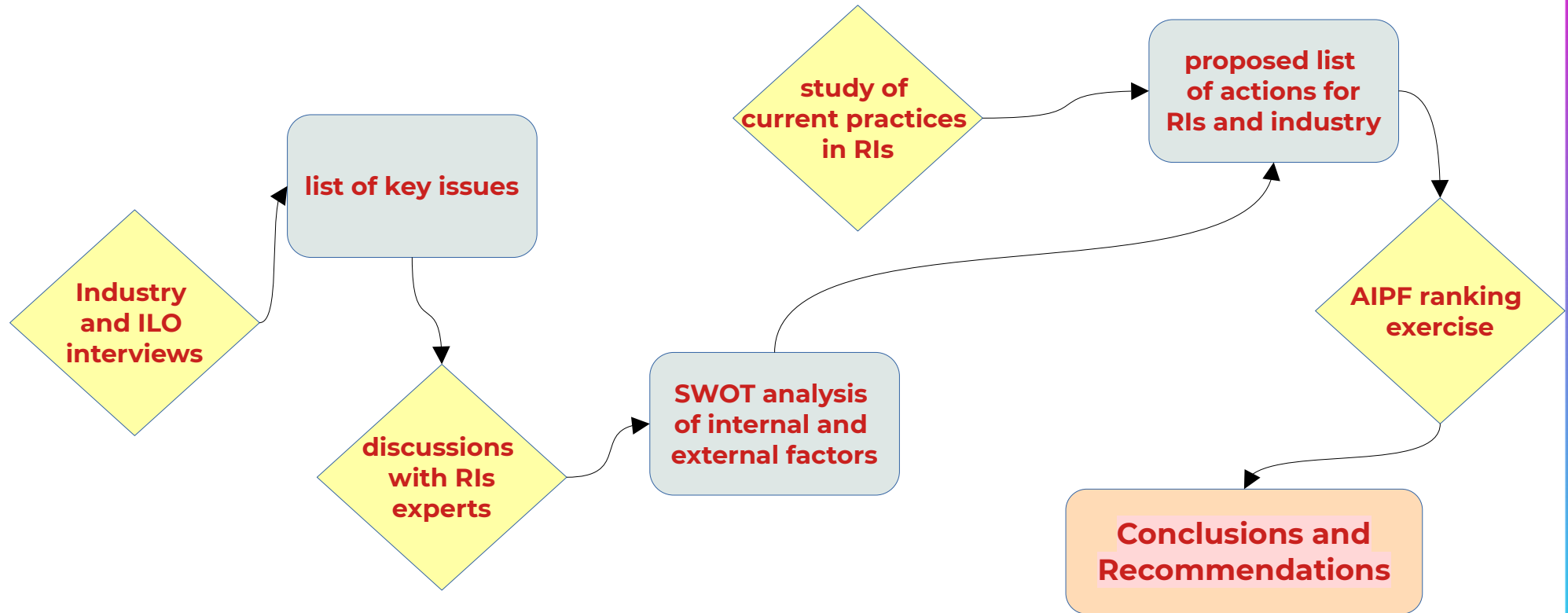
DELIVERABLE D3.3

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ABSTRACT

The fundamental goal of the Task 3 of WP3 of IFAST (WP3.3) is to identify how the accelerator science and technology community can improve the effectiveness of industry-research institution collaboration at early stages. In this deliverable report, the workplan of WP3.3 is described, together with the collection of feedback both from industrial partners and research institutions to the central issue addressed. An effort has been made to guarantee a representative contact with the industrial sector. The analysis developed has been discussed in a second iteration with industry and research institutions and their feedback are compiled. The conclusions obtained provide a number of topics to address. None of them are simple, nor implementable at a short-range without a strong commitment of the whole community. Some of them may be controversial, since they can affect to the internal strategy of research institutions and may represent an effort difficult to accomplish without implementing specific plans that will demand funds and resources. In this context, the ideas collected and discussed in this work with the industry and the research institutions may represent a valuable reference for incoming initiatives, both for specific developments and for wider roadmaps of the accelerator science and technology community.

Process flow



Conclusions

- The report provide a **comprehensive description of the issues** that need to be addressed and the **possible actions to be taken** as perceived by the involved parties.
- It can represents a **valuable reference for future initiatives**, both for specific developments and for broader road-maps of the accelerator Sc&T community.
- However, the study also highlighted the fact that **no actions are easy or quick to implement without a strong commitment** from the entire community.
- Some of them may be controversial, as they in some cases may affect the internal strategy of research institutions and, in other cases, may require **specific planning with associated funds and resources**.
- Therefore it was felt most useful to distill a limited number of **higher priority and broad recommendations** that are finally proposed for the attention of the Accelerator Sc&T community

Recommendations

- 1) To make progress in the right direction it's important that, wherever possible, both the RIs and industry succeed in **bringing out the clear positions of their respective sides**, so that they can then be discussed in **a context of mutual understanding** and lead to **shared initiatives**
- 2) Continuity of this process is essential, so a relevant effort must be carried out to create **a permanent and effective ASc&T-Industry forum** and **secure the resources needed for supporting its activities**
 - the newly created **AIPF** is a first attempt in this direction
- 3) An objective on which there is already a broad consensus is the **wider adoption of best practices and tools for innovation procurement** to facilitate business participation in development activities.
 - to be taken into account also in future project proposals
- 4) Contractual aspects that are deemed most critical for engaging SME in R&D activities (e.g.: liability terms, guarantees, terms of payment) should be analyzed to find possible ways of **mitigating their negative impact**
- 5) Explore and promote the development of **accelerator industrial applications beyond basic Science**.
- 6) Implement a longer-term strategy and coherent planning for **addressing the list of actions** that have already been identified as most promising.

About this special session

- proposal triggered by the first discussions within the newly created **Accelerator Industry Permanent Forum**
- the idea is to **give the floor to Industry** to present their views on
 - how to **make the collaboration with research institutions more effective**, especially in terms of **improving the commercial exploitation** of technology developments.
- European companies working in the accelerator field have been invited to propose **15-20 minutes talks**
- Response from industry **has been good** as it appears from the agenda