Instrumentation Technologies
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Institute-Industry Partnerships

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Overview

- **Context**
- **Partner Identities**
- **Interactions**
- **Technology Transfer**
  - Examples
- **Partnership**
  - Examples
- **Observations**
- **Concluding Remarks**

Research Infrastructures - Accelerators

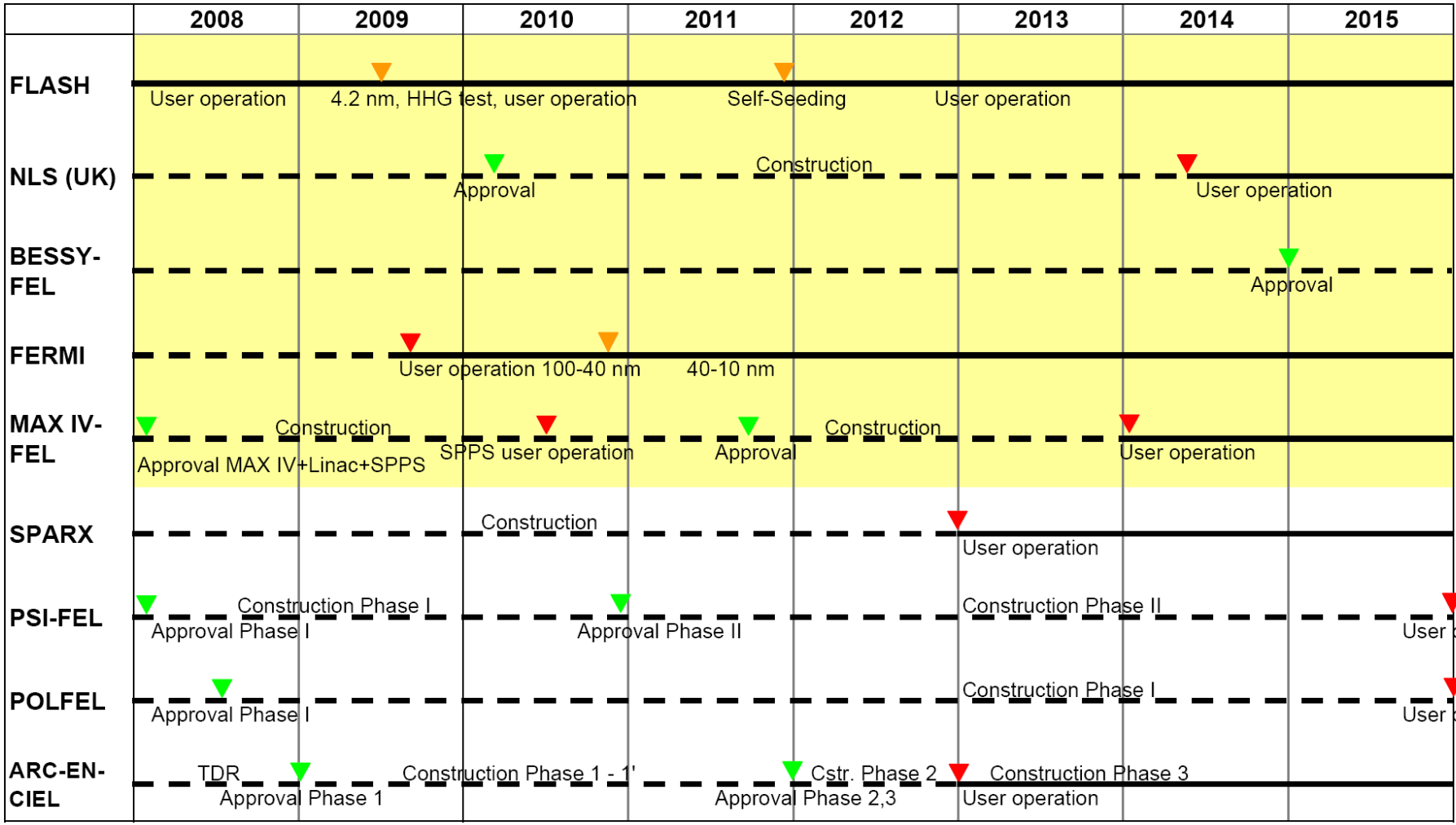
- **Many projects worldwide facing similar challenges**
  - Extreme performance
  - State of the art technologies
  - Budget Constraints
  - Challenging timelines
  - Lack of Human Resources

- **The challenges are alleviated**
  - Many projects use similar techniques and technologies
  - Cooperation between institutes
  - Collaboration with Industry

Situation in the EU

- **EU roadmap (10-15 years) for research infrastructures estimate is 13.5 B€ (~20 B€ expected for 2008 update).**
- **Synchrotron radiation, Heavy Ion and Proton sources are important developments. Representing ~5.2 B€.**
- **International collaborations and industrial involvement are essential.**

FELs in the EU - IRUVX



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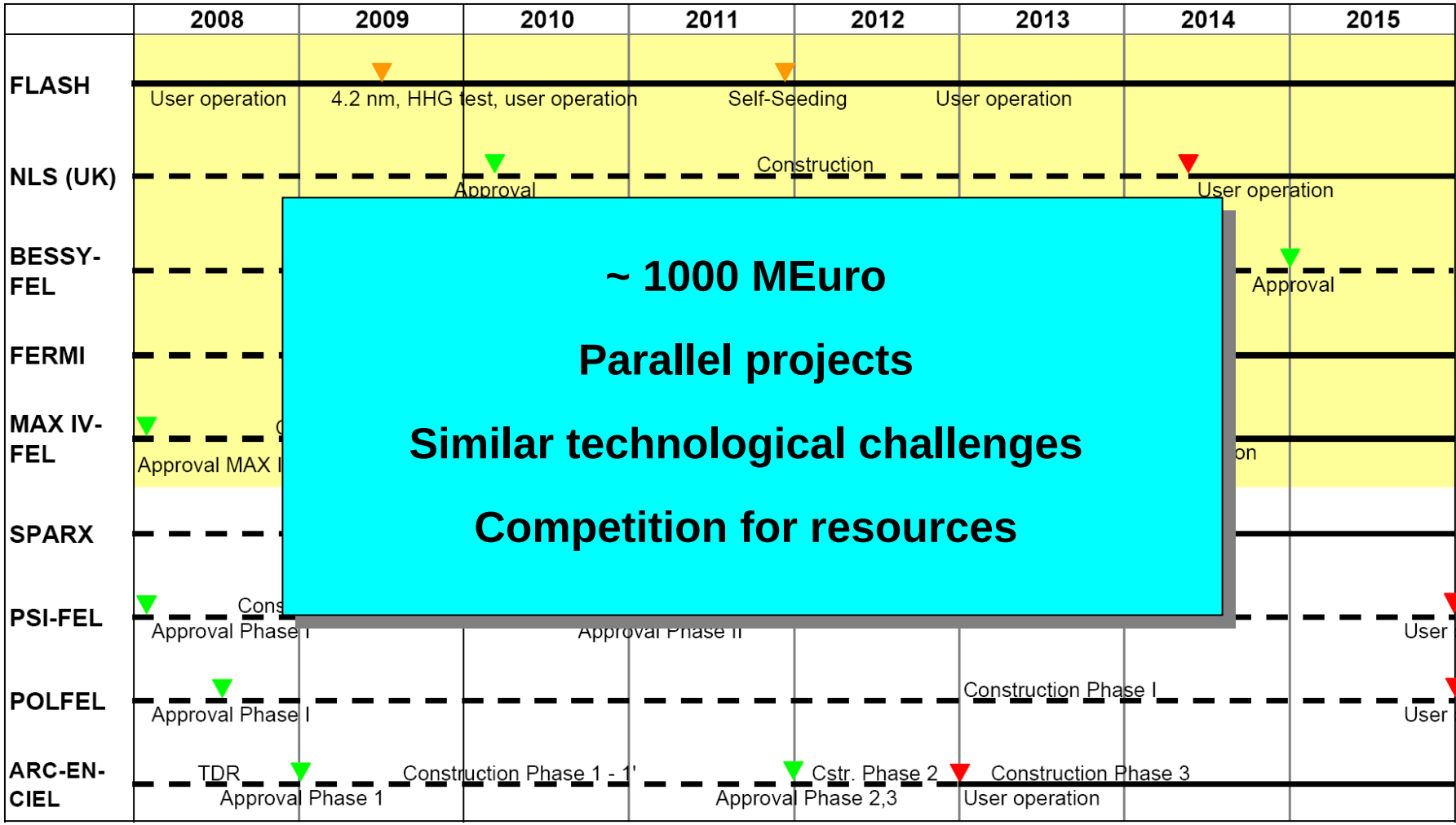


The Partners - Research Institutes (RI)

- **Publicly Funded**
- **Built to carry out basic research**
- **Project realization ~5 to 15 years (Concept to Operation)**
- **Projects come once in a while 5 to 10 years**
  - Makes it difficult for SMEs
- **Operational as a service ~15 to 25 years**
  - Continuously Upgraded - Good for SMEs
- **Manpower during construction > operation (machine)**
- **Project base**
  - At existing infrastructure - laboratory support and initial manpower (usually operations focused).
  - Greenfield - all new

The Partners - Industry

- **Privately Funded - Needs income**
  - Cash Flow is important, Market is important
  - Profit important - funds R&D and growth
- **Carries out applied and market driven research**
- **Industry project durations are (typically) < RI Project**
- **Can build to Print, to Specification, Turn-Key & Supply**
  - Apply Industry Standards, Best Practices & Quality Assurance
  - Repository of expertise and knowledge (Human Capital)
- **Provides support, service and manpower**
  - Design studies and prototypes as well as series production
  - Mobility of people from industry is greater than in RI's
- **Global Market**
  - Buffers against sporadic nature of project approval

Institute & Industry Interactions

- **The institute is a customer and industry provides standard equipment.**
- **Institute designs and industry builds to print.**
- **Institute gives specifications and industry custom builds.**
- **The institute is an end-user and industry provides a Turn-Key Solution.**
- **The institute transfers Technology and Knowledge to industry.**
  - INFN - Detector Technology transferred to Space Industry
  - ESRF - Transfer of undulator manufacturing knowledge to industry
  - Daresbury - Ceramic anti-multipactor coating process for Klystrons
  - ASP - Tenders conditional on involvement of local industry
- **The Institute and Industry partner and collaborate in design, prototyping & manufacture.**

Technology Transfer - I

- **The importance of Technology & Knowledge Transfer**
  - Governments want a return on their investment.
  - Funding is increasingly conditional on the benefit to Industry.
  - Technology Transfer triggers innovation and improves a country's long term growth.
  - Society benefits from academic & industrial partnership.
  - Technologies are spread to wider markets - medicine, space, telecommunications, nanotechnologies, …
  - Both parties are more effective in their given research (whether it is basic, applied or market driven) when knowledge is exchanged.
  - Research Institutes can provide skills, intellectual property, access to facilities and money towards the growth of industry.

Technology Transfer - II

- **Technology and Knowledge transfer is not easy**
  - Knowledge is “sticky” it does not want to move.
  - Different cultures exist between Universities, Research Institutes and Industry.
  - Communication not effective and information flow difficult.
  - Reluctance to provide information (“it’s my idea”) or accept new concepts (“not invented here”).
  - Mobility of people is low (especially from Research Institutes to Industry).
  - Management and economic skills in universities and research institutes is not the highest priority, basic research and teaching is.
  - Industry fears loss of intellectual property and know-how to competitors.

Making Technology Transfer Easier

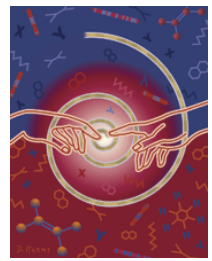
- **Government initiatives**
  - Conditional RI funding, tax benefits, grants, …
  - EU Programs
  - Innovation Centres and Science Parks
- **Institute Initiatives**
  - Industrial liaison group
  - Foster industrial collaboration from the start of a project
  - Educate scientists in management
  - Encourage mobility, industrial sabbaticals.
  - Organize workshops, maintain open project databases, foster networks and forums.
  - Promote in-kind contributions - facilitates national Institute - Industry partnerships.

Making Technology Transfer Easier

- **Industry Initiatives**
  - Safe guard Human Capital - Maintain high level of expertise, internal training & transfer of knowledge. Institutes hesitate if there is commitment of own personnel to training - especially for pressured projects.
  - Listen to RI needs and implement them (Risk Sharing)
  - Provide forums for discussion
  - Technology Training workshops for RI personnel
  - Train RI students and participate in Government/EU programs
  - Share knowledge and management skills
  - Provide political support to Institutes

FP6 - ERID Watch

- **European Research Infrastructures Development Watch**
  - Increase public investment efficiency for European Research Infrastructures and develop Public/Private Partnership
- **Aims: to improve the private involvement in RIs in:**
  - Identifying and benchmarking current practices to optimise private-public relationship,
  - Quantifying and qualifying the economic weight of existing and forthcoming RI markets in Europe (ESFRI Road-Map),
  - Provide public authorities in charge of RI programmes with recommendations,
  - Making recommendations known to all RI stakeholders on a wider European scale.
- **Results will be presented October 2008**
- **More info at http://www.eridwatch.eu**



FP7 - IRUVX

- **The IRUVX Consortium will join the FEL resources now in construction and planned in Europe into a unique Research Infrastructure. Five starting partners, two associates and two new.**
- **The EU FP7 funded preparatory phase is composed of 8 Work packages of which many deal with industry.**
- **Work package 6 is specific to industry:**
  - Identify and organise long term collaboration between the consortium and industry.
  - Improve economic impact of consortium and the scientific exploitation of the facilities.
  - Coordinate approach to suppliers to maximize efficiency in use of national resources.

EIFasT

- **European Industry Forum for Accelerators with SCRF Technology (EIFast) founded at DESY on October 27 2005.**
- **EIFast Mandate:**
  - Form a visible body to generate support for the realisation of scientific projects at the political level in Europe.
  - Ensure a flow of up-to-date information about projects between research institutes and industrial companies. Support the members in gaining access to information channels and decision makers otherwise difficult to obtain.
  - Promote involvement of industry in scientific projects - especially large projects - at an early stage.
- **Membership is open to**
  - All European research institutes involved or interested in getting involved in SCRF technology.
  - Companies and institutes interested in systems and components needed for an SCRF accelerator, including all supplies and services for the balance of plant.
  - Companies with production capacity related to the objectives of the Forum in Europe as well as European research institutes.
- **45 Members**
- **Contact: karsten.wurr@desy.de**

Partnership in building accelerators - I

- Partnership and collaboration is an intermediate step towards full technology transfer and knowledge exchange.
- It involves the early joint design, engineering and construction of (accelerator) systems.
- Resources (people and money) are optimized.
- Response to project needs is optimised
- Institute - the sponsor and first beneficiary of the work.
- Industry - is open to “customization”, sharing initial costs and part of the risk.

Partnership in building accelerators - II

- **The institute uses its own resources in specialized areas in a cost-effective way.**
- **Industry does the rest in its own specialized area in a cost-effective way.**
- **Benefits**
  - The institute gets what it wants (no surprises).
  - The institute does not have to hire a large team and can focus on what it does best.
  - Implicit and explicit Technology and Knowledge Transfer. Indirect training of people with different backgrounds. Stimulates people mobility.
  - Collaboration prepares industry: knowledge, hiring, equipment, capital, budgets, …
  - Collaboration informs institutes of technological challenges, reduces risks, cost-effective, task done on time.
  - Collaboration allows industries to know other industries, catalyzing cooperation.

Australian Synchrotron Project

- **Construction of the synchrotron light source magnets**
  - Partners: ASP, CMS Alphatec/Buckley Systems
  - ASP had a small institute "delivery" team that put the detailed design, project management, installation (except for the magnets), commissioning and 'all' of the risk into the contracts.
  - Magnet construction done by inexperienced firm - significant technical support & knowledge given by Institute. Measurement system copied from SLAC and SPEAR III magnet used for tests.
  - Commissioning of systems done by contractors open to assistance from Institute team - transfer of operational knowledge from industry to Institute.
  - Project completed on time, within budget with small Institute team.

SOLEIL - France

- **Construction of Pre Injector Linac**
  - Partners - SOLEIL, Thales, Euromev
  - Reorganization lead to dilution of industry know-how, SOLEIL provided fresh knowledge. SOLEIL designed the linac and got what it wanted.
  - Industry got the know-how and got to use the facility to test codes.

- **Construction of Beamline optics - (a) Varying Groove Depth (VGD) Gratings and (b) multilayer coatings**
  - Partners (a & b) SOLEIL, Jobin-Yvon, (b) LCFIO
  - Based on long-term relationships
  - SOLEIL got innovative optics not available elsewhere
  - Joint Institute-Industry patent applied for (b)

Daresbury Laboratory CCLRC - UK

- **Development of L-Band IOT**
  - Partners - Daresbury Laboratory, E2V
  - Outline IOT specifications and initial investment by Daresbury
  - First 1.3 GHz IOT available commercially
  - Daresbury staff were trained in the use of IOTs
  - Daresbury had preferential delivery time

- **Development of 12 kW L-Band IOT Amplifier**
  - Partners - Daresbury Laboratory, E2V
  - Modest investment
  - Daresbury set the outline specification in line with ERL requirements
  - First 1.3 GHz high power amplifier available commercially
  - Daresbury had preferential delivery time
  - Daresbury was able to use the amplifier system on ALICE and evaluate its performance.

SCSS - Japan

- **Construction of high stability 50kV PS for 50 MW C-band klystron modulator**
  - Partners: RIKEN/Spring-8, Toshiba
  - Improvement by factor 50 in stability to 10 ppm.
  - Relied on mentoring by institute experts and access to the facility for testing.
  - Industry developed key technologies for the improvement of performance.
  - Relied on NDA's between the Industry and the Institute
  - Product commercially available

Canadian Light Source

- **Development of remote control and integrated experiment management for Beamlines**
  - Partners: CLS, Uni Alberta & W. Onatrio, IBM, BigBangwidth
  - 75% funding by Government - Industry Canada (CANAIRE)
  - First remote access project for a synchrotron beamline using UCLP technology. The use of UCLP technology and managed experiment collaboration and control in this fashion represents the state of the art in the field.
  - Deliverables: Users got innovative remote access, greatly increased efficiency (results, time & money). Industry made the system robust and capable.
  - All of the software developed is open source and available for exploitation by all the parties involved.
  - Following success of project, CANAIRE funded a follow-up project ScienceStudio with same partners.

Instrumentation Technologies - Slovenia

- **Development of Digital BPM Electronics**
  - Partners: SOLEIL, DIAMOND, Instrumentation Technologies
  - SOLEIL initial concept and sponsor.
  - DIAMOND sponsor of all-in-one solution and guidance.
  - Growth of large institute community around the product.
  - Continual collaboration between the community and industry for improvements, implementation and new developments.
  - Gained knowledge applied to new areas - advanced feedback systems, low-level rf control, single pass instrumentation…

Observations

- Industry re-structuring during project phase, leading to loss of key people or re-scoping of work.
- Small companies have difficulties covering development costs if sales are not guaranteed. Public funds can help but are burdened with paper work.
- Paper work associated with public funding can cause big delays.
- Partnership contract agreements may take significant time to set up.
- PhD's, Post-docs trained in industry can leave, taking knowledge with them.
- Difficulties in making common publications (patents granted if info not yet public).
- Tendency to keep things secret or IP not being shared. "Black-Box" syndrome not good for institutes.

Can be resolved by good initial planning, project management and communication.

Concluding Remarks

- Industry is capable and desires to participate in accelerator activities from the beginning.
- Partnerships and collaboration are a pre-cursor to full technology transfer.
- Institutes should plan for partnerships from the beginning of a project. Resource allocation is then optimized.
- Collaboration builds a community and fosters accelerated response to new project requirements.
- Government initiatives catalyze the process but the effectiveness depends on relationships, mutual trust and an appreciation of cultural differences between industry & institutes.
- Key to successful collaboration relies on People - with high motivation, project focused and trust.

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