
Technology Transfer to Industry at PSI's SwissFEL Project and a Joint PSI/Industry Initiative **beyond**

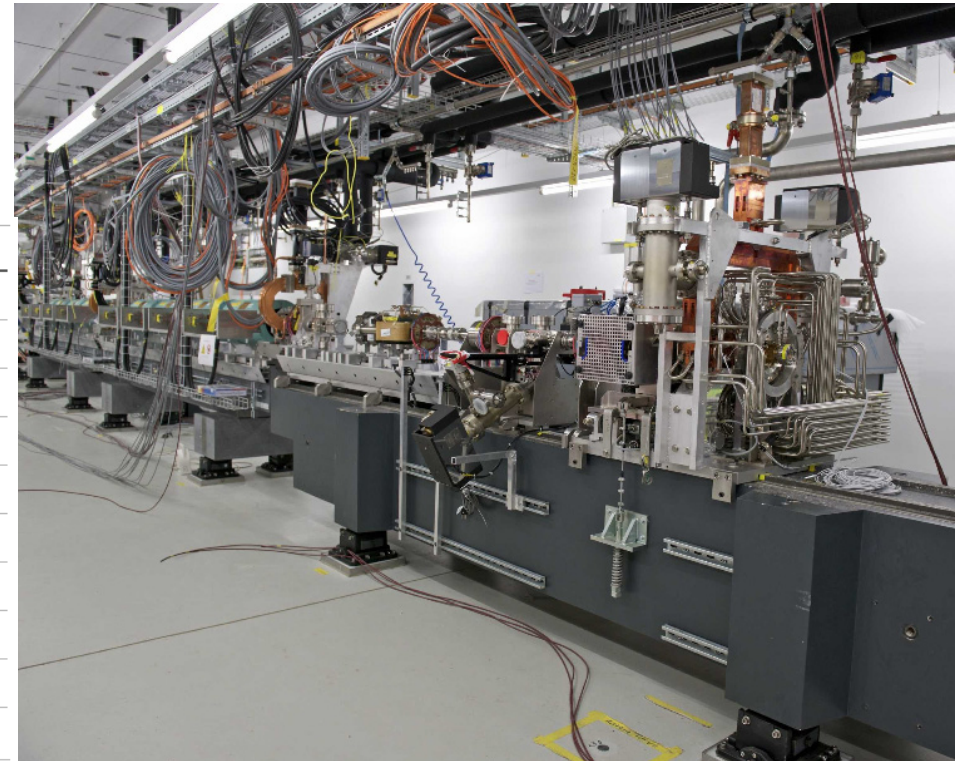
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Advanced Accelerator Technologies AG
PARK InnovaARE, CH-5234 Villigen
is a Joint PSI/Industry Business Development Initiative

- Technology Transfer (TT) is one of the 3 pillars of PSI's mission
 - Cutting edge Research
 - Education
 - Technology Transfer
- Inducing innovation and job creation, return on tax payer's money for society, economics and industry also short term
- PSI undertakes TT activities in many ways
 - transfer of specialists, technologies, processes, know-how and licensing of IP
 - support of or joint research & development projects with industry
 - development of demonstration and pilot projects, shared laboratories
 - fostering entrepreneurship among its scientists for implementing and exploiting their inventions which may lead to spin-off companies
- Intensified TT efforts during the ongoing SwissFEL project, examples...
- **Additional, enforced TT approach developed → 2nd part of talk**

The SwissFEL Project

Key parameters of the SwissFEL	
Overall length (incl. experimental hall)	740 m
Total electric power consumption	3.8 MW
Electron beam energy	5.8 GeV
Technology of linear accelerator	Normal-conducting copper cavities at 6 GHz
Charge per electron pulse	0.2 nC
Normalized beam emittance	0.4 mm•mrad
Number of X-ray pulses per second	200 (100 at each photon beamline)
X-ray pulse duration	24 fs
X-ray brilliance	$1.3 \cdot 10^{33}$ photons/(s•0.1%•b.w.•mm ² •mrad ²)
Shortest lasing wavelength	0.1 nm



PSI initiated cooperation with industry wherever feasible, e.g. for delicate, high precision parts and devices like accelerating structures, pulse compressors, and insertion devices.

C-Band structure production in cooperation PSI/industry

- PSI designed & developed C-Band accelerating structure, 2m long; 104 pcs for SwissFEL
- Technology/production process development at PSI's central technical unit
- Diamond machining, robotic stacking, cleaning/heating/multiple brazing procedures, extended survey, vacuum and RF testing...

Storage and transport under N₂

Cup washing

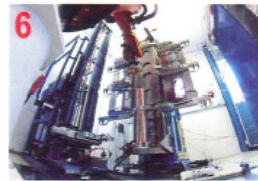


Vacuum dryer

4

Transport

5

Heat treatment
in vacuum oven

Disk stacking



Vacuum brazing

8

Cooling channels pressure test
(with 9 bar nitrogen)

9

leak test for vacuum part
and cooling channels

10

Wire insertion for
the bead pullingStructure reversed to horizontal
position on a temporary girder

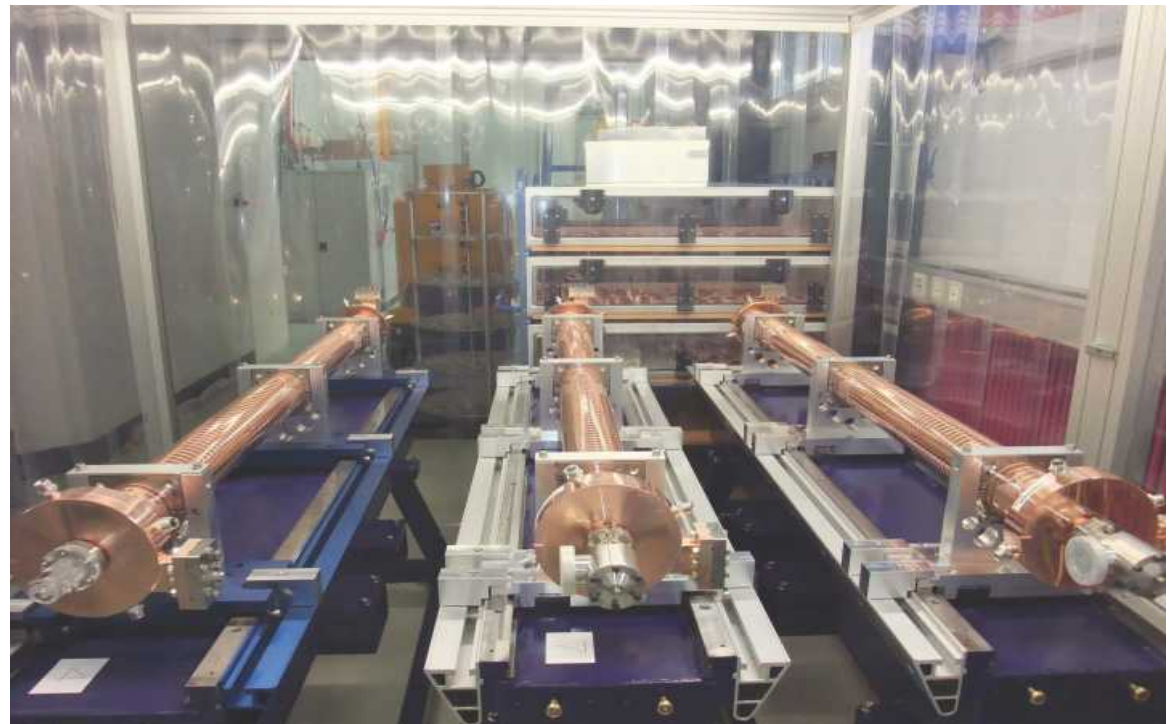
12



Bead pulling

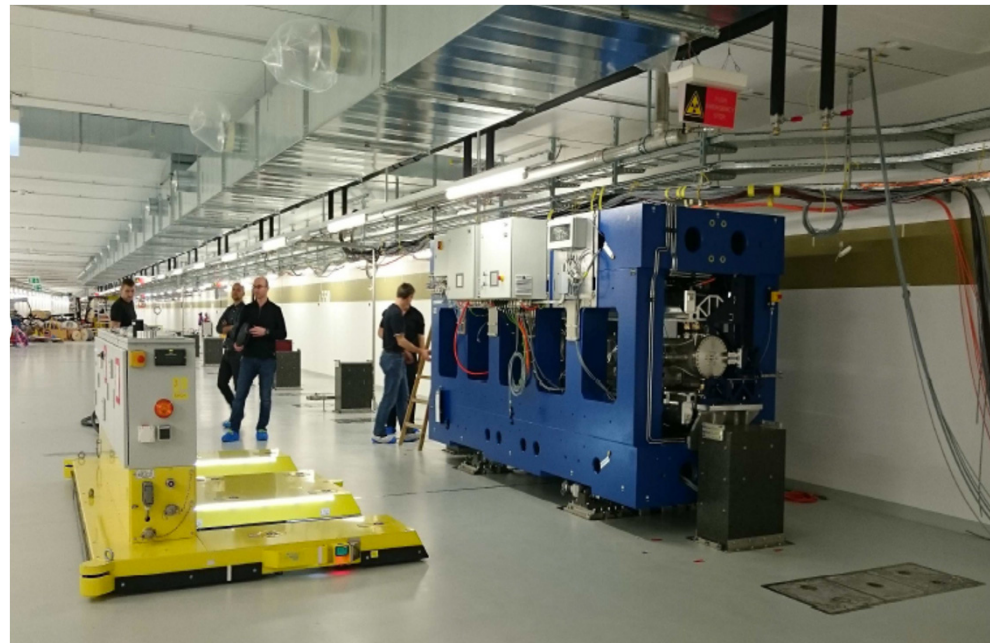
C-Band structure production in cooperation PSI/industry

- Transfer of certain steps to industry (VDL/NL , TEL-VDL CH, especially UP machining)
- training & supervision by PSI
- other steps in house PSI
- rf manifold by MHI/JP
- Series production launched at the end of 2014
- Industry now at ~80% delivery level
- All structures completed, tested and installed into SwissFEL by Q4/2016



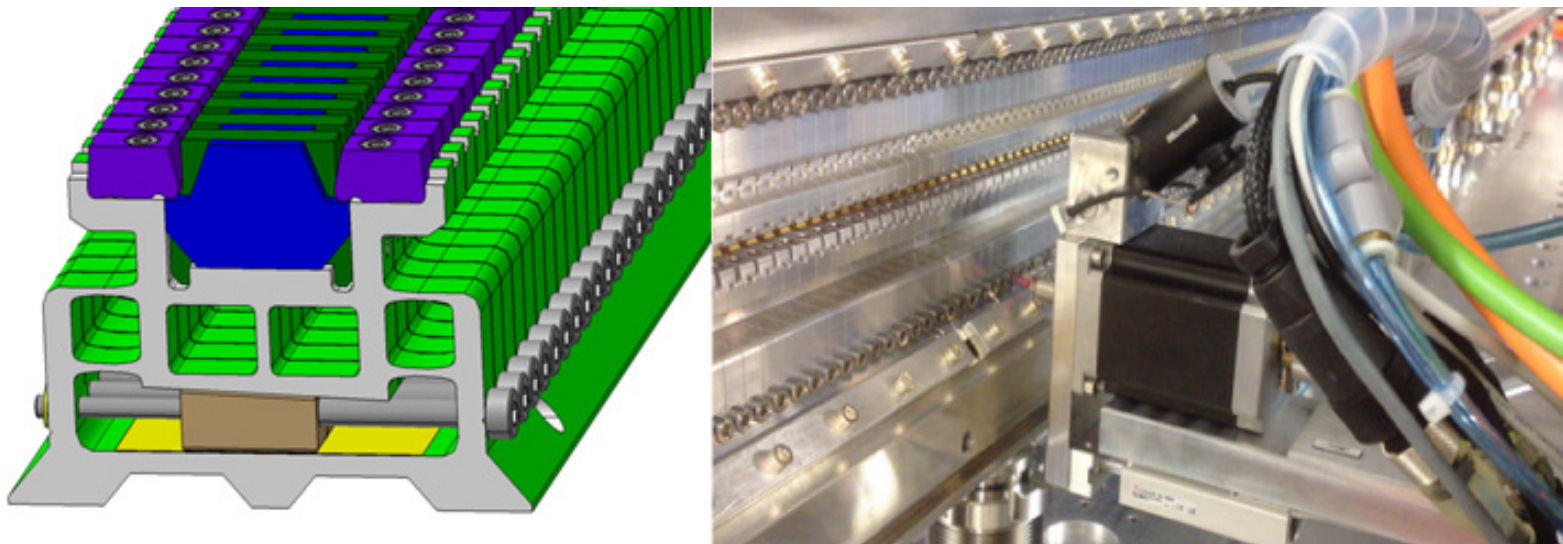
Novel Undulators in Cooperation PSI/industry

- Modular support suitable for in-vacuum, APPLE II or standard applications
- Design and technology development at PSI, close collaboration with industry
- Critical: Precision machining of large pieces and assembly in temperature controlled area
- Split of tasks
 - Support structure/drive systems (Daetwyler/CH)
 - UHV comp. (VDL/Comvat/CH)
 - magnets (Hitachi JP)
 - magnet assy (Daetwyler/CH, Bruker ASC-RI/D)
- Final assembly and field optim. PSI
- Series production launched end '14
- Industry now at >90% delivery level
- All 13 undulators completed, tested and installed into SwissFEL by 10'16



Novel undulators in cooperation PSI/industry

Key feature: automated field optimization



< 2h for 1060 individual corrections with μm accuracy

A Challenge beyond „Standard“ TT process

- Design and integration of subsystems and systems
- beyond transfer of single technologies
- overcome time/resources/budget constraints
- integrate industrial know how

→ **PSI Directorate/PSI Stakeholders:
Create new opportunities !**

Search for alternate concept

- New format, external to institute
- Additional budget
- Involve industry from start

New platform for

- evaluation of PSI Know How for economic potential
- identifying prospects, search for applications
- more systematic business development, market studies
- and for emerging business

Form a company

- shareholders are companies with complementary activities/fields
- ... and willingness to invest together into Business Development
- i.e. to take considerable risk

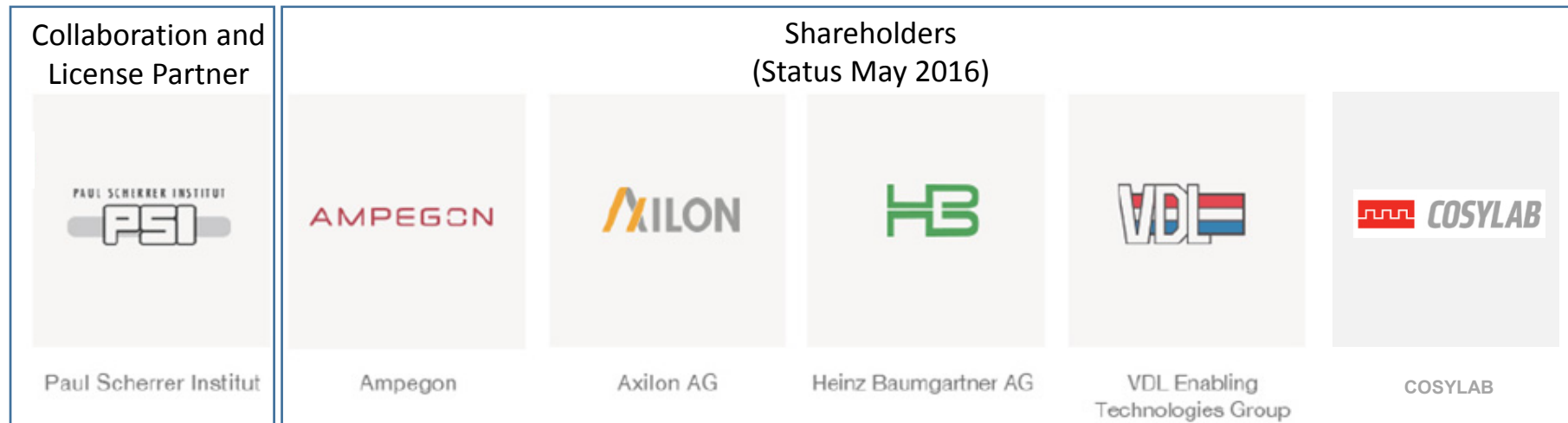
Partner up with PSI

- broad collaboration and license agreement

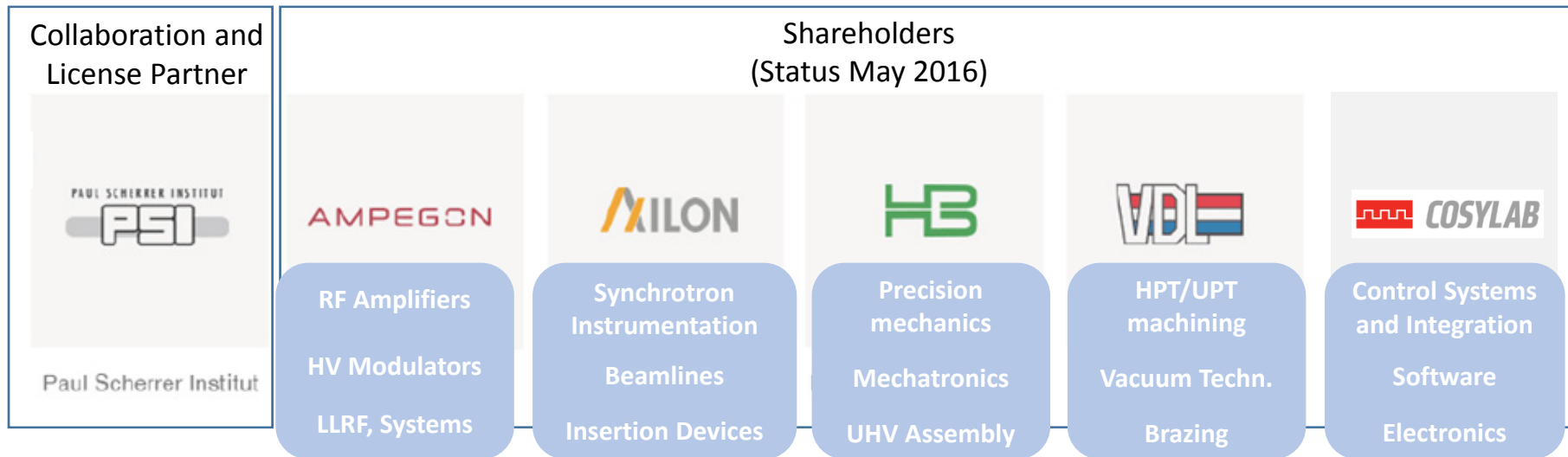
Phase 1 evaluation, business development, prepare business cases

Phase 2 business operation

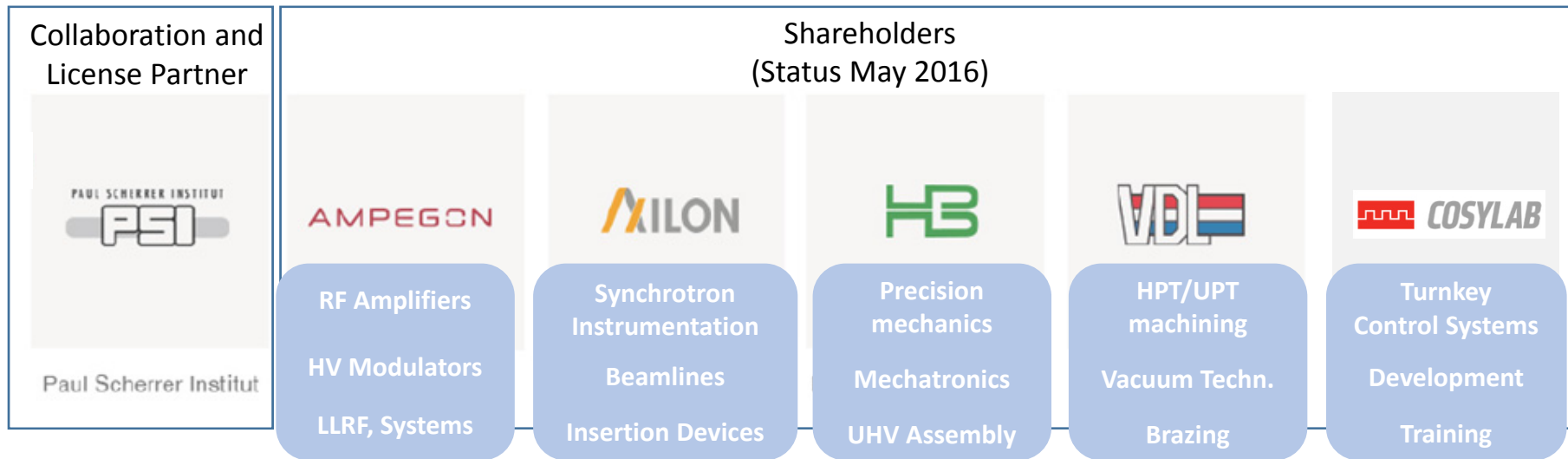
Partners of Advanced Accelerator Technologies



Partners of Advanced Accelerator Technologies



Partners of Advanced Accelerator Technologies



**Enhance economic impact of combined PSI and AAT Know How
Create value beyond individual expertises**



AAT is embedded into federal initiative Swiss Innovation Funds/PARK innovAARE



Accelerator
technologies

Human Health



Materials &
processes



Energy

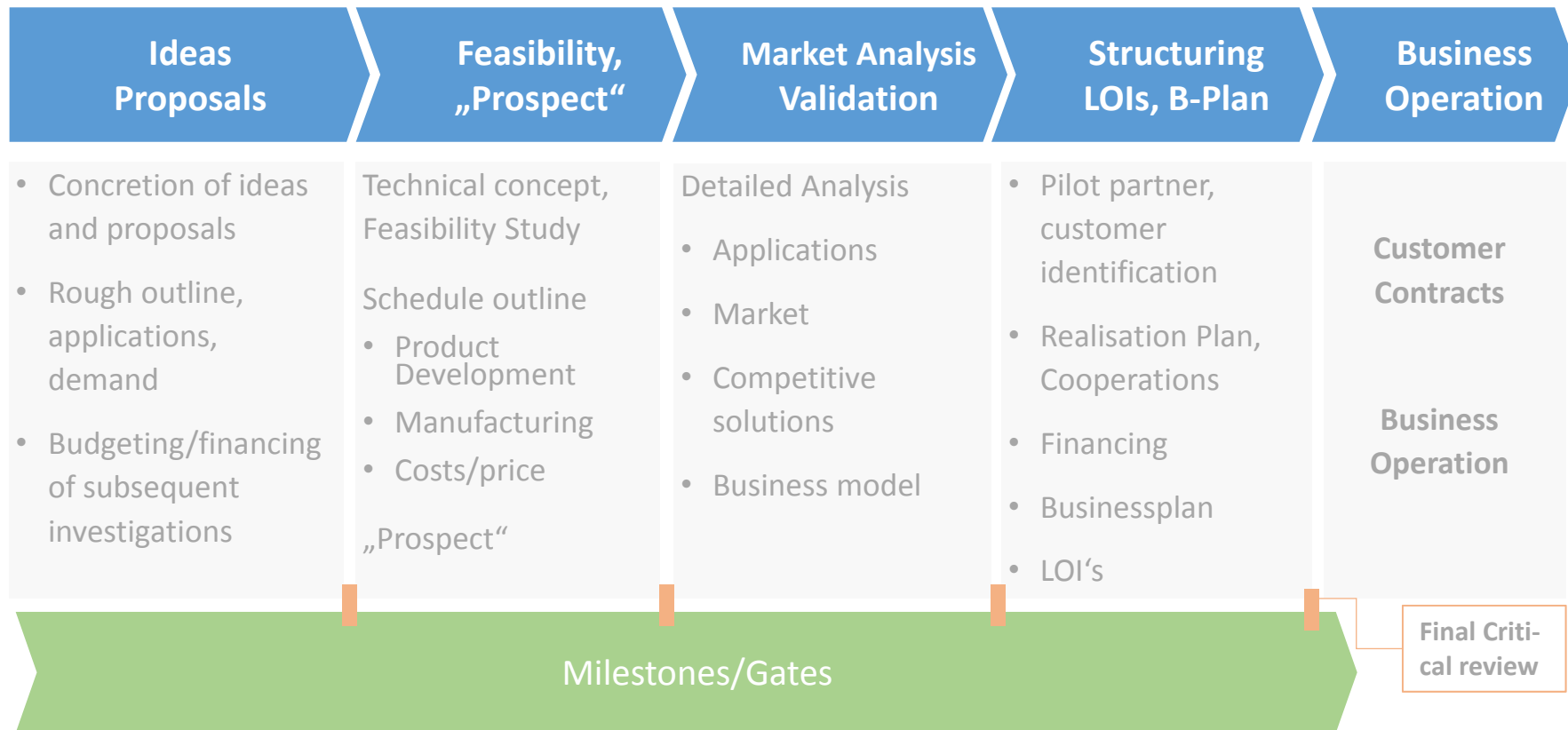


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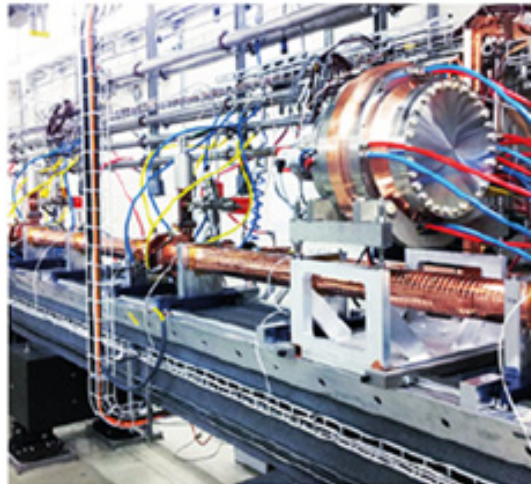
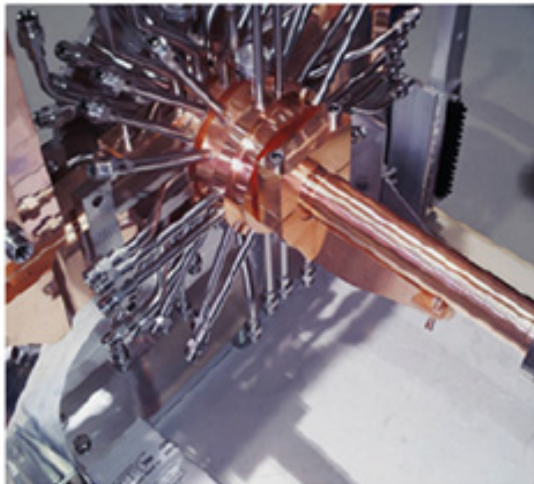
How we work

Generic Stage Gate Process for BD



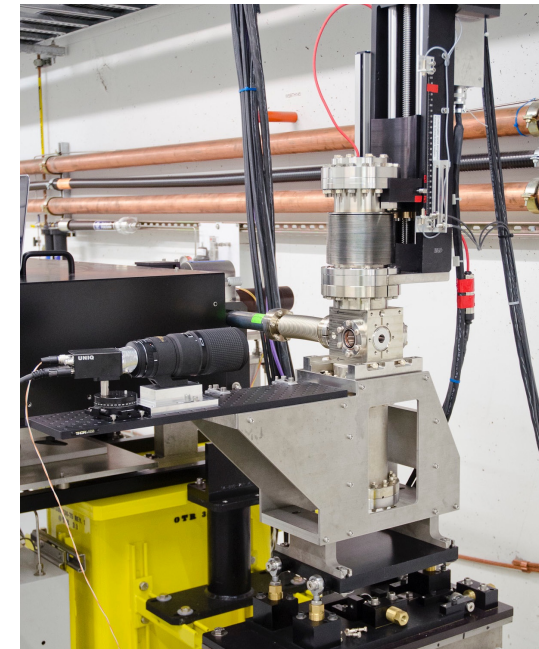
- Evaluation of PSI Know How/IP regarding potential for commercialisation & good fit to our aim to create value on the AAT level, i.e. beyond the individual partner's expertise
- **System level, integrated devices**
 - take longer development time, larger budget...
- **Specific „unique“ capabilities, instruments, applications...**
 - shorter time to market
- Few examples...

- In the course of the development and realisation of the SwissFEL many technologies, components, and systems have been developed, thoroughly tested, and brought to maturity; enormous Know How
- RF components, structures, modules, controls, timing systems, subassemblies or complete systems - based on SwissFEL technology
- Look out, identify, develop who could efficiently use this for upcoming projects, applications or products !



- PSI is already now realising a wide range of diverse diagnostic components and complete systems including electronics, firmware and software
- There is extended demand in other laboratories for PSI technologies

→ Investigation in broader, systematic commercialisation



BPM Block and Feedthrough

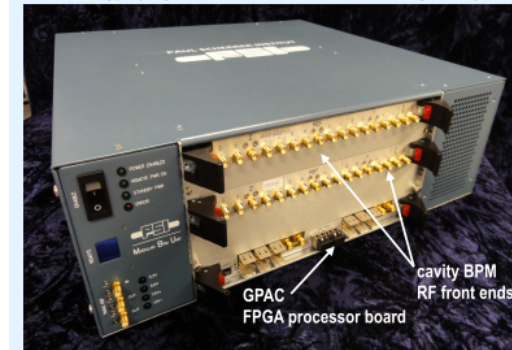


BPM Installation in FLASH



TPI Transverse Profile Imager (Heinz Baumgartner AG), upper right; BPM and BPM electronics (PSI)

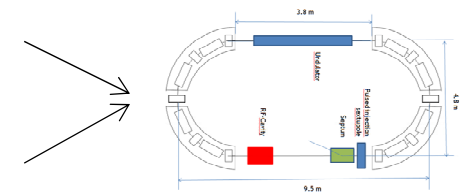
MBU Prototype (fully assembled for two undulator cavity BPMs)



EUV-Lithography (13,5 nm) is eventually being broadly introduced in Semi-HVM

PSI is developing unique metrology methods in this regime at the SLS

We are designing a specialised compact synchrotron as stand alone EUV-source



70 - 80 m²

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- AAT is a PSI/industry initiative, investing into enhanced transfer of PSI's large know how in accelerator technologies and applications
 - AAT undertakes business development through evaluating and combining Know How, investigating demand and establishing cooperations
 - If we can identify business cases, get the right team together, and secure financing, we go into operations

Hence AAT is a new approach – beyond the classical tools - to enhance TT from science into economics, based on private investment and intense collaboration with PSI and the whole scientific community.

**YES, WE ARE OPEN !
... for more ideas, discussion, cooperation, applications**

Thank You