Some News from Europe

Selected Issues

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ILC Integration and CFS Workshop
23 February 2018

HELMHOLTZ RESEARCH FOR GRAND CHALLENGES

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E-JADE

DESY

Topics

The European Strategy Update Process

News from the European XFEL (material from H. Weise)

Other SRF uses in Europea

The ILC European Action Plan

Topics

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The ILC European Action Plan

The Update of the European Strategy for Particle Physics

Relevance and Scope

https://council.web.cern.ch/en/content/european-strategy-particle-physics:

The Convention bestows two missions upon the Organization, namely the operation of laboratories and the organisation and sponsoring of international co-operation in the field of elementary particle physics.

[…] In this context, the Council has assumed full responsibility for defining the strategic orientations of European particle physics, a bottom-up process that starts with the broad consultation of all stakeholders in Europe's particle physics community and culminates in a dedicated meeting of the European Strategy Group, which brings together representatives of the CERN's Member States and of the major European laboratories active in the field, particle physicists from outside Europe and specialists in related fields of physics. The Strategy updates are drafted at this special "drafting" session of the European Strategy Group and are then validated at a dedicated "European Strategy Session" of the Council.
The last one of these was held on 28 May 2013 in Brussels.

➔ Strategy process defines long-term commitments of European community

➔ ILC competing with large CERN projects (and others; note that CERN needs a future after LHC)

➔ Firm European statement requires firm Japanese statement by the end of 2018

The Update of the European Strategy for Particle Physics

Reminder (2) – from H. Abramowicz

- Strategy update approval by Council (date fixed, May 2020)
- The strategy update is drafted by the European Strategy Group (ESG)
- The drafting is based on input from the community – collaborations, projects, national institutes, national roadmaps, individuals
- The input is collected by the Physics Preparatory Group (PPG)
- The PPG organizes the Open Symposium to discuss the proposals
- The PPG summarizes the input, the discussions and their conclusions in a Briefing Book
- The Briefing Book constitutes the input for the ESG for drafting the update
- The drafting of the strategy update takes place during a dedicated Drafting Session (the conclave of the EPPSU process)
- The organization is handled by the Strategy Secretariat
- All the groups are chaired by the Strategy Secretary

Halina Abramowicz
Strategy Secretary

The Update of the European Strategy for Particle Physics

Members of the Strategy Secretariat

Members

- The Strategy Secretary – Halina Abramowicz
- SPC chair – Keith Ellis
- ECFA chair – Jorgen D'Hondt
- Chair of the *European Laboratory Directors Group* – Lenny Rivkin

The European Laboratory Directors Group

- CERN
- CIEMAT
- DESY
- IRFU
- LAL
- NIKHEF
- LNF
- LNGS
- PSI
- STFC-RAL

The Update of the European Strategy for Particle Physics

Members of the PPG

Members

- The Strategy Secretary (chair)
- Four members recommended by the SPC
- Four members recommended by ECFA
- SPC chair
- ECFA chair
- Chair of the the European Laboratory Directors Group
- One representative appointed by CERN
- Representative(s) from Asia (≤2)
- Representative(s) from the Americas (≤2)

15 to 17 people

The Update of the European Strategy for Particle Physics

Members of the ESG

Members

- The Strategy Secretary (chair)
- One representative appointed by each CERN MS (22)
- One representative appointed by each of the Labs participating in the European Laboratory Directors Group including its Chairperson (9)
- CERN DG
- SPC chair
- ECFA chair

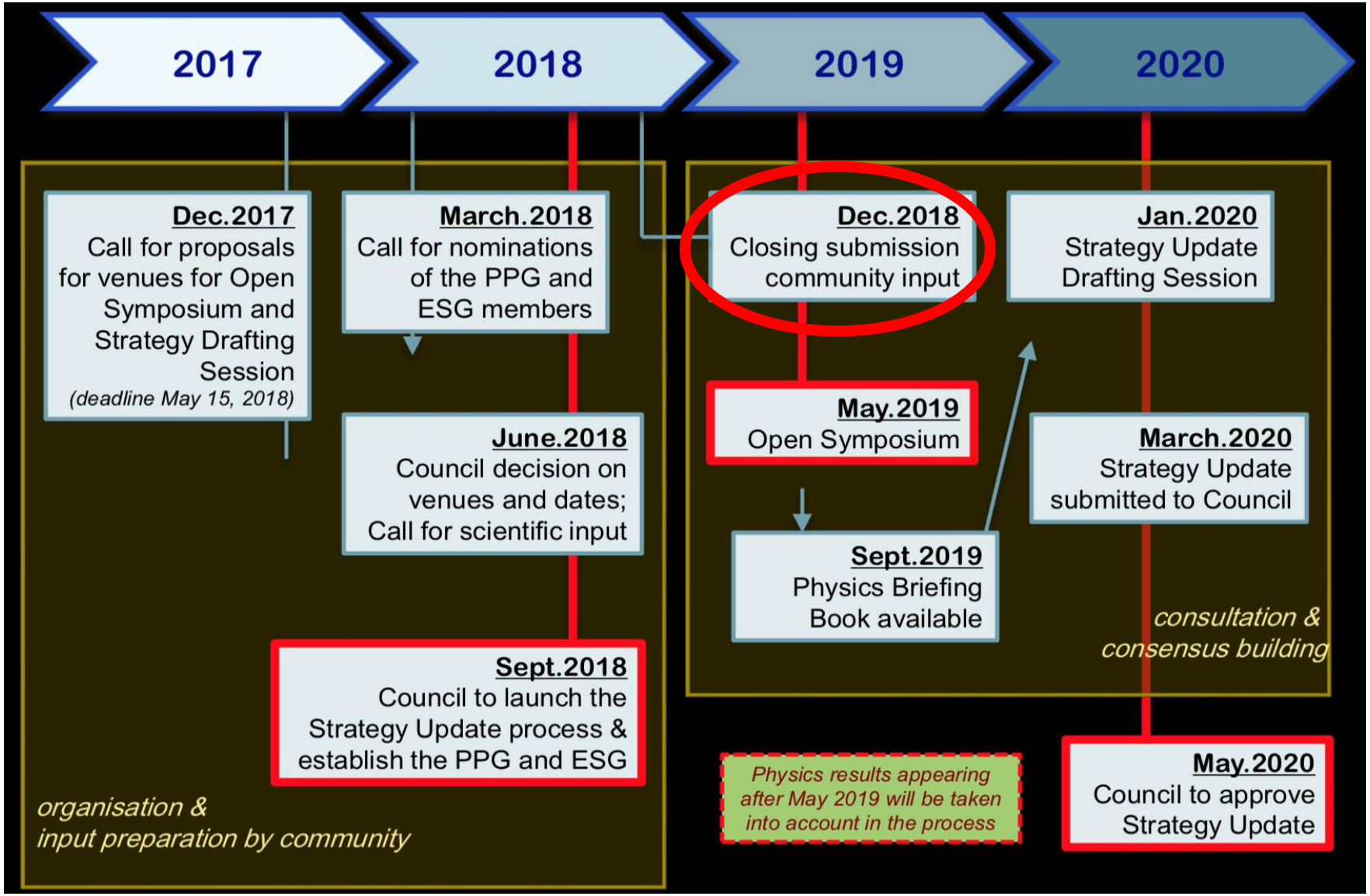
Invitees

- President of CERN Council
- One representative from each AMS and OS (7+3)
- One representative from the European Commission
- Chairs of ApPEC, NuPECC, FALC, ESFRI
- Members of the PPG (17 - Secretariat)

62 to 64 people

The Update of the European Strategy for Particle Physics

Timeline



Topics

The European Strategy Update Process

News from the European XFEL

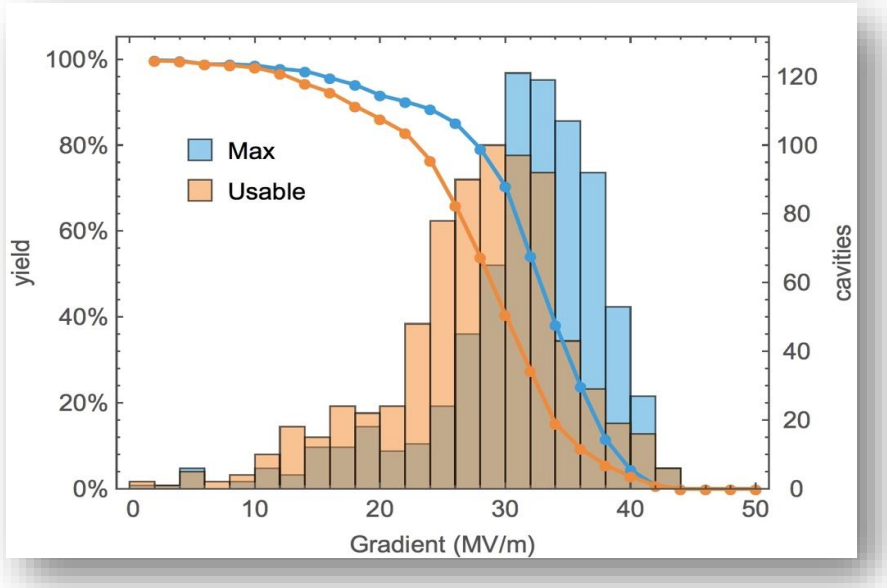
Other SRF uses in Europe

The ILC European Action Plan

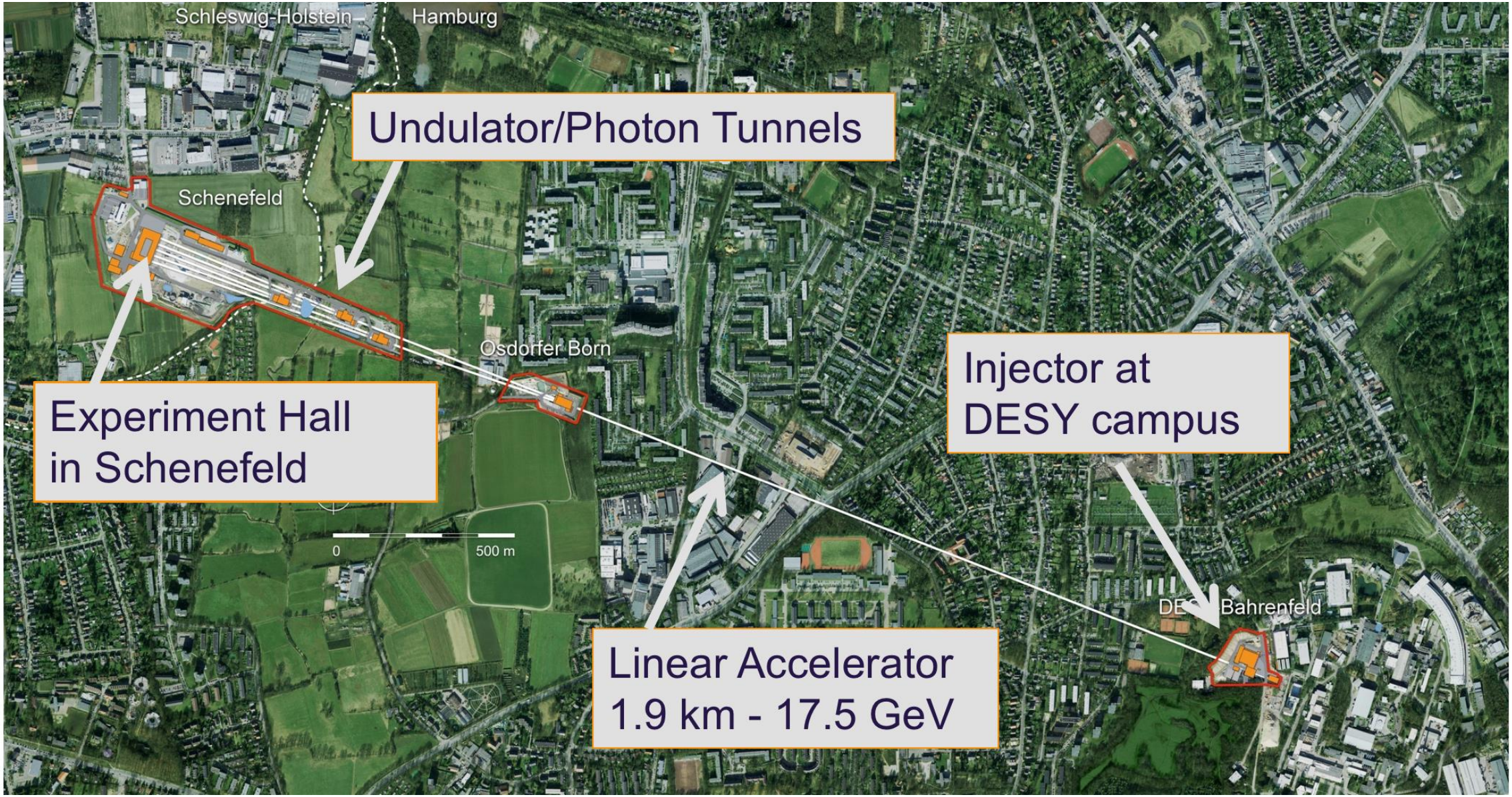
The European XFEL

Reminder

- 2.1 km 17.5 GeV SCRF linac
- First light: May 2017
- User operation since … now
- 800 cavities in 100 modules
- Current energy: 14.6 GeV



The European XFEL



The European XFEL

History

2000:

First laser light (109 nm) at the Tesla Test Facility (TTF); today known as FLASH

2001 / 2002 / 2006:

TESLA Linear Collider TDR with XFEL Appendix (2001)
TESLA TDR Supplement with stand-alone XFEL (2002)
European XFEL TDR (2006)

2009:

Foundation of the European XFEL GmbH
Start civil construction

2010:

Foundation of the **Accelerator Consortium**
16 institutes coordinated by DESY

2012:

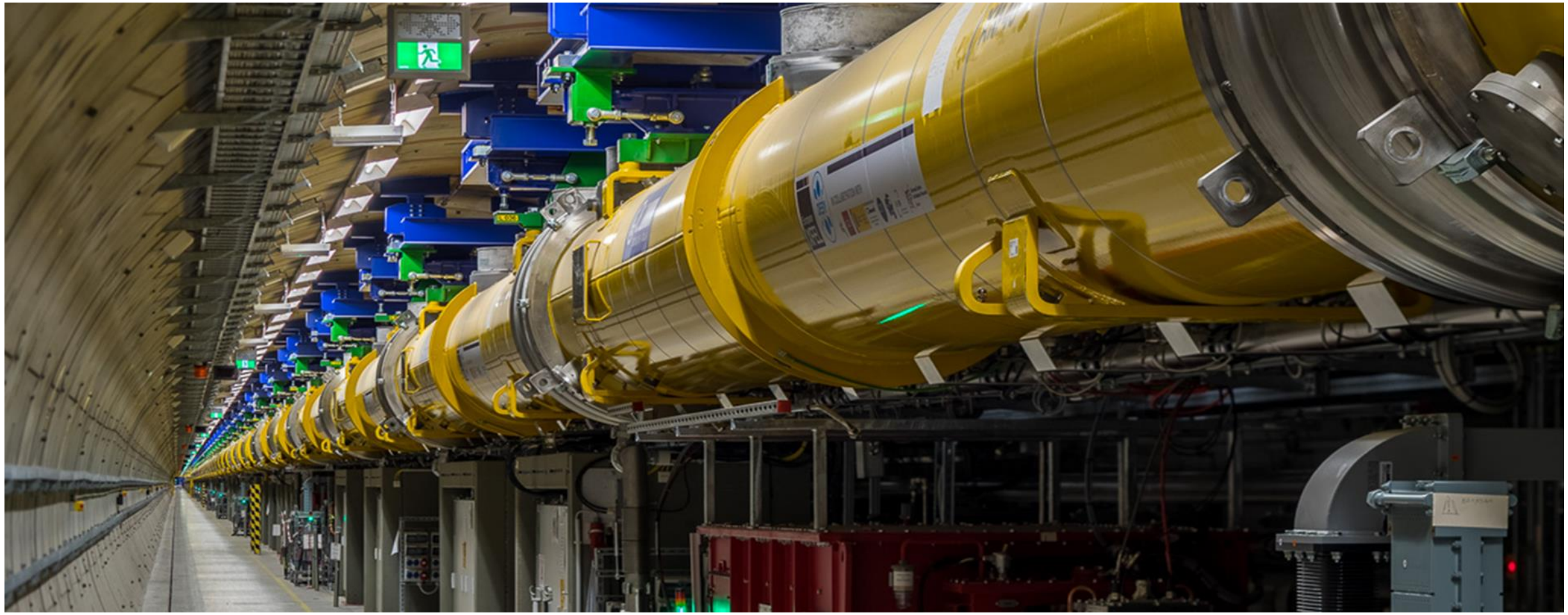
Tunnel finished
Start infrastructure installation

2016:

Accelerator finished
Start commissioning with cool down

The European XFEL

The by far longest cold linac in the world



The European XFEL

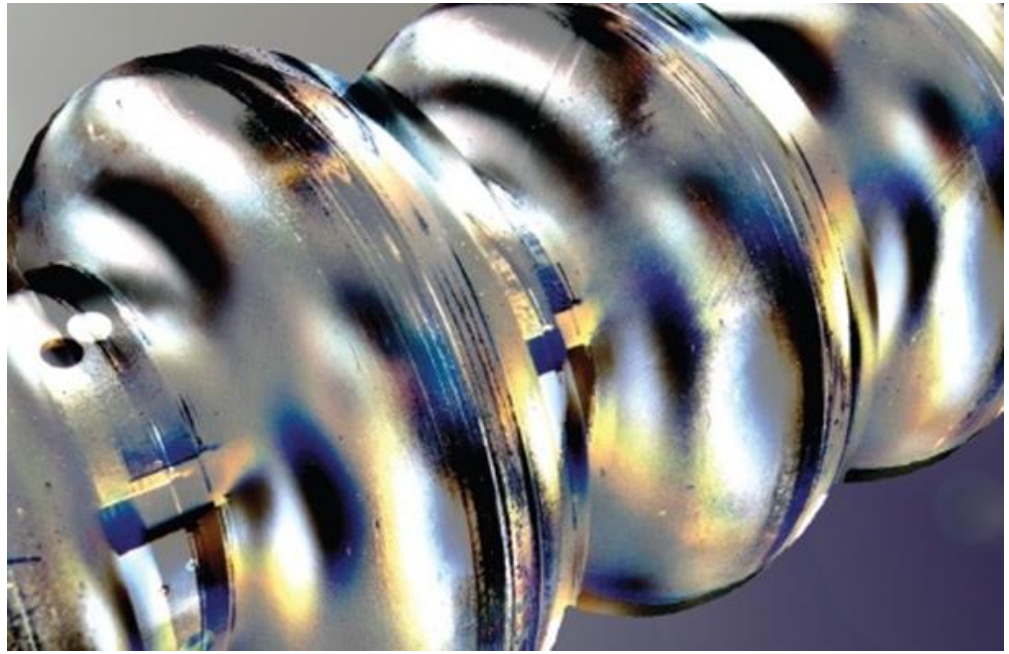
Superconducting technology

- Superconducting radiofrequency **(SRF) accelerators are a figurehead** of DESY‘s engagement in the design, construction and operation of accelerators for science.

- The successful construction and commissioning of the European XFEL was the result of excellent cooperation within the DESY coordinated **Accelerator Consortium** consisting of 16 institutes.

- The used **TESLA technology** was developed since the early 90ies. **FLASH** is the first result of this R&D and can be seen as the prototype.

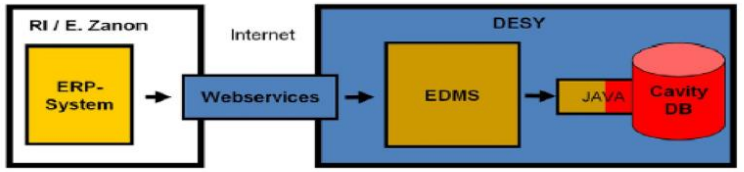
- With the European XFEL the **fully successful technology transfer to industry** reached an important point. Other worldwide projects (LCLS-II, ESS, new SRF based FELs at e.g. SINAP, China) are profiting greatly from DESY efforts.



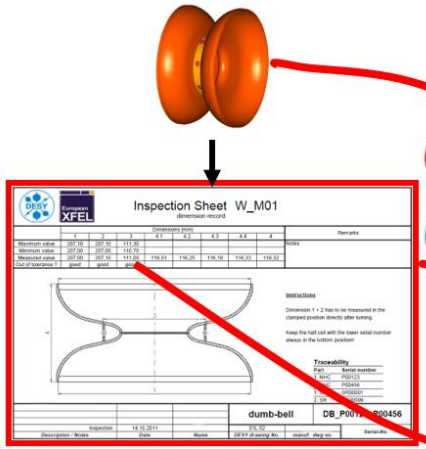
The European XFEL

Documentation was a Must

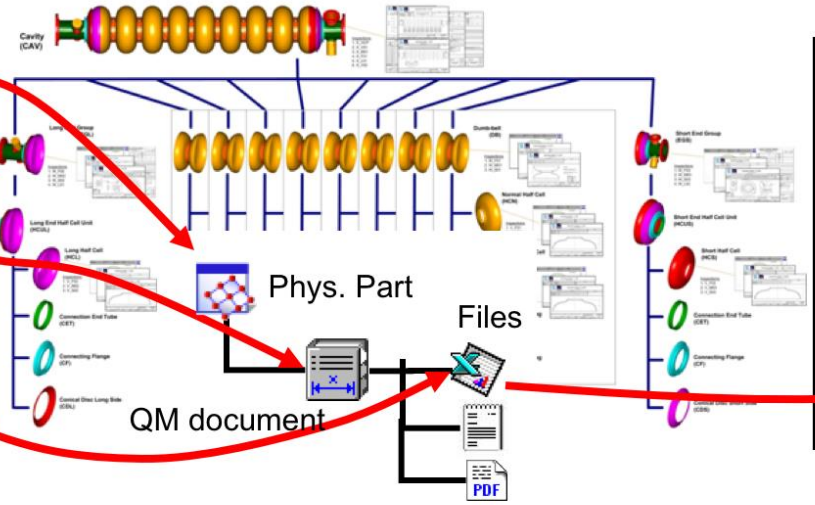
- The European XFEL consists of 800 s.c. cavities. And the path from the niobium material to a successfully commissioned cavity is long!

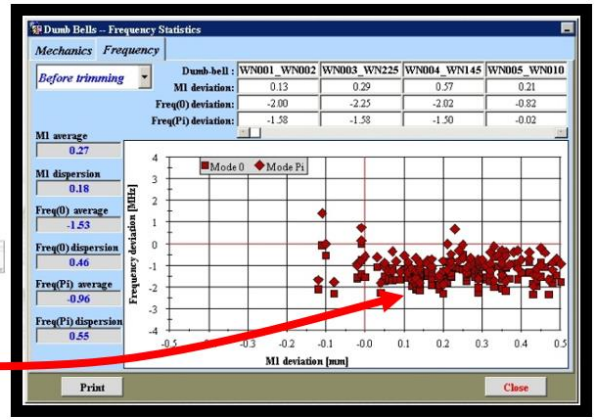


Manufacturer **EDMS** **XFEL database**

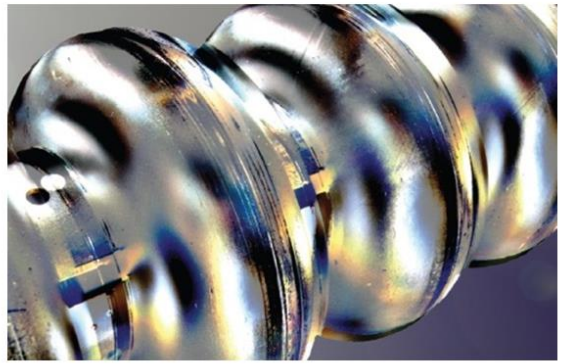


Inspection sheets





Statistical analysis

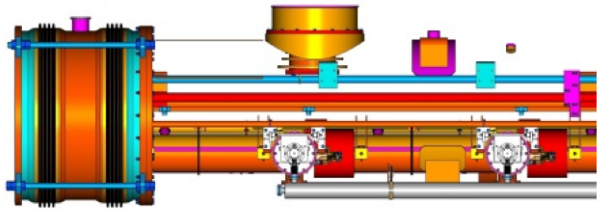


- In-process documentation, automatized and paperless, was using DESY developed and implemented tools.
- All involved project partners (companies, in-kind contributor and coordinator / DESY) were feeding one EDMS.

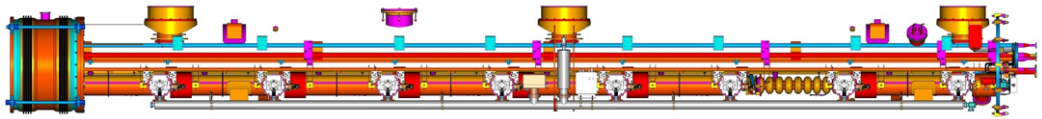
The European XFEL

Each accelerator module has 500 major sub-parts

- Documentation of all sub-parts and assembly steps was required. In-kind partners delivered.
- DESY integrated the documentation and offers easy access to all relevant data.



	Pos 1	Pos 2
E_acc_max_VT	29.1 MV/m	27.5 MV/m
E_acc_use_VT	28.8 MV/m	27.5 MV/m
E_acc_max_MT	28.6 MV/m	27.6 MV/m
E_acc_use_MT	28.1 MV/m	27.1 MV/m
E_acc_use_OP	28.0 MV/m	27.1 MV/m
P_use_OP	187 kW	175 kW
Operation Mode	on resonance	on resonance
Attenuation		
Cavity (CAV_FE)	CAV_FE00089	CAV_FE00235
Helium Tank	HT01194	HT01167
Coupler Cold Part	THRI-CP-346	THRI-CP-510
Coupler Warm Part	THRI-WP-470	THRI-WP-369
Coupler Push Rod	THRI-PR-265	THRI-PR-267



	Pos 1	Pos 2	Pos 3	Pos 4	Pos 5	Pos 6	Pos 7	Pos 8	Pos 9
	Cavity Characteristics								
E_acc_max_VT	29.1 MV/m	27.5 MV/m	28.3 MV/m	30.3 MV/m	29.3 MV/m	30.1 MV/m	28.0 MV/m	29.6 MV/m	
E_acc_use_VT	28.8 MV/m	27.5 MV/m	28.3 MV/m	30.3 MV/m	29.0 MV/m	27.8 MV/m	28.0 MV/m	27.1 MV/m	
E_acc_max_MT	28.6 MV/m	27.6 MV/m	28.4 MV/m	31.0 MV/m	29.8 MV/m	30.6 MV/m	23.8 MV/m	31.0 MV/m	
E_acc_use_MT	28.1 MV/m	27.1 MV/m	27.9 MV/m	31.0 MV/m	29.3 MV/m	30.1 MV/m	23.3 MV/m	31.0 MV/m	
E_acc_use_OP	28.0 MV/m	27.1 MV/m	27.4 MV/m	30.6 MV/m	29.0 MV/m	29.7 MV/m	23.0 MV/m	30.5 MV/m	
P_use_OP	187 kW	175 kW	180 kW	224 kW	202 kW	212 kW	126 kW	222 kW	
Operation Mode	on resonance	on resonance	on resonance	on resonance	on resonance	on resonance	on resonance	on resonance	
Attenuation									
	Configuration								
Cavity (CAV_FE)	CAV_FE00089	CAV_FE00235	CAV_FE00315	CAV_FE00334	CAV_FE00346	CAV_FE00349	CAV_FE00770	CAV_FE00695	
Helium Tank	HT01194	HT01167	HT01570	HT01109	HT01540	HT01117	HT00866	HT00747	
Coupler Cold Part	THRI-CP-346	THRI-CP-510	THRI-CP-845	THRI-CP-944	THRI-CP-257	THRI-CP-621	THRI-CP-916	THRI-CP-955	
Coupler Warm Part	THRI-WP-470	THRI-WP-369	THRI-WP-811	THRI-WP-401	THRI-WP-429	THRI-WP-215	THRI-WP-469	THRI-WP-838	
Coupler Push Rod	THRI-PR-265	THRI-PR-267	THRI-PR-263	THRI-PR-276	THRI-PR-261	THRI-PR-260	THRI-PR-264	THRI-PR-268	
Coupler Waveguide Box	THRI-WG-581	THRI-WG-582	THRI-WG-586	THRI-WG-587	THRI-WG-585	THRI-WG-594	THRI-WG-588	THRI-WG-589	
Coupler Actuator	THRI-AC-081	THRI-AC-140	THRI-AC-309	THRI-AC-714	THRI-AC-308	THRI-AC-571	THRI-AC-092	THRI-AC-304	
Tuner Piezosystem	206_8327_E_000-#0564	206_8327_E_000-#0566	206_8327_E_000-#0565	206_8327_E_000-#0567	206_8327_E_000-#0568	206_8327_E_000-#0569	206_8327_E_000-#0571	206_8327_E_000-#0570	
Tuner Frequency Drive	206_8328/B.000-#0065	206_8327/B.000-#0649	206_8327/B.000-#0650	206_8327/B.000-#0645	206_8327/B.000-#0648	206_8327/B.000-#0646	206_8327/B.000-#0647	206_8327/B.000-#0651	
Tuner Mechanics	006.8328/0.000-#0084	006.8327/0.000-#0627	006.8327/0.000-#0628	006.8327/0.000-#0342	006.8327/0.000-#0339	006.8327/0.000-#0341	006.8327/0.000-#0340	006.8327/0.000-#0338	
BMP-Quadrupole-Unit									BOU074_C
Magnet (QUAD)									XMP-S70
BPM (button or reentrant)									Wolf_059
Gate Valve									472XX-XE0X-AGW
Gate Valve Assembly (@Cav1)	472XX-XE0X-AGW1/0150								
Gate Valve	472XX-XE0X-AGW1/0150								
Cavity Bellow	FEL VB1 000002-485	FEL VB1 000002-581	FEL VB1 000002-404	FEL VB1 000002-257	FEL VB1 000002-464	FEL VB1 000002-774	FEL VB1 000002-513	FEL VB1 000002-284	
Gate Valve Support	3_06_8326/0.000_#0063								
Ti-Bellow	3_06_8322/0.000_#0448	3_06_8322/0.000_#0447	3_06_8322/0.000_#0446	3_06_8322/0.000_#0445	3_06_8322/0.000_#0444	3_06_8322/0.000_#0443	3_06_8322/0.000_#0442		
2Ph Q-pole Pipe									2_09_9610/2.800
2Ph End Connect	3_08_9610/2.C00_#0031								
	Lot Parts								
1-AL Seal (NW78)	SEY-BEL381 207	SEY-BEL381 207	SEY-BEL381 207	SEY-BEL381 207	SEY-BEL381 207	SEY-BEL381 207	SEY-BEL381 207	SEY-BEL381 207	SEY-BEL381 2
2-AL Seal (NW78)	SEY-BEL381 207	SEY-BEL381 207	SEY-BEL381 207	SEY-BEL381 207	SEY-BEL381 207	SEY-BEL381 207	SEY-BEL381 207	SEY-BEL381 207	

- Good collaboration is based on excellent communication… leading into structured documentation.

The European XFEL

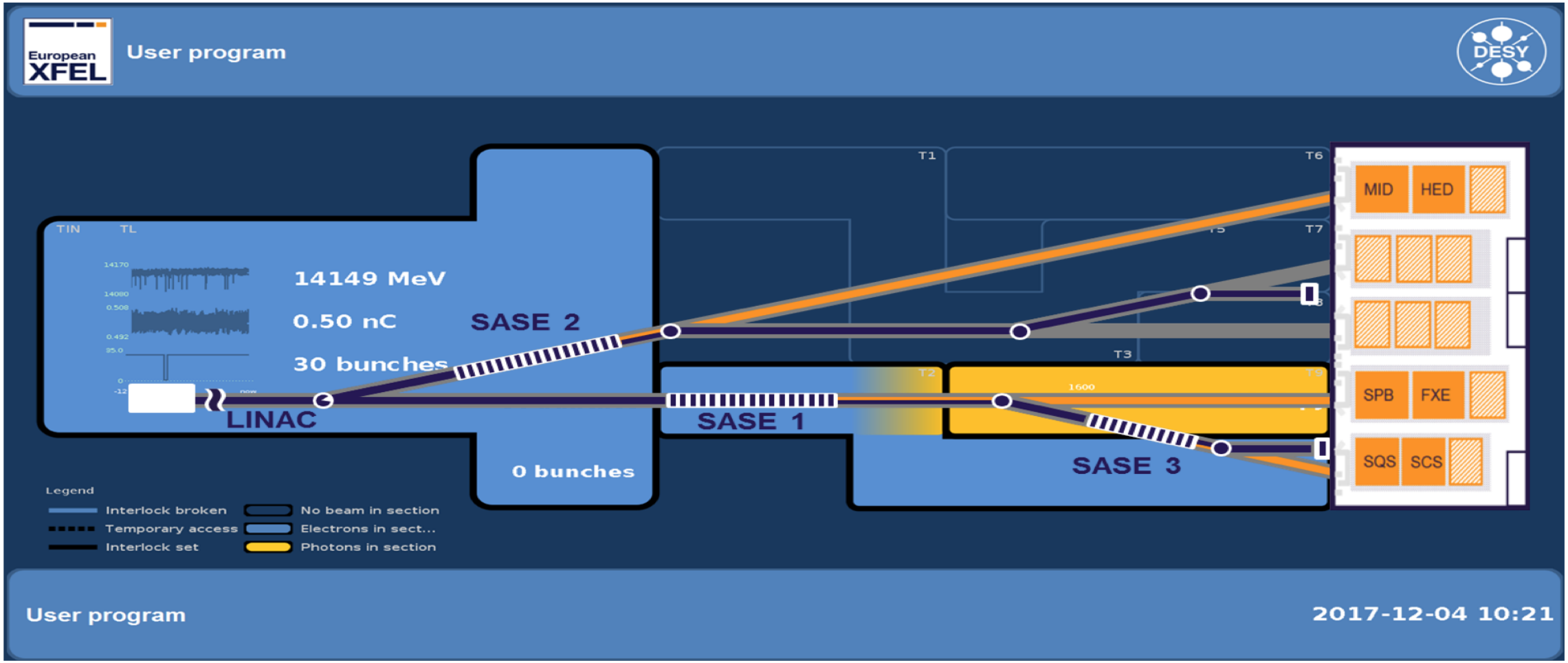
Re-treatment of cavities

- 40% of 800 XFEL cavities needed retreatment by DESY
- success rate of 80%

The European XFEL

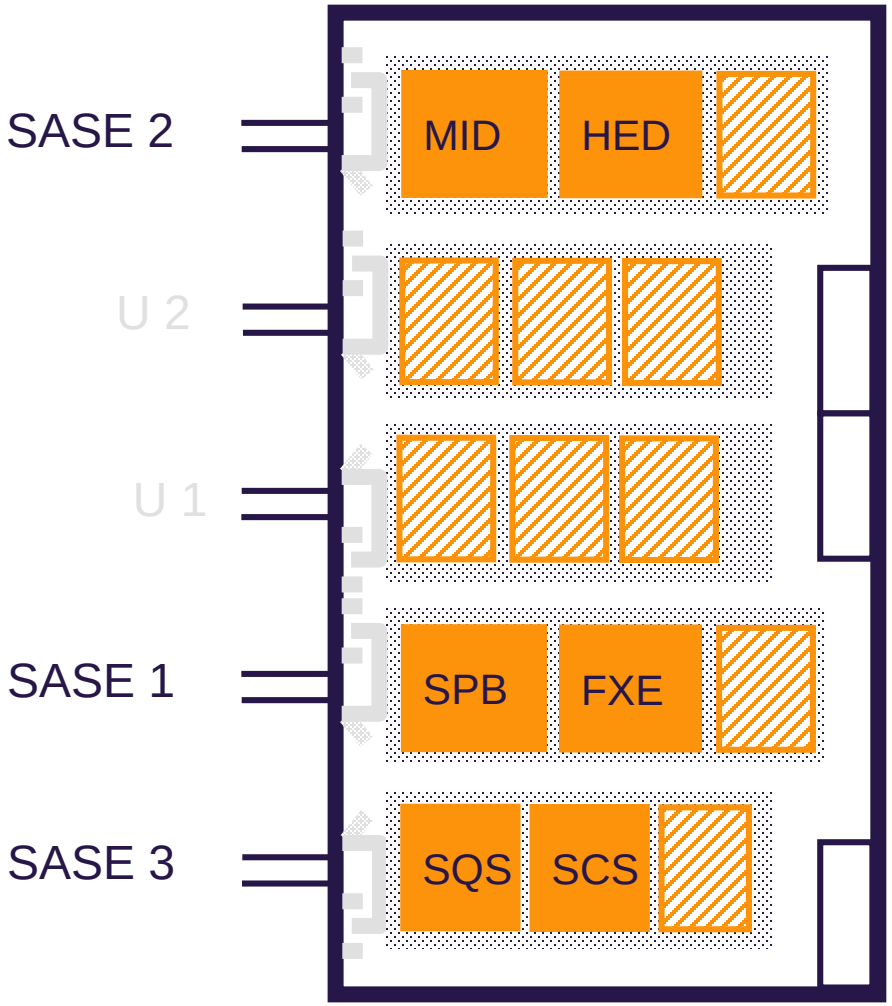
Experiments

Who is getting the First Photons?

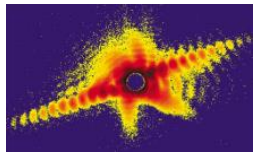


The European XFEL

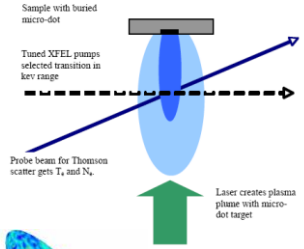
Experiments



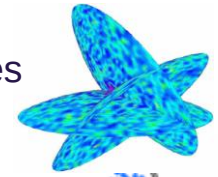
MID Materials Imaging & Dynamics



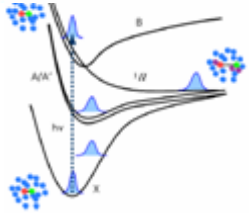
HED High Energy Density Science



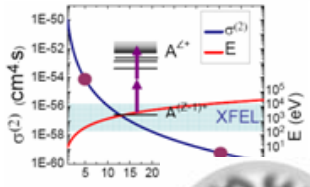
SPB Single Particle & Biomolecules



FXE Femtosecond X-ray Experiments



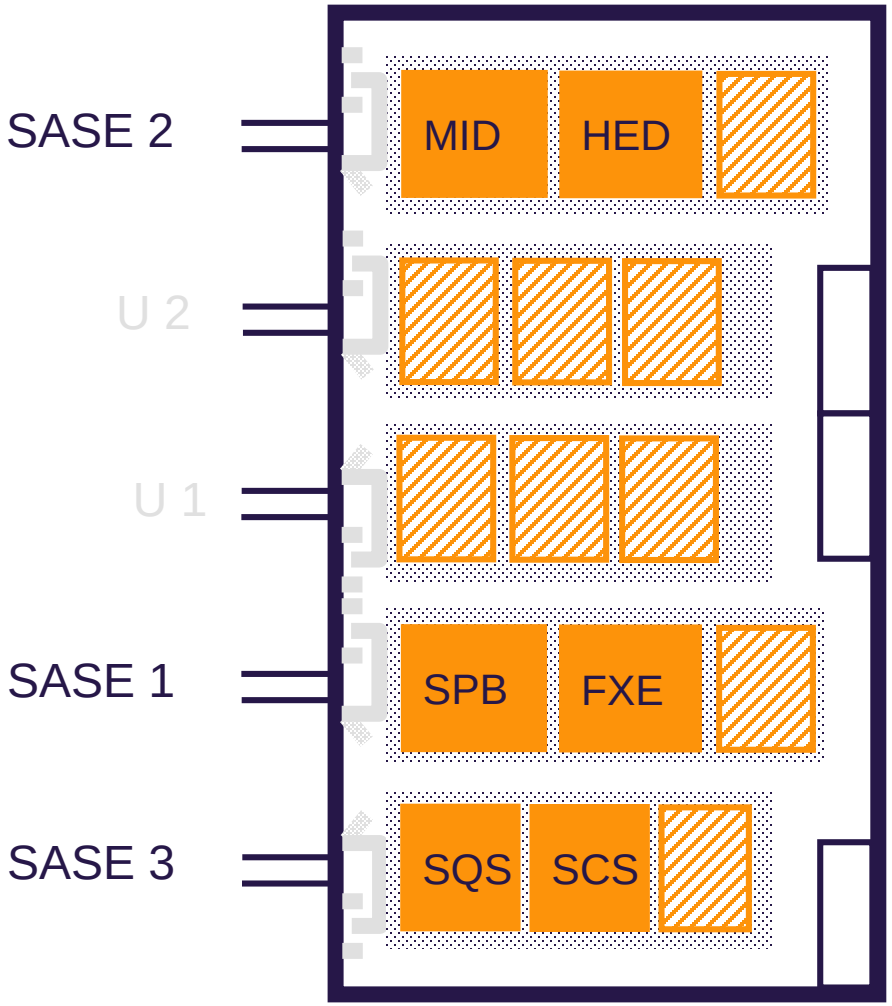
SQS Small Quantum Systems

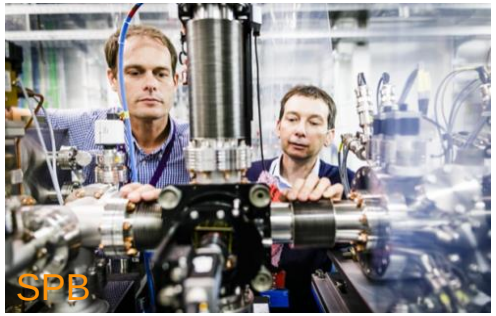


SCS Spectroscopy & Coherent Scattering

The European XFEL

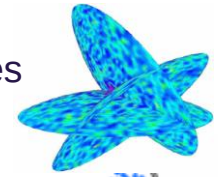
Experiments



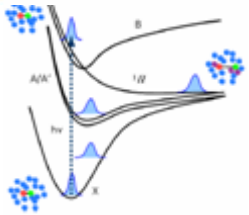


- study of molecule structure and functions

SPB Single Particle & Biomolecules



FXE Femtosecond X-ray Experiments

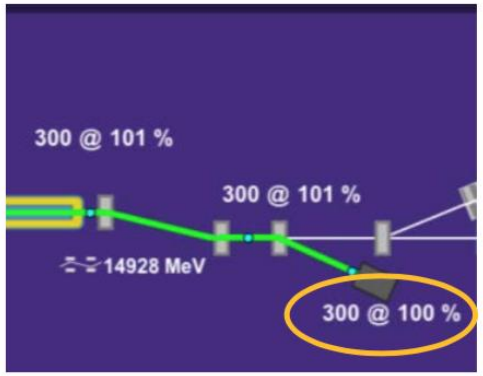


- molecular movies and chemical reactions

The European XFEL

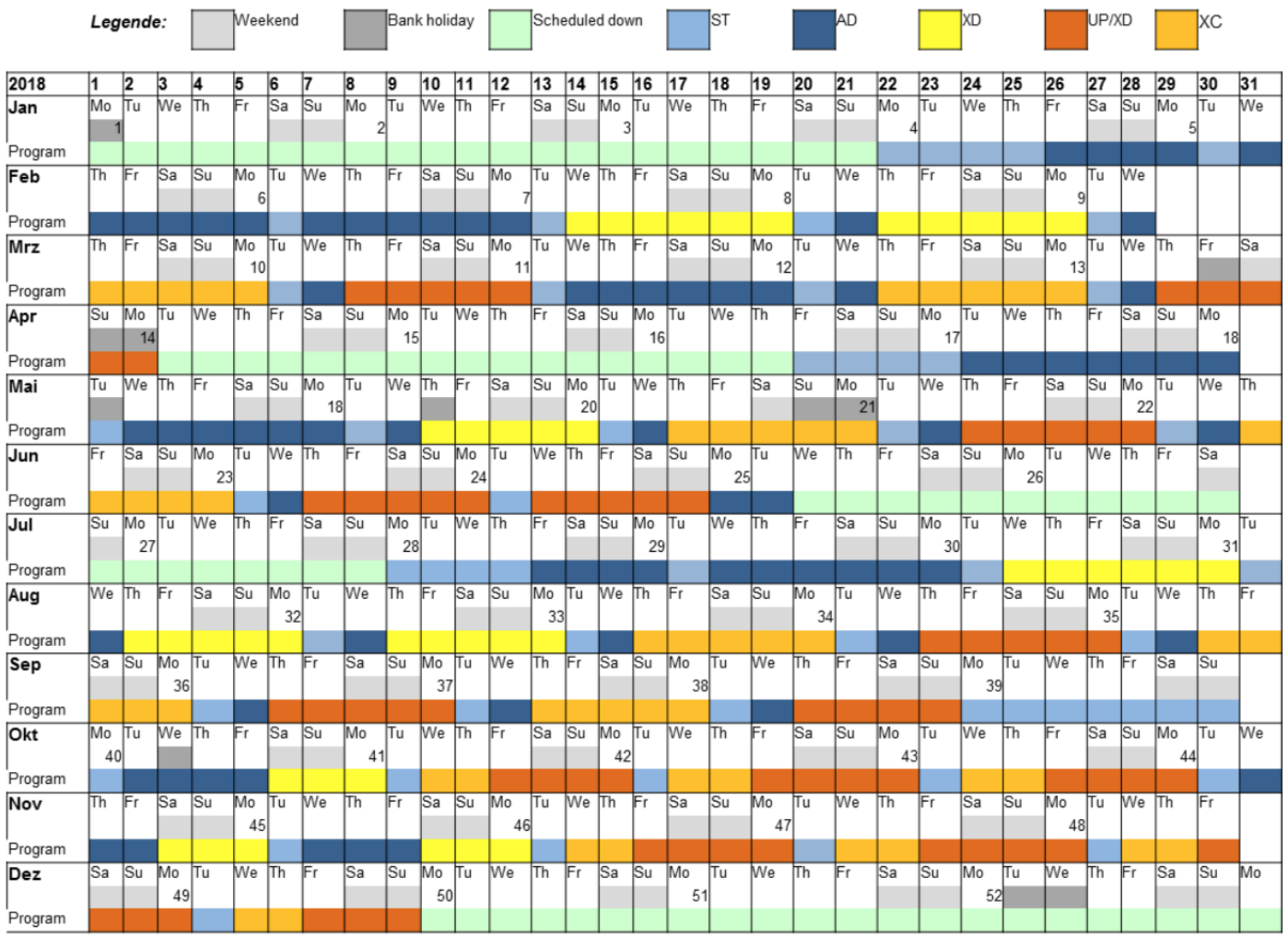
Accelerator status of 20 January 2018

- Accelerator has been commissioned according to schedule and towards expected parameters, about 6400 h of scheduled beam time, always being very close to the commissioning schedule
- **23 out of 25 RF** stations commissioned (last two in CS9, will be ready in Q2/2018)
- Maximum potential final energy obtained during dedicated LLRF studies: **16.1 GeV**
- Maximum beam energy **14.9 GeV**, user operation with **14.0 GeV**
- Routine operation with **300 bunches/second** in user mode
- Test operation in linac mode with **3000 bunches/second** (≈ 18 kW beam power)



The European XFEL

Schedule 2018



2018	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
Jan	Mo	Tu	We	Th	Fr	Sa	Su	Mo	Tu	We	Th	Fr	Sa	Su	Mo	Tu	We	Th	Fr	Sa	Su	Mo	Tu	We	Th	Fr	Sa	Su	Mo	Tu	We
	1							2							3							4							5		
Program																															
Feb	Th	Fr	Sa	Su	Mo	Tu	We	Th	Fr	Sa	Su	Mo	Tu	We	Th	Fr	Sa	Su	Mo	Tu	We	Th	Fr	Sa	Su	Mo	Tu	We			
					6							7							8							9					
Program																															
Mrz	Th	Fr	Sa	Su	Mo	Tu	We	Th	Fr	Sa	Su	Mo	Tu	We	Th	Fr	Sa	Su	Mo	Tu	We	Th	Fr	Sa	Su	Mo	Tu	We	Th	Fr	Sa
					10							11							12							13					
Program																															
Apr	Su	Mo	Tu	We	Th	Fr	Sa	Su	Mo	Tu	We	Th	Fr	Sa	Su	Mo	Tu	We	Th	Fr	Sa	Su	Mo	Tu	We	Th	Fr	Sa	Su	Mo	
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Program																															
Mai	Tu	We	Th	Fr	Sa	Su	Mo	Tu	We	Th	Fr	Sa	Su	Mo	Tu	We	Th	Fr	Sa	Su	Mo	Tu	We	Th	Fr	Sa	Su	Mo	Tu	We	Th
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Program																															
Jun	Fr	Sa	Su	Mo	Tu	We	Th	Fr	Sa	Su	Mo	Tu	We	Th	Fr	Sa	Su	Mo	Tu	We	Th	Fr	Sa	Su	Mo	Tu	We	Th	Fr	Sa		
				23							24							25							26							
Program																															
Jul	Su	Mo	Tu	We	Th	Fr	Sa	Su	Mo	Tu	We	Th	Fr	Sa	Su	Mo	Tu	We	Th	Fr	Sa	Su	Mo	Tu	We	Th	Fr	Sa	Su	Mo	Tu	
		27							28							29							30							31	
Program																															
Aug	We	Th	Fr	Sa	Su	Mo	Tu	We	Th	Fr	Sa	Su	Mo	Tu	We	Th	Fr	Sa	Su	Mo	Tu	We	Th	Fr	Sa	Su	Mo	Tu	We	Th	Fr	
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Program																															
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Program																															
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	40							41							42							43							44		
Program																															
Nov	Th	Fr	Sa	Su	Mo	Tu	We	Th	Fr	Sa	Su	Mo	Tu	We	Th	Fr	Sa	Su	Mo	Tu	We	Th	Fr	Sa	Su	Mo	Tu	We	Th	Fr		
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Program																															
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			49							50							51							52								
Program																															

SD	Scheduled down
ST	Access, Setup, Tuning
AD	Accelerator Development
XD	X-ray Development
XC	Experiment Development
UP	User Program

- About 6800 hours of operation
- Shutdowns:
  - January & April for CS9
  - June/July for IL and MKK work
  - December for SASE2 self-seeding

The European XFEL

Goals for 2018

- SASE1: About 1,600 h user operation
- SASE2: First e-beam in March, first lasing in May
  - Commission laser and photon systems parallel to user runs
  - Installation of Self-Seeding Chicanes (December)
- SASE3: First lasing in February
  - photon systems commissioning influences SASE1 operation
- Accelerator:
  - 17.5 GeV by July (continue high gradient task force & CS9 installation and commissioning)
  - 3,000 bunches/second lasing in SASE1 by mid of the year (Possible limitation: dose rate in undulators)
  - 27,000 bunches in XTL by December

Topics

The European Strategy Update Process

News from the European XFEL

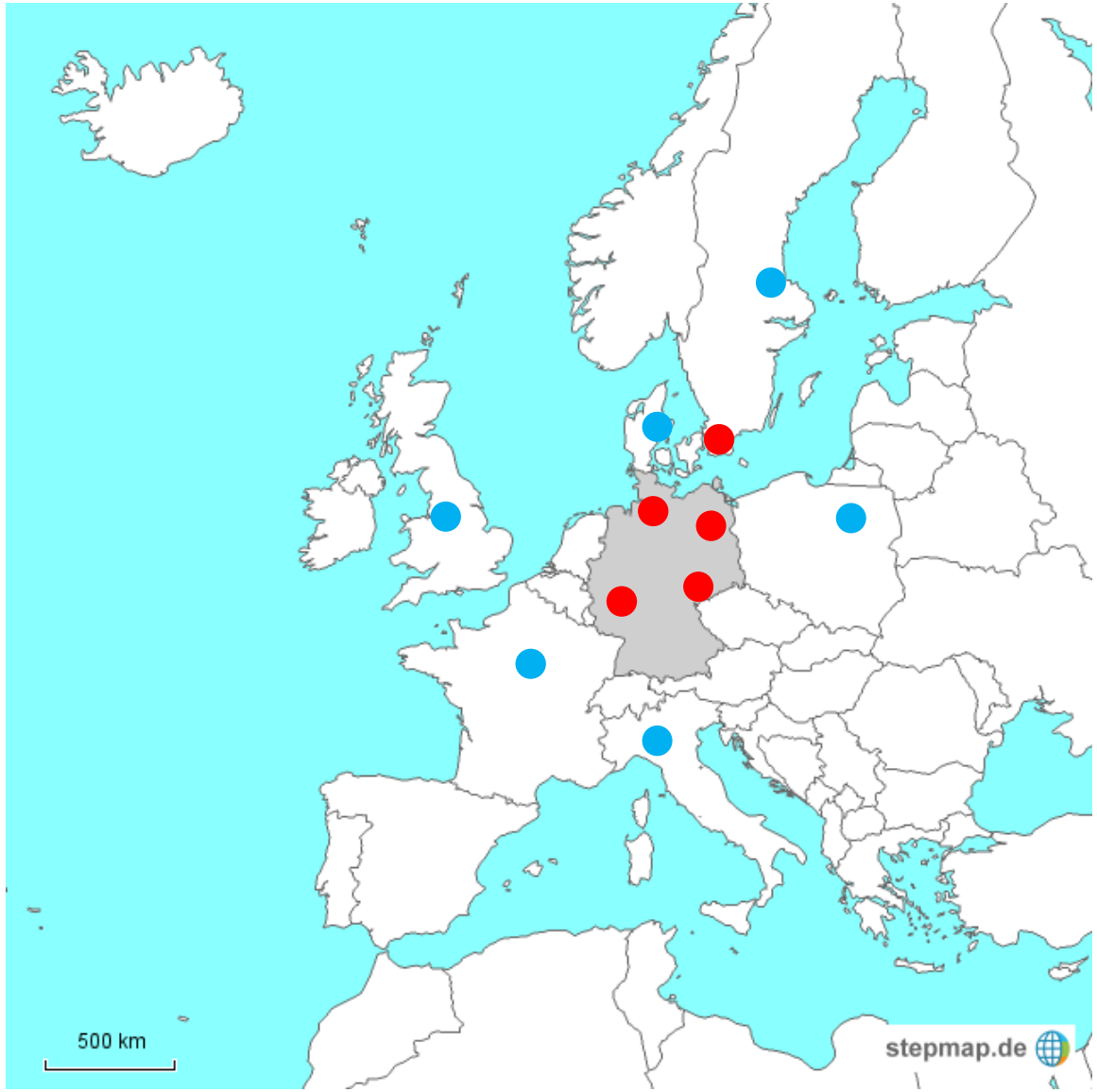
Other SRF activities in Europe

The ILC European Action Plan

SCRF Developments in Europe

Overview

- Projects
  - European XFEL (DESY, +800 cavities)
  - European Spallation Source (146)
  - ELBE / HZDR (SRF gun R&D)
  - BERLinPro (HZB): SRF ERL for accelerator R&D (gun, beam dynamics)
  - SCRF accelerators at universities (Darmstadt, Mainz, Bonn, …)
- Partners
  - CEA Saclay, LAL Orsay, IRFU
  - Uppsala U, Aarhus U
  - INFN Milano
  - STFC Daresbury
  - Wroclaw U, IFJ
  - +50 other



News from ESS

European Spallation Source, Lund (Sweden)

ESS: Neutron-source facility under construction in Lund

- Size comparable to European XFEL, similar institutions and industries involved.
- First beam from the medium-beta section in 2019; first 2 GeV beams 2022

Plan: Produce 5 MW average-power proton beams on spallation target.

- Proton driver; SCRF linac with 62.5 mA proton beam pulsed with 4% duty cycle to 2 GeV.
- Cold linac involves three families of cryomodules with 704 MHz RF resonators
- Number of cryomodules / cavities much smaller than for European XFEL; but complexity, high input power and maximum cavity surface fields make project extremely challenging.

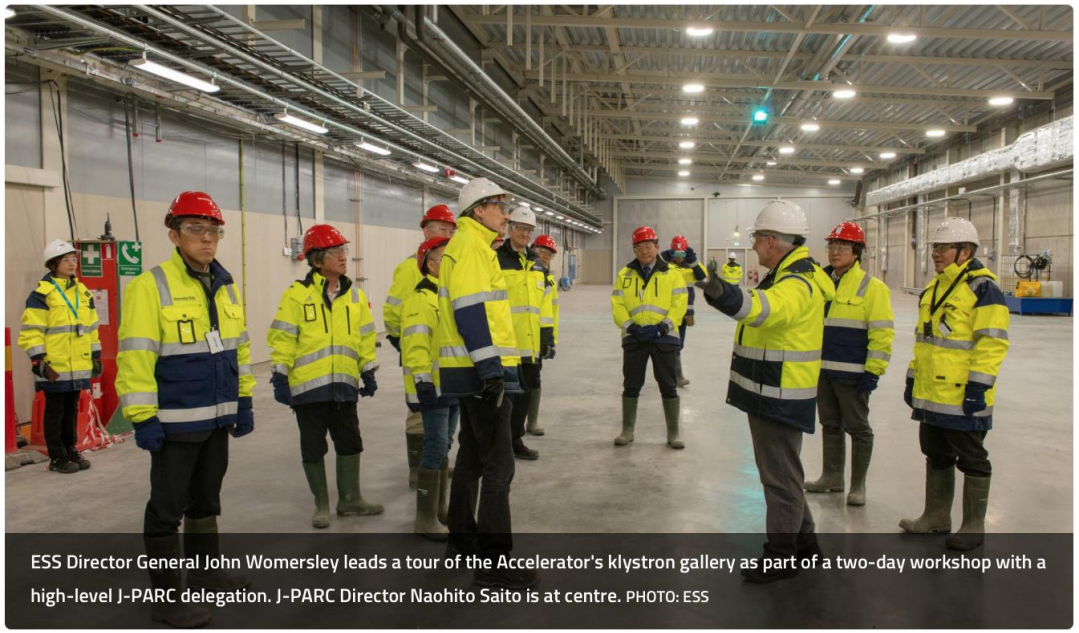
	Germany	France		Italy		Poland	Spain	Sweden		UK
	DESY	CEA	IPNO	Elettra	INFN-LASA	IFJ-PAN	ESS Bilbao	ESS	Uppsala	STFC
RF systems				✓			✓	✓		
LLRF									✓	
Cryomodules		✓	✓							
SCRF Cavities		✓	✓		✓					✓
Power Couplers		✓	✓							
HOM couplers										
Frequency Tuners		✓	✓							
Cold Vacuum		✓	✓					✓		
Cavity String Assembly		✓	✓							
RF Tests (Cavites)	✓									✓
RF Tests (Cryomodules)		✓	✓			✓		✓	✓	

Responsibility matrix for the cryomodule production and testing for the ESS

News from ESS

European Spallation Source, Lund (Sweden)

CONSTRUCTION START	USER PROGRAM BEGINS	IN-KIND PARTNERS	STAFF	FACILITY CONTROL POINTS	COMPLETION STATUS
2014	2023	37	434	1.68x10^6	43%



ESS Director General John Womersley leads a tour of the Accelerator's klystron gallery as part of a two-day workshop with a high-level J-PARC delegation. J-PARC Director Naohito Saito is at centre. PHOTO: ESS

Memomrandum of Collaboration with J-PARC; common workshop in Feb. 2018

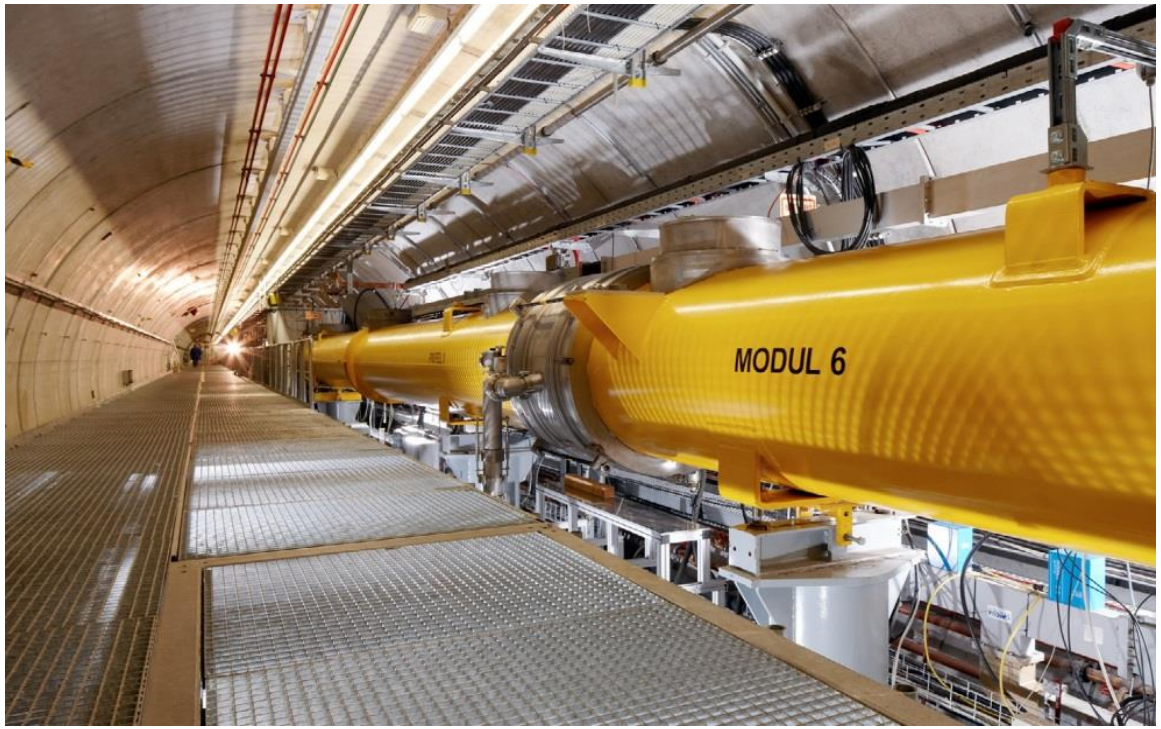
Construction progressing well; new SRF installations in Sweden and UK further anhancing Europe‘s SRF capabilities

SCRF Developments at DESY

Only cavity R&D – no LLRF, couplers, cryomodules …

- Project-based
  - SRF gun
    - Two guns produced (last week)
    - XFEL upgrade for cw (long-term)
  - FLASH upgrade
    - Two modules exchanged
    - One module: ILCHiGrade cavities

- Fundamental R&D
  - Infusion / doping: Nitrogen baking to reduce losses; cavity R&D - process parameter studies; sample R&D - material studies
  - Large-grain studies: lower losses? Statistical analysis of cavity data, material studies



Topics

The European Strategy Update Process

News from the European XFEL

Other SRF uses in Europe

The ILC European Action Plan

The European Action Plan

Towards defining a European contribution to the ILC?

The ILC EAP was originially requested by Okada-san, as a complement to the KEK action plan.

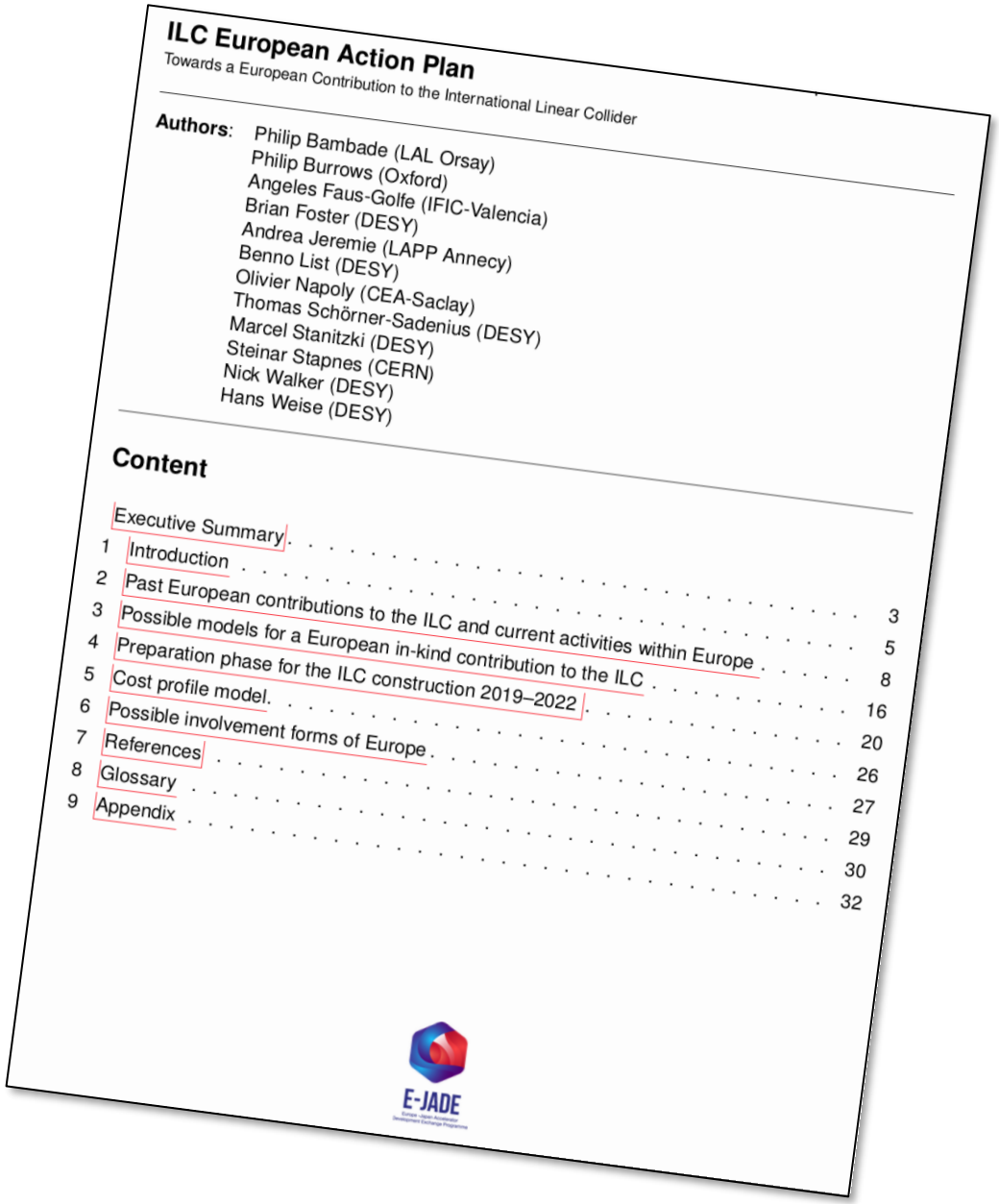
- Getting an overview of who in Europe could / might want to do what in case of ILC greenlight.

History and contents:

- Request to CERN management, passed on to E-JADE
- Preparation of document since about 1 year.
- Long version based on some sharing model presented to CERN management; positive reaction
  - Detailed discussion of possible contributions during pre-preparatory phase, preparatory phase, and construction.

Currently preparing shorter version without details

- i.e. no models for cost and IKC sharing with European countries – don't want to prejudice the funding agencies
- To be ready by Easter
- Long version as input for European strategy update process



ILC European Action Plan

Towards a European Contribution to the International Linear Collider

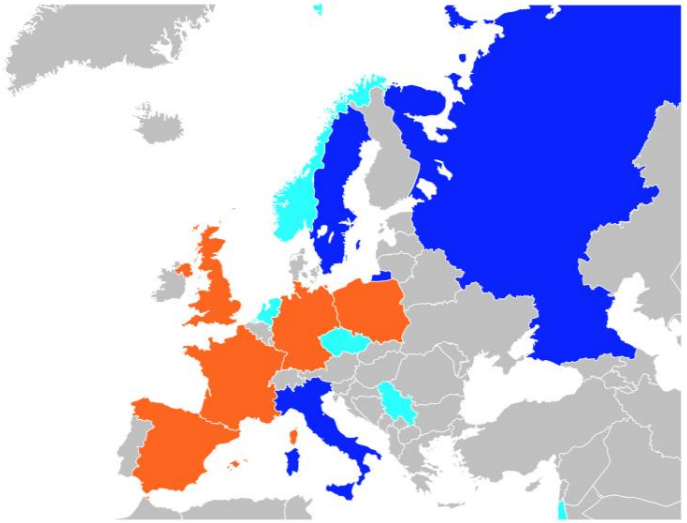
Authors: Philip Bambade (LAL Orsay)
Philip Burrows (Oxford)
Angeles Faus-Golfe (IFIC-Valencia)
Brian Foster (DESY)
Andrea Jeremie (LAPP Annecy)
Benno List (DESY)
Olivier Napoly (CEA-Saclay)
Thomas Schörner-Sadenius (DESY)
Marcel Stanitzki (DESY)
Steinar Stapnes (CERN)
Nick Walker (DESY)
Hans Weise (DESY)

Content

E-JADE

The ILC European Action Plan

Information contained in the EAP



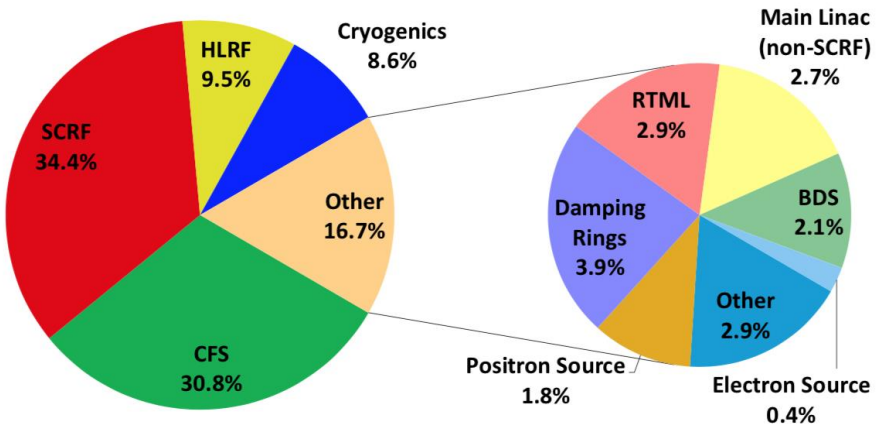
European countries with ILC-related activities
(blue: acc., cyan: det., red: both)

	Germany DESY	France CEA Saclay	France LAL	Italy INFN Milan	Poland IFJ PAN	Poland WUT	Poland NCBJ	Russia BINP	Spain CIEMAT
Linac									
Cryomodules	✓	✓		✓					
SCRF Cavities	✓			✓					
Power Couplers	✓		✓						
HOM Couplers							✓		
Frequency Tuners	✓								
Cold Vacuum	✓							✓	
Cavity String Assembly	✓	✓							
SC Magnets	✓				✓				✓
Infrastructure									
AMTF	✓				✓	✓		✓	
Cryogenics	✓								
Sites & Buildings									
AMTF hall	✓								

Responsibility matrix for cryomodule production and testing for the European XFEL

Long version potentially (given political will) also containing

- models for cost sharing and cost profile
- concrete ideas for European contributions (mainly key R&D issues) during 4-year preparatory phase
- discussion of concrete forms of European involvement
- …



Primary cost drivers for the ILC
(breakdown based on ILCU)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