Schweizerische Eidgenossenschaft
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Swiss Confederation

Federal Departement of Economic Affairs,
Education and Research EAER
**State Secretariat for Education,**
**Research and Innovation SERI**
International Cooperation in Research and Innovation

# Participation of Switzerland in the operation of European XFEL

# Stakeholder's survey

*Preliminary remark:*

*All answers ought to reflect consolidated needs and opinions of institutions or companies represented by you.*

**1.** Does Switzerland have to pursue its participation in the operation of European XFEL up to at least 2026?

| YES | NO |
|---|---|
| X | ☐ |

**2.** From the following Swiss **scientific/industrial fields** hereunder, some may have to make use of XFEL machines from 2017 onwards. Please distinguish **those for which European XFEL specific features are requested** and **those for which SwissFEL features would be sufficient**.

| | European XFEL needed | SwissFEL sufficient | No XFEL needed | No opinion |
|---|---|---|---|---|
| Biology | X | ☐ | ☐ | ☐ |
| Pharmacy | X | ☐ | ☐ | ☐ |
| Medicine | ☐ | ☐ | X | ☐ |
| Chemistry | X | ☐ | ☐ | ☐ |
| Materials science | X | ☐ | ☐ | ☐ |
| Astrophysics | X | ☐ | ☐ | ☐ |
| Energy research | X | ☐ | ☐ | ☐ |
| Electronics | ☐ | ☐ | X | ☐ |
| Nanotechnology | ☐ | ☐ | X | ☐ |
| Photonics | | ☐ | X | ☐ |
| Environmental research | X | ☐ | ☐ | ☐ |
| Art, archaeology | ☐ | ☐ | X | ☐ |
| Other | ☐ | ☐ | ☐ | ☐ |

**3.** Please list below **institutions / industrial concerns** represented by you, which would require European XFEL specific features from 2017 onwards, and indicate for which particular experiments European XFEL would be needed.

Instead of listing academic institutions and industrial enterprises, we take the opportunity to draw the attention of the authorities that will take the decision on the Swiss participation in the exploitation of the European XFEL to some general facts concerning the future use of XFEL's that ought to be considered. XFEL's are the technically most advanced light sources

today and differ from electron-synchrotron (ES) light sources in many respects. In particular, XFEL's provide light-beam intensities that exceed those of ES installations by many orders of magnitude and the time structure of XFEL beams allows for experiments with much higher time resolution than currently available at ES sources. As a consequence, experiments will be much more complicated and their execution will demand skills that have to be learned and explored by all future users at XFEL's. In this sense, both the preparation and the execution of experiments will require more time than what is common at ES sources. Since the number of beam ports at XFEL's is much reduced with respect to those available at ES light sources, the number of accepted experiments will likewise be much reduced. At present, approximately 20 individual researchers in Switzerland have practical experience in using and exploiting XFEL radiation. Swiss researchers that are new in the field will have the privilege to get acquainted with the corresponding problems at the new Swiss FEL at the PSI in Villigen. The mentioned more experienced users will be qualified to apply for beam time at the European XFEL with a high probability of success (allocation of beam time) once the installation goes into operation. They will serve to help other potential Swiss users to gain experience in using the extraordinary features of XFEL radiation. In this sense, it is important that Switzerland participates in the operation of the European XFEL right from the beginning. Only in this way will Swiss researchers be able to stay competitive in the international community and be requested partners in international collaborations. In this context it should be noted that the mentioned scarcer availability of XFEL beams will enforce new and probably larger collaborations in order to enhance the chances to obtain the required beam time for a particular experiment. The chances to be accepted as partners requires high qualifications in using XFEL radiation which can obviously only be acquired by active participation in the operation of such facilities. Concerning industrial users it is quite clear that they will require and expect guidance and support from experienced users in the academic sector. These comments are intended to explain why a reliable list of potential users and their experiments at the European XFEL doesn't make sense and is not really possible at this time. Nevertheless, for the reasons mentioned above, an active participation in the operation of the European XFEL as soon as it is operative, should be envisaged with highest priority.

**4.** What are the **priority scientific advantages** that a participation in the operation phase of the European XFEL would bring to Switzerland?

| | Absolute priority | Secondary priority | Not a priority / already achieved without E-XFEL in a satisfactory fashion | No opinion |
|---|---|---|---|---|
| Deciphering the structure of biomolecules | X | ☐ | ☐ | ☐ |
| Exploring the nanoworld in 3D | ☐ | X | ☐ | ☐ |
| "Filming" chemical reactions | X | ☐ | ☐ | ☐ |
| Spatial and temporal | X | ☐ | ☐ | ☐ |

| | | | | |
|---|---|---|---|---|
| investigation of magnetization | | | | |
| Observing small objects in strong fields | ☐ | X | ☐ | ☐ |
| Investigating extreme states of matter | X | ☐ | ☐ | ☐ |
| Other (specify) | ☐ | ☐ | ☐ | ☐ |
| Other (specify) | ☐ | ☐ | ☐ | ☐ |

**5.** Which important societal challenges could these advantages help to overcome in Switzerland? Please mention at least three.

- Health (understanding the origins of diseases, achieve progress in pharmaceutical medication)
- Technological competitiveness of Switzerland (low level of unemployment and high average level of wealth of the population).
- Competitiveness of Switzerland as a global player with respect to higher education and research, attracting the best minds (students, doctoral students, professors) at an international scale.
- Understanding of fundamental chemical reactions with respect to the optimal use of resources and optimizing the efficiency of energy-providing installations.

**6.** The European XFEL linear accelerator might be initially commissioned without the capability of delivering photons in the entire range from 0.3 up to 25 keV. It would instead only provide photons with energy lower than 20 keV, and no photons at all in the range between 2 and 3 keV. If this "**underpowered European XFEL**" scenario took place, would the usefulness of the European XFEL be reduced for institutions / industrial concerns mentioned at point 3? If so, which particular experiments would have to be put on hold?

The initial limitation of the available operational energy range has no significant influence on the type of experiments that would be feasible. A majority of possible experiments can be done with the reduced performance in the available energy range.

**7.** **How much beamtime per year** do you expect the institutions / industrial concerns mentioned at point 3 to require at the European XFEL in the different scenarios below?

| | |
|---|---|
| In the foreseen energy range<br>(photons in the entire range from 0.3 to 25 keV) | XX hours/year |
| In the "underpowered European XFEL" scenario<br>(photons with energy lower than 20 keV, gap between 2 and 3 keV) | XX hours/year |

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# Comments to the Stakeholder's Survey that could technically not be implemented in the provided form

## General comments:

The response is intended to represent all academic and industrial stakeholders that are active in the research fields that are covered in this survey. It should be noted that the allocation of beamtime at the facilities SACLA (Japan) and LCLS (Stanford, USA) is handled in a very protective mode to the benefit of respective national applicants. Therefore the active participation of Swiss-based researchers at the European XFEL (EUXFEL) has to be facilitated through a participation of Switzerland in the operative phase of the EUXFEL from the beginning.

## Item 2:

The two facilities (EUXFEL and SWISSFEL) are to be regarded as complementary in many respects. Without going into details, some types of experiments need the specifications of the EUXFEL, for others the features of the SWISSFEL are more favourable. It really depends on the particular type of experiment. The EUXFEL is specifically needed if very high energies and very fast data acquisition are required (statics vs dynamics).

## Item 4:

Other fields that seem possible but technically could not be incorporated in the form are:
- MEMS (fatigue and/or friction of small mechanical systems)
- metallurgy (materials with high density)

## Item 7:

The number of Swiss-based experts that are able to use an XFEL independently is of the order of 20. A typical experiment is expected to require of the order of 60 h beamtime including preparation on site at the respective beamline. However, the allocation of 1200 h beamtime per year for Swiss-based users alone is completely unrealistic and we refer to our text in item 3 of the form.

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