

TECHNICAL NOTE

# **CAD Integration**

# **Guidelines for Photon**

# **Beamline Components**

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*for X-Ray Optics and Beam Transport (WP73)*

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# 1 Introduction

This document presents guidelines for the computer-aided design (CAD) integration of photon beamline components at the European XFEL facility. The guidelines are valid for all people designing components for the photon beamlines. Follow these guidelines when exchanging and sharing information between work packages and the quality assurance (QA) team of DESY.

This document contains rules and important information about working with the existing component list and the structure of the SharePoint Portal Server (SPPS). It describes the general routine for creating CAD files and where to put CAD working data. Furthermore, it shows how to make a change request for shifting the position of components in the tunnel.

## 2 Component list

The component list provides an overview of all devices with their particular position in the photon beamlines. Each value in the table (except the length S) always describes the middle of each component with respect to the z-direction of the Linear Accelerator (LA) coordinate system. The component list is provided by the CAD integration coordinator of WP73 (Nicole Kohlstrunk).

The current component list for SASE1, SASE2, and SASE3 is available in EDMS (**D\*2278111**) and is updated every six months. Figure 1 shows an abstract of the component list of SASE1.

| ID | EADR | FUNC LAB | Exp | WP | DEVICE               | Type                  | SOURCE DIST<br>ZA             | ROOM DIST<br>ZA | LENGTH<br>S | LA      |         |            | PO        |           |          | RO<br>Z  |          |
|----|------|----------|-----|----|----------------------|-----------------------|-------------------------------|-----------------|-------------|---------|---------|------------|-----------|-----------|----------|----------|----------|
|    |      |          |     |    |                      |                       |                               |                 |             | X       | Y       | Z          | X         | Y         | Z        |          |          |
|    |      |          |     |    | Origin PD            |                       |                               |                 |             | 0.0000  | -2.4380 | 1994.49200 | 0.0000    | 0.0000    | 0.0000   |          |          |
|    |      |          |     |    | Tunnel start         | START                 | -273.33                       |                 | 394.92      | -1.8000 | -2.6992 | 2195.4438  | -1.8000   | -2.1100   | 185.9519 |          |          |
|    |      |          |     |    | Undulator start      |                       | -195.20                       |                 | 297.40      | 0.0000  | -3.5270 | 2238.5771  | 0.0000    | -0.0001   | 244.5851 |          |          |
|    |      |          |     |    | Undulator start 100% |                       | 0.00                          |                 | 0.00        | 0.0000  | -0.0000 | 1935.2711  | 0.0000    | 0.0000    | 198.2899 |          |          |
|    |      |          |     |    | Undulator end        |                       | 12.20                         |                 |             | 0.0000  | -2.8549 | 2445.9771  | 0.0000    | -0.0001   | 451.4851 |          |          |
|    |      |          |     |    | XTD2_R9              | START                 | 142.87                        |                 | 30.48       | -1.8000 | -2.7811 | 2576.4438  | -1.8000   | -2.1100   | 581.9519 |          |          |
|    |      |          |     |    | T9 start             | START                 |                               |                 |             | 0.0000  | -2.6937 | 2583.3201  | 0.0000    | -0.0001   | 588.8281 |          |          |
|    |      |          |     |    | Beam separation      |                       | 151.30                        | 8.63            |             | 0.0000  | -2.8542 | 2585.0771  | 0.0000    | 0.0000    | 590.5851 |          |          |
|    |      |          |     |    | Beam outlet          |                       | 151.30                        | 8.63            |             | 0.0000  | -2.8542 | 2585.0771  | 0.0000    | 0.0000    | 590.5851 |          |          |
|    |      |          |     |    | 9SEC 2604 T9         | 19                    | safety magnet                 | 9SEC            | 175.54      | 27.88   | 2.00    | 0.0000     | -2.6614   | 2684.3201 | 0.0000   | -0.0001  | 609.8281 |
|    |      |          |     |    | 19                   | LiHac valve           |                               | 172.54          | 29.88       | 2.00    | 0.0000  | -2.8621    | 2686.3201 | 0.0000    | -0.0001  | 611.8281 |          |
|    |      |          |     |    | XTD2_R10             | START                 | 173.14                        |                 | 6.64        | -1.8000 | -3.7722 | 2686.9015  | -1.8000   | -2.1100   | 612.4296 |          |          |
|    |      |          |     |    | Ion Pump             |                       | 174.54                        | 1.40            |             | 2.00    | 0.0000  | -2.8626    | 2686.3201 | 0.0000    | -0.0001  | 613.8281 |          |
|    |      |          |     |    | 73                   | beam pipe DM3 start   | START                         | 175.54          | 2.40        | 10.56   | 0.0000  | -2.6632    | 2686.3201 | 0.0000    | -0.0001  | 614.8281 |          |
|    |      |          |     |    | Ion GP 75i           |                       |                               |                 |             |         |         |            |           |           |          |          |          |
|    |      |          |     |    | XTD2_R11             | START                 | 179.76                        |                 | 19.98       | -1.6000 | -2.8022 | 2613.5612  | -1.6000   | -2.1376   | 619.0693 |          |          |
|    |      |          |     |    | Ion GP 75i           |                       |                               |                 |             |         |         |            |           |           |          |          |          |
|    |      |          |     |    | 73                   | beam pipe DM3 end     | END                           | 186.10          | 6.32        |         | -1.8000 | -2.9961    | 2619.8769 | -1.8000   | -2.3294  | 625.5851 |          |
|    |      |          |     |    | 2620 T9              |                       | 186.35                        | 6.57            | 0.50        | 0.0000  | -2.6670 | 2620.1271  | 0.0000    | 0.0000    | 625.6351 |          |          |
|    |      |          |     |    | 73                   | Diff Pump DN40 start  | START                         | 186.60          | 6.82        | 15.00   | 0.0000  | -2.6671    | 2620.3771 | 0.0000    | 0.0000   | 626.8851 |          |
|    |      |          |     |    | XTD2_R12             | START                 | 199.76                        |                 | 5.10        | -1.8000 | -2.9753 | 2633.5374  | -1.8000   | -2.3034   | 639.8456 |          |          |
|    |      |          |     |    | 73                   | Diff Pump DN40 end    | END                           | 201.60          | 1.84        |         | 0.0000  | -2.6726    | 2635.3771 | 0.0000    | 0.0000   | 640.8851 |          |
|    |      |          |     |    | XBRM 2636 T9         | 74                    | XBRM                          | XBRM            | 202.60      | 2.84    | 2.00    | 0.0000     | -2.6730   | 2636.3771 | 0.0000   | 0.0000   | 641.8851 |
|    |      |          |     |    | 73                   | beam pipe DN40 start  | START                         | 203.60          | 3.84        | 5.00    | 0.0000  | -2.6733    | 2637.3771 | 0.0000    | 0.0000   | 642.8851 |          |
|    |      |          |     |    | XTD2_R13             | START                 | 204.96                        |                 | 62.00       | -1.8000 | -3.0032 | 2638.6400  | -1.8000   | -2.3294   | 644.1482 |          |          |
|    |      |          |     |    | 73                   | beam pipe DN40 end    | END                           | 208.60          | 3.74        |         | 0.0000  | -2.6750    | 2642.3771 | 0.0000    | 0.0000   | 647.8851 |          |
|    |      |          |     |    | XGMD 2643 T9         | 74                    | XGMD                          | XGMD            | 209.60      | 4.74    | 2.00    | 0.0000     | -2.6755   | 2643.3771 | 0.0000   | 0.0000   | 648.8851 |
|    |      |          |     |    | SRA 2645 T9          | 73                    | SRA                           | SRA             | 211.35      | 6.49    | 1.50    | 0.0000     | -2.6762   | 2645.1271 | 0.0000   | 0.0000   | 650.6351 |
|    |      |          |     |    | 2647 T9              | 73                    | Soleid attenuator / Be-lenses |                 | 213.30      | 8.44    | 2.40    | 0.0000     | -2.6769   | 2647.0771 | 0.0000   | 0.0000   | 652.5851 |
|    |      |          |     |    | XGMD 2649 T9         | 74                    | XGMD                          | XGMD            | 215.50      | 10.64   | 2.00    | 0.0000     | -2.6777   | 2649.2771 | 0.0000   | 0.0000   | 654.7851 |
|    |      |          |     |    | Particle-free        |                       | 216.50                        |                 |             |         |         |            |           |           |          |          |          |
|    |      |          |     |    | 73                   | beam pipe DN40 start  | START                         | 218.50          | 11.64       | 5.00    | 0.0000  | -2.6780    | 2650.2771 | 0.0000    | 0.0000   | 655.7851 |          |
|    |      |          |     |    | 73                   | beam pipe DN40 end    | END                           | 221.50          | 16.64       |         | 0.0000  | -2.6799    | 2655.2771 | 0.0000    | 0.0000   | 660.7851 |          |
|    |      |          |     |    | 9PM 2656 T9          | 74                    | XBRM                          | 9PM             | 222.50      | 17.64   | 2.00    | 0.0000     | -2.6802   | 2656.2771 | 0.0000   | 0.0000   | 661.7851 |
|    |      |          |     |    | 73                   | Diff Pump DN40 start  | START                         | 223.50          | 18.64       | 15.00   | 0.0000  | -2.6806    | 2657.2771 | 0.0000    | 0.0000   | 662.7851 |          |
|    |      |          |     |    | 73                   | Diff Pump DN40 end    | END                           | 236.50          | 33.64       |         | 0.0000  | -2.6861    | 2672.2771 | 0.0000    | 0.0000   | 677.7651 |          |
|    |      |          |     |    | 2674 T9              | 74                    | K-Monochromator               |                 | 240.00      | 35.14   | 3.00    | 0.0000     | -2.6866   | 2673.7771 | 0.0000   | 0.0000   | 679.2851 |
|    |      |          |     |    | 2676 T9              | 74                    | 2D-Imager                     |                 | 242.00      | 37.14   | 1.00    | 0.0000     | -2.6874   | 2675.7771 | 0.0000   | 0.0000   | 681.2851 |
|    |      |          |     |    | 2677 T9              | 73                    | Ring collimator               |                 | 243.00      | 38.14   | 1.00    | 0.0000     | -2.6877   | 2676.7771 | 0.0000   | 0.0000   | 682.2851 |
|    |      |          |     |    | 73                   | beam pipe DN40 start  | START                         | 243.50          | 38.64       | 2.00    | 0.0000  | -2.6879    | 2677.2771 | 0.0000    | 0.0000   | 683.2851 |          |
|    |      |          |     |    | 73                   | beam pipe DN40 end    | END                           | 245.50          | 40.64       |         | 0.0000  | -2.6886    | 2679.2771 | 0.0000    | 0.0000   | 684.2851 |          |
|    |      |          |     |    | MRR 2680 T9          | 73                    | 1st offset mirror             | MRR             | 246.50      | 41.64   | 2.00    | 0.0000     | -2.6890   | 2680.2771 | 0.0000   | 0.0000   | 685.2851 |
|    |      |          |     |    | 73                   | beam pipe DN100 start | START                         | 247.50          | 42.64       | 8.00    | 0.0000  | -2.6894    | 2681.2771 | 0.0000    | 0.0000   | 686.2851 |          |
|    |      |          |     |    | 73                   | beam pipe DN100 end   | END                           | 255.50          | 50.64       |         | 0.0000  | -2.6923    | 2686.2771 | 0.0000    | 0.0000   | 694.2851 |          |
|    |      |          |     |    | MRR 2690 T9          | 73                    | 2nd offset mirror             | MRR             | 256.50      | 51.64   | 2.00    | 0.0000     | -2.6926   | 2690.2771 | 0.0000   | 0.0000   | 695.2851 |
|    |      |          |     |    | XTD2_R14             | START                 | 256.96                        |                 | 17.61       | -1.6000 | -3.1222 | 2690.6399  | -1.6000   | -2.4294   | 696.1481 |          |          |
|    |      |          |     |    | MCP 2692 T9          | 74                    | MCP detector                  | MCP             | 258.25      | 1.39    | 1.50    | 0.0000     | -2.6933   | 2692.6271 | 0.0000   | 0.0000   | 697.5351 |
|    |      |          |     |    | PE5 2694 T9          | 74                    | PE5                           | PE5             | 265.50      | 3.64    | 3.00    | 0.0000     | -2.6941   | 2694.2771 | 0.0000   | 0.0000   | 699.7851 |
|    |      |          |     |    | 2697 T9              | 73                    | C-Monochromator               |                 | 263.50      | 6.64    | 3.00    | 0.0000     | -2.6952   | 2697.2771 | 0.0000   | 0.0000   | 702.7851 |
|    |      |          |     |    | 73                   | beam pipe DN100 start | START                         | 265.00          | 8.14        | 5.00    | 0.0000  | -2.6958    | 2698.7771 | 0.0000    | 0.0000   | 704.2851 |          |

Figure 1: Component list of SASE1 (extract)

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## 2.1 Structure of the component list

The component list of each beamline is structured as follows. You will find the definition of the Linear Accelerator (LA) and Photon Distribution (PD) coordinate system in EDMS (**D\*497635**).

### 2.1.1 Component list colours

|        |  |
|--------|--|
| Blue   | Start/end of tunnel, shaft, or dump building (taken from the BO list D*0496900). |
| Green  | Start of each room (taken from the BO list D*0496900).                           |
| Red    | Source point (the second to last undulator is chosen).                           |
| Orange | Start/end of particle-free area.   |
| Grey   | Optional components.   |
| Purple | Start/end of beam pipe.  |
| White  | Devices.   |

### 2.1.2 Component list columns

|                        |   |
|------------------------|---|
| <b>Section</b>         | Name of the section according to the “naming convention for XFEL beamline sections” ( <b>D*886471</b> ).  |
| <b>CAD Room</b>        | Name of the tunnel, shaft, or dump building.  |
| <b>Func. label</b>     | Description of the particular function and location in the XFEL. Consists of an abbreviation for the function or type, the beamline section, and the z-coordinate (LA in meters) where it is installed according to the “naming convention for XFEL components” (D*886471). |
| <b>Exp.</b>            | Name of the scientific instrument.  |
| <b>WP</b>              | Name of the work package responsible for the component.   |
| <b>Device</b>          | Name of the component.  |
| <b>Typ.</b>            | Type of the component needed for the functional label (a list of the different types is shown in Section 2.1.3, “Component types”).   |
| <b>Source distance</b> | Distance of the component to the source point in z-direction.   |
| <b>Room distance</b>   | Position of the component with respect to the room start.   |
| <b>Length</b>          | Length of the component, tunnel, shaft, dump, or room.  |
| <b>LA (x,y,z)</b>      | LA coordinates in the x-, y-, and z-direction.  |
| <b>PD (x,y,z)</b>      | PD coordinates in the x-, y-, and z-direction   |

### 2.1.3 Component types

|             |                                |
|-------------|--------------------------------|
| <b>APT</b>  | Aperture                       |
| <b>XBPM</b> | X-ray beam position monitor    |
| <b>XGMD</b> | X-ray gas monitor detector     |
| <b>SRA</b>  | Spontaneous radiation aperture |
| <b>ATT</b>  | Attenuator                     |
| <b>KMON</b> | K-monochromator                |
| <b>MONO</b> | Monochromator                  |
| <b>IMAG</b> | Imager / pop-in monitor        |
| <b>COLL</b> | Collimator                     |
| <b>MIRR</b> | Mirror                         |
| <b>MCP</b>  | Multi-channel plate detector   |
| <b>PES</b>  | Photo electron spectrometer    |
| <b>ABS</b>  | FEL beam absorber              |
| <b>BSTP</b> | Bremsstrahlung beam stop       |
| <b>SHUT</b> | Shutter                        |
| <b>VLSG</b> | Variable line spacing grating  |
| <b>SLIT</b> | Exit slit                      |

## 2.2 Change requests

If something in the component list has to be changed (e.g. the position of a device has to be shifted upstream or downstream), submit a change request to the CAD integration coordinator explaining what should be changed and why. The CAD integration coordinator then puts the change request into a separate list in EDMS (change request component list **D\*2629421**) indicating the date, the name and work package of the requester, the description, and the influence on other devices. Whenever there is a new change request, this list is updated and routed to everyone in charge of designing components for the photon beamlines. When you receive a new list, make sure there are no mistakes and no reasons the change request cannot be approved.

Requested changes are marked red in the history of the component list. Approved changes appear in yellow in the component list. When they are adapted in the CAD model, they turn green.

Figure 2 shows the change history of the component list.

| No. | date       | requester    | WP | description  | Influence on other devices   | requested | approved | list/CAD |
|-----|------------|--------------|----|--|--|-----------|----------|----------|
| 1   | 02-09-2011 | M. Dornmayer | 73 | Add particle-free area +/- 30m around distribution mirrors                           | no   | x         | x        | x        |
| 2   | 05-12-2011 | H. Sinn      | 73 | SASE3 Add horizontal slit for SQS and SQS2 (Z=5331.2910)                             | beam pipe DN100 splitted, length was 58.48m, now 53.25m and 3.73m  | x         | x        |          |
| 3   | 05-12-2011 | C. Ozkan     | 74 | SASE1 Add transmissive imager right before 30mm Aperture (Z=2613.3771m)              | beam pipe DN63 net of 1m (was 10.00m, now 9.00m)                   | x         |          |          |
| 4   | 05-12-2011 | C. Ozkan     | 74 | SASE1 Add Pippin monitor right after MCP before the PES (Z=2653.2771m)               | PES and C-Mono shifted, beam pipe DN100 net of 1m (was 5m, now 4m) | x         |          |          |
| 5   | 05-12-2011 | C. Ozkan     | 74 | SASE1 Add corresponding Pippin monitor for SPS (Z=3032.7702m)                        | beam pipe DN100 splitted, length was 520.88m, now 487m and 52.88m  | x         |          |          |
| 6   | 05-12-2011 | C. Ozkan     | 74 | SASE1 Add Pippin monitor for FVC after S-Monochromator (Z=3285.7770m)                | beam pipe DN100 net of 1m (was 55.00m, now 49.88m)                 | x         |          |          |
| 7   | 05-12-2011 | C. Ozkan     | 74 | SASE2 Add transmissive imager right before 30mm Aperture (Z=2590.2695m)              | beam pipe DN63 net of 1m (was 10.00m, now 9.00m)                   | x         |          |          |
| 8   | 05-12-2011 | C. Ozkan     | 74 | SASE2 Add Pippin monitor right after MCP before the PES (Z=2593.2667m)               | PES shifted, beam pipe DN100 net of 1m (was 2m, now 2m)            | x         |          |          |
| 9   | 05-12-2011 | C. Ozkan     | 74 | SASE2 Add corresponding Pippin monitor for HD (Z=3083.3000m)                         | beam pipe DN100 splitted, length was 544.22m, now 492m and 51.22m  | x         |          |          |
| 10  | 05-12-2011 | C. Ozkan     | 74 | SASE2 Add Pippin monitor for MD after S-Monochromator (Z=3285.2904m)                 | beam pipe DN100 net of 1m (was 45.22m, now 42.2m)                  | x         |          |          |
| 11  | 05-12-2011 | C. Ozkan     | 74 | SASE3 Add transmissive imager right before 30mm Aperture (Z=3101.5117m)              | beam pipe DN63 net of 1m (was 10.00m, now 9.00m)                   | x         |          |          |
| 12  | 05-12-2011 | C. Ozkan     | 74 | SASE3 Add Pippin monitor right after MCP before the PES (Z=3205.1841m)               | PES shifted, beam pipe DN100 net of 1m (was 5m, now 4m)            | x         |          |          |
| 13  | 05-12-2011 | C. Ozkan     | 74 | SASE3 Add Pippin monitor right after horizontal slit for SQS and SQS2 (Z=3332.1306m) | beam pipe DN100 net of 1m (was 3.73m, now 2.73m)                   | x         |          |          |
| 14  | 05-12-2011 | C. Ozkan     | 74 | SASE3 Shift Pippin monitor right after horizontal slit for SQS (Z=3332.5306m)        | beam pipe DN100 extended 1m (was 52.25m, now 53.25m)               | x         |          |          |
|     |            |              |    |  | beam pipe DN100 net of 1m (was 3.73m, now 2.73m)                   | x         |          |          |

Figure 2: Change history of component list

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## 3 Working in SPPS

The SharePoint Portal Server (SPPS) is a document management system provided by Microsoft. Acting as a portal, SharePoint is able to make data available centrally. It enables different people and groups to share information and to work on the same data or projects.

“View & Markup” and “RevisionManager” include tools for design management and administration. They are part of Solid Edge with an interface to SPPS. Together, they are called “Insight Connect”.

The SharePoint Portal Server consists of two computers. One serves as an SQL server. Together with “Insight Connect”, it is called the SharePoint Portal System.

The CAD data in the SPPS can be reached in one of two ways:

- *Solid Edge*  
Open → Computer → SE\_SPPS\_II
- *Internet Explorer*  
[http://adsepsps2/sites/SE\\_CAD](http://adsepsps2/sites/SE_CAD)

To avoid mistakes that might cause data loss, it is very important to follow certain rules when working with the SPPS.

The DESY IPP group provides a training course called “Document Management with Solid Edge and SharePoint Portal Server“ (*“Dokumentenverwaltung mit Solid Edge und SharePoint Portal Server“*).

You can register for the course from the IPP website:

<http://www.desy.de/ipp/Anwendersupport/Schulungen/schulungen.html>

The courses are typically provided in German. IPP offers an English-language Solid Edge course (with the German-language user interface) if there are enough participants (minimum of eight). When applying for the course, indicate which language you prefer.



This course and a minimum basic knowledge of Solid Edge are required to get access to the SPPS. It is also mandatory to use the German-language user interface of SPPS and the German-language version of Solid Edge.

▲ CAUTION: If you work with the English-language version in SPPS, files can be destroyed because Solid Edge and SPPS “wire” file attributes differently in different languages. These problems may occur only after a while. Also, if you work with the English-language version of Solid Edge, it is possible to work locally on a computer only. In this case, the Solid Edge macros are not available.

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## 3.1 Structure of SPPS

At the top of the structure are the sites (*Arbeitsbereiche*), followed by the libraries (*Bibliotheken*), folders (*Ordner*), and subfolders (*Unterordner*).

The “XFEL” site contains libraries for each work package and group that works with CAD data.

Work packages can create folders and subfolders within their library.

In the current SPPS version, it is possible to give write access to others on folder level.

The name of each folder and file name and the structure is to be kept as short and flat as possible.

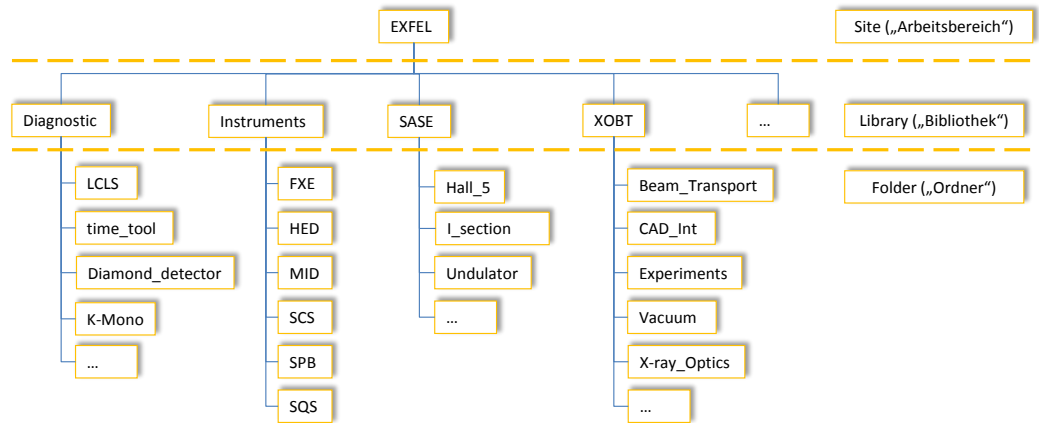
It is only allowed to use following characters for folder and file names:

0-9, a-z, A-Z, hyphen (-) or underscore (\_)

For SPPS guidelines, go to the following site:

[\\ippfatcad\cad\web4tools\se\richtlinien\spps\index\\_rili\\_spps.htm](\\ippfatcad\cad\web4tools\se\richtlinien\spps\index_rili_spps.htm)

The structure (as of September 2011) of the XFEL site is shown in Figure 3.



*Figure 3: CAD integration structure of the EXFEL site in SPPS*

## 3.2 Overview assemblies of photon beamlines

The overview assemblies are a formation of the rooms of one tunnel section. They are available for all beamlines from the room with the e-beam separation until the last tunnel room before the experiment hall.

The overview assemblies for the beamlines can be found in SPPS at EXFEL → XOBT → CAD\_Int → SASE1/SASE2/SASE3.

The overview assemblies for the different sections of the beamlines are:

|              |                                 |
|--------------|---------------------------------|
| <b>SASE1</b> | ASM_XTD2_R9-R16-SE000398612.asm |
|              | ASM_XS3-SE000414101.asm         |
|              | ASM_XTD9_R1-R11-SE000414821.asm |
| <b>SASE2</b> | ASM_XTD1_R9-R11-SE000399490.asm |
|              | ASM_XS2-SE000416837.asm         |
|              | ASM_XTD6_R1-R13-SE000417732.asm |
| <b>SASE3</b> | ASM_XTD4_R6-R7-SE000402089.asm  |
|              | ASM_XSDU2-SE000402095.asm       |
|              | ASM_XTD10_R1-R5-SE000402105.asm |

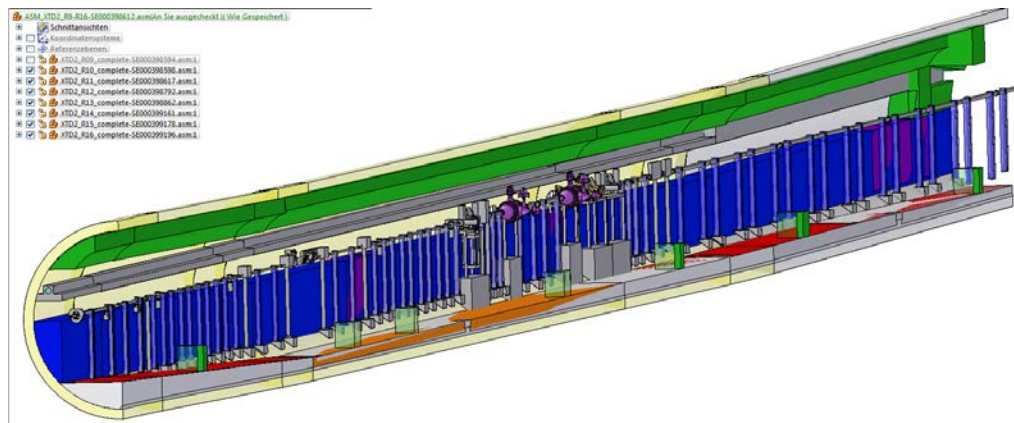
The overview assemblies are structured room by room. The filename of each room indicate the tunnel, shaft or dump name, room number, “complete”, SE number. Each part of the filename is divided by an underscore (\_) or hyphen (-).

Example:

XTD2\_R13\_complete-SE000xxxxxx.asm

Each room contains the assemblies of Work Package 34—DESY group Maschine, Kraft, Kühlung (MKK)—with the tunnel itself, as well as the cabling, water cooling, and components of other work packages, such as WP32 (survey and alignment), and all components of WP73 and WP74.

Figure 4 shows an example for an overview assembly in SPPS.



**Figure 4:** Example overview assembly (XTD2 Rooms 9–16, Room 9 is hidden)

The overview assemblies of the complete XFEL are available in EDMS (**D\*912163**). This document also contains the components of all photon beamlines.

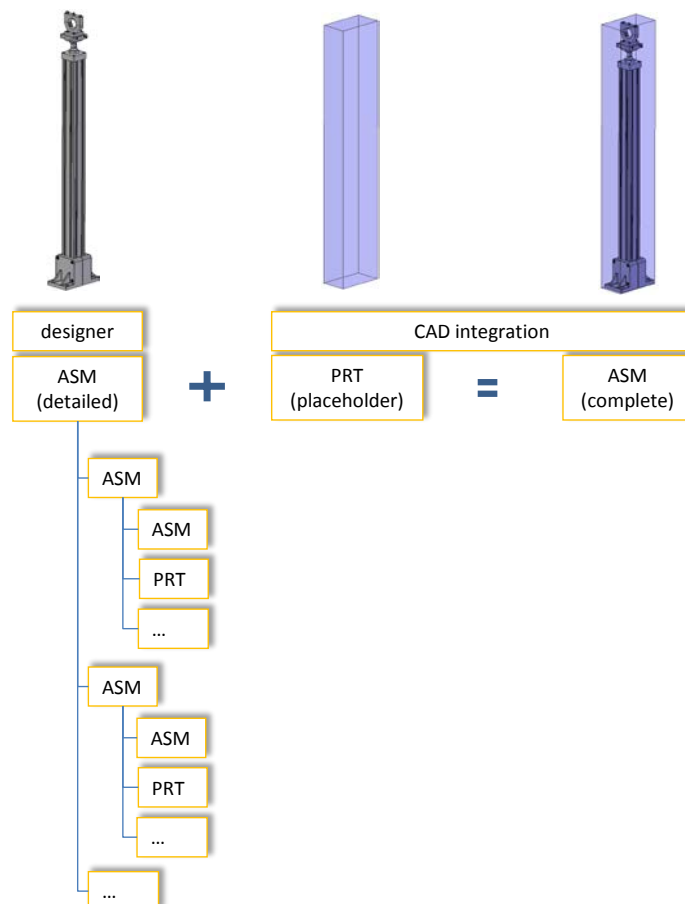
## 4 Building up CAD files

This chapter explains how CAD files should be built up. This is important in order to prevent major collisions and minimize the iterations between the designer and the CAD integration coordinator of WP73.

Each component is an assembly consisting of the detailed model and the placeholder model. The detailed model is created by the responsible designer; the placeholder and the complete assembly are created by the CAD integration coordinator.

The responsible designer has write access to the detailed model only. The CAD integration coordinator has write access to all files in the library.

Figure 5 shows an example of building up CAD files.



**Figure 5:** Example of building up a CAD file

The detailed 3D model has to stay within the length given in the component list. If the model is shorter, it has to be extended to the margins with pipes. The diameter of the connecting flanges should also be chosen according to the component list.

---

## 4.1 Working in SPPS with Solid Edge (preferred case)

Working with the German-language user interface of Solid Edge is the preferred use case because it is easiest and fastest. Collisions can be seen directly and files are in SPPS from the beginning.

When working in SPPS on the detailed model, open the complete model first, and then open the detailed model from there. That way, it is easier to recognize collisions between the placeholder and the detailed model.

The detailed model should stay within the boundaries of the placeholder model. If there are any collisions with the placeholder model that cannot be avoided, discuss the problem with the CAD integration coordinator.

---

## 4.2 Working locally on the computer (exception)

It is not possible to put a Solid Edge file created with the English-language user interface directly into a complete model because there cannot be a mixture of managed and unmanaged documents. Therefore, when working locally on a computer with the English-language user interface of Solid Edge or another 3D CAD program, create a STEP file of the detailed 3D model and send it to the CAD integration coordinator. The CAD integration coordinator will then change it into a Solid Edge file and integrate it into the complete model. In this case, collisions are checked by the CAD integration coordinator.

When the detailed model is finished, it should be put into the SPPS.

Files created with the English-language version of Solid Edge have to be specially prepared by the designer. Each file needs an SE number (in the attribute field of the file and at the end of the filename). IPP provides two programs that perform these steps automatically.

#### 4.2.1 Starting the Set Properties program

The Set Properties program creates an SE number for every file created with the English-language version of Solid Edge. It puts the SE number in the attributes field of a log file for the Solid Edge file.

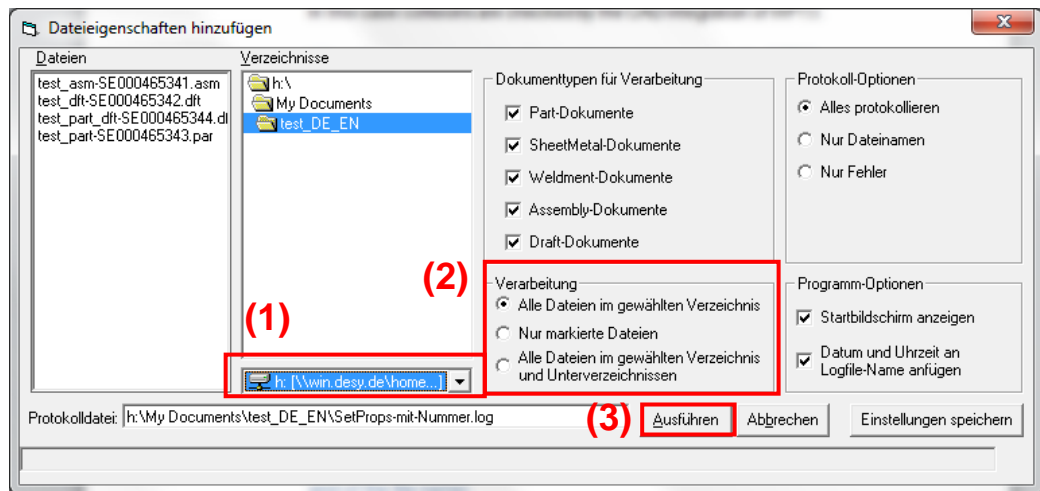
To start the Set Properties program, follow these steps:

- 1 Click the **Set Properties** link:

[//ippfatcad/SolidEdge/system/4all\\_vers/Programme/DatSys-SPPS/SetProps-mit-Nummer.exe](http://ippfatcad/SolidEdge/system/4all_vers/Programme/DatSys-SPPS/SetProps-mit-Nummer.exe)

- 2 Click **OK**.

The following window displays.



- 3 Choose the directory (1).
- 4 Choose the type of processing (2).

There are three different types of processing (from top):

- All files in chosen directory (“*Alle Dateien im gewählten Verzeichnis*”)
- Only marked files (“*Nur markierte Dateien*”)
- All files in chosen directory and subdirectory (“*Alle Dateien im gewählten Verzeichnis und Unterverzeichnissen*”)

- 5 Start processing (3) by clicking **Ausführen**.

## 4.2.2 Starting the Rename program

The Rename program adds the SE number from the attribute field of the log file to the end of the filename for the Solid Edge file.

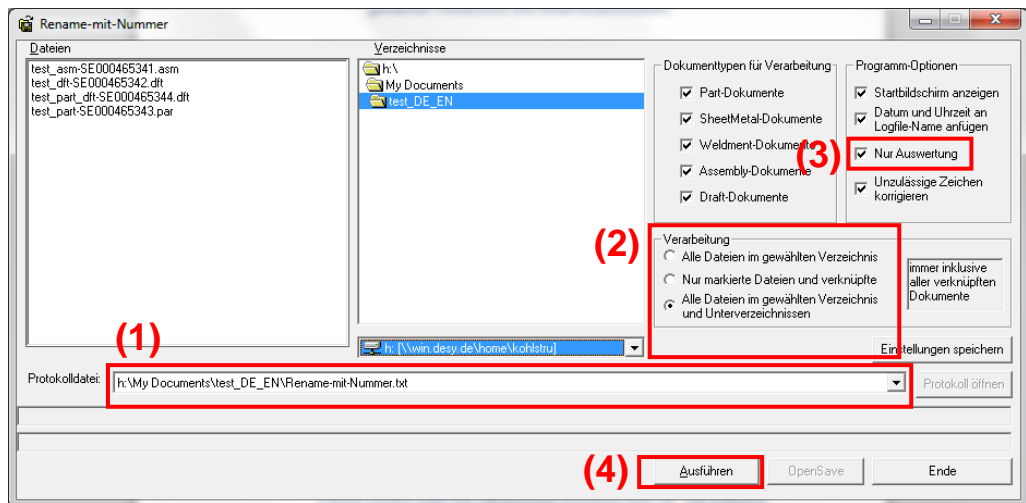
To start the Rename program, follow these steps:

- 1 Click the **Rename** link:

[/ippfatcad/SolidEdge/system/4all\\_vers/Programme/DatSys-SPPS/Rename-mit-Nummer.exe](/ippfatcad/SolidEdge/system/4all_vers/Programme/DatSys-SPPS/Rename-mit-Nummer.exe)

- 2 Confirm the subsequent two messages by clicking **OK** twice.

The following window displays.



- 3 Choose the directory (1) and the type of processing (2).

For details, see “Starting the Set Properties program” on page 14.

The check mark in (3) “reporting only” (“Nur Auswertung”) is set by default. In this case only a log file is generated showing the action that would be committed.

- 4 Remove the check mark in the box (3) “reporting only” (“Nur Auswertung”).
- 5 Execute (4) by clicking **Ausführen**.

The program puts the SE number behind the file name.

Now the CAD integration coordinator can check the attributes of the files and add all files to the library in SPPS.

After all files of the detailed 3D model have been added to the library, the detailed model can also be integrated in the complete 3D model by the CAD integration coordinator.

---

## 4.3 Drawings

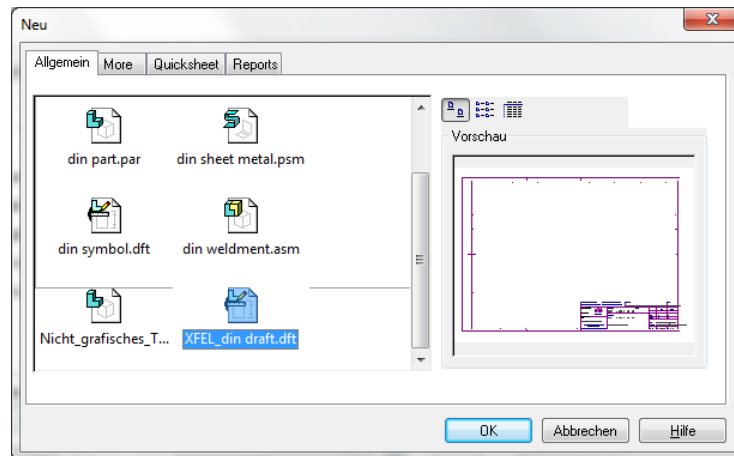
For technical drawings, there is a template with the corporate title block available in Solid Edge. This template was created in collaboration with engineers from several work packages and was approved by the European XFEL Management Board.

### 4.3.1 Creating a new drawing

To create a new drawing in Solid Edge, follow these steps:

- 1 Click **Neu** (“new”).

The following window displays.



- 2 Open the **XFEL\_din draft.dft** template.



### 4.3.2 English-language title block

Use the new template to create a technical drawing with an English-language title block. This title block is shown in Figure 6.



|  |  |                                    |                   |                       |                          |
|--|--|------------------------------------|-------------------|-----------------------|--------------------------|
| Surface texture according to DIN EN ISO 1302, 4287 and 4288, respectively                        | General tolerances according to DIN ISO 2768 (all dimensions in mm) Tolerance class  | Material: 1.4404 (X2CrNiMo17-12-2) | Weight: 30,186 kg |                       |                          |
| <br>Group: WP73 | <br>Title / subtitle: Pipe CF DN100<br>L=6000mm | Document No.: ---                  | Scale: 1.50       | Date: 12.10.2011      | Name: Kohlschrank        |
|  |  | Checked:                           | Approved:         | Part No.: SE000445875 | Drawing No.: SE000465102 |
| Property of European XFEL GmbH. All rights reserved. Referred to protection notice ISO 16016.    |  | Size: A3                           | Plot: 12.10.2011  | Sheet: 1 of 1         |                          |

Figure 6: English-language title block for a Solid Edge drawing

The fields of the title block can be filled with the macro “SE Tools” (only available with the German-language user interface) or in the file attributes of the part, assembly, etc., as shown in Figure 7.

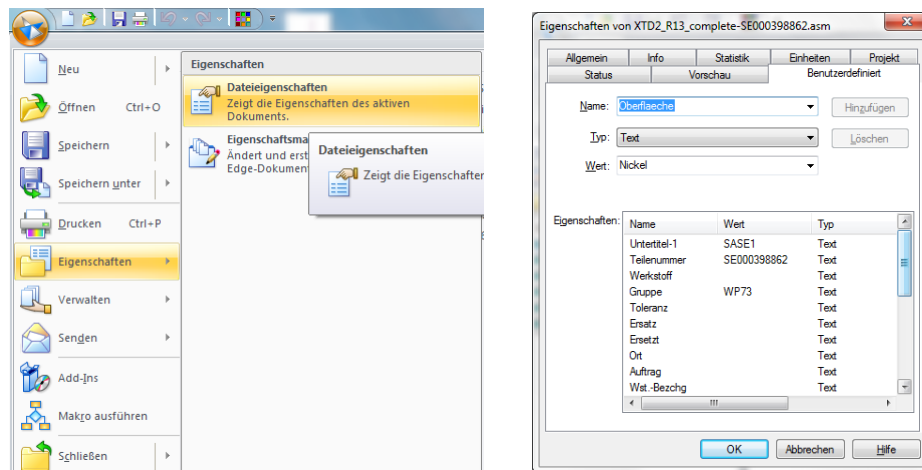


Figure 7: File attributes in Solid Edge

To find the file attributes in Solid Edge, follow these steps:

- 1 Click **Eigenschaften** (properties) → **Dateieigenschaften** (“file properties”).
- 2 Click **Info** → **Projekt** (“project”) → **Benutzerdefiniert** (“user-defined”).

### 4.3.3 English-language BOM

In addition to the new English-language title block for Solid Edge drawings, there is also a BOM available with English titles, as shown in Figure 8.

| Pos   | Qty | Title               | Subtitle           | Document No./ DIN/ISO | Material                                      | Semi-finished product / Comments   | Part No.    |
|---|-----|---------------------|--------------------|-----------------------|---|--|-------------|
| 1   | 1   | Pipe CF DN100       | L=6000mm           | ---                   | 14404   |  | SE000445875 |
|   |     |                     |                    |                       |   |  |             |
| <b>European XFEL</b><br>Property of European XFEL GmbH<br>All rights reserved.<br>Referenced to protection notice ISO 15016 |     | Document No.<br>--- | Date<br>12.10.2011 | Name<br>Kolbaszko     | Title / subtitle<br>Pipe CF DN100<br>L=6000mm | Positions with * are not attached on the drawing<br>Part No. SE000445875<br>Drawing No. SE000465102 Rev.<br>Plot 12.10.2011 Sheet 2 of 2 |             |

**Figure 8:** English-language BOM for a Solid Edge drawing

# 5 CAD Integration process

The CAD integration process involves three people:

- Engineer who designs the detailed model
- CAD integration coordinator of WP73 (European XFEL)
- QS team of IPP (DESY)

## 5.1 Preferred use case

Figure 10 shows the CAD integration process for the preferred case of building up CAD files.

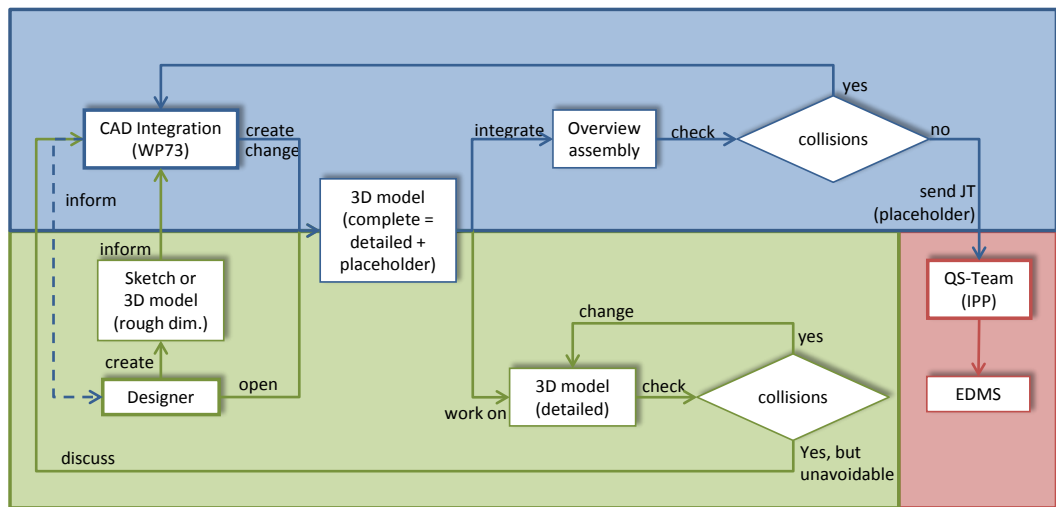



Figure 10: CAD integration process (preferred use case)

### 5.1.1 Creating a model

When working in SPPS with the German-language user interface, the designer creates a detailed 3D model. At the beginning, the “detailed” model might be only a box model with the rough dimensions of the device or a 2D sketch sent by email.

When the model is complete, the designer tells the CAD integration coordinator where to find the detailed model in SPPS, so it can be integrated into the complete 3D model.

 **CAUTION:** To avoid massive collisions with other components in the tunnel, these first steps should be performed as early as possible in the design process.

### 5.1.2 **Creating a placeholder**

Knowing the rough dimensions of the device, the CAD integration coordinator creates a placeholder model.

After the detailed model is integrated into the complete 3D model, the detailed model should always stay within the margins of the placeholder. If collisions are unavoidable, the designer has to discuss with the CAD integration coordinator whether the complete 3D model could be changed without causing new collisions with components of other work packages or the tunnel itself. If this is not possible, the designer has to change the detailed model.

When the complete 3D model is integrated into the overview assembly, the CAD integration coordinator checks whether there are any collisions between the 3D model and the overview assembly. If there are collisions, the 3D model has to be changed. If the change of the complete 3D model again causes collisions between the placeholder and the detailed model, the CAD integration coordinator informs the designer.

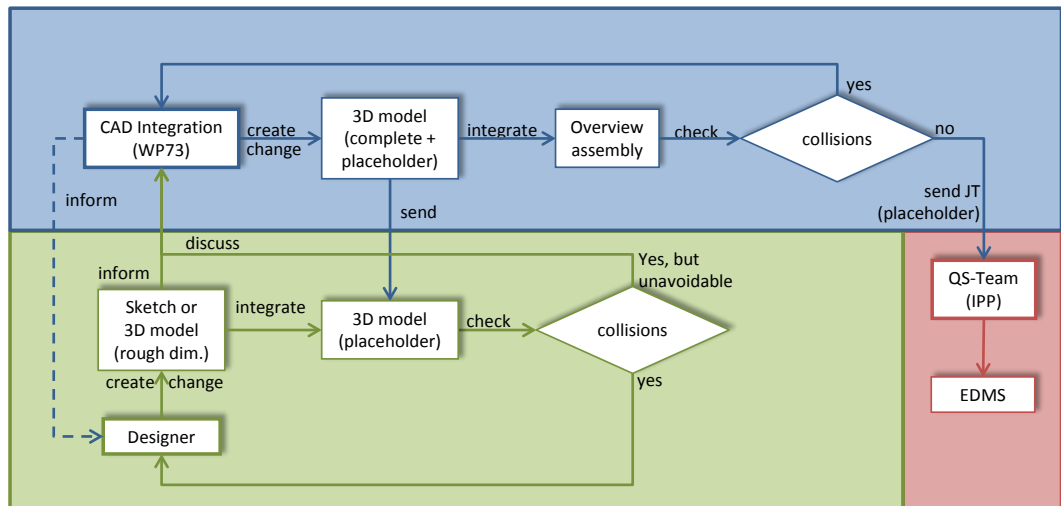
### 5.1.3 **Integrating the model into EDMS**

If there are no collisions between the detailed and placeholder models, or between the 3D model and the overview assembly, the CAD integration coordinator sends a JT file (consisting only of the placeholder models) to the quality assurance (*Qualitätssicherung* = QS) team. The QS team integrates the JT file into EDMS.

After the 3D model is integrated into EDMS, everyone can view the 3D model with the 3D viewer, VisView, available via NetInstall.

## 5.2 Workaround use case

If you are working locally on a computer, the CAD integration process is slightly different, as shown in Figure 11. This workaround use case is more extensive (especially for the CAD integration coordinator). Use it only when it is not possible to work in SPPS.



**Figure 11:** CAD integration process (workaround)

In this workaround process, the designer sends an email of a box model or a 2D sketch with rough dimensions to the CAD integration coordinator, who creates the placeholder and integrates it into the complete 3D model.

The CAD integration coordinator sends the placeholder to the designer so that the checking of collisions between the placeholder and the detailed model can be done by the designer.

The detailed 3D model should be send as a STEP file to the CAD integration coordinator to be integrated into the complete 3D model.

---

# 6 Components

This chapter describes how to build, change, and view components.

---

## 6.1 Building a new component

Before building a new component, write an email to the CAD integration coordinator of WP73, Nicole Kohlstrunk ([nicole.kohlstrunk@xfel.eu](mailto:nicole.kohlstrunk@xfel.eu)), with a copy to Harald Sinn ([harald.sinn@xfel.eu](mailto:harald.sinn@xfel.eu)) and Martin Dommach ([martin.dommach@xfel.eu](mailto:martin.dommach@xfel.eu)). This email should contain the position of the component, its total length, and a sketch of the component with the approximate dimensions, as well as the electricity and water requirements, the weight, and the vacuum conditions.

With these details, the CAD integration coordinator is able to create a 3D placeholder model. This placeholder model also contains the space for assembly and disassembly.

### 6.1.1 German-language user interface

With the Solid Edge German-language user interface, you build a new component as follows:

- *CAD integration coordinator*
  - Provides the complete assembly, consisting of the placeholder model and an empty file for the designer, where the detailed model has to be created.
  - Passes the location or the SE number of these models to the designer.
  - Tells the designer the size of the connecting flanges or the responsible person.

- *Designer*
  - Opens the complete model (no write access) and works on the detailed model. The coordinate system of the detailed model should have two planes in the middle of the connecting flange (middle of the beam) and one plane in the middle of the entire component (z-direction).
  - Checks the collisions between the detailed and placeholder models, and changes the detailed model if there are any collisions. The detailed model should always stay within the margins of the placeholder model.
  - Discusses unavoidable collisions with the CAD integration coordinator.

### 6.1.2 English-language user interface

If the designer uses Solid Edge with the English-language user interface or another CAD program, the new component is built as follows:

- *CAD integration coordinator*
  - Sends the placeholder model, including the three planes for positioning, to the designer
- *Designer*
  - Integrates the placeholder model into the detailed model.
  - Checks the collisions between the detailed and placeholder models, and changes the detailed model if there are any collisions. The detailed model should always stay within the margins of the placeholder model.
  - Discusses unavoidable collisions with the CAD integration coordinator.
  - Sends the detailed model to the CAD integration coordinator to integrate it into the complete assembly.

---

## 6.2 Changing a component

When a component needs to be changed, the designer does not need to inform the CAD integration coordinator as long as the detailed 3D model stays within the boundaries of the placeholder model. However, if the detailed model is outside the placeholder model, the designer has to discuss the problem with the CAD integration coordinator.

If the model was created with the English-language user interface of Solid Edge or another CAD program, a STEP file has to be sent to the CAD integration coordinator.

---

## 6.3 Viewing a component or part of a beamline

When working with the German-language user interface of Solid Edge, the designer can ask the CAD integration coordinator for the SE number of the component.

To view the overview assemblies and the rooms for the beam lines in detail, do one of the following:

- *Solid Edge*

Go to SPPS at EXFEL → XOBT → CAD\_Int → SASE1/SASE2/SASE3.  
(For details, see Section 3.2, “Overview assemblies of photon beamlines”, on page 10.)

- *EDMS*

View the overview assembly in EDMS (**D\*912163**). When the file is opened in VisView, the entire 3D model of XFEL is shown and each room can be viewed.