# From CAD Beamline Design to Tunnel Installation at XFEL

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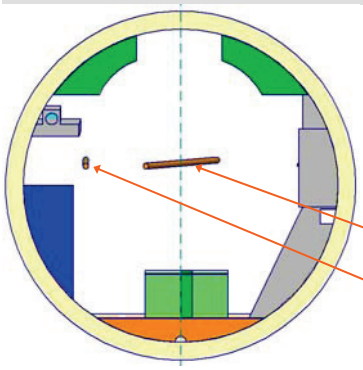
The European XFEL will generate up to 27000 ultra short X-ray pulses per second with a brilliance that is a billion times higher than that of the best conventional X-ray radiation sources. The outstanding characteristics of the facility are unique worldwide. Starting in 2017, it will open up completely new research opportunities for scientists and industrial users.

This poster explains the steps from CAD Design of the photon beam transport system to tunnel installation.

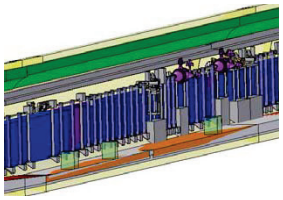



**3D model (SASE1) with infrastructure placeholder**

The initial step is a 3D model of the tunnel with rough placeholders of the infrastructure and a nearly empty tunnel in 2013.

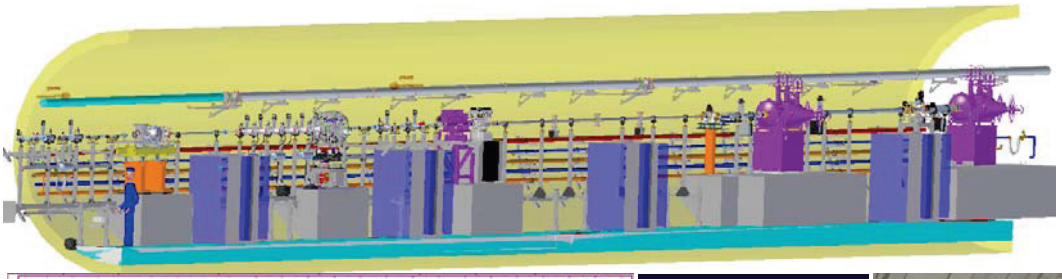
In a second step, a complete integration model is built up of the photon beam transport system with placeholders for all components and beamline sections.

**Placeholder model SASE1 from 2012**

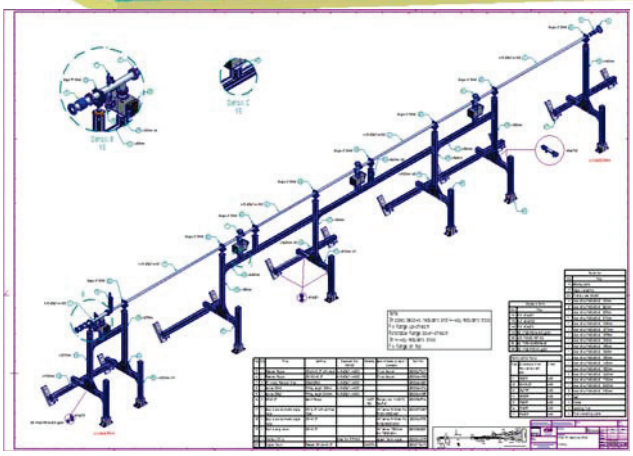


To know exactly the location of the single components a separate component list with all the coordinates is created.[3]
Since the European XFEL facility is overall more than 3 km long, two coordinate systems have been defined to follow the curvature of the earth: The linear accelerator (LA) system is designed for the XTL tunnel, while the photon distribution (PD) system describes a line in the plane of the undulator and photon system along the SASE1 beam.[4]

| CTI | CADRoom | FUNC_LABEL | Exp | WP | DEVICE | TYPE | E DIST | DIST | H | LA | LA | LA | PD | PD | PD |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| T9 | XTD2 | COLA1 2677 T9 | | 73 | Collimator 12x20mm (DN63/100) b | COLA1 | 243,36 | 38,50 | 0,98 | 0,0000 | -2,6878 | 2677,1371 | 0,0000 | 0,0000 | 682,6451 |
| T9 | XTD2 | | | 73 | beam pipe DN100 | START | 243,85 | 38,99 | 1,90 | 0,0000 | -2,6880 | 2677,6271 | 0,0000 | 0,0000 | 683,1351 |
| T9 | XTD2 | | | 73 | gate valve DN100 | STAN | 244,44 | 39,57 | 0,070 | | | | | | |
| T9 | XTD2 | | | MKK | cooling water 20° (M1) | | 244,47 | 39,60 | | | | | | | |
| T9 | XTD2 | | | 73 | ion pump 150l | STAN | 244,57 | 39,71 | | | | | | | |
| T9 | XTD2 | | | 73 | roughing valve DN40 WC | STAN | 245,27 | 40,41 | | | | | | | |
| T9 | XTD2 | | | 73 | bellow DN100 | STAN | 245,50 | 40,63 | 0,250 | | | | | | |
| T9 | XTD2 | | | 73 | reducer DN100/DN160 | STAN | 245,69 | 40,82 | 0,127 | | | | | | |
| T9 | XTD2 | | | 73 | beam pipe DN100 (DN160 flange) | END | 245,75 | 40,89 | | 0,0000 | -2,6887 | 2679,5271 | 0,0000 | 0,0000 | 685,0351 |
| T9 | XTD2 | MIRR 2680 T9 | | 73 | 1st offset mirror (M1) | MIRR | 246,50 | 41,64 | 1,80 | 0,0000 | -2,6890 | 2680,2771 | 0,0000 | 0,0000 | 685,7851 |
| T9 | XTD2 | | | 73 | beam pipe DN100 (DN160 flange) | START | 247,55 | 42,69 | 7,105 | 0,0000 | -2,6894 | 2681,3271 | 0,0000 | 0,0000 | 686,8351 |
| T9 | XTD2 | | | 73 | reducer DN160/DN100 (0,33°) | STAN | 247,61 | 42,75 | 0,127 | | | | | | |
| T9 | XTD2 | | | 73 | bellow DN100 (0,33°) | STAN | 247,80 | 42,94 | 0,250 | | | | | | |



Step by step placeholders are filled with the detailed design of the components.
Defined reference planes are used to place components into integration model according to the positions from the component list.
Very important is to check collisions during the early design phase.



Finally workshop drawings are created for building up the beamline sections and components in the tunnel. Important information like coordinates of the drill holes, parts lists (separated in standard vacuum parts and general parts) and pallet list can be found on a single drawing. [5]

**References**

[1] H. Sinn et al.: “Conceptual Design Report X-Ray Optics and Beam Transport” (2011), DOI: http://dx.doi.org//10.3204/XFEL.EU/TR-2011-002

[2] H. Sinn et al.: “Technical Design Report X-Ray Optics and Beam Transport” (2012), DOI: http://dx.doi.org//10.3204/XFEL.EU/TR-2012-006

[3] N. Kohlstrunk: “CAD Component List”, https://teamcenter.desy.de/TC90PRD/controller/download_file?file_name=change+request+component+list+04-2016.xlsx&file_handle_name=MTIObjectHandle-0002-1~R~AhCj5wkadam--mpprdusrsou~ExcelShtX~mpprdusr~~L

[4] H. Sinn: “Coordinate Systems for the Beam distribution systems”,(2012) XFEL.EU TN-2012-003-02

[5] H. Sinn: „X-Ray Component List “ https://docs.xfel.eu/alfresco/d/a/workspace/SpacesStore/76bd0e9c-fe53-4622-8768-628c8876178/X_ray_component_list.xlsx