EIFast Workshop
for the European X-FEL Project

Contribution 3
Power Distribution and Mains

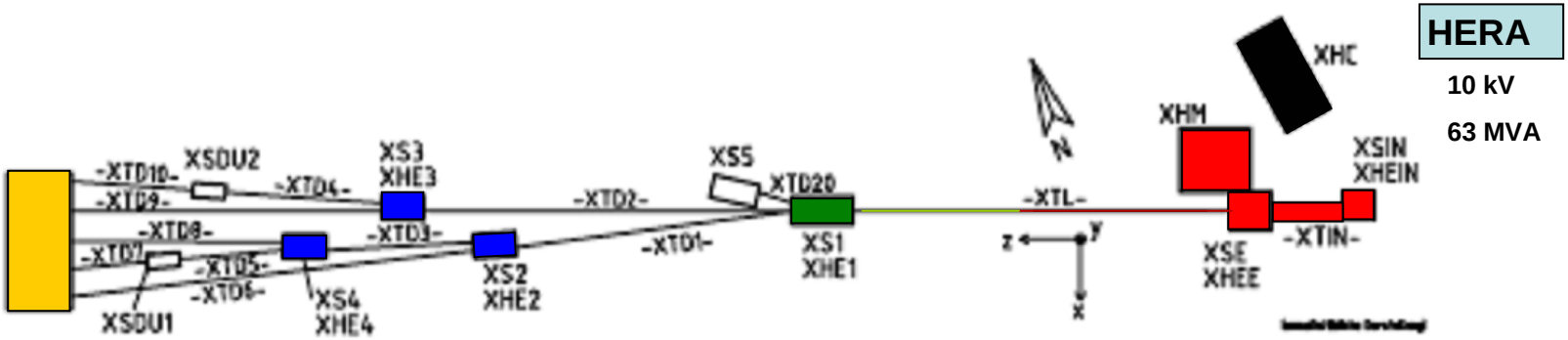
Electrical Power Requirement of XFEL

required power:

3,4 MW	2,2 MW	2,9 MW	10,5MW

upgrade:

3,4 MW	3,3 MW	5,2 MW	20,1 MW



Schenefeld Osdorfer Born DESY

maximal power

17 GeV: 19 MW

25 GeV: 32 MW

Grid Connection

The power of 20 MW requires a 110 kV grid connection

110 kV connection of HERA is availiable

transformer 2 x 31,5 MVA

10kV mains for distribution

a) on the DESY site

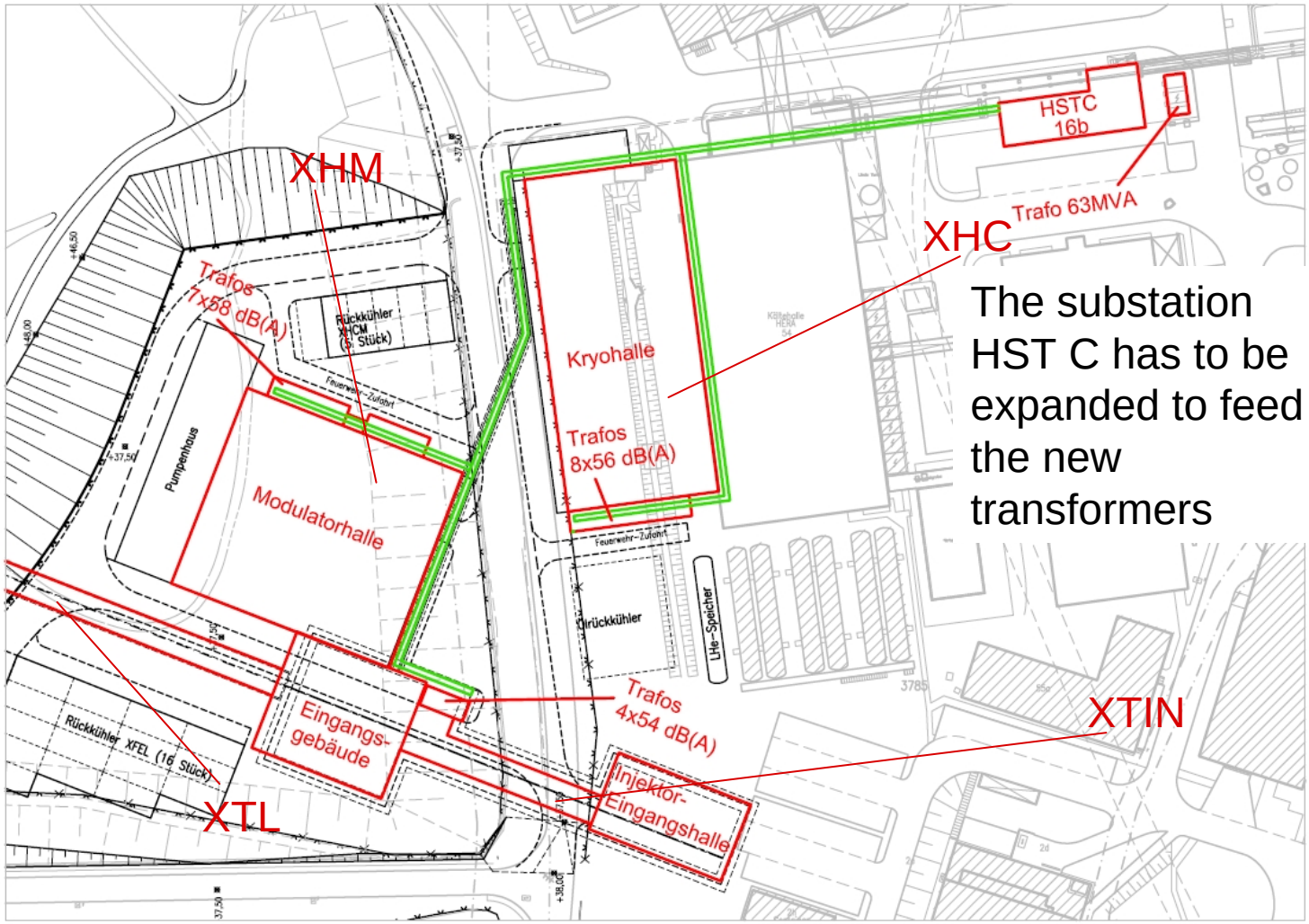
b) on the Osdorfer Born and Schenefeld

690 V/ 400 V/ 230V low voltage mains

The HERA Substation HST C

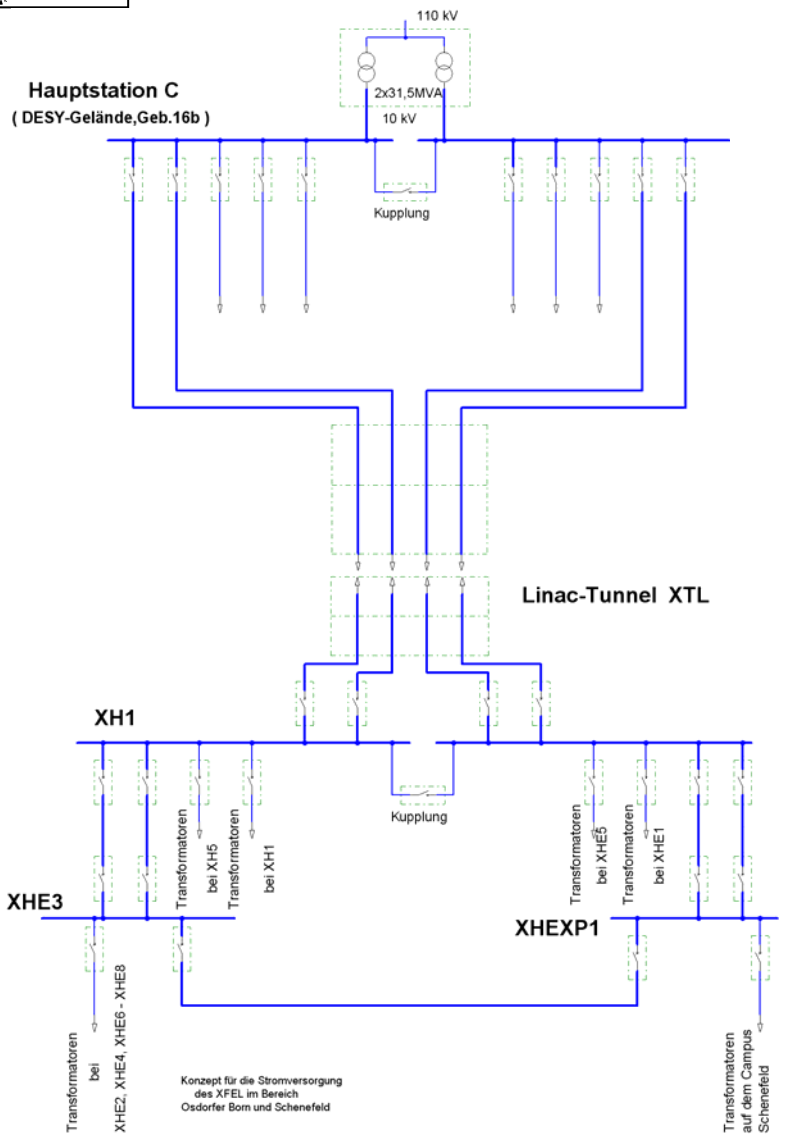
- HERA will shutdown June 2007
- 110/10 kV transformer and substation will supply XFEL facility
- The distribution on the DESY/ XFEL sites will be done at the 10 kV – medium voltage level

Power Distribution and Mains on DESY Site



The substation HST C has to be expanded to feed the new transformers

10 kV Cables through the Tunnel



4 systems cables
are installed in Linac Tunnel XTL

arrangement of wiring
operation as an open ring

Cable in tunnel XTL

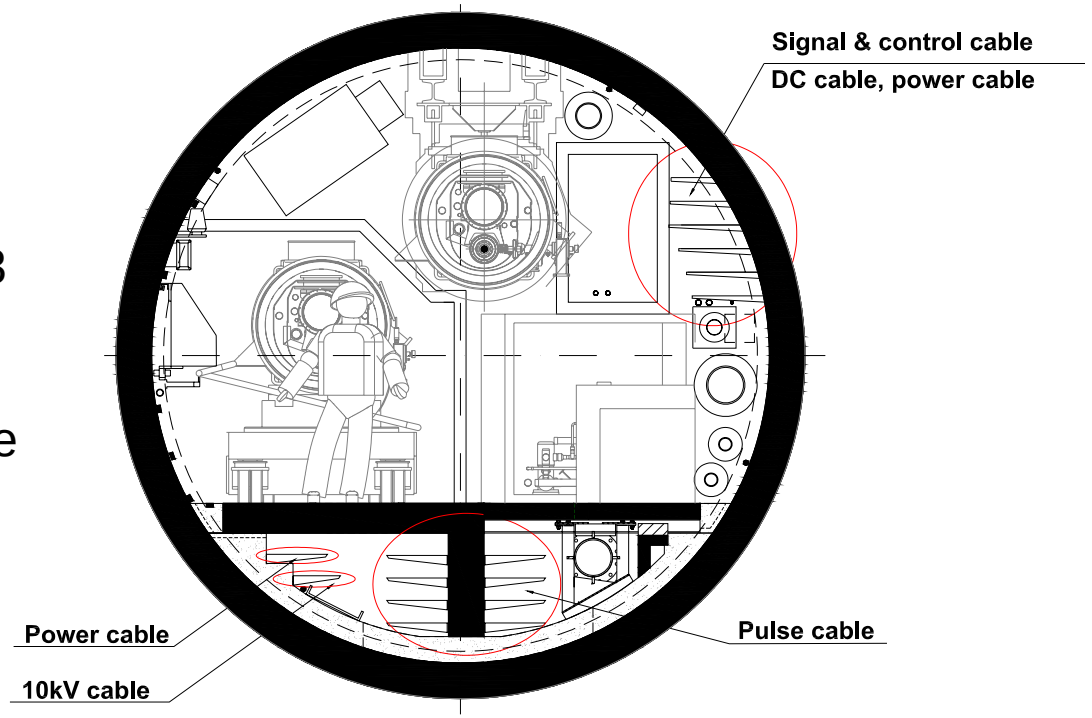
The 10 kV cables for the Osdorfer Born and Schenefeld sites use the linac tunnel XTL.

4 cables systems consisting each of 3 x 240 mm² Cu cables

FRNC cables will be installed on cable trays under the tunnel floor.

Each 10 kV cable system will be twisted in order to reduce magnetic fields.

Sensitive monitors and electronic equipment will not be disturbed.



The electrical supply for the Osdorfer Born and Schenefeld

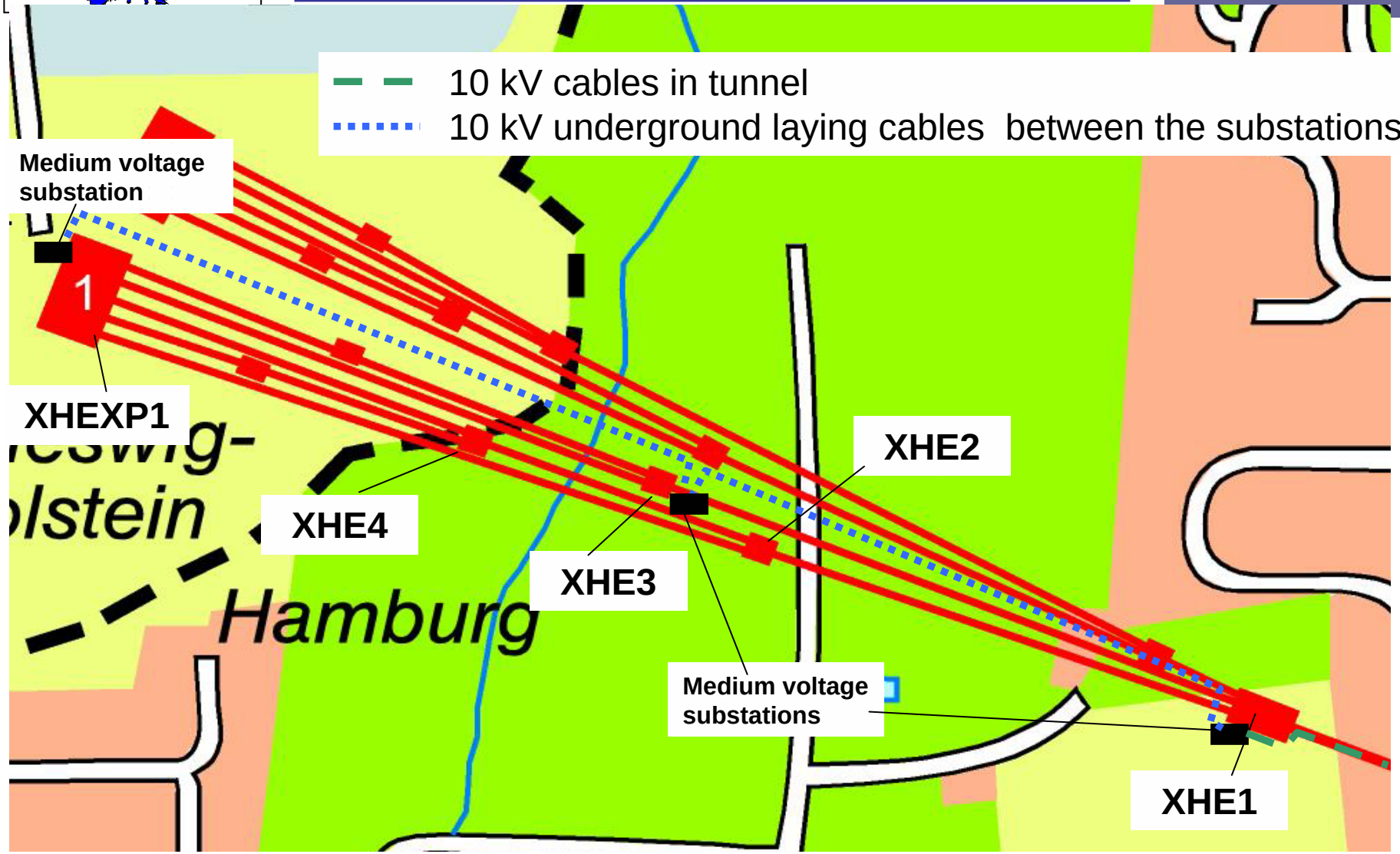
- Osdorfer Born site and Schenefeld site
  - 3 central 10 kV substations
  - near the halls XHE1, XHE3 and XHEXP1.

- The 10 kV substations will be installed above surface in order to have direct access in case of hazardous situation.

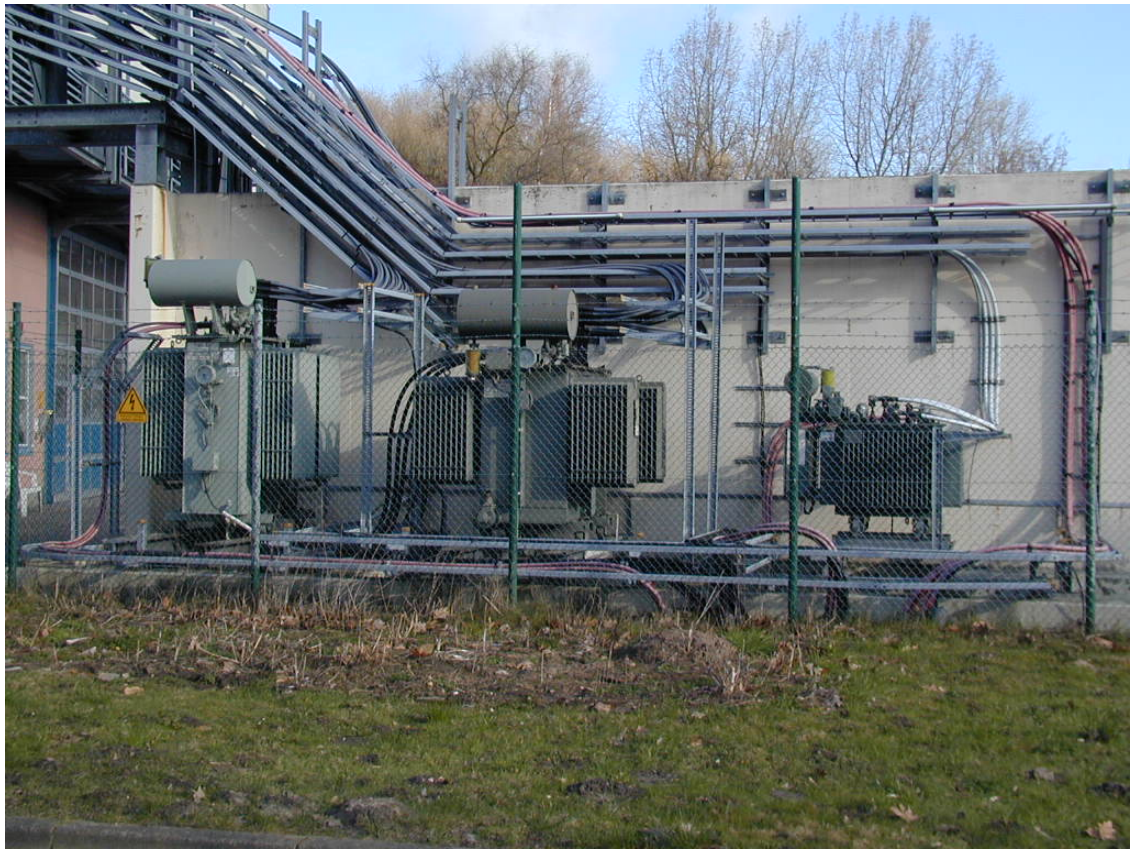
- A group of transformers is located adjacent to each service building.

- The power of the transformers should be approximate 0,6 MVA till 4 MVA.

The electrical supply for the Osdorfer Born and Schenefeld



Transformer



A similar group of transformers will be located adjacent to each service building on the XFEL halls.

Distribution of the low voltage mains

The levels of the low voltage loads are:

- 690V/ 400 V for the modulators and power supplies
- 400 V / 230 V for the electronic cupboards, water pumps, heating systems, ventilation, air conditioning, automation and lighting

The 10 kV transformers provide the applied voltages.

The low voltage energy will be distributed in switchboards.

These are located in the electric rooms or in the near of the water pumps, air conditioning or power supplies.

The amount of the low voltage switchboards is equal the amount of the transformers.

Low voltage switchgear

Similar 690 V or 400 V switchboards will be located in the XFEL halls.

Distribution Panels in the Tunnel

400 V/ 230 V are required for:

The loads in the tunnel are auxiliaries of the klystrons, electronic racks, magnet power supplies, diagnostics, magnet movers etc.

Sub-distributions panels and mobile distribution panels will be placed on
- the walls in the halls or
- on the floor in the tunnels

The distance between the mobile panels is 24 m

Cables in service rooms, shafts and tunnels

All power cables are flame retardant and non corrosive, so called FRNC cables
- 10 kV power cables and modulator pulse cables as well.

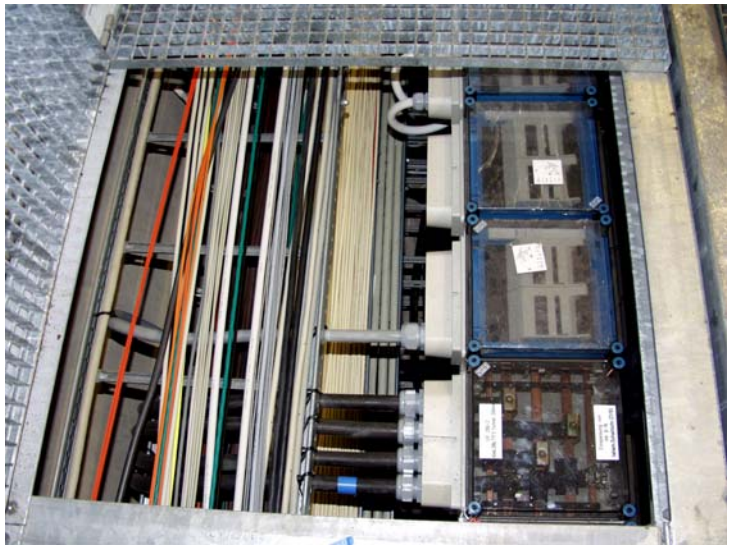
The AC cables run on trays from the tunnel floor through shafts between the tunnel and the service rooms.

The DC, control and signal cables are placed on separate cable trays and routes.

Vertical cable trays in a shaft

Cable trays

Similar cable trays will be located in the XFEL tunnels and halls

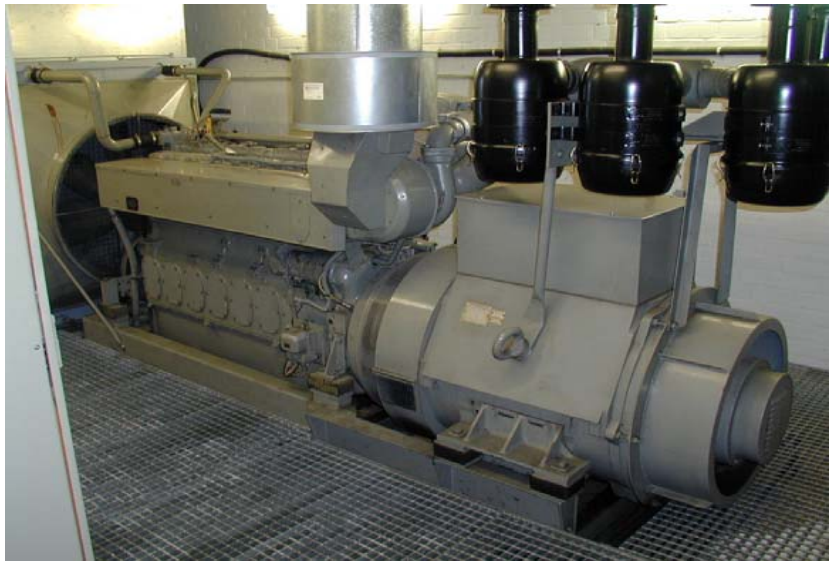


Emergency and auxiliary power

Emergency power diesel generator (approx. 500 kVA) are located near the 4 halls (modulator hall, XHE1,XHE3 and the exp. hall XHEXP1)

Uninterruptible power supply or DC batteries will be located in the 10 kV substations.

The emergency diesel-generators will power the illumination of escape routes, cranes, stairways, smoke extractors etc.



Tunnel Lighting

The tunnels will be lighted by fluorescent lamps under the tunnel ceiling above the walkway.

The tunnel illumination is basically a lane illumination.

For temporary workplaces portable lamps or spotlights have to be used.

Electrical Components

Delivery by industry:

- transformers
- switchgears
- switchboards
- power cables
- cable trays
- emergency diesel generators
- lightings
- MV , LV and signal cables

Quantity of Electrical Deliverance

number of 10 kV transformers: (0,6 MVA till 4 MVA)	approx.	35	
number of LV distribution panels: (690 V and 400 V)	approx.	35	
number of 10 kV switchgears:	approx.	60	
quantity of 10 kV power cables:	approx.	65 km	
quantity of modulator pulse cables:	approx.	150 km	FRNC
quantity of DC power cables:	approx.	350 km	FRNC
quantity of cable trays: (only in the XTL tunnel)	approx.	24 km	

Tasks and Deliverables

By DESY

- evaluation of the electrical power and mains
- evaluation of the location and required floor space
- specification of the components, switchboards, substations, panels, cables etc
- asking for tender
- award contracts and construction supervision

By industry

- delivery of all components, equipments and cables
- final design and calculations
- installation of all components
- commissioning and documentation
- service and preventive maintenance

Installation Schedule for Phase I

Start of installation cable trays	**Modulator hall XHM shaft XSE , Linac tunnel XTL**	**August 2009**
Start of cables laying pulse cables, 10 kV cables	**Modulator hall XHM shaft XSE , Linac tunnel XTL**	**January 2010**
Start of installation cable trays	**Injector XTIN**	**March 2010**
Start of cables laying DC- and low voltage cables, pulse cables	**Injector XTIN**	**July 2010**

Installation Schedule for Phase I

Start of installation cable trays	**shaft XS1, tunnels XTD1, XTD2**	**July 2010**
Start of laying cables DC- and low voltage cables	**shaft XS1, tunnels XTD1, XTD2**	**Nov 2010**
Start of installation cable trays	**shaft XS3, tunnel XTD4, XTD9,**	**April 2011**
laying cables (DC and AC cables)		**August 2011**

Installation Schedule for Phase I

Start of installation	**shaft XS4, tunnels XTD5, XTD8,**	
cable trays		**November 2010**
DC and AC cables		**January 2011**
Start of installation	**XHEXP1, tunnels XTD7, XTD10,**	
cable trays		**July 2011**
DC and AC cables		**January 2012**

Parallel to the installation of cable the another electrical equipment will be assembled

- **transformers, switchgears, switchboards, illuminations , diesel generators**

Milestones will be provided by the surface-building - group