

Safety Requirements for IR

*Conventional Facilities and Siting Group
Atsushi Enomoto (KEK)*


*IRENG07
17-21 September 2007, SLAC*

Contents

- **General Aspects of Safety Issues in ILC**
 - *About regulation*
 - *Safety category and respective requirements*
 - *Basic ideas of evacuation in case of fire*
- **Safety Issues Related to IR Area**
 - *Case1: Fire at detector hall A.*
 - *Case2: Fire at detector hall B.*
 - *Case3: Fire at utility (service) hall.*
 - *Case4: Fire at beam tunnel near detector hall.*

General Aspects of Safety Issues in ILC

Regulation

- ***Because there are no existing laws and standards in any region which directly and comprehensively stipulate the safety measures for a facility like ILC,***
 ***the currently planned safety measures are based on examples of existing accelerator tunnels and the regulations for buildings and underground structures of various types.***
- ***The final plan will be subject to the approval of the competent authority that has jurisdiction over the selected site.***

Safety category and respective requirements

- **Fire Safety**
 - *Fire safety measures are the main subject to be considered by CFS group.*
- **Radiation Safety and Safety Access Control**
 - *Wall thickness for shielding radiation from Beam Tunnel is determined according to studies by radiation control experts.*
 - *Access control equipment such as a card lock is installed at the entrances to the radiation control areas as required by the radiation safety plan.*
- **Helium**
 - *The helium supply system is equipped with an oxygen meter which activates an alarm and stops the gas supply in case of oxygen deficiency. Air in the Beam Tunnel is automatically pressurized.*
- **Other Safety Control**

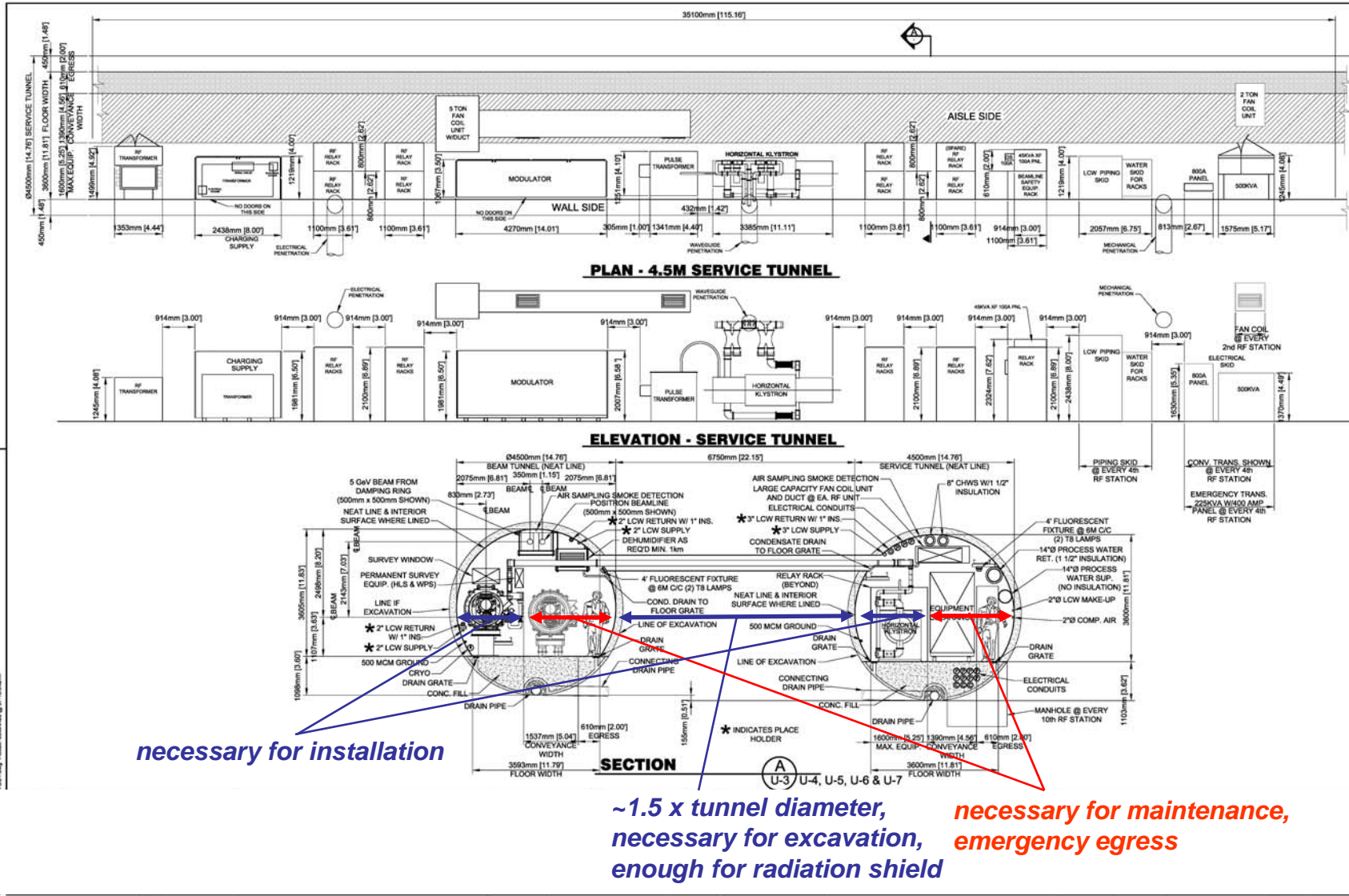
Fire Safety Requirements

- **Structures of tunnels and caverns**
 - *Primary concern. Enough space and smooth path for evacuation*
- **Safety Equipments**
 - *Smoke detector, fire alarm, fire extinguisher, etc.*
- **Smoke Exhaust or Control**
 - *To have enough time to escape*
- **Materials**
 - *Incombustible cable, etc., to prevent spread of fire.*

- *Existing guideline and regulations of LHC will be a good example, if ILC finally takes deep tunnel scheme.*
- *Anyway the final plan will be subject to the approval of the competent authority that has jurisdiction over the selected site.*

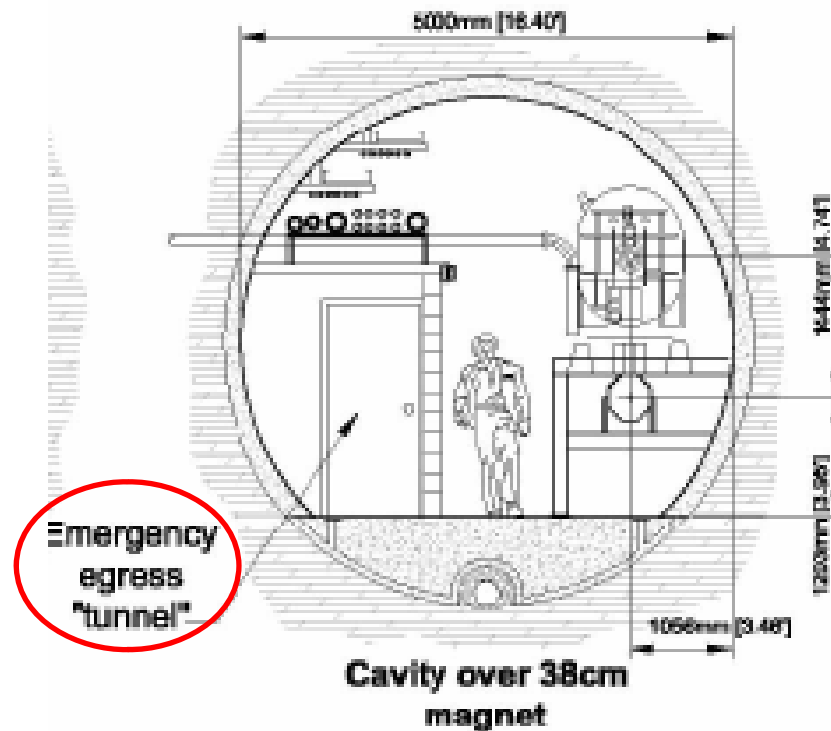


Evacuation Space in Accelerator Tunnels



Evacuation Space

- Evacuation form Damping Ring Tunnel

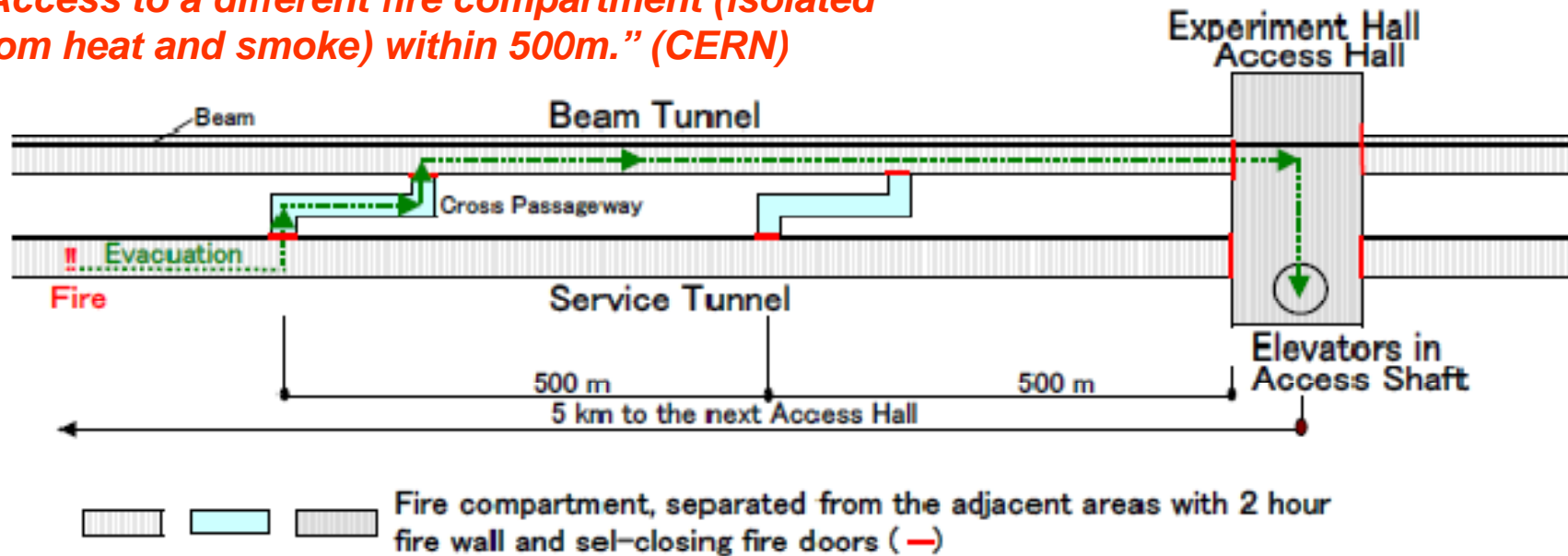


Evacuation Path

Evacuation from Service Tunnel

1. Potential fire origin is power cables in the Service Tunnel
2. People in the Service Tunnel evacuate to the Beam Tunnel through Cross passageway
3. Cross Passageways are provided at an interval of 500 m
4. At walking speed of 1 m/sec., he may reach to cross passageway from the furthest point in the Service Tunnel in about 8 min., torelable evacuation time

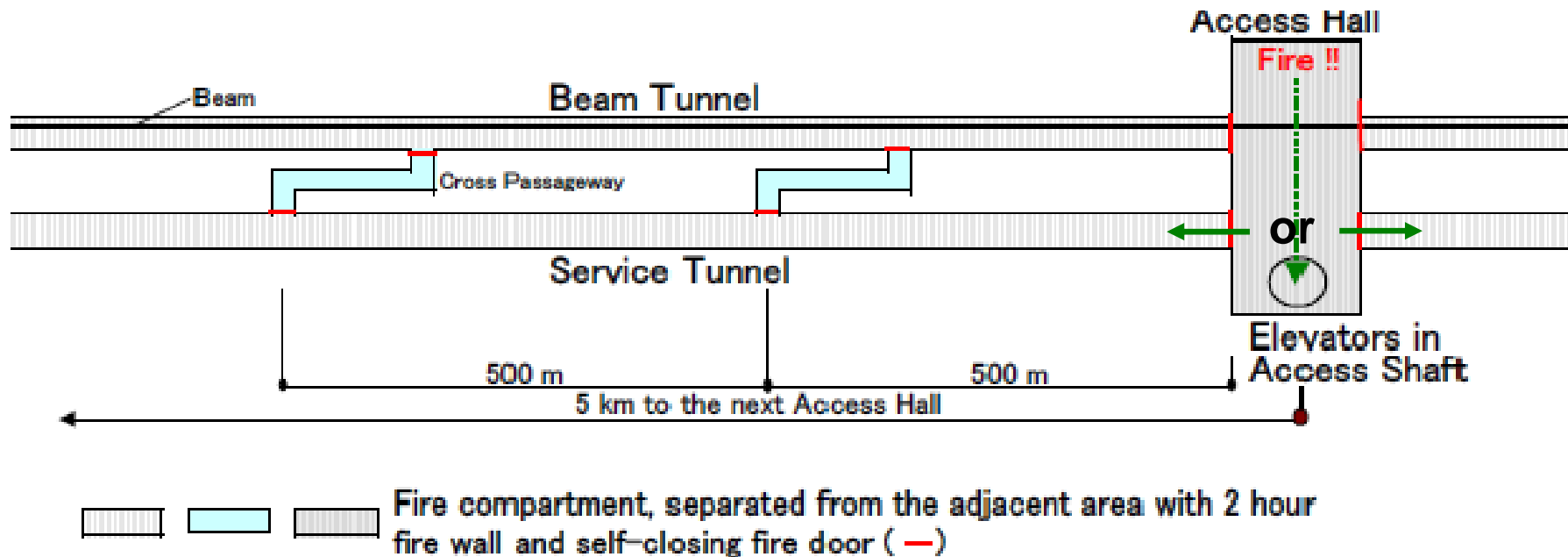
“Access to a different fire compartment (isolated from heat and smoke) within 500m.” (CERN)



Evacuation Path

Evacuation from Access Hall/Experiment Hall

- Access from any place in the Hall to the elevator must be secured

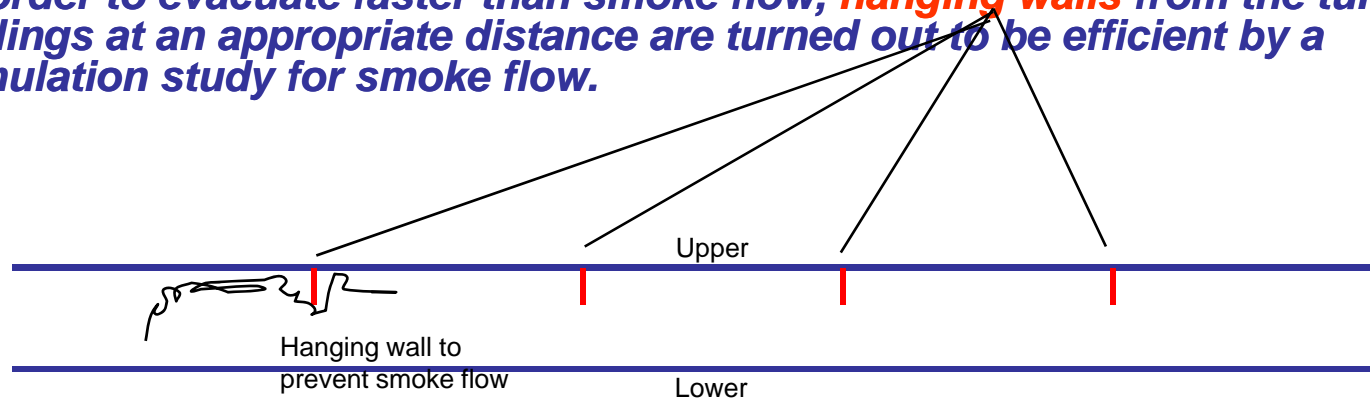


Safety Equipments

- **Fire detection & alarm**
 - - **Smoke detector @ 30m in Service Tunnel**
 - - **Manual alarm @ 50m in Service Tunnel**
- **Fire suppression equipment**
 - - **Portable fire extinguisher @ 25m in Service Tunnel**
- **Evacuation equipment**
 - - **Evacuation to the Beam Tunnel through cross passageway**
 - - **Smoke control: smoke exhaust system, pressurizing system**
 - - **Emergency lighting @ 10m**
 - - **Illuminated exit signs & exit leading signs**
- **Communication equipment**
 - - **Public addressing system**
 - - **Security cameras**
- **Emergency power supply**

Smoke Exhaust System

- In case of fire accidents at **Access/Experiment Halls** located every ~5 km.
 - Smoke is exhausted **with large-diameter (~1.5 m) air ducts** from the surface.
- In case of fire at **Accelerator tunnels**.
 - Smoke is also exhausted but without using air ducts.
 - Because of long distance from the surface, air ducts are not able to obtain sufficient speed for exhaust.
 - The **tunnels themselves are using as air ducts**.
 - In this case smoke has to be **carefully evacuated by noticing human existence**.
 - In order to evacuate faster than smoke flow, **hanging walls** from the tunnel ceilings at an appropriate distance are turned out to be efficient by a simulation study for smoke flow.

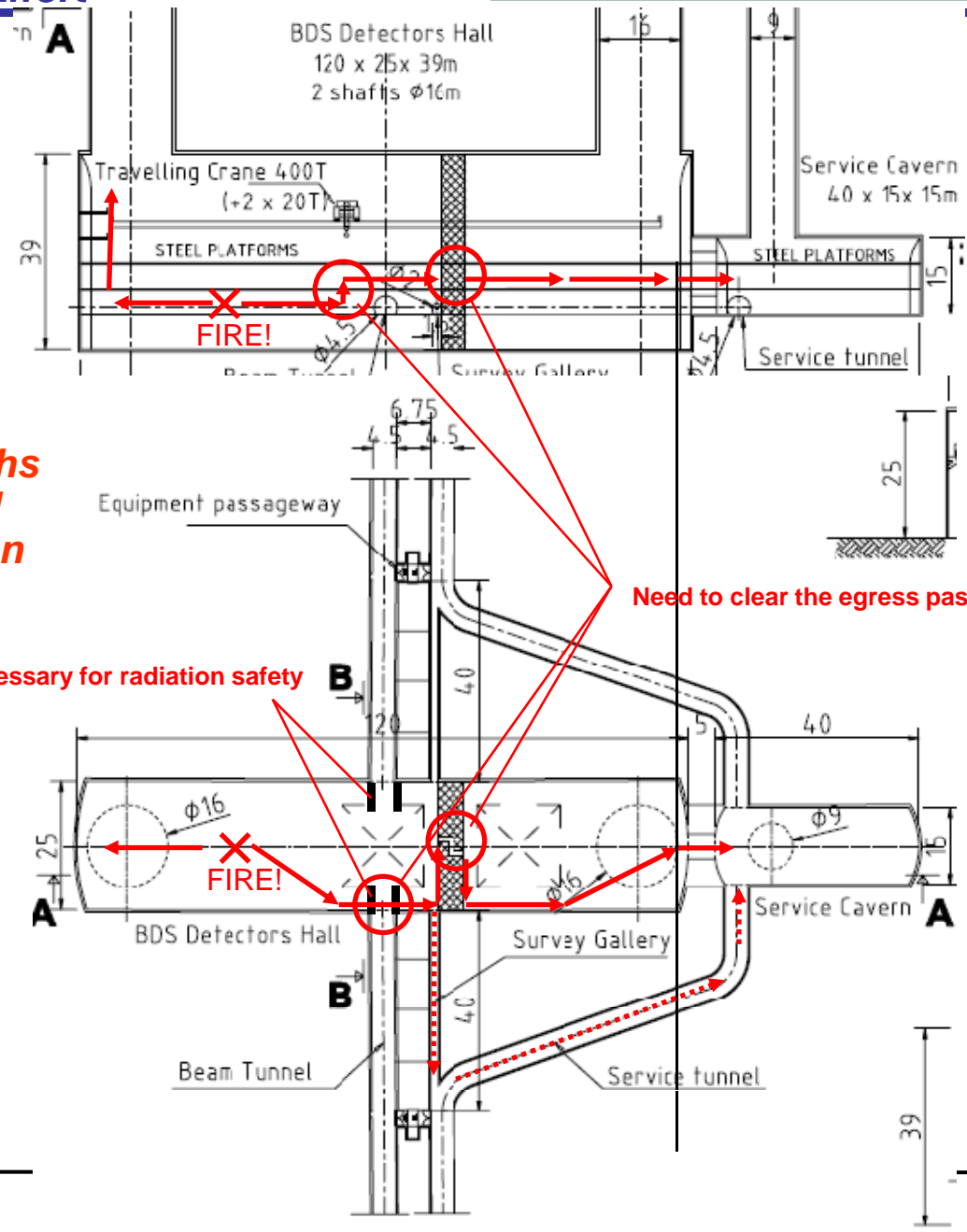


Safety Issues Related to IR Area

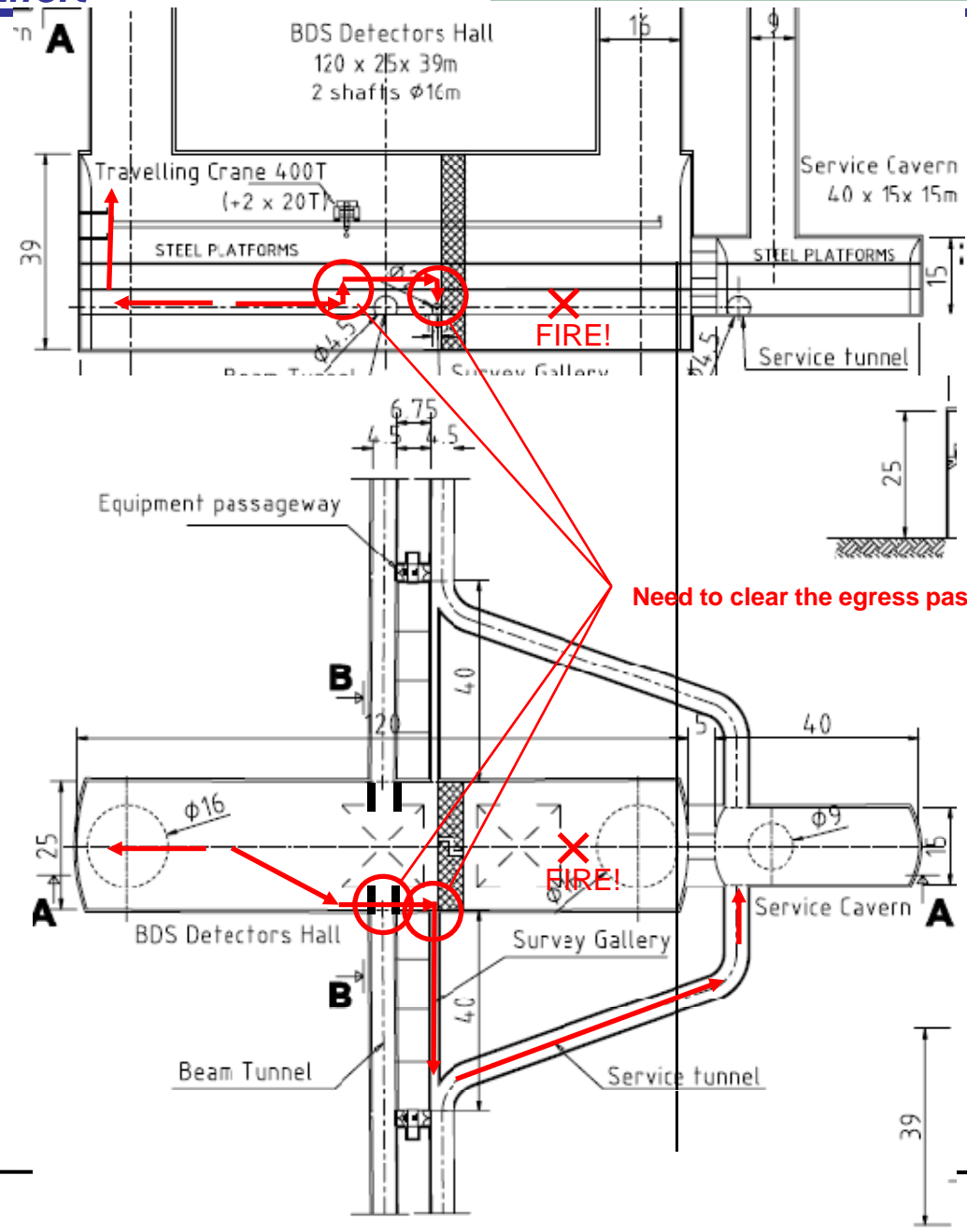
In Case of Fire at Left side

“At east two independent exit paths from all points: blind corridors shorter than 10m” (CERN)

Concrete Shielding may be necessary for radiation safety

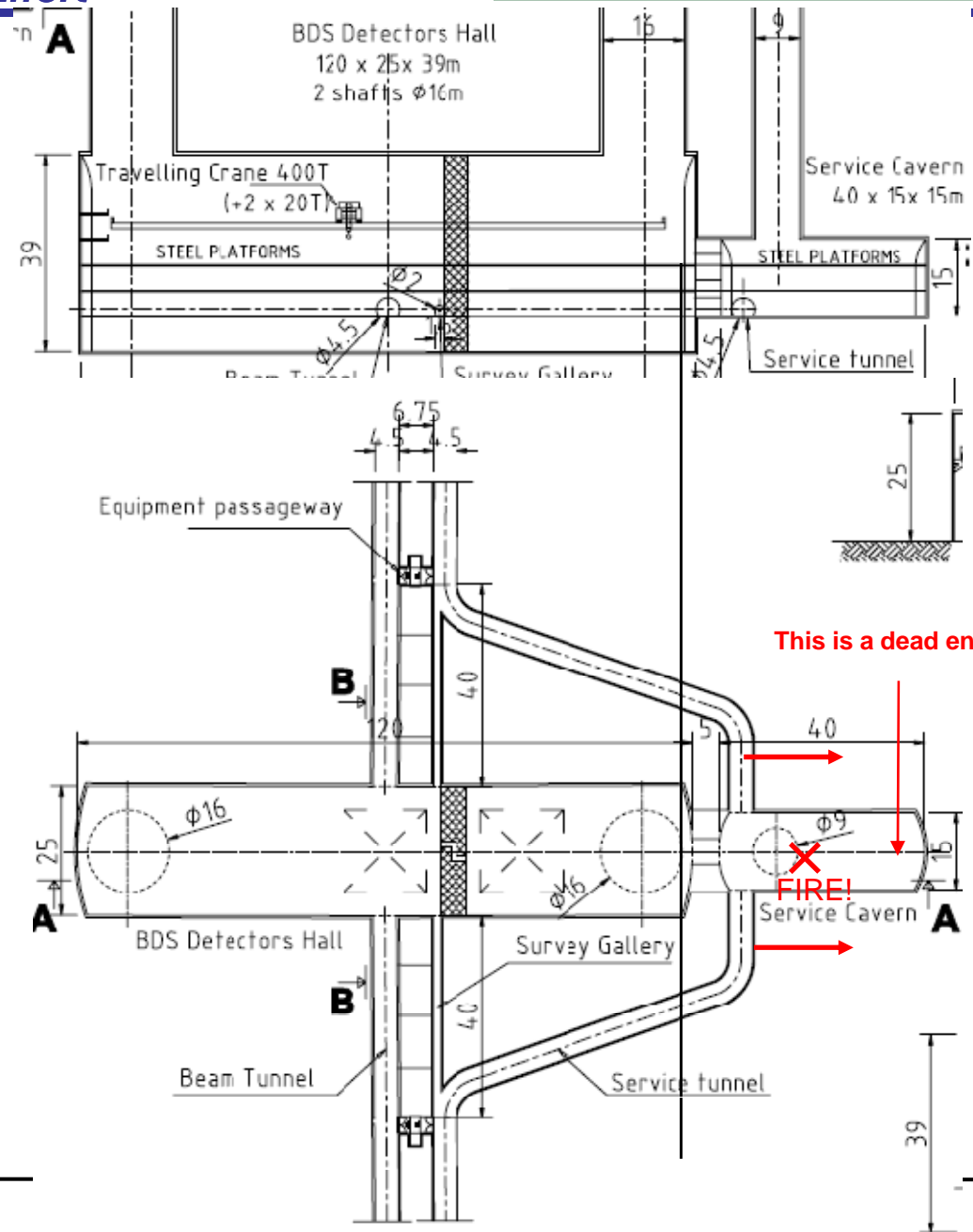


**In Case of Fire
at Right Side**

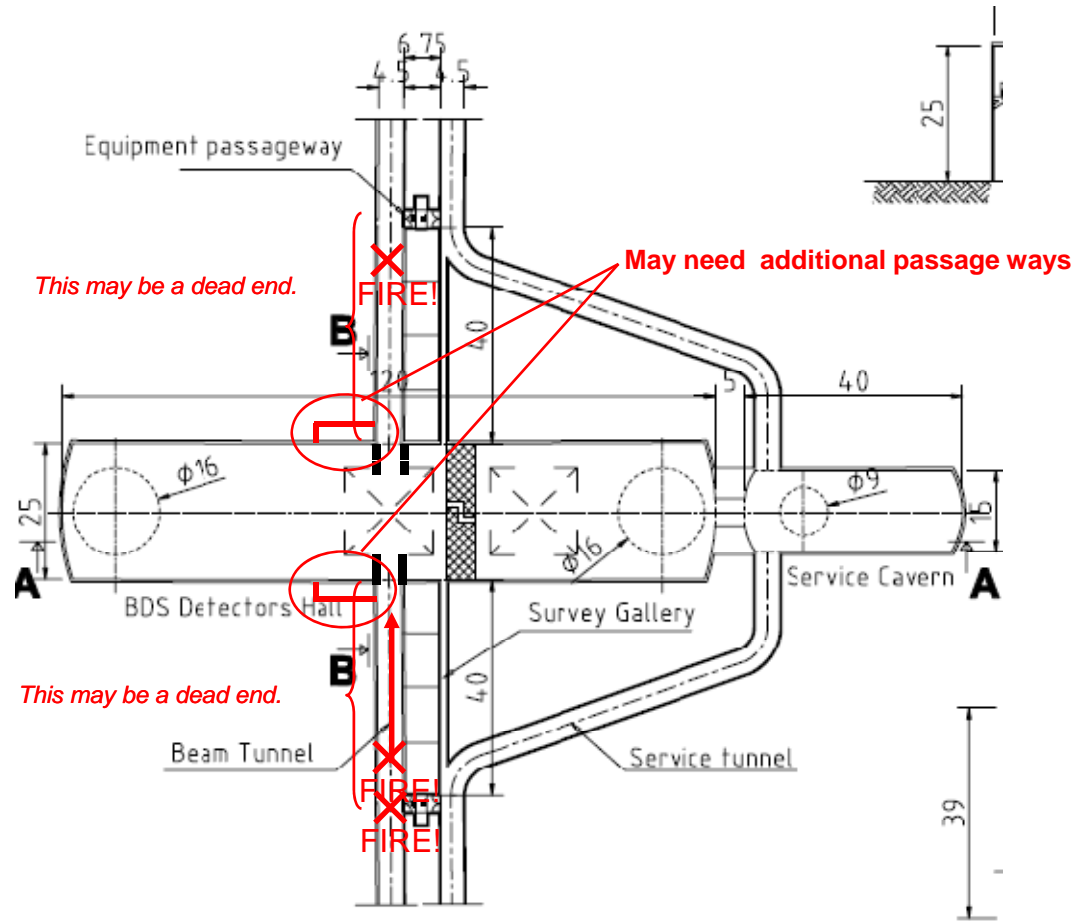


Need to clear the egress pass from the detector hall

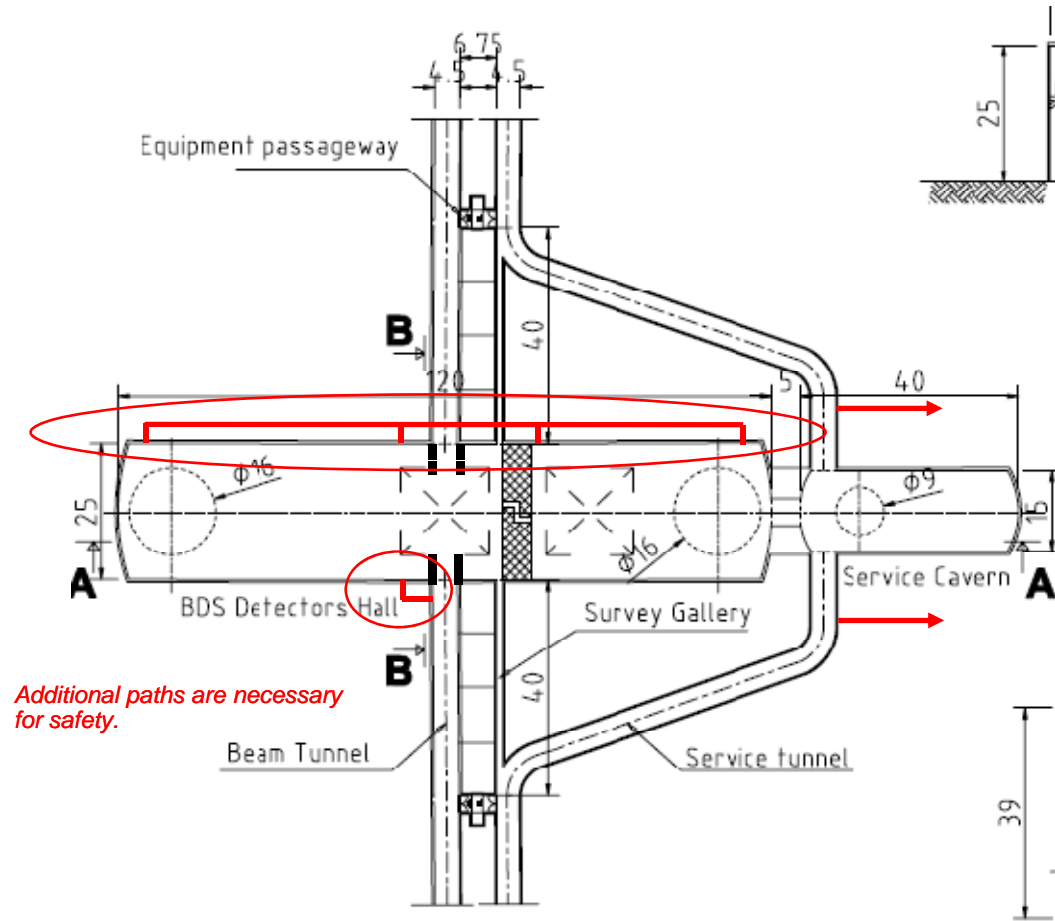
In Case of Fire at Utility Hall



In Case of Fire/Trouble at Beam Tunnel near Detector Hall



One Solution



Additional paths are necessary for safety.

Conclusion

- ***CF structures for evacuation space and path will be designed based on considerations of fire safety and earthquake.***
- ***Smoke control will be taken into account in air ventilation system.***
- ***General safety equipment, for example, that for fire safety, is included in CFS work.***
- ***As for other safety requirements like radiation shield, and door control, will be taken according to each corresponding group.***