LEP note 123
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THE CAPACITY OF AN ACCESS TUNNEL TO THE EXPERIMENTAL AREAS

L. Leistam

In LEP version 8 the machine will be situated such as to force one or more experimental areas to be far under the ground in the Jura mountains.

It is most likely that, in this case, access via vertical shafts down to the experimental areas would be excluded for technical and economical reasons for these intersections.

It is therefore interesting to study whether a horizontal or tilted tunnel,having the same cross section as the main tunnel(i.e. net internal diameter of 4 m), could serve for access to the experimental area. The length of the tunnel would be up to 3 km.

1. THE TUNNEL

The tunnel would have an internal diameter of 4 m, a maximum height of 3 m, with 1 m being used for the floor. The tunnel has been assumed to be straight and terminate naturally in the experimental hall. A loading area hall would be erected around the entrance. See fig. 1. Compared to the ISR entrances which measure 4.5 x 4.8 m, this access tunnel is indeed smaller. Expressed as a ratio between the cross-section it is smaller by 2.1:1. It is probable that for safety and service reasons a special gang way would have to run along the entire length of the tunnel. See fig. 2. This reduces the useful cross-section of the tunnel by about 15% but since a special transport can easily be arranged, using the full cross-section, it does not impose a serious limitation.

2. THE TRANSPORTER

In order to transport goods through the tunnel some form of movable platform mounted on rails, or transporter would be necessary. The load-rating of the transporter should match the capacity of the cranes in the experimental area, i.e 60 t total load and ~ 10 t/m^2. The width of the loading surface is restricted by the tunnel to 3.7 m if one assumes that the transporter itself can be made no higher than 35 cm. This implies that the rails would have to be insert into the floor. See fig. 2.
The effective length of the transporter can be made variable, i.e the basic transporter would be 6 m long but the loading surface could easily be extended. The end station has a door arrangement that would allow very long pieces to be transported.

3. TRANSPORTING CAPACITY

Since the length of equipment which can pass through the tunnel is essentially unrestricted the restrictions come from the tunnel cross-section. It is therefore important that the space above the transporter is kept completely free. In fig. 2, it is suggested that cables, tubes, power for the transporter, etc., are placed in a trench in the concrete floor underneath the transporter. The maximum height would then be 2.6 m (assuming a .8 m wide object) and the maximum width 3.9 m (for .8m high object).

It is probably realistic to assume that the speed of the transporter would be low ~ 5 km/h, which would make the complete return journey very long 1-1½ h.

Since equipment can be transported and stored outside the experimental intersection area this should not slow down the installation of an experiment but it must clearly be regarded as a drawback.

Examples of what can be transported through the tunnel

The tunnel cross-section seems at first to be very restrictive and fatal for heavy and cumbersome equipment. However, this is not necessarily the case as can be seen from the following table :

Object	Cross-section m x m	length m	weight ton	figure no
- Largest part of R 807 magnet	3.0 x 1.4	3.7	57.5	3a
- SFM-coil	3.2 x .4	4.7	-	3b
- Concrete blocks	10 x .8 x .8	.8	10 x 1.3	
- Largest part of tipping device	2.1 x 2.0	2.0	20	4a
- TASSO drift-chamber	Ø 2.6	4.0	-	4b

In addition to the above items I have performed an imaginary installation of experiment R 209, see fig. 5, via the tunnel and I have not found any incompatibilities.

This exercise is interesting since both at PETRA and the $p\bar{p}$ facility similar size and weight μ-experiments are installed or proposed (size ~ 6m x 6 m x 8 m, weight ~ 500 t).

The largest parts of experiment R 209 are :

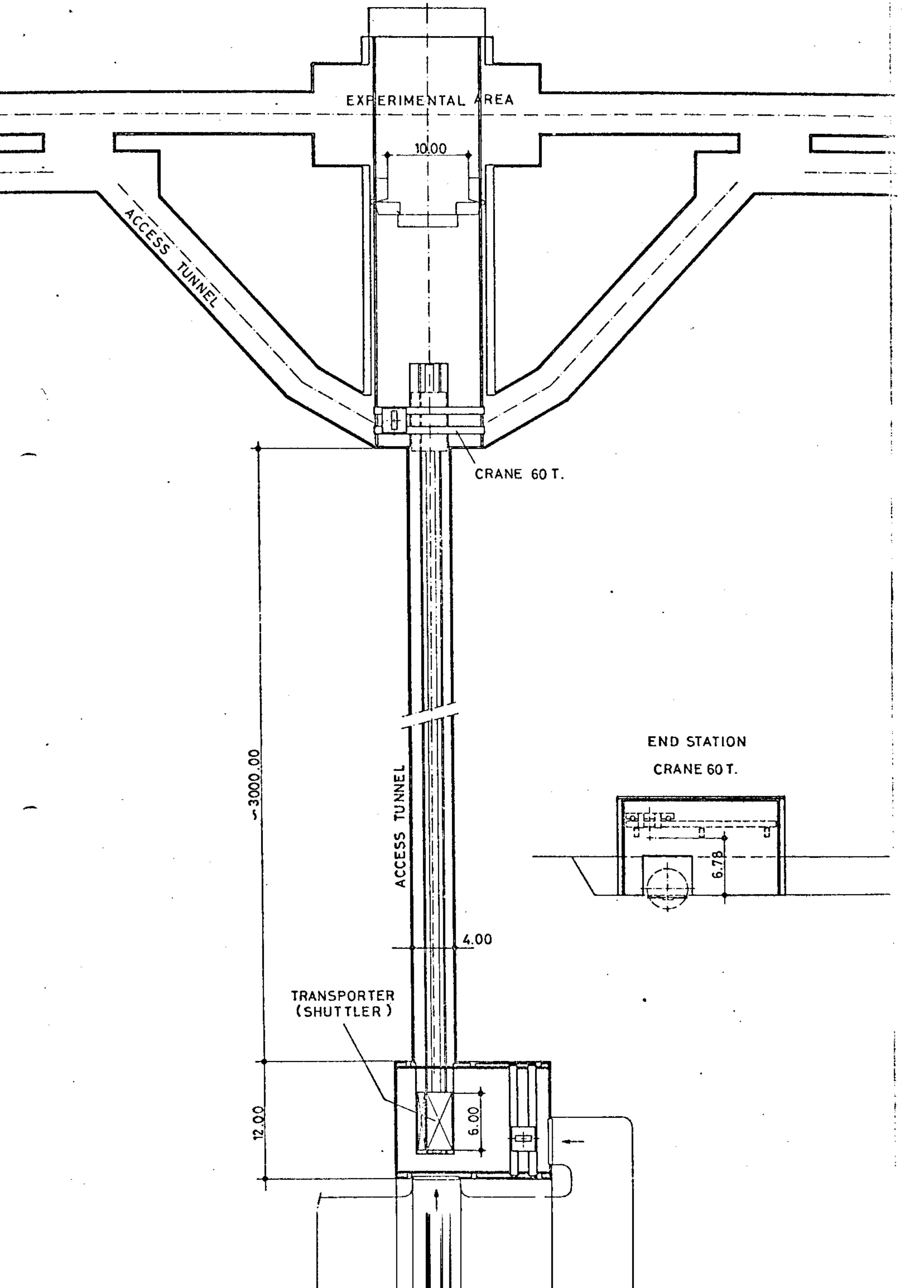
Object	Cross-section m x m	length m	weight ton	figure no
- Yoke 3	2.1 x 75	4.2	32	6a
- Driftchamber	2.5 x .3	6.0	.4	5
- Yoke 1	1.5 x .4	4.4	20	5

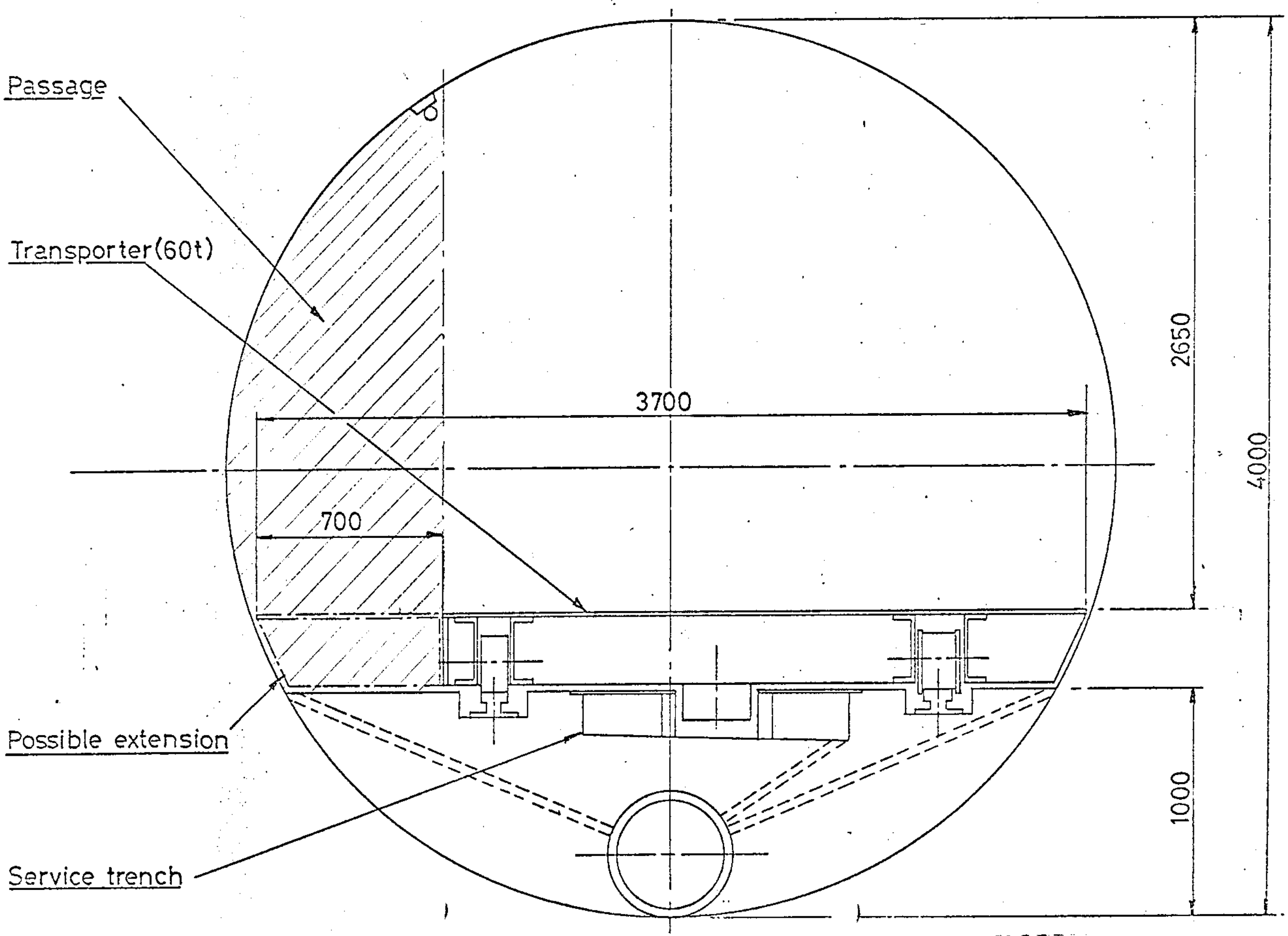
It is however not always the size of the entrance to the experimental areas that limits what can be transported, but also the crane coverage in the experimental area and transfer zones.

One example of equipment, that cannot be passed down the vertical access shaft as proposed by the "blue book" but does fit into the tunnel cross-section, is the high pressure Cerenkov counter of R 807 (dimension 2 m x 3.5 m x 8 m). See fig. 6b.

4. CONCLUSION

It is quite clear that a 3 km long tunnel for access to the experimental areas would be restrictive and in many ways inconvenient. However, in comparison with a vertical access shaft it could have the same or even slightly improved capacity. It would be much easier to arrange a good crane coverage in the transfer zones than to arrange systems for moving equipment in and out of a goods lift.


EXPERIMENTAL AREA
10.00
ACCESS TUNNEL
CRANE 60 T.
~3000.00
ACCESS TUNNEL
END STATION
CRANE 60 T.
6.78
4.00
TRANSPORTER
(SHUTTLER)
12.00
6.00



Passage
Transporter(60t)
3700
700
Possible extension
Service trench
2650
4000
1000

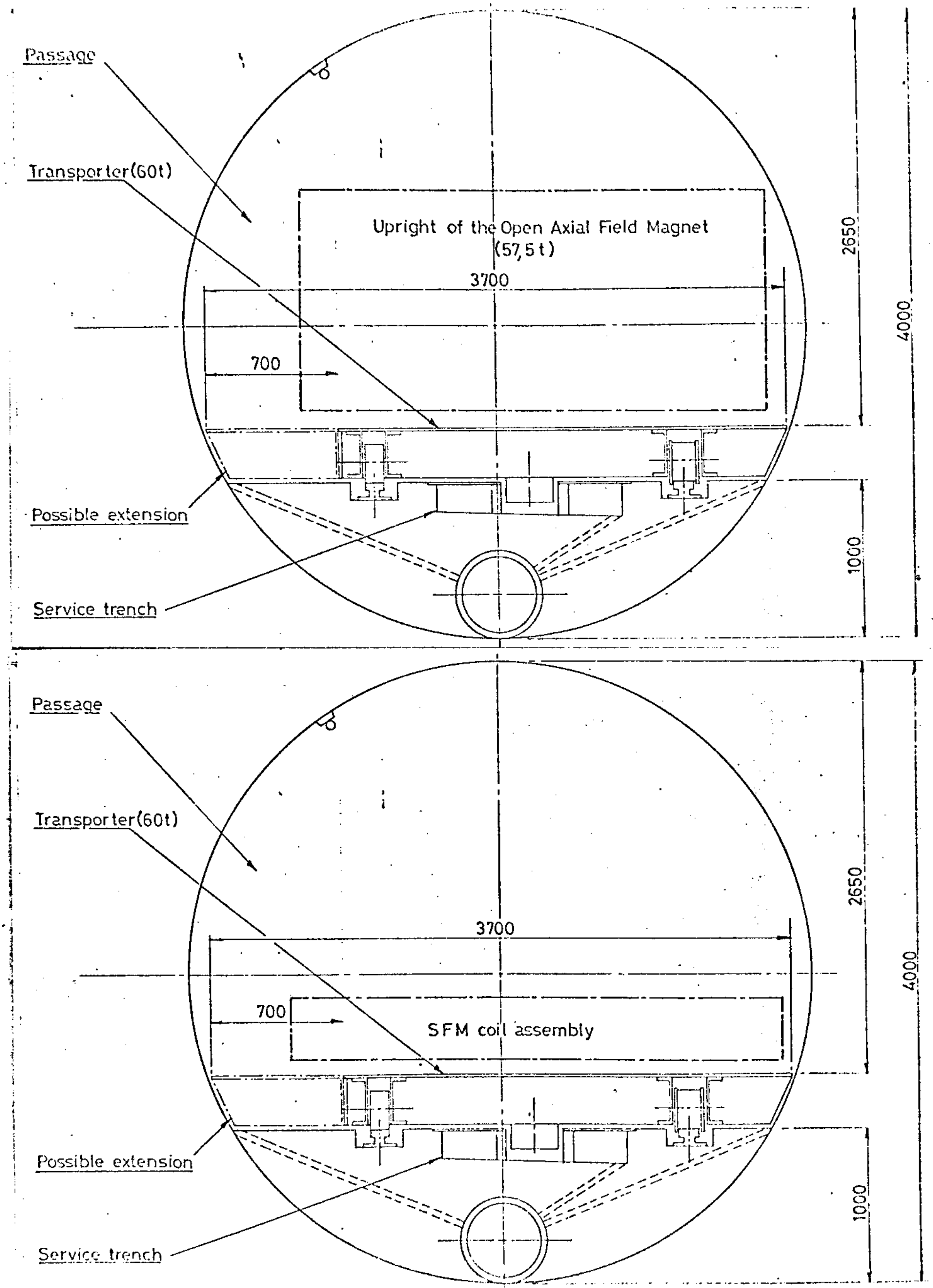

Passage
Transporter(60t)
Upright of the Open Axial Field Magnet
(57,5 t)
3700
700
2650
4000
1000
Possible extension
Service trench
Passage
Transporter(60t)
3700
700
SFM coil assembly
2650
4000
1000
Possible extension
Service trench

FIG. 3 a, b

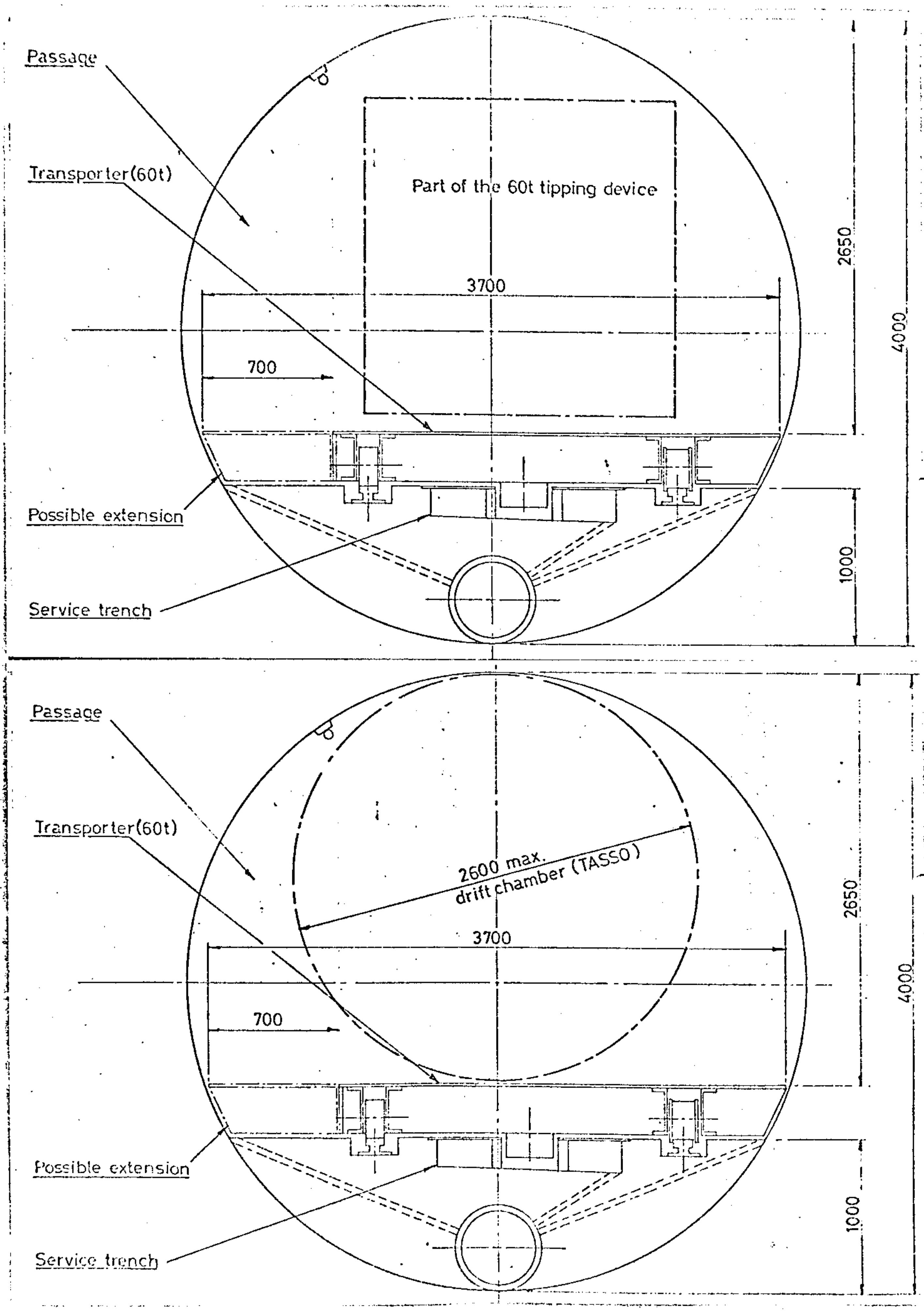

Passage
Transporter(60t)
Part of the 60t tipping device
3700
700
2650
4000
1000
Possible extension
Service trench
Passage
Transporter(60t)
2600 max.
drift chamber (TASSO)
3700
700
2650
4000
1000
Possible extension
Service trench

FIG. 4 a, b

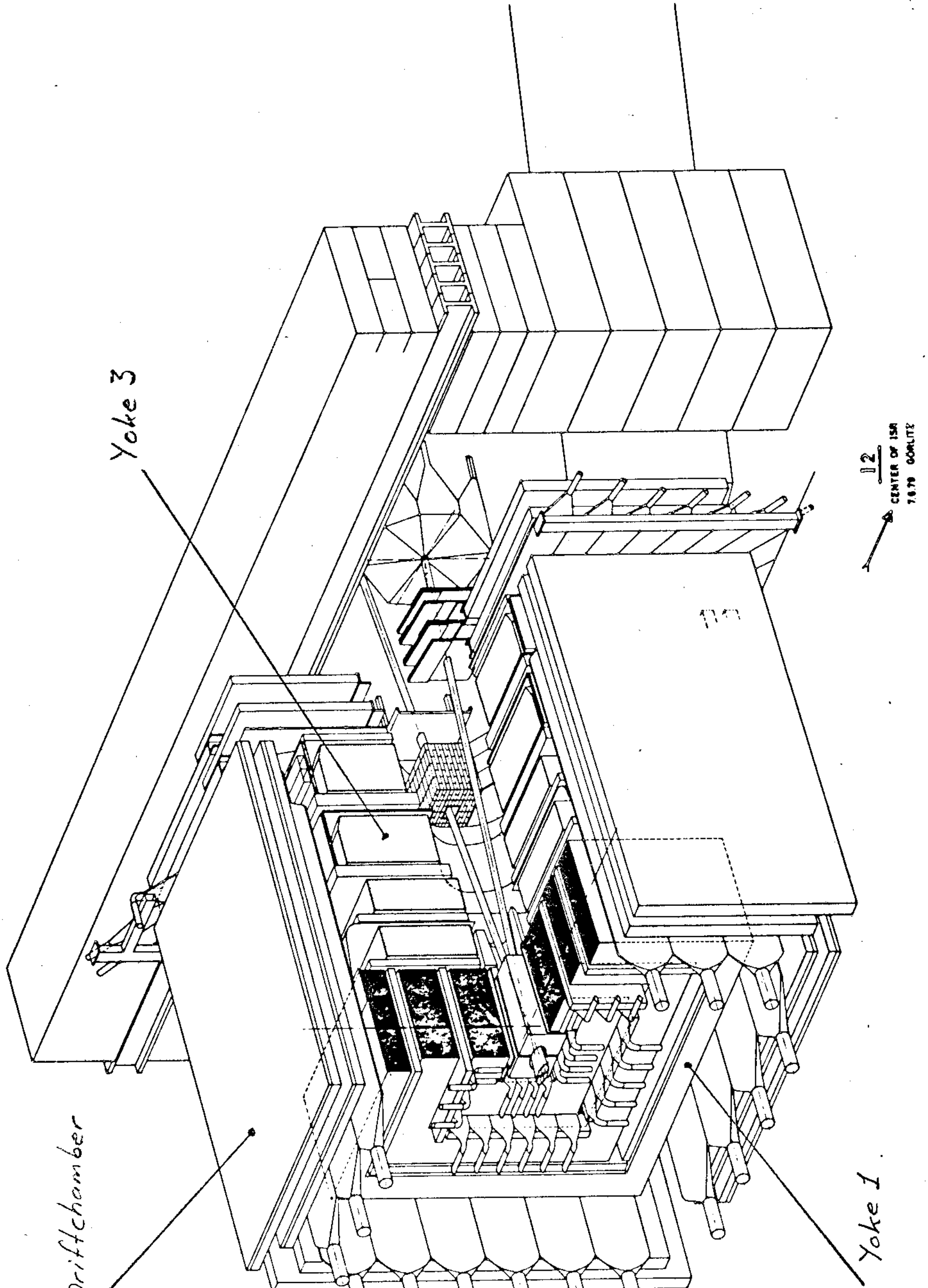


FIG. 5

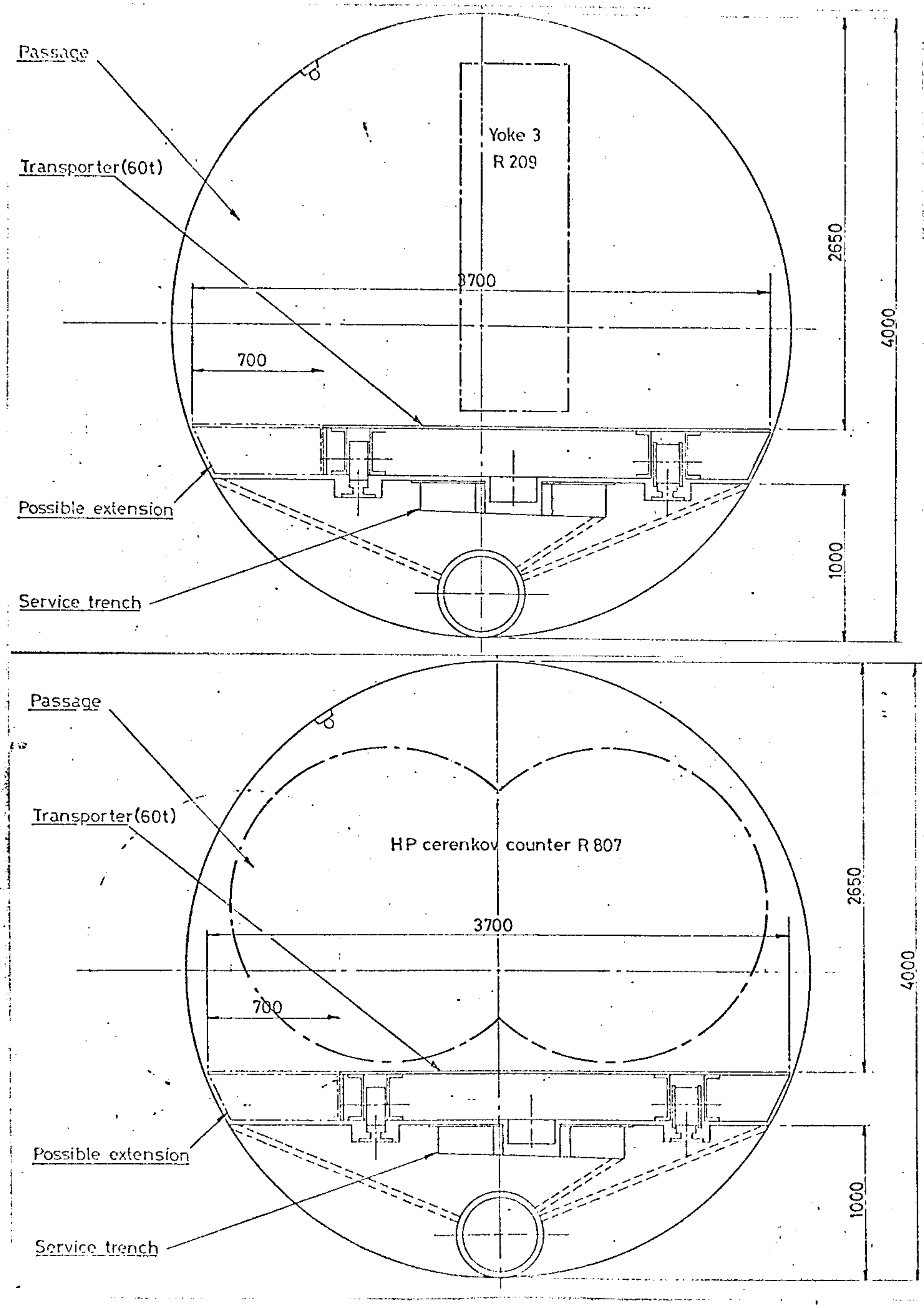

Passage
Yoke 3
R 209
Transporter(60t)
3700
700
2650
4000
Possible extension
1000
Service trench
Passage
Transporter(60t)
HP cerenkov counter R 807
3700
700
2650
4000
Possible extension
1000
Service trench

FIG. 6 a, b