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Technical Description

DOORS AND KEYS IN THE CNGS FACILITY

Abstract

This Technical Description gives an overview of all the doors in the CNGS facility and describes their location and their functions. A number of "special" doors and keys exist and are described in detail. Examples for the procedures to be followed for access to various CNGS underground areas are given – those procedures are described in detail in other documents. A summary of all the keys used in the CNGS facility is provided.

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1. SCOPE

This document presents all the doors in the CNGS facility. The function of each door and, where applicable, the particularity of its key is also described.

2. THE CNGS FACILITY

2.1 OVERVIEW

An overview of the CNGS underground structures is shown in Figure 1.

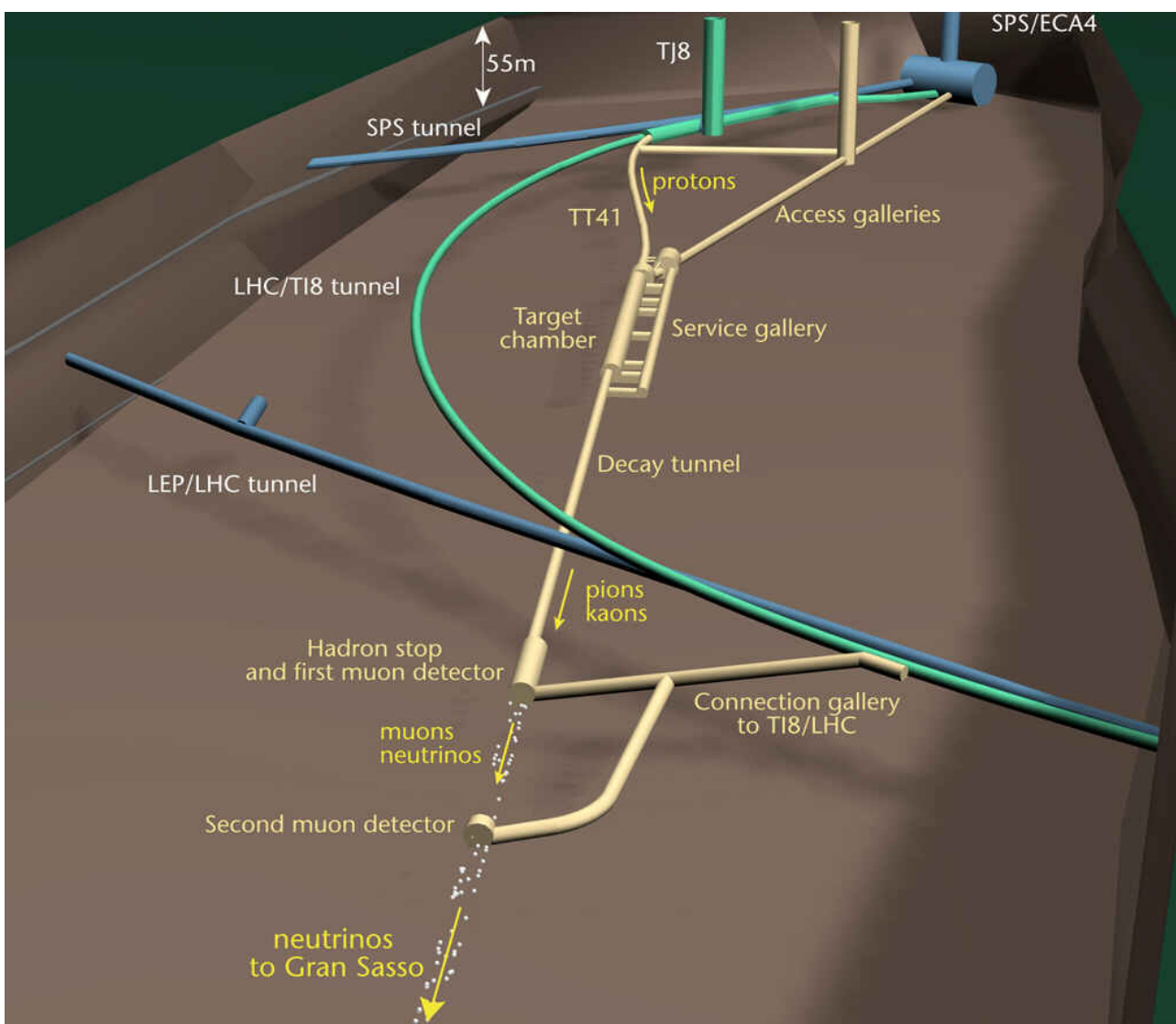


Figure 1: Layout of the CNGS facility

2.2 THE UPSTREAM AND TARGET AREAS

Figure 2 schematically shows the ECA4 cavern, the TA40-TT40-TJ8 complex, the upstream part of the T18 tunnel, the CNGS proton beam tunnel TT41 and the access gallery TAG41.

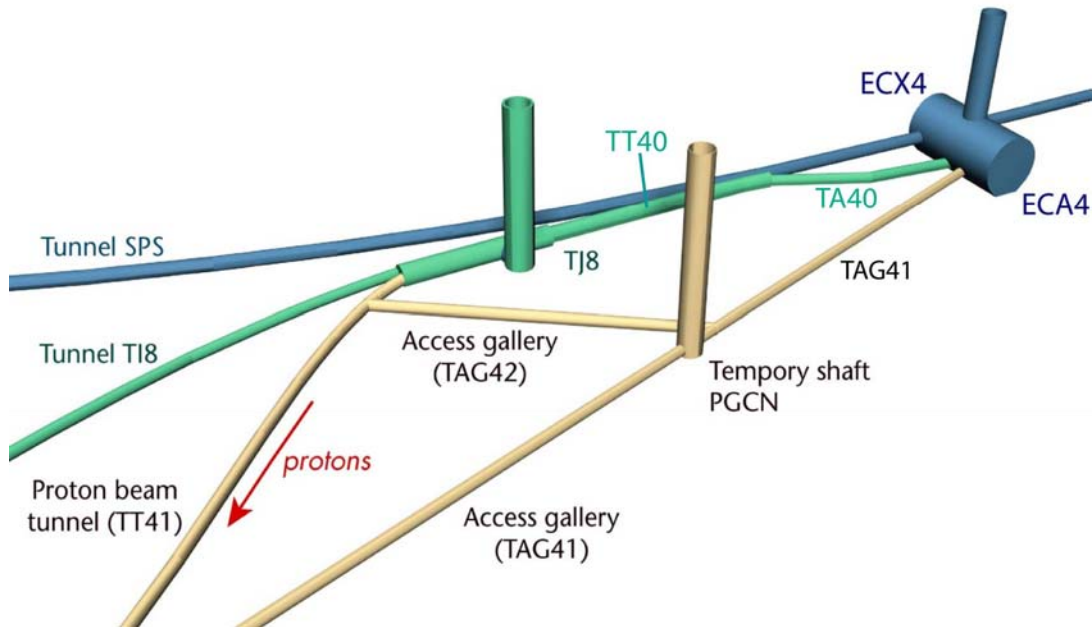


Figure 2: Upstream areas of CNGS

In Figure 3, details of the target chamber area are shown. The ventilation chamber TCV4, the target cavern TCC4 and the service gallery TSG4 are shown. Also indicated are the various service / connection galleries, TSG40-TSG48.

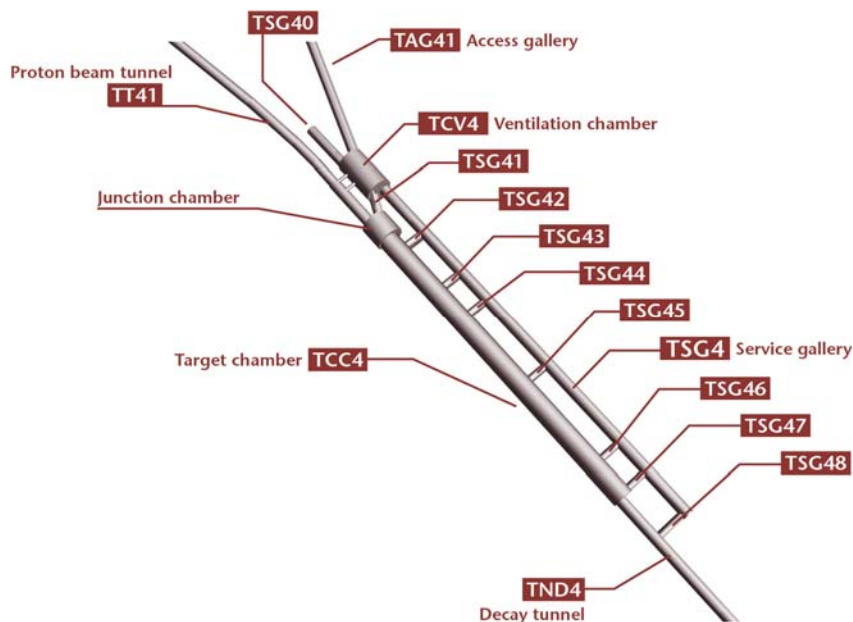


Figure 3: Target chamber and surrounding areas of CNGS

2.3 THE MUON DETECTOR/HADRON STOP AREAS

The muon detector areas must be accessed via the T18 tunnel - as a general rule, access is via point 8 of the LHC and T18². An overview of the CNGS underground structures in this area is shown in Figure 4. There is no door separating T18 from the equipment alcove TE80. Access to TZ80 and beyond is very restricted - once the CNGS facility is operational, only a few accesses per year to the muon detector chambers are envisaged.



Figure 4: Hadron stop and muon chamber areas of CNGS

2.4 DOORS AND SEARCH SECTORS

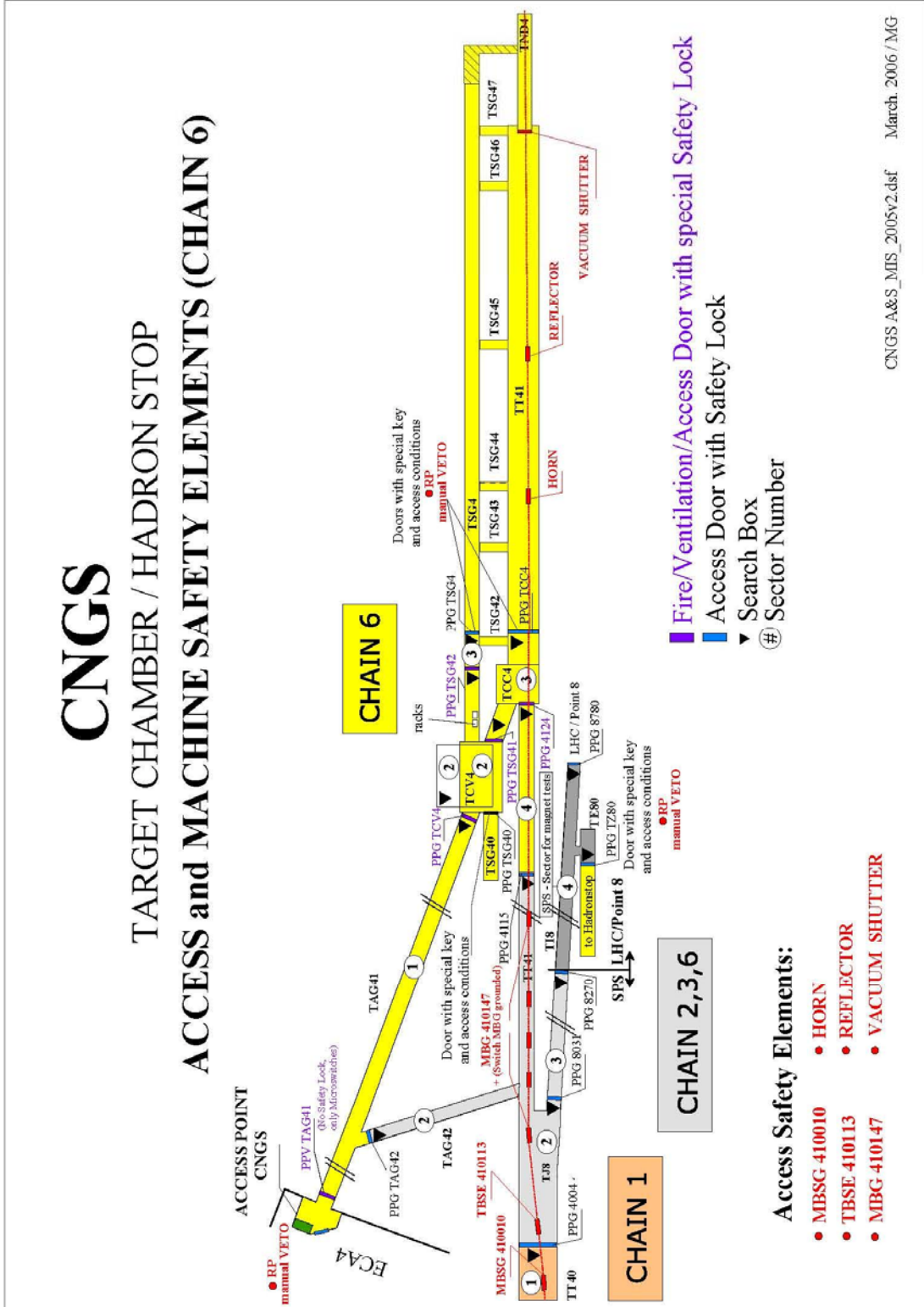
In analogy to the SPS access and safety system, the CNGS tunnels and caverns are separated into search sectors. A schematic view of these sectors is shown in Figure 5, together with the doors which have an access function. Note that TAG42 and the upstream part of TT41 are linked to safety chains 2, 3 and 6, while the rest of the CNGS facility is linked to safety chain 6. Chain 6 has 4 search sectors. Note that the galleries TZ and the muon detector chambers are part of chain 6 - since access to these areas is governed by a special procedure (see Ref [1]), this area is not a search sector. Similarly, the downstream parts of TCC4 and TSG4 and TSG40 are fenced off and are not part of a search sector.

² Access from ECA4 is only possible in very exceptional cases - passage through a door separating the LHC and SPS access systems would be necessary for this.

CNGS

TARGET CHAMBER / HADRON STOP

ACCESS and MACHINE SAFETY ELEMENTS (CHAIN 6)



CNGS A&S_MIS_2005v2.dsf March, 2006 / MG

Figure 5: Search Sectors and Access Doors in CNGS

3. DOORS AND KEYS IN THE UPSTREAM AND TARGET AREAS

3.1 OVERVIEW

A list of tables and doors is given below. Figure 6 shows a schematic overview of the door locations in CNGS.

Door Name	Location	Function(s)	Key	Comments
CNGS	in ECA4	CNGS access point	RADIATION VETO / CNGS Access Key	Standard SPS access point
PPV TAG41	in TAG41 near ECA4	Ventilation / Fire Protection		Microswitches to detect open / closed; interlocked
PPG TAG42	in TAG42 near TAG41	Access door (fenced door)	CNGS Access Key	Must be closed for beam in T18
V/F TAG42	in TAG42 near TT41	Ventilation / Fire Protection		
PPG TCV4	in TAG41 near TCV4	Access Door/ Ventilation / fire Protection	CNGS Access Key	
PPG TSG42	in TSG4 upstream TSG42	Access door/ Ventilation / fire protection	CNGS Access Key	
PPG TSG4	in TSG4 downstream TSG42	No passage beyond this point	RADIATION VETO + SPECIAL KEY	High fence

PPG TCC4	in TCC4 near TSG42	No passage beyond this point	RADIATION VETO + SPECIAL KEY	High fence
PPG TSG41	In TSG41 near TCV4	Access Door/ Ventilation / fire protection	CNGS Access Key	Microswitches to detect open / closed of the large wings
PPG 4004	End of TT40	door between different safety chains	NO PASSAGE	Door linked to emergency stop ³ - must be closed for beam in SPS
V/F TT41	TT41 / TJ8	Ventilation / fire protection		
PPG 4115	TT41 half-way	Access door (fenced door)	CNGS Access Key	Must be closed for beam in TI8
PPG 4124	TT41 near TCC4	Access door/ Ventilation/ fire protection	CNGS Access Key	
PPG TSG40	TSG40 / TCV4	No passage beyond this point	padlocked - CNGS_RP key	8 cm thick steel door

³ Special safety measure in the SPS access system for the year 2006: This door is connected to the general emergency stop AUG - opening this door will induce a general stop of all equipment in SPS and CNGS. During a long shutdown, this special measure will be removed. See also the report on special measures Ref. [1].

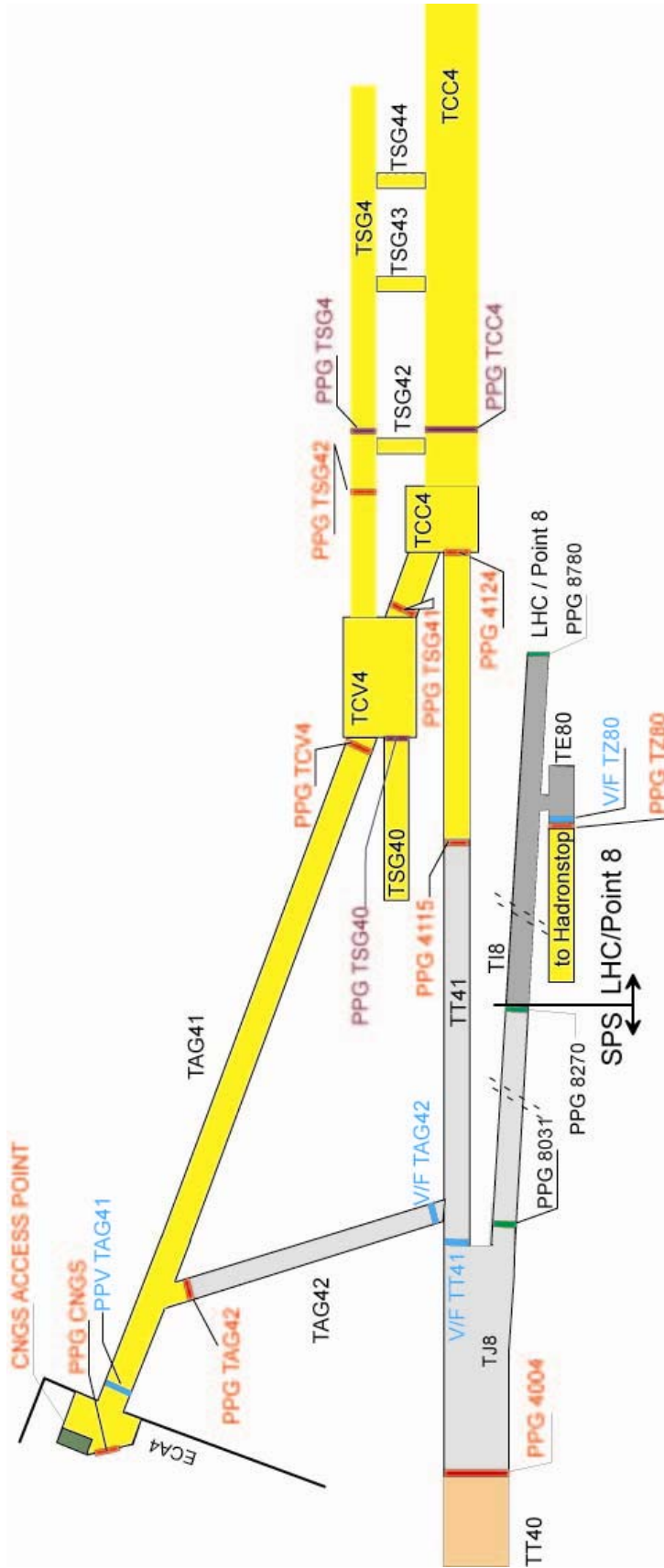


Figure 6: Doors in the CNGS facility, as described in the text.

3.2 THE CNGS ACCESS POINT IN ECA4

This is a standard SPS-type access point with turnstile, material door etc. (see Figure 7 below). The access point is built into a cage made of fences. Its roof is partially dismountable **from the inside** of the access point, in order to allow the lowering of e.g. a spare reflector onto the transport chariot (which must be aligned with TAG41 before loading, due to the very tight space available for passage). **N.B. Such an operation is not part of the normal access procedure to CNGS - a special request must be made to the DSO of AB.**

This access point is equipped with a radiation veto (key), in analogy to the access points to other target and high intensity SPS areas.



Figure 7: CNGS access point in ECA4, with material door PPG CNGS.

3.3 DOORS WITH A FUNCTION IN THE ACCESS SYSTEM

All of the doors described below are linked to the Access System of the SPS-ECX4-TI8-CNGS complex. Some of the doors simultaneously have a function as ventilation / fire protection doors. The following doors can be opened with the key obtained at the CNGS access point.

3.3.1 PPG TAG42

This fenced door defines, together with PPG 4115, the area which is not accessible when beam is extracted onto the TED in TT40 (chain 2 - extraction TT40) and/or is sent to T18 (chain 3 - injection LHC). The door provides a separation of search sector 1 of chain 6 from sector 2 of chains 2 and 3.



Figure 8: PPG TAG42, near the junction with TAG41.

3.3.2 PPG TCV4

This door (see picture next page) is equipped as ventilation / fire protection door and delimits the access gallery TAG41 from the ventilation chamber TCV4. The door provides a separation of search sectors 1 and 2 of chain 6.

3.3.3 PPG TSG42

This door (see picture next page) is equipped as ventilation / fire protection door and delimits the ventilation chamber TCV4 and the first section of the service gallery TSG4 (where the powering station and electronics racks are located) from the lower section of TSG4. The door provides a separation of search sectors 2 and 3 of chain 6.

3.3.4 PPG TSG41

This door in TSG41 (near TCV4) is equipped as ventilation / fire protection door and delimits the access the ventilation chamber TCV4 from the target chamber TCC4. The door provides a separation of search sectors 2 and 3 of chain 6. Microswitches on the large "wings" of the door provide a signal to the access system - CNGS can not operate when this door is open.



Figure 9: PPG TCV4, at the entrance to the ventilation chamber (here, both wings are open).



Figure 10: PPG TSG42, downstream of the electronics racks in TSG4.



Figure 11: PPG TSG41, separating the target chamber air volume from TCV4.

3.3.5 PPG 4004

This fenced door delimits the junction chamber TJ8 from the area which is not accessible when beam is circulating in the SPS accelerator. PPG 4004 is a door separating different safety chains (chains 1-2,3). This door allows **emergency passage only**⁴ in both directions (from TT40 to TJ8 or from TJ8 to TT40).

Note that, as part of the compensatory measures (pending an upgrade of the SPS access system, see Ref. [1]), this door will be directly linked to the general emergency stop (AUG) for the duration of the SPS run 2006. This implies that opening this door will cut all power and services in SPS and CNGS, with the exception of the emergency lights.

3.3.6 PPG 4115

This fenced door (see picture next page) defines, together with PPG TAG42, the area which is not accessible when beam is extracted onto the TED in TT40 (chain 2 - extraction TT40) and/or is sent to TI8 (chain 3 - injection LHC). The door provides a separation of search sector 4 of chain 6 from sector 2 of chains 2 and 3. (This door is in FREE mode for magnet tests NR. 4).

3.3.7 PPG 4124

This door is equipped as ventilation / fire protection door and delimits the target chamber TCC4 and the downstream part of the proton beam tunnel TT41. The door provides a separation of search sectors 3 and 4 of chain 6.

⁴ an exception is made for magnet test NR4 (MBSG 410010, MBG 410147) - the door is in FREE mode during these tests



Figure 12: PPG 4115, about half-way in TT41.



Figure 13: PPG 4124, separating TT41 from TCC4.

3.3.8 PPV TAG41⁵

This door provides a separation of the air volume in the access gallery TAG41 from the air in the cavern ECA4. It must be closed during operation of the ventilation system in "BEAM" mode. Microswitches on both wings of the door assure that CNGS can not operate when this door is open.



Figure 14: Door PPV TAG41, seen from the access point in ECA4

3.4 VENTILATION AND FIRE PROTECTION DOORS WITHOUT A FUNCTION IN THE ACCESS SYSTEM

3.4.1 V/F TAG42

This door (see picture next page) provides a separation of the air volume in the access gallery TAG42 from the air in the proton beam tunnel TT41. This door must stay closed at all times, it must be checked during the SEARCH of the area.

3.4.2 V/F TT41

This door provides a separation of the air volumes in the proton beam tunnel TT41 from the junction chamber TJ8 (incl. TT40 and T18). This door must stay closed at all times, it must be checked during the SEARCH of the area.

⁵ fenced access doors are usually called PPG (G for "grillage") - this door is a ventilation door, thus the name PPV



Figure 15: Ventilation and fire protection door V/F TAG42, separating TT41 from TAG42.



Figure 16: Ventilation and fire protection door V/F TT41, separating TJ8 from TT41.

3.4.3 SEPARATIONS BETWEEN TCC4 AND TSG4

Each of the side galleries between TCC4 and TSG4 is closed by a thin aluminium plate which can be opened for emergency passage - these "doors" must be closed for reasons of ventilation and separation of volumes (smoke propagation) in case of a fire.

3.5 SPECIAL DOORS AND SPECIAL KEYS

During CNGS operation, the TCC4 areas from the target station T40 downstream (T40 included) are expected to have high remnant radiation levels. Such areas are classified as "forbidden zones" - it has been decided to de-limit this area by a system of high fences and locked doors (emergency passage to exit only).

The area directly concerned is the TCC4 cavern downstream of TSG42. Since there are several cross passages between TCC4 and TSG4, it was decided to close off, with a fenced door, also TSG4 downstream of TSG42.

3.5.1 PPG TSG4

This fenced door covers the complete section of TSG4 just downstream of TSG42. It is equipped with a SPS-type lock but requires a special key to enter. Emergency passage into the zone is prevented by the "bouchon" (exit emergency passage is always possible). To open this door the technician of the radiation protection group uses the RADIATION_VETO key to electrically unblock the door. The AB/ATB expert for the "consignation" of horn and reflector in TSG4/TCC4 uses his SPECIAL KEY to access these tunnels.



Figure 17: PPG TSG4, separating the "local électrique" from the upstream part of TSG4.

3.5.2 PPG TCC4

This door is located inside a wide and high fence covering the complete width of TCC4 downstream of TSG42 (height of the fence: 3.00 metres). It is equipped with an SPS-type lock but requires a special key to enter. Emergency passage into the zone is prevented by the "bouchon" (exit emergency passage is always possible). To open this door the technician of the radiation protection group uses the RADIATION_VETO key to electrically unblock the door. The AB/ATB expert for the "consignation" of horn and reflector in TSG4/TCC4 uses his SPECIAL KEY to access this cavern.



Figure 18: PPG TCC4, separating the high radiation area and the "local électrique" (open stripline connections) from the upstream part of TCC4.

3.5.3 PPG TSG40

The radioactive storage TSG40 is closed of by a 8 cm thick steel shielding door. This door is pad-locked⁶ and can only be opened by an RP technician with the CNGS_RP key. This door is equipped with a micro-switch allowing to indicate its position (open/closed) in the synoptic of the access system.

⁶ This door will be installed in week 32, 2006.

4. DOORS AND KEYS IN THE MUON DETECTOR/HADRON STOP AREAS

4.1 SUMMARY

A summary of doors in this region is given below. Doors V/F TZ80 and PPG TZ80 are also indicated in Figure 6. The location of doors TNB4 and TND4 is shown in Figure 7.

Door name	Location	Function(s)	Key	Comment(s)
V/F TZ80	TZ80 near TE80	Ventilation / Fire Protection		
PPG TZ80	TZ80 near TE80	Access door (fenced door)	RADIATION VETO + SPECIAL TZ access key in CCC	Must be closed for beam in CNGS
TNB4	TNM41 / TNB4	NO PASSAGE	CNGS_RP key	Must remain closed at all times
TND4	TNB4 / decay tube	NO PASSAGE	CNGS_RP key	Must remain closed at all times

4.2 ACCESS TO THE TZ GALLERIES AND THE AREAS BEYOND

The access to the TZ galleries is via the TI8 tunnel, approximately 250 metres from point 8 or 1800 metres from ECA4. Equipment in these galleries and the muon chambers has been requested to be very reliable - only a few accesses per year should be envisaged.

4.2.1 VENTILATION AND FIRE PROTECTION DOOR V/F TZ80

This door has been built in TZ80 near TE80, to separate the air volumes in the TZ galleries from the air in the TI8 tunnel. It is also a fire protection door. For reasons of simplicity in the construction of the door, the functionality of an access door has not been integrated.

4.2.2 ACCESS DOOR PPG TZ80

This fenced door follows immediately after the ventilation door in TZ80. It is equipped with an SPS-type lock, but can be opened only with a special key. A RADIATION_VETO must be first removed by radiation protection. The key can be obtained from the access console in the CCC following a specific procedure (see Ref. [2]). A "bouchon" prevents forced passage from TE80 into TZ80. Emergency passage from inside TZ80 towards TE80->TI8 is possible.

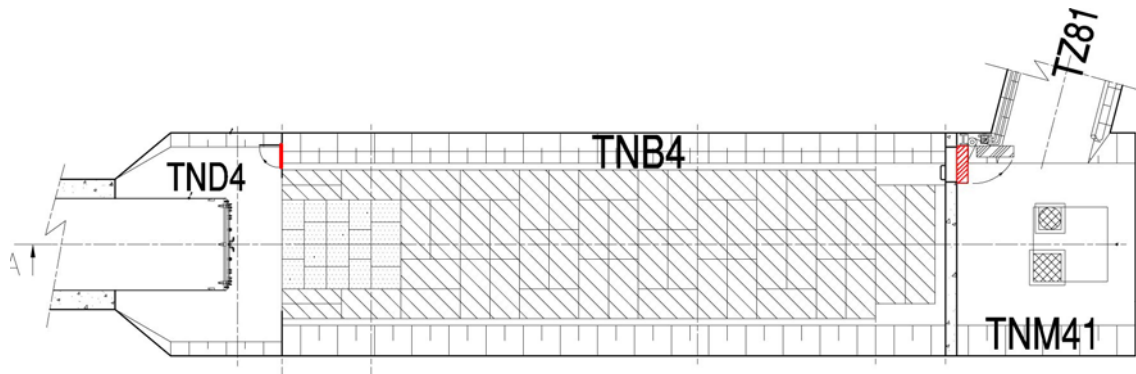


Figure 19: Hadronstop area - the concrete shielding door leading to TNB4 and the metal door to TND4 are indicated in red.



Figure 20: Ventilation and fire protection door V/F TZ80



Figure 21: Access door PPG TZ80 seen through the (opened) ventilation door V/F TZ80.

4.3 SHIELDED DOOR BETWEEN TNM41 AND TNB4

A 40 cm thick concrete wall separates the TNM41 muon detector chamber from the TNB4 hadron stop cavern. While also separating the air volumes, this wall is dimensioned to absorb slow neutrons which are produced by hadronic cascades in the beam dump.

Inside the hadron stop chamber, water cooling valves and flow meters are the only equipment which might require an access during the 10 years of anticipated operation of the CNGS facility. Since the hadron stop chamber is not ventilated, opening this door will require a long shut-down of the facility and a series of precautions (radiological aspects, oxygen deficiency, etc.).

The shielded door is a 30 cm thick concrete door with a steel frame. A special seal guarantees that the door is air-tight. The door is pad-locked; the CNGS_RP key is needed to open this door.

4.4 AIR SEPARATION DOOR BETWEEN TNB4 AND DECAY TUBE EXIT WINDOW

The small volume upstream of the hadron stop entrance face has been closed off by a wall of syporex. During the construction phase of CNGS, a thin metal door allowed access through this wall to the exit window of the decay tube. This door is now pad-locked; the CNGS_RP key is with the radiation protection group. There is no active equipment⁷ at or near the exit flange of the decay tube - therefore, no access should ever be required through this door.

⁷ The temperature probes installed in this area are not crucial for the operation of the CNGS facility. Should these probes stop working, they will not be repaired/replaced.



Figure 22: Shielded door separating TNM41 from the hadron stop chamber TNB4.

5. SUMMARY OF KEYS

The following keys are used in the CNGS facility:

- **standard CNGS access key** (obtained at the access point, use dosimeter)
- **special access key for TZ + muon areas** (obtained from CCC access console, special form to be filled in since these areas are "confined spaces")
- **RADIATION VETO key** (common to all SPS - every RP technician has one)
- **CNGS_RP key** (for TSG40 radioactive storage, TNB4 hadron stop shielded door, door from TNB4 to decay tube exit window -> key is with the SC/RP group)
- **PPG TSG4 and PPG TCC4 key** (due to the open electrical connections for horn and reflector, the areas beyond these doors are considered as "local électrique" -> key is with AB/ATB group)

6. REFERENCES

[1] Talk on SPS access system in 2006, by P. Lienard and E. Manola-Poggioli, <http://indico.cern.ch/contributionDisplay.py?contribId=37&sessionId=5&confId=86>

[2] Rules and procedures for personnel access to CNGS target and muon detector areas, EDMS doc. No. 693630, <https://edms.cern.ch/document/693630/>

[3] "Procédure pour les travaux dans les tunnels TCC4 et TSG4 (Sécurité Electrique)" <https://edms.cern.ch/document/703672/>

ANNEX: Overview of doors, keys and their functions

DOOR NAME	LOCATION	Door linked to SPS Access System	Ventil. Fire Protect.	Restricted Access	Radiation VETO	Access Key	Special Key	INTERLOCKS	BEAM OFF if Forced	COMMENTS
PPG CNGS	ECA4	Yes			Yes	Yes	No	Yes	Yes	Standard SPS Access Point
PPG TAG42	TAG 42 near TAG 41	Yes			No	Yes	No	Yes	Yes	Must stay closed if beam in TT40 -T18
PPG TCV4	TAG 41 near TCV4	Yes	Yes		No	Yes	No	Yes	Yes	
PPG TSG42	TSG4 ventil. chamber	Yes	Yes		No	Yes	No	Yes	Yes	
PPG TSG41	TSG41 ventil. chamb.	Yes	Yes		No	Yes	No	Yes	Yes	microswitches on large wings of door
PPG 4004	TT40	Yes		Yes	No	No	No	Yes	Yes	Linked to General Emergency Stop
PPG 4115	TT41 "half-way"	Yes			No	Yes	No	Yes	Yes	Must stay closed if beam in TT40-T18
PPG 4124	TT41 jonction chamb.	Yes			No	Yes	No	Yes	Yes	
PPV TAG 41	TAG41 near ECA4	Yes	Yes		No	No	No	Yes	Yes	microswitches for interlock - must stay closed during operation for RP reasons (controlled leak air flow)
V/F TAG 42	TAG42 near TT41	No	Yes		No	No	No	No	No	closed for fire protection reasons
V/F TT41	TT41 near TJ8	No	Yes		No	No	No	No	No	closed for fire protection reasons
PPG TSG4	TSG4 near the entrance	Yes		Yes	Yes	No	3)	Yes	Yes	High fence
PPG TCC4	TCC4 near the entrance	Yes		Yes	Yes	No	3)	Yes	Yes	High fence
PPG TSG40	TSG40 ventil. chamb.			Yes	No	No	2)	No	No	Must stay closed all the time
PPG TZ80	TZ80 near TE80	Yes			Yes	No	1)	Yes	Yes	bouchon (no forced entry possible) Must stay closed if beam in CNGS
V/F TZ80	TZ80 near TE80		Yes		No	No	No	No	No	closed for fire protection reasons
TNB4	TNM41 entrance TNB4			Yes	No	No	2)	No	No	Must stay closed all the time
TND4	TNB4 near decay tube end			Yes	No	No	2)	No	No	Must stay closed all the time

- 1) Key TZ + Muon Areas on Access System in CCC
- 2) Key CNGS-RP under SC-RP responsibility
- 3) Key Horn and Reflector under AB-ATB responsibility