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Procedures to be followed in case of an ARCON system or monitor failure

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Abstract:

This paper provides the procedures required to assure a safe SPS machine operation in case of a failure of single ARCON monitors, a full ARCON subsystem or its alarm transmission functionality.

The document is structured as follows:

1. Alphabetic order of all ARCON monitors including the correlation between the single monitors and the according ARCON subsystem.
2. Procedures to be followed in case of a failure of a single monitor or a full ARCON subsystem (BA1 – BA6) or its alarm transmission functionality. Each chapter is structured in three subchapters:
    - Short description of the functionality of the single monitors.
    - Procedures to be followed in case of a failure of the whole ARCON system.
    - Procedures to be followed in case of a failure of single monitors (monitors listed in alphabetic order).

How to use this document

Failure of a single ARCON monitor:

1. Find the monitor name (listed in alphabetic order) and the according ARCON sub-system (BA1 – BA6) in Table 1.
2. Go to the Chapter of the according ARCON sub-system (BA1 – BA6).
3. Go to the subchapter "**Procedure of actions to be followed in case of problems with single monitors**" and find in there the monitor of your interest including the procedure in case of a failure.
4. Follow the procedural steps described in there.

Failure of a whole ARCON subsystem or its alarm transmission functionality:

1. Go to the Chapter of the according ARCON sub-system (BA1 – BA6).
2. Go to the subchapter "**Failure of whole ARCON BA1 subsystem or its alarm transmission functionality**".
3. Follow the procedural steps described in there.

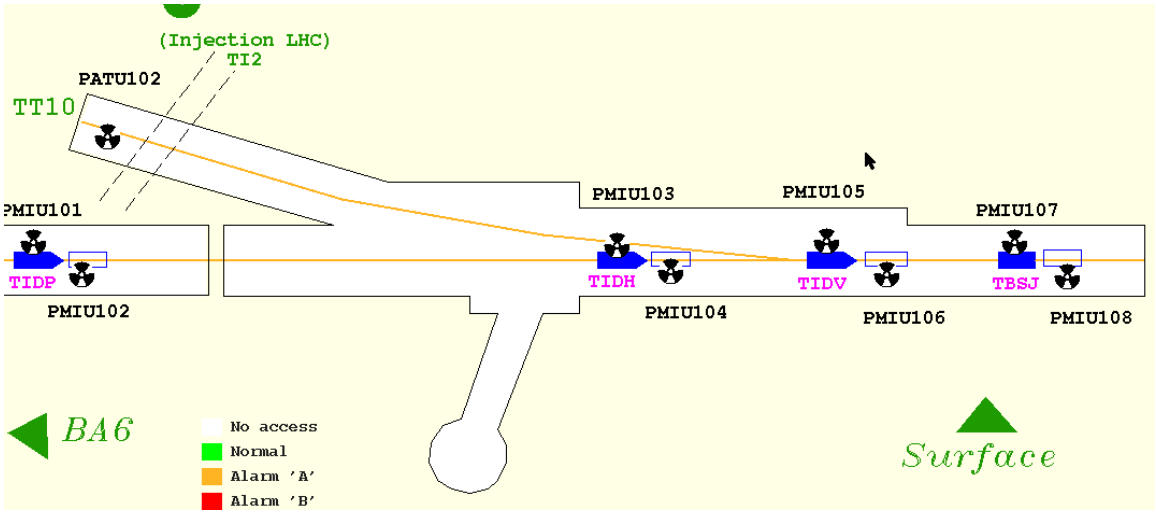
List of Monitors of the SPS machine ARCON systems

Table 1: Correlation between monitor name and according ARCON system listed in alphabetic order.

Monitor name	ARCON system/page	Monitor name	ARCON system/page	Monitor name	ARCON system/page
PAM11	BA1 (page 4)	PCMA11	BA1 (page 4)	PMIU604	BA6 (page 32)
PAM21	BA2 (page 10)	PMB11	BA1 (page 4)	PMS12	BA1 (page 4)
PAM41	BA4 (page 18)	PMB21	BA2 (page 10)	PMS22	BA2 (page 10)
PAM51	BA5 (page 27)	PMB31	BA2 (page 10)	PMS32	BA2 (page 10)
PAM61	BA6 (page 32)	PMB41	BA4 (page 18)	PMS42	BA4 (page 18)
PAMP01	BA2 (page 10)	PMB51	BA5 (page 27)	PMS52	BA5 (page 27)
PATI801G	BA4 (page 18)	PMB61	BA6 (page 32)	PMS62	BA6 (page 32)
PATT411G	BA4 (page 18)	PMB71	BA6 (page 32)	PMS71N	BA6 (page 32)
PATTI2	BA6 (page 32)	PMITT401	BA4 (page 18)	PMS72	BA6 (page 32)
PATTT60	BA6 (page 32)	PMITT404	BA4 (page 18)	PMS72N	BA6 (page 32)
PATU102	BA1 (page 4)	PMIU101	BA1 (page 4)	PMS810	BA2 (page 10)
PATU421G	BA4 (page 18)	PMIU102	BA1 (page 4)	PMV21W	BA2 (page 10)
PATU421N	BA4 (page 18)	PMIU103	BA1 (page 4)	PMV4A	BA4 (page 18)
PATU440N	BA4 (page 18)	PMIU104	BA1 (page 4)	PMV4F	BA4 (page 18)
PAXTA40	BA4 (page 18)	PMIU105	BA1 (page 4)	PMV4R	BA4 (page 18)
PAXU401	BA4 (page 18)	PMIU106	BA1 (page 4)	PMVG11C	BA1 (page 4)
PAXU402	BA4 (page 18)	PMIU107	BA1 (page 4)	PMVG11F	BA1 (page 4)
PAXU403	BA4 (page 18)	PMIU108	BA1 (page 4)	PMVG11R	BA1 (page 4)
PAXU404	BA4 (page 18)	PMIU201	BA2 (page 10)	PMVG31C	BA2 (page 10)
PAXU405	BA4 (page 18)	PMIU202	BA2 (page 10)	PMVG31F	BA2 (page 10)
PAXU501	BA5 (page 27)	PMIU203	BA2 (page 10)	PMVG31R	BA2 (page 10)
PAXU502	BA5 (page 27)	PMIU204	BA2 (page 10)	PMVG51C	BA5 (page 27)
PAXU503	BA5 (page 27)	PMIU205	BA2 (page 10)	PMVG51F	BA5 (page 27)
PAXU504	BA5 (page 27)	PMIU206	BA2 (page 10)	PMVG51R	BA5 (page 27)
PBXU401	BA5 (page 27)	PMIU207	BA2 (page 10)	PMVG70C	BA6 (page 32)
PBXU501	BA4 (page 18)	PMIU208	BA2 (page 10)	PMVG70F	BA6 (page 32)
PCM21	BA2 (page 10)	PMIU401	BA4 (page 18)	PMVG70R	BA6 (page 32)
PCM31	BA2 (page 10)	PMIU402	BA4 (page 18)	PMW21I	BA2 (page 10)
PCM41	BA4 (page 18)	PMIU403	BA4 (page 18)	PMW21S	BA2 (page 10)
PCM42	BA4 (page 18)	PMIU404	BA4 (page 18)	PMW61I	BA6 (page 32)
PCM51	BA5 (page 27)	PMIU601	BA6 (page 32)	PMW61W	BA6 (page 32)
PCM61	BA6 (page 32)	PMIU602	BA6 (page 32)	PMW62I	BA6 (page 32)

PCM71	BA6 (page 32)	PMIU603	BA6 (page 32)	PMW62W	BA6 (page 32)

Area covered by ARCON sub system BA1



List of monitors

PAM11: BA1 gate monitor

PATU102: Stray radiation monitor inside TT10 transfer line monitor

PCMA11: Monitor to control material leaving the radiation area

PMB11: Monitor to control radiation levels close to the ion-exchanger in BA1 (surface)

PMIU101: Monitor to measure residual dose rate close to the beam line during beam off periods.

PMIU102: Monitor to measure residual dose rate close to the beam line during beam off periods.

PMIU103: Monitor to measure residual dose rate close to the beam line during beam off periods.

PMIU104: Monitor to measure residual dose rate close to the beam line during beam off periods.

PMIU105: Monitor to measure residual dose rate close to the beam line during beam off periods.

PMIU106: Monitor to measure residual dose rate close to the beam line during beam off periods.

PMIU107: Monitor to measure residual dose rate close to the beam line during beam off periods.

PMIU108: Monitor to measure residual dose rate close to the beam line during beam off periods.

PMS12: Monitor to measure stray radiation in the environment around the accelerator

PMVG11C: Monitor measuring the specific airborne radioactivity released to the environment

PMVG11F: Monitor measuring the air flow rate released to the environment

PMVG11R: Monitor measuring the airborne radioactivity released to the environment

Failure of whole ARCON BA1 subsystem or its alarm transmission functionality

- SPS must be stopped
- Areas around water ion exchangers (area BA1) have to be evacuated and closed
- Beam can be restarted
- Inform RP for further actions concerning the Arcon problem (phone: 75252 or 74848).
- If the ventilation monitors (PMVG11C, PMVG11F and PMVG11R) are not back in operation within 72 hours, SPS must be stopped until these monitors are operational.
- If the stray radiation monitor (PMS12) is not back in operation within 168 hours, SPS must be stopped until these monitors are operational.
- The consequences in case of a partial failure of the BA1 ARCON will be discussed in the chapter "Procedure of actions to be done in case of problems with single monitors".

Procedure of actions to be followed in case of problems with single monitors

PAM11:

Function: BA1 gate monitor

Procedure to be done in case of failure or unavailability of monitor:

- Beam operation can continue
- Inform RP for further action concerning the monitor problem (phone: 75252 or 74848).

PATU102:

Function: stray radiation monitor inside TT10 transfer line monitor (area not accessible during SPS operation)

Procedure to be done in case of failure or unavailability of monitor:

- SPS beam operation can continue
- Inform RP for further action concerning the monitor problem (phone: 75252 or 74848).

PCMA11:

Function: Monitor to control material leaving the radiation area

Procedure to be done in case of failure or unavailability of monitor:

- Beam operation can continue
- Monitor needs to be repaired
- Inform RP for further action concerning the monitor problem (phone: 75252 or 74848).

PMB11:

Function: Monitor to control radiation levels close to the ion-exchanger in BA1 (surface)

Procedure to be done in case of failure or unavailability of monitor:

- SPS beam operation has to be stopped
- Area BA1 has to be evacuated and closed.
- SPS beam can be restarted
- Inform RP for further action concerning the monitor problem (phone: 75252 or 74848).

PMIU101:

Function: Monitor to measure residual dose rate close to the beam line during beam off periods.

Procedure to be done in case of failure or unavailability of monitor:

- Operation can continue since monitor is not critical during beam operation
- Inform RP for further action concerning the monitor problem (phone: 75252 or 74848).

PMIU102:

Function: Monitor to measure residual dose rate close to the beam line during beam off periods.

Procedure to be done in case of failure or unavailability of monitor:

- Operation can continue since monitor is not critical during beam operation
- Inform RP for further action concerning the monitor problem (phone: 75252 or 74848).

PMIU103:

Function: Monitor to measure residual dose rate close to the beam line during beam off periods.

Procedure to be done in case of failure or unavailability of monitor:

- Operation can continue since monitor is not critical during beam operation
- Inform RP for further action concerning the monitor problem (phone: 75252 or 74848).

PMIU104:

Function: Monitor to measure residual dose rate close to the beam line during beam off periods.

Procedure to be done in case of failure or unavailability of monitor:

- Operation can continue since monitor is not critical during beam operation
- Inform RP for further action concerning the monitor problem (phone: 75252 or 74848).

PMIU105:

Function: Monitor to measure residual dose rate close to the beam line during beam off periods.

Procedure to be done in case of failure or unavailability of monitor:

- Operation can continue since monitor is not critical during beam operation
- Inform RP for further action concerning the monitor problem (phone: 75252 or 74848).

PMIU106:

Function: Monitor to measure residual dose rate close to the beam line during beam off periods.

Procedure to be done in case of failure or unavailability of monitor:

- Operation can continue since monitor is not critical during beam operation
- Inform RP for further action concerning the monitor problem (phone: 75252 or 74848).

PMIU107:

Function: Monitor to measure residual dose rate close to the beam line during beam off periods.

Procedure to be done in case of failure or unavailability of monitor:

- Operation can continue since monitor is not critical during beam operation
- Inform RP for further action concerning the monitor problem (phone: 75252 or 74848).

PMIU108:

Function: Monitor to measure residual dose rate close to the beam line during beam off periods.

Procedure to be done in case of failure or unavailability of monitor:

- Operation can continue since monitor is not critical during beam operation
- Inform RP for further action concerning the monitor problem (phone: 75252 or 74848).

PMS12:

Function: Monitor to measure stray radiation in the environment around the accelerator

Procedure to be done in case of failure or unavailability of monitor:

- SPS operation can continue for 168 hours
- Inform SC/IE for further action concerning the monitor problem (phone: 73893).
- If after 168 hours the monitor is not operational, the SPS has to be stopped until the monitor is repaired

PMVG11C:

Function: Monitor measuring the specific airborne radioactivity released to the environment

Procedure to be done in case of failure or unavailability of monitor:

- SPS operation can continue for 72 hours
- Inform SC/IE for further action concerning the monitor problem (phone: 73893).

- If after 72 hours the monitor is not operational, the SPS has to be stopped until the monitor is repaired

PMVG11F:

Function: Monitor measuring the air flow rate released to the environment

Procedure to be done in case of failure or unavailability of monitor:

- SPS operation can continue for 72 hours
- Inform SC/IE for further action concerning the monitor problem (phone: 73893).
- If after 72 hours the monitor is not operational, the SPS has to be stopped until the monitor is repaired

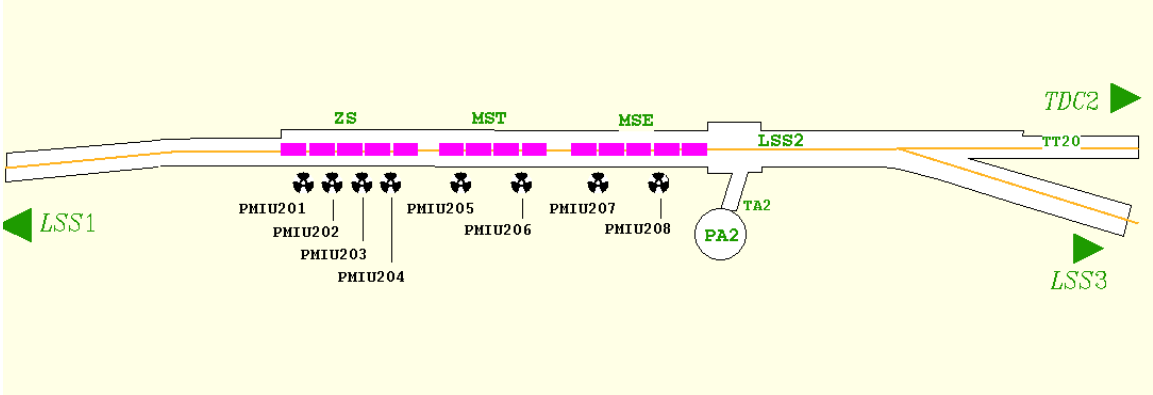
PMVG11R:

Function: Monitor measuring the airborne radioactivity released to the environment

Procedure to be done in case of failure or unavailability of monitor:

- SPS operation can continue for 72 hours
- Inform SC/IE for further action concerning the monitor problem (phone: 73893).
- If after 72 hours the monitor is not operational, the SPS has to be stopped until the monitor is repaired

Area covered by ARCON sub system BA2



List of monitors

PAM21: BA2 gate monitor

PAMP01: Prevessin gate monitor

PCM21: Monitor to control material leaving the radiation area (BA2)

PCM31: Monitor to control material leaving the radiation area (BA3)

PMB21: Monitor to control radiation levels close to the ion-exchanger at the surface of BA2

PMB31: Monitor to control radiation levels close to the ion-exchanger at the surface of BA3

PMIU201: Monitor to measure residual dose rate close to the beam line during beam off periods.

PMIU202: Monitor to measure residual dose rate close to the beam line during beam off periods.

PMIU203: Monitor to measure residual dose rate close to the beam line during beam off periods.

PMIU204: Monitor to measure residual dose rate close to the beam line during beam off periods.

PMIU205: Monitor to measure residual dose rate close to the beam line during beam off periods.

PMIU206: Monitor to measure residual dose rate close to the beam line during beam off periods.

PMIU207: Monitor to measure residual dose rate close to the beam line during beam off periods.

PMIU208: Monitor to measure residual dose rate close to the beam line during beam off periods.

PMS22: Monitor to measure stray radiation in the environment around the accelerator

PMS32: Monitor to measure stray radiation in the environment around the accelerator

PMS810: Monitor to measure stray radiation in the environment of building 867

PMVG31C: Monitor measuring the specific airborne radioactivity released to the environment

PMVG31F: Monitor measuring the air flow rate released to the environment

PMVG31R: Monitor measuring the airborne radioactivity released to the environment

PMW21W: Monitor measuring the radioactivity in water released to the environment

PMW21I: Monitor measuring the radioactivity in water released to the environment

PMW21S: Monitor measuring the radioactivity in water released to the environment

Failure of whole ARCON subsystem or its alarm transmission functionality

- SPS must be stopped
- Areas around water ion exchangers (area BA2 and area BA3) have to be evacuated and closed
- Beam can be restarted
- If the ventilation monitors (PMV31C, PMV31F and PMV31R) are not back in operation within 72 hours, SPS must be stopped until these monitors are operational.
- If the stray radiation monitors (PMS22 and PMS32) are not back in operation within 168 hours, SPS must be stopped until these monitors are operational.
- If the water monitors (PMW21W, PMW21I and PMW21S) are not back in operation within 168 hours, SPS must be stopped until these monitors are operational.
- The consequences in case of a partial failure of the BA2 ARCON will be discussed in the chapter “Procedure of actions to be done in case of problems with single monitors”.

Procedure of actions to be followed in case of problems with single monitors

PAM21:

Function: BA2 gate monitor

Procedure to be done in case of failure or unavailability of monitor:

- Beam operation can continue
- Inform RP for further action concerning the monitor problem (phone: 75252 or 74848).

PAMP01:

Function: Prevessin gate monitor

Procedure to be done in case of failure or unavailability of monitor:

- Beam operation can continue
- Inform RP for further action concerning the monitor problem (phone: 75252 or 74848).

PCM21:

Function: Monitor to control material leaving the radiation area (BA2)

Procedure to be done in case of failure or unavailability of monitor:

- Beam operation can continue
- Inform RP for further action concerning the monitor problem (phone: 75252 or 74848).

PCM31:

Function: Monitor to control material leaving the radiation area (BA3)

Procedure to be done in case of failure or unavailability of monitor:

- Beam operation can continue
- Inform RP for further action concerning the monitor problem (phone: 75252 or 74848).

PMB21:

Function: Monitor to control radiation levels close to the ion-exchanger at the surface of BA2

Procedure to be done in case of failure or unavailability of monitor:

- SPS beam operation has to be stopped
- Area BA2 has to be evacuated and closed
- Beam operation can be restarted
- Inform RP for further action concerning the monitor problem (phone: 75252 or 74848).

PMB31:

Function: Monitor to control radiation levels close to the ion-exchanger at the surface of BA3

Procedure to be done in case of failure or unavailability of monitor:

- SPS beam operation has to be stopped
- Area BA3 has to be evacuated and closed.
- Beam operation can be restarted
- Inform RP for further action concerning the monitor problem (phone: 75252 or 74848).

PMIU201:

Function: Monitor to measure residual dose rate close to the beam line during beam off periods.

Procedure to be done in case of failure or unavailability of monitor:

- Operation can continue since monitor is not critical during beam operation
- Inform RP for further action concerning the monitor problem (phone: 75252 or 74848).

PMIU202:

Function: Monitor to measure residual dose rate close to the beam line during beam off periods.

Procedure to be done in case of failure or unavailability of monitor:

- Operation can continue since monitor is not critical during beam operation
- Inform RP for further action concerning the monitor problem (phone: 75252 or 74848).

PMIU203:

Function: Monitor to measure residual dose rate close to the beam line during beam off periods.

Procedure to be done in case of failure or unavailability of monitor:

- Operation can continue since monitor is not critical during beam operation

- Inform RP for further action concerning the monitor problem (phone: 75252 or 74848).

PMIU204:

Function: Monitor to measure residual dose rate close to the beam line during beam off periods.

Procedure to be done in case of failure or unavailability of monitor:

- Operation can continue since monitor is not critical during beam operation
- Inform RP for further action concerning the monitor problem (phone: 75252 or 74848).

PMIU205:

Function: Monitor to measure residual dose rate close to the beam line during beam off periods.

Procedure to be done in case of failure or unavailability of monitor:

- Operation can continue since monitor is not critical during beam operation
- Inform RP for further action concerning the monitor problem (phone: 75252 or 74848).

PMIU206:

Function: Monitor to measure residual dose rate close to the beam line during beam off periods.

Procedure to be done in case of failure or unavailability of monitor:

- Operation can continue since monitor is not critical during beam operation
- Inform RP for further action concerning the monitor problem (phone: 75252 or 74848).

PMIU207:

Function: Monitor to measure residual dose rate close to the beam line during beam off periods.

Procedure to be done in case of failure or unavailability of monitor:

- Operation can continue since monitor is not critical during beam operation
- Inform RP for further action concerning the monitor problem (phone: 75252 or 74848).

PMIU208:

Function: Monitor to measure residual dose rate close to the beam line during beam off periods.

Procedure to be done in case of failure or unavailability of monitor:

- Operation can continue since monitor is not critical during beam operation
- Inform RP for further action concerning the monitor problem (phone: 75252 or 74848).

PMS22:

Function: Monitor to measure stray radiation in the environment around the accelerator

Procedure to be done in case of failure or unavailability of monitor:

- SPS operation can continue for 168 hours
- Inform SC/IE for further action concerning the monitor problem (phone: 73893).
- If after 168 hours the monitor is not operational, the SPS has to be stopped until the monitor is repaired

PMS32:

Function: Monitor to measure stray radiation in the environment around the accelerator

Procedure to be done in case of failure or unavailability of monitor:

- SPS operation can continue for 168 hours
- Inform SC/IE for further action concerning the monitor problem (phone: 73893).
- If after 168 hours the monitor is not operational, the SPS has to be stopped until the monitor is repaired

PMS810:

Function: Monitor to measure stray radiation in the environment of building 867

Procedure to be done in case of failure or unavailability of monitor:

- SPS beam operation can continue
- Inform SC/IE for further action concerning the monitor problem (phone: 73893).

PMVG31C:

Function: Monitor measuring the specific airborne radioactivity released to the environment

Procedure to be done in case of failure or unavailability of monitor:

- SPS operation can continue for 72 hours
- Inform SC/IE for further action concerning the monitor problem (phone: 73893).
- If after 72 hours the monitor is not operational, the SPS has to be stopped until the monitor is repaired

PMVG31F:

Function: Monitor measuring the air flow rate released to the environment

Procedure to be done in case of failure or unavailability of monitor:

- SPS operation can continue for 72 hours
- Inform SC/IE for further action concerning the monitor problem (phone: 73893).
- If after 72 hours the monitor is not operational, the SPS has to be stopped until the monitor is repaired

PMVG31R:

Function: Monitor measuring the airborne radioactivity released to the environment

Procedure to be done in case of failure or unavailability of monitor:

- SPS operation can continue for 72 hours
- Inform SC/IE for further action concerning the monitor problem (phone: 73893).
- If after 72 hours the monitor is not operational, the SPS has to be stopped until the monitor is repaired

PMW21W:

Function: Monitor measuring the radioactivity in water released to the environment

Procedure to be done in case of failure or unavailability of monitor:

- SPS operation can continue for 72 hours
- Inform SC/IE for further action concerning the monitor problem (phone: 73893).
- If after 72 hours the monitor is not operational, the SPS has to be stopped until the monitor is repaired

PMW21I:

Function: Monitor measuring the radioactivity in water released to the environment

Procedure to be done in case of failure or unavailability of monitor:

- SPS operation can continue for 72 hours
- Inform SC/IE for further action concerning the monitor problem (phone: 73893).
- If after 72 hours the monitor is not operational, the SPS has to be stopped until the monitor is repaired

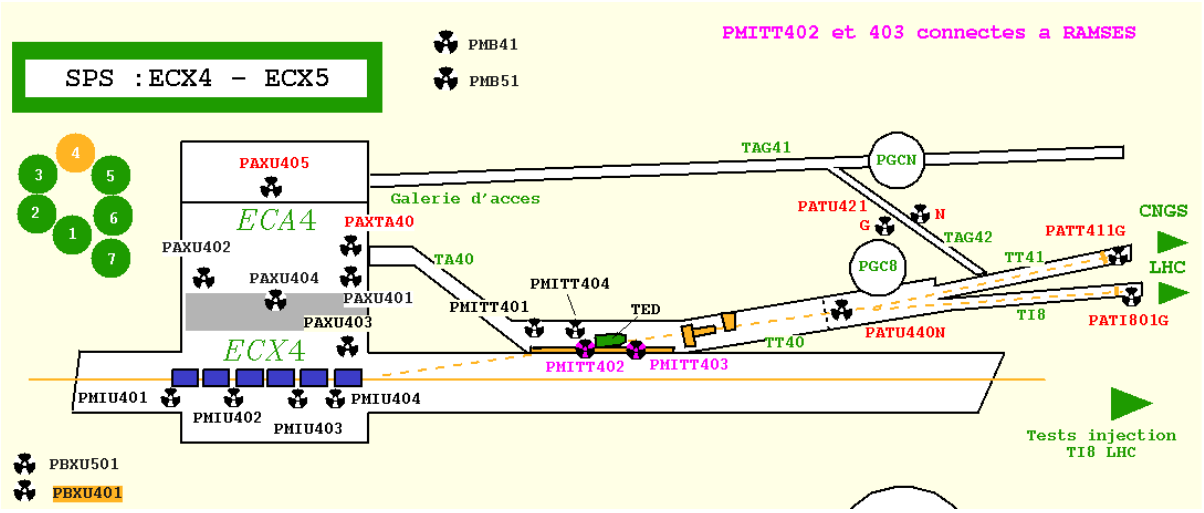
PMW21S:

Function: Monitor measuring the radioactivity in water released to the environment

Procedure to be done in case of failure or unavailability of monitor:

- SPS operation can continue for 72 hours
- Inform SC/IE for further action concerning the monitor problem (phone: 73893).
- If after 72 hours the monitor is not operational, the SPS has to be stopped until the monitor is repaired

Area covered by ARCON sub system BA4



List of monitors

PAM41: BA4 gate monitor

PATI801G: Stray radiation monitor to protect personnel in the lower part of the tunnel TI8 during SPS beam extraction onto the TED in TT40 or into the TI8 tunnel.

PATT411G: Stray radiation monitor to protect personnel in the lower part of the tunnel TT41 during SPS beam extraction onto the TED in TT40 or into the TI8 tunnel.

PATU421G: Stray radiation monitor to protect personnel in the tunnel TAG41 during beam extraction into TT40.

PATU421N: Stray radiation monitor to protect personnel in the tunnel TAG41 during beam extraction into TT40.

PATU440N: Stray radiation monitor to protect personnel in the tunnel TJ8 during SPS operation without beam extraction.

PAXTA40: Stray radiation monitor to protect personnel in the ECA4 cavern at floor level during SPS operation.

PAXU401: Stray radiation monitor in non accessible part of ECA4 area

PAXU402: Stray radiation monitor in non accessible part of ECA4 area

PAXU403: Stray radiation monitor in the ECX4 area (non accessible)

PAXU404: Stray radiation monitor in non accessible part of ECA4 area

PAXU405: Stray radiation monitor to protect personnel in the ECA4 barracks at floor level during SPS operation.

PBXU501: Backup channel for left monitor PAXU501 on the floor level of ECA5

PCM41: Monitor to control material leaving the radiation area

PCM42: Monitor to control material leaving the radiation area

PMB41: Monitor to control radiation levels close to the ion-exchanger in BA4

PMITT401: Monitor to measure residual dose rate close to the beam line during beam off periods.

PMITT404: Monitor to measure residual dose rate close to the beam line during beam off periods.

PMIU401: Monitor to measure residual dose rate close to the beam line during beam off periods.

PMIU402: Monitor to measure residual dose rate close to the beam line during beam off periods.

PMIU403: Monitor to measure residual dose rate close to the beam line during beam off periods.

PMIU404: Monitor to measure residual dose rate close to the beam line during beam off periods.

PMS42: Monitor to measure stray radiation in the environment around the accelerator

PMV4A: Monitor measuring the airborne radioactivity released to the environment

PMV4F: Monitor measuring the air flow rate released to the environment

PMV4R: Monitor measuring the specific airborne radioactivity released to the environment

Failure of whole ARCON subsystem or its alarm transmission functionality

- SPS must be stopped
- ECA4, CNGS, TAG41, TAG42, TJ8, TI8 and TT41 must be evacuated and closed
- BA4 has to be emptied and closed in case of beam extraction into TT40
- Beam can be restarted
- Inform RP for further action concerning the Arcon problem (phone: 75252 or 74848).
- If the stray radiation monitor (PMS42) is not back in operation within 168 hours, SPS must be stopped until this monitor is operational.

- The consequences in case of a partial failure of the BA4 ARCON will be discussed in the chapter “Procedure of actions to be done in case of problems with single monitors”

Procedure of actions to be followed in case of problems with single monitors

PAM41:

Function: BA4 gate monitor

Procedure to be done in case of failure or unavailability of monitor:

- Beam operation can continue
- Inform RP for further action concerning the monitor problem (phone: 75252 or 74848).

PATI801G: **(monitor in the interlock system)**

Function: stray radiation monitor to protect personnel in the lower part of the tunnel TI8 during SPS beam extraction onto the TED in TT40 or into the TI8 tunnel.

Procedure to be done in case of failure or unavailability of monitor:

- Beam extraction into TT40 must be stopped.
- Whole TI8 tunnel must be emptied and closed
- Door (PPG8780) at the end of TI8 (entry point to LHC) must be closed (if possible interlocked with the SPS beam extraction).
- Beam extraction into TT40 can be restarted
- Inform RP for further action concerning the monitor problem (phone: 75252 or 74848).
- Access to whole TI8 tunnel (up- and downstream door PPG8270) is prohibited until monitor is operational or beam extraction into TT40 is inhibited.

PATT411G: **(monitor in the interlock system)**

Function: stray radiation monitor to protect personnel in the lower part of the tunnel TT41 during SPS beam extraction onto the TED in TT40 or into the TI8 tunnel.

Procedure to be done in case of failure or unavailability of monitor:

- Extraction into TT40 must be stopped.
- Whole TT41 tunnel must be emptied and closed
- Door (PPG4124) at the end of TT41 (entry point to CNGS) must be interlocked with beam extraction.
- Beam extraction into TT40 can be restarted.
- Inform RP for further action concerning the monitor problem (phone: 75252 or 74848).
- Access to whole TT41 tunnel (up- and downstream door PPG4115) is prohibited until monitor is operational or beam extraction into TT40 is inhibited.

PATU421G: (**monitor in the interlock system)**

Function: stray radiation monitor to protect personnel in the tunnel TAG41 during beam extraction into TT40.

Procedure to be done in case of failure or unavailability of monitor:

- Functioning of PATU421N has to be controlled.
- In case PATU421N is operational
  - TT40 extraction can be continued and monitor PATU421G must be repaired
  - Inform RP for further action concerning the monitor problem (phone: 75252 or 74848)
- In case PATU421N is not operational
  - TT40 extraction must be stopped
  - TAG41 and CNGS have to be emptied and closed.
  - Extraction can be restarted
  - Inform RP for further action concerning the monitor problem (phone: 75252 or 74848)
  - Access to TAG41 stays prohibited until either PATU421G or PATU421N is repaired or extraction to TT40 is inhibited

PATU421N: (**monitor in the interlock system)**

Function: stray radiation monitor to protect personnel in the tunnel TAG41 during beam extraction into TT40.

Procedure to be done in case of failure or unavailability of monitor:

- Functioning of PATU421G has to be controlled.
- In case PATU421G is operational
  - Either the alarm levels of the monitor PATU421G have to be lowered by a factor of 7 or the calibration factor (nSv/pC) has to be increased by a factor of 7 in order to account for the reduced sensitivity of this chamber to neutron dominated radiation fields. Ask RP to apply these changes (phone: 75252 or 74848)
  - TT40 extraction can be continued and monitor PATU421N must be repaired
- In case PATU421G is not operational
  - TT40 extraction must be stopped.
  - TAG41 and CNGS have to be emptied and closed
  - Extraction can be restarted
  - Access to TAG41 and CNGS remain prohibited until either PATU421G or PATU421N is repaired or extraction to TT40 is interlocked.

- Inform RP for further action concerning the monitor problem (phone: 75252 or 74848)

PATU440N: (**monitor in the interlock system)**

Function: stray radiation monitor to protect personnel in the tunnel TJ8 during SPS operation without beam extraction.

Procedure to be done in case of failure or unavailability of monitor:

- SPS operation must be stopped
- TJ8 and upper part of TI8 (up to door PPG8270) and upper part of TT41 (up to door PPG4115) have to be emptied and closed.
- Door PPG4115and PPG8270 must be interlocked with SPS operation
- Beam can be restarted
- Inform RP for further action concerning the monitor problem (phone: 75252 or 74848)

PAXTA40: (**monitor in the interlock system)**

Function: stray radiation monitor to protect personnel in the ECA4 cavern at floor level during SPS operation.

Procedure to be done in case of failure or unavailability of monitor:

- SPS operation must be stopped
- ECA4 floor must be emptied and closed.
- If not possible to block access to floor level of ECA4 only, the whole ECA4 area has to be emptied and closed at the surface.
- Beam can be restarted.
- Inform RP for further action concerning the monitor problem (phone: 75252 or 74848).

PAXU401:

Function: stray radiation monitor in non accessible part of ECA4 area

Procedure to be done in case of failure or unavailability of monitor:

- SPS beam operation can continue.
- Monitor needs to be repaired as soon as possible since it gives useful indication of beam losses.
- Inform RP for further action concerning the monitor problem (phone: 75252 or 74848).

PAXU402:

Function: stray radiation monitor in non accessible part of ECA4 area

Procedure to be done in case of failure or unavailability of monitor:

- SPS beam operation can continue.
- Monitor needs to be repaired as soon as possible since it gives indication of beam losses
- Inform RP for further action concerning the monitor problem (phone: 75252 or 74848).

PAXU403:

Function: stray radiation monitor in the ECX4 area (non accessible)

Procedure to be done in case of failure or unavailability of monitor:

- SPS beam operation can continue.
- Monitor needs to be repaired as soon as possible since it gives indication of beam losses
- Inform RP for further action concerning the monitor problem (phone: 75252 or 74848).

PAXU404:

Function: stray radiation monitor in non accessible part of ECA4 area

Procedure to be done in case of failure or unavailability of monitor:

- SPS beam operation can continue.
- Monitor needs to be repaired as soon as possible since it gives indication of beam losses
- Inform RP for further action concerning the monitor problem (phone: 75252 or 74848).

PAXU405: (**monitor in the interlock system)**

Function: stray radiation monitor to protect personnel in the ECA4 barracks at floor level during SPS operation.

Procedure to be done in case of failure or unavailability of monitor:

- SPS operation must be stopped
- Evacuation of ECA4 barracks
- If not possible to block access to barracks only, the whole ECA4 area has to be emptied and closed at the surface.
- Beam can be restarted
- Inform RP for further action concerning the monitor problem (phone: 75252 or 74848).

PBXU501:

Function: backup channel for left monitor PAXU501 on the floor level of ECA5 (non accessible)

Procedure to be done in case of failure or unavailability of monitor:

- SPS beam operation can continue.
- Inform RP for further action concerning the monitor problem (phone: 75252 or 74848).

PCM41:

Function: Monitor to control material leaving the radiation area

Procedure to be done in case of failure or unavailability of monitor:

- Operation can continue since monitor is not critical during beam operation
- Inform RP for further action concerning the monitor problem (phone: 75252 or 74848).

PCM42:

Function: Monitor to control material leaving the radiation area

Procedure to be done in case of failure or unavailability of monitor:

- Operation can continue since monitor is not critical during beam operation
- Inform RP for further action concerning the monitor problem (phone: 75252 or 74848).

PMB41:

Function: Monitor for to control radiation levels close to the ion-exchanger in BA4

Procedure to be done in case of failure or unavailability of monitor:

- SPS operation has to be stopped.
- Area BA4 has to be evacuated and closed.
- SPS operation can be restarted.
- Inform RP for further action concerning the monitor problem (phone: 75252 or 74848).

PMITT401:

Function: Monitor to measure residual dose rate close to the beam line during beam off periods.

Procedure to be done in case of failure or unavailability of monitor:

- Operation can continue since monitor is not critical during beam operation
- Inform RP for further action concerning the monitor problem (phone: 75252 or 74848).

PMITT404:

Function: Monitor to measure residual dose rate close to the beam line during beam off periods.

Procedure to be done in case of failure or unavailability of monitor:

- Operation can continue since monitor is not critical during beam operation
- Inform RP for further action concerning the monitor problem (phone: 75252 or 74848).

PMIU401:

Function: Monitor to measure residual dose rate close to the beam line during beam off periods.

Procedure to be done in case of failure or unavailability of monitor:

- Operation can continue since monitor is not critical during beam operation
- Inform RP for further action concerning the monitor problem (phone: 75252 or 74848).

PMIU402:

Function: Monitor to measure residual dose rate close to the beam line during beam off periods.

Procedure to be done in case of failure or unavailability of monitor:

- Operation can continue since monitor is not critical during beam operation
- Inform RP for further action concerning the monitor problem (phone: 75252 or 74848).

PMIU403:

Function: Monitor to measure residual dose rate close to the beam line during beam off periods.

Procedure to be done in case of failure or unavailability of monitor:

- Operation can continue since monitor is not critical during beam operation
- Inform RP for further action concerning the monitor problem (phone: 75252 or 74848).

PMIU404:

Function: Monitor to measure residual dose rate close to the beam line during beam off periods.

Procedure to be done in case of failure or unavailability of monitor:

- Operation can continue since monitor is not critical during beam operation
- Inform RP for further action concerning the monitor problem (phone: 75252 or 74848).

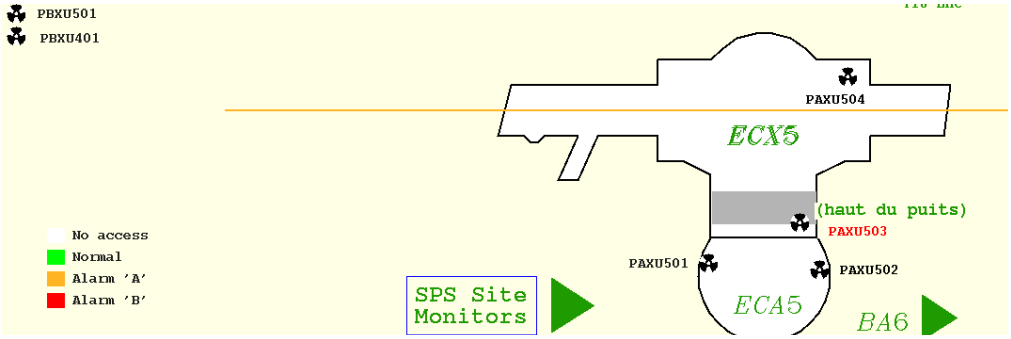
PMS42:

Function: Monitor to measure stray radiation in the environment around the accelerator

Procedure to be done in case of failure or unavailability of monitor:

- SPS operation can continue for 168 hours
- Inform SC/IE for further action concerning the monitor problem (phone: 73893).
- If after 168 hours the monitor is not operational, the SPS has to be stopped until the monitor is repaired

Area covered by ARCON sub system BA5



List of monitors

PAM51: BA1 gate monitor

PAXU501: Stray radiation monitor in non accessible part of ECA5 area

PAXU502: Stray radiation monitor in non accessible part of ECA5 area

PAXU503: Stray radiation monitor to protect personnel at the surface level of ECA5 (BB5)

PAXU504: Stray radiation monitor in the ECX4 area (non accessible)

PBXU401: Backup channel for left gangway in ECA4 (PAXU401)

PCM51: Monitor to control material leaving the radiation area (surface BA5)

PMB51: Monitor for to control radiation levels close to the ion-exchanger in BA5 (surface)

PMS52: Monitor to measure stray radiation in the environment around the accelerator

PMVG51C: Monitor measuring the specific airborne radioactivity released to the environment

PMVG51F: Monitor measuring the air flow rate released to the environment

PMVG51R: Monitor measuring the airborne radioactivity released to the environment

Failure of whole ARCON subsystem or its alarm transmission functionality

- SPS must be stopped
- BA5 and BB5 must be evacuated and closed
- Beam can be restarted
- Inform RP for further action concerning the Arcon problem (phone: 75252 or 74848).
- If the stray radiation monitor (PMS52) is not back in operation within 168 hours, SPS must be stopped until this monitor is operational.
- If the ventilation monitors (PMVG51C, PMVG51F and PMVG51R) are not back in operation within 72 hours, SPS must be stopped until this monitor is operational.
- The consequences in case of a partial failure of the BA5 ARCON will be discussed in the chapter “Procedure of actions to be done in case of problems with single monitors”.

Procedure of actions to be followed in case of problems with single monitors

PAM51:

Function: BA1 gate monitor

Procedure to be done in case of failure or unavailability of monitor:

- Beam operation can continue
- Inform RP for further action concerning the monitor problem (phone: 75252 or 74848).

PAXU501:

Function: stray radiation monitor in non accessible part of ECA5 area

Procedure to be done in case of failure or unavailability of monitor:

- SPS beam operation can continue.
- Monitor needs to be repaired as soon as possible since it gives indication of beam losses
- Inform RP for further action concerning the monitor problem (phone: 75252 or 74848).

PAXU502:

Function: stray radiation monitor in non accessible part of ECA5 area

Procedure to be done in case of failure or unavailability of monitor:

- SPS beam operation can continue.
- Monitor needs to be repaired as soon as possible since it gives indication of beam losses
- Inform RP for further action concerning the monitor problem (phone: 75252 or 74848).

PAXU503: (**monitor in the interlock system)**

Function: stray radiation monitor to protect personnel at the surface level of ECA5 (BB5)

Procedure to be done in case of failure or unavailability of monitor:

- SPS operation must be stopped
- BB5 area has to be emptied and closed
- Beam can be restarted
- Inform RP for further action concerning the monitor problem (phone: 75252 or 74848).

PAXU504:

Function: stray radiation monitor in the ECX4 area (non accessible)

Procedure to be done in case of failure or unavailability of monitor:

- SPS beam operation can continue.
- Monitor needs to be repaired as soon as possible since it gives indication of beam losses
- Inform RP for further action concerning the monitor problem (phone: 75252 or 74848).

PBXU401:

Function: backup channel for left gangway in ECA4 (PAXU401)

Procedure to be done in case of failure or unavailability of monitor:

- SPS beam operation can continue.
- Inform RP for further action concerning the monitor problem (phone: 75252 or 74848).

PCM51:

Function: Monitor to control material leaving the radiation area (surface BA5)

Procedure to be done in case of failure or unavailability of monitor:

- Operation can continue since monitor is not critical during beam operation
- Inform RP for further action concerning the monitor problem (phone: 75252 or 74848).

PMB51:

Function: Monitor for to control radiation levels close to the ion-exchanger in BA5 (surface)

Procedure to be done in case of failure or unavailability of monitor:

- Beam has to be stopped
- Area BA5 has to be evacuated and closed.
- Beam can be restarted
- Inform RP for further action concerning the monitor problem (phone: 75252 or 74848).

PMS52:

Function: Monitor to measure stray radiation in the environment around the accelerator

Procedure to be done in case of failure or unavailability of monitor:

- SPS operation can continue for 168 hours
- Inform SC/IE for further action concerning the monitor problem (phone: 73893).
- If after 168 hours the monitor is not operational, the SPS has to be stopped until the monitor is repaired

PMVG51C:

Function: Monitor measuring the specific airborne radioactivity released to the environment

Procedure to be done in case of failure or unavailability of monitor:

- SPS operation can continue for 72 hours
- Inform SC/IE for further action concerning the monitor problem (phone: 73893).
- If after 72 hours the monitor is not operational, the SPS has to be stopped until the monitor is repaired

PMVG51F:

Function: Monitor measuring the air flow rate released to the environment

Procedure to be done in case of failure or unavailability of monitor:

- SPS operation can continue for 72 hours
- Inform SC/IE for further action concerning the monitor problem (phone: 73893).
- If after 72 hours the monitor is not operational, the SPS has to be stopped until the monitor is repaired

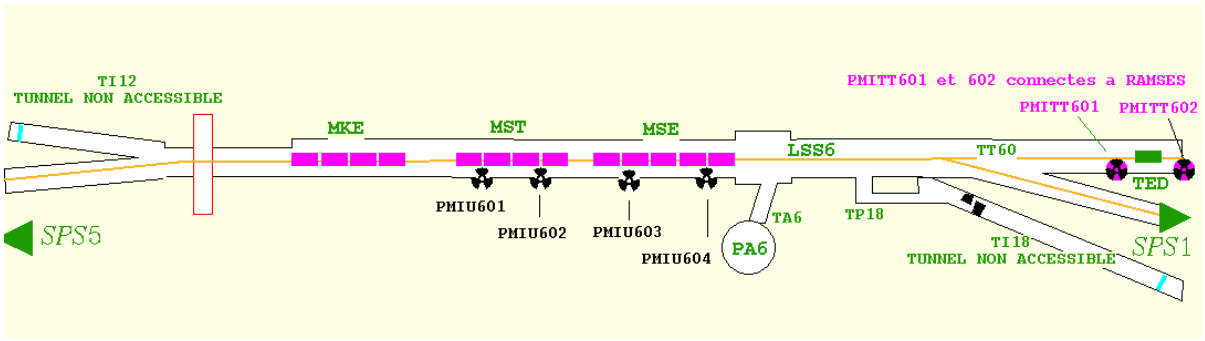
PMVG51R:

Function: Monitor measuring the airborne radioactivity released to the environment

Procedure to be done in case of failure or unavailability of monitor:

- SPS operation can continue for 72 hours
- Inform SC/IE for further action concerning the monitor problem (phone: 73893).
- If after 72 hours the monitor is not operational, the SPS has to be stopped until the monitor is repaired

Area covered by ARCON sub system BA6



List of monitors

PAM61: BA1 gate monitor

PATTI2: Stray radiation monitor to protect personnel in the lower part of the tunnel TI2 during SPS beam extraction onto the TED in TT60.

PATTT60: Stray radiation monitor to protect personnel in TCC6, BA7, TT61 and upstream part of TI2

PCM61: Monitor to control material leaving the radiation area (surface BA6)

PCM71: Monitor to control material leaving the radiation area (surface BA7)

PMB61: Monitor to control radiation levels close to the ion-exchanger in BA6 (surface)

PMB71: Monitor to control radiation levels in the radiation local in BA7 (surface)

PMIU601: Monitor to measure residual dose rate close to the beam line during beam off periods.

PMIU602: Monitor to measure residual dose rate close to the beam line during beam off periods.

PMIU603: Monitor to measure residual dose rate close to the beam line during beam off periods.

PMIU604: Monitor to measure residual dose rate close to the beam line during beam off periods.

PMS62: Monitor to measure stray radiation in the environment around the accelerator

PMS72: Monitor to measure stray radiation in the environment around the accelerator

PMVG70C: Monitor measuring the specific airborne radioactivity released to the environment

PMVG70F: Monitor measuring the air flow rate released to the environment

PMVG70R: Monitor measuring the airborne radioactivity released to the environment

PMW61I: Monitor measuring the radioactivity in water released to the environment

PMW61W: Monitor measuring the radioactivity in water released to the environment

PMW62I: Monitor measuring the radioactivity in water released to the environment

PMW62W: Monitor measuring the radioactivity in water released to the environment

Failure of whole ARCON subsystem or its alarm transmission functionality

- SPS must be stopped
- BA7 (underground area), TCC6, TT61 and upstream part of TI2 (door PPG2145) have to be emptied and closed.
- Beam can be restarted
- Inform RP for further action concerning the Arcon problem (phone: 75252 or 74848).
- If the stray radiation monitors (PMS62 and PMS72) are not back in operation within 168 hours, SPS must be stopped until this monitor is operational.
- If the ventilation monitors (PMVG70C, PMVG70F and PMVG70R) and water monitors (PMW61I, PMW61W, PMW62I and PMW62W) are not back in operation within 72 hours, SPS must be stopped until this monitor is operational.
- The consequences in case of a partial failure of the BA5 ARCON will be discussed in the chapter “Procedure of actions to be done in case of problems with single monitors”.

Procedure of actions to be followed in case of problems with single monitors

PAM61:

Function: BA1 gate monitor

Procedure to be done in case of failure or unavailability of monitor:

- Beam operation can continue
- Inform RP for further action concerning the monitor problem (phone: 75252 or 74848).

PATTI2: **(monitor in the interlock system)**

Function: stray radiation monitor to protect personnel in the lower part of the tunnel TI2 during SPS beam extraction onto the TED in TT60.

Procedure to be done in case of failure or unavailability of monitor:

- Beam extraction into TT60 must be stopped.
- Whole TI2 tunnel must be emptied and closed
- Door at the end of TI2 (entry point to LHC) must be closed (if possible interlocked with beam extraction into TT60).
- Beam extraction into TT60 can be restarted
- Access to whole TI2 tunnel (up- and downstream door PPG2145) is prohibited until monitor is operational or beam extraction into TT60 is inhibited.
- Inform RP for further action concerning the monitor problem (phone: 75252 or 74848).

PATTT60: **(monitor in the interlock system)**

Function: stray radiation monitor to protect personnel in TCC6, BA7, TT61 and upstream part of TI2

Procedure to be done in case of failure or unavailability of monitor:

- SPS beam operation must be stopped.
- TCC6, BA7, TT61 and upstream part of TI2 (door PPG2145) have to be emptied and closed.
- Doors PPG2145 (middle of TI2) has to be interlocked with the SPS operation
- Beam extraction into TT60 can be restarted
- Access to TCC6, BA7, TT61 and upstream part of TI2 is prohibited until monitor is operational or beam extraction into TT60 is inhibited.
- Inform RP for further action concerning the monitor problem (phone: 75252 or 74848).

PCM61:

Function: Monitor to control material leaving the radiation area (surface BA6)

Procedure to be done in case of failure or unavailability of monitor:

- Operation can continue since monitor is not critical during beam operation
- Inform RP for further action concerning the monitor problem (phone: 75252 or 74848).

PCM71:

Function: Monitor to control material leaving the radiation area (surface BA7)

Procedure to be done in case of failure or unavailability of monitor:

- Operation can continue since monitor is not critical during beam operation
- Inform RP for further action concerning the monitor problem (phone: 75252 or 74848).

PMB61:

Function: Monitor to control radiation levels close to the ion-exchanger in BA6 (surface)

Procedure to be done in case of failure or unavailability of monitor:

- Beam has to be stopped
- Area BA6 has to be evacuated and closed.
- Beam can be restarted
- Inform RP for further action concerning the monitor problem (phone: 75252 or 74848).

PMB71:

Function: Monitor to control radiation levels in the radiation local in BA7 (surface)

Procedure to be done in case of failure or unavailability of monitor:

- Operation can continue since monitor is not critical during beam operation
- Inform RP for further action concerning the monitor problem (phone: 75252 or 74848).

PMIU601:

Function: Monitor to measure residual dose rate close to the beam line during beam off periods.

Procedure to be done in case of failure or unavailability of monitor:

- Operation can continue since monitor is not critical during beam operation
- Inform RP for further action concerning the monitor problem (phone: 75252 or 74848).

PMIU602:

Function: Monitor to measure residual dose rate close to the beam line during beam off periods.

Procedure to be done in case of failure or unavailability of monitor:

- Operation can continue since monitor is not critical during beam operation
- Inform RP for further action concerning the monitor problem (phone: 75252 or 74848).

PMIU603:

Function: Monitor to measure residual dose rate close to the beam line during beam off periods.

Procedure to be done in case of failure or unavailability of monitor:

- Operation can continue since monitor is not critical during beam operation
- Inform RP for further action concerning the monitor problem (phone: 75252 or 74848).

PMIU604:

Function: Monitor to measure residual dose rate close to the beam line during beam off periods.

Procedure to be done in case of failure or unavailability of monitor:

- Operation can continue since monitor is not critical during beam operation
- Inform RP for further action concerning the monitor problem (phone: 75252 or 74848).

PMS62:

Function: Monitor to measure stray radiation in the environment around the accelerator

Procedure to be done in case of failure or unavailability of monitor:

- SPS operation can continue for 168 hours
- Inform SC/IE for further action concerning the monitor problem (phone: 73893).
- If after 168 hours the monitor is not operational, the SPS has to be stopped until the monitor is repaired

PMS72:

Function: Monitor to measure stray radiation in the environment around the accelerator

Procedure to be done in case of failure or unavailability of monitor:

- SPS operation can continue for 168 hours
- Inform SC/IE for further action concerning the monitor problem (phone: 73893).
- If after 168 hours the monitor is not operational, the SPS has to be stopped until the monitor is repaired

PMVG70C:

Function: Monitor measuring the specific airborne radioactivity released to the environment

Procedure to be done in case of failure or unavailability of monitor:

- SPS operation can continue for 72 hours
- Inform SC/IE for further action concerning the monitor problem (phone: 73893).
- If after 72 hours the monitor is not operational, the SPS has to be stopped until the monitor is repaired

PMVG70F:

Function: Monitor measuring the air flow rate released to the environment

Procedure to be done in case of failure or unavailability of monitor:

- SPS operation can continue for 72 hours
- Inform SC/IE for further action concerning the monitor problem (phone: 73893).
- If after 72 hours the monitor is not operational, the SPS has to be stopped until the monitor is repaired

PMVG70R:

Function: Monitor measuring the airborne radioactivity released to the environment

Procedure to be done in case of failure or unavailability of monitor:

- SPS operation can continue for 72 hours
- Inform SC/IE for further action concerning the monitor problem (phone: 73893).
- If after 72 hours the monitor is not operational, the SPS has to be stopped until the monitor is repaired

PMW61I:

Function: Monitor measuring the radioactivity in water released to the environment

Procedure to be done in case of failure or unavailability of monitor:

- SPS operation can continue for 72 hours
- Inform SC/IE for further action concerning the monitor problem (phone: 73893).
- If after 72 hours the monitor is not operational, the SPS has to be stopped until the monitor is repaired

PMW61W:

Function: Monitor measuring the radioactivity in water released to the environment

Procedure to be done in case of failure or unavailability of monitor:

- SPS operation can continue for 72 hours
- Inform SC/IE for further action concerning the monitor problem (phone: 73893).
- If after 72 hours the monitor is not operational, the SPS has to be stopped until the monitor is repaired

PMW62I:

Function: Monitor measuring the radioactivity in water released to the environment

Procedure to be done in case of failure or unavailability of monitor:

- SPS operation can continue for 72 hours
- Inform SC/IE for further action concerning the monitor problem (phone: 73893).
- If after 72 hours the monitor is not operational, the SPS has to be stopped until the monitor is repaired

PMW62W:

Function: Monitor measuring the radioactivity in water released to the environment

Procedure to be done in case of failure or unavailability of monitor:

- SPS operation can continue for 72 hours
- Inform SC/IE for further action concerning the monitor problem (phone: 73893).
- If after 72 hours the monitor is not operational, the SPS has to be stopped until the monitor is repaired