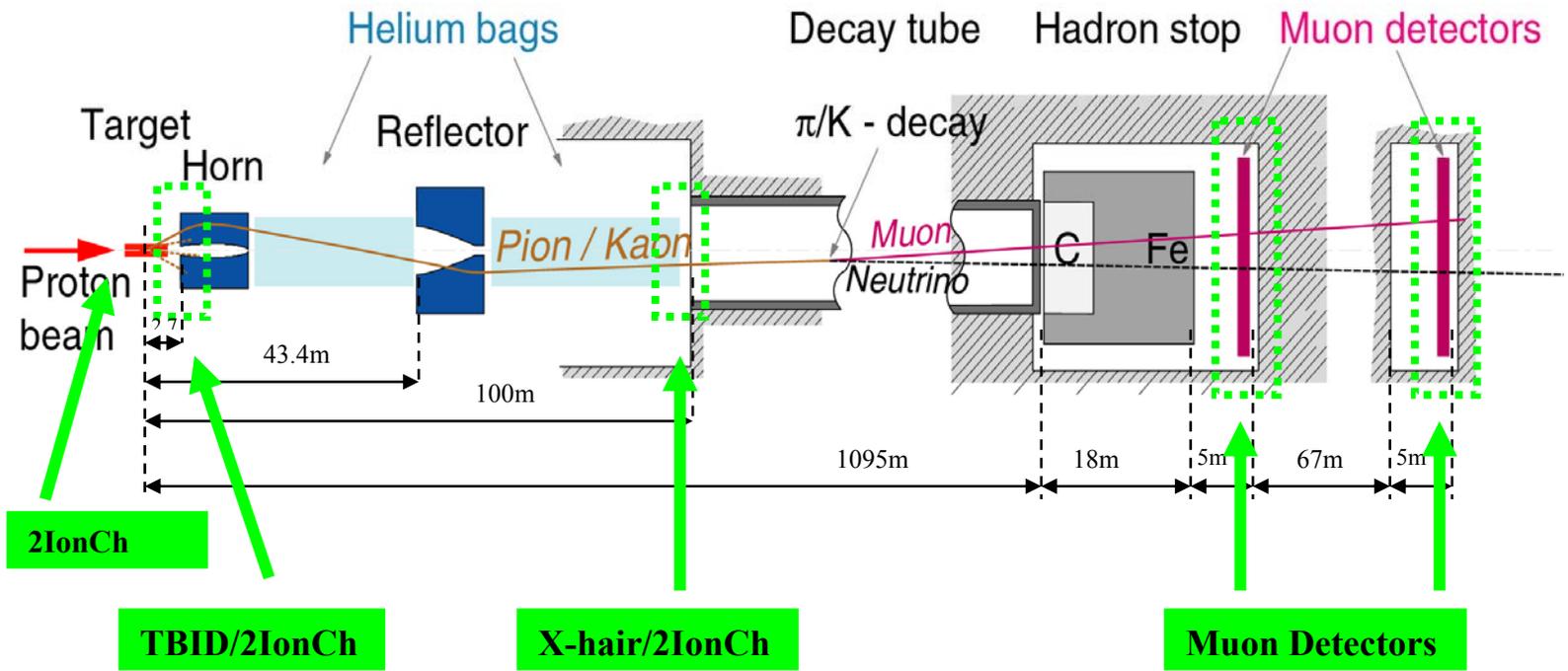
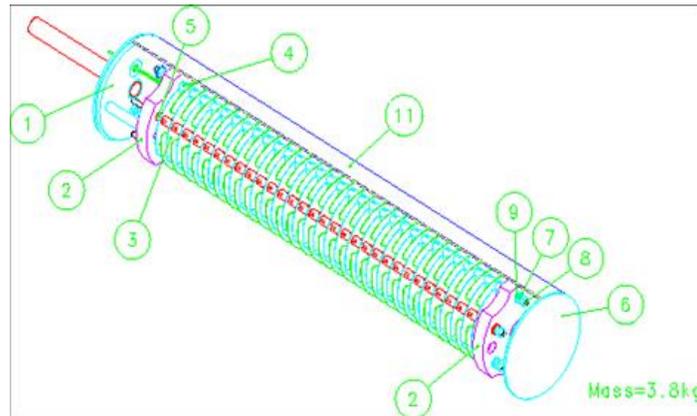


CNGS Secondary Beam Control Requirements



BDI Instrumentation

Ionization Chambers in TCC4



Ionization Chamber.

Dead-line: February 2006

The values are read out in Gray (as the BLMs in the proton line) using the FESA class 'BLMI'. A constant conversion factor has to be applied in CESAR to translate from 'Gray' to 'charges' for each channel out of 40.

The reading of the current transformer BFCT412425 is the equivalent of 'NORM2' in the other EA beam-lines.

GUI:

Operator Level:

For all detectors:

- **Set gain per channel (1,2,4,8,16,32) – corresponds to amplifier gain**
- **Set gain for all 6 Ionization chamber (low, high) – corresponds to different capacitance**
- Display signal status ('saturation-flag': (LOW,) OK, HIGH)

Ionization Chambers at the Collimator

- Read IC_COLL_L = BLML412445/BFCT
- Read IC_COLL_R = BLMR412445/BFCT

- Graphs of IC_COLL_L and IC_COLL_R versus extraction, cycle numbers and time.

Ionization Chambers at the TBID

- Read IC_TBID_L = XGBL400002/BFCT
- Read IC_TBID_R = XGBL400003/BFCT
- Graphs of IC_TBID_L and IC_TBID_R versus extraction, cycle numbers and time.

Ionization Chambers at the Cross-Hair

- Read IC_XHAIR_L = XGBL400094/BFCT
- Read IC_XHAIR_R = XGBL400095/BFCT
- Graphs of IC_XHAIR_L and IC_XHAIR_R versus extraction, cycle numbers and time.

Position/Angle scans for the IC_TBID_L and IC_TBID_R at the TBID

Used magnets:

- i. MDSV412153
- ii. MDSH412244
- iii. MDSV412419
- iv. MDSH412422

- Graph of IC_TBID_L, IC_TBID_R vs. **scan parameter (position or angle)**
- **Show value of BFCT (in the same graph)**
- Calculate centre value of measured distribution
- ➔ **Examples of graph see muon monitors!!!**

Position/Angle scans for the IC_XHAIR_L and IC_XHAIR_R at the Cross-hair

Used magnets:

- v. MDSV412153
- vi. MDSH412244
- vii. MDSV412419
- viii. MDSH412422

- Graph of IC_XHAIR_L, IC_XHAIR_R vs. **scan parameter (position or angle)**
- **Show value of BFCT (in the same graph)**
- Calculate centre value of measured distribution
- ➔ **Examples of graph see muon monitors!!!**

Logging:

- Log gain
- The value of each ionization chamber has to be logged (BLML412445, BLMR412445, XGBL400002, XGBL400003, XGBL400094, XGBL400095). Note: this is in Gray. **How do we log the conversion-factor from Gray to Charges?**
- Is it possible to log the double scans (ionization chambers vs. magnet currents). It anyway will be calculated in CESAR. **(Vito & Marine to discuss-> yes (15.11.05))**

Alarm:

Ionization chambers at the collimator are hardware interlocked. → Alarm.

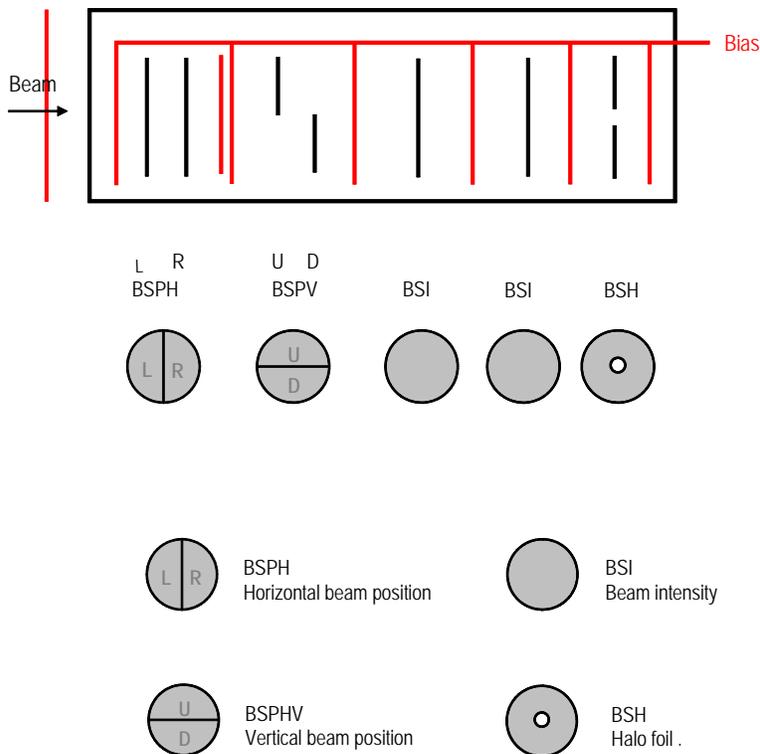
Other alarms?

- Alarm when IC_TBID_L/IC_TBID_R passes a certain threshold. → included in CESAR, sends Alarm to LASER
- There will be software interlocks → then Alarm!

A first draft of the *functional specifications* for the SEM acquisition system that is used for the **TBID** and the **Muon Monitors** can be found at <https://edms.cern.ch/file/639610/1/bestldDoc.pdf>

TBID (XGTB400003)

TBID : Target Beam Instrumentation Downstream



Dead-line: January 2006.

The output format of the TBID is in ‘charges’ (Unit = Coulomb) and are acquired using **the FESA class ‘BESTLD’**. *(It will be up to CNGS experimenters to provide the calibration factor $Ccal_n$ for each detector. By default all factors will be set to 1.0.)*

The reading of the current transformer BFCT412425 is the equivalent of ‘NORM2’ in the other EA beam-lines.

All graphs/plots must be printable.

GUI:

Operator Level:

- **Set gain per channel (1,2,4,8,16) – corresponds to amplifier gain**
- **Set gain for all foils (1, 10, 100) – corresponds to different capacitance**
- Display signal status ('saturation-flag': LOW, OK, HIGH)

The elements that need to be read out are several foils in the TBID:

- BSI₁
- BSI₂
- BSPHL
- BSPHR
- BSPVU
- BSPVD
- BSH

and

- BFCT (BFCT412425) **using the FESA class BCTFI**

The BFCT equipment will also return calibrated intensity data (charges).

2. Intensity (from BSI integral foils)

- The fixed calibration factors will be calculated by acquiring the signals with target 'out' and doing:

$$Ccal_n = BFCT/BSI_n$$

- Once the calibration factors have been established,

→ **Ccal_n must be set to the equipment (!!!!)**

in order to calibrate on the equipment level the signals (*By default all factors will be set to 1.0 without calibration*) with the following formula:

$$INTBSI_1 = BSI_1 * Ccal_1$$

$$INTBSI_2 = BSI_2 * Ccal_2$$

3. Multiplicity (from BSI integral foils)

The multiplicity values M_{1n}, M_{2n} are calculated as:

$$M_{1n} = \text{INTBSI}_{1n} / \text{BFCT}$$

$$M_{2n} = \text{INTBSI}_{2n} / \text{BFCT}$$

- Graphs of M_{1n} , M_{2n} vs. extractions, cycle numbers and time (e.g. last hour, last week, ...)

4. Symmetry (from BSP split foils)

- Measure values:

- i. $R_n = \text{BSPHR}$

- ii. $L_n = \text{BSPHL}$

- iii. $U_n = \text{BSPVU}$

- iv. $D_n = \text{BSPVD}$

- v. $A_H = (L_n - R_n) / (L_n + R_n)$

- vi. $A_V = (U_n - D_n) / (U_n + D_n)$

- vii. $S_H = 1 - |A_H|$

- viii. $S_V = 1 - |A_V|$

- ix. $S_{\text{POS}_n} = \sqrt{S_H \cdot S_V}$

- Graphs of v.-ix. vs. extractions, cycle numbers and time

5. Halo (from BSH integral foil)

- Measure normalized halo H_n

- i. $H_n = \text{BSH} / \text{BSI}_{n(1 \text{ or } 2)}$

- Graphs of H_n vs. extractions, cycle numbers and time

6. Position/Angle double scans

Used magnets:

- ix. MDSV412153

- x. MDSH412244

- xi. MDSV412419

- xii. MDSH412422

- Graph of M_{1n} , M_{2n} vs. **scan parameter (position or angle)**
- **Show value of BFCT (in the same graph)**
- Calculate centre value of measured distribution
- **→ Examples of graph see muon monitors!!!**

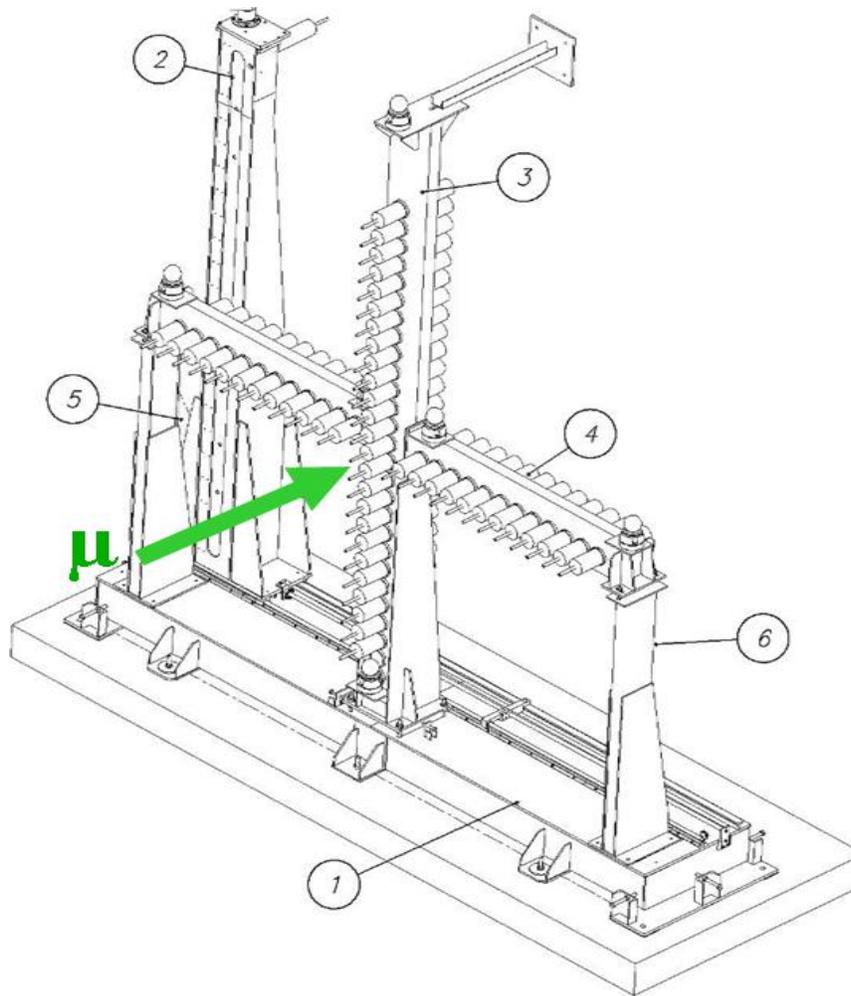
Logging:

- Log gain.
- The raw data from the TBID foils: BSI₁, BSI₂, BSPHL, BSPHR, BSPVU, BSPVD, BSH
- Multiplicity INTBSI_{1n}, INTBSI_{2n} (not normalized with BFCT, but calibrated with 'no target run' Ccal_n).
- Symmetry and Halo: this includes simple calculations. Can this combined with CESAR? (Vito & Marine to discuss -> yes (15.11.05))
- Is it possible to log the double scans (TBID vs. magnet currents). It anyway will be calculated in CESAR. (Vito & Marine to discuss -> yes (15.11.05))

Alarms:

- Alarm when multiplicity M_{1n}, M_{2n} passes a certain threshold. → included in CESAR, sends Alarm to LASER
- There will be software interlocks → then Alarm!

Muon Monitors



At the moment the muon detector consisting of 17 fixed Muon Monitors and one movable Monitor (2).

Dead-line: February 2006

There is a Muon Detector XGMM401118 in TNM41 (pit#1) and another Muon Detector XGMM401190 in TNM42 (pit#2). Each of the Muon Detectors consists of 17 fixed Muon Monitors and one movable Muon Monitor. **The total possible muon monitor number per pit is 42 (41 fixed muon monitors plus 1 movable monitor).**

The values are read out as 'charges' using the FESA class 'BESTLD'.

The reading of the current transformer BFCT412425 is the equivalent of 'NORM2' in the other EA beam-lines.

GUI:

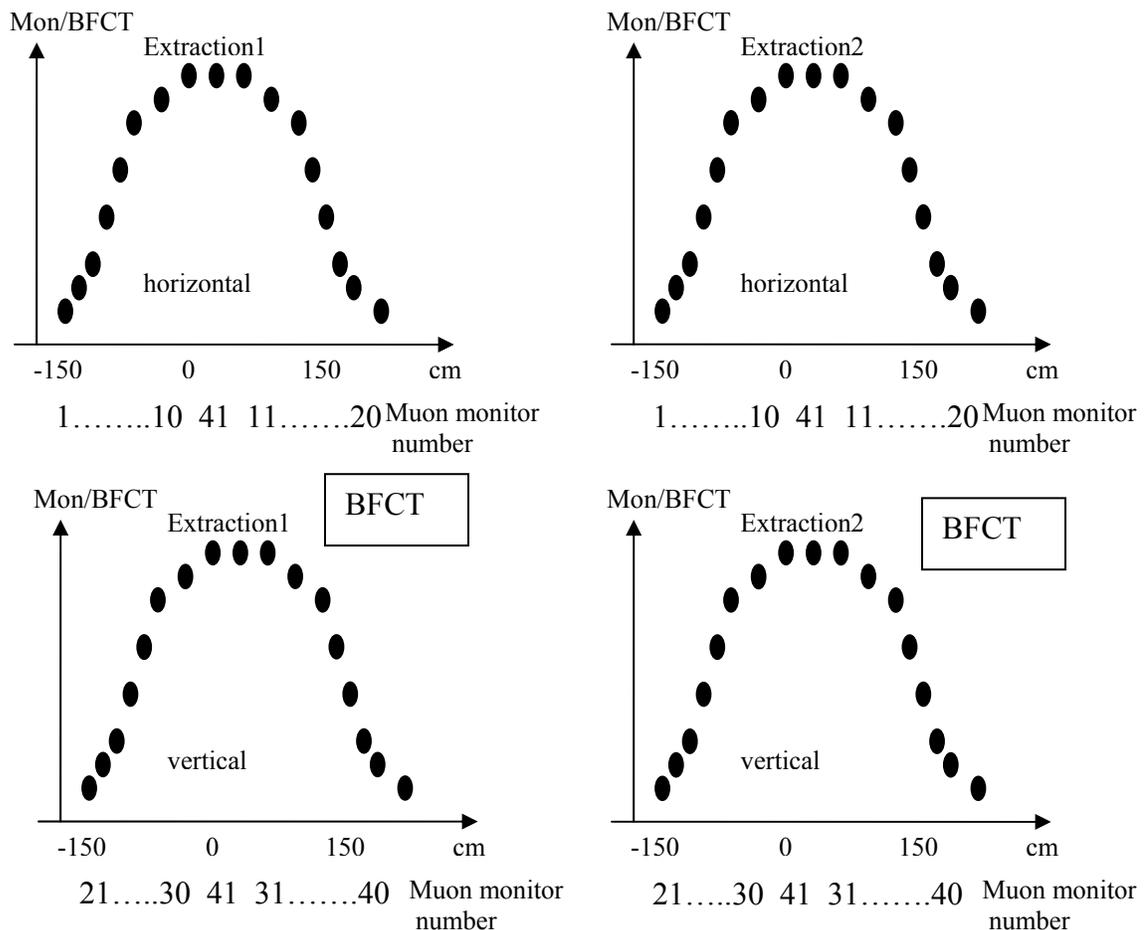
Operator Level:

- Set gain per channel (1,2,4,8,16) – corresponds to amplifier gain
- Set gain for all detectors per pit (1, 10, 100) – corresponds to different capacitance
- signal status (‘saturation-flag’: (LOW,) OK, HIGH)

For the muon monitor XGMM401118 in chambers TNM41 (pit#1) and for XGMM401190 in TNM42 (pit#2):

Normalized Monitor = Monitor/BFCT!

- Read and calculate normalized Monitor1
- Read and calculate normalized Monitor2
- ...
- Read and calculate normalized Monitor17



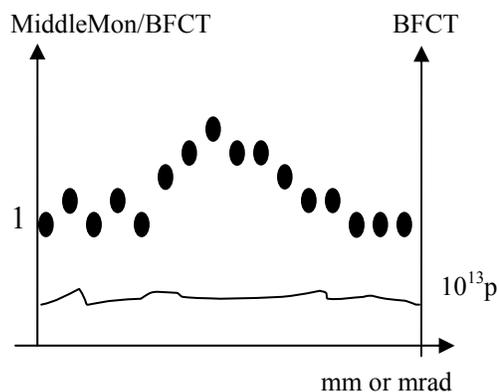
- Graph of horizontal normalized monitors versus monitor position and monitor number
- Graph of vertical normalized monitors versus monitor position and monitor number
- Show value of BFCT
- Show list of muon detectors that saturate (scroll)
- Save scan

Comment: Extraction 1 and 2 could also be in the same plot.

In the plot saturating detectors are shown in a different color.

Position/Angle Scans

- Set min/max value for position scan in [mm]
- Set min/max value for angle scan in [mrad]
- Graph of normalized monitor in the middle versus scan parameters (position or angle)
- Show value of BFCT
- Save scan
- **!!!! Limits of scans must be known!!!!!!**



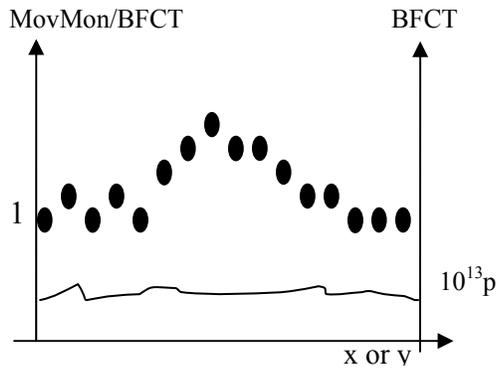
Movable Muon Motor controlled with two BOSTEP instances (X, Y)

- Read position
- Reset (home)
- Initiate
- IN
- OUT
- Error message

Two kinds of scanning:

1. scanning in X,Y

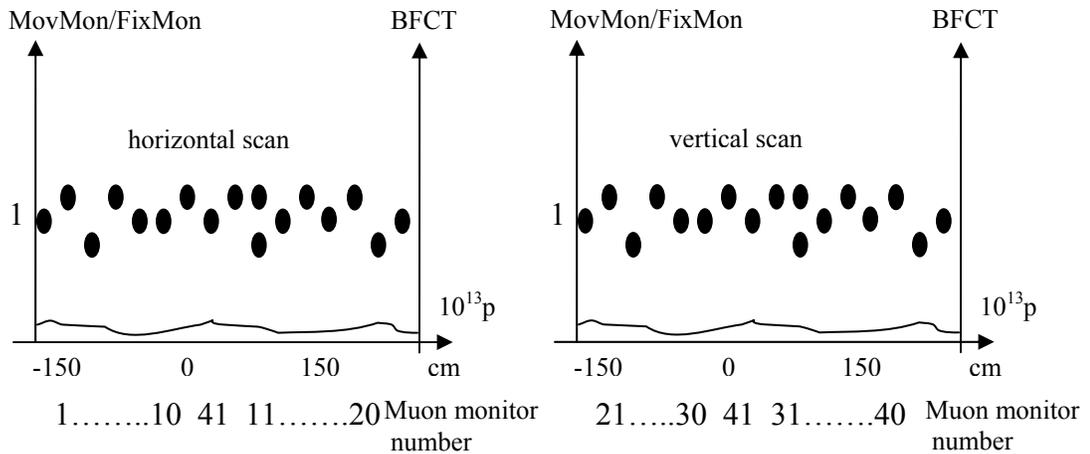
- set x_{start} , set x_{stop} , set step-size
- set y_{start} , set y_{stop} , set step-size
- graph of normalized movable monitor versus scan-steps in x (y)
- Show value of BFCT
- Show values during scanning (x_{pos} , y_{pos} , normalized value, BFCT)
- Save scan



2. Scanning along the fixed monitors

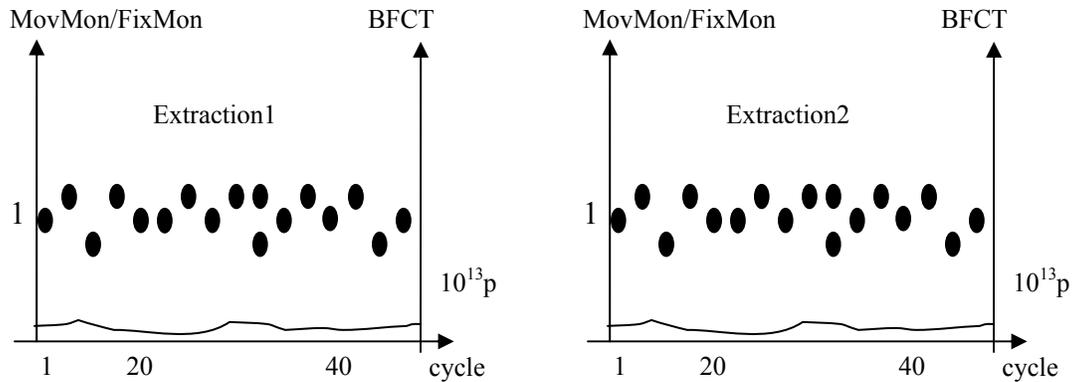
Calibration scan:

- Move movable monitor along horizontal monitors
- Move movable monitor along vertical monitors
- Graph of horizontal and vertical scan. Ratio movable monitor/ fixed monitor versus monitor position and monitor number
- Show value of BFCT
- Save scan



Stability scan:

- Set movable monitor at a position of a certain fixed monitor
- Set for how many cycles the measurements are done
- Graph of ratio movable monitor/fixed monitor versus cycle-number
- Show value of BFCT
- Save scan



Comment: eventually extraction 1 and 2 can be shown in the same plot.

Camera controlled with two BTVI instances (pit#1, pit#2)

- On
- Off
- Real-time observation of camera signals

Light controlled with two BTVI instances (pit#1, pit#2)

- On
- Off

Logging:

- Log gain.
- Reading of each muon monitor (not normalized values).
- Reading of movable monitor

- For movable monitor: Log position (X,Y)

Alarms:

→ Alarm

When movable monitor is stuck?

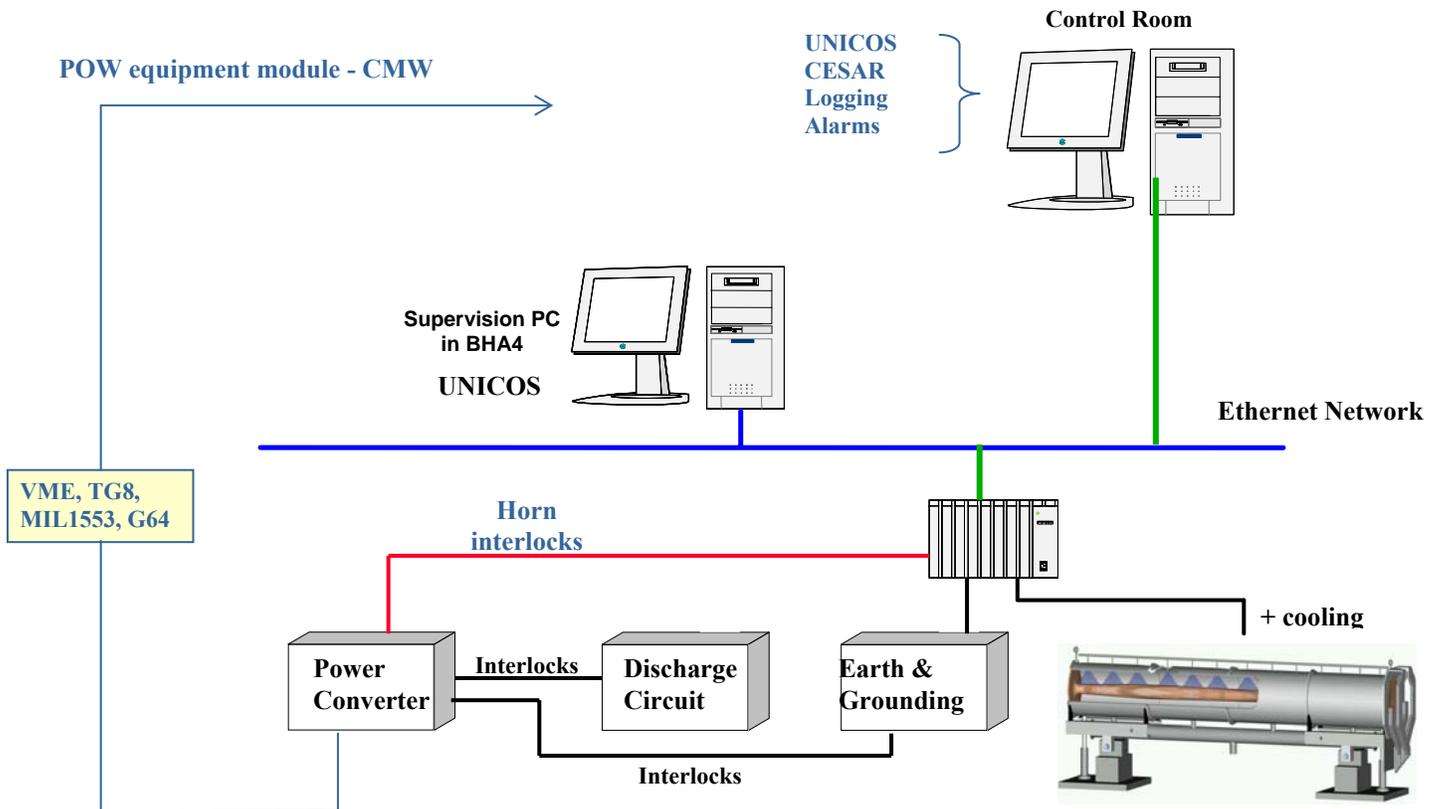
When camera does not work?

- Alarm when centered Monitor/BFCT passes a certain threshold. → included in CESAR, sends Alarm to LASER
- Alarm when some asymmetries (→**TBD!!**) concerning all monitors pass a certain threshold. → included in CESAR, sends Alarm to LASER

- There will be software interlocks → then Alarm!

Horn/Reflector

The Horn/Reflector control can be separated into two systems: the Power Supply/Converter and the Equipment system.



Power Supply/Converter

Power Supply/Converters system is based on POW / CESAR.
Horn/Reflector charging/discharging with POW (Principle is similar to Kicker)
In POW: interlock from Horn/Reflector equipment is flagged as external error....

GUI (gives working Set/Knobs, done by CESAR)

Operator Level:

Current

- ON
- OFF
- STANDBY
- RESET

- Error message:
 - Internal error
 - External error (**concerns horn/reflector equipment (UNICOS-part)**)

- Set Current (+/- 10% of nominal)
- Read current of pulse 1
- Read current of pulse 2

Visualize Pulse

From OASIS (or sampler)

- Shows analog signal of the pulse

Timing

- Enable/Disable FW (ForeWarning)

Single/Double Pulse

- Like it is done for the septum PE.SMH16 in PS:
 - Single pulse: when ref2 of message 1553 ==0
 - Double pulse: when ref2 of message 1553 <>0

Expert Level:

- Set nominal current
- Set current limits, etc...

Timing

From TG8... (class **PTIM-V**)

- FW (ForeWarning)

- W (Warning)
- ST1 (Start1)
- ACQ1 (Acquisition1)
- ACQ2 (Acquisition2)

TIMINGS should be logged. To be confirmed.

Horn/Reflector Equipment

PLC-based → UNICOS is used.

GUI: A small supervision application with synoptics is (will be) is already developed.

Attention: UNICOS runs only on Windows, Working Set on both Windows and Linux.

GUI

Operator Level:

Hydraulic system near TSG43 for the Horn and TSG45 for the Reflector

- Pump temperature
- Error message of the pump
- Command Stop the pump
- Command Start the pump

- Flow in the demineralization circuit
- Temperature at horn entrance (exit of water cooling system)
- Temperature at horn exit (exit of water cooling system)
- Pressure at horn entrance (exit of water cooling system)
- Flow at horn entrance (exit of water cooling system)
- Conductivity at horn entrance (exit of water cooling system)

- Temperature of chilled water at entrance to water cooling system
- Temperature of chilled water at exit of water cooling system
- Primary flow chilled water network

- Water level in the recovering tank (2x)

→ *Error message of the hydraulic system (sent to CESAR Horn/Reflector part as external error)*

Electrical systems in TSG4 (near TSG43 and TSG45)

Every transformer in TSG is made of 4 secondary coils. For every coil the temperature is measured.

- Temperature at transformer exit 1
- Temperature at transformer exit 2
- Temperature at transformer exit 3
- Temperature at transformer exit 4

→ *Error message for the electrical system (sent to CESAR Horn/Reflector part as external error)*

→ *Check whether to measure also current at each transformer exit → Gilles!*

Polarity inversion (neutrino/antineutrino)

- Status Remote
- Status Ready
- Status Neutrino
- Status Antineutrino

Grounding

- Status Remote
- Status Ready
- Status Earth
- Status Normal

Expert Level:

- Command Neutrino
- Command Antineutrino

Alarms

LASER: alarms handling program

Two alarms, provided by the Power Converter System:

1. Alarm 1: something is wrong in the internal system (i.e. Power Converter)
2. Alarm 2: something is wrong in the external system (i.e. Equipment)

This is similar to the error messages in the power converter system

Logging

Horn/Reflector Power Converter:

To be discussed within AB/CO (Vito, Veronique) as the same time stamp as for FESA has to be used.

How to store acquisition in the right variable (I or I + II) according to actual extraction scheme? See POW-V format.

List of data to log:

Current, status (On/Off/Standby/Reset), 1 or 2 extractions, Timing!

Horn/Reflector equipment:

Logging is sent from PVSS to LHC logging. The delay is configurable, typically 5 min.

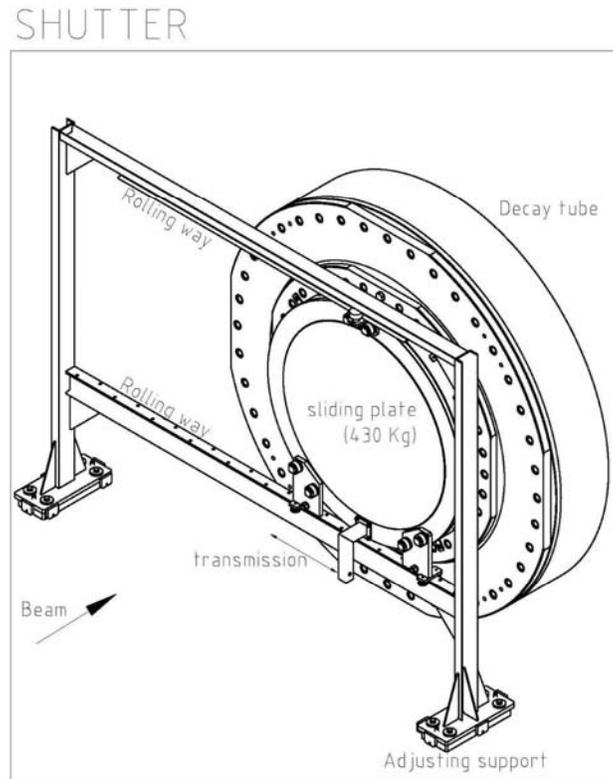
H. Milcent...

To be checked: same time stamping for both PVSS and Java

ACCESS

Access is controlled by the SPS Access system. The access system sends a request for access to Gilles' system. Gilles sends an 'OFF' to the power supply (via HW interlock), then the Horn/Reflector is grounded. Once finished a feedback comes back to the access system. Attention: No control from the OP GUI!

Shutter



A detailed list of the FESA operator interface properties has been established by A. Masi (see fesa1_CNGS.xls).

GUI

Operator Level:

Acquisition:

- Acquisition time stamp `acqStamp`
- Cycle stamp (occurrence) `cycleStamp`
- Current position of shutter [mm] `positionShutter`

- Minimum position of shutter [mm] positionShutter_min
- Maximum position of shutter [mm] positionShutter_max
- Minimum position of shutter [mm] positionShutter_closed
- Maximum position of shutter [mm] positionShutter_opened
- Status of shutter position positionShutter_status
- Status of closed switch of shutter switchClosedShutter
- Status of opened switch of shutter switchOpenedShutter

Status:

- Shutter errors shutterErrorsBitPattern
- Message of the error (string) errorMsg
- Summary of the device status status
- Shutter opening in progress ShutterOpening
- Shutter closing in progress ShutterClosing
- Device mode (always ON) Mode

Settings:

- Request to open the shutter shutterOpenRequest
- Request to close the shutter shutterCloseRequest
- Request to stop the shutter motion shutterStopRequest

Expert Level:

Status:

- Shutter is in safety mode shutterIsSafety

Settings:

- Request to open the shutter shutterOpenRequest
- Request to close the shutter shutterCloseRequest
- Request to stop the shutter motion shutterStopRequest
- Ratio between potentiometer and physical position shutterRatio
- Offset to calculate the physical position shutterOffset
- Closed position to stop the motor [mm] shutterClosedPosition
- Opened position to stop the motor [mm] shutterOpenedPosition

Logging

List of parameters to be logged:
positionShutter, switchClosedShutter, switchOpenShutter

Alarms

1. Shutter is stuck → alarm – highest level! Beam must be switched off!

Decay Tube

AT/VAC, PVSS; Victor, Isabelle Laugier

GUI: Will be done as the vacuum pumps in the North Area.!

→ Mapping from device to MW should be ok according to Isabelle.

Herve Milcent, Celine Vouillermoz!

What parameters to see → vacuum value.

Logging

TBC: PVSS or standard logging ? (Vito & Marine to discuss)

(according to Vito: PVSS) → Check with Herve Milcent

Alarms

→ Check with Herve Milcent- done as for North Area?

Helium Tube

GUI: Analog acquisition card into Gilles' PLC from Oxymeter

Might be included into Gilles Horn/Reflector Equipment Software (PVSS, Unicos)

Logging

Directly from PVSS → Check with Gilles, Herve Milcent

Alarms

Directly from PVSS, needs configuration file! → Check with Gilles! If it is that complicated, then there will not be an alarm!

Temperature Probes

GUI: Didier Blanc, Robin Martini,

Logging

Robin Martini (automatically); then TIMBER!

Alarms

Directly, special category for CNGS (should not only be in 'Technical Infrastructure' Alarm system)

Target

GUI: CESAR, A. Masi, Vito, Luca Bruno,

Logging

Usually with Fesa-class CNGSShutter- is done via A. Masi and Marine.

But:

2 values from CV: **humidity and ozone.**

Coordinated via Didier Blanc, Bernard Pirollet, Robin Martini

Alarms

As is done for logging?

Timing

Application to read and visualize the logged data at Gran-Sasso

Windows Terminal Server (WTS) or another application gateway (e.g. Ixplus)

To be further defined!