

**CERN**  
CH-1211 Geneva 23  
Switzerland



the  
**SPS-LHC**  
Division

**SL-BI Software Section  
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## User Manual & Trouble Shooting

# BI Scrapers

### Abstract

The SPS Scrapers have been designed to control the emittance. It could also occasionally be used as a way to control the beam intensity. **It's currently set for the second proton cycle (proton MD cycle)**. It's possible to use it during the first proton cycle but this requires an software intervention described in this document. The usage process described in this document clearly shows that this is still a **"prototype non operational MD"** instrument.

**Author**

SL/BI/SW

# Table of Contents

|           |  |          |
|-----------|--|----------|
| <b>1.</b> | <b>PURPOSE .....</b>   | <b>3</b> |
| <b>2.</b> | <b>PROCESS .....</b>   | <b>3</b> |
| <hr/>     |  |          |
| 2.1.      | PREPARE THE INSTRUMENT .....                                     | 3        |
| 2.1.1.    | CHECK.....   | 3        |
| 2.1.2.    | REPAIR.....  | 4        |
| 2.2.      | START THE APPLICATION .....                                      | 4        |
| 2.3.      | PREPARE THE MEASUREMENT .....                                    | 7        |
| 2.4.      | MEASURE. ....  | 8        |
| 2.4.1.    | SET YOUR PARKING/TARGET POSITIONS.....                           | 8        |
| 2.4.2.    | SET YOUR TIMING. ....  | 8        |
| 2.4.3.    | CLEANING TIME.....   | 9        |
| <b>3.</b> | <b>TROUBLE SHOOTING .....</b>                                    | <b>9</b> |
| <hr/>     |  |          |
| 3.1.      | KNOWN BUGS.....  | 9        |
| 3.1.1.    | MOTORS DOES NOT SEEM TO MOVE. ....                               | 9        |
| 3.1.2.    | LOAD DOES NOT WORK PROPERLY. ....                                | 9        |
| 3.1.3.    | BAD SYNCHRONIZATION BETWEEN BCT AND COLMON<br>ACQUISITIONS ..... | 9        |
| 3.1.4.    | SCRAPING DOES NOT OCCUR.....                                     | 9        |
| 3.2.      | OTHERS .....   | 9        |

## 1. PURPOSE

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The SPS Scraper has been designed to control the emittance. It could also occasionally be used as a way to control the beam intensity. **It's currently set for the second proton cycle (proton MD cycle)**. It's possible to use it during the first proton cycle but this requires an soft intervention described in ....  
The usage process described in this document clearly shows that this is a **"prototype non operational MD"** instrument.

## 2. PROCESS

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### 2.1. PREPARE THE INSTRUMENT

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#### 2.1.1. CHECK

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Use the Scraper Status test program to check that the scraper hardware is ready to be used. Launch it via: *Operation -> New Programs -> BI Quick Answers*

and then *Start -> SPS -> Scraper Status*

The result should look like:

```

      8 motors installed in bsc50s
      2 motors installed in buv865
      10 motors installed.
enable_flag           = DISABLE [0]
internal_enable_flag   = SCRAPING LOOP IDLE [0]
infinite_flag         = SCRAP ONCE [0]
plane_flag            = HORIZONTAL [0]
consigne_H            = 10000
consigne_V            = 10000
parking_H             = 14000
parking_V             = 14000
fast_disp             = 3400
fast_delay[300]      = 300
slow_delay[400]      = 0
scraped cycle        = P2
BRCV-BOT at -0.00 mm - Idle - Not In -   Out - Pwr On
BRCV-TOP at -0.00 mm - Idle - Not In -   Out - Pwr On
BRCH-INT at -0.00 mm - Idle - Not In -   Out - Pwr On
BRCH-EXT at -0.00 mm - Idle - Not In -   Out - Pwr On
SCH514  - POS    at +77.86 mm - On Limit Plus -
SCV514  - POS    at +78.37 mm - On Limit Plus -
SCH514  - FAST   at +13.02 mm - On Limit Plus -
SCV514  - FAST   at +13.03 mm - On Limit Plus -
COL519  - BOTTOM  at -49.90 mm - On Limit Minus -
COL519  - TOP    at +49.88 mm - On Limit Plus -
COL519  - INTERN at -49.88 mm - On Limit Minus -
COL519  - EXTERN at +49.89 mm - On Limit Plus -

```

Type return <CR> to quit

If the bold terms correspond, you should be able continue and forget the following 'Repair' chapter. Otherwise, you'll find there the solution of your problem.

The reasons that may prevent you from scraping are:

- `enable_flag = ENABLE`. This means that somebody else is already scraping. Look around you and solve this first!
- The scraped cycle is not the one you're interested in. Fix that (see 2.1.2.1).
- One of the FAST scraping motors is not on the limit plus. Scraping will be hardware wise prevented. (see 2.1.2.2)

## 2.1.2. REPAIR

### 2.1.2.1. CHANGE SCRAPING CYCLE

The scraper software is still based on CPUs running OS9. It is not ready for multi-sequencing or even cycling. You have to select and configure the cycle you want to play with by hand and restart (reboot) the crate. Follow the following recipe for scraping on P1 for instance.

- `telnet bsc50s`
- `log in as bws [bws]`
- `cd /h0/SCRAPER`
- `cp -r scraper_file.forp1 scraper_file`
- `reboot`

[You can also reboot the crate via the scraper GUI.]

Obviously, if you want to scrape on P2, copy `scraper_file.forp2` instead!

Wait a few minutes after the reboot and everything should be ready.

### 2.1.2.2. FAST MOTORS OUT OF LIMIT

In this case, a specialist intervention is needed. This preparation should be done for the time being by a BI expert (G Burtin or JM Vouillot or JJ Gras).

They will, using the standard scraper expert program set the BI motors correctly.

It can be launched from a standard OP console through the following path:

*Operation -> New Programs -> BI Quick Answers*

and then

*Start -> SPS -> Scraper Expert*

The family, member of the BI motors involved are the following:

|        |        |  |
|--------|--------|--|
| SCH514 | POS    | (resolver should be within tolerance)    |
| SCH514 | FAST   | (should be on limit +, position ~13.000) |
| SCV514 | POS    | (resolver should be within tolerance)    |
| SCV514 | FAST   | (should be on limit +, position ~13.000) |
| COL519 | BOTTOM | (resolver should be within tolerance)    |
| COL519 | TOP    | (resolver should be within tolerance)    |
| COL519 | INTERN | (resolver should be within tolerance)    |
| COL519 | EXTERN | (resolver should be within tolerance)    |

## 2.2. START THE APPLICATION

One BI Graphical User Interface is available for the Scraper system.

It allows controlling the standard acquisition parameters, acquiring the related colmon channels and the BCT and rebooting the crates if necessary.

It can be launched from a standard OP console through the following path:

*Start Tasks*

-> *SPS Control*

-> *SPS Equipment Control*

-> *SPS Beam Obstacles*

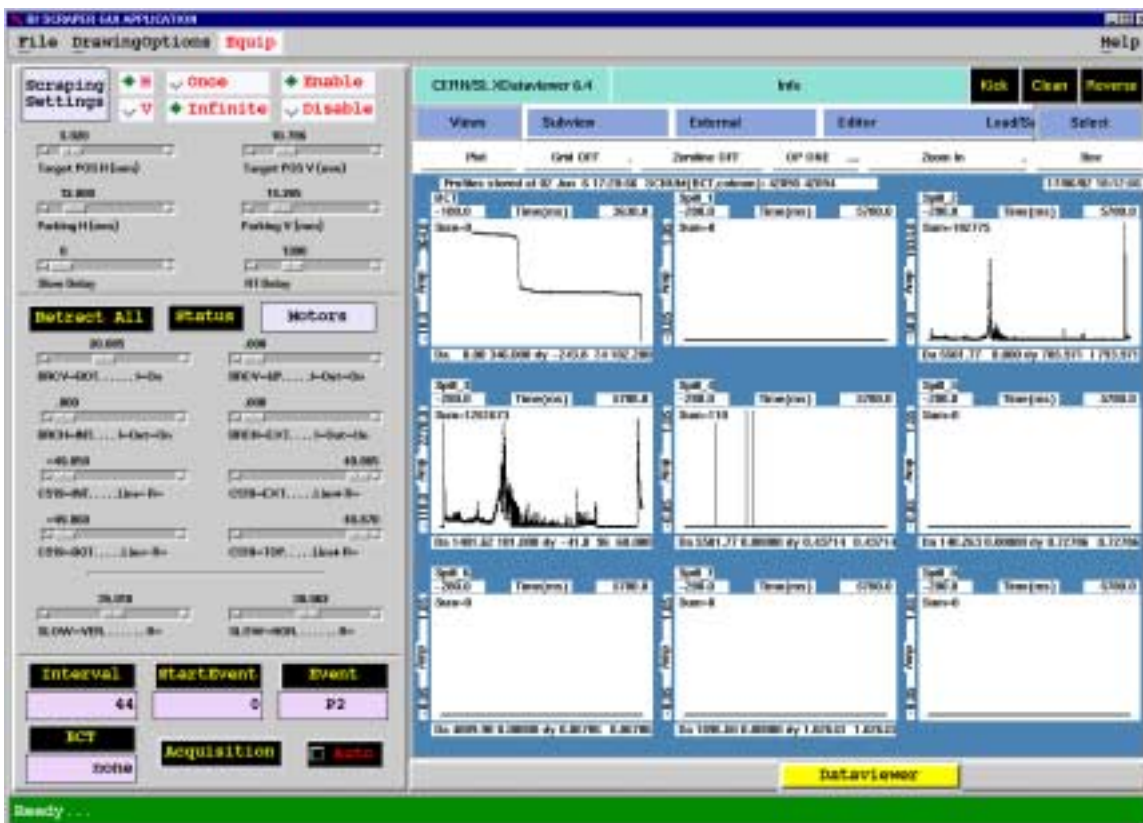
-> *BI Scrapers and Collimators*

Or from bipmop account with the command 'start' on an Xterm and then:

*Start -> SPS -> Scraper*

The application should then appear. If you need to move the window. Put the mouse inside the window and type Alt-F7. Move the window with the mouse and click the left button when you're happy.

The application looks like this once correctly set for scraping on P2:



The left part (see picture below) is used to control the acquisition, the scraping and the data displayed.

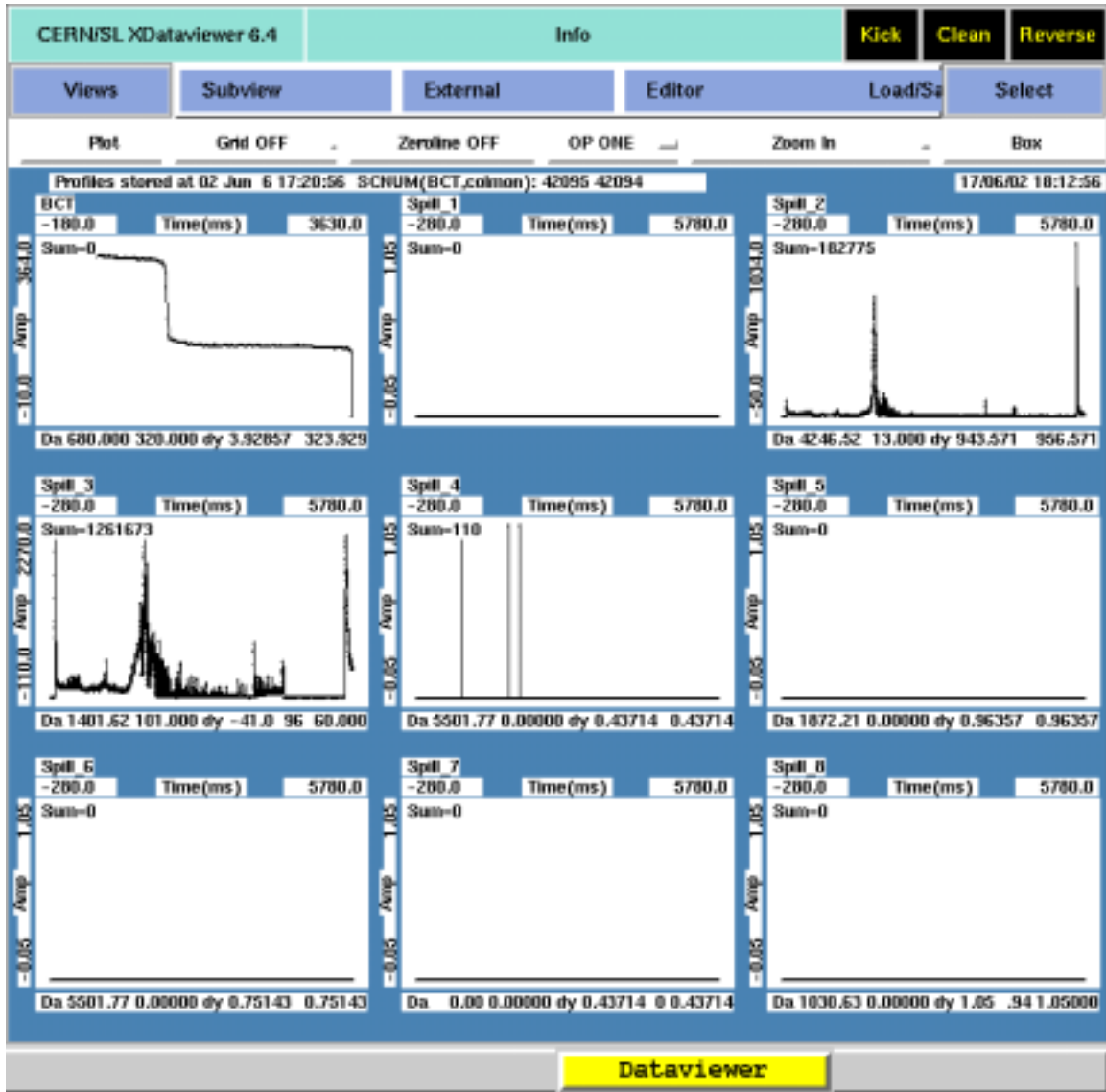
- Top part controls the scraping parameters as explained in 2.3. The CPU targeted here is bsc50s (Themis131/OS9/TG3). The Hardware responsible are G Burtin and JM Vouillot. The SW responsible is JJ Gras.
- Middle part controls the position of the primary and secondary collimators used to protect LSS5 during scraping and the position of the scrapers. **The display convention is: the closer to the beam ~ the closer to the center of the control panel.** The CPU targeted here is bsc50s (Themis131/OS9/TG3). The Hardware responsible are G Burtin and JM Vouillot. The SW responsible is JJ Gras.

- The bottom part controls the settings for the colmon acquisition ('Interval' and 'StartEvent') and for the BCT acquisition ('BCT' and 'Event'). The CPU targeted here is bco50s (Themis131/OS9/TG3) for Colmon. The Hardware responsible is F Ferioli. The SW responsible is JJ Gras. The CPU targeted for BCT are the bctXXs (PPC/LynxOS/TG8). The Hardware responsible is H Jakob. The SW responsible is L Jensen.

The screenshot shows a control interface with several sections:

- Scraping Settings:** Includes a 'Scraping Settings' button, a diamond icon with 'H', a dropdown menu set to 'Once', a diamond icon with 'Enable', a dropdown menu set to 'V', a diamond icon with 'Infinite', and a dropdown menu set to 'Disable'. Below these are sliders for 'Target POS H (mm)' (3.020), 'Target POS V (mm)' (10.786), 'Parking H (mm)' (12.000), 'Parking V (mm)' (14.265), 'Slow Delay' (0), and 'RT Delay' (1300).
- Retract All / Status / Motors:** A row of three buttons: 'Retract All' (yellow text on black background), 'Status' (yellow text on black background), and 'Motors' (white text on light blue background).
- Sliders for Retraction:** A grid of sliders for various components: 'BRCV-BOT. .... I-On' (20.085), 'BRCV-UP. .... I-Out-On' (.000), 'BRCH-INT. ... I-Out-On' (.000), 'BRCH-EXT. ... I-Out-On' (.000), 'C519-INT. .... Lim- R-' (-49.850), 'C519-EXT. .... Lim+ R-' (49.865), 'C519-BOT. .... Lim- R-' (-49.860), and 'C519-TOP. .... Lim+ R-' (49.870).
- Sliders for Slow Motion:** Two sliders at the bottom: 'SLOW-VER. .... R-' (35.010) and 'SLOW-HOR. .... R-' (38.062).
- Interval / StartEvent / Event:** Three buttons: 'Interval' (yellow text on black background), 'StartEvent' (yellow text on black background), and 'Event' (yellow text on black background). Below them are input fields: '44' under Interval, '0' under StartEvent, and 'P2' under Event.
- BCT / Acquisition / Auto:** A 'BCT' button (yellow text on black background) with 'none' below it, an 'Acquisition' button (yellow text on black background), and an 'Auto' checkbox (white text on black background) which is currently unchecked.

The right part is used to view the data (see picture below):  
 The first graph display the BCT acquisition (if one has been selected)  
 The others display the 8 colmon channels present in the bco50s crate. Their meaning depends on the MD. It should be asked to Franco if necessary.



### 2.3. PREPARE THE MEASUREMENT

You're then ready to scrape and make a measurement using the Scraper GUI (see next chapter):

**BUT Don't forget that:**

You should first disable the Veto on the scrapers and collimators (if you intend to use them) [Action SL/OP].

If you want to use the collimators, you should do it carefully. The basic principle is: move one collimator jaw and make a colmon acquisition and repeat till you see losses appearing.

A good and easy setting for the colmon acquisition for P2 scraping is to force the StartEvent to 0 (by editing the value and not using the slider) and set the interval to 44. This will make an acquisition around P2 (~100 ms before P2 beam in to ~100 ms after P1 beam in).

For the BCT in this case (scraping on P2), the settings are BCT=41, Event=P2.

A good side effect of this setting will be that BCT and colmon acquisition SuperCycles will then match. It is not always the case otherwise. Always check the 2 supercycles numbers displayed on the dataviewer. They have to match if you want to correlated BCT and Colmon acquisitions.

## 2.4. MEASURE.

### 2.4.1. SET YOUR PARKING/TARGET POSITIONS.

The slow Position motor takes around 900 ms to go from Parking to Target position. The difference between the two should not exceed 10 mm. (see annex 1 for details).

The scraping principle is the following.

- 1. You start in the disable state. The scraper is in a rest position (usually Parking + 35mm or to the limit after a 'Retract All').
- 2. You enable scraping.
- 3. Selected scraper (H or V. It is not possible to scrape both planes simultaneously) will go on parking position.
- 4. 900ms (+ 'slow delay', if necessary see next chapter) before the selected 'beam in' (P1 or P2), the scraper will go to the target position. This movement is slow (but precise). The time needed to move is described in annex 1.
- 5. On the selected 'beam in' + 'RT Delay' the scraper will scrape the beam (it takes around 100ms).
- 6. Immediately after, the scraper will go to rest position (parking + 35mm) and then cross again the chamber (but now far from the beam).
- 7. We are back to 1. If you selected the 'Once' toggle, we stay here. If you selected 'Infinte', we jump again to 3.

### 2.4.2. SET YOUR TIMING.

A slow delay of 0 ms means that the scraper starts to go slowly from parking to target position 900ms after beam.in event. **You don't have to touch this in principle** unless there is still beam at this stage in the previous cycle!

A RT Delay of M ms means that the scraper will scrape the beam a ~ M ms after beam in. The scrap takes place during about 100 ms. You can crosscheck this with the BCT measurements.

First press the Acquisition Button to acquire colmon and BCT once and initialise the dataviewer correctly and save this as a reference value.

Select a plane.

Select scraping 'Once' to start.

Press 'Enable'.

The next cycle should be scraped.

It is pretty difficult to get the right acquisition of the Colmon and BCT in 'Once' mode because they are separated applications with different synchronization principle. But you should try to put the acquisition in 'Auto' acquisition mode and press acquisition. **You'll loose the control on the GUI till you press 'Auto' again.** Stop it quick!



### 2.4.3. CLEANING TIME

You've finished. It's time to clean.

- Disable scraping.
- Put Back Parking to ~14000 and Target to ~10000.
- Put all collimators and scrapers back to Out. The Retract All Button will do it automatically for you. Check with the status button if everything went well. It can take a few seconds after Retract All finishes.
- Quit the application
- Ask OP to re-enable the collimators and scrapers interlocks.

## 3. TROUBLE SHOOTING

### 3.1. KNOWN BUGS.

#### 3.1.1. MOTORS DOES NOT SEEM TO MOVE.

Check with HW experts that the motors are not unplugged!

#### 3.1.2. LOAD DOES NOT WORK PROPERLY.

If you start the application and immediately try to load an old acquisition, the dataviewer won't be filled correctly.

Before to make a load, you should make a 'dummy' colmon acquisition (you don't need to enable scraping) by pushing the "Acquisition" button once.

#### 3.1.3. BAD SYNCHRONIZATION BETWEEN BCT AND COLMON ACQUISITIONS

See Measure Section. Use the standart colmon settings for P2, ie StartEvent forced to 0 (by editing the value and not using the slider), Interval set to 44.

Such a setting for P1 has to be tuned a soon as we can try this configuration.

#### 3.1.4. SCRAPING DOES NOT OCCUR.

Check that the system is configured for the right cycle (see chapter 2)

### 3.2. OTHERS

In case none of the problems described in above or Process chapter help you, first try to reboot the related crate via the GUI top Menu "Equip".

If the problem remains, call the experts.



### Annex 1: Slow and RT Movement Delays.

| Slow Motion Length from Parking to Target [mm] | Slow Motion Duration [ms] | Minimum User Fast Delay to set to avoid simultaneous move [ms] |
|--|---------------------------|--|
| 2  | 450                       | -150   |
| 4  | 685                       | 85   |
| 6  | 875                       | 275  |
| 8  | 1030                      | 430  |
| 10   | 1165                      | 565  |
| 12   | 1290                      | 690  |
| 14   | 1405                      | 805  |
| 16   | 1510                      | 910  |

Fast Motion Duration = 570 [ms] for 13 [mm]

Delay Interrupt -> Start Fast or Slow = 65 ms

Delay Slow Interrupt -> Beam In = 900 ms

Delay RT Interrupt -> Beam In = 300 - User RT Delay [ms]

A user Fast Delay of X ms will scrape the beam at  $\sim X + (570/2) + 65 - 300 = 50 \text{ ms} + X$

