

Tuning Procedure for H8 Secondary and Tertiary Beam Setting

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24th of January 2020

1. INTRODUCTION

The secondary beams for the H8 beamline are generated at the T4 target of the North Area. Via the T4 wobbling station the H8 beam conditions are coupled to the operating conditions of H6 and P41/P42. The beam can provide mixed secondary hadron and electron beams or tertiary hadron, electron or muon beams of good purity. The beam described in sections 3 to 7 of the document is the mixed secondary beam, composed of hadron with some minor share of muons (~1% of beam intensity) and electrons. The possibilities to change the particle type (composition) of the beam are presented in section 9.

2. ACCESS ELEMENTS

There exists a dedicated Target Attenuator (TAX) collimator after the T4 target (XTAX.042.018, XTAX.042.020). The TAX has large holes for the beam directed towards H6 next to the corresponding holes for the beam in the direction of H8. In case of access to H8 the TAX is moved into the dump position for the H8 beam. In this position it still provides a hole for the beam into the direction of H6. During the moving process of the H8 TAX between the positions (which can take up to several minutes), the beam in the direction of H8 and H6 is temporarily interrupted.

3. 400 GeV/c PROTON BEAM TO T4

- Switch on the T4 wobbling by loading e.g. the file T4A.SBA.001 with properties
 - P0 beam is set to primary protons (400 GeV/c, 0 mrad)
 - H8 beam is set to secondary hadrons (+180 GeV/c, 0 mrad)
 - H6 beam is secondary (+120 GeV/c, -0.20 mrad)Alternative wobbling settings can be considered (e.g. different H8 momentum or secondary beam in P42)
- After every wobbling change a double scan of BEND01 (BEND.042.049) and BEND02 (BEND.042.061) should be performed (see section 6)
- Set T4 target head:
 - To position 4 (100 mm Be) if the primary protons are delivered to P42 beamline for the NA62 experiment.
 - To position 2 (300 mm Be) if no beam is delivered to P42 beamline for the NA62 experiment.
- Beam intensity at T4: up to 60 units if NA62 is taking beam.
- Combined symmetry (position and angle) of proton beam incident onto T4 $\geq 90\%$ (SPS Page 1).

Ask CCC to re-steer if necessary.

- Ask CCC to scan the T4 spot on BBST-H,-V 241.150 (TBIU (T4)) from +7 to +13 mm in steps of 0.2 mm (miniscan).

4. BEAM FILE SETUP

- Switch to the H8 Tab in CESAR
- Load beam file H8A.UA9-TOTEM.001 (Secondary Hadron Beam, Beam Momentum: +180 GeV/c, Last Modification date: 14.06.2018). Please see the optics drawing at the end of the document. The optics file is called h8fmicro07. The MADX optics input file can be found under this [link](#), the TRANSPORT output file can be found [here](#). The BEATCH output file for the beam line layout can be found [here](#).
- Check in the Collimator Status window that the Read Jaw 1 and the Read Jaw 2 collimator settings are as follows:
 - XCSV.042.132 = ± 15 mm
 - XCSV.042.185 ± 15 mm
 - XCHV.042.202 ± 1.2 mm
 - XCHV.042.203 ± 5 mm
 - XCSV.042.404 -3.5, +3 mm
 - XCHV.042.406 ± 2 mm
 - XCHV.042.407 ± 6 mm
 - XCSH.042.424 ± 10 mm

5. IF NEEDED: EXTRAPOLATE THE MAGNET SETTINGS TO A DIFERENT MOMENTUM

If in step 3 (see above) a wobbling file with another beam momentum than +180 GeV/c has been selected for the H8 beamline, the beamline magnets have to be scaled accordingly. It can be done via the following method:

- In the H8 BeamFileExplorer window select a beam file H8A.UA9-TOTEM.001 and click on Extrapolate button.
- In Secondary Momentum field enter the required momentum. Modify other entries (Experiment Name, Beamfile Index, Description etc) as desired.
- Click OK to create a new file.
- Load the newly created file.

6. STEER HADRON BEAM FROM T4 TO THE EXPERIMENT LOCATION

- Steering through COLL01 (XCSH.042.064) and COLL02 (XCSH.042.128)
 - Vertical scan COLL01 (XCSH.042.064) collimator

- Scan COLL01 (XCSH.042.064) from -40 to +40 mm onto SCINT01 (XSCI.042.198) with slit opening of 5 mm in 17 steps.
 - Set COLL11 (XCSV.041.047) center to the value providing maximal beam intensity at SCINT01 (XSCI.042.198).
 - Scan COLL02 (XCSH.042.128) from -40 to +40 mm onto SCINT01 (XSCI.042.198) with slit opening of 5 mm in 17 steps.
 - Set COLL02 (XCSH.042.128) center to the value providing maximal beam intensity at SCINT01 (XSCI.042.198).
 - Vertical double scan of BEND01 (BEND.042.049) and BEND02 (BEND.042.061)
 - Scan BEND01 (BEND.042.049) from -590 A to -540 A in 11 steps of 5 Amps and BEND02 (BEND.042.061) with factor 1.0, counting on SCINT01 (XSCI.042.198).
 - Set BEND01 (BEND.042.049) and BEND02 (BEND.042.061) to the values giving maximal intensity at SCINT01 (XSCI.042.198).
- Horizontal steering through COLL10 (XCSH.042.424) and COLL11 (XCSH.042.442)
 - Double scan of BEND05 (BEND.042.412) and BEND06 (BEND.042.412) through collimator COLL10 (XCSH.042.424) and COLL11 (XCSH.042.442).
 - Double scan BEND05 (BEND.042.412) and BEND06 (BEND.042.412) from -430 A to -400 A in 7 steps of 5 Amps with factor 1.0, counting on SCINT04 (XSCI.042.420).
 - Set BEND05 (BEND.042.412) and BEND06 (BEND.042.412) to the values providing maximal beam intensity at SCINT04 (XSCI.042.420).
- After performing the scans, save the new settings into a new beam file.

Note that the value of BEND03 (BEND.042.325) and BEND04 (BEND.042.330) should always be left untouched – it is the reference values for your beam momentum. For example, for +180 GeV/c hadrons both bends should be at 567.0 A.

7. SET THE REQUIRED BEAM SIZE AND INTENSITY

The modification of the beam size can be performed in two ways – via changing the settings of the quadrupoles immediately upstream of the user zone or via the beam collimation. However, collimating the beam simultaneously changes the beam intensity and, to some degree, beam profile shape. Hence, in case the beam size should be modified without change of intensity, the first method (via quadrupoles) should be preferred. Alternatively, the beam intensity can be modified via opening and closing of the collimators far upstream of the user zones, close to the primary target – see section 8.

It is often required to have a parallel beam in the zones H8Z and H8A - in particular for the UA9 experiment. This can be seen as default beam option in case several users, e.g. telescopes, are

performing the measurement on the same beam simultaneously. The parallelism can be ensured by executing a FISC double scan:

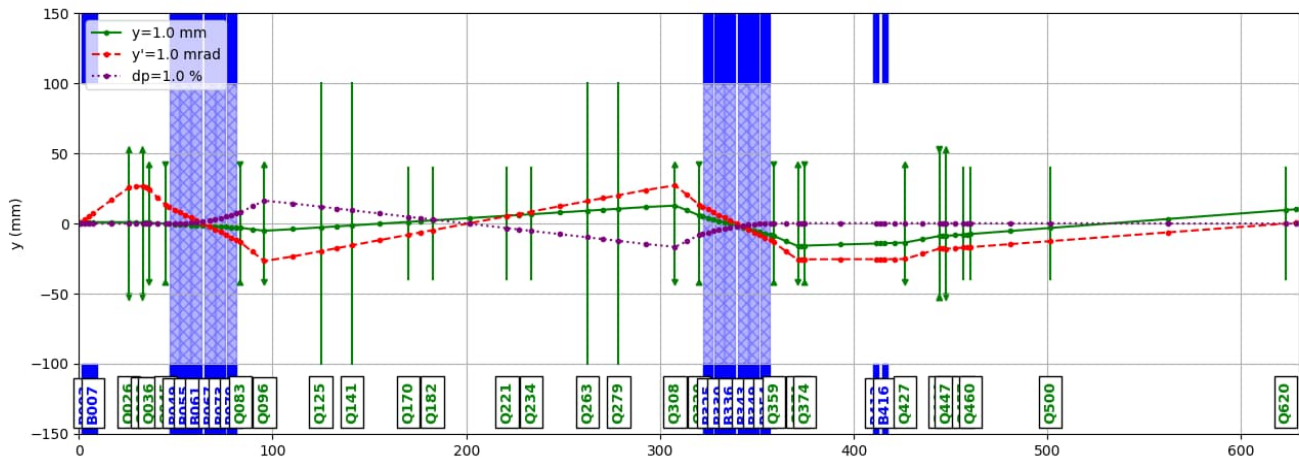
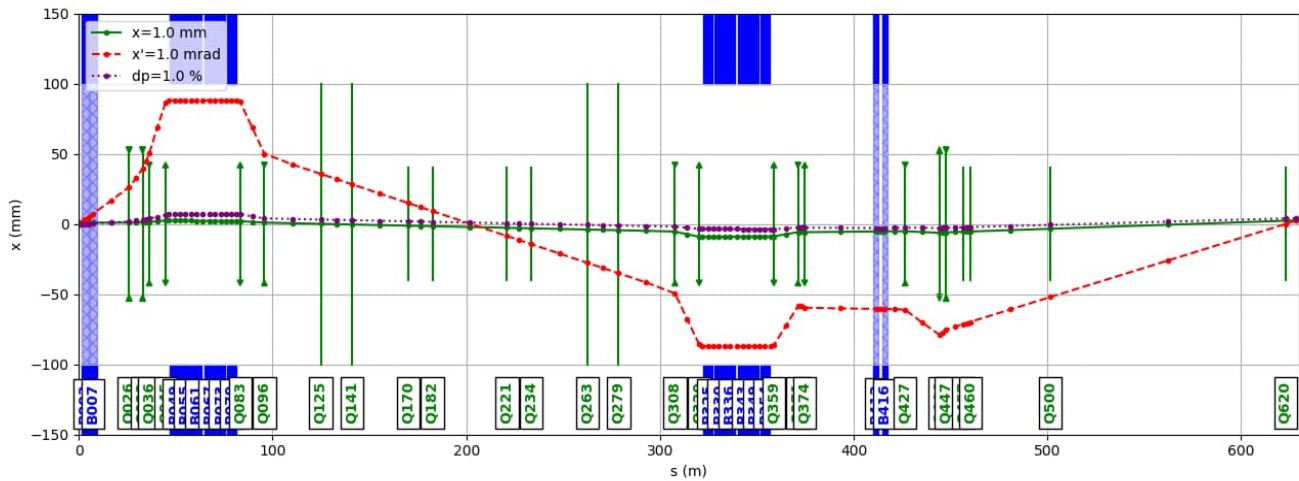
- Open FISC Scan window
- For horizontal parallelism check:
 - Perform fisc scans on FISC10 (XFFH.042.419) and FISC14 (XFFH.041.494)
 - Scan in range from -30 mm to +30 mm with 3 mm steps in 21 steps
 - Note the offset of the beam profile peak for FISC10 (δ_{10}) and FISC14 (δ_{14})
 - Set FISC10 (XFFH.042.419) to the location $-10 + \delta_{10}$ mm
 - Perform coincidence scan on FISC14 (XFFH.041.494)
 - Scan in range from $-13 + \delta_{14}$ mm to $-7 + \delta_{14}$ mm with 0.5 mm steps in 13 steps
 - Set FISC10 (XFFH.042.419) to the location $+10 + \delta_{10}$ mm
 - Perform coincidence scan on FISC14 (XFFH.041.494)
 - Scan in range from $+7 + \delta_{14}$ mm to $+13 + \delta_{14}$ mm with 0.5 mm steps in 13 steps
 - If the beam is sufficiently parallel the distance between the means of two peaks measured at FISC14 (XFFH.041.494) must be within (20 ± 2.5) mm. If it is not the case, this implies particle angles of $>33 \mu\text{rad}$ (Note – in case different value for maximal divergence/convergence is required, scale the distance between the peaks linearly). The beam is too convergent if the distance between the means of two peaks measured at FISC14 (XFFH.041.494) is below 17.5 mm and the beam is too divergent if this distance is above 22.5 mm.
 - The following steps need to be performed to improve parallelism.
 - Assumptions
 - H8 beamline acceptance is 0.5 mrad in X-plane
 - Initial settings of beam optics correspond to the h8fmicro07 optics for 180 GeV/c
 - QUAD.042.359 = +84.868 A
 - QUAD.042.371 = -189.784 A
 - QUAD.042.374 = +35.62A
 - To make the beam more divergent in X by $10 \mu\text{rad}$ (corresponding to 0.85 mm offset between the measurements at FISC10 (XFFH.042.419) and FISC14 (XFFH.041.494)) without change of divergence in Y
 - Modify QUAD.042.359 setting by +0.42 A
 - Modify QUAD.042.371 setting by -0.32 A
 - Modify QUAD.042.374 setting by -0.83 A
- For vertical parallelism check:
 - Perform fisc scans on FISC09 (XFFV.042.418) and FISC13 (XFFV.042.493)
 - Scan in range from -30 mm to +30 mm with 3 mm steps in 21 steps
 - Note the offset of the beam profile peak for FISC09 (δ_9) and FISC13 (δ_{13})
 - Set FISC09 (XFFV.042.418) to the location $-10 + \delta_9$ mm
 - Perform coincidence scan on FISC13 (XFFV.042.493)
 - Scan in range from $-13 + \delta_{13}$ mm to $-7 + \delta_{13}$ mm with 0.5 mm steps in 13 steps

- Set FISC09 (XFFV.042.418) to the location $+10 + \delta_9$ mm
- Perform coincidence scan on FISC13 (XFFV.042.493)
 - Scan in range from $+7 + \delta_{13}$ mm to $+13 + \delta_{13}$ with 0.5 mm steps in 13 steps
- If the beam is sufficiently parallel the distance between the means of two peaks measured at FISC13 (XFFV.042.493) must be within (20 ± 2.5) mm. If it is not the case, this implies particle angles of $>33 \mu\text{rad}$ (Note – in case different value for maximal divergence/convergence is required, scale the distance between the peaks linearly). The beam is too convergent if the distance between the means of two peaks measured at FISC13 (XFFV.042.493) is below 17.5 mm and the beam is too divergent if this distance is above 22.5 mm.
- The following steps need to be performed to improve parallelism.
 - Assumptions
 - H8 beamline acceptance is 1.5 mrad in Y plane
 - Initial settings of beam optics correspond to the h8fmicro07 optics for 180 GeV/c
 - QUAD.042.359 = +84.868 A
 - QUAD.042.371 = -189.784 A
 - QUAD.042.374 = +35.62A
 - To make the beam more divergent in Y by $10 \mu\text{rad}$ (corresponding to 0.85 mm offset between the measurements at FISC09 (XFFV.042.418) and FISC13 (XFFV.042.493) without change of divergence in X
 - Modify QUAD.042.359 setting by +0.51 A
 - Modify QUAD.042.371 setting by +0.38 A
 - Modify QUAD.042.374 setting by -0.33 A

Having the focal point of the beam to be in the zones H8B and H8C can be achieved by using the quadrupoles QUAD17 (QUAD.042.495), QUAD18 (QUAD.042.502) and QUAD19 (QUAD.042.526). Start with a parallel beam in the zones H8Z and H8A achieved via the h8fmicro07 optics settings described above

- QUAD.042.359 = +84.868 A
- QUAD.042.371 = -189.784 A
- QUAD.042.374 = +35.62A
- QUAD.042.427= 0 A
- QUAD.042.444= 0 A
- QUAD.042.457= 0 A

The example of the AppLE.py output for the beam optics with a focus on 620 m downstream of T4 is presented below.



- Focusing: Vertical and horizontal beam size
 - To focus the beam at the different locations (500 m – 620 m) in the user zones H8B and H8C use the following quadrupole settings (@180 GeV/c, scale proportionally if the beam momentum is different)
 - To move the focus on both planes by 1 m downstream modify:
 - QUAD14 (QUAD.042.427) by +0.28 A
 - QUAD15 (QUAD.042.444) by -0.34 A
 - QUAD16 (QUAD.042.457) by -0.49 A
 - To move the focus in X-plane by 1 m downstream (and leave the focus location in Y-plane unmodified) modify:
 - QUAD14 (QUAD.042.427) by +0.11 A
 - QUAD15 (QUAD.042.444) by -0.26 A
 - QUAD16 (QUAD.042.457) by -0.40 A

- To move the focus in Y-plane by 1 m downstream (and leave the focus location in X-plane unmodified) modify:
 - QUAD14 (QUAD.042.427) by +0.11 A
 - QUAD15 (QUAD.042.444) by -0.01 A
 - QUAD16 (QUAD.042.457) by -0.08 A
- After performing the focusing changes, save the new settings into a new beam file.

8. COLLIMATION

The collimators can be used in different roles, such as selecting the beam momentum width, defining transverse beamline acceptance and cleaning the beam of unwanted tertiary particles.

Setting the beam momentum width

- For the secondary beam the momentum width is set by COLL03 (XCHV.042.132)
 - The vertical dispersion of the secondary beam in the microbeam optics (h8micro07) mentioned above is -10.82 mm/% of $\Delta p/p$ at the location of COLL03 (XCHV.042.132). Hence, to achieve $\pm X$ % of momentum width open COLL03 to $(\pm X \cdot 10.82)$ mm.
- For the tertiary beam the momentum width is set by COLL09 (XCHV.042.407)
 - The vertical dispersion of the tertiary beam in the microbeam optics (h8micro07) mentioned above is -10.82 mm/% of $\Delta p/p$ at the location of COLL09 (XCHV.042.407). Hence, to achieve $\pm X$ % of momentum width open COLL09 to $(\pm X \cdot 10.82)$ mm.
- Collimation: vertical beam size at the experiment location
 - Scan collimator COLL09 (XCHV.042.407)
 - Start with following jaw settings: left: ± 1.0 mm
 - Scan until following jaw settings: left: ± 19.0 mm
 - Number of steps: 19
 - Set COLL09 (XCHV.042.407) to the values providing desired vertical beam size at the profile monitor at the location of the experiment
 - Monitor XDWC02 (XDWC.042.476) in the zone H8A
 - Monitor XDWC04 (XDWC.042.544) in the zone H8B
 - Monitor XDWC06 (XDWC.042.584) in the zone H8C
- Collimation: horizontal beam size at the experiment location
 - Scan collimator COLL08 (XCHV.042.406)
 - Start with following jaw settings: left: ± 1.0 mm
 - Scan until following jaw settings: left: ± 10.0 mm

- Number of steps: 19
 - Set COLL08 (XCHV.042.406) to the values providing desired horizontal beam size at the profile monitor at the location of the experiment
 - Monitor XDWC01 (XDWC.042.475) in the zone H8A
 - Monitor XDWC03 (XDWC.042.543) in the zone H8B
 - Monitor XDWC05 (XDWC.042.583) in the zone H8C
- Cleaning of the beam
 - The goal of the cleaning of the beam is to remove from the beam the unwanted particles generated at the collimator walls during the collimation. Those particles frequently have momenta much lower than of the nominal beam and very large position offset and propagation angles.
 - For horizontal beam cleaning
 - Modify the setting of COLL11 (XCSH.042.442) until the “tails” around the Gaussian beam profile disappear on the following monitors at the location of the experiment
 - Monitor XDWC01 (XDWC.042.475) in the zone H8A
 - Monitor XDWC03 (XDWC.042.543) in the zone H8B
 - Monitor XDWC05 (XDWC.042.583) in the zone H8C
- Beam intensity modulation
 - Open collimator COLL01 (XCSH.042.064) to the values providing desired beam intensity at the scintillator at the location of the experiment
 - SCINT05 (XSCI.042.463) and SCINT06 (XSCI.042.463) in the zone H8A
 - SCINT09 (XSCI.042.543) in the zone H8B
 - SCINT10 (XSCI.042.574) in the zone H8C
 - If the required beam intensity has not been achieved set COLL01 (XCSH.042.064) to the value closest to the required intensity
 - Scan collimator COLL02 (XCSH.042.128)
 - Start with following jaw settings: left: ± 1.0 mm
 - Scan until following jaw settings: left: ± 19.0 mm
 - Number of steps: 10
 - If the required beam intensity has not been achieved set COLL02 (XCSH.042.128) to the value closest to the required intensity
 - Modify the setting of the collimator COLL03 (XCHV.042.132)
 - Attention: Modifying the setting of COLL03 changes the momentum width of the beam as described in the beginning of the current section.
 - Count the intensity on the scintillator close to the location of the experiment
 - SCINT05 (XSCI.042.463) and SCINT06 (XSCI.042.463) in the zone H8A
 - SCINT09 (XSCI.042.543) in the zone H8B
 - SCINT10 (XSCI.042.574) in the zone H8C

- Start with following jaw settings: left: ± 1.0 mm
 - Modify the collimator setting to ± 5.0 mm
 - Modify the collimator setting to ± 9.0 mm
 - For practical purposes, the gap of COLL03 is proportional to the beam intensity.
 - Extrapolate the collimator setting to reach the beam intensity required for the experiment
- After modifying the collimator settings, save the new settings into a new beam file.

9. MODIFYING THE PARTICLE TYPE

The procedure described above is valid for the delivery of mixed hadron beam to the user zones. In order to modify the particle content please apply the following steps:

- Hadrons cleaned from electrons
 - Move obstacle TARGET01 (XCON.042.130) into position -40.0 mm (Pb-3mm)
- High-energy electrons (> 120 GeV/c), cleaned of hadrons and muons
 - By using "Extrapolate" function of CESAR
 - In the beam file browser, click on the beam file for the hadron beam.
 - Press "Extrapolate" button on the bottom.
 - Set Conversion Type to "Hadron => Electron".
 - Load the created beam file.
 - This file adjusts the bend currents considering the momentum loss by the electrons due to synchrotron radiation. All other particles do not experience the same amount of synchrotron radiation loss and are filtered out after BEND03 (BEND.042.325) and BEND04 (BEND.042.330).
 - By scanning BEND03 (BEND.042.325) and BEND04 (BEND.042.330)
 - Double scan BEND03 (BEND.042.325) and BEND04 (BEND.042.330) with factor 1.0, decreasing their current in 20 steps using step size of 0.3 A counting on SCINT02 (XSCI.042.403).
 - In the intensity measured at SCINT02 (XSCI.042.403) below the large peak at the nominal current setting at BEND03 and BEND04 (from hadron beam) there will be a second smaller peak at a lower current setting (from the electron beam).
 - Set the currents of BEND03 (BEND.042.325) and BEND04 (BEND.042.330) to the center of the second peak.

There are two options for the muon beam generation: the momentum-defined option and the wide band option. The first one implies closing the collimators to absorb all non-muon particles before the momentum-selecting bends BEND03 (BEND.042.325) and BEND04 (BEND.042.330), while in the latter

case the collimators right upstream of the experiment are closed. In that case the muon flux is dominated by the muons from the pion decays with $0.57 \cdot p(\pi) < p(\mu) < p(\pi)$

- Momentum-defined muon beam generation
 - Close COLL05 (XCHV.042.202) asymmetrically to position -40 mm (Jaw 1) and -39 mm (Jaw2)
 - Close COLL06 (XCHV.042.203) asymmetrically to position -40 mm (Jaw 1) and -39 mm (Jaw2)
 - Create the file for the muon beam
 - Open the BeamFileExplorer and select the currently loaded beam file
 - Extrapolate Secondary Momentum to 109 % of the desired muon beam momentum
 - Set position of momentum change TRIM.042.203
 - Set Tertiary Momentum to the desired muon beam momentum
 - Click on "Ok"
 - Horizontal double scan of BEND01 (BEND.042.049) and BEND02 (BEND.042.061).
 - Double scan BEND01 (BEND.042.049) from -900 A to -700 A in 11 steps of 20 Amps and BEND02 (BEND.042.061) with factor 1.0, counting on SCINT02 (XSCI.042.403).
 - Set BEND01 (BEND.042.049) and BEND02 (BEND.042.061) to the values providing maximal beam intensity at SCINT02 (XSCI.042.403).
 - Overwrite the new settings on the previously created file in BeamFileExplorer

- Wide band muon beam generation
 - Close COLL07 (XCSV.042.404) asymmetrically to position -40 mm (Jaw 1) and -39 mm (Jaw2)
 - Close COLL08 (XCHV.042.406) asymmetrically to position +39 mm (Jaw 1) and +40 mm (Jaw2)
 - Close COLL09 (XCHV.042.407) asymmetrically to position +39 mm (Jaw 1) and +40 mm (Jaw2)
 - Horizontal double scan of BEND01 (BEND.042.049) and BEND02 (BEND.042.061).
 - Scan BEND01 (BEND.042.049) from -900 A to -700 A in 11 steps of 20 Amps and BEND02 (BEND.042.061) with factor 1.0, counting on SCINT02 (XSCI.042.403).
 - Set BEND01 (BEND.042.049) and BEND02 (BEND.042.061) to the values providing maximal beam intensity at SCINT02 (XSCI.042.403).
 - Overwrite the new settings on the previously created file in BeamFileExplorer

In order to be able to modify the energy of the beam in H6 beamline independent of T4 wobbling setting one can generate tertiary beams in H6 by introducing the secondary beam target XCON.042.130 into the beam trajectory. For the momenta below 80 GeV/c the particle rate of the tertiary beams is acceptable

and the share of electrons in the total composition of the beam is higher than in case of the higher energy mixed secondary beams. In order to generate tertiary beams follow the steps below:

- Tertiary electron beam
 - In the beam file browser, click on the beam file for the hadron beam.
 - Press “Extrapolate” button on the bottom.
 - Keep Conversion Type at “Hadron => Hadron” (!)
 - Keep the secondary momentum.
 - Set “Momentum change at” to TRIM.042.133
 - Set “Tertiary Momentum” to the required value in GeV/c.
 - Load the created beam file.
 - Verify if the TARGET01 (XCON.042.130) is set to Pb-6mm. If it is not the case, set it to Pb-6mm.
 - Verify if the Absorber (XCON.042.411) is set to Pb-4mm. If it is not the case, set it to Pb-4mm.

- Tertiary hadron beam
 - In the beam file browser, click on the beam file for the hadron beam.
 - Press “Extrapolate” button on the bottom.
 - Keep Conversion Type at “Hadron => Hadron”.
 - Keep the secondary momentum.
 - Set “Momentum change at” to TRIM.042.133
 - Set “Tertiary Momentum” to the required value in GeV/c.
 - Load the created beam file.
 - Verify if the TARGET01 (XCON.042.130) is set to 400 mm Cu. If it is not the case, set it to 400 mm Cu.
 - Verify if the Absorber (XCON.042.411) is set to Pb-4mm. If it is not the case, set it to Pb-4mm.

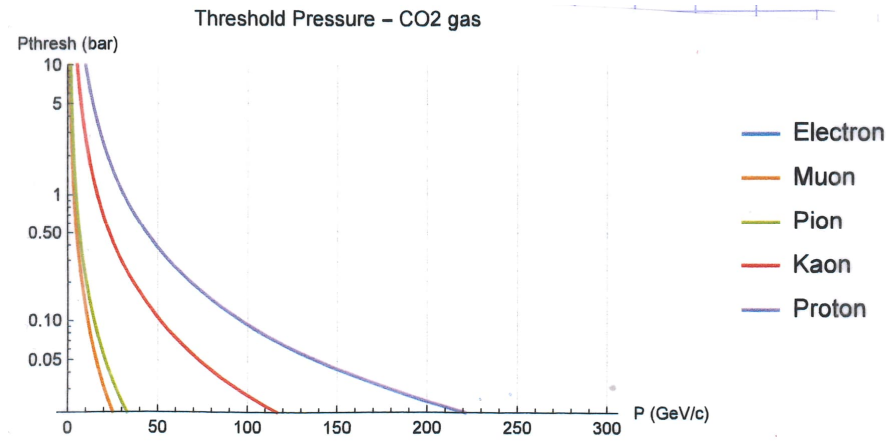
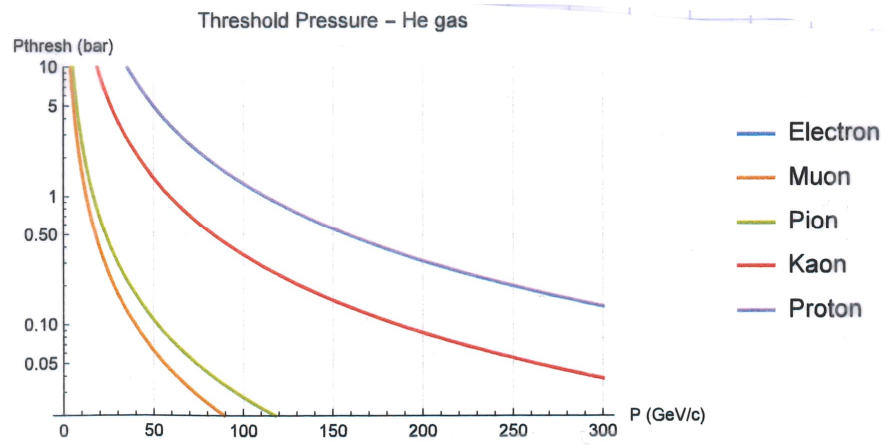
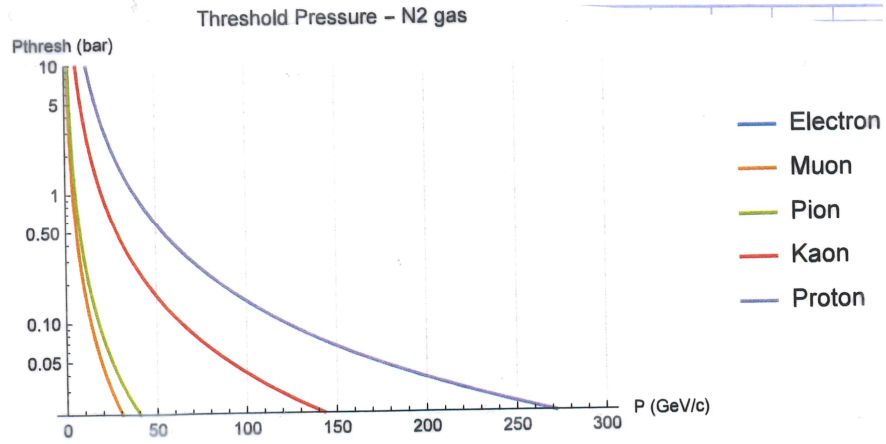
The share of the different particle types in a beam can be measured with help of several methods. Start with a mixed secondary or tertiary hadron beam

- In order to estimate the electron content of the beam
 - Note the beam intensity at the scintillator SCINT04 (XSCI.042.420)
 - Open the “Obstacle Status” window
 - Select XCON.042.411, click on move and set it to 4 mm lead, click on “Ok”
 - When the movement of the obstacle is finished, note the beam intensity at the scintillator SCINT05 (XSCI.041.438)
 - The difference between the beam intensity with obstacle out and obstacle in corresponds to the electrons, which have been absorbed/slowed down by the obstacles
 - Set XCON.042.411 back to “Air” in order to have the beam containing electrons.

- The electron content of the beam can be directly measured with help of the Electro Magnetic Calorimeters (XEMC.042.420 and XEMC.042.475). It comprises the lead glass and a set of photomultipliers, measuring the energy deposited by the beam as a function of penetration depth into the detector material. More information can be found on the [EDMS document](#).
 - The XEMC must be installed in advance in the beamline.
 - To move it into the beam trajectory
 - Open “Emc Status” window in CESAR
 - Click on “Move In EMS” button
 - The peak in counts at the right part of the diagram displayed after measurement corresponds to the electron contribution in the beam. In order to calculate its share of the total beam :
 - Set the bar to the location just left of the electron peak
 - Read out the “Right Counts (%)” for the electron content.

- In order to measure the muon content of the beam
 - Note the beam intensity at the scintillator SCINT04 (XSCI.042.420)
 - Close COLL07 (XCSV.042.404) asymmetrically to position -40 mm (Jaw 1) and -39 mm (Jaw2)
 - Close COLL08 (XCHV.042.406) asymmetrically to position +39 mm (Jaw 1) and +40 mm (Jaw2)
 - Close COLL09 (XCHV.042.407) asymmetrically to position +39 mm (Jaw 1) and +40 mm (Jaw2)
 - Note the beam intensity at the scintillator SCINT04 (XSCI.042.420). It corresponds to the intensity of the muon beam.
 - The difference between the beam intensity measured with collimators open and collimators closed is the intensity of all other particle types (hadrons, electrons), which have been absorbed at the collimator jaws.
 - Open the collimators COLL07 (XCSV.042.404), COLL08 (XCHV.042.406) and COLL09 (XCHV.042.407) to their previous settings to restore the mixed beam.

- The content of different particle types can be measured with help of Threshold Cherenkov counters (XCET.042.474, XCET.042.519 and XCET.042.537) and CEDAR (Cherenkov Differential counters with Achromatic Ring focus, currently not installed in H8 beamline).
 - Before their use, Cherenkov counters need to be installed in the beamline and aligned.
 - The gas type of Cherenkov counters has to be set in advance of its use.
 - The pressure of the counters has to be set up in order to be able to distinguish different particle types. The diagrams for the common gas types in Threshold counters can be found below.
 - For the differentiation between the particle types:
 - At higher energies (>100 GeV) Helium is the most useful choice
 - At lower energies (<20 GeV) CO₂ is the most useful choice
 - At the middle energies (20 GeV < E < 100 GeV) N₂ is the most useful choice



o The diagrams for the gas pressure in CEDAR counters can be found below:

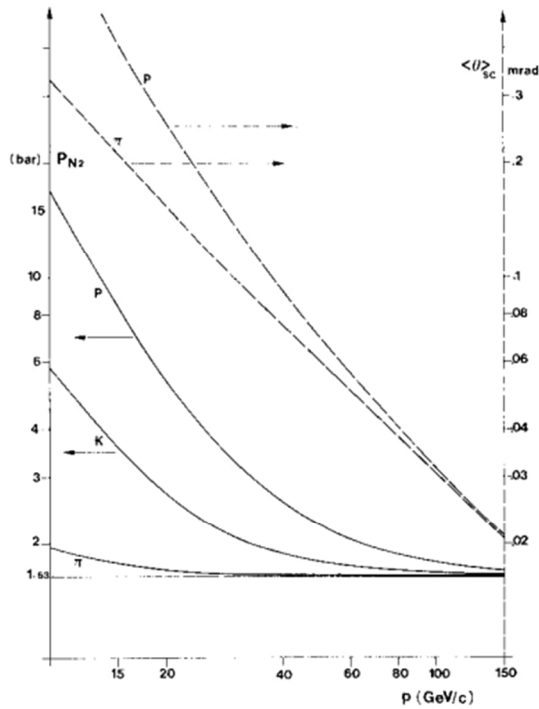


Fig. 6 Working pressure and multiple scattering for CEDAR-W (gas: N_2)

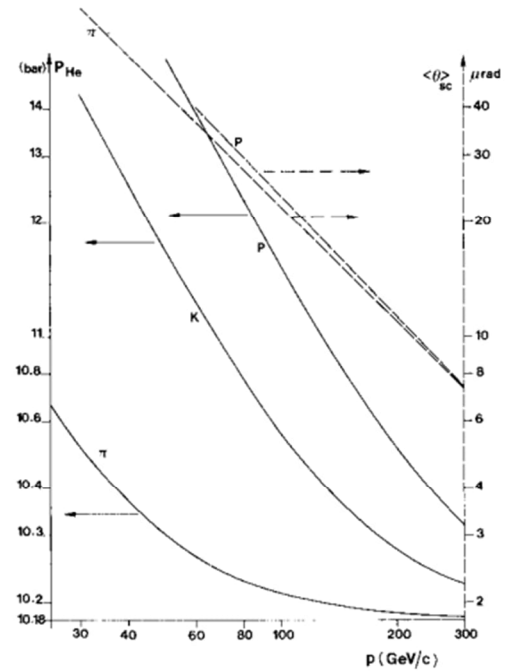


Fig. 7 Working pressure and multiple scattering for CEDAR-N (gas: He)

10. SETTING THE CORRECT USER

The beam line elements can be controlled via CESAR not only by the operators and beam physicists and not only from the CCC, but also by the users from the user barracks in EHN1.

For the moment there are four test zones in H8 (in order from upstream to downstream of the beam):

- H8Z (door PPE128, control from barrack HNA-451) for the CERF experiment,
- H8A (door PPE138, control from barrack HNA-443),
- H8B (door PPE158, control from barracks HNA-257 and HNA-262),
- H8C (door PPE168, control from barracks HNA-468, HNA-480, HNA-483 and HNA-484).

In order to set the correct location and group as a master user, the steps below must be followed:

- Open "Terminals Info" window
- Click on the terminal corresponding to the barrack, in which the master user is located
- Click on "Set Experiment" button
- Select the experiment to which the master user belongs
 - In case the experiment is not listed click on "Add experiment" button and enter the name of the experiment
- Click on "Set To Main Terminal" button