P42 + K12 BEAM TUNING PROCEDURE - revised for 1999

12. 4. 1999

O. CHECK PROTON BEAM TO T4

-> Check the **horizontal**, vertical reference positions of **BSM 241105** (~26m upstream of T4):
[IM(122) T STEP(**3**) , (4) = **63**, 65 (mm)].

-> Set **nominal T4 wobbling**;
Select **T4 target head=3** (200 mm Be) for nominal-intensity beam P42,
(or T4 target head=1 (300 mm Be) to reduce intensity by factor ~0.75);
Check flux on BSI (T4) = NORM 2, (nominally = $5 * 10^{12}$ ppp);
Combined symmetry (position and angle) of proton beam incident onto T4 >80 % (SPS Page 1);
Ask PCR to adjust sharing and re-steer if necessary.

1. **Scan T4 spot** (BBS/BSI (T4)), from -2.0 to +2.0 mm in steps of 0.2 mm, and **angle** (asymmetry)

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-> **To open a window with SECTION=17** on a NA48 terminal**:**

Click on: Local xterm
>su –l bioper
Password: >eaopbi
>setenv DISPLAY xna48.cern.ch:0.0
or: xna48c
>nodal

-> **To access rectifiers:** >RUN <364>SLEA

I. STEER P42 PROTON BEAM TO KL-TARGET (T10)

-> Load **file** P42.6, P42.5, **P42.1**, P42.2, P42.3, *P42.4*, (H-; V-magnification from T4 to T10 = +0.20, 0.222, **0.25**, 0.27, 0.30, *0.333*; **-1.0** ; focusing for p_o =444.0 GeV/c, i.e. dp_o/p_o = -1.33 %).

-> Check that P42 CONVERTER and FISCs are OUT of beam and HV off (P0-PROTECT), **DUMP CONTROL** sources are **enabled** (**P0-SURVEY = disabled**) with no alarms affecting TAX 7.
Select **TAX 7: large range**, **TAX 8: medium range**.

-> Ask PCR to **enable Chain 16** and **before** proceeding to END ACCESS, **degauss B6** (10MCAH) – starting from –2667 A. **-> 0**.

2. **Open TAX 7, 8** to positions: +59, +99 mm (Φ=6.0, 2.0 mm apertures, respectively, corresponding to acceptance angles: $x_o' = y_o' \sim= + - 0.05$ mrad.) and record proton beam transmission onto **BSI 769 (Ti)** (NORM10) and BSI(T10): **BSI(Ti)**/NORM 2 ~= 1.0 * 10^{-2} (T4 head=3).

Check horizontal alignment of beam with TAX 7, 8:

3. Starting from nominal T4 wobbling settings, **double scan B1** (2MTNH) (= B3 of target station T4) **and B2** (MSNH) in + - 5 steps of :
+10 A. and factor -0.9 - for B1 <800 A. (H8=-ve. momenta),
+14 A. and factor -0.65 - for B1=-1071.8 A. (H8=+180 GeV/c),
(dx = -1.2 mm at TAX 8; dx = 0, dx' = -0.06 mrad. at T4).

-> A significant displacement of the beam by Δx at TAX 8 for the nominal setting of B1 can be corrected by changing the horizontal reference position of BSM 241105 [IM(122) STEP(3)] by -1.3 Δx and asking PCR to re-steer.

Vertical positions of TAX 7 and TAX 8:

4. Set **TAX 7** to position -140 mm (40 mm * 20 mm aperture) and **scan TAX 8** (Φ=2.0 mm) from +88 to +110 in steps of 2 mm.
Select the position corresponding to the centre of the distribution measured at + - 5 mm displacement.

5. **Scan TAX 7** (Φ=6.0 mm) from +54 to +64 in steps of 1 mm to find the centre of TAX 7 compared to TAX 8.

-> **Set TAX 7, 8** to positions: +59, +99 mm as in **2.**, corrected for any off-sets found in **5.** and **4.**, respectively, to define the **reduced-intensity proton beam** used for **6. - 15.**

Horizontal steering to C1 and C3:

6. With nominal B3 (MSNH) =+1308.4 A. and B4 (4 MBWT) =B5 (MBWH) =+1010.8 A., close C1 to + -1 mm and **double scan B2** (MSNH) **and TRIM3** in + - 5 steps in **current** of +3.0 A. and factor -1.2, (dx = - 1.3 mm at C1, 0 at C3). Reopen C1 to + -40 mm.

7. Close C3 to + -2 mm and **double scan B2 and TRIM3** in + - 6 steps of +4.0 A. and +0.9 A. (factor +0.225), respectively, (dx = +2.4 mm at C3, 0 at C1). Reopen C3 to +-40 mm.

Vertical steering to C2 and C4:

8. With TRIM 2 =0, close C2 to + -1 mm and **double scan TRIM1 and TRIM4** in + - 5 steps of +3.0 A. and factor +0.33, (dy = -1.9 mm at C2, 0 at C4). Reopen C2 to + -40 mm.

9. Close C4 to + -1 mm and **double scan TRIM1 and TRIM4** in + - 5 steps of +2 A. and factor +6.0, (dy = +1.0 mm at C4, 0 at C2). Reopen C4 to +-40 mm.

Horizontal steering to C7 and centre of B10 aperture:

10. With TRIM5 (MDSH) = -30 A. (see **11.**), close C7 to + -2 mm and **scan B7** (9 MBNH) from -1282 to -1274 in steps of +1.0 A., (dx = -1.8 mm at C7, ~0 at B10). Reopen C7 to + -40 mm.

11. With nominal B8 (2 MBNH) =-1596.0 A., B9 (2 MBNH) =+558.2 A., TRIM 8 =0, check centre of beam in horizontal aperture (+ -28 mm) of B10, counting **BSI(T10)**/N2: **scan TRIM5** from -60 to 0 in steps of +5 A. (dx = **-3.4**, *-4.8* mm at B10, -0.4 mm at C7, 0 at T10, **+3.7**,*+2.8* mm at TAX18).
If TRIM5 is changed, repeat **10.**

Vertical steering to C8 and centre of Q20 aperture:

12. Close C8 to + -2 mm and **double scan TRIM6 =TRIM7** in + - 5 steps of +2 A. and factor +1.0, (dy = +1.2 mm at C8, -4.4 mm at Q20, 0 at T10, +0.75 mm at TAX18). Reopen C8 to + -40 mm.

13. With TRIM9 =0 (see **15.**), check centre of beam in vertical aperture (+ -48 mm) of Q20, counting **BSI(T10)**/NORM2:
double scan TRIM6 =TRIM7 in + - 10 steps of +3 A. and factor +1.0, (dy = -6.6 mm at Q20).

Steering onto KL target (T10) :

-> Set T10 target head =1 and T10-COLLIMATOR =position 4 (Φ=15 mm aperture); set collimators: XCLD-P,-D,-C and CONVERTER =>in beam. Load **file K12.1** and select **mode KL** (TAX17, 18 = +59.5, +59.5 mm).

-> Count KL decays with detector: **HAC-K** = EXP18, **QX** = EXP14
or **QX.MU** = EXP19/NORM10.

14. **Horizontal steering**, with TRIM11= 0: **scan TRIM10** over T10 from -60 to +60 in steps of +10 A. (dx = -0.33 mm at T10, -0.6 mm at TAX18).

15. **Vertical steering**, with nominal B10 (MBNV) = -1206.0 A. and B11 (MBNV)=-1393.0 A. (for +2.4 mrad. KL production angle):
scan TRIM9 over T10 from -36 to +36 in steps of +6 A.
(dy = -0.3 mm at T10, +1.0 mm at Q20, -0.6 mm at TAX18).
If TRIM9 is changed significantly, repeat **13.**

-> **Re-steer after a change of T4 wobbling:**
In mode KL+KS, repeat **14.**, (**15.**) and **41.**, (**42.**) to re-optimise KL and KS beams, respectively.

II. FOCUS P42 PROTON BEAM ONTO KL-TARGET (T10)

-> This is carried out with the **full-emittance proton beam**:
Update and **enable P0-SURVEY**.
Open **TAX7, TAX8** to positions -51, -51 mm (Φ=9.6, 12.0 mm apertures, corresponding to: $x_O' = y_O' = +- 0.27$ mrad.), corrected for any off-sets found in **5.** and **4.**.
Observe BSI (Ti)/NORM2 ~= $2.5 * 10^{-1}$ with T4 head 3 (200 mm Be).

-> Count with **HAC-K**=EXP18, **QX**=EXP14 or **QX.MU**=EXP19/NORM10.

16. **Check** horizontal, vertical **steering** onto T10 (repeat **14.**, **15.**) and iterate with **17.**: horizontal -, **18** : vertical - focusing.

17. **Horizontal focus**: **double scan Q21** (2QNL - FH) **and Q20** (2QNL - FV) in + - 10 steps of +3.0 A. and factor -0.1., (dz(H) = -0.3 m, dz(V) = 0 at T10).

18. **Vertical focus**: **double scan Q20 and Q21** in + - 10 steps of +1.0 A. and factor -0.3, (dz(V) = +1.5 m, dz(H) =0 at T10).

19. **Scan T10** '**spot**' (BBS/BSI (T10)): horizontally and vertically from -6.0 to +4.0 in steps of 0.2 mm.
Repeat scans with horizontal + vertical foci displaced upstream by dz(H) =dz(V) =-0.96 m from T10 onto BBS, changing (strengthening) Q21 by +9.6 +0.2 = +9.8 A. and Q20 by -0.8 -0.6 = -1.4 A.
Reset Q20 and Q21.

Check effect of varying horizontal, vertical angles onto T10:

20. Counting rate should show a flat plateau over **+ -9**, + *-14* mm free aperture of B10, for **+ -0.5**, + *-0.8* mrad. variations of the horizontal angle onto T10.
This corresponds to **- +10**, - *+15* A. in a **scan** of **TRIM5** from -50 to -10 in steps of +2 A.; (c.f. **11.**).

21. Counting rate should show a plateau (with slope ~ -0.2 $mrad^{-1}$ for KL) over + -26 mm free aperture of Q20, for + -0.33 mrad. variations (around +2.4 mrad.) of the vertical (production-) angle onto T10.
This corresponds to - +12 A. in a **double scan** of **TRIM6=TRIM7** in + - 10 steps of +2 A. and factor +1.0; (c.f. **13.**).

III. ALIGN K12 COLLIMATORS ON KL BEAM

-> Check **HV** of **NA48 Drift Chambers** switched **off**!
-> Set **XCLD-P, -D, -C** => **out** of beam.
-> Observe horizontal, vertical profiles and centres: <x>, <y> of neutral (KL) beam on **MWPC 1** and **FISC 9** (-72 to +72 in steps of 6 mm), **MWPC 2** and **FISC 10** (-68 to +76 in steps of 6 mm), respectively.
-> Count with **HAC-K**=EXP18, **QX**=EXP14 or **QX.MU**=EXP19/NORM10.

Align KL-cleaning collimator (XCLD-C):

22. Set **XCLD-C** => **in** beam.
Scan XCLD-C horizontal position from –4.2 to +5.4 in steps of 0.4 mm, **vertical** position from –5.8 to +3.8 in steps of 0.4 mm to find centres of + - 3.2 mm plateau.
Record horizontal, vertical beam profiles.
Differences of their centres: d<x>, d<y> from <x>, <y> can be corrected by displacing XCLD-C by: dx = -0.41 d<x>, dy = -0.41 d<y>.

Align KL-defining collimator (XCLD-D):

23. Set **XCLD-D** => **in** beam, **XCLD-C** => **out** of beam.
Scan XCLD-D horizontal position from –3.4 to +4.6 in steps of 0.4 mm, **vertical** position from –5.0 to +3.0 in steps of 0.4 mm to find centres of + -2.4 mm plateau.
Set **XCLD-C** => **in** beam (at horizontal, vertical positions found in **22.**) and repeat **scans** of **XCLD-D**.
Record horizontal, vertical beam profiles.
Differences of their centres: d<x>, d<y> from <x>, <y> can be corrected by displacing XCLD-D by: dx = -0.16 d<x>, dy = -0.16 d<y>.

Check positions of TAX18 and TAX17:

24. **Scan TAX18** (Φ=8.0 mm KL aperture) from +51.5 to +67.5 in steps of 1 mm to check its centre and + -1.2 mm plateau for the KL beam.
Scan TAX17 (Φ=10.8 mm KL aperture) from +51.5 to +67.5 in steps of 1 mm to check its centre and + -2.8 mm plateau for the KL beam.

IV. TUNE K12 BENT CRYSTAL (XBCV)

-> Use **P42 full-emittance proton beam**, (TAX7, 8 = -51, -51 mm), as for **II.**, with **P0-SURVEY disabled** !

-> Select **K12 mode KS** (file K12.1), **TAX17=>-84.5 mm**, TAX18=+59.5mm; set **B5, B6, B7, [B8+9] => 0**, XCLD-P, -D, -C and CONVERTER => **out** of beam.
(Q1,Q2 focusing gives profiles * -1/2.7 at MWPC1, * -1/1.2 at MWPC2).

-> Insert the **η-target** (35mm $(CH_2)_n$) at the exit of the KL final collimator (requires **ACCESS**).

-> **Calibrate crystal** movements initially and thereafter always set by moving in +ve. sense.

-> Starting from previously aligned settings:
x= -2.7 mm, y = -1.3 mm, ϕ = **-29.7°**, (+27.5°), α = -5.1 mrad.,
iterate to find the optimum settings of the crystal goniometer positions and angles, to maximise the transmission of protons passing via the TAGGER along the KL axis and onto the η-target, counting secondary particles in the detector: **HAC-K** = EXP18
or **QX** = EXP14/NORM10.

25. Tune vertical rotation angle:
Scan the **vertical rotation angle** of the crystal, α , from -8 to -2 in steps of 0.2 mrad. to search for the channeling condition.
(The full width of the distribution is given by the horizontal size of the beam at the crystal (δx = 2.0 mm) that can pass through the Φ=2.4 mm aperture in TAX18, via the relation:
$\delta\alpha = 1/\cos\phi * |\Delta y'/\Delta x| * \delta x \sim= 1.4$ mrad.,
where $\Delta y'/\Delta x \sim= 0.6$ mrad./mm.).

26. Tune horizontal rotation angle:
Scan the **horizontal rotation angle** of the crystal, ϕ , from -29° to -26°, (+26° to +29°) in steps of $\Delta\phi$ = 0.2°, corresponding to changes of the vertical beam deflection angle, $\Delta\theta$ = + (-) 0.1 mrad.
(The width of the distribution is given by the spread in vertical angle of the beam impinging on the crystal ($\delta y'$ ~= 0.25 mrad.), via the relation:
$\delta\phi = 2\ |\Delta\phi/\Delta\theta\ |\ \delta y' \sim= 1.0°$, where $\Delta\phi/\Delta\theta \sim= +(-)\ 2°$/mrad.).

27. Tune vertical displacement:
Scan the **vertical displacement**, y, of the crystal from -2.4 to +0.8 in steps of 0.4 mm.
(The full width of the distribution is given by the sum of the thickness of the crystal (t =1.5 mm.) and the height of the beam (δy = 2.0 mm.) that can pass through the TAX18 aperture: t + δy = 3.5 mm.).

28. Tune vertical beam angle at T10 onto crystal:
Double scan TRIM6=TRIM7(P42) in + -5 steps of +2 A. and factor +1.0, (c.f. **13.** and **21.**).
If TRIM6=TRIM7 are changed, repeat **scan** of **y** according to **27.**;
Iterate if necessary.
Then repeat **scans** of ϕ according to **26.** and α according to **25.**

-> Observe the horizontal, vertical profiles of the transmitted proton beam on scans of ALL FISCs over + -10 mm in steps of 0.5 mm
[FISC 1: full width ~2.5 mm, FISC 2: full height ~10 mm at XCLD-D (XBCV +29 m)]; [FISC 5: ~1 mm, FISC 6: ~9 mm at XCLD-C (KS-target –17.5 m)] and on MWPC 1, 2.

29. Tune crystal with opposite horizontal rotation:
A second, symmetrical solution exists with the opposite sign of the horizontal rotation, ϕ.
Starting from this setting, **scan** α according to **25′.**, (see **30.**), ϕ according to **26′.** and **y** according to **27′.**, (**28′.**).

30. Adjust horizontal displacement:
The settings of α found in **25.** and **25′.** should agree within ~0.4 mrad.
The difference, 2$\Delta\alpha$, between the settings for +ve. and –ve. signs of ϕ can be corrected by a horizontal displacement of the crystal transverse to the beam by: $\mathbf{\Delta x} = \Delta\alpha * R \sin\phi \sim= \mathbf{+ 1.5\ \Delta\alpha}$,
(mm) (mrad.)*(m) where R = 3.0 m.

-> **Select** the setting for **+ve.** or **-ve.** ϕ which yields the more regular profiles on FISC 1, 2; 5, 6 and MWPC 1, 2.

V. TUNE K12 PROTON BEAM TO KS-TARGET

It is possible to choose either –**F-D-F-D-** focusing for p_0 = 444.0 GeV/c with H-, V- magnification: -1.5, -0.667 from the crystal to the KS-target: **Q1** (QNL(F)+QNL(D)) = **-463.0 A.**, **Q2** (QTR(D)+QTR(F)) = **+213.6 A.**; or *–D-F-D-F-* focusing:

Q1 (D) + (F) = +199.7 A., Q2 (F) + (D) = -210.8 A.,

The stray field due to B4 = +40 A. (3MBPL with Φ=40 mm aperture in Fe inserts) is compensated by TRIM2 = **+146**, *+115* A.
Starting with B5, B6, B7, [B8+9] = 0, count secondary particles from the **η-target** in the detector: **HAC-K** = EXP18 or **QX** = EXP14/NORM10;
Observe horizontal, vertical profiles on FISC 1, 2; 5, 6 and MWPC 1, 2.

Steer through KL-defining collimator (XCLD-D):
Set **XCLD-D** (Φ =12.2 mm aperture) =**> in** beam at x, y positions aligned on KL beam (see **23.**).

31. **Horizontal steering: scan XCLD-D horizontal** position over – +6 mm in steps of 0.5 mm and then reset to the KL beam position: **Set TRIM1** (MDXH 80) to centre proton beam (~+-1.5 mm wide) in the aperture **and TRIM2** (MDXH 80) to compensate displacement at KS-target:
ΔTRIM1 = -80 A. displaces beam by: dx = +1.0 mm at XCLD-D;
ΔTRIM1 = -80 A. and ΔTRIM2 = **+70**, *+35* A. displaces beam by:
dx =**+1.1**, *+0.7* mm at XCLD-C, ~0 at KS-target, **-10**, *-6* mm at MWPC 1.

32. **Vertical steering: scan XCLD-D vertical** position over – +6 mm in steps of 0.5 mm and then reset to the KL beam position. **Set B2** (MBNV) **and B3** (2MCWV) to centre proton beam (~+-5 mm high) in the aperture and compensate displacement at KS-target:
ΔB2 = -16 A. and ΔB3 = -6 A. displaces beam by: dy = +0.9 mm at XCLD-D, +0.8 mm at XCLD-C, 0 at KS-target, -6 mm at MWPC 2.

-> At the selected settings, check counting rates in the detector and profiles on FISC 1, 2; 5, 6 and MWPC 1, 2.

Passage through KL-cleaning collimator (XCLD-C):
Set **XCLD-C** (Φ =37.2 mm aperture) => **in** beam at x, y positions aligned on KL beam (see **22.**).

33. **Check horizontal steering: Scan of TRIM1** should be flat over - + 160 A. about value set in **31.**, corresponding to displacements of the beam by: dx = + -2 mm in XCLD-D, + -9 mm in XCLD-C.

34. **Check vertical steering: Scan** of **B3** should be flat over - +30 A. about value set in **32.**, corresponding to displacements of the beam by: dy = - + 1.0 mm in XCLD-D, - +2.5 mm in XCLD-C.

Align Proton collimator (XCLD-P):

35. Set **XCLD-P** (Φ =6.0 mm aperture for proton beam) => **in** beam and **scan XCLD-P vertical** and **horizontal** positions from -6 to +6 in steps of 0.5 mm.

-> **Alternatively**: count the **neutral (KS) beam** after the proton beam has been steered and focused onto the KS-target (**36.- 39.** below).

Steer onto KS-target (XTGU):
Set to nominal: **B5** (MBNV) = -1553.2 A., **B6** (MCWV) = -1034.4 A., **B7** (MTNV) = +1500 A.;
With the **KS-target** at the previously aligned position (x= -0.4 mm, y= +0.4 mm); set CONVERTER and **XAKS (Ir-crystal converter)** => **in** beam (horizontal displacement = 0) and count the neutral (KS) beam on **AKS** –**L**ow threshold) **=** EXP6/NORM10.

36. **Horizontal steering: scan TRIM3** (MDXH 80) from -60 to +60 in steps of +10 A. (dx = -0.28 mm at KS-target).

37. **Vertical steering: scan TRIM4** (new MDXV 80) from **–40**, *-60* to **+40**, *+60* in steps of **+4**, *+6* A., (dy = 0.3 mm at KS-target).

38. Set **XAKS-converter => out** of beam (horizontal displacement = -66 mm) and observe centres: <x>, <y> of horizontal, vertical profiles with **FISC 9** (-72 to +72 in steps of 6 mm),
FISC 10 (-76 to +68 in steps of 6 mm), respectively.
These should be at the same position horizontally and at -8 mm vertically compared to the centres of the KL beam (**23.**).

-> Correct displacements d<x>, d<y> from the wanted positions by displacing KS-target by: dx = -0.04 d<x>, dy = -0.04 d<y>.
Then repeat steering: **36.**, **37.**, with **XAKS Ir-crystal converter in**; and set it **out** to check profiles on FISC 9, 10 and MWPC 1, 2.

Focus onto KS-target:
With **XAKS Ir-crystal converter in**, count the neutral beam on **AKS-L** = EXP6/NORM10.

39. **Scan Q2 (D+F)**, *(F+D)* from **+206**, *-215* to **+221**, *-206* in steps of **+1.0**, *+0.6* A., corresponding to displacements of the foci in the ratio of $(M(H)/M(V))^2 = 9/4$: dz(H) = **-0.9**, *+0.9* m, dz(V) = **-0.4**, *+0.4* m.

-> **Check** horizontal, vertical **steering** onto the KS-target, according to **36.**, **37.**

-> **Update** and **enable P0-SURVEY**.

-> **Retract** the **η-target** used to tune the KS-proton beam on the KL axis, (**25. - 35.**), (requires **ACCESS**).

Adjust KS relative to KL beam:

-> In **mode KL+KS**, count KS beam: AKS-L = EXP6/NORM10.

40. **Vertical angle** of proton beam at T10 onto crystal:
Double scan TRIM6 =TRIM7 (P42) in + -5 steps of +2 A. and factor +1.0 on plateau of KL-beam found in **21.**
Set TRIM6=TRIM7 to maximum of KS (= setting found in **28.**).

41. **Horizontal angle** of proton beam at T10 onto crystal:
Scan TRIM5 (P42) from -40 to -20 in steps of +1 A. on plateau of KL-beam found in **20.**
Observe **time-variation** (spill shape) of **KS** (on TAGGER MONITOR, KS-MONITOR and AKS) and **KL** (on QX and BEAM COUNTER) and their **ratio** as a function of TRIM5 settings.
Set TRIM5 to render the ratio as constant as possible over the spill.

42. **Record horizontal, vertical positions of P42-proton beam** at exit of Q21, (18.8 m upstream of T10):
scan BSM1 (H), (V) from 50 to 80 in steps of 2 mm and note positions for asymmetry=0, (c.f. nominal axis = 65 mm).

43. **Record horizontal, vertical profiles of K12-proton beam** onto the KS-target with **FISC 7** (-0.5 to +1.5 in steps of 0.25 mm),
FISC 8 (nominally at +69.8 - 30 mm vertical off-set = +39.8 mm: +38.0 to +40.0 in steps of 0.25 mm).
[These profiles can be checked with the proton beam displaced parallel downwards by –28.8 mm to a nominal vertical position of +11 mm on FISC 8 by setting B5 = -744.4 A., B6 = 0 with P0-SURVEY temporarily disabled].

-> Set **FISC**s **out of beam** and **out-of-service**:
FISC 1, 2, 3, 5, 6, 7 => -40 mm, FISC 8 => +20 mm (between KL and KS-proton beams), [FOR I=117,124; SET FMOT(I,#SBT)=1];
FISC 9 => -70 mm, [SET FMOT(64,#SBT)=1],
FISC 10 => -70 mm, [SET FMOT(63,#SBT)=1].

VI. CHANGE RATIO OF KS/KL FLUXES

-> Count KS-/KL-proton ratio (nominally = $2 * 10^{-5}$):
either directly on TAGGER MONITOR counters
or via AKS-L(with aligned Ir-crystal converter) ~=600*EXP6/NORM10.

This ratio is approximately proportional to the H-magnification of the P42 proton beam from T4 onto T10 and can be changed in steps of ~10% according to files:

~10% according to files:	P42.6,	P42.5,	**P42.1**,	P42.2,	P42.3,	*P42.4*;
H-magnification:	+0.20,	0.222,	**0.25**,	0.27,	0.30,	*0.333*;
Relative KS-/KL-proton ratio:	0.80,	0.89,	**1.00**,	1.08,	1.20,	*1.33*.

Retune to optimise KL and KS beams after loading a new file**:**

44. **Horizontal, vertical steering** of the proton beam onto T10:
Scan TRIM10, **TRIM9**, respectively, according to **14.**, **15.**;
Check horizontal, vertical **focusing**, according to **17.**, **18.**, (**19.**).

45. **Vertical, horizontal angles** of the proton beam at T10 onto crystal:
Double scan TRIM6=TRIM7, **scan TRIM5**, respectively,
according to **40.**, **41.**