Tuning Procedure for the βNMR/βNQR beamline

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1 Setup

a) Follow Phils procedure (steps 1 and 2).

b) Ensure that all beamline elements (quadrupoles, steerers, benders, Einzel Lenses) from ILE2:Q16 onwards are set to theoretical values (**He off**).

c) Ask a βNMR experimenter to set the Helmholtz coil (ILE2A1:HH) and solenoid (BNMR:SOL) to 0 A.

2 Transport of non-radioactive ion beam [Polarizer Off]

2.1 Tuning to ILE2A1:FC2 at βNQR [Polarizer Off]

a) Set the beamline switch (ILE2A:XCB2S) for delivery to βNQR.

b) Confirm with a βNQR experimenter that the fixed (5 mm $\times$ 7 mm) aperture is installed in front of ILE2A1:FC2.

c) Maximize the transmission to ILE2A:FC2 and center the beam on ILE2A:RPM2 by adjusting ILE2:B21 and ILE2:YCB19. Beam should be circular at ILE2A:RPM2. If it is not, adjust ILE2:Q16-Q19.

d) Maximize the transmission to ILE2A1:FC2 by adjusting ILE2A:B3 and ILE2A:YCB2 (from ILE2:FC19 we expect around 90 % transmission). ILE2A:XCB2S can be adjusted, but only as a last resort.

2.2 Tuning to ILE2A3:FC2 at βNMR [Polarizer Off]

a) Set the beamline switch (ILE2A:XCB2N) for delivery to βNMR.

b) Confirm with a βNMR experimenter that slits ILE2A3:VA1 and ILE2A3:VA2 are in and set its width appropriately (6 mm $\times$ 6 mm). Experimenters are responsible for adjusting the slits.

c) Maximize the transmission to ILE2A3:FC1 using ILE2A3:XCB1 and ILE2A3:YCB1. ILE2A:XCB2N can be adjusted, but only as a last resort.

d) Maximize the transmission to ILE2A3:FC2 using the steerers from ILE2A3:XCB1 to ILE2A3:YCB2 (not including ILE2A3:EL1). Attempt to minimize the steerers between ILE2A3:EL1 and ILE2A3:EL2.

e) Ask a βNMR experimenter to close βNMR slits ILE2A3:VA1 and ILE2A3:VA2 to 5 mm $\times$ 5 mm.

f) Fine tune the transmission to ILE2A3:FC2 by using the steerers from ILE2A3:XCB1 to ILE2A3:YCB2 (not including ILE2A3:EL1). More than 90 % transmission from ILE2:FC19 to ILE2A3:FC2 should be possible. As above, attempt to minimize the steering on ILE2A3:YCB2.

g) Ask a βNMR experimenter to set (open) slits ILE2A3:VA1 and ILE2A3:VA2 to 6 mm $\times$ 6 mm.

h) Document the tune (save the tune, Faraday cup readings and RPMs).

3 Turning on the Polarizer

a) Ensure that quadrupoles from ILE2:Q16 onwards are set to theoretical values (**He on**).

b) Ensure that the Helmholtz coil (ILE2A1:HH) is set to 0 A and confirm with an experimenter that the solenoid (BNMR:SOL) is set to 0 A as well.

c) Follow Phils procedure (steps 3 to 8).

4 Transport of non-radioactive ion beam [Polarizer On]

4.1 Check and fine-tune the tune to βNQR [Polarizer On]

a) Set the beamline switch (ILE2A:XCB2S) for delivery to βNQR.

b) Center the beam on ILE2A:RPM2 by adjusting ILE2:B21 and ILE2:YCB19. Beam should be roughly circular at ILE2A:RPM2. If it is not, adjust ILE2:Q16-Q19.

c) Maximize the transmission to ILE2A1:FC2 by adjusting ILE2A:B3 and ILE2A:YCB2 (from ILE2:FC19 we expect around 80 % transmission).

4.2 Check and fine-tune the tune to βNMR [Polarizer On]

a) Set the beamline switch (ILE2A:XCB2N) for delivery to βNMR.

b) Maximize the transmission to ILE2A3:FC2 using the steerers and quadrupoles from ILE2A3:XCB1 to ILE2A3:YCB2 (not including ILE2A3:EL1).

c) Ask a βNMR experimenter to close βNMR slits ILE2A3:VA1 and ILE2A3:VA2 to 5 mm $\times$ 5 mm.

d) Fine tune the transmission to ILE2A3:FC2 by using the steerers and quadrupoles from ILE2A3:XCB1 to ILE2A3:YCB2 (not including ILE2A3:EL1). Around 90 % transmission from ILE2:FC19 to ILE2A3:FC2 should be possible through the 5 mm $\times$ 5 mm slits.

e) Ask a βNMR experimenter to set (open) slits ILE2A3:VA1 and ILE2A3:VA2 to 6 mm $\times$ 6 mm.

f) Document the tune (save the tune, Faraday cup readings and RPMs).

5 Switch to Radioactive Beam

a) Perform a standard mass change.

b) Optimize the separator magnets and alpha/beta coils for higher beam transmission at IMS:FC34.

6 Transport of radioactive ion beam [Polarizer On]

6.1 Tuning to the sample at βNQR [CCD setup]

a) Set the beamline switch (ILE2A:XCB2S) for delivery to βNQR.

b) Center the beam on the βNQR sample using ILE2A1:YCB1 to ILE2A1:YCB3 and adjust the beam spot size using ILE2A1:EL2 (the total of their "left" and "right" detector rates should be at least 20 % of what was measured at the Yield Station).

c) The βNQR experimenter will likely set the Helmholtz coil (ILE2A1:HH) to some non-zero value. To compensate for any vertical deflection, maximize the rates at βNQR using ILE2A1:YCB3. Fine tune the steerer using the CCD setup as a diagnostic.

6.2 Tuning to the sample at βNMR [CCD setup]

a) Set the beamline switch (ILE2A:XCB2N) for delivery to βNMR.

b) Center the beam on the βNMR sample using ILE2A3:XCB1 to ILE2A3:YCB2 and adjust the beam spot size using ILE2A3:EL1 and BNMR:EL3 (the total of their "forward" and "back" detector rates should be at least 20 % of what was measured at the Yield Station).

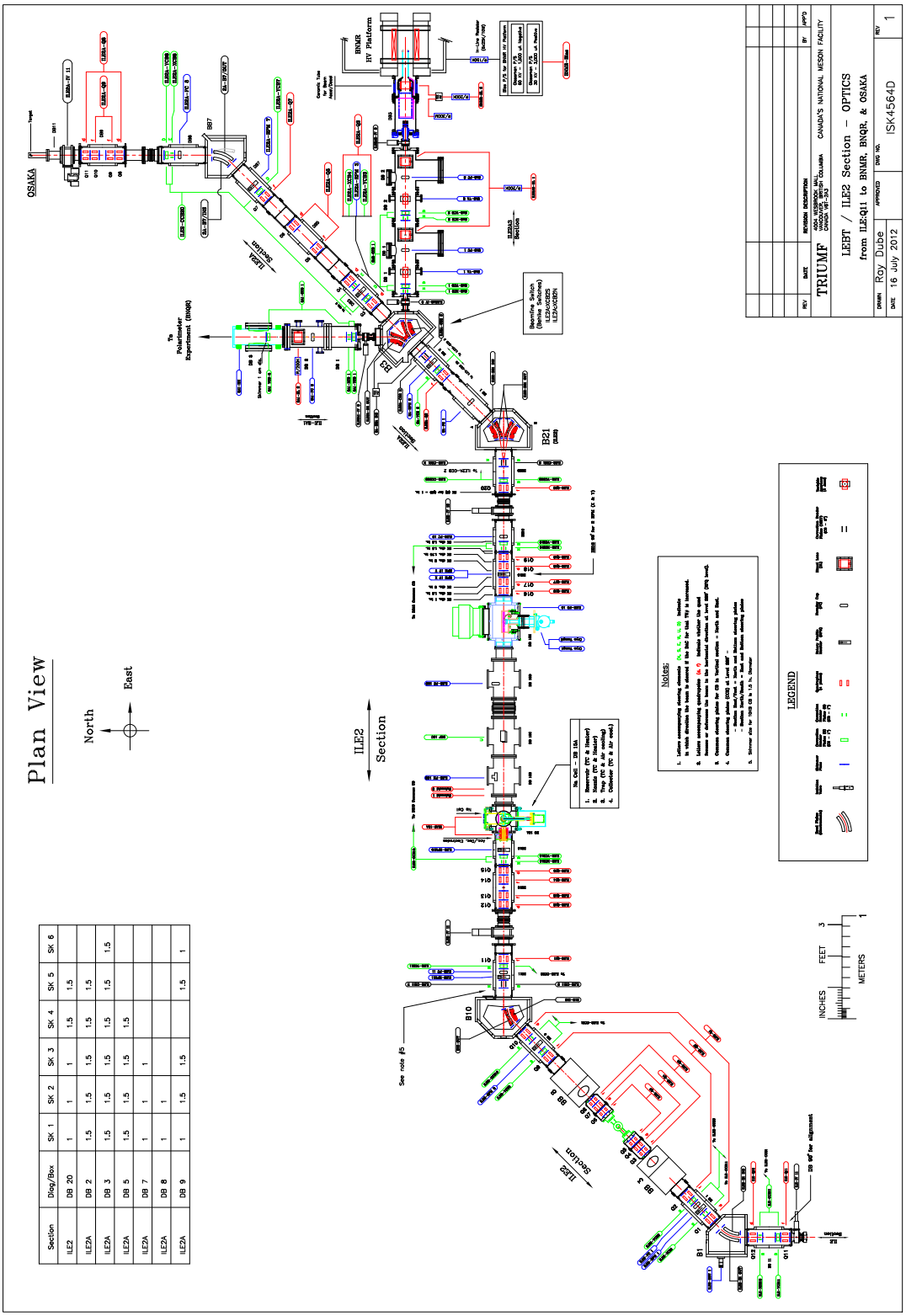
c) The βNMR experimenter will likely set the Solenoid to some non-zero value(optimum **B** field). If required, fine tune the steerers again using the CCD setup as a diagnostic.

d) The βNMR experimenter will set the slit size to meet their needs.

7 Document the Tune

a) Before delivering beam, document the tune (save, reverse bias Faraday cup readings, neutral beam monitor readbacks, experimental scaler readbacks).

b) Document the tune once again at the end of the beam delivery.



Section	Disp/Box	Sk. 1	Sk. 2	Sk. 3	Sk. 4	Sk. 5	Sk. 6
ILE2	DB 20	1	1	1	1.5	1.5	
ILE2A	DB 2	1.5	1.5	1.5	1.5	1.5	
ILE2A	DB 3	1.5	1.5	1.5	1.5	1.5	1.5
ILE2A	DB 5	1.5	1.5	1.5	1.5		
ILE2A	DB 7	1	1	1			
ILE2A	DB 8	1	1				
ILE2A	DB 9	1	1.5	1.5		1.5	1

Figure 1: Layout of the polarizer and βNMR/βNQR beamline at ISAC.

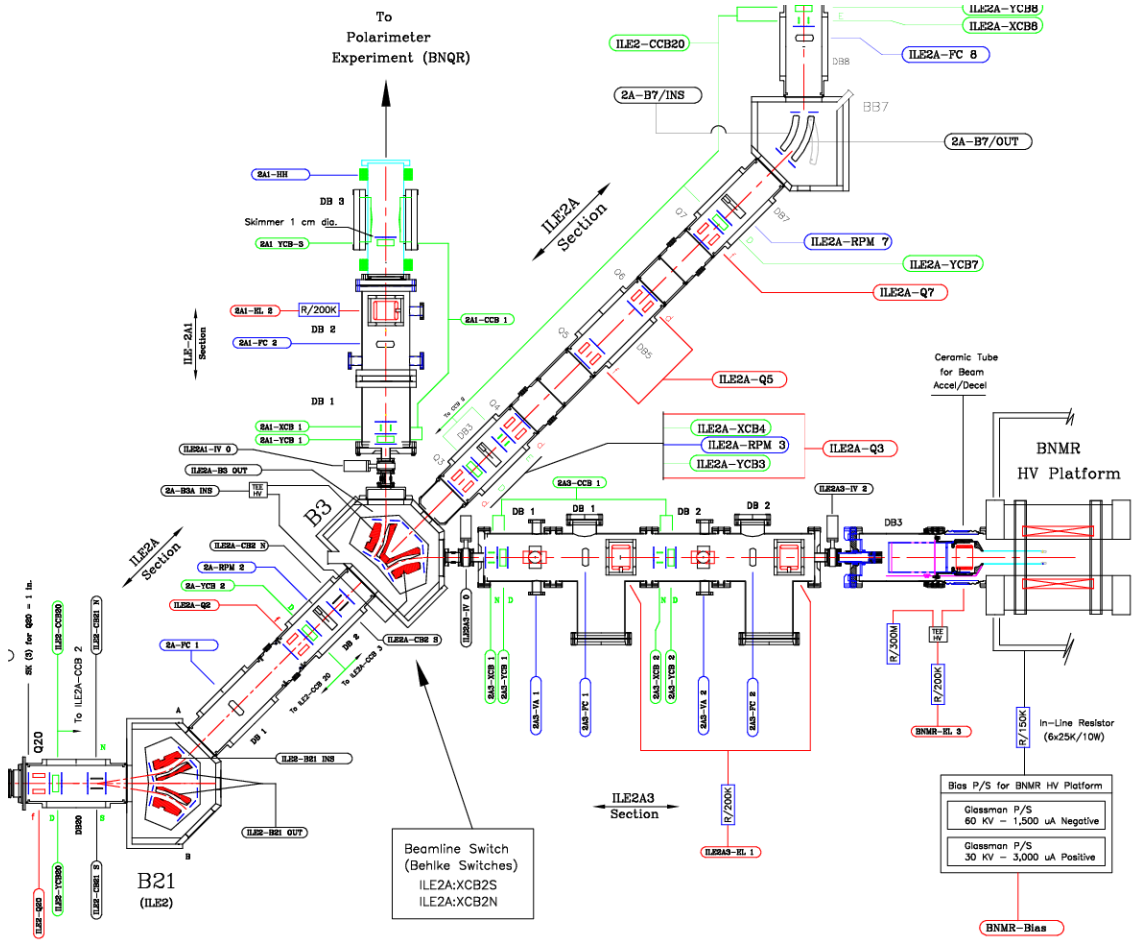


Figure 2: Layout of the βNMR/βNQR beamline at ISAC.