# Nsrl7 Schedule and Parameters

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**Caution! The following schedule is subject to change. Please note release date above.**

NSRL is to begin taking beam on 3 October 2005.

Beam Order (with nominal Booster Extraction energy):

1. Protons. 1000 MeV. Oct. 3–8 (Mon–Sat).
2. Protons. 1000 MeV. Oct. 10 (Mon).
3. Titanium. 1000 MeV per nucleon. Oct. 10–13 (Mon–Thur).
4. Chlorine. 550 MeV per nucleon. Oct. 14–18 (Fri–Tue).
5. Iron. 600 MeV per nucleon. Oct. 19–21 (Wed–Fri).
6. Iron. 1000 MeV per nucleon. Oct. 24–28 (Mon–Fri).
7. Iron. 1000 MeV per nucleon. Oct. 31–Nov. 4 (Mon–Fri).
8. Iron. 1000 MeV per nucleon. Nov. 7–10 (Mon–Thur).
9. Iron & Protons. 1000 MeV per nucleon. Nov. 11 (Fri).
10. Iron & Protons. 1000 MeV per nucleon. Nov. 14–15 (Mon–Tue).
11. Oxygen. 1000 MeV per nucleon. Nov. 16 (Wed).
12. Silicon. 1000 MeV per nucleon. Nov. 17 (Thur).
13. Silicon. 300 MeV per nucleon. Nov. 18 (Fri).

Protons (from Tandem) will be set up on BU2. All other ions for NSRL will be set up on BU3.

Table 1: Proton, Titanium, and Iron Parameters at Booster Injection

| Parameter | Proton | $Ti^{18+}$ | $Fe^{20+}$ | Unit |
|---|---|---|---|---|
| Protons<br>Nucleons | 1<br>1 | 22<br>48 | 26<br>56 | |
| $mc^2$ | 0.938271998 | 44.6540277 | 52.0928437 | GeV |
| Archive<br>Date | 24 Sept 04 | 15 Jun 05 | 8 Apr 05<br>17 Jun 05 | |
| 11DH1<br>NMR Probe | 3971.15 | 4364.1 | 4364.1 | Gauss |
| $hf$ | 566.033 | 358.056 | 341.131 | kHz |
| $h$ | 2 | 3 | 3 | |
| $T = 1/f$ | 3.53336 | 8.37857 | 8.79427 | $\mu$s |
| Kinetic<br>Energy $W$ | 17.5008 | 144.7817 | 153.2415 | MeV |
| $B\rho$ | 0.6073 | 0.6669 | 0.6669 | Tm |
| $B\rho/\rho$ | 437.990 | 480.974 | 480.974 | Gauss |
| Booster<br>Hall Probe | 418.2 | – | 453.4 | Gauss |
| Booster<br>Gauss Clock | 14.3 | – | 23.5 | Gauss |
| Injection<br>Field $H$ | 432.5 | 476.9 | 476.9 | Gauss |
| Inflector<br>Setpoint $V_S$ | 67.507 | – | 29.781 | kV |
| Inflector<br>Predicted $V_I$ | 67.448 | 31.235 | 29.759 | kV |

Table 2: Chlorine, Oxygen, and Silicon Parameters at Booster Injection

| Parameter | $Cl^{14+}$ | $O^{7+}$ | $Si^{13+}$ | Unit |
|---|---|---|---|---|
| Protons<br>Nucleons | 17<br>35 | 8<br>16 | 14<br>28 | |
| $mc^2$ | 32.56612296 | 14.89559022 | 26.05369658 | GeV |
| Archive<br>Date | – | 31 Mar 05 | 6 Jul 05<br>8 Jul 05 | |
| 11DH1<br>NMR Probe | 4364.1 | 4364.1 | 4364.1 | Gauss |
| $hf$ | 381.688 | 416.9434 | 442.455 | kHz |
| $h$ | 3 | 3 | 3 | |
| $T = 1/f$ | 7.85981 | 7.19522 | 6.78035 | $\mu$s |
| Kinetic<br>Energy $W$ | 120.0668 | 65.6018 | 129.3224 | MeV |
| $B\rho$ | 0.6669 | 0.6669 | 0.6669 | Tm |
| $B\rho/\rho$ | 480.974 | 480.974 | 480.974 | Gauss |
| Booster<br>Hall Probe | – | – | – | Counts |
| Booster<br>Gauss Clock | – | – | – | Counts |
| Injection<br>Field $H$ | 476.9 | 476.9 | 476.9 | Gauss |
| Inflector<br>Setpoint $V_S$ | – | 36.285 | – | kV |
| Inflector<br>Predicted $V_I$ | 33.297 | 36.372 | 38.598 | kV |

Table 3: Proton, Titanium, and Chlorine Parameters at Booster Extraction

| Parameter | Proton | $Ti^{18+}$ | $Cl^{14+}$ | Unit |
|---|---|---|---|---|
| $mc^2$ | 0.938271998 | 44.6540277 | 32.56612296 | GeV |
| Archive Date | 24 Sept 04 | 15 Jun 05 | – | |
| $hf$ | 2.6001199 | 3.912198 | 3.466888 | MHz |
| $h$ | 2 | 3 | 3 | |
| $T = 1/f$ | 0.769195 | 0.766832 | 0.865329 | $\mu$s |
| Kinetic E per Nucleon | 1000.0000 | 1011.1732 | 550 | MeV |
| $B\rho$ | 5.65737292 | 15.15774913 | 9.60267363 | Tm |
| $B\rho/\rho$ | 4080.15 | 10931.91 | 6925.54 | Gauss |
| Magnetic Field Setpoint | 4159 | 11100 | 7041 | Gauss |
| MM Current Setpoint | 1710 | 4663 | 2899 | Amps |

Table 4: Iron Parameters at Booster Extraction

| Parameter | $Fe^{20+}$ | $Fe^{20+}$ | Unit |
|---|---|---|---|
| $mc^2$ | 52.0928437 | 52.0928437 | GeV |
| Archive Date | 17 Jun 05 | 8 Apr 05 | |
| $hf$ | 3.908086 | 3.563032 | MHz |
| $h$ | 3 | 3 | |
| $T = 1/f$ | 0.76764 | 0.84198 | $\mu$s |
| Kinetic E per Nucleon | 1004.2975 | 618.0385 | MeV |
| $B\rho$ | 15.84208582 | 11.55950682 | Tm |
| $B\rho/\rho$ | 11425.46 | 8336.82 | Gauss |
| Magnetic Field Setpoint | 11600 | 8471 | Gauss |
| MM Current Setpoint | 4934 | 3495 | Amps |

Table 5: Oxygen and Silicon Parameters at Booster Extraction

| Parameter | $O^{7+}$ | $Si^{13+}$ | $Si^{13+}$ | Unit |
|---|---|---|---|---|
| $mc^2$ | 14.8955902 | 26.05369658 | 26.05369658 | GeV |
| Archive Date | 31 Mar 05 | 8 Jul 05 | 6 Jul 05 | |
| $hf$ | 3.908024 | 3.906012 | 2.9165665 | MHz |
| $h$ | 3 | 3 | 3 | |
| $T = 1/f$ | 0.767651 | 0.768047 | 1.028607 | $\mu$s |
| Kinetic E per Nucleon | 1005 | 1001.1739 | 300 | MeV |
| $B\rho$ | 12.94178669 | 12.16172311 | 5.784686256 | Tm |
| $B\rho/\rho$ | 9333.74 | 8771.15 | 4171.97 | Gauss |
| Magnetic Field Setpoint | 9481 | 8911 | 4252 | Gauss |
| MM Current Setpoint | 3923 | 3680 | 1749 | Amps |

Table 6: Longitudinal Emittance and Bucket Area in Booster at Injection. Emit is the emittance of the beam in one bucket assuming $\Delta p/p = \pm 0.00025$. $A_S$ is the stationary bucket area at the indicated gap voltage. The units are eV-s. Note that if the gap voltage is 30 kV and $dB/dt = 80$ G/ms, then the stable phase is 48.25 degrees and the bucket area is $\alpha A_S$ where $\alpha = 0.135$.

| Ion | Emit | $A_S$ 0.5 kV | $A_S$ 30 kV |
|---|---|---|---|
| $H^+$ | 0.031 | 0.174 | 1.35 |
| $Ti^{18+}$ | 0.404 | 2.711 | 21.0 |
| $Fe^{20+}$ | 0.449 | 3.085 | 23.9 |
| $Cl^{14+}$ | 0.314 | 2.043 | 15.82 |
| $O^{7+}$ | 0.157 | 0.978 | 7.58 |
| $Si^{13+}$ | 0.292 | 1.764 | 13.7 |