

# Nsrl06c 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 11 September 2006.

Beam Order (with nominal Booster Extraction energy):

1. Chlorine. 650 & 1000 MeV per nucleon. Sept 11–12 (Mon–Tue).
2. Protons. 1000 MeV per nucleon. Sept 12–15 (Tue–Fri).
3. Protons. 1000 MeV per nucleon. Sept 18 (Mon).
4. Protons & Iron. 1000 MeV per nucleon. Sept 19–21 (Tue–Thur).
5. Protons. 2500 MeV per nucleon. Sept 22 (Fri).
6. Protons. 200 & 500 MeV per nucleon. Sept 22 (Fri).
7. Iron. 1000 MeV per nucleon. Sept 25–29 (Mon–Fri).
8. Iron. 300 & 600 MeV per nucleon. Sept 26 (Tue).
9. Iron. 600 & 1000 MeV per nucleon. Sept 29 (Fri).
10. Iron. 600 & 1000 MeV per nucleon. Oct 2–6 (Mon–Fri).
11. Iron. 600 & 1000 MeV per nucleon. Oct 9–13 (Mon–Fri).
12. Iron. 600 & 1000 MeV per nucleon. Oct 16–19 (Mon–Thur).
13. Silicon. 1000 MeV per nucleon. Oct 20 (Fri).

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

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

Parameter	Proton	Cl <sup>14+</sup>	Fe <sup>20+</sup>	Unit
Protons	1	17	26	
Nucleons	1	35	56	
$mc^2$	0.938271998	32.56612296	52.0928437	GeV
Archive Date	29 Jun 06	14 Oct 05	29 Jun 06	
11DH1 NMR Probe	3971.15	4364.1	4364.1	Gauss
$hf$	566.033	381.688	341.131	kHz
$h$	2	3	3	
$T = 1/f$	3.53336	7.85981	8.79427	$\mu$ s
Kinetic Energy $W$	17.5008	120.0668	153.2415	MeV
$B\rho$	0.6073	0.6669	0.6669	Tm
$B\rho/\rho$	437.990	480.974	480.974	Gauss
Booster Hall Probe	418.2	–	453.4	Gauss
Booster Gauss Clock	14.3	–	23.5	Gauss
Injection Field $H$	432.5	476.9	476.9	Gauss
Inflector Setpoint $V_S$	67.367	33.367	29.605	kV
Inflector Predicted $V_I$	67.448	33.297	29.759	kV

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

Parameter	Si <sup>13+</sup>	Cl <sup>14+</sup>	Fe <sup>20+</sup>	Unit
Protons	14	17	26	
Nucleons	28	35	56	
$mc^2$	26.05369658	32.56612296	52.0928437	GeV
Archive Date	17 Nov 05 7 Apr 06	14 Oct 05	29 Jun 06	
11DH1 NMR Probe	4364.1	4364.1	4364.1	Gauss
$hf$	442.455	381.688	341.131	kHz
$h$	3	3	3	
$T = 1/f$	6.78035	7.85981	8.79427	$\mu$ s
Kinetic Energy $W$	129.3224	120.0668	153.2415	MeV
$B\rho$	0.6669	0.6669	0.6669	Tm
$B\rho/\rho$	480.974	480.974	480.974	Gauss
Booster Hall Probe	–	–	453.4	Gauss
Booster Gauss Clock	–	–	23.5	Gauss
Injection Field $H$	476.9	476.9	476.9	Gauss
Inflector Setpoint $V_S$	38.588	33.367	29.605	kV
Inflector Predicted $V_I$	38.598	33.297	29.759	kV

Table 3: Proton and Chlorine Parameters at Booster Extraction

Parameter	Proton	Proton	Cl <sup>14+</sup>	Unit
$mc^2$	0.938271998	0.938271998	32.56612296	GeV
Archive Date	29 Jun 06	22 Jun 06	14 Oct 05	
$hf$	2.6001199	2.8586962	3.466888	MHz
$h$	2	2	3	
$T = 1/f$	0.769195	0.699620	0.865329	$\mu$ s
Kinetic E per Nucleon	1000	2500	550	MeV
$B\rho$	5.65737292	11.03354195	9.60267363	Tm
$B\rho/\rho$	4080.15	7957.49	6925.54	Gauss
Magnetic Field Setpoint	4159.68 4159	8112.60 8086.7085	7060.54 7041	Gauss
MM Current Setpoint	1710	3333.6537	2899	Amps

Table 4: Chlorine Parameters at Booster Extraction

Parameter	Cl <sup>14+</sup>	Cl <sup>14+</sup>	Cl <sup>14+</sup>	Unit
$mc^2$	32.56612296	32.56612296	32.56612296	GeV
Archive Date			14 Oct 05	
$hf$	3.9053130	3.6029097	3.466888	MHz
$h$	3	3	3	
$T = 1/f$	0.768184	0.832660	0.865329	$\mu$ s
Kinetic E per Nucleon	1000	650	550	MeV
$B\rho$	14.10497310	10.6535055	9.60267363	Tm
$B\rho/\rho$	10172.64	7683.41	6925.54	Gauss
Magnetic Field Setpoint	10370.93	7833.18	7060.54	Gauss
MM Current Setpoint	4313.20	3227.92	2907.04	Amps

Table 5: Proton Parameters at Booster Extraction

Parameter	Proton	Proton	Unit
$mc^2$	0.938271998	0.938271998	GeV
Archive Date	–	–	
$hf$	1.6823335	2.2521094	MHz
$h$	2	2	
$T = 1/f$	1.188825	0.888056	$\mu s$
Kinetic E per Nucleon	200	500	MeV
$B\rho$	2.14963569	3.63611180	Tm
$B\rho/\rho$	1550.337	2622.398	Gauss
Magnetic Field Setpoint	1580.557	2673.52	Gauss
MM Current Setpoint	–	–	Amps

Table 6: Iron Parameters at Booster Extraction

Parameter	Fe <sup>20+</sup>	Fe <sup>20+</sup>	Fe <sup>20+</sup>	Unit
$mc^2$	52.0928437	52.0928437	52.0928437	GeV
Archive Date	29 Jun 06	29 Jun 06	–	
$hf$	3.9054651	3.5390849	2.9168317	MHz
$h$	3	3	3	
$T = 1/f$	0.768154	0.847677	1.028513	$\mu$ s
Kinetic E per Nucleon	1000	600	300	MeV
$B\rho$	15.79629259	11.34804355	7.519187947	Tm
$B\rho/\rho$	11392.43	8184.31	5422.91	Gauss
Magnetic Field Setpoint	11614.50 11600	8343.84 8471	5528.62 –	Gauss
MM Current Setpoint	4934	3495	–	Amps

Table 7: Silicon Parameters at Booster Extraction

Parameter	Si <sup>13+</sup>	Si <sup>13+</sup>	Unit
$mc^2$	26.05369658	26.05369658	GeV
Archive Date	17 Nov 05 7 Apr 06	17 Nov 05 7 Apr 06	
$hf$	3.9052942	2.9165665	MHz
$h$	3	3	
$T = 1/f$	0.768188	1.028607	$\mu s$
Kinetic E per Nucleon	1000	300	MeV
$B\rho$	12.152097912	5.784686256	Tm
$B\rho/\rho$	8764.21	4171.97	Gauss
Magnetic Field Setpoint	8911	4252	Gauss
MM Current Setpoint	3680	1748	Amps



Table 8: 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 <sup>+</sup>	0.031	0.174	1.35
Si <sup>13+</sup>	0.292	1.764	13.7
Cl <sup>14+</sup>	0.314	2.043	15.82
Fe <sup>20+</sup>	0.449	3.085	23.9