|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Quantity (Unit)** | **PS** | **PSB** | **LEIR** | **ELENA** | | **SPS** |
| Injection time (ms) | 170 (p+)  235 (Pb54) | 275 | 245 | 2727 | |  |
| Extraction time (ms) | 1650 (p+)  1360 (Pb54) | 805 | 2880 | 30000 | |  |
| Excitation current (A) | 404 (p+)  685 (Pb54) | 580 | 769 | 276 | |  |
| Measured B-train field   (G) | 1013.5 (p+)  685 (Pb54) | 1250 | 2719.4 | 3593 | |  |
| Excitation current (A) | 5372 | 4014 | 3289.7 | 38 | |  |
| Measured B-train field (G) | 12550 | 8610 | 11476 | 493 | |  |
| Field marker value, (G) | 495 (Dside)  485 (Fside) | 1108 | 2512.13 | 4501 | 3400 |  |
| Field marker trigger time, (ms from C0) | 84.2 (Dside)  85.1 (Fside) | 197 | 117.8 | 535.2 | 2315 |  |
| Ramp rate at field marker value   (G/s) | 20502 | 5130 | 2800 | 1000 | 1600 |  |
| Current drift (A/s) | N/A | N/A | N/A | 0.00054 | |  |
| Current jitter @ marker time (A) | N/A | N/A | N/A | 0.0028 | |  |
| Nominal current-to-field ratio (G/A) | 2.50 | 2.14 | 3.54 | 13.01 | | 3.5 |
| Effective coil width for operational chain (m) | 1.1032 (Dside)  1.3240 (Fside) | 1 | 0.60367 | 2.8415 | |  |

**FIRESTORM Commissioning Performance Evaluation – Dec 2018**

A. Cycle and sensor parameters

1 Low field marker in use only during acceleration cycles.

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **Quantity (Unit)** | | **PS** | **PSB** | **LEIR** | **ELENA** | | **SPS** |
| Correlation of measured chains | Gain | 1.0000 | N/A | 0.9985 | 0.9992 | |  |
| Offset (G) | 0.0768 | N/A | 2.031 | 2.0842 | |  |
| Correlation of new/old B-train | Gain | 1.0001 | 1.00005 3.5 | 0.9969 | N/A | |  |
| Offset (G) |  | -0.14 0.13 | 3.92 | N/A | |  |
| Difference new/old B-train @ injection (G) | | 0.20.1 | 0.050.12 | -0.490.15 | N/A | |  |
| Difference new/old B-train @ extraction (G) | | 1 0.2 | -0.230.44 | -4.860.25 | N/A | |  |
| Measured drift (G/s) | | 0.1 0.1 | 0.088 0.031 | 0.0373 | 0.010 0.015 | |  |
| Measured St. dev.noise level (G) | | 0.0096 | 0.0770.010 | 0.150.015 | 0.029 0.001 | |  |
| Measured peak-to-peak noise level (G) | | 0.053 | 0.3670.049 | 0.90.079 | 0.138 0.005 | |  |
| Time-harmonic field noise components B signal ( kHz for PSB) | | N/A | 8.2 5 | N/A | N/A | |  |
| Time-harmonic field noise components I signal ( kHz for PSB) | | N/A | 70 50 | N/A | N/A | |  |
| Marker signal amplitude (V) | | 0.7 0.1 (Dside)  1.7 0.2 (Fside) | 2.830.22 | 3.4540.005 | 0.16  0.02 | 1.7 0.03 |  |

B. Quality indicators

2 RMSE of fit = 1.67 G over 40 cycles

C. Stability parameters

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Quantity (Unit)** | **PS** | **PSB** | **LEIR** | **ELENA** | | **SPS** |
| Measured field repeatability/reproducibility @ injection (G) | 0.012 | 0.15 | 0.137 | 0.041 | |  |
| Measured field repeatability/reproducibility @ extraction (G) | 0.159 | 0.17 | 0.188 | 0.37 | |  |
| Average/Standard deviation of field jump at marker (G) | N/A | 0.453 0.43 | -2.17 0.49 | N/A | |  |
| Marker jitter **repeatability**, () | 3.3 (Dside)  3.1 (Fside) | 180 | 43 | 60.1 | 21.5 |  |
| Marker relative **repeatability**  () | 1.35 (Dside)  1.32 (Fside) | 0.81 | 0.42 | 1.3 | 0.10 |  |

D. Beam parameters

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Quantity (Unit)** | **PS** | **PSB** | **LEIR** | **ELENA** | **SPS** |
| Revolution frequency @ injection (kHz) | 436.585 0.001 |  | 360.5540.018 | 1043.4 0.063 |  |
| Revolution frequency @ extraction (kHz) | 476.821 0.001 |  | 1419.9920.11 | 144.0 0.107 |  |
| Mean radial position @ injection (mm) |  |  | 12 | -0.353 0.008 |  |
| Mean radial position @ extraction (mm) |  |  | -1.630.46 | 1.596 0.110 |  |
| Radial RF loop @ injection (kHz) | -0.050 |  | N/A | 0.034 0.055 |  |
| Radial RF loop @ extraction (kHz) | +0.025 |  | -0.4150.045 | 0.116 0.153 |  |
| Energy mismatch @ injection |  |  | N/A | N/A |  |
| Energy mismatch @ extraction | N/A |  | N/A | N/A |  |
| **Comparison old/new B-train** |  |  |  |  |  |
| Tomograph (beam profile vs. time) | Cycle dependent | N/A | N/A | N/A |  |
| Beam revolution frequency | N/A | N/A | N/A | N/A |  |
| Beam current | Cycle dependent | N/A | N/A | N/A |  |
| Impact of ad-hoc B0 offsets (PS, LEIR) | N/A | N/A | N/A | N/A |  |