Comparison of spill structures

S. Sorge, G. Franchetti, GSI
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Using the data provided in the indico web site of "The Slow Extraction Workshop" the following table is constructed.

Institution Name	PPBrms/ PPBave 1 ms bin	Particles per 1 ms bin	PPBrms/ PPBave Original bin	Particles per original bin	Spill duration (sec)	Total particles Per Spill	Original Bin (ms)	Efficiency	Beam type, Remarks
1	2	3	4	5	6	7	8	9	10
CERN, M. Fraser	0.157	1.0e10	0.158	4.0e9	4.0	4.0e13	0.4	98%	proton, unbunched
MIT, C. Krantz	0.166	34000	0.250	1700	8.0	2.72e8	0.05		ion (C12+), bunched KO
BNL, K. Brown	0.188	3.17e10	0.208	1.27e9	2.4	7.6e13	0.04	98 %	proton, empty 93 MHz bucket at 5 kV
HIT, C. Schoemers	0.210	30000	0.305	1500	5.0	1.4e8	0.05	C: 65%, P: 60%	ion (C12+), bunched KO
FJZ, H. Stockhorst	0.279	3700	0.279	3700	3.5	1.3e7	1.0	98%	proton, unbunched stochastic
IHEP, S. Ivanov	0.329	(1.5-7.5)e8	0.448	6.0e7 – 3.0e8	1.35	(2-10)e12	0.04	90 – 94%	proton, unbunched stochastic
GSI, P. Forck	0.334	900	0.575	18	1.55	1.4e6	0.02		ion, bunched KO
MedAustron, A.Wastl	0.541	3.6e6	0.901	72000	5.0	1.8e10	0.02	80 %	proton, unbunched with betatron core
BNL, K. Brown	0.565	3.88e10	0.870	1.55e9	1.6	6.2e13	0.04	98 %	proton, no empty bucket filtering, random noise, no power supply harmonics
J-PARC, M. Tomizawa	0.637	2.3e10	0.911	2.3e8	2.1	4.774e13	0.01	99.5 %	proton, unbunched
GSI, P. Forck	0.642	550	0.806	11	2.0	1.1e6	0.02		ion, bunched resonant
GSI, P. Forck	0.726	1000	1.40	20	2.1	2.1e6	0.02		ion, unbunched resonant
FZJ, H. Stockhorst	1.11	1400	1.11	1400	3.0	4.3e6	1.0	98%	proton, resonant extr.

Notes for column 2:

PPB   = particles units per bin, i.e. are not necessarily physical particles.
PPB_av   = averaged particle units per bin
dPPB_rms = rms deviation of particle units per bin from PPB_av

1 ms:
(dPPB_rms) / (PPB_average) obtained from data clustered in bins of 1 ms.
The binning time is normalized to 1 ms, because that was the longest found in one of the
spill files: this is obtained by merging consecutive bins to reach blocks of 1 ms.

dt_bin_original:
(dPPB_rms) / (PPB_average) obtained from the original data,
for the bin length as provided by original files (i.e. bin length=dt_bin_original).

Remark on column 6:

Efficiencies are according to survey files received.
Definitions are not necessarily the same, some number are efficiency of
pure extraction process, some others of a whole cycle including injection
and acceleration.

Rescaling the spill data

All data are provided as particle per bin (**PPB**) with bins of a given length (column 8). In order to compare the statistical properties of the spill structure, data are clustered in bins of 1 ms, and the statistics is performed in this structure.   This is an example of clustered bin from 4-neighbored bins.

original
bin

| n1 | n2 | n3 | n4 |

1 ms bin

Clustered bin

nb = n1+n2+n3+n4