

Accelerator operation report

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This report describes the operation statistics of the GSI accelerator facility of the year 2014. The information is based on the data of the GSI electronic operation logbook OLOG [1] which allows a detailed evaluation of operation statistics especially for the time-sharing operation mode of the accelerators.

General Overview

After a long (14 months) shutdown period, which already began in 2012, the re-commissioning started in January. From January till November, two major beam time blocks were scheduled, which resulted in an operating time in the same order of magnitude as in 2012. In total, the SIS has been operated for 5832 hours and the UNILAC for 6432 hours (1032 hours are included for the commissioning of the accelerators after shutdown).

The intermediary shutdown period lasted from May 19th till June 24th. Because of performance issues and the obvious misalignment of the ring, the SIS shutdown was brought forward to May 2nd. The break was used to completely realign the SIS. In addition an aperture limiting piece of aluminium foil could be localized and removed from the vacuum chamber.

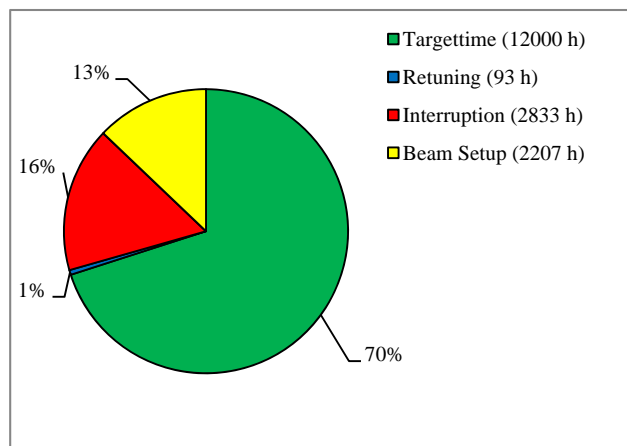


Figure 1: Distribution of overall beam time for all experiments

Figure 1 shows the overall beam time of the whole facility. In total 12000 hours of beam-on-target-time were successfully delivered to the different experiments, which is 70% of total beam time (76% in 2012).

The percentage of interruption time increased by 14%, you find the absolute numbers for 2012 and 2014 in Table 1. Similarly the percentage of the time needed for beam setup increased by 30%. Main reason for this gain was the complicated beam time schedule and the higher percentage of accelerator experiments (22%). At the UNILAC 1575 hours of beam time have been used for accelerator experiments, at the SIS there were 1798 hours and at the

ESR 390 hours for accelerator experiments, which is in total an increase by a factor of 6 compared to 2012. At the UNILAC it is even a factor of 8.

Table 1: Overall beam time of the accelerator facility

	2014	2012
Integral target time for all experiments	12000 h	12105 h
Beam Setup	2207 h	1656 h
Time for retuning	93 h	102 h
Time of interruption	2833 h	2323 h
Total beam time	17133 h	16220 h

Operation for Experiments

Figure 2 gives an overview of target time for different experimental areas. The fraction of the beam branches of the UNILAC are marked in blue, the ESR in green and the different experimental caves behind the SIS are displayed as orange slices. Details corresponding to the different experimental programs are given in [2].

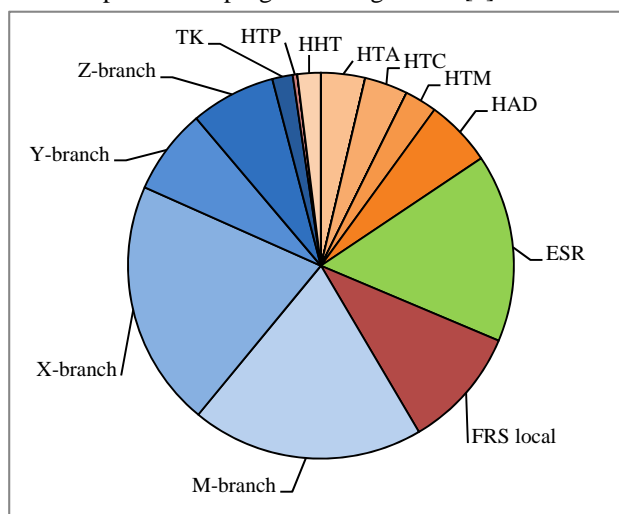


Figure 2: Distribution of target time to the different experimental areas

UNILAC Experiments

Details of the beam time for UNILAC experiments are shown in Table 2. Over the year 23 different experiments have been performed at the UNILAC. In total 6782 hours of target time have been achieved. The main user was the Material Science (2097 hours). The fraction of target time remained almost constant compared to 2012 but an increase of time for accelerator setup was observed.

Table 2: Beam delivery to UNILAC experiments

	Time	Ratio
Target time for experiments	6782 h	75,2%
Time for retuning	48 h	0,5%
Accelerator setup	1008 h	11,2%
Ion source service	407 h	4,5%
Unscheduled down time	774 h	8,6%
Total beam time	9018 h	100%

SIS/ESR Experiments

The SIS delivered beams to 19 fixed target experiments and to 7 experiments at the ESR. In total 5219 hours of target time have been achieved. The fraction of target time decreased by more than 10% compared to 2012, which was mainly caused by the increased unscheduled downtime. A more detailed overview is given in Table 3.

Table 3: Beam delivery to SIS/ESR experiments

	Time	Ratio
Target time for experiments	5219 h	64,3%
Time for retuning	45 h	0,6%
Accelerator setup	1199 h	14,8%
Ion source service	114 h	1,4%
Unscheduled down time	1538 h	19,0%
Total beam time	8115 h	100%

In 2014 the target time for the ESR (direct beam and beam via FRS) increased to 2106 hours. For about 1359 hours the beam was delivered to the local experiments of the FRS. 747 hours of beam time were scheduled for HAD, another main user at the SIS.

Accelerator Operation

Table 4 shows more detailed all unscheduled down time events. In comparison to 2012 the downtime increased by 47%. In addition to the previously described SIS problems, which are excluded from these statistics, a water leak of the newly installed MA-cavity stopped the SIS operation for several days.

The total downtime of power supplies and controls were increased by more than a factor of two, compared to 2012. The main reason for control problems was the high maintenance requirement for old hardware and legacy software during the beam time. The time spent for operation failures increased slightly, which was to be expected in the face of the complex operating mode (switching experiments several times per day) and the special settings for the accelerator experiments.

Table 4: Statistics of all unscheduled down time events

	Down time	No. of events
Power supplies	580 h	412
Vacuum and structures	438 h	119
Beam diagnostics	31 h	19
Operation	38 h	38
Safety-/ Interlock system	38 h	36
Ion Sources	143 h	53
RF system	328 h	434
Controls	164 h	70
Infrastructure	40 h	16
Others / ambiguous	186 h	89
Total of unscheduled down time	1986 h	1286

During 2014, 19 different isotopes have been accelerated. Figure 3 shows the operation time for each isotope. Besides nitrogen, the heavy elements beyond samarium were dominating the ion source statistics.

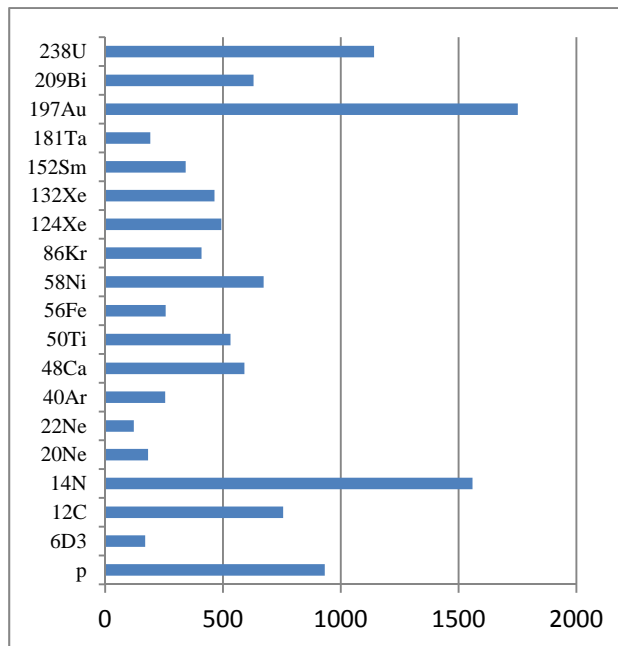


Figure 3: Total beam time for different ion species

References

- [1] P.Schuett, the GSI Operation Logbook OLog, WAO2010 (<http://wao10.komac.re.kr/PDF/O-17.pdf>)
- [2] Report of beam time coordinator, this report