

Accelerator Operation Report

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This report describes the operation statistics of the GSI accelerator facility in the year 2012. The presented information is based on the data of the GSI electronic operation logbook OLOG [1] which allows for a detailed evaluation of operation statistics especially for the time-sharing operation mode of the accelerators.

General Overview

From March till November three beam time blocks were scheduled. This led to an increase in operation time compared to 2011. In total, the SIS has been operated for 5032 hours and the UNILAC for 5880 hours. 552 hours are included for the commissioning of the accelerators after shutdown.

The first shutdown period lasted from January the 1st till March the 25th. This shutdown was used for a careful and detailed maintenance of the second Alvarez section. The vacuum pressure in the SIS injection section was improved and the reinjection septum was replaced by a NEG coated vacuum chamber with a bigger aperture. Both measures improved the life time of low charged heavy ions. Leaks in the northern arc of the ESR were also repaired. The other long shutdown started on December the 1st. It will last until the second half of the year 2013.

Table 1: Overall beam time of the accelerator facility

	2012	2011
Integral target time for all experiments	12105 h	8809 h
Time for retuning	103 h	96 h
Time of interruption	3680 h	3518 h
Total beam time	15888 h	12432 h

In Table 1 the overall beam time of the whole facility is shown. In total 12105 hours of beam-on-target-time were successfully delivered to the different physics experiments, about 3296 hours more than in 2011. The category *retuning* includes the time necessary to improve the beam performance during the running experiment. The *time of interruption* covers the categories *accelerator setup* (1436 h), *ion source service* (553 h) and *unscheduled down time* (1690 h). These are all events which lead to a break of the running beam for the corresponding experiment. Altogether these times add up to the *total beam time*. Due to time sharing operation this amount is higher than the sum of the operation hours. Compared to 2011 the ratio between target time and total beam time (availability of the facility) increased by 5 percentage points to 76%. Less time for set up was needed and the unscheduled down time for SIS/ESR decreased as well.

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Experimental Operation

Figure 1 gives an overview of target time for different experimental areas with the fraction of the 4 beam branches of the UNILAC on the right side, the ESR below and the different experimental caves behind the SIS on the left side. Details corresponding to the different experimental programs are given in [2].

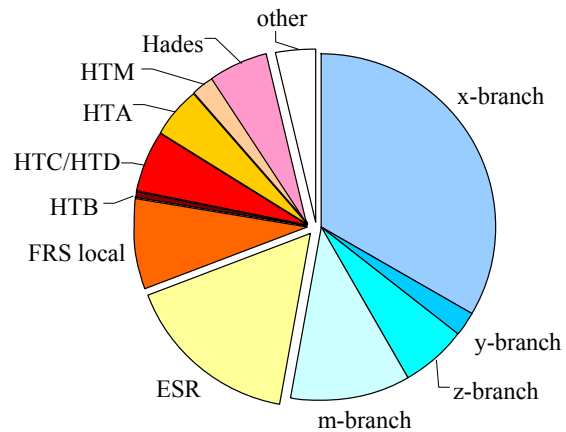


Figure 1: Distribution of target time with respect to the different experimental areas.

UNILAC Experiments

Details of the beam time for UNILAC experiments are shown in Table 2. Over the year 13 different experiments were performed at the UNILAC. In total 6501 hours of target time for physics experiments have been achieved. The main user was the TASCAs experiment (3600 hours). Furthermore the beam was used by Material Science (1426 hours) and for biological experiments (277h). The fraction of target time remained constant compared to last year. We observed a decrease of time for accelerator setup and an increase of unscheduled down time.

Table 2: Beam delivered to UNILAC experiments

	Time	Fraction
Target time for experiments	6501 h	76,7%
Time for retuning	49 h	0,6%
Accelerator setup	743 h	8,8%
Ion source service	420 h	5,0%
Unscheduled down time	766 h	9,0%
Total beam time	8478 h	100%

SIS/ESR Experiments

The heavy ion synchrotron delivered beams to 23 fixed target experiments and to 9 experiments at the ESR. In total 5604 hours of target time have been achieved. A more detailed overview is given in Table 3.

Table 3: Beam delivered to SIS/ESR experiments

	Time	Ratio
Target time for experiments	5604 h	75,6%
Time for retuning	54 h	0,7%
Accelerator setup	948 h	12,8%
Ion source service	133 h	1,8%
Unscheduled down time	670 h	9,0%
Total beam time	7410 h	100%

In 2012 the target time for the ESR (direct beam and beam via FRS) increased to 1983 hours, 224 hours for HITRAP commissioning is included in this amount. For about 1005 hours beam was used at the local experiment of the FRS. 684 hours of beam time were delivered to HAD, which also was a main user at the SIS. Altogether 394 hours beam were delivered for biological experiments to HTA and HTM.

Accelerator Operation

In Table 4 all unscheduled down time events are shown in more detail. In 2012 the total amount of down time decreased about 96 hours although there were two major vacuum leaks, one in the second Alvarez section and the other at the entrance to the X-branch. Furthermore many interruptions due to leaks in cooling pipes of different accelerator components occurred. This led to an increase in down time for vacuum and structures compared to 2011.

Table 4: Statistics of all unscheduled down time events

	Down time	No. of events
Power supplies	256 h	279
Vacuum and structures	309 h	95
Beam diagnostics	29 h	13
Operation	6 h	11
Safety-/ Interlock system	110 h	25
Ion Sources	80 h	92
RF system	331 h	368
Controls	63 h	48
Infrastructure	59 h	15
Others / ambiguous	103 h	56
Total of unscheduled down time	1346 h	1002

Mainly problems with the control of interlock devices caused break downs of the interlock system. On the other hand the down time of ion sources was very low com-

pared to the last years. The down time for the RF system decreased as well.

Over the year 16 different isotopes have been accelerated. Figure 2 shows the operation time for each isotope. The rare isotopes ^{48}Ca and ^{48}Ni were produced by the ECR ion source, which in total has been operated for 2723 h. The Penning ion source was mainly operated with ^{50}Ti and ^{197}Au (in total 4870 hours of operation). The high-current ion source was used for 4281 hours. Especially ^{136}Xe , ^{84}Kr and $^6\text{D}^3$ beams were delivered from the MUCIS ion source, ^{238}U was accelerated from the MEVVA ion source for 1472 hours. ^{197}Au and ^{208}Pb was provided for the first time for high current operation and it ran very stable and successful.

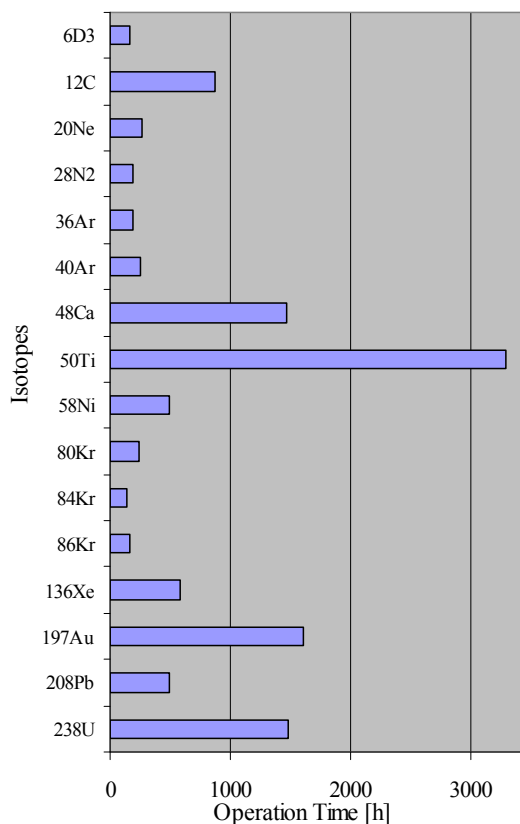


Figure 2: Total beam time for different ion species

For accelerator experiments at the UNILAC 195 hours, at SIS 317 hours and at ESR 101 hours beam were delivered, which is an increase for UNILAC and SIS. But for the ESR it is a decrease by a factor of three compared to last year.

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