Calculation of the Machine Availability for the complex parallel operation

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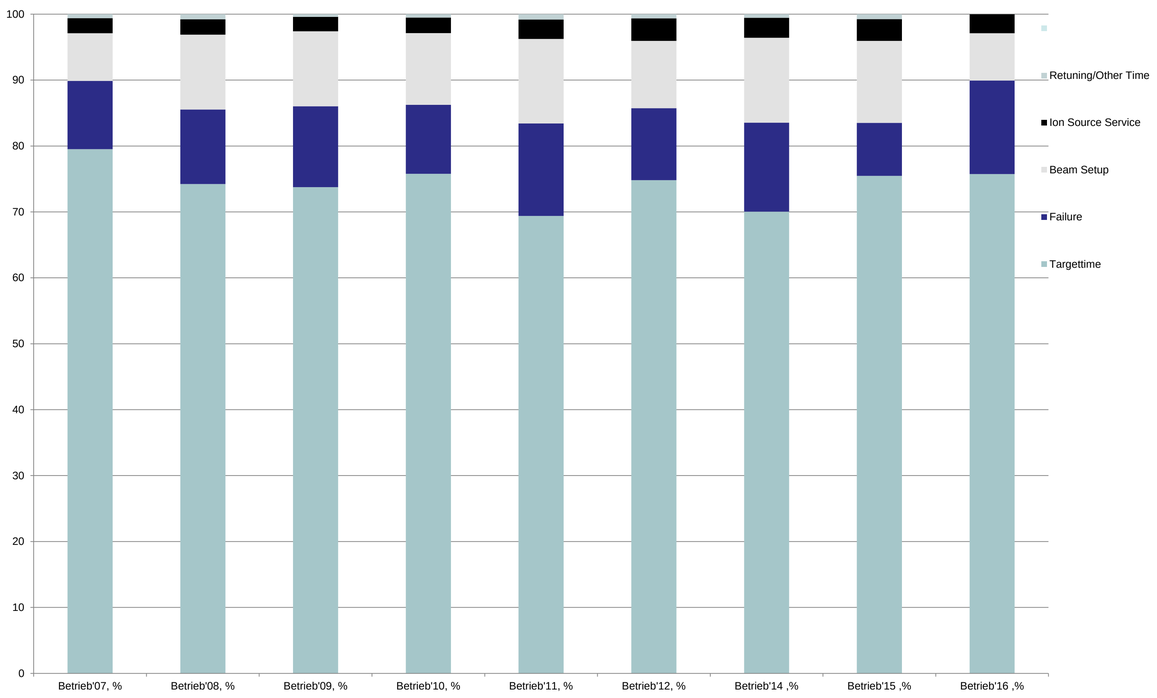
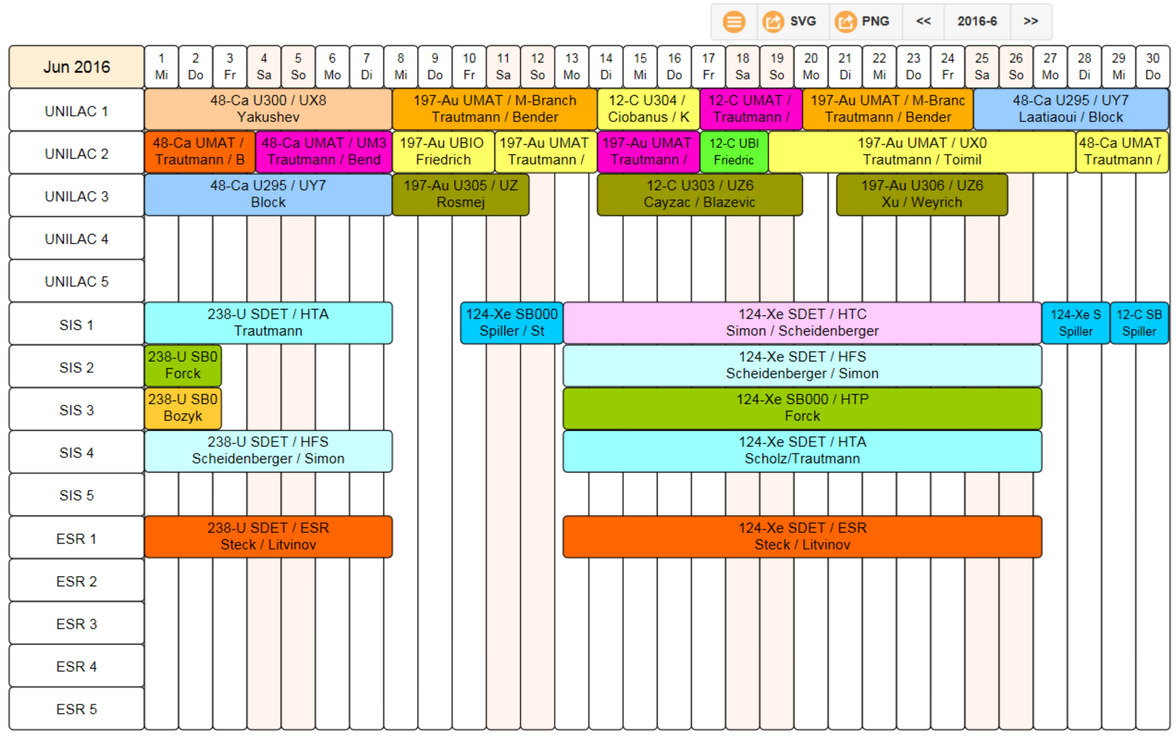
Present Status

The calculation of the machine availability has never been done at GSI so far. The whole accounting was experiments-oriented. Hence, for the general statistics per beamtime, times were scaled with the number of concerned parallel experiments.
The accounting per machine was not possible as OLOG has never used proper Nomenclature for the failed asset, which would allow distinguishing the machines.
Additionally, a precise failure analysis per technical system was not possible due to the 2 reasons: 1) a pre-defined classification of the systems was not precise enough (for instance just RF, no distinguishing RF supply, cavity or control..); 2) 'first guess' OLOG entry for the failure source was never corrected afterwards, when the failure was completely understood (for instance we have a lot of vacuum 'failures', though the reason was mainly infrastructure/cooling water).





Machine Availability calculations from 2018

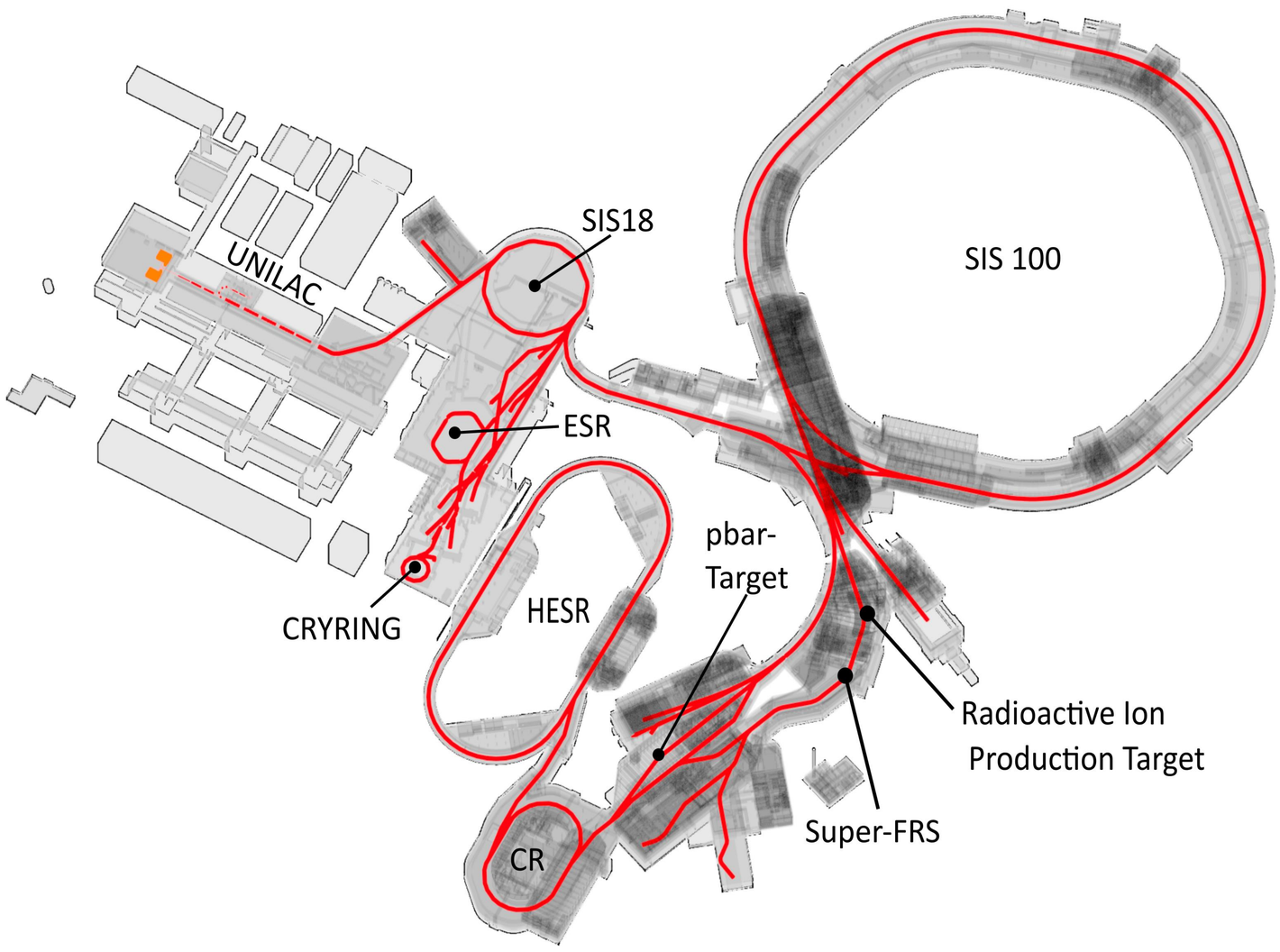
We want to see the availability of every machine in existing facility: UNILAC (+TK), SIS18, HEST, FRS, ESR, HITRAP, CRYRING and future FAIR machines. For that purpose a whole existing nomenclature list was integrated now into OLOG. Typing just first several nomenclature letters, a prompt list is visible. The concerned machine is then automatically defined. Additionally, a shift supervisor is obligated from 2018 to complement/correct the entered shift failures for the right failure source, when it is clarified.
A detailed classification of the technical systems is included now in OLOG (its content is verified with technical departments), hence allowing to perform the failure analysis in the future more precise.
The machine availability calculation will have the following philosophy:
- The machine works in 2 regimes: serving the local experiments or serving further machines (working as part of the production chain);
- The availability calculation will be done separately for those regimes: A_{local}, A_{chain}
- Example: the availability of the PANDA production chain then would be:
$A_{chain\_pLinac} * A_{chain\_SIS18} * A_{chain\_HEBT} * A_{chain\_SIS100} * A_{chain\_pbar} * A_{chain\_CR}$

There is still open question how to calculate the availability of the machine for the local experiments. There are several possibilities:

1) $\text{Availability\_machine} = \sum_{k=1}^{n} G * \left(\frac{Targettime}{Scheduled\ time}\right)_{EXP\_k}$, where n is the number of the local parallel experiments and G is the weighting factor (G = 0.9 for the main experiment and
G = 0.1/i for the parasitic experiments, i is the number of simultaneous parasitic experiments);

2) $\text{Availability\_machine} = \sum_{k=1}^{n} \frac{1}{n}\left(\frac{Targettime}{Scheduled\ time}\right)_{EXP\_k}$, where n is the number of the local parallel experiments; one does not distinguish here if the concerned experiment is main or parasitic;

3) Or one could scale the 'ist/soll' ratio with the scheduled number of pulses per cycle (for instance the parallel operation of UNILAC with 50Hz)



Time classification

Targettime: ‚beam on target' time, when all required machines (in production chain) are running and the planed experiments are served with beam
Retuning: targettime interruption in order to improve the beam performance (mostly requirement from experiments)
Interruption (Failure): unplanned targettime interruption. Includes failure diagnose, repair/replace, heat up, conditioning, etc...
Ion Source Service: targettime interruption in order to exchange the cathodes
Beam Setup: targettime interruption in order to setup the machine for the new projectile or new production chain
Stand by: targettime interruption when either a) experiments cannot take the beam or b) another machine in the production chain gets failure or c)ion source service takes place or d) retuning of the another machine in the production chain takes place

Future Prospective

There are several main goals concerning the machine availability topic in the future:
- Complement the machine availability criteria with delivered beam quality (data retrieving from archiving system)
- Complement the human OLOG accounting and failure analysis with digitalized data recording (archiving system, post-mortem system);
- Prevent the failures by 1) executing the automated dry runs; 2) HW online tracking (archiving system);