Integration of operators into the maintenance of the insertion device

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In addition to shift work in the control room, we, the operators, perform secondary activities in various specialist groups during our normal working hours.
Example for the three of us: secondary engagement in the Insertion Device group
We are involved in the maintenance of SLS and SwissFEL insertion device. These maintenances can only take place during machine shutdowns, which causes problems of manpower allocation.
The maintenance, which is needs to be performed fixed intervals, includes the lubrication of guide rails and drive spindles as well as gear boxes oil change. This procedures guarantee a smooth operation and eliminate any impurity deposits. Likewise possible damage and/or wear and tear can be detected ahead of time during regular maintenance.
An analysis of the used oil from the gearboxes has shown that it is possible to extend the maintenance interval to one year. Through this analysis, the PSI is able to cut costs of approx. CHF 5500.-- ($6000) per skipped oil change, considering the costs for all insertion devices. A new, more detailed analysis is in process which in due time will provide information on whether the interval can be even further extended.
A further task of our team is to assembly the insertion devices for SwissFEL and their maintenance during operation. In the course of this work, we will also be involved in smaller projects of our department and will be able to work on and follow up on them independently.

Fundamentals

The Paul Scherrer Institute PSI is the largest research institute for natural and engineering sciences in Switzerland. We conduct cutting-edge research in the fields of matter and materials, people and health, energy and the environment. Through basic and applied research, we work on sustainable solutions for central questions from society, business and science. The section operation is responsible for the main control room, from which all accelerator facilities are controlled. 24/ 7 operation, the High-Current Proton Accelerator, the PROSCAN project's COMET Medical Cyclotron, the SLS Synchrotron Light Source and the SwissFEL project's free-electron laser, which is currently in commissioning, will be operated in three shifts. With the help of complex control systems, optimum parameters for reliable beam operation are constantly being developed in order to guarantee maximum safety and high availability. Access control to machine bunkers and certain experimental areas is also provided by the control room personnel by means of personal security systems (PSYS). The control room is the central point of contact for questions and technical problems of the beamline users (experimenters) and offers appropriate specialist personnel to support them if required.2/3 of the control room personnel work in shifts in the control room and 1/3 in so-called specialist groups. There are various specialist groups from planning to electrical installation. We are active in the Insertion Device group. Our tasks include planning and carrying out maintenance work such as: Assembly and installation of new insertion device (SwissFEL)Maintenance (oil change of gears and lubrication of gap guides)Chiller maintenance and service work. At the same time, we are involved in sub-projects that can go in a wide variety of technical directions.

Solution at PSI

By coordinating resources, the necessary manpower is divided up and the necessary work is carried out. For a maintenance we need at least four employees.
In addition, an oil analysis is carried out using the latest technology to determine the maintenance interval.

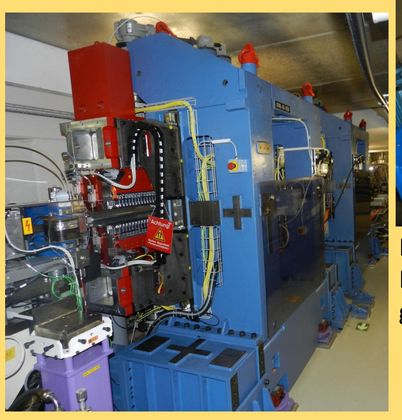

Fig.2: Insertion Device inside SLS tunnel

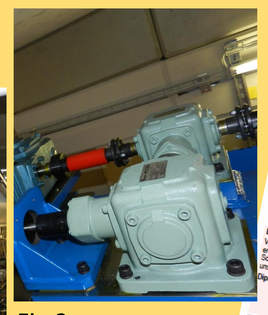

Fig.3: Insertion device gear box

Fig.4: Oil analysis report

→ Sustainable and resource saving.

Concrete question

The reliable operation of the Undulators is a key factor for the reliable operation of the facilities.
The maintenance works carried out by us takes place in addition to the shift work, which is coordinated in advance with the shift and shutdown schedule.

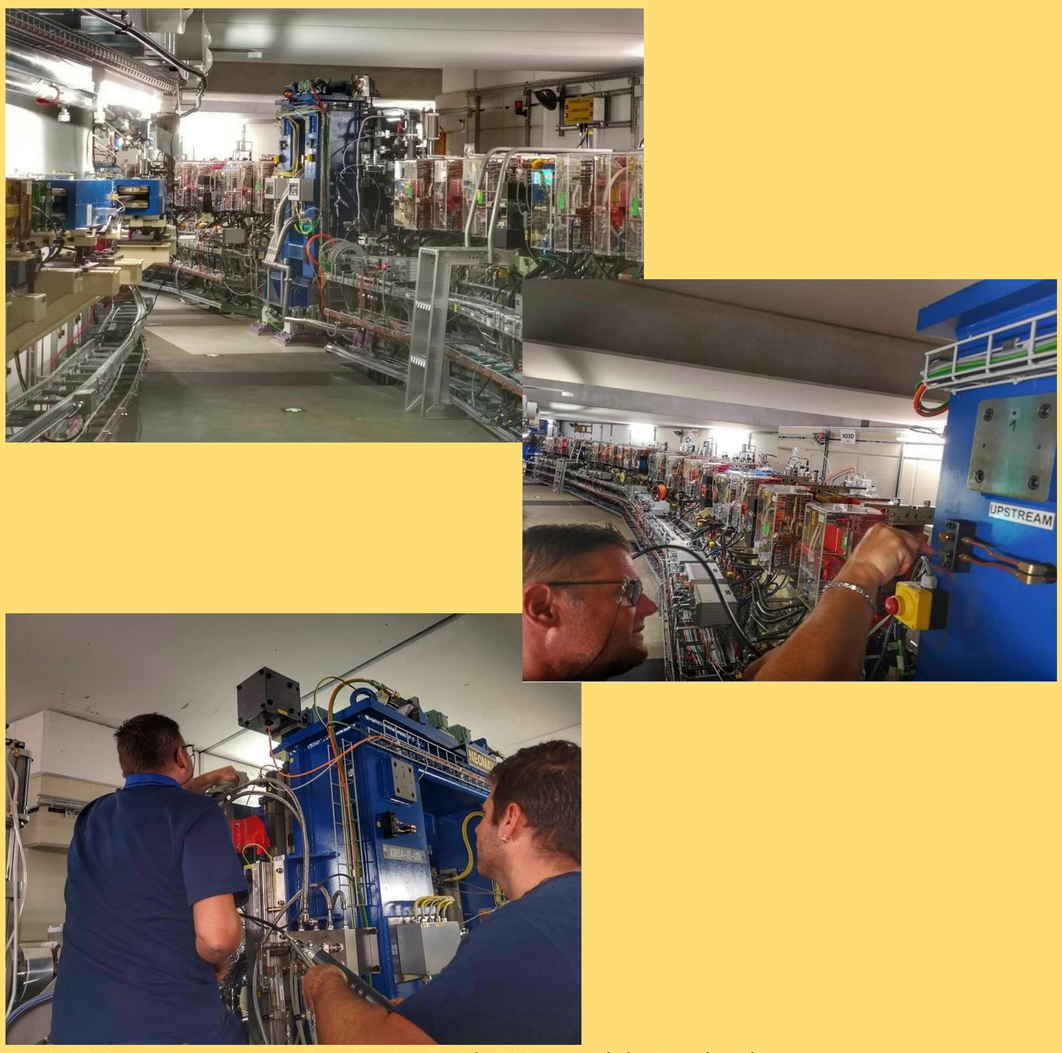

Fig.1: Maintenance at Insertion Device inside SLS tunnel during shutdwon

Discussion/Experience

With the growing experience of the employees, the processes can be optimized in time.
Due to this, the limited time windows can be used optimally.
Unfortunately it is not always possible to put together a powerful team in every shutdown (SLS/ SwissFEL). As a consequence some of the maintenance work has to be occasionally postponed to the next possible time window.

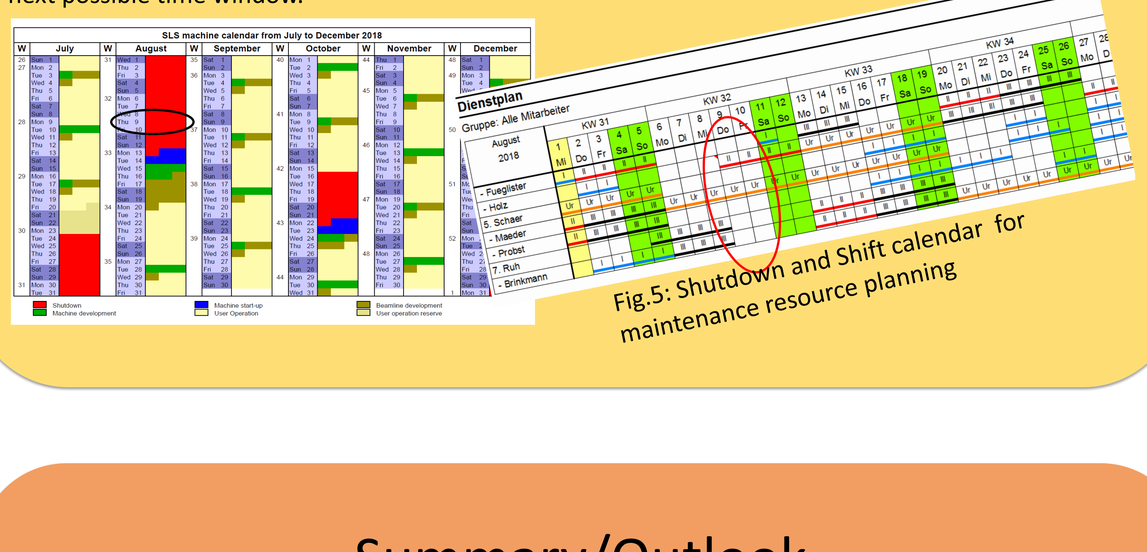

Fig.5: Shutdown and Shift calendar for maintenance resource planning

Summary/Outlook

- Very time consuming
- Resource intensive
- Difficult to plan manpower
- Service interval extension by oil analyses
- Reduction of service costs
- Resource saving
- Sustainable use of raw materials