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INSTALLATION AND ALIGNMENT OF SESAME STORAGE RING

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Abstract

SESAME (Synchrotron-light for Experimental Science and Applications in the Middle East) is the first international 3rd generation synchrotron light source in the Middle East region. This paper presents the method used for installing the Storage ring girders, magnets, vacuum chambers, straight sections, and how the alignment was done. The Installation have been done in a short time with few staff. It was hard and difficult but went great.

A substantial progress has been made in the design, construction and installation of the SESAME Mechanical Systems. All Storage Ring accelerator systems are ready and commissioned.

INTRODUCTION

SESAME was officially opened in Allan (Jordan) on 16 May 2017. It is the Middle East's first major international research centre [1]. It is a cooperative venture by scientists and governments of the region set up on the model of CERN although it has very different scientific aims. Figure 1 shows SESAME building at Allan, Jordan, almost 35km northwest of Amman, and Fig. 2 shows SESAME machine components.

Figure 1: The SESAME building.

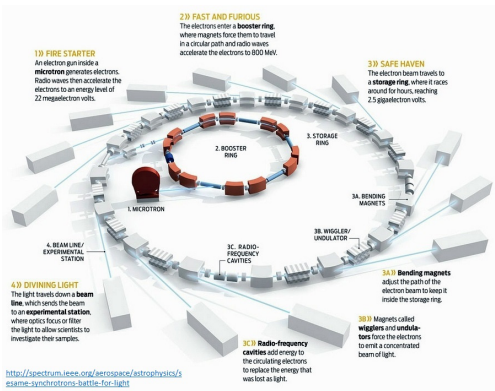

Figure 2: The SESAME machine.

STORAGE RING STRUCTURE

The storage ring is composed from 16 cells connected with straight sections, as shown in Fig. 3.

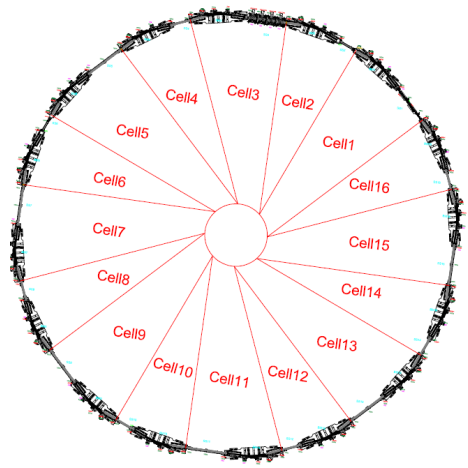

Figure 3: SESAME Storage Ring.

Girder length = 5.2m, Flatness error < ± 50 µm, Magnet position error < ± 50 µm. Girder-to-girder position error < ± 100 µm, Girder deflection under load < 50 µm.

Figure 4 shows the magnets of the main ring after installation; with a list of all parts of the main ring. Table 1 shows the parameters of SESAME storage ring.

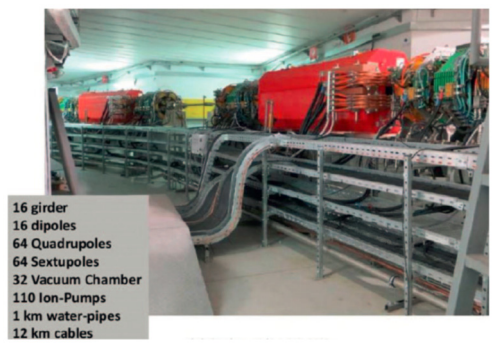

Figure 4: Magnets of main ring.

Table 1: Storage Ring Parameters

Parameter	Unit	Value
Energy	GeV	2.5
Circumference	m	133.2
Electron beam current	mA	100 - 400

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INSTALLATION STEPS

Floor Preparation

SESAME floor consists of two layers; 22 cm reinforced concrete, and 8 cm solid concrete. In order to avoid the cracks or deformation of the upper 8 cm slab, we decided to remove it, then install the baseplates of girders, and inject epoxy resin that is dedicated for such loads with good stability. Figure 5 shows the baseplates of one girder after alignment and injection of epoxy resin.

Figure 5: Girder Baseplates installed.

Girders Installation

Once the baseplates have been installed and aligned, the girder can be lowered into position. The girder then is surveyed with respect to the local network and its position adjusted as required to enable the vacuum chamber connections to be made. Figure 6 shows one girder installed and aligned on its final location.

Figure 6: Girder installed on Baseplates.

For aligning the girders, the following Fig. 7 shows the adjusting mechanism.

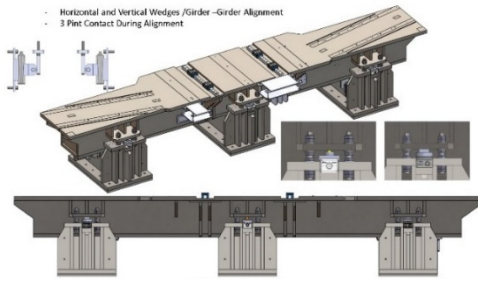

Figure 7: Girder adjusting system.

Magnets Installation

All magnets are magnetically measure, shimmed, and self-aligned on girders with pins. Only girder to girder alignment is required.

We have started by installing the dipole bending magnet, Fig. 8.

Figure 8: Dipole Bending Magnet.

Then, sextuples and quadrupoles are installed, Fig. 9.

Figure 9: Magnets installed on Girder.

Vacuum Chamber Installation

For installing the vacuum chamber, upper half of multipoles is removed, as shown in Fig. 10.

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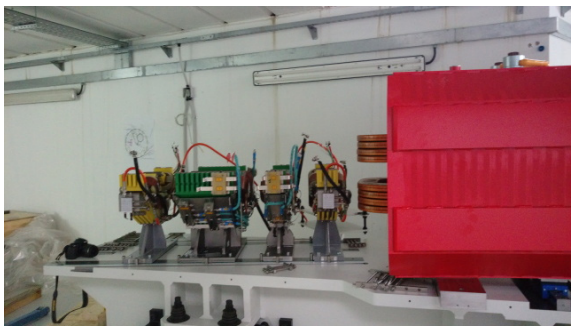

Figure 10: Multipoles upper half removed.

Then, the dipole is raised on rails and pushed back as described in Fig. 11 below.

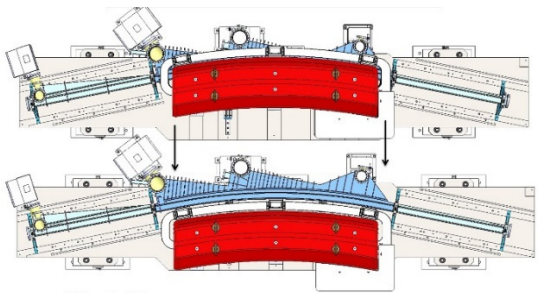

Figure 11: Pushing the dipole out.

Now, the system is ready to have the vacuum chamber, where it is installed using a skeleton with the crane as shown in Fig. 12.

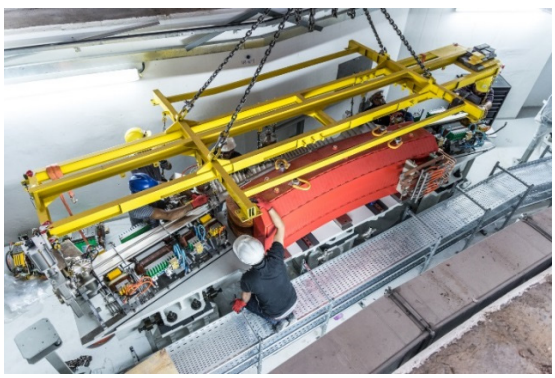

Figure 12: Installing Vacuum Chamber.

Finally, the dipole is pulled back to its location, and the upper half of multipoles is assembled again. Now, a final alignment girder to girder is done, and a survey of all magnets was succeeded. The 16 cells are ready to be connected with the straight sections. Figure 13 shows a complete aligned cell.

Figure 13: One Complete Cell.

CURRENT STATUS

Storage ring is fully installed and commissioned, Fig. 14. Two beamlines are commissioned, other beamlines are foreseen. A plan for full energy injector is under investigation.

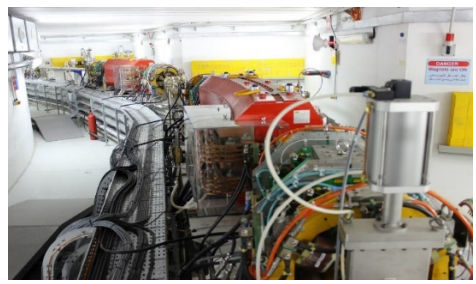

Figure 14: Fully Installed Storage Ring.

CONCLUSION

The commissioning trials of the machine started with the conditions of good alignment. After a few days of injection trials, it was possible to circulate and accelerate the beam. The successful circulation and acceleration of beam verifies the great installation and alignment with no gross error in alignment.

SESAME is now passing from the stage of construction to the phase of exploitation. A number of technically oriented scientists and engineers participated actively in the design and construction of the facility and this provides a valuable stock of professionals when some of the Members will build their own SR facilities.

ACKNOWLEDGEMENTS

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REFERENCES

[1] SESAME website: www.sesame.org.jo