# SESAME Status Update

M. Attal, E. Al-Dmour, G. Vignola – SESAME, JORDAN
D. Einfeld – CELLS, SPAIN

**SESAME is an independent intergovernmental organization developed under the auspices of UNESCO. It will be a major international research center in the Middle East region, located in Allan, Jordan. The upgraded machine design is based on a 2.5 GeV 3rd generation Light Source with an emittance of 26 nm.rad and 11 straights for insertion devices.**

## SESAME Main Parameters

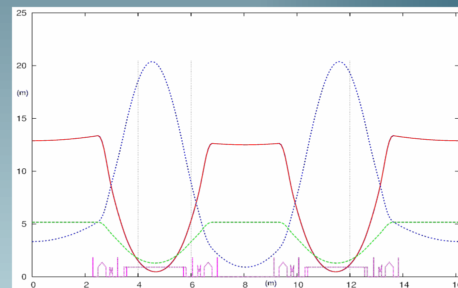
| | |
|---|---|
| Energy (GeV) | 2.5 |
| Circumference (m) | 129 |
| Nominal dipole field (T) | 1.45545 |
| Dipole gradient (T/m) | -2.7943 |
| Betatron tunes; $Q_x$, $Q_z$ | 7.23, 5.19 |
| Emittance (nm.rad) | 26 |
| Nat. chromaticity; $\xi_x$, $\xi_z$ | -14.64, -14.81 |
| Energy loss / turn (keV) | 589.7 |
| Damp. times; $\tau_s$, $\tau_x$, $\tau_z$ (ms) | 2.71, 2.21, 3.65 |
| No. of straight sections | 8x4.48m + 8x2.02m |
| Quadrupole families | 2 |
| Sextupole families | 2 |
| RF frequency (MHz) | 499.654 |
| Bunch length (mm) | 11 |
| Design current (mA) | 400 |

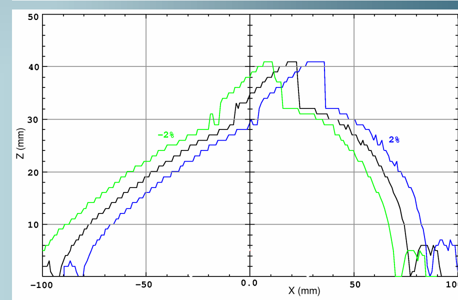
## SESAME Optics

The SESAME lattice is a DBA with vertical defocusing gradient inside the dipoles and dispersion distribution in the straight sections. The storage ring is composed of 8 super periods with 16 dipoles and 16 straight sections of 2 different alternate lengths (4.48m and 2.02m). The long straight sections will allow to host up to 7 Insertion Devices (ID) with a maximum length of ~ 4m, while the short ones can accommodate up to 4 ID with a length of ~ 1.5 m.

Our target has been to define a basic lattice (without ID) which is very simple, has only 2 families of quadrupoles and 2 of sextupoles, flexible enough to be easily retuned, to eliminate the perturbation of the ID's, and with acceptable dynamic aperture.

The β-tune working point ($Q_x$=7.23, $Q_z$=5.19) has been chosen to minimize the amplitudes of the 3rd order resonance driving terms and with fractional parts that avoid any tune coupling in the physical aperture (70mmx30mm) and offer large momentum acceptance for positive corrected chromaticity (few units in both planes).

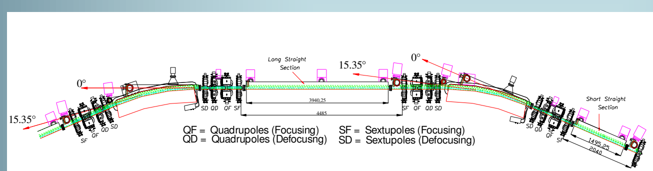


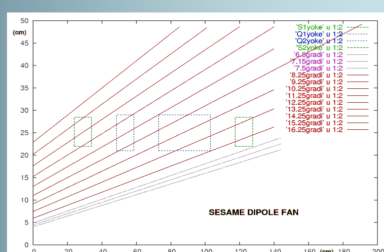




The linear and nonlinear optimizations resulted in a good on-momentum and off-momentum dynamic apertures.

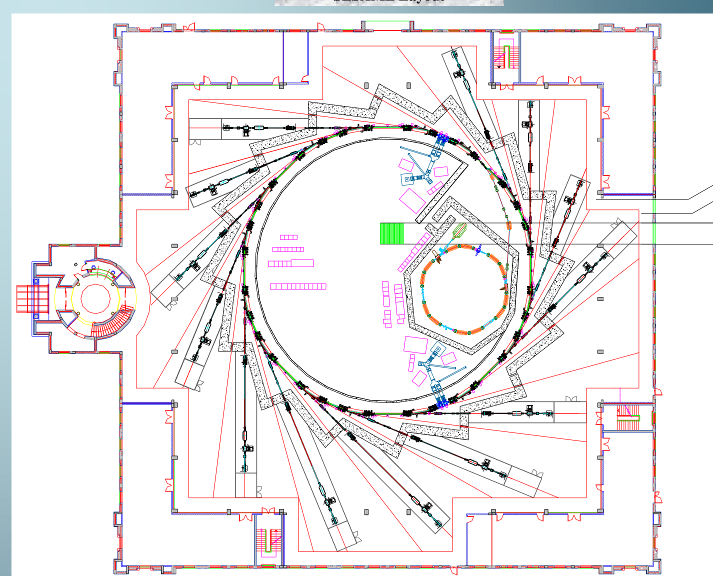
## Dipole Beam Port

Each dipole vacuum Chamber will be equipped with a port, to collect the synchrotron light, centered at 7.15° from the dipole end, allowing to install up to 16 Beam lines. This angle is not centered on the minimum beam size angle (11.25°), but due to the properties of the lattice adopted the beam size increase is only 10% and it is more than compensated by the fact that will not be necessary to use a quadrupole/sextupoles design with *split* yoke in the horizontal plane



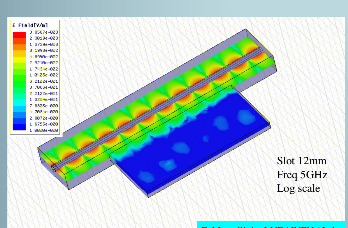

## SESAME Layout

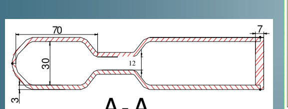


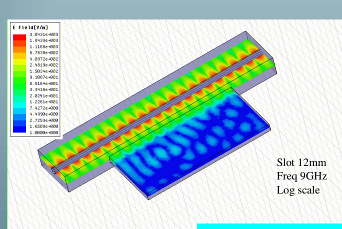
The sizes of the experimental hall are 60x60 m². These fixed dimensions together with a target of ~30m for the Beam lines length put a limit on the maximum ring circumference of ~130m. A reasonable circumference increase can be compensated by having the storage ring eccentric from the center of the experimental hall

## Vacuum Chamber Design

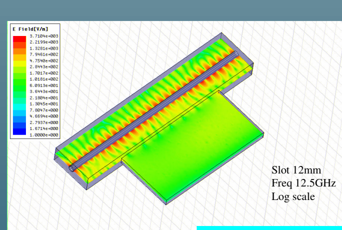
The slot height between the vacuum chamber and the antechamber is 12 mm. This value has been chosen in order to get good vacuum conductance and negligible RF losses. (More detailed evaluation are in progress).




For the vacuum system of SESAME, an antechamber design is foreseen and it will be fabricated from stainless steel with copper absorbers to absorb the unused radiation. With an overall pumping speed of 32000L/s, the expected pressure after the commissioning stage is $10^{-9}$ mbar, leading to a reasonable lifetime. A cross section of the vacuum chamber in the dipole vessel is shown.




## Phase 1 Beam Lines

| No. | Beamline | Energy Range | Source Type |
|---|---|---|---|
| 1. | MAD Protein Crystallography | 7.5 – 15 (keV) | MPW (In-vacuum undulator in phase 2) |
| 2. | Small angle X-ray scattering | 5.0 – 15 (keV) | Undulator |
| 3. | Spectroscopy of gases and solids | 0.05 – 2 (keV) | Undulator |
| 4. | XAFS | 3 –5 (keV) | 2.5 Tesla MPW |
| 5. | Powder diffraction | 3 – 25 (keV) | 2.5 Tesla MPW |
| 6. | Infrared spectroscopy | 0.01 – 1 (eV) | Large Aperture bending magnet |

SESAME is expected to begin operation in 2009 with about five to six beam lines, this number is expected to rise by time. These beam lines will cover scientific research ranging from archaeology to the biological and medical sciences.