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Note: **O-5**

SESAME LIFETIME

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In order to have a comprehensive scenario of how the RF peak voltage V_{RF} and the horizontal/vertical vacuum chamber half aperture (A_x/A_z) affect the SESAME lifetime we present in Tab. 1 the values of the lifetime evaluated vs. these 3 parameters at 2.5 GeV. The (1/e) lifetimes refer to the present lattice version of SESAME [1,2] and are evaluated by the LEDA code [3] for an average pressure of 1 ntorr of biatomic gas with <Z> = 8 and single bunch current i_b = 2 mA.

Table 1: SESAME's lifetime @ 2.5 GeV.

Q_x = 7.23 – Q_z = 6.19 - i_b = 2 mA						
V_{RF}(kV)	A_x(cm)	A_z(cm)	τ_{GB}(hr)	τ_{SC} (hr)	τ_T(hr)	τ_{Tot}(hr)
2400	3.0	1.5	37.20	70.08	75.22	16.87
"	2.5	"	"	66.89	"	16.68
"	2.0	"	"	61.71	"	16.34
"	1.5	"	"	52.87	"	15.65
"	1.0	"	"	37.51	75.04	13.95
"	0.75	"	"	26.67	61.08	11.69
"	0.5	"	"	14.60	22.44	06.91
"	3.0	1.5	"	70.08	75.22	16.87
"	"	1.25	"	50.34	"	15.42
"	"	1.0	"	33.15	"	13.30
"	"	0.75	"	19.07	"	10.26
"	"	0.5	"	8.62	"	06.21
1800	3.0	1.5	34.98	70.08	48.98	14.60
"	2.5	"	"	66.89	"	14.45
"	2.0	"	"	61.71	"	14.20
"	1.5	"	"	52.87	"	13.67
"	1.0	"	"	37.51	"	12.36
"	0.75	"	"	26.67	48.52	10.88
"	0.5	"	"	14.60	26.24	07.12
"	3.0	1.5	"	70.08	48.98	14.60
"	"	1.25	"	50.34	"	13.49
"	"	1.0	"	33.15	"	11.85
"	"	0.75	"	19.07	"	09.38
"	"	0.5	"	8.62	"	05.87
1200	3.0	1.5	31.58	70.08	22.55	10.26
"	2.5	"	"	66.89	"	10.19
"	2.0	"	"	61.71	"	10.06
"	1.5	"	"	52.87	"	09.80
"	1.0	"	"	37.51	"	09.11
"	0.75	"	"	26.67	"	08.29
"	0.5	"	"	14.60	22.40	06.58
"	3.0	1.5	"	70.08	22.55	10.26
"	"	1.25	"	50.34	"	09.71
"	"	1.0	"	33.15	"	08.82
"	"	0.75	"	19.07	"	07.38
"	"	0.5	"	8.62	"	05.02

In the columns 4, 5, 6 are listed only the 3 main contributions to the lifetime: inelastic (τ_{GB}) and elastic (τ_{SC}) scattering on nuclei and the Touschek lifetime (τ_T) respectively. The total lifetime (τ_{Tot}) listed in column 7 takes properly in account all the contributions. Finally, all the lifetime values are shown together in Fig. 1.

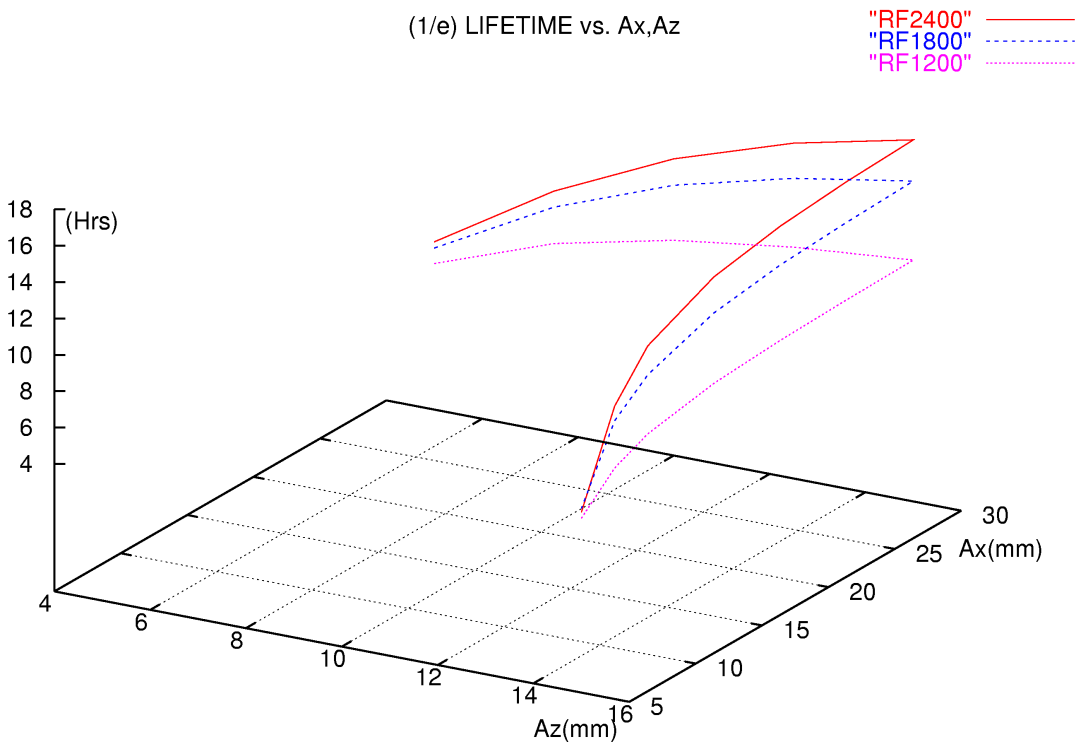

Figure 1: SESAME lifetime vs. Ax, Az for different values of V_{RF}

The lifetime values listed in Tab.1 are very useful, for rough (10%) lifetime evaluation, if we will be forced to practice some *gymnastic* on the RF system [4] or orbit correction [4]. Let me give just 2 examples:

The SESAME RF system is based, so far, on ELETTRA type cavity. Each single cell can arrive to 600 kV (~60 kW of RF power) and can supply up to ~60 kW to the beam. To have decent lifetime it is necessary, of course, some over voltage: therefore, we need at least 2 cells (= 1.2 MV). If only 2 cells will be available on *day one,* we can store only 200 mA: anyway, the lifetime, also with the nominal apertures with a zero closed orbit distortion (c.o.d.), will be not necessarily the one indicated in Tab.1, since we have the freedom to distribute 200 mA, let us say, in 200 bunches. In this case τ_T will double and the lifetime, by using the values of Tab. 1, became 14.7 hrs (13.3 hrs evaluated with all the contributions).

The inspection of the τ_{Tot} values vs. A_x and A_z shows the different sensitivity of the lifetime to (c.o.d.): 5 mm in the horizontal plane decrease the lifetime by only ~ 3%, while 2.5 mm in the vertical one give a reduction of ~ 9%.

References

[1] G. Vignola, M. Attal - SESAME Technical Note **O-1**, December 2004

[2] G. Vignola et al. - SESAME in Jordan, PAC 2005 Proceedings

[3] J.B. Murphy and G. Vignola – LEDA Code, Unpublished

[4] Yellow book – Chapter 8 – www.sesame.org.jo