ABSTRACT The conceptual design of an abort system for the future electron positron circular collider is presented. A dedicated abort system has been studied based on MAD-X simulations. The proposed abort system consists of abort kickers, septum magnets and a dilution kicker system. The abort system must safely remove the beam the accelerator ring and transport it to a dedicated beam dump. The dilution kickers must spread the beam evenly on the surface of the beam dump and on the vacuum chamber window, in order to prevent damages due to high energy electron and positron beams. Simulation studies are carried out in order to determine an operational configuration of the abort system and the required apertures of the abort beam lines.

INTRODUCTION The extraction system is designed to remove the electron and positron beams from the main ring and transport them to the external beam dump. A set of kicker magnets is pulsed rapidly to kick the whole beam out of the machine in a single turn (333 μs). The kicker deflects the beam horizontally into a Lambertson septum, which provides a strong vertical deflection to clear the downstream lattice quadrupole. In order not to melt the dump block absorber material, the beam is spread over the front surface of the dump by means of horizontal and vertical dilution kicker magnets. The extracted beam is transported by 2.4 km long vacuum line to increase the beam size. It is deposited on absorber blocks specially designed to take the enormous instantaneous power (20 MJ in 333 μs is 60 GW). The extraction line geometry and dump block location are arranged so as to be compatible with the infrastructure of the FCC-hh dump.

Extracted beam
- At QD, 7.3 mm off-axis gives additional 77% kick
- The beam clears the downstream lattice quadrupole vertically
- A bending of 10(1) mm is needed in V(H) to match the trajectory to FCC-hh dumped beam in both planes. This is easily incorporated

Line geometry
- Archimedean spiral with equal spacing between turns
- Fixed outer sweep radius as 200 mm
- Bunch spacing depends on inner radius
- Maximum kicker frequency 200 kHz (losses in tape-wound 50 μm steel)
- 57 turns optimum ~ 0.89 mm spacio

Dilution system and sweep on dump
- Archimedean spiral with equal spacing between turns
- Fixed outer sweep radius as 200 mm
- Bunch spacing depends on inner radius
- Maximum kicker frequency 200 kHz (losses in tape-wound 50 μm steel)
- 57 turns optimum ~ 0.89 mm spacio

Deposited Energy Density in the Graphite
- The energy density deposited on the graphite beam dump in the transverse (x-y) plane.
- The energy density deposited on the graphite beam dump in the vertical (x-z) plane.

Summary In case of one turn of the spiral, the maximum energy deposition density by the beam of electrons in the graphite is found to be 605 J/cm², which is equivalent to 356 J/g. The associated peak temperature rise in the graphite due to the impact of a beam of electrons is 493 °C.

In case of 57 turns of the spiral, which keeps the dilution sweep frequency below 200 kHz, the maximum energy deposition density by the beam of electrons in the graphite is found to be 130 J/cm², which is equivalent to 76 J/g. The associated peak temperature rise in the graphite due to the impact of a beam of electrons is 106 °C.

The next steps are i) generate the full optics for the LSS, with the RF elements and beam envelopes, which may refine the kicker and septum openings and parameters, and ii) to study the feasibility of an extraction kicker rise time of ~100 ns, for RF beam-loading reasons.

REFERENCES