# Executive Summary

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#### Introduction

To reduce the transverse emittance of the positron beam, the Damping Ring will be designed and installed at the end of the Linac. The control of the Damping Ring, as a part of the CEPC control system, not only shares the global control system, but also has its own special control requirements. Similar to the requirements of Linac accelerator control, the control of Damping Ring allows the operators to monitor and control the equipment in the Linac temporary control room and central control rooms. Global control system provides it with the function of timing, machine-protection and Data Server.

#### Magenet poewer supply control

There are 105 varieties of magnet power supplies in the Linac of CEPC, including the power supplies of dipole, quadruple and Sextupole, etc. These power supplies are distributed along a Damping Ring’s auxiliary tunnel. The power supply control systems for Damping Ring and Linac are similar, which should be local control and remote control functions.

#### Injection and extraction kicker control

There is an injection system and an extraction system respectively in the Damping Ring and its control system should have the following functions:

* Monitoring the current, voltage and running status (on/off, normal/alarm、local/remote) of the kicker power supplies;
* Switching on/off the kicker power supplies and setting voltage value locally and remotely;
* Sending two trigger signals by timing system for the kicker pulser to synchronize the bunch injection with the positron;
* Checking all kicker power supplies. When a fault happens, the alarm messages will be sent to the center console and the fault will be solved locally;
* Monitoring the status and temperature of the kicker magnet cooling system and
* Storing the status of the devices and alarm information for maintenance and shift staff.

There are 3 operation modes of the injection and extraction kickers Power Supply:

* + Check model: switch on/off locally, current setting, and heating.
  + Positron model: In this mode, the high voltage keeps heating and the low voltage is always on.
  + Electron model: In this mode, keep the high voltage half heating after the end of the injection for saving power.

#### Vaccum control

There are total about 4 vacuum valves, 80 pump and 6 gauges distributed in the Damping Ring. Vacuum control system will measure the vacuum pressure for vacuum chamber, and close valves to to protect the machine from being damaged due to vacuum leak of Damping Ring’s chamber.

#### RF control

The Damping Ring RF system consists of two accelerating cavities, two RF high power source and the low level control system. The RF frequency of Damping Ring is 650Mhz and the RF system provides 1.25MV voltage for Damping ring. The SC cavities will be installed Straight section of the Damping ring. The functions of the RF control system should be:

(1) Monitoring the parameters and status of RF equipment, including the klystron, the SC cavities and the low level control loops. The following devices and parameters have to be measured:

* The RF Gap-voltage
* RF phase
* Forward/Reflected volts
* Forward/Reflected power
* Tuner position and status of the cavity tuning system
* Parameters of HOM
* Temperature and vacuum of the cavities
* Cooling water and gas system of the cavities
* Status of klystron, waveguide, RF windows and so on

1. Controlling RF equipment
   * Switch on/off high power source
   * Setting up and down RF voltage and ramp for acceleration, the control accuracy of the voltage is 1%.
   * Operating the cavity tuning system, such as adjusting the tuner position step by step and the minimum step is 1kHZ.
   * Adjusting the RF phase continuously from 0-360degree.
2. Interlock system

The interlock system switches off the cavity tuning, when the RF high voltage power supplies are in the event of a fault or unsafe condition. Fault might happen in the cooling water system, the vacuum and temperature of a cavity. The local interlock system sends a warning message and failure signal to the central control room when the fault has been detected.