ABSTRACT
This poster addresses challenging questions regarding a cyclotron based high-power proton driver in the range of 8 to 12 MW with a kinetic energy of 800 MeV, for accelerator-driven sub-critical reactor application. The cyclotron technology contemplated brings highest performance in beam energy and power, while maintaining cost effectiveness. The accelerated particle is molecular H2+, the magnetic sector uses superconducting technology, acceleration is of the order of 4 MV/turn, extraction is based on stripping. Beam dynamics simulations show that the maximum energy is achievable with a six sectors ring-superconducting cyclotron. This solution allows reducing the cost and leaving enough room for installation of the RF cavities and for the magnetic device to inject and extract the beam. The poster also summarizes on-going studies regarding magnetic field computations and beam dynamics assessments, and a design of the injection channel.

BEAM DYNAMICS STUDIES
We essentially focus here on lattice parameters and dynamic aperture performance in relation with the design of the SRC 60 degrees spiral sector superconducting magnet.

Closed orbits across one of the six cells of the cyclotron, at different energies. The magnetic field along these orbits is shown on the right.

The time of flight evolution is still far from optimal and more work is needed to achieve $dT/T < 0.01\%$ departure from isochronism.

The time of flight corresponds to an improvement of the field map at inner radii is displayed as well. It can be seen that the requirement $dT/T < 0.01\%$ is fulfilled at this region.

Paraxial tunes along the acceleration range are displayed here. Resonance lines up to 3rd order, normal multiples, random, are shown. The Walkinshaw resonance is crossed three times. Yet, given the strong acceleration rate, this should not be harmful. Further investigation with tracking simulations is in progress.

**Beam Envelopes**
The beam envelopes on the injection (top row) and extraction (bottom row) orbits are shown below: horizontal (left col) and vertical (right col).

Horizontal betatron functions at extraction energy have about 4.5 larger value than at injection, whereas $B_y$ is a factor about 4.16 larger. Hence envelopes at extraction are smaller by a factor about $\frac{B_y^{\text{ex}}}{B_y^{\text{inj}}} = 0.42$ (left column).

Vertical betatron functions at extraction energy are about 6 times greater than injection. Hence the difference is about $\frac{B_x^{\text{ex}}}{B_x^{\text{inj}}} = 1.5$ (right column).

The dynamical acceptance (DA) is the limit of stable motion in $(r,z)$ space, resulting from misalignments, field defects, nonlinearities, and is normally expected to exceed the geometrical acceptance. Field nonlinearities are only considered here.

The DA given is a point of possible radial values in the ring where some local shape of the field could excite resonant motion causing particle loss after a small number of turns.

**References**