virtual cathode formed by the electron core. To maintain the stable, non-thermal state which is important to achieve the density gradient required, a constant throughput of particles will be provided. Electrons will be injected near r=0 through a small hole in the "polar region" of the spherical well. Electrons will fall down into the well and get deflected at the central core and will (in the absence of collisions) undergo a number of transits in the well until they return to the injection hole and can escape. This confinement time is typically given by the transit time and the ratio of the hole area to the surface of the spheroid, and is for typical parameters of this proposal in the order of 10^{-8} sec, which is several orders of magnitude shorter than the beam-beam collision times. A schematic of this experiment is shown in figure 5.

To test the fundamental principle of this idea, we have designed and constructed a small Penning trap (r = 3 mm) which will be operated at several 10's of kV in a ultra-high vacuum system. Electrons from a LaB_6 field emitter will be focussed through a 100 μm entrance hole and generate a beam-like distribution in the spherical well. Initial diagnostic of the density of the core will be obtained by relaxing the potential at the opposite end-cap after a predetermined time, which will let the beam traverse through the trap.

If a significant density at the center of the trap has been obtained, the beam will be deflected radially and the beam spot on a detector in the fringe magnetic field (for initial amplification) will be enlarged compared to the empty trap case. Besides this initial diagnostics for the fundamental principle of the proposed method, a number of technical issues like high voltage stand-offs and corona discharges from surfaces, avoidance of filling the trap with a thermal background charge from ionizing residual gas molecules, alignment requirements, etc. will be addressed at the same time. One specifically interesting challenge lies in the fact, that in contrast to standard trap experiments, where only a tiny fraction of the trap volume near the center is being utilized and where highly harmonic electrostatic potentials and extremely homogeneous magnetic fields can be readily maintained, here a spherical volume which nearly touches the electrode surfaces will be utilized. To achieve a harmonic potential in this volume with relative deviations from the ideal case being less than 10^{-3} while at the same time allowing for truncated electrodes and injection and ejection holes, careful electrostatic modelling has been used to generate a specific surface shape of the electrodes. Monitoring axial and radial modes of (low density) plasmas generated in this trap the harmonicity of the actual potential can be probed. We expect to be able to answer these and many other technical questions in our test system in the next few years, and will then be able to shed light on the question: "Can we build a fusion