# High Energy Density Research at the future project HIAF in China

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A large scale scientific research platform, named the High Intensity heavy-ion Accelerator Facility (HIAF), was proposed in light of the trend and development in nuclear physics and the associated high energy heavy ion research fields. HIAF is one of the 16 approved national projects for basic sciences and technologies as the 12th five-year-plan in China; it will be a laboratory open to the outside world, similar to CSR which was built as the 9th five-year-plan in China [1]. The HIAF complex, as shown in Fig. 1, includes a SECR (Superconductive Electronic Cyclotron Resonance) ion source, an ion linear accelerator (i-Linac), a Booster Ring (BRing), a Spectrometer Ring (SRing), a Compression Ring (CRing) and about 8 experimental terminals.


**Figure 1.** Layout of the HIAF complex and the two terminals for HEDP research

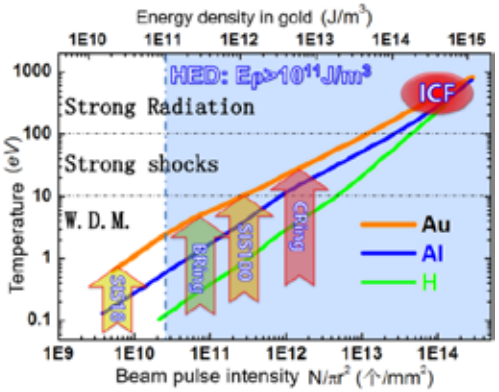


**Figure 2.** Temperature and energy density achievable by diffferenct accelerators

Since both BRing and CRing can produce high-energy and high-intensity ion beams (see Fig. 2), two terminals for HEDP (High energy density physics) research were proposed at HIAF, one for crossing (T1) and the other for colliding (T2) of the beams from BRing and CRing at the target area. However, mainly due to the budget limitation and technical challenges, CRing will **NOT** be included in the first stage of the HIAF project.

The key parameters related to HEDP research at HIAF and other advance heavy ion drivers is listed in Table 1, where $E_0$, $N$, $E_{total}$, $S_f$, $t$ and $E_\rho$ are the particle energy, the beam intensity (unit, ppp), the total beam energy per pulse, FWHM of the beam spot, the pulse duration and energy density in a lead target (J/m$^3$), respectively.

| | **SIS-18** | **FAIR(Ph-I)** | **HIAF (Ph-I)[a]** |
|---|---|---|---|
| $\mathbf{E_0}$ | 0.4GeV/u | 1 GeV/u | 1.1 GeV/u |
| **N** | $4\times10^9$ | $4\times10^{11}$ | $1\text{-}3\times10^{11}$ |
| $\mathbf{E_{to\text{-}tal}}$ | 0.06 kJ | 15 kJ | 4-12 kJ |
| $\mathbf{S_f}$ | ~1 mm | ~1 mm | 1 mm |
| **t** | 130 ns | 50 ns | 130-400 ns |
| $\mathbf{E_\rho}$ | $2\times10^{10}$ | $2.4\times10^{12}$ | $6\text{-}18\times10^{11}$ |

**Table 1.** Key parameters related to HEDP research at HIAF and other heavy ion drivers (for uranium beam).
[a] The upper limit may rely on the budgets of HIAF, and Ph-I means that we take the beam parameters of BRing.

## References

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