

## Digital Accelerator based on the Induction Acceleration Method

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### 【Outline of survey】

The digital accelerator is based on the induction synchrotron concept, which had been demonstrated at KEK in 2006. All ions including cluster ions and RI ions in the digital accelerator are accelerated and captured with pulse voltages generated by transformers (induction acceleration cell). The transformer is energized by the corresponding switching power supply, in which power solid-state conductors are employed as switching elements and their tuning on/off is maneuvered by gate signals digitally manipulated from the circulating signal of an ion beam. This digital accelerator will be realized by modifying the existing KEK 500 MeV Booster. Actually the RF cavities will be replaced by the induction cells. An operation frequency of the main magnet system will be changed from 20 Hz to 10 Hz to reduce a required maximum acceleration voltage. In addition, a vacuum of the beam pipe will be improved so as to accommodate heavy ions, which are injected from a 200 kV ion source. At the end of survey, various ion beams will be ready to be delivered to applications of nano science, warm dense matter science, and mutation.

### 【Expected results】

- The third type of circular accelerator beyond the cyclotron and conventional synchrotron will be demonstrated.
- Heavy ions, such as Ar, will be accelerated from a quite low energy to high energy by the digital accelerator without an injector, such as an RFQ or linac c.
- The demonstrated digital accelerator will become a typical ion driver for a particle cancer therapy, where a cost performance is strongly required for the spread of this therapy.

### 【References by the principal researcher】

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- K.Takayama, K.Torikai, Y.Shimosaki, Y.Arakida, E.Nakamura,H.Sato *et al.*, "Experimental Demonstration of the Induction Synchrotron", *Phys. Rev. Lett.* **98**, p054801 (2007).
- K.Takayama et al. "Observation of the Acceleration of a Single Bunch by Using the Induction Device in the KEK Proton Synchrotron", *Phys. Rev. Lett.* **94**, p144801 (2005).
- K.Takayama and J.Kishiro, "Induction Synchrotron", *Nucl. Inst. of Meth*, **A451**, p304 (2000).

【Term of project】 FY2008– 2010

### 【Budget allocation】

166,700,000 yen (direct cost)

### 【Homepage address】

<http://www-accps.kek.jp/Superbunch/>