Program on open innovation platform for new accelerator applications

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A new program for open innovation in accelerator science and technology started in October, 2017 with the cooperation of six universities, four research institutes and sixteen enterprises. Our proposal was approved by Japan Science and Technology Agency (JST) in the program on Open Innovation Platform with Enterprises, Research Institute and Academia (OPERA) [1]. We aim at creating innovative technology of sophisticated quantum applications for realization of a secure and smart longevity society. New consortium called QiSS which stands for Quantum innovation for Safe and Smart Society [2] was founded to organize individual cooperative research using accelerators and radioisotopes (RIs), and to pursue basic research in pre-competitive stage for creation of key industry in near future. Universities, research institutes and enterprises participating in the QiSS consortium are listed in Table 1.

In the QiSS program, one of the main subject is to develop an economical technique for evaluating soft errors generated in semiconductor devices by terrestrial neutrons and to contribute to formation of safe and smart IoT society. The other key subject is to develop targeted alpha-particle therapy using At-211 for treatment of advanced cancer and to realize healthy and secure longevity society. For achievement of the program goal, we need to develop the following four key technologies; stable supply of plenty of short-lived RIs and intense quantum beams such as neutrons and muons, a highly-developed radiation protection technique, medical applications of short-lived RIs, advancement in radiation measurement technology. Research and development problems to be solved for improvement of these key technologies were categorized into the following eight subjects;

- 1) Advancement of compact accelerator and irradiation technologies
- 2) Production and separation of short-lived RI
- 3) Establishment of neutron beam application methods for a compact accelerator
- 4) Completion of evaluation technique for soft errors occurred in semiconductor devices
- 5) Synthesis of molecules labeled by a short-lived RI for suppression of refractory cancer
- 6) Establishment of safety standard for radiopharmaceutical treatment
- 7) Development of radiation detectors for high-resolution imaging
- 8) Basic research for clinical application of short-lived radiopharmaceuticals to treatment

In the subject 1, we plan to develop a new type of a compact high-temperature superconducting AVF cyclotron used for providing intense 28 MeV helium ion and proton beams for mass production

of At-211 and intense white neutron flux. The specification of the cyclotron will be optimized for business use.

Table 1. List of universities, research institutes and enterprises participating in the QiSS consortium in JFY2017.

University	Institute	Enterprise
Osaka University,	RIKEN,	Socionext Inc.
Nagoya University,	KEK,	ATOX Co., Ltd.
Tohoku University,	J-PARC,	Metal Technology Co., Ltd.
Kyushu University,	QST	EPS Corporation
Kyoto Institute of		Toyota Motor Corporation
Technology,		Toyota Radiation Research Institute
Waseda University		Kyoto Medical Technology Co., Ltd.
		Sumitomo Heavy Industries, Ltd.
		Nihon Medi-Physics Co., Ltd.
		Hitachi, Ltd.
		FUJIFILM RI Pharma Co., Ltd.
		High Reliability Engineering & Components
		Co.(HIREC)
		Fuji Electric Co., Ltd.
		SHIMAFUJI Electric Inc.
		Mitsubishi Electric Co.
		Chubu Electric Power Co., Inc.

References

[1] http://www.jst.go.jp/opera/

[2] https://www.rcnp.osaka-u.ac.jp/~qiss/index.html