References

1. wiki.debian.com. DHCP_SERVER
URL: https://wiki.debian.org/DHCP_Server
(Access date: 20.10.2015)
2. learn.adafruit.com. Handling PWM
URL: https://learn.adafruit.com/setting-up-io-python-library-on-beaglebone-black/pwm
(Access date: 25.01.2016)
3. learn.adafruit.com. Handling GPIO
URL: https://learn.adafruit.com/setting-up-io-python-library-on-beaglebone-black/gpio
(Access date: 25.01.2016)
4. LM3406 (ACTIVE) 1.5A Constant Current Buck Regulator for Driving High Power
LEDs datasheet
URL: http://www.ti.com/lit/ds/symlink/lm3406.pdf
(Access date: 15.10.2015)

OVERVIEW OF THE MARKET OF PARTICLE ACCELERATORS USED FOR NON-DESTRUCTIVE TESTING

Kolomeytsev A.A.
Tomsk Polytechnic University, Tomsk
Scientific Supervisor: Associate professor, Dr. Borikov V.N.

Introduction

Currently, radiation technologies are an inherent part of everyday life. Many people do not even realize how often they encounter products and products derived from the use of radiation technologies. There are tropical fruit, tires and a chip in a mobile phone, and aviation turbine blade as part of the aircraft. All these products have one common thing: they have been processed on the particle accelerator. The flow of particles (or ionizing radiation), which is generated by an accelerator or ion source ensures the destruction of insect pests in mango, "bonding" of polymers in the rubber material for tires, form a new semiconductor layer of the material for the chip, provides the test turbine blades for cracks. Further accelerators have become the basis for inspection systems that allows detection of the baggage and cargo of weapons, explosives and drugs, fissile materials. These systems have been proliferated in customs and border points, seaports, and airports and at railway junctions.

The penetrating ability of the particle flow also allows you to scan the metal parts of aircraft and rocket engines, the car and detect even small cracks or inaccuracies welds without destroying the product.

Electron beam additive manufacturing technology is gradually being introduced for the production of a new generation of metal products in the aerospace, automotive and medical industries. With the improvement of production technologies in these industries share of these technologies will increase.

This review describes the key application areas of industrial accelerators, as well as information on products and services of the Russian manufacturers of this equipment.

Experts estimate that over the past 60 years all over the world was put into operation more than 27000 accelerators for various industrial applications. A large portion of them in the ion implantation and electron beam processing of materials (Figure 1). It should be noted that the categories of industrial accelerators considered excluded inner beam forming apparatus (cathode-ray tubes, x-ray tube system for lithography or electron beam microscopy, etc.). Since the average industrial accelerators life cycle is estimated at 20-40 years, it can be assumed that at present this number is operated by about 75% (or about 20000 units) accelerators [1].

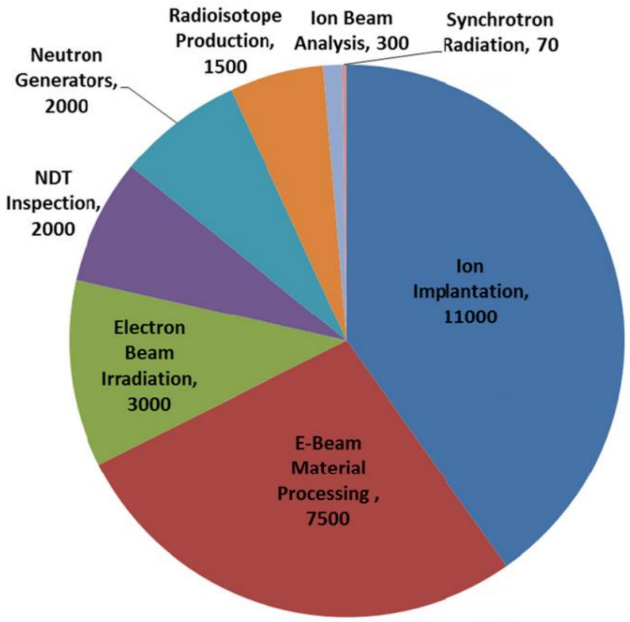

Figure 1. Distribution of the worlds established industrial accelerators (units) by application

In general, despite the fairly slow change in technology, the speed of implementation accelerators as industrial processing tools has been steadily increasing in recent years. So according to the 2010 total value of products and goods, processed, irradiated, or a checked using a charged particle beam has exceeded $ 500 billion.

Robert Hamm estimated based on published statistics and surveys of large manufacturers, the share of these companies supply volume accounts for about 1000 accelerators per year, which corresponds to an annual market volume of about 2.2 billion dollars USA [2].

Today in Russia there are 8 manufacturers of accelerators: Institute of Nuclear Physics, Research Institute of Nuclear Physics, Research and Production Enterprise Korad, National research Tomsk Polytechnic University and other. To date, 22 countries of the world are more than 515 accelerators and ion sources, produced by Russian companies, members of the "Radteh 'Association.

The largest number of Russian accelerator is operated in developed countries such as the UK, Germany, USA and France. The most demanded in these markets for steel cargo inspection system (254 accelerator) and non-destructive testing (157 accelerators). Accelerators betatron type used in such systems are characterized by small size, easy to operate, less energy-intensive. Penetration level of up to 300 mm of steel allows both to detect prohibited materials (weapons, explosives, etc.) In containers and cars, as well as to monitor the casting of parts, welds for defects.

Non-destructive testing refers to the types of materials testing equipment and methods which do not alter the structure, properties and performance characteristics of the object. One of the key non-destructive testing technologies is the X-ray or radiography, consisting in scanning X-ray products, the source of which can act as X-ray tubes, accelerators and radio nuclides.

The Russian company "PromIntro" first in the world to mark the two light sources on one platform: X-ray tube with an energy of 450 keV and electron accelerators (betatron production Tomsk Polytechnic University) 5 MeV for dense and thick products. So on one platform can be equally effective shine and components, and a thick metal product as a whole, having detection and sampling system.

Currently, the world operated about 1000 accelerators in non-destructive testing. Market electron accelerators with energies of 3-15 MeV in 2010 was estimated at 200-300 accelerators per year, which amounted to about US $ 250 million in cash. More portable and compact accelerators with energies of 1-3 MeV can also over the next few years to make a significant contribution to the total number of operated setting. In addition, the need for new accelerators will increase as a result of the replacement demand worn out and obsolete accelerator. According to Frost & Sullivan global market volume of non-destructive testing systems and services, including not only radiography, by 2018 will amount to approximately US $ 11.6 billion (in 2013 the market volume was about 8 billion US dollars) (figure 2). The average annual is growth rate of 7.5% per year.

About 160 Russian-made accelerators operate abroad. Tomsk Polytechnic University in cooperation with JME Ltd since the mid 80-ies more than 110 betatrons was delivered to the UK. Small Betatrons different energies are used for testing of welded joints at the installation site, the stocks, the repair of boilers and power plants, control of concrete supports of bridges and other engineering structures.

Conclusion

This paper has endeavored to provide an overview of market of the main accelerating technologies for charged particles. This is a field which is always working at the boundaries of knowledge and the techniques which have been described have a history of many decades of research and development behind them. The demands from users of accelerators will continue to drive the field forward with emphasis on higher performance coupled with smaller size and reduced capital and running costs [3]. These factors apply to small machines for cargo inspection and industrial applications as much as to the huge machines for fundamental scientific experiments.

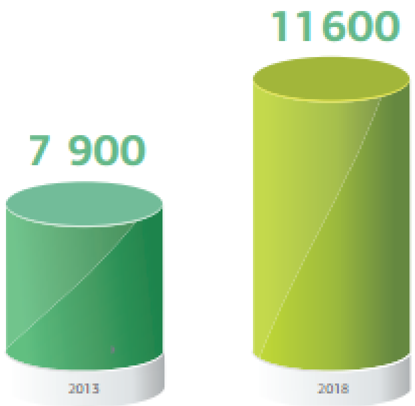

Figure 2. The volume of the world market of non-destructive testing systems and services (millions of US dollars) [3]

The research which will provide the basis for future accelerators is already in progress. As might be expected, much of it is focused on issues like increasing the accelerating gradient in superconducting structures. For normal-conducting machines there is a trend towards the use of higher frequencies for this purpose [4-6].

Market research has shown that the accelerator technique has great potential in the market and Russia occupies a leading position here.

References

1.Robert W Hamm, Current and future industrial applications of accelerators // R & M Technical Enterprises, October 4, 2013, NA-PAC-13, Pasadena, California, p. 201

2.Industrial Accelerators and Their Applications / edited by Robert W. Hamm and Marianne E. Hamm - R & M Technical Enterprises, California, USA, 2012, Chapter 7, the author William A. Reed, p. 312

3.Frost & Sullivan "Beyond BRIC: exploring the next game changers for the NDT industry", 2012, p 5-6.

4.Döbert , S. Status and future prospects of CLIC, Victoria, BC, Canada: LINAC 08. 2008; pp 364–368

5.Rene Flukiger, Reviews of Accelerator Science and Technology 5 - JAMA. 2012, p 3-7

6.Industrial Electron Beam Processing, IAEA draft report, Dec. 2010; (www.cirms.org/pdf/industrial-eb-processingdecember-2010-revision4.pdf)

STABILIZER FOR WEB-CAM

Levchenko M.V., Yurkina I.A.
Tomsk Polytechnic University, Tomsk
Supervisor: Filippov G. A., assistant, Department of precision engineering
Linguistic advisor: Kosheleva E.Y., PhD in History, Foreign English department of Physics and Technology Institute

We have stated a problem to simulate and create stabilizer for our web-cam, but first it is necessary to determine what stabilizer is. In common, stabilizer is a device that provides stability, permanent position, condition of whatever.

Our aim is creation of device that will hold cam in position of balance to horizon.

A gimbals is a pivoted support that allows the rotation of an object about a single axis. A set of three gimbals, one mounted on the other with orthogonal pivot axes, may be used to allow an object mounted on the innermost gimbal to remain independent of the rotation of its support. The