MIRRORCLE-CV the portable synchrotron for precise non-destructive testing and medical diagnosis

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We are developing portable synchrotrons MIRRORCLE-CV1 and –CV4* as commercial products for a practical use in the fields of non-destructive testing (NDT) and medical diagnosis. The X-ray imaging quality featured by the phase contrast, largely magnified projection, and large exposure field caused by its highly coherent beam produced from one micron order X-ray emission point is already demonstrated by MIRRORCLE-6X [1-3]. Downsizing the synchrotron to 30 cm outer diameter is our goal for more convenient use and easy handling. This synchrotron size will be comparable to that of a conventional X-ray tube. In addition, their total weight including the radiation shield will be less than 1 ton as shown in Fig. 1. Both synchrotron magnet systems are made of a one-piece cylindrical iron yoke and permanent magnet arrangements allowing the reduction of dimensions, weight, and total cost.

The MIRRORCLE-CV1 is composed of a storage ring magnet designed for 1 MeV electrons and a 1 MeV RF gun as an injector with its synchrotron magnet set in the vertical position. CV1 is designed with an upright form to make it appropriate for medical diagnosis. This machine is suitable for medical imaging of soft tissue or human body by its x-ray energy around 50-100 keV.

The MIRRORCLE-CV4 storage ring is designed for 4 MeV electrons with a 30 cm OD synchrotron magnet similar to CV1. A 4 MeV LINAC is used as an injector. The complete CV4 system including the pulse klystron will fit in a module with dimensions of 150 × 60 × 60 cm. With a weight of 1 ton, CV4 can be installed on a mechanical arm allowing unrestricted movement and positioning. This flexibility will make these machines practical for NDT of bridges, engines, containers, and security control at airports.

Of course there are no restriction, if user wish to use these machines as a source for X-ray microscope, nano CT as well as an advanced material analysis corporation with a double crystal monochrometer.

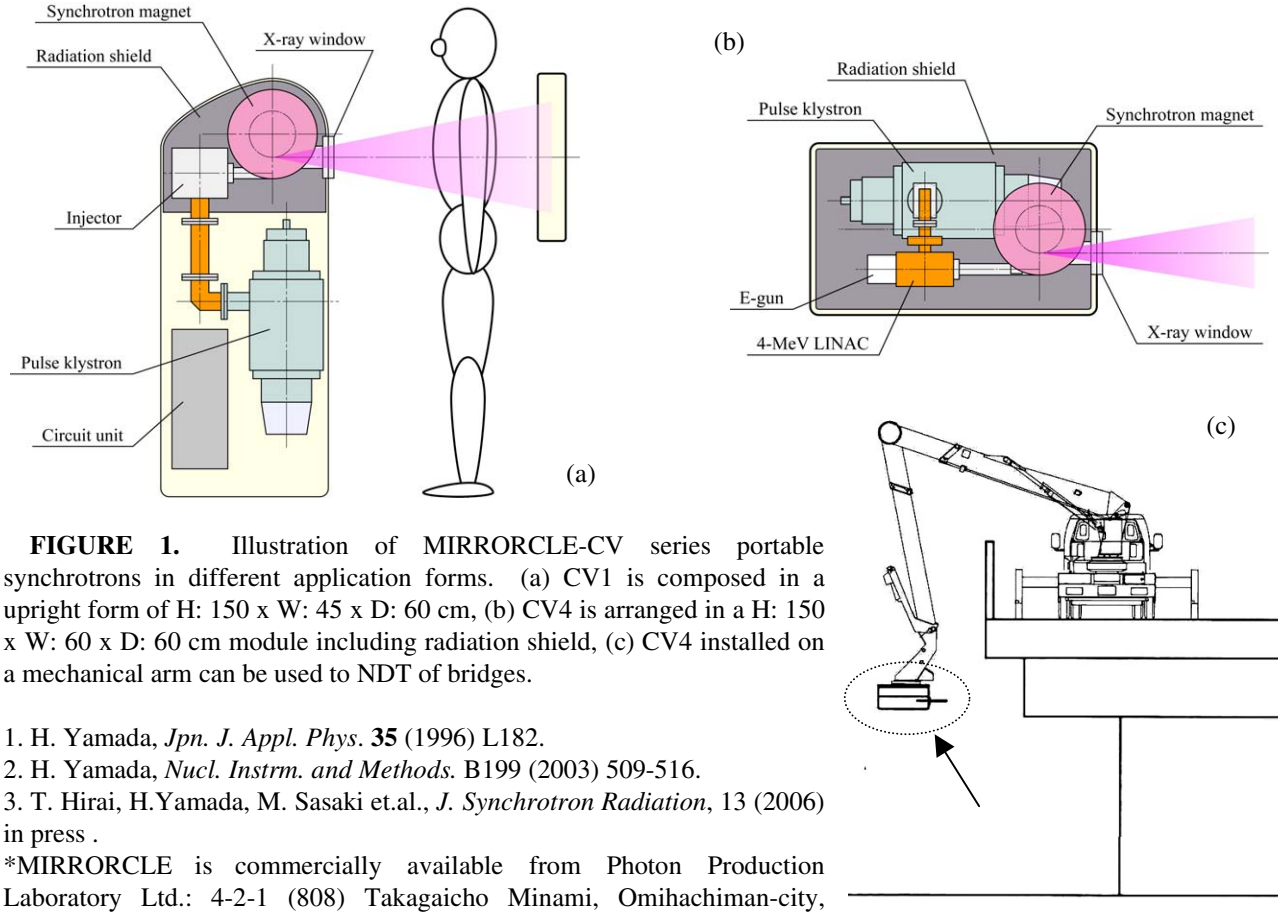

FIGURE 1. Illustration of MIRRORCLE-CV series portable synchrotrons in different application forms. (a) CV1 is composed in a upright form of H: 150 x W: 45 x D: 60 cm, (b) CV4 is arranged in a H: 150 x W: 60 x D: 60 cm module including radiation shield, (c) CV4 installed on a mechanical arm can be used to NDT of bridges.

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*MIRRORCLE is commercially available from Photon Production Laboratory Ltd.: 4-2-1 (808) Takagaicho Minami, Omihachiman-city, SHIGA, 523-0898, Japan, URL: http://www.ppl-xray.com