8 - 31 Radiological Assessment of CiADS Linac

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The radiological assessment of CiADS Linac was accomplished and the Linac is currently under construction at Huizhou, China. Due to the commissioning scheme, the accelerator will operate 3 months per year. In order to assess the radiological impacts on workers and the public while the accelerator is operating, a detailed studies of prompt radiation level in accessible areas outside the Linac tunnel by Monte Calo code FLUKA are presented.

In our calculations, we have assumed a beam loss of 1 W/m[1], and the maximum proton energy available in the superconducting line, which correspond to 500 MeV. Figure 1 shows a cross-section of the Linac, which comprises several meters of soils and concrete structures located around the tunnel. The equipment building is classified as a Supervised Radiation Area which allows to access during beam operation. In addition, the area on the top of the tunnel should be set to restrict access for the general public to enter that area. The designed dose limits of CiADS are shown in Table 1, in which dose rate limits are 2.5 μSv/h for worker and 0.1 μSv/h for the public, respectively. In order to evaluate the radiation levels when secondary radiations penetrate through the ventilation and cable ducts into the equipment building, a detail geometry model with those ducts was built.

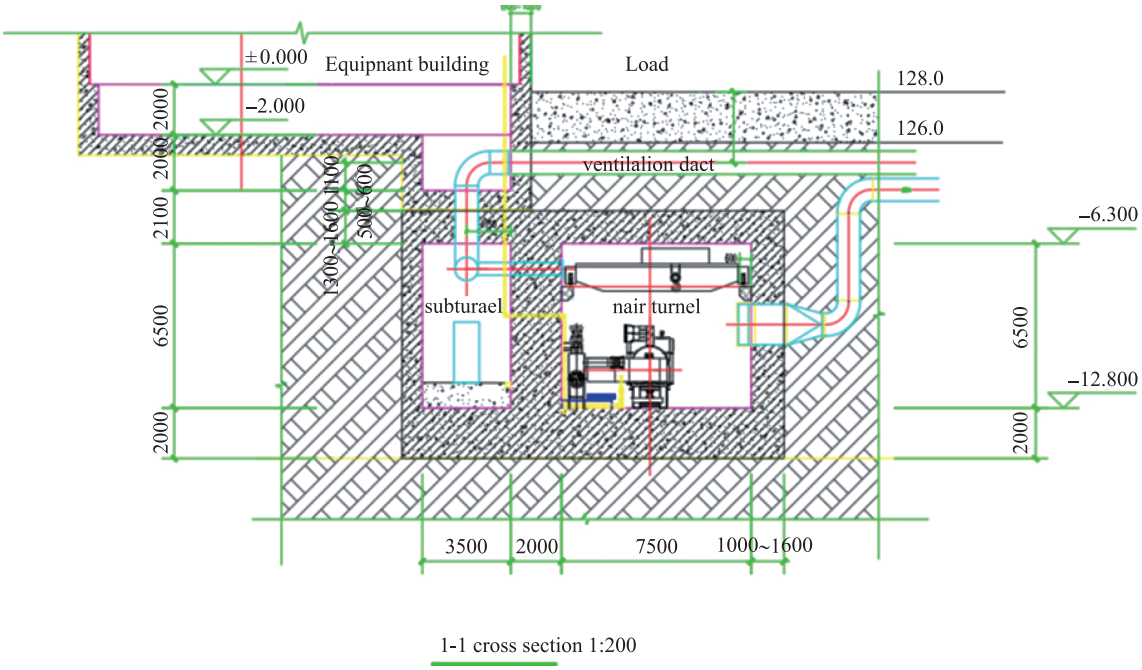

Fig. 1 (color online) Cross-section of Linac with surrounding soil and concrete structures.

Figure 2 shows the prompt dose rates distribution of Linac in elevation view. From the results, the dose rates in the equipment building and on the top of the Linac is less than 1.2 and 0.09 μSv/h, respectively. Therefore, the shielding design of Linac tunnel meets the requested dose limit demands. In addition, at the bottom and the sides of the Linac tunnel, the dose rates drop down to below 1 mSv/h in the surrounding soils such that levels of soil activation are considered acceptable[2]. In conclusion, these calculation results indicates that the dose rates in various areas do not exceed the design goals of CiADS.

Table 1 Regulatory limits and design goals for CiADS.

Target Receptor	Limit
Radiation Dose - Worker	GB 18871-2002 Standard: 20 mSv/a CiADS ALARA Goal: 5 mSv/a
Radiation Dose - Public	GB 18871-2002 Standard: 1 mSv/a CiADS ALARA Goal: 0.5 mSv/a and 0.1 μSv/ (any one hour)
Radiation Dose – Soil	CiADS ALARA Goal: 5 mSv/h

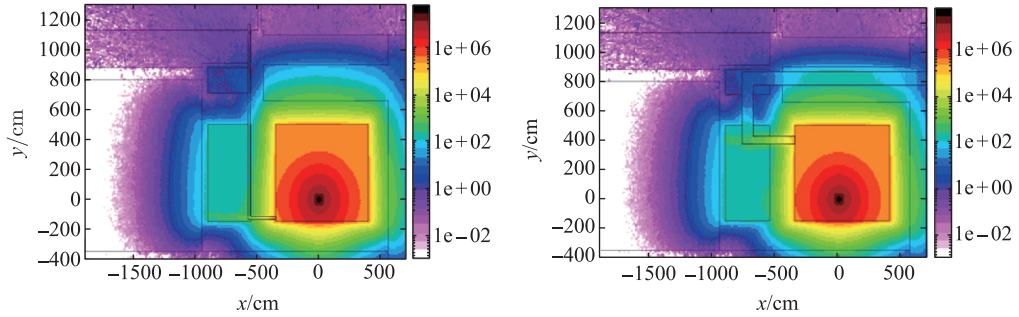

Fig. 2 (color online) Dose rate map in elevation views for CiADS linac with cable duct(left) and ventilation duct (right), μSv/h (the red contour lines on each plot are at 2.5 μSv/h).

References

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[2] C. Strabel, H. Vincke, K. Zabrzycki, "Radiation Protection studies for the CERN Neutrino Facility (CENF)", EDMS, (2014)1427729.

8 - 32 The Establishment of the Standard Device for Gamma Ray Air Specific Release Kinetic Energy in the Inspection and Testing Center of Large Scientific Equipment

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In accordance with the recommendations of IAEA 398 Technical report and AAPM TG51 report of the American Association of Medical Physicists, it is necessary to establish the necessary metrology support capacity for the measuring equipment of radiation therapy in proton and heavy ion therapy centers, as well as equipment for personnel radiation safety protection and radiation environment monitoring. Therefore, The gamma ray air specific kinetic energy (protective level) standard device and gamma ray air specific kinetic energy (therapeutic level) standard device have been established at IMP, which can not only satisfy the metrology support service of the treatment center, but also fill the gap in the verification and calibration metrology support ability of ionizing radiation measuring instruments in northwest China.

The standard device for gamma ray air specific kinetic energy is shown in Fig 1. It is mainly composed of gamma radiation source, irradiation system, trolley positioning and three-dimensional mobile trolley, radiation safety and control system, *etc.* It is transmitted to the national standard through the standard ionization chamber to achieve accurate measurement of the ratio of air specific kinetic energy in radiation field. Next, we will conduct remote control in the control room (Fig. 2), conduct repeatability measurement, stability evaluation and uncertainty evaluation experiments, and complete the traceability of quantity values.

The establishment of ionizing radiation standard measuring station can be used for the verification and calibration of relevant ionizing radiation measuring equipment in northwest China. To establish the calibration method and process of therapeutic dose in advanced particle radiotherapy; to provide research tools and sites for the applied basic research of radiation dosimetry, micro-dosimetry, radiation protection and environmental protection.