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A New Branching Point and Primary Beam Line at the J-PARC Hadron Experimental Facility

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Construction of a new primary proton beam line, which is called B-line, started in 2013 at the J-PARC Hadron Experimental Facility. The B-line is branched at the middle of an existing primary proton beam line (A-line) in the beam switching yard (SY), which is the connecting tunnel between the Main Ring (MR) and the Hadron experimental hall (HD-hall). At the branching point, about 0.1% of the primary beam is kicked off at 5 degrees using a Lambertson magnet and two septum magnets. The Lambertson magnet has a field free hole in its yoke. The proton beam that goes through a field region is separated from the A-line is extracted to the B-line. The rest of the beam that goes through the field free hole is transported through the existing primary beam line. Since a significant beam loss as much as 420W occurs at the edge of field free hole, the magnets near the Lambertson magnet are operated under a very high radioactive environment.

We have developed a "mini-chimney system" regarding easy maintenance of those magnets more than 1mSv/h on contact. The mini-chimney means a vertical tower of approximately 1 m in height. The tower is comprised of water pipes, power electrodes, and signal cables for safety interlock. Those can be easily connected and disconnected at the top of the chimney on the ceiling iron shields. In this paper, we summarize the maintenance scheme developed for the B-line, as well as the design of B-line.

In May 2020, the first proton beam was successfully extracted to the B-line by means of the Lambertson and the septum magnets. Up to now, the 1010 protons per 5.2 sec accelerator cycle shot have been available.

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