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A multi-waveform pulsed current generator for slow kicker magnets

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In the framework of the LHC Injector Upgrade (LIU) project, the Proton Synchrotron Booster (PSB) at CERN will be upgraded to receive 160 MeV H–beam from the new linear accelerator LINAC4. During the injection process the two electrons of the H–ions are removed with a stripping foil and the resulting protons are injected into the ring on a machine orbit locally bumped with four individually-pulsed ferrite-cored kicker magnets. The local bump is shifted during the injection process in order to fill the machine aperture ('phase space painting') and thereby produce high intensity proton beams. The magnets, two of 36μH inductance and two of 320μH inductance, will be excited by piecewise linearly decreasing currents with a maximum current of 400A for the 36μH magnets. The waveforms will comprise four different programmable slopes, changeable from pulse to pulse in the range of 8μs to 150μs. The four kicker waveforms must be well synchronized and deviate less than 0.5% from a reference waveform. Each pulse generator contains four stages of pre-charged capacitors that one after another are switched to the magnet to generate the current with the required slopes; an additional stage with a power amplifier allows fine control of the slope linearity. The switching stages are connected in series like in a Marx generator but are controlled individually. Special capacitor chargers were developed featuring a floating output, a discharge function, a digital PI-controller and a PROFINET interface. The performance of the first operational prototype is presented and compared to theoretical calculations.

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