FEU115: tests of rate effects at low frequencies

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We tested the possibility of gain changes with signal rate on the FEU115 phototubes using bases built from discrete components. We used a green LED to illuminate 4 tubes, all driven by 2100 V. Complementary to earlier measurements done at IHEP we concentrated on the low frequency region (0.6 Hz to 250 Hz), since these rates (1-5 Hz) will be the typical exposure at RHIC.

We made two series of measurements. In the first series the pulses were periodic (equidistant in time), in the second series while changing the average rate the time intervals between the pulses had a Poisson-distribution.

We noticed that the amount of light varied strongly with the pulsing frequency (see Fig. 1). Separate measurements of the total charge/pulse emitted from the pulser convinced us that the majority of these variations are due to the pulser. While the amount of charge is quite stable from pulse to pulse while the frequency is stable, the total charge at different pulsing frequencies is quite different. As a consequence, we had to discard our Poisson-type measurements as useless.

The data taken with periodic (equidistant in time) pulses are summarized on Fig. 2. Relative gains at different frequencies are normalized at their highest value. While there is almost 40% change in the total amount of light (number of photoelectrons) from 0.6 to 250 Hz, the average gain change is less than 1.5% which is approximately the error of the measurement itself. There is one tube (solid triangles) that makes slightly wider excursions.

As a summary, when using periodic pulses **we see no rate effect on the tube-base assembly in the rate region relevant for RHIC**. Once the final bases are available, a quick recheck using a rate-independent pulser and Poisson-type time distributions may be interesting, but we do not expect major surprises.

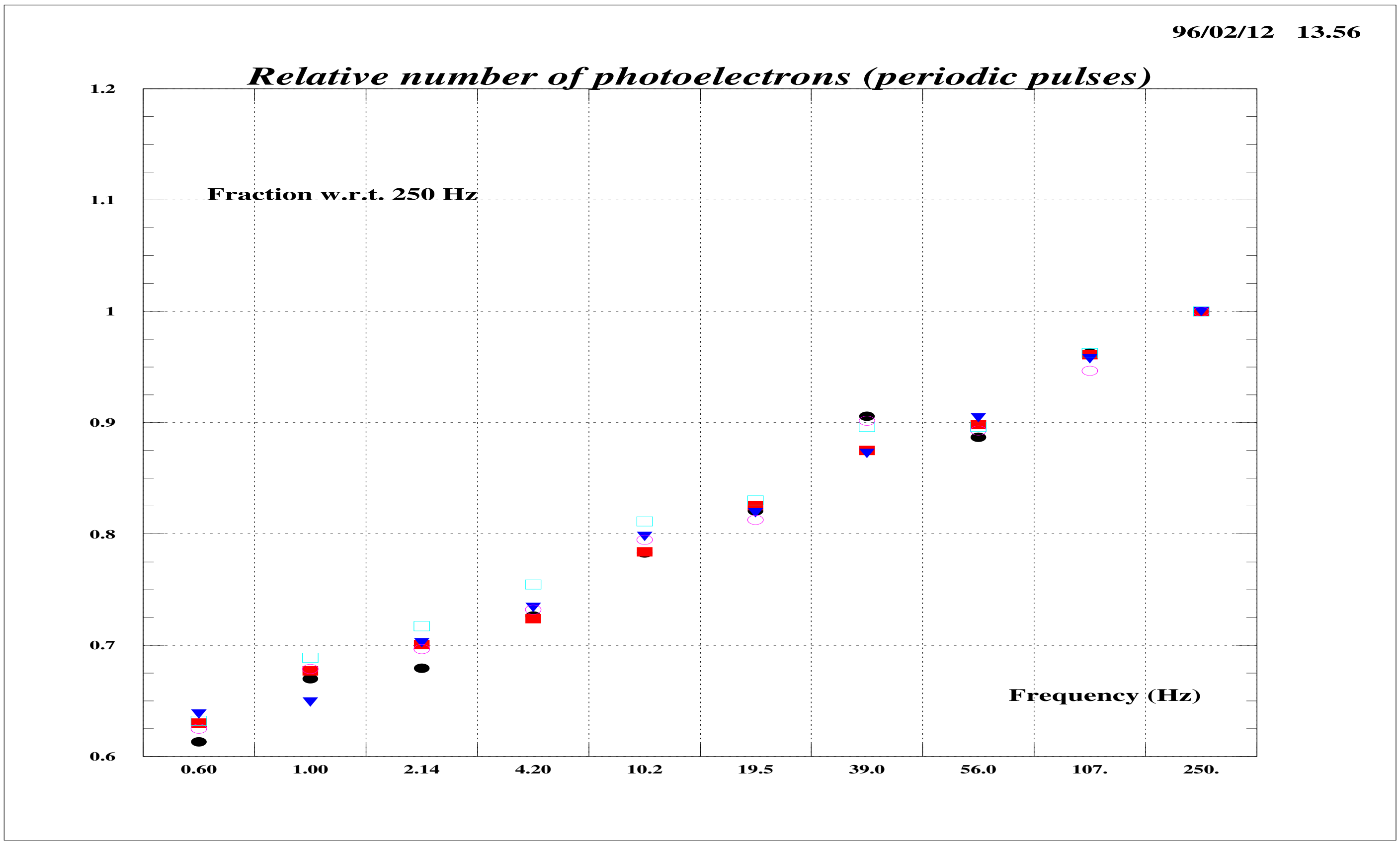

Figure 1: Number of photoelectrons as a function of pulser frequency, normalized to the number of photoelectrons measured at 250 Hz. Different symbols stand for different tubes.

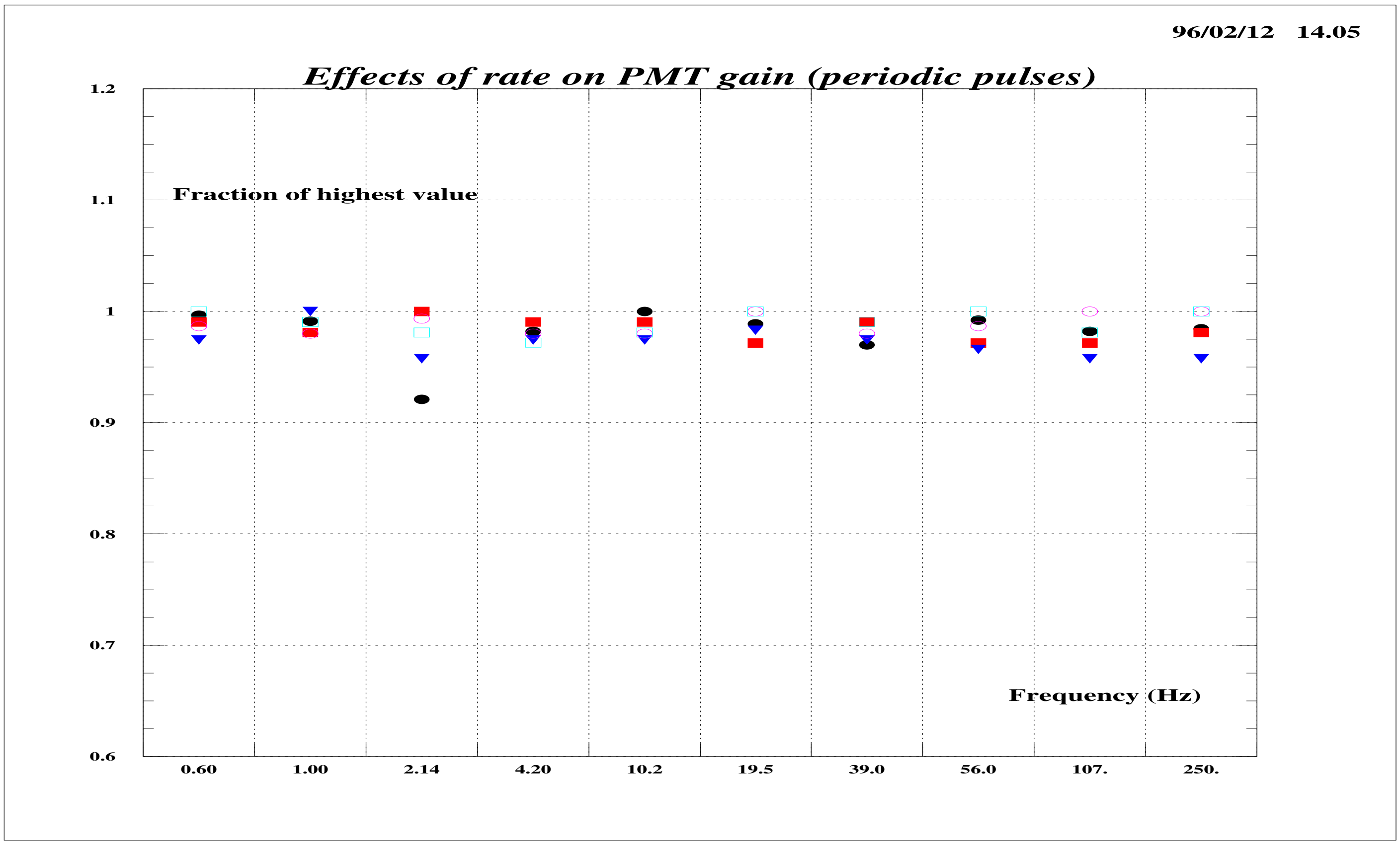

Figure 2: Gains of four tubes as a function of illumination frequency. All gains are normalized to their highest value.