

CLAIMS

- 5 1. Particle detector (1) comprising:
a measuring electrode (6) for measuring charged particles (2), a detection
device (7) for detecting the charged particles (2) measured by the
measuring electrode (6), and an evaluation device (8) for determining the
number (Q_N) of charged particles (2) detected by the detection device (7),
10 characterized in that the detection device (7) has a charge amplifier (6) for
converting a charge signal ($Q(t)$) generated by the charged particles (2) into
a voltage signal ($U(t)$) and an amplifier device (10) for amplifying the voltage
signal ($U(t)$).
- 15 2. Particle detector according to claim 1, wherein the evaluation device (8) is
designed to evaluate the voltage signal ($U(t)$) in a respective counting
window (dT_i) around a measuring time (T_i) of the charged particles (2) at the
measuring electrode (6) in order to determine the number (Q_N) of charged
particles (2) detected.
- 20 3. Particle detector according to claim 2, wherein the detection device (7) has a
trigger device (11) for defining the respective counting window (dT_i).
4. Particle detector according to claim 3, wherein the counting window (dT_i)
25 defined by the trigger device is shifted in time to later times preferably by
 $dT_i/2$ such that the counting window (dT_i) is around the respective measuring
time T_i .
5. Particle detector according to one of claims 2 to 4, wherein the evaluation
30 device (8) is designed to filter the voltage signal ($U(t)$) in the respective
counting window (dT_i) in order to increase the signal-to-noise ratio.
6. Particle detector according to any of claims 2 to 5, wherein the evaluation
device (8) is designed to determine a voltage difference (U_i) in the voltage
35 signal ($U(t)$) before the measuring time (T_i) and after the measuring time (T_i)

in order to determine the number (Q_N) of charged particles (2) detected in a respective counting window (dT_i).

- 5 7. Particle detector according to claim 6, wherein the evaluation device (8) is designed to determine the voltage signal ($U(t)$) after the measuring time (T_i) at a sampling time ($t_{s,i}$) within the respective counting interval (dT_i) in order to determine the voltage difference (U_i), for which the following applies: $3/f_0 < t_{s,i} < 4.5 / f_0$, wherein f_0 denotes a resonance frequency of the charge amplifier (6).
- 10 8. Particle detector according to any of the preceding claims, wherein the charge amplifier (6) is a low-noise charge amplifier which has a signal-to-noise ratio greater than 10 dB in a predetermined frequency interval ($[f_1, f_2]$).
- 15 9. Particle detector according to any of the preceding claims, wherein the charge amplifier (6) has a phase margin (α) of at least 45° , preferably of at least 60° .
- 20 10. Particle detector according to any of the preceding claims, wherein the amplifier device (10) has an amplification factor (10^{N_x}) which is adjustable by means of the evaluation device (8) as a function of the voltage signal ($U(t)$).
- 25 11. Particle detector according to claim 10, wherein the amplification factor (10^{N_x}) is adjustable over at least four decades, preferably over at least five decades.
12. Particle detector according to any of the preceding claims, wherein the measuring electrode is designed as a Faraday cup (6).
- 30 13. Particle detector according to any of the preceding claims, further comprising: an extraction device (4) for extracting the charged particles (2).

14. Particle detector according to claim 13, further comprising: a particle guide device (5) for guiding the charged particles (2) from the extraction device (4) to the measuring electrode (6).
- 5 15. Particle detector according to either claim 13 or claim 14, wherein the extraction device (4) and/or the particle guide device (5) are designed to filter the charged particles (2).