

Turbo-ICT & BCM-RF

***Turbo Integrating Current Transformer
RF Beam Charge Monitor***



Preliminary data sheet
Turbo-ICT and BCM-RF are new instruments.
When additional measurements become available, this data sheet will be updated

**~0.1 μ Arms* (!) total
wideband current noise
current measurement
~5 fC* (!) noise in single
bunch measurement**

**with Turbo2 option*

**Optimized for low beam current $\leq 20\text{mA}$
Optimized for low bunch charge $\leq 100\text{pC}$**

CW and macropulse current measurement

Maximum current 20mA
RF from 1 MHz to 350 MHz
Output bandwidth >5 MHz
Total noise ~ 0.1 μA rms over DC to 5 MHz.

Single bunch charge measurement

Bunch length 1 fs to 1 ns
Bunch charge 100 fC to 100 pC
Noise in single bunch measurement 10 fC (!)
Output DC voltage held until next bunch
Maximum bunch repetition rate 2 MHz

80-dB measuring range without range change
Resolution / accuracy 1% of measured value
Output voltage logarithm of current or charge
USB 2.0 output (to be announced)
Negligible temperature dependance
Negligible magnetic fields dependance
Simple installation between two flanges
UHV Ultra-High Vacuum down to 10^{-10} mbar
Core material radiation tolerance* $>10^{16}$ n/cm²

* Est.: IRMM Geel, Dr. J.-M. Salomé

Innovative features in Turbo-ICT* and BCM-RF

A lower-loss alloy to transfer charge through Turbo-ICT up to 350 MHz, while core loss remains under 1%. Output pulse duration is 3 ns compared to 70ns for traditional ICT. The increased output amplitude improves the signal-to-noise ratio by 5.

Turbo-ICT is made with more than one core: 2, 4 or 8 cores adjacent or superposed in a single In-flange package.

Core windings connect with each other in series to increase output voltage or in parallel to increase output current.

A combination of series and parallel windings allows to control the Turbo-ICT output impedance in order to match the first amplifier input impedance to lower the amplifier noise.

Improved EMI/RFI immunity results from narrow-band transmission between Turbo-ICT and BCM-RF via a TV-frequency carrier.

Turbo-ICT amplifier and RF modulator are powered from BCM-RF via the transmission cable to avoid ground loop.

BCM-RF is essentially an RF receiver. with two modes of operation:

- Track-Continuous for CW and long macropulses.
- Sample&Hold for single bunch, with auto trigger feature.

Output is log of the beam current or bunch charge.

*Patent INPI 12/00667 March 6, 2012

Turbo-ICT dimensions and order codes

| Model (mating flange) | ID (mm) | Pipe dia. | Part number Order code |
|-------------------------|---------|-----------|---------------------------|
| CF3"3/8 (DN50 NW50CF) | 22.2 | 1" | ICT-CF3"3/8-22.2-40-UHV- |
| CF4"1/2 (DN63 NW63CF) | 34.9 | 1.5" | ICT-CF4"1/2-34.9-40-UHV- |
| CF4"1/2 (DN63 NW63CF) | 38.0 | 40mm | ICT-CF4"1/2-38.0-40-UHV- |
| CF6" (DN100 NW100CF) | 47.7 | 2" | ICT-CF6"-47.7-40-UHV- |
| CF6" (DN100 NW100CF) | 60.4 | 2.5" | ICT-CF6"-60.4-40-UHV- |
| CF6"3/4 (DN130 NW130CF) | 96.0 | 4" | ICT-CF6"3/4-96.0-40-UHV- |
| CF8" (DN160 NW150CF) | 96.0 | 4" | ICT-CF8"-96.0-40-UHV- |
| CF10" (DN200 NW200CF) | 147.6 | 6" | ICT-CF10"-147.6-40-UHV- |
| CF12" (DN250 NW250CF) | 198.4 | 8" | ICT-CF12"-198.4-40-UHV- |

Turbo-ICT options and order codes

| Option | Available on all models |
|---------|------------------------------|
| -Turbo1 | 1 core only |
| -Turbo2 | 2 cores |
| -Turbo4 | 4 cores |
| -Turbo8 | 8 cores |
| -CAW | Calibration winding |
| -H | Improved radiation tolerance |
| -316 | AISI-316LN instead of 304 |
| -ARBxxx | Non-round arbitrary aperture |



One BCM-RF-E module plugged into powered BCM chassis

Turbo-ICT assembly

Improved radiation tolerance on option
 UHV compatible to 10^{-10} mbar
 Ceramic gap vacuum-brazed over kovar transitions
 Material AISI-304. 316LN on option
 Non-round arbitrary shape aperture on option
 1 core, 2 cores, 4 cores or 8 cores on option
 Calibration winding on option (limited coupling)

BCM-RF-E dimensions and order code

BCM-RF-E: Eurocard format 100 x 160mm, 20mm wide to be plugged into BCM-RFC chassis station
 May be mixed with BCM-IHR-E in same chassis

BCM-RFC chassis and order code

BCM-RFC/xx: 19"x3U RF-shielded chassis with xx wired stations (max. 10)
 AC mains 90-125Vac or 220-245Vac, switch selectable 50/60Hz

Performance measured with Turbo2 option

| Beam type | CW beam and macropulses | Single bunch |
|------------------------------|---|------------------------------|
| Set BCM-RF to: | Track-Continuous mode | Sample&Hold mode |
| Measurement single range | 10 uA - 100 mA | 100 fC - 100 pC |
| Bunch repetition frequency | 1 MHz - 350 MHz | Single bunch - 2 MHz |
| Output specifications | | |
| Voltage | 0 - +5V, log of beam current | 0 - +5V, log of bunch charge |
| Risetime | <70 ns | |
| Reaction time | 100 ns for RF=100 MHz 300 ns for RF=10 MHz | 500 ns to >99% final value |
| Noise | 0.1 uArms or 1% of current | 10 fC (!) or 1% of charge |
| Non-linearity | ~2 % | ~2 % |
| Time response | Reports current variation to 10 MHz | Hold till next bunch |

Distributors

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Instrumentation