

Tuned-CT

Narrowband Current Transformer

For beam loss monitoring in low energy hadron accelerators

Measures current difference between two monitoring points with 0.05% resolution. E.g. measures 5% loss with 1% resolution

To keep machine activation low enough for hands-on maintenance, personnel safety and environmental protection

To protect machine parts from beam radiation damage

To achieve efficient beam transport

To measure beam loss along an accelerating structure, when no secondary particles can exit the vacuum chamber, the only option is to measure the beam current at regular intervals. Non-interceptive current transformers can be used for this purpose.

But wideband transformers cannot measure the beam current accurately because their response is dependant on the frequency spectrum, thus dependant on the bunch width.

Tuned-CT is a narrowband transformer tuned to the beam fundamental frequency. Its output is a near-sinewave independant of the bunch width. It is therefore a solution when beam loss must be measured in low-energy hadron accelerators, an area where, so far, no non-destructive diagnostics existed.

Resolution < 5E-4

Stability < 5E-4

Thickness 40 mm

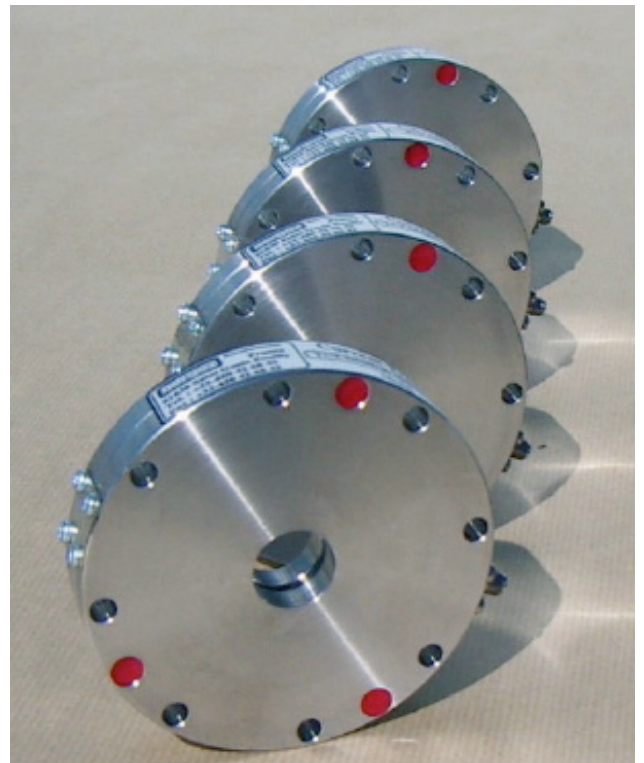
No noticeable temperature dependance

No dependance on external magnetic fields

Radiation resistant

Bakable

Vacuum down to 1E-10 mbar on option



Shown on picture: PEFP Tuned-CTs (non-Conflat flanges)

The Tuned-CT was developed in collaboration with KAERI the Korean Atomic Energy Research Institute and PAL Pohang Accelerator Laboratory, to measure beam loss along the PEFP acceleration path.

Specifications

Operating frequency Fixed at time of manufacturing in range 10 MHz to 1 GHz

Output Near-sinewave at operating frequency

Sensitivity

Turns ratio	50:1	20:1	10:1	05:1	
Sensitivity	0.50	1.25	2.50	5.00	Vrms/Adc

Sensitivity to primary current harmonics < 5E-4

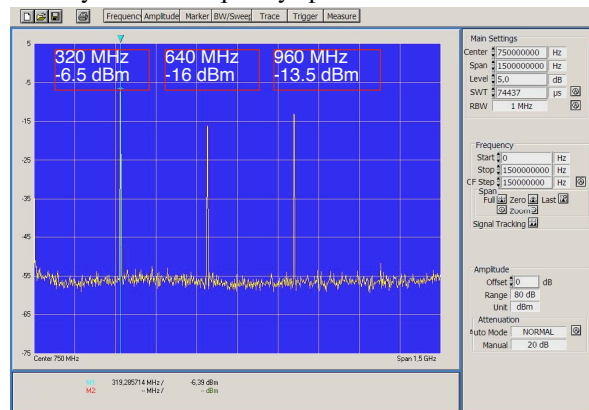
Stability over time < 5E-4

Unit-to-unit matching error < 2E-3

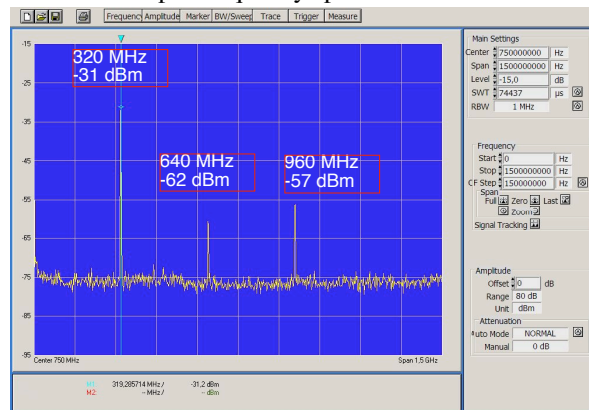
Q at operating frequency 1±0.003

Harmonics rejection

Primary current frequency spectrum



Tuned-CT output frequency spectrum



Environment

Maximum temperature

- 1E-7 mbar models 150°C (300°F) any time
- 1E-10 mbar models 200°C (400°F) any time

Core saturation 20 Gauss radial field
2A permanent dc current

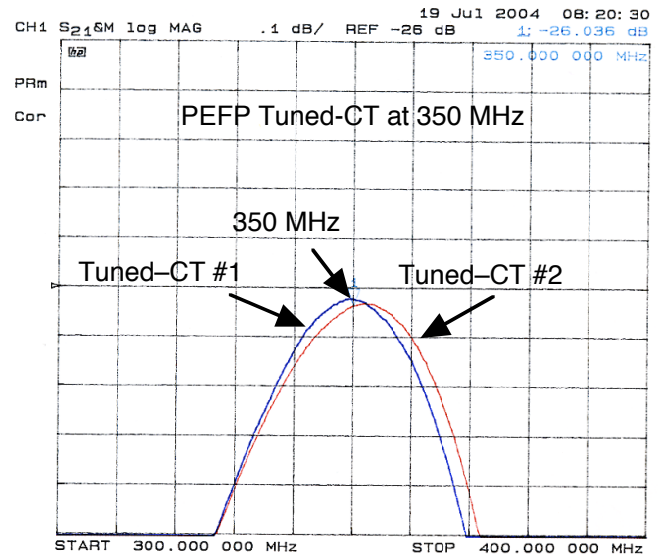
Radiation damage level

- 1E-7 mbar models 1E5 Gray max
- 1E-10 mbar models 6E7 Gray max
1E17 n/cm2 max

Connector

Output SMA jack 50 ohms
Kapton dielectric

Tuned-CTs matching



Ordering codes

TCT- Tuned Current transformer
 -CF Conflat Flange
 -KF Klamp Flange
 X"/ Outer diameter (inch)
 XXX- Inner diameter (mm)
 -XXXMHz- Operating frequency
 -XX:1 Turns ratio
 -HV EPDM O-ring gap for High Vacuum
 -UHV Brased ceramic gap for UHV

E.g. TCT-CF6"/63-500MHz-20:1-UHV
<http://www.allergyfoundation.ca/baby-cannot-drink-milk-french.html>

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