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Functional Requirement Specification PXIE, TIME OF FLIGHT MONITOR, FRS ED0004201, Rev. -

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0	03 AUG 2015	Initial DRAFT	Vic Scarpine	ALL	
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В					

Introduction and Scope

The specification describes requirements for PXIE [1] Time-of-Flight monitor (ToF) intended for measuring the energy (speed) of a non-relativistic H- bunched beam during PXIE MEBT [2] commissioning. ToF is an electrostatic pickup movable longitudinally with a high precision. The relative phase of coming bunches is measured as a function of the pickup longitudinal position, and the speed of particles is evaluated from the linear fit to these data.

Relevant Beam Parameters

For the purpose of the ToF measurements, the beam is assumed coming in trains (pulses) of 162.5 MHz bunches with parameters indicated in Table 1.

Parameter	Unit	Nominal	Range
		value	
Particles type		H⁻	
Energy	MeV	2.1	2.0 – 2.2
Velocity	mm/ns	20.01	
Bunch frequency	MHz	162.5	
Bunch length, rms	degrees of	10	7 -35
	162.5MHz		
Bunch Length, rms	ns	0.17	0.12 – 0.60
Nominal pulse repetition rate	Hz	60	0.1 - 60
Nominal pulse length	μs	20	5 - DC
Current averaged over 1 µs	mA	5	1 - 10
Corresponding particles per bunch	108	1.9	0.38 - 3.8

Table 1. Relevant beam parameters

ToF Functional Requirements

For the nominal beam parameters listed in Table 1, the ToF monitor should provide energy measurement accuracy $\leq 0.3\%$ with the time per the measurement $\leq 1 \text{ min}$.

Interfaces

Table 2. Mechanical interfaces for the ToF monitor

Parameter	Unit	Value
Longitudinal space, flange-to-flange	mm	≤ 400
Clear aperture	mm	≥ 30
Matching flanges		CF 2 3/4

The design should allow using the monitor in UHV environment.

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Recommended Technical Parameters

Table 3. Recommended technical parameters of the ToF monitor

Parameter	Unit	Value
Full range of motion	mm	30
Step size	mm	≤ 0.025
Position measurement accuracy	mm	≤ 0.025
Phase measurement accuracy	degrees of	≤0.2°
	162.5MHz	
Number of sampling points		100

References

- 1. PXIE Functional Requirements Specification, TC # ED0001223, uncontrolled copy is available at http://projectx-docdb.fnal.gov/cgi-bin/ShowDocument?docid=980
- 2. MEBT Functional Requirements Specification, TC# ED0001303, uncontrolled copy is available at http://projectx-docdb.fnal.gov/cgi-bin/ShowDocument?docid=938