

## Functional specifications for PXIE MEBT scrapers

The H- beam of PXIE MEBT should be collimated to minimize chances for damaging sensitive components, first of all, cryomodules and MEBT kickers. It will be accomplished by installing scraper assemblies in 4 locations in the MEBT line.

The scrapers will be used for several purposes:

1. For beam halo removal
2. To protect the downstream equipment a beam loss caused by beam envelope and trajectory mismatches. A high-loss signal from a scraper will trigger turning the beam off.
3. For beam halo measurements
4. As an axillary beam density distribution device (pulse mode)
5. To form a pencil H- beam for measurements downstream (pulse mode)

### *Beam parameters*

Energy	2.1	MeV
Maximum average current	10	mA CW or pulsed
Current density distribution		Gaussian
Rms beam size, X and Y	2	mm

### *Assembly mechanical parameters*

Each scraper assembly contains 4 individual electrically isolated scrapers that can be moved into any radial position from overlapping to being completely retracted out of the 32 mm ID aperture.

Number of scrapers per assembly	4	2 in each X and Y directions
Length, flange-to-flange	$\leq 100$	mm
Equilibrium pressure with no beam	$\leq 1.E-8$	Torr
Pressure with maximum beam loss	$\leq 2.E-7$	Torr
Scraper electrical insulation	$\geq 100$	V
Average time between maintenance	1	year (normal operation)

### *Scraper motion*

Range	18	mm
Step size	$< 0.02$	mm
Reproducibility	$< 0.05$	mm

### *Beam loss*

Maximum average power per scraper	100	W
Maximum average power per assembly	200	W

### *Measuring capabilities(per scraper)*

The scraper electronics should be capable of reading the current to scraper in 3 modes:

1. CW (normal operation )
2. Fast increase of the beam loss (accident mode). Meant to be used for tripping the beam.
3. Pulse mode (tuning). Remotely switchable to from the operational mode.

#### *Operation*

Average current	±0.1	mA
Resolution	0.1	μA
Bandwidth	100	Hz (from DC)

#### *Accident mode*

Trip limit	±0.1	mA, adjustable
Time to generate a trip indication	< 1	μs

#### *Pulse mode*

Peak current	±10	mA
Minimum pulse duration	1	μs
Maximum pulse duration	100	μs
Reportable value		Average current over the pulse
Resolution	10	μA
Maximum repetition frequency	60	Hz