

Cavity Tuner

Spec. profile for Plug Compatibility

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Spec. Profile Table (Slow tuner) @Mar.2008 GDE meeting/Sendai

tuner	specification item	Rough guess	unit and comments	
Slow tuner	Tuning range	>600	kHz	←
	Hysteresis in Slow tuning	<10	µm	←
	Motor requirement	step-motor use, Power-off Holding, magnetic shielding		←
	Motor specification	ex) 5 phase, xxA/phase, ...	match to driver unit, match to connector pin assignment,...	←
	Motor location	inside 4K? / outside 300K? / inside 300K accessible from outside?	need availability discussion, MTBF	
	Magnetic shielding	<20	mG at Cavity surface, average on equator	← discuss later
	Heat Load by motor	<50	mW at 2K	← discuss later
	Physical envelope	do not conflict with GRP, 2-phase line, vessel support, alignment references, Invar rod, flange connection,...		← cable connection, Mag shield
	Survive Frequency Change in Lifetime of machine	~20 Mio. steps	could be total number of steps in 20 years,	←

Spec. Profile Table (Fast tuner) @Mar.2008 GDE meeting/Sendai

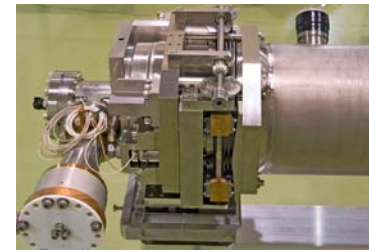
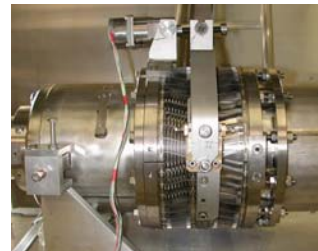
tuner	specification item	Rough guess	unit and comments	
Fast tuner	Tuning range	>1	kHz over flat-top at 2K	←
	Lorentz detuning compensation	<100	Hz at 31.5MV/m flat-top match to driver unit,	←
	Actuator specification	ex) low voltage piezo 0-1000V, ...	match to connector pin assignment, ...	← decide later
	Actuator location	inside 4K?/inside 4K accessible/inside 100K? accessible / inside 300K accessible from outside?		decide later
	Magnetic shielding	<20	mG at Cavity surface average	←
	Heat Load in operation	<50	mW	← measure first, discuss later
	Physical envelope	do not conflict with GRP, 2-phase line, vessel support, alignment references, Invar rod, flange connection,...		←
	Survive Frequency Change in Lifetime of machine	>10 ¹⁰	number of pulses over 20 years, (2x10 ⁹ :operational number)	←

Major spec. items not yet determined

- Slow tuner: Motor Location
- Fast tuner: actuator Location

Example of comparison table

Slow Tuner					
		TTF		STF	STF
		Saclay -1	Blade	Slide Jack	Ball Screw
		Lifetime Test (~ 0.1mm x 10000 Times) is necessary.			
Mechanism		Double Lever	Blade+Lever+Screw	Wedge+Screw+Gear	Screw+Worm Gear
			Blade has the potential Problem of Fatigue.		Life time of Coating?
Stiffens	N / μm	40	25	290	1000
		Not Stiff	Not Stiff. If used to TESLA Cavity DLD at Flat-Top becomes ~900Hz.		
Stroke	mm		< 2	3.5	Long enough
Location		Beam Pipe	Jacket Cylinder	Jacket Cylinder	Jacket Cylinder
		The room for tuner is small. Top Heavy. Alignment?			
Cost					



Cont.

Fast Tuner					
		TTF		STF	STF
		Saclay -1	Blade	Slide Jack	Ball Screw
		Piezo(200V)	Piezo(200V)	Piezo(150V)	Piezo+Blade
			Speed ?		Blade has the potential Problem of Fatigue. Speed ?
		NORIAC (1 Spare)	NORIAC (1 Spare)	Piezo Mechanic x 1	Piezo Mechanic x 1
Size	mm	10 x 10 x 26	10 x 10 x 38	φ20 x 18	
Stiffness	N / μm	105	70	500	
Max. Load	kN	4	4	14	
Stroke:RT	μm	40	60	20	
Stroke:2k	μm	4	6	2	
Compensation	μm	3.4	6	1	
Speed					
Delay		0.6 msec.			
Repairability					
Motor		need Disassemble	need Disassemble	Outside	Poor
Piezo		need Disassemble	need Disassemble	Repairable	need Disassemble
		US Study on this Subject exists.			
		How to check Piezos just we install. There are no experience for long term operation in Pulsed mode. Life time Test is necessary.			

Plan for developing Tuner Work Package

- Finalize spec. profile table, today.
22 April, ILC-GDE meeting at FNAL
- Upload to EDMS team workspace now.
- Revise any spec. in any time, if it is inconsistent.
- Develop tuner comparison table and R&D of each tuner.
- Write and develop 'recommendation of motor location' according to the past presentations and R&D, report it to PM by the next FNAL meeting.