SRF Cavity Tuner Specifications

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ILCTA & Projet X Cavity Tuner Performance specifications.

Parameter	Value		
	ILCTA	SSR1	650MHz
Cavity Frequency	1.3GHz	325MHz	650MHz
Cavity bandwidth	200Hz	85Hz	20Hz
Cavity elongation tuning	300Hz/µm	540Hz/µm	200Hz/µm
Cavity Spring constant	3N/µm	30N/µm	19N/µm
"Thermocycle related" cavity frequency range	500kHz	135kHz	200kHz
"Thermocycle related" tuner dimensional range	1650µm	250µm	1000µm
"Thermocycle related" tuning resolution	20Hz	2Hz	2Hz
"Thermocycle related" tuning speed	60Hz/sec	60Hz/sec	60Hz/sec
"Operational cycle" cavity frequency range	3kHz	2kHz	2kHz
"Operational cycle" tuning resolution	1Hz	0.2Hz	0.2Hz
"Operational cycle" response bandwidth	5kHz	1kHz	1kHz
Minimum tuner spring constant	30N/µm	300N/µm	200N/µm
Minimum tuner mechanical resonance	5kHz	1kHz	1kHz
Lifetime of machine	10(20?)years	40years	40years
expected number of thermocycle per year	2	2	
operational cycles per year	3*10e8	3*10e6	
mean time between failures	20(?)year	40 years	
mean time between repairs	3(?) year	1 year	
mean time for repairs	1month	10days	

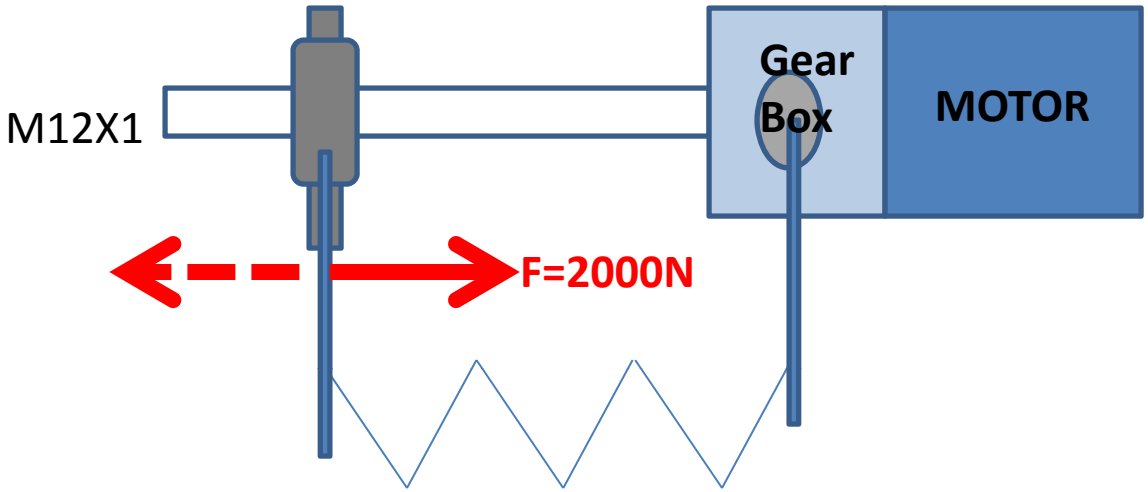
- **“Thermocycle related” tuning cycle:**
  - To bring cavity to/from resonance after/before cryomodule cool down;
  - To de-tune cavity from resonance (cavity failure; etc..);
  - To protect cavity from excessive detuning during cool-down (example of CM2/slim blade tuner);
- **“Operation cycle” – to keep cavity on resonance during operation:**
  - To compensate microphonics;
  - To compensate dynamic Lorentz Force Detuning & cavity pre-detuning;
  - To compensate static LFD during powering up cavity;

SSR1 (325MHz) cavity Tuner Performance specifications.

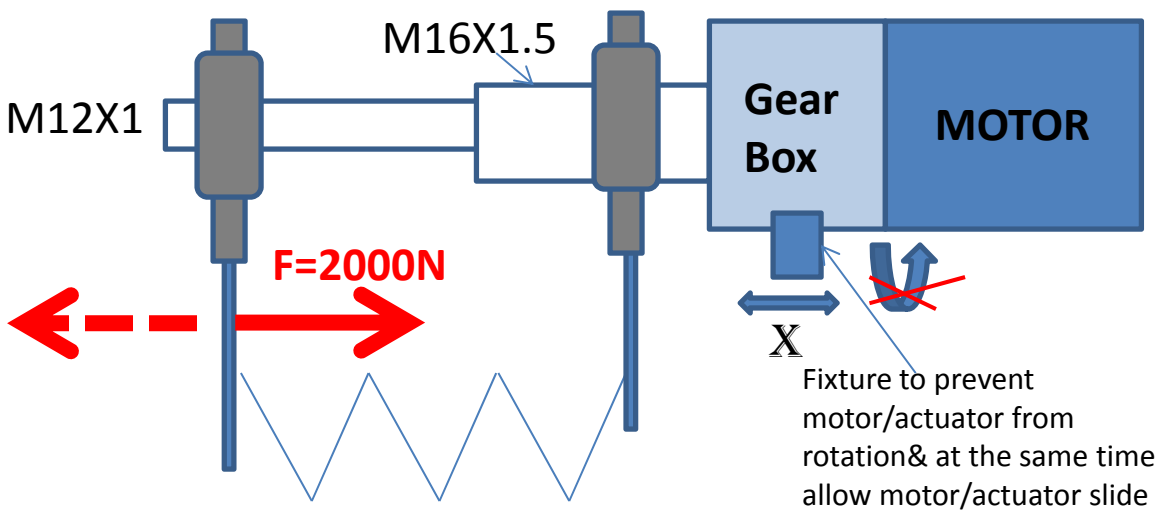
Parameter	Value
Cavity Frequency	325MHz
Cavity bandwidth	85Hz
Cavity elongation tuning	540Hz/μm
Cavity Spring constant	30N/μm
Cavity Force Tuning	*18Hz/N*
Slow Tuner cavity frequency range	135kHz
Slow Tuner dimensional range	250μm
Slow/coarse tuning resolution	2Hz
Fast Tuner response bandwidth	5kHz
Fast Tuner cavity frequency range	2kHz
Fast Tuner dimensional range	4μm
Fast Tuner tuning resolution	1Hz
Minimum piezo preload force /per mm^2 of piezo cross-section	5N
Maximum piezo preload force /per mm^2 of piezo cross-section	25N
Maximum piezo voltage	200V
Minimum tuner spring constant	30N/μm
Minimum tuner mechanical resonance	5kHz
Tuner operating condition	insulated vacuum; T=20-60K
Slow/coarse Tuner lifetime range (20years)	**25MHz**
Fast/fine Tuner lifetime range	1*10e8 pulses (sinewave F=0.1Hz with A=50% max V)

7500N 4000N 40N 20N/mm2

What can be done to address large forces between actuator/motor and nut/shaft



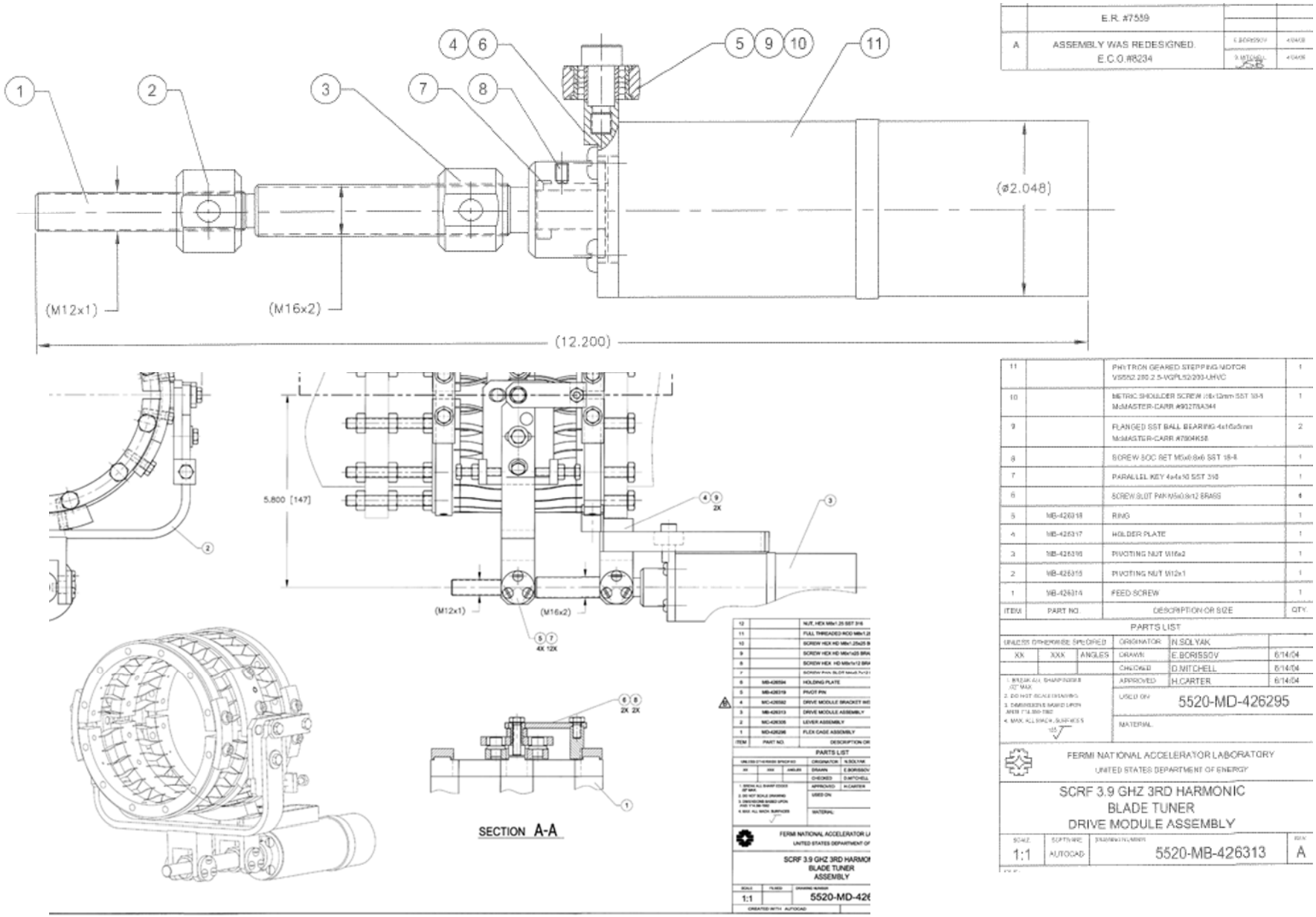
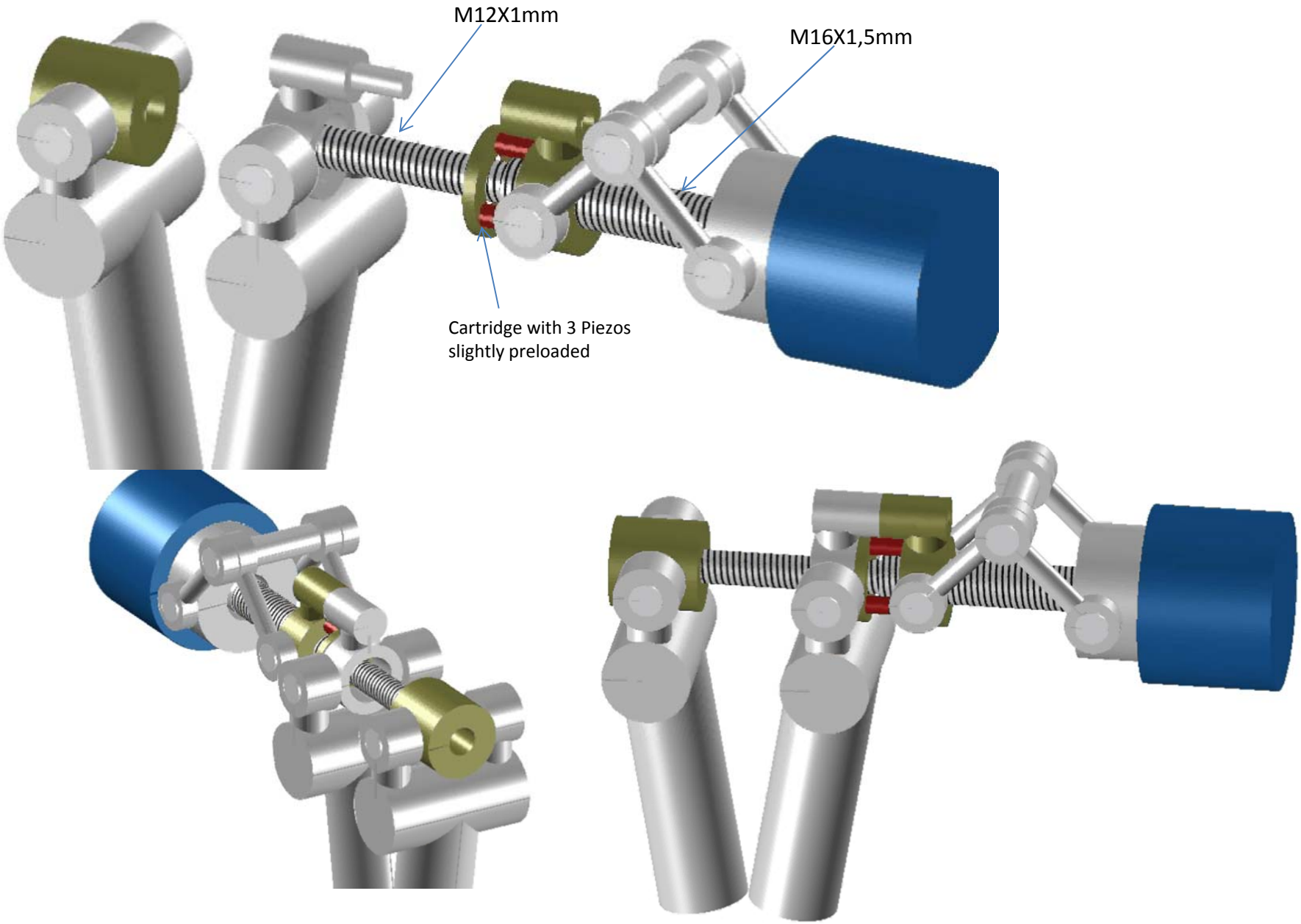
DESY Lever Tuner
Slim Blade Tuner
Proposed SSR1 Design



FNAL 3.9GHz Blade Tuner

Fixture to prevent motor/actuator from rotation& at the same time allow motor/actuator slide in X direction

3.9GHz Blade Tuner (Evgeniy Borrisov)



Warren Schappert – Tuner-Cartridge Conceptual Design