WG5: Frequency Tuners and LF Detuning

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Intro: Tuner Objectives

- Provide means to tune the cavity on resonance
- Detune a cavity to by-pass operation if needed
- Compensate Lorentz-force detuning
- Allow for a high linac fill factor (compact design)
- Should be hysteresis free
- Should not cause cross-tuning of neighboring cavities
- Long life time
- Lowest cryogenic losses
- Low cost
- …

Discussion Topics

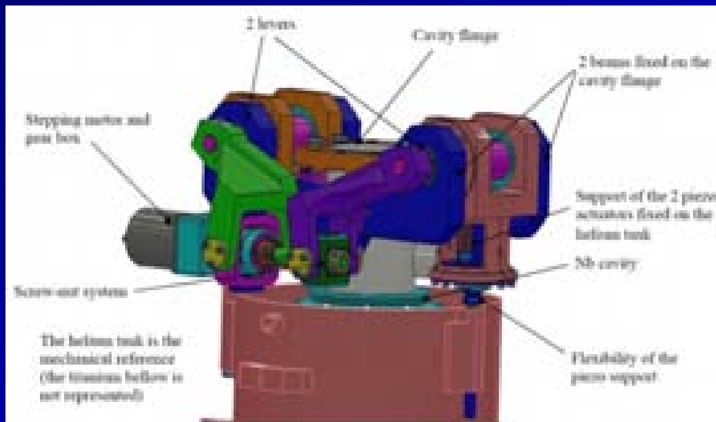
1. Slow tuner requirements?
2. Fast tuner requirements?
3. Tuner motor inside or outside?
4. Piezo inside or outside?
5. Type of fast actuator?
6. Required stiffness of tuner and vessel?

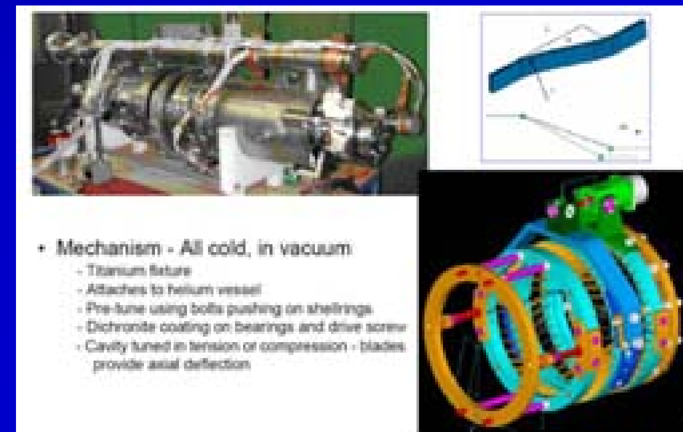
Tuner Options

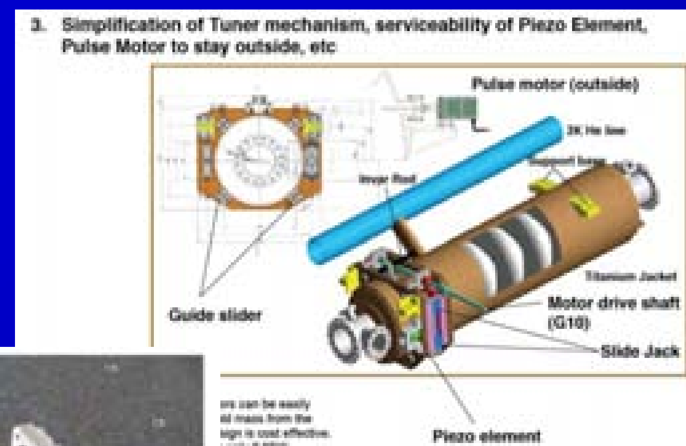
1. Saclay “PTS” tuner
2. INFN Blade tuner
3. TJANF upgrade tuner
4. KEK slide jack tuner
5. KEK coaxial ball screw tuner

Listed pros, cons and required R&D for each of the existing tuner designs.

Tuner Options







Detail of slow and fast tuning mechanism

Conclusions (I)

- BCD (for 1 TeV cavities):
  - 500 kHz slow, >3 kHz fast tuning range
  - Motor inside of vacuum vessel with some access or motor outside of vessel (no 100% consensus on this issue)
  - Piezo driven, direct fast actuator
  - Piezos inside of vessel; redundant design for piezo
  - No existing tuner design fulfills specs on fast tuning range above 35 MV/m; existing designs give good starting point for an ILC tuner and for cost estimate

Conclusions (II)

- **ACD:** Tuner with very reliable motor inside
- **R&D for BCD and ACD:**
  - Need to design tuner for 40+MV/m operation and test prototypes including demonstration of Lorentz-force detuning at highest fields with BCD cavity.
  - Study reliability of motor / gearing / piezo / magnetostrictive actuator. How to do this?
  - Study performance of magnetostrictive actuator.
  - Cavity design with smaller Lorentz-Force detuning.
  - Estimate additional cost of external motor.