A longitudinal damper for the PS
(preliminary ideas)

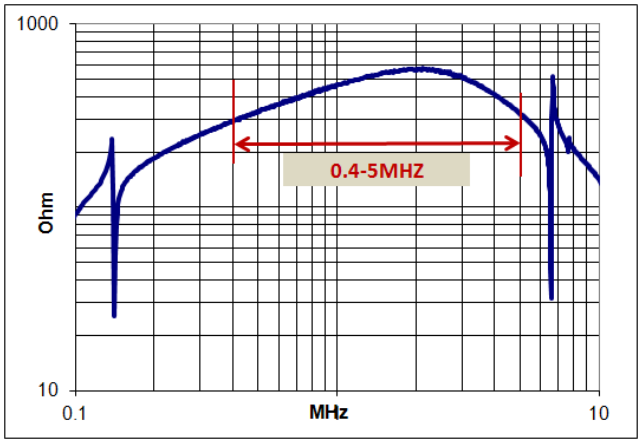
Specifications

Just some basic specifications are now available for the PS longitudinal wide-band kicker.

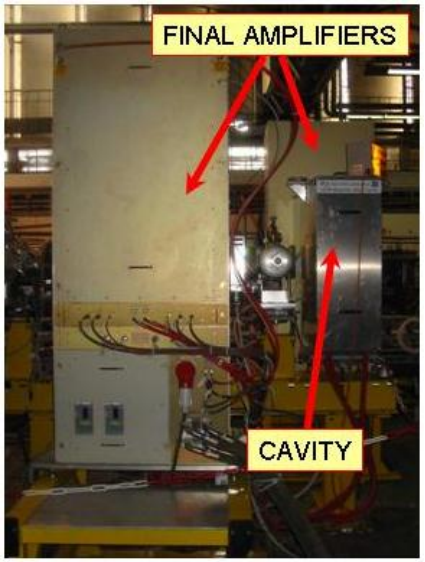
- The lowest mode to be damped is at the revolution frequency : ~400 kHz
- The highest is half the bunch frequency : ~5 MHz
- The RF voltage required is of the order of : ~5 kV.

- As the feedback will damp several modes simultaneously, RF voltage will be generated at several f_{rev} harmonics (i.e. synchrotron frequency side-bands) simultaneously.
- The kicker impedance should be comparable with that of a C10 cavity (~150 Ω)
- To not jeopardize beam stability in case of problems, the cavity must be equipped with gap short-circuits.

Use broadband LEIR cavity



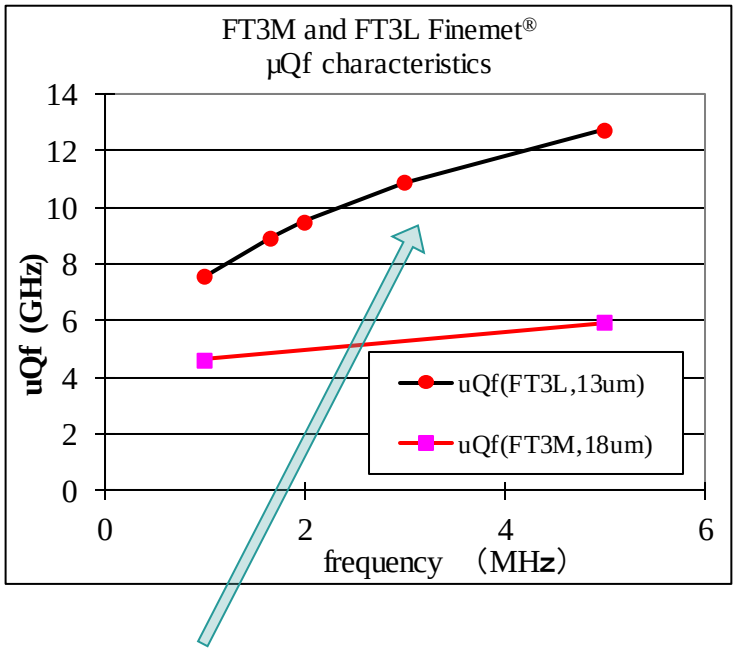
Frequency	MHz	**0.35**	**0.7**	**2**	**5.0**
Nominal gap voltage	kV	2	4	4	4
Cavity power	kW	5	18	14	12
Cavity R_{gap}	Ω	390	450	570	660
Cavity $\|Z_{gap}\|$	Ω	275	390	560	320
Max power density	W/cm^3	0.2	0.8	0.7	0.6
Average power density	W/cm^3	0.1	0.4	0.3	0.3



- Performances almost compatible.
- Low frequency voltage increasable limiting the duty-cycle (i.e. 4kV at 50%)
- Gap voltage increasable with adding additional cores (8 instead of 6).
- **One power amplifier already available!**

Voltage improvement with low loss Finemet® (FT3L).

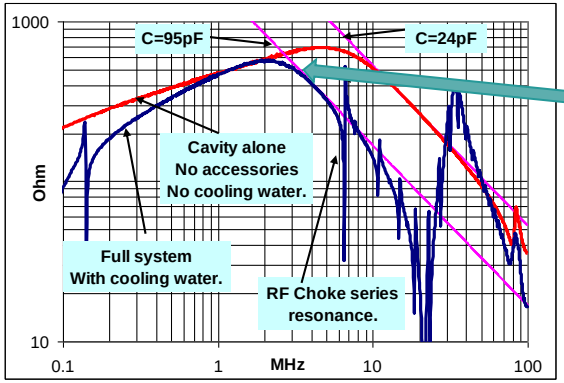
With the new low-loss Finemet® type FT3L higher voltages can be achieved.



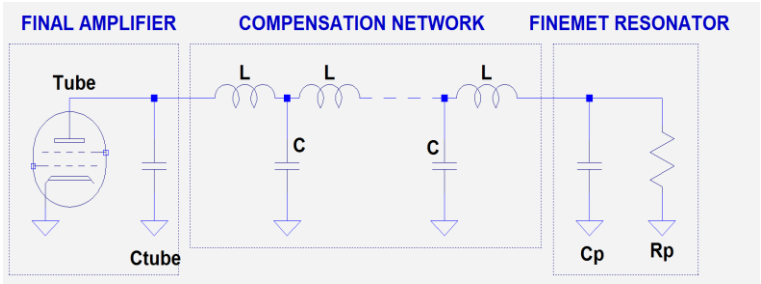
Kindly provided by Dr. Chihiro Ohmori (KEK)

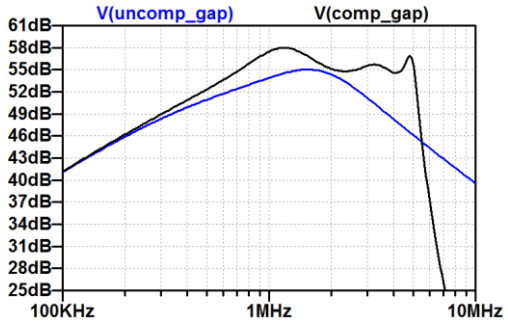
Core losses (R_P) are proportional to µQf.
Almost a factor 2 improve achievable with FT3L!

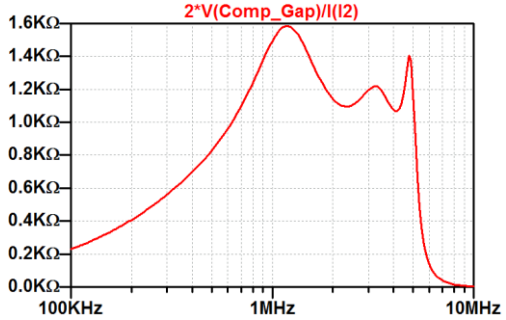
Wideband system capacitance compensation.



- With the low-loss Finemet® R_P increases but the system capacitance stays constant.
- To make full use of the Finemet® wideband properties it is essential to use different capacitance compensation approach.

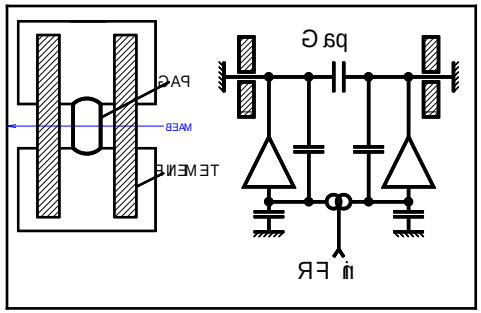


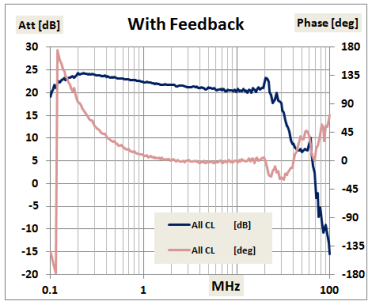


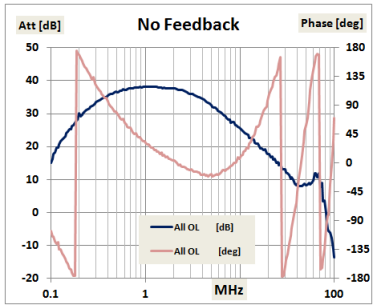


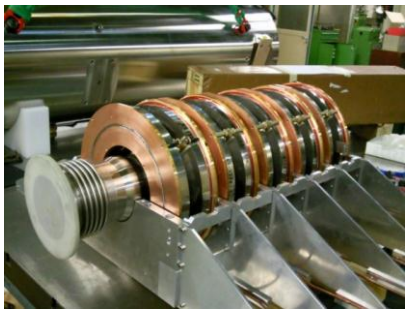
High wideband impedance seen by the beam!!!
Need some kind of cancellations scheme.

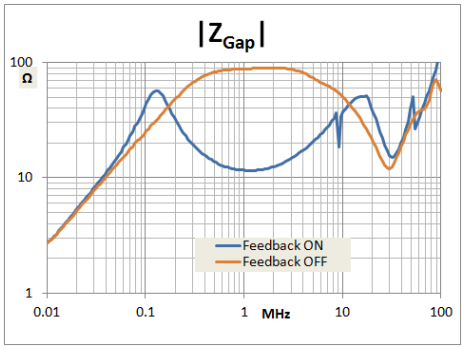
Use broadband PSB cavity











- Frequency coverage compatible with requests.
- Modular system providing ~700V per cell.
  - Voltage limited by the power amplifier
  - Easily increasable to 1kV.
- Existing design for 5 cells system.

… but:

- Are solid-state components admissible in the PS machine?
- Can the required power be provided by solid-state amplifiers.

Planning.

Spring-Summer 2012 : Preliminary study

- Identify location
- Select technology
- Evaluate radiation damage risks

Autumn-Winter 2012 : System design

- Cavity electrical design (Collaboration established with KEK and J-PARC)
- Power sections and ancillary electronics design

Spring-Summer 2013 : Procurements and manufacturing

Autumn-Winter 201 : Assembly and tests

Beginning 2014 : Installation