Low Voltage Power Supply Using Step-Down Piezoelectric Transformer

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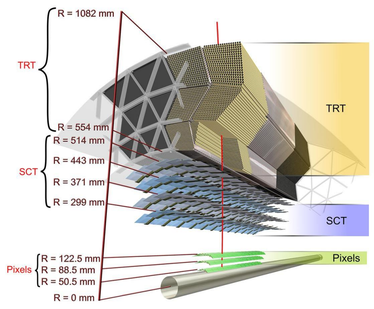
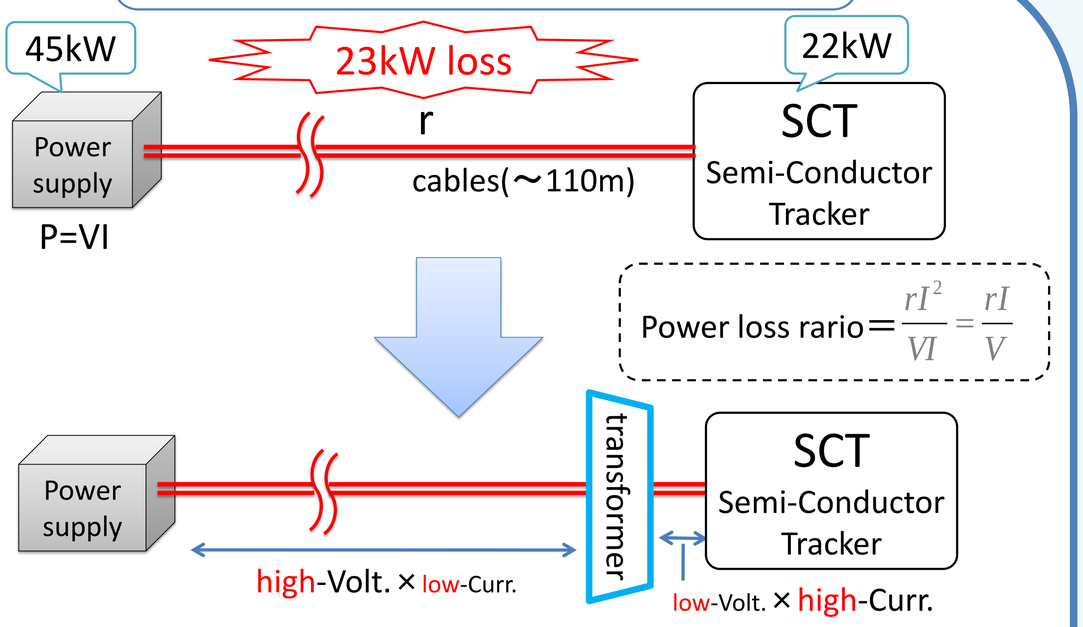
ATLAS inner detector upgrade for SLHC



Replacement of whole inner detector in 2020
with the increased # of readout channels (X10)

Need for the stable power supply

Power efficiency on ATLAS detector



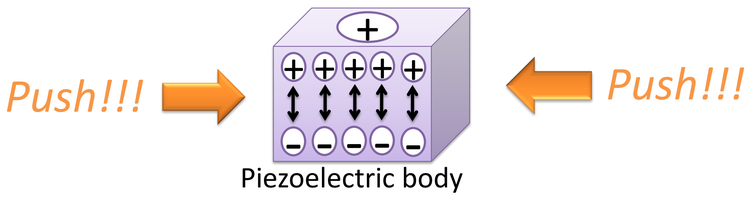
Conditions required for the transformer

- compact size
- radiation tolerance
- magnetic field insensitivity

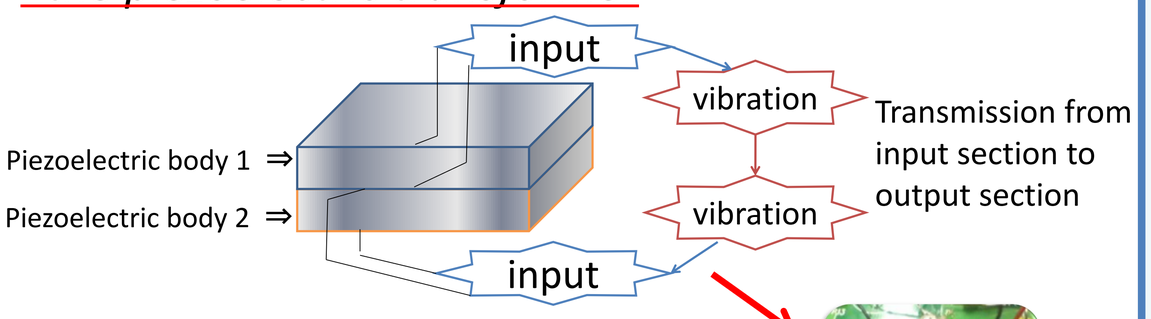
→ Piezoelectric element

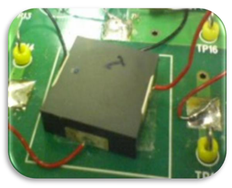
Piezoelectric element

・"Piezoelectric element" is

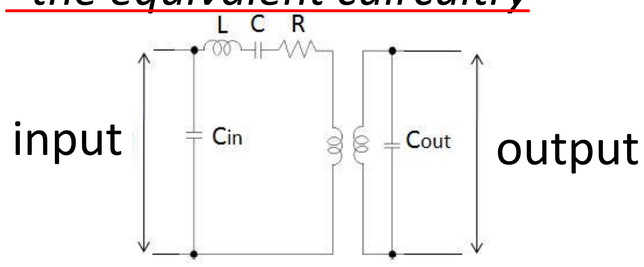


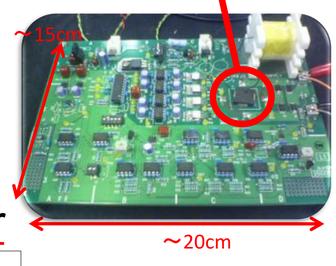
・the piezoelectric transformer



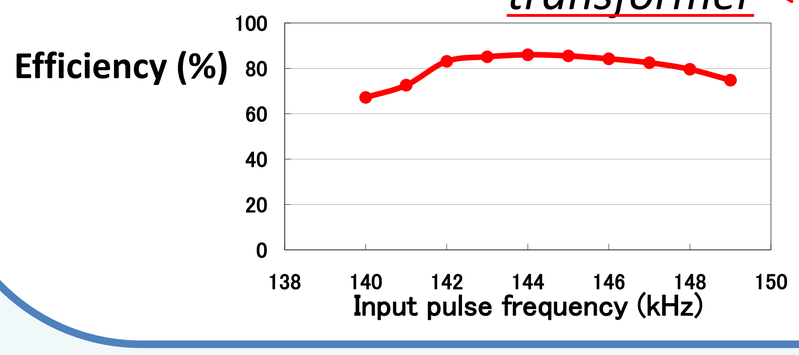


・the equivalent cuircuitry

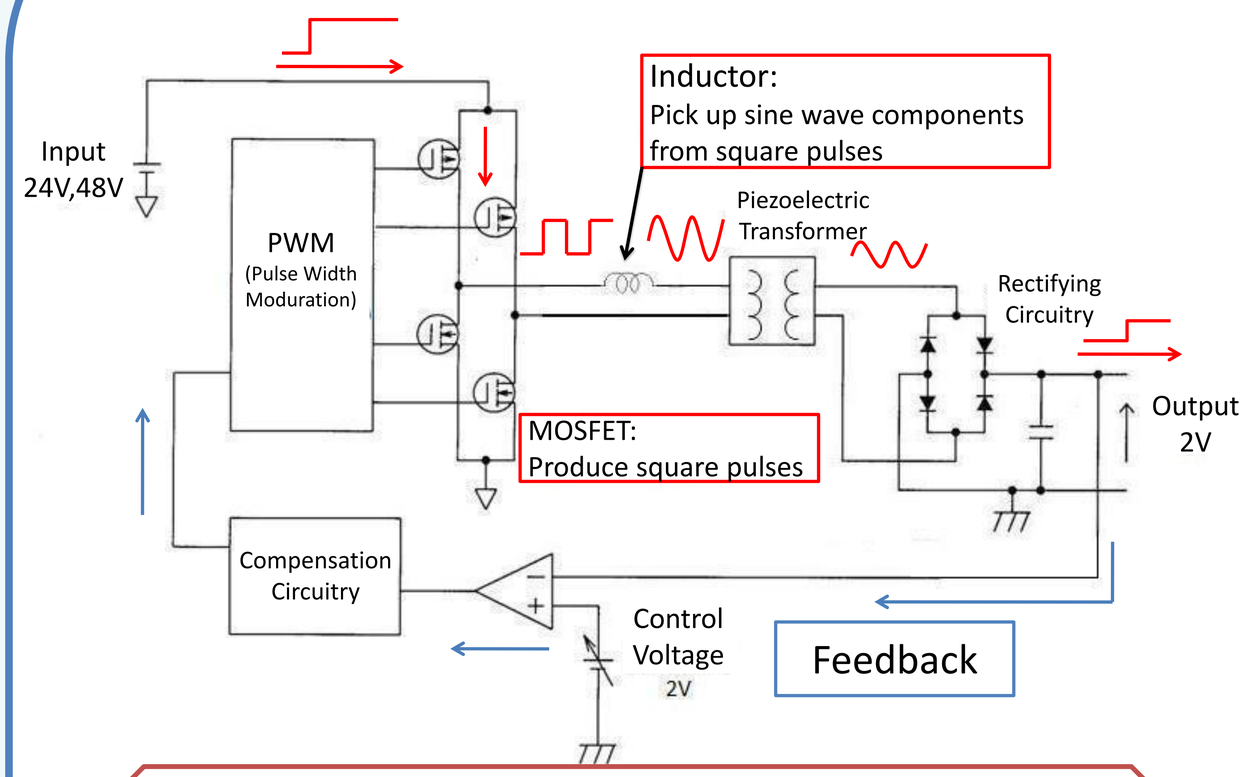




・the efficiency of Piezoelectric transformer



Outline of the circuitry of the compact power supply

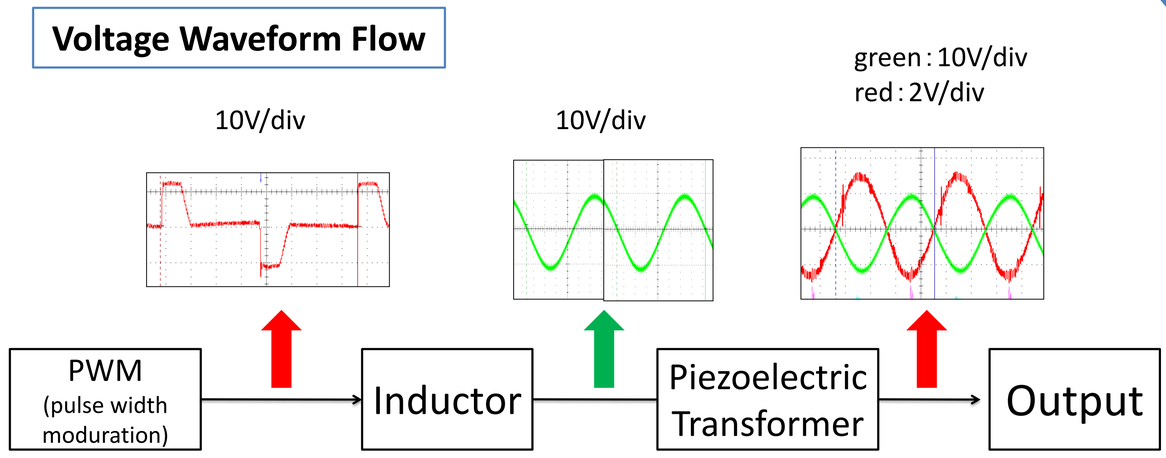


GOAL : to operate without the inductor

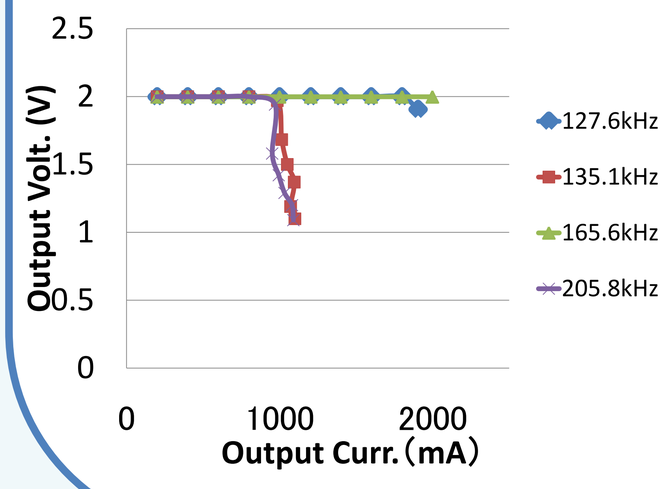
At present : The feedback without the inductor does not work as designed

Operation

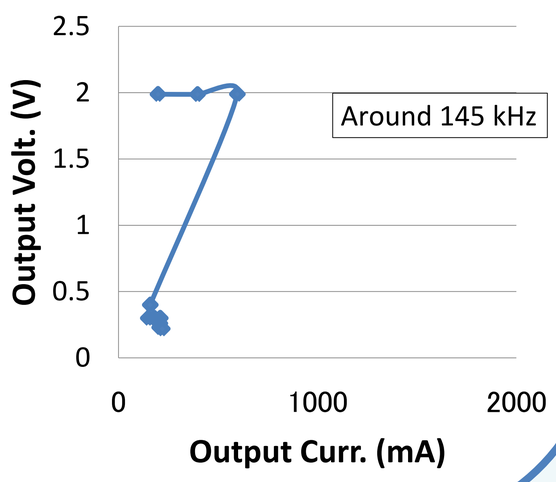
Voltage Waveform Flow



With Inductor



Without Inductor



Summary

Current Conditions

- With the inductor, output current of 2A at 2 V is attained.
- Without the inductor, output current is 600 mA at most at 2 V

Required Improvements

- Improvement of such feedback that works without inductor
- Improvement of piezoelectric transformer itself