**Liquid nitrogen cooling test with linear driven Stirling cryocooler**

**Introduction**

- **Background & Objective**
  - Reliable and efficient large cooling capacity cryocooler is required for cryogenic cooling system of HTS applications.
  - Crank-driven Stirling cryocooler is widely used at present.
  - Issued problems of vibration absorption, oil removal and frequent maintenance in crank-driven Stirling cryocooler
  - Gamma-type Stirling cryocooler with linear compressor is suggested.

- **Development of 2 kW (at 77 K) Stirling cryocooler driven by linear compressor & LN2 cooling test**

<table>
<thead>
<tr>
<th>Previous work (presented at CEC 2015, ICC19)</th>
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<td>1st &amp; 2nd prototype (module) was fabricated and tested</td>
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<td>1st (CEC 2015)</td>
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<td>2nd (ICC 19)</td>
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**Experimental setup**

- (Stirling cryocooler module (KIMM))
- [Schematic diagram of LN2 circulation test setup]

**Experimental Results**

- [Temperature at coil inside linear motor]
- [Mean pressure of each cooler module]
- [Power input to each module]
- [LN2 pump performance]
- [Temperature profile during experiment]
- [Cooling performance as input power]
- [Total input power]

**Summary**

- Four linear compressor driven Stirling cryocoolers are integrated into the single cooling system to produce 2 kW of cooling capacity.
- LN2 cooling test are performed to simulate the cooling system of HTS cable
- From LN2 cooling performance test,
  - The amount of heat rejection is estimated from the measured enthalpy difference of LN2 flow
  - With the fixed mass flow rate of LN2, temperature difference between in/out is 2.60 ~ 2.97 K and it corresponds to 2.04 ~ 2.33 kW of heat rejection.
  - The results of system monitoring show the stable operation of the developed 2 kW Stirling cryocooler.
  - LN2 pump shows the better performance than the predicted data at high speed. It might be due to low flow resistance of test loop.