An amplifier for VUV photomultiplier operating in cryogenic environment

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Main features:
- double output (1X and 10X amplified channels, nominal bandwidth 100 MHz)
- commercial components
- low power consumption:
  - (20 mW, 173 K, 10X amplification)
  - (10 mW, 83 K, 7X amplification)
- voltage divider on board

Gain = (10.3 ± 0.2)

Pedestal events

Counts

Amplification Factor

173 K (LXe)

LAr

LXe

Absorbed Current vs Temperature

Gain vs Absorbed Current

LXe

LAr
Signal amplification at different temperatures (10 factor scale for red waveforms):

- **293 K**: 10X amplification up to LXe temperature.
- **173 K (LXe)**: ~7X amplification at LAr temperature.
- **83 K (LAr)**

Na22 gamma ray spectra at 173 K and 293 K using 1X (Red, factor 10 of scale) and 10X (Blue) outputs.

The 1X- and 10X-based spectra superimpose: low temperature reduces the PMT gain, while the preamplifier performance is unaffected.