



Contribution ID: 126

Type: **Poster plus Minioral**

## A 10-bit Resistor-Floating-Resistor-String DAC for Multi-Voltage Threshold Digitizer in PET

**Abstract**—This work presents a low-area and high-precision 8-channel 10-bit resistor-floating-resistor-string (RFR) digital to analog converter for multi-voltage threshold digitizer in PET medical imaging equipment. Two-stage segment structure is adopted to reduce the chip area, which the first-stage coarse quantization circuit can be shared among each channel. And the RFR-DAC combines a 6-bit RDAC and a 4-bit floating resistor string DAC to offer unique two-voltage-selection scheme without the need of unity-gain buffers to isolate parallel-connected resistor strings. At the same time, the optimal segmentation strategy is realized by mathematical modeling of the multi-channel RFR DAC segmentation strategy and the chip area. According to the demand characteristics for the multi-voltage threshold digitizer, the output voltage range of each channel is optimized to reduce the chip area. The 8-channel 10-bit RFR-DAC experimental prototype chip designed and implemented based on the 180-nm standard CMOS process has an core area of  $670\mu\text{m}\times 880\mu\text{m}$ . The experimental results show that DNL of the prototype chip is  $\pm 0.07\text{LSB}$ , INL is  $\pm 0.55\text{LSB}$ , the output error voltage (DVO) is  $0.8\text{LSB}$ , and the overall power consumption is  $0.22\text{mW}$ .

**Index Terms**—DAC, RFR-DAC, low-area, high-precision, PET, MVT, digitizer.

### Minioral

Yes

### IEEE Member

No

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Yes

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**Session Classification:** Mini Oral - IV

**Track Classification:** Front End Electronics and Fast Digitizers