
Contribution ID: **28** Type: **Contributed Oral**

# A Compact Source of Positron Beams with Small Thermal Emittance

*Monday, 7 November 2022 14:50 (20 minutes)*

We investigate electrostatic traps as a novel source of positron beams for accelerator physics applications. The electrostatic trap is a simple device that accumulates and cools positrons produced by a radioactive source. Using well-established techniques, the positron beam is cooled down to or below room temperature. The thermal beam emittance is an order of magnitude smaller than beams produced by rf photocathodes [1]. The compact positron source can be built and operated at a fraction of the cost of traditional target-based positron sources. Despite these advantages, there are several features of electrostatic trap-based beams which limit their use to specialized applications. In this work, we study the features of positron beams from electrostatic traps. The positron bunch is first accelerated and compressed by an electrostatic buncher before being injected into an rf-cavity for further acceleration. We model the acceleration of the positron bunch up to an energy of 17.57 MeV with a transverse thermal emittance of 0.45 $\mu$m-rad, and bunch length of 0.21 mm. The beamline used in our model is about 1.5 meters long, which is comparable to an rf photocathode source, and far more compact than traditional target-based positron sources.

[1] B. J. Claessens, S. B. Van Der Geer, G. Taban, E. J. Vredenbregt, and O. J. Luiten, "Ultracold electron source," Physical Review Letters, vol. 95, no. 16, pp. 1–4, 2005.

## Acknowledgments

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**Session Classification:** WG5: Beam Sources, Monitoring, and Control

**Track Classification:** Working Group Parallel Sessions: WG5 Oral: Beam Sources, Monitoring, and Control