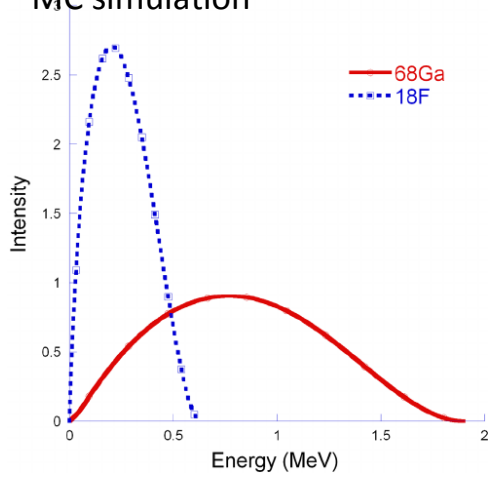
Positron Applications at JLab

- MeV Positrons
  - Bulk Ferromagnetic properties of Material
  - Paramagnetic Defects in Semiconductors
- Slow (< 100 keV) Positrons
  - Positron Annihilation Spectroscopy
  - Ferromagnetic properties on surfaces and interfaces
  - Atomic spin structure in films (spintronics)
- Moderating positrons
  - Solid neon
  - Tungsten

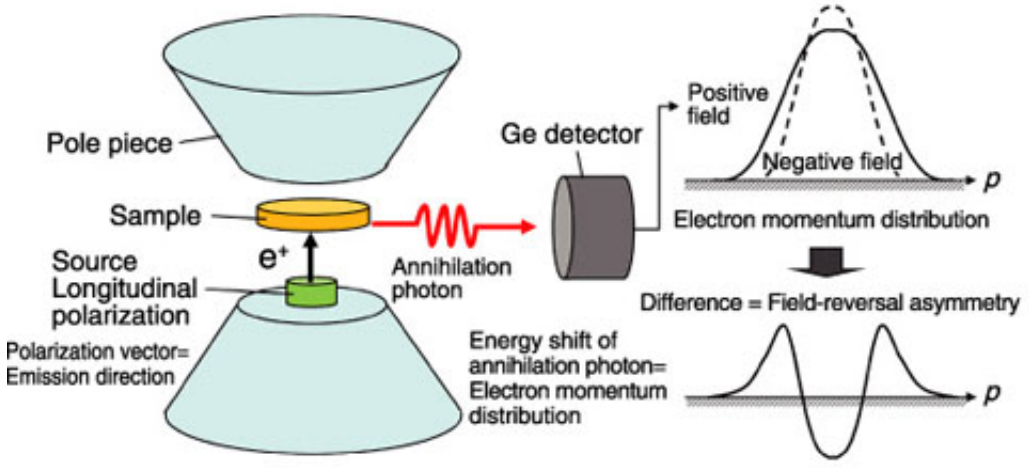
MeV Positrons (PPAS)

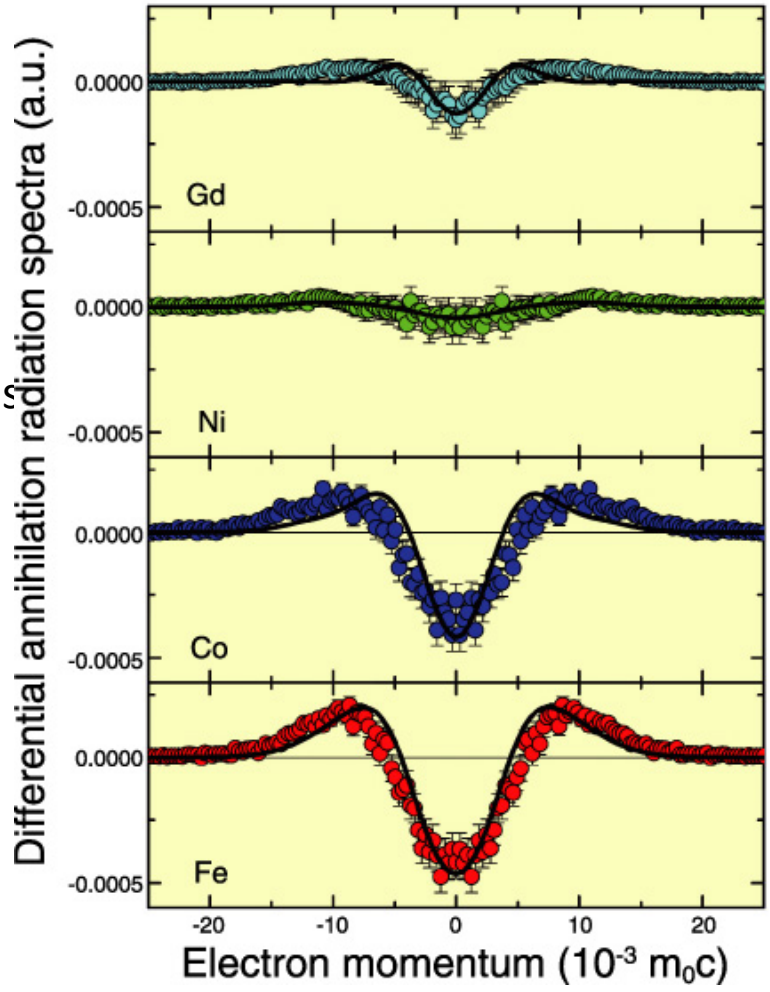
MC simulation



20 MBq Ge-68 source made from proton irradiation of Ga-69

70% polarized positrons from Ge-68





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polarized electrons are directly detected through annihilation with polarized positrons. This is an important feature for the investigation of polarized electron states

Slow Positrons

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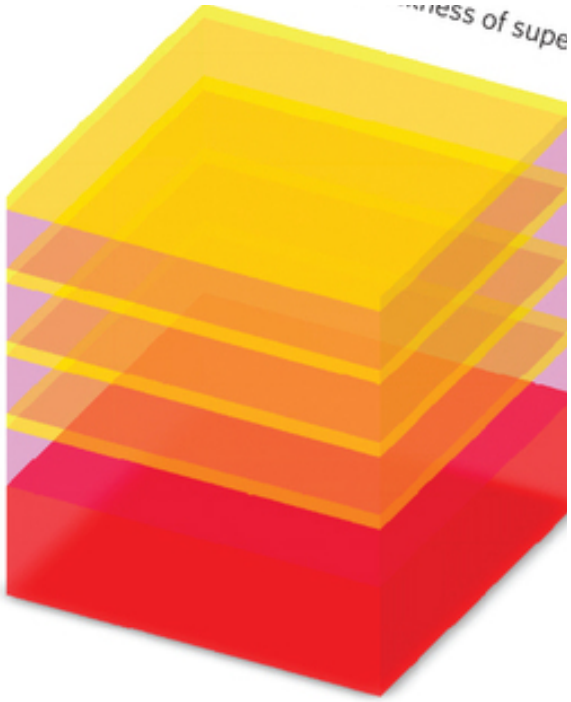
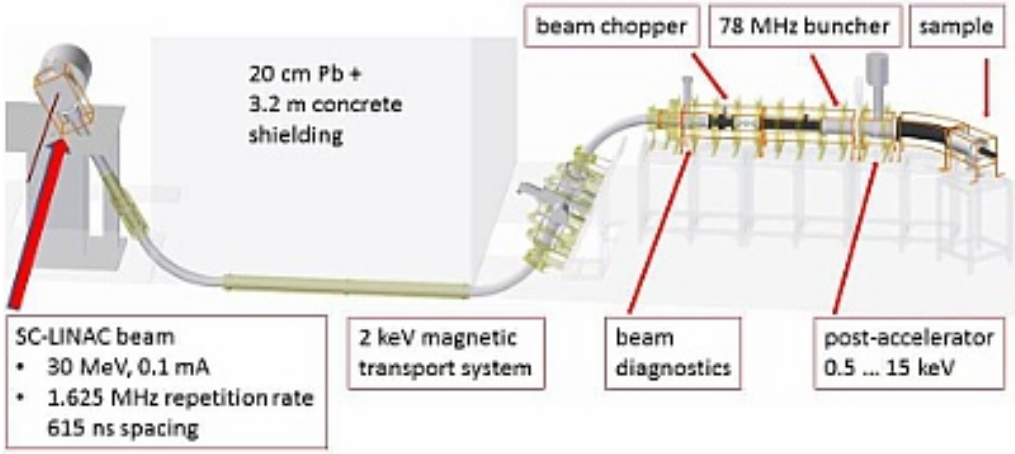


MePs positron beam at HZDR, Germany



Defects at the interface induce novel electronic phenomena triggering new devices

Depth defect profiling by positrons is crucial to study these surfaces and interfaces

Slow Positrons

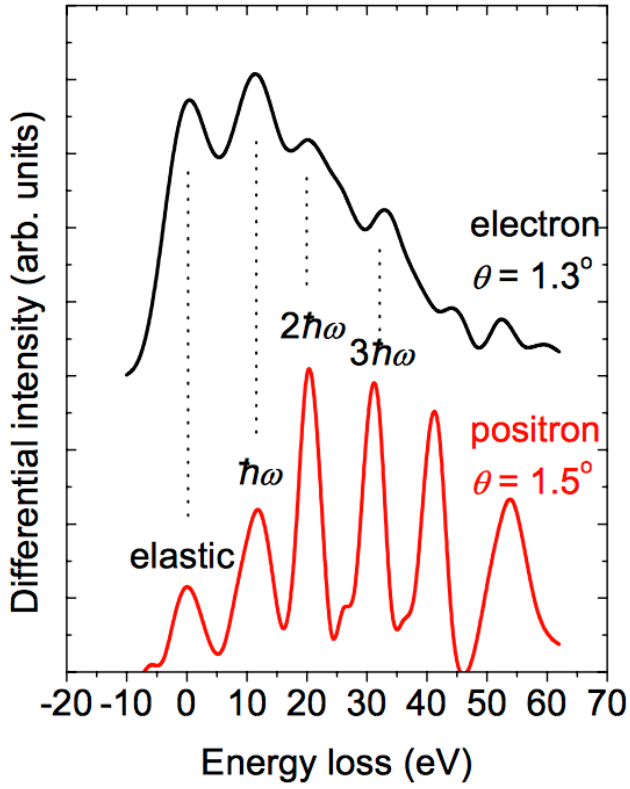
Reflection High Energy Positron Diffraction

- 10^7 positrons/sec beam from the Slow Positron Facility KEK LINAC
- 10-20 keV
- 8 keV energy spread
- 100 nm-thick W foil moderator + Magnetic Lens

Reflected positrons excite more surface plasmons than electrons.

Plasmons are a quantum of plasma oscillations. They play a large role in the optical properties of materials. Surface plasmons are the coherent delocalized electron oscillations that exist at the interface of materials

Surface Plasmons



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Moderators

Can a moderator be used to slow High energy Positrons (MeV) to slow positrons (<40 keV)?

W foils moderating fast (100 keV) Na-22 positrons to eV energies

Solid Neon (6.8 Kelvin) moderator with a 40 mCi Na-22 source yields 5×10^6 positrons/sec (can have x2 higher efficiency than W

How could Jlab moderate positrons?