g) ***Positron source development at ANL:*** After the International Technology Recommendation Panel's decision on the technology choice for the International Linear Collider (ILC), with our group's expertise in high current and high brightness beam generations, we have started to investigate positron source production, accumulation and acceleration schemes for the ILC. The positron source in this study is based on gamma rays on a thin Ti target. A detailed PARMELA simulation has been done to study beam dynamic in positron capture optics, which consists of an Adiabatic Matching Device (AMD) and a copper pre-accelerator. Both positron and electron beam initial distributions are produced by using EGS4 from the target, and with beam energy 120MeV at the end of the pre-accelerator. By adjusting the injection phase and adiabatic matching solenoid, positron capture efficiency of 27% can be achieved with beam energy spread of ±1% and emittance $\varepsilon x+\varepsilon y < 0.048$ m·rad. We have also both electron and positron losses along the beam lines, thus the background radiations.

We have also proposed a scheme that uses a scattered electron source to commission the positron beam lines such as capturing optics, accelerator and even damping ring. This is because the positron production can not be realized until high energy (> 150 GeV) electron beam is fully conditioned. Our simulation showed that by carefully choosing target material and thickness, and adjusting electron beam energy, most properties of initial positron distribution can be matched by the scattered electron beam.