

Source Modelling using Geant4

- Validation -

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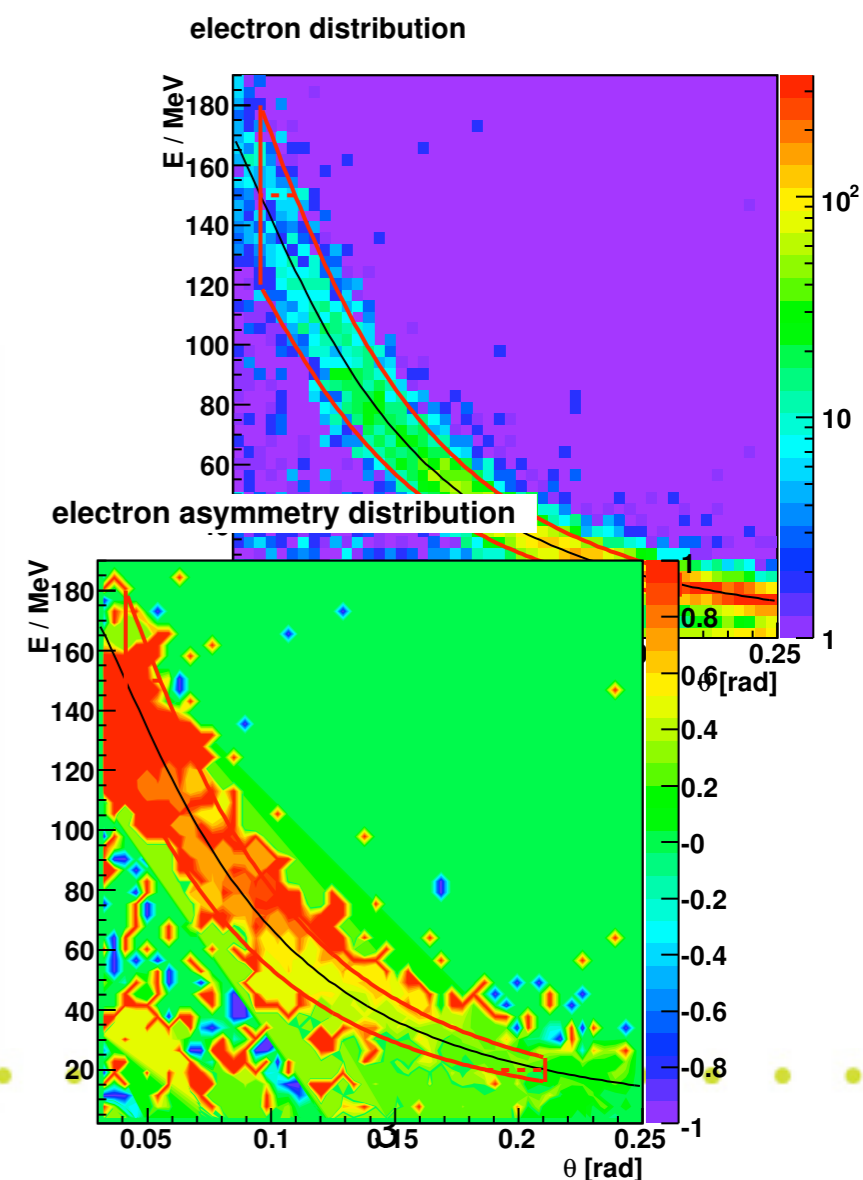
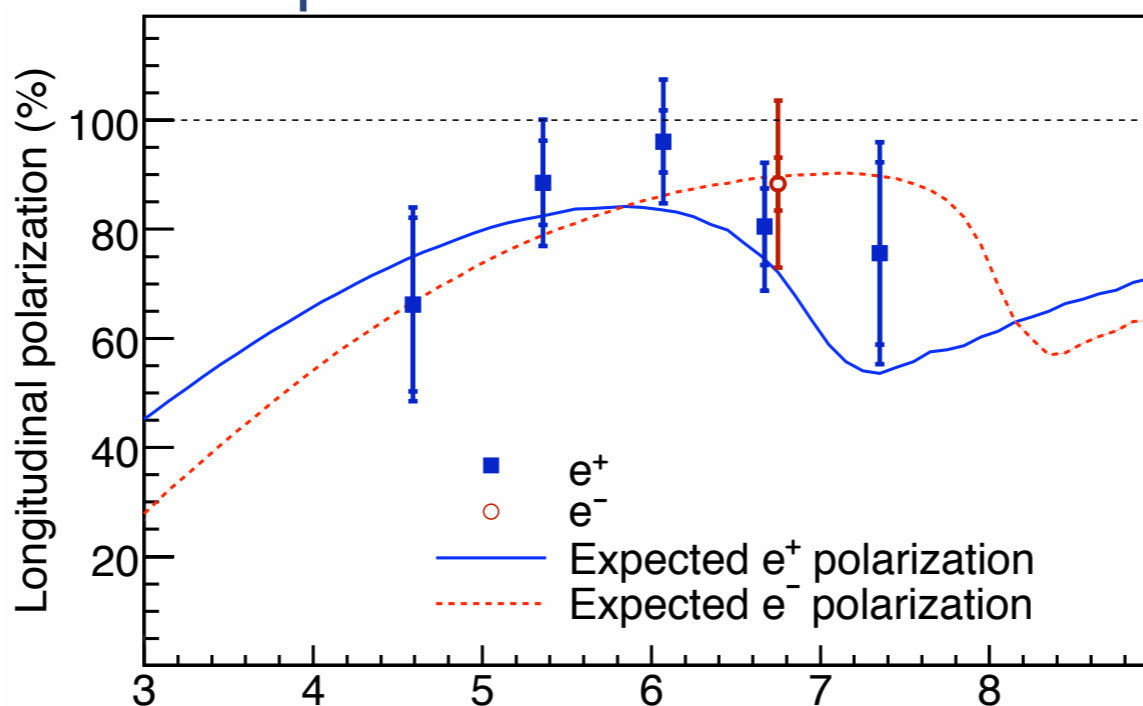
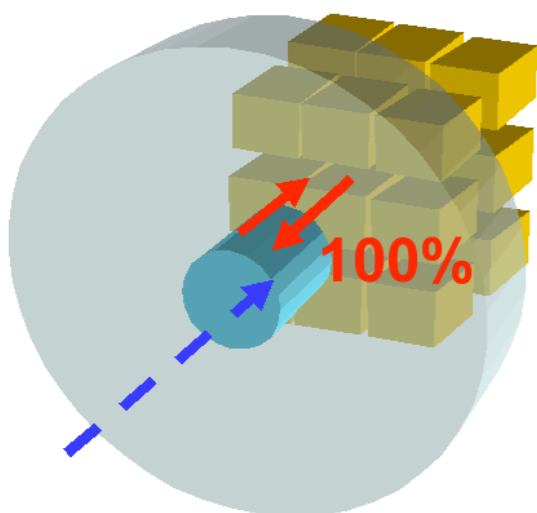
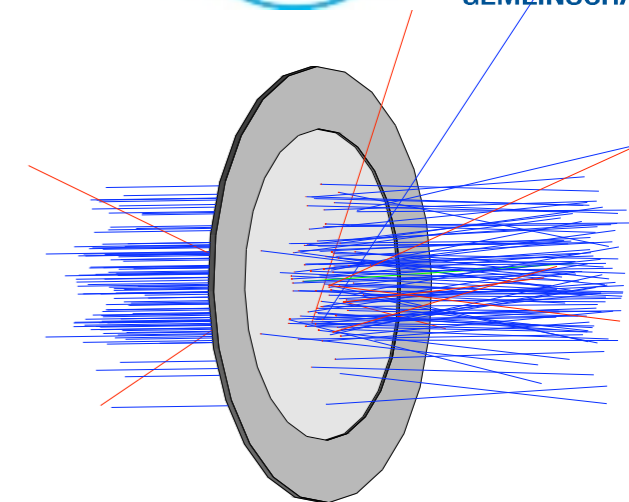
Polarisation extension to Geant4

- 5 polarised processes (since Dec. 2006)
- 1 polarised process add Dec. 2007 (E166 needs)
- support for polarised media (for polarimetry)

Magnetic fields

- Runge-Kutta integrator
- equation of motion for magnetic field
- equation of motion for electric & magnetic field
(new since Dec. 2007 release 9.1)
- T-BMT equation for spin transport

- Applications:
 - ILC Polarised Positron Source Modelling
 - Talk by Andriy
 - ILC Low Energy Polarimeter
 - Talk by Ralph
 - E166 experiment
 - Analysing power
 - Expected Positron polarisation

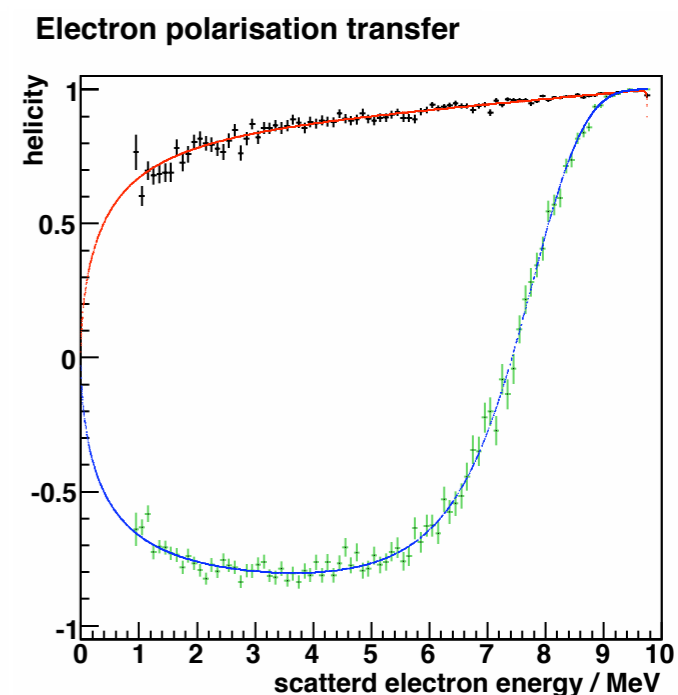
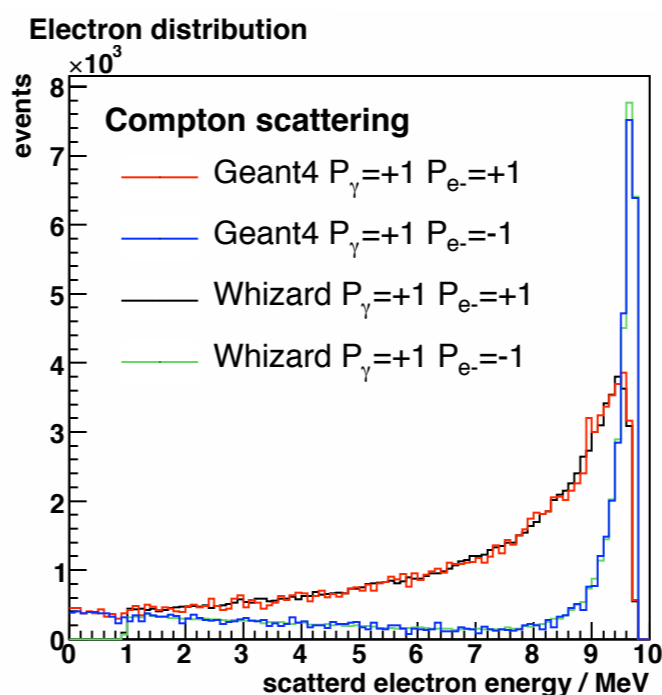
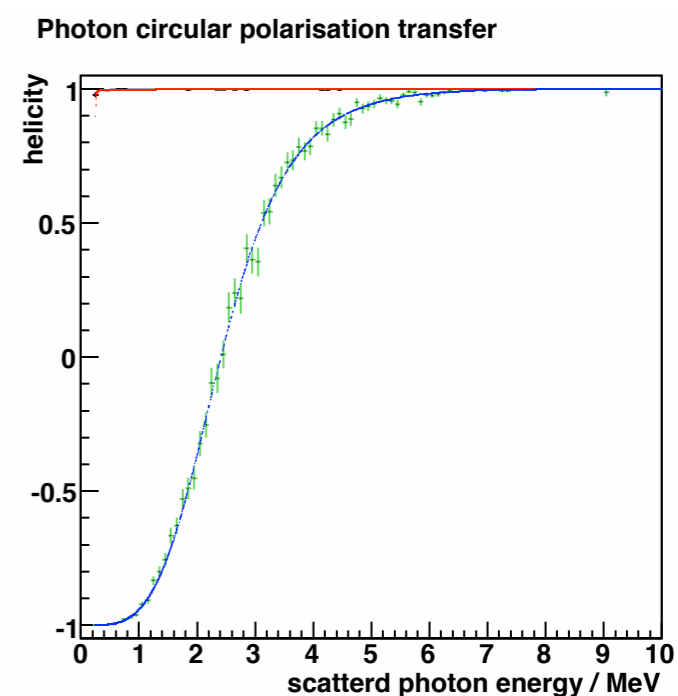
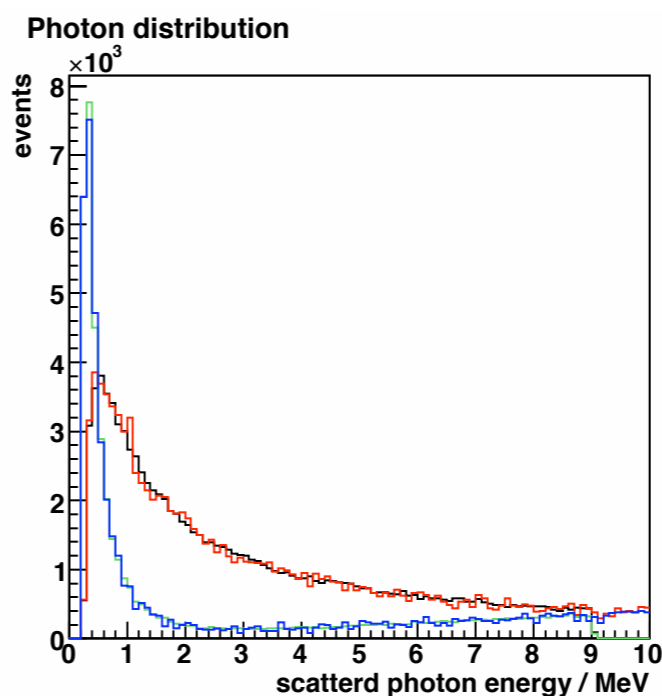




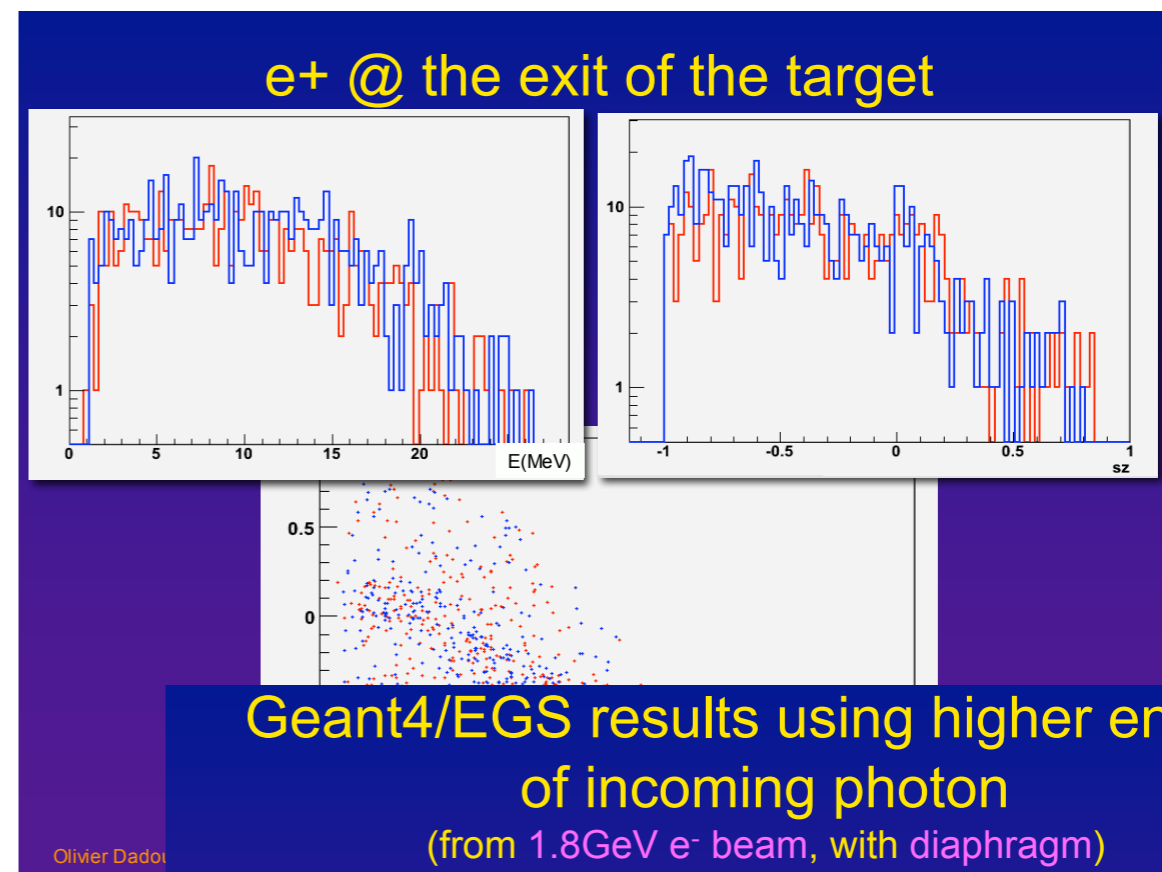
Validation using Whizard/O'mega



- arbitrary initial polarisation
- final state helicity
- simple $2 \rightarrow 2$ processes
 - Compton
 - Møller/Bhabha
 - e^+e^- annihilation
- Checks:
 - polarisation transfer
 - asymmetries
- Missing:
 - Interactions with nuclei
e.g. Pair-production
 - linear polarised photons



- EGS polarisation
 - implementation by K. Flöttmann
 - describes polarisation transfer
 - **no** depolarisation via ionisation
 - **no** target polarisation
- Checks by O.Dadoun (context of Compton based source)
 - good agreement for polarisation transfer to high energetic positrons
- **More detailed comparison needed**



		Geant4	EGS
γ	<E(MeV)>(RMS)	37.10(12.33)	37.08 (12.40)
	Sz (RMS)	-0.40 (0.60)	-0.40 (0.60)
e ⁻	<E(MeV)>(RMS)	26.32 (8.48)	26.79 (8.55)
	Sz (RMS)	-0.50(0.37)	-0.45 (0.37) ?
e ⁺	<E(MeV)>(RMS)	26.62 (8.73)	26.21 (8.30)
	Sz (RMS)	-0.54 (0.32)	-0.53 (0.32)

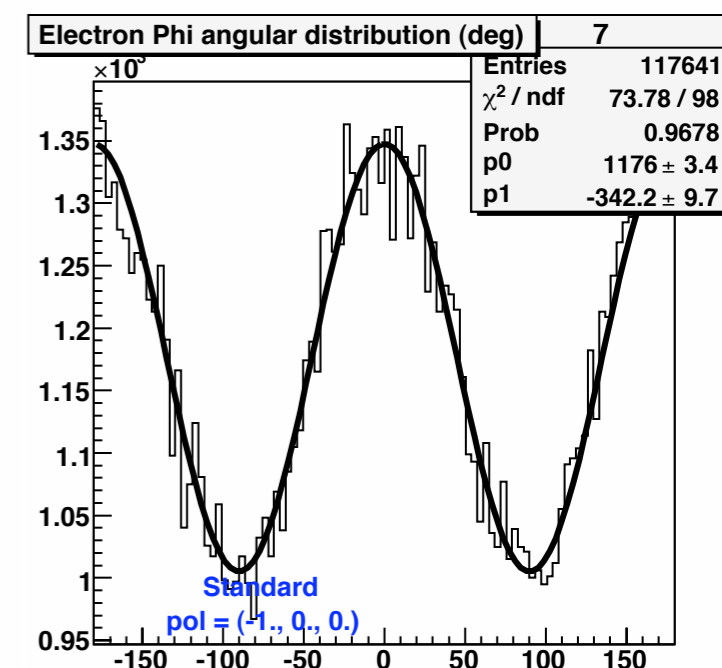
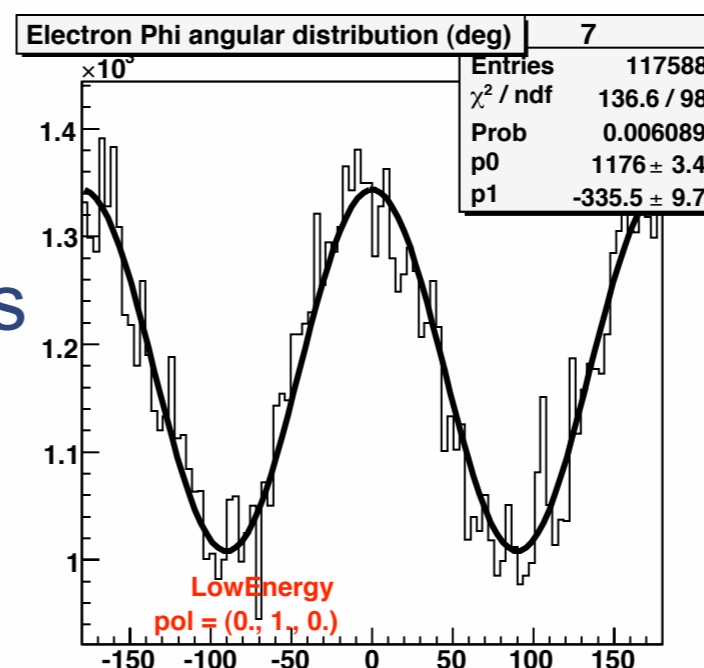
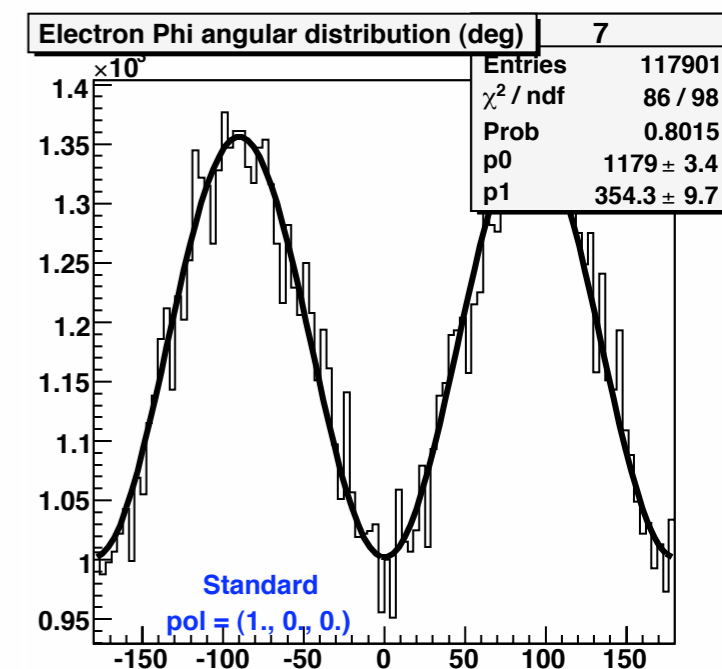
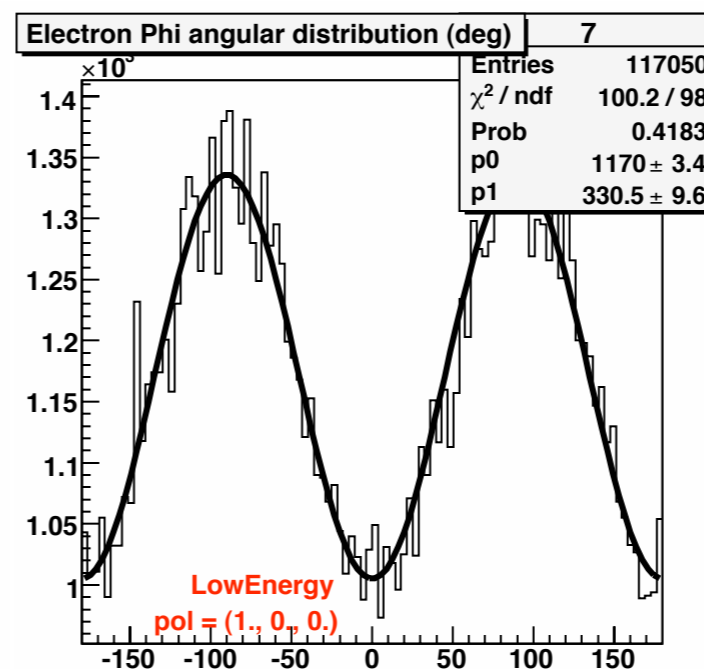
>15 MeV Energy selection For all particles

Oliver Dadoun EGS/Geant4 Benchmark For γ e⁺ Sz: EGS = Geant4

- Polarised EM standard vs. LowEnergy

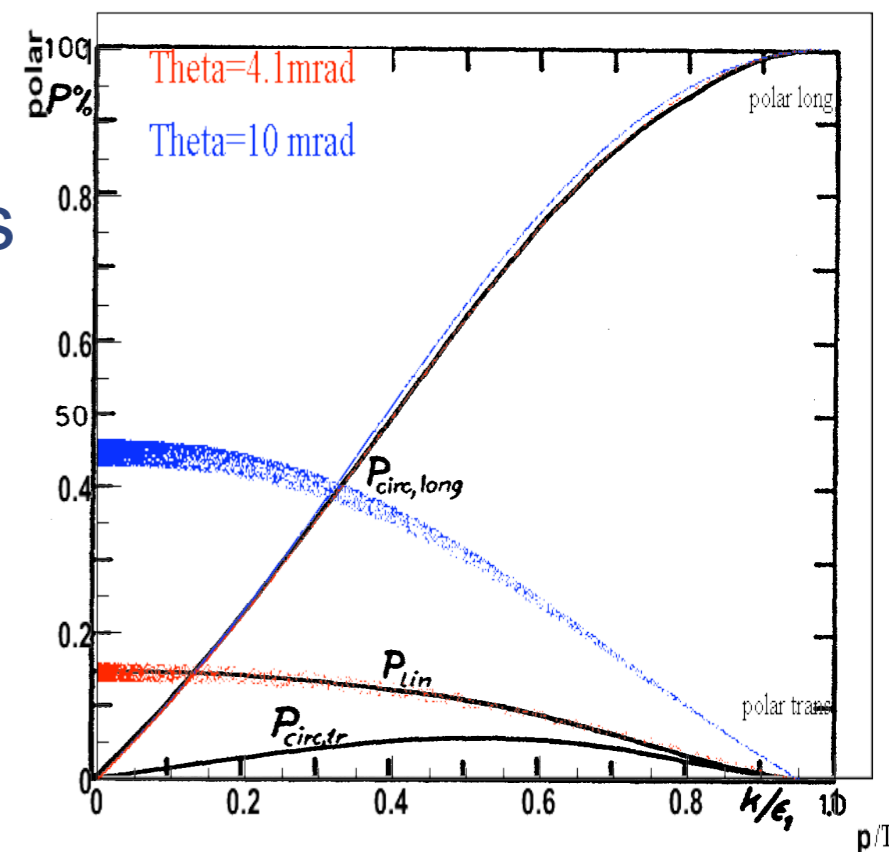
- Existing in LowEnergy
 - Rayleigh scattering
 - Compton scattering
 - Photo electric effect

- Limitations:
 - only linear polarised photons
 - limited overlap in processes
 - (different models)



- Problem:

- calculations based on reference from 60ties [Olsen & Maximon, 1959]
- employs old screen model [Olsen, Maximon, Wergeland, 1957]
- uses small angle approximation
- only applicable in relativistic



by J. Dumas

- Plan:

- start with review of Bremsstrahlung (already envisaged from unpolarised physics)

Action-Items (April-Meeting):

- Validation/Documentation → in progress.
- T-BMT for Stokes-Vectors ... needs manpower.
- comparison of PPS Yield/Pol. vs. other codes

→ to do!

Remarks:

- Bremsstrahlung review → in progress
- Extension of simulation scope envisaged
 - using a polarised version of ASTRA or
 - employing **G4beamline** (www.muonsinc.com)
("Swiss Army Knife" for Geant4, optimized for simulating beamlines)
- need further discussion with other groups doing "start to end" simulations ...