Rod Target for POSIPOL

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Spectrum of Gammas and Polarization

Equivalent Expansions

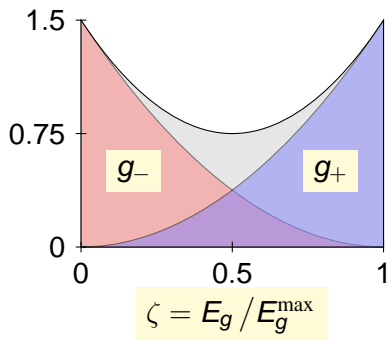'Horizontal' and 'Vertical'
linear polarizations

- Laser pulse circular = hor + vert
- Scattered gammas presented in terms "intensity–polarization–energy"
- Positrons attributed by polarization degree and energy

We choose circular 'left and right' presentation

'Left' and 'Right'
circular polarizations

- Laser pulse circular (e.g. left)
- Scattered gammas presented as two distinct ensembles: left– and right polarized
- Left–polarized gammas produce 'forward' polarized positrons, right–polarized 'backward' – two ensembles of positrons

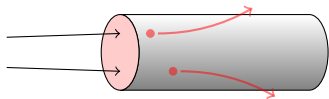# Ideal Spectrum of Gammas and Polarization

Definition of polarization

$$\mathcal{P} = \frac{N^{(+)} - N^{(-)}}{N^{(+)} + N^{(-)}}$$

- ▶ High energy gammas, g_+, mostly polarized positively (right)
- ▶ low energy ones, g_-, negatively (left)
- ▶ Energy spectra are the same for all sources
- ▶ Total polarization is zero

Rod target to improve emittance

[V.Lapko, N.Shul'ga 2006]

main idea

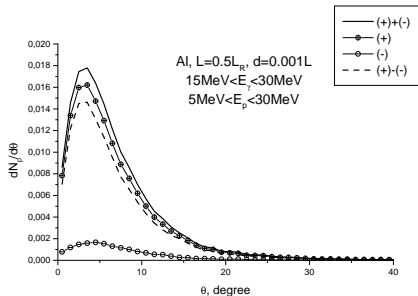## Shortening the positron path in target

- ▶ improves emittance
- ▶ reduces positron losses

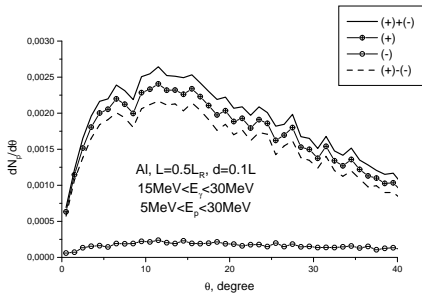Efficiency of the method in proportion to 'length/radius' ratio
The rod target produces 'natural collimation' of the gamma beam

Lapko and Shulga calculations

Round aluminum target, preselected gammas

Angular distribution of positrons from a 'slim' aluminum target

Angular distribution of positrons from a 'fat' aluminum target

Outlook

- ▶ Separate consideration of the 'right' and 'left' circular polarized ensembles of gammas and produced positrons enables one to determine changes in polarization not only in a conversion target, but in the process of capturing, acceleration, and storing of positrons in the damping ring
- ▶ Rod conversion targets may improve angular distribution of positrons and therefore increase efficiency of positron production