



Polarization update

U. Wienands, SLAC

with input from S. Nikitin (BINP),
P. Raimondi (LNF), D.P. Barber (DESY)



Where we left off in Perugia...

- Antisymmetric HER looked promising
- Symmetric LER (LNF lattice) marginal
- To do list:
 - Continue investigating the options
 - Put detector solenoid & compensation into IR lattice, investigate its effect
 - Start thinking about space for polarimetry
 - Spin tracking & higher orders once we have a lattice that looks reasonable to 1st order.
 - Solenoid parameter optimization.
 - It has been suggested to investigate snakes (again)
 - Beam-beam effect on P (relevant by HERA exp.)



SlickTrack work

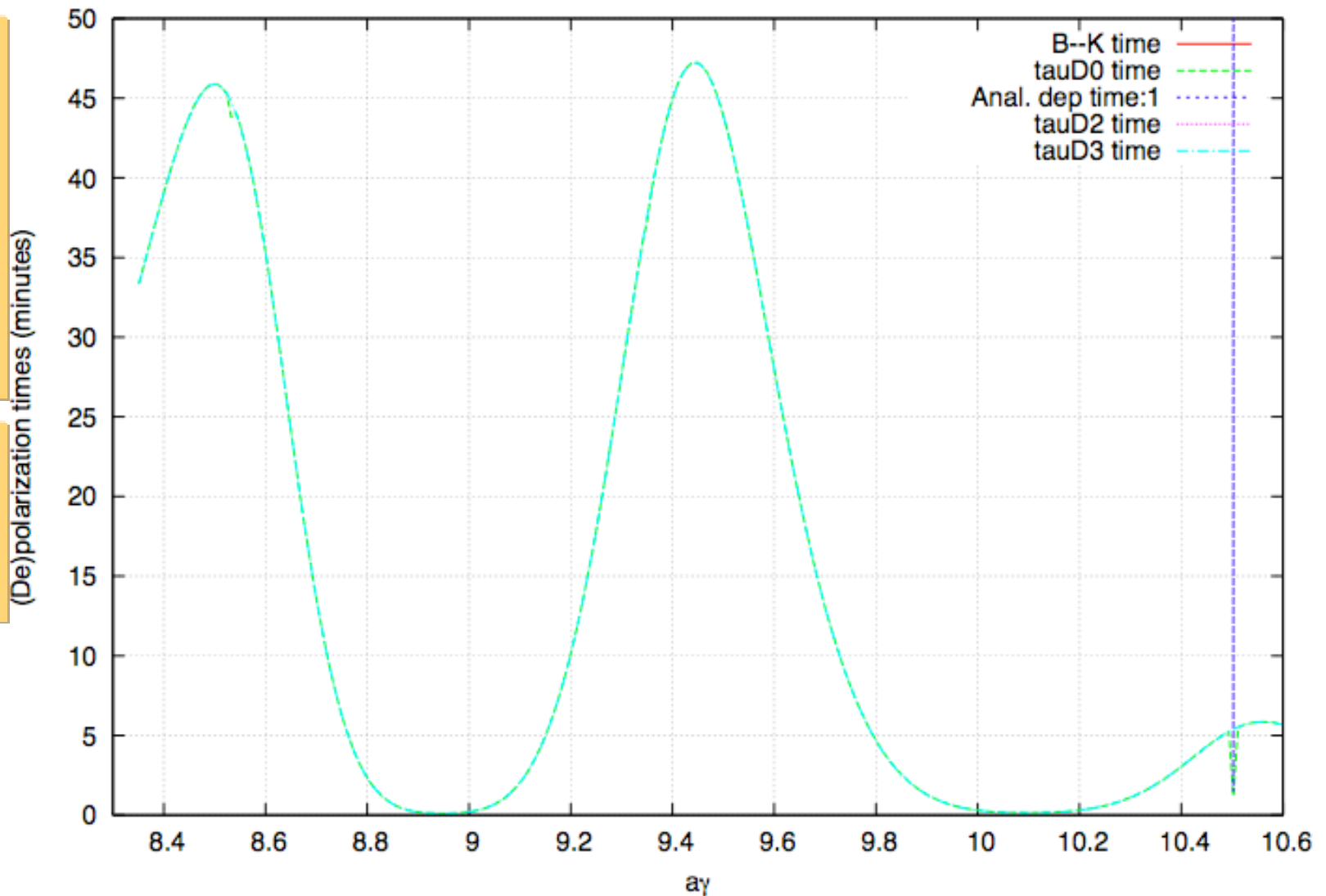
- Focused on the LNF LER
- Begun to look at spin tracking
 - Alignment & orbit excursions
 - Higher-order effects (later)



@ Perugia

The settling time for polarization is about 45 min at best. P will settle to a few % i.e. this is the depolarization time.

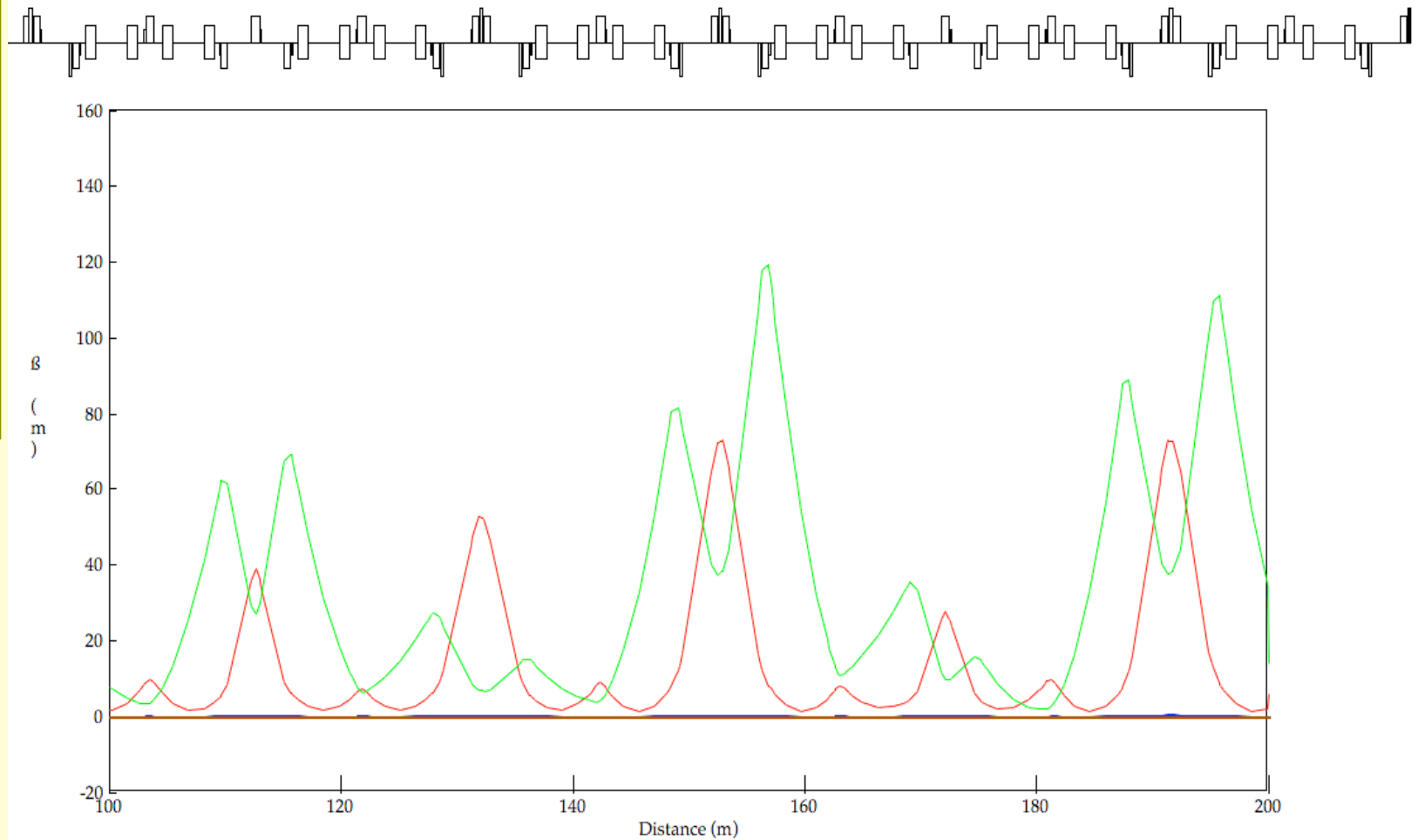
Disclaimer: Optics in this Slicktrack run is not verified yet.





New LER Lattice with partial o.c.

Conventional
orbit
correction
(β mismatch)



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Slicktrack Result (SB418 29-Jly)

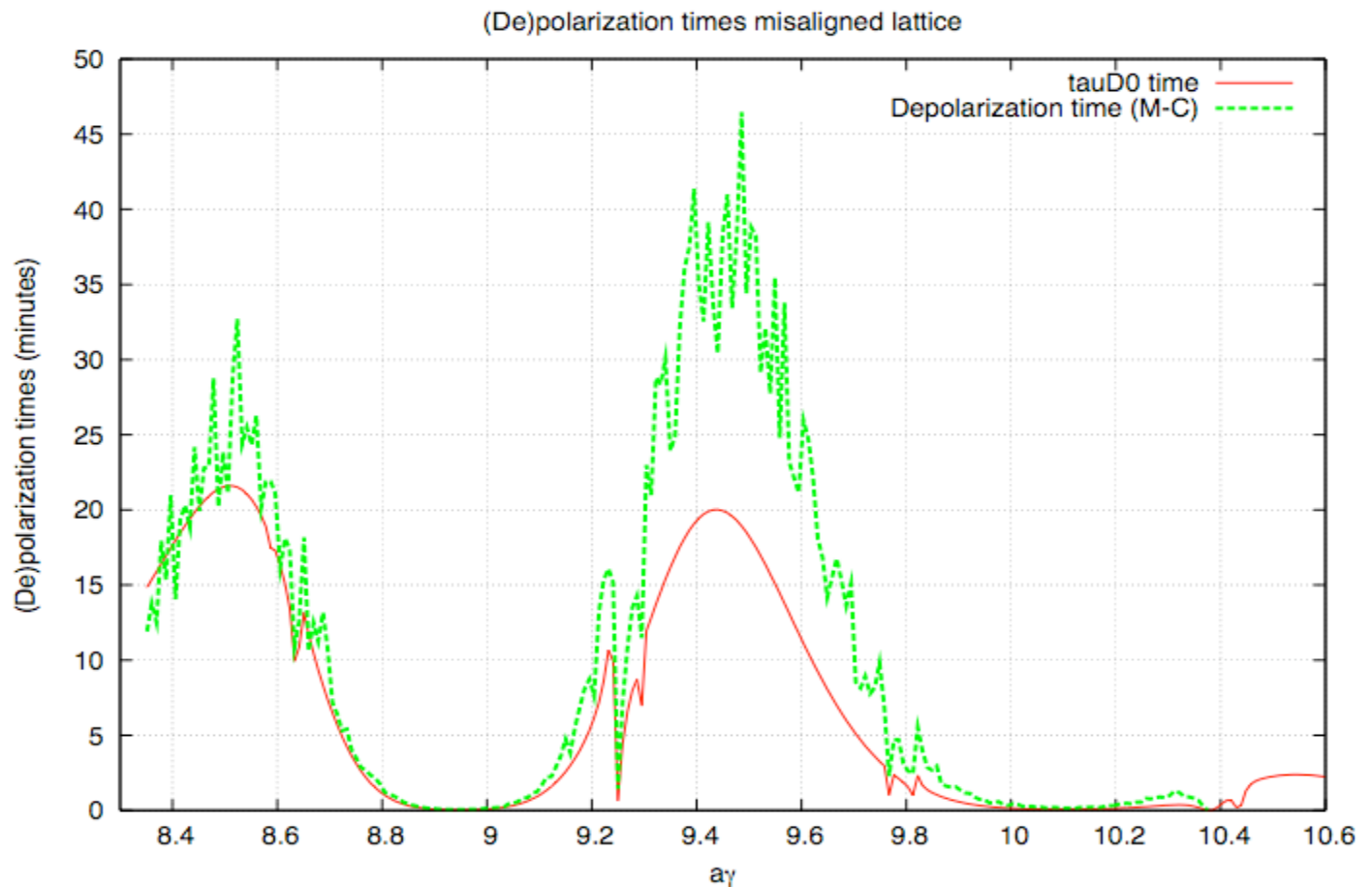
$$\varepsilon_x \approx 1.7 \text{ nmr}$$

$$\varepsilon_y \approx 1 \text{ nmr(!)}$$

$$\nu_x = 0.69$$

$$\nu_y = 0.73$$

shorter time
mostly due
to shorter
dipoles



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Slicktrack Status...

- Not yet conclusive, work in progress
 - Optics transfer has issues
 - tunes tend to come out off
 - not just related to different orbit correction.
 - Deviation between M-C and analytic needs to be understood.
 - Need to redo with fully matched lattice & realistic vertical emittance
- The short answer is: 20 min. depolarization time



Snake

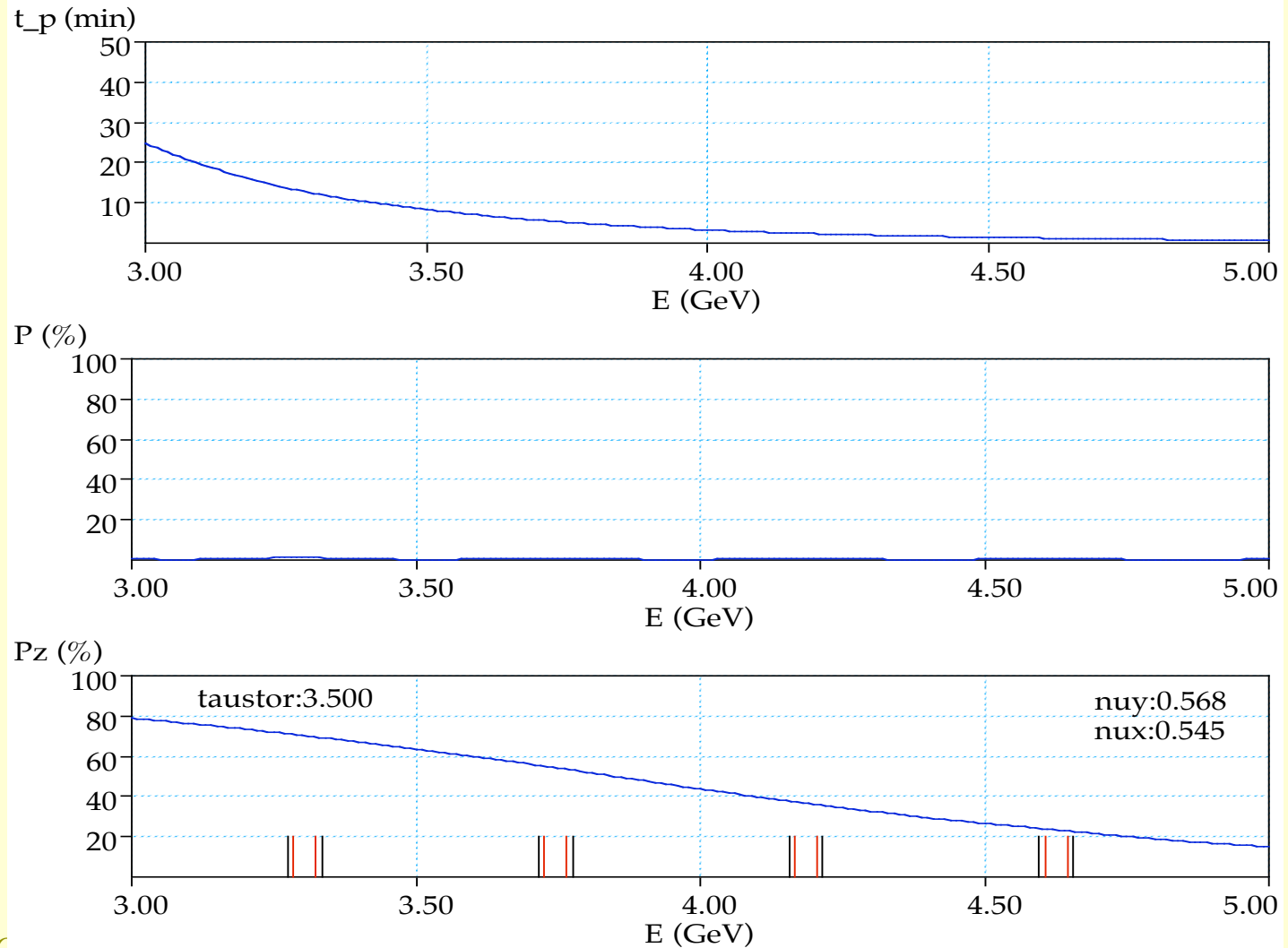
- The LER with a Siberian Snake was investigated
 - Both by UW and by S. Nikitin
 - Depolarization time about 3 min.
 - $P_{ave} \approx 40\%$ (@4.18 GeV) @ full luminosity
- S. Nikitin also investigated a partial (1/2) snake
 - Better, but not good enough.
- Possibility of “fast injection”
 - replace rather than top-up each bunch on injection
 - in that case, $P_{ave} \approx 75\%$ ($t_{inj} \approx 1/2$ beam life time)



Parameters vs E , full Snake

Depolarization time, LER, Snake

05-Oct-09





Same w/ Fast Injection

Depolarization time, LER, Snake

05-Oct-09

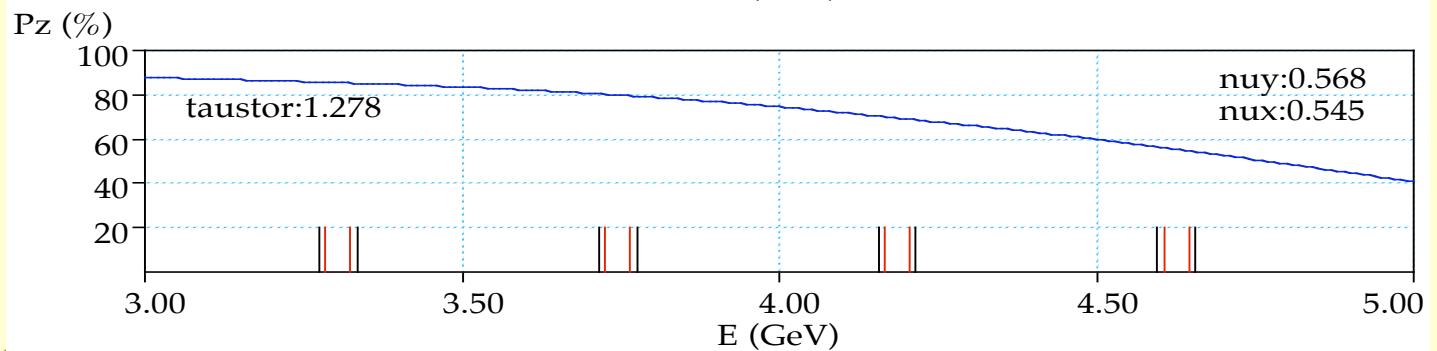
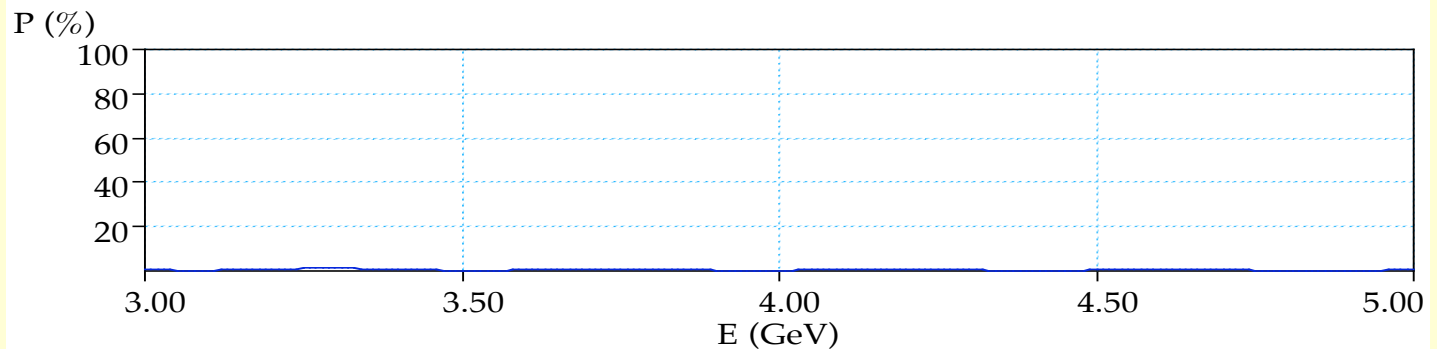
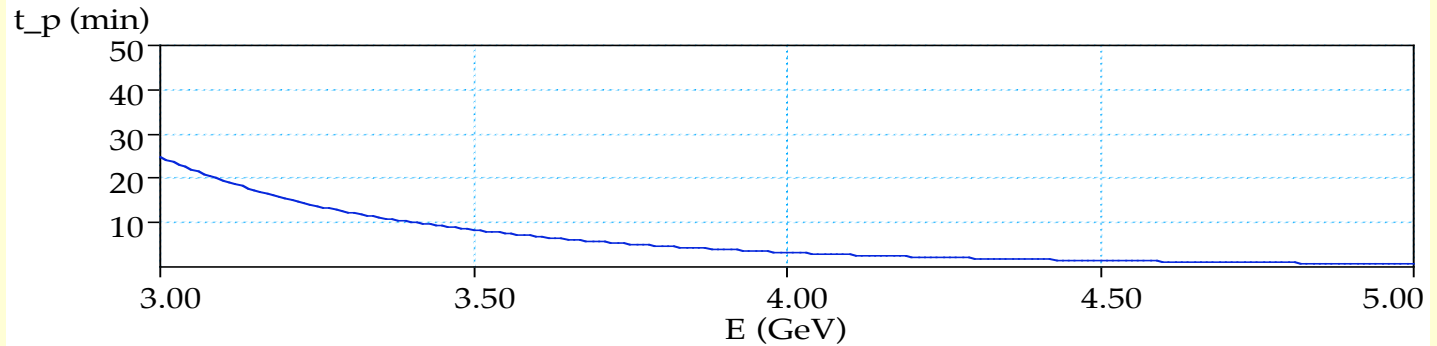
25 Hz injection

$ppp=5.74 \times 10^{10}$

90% P_{inj}

958 bunches

UW code



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SuperB WS SLAC, 8-Oct



Back to the List...

- Continue investigating the options
- Put detector solenoid & compensation into IR lattice, investigate its effect
- Start thinking about space for polarimetry
 - See Moffeit/Woods talk
- Spin tracking & higher orders once we have a lattice that looks reasonable to 1st order.
- Solenoid parameter optimization.
- It has been suggested to investigate snakes (again)
- Beam-beam effect on P (relevant by HERA exp.)



Summary

- BINP, UW and Slicktrack in general agreement.
- Latest (29-Jly) LER lattice \approx 20 min. depolarization time
 - $>$ reach \approx 80% polarization near 10^{36} luminosity.
- Siberian Snake only a possibility with “fast Injection”.
 - reach 75% polarization \approx independent of beam lifetime
 - $>$ total spin rotation (180°) like spin rotators
 - away from the IP & in one device
 - interference with injection?
 - $>$ challenge to injection system (on-axis kicker, linac throughput)
 - $>$ becomes dependent on # of bunches
 - $>$ independent of beam lifetime
 - $>$ depol. resonances become mostly irrelevant
 - $>$ Polarization strongly dependent on bunch #
 - 90% \Rightarrow 60% (youngest vs oldest bunch)
 - need bunch-by-bunch polarimetry (desirable in any case)