# Status: 'accelerator physics'

- **Done**
  - tracking from source to IP
  - progress in spin tracking
  - progress in inclusion of higher order calculations
  - GigaZ specifications

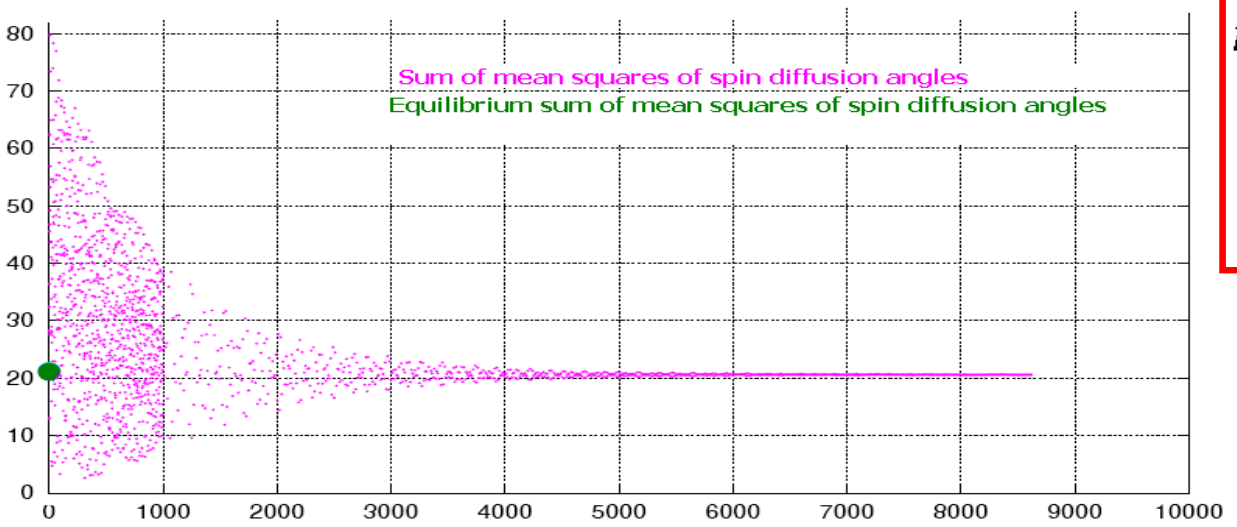
- **Still to do**
  - complete tracking from source to IP including spin
  - working out the beam tolerances
  - optimization of reduction of costs vs. reduction of particle loss
  - alternatives to commissioning w/o KAS
  - writing the report(s)

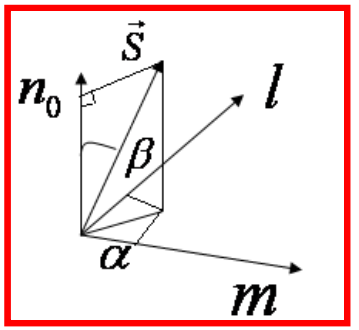
# Yesterday's talk

- **Start-to-end particle tracking:**
  - **read with great interest your papers from January 2007 and June 2007, but have a question (had micro problems yesterday and could also not follow the discussion in the audience):**
  - **how many positrons are finally kept within the 6D acceptance? The papers seem to differ..... (49.8% vs. 15.1% for different schemes) relation to current design ???**
  - **In case we have such a tremendous particle loss, do we still match the luminosity requirements? More effort on the collimation and/or target parameter needed?**
- **Since we have polarized positrons from the beginning, full tracking including the spin is needed**
  - **under work within the UK heLiCal group, but not yet finished**
  - **some progress in the following**

# Spin tracking -- progress

- **spin tracking in DR, main linac and BDS (Larisa Malysheva):**
  - **the depolarization is the DR was simulated and found to be negligible.**
  - **variance of transverse spin component distribution in the positron DR is smaller than 20 m rad$^2$**
  - **the OCS6 DR at 5 GeV with +- 25 MeV injected energy spread (expected at ILC):**




  - **however, no full decoherence of long. component in DR -> spin rotators**

# Spin Tracking – beam-beam progress

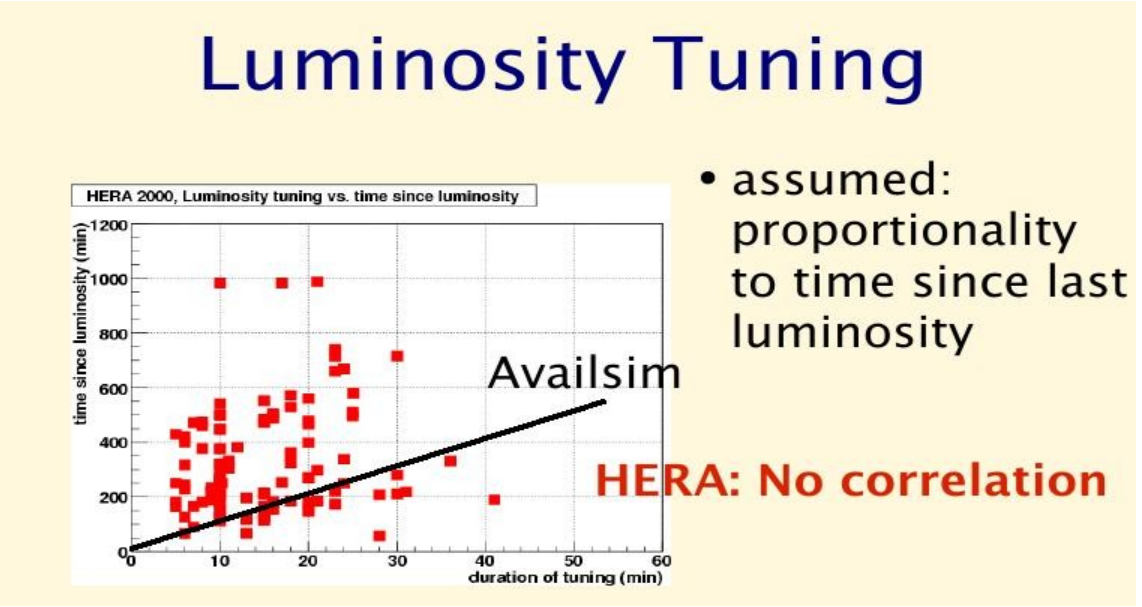
- **Incoherent and coherent background processes (Tony Hartin)**
  - update of CAIN program: polarization in all coherent processes now fully included
  - also final polarizations are now included (which is important when calculating the impact on the parent beam)
- **Striking results in BW**
  - full polarizations show 10-20% less pair particles
  - no loss in luminosity
  - i.e. lower cross sections than assumed/calculated than before
  - but practically no changes at higher energy or higher pT
- **Analytic solution of CBW in 2-bunch system under work**
- **Verification of analytic expressions in the strong fields regime**

# Keep-alive source

- **Everybody talks about costs,....., but is the KAS really needed?**
  - **still listed in the RDR**
  - **however need for such a source cannot be seen verified via availability studies**
  - **result depends strongly on made assumptions**
  - **made assumptions on MTBF not reflected by real machine data**
  - **commissioning aspects? -> probably e- beam more suitable, see new outline of DR's....**
  - **at least not a source with 10% intensity needed, so, we could save some costs.**

# KAS, cont.

- **Let me repeat: in the availability studies the assumption was made, *'that the recovery time is proportional to the time without beam'***
  - **under this assumption it was argued that a KAS achieving 1%-20% intensity recovers pratically all loss of lumi.**
  - **however, the assumption (see above) itself could not be verified by actual collider data (HERA, PEP II):**



# KAS, cont.

- **Another assumption: *'recovery time is fixed tune time'***
  - **better matching of actual collider data**
- **Result: machine uptimes practically the same between undulator and conv. source**
  - **shows redundancy of KAS in that case....**
- **Study also showed the impact of the made assumptions**
  - **more details, please see: *www.ippp.dur.ac.uk/~gudrid/source***
- **Since everything is concerned about costs.....**
  - **alternative schemes for commissioning on task list**
  - **propose that our group asks for 'reconsidering' of the KAS**

# Impact on e- beam in helical undulator

- There exist several calculations/estimates
  - Shatunov 1992 as well as from Alexander (Snowmass 2001)
- Summary: there are different effects
  - Sokolov Ternov effect: negligible
  - Effects from angular and energy spreads: spin motion in a helical undulator (also perturbation terms have been taken into account): negligible
  - Diffusion: has not yet been precisely been calculated, but expected to cause no major depolarization as well
  - Only effects maybe from edges: but the magnetic field at the edges dies out over a length less than one undulator period : so negligible as well
- So, e- beam should be save and we could stop these worries

# Last-but-not-least: GigaZ options

- e+ polarization required to achieve ultimate precision:
  - physics requirements: a) lumi ~ several $10^{33}cm^{-2}s^{-1,}$ b) beam energy stability and precision < 0.1, c) cms energy known up to 1 MeV around Z-pole
- Beam specifications:
  - energy measurement aimed at 100 ppm level and accepted beam jitter: train-to-train $\sigma$ < 0.5, bunch-to-bunch < 0.1
  - values at Z-pole: approximately the same (only estimates so far)
- GigaZ via deceleration: expected uncertainties
  - absolute energy spread same as for full energy: 1.5% per RF unit

    i.e. about $1.5*10^{-2} * sqrt(1/350) \sim 0.8*10^{-3}$ at 250 GeV, corresponding scaling down to GigaZ ~ $4*10^{-3}$ ( note 1.5%: only simple model)
  - detailed study needed (not highest priority), but seems to be ok

# 'To-do-list' for the report

- **John reminded me that every topic should have a final report**
  - **very happy to have Wei now by my side ..... !**
- **What are the priorities?** *(proposal)*
  - **capture issues** *( Wei ?)*
  - **start-to-end tracking** *( Wei ? )*
  - **need for KAS** *(myself ? )*
  - **spin tracking** *(myself ? )*
  - **beam tolerances, with specific example GigaZ accuracies** *(myself ?)*
- **Proposal: report should be a final draft for the Zeuthen meeting**
  - **Fine with the EDR schedule?**
- **Discussion? Something forgotten?**