LDC Machine Detector Interface Update

Karsten Büßer

LDC Meeting
Vienna
17. November 2005

Important Topics

- Crossing Angles
- Magnetic Field Configurations
- Backgrounds

- Disclaimer: as just a few of transparencies of the ECFA workshop in Vienna are on the web until now, I could not follow the actual discussions. So some of my topics might be outdated already.

Inflation of Crossing Angles

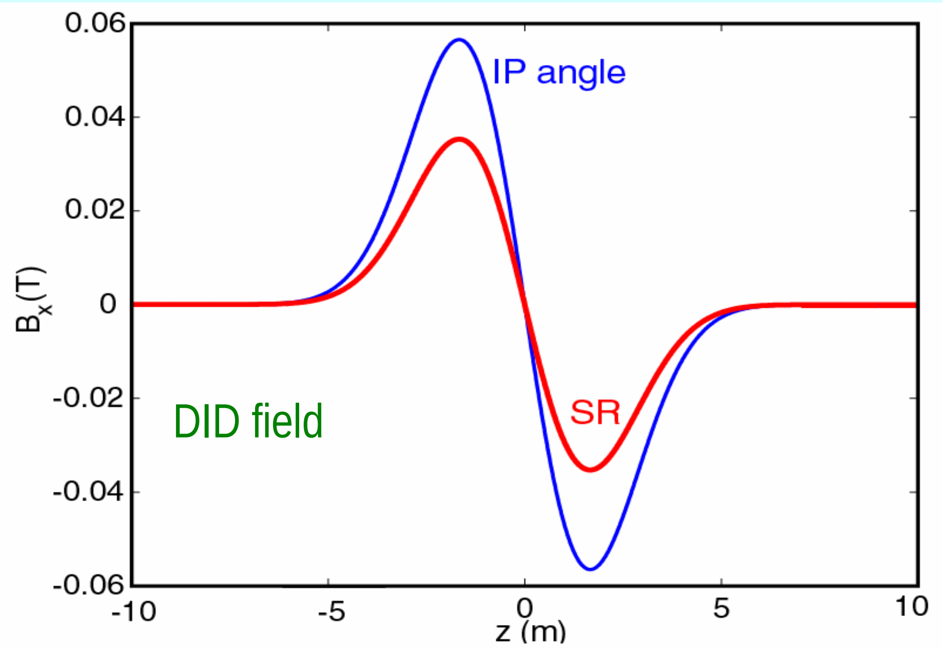
- ILC Baseline Configuration Document recommends:
  - Two beam delivery systems with two IRs:
    - 2mrad and
    - 20 mrad crossing angle
  - Alternatives:
    - 0 mrad (with RF kicker or modified electrostatic separator system)
    - 14 mrad: smallest crossing angle which could be accomodated with small s/c quadrupoles for final doublets
- So far 14 mrad option has not been studied in LDC
  - Requires:
    - Modified forward region
    - Background studies
    - DID/ Anti-DID studies
  - Is probably a good compromise between small and large crossing angles

Magnetic Field Configurations

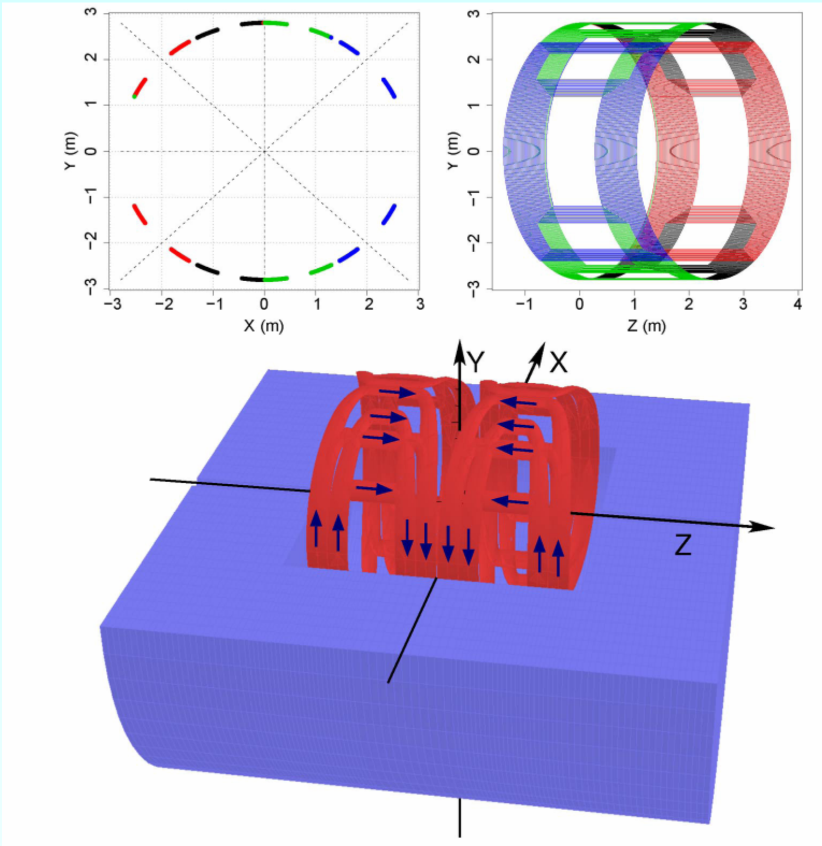
- Shorten the solenoid coil
  - → See talk from Olivier Delferrierre at last LDC phone meeting (27.10.2005)
  - Shorten the coil and the detector should have no or just limited influence on detector backgrounds
    - Caveat: when changing geometries you never know for sure in advance!
    - If detector becomes shorter and L* stays large (~4m), then quadrupole fringe field effects might become less
      - BUT: quadrupole fringe field effects have not been studied yet anyhow!
- Including Detector Integrated Dipole (DID) or
- Anti-DID

DID for LDC

Detector Integrated Dipole: suggested for large crossing angles by A. Seryi and B. Parker to correct for IP angle (polarisation alignment) and SR effects due to vertical orbit corrections

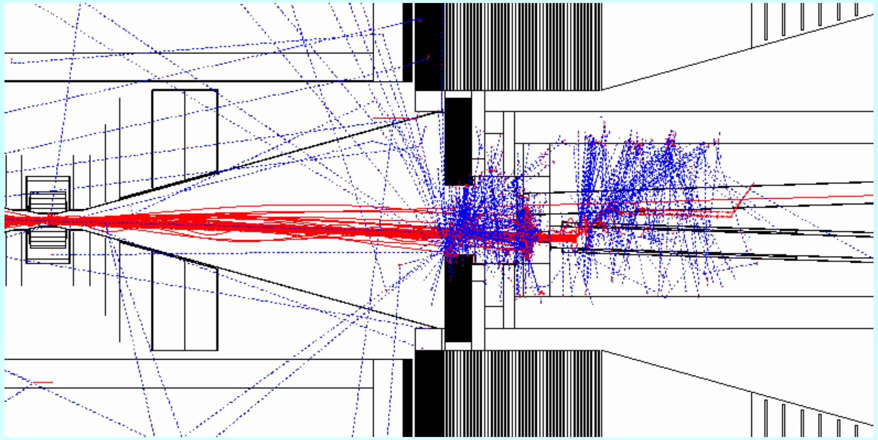


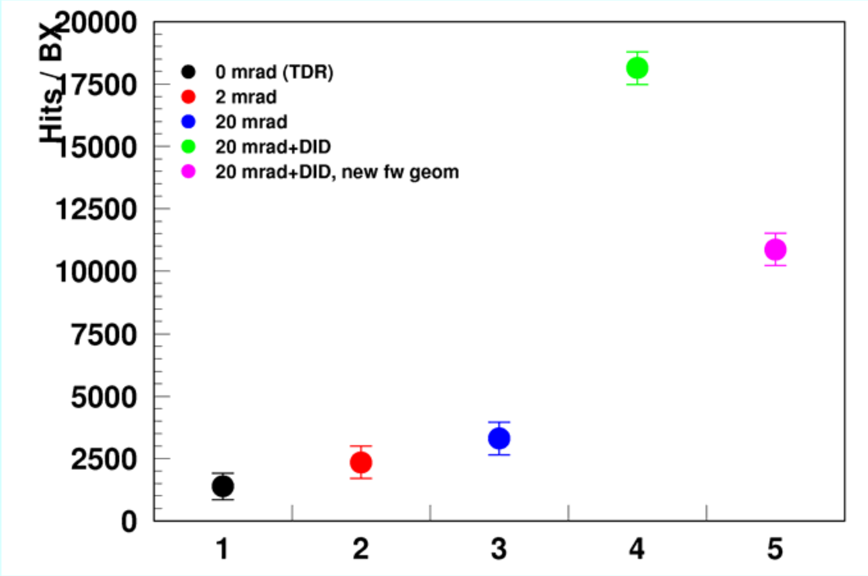
DiD field optimised for LDC solenoid
(thanks to A. Seryi and B. Parker)



Effect of DID for Current LDC Design

- Backgrounds: Increase of hits in TPC
- Tracking: Problem for track based calibration of magnetic field ?

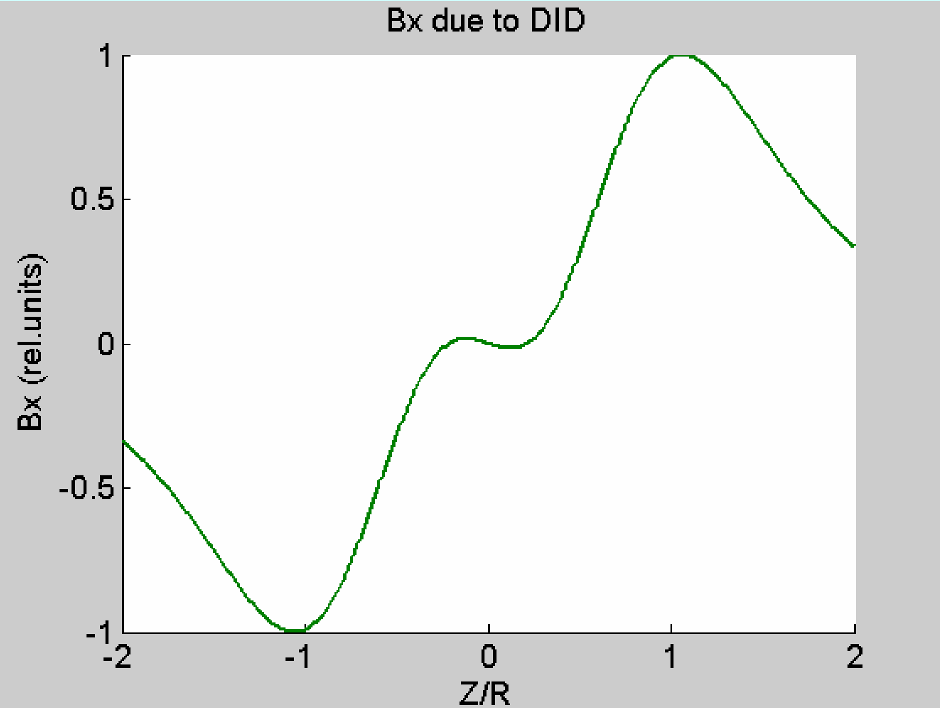


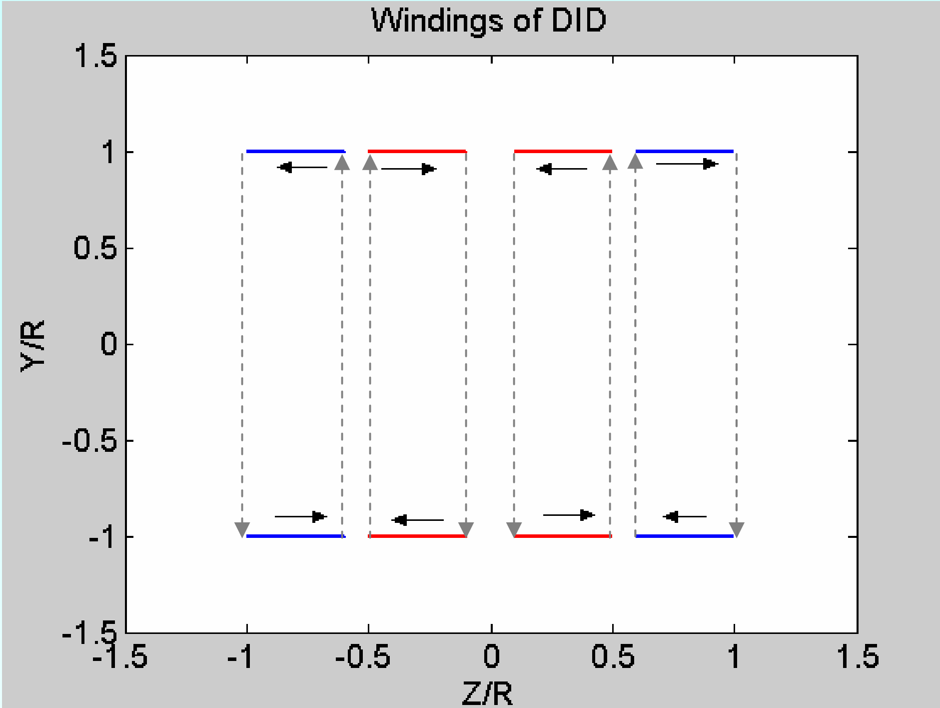


Forward geometries could probably be optimised for DID (work in progress) → improve background situation

New Proposal: Modified DID for TPC

- Dan Peterson: “a uniform magnetic field is required at small z for the purpose of performing a track-based calibration the magnetic field. The region of uniform field would allow us to isolate the effects of the field distortions on track trajectories from the effects of field distortions on the drift path. I believe that uniformity is less important at larger z; the current DID design field of 0.08T at |z|= 2.2m would be acceptable.”

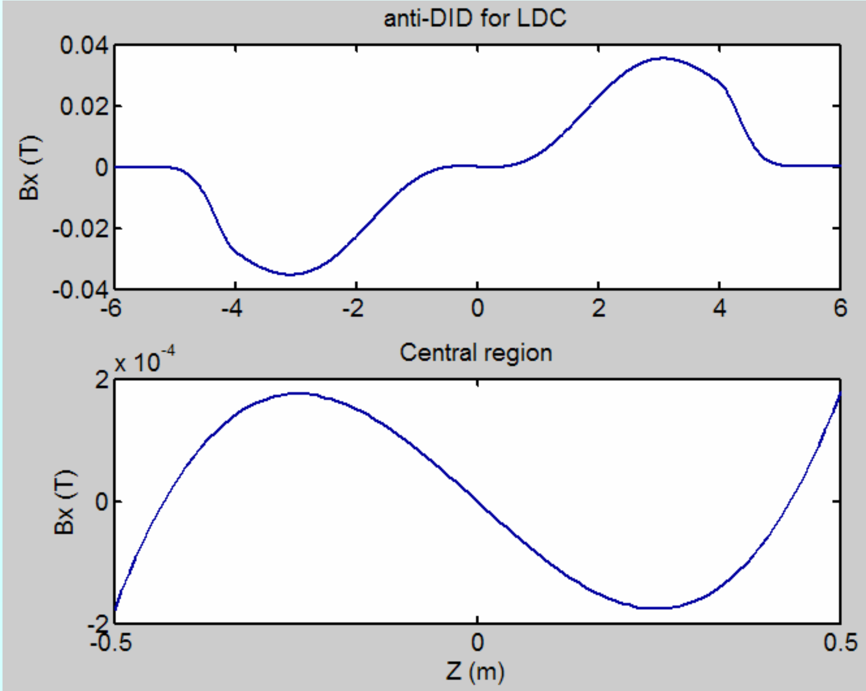




A. Seryi, B. Parker

Another New Proposal: Anti-DID

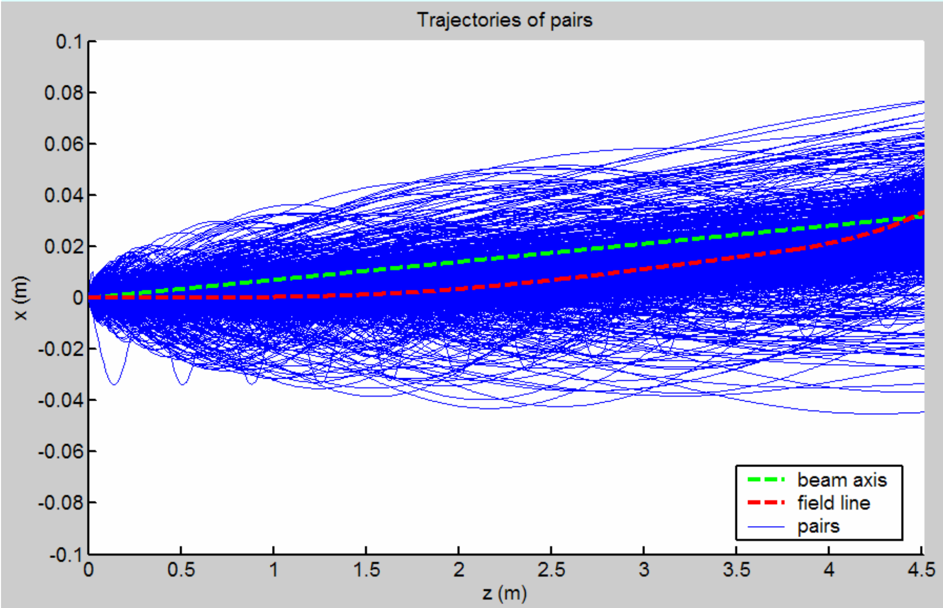
- For 14mrad x-ing, the SR effects are reduced => can optimize DID for *outgoing beam* (anti-DID)
- Optimize field strength of anti-DID in order to direct maximum number of pairs into extraction hole
  - for that, tracking of Guinea-pig pairs was included into the process
- For detectors with TPC, use DID with new field shape, with reduced field in the center



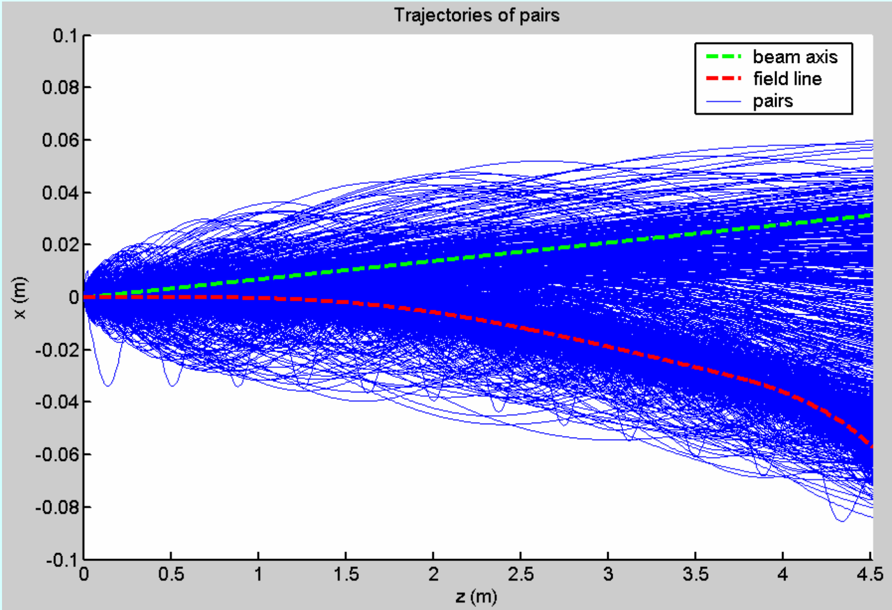
A. Seryi, B. Parker

Effect of Anti-DID

- Low-energetic pairs are guided to exit hole
- High-energetic pairs go to exit hole anyhow



Anti-DID



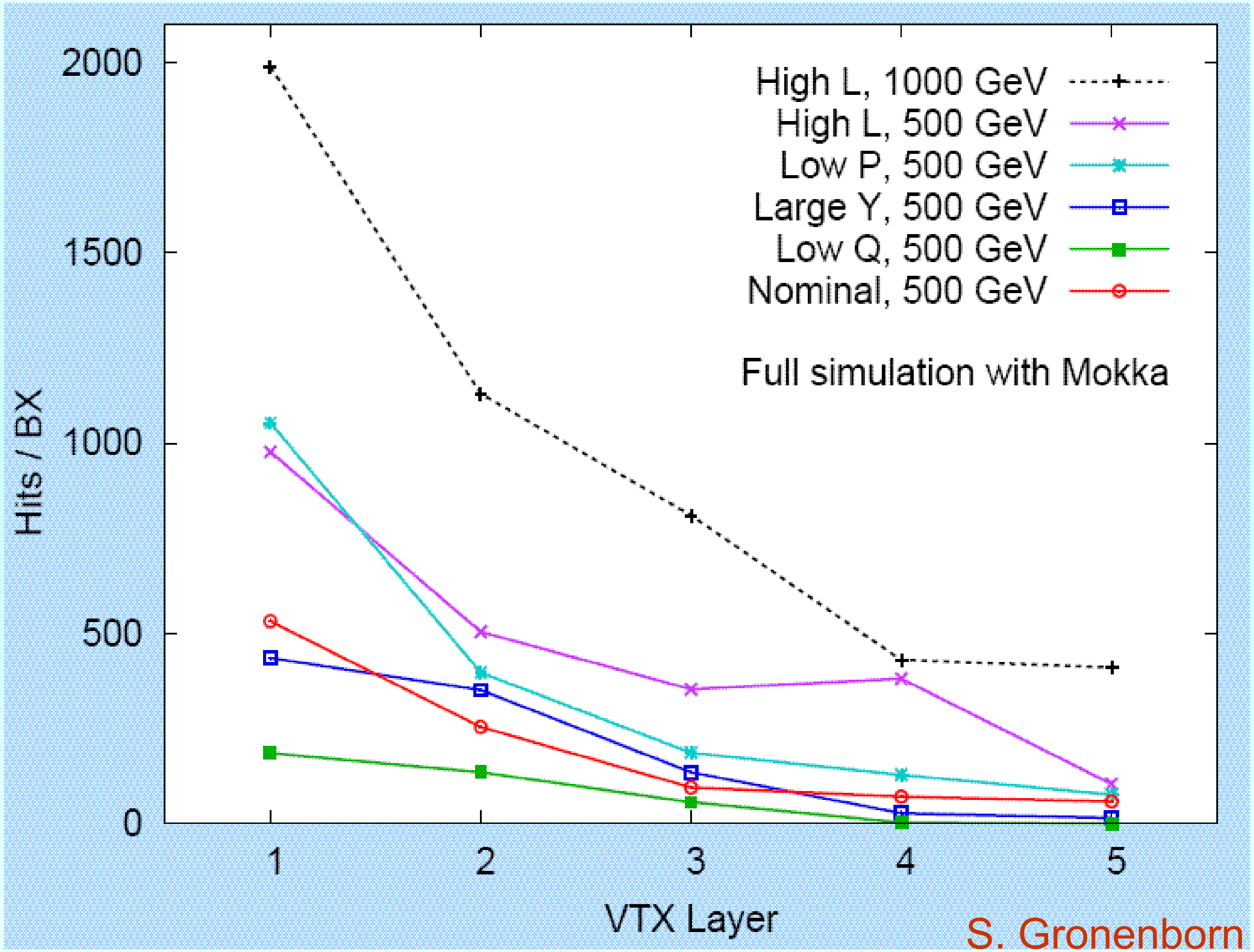
Normal DID

A. Seryi, B. Parker

ILC Parameter Sets

		nom	low N	lrg Y	low P	High L
N	$\times 10^{10}$	2	1	2	2	2
n_b		2820	5640	2820	1330	2820
$\varepsilon_{x,y}$	μm, nm	9.6, 40	10,30	12,80	10,35	10,30
$\beta_{x,y}$	cm, mm	2, 0.4	1.2, 0.2	1, 0.4	1, 0.2	1, 0.2
$\sigma_{x,y}$	nm	543, 5.7	495, 3.5	495, 8	452, 3.8	452, 3.5
D_y		18.5	10	28.6	27	22
δ_{BS}	%	2.2	1.8	2.4	5.7	7
σ_z	μm	300	150	500	200	150
P_{beam}	MW	11	11	11	5.3	11
L	$\times 10^{34}$	2	2	2	2	4.9!

VTX Hits for ILC Parameter Sets



To be done

- Design forward region for 14 mrad crossing angle
- Check background numbers with full detector simulations for:
  - Modified DID
    - Optimise forward region geometries for DID
  - Anti-DID
  - All this for different crossing angles: (0, 2), 14, 20 mrad
- Understand detector tolerance levels
  - Work ongoing by A. Vogel for TPC
  - Are all other sub-detectors fully understood?
- Continue the work started by S. Gronenborn:
  - Background situation for different ILC parameter sets
- Continue switch from BRAHMS to MOKKA (A. Vogel)
  - Understand differences, e.g. in VTX hits numbers
  - Can the neutron simulations be trusted?