

ILC beam parameter optimization

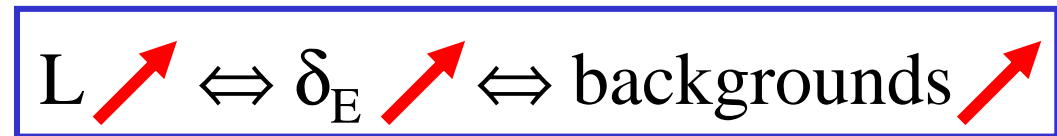
		nom	low N	lrg Y	low P	High L
N	$\times 10^{10}$	2	1	2	2	2
n_b		2820	5640	2820	1330	2820
$\epsilon_{x,y}$	$\mu\text{m}, \text{nm}$	9.6, 40	10,30	12,80	10,35	10,30
$\beta_{x,y}$	cm, mm	2, 0.4	1.2, 0.2	1, 0.4	1, 0.2	1, 0.2
$\sigma_{x,y}$	nm	543, 5.7	495, 3.5	495, 8	452, 3.8	452, 3.5
D_y		18.5	10	28.6	27	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

2.08.2005 Nick Walker - 2nd ILC Workshop - Snowmass - Colorado

← $L/L_{\text{nom}} \sim 3$

Nominal
Luminosity
[$\text{cm}^{-2} \text{s}^{-1}$]
 $\sim 2 \times 10^{34}$

$$L \sim \eta \frac{P_{\text{electrical}}}{E_{CM}} \sqrt{\frac{\delta_E}{\epsilon_{n,y}}} H_D$$



(E.C.M. resolution) (forward hermeticity)

EuroTeV: ILPS-BBSIM: validation, benchmark and improvements of beam-beam interaction simulation

1. $e+e-$ pair backgrounds in vertex detector (finished, being published)
2. Systematics to luminosity measurement based on Bhabha scattering due to electromagnetic deflections from opposite bunch (in progress)
3. Extend phase-space for hadronic minijets and check (not started)
4. Implementation of beam-beam depolarizing effects (not started)
5. Documentation & version management for **GUINEA-PIG** (in progress)
- (6. Parallelization to run large statistics on PC farms – under study)

Staff at LAL: P.Bambade, G.Le Meur, K.Mönig, F.Touze

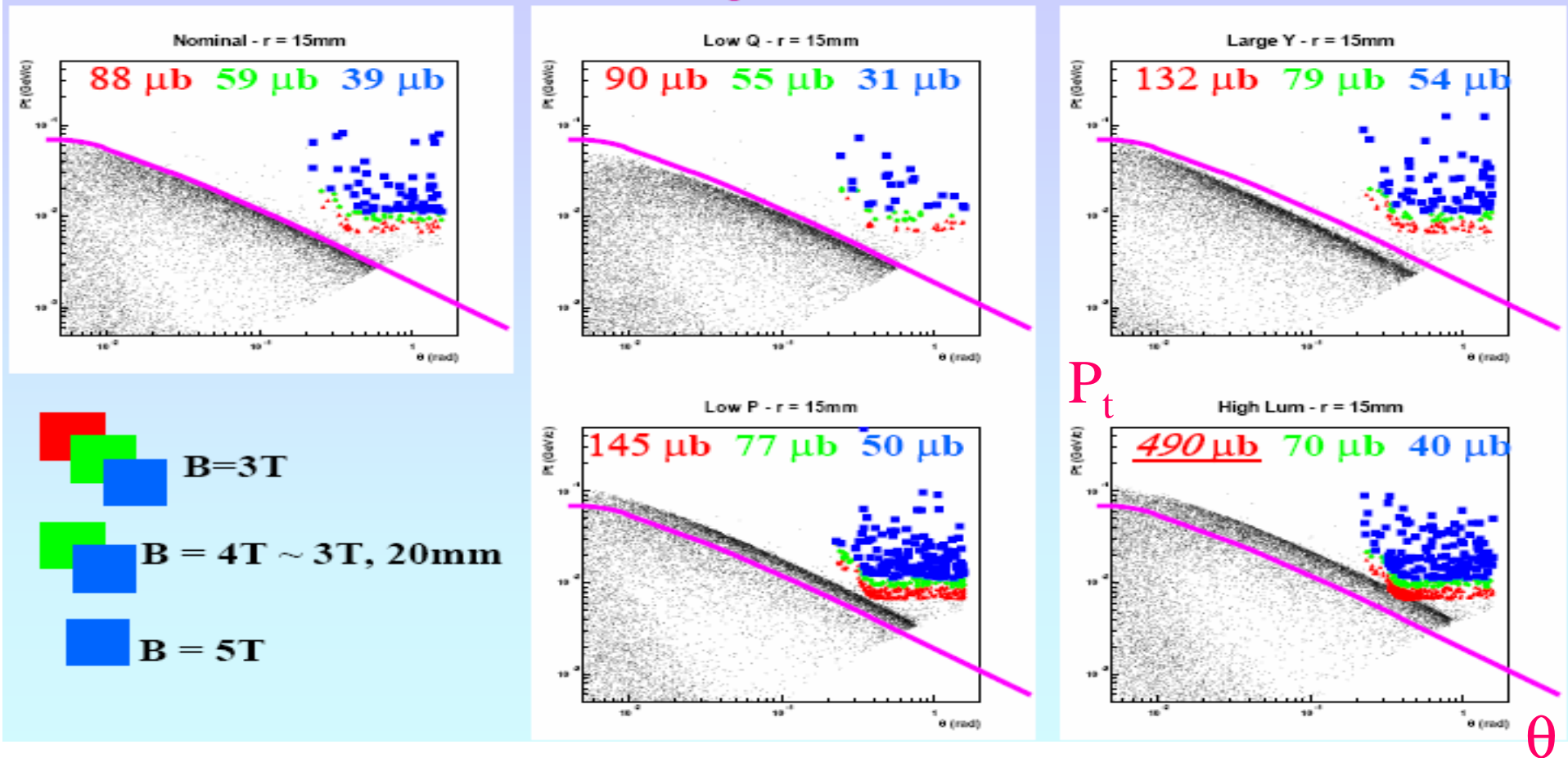
Staff at CERN: D.Schulte

EU funding: *24 months at post-doc level* → C. Rimbault

Collaborators: K.Yokoya, T.Tauchi (KEK) → **CAIN** program

Talks in London & Snowmass - EuroTeV-Report-2005-016-1

Impact of beam parameter sets on VD background for $r_1 = 15$ mm



“Low power” and especially “high luminosity” parameter sets :

- Constraints on VD design (B , radius, readout)
- Incompatible with present GLD & LDC detector concepts

Modeling e^+e^- pair backgrounds in GUINEA-PIG and CAIN

Events reaching the VD			effective $\sigma(\mu\text{b})$	
$\sigma(\mu\text{b})$	GuineaPig $Q^2_{\text{max}}=s/4$	CAIN $Q^2_{\text{max}}=m_e^2$	BDK	(GP-CAIN)/GP
All	60.5 ± 6.0 <i>64.1 ± 5.9</i>	36.5 ± 4.5 <i>37.4 ± 4.5</i>	- -	$\sim 0.41 \pm 0.12$
BW	10.3 ± 2.4 <i>8.2 ± 2.1</i>	7.0 ± 2.0 <i>6.4 ± 1.9</i>	- -	$\sim 0.27 \pm 0.33$
BH	20.5 ± 3.3 <i>26.6 ± 3.8</i>	16.6 ± 3.0 <i>20.9 ± 3.3</i>	- -	$\sim 0.20 \pm 0.20$
LL	29.7 ± 4.0 <i>29.3 ± 4.0</i>	13.4 ± 2.7 <i>10.2 ± 2.3</i>	37.5 ± 5.3 -	$\sim 0.60 \pm 0.18$

without & *with* Beam Size Effect

GUINEA-PIG predicts a factor ~ 2 more pairs in the VD than CAIN

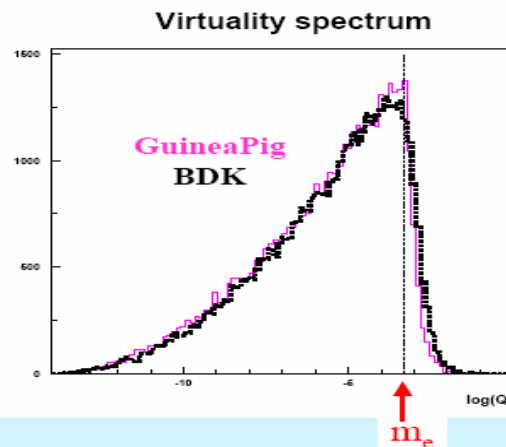
Origin = choice of max. virtuality in effective photon spectrum used

Compare with the BDK four fermion explicit LO matrix element generator (Landau-Lifshitz process)

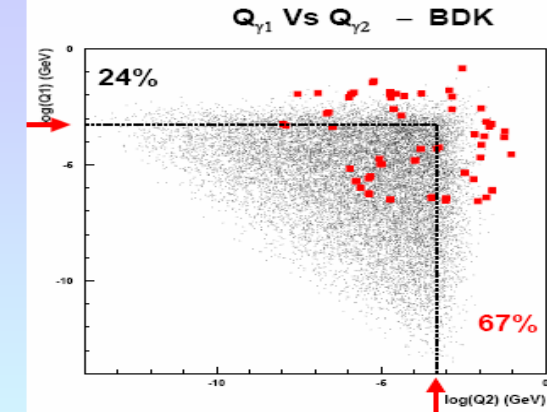
→ Validate GUINEA-PIG

Check of Bethe-Heitler process also planned

The photon virtuality spectrum in BDK



Nice agreement between GuineaPig & BDK both at low and large virtuality



BDK prediction at low virtuality:
 $\sigma_{\text{prod}} = 24 \text{ mb}$; $\sigma_{\text{VD}} = 12 \mu\text{b}$
 \sim CAIN results

EuroTeV: ILPS-PCDL: evaluation of post-IP beam transport \Rightarrow detector backgrounds + diagnostics

1. GEANT4 simulation of IR and extraction lines in 2 and 20 mrad crossing-angle geometries (~ finished, head-on scheme also planned)
2. Cross-check of tracking with standard beam-line codes (~ finished)
3. Spent beam power losses for different ILC parameters (in progress)
4. Backscattered γ and neutrons from spent beam power losses (in prog.)
5. Apply simulation tool to study backgrounds at ATF-2 (not started)

Staff at LAL: P.Bambade, B. Mouton (ILC)

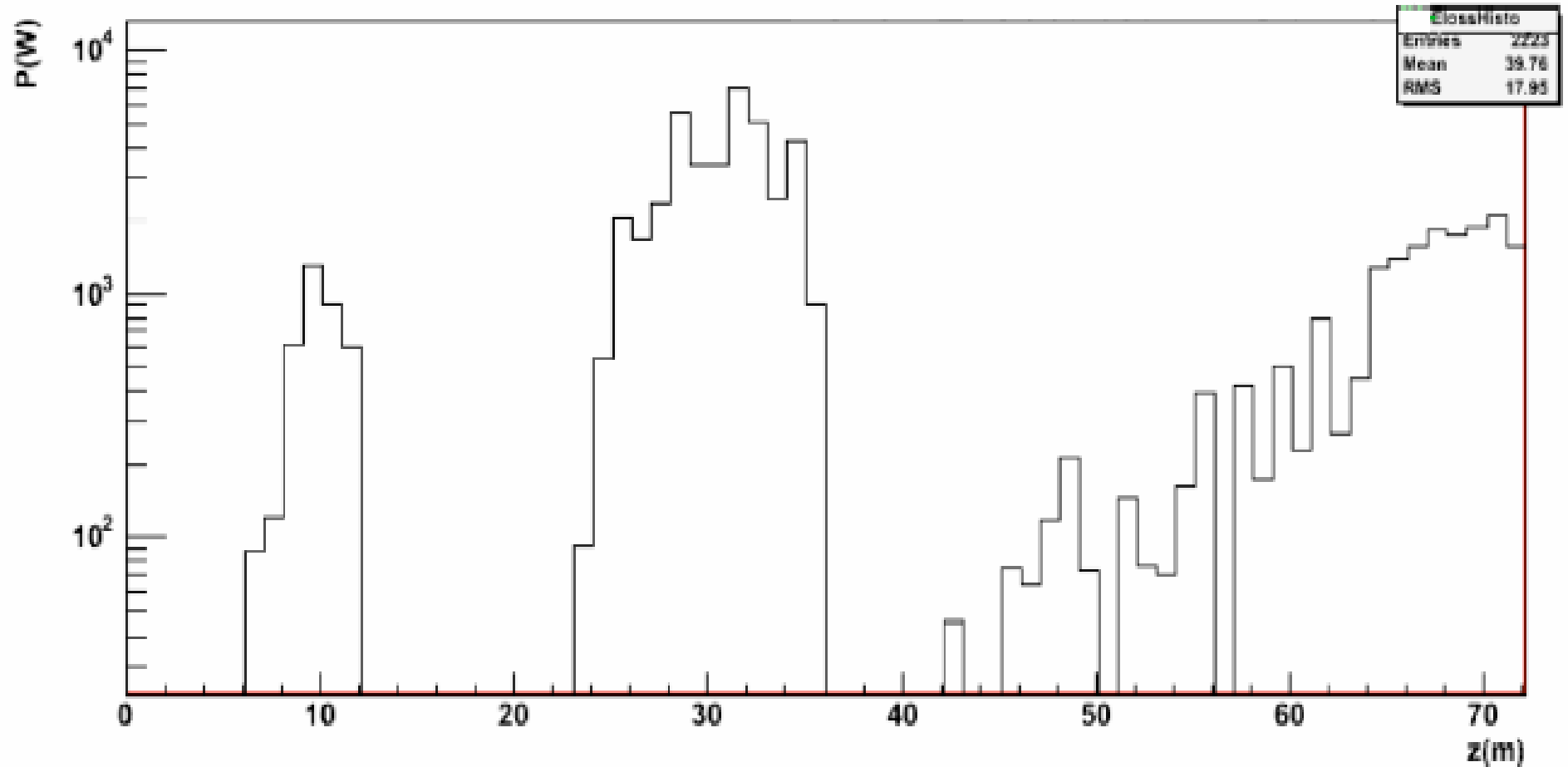
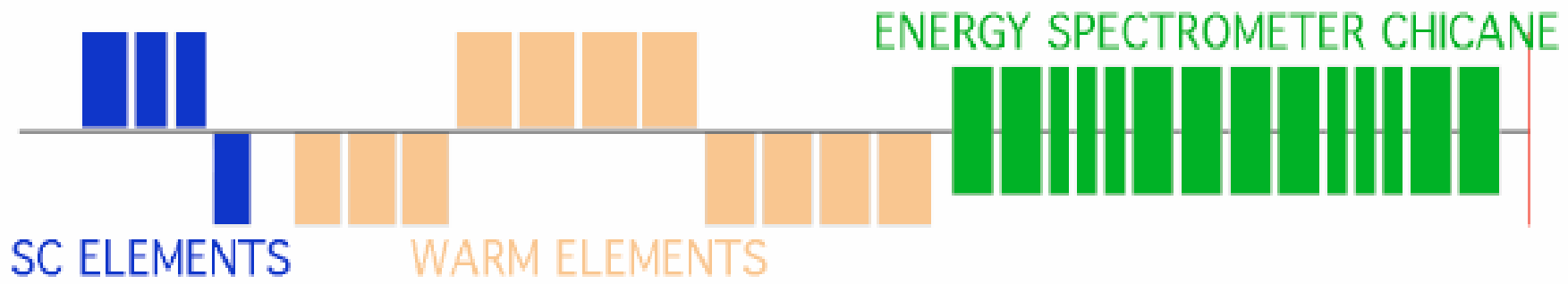
EU funding at LAL: **24 post-doc months** \rightarrow **O. Dadoun**

Staff in Uppsala & CERN: V. Ziemann, D.Schulte (CLIC)

EU funding in Uppsala : **24 post-doc months** \rightarrow **A. Ferrari**

Collaborators: R.Appleby et al. (Daresbury), O.Napoly et al. (Dapnia),
G.Blair et al. (Londres) \rightarrow **BDSIM (GEANT4 based)**

Talks in London & Snowmass : 2 EuroTeV Reports in progress



Power losses for high luminosity at 1TeV (no offset)

20mrad Extraction Line-

Disrupted beam loss on collimators and max loss density in the magnets.

Both collimators using round aperture: $R_{COL1} = 88\text{mm}$, $R_{COL2} = 132\text{mm}$.

Tracked in BDSIM using $7e4$ particles (except 1TeV Nom. Dy100 - 640K particles)

E_{cm} [TeV]	Vertical Offset [nm]	E-Loss [kW]		Max E-Loss density in Magnets [W/m]		
		Col1	Col2	SC Quads	Warm Quads	Bends
0.5 Nominal	0	0	0	0	0	0
	200	0	0	0	0	0
0.5 High Lumi	0	46.4	75.5	0	58	52
	120	174.1	179.7	0	95	265
1.0 Nominal	0	0.86	0	0	0	0
	100	4.21	0.42	0	10	95
1.0 High Lumi	0	49.7	56.7	1284	6205	2162
	80	122.3	67.7	1125	7250	5725

Set up of interaction region with 2 mrad crossing-angle

Current doublet parameters for 0.5-1 TeV

SC QD ($r = 31\text{mm}$) warm QF ($r \sim 10\text{mm}$)
 214-228 T/m 140-153 T/m

