Zeuthen/Bielefeld/Freiburg/Hamburg node

Tord Riemann, DESY Zeuthen

Mid-Term Review Meeting

Durham, 9. April, 2002

- Zeuthen – less favored region
- Role of the node within the network
- Contributions of the team

Members of the Zeuthen/Bielefeld/Freiburg/Hamburg node

category	name (gender)	remark
permanent staff	Tord Riemann (Z)	scientist in charge
	Johannes Blümlein (Z)	
	Jochum v.d. Bij (F)	
	Jochem Fleischer (B)	
	Peter Zerwas (H)	
post-docs	Stefan Dittmaier (H)	
	Hiroyuki Kawamura (Z)	
	Gudrid Moortgat-Pick (H,f)	to Durham 09/2002
	George Jikia (F)	
	Anja Werthenbach (Z,f)	to CERN 10/2000
	Konstantin Chetyrkin (F)	
new post-docs in fall 2002	Roberto Bonziani (F) A. de Freitas (Z)	young researcher
Ph.D. students	R. Boughezal (F,f)	
	A. Lorca (Z)	from Granada 10/2001
	P. Marquard (F)	

Collaboration of Zeuthen/Bi/Fr/HH node with other nodes

node	joint publications (+ joint workshop reports)	milestones	task areas
1 Granada	2 (+1)	(3,5,7,8,11,13),14	(i-v),i
2 Demokritos	0 (+1)	(3,5,7,8,11,13)	(i-v)
3 Durham	2 (+3)	(3,5,6,7),2,6,10	(i-v),i,iii,iv
4 Karlsruhe	11 (+2)	(6,7,8,11,13),2,3,6,10,12,14	(i-v),i,iii,iv
5 HNINP Krakow	1 (+3)	(5,8,11,13),3,6,7	(i-v),i
6 Lisbon	1 (+0)	(3,5,7,8,11,13),10	(i-v),iii
7 Montpellier	2 (+2)	(3,5,7,11),8,13	(i-v),ii,iv
8 KU Nijmegen	2 (+1)	(3,5,7,13),6,8,11	(i-v),i,ii
9 INFN Padova	0 (+0)		
10 Torino	0 (+1)	(3,5,7,8,11,13)	(i-v)
11 Wien	2 (+1)	(3,5,7,8,11,13),12	(i-v),iv
12 PSI Villigen	12 (+3)	(3,5,7,8,11,13),3-8,11,13	(i-v),i,ii,iv
all nodes	27 (+5)		

3. Electroweak corrections in e^+e^-
4. W and Z production at LHC
5. Triple and quartic gauge-boson couplings
6. Higher-order corrections to precision observables
7. Multi-particle production
8. Production of Higgs bosons
10. Top production and decay
12. Chargino + neutralino production
13. Corrections to SUSY particle production
14. FCNC + CP violation in SUSY

Broad area of activities and interaction with many nodes

Adressed Milestones

Mid-term	Joint publications																					
Task areas	Electroweak											Higgs			Top		Susy					New
Milestones	1	2	8	9	12-13	14	16	17	18	22	**23-28**	32	33	36	38	41	44	51	52	53-54	**55-58**	61
2.				•																		
3.	•		•				•				•											
4.											•											
5.	•							•			•											
6.			•		•	•				•									•			
7.	•								•		•											
8.	•	•										•	•	•								
10.															•	•						
11.													•									
12.																	•			•	•	
13.	•																	•				
14.																					•	•

2. High precision Bhabha scattering
3. Electroweak corrections in e^+e^-
4. W and Z production at LHC
5. Triple and quartic gauge-boson couplings
6. Higher-order corrections to precision observables
7. Multi-particle production

8. Production of Higgs bosons
10. Top quarks in e^+e^-
11. Top quarks at LHC
12. Chargino + neutralino production
13. Corrections to SUSY particle production

New:14. FCNC + CP violation in SUSY

Joint publications

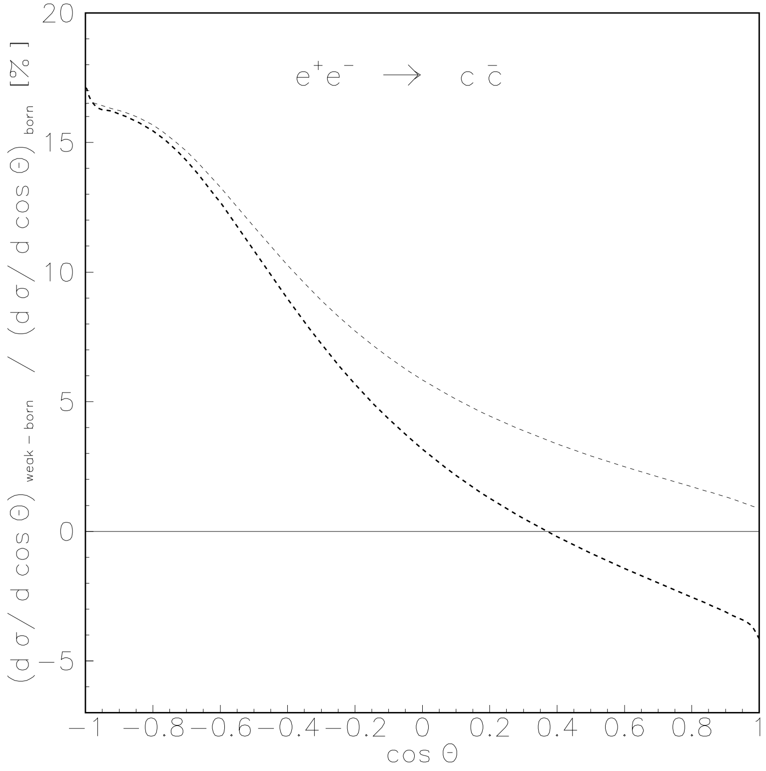
Task areas	Joint publications: Electroweak											Higgs			Top		Susy					New
other nodes	1	2	8	9	12-13	14	16	17	18	22	**23-28**	32	33	36	38	41	44	51	52	53-54	**55-58**	61
1. Granada	●	●																				●
2. Democritos	●																					
3. Durham	●		●	●		●													●			
4. Karlsruhe	●		●	●	●	●	●									●	●				●	
5. Krakow	●	●					●		●													
6. Lisbon															●							
7. Montpellier	●													●			●	●				
8. Nijmegen	●									●			●									
9. INFN Padova																						
10. Torino	●																					
11. Wien	●																			●		
12. PSI Villigen	●	●	●			●	●	●			●	●	●					●				

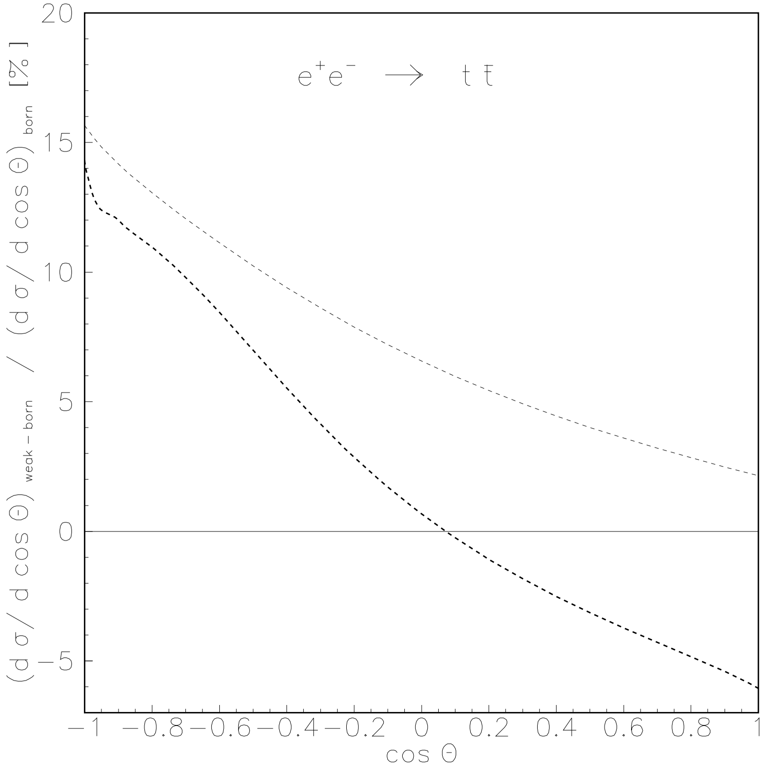
Main Zeuthen/Bielefeld/Freiburg/Hamburg contributions

Work	Milestone	Task Area	other teams involved
• RacoonWW – 1-loop MC for $e^+e^- \to 4f(\gamma)$ • 2-loop corr's for $e^+e^- \to e^+e^-$ • KKMC – MC for $e^+e^- \to \nu\bar{\nu}\gamma$	2. High precision Bhabha scattering 3. Electroweak corrections for e^+e^- colliders 5. Study of triple and quartic gauge-boson couplings 7. Multi-particle production	(i)	Karlsruhe Krakow PSI
Higgs excitation curve and radiation off quarks	8. (Supersymmetric) Higgs bosons at LHC and e^+e^- colliders 11. Top quarks at LHC	(ii)	Leiden Montpellier PSI
Electroweak corrections to $e^+e^- \to t\bar{t}$	10. Top production and decay at e^+e^- colliders	(iii)	Karlsruhe
QCD corrections to susy Higgs production in $\gamma\gamma$ collisions	13. electroweak and strong corrections to SUSY particle production and decays	(iv)	Durham Montpellier PSI
Lepton number violation in $Z \to \mu + \tau$	new Lepton flavor violation (close to 14.: FCNC + CP-viol.)	(v)	Granada

Top-quark Pair-production Cross section

$\frac{d\sigma}{dcos\theta}$ for $e^{+} + e^{-} \to c + \bar{c} + \gamma$ and $e^{+} + e^{-} \to t + \bar{t} + \gamma$ at TESLA

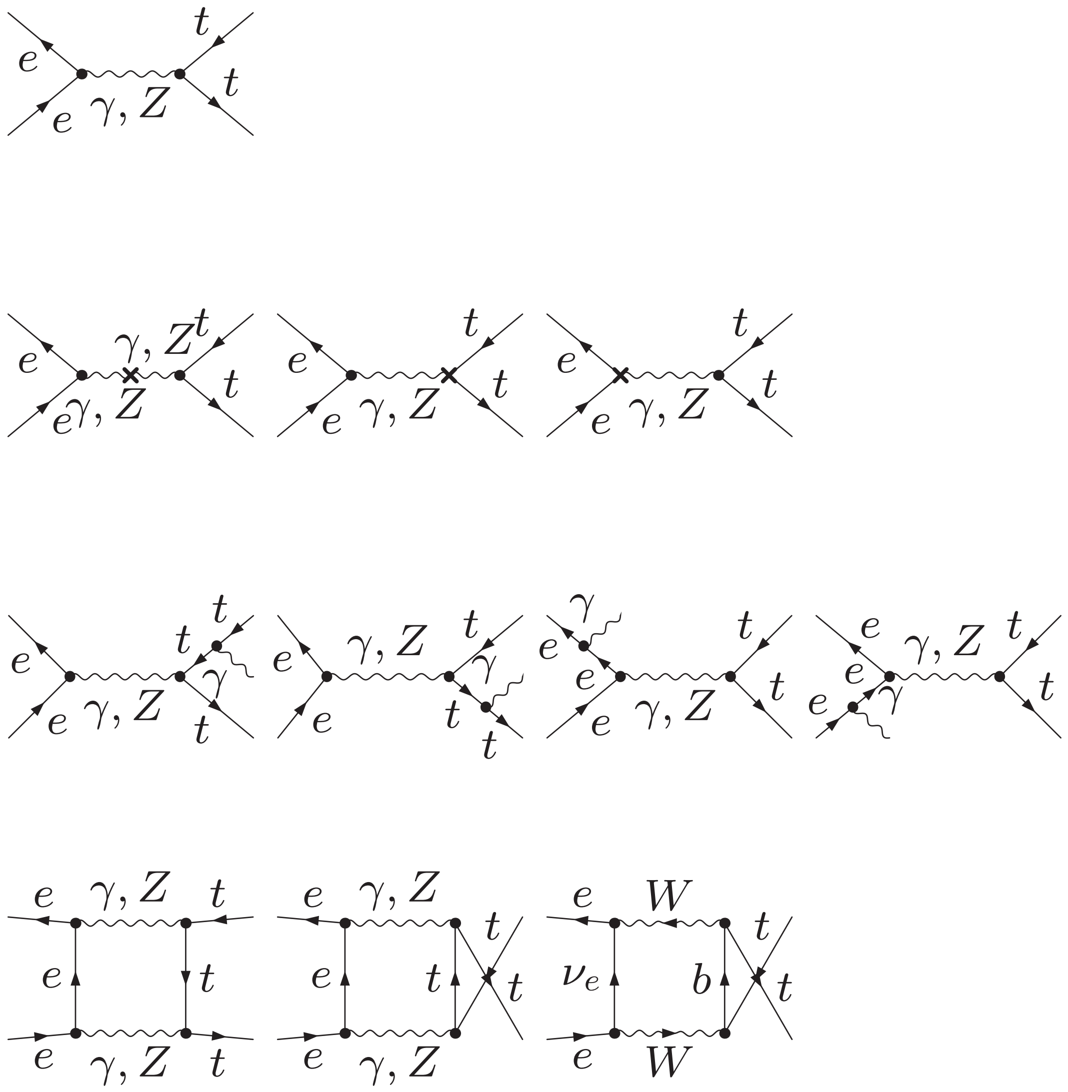


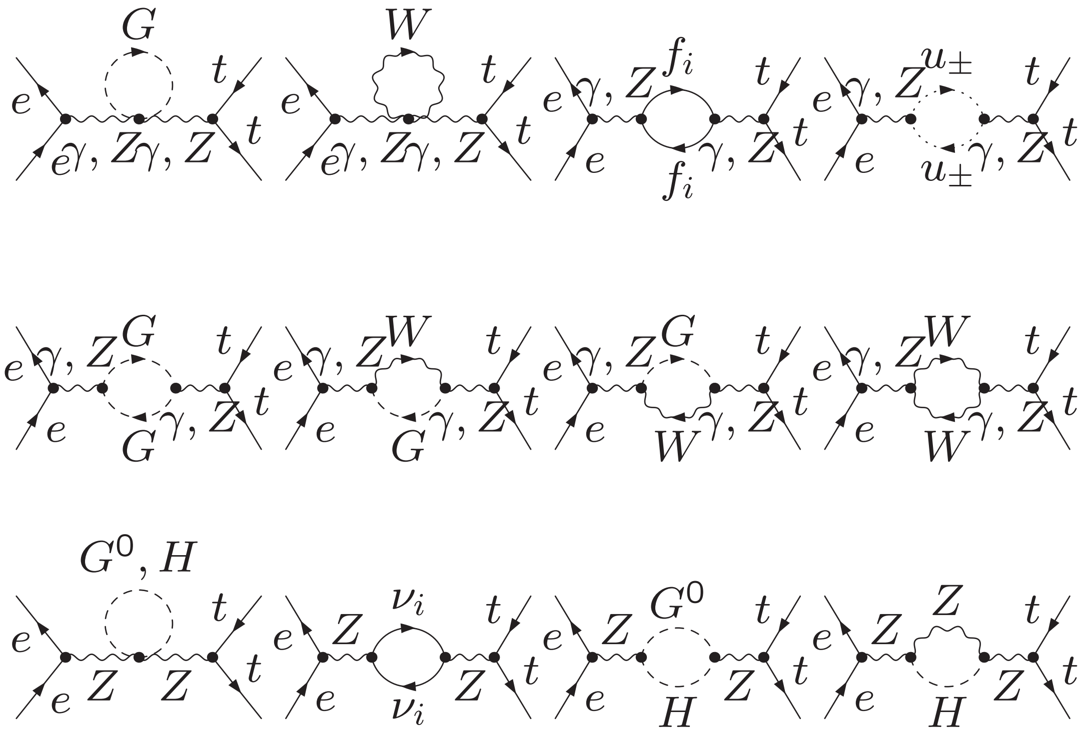


One-loop percentage corrections with respect to Born.

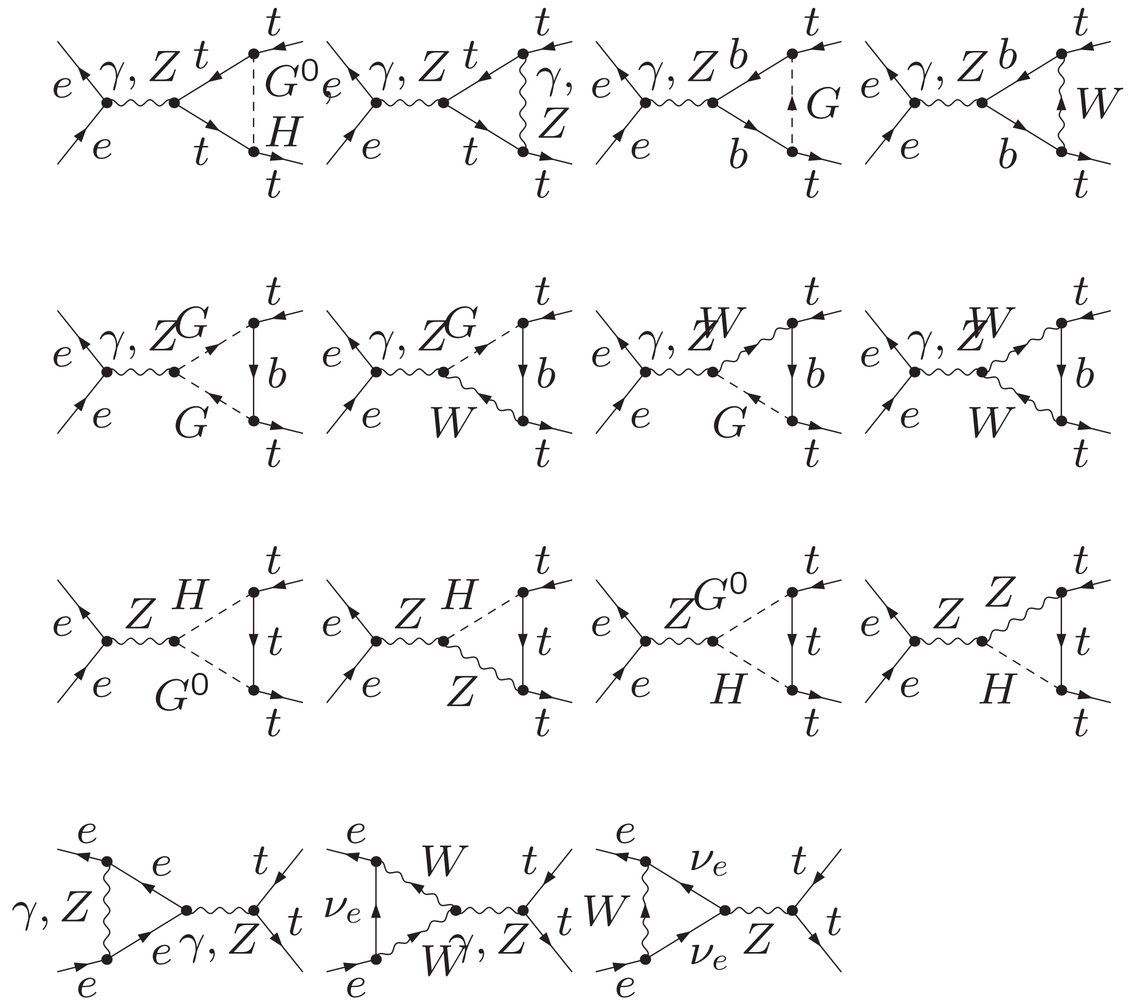
Thin lines: $\sqrt{s} = 500$ GeV, thick lines: $\sqrt{s} = 1000$ GeV.

Feynman diagrams for Top-quark Pair-production





e t G γ, Z W f_i $u_\pm$
G^0, H Z ν_i G^0 H


e γ, Z t t G0 H e t t
e γ, Z t t γ, Z e t t
e γ, Z b t G e b t
e γ, Z b t W e b t
e γ, Z G t b e G t
e γ, Z G t b e W t
e γ, Z W t b e G t
e γ, Z W t b e W t
e Z H t t e G0 t
e Z H t t e Z t
e Z G0 t t e H t
e Z Z t t e H t
e e γ, Z t e γ, Z t e
e W νe t W γ, Z t e
e νe W t νe Z t e

Top-quark Pair-production Cross Section

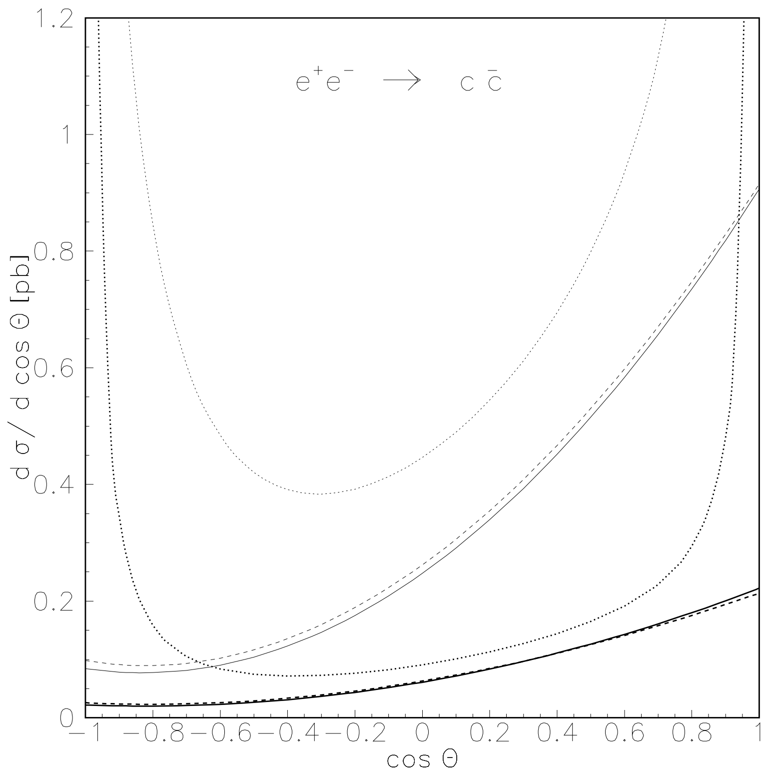
$\sqrt{s} = 500$ GeV: $e^+ + e^- \to \bar{t} + t$ at TESLA

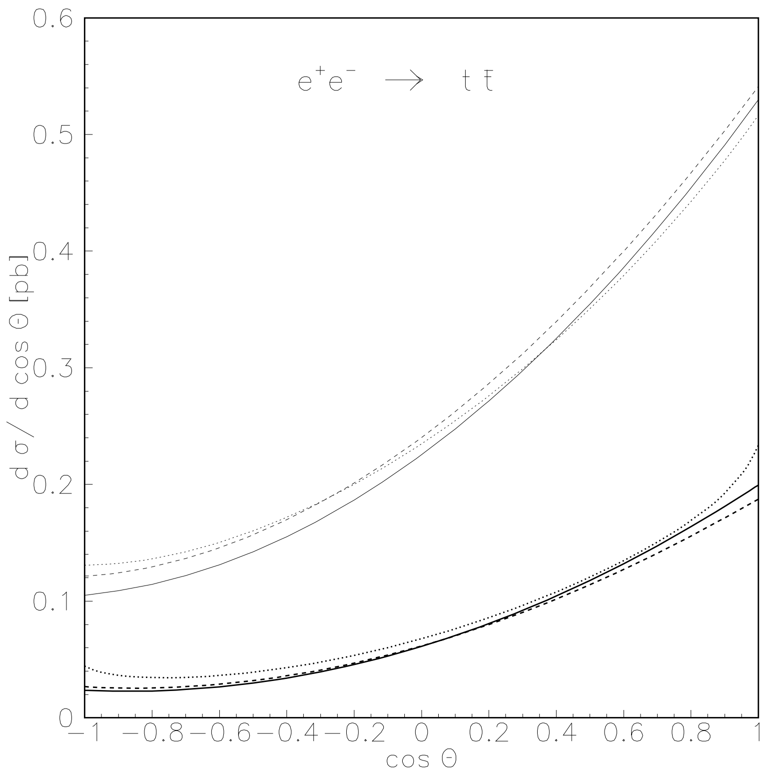
$\cos\theta$	$\left[\frac{d\sigma}{d\cos\theta}\right]_{\text{Born}}$	$\left[\frac{d\sigma}{d\cos\theta}\right]_{\text{QED}}$	$\left[\frac{d\sigma}{d\cos\theta}\right]_{\text{weak}}$	$\left[\frac{d\sigma}{d\cos\theta}\right]_{\text{SM}}$
−0.9	0.1088 3919 4075	0.09866 4253	0.1242 59037 1	0.1140 8410
	0.1088 3919 4075	0.09866 4253	0.1242 59037 6	0.1140 8410
−0.5	0.1422 7506 9392	0.1285 0790	0.1568 48371 9	0.1430 8121
	0.1422 7506 9392	0.1285 0790	0.1568 48371 8	0.1430 8121
0.	0.2254 7046 4032	0.2023 9167	0.2402 6680 4	0.2171 8801
	0.2254 7046 4033	0.2023 9167	0.2402 6680 3	0.2171 8801
0.5	0.3546 6647 0331	0.3151 1724	0.3688 8650 7	0.3293 3727
	0.3546 6647 0332	0.3151 1723	0.3688 8650 5	0.3293 3727
0.9	0.4911 4371 5766	0.4307 1437	0.5033 3751 2	0.4429 0817
	0.4911 4371 5767	0.4307 1437	0.5033 3750 8	0.4429 0816

Agreement confirms accuracy of electroweak calculations of two nodes

Top-quark Pair-production Cross section

$\frac{d\sigma}{dcos\theta}$ for $e^+ + e^- \to c + \bar{c} + \gamma$ and $e^+ + e^- \to t + \bar{t} + \gamma$ at TESLA





Solid, dashed, dotted lines: Born, weak, and SM.

Thin lines: $\sqrt{s} = 500$ GeV, thick lines: $\sqrt{s} = 1000$ GeV.

General activities of the Zeuthen/Bi/Fr/HH node in the network

- Lectures on Higgs Physics and on SUSY Physics were held at the Graduate School in Physics at Colliders, Torino (Italy), October 2001 – organized by the Torino node

- Organization of the Symposium RADCOR 2002 in Banz (Germany), September 2002 – together with the Karlsruhe node

- Young researchers, even if not being paid by the network, take profit from the lively existence of the network