

Kinematic Fits in the Leptonic Channel

Hamburg SUSY Meeting
25.08.2009



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Motivation

- Determine (or at least constrain) masses of SUSY particles
- Method: kinematic fit of certain decay topologies
 - Combine final states to yield intermediate particle masses
- Challenges:
 - Unknown LSP momenta
 - Combinatorial problem
 - Backgrounds from standard model & SUSY
- Leponic signature vs. Hadronic channel
 - (Strongly) reduced combinatorics
 - Better momentum resolution w.r.t. Jets
 - Easier (standard model) background reduction
 - (Much) smaller branching ratios
 - Nothing for first data

Benchmarkpoint

Chose SPS1a('):

	SPS1a	SPS1a'
m_0	100 GeV	70 SPS1a - b
$m_{1/2}$	250 GeV	250 GeV
A_0	-100 GeV	-300 GeV
$\tan(\beta)$	10	10
μ	>0	> 0

- Similar to LM 1 etc.
- x-section@10 TeV: ~15pb
- Dominant production channels
 - gluino-squark
 - squark-squark

- Possible leptonic cascade (2x): (only 16-96 combinations!)

$$\tilde{g} \rightarrow \tilde{q}_L(+q) \rightarrow \tilde{\chi}_2^0(+q) \rightarrow \tilde{l}_R(+l) \rightarrow \tilde{\chi}_1^0(+l)$$

or with hadronic branch:

$$\tilde{g} \rightarrow \tilde{q}_L(+q) \rightarrow \tilde{\chi}_1^\pm(+q) \rightarrow \tilde{\chi}_1^0(+W \rightarrow qq)$$

- Masses:
 - Gluino: 606 GeV
 - Squarks_L: ~560 GeV
 - Chargino1/Neutralino2: 180 GeV
 - Slepton_R: 143
 - Neutralino1: 97 GeV

Branching Ratios

- Counted in 500k generated events

1. 4 Lepton Channel (2x2 OSSF)

Channel	Jet Multiplicity	Predicted rate (x-sec Fraction*BR)	Counted ($\tilde{e} + \tilde{\mu}$)	Fraction of 500k	Counted ($\tilde{\tau}$)
$\tilde{q}\tilde{q}$	2	1.41×10^{-4}	76	1.52×10^{-4}	2968
$\tilde{g}\tilde{q}$	3	6.70×10^{-5}	38	7.60×10^{-5}	1574
$\tilde{g}\tilde{g}$	4	4.00×10^{-6}	4	8.00×10^{-6}	79

1. 2 Lepton Channel (2 OSSF)

Channel	Jet Multiplicity	Total rates (x-sec Fraction*BR)	Counted ($\tilde{e} + \tilde{\mu}$)	Fraction of 500k	W decay mode	Counted ($\tilde{\tau}$)
$\tilde{q}\tilde{q}$	4	9.90×10^{-5}	57	1.14×10^{-4}	all	477
		6.70×10^{-5}	45	9.00×10^{-5}	hadronic	
$\tilde{g}\tilde{q} + \tilde{q}\tilde{g}$	5	9.50×10^{-5}	38	7.60×10^{-5}	all	248
		6.40×10^{-5}	20	4.00×10^{-5}	hadronic	
$\tilde{g}\tilde{g}$	4	3.00×10^{-6}	2	4.00×10^{-6}	all	-
			2		hadronic	

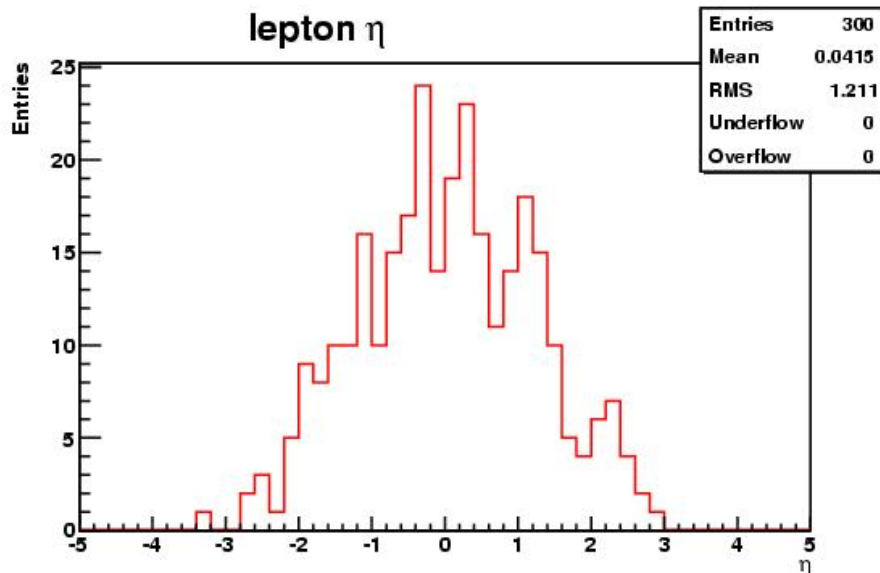
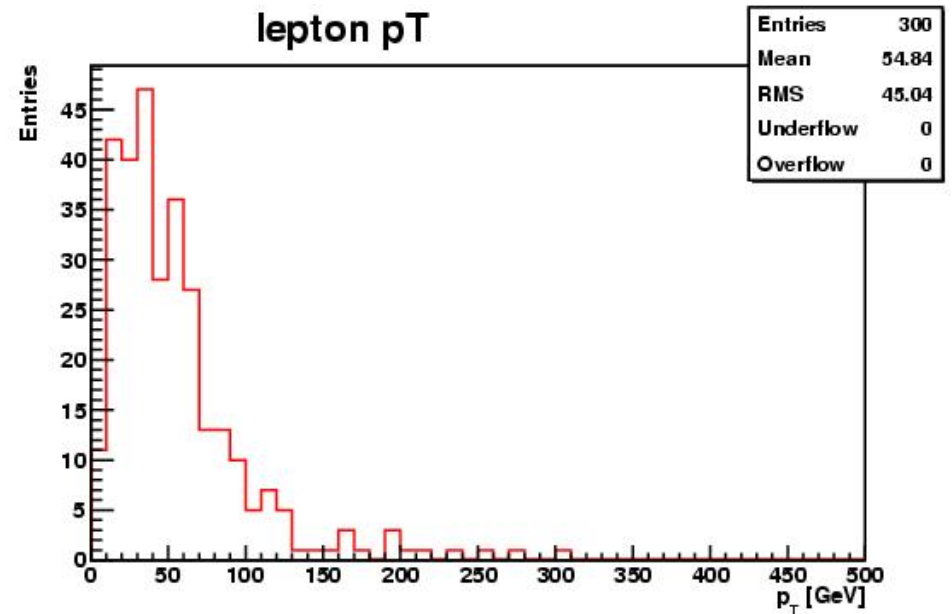
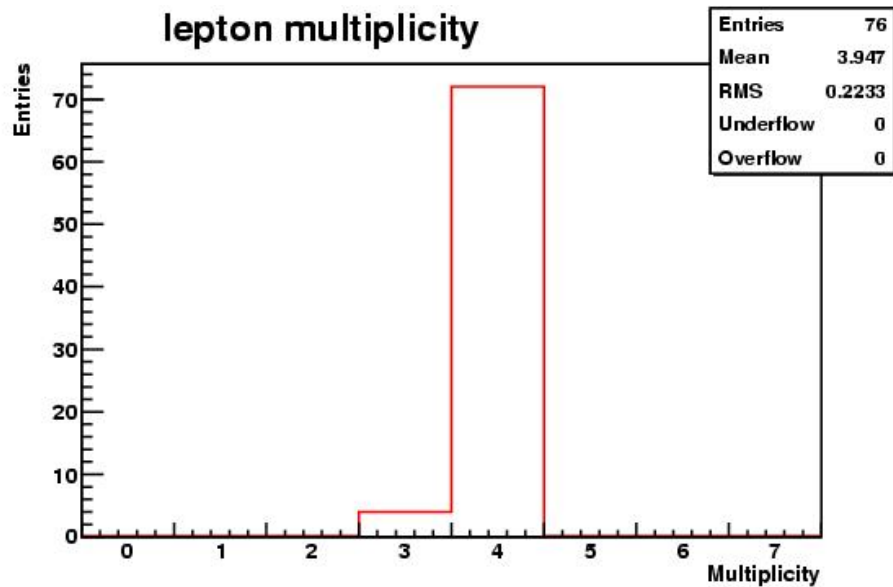
Event Selection

Event Selection @ SPS1a

Total number of signal events 76

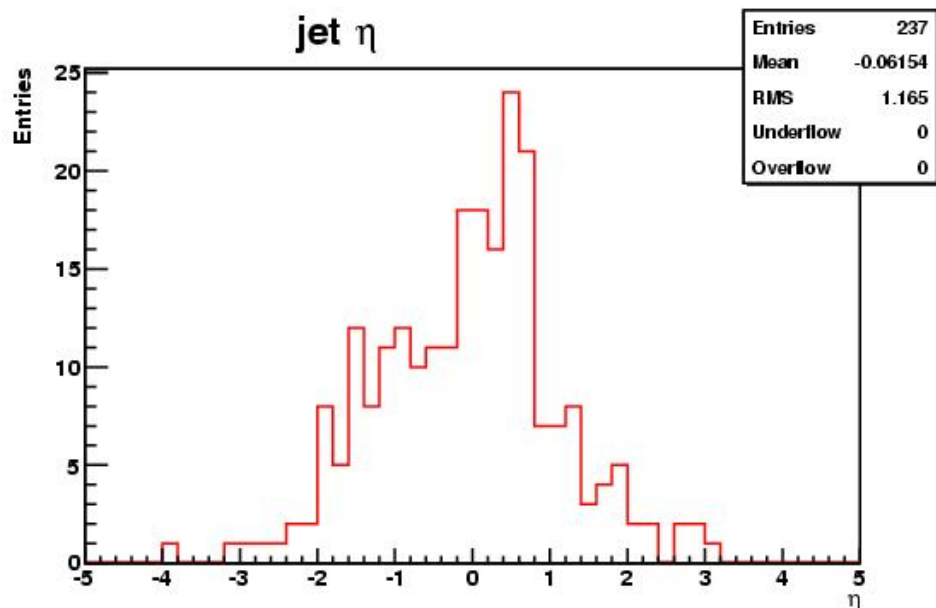
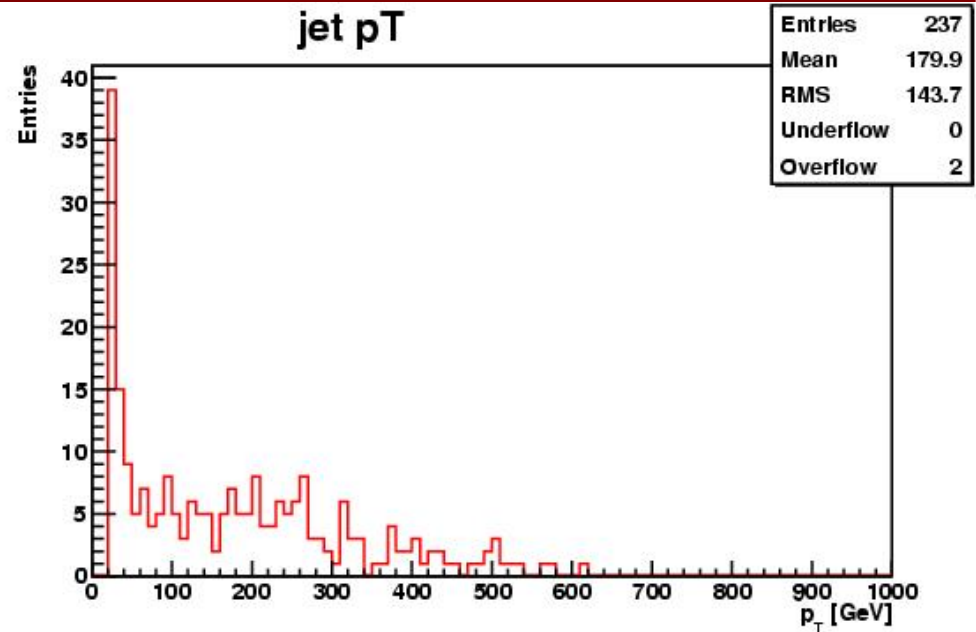
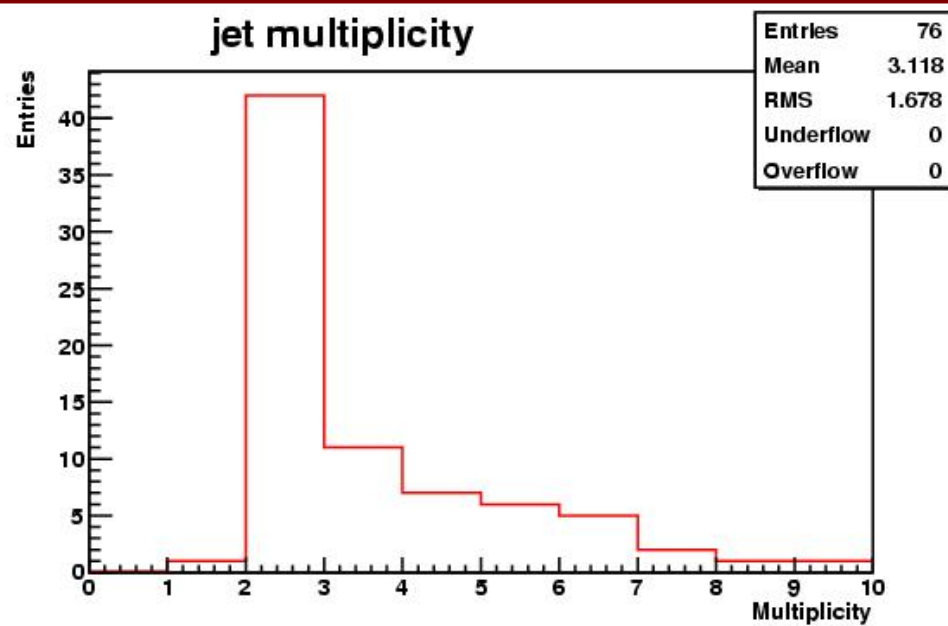
Jets				Leptons				Result				
pT [GeV]	eta	N	b-Jet veto	pT [GeV]	eta	N	2xOSSF	Signal	Efficiency	Background	Fake rate	S/B
30	3.0	2	no	15	2.5	4	no	22	0.29	31	0.58	0.71
30	3.0	2 or 3	no	15	2.5	4	no	30	0.39	88	0.75	0.34
30	3.0	2	no	15	2.5	4	yes	22	0.29	29	0.57	0.76
30	3.0	2 or 3	no	15	2.5	4	yes	30	0.39	75	0.71	0.4
30	3.0	2	yes	15	2.5	4	yes	22	0.29	19	0.46	1.16
30	3.0	2 or 3	yes	15	2.5	4	yes	30	0.39	39	0.57	0.77
100	3.0	2	no	15	2.5	4	yes	30	0.39	67	0.69	0.45
100	3.0	2 or 3	no	15	2.5	4	yes	33	0.43	96	0.74	0.34
100	2.5	>=2	yes	10	2.5	4	yes	46	0.61	47	0.51	0.98
30	3.0	>=2	yes	15	2.5	4	yes	37	0.49	160	0.81	0.23
20	5.0	>=2	no	5	3.5	>=4	no	71	0.93	324	0.82	0.22

Signal Lepton Kinematics



- No additional leptons
- Very soft spectrum

Jet Kinematics in Signal Events



- $\sim 50\%$ of events have only 2 jets
- Need to look at signal jets only for statement about spectra