Particle Id at the Energy Frontier

From 3-Vector to 4-Vectors

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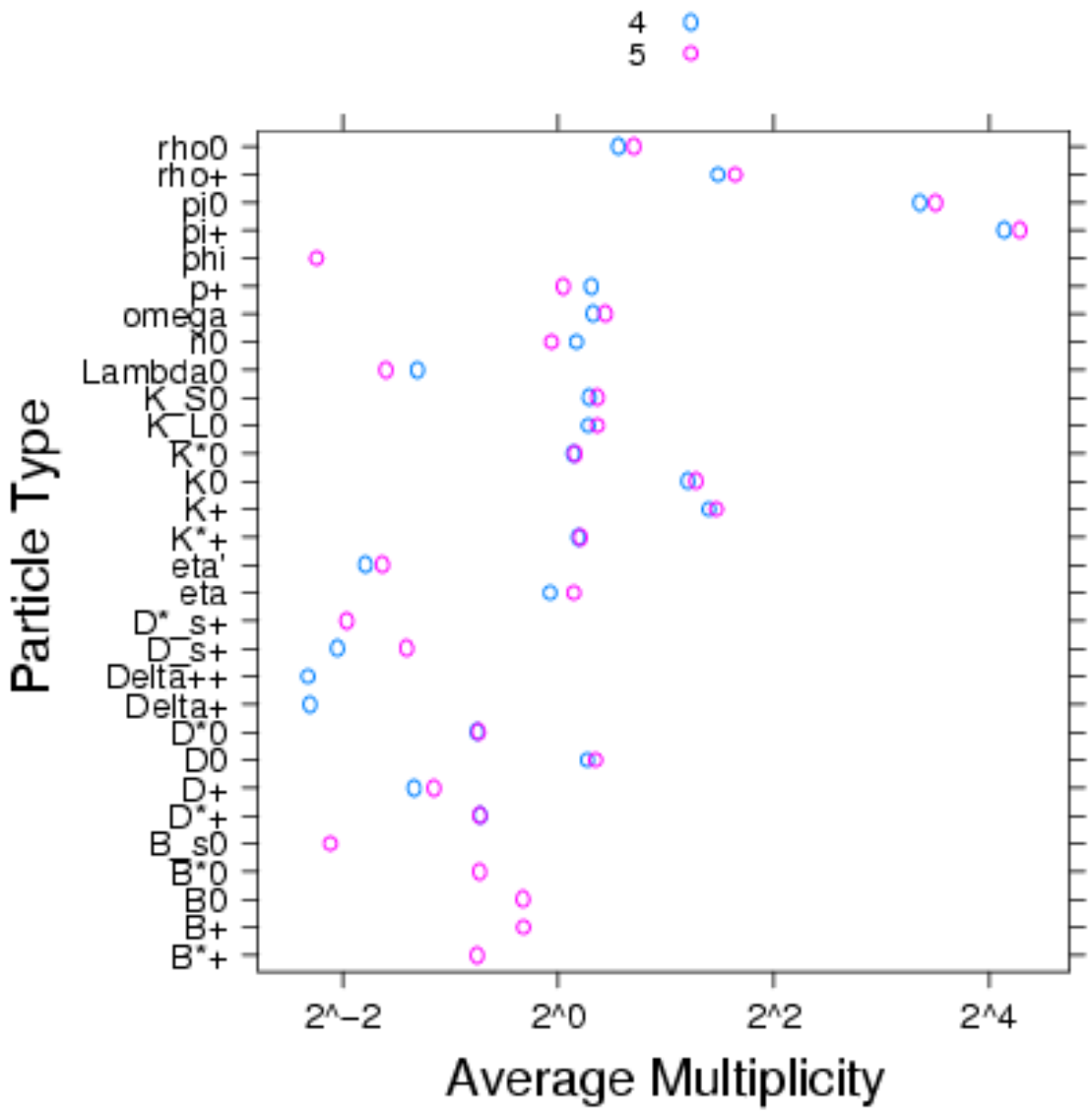
TOF WorkShop

BTeV Overview

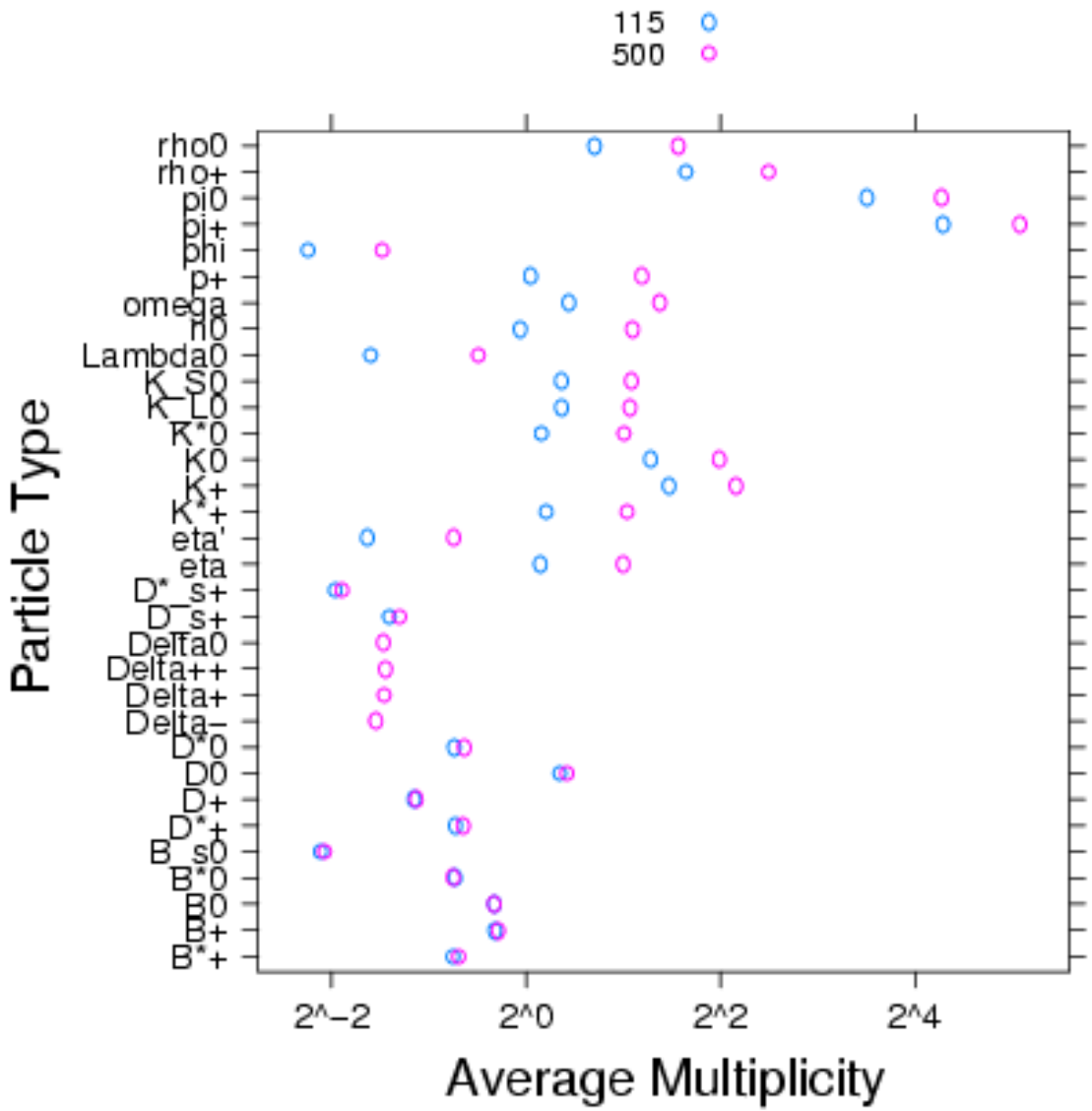
Physics Quantity	Decay Mode	Detector Property				
		Vertex trigger	K/π separation	γ detection	superb τ resolution	lepton id
$\sin(2\alpha)$	$B^o \to \rho\pi \to \pi^+\pi^-\pi^o$	$\surd$	$\surd$	$\surd$		
$\cos(2\alpha)$	$B^o \to \rho\pi \to \pi^+\pi^-\pi^o$	$\surd$	$\surd$	$\surd$		
$\mathrm{sign}(\sin(2\alpha))$	$B^o \to \rho\pi, B^o \to \pi^+\pi^-$	$\surd$	$\surd$	$\surd$		
$\sin(\gamma)$	$B_s \to D_s K^-$	$\surd$	$\surd$		$\surd$	
$\sin(\gamma)$	$B^+ \to D^o K^+$	$\surd$	$\surd$			
$\sin(\gamma)$	$B \to K\pi$	$\surd$	$\surd$	$\surd$		
$\sin(\gamma)$	$B \to \pi^+\pi^-, B_s \to K^+K^-$	$\surd$	$\surd$		$\surd$	
$\sin(2\chi)$	$B_s \to J/\psi\eta', J/\psi\eta$	$\surd$	$\surd$	$\surd$	$\surd$	$\surd$
$\sin(2\beta)$	$B^o \to J/\psi K_s$					$\surd$
$\sin(2\beta)$	$B^o \to \phi K_s, \eta' K_s, J/\psi\phi$	$\surd$	$\surd$	$\surd$		$\surd$
$\cos(2\beta)$	$B^o \to J/\psi K^*, B_s \to J/\psi\phi$					$\surd$
x_s	$B_s \to D_s\pi^-$	$\surd$	$\surd$		$\surd$	
$\Delta\Gamma$ for B_s	$B_s \to J/\psi\eta', K^+K^-, D_s\pi^-$	$\surd$	$\surd$	$\surd$		$\surd$

$D - \bar{D}$ Mixing (?)

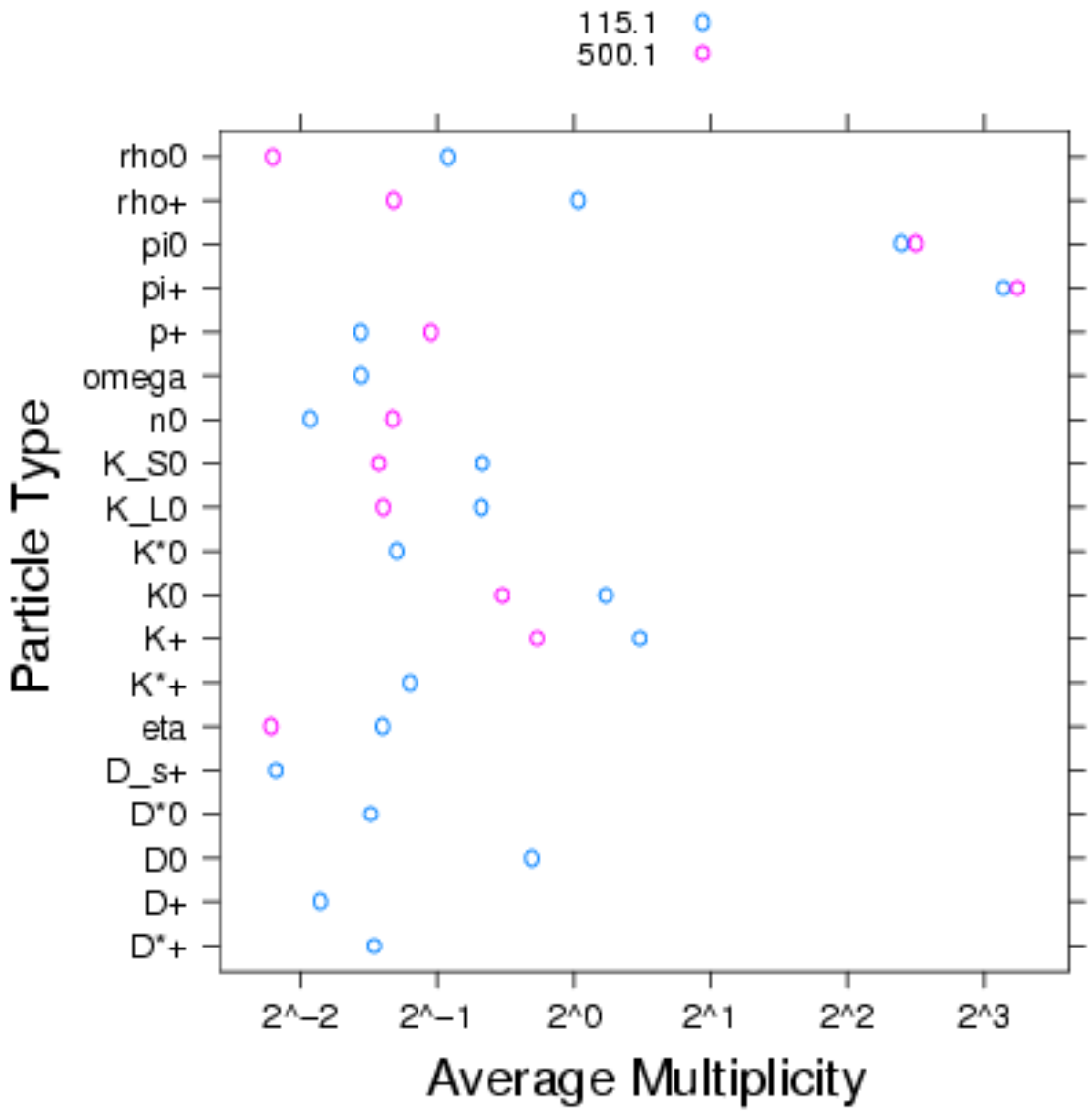
Particle Counting: b vs c at $\sqrt{s} = 115$ GeV



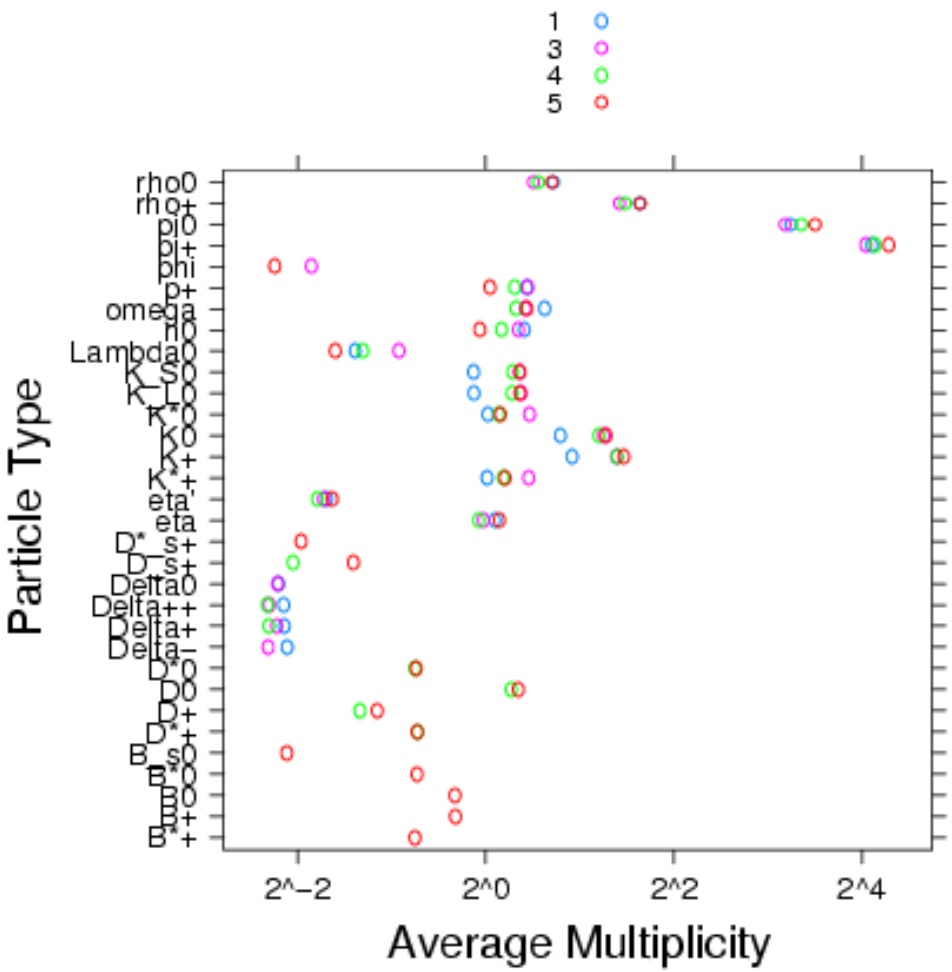
b at $\sqrt{s} = 115$ vs 500 GeV

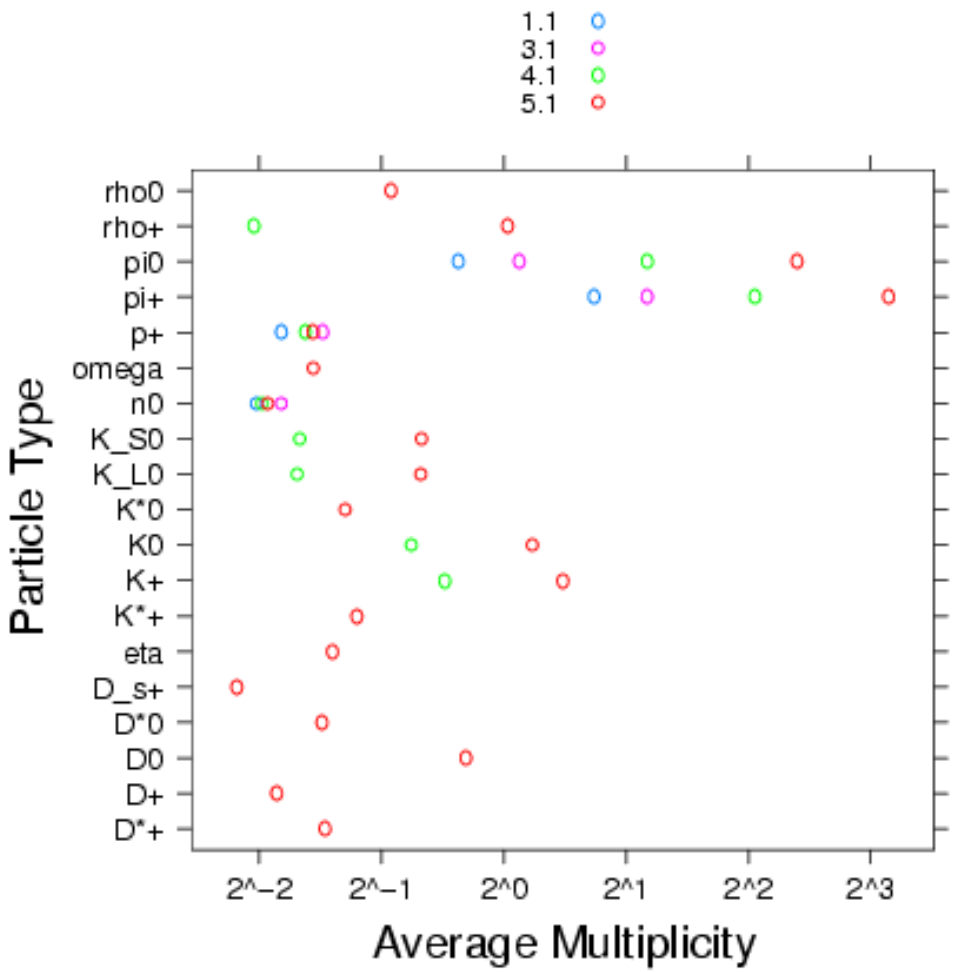


E< 20 GeV && $d > 0.5$ mm

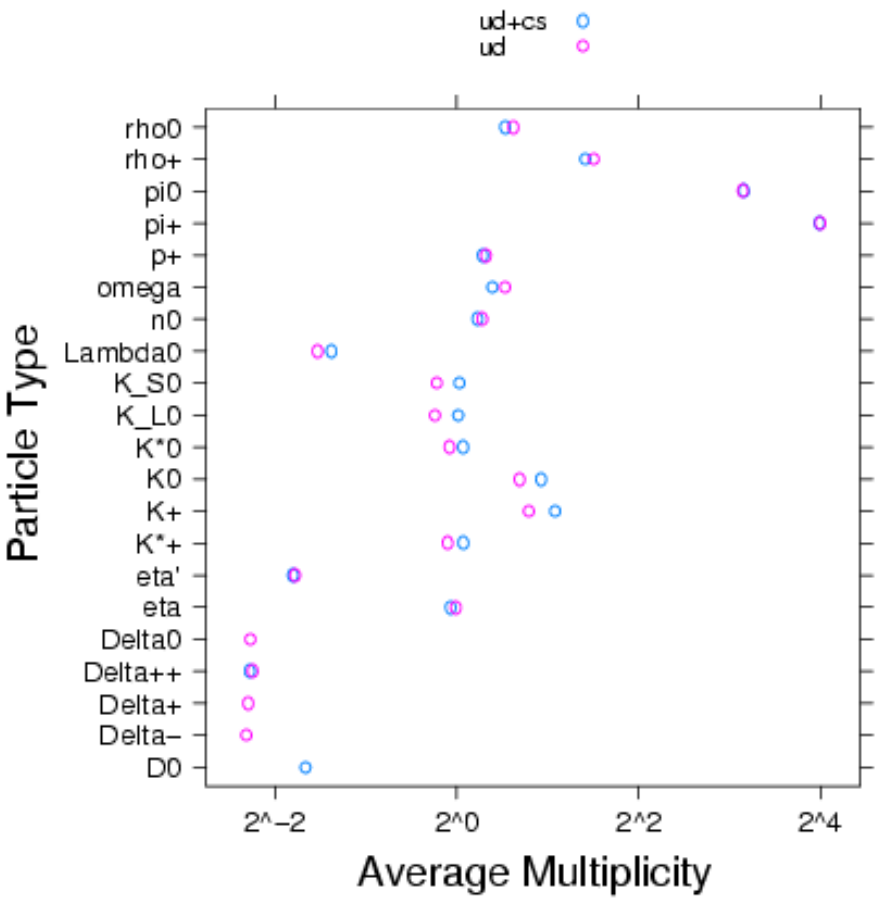


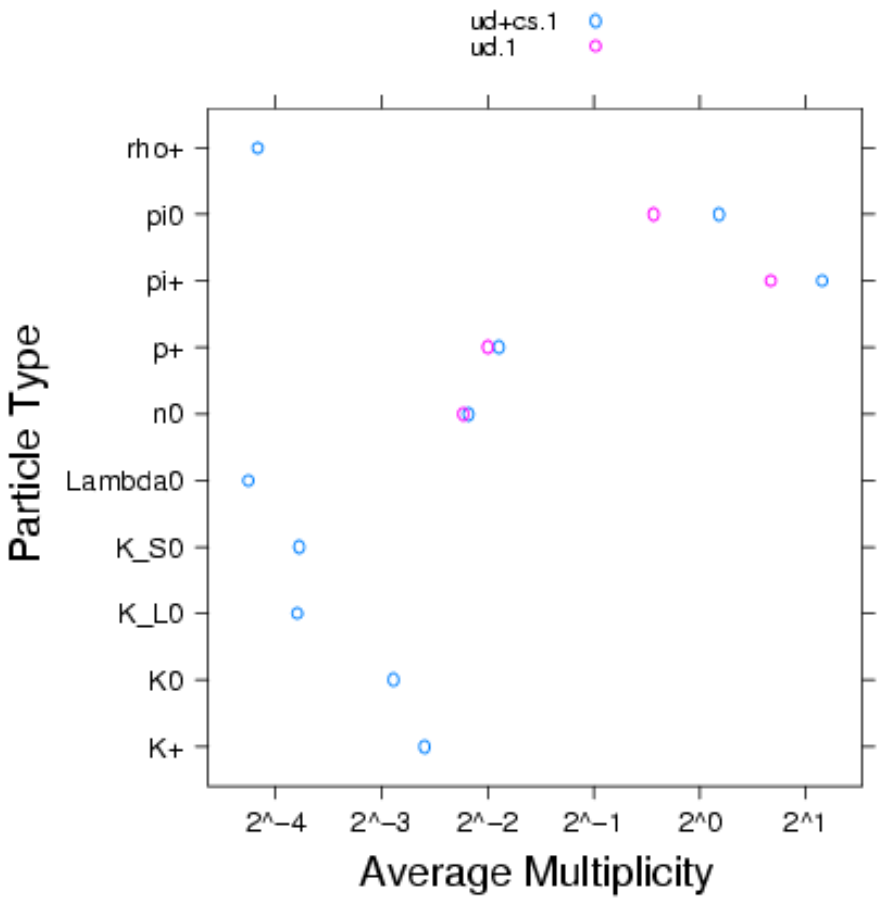
Multiplicity from different hard partons





WW at $\sqrt{s} = 250$ GeV



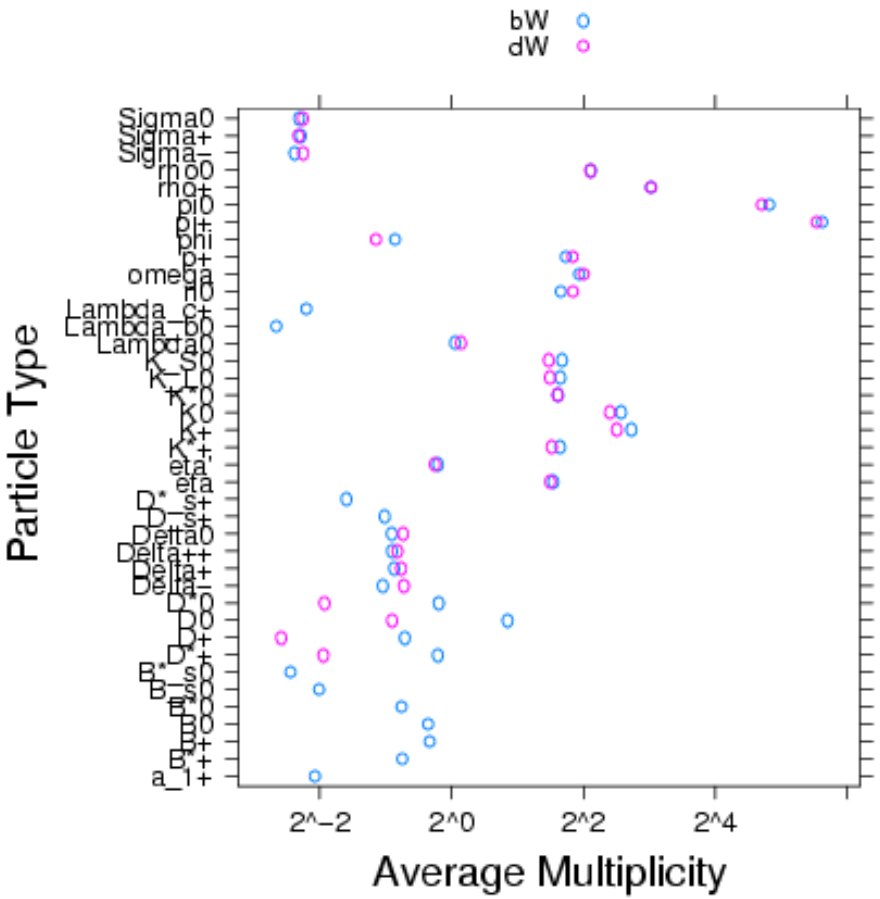


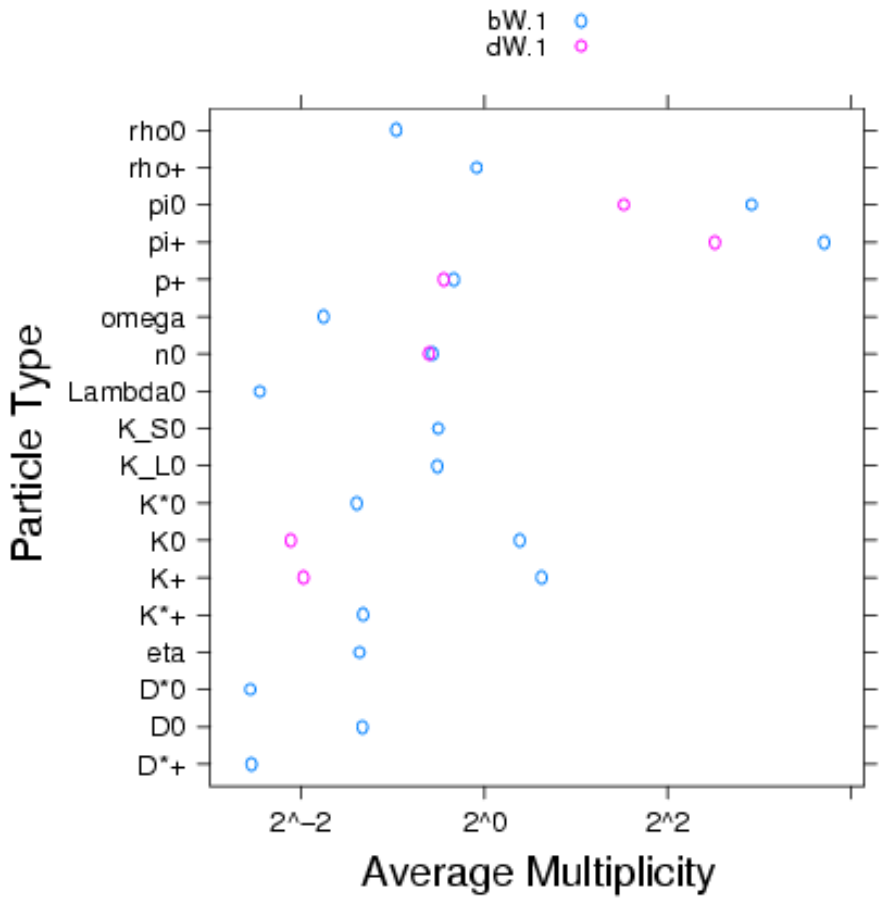
Matched Datasets have a systematically larger rate and different shape

Truncated Datasets contain only $Wb\bar{b} + Wb\bar{b}j$

HO topologies modify shape

$t\bar{t}$ at $\sqrt{s} = 500$ GeV





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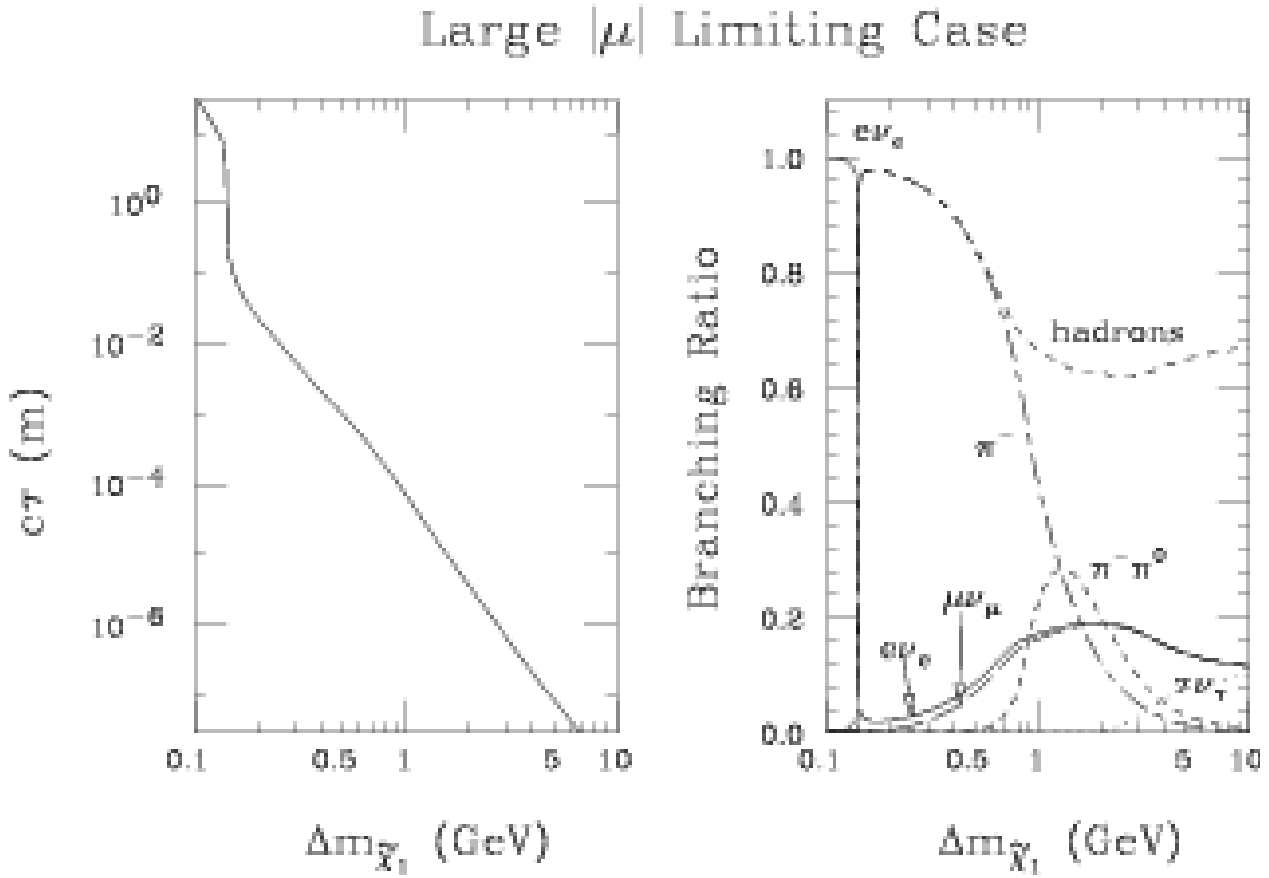
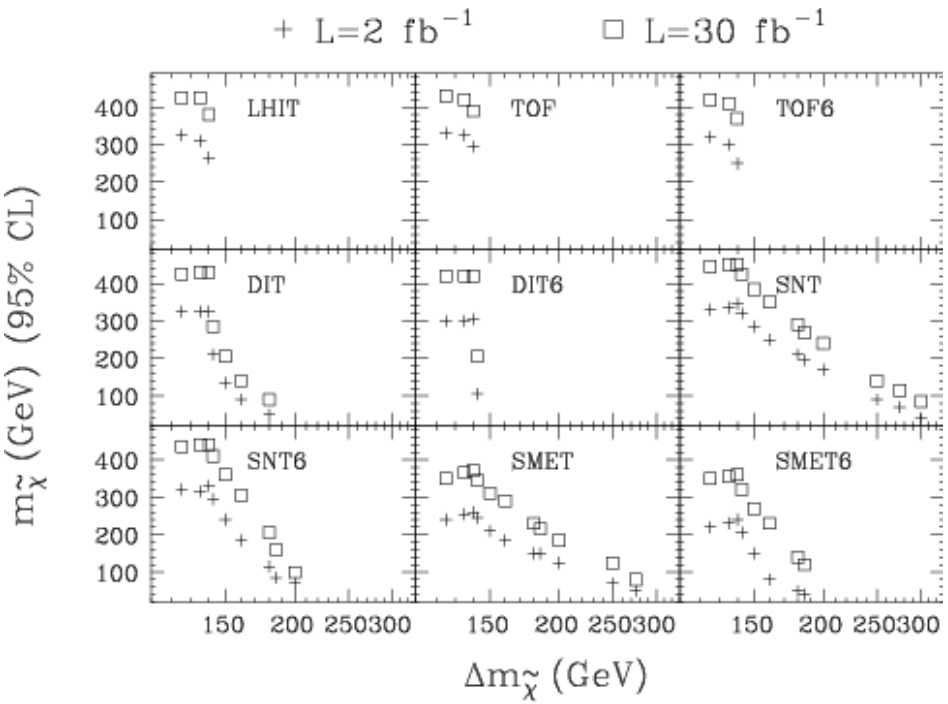
HO topologies modify shape

Long-lived Particles
Nearly Degenerate Charged-Neutral Pairs

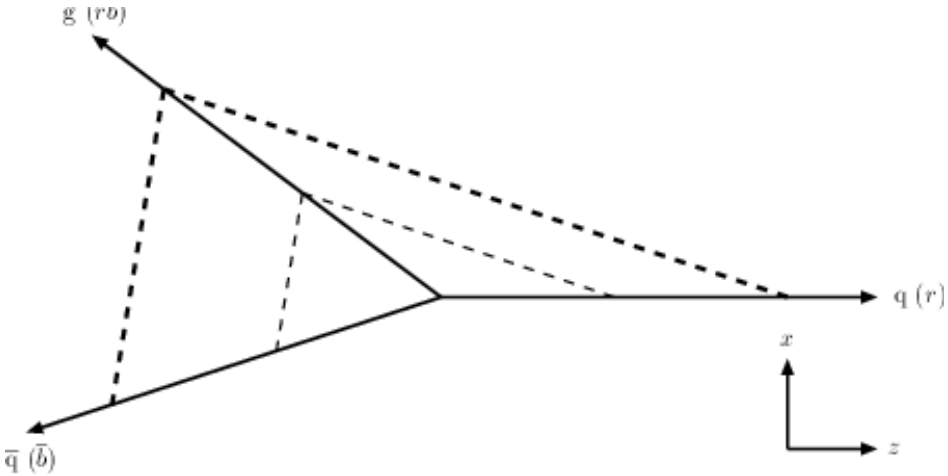


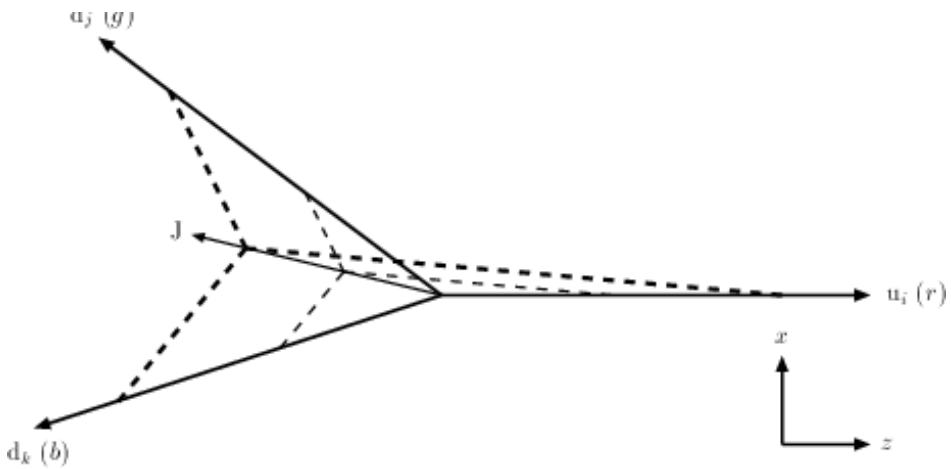
Collider Signatures

Signal	Definition
LHIT	Long, heavily–ionizing ($\geq$ 2MIP's as measured by SVX+CT+PS), large–p_T track that reaches the MC. The energy deposit in the HC in the track direction must be consistent with expected ionization energy deposit for the β measured (using TOF and/or SVX+CT+PS), i.e. no hadronic energy deposit.
TOF	A large–p_T track seen in the SVX and CT along with a signal in the TOF delayed by 500 ps or more (vs. a particle with $\beta = 1$). HC energy deposit (in the direction of the track) is required to be consistent with the ionization expected for the measured β (i.e. no hadronic deposit).
DIT	An isolated, large–p_T track in the SVX and CT that fails to reach the MC and deposits energy in the HC no larger than that consistent with ionization energy deposits for the measured (using SVX+CT+PS) β. Heavy ionization in the SVX+CT+PS, corresponding to $\beta < 0.8$ or $\beta < 0.6$ (DIT8 or DIT6), may be required.
KINK	A track that terminates in the CT, turning into a soft, but visible, charged–pion daughter–track at a substantial angle to parent.
STUB	An isolated, large–p_T (as measured using SVX) track that registers in all SVX layers, but does not pass all the way through the CT. Energy deposits in the EC and HC in the direction of the track should be minimal.
SNT	One or more STUB tracks with no additional trigger. Heavy ionization of the STUB in the SVX, corresponding to $\beta < 0.6$ (SNT6), may be required.
SMET	One or more STUB tracks with an $\not\!\!E_T > 35$ GeV trigger. Heavy ionization of the STUB in the SVX, corresponding to $\beta < 0.6$ (SMET6), may be required.
HIP	A high–impact–parameter ($b \geq 5\sigma_b$) track in the SVX, with large $\not\!\!E_T$ triggering, perhaps in association with a visible KINK in the SVX.
$\gamma + \not\!\!E_T$	Isolated, large–p_T photon and large $\not\!\!E_T$.
monojet+$\not\!\!E_T$	Large–p_T jet and large $\not\!\!E_T$.
mSUGRA–like	jet(s)+$\not\!\!E_T$, tri–leptons, like–sign di–leptons, *etc.*, except that the cross section for the $\tilde{\chi}_1^{\pm}\tilde{\chi}_2^0$ tri–lepton signal can be suppressed.



R Parity Violation and Baryon Production





RPV Signature