Physics Prospects at the LHC

- Introduction
- SM Higgs
- SUSY Higgs
- SUSY
- Extra Dimensions
- Beyond the LHC Baseline
- Conclusions

Emphasis on results since Snowmass '96

M. Shapiro, U.C. Berkeley/LBNL

Introduction: New physics at the LHC

Physics Motivation for the LHC has not changed:

- General arguments regarding unitarity imply that either $m_H \lesssim 750$ GeV or new physics or both

Past 5 years have seen a blossoming of theoretical possibilities:

- Models of SUSY breaking
  - Gravity mediation
  - Gauge mediation
  - Anomoly mediation
- Composite Higgs
- Extra Dimensions

And new experimental input:

- LEP II: $M_h > 107.7$ GeV
- Precision Electroweak: $M_h < 188$ GeV at 95%CL within SM
- No evidence for SUSY from LEP or Tevatron

It is sensible to review LHC capabilities within context of these new developments

Topics Not Covered Here

- This talk will concentrate on prospects for physics of EWSB and direct observation of new phenomena at the TeV scale
- LHC, of course, will make many other contributions:

$\Delta(m_t)$	<2 GeV
$\Delta(m_W)$	<15 MeV
$\sin 2\beta$	$\sim$ 0.012
Quark Compositeness	up to 40 TeV
New W's/Z's	$\sim$3-6 TeV
Anomalous W Couplings	$\Delta\kappa_g < 0.035$, $\Delta\lambda_g < 0.0025$

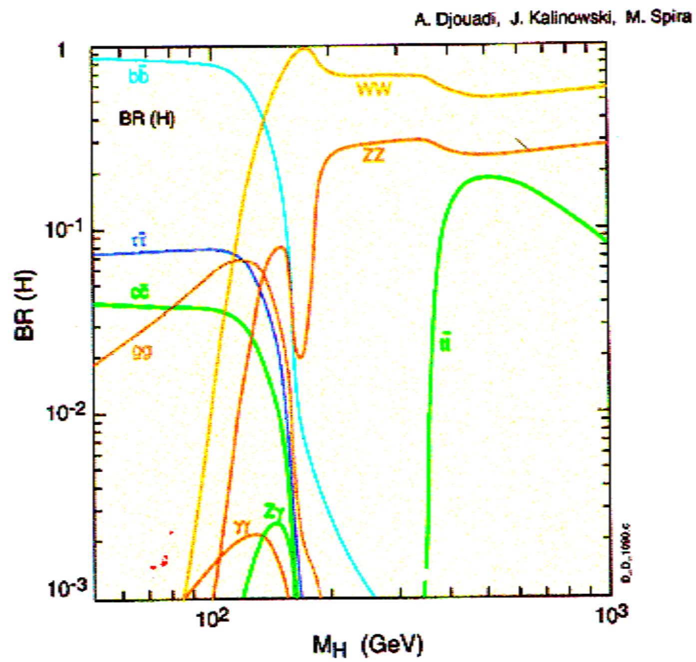
(see, eg, Atlas Physics TDR for details)

Standard Model Higgs

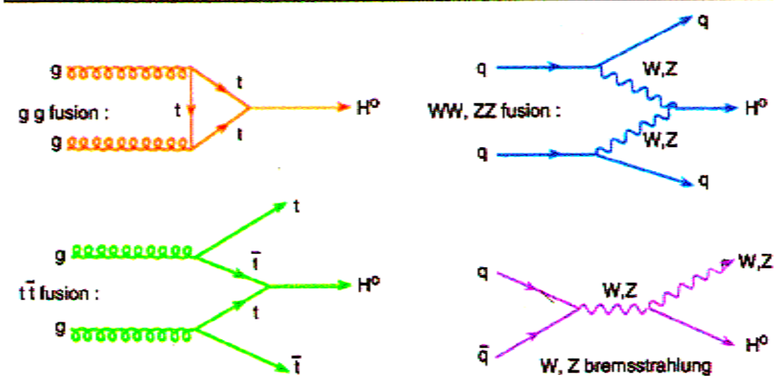
SM Higgs remains a benchmark process for LHC

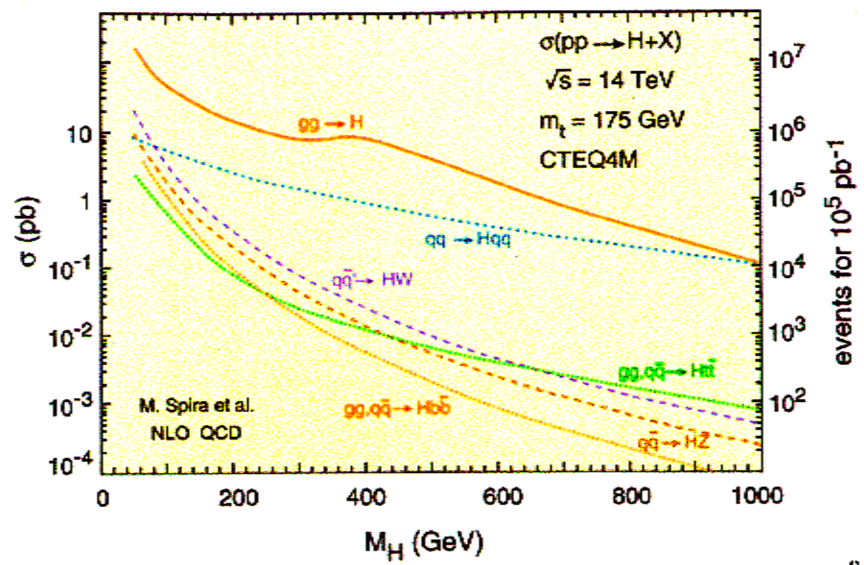
- Search strategies developed for complete mass range
- EW results $\longrightarrow$ greatest emphasis on $m_h < 200$ GeV

Higgs Branching Ratios



H^o production at hadron colliders:





But : BR ($H \to Z^o Z^o \to 4 l^{\pm}$) = $1.4 \cdot 10^{-3}$

BR ($H \to Z^o Z^o \to 4 \mu^{\pm}$) = $3 \cdot 10^{-4}$

Search Strategies

Focus on discovery (5σ) not exclusion

- Accessible modes vary with mass
- For $m_h < 190$ at least 2 search channels at each mass
- Channels with low background and/or good resolution observable from gg fusion mode
- Higher background or worse resolution require associated production
  - W/Z
  - $t\bar{t}$
  - forward tagged jets

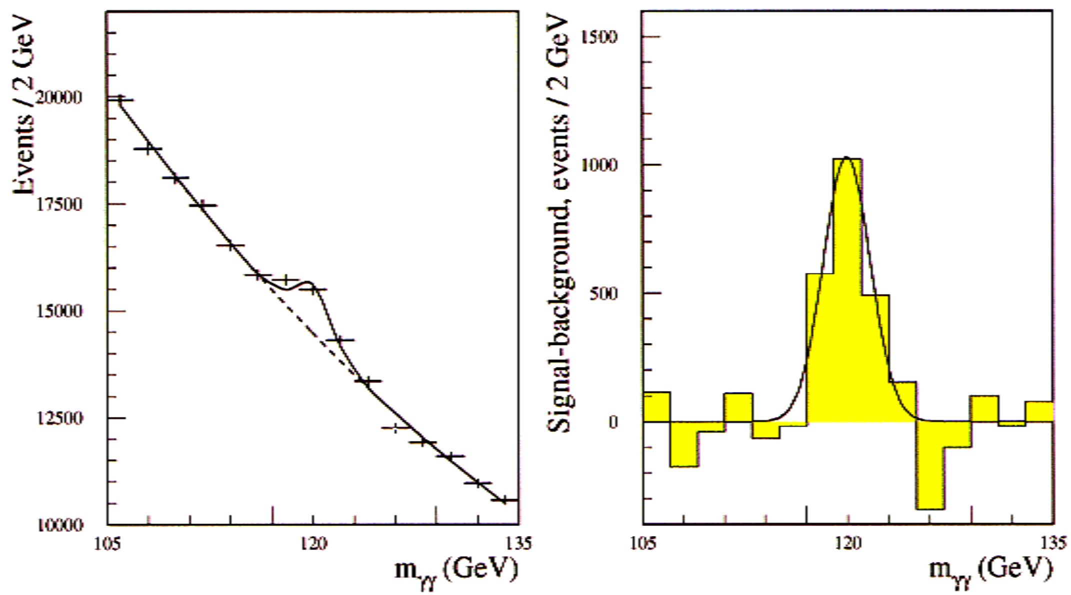
Search modes:

- $h \to \gamma\gamma$ $(100 < m_h < 150)$ Direct and associated
- $h \to b\bar{b}$ $(100 < m_h < 130)$ Associated
- $h \to ZZ^* \to 4\ell$ $(120 < m_h < 180)$
- $h \to WW^{(*)} \to 4\ell$ $(150 < m_h < 190)$ Direct and associated
- $h \to ZZ$ $(m_h > 180)$

$h \to \gamma\gamma$

In direct channel dominant background real $\gamma\gamma$ pairs not fakes

- Good mass resolution (including pointing to vertex) essential
- Needs full LHC luminosity



100 fb^{-1}, Atlas

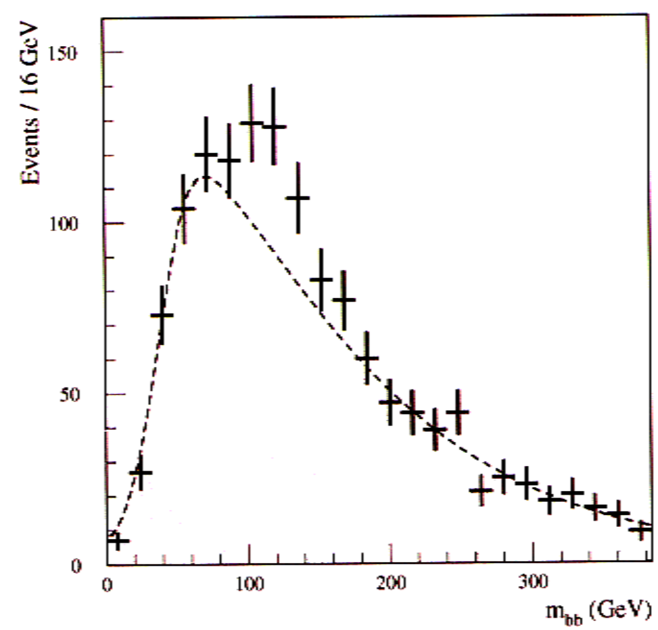
Associated production is clean, but rate limited

Works for $100 < m_h < 150$ GeV

$h \to b\bar{b}$

Large QCD background

- Requires excellent b-tagging efficiency
- Depends on good jet mass resolution
- Requires associated production (W/Zh or $t\bar{t}h$)
- Detailed studies with full Geant simulation

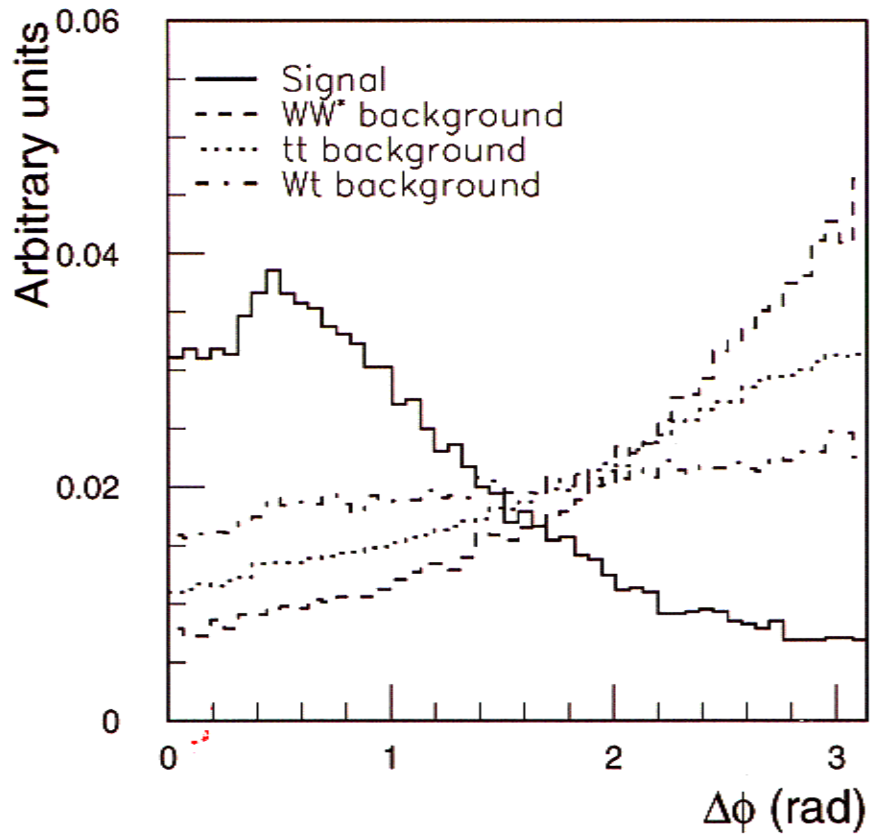


$t\bar{t}h$, $m_h = 120$ GeV, 100 fb^{-1}, Atlas

Works for $100 < m_h < 130$ GeV

$h \to 4\ell$

- Most important channel $ZZ^{(*)}$
- Need WW^* near 160 GeV
  - In this region, must use angular distribution to separate signal and background
- In 4 charged lepton mode, mass resolution excellent
  In mode with ν's, mass only known ∼3-5 GeV



$h \to \tau\tau$ in qqh ($qq \to qqh$)

- Would allow measurement of $h\tau\tau$ coupling
- Requires 1 leptonic decay (for trigger) plus τ jet identified with calorimeter and tracker
- Forward jet tagging
- May only work at low luminosity (τ ID)
- Studied by CMS:

Process	$\sigma \cdot$ BR	Events for 30 fb^{-1} with selection cuts
qqh ($m_h = 135$)	0.17 pb	7.4
QCD Z+jj	3.94 pb	1.2
EW Z+jj	33.6 fb	0.76

- Very low rate but good S/B if $\tau\tau$ mass resolution good

At the time of Les Houches workshop

A. Nikitenko. contribution for Les Houches workshop

τ - jet identification obtained with full simulation of CMS calorimetry

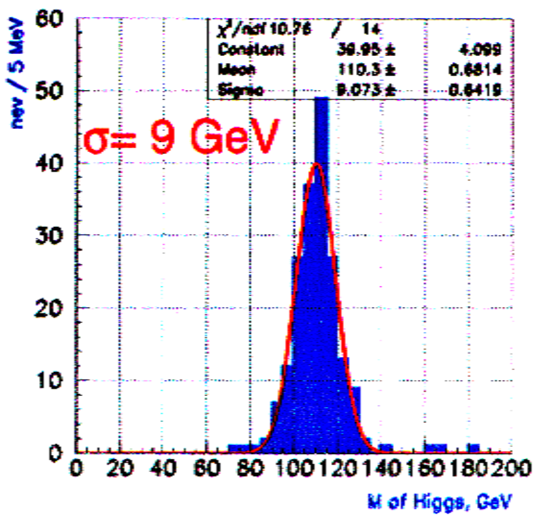
(R. Kinnunen, A. Nikitenko CMS Note 1997/002)

1. electromagnetic collimation: $\Sigma E_t^{cryst}(R<0.13) / \Sigma E_t^{cryst}(R<0.4) > r_{cut}$
2. calorimeter isolation : max $E_t^{ecal+hcal\ cell}(0.13<R<0.40) < E_t^{cut}$
3. one $p_t^{hadr} > 10$ GeV, no tracks $p_t > 2$ GeV in cone 0.4

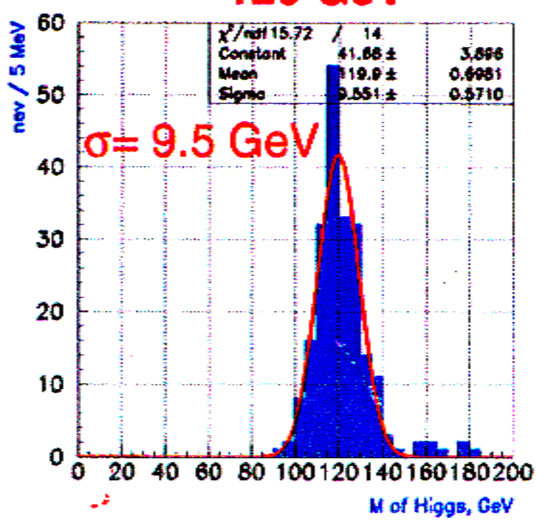
efficiency for τ-jet E_t>40 GeV from Higgs of 140 GeV = 0.32
misidentification for jet from W+jet events = 0.0019; b-jet from bb events < 0.001

Higgs mass reconstruction assuming m_τ=0

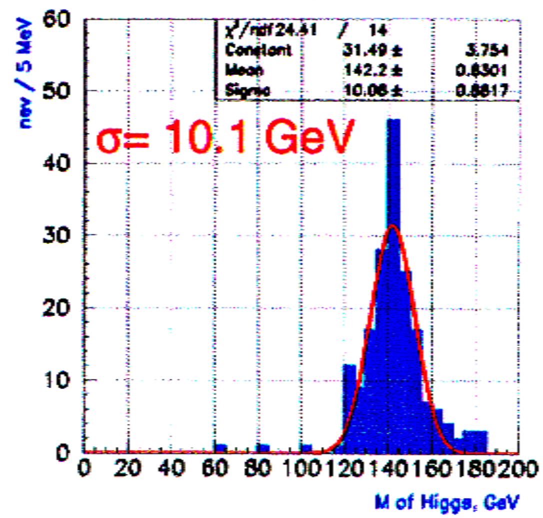
110 GeV



120 GeV



140 GeV



11

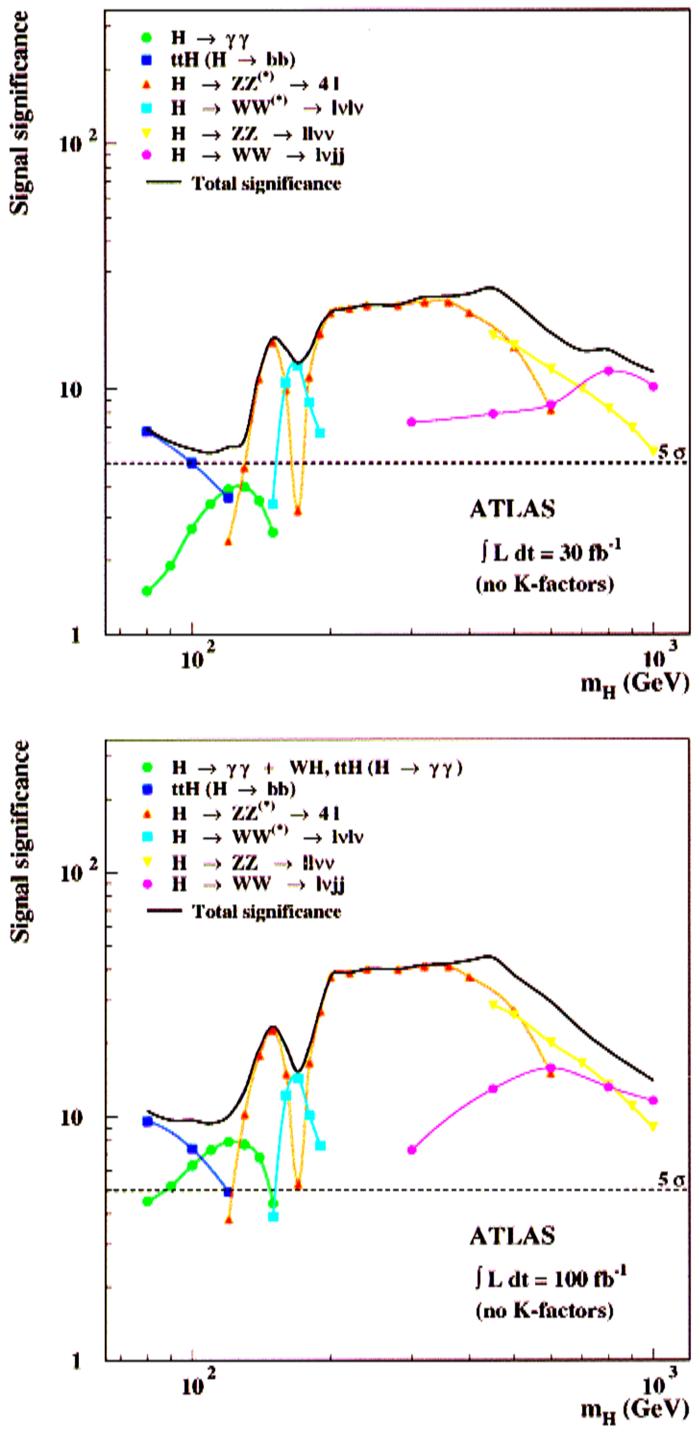


Figure 19-I ATLAS sensitivity for the discovery of a Standard Model Higgs boson. The statistical significances are plotted for individual channels, as well as for the combination of all channels, assuming integrated luminosities of 30 fb^{-1} (top) and 100 fb^{-1} (bottom). Depending on the numbers of signal and background events, the statistical significance has been computed as $S/\sqrt{B}$ or using Poisson statistics. In the case of the $H \rightarrow WW^*$ channel, a systematic uncertainty of ±5% on the total number of background events has been assumed (this uncertainty has been included in this case, since no mass peak can be reconstructed and the Higgs boson signal has therefore to be extracted from an excess of events).

Determination of SM Higgs Parameters

Concentrate here on region preferred by EW measurements:

- Mass: $\Delta m/m \simeq 10^{-3}$
- Width: Resolution dominated for $m_h < 200$ GeV, $\Delta\Gamma/\Gamma \sim 6\%$ asymptotically
- Couplings and Branching Ratios:
  - $\frac{BR(h\to\gamma\gamma)}{BR(h\to b\bar{b})} \sim 30\%$ for $80 < m_h < 120$
  - $\frac{BR(h\to\gamma\gamma)}{BR(h\to ZZ^*)} \sim 15\%$ for $125 < m_h < 155$
  - $\frac{g(tth)}{g(hWW)} \sim 25\%$ for $80 < m_h < 120$
  - $\frac{g(hZZ)}{g(hWW)} \sim 30\%$ for $160 < m_h < 180$
  - $h \to \tau\tau$ studies in progress

Above for 300 fb^{-1}. All dominated by statistical error.

Some things are extremely difficult:

- Spin (except $h \to \gamma\gamma$ would exclude spin 1)
- CP structure
- Precision measurement of couplings
- $h \to c\bar{c}$ (not studied yet)

SUSY Higgs

In MSSM, 5 SUSY Higgs:

$$h,\ H,\ A,\ H^{\pm}$$

- At tree-level, mases and couplings depend only on two parameters (choose m_A, $\tan\beta$).
- Loop corrections (top or SUSY), however, modify masses and mixings
- Studies done with two-loop equivalent calculations of masses and couplings, one-loop for some decay BRs

Two possible scenarios for SUSY Higgs

- All Higgs lighter than m_{SUSY}: Decays to SM particles, eg:
  - $h \to b\bar{b}$, $h \to \gamma\gamma$
  - $H \to ZZ \to 4\ell$
  - $H/A \to \tau\tau$, $H/A \to \mu\mu$ at large $\tan\beta$
  - $H/A \to t\bar{t}$
  - $A \to Zh$
  - $H \to hh$
- Heavy Higgs can decay to SUSY particles
  - To date, studied in SUGRA models only

Models with Heavy SUSY Particles

$h, H, A \to \gamma\gamma$:

- Search strategy same as SM h
- In general, BR suppressed relative to SM $\to$ requires high luminosity
  - 5σ discovery $m_A > 160$ plane for $\tan\beta > 2$ when all SUSY particles heavy
  - Problematic for $m_{\tilde{t}} < 400$ GeV (destructive t-$\tilde{t}$ interference in gg production)

$h \to b\bar{b}$:

- Observable in $t\bar{t}h$ only (this requires full reconstruction)
- Essential for 5σ discovery in 100 fb^{-1} for $3 < \tan\beta < 10$, $120 < m_A < 220$

$H \to ZZ^{(*)} \to 4\ell$:

- Strongly suppressed, except at low $\tan\beta$ (opening of $H \to hh$ and $H \to t\bar{t}$)
- Covers $\tan\beta < 2$ and $150 < m_A < 350$

$H/A \to \tau\tau$

- For wide range of MSSM, large enhancement in ττ BR over SM
- At high $\tan\beta$, $b\bar{b}H/A$ production strongly enhanced
- 5σ discovery for $m_A > 100$ for $\tan\beta > 10$-15

Charged Higgs

If $H^{\pm} < m_t$, $t \rightarrow H^+ b$

- $H^+ \rightarrow \tau^+ \nu$: 5σ discovery for $m_A > 150$, no mass measurement
- $H^+ \rightarrow c\bar{s}$: Reconstruction of mass peak for $110 < m_H < 130$

If $H^{\pm} > m_t$, $H^+ \rightarrow t\bar{b}$

- $bg \rightarrow H^{\pm}t$, $gg \rightarrow H^{\pm}tb$ ($b + 2t$ final states)
- $H^{\pm}tb$ coupling $\sim (m_t \cot\beta \pm m_b \tan\beta)$: minimum at $\tan\beta \sim 7.5$
- Discovery at large and small $\tan\beta$

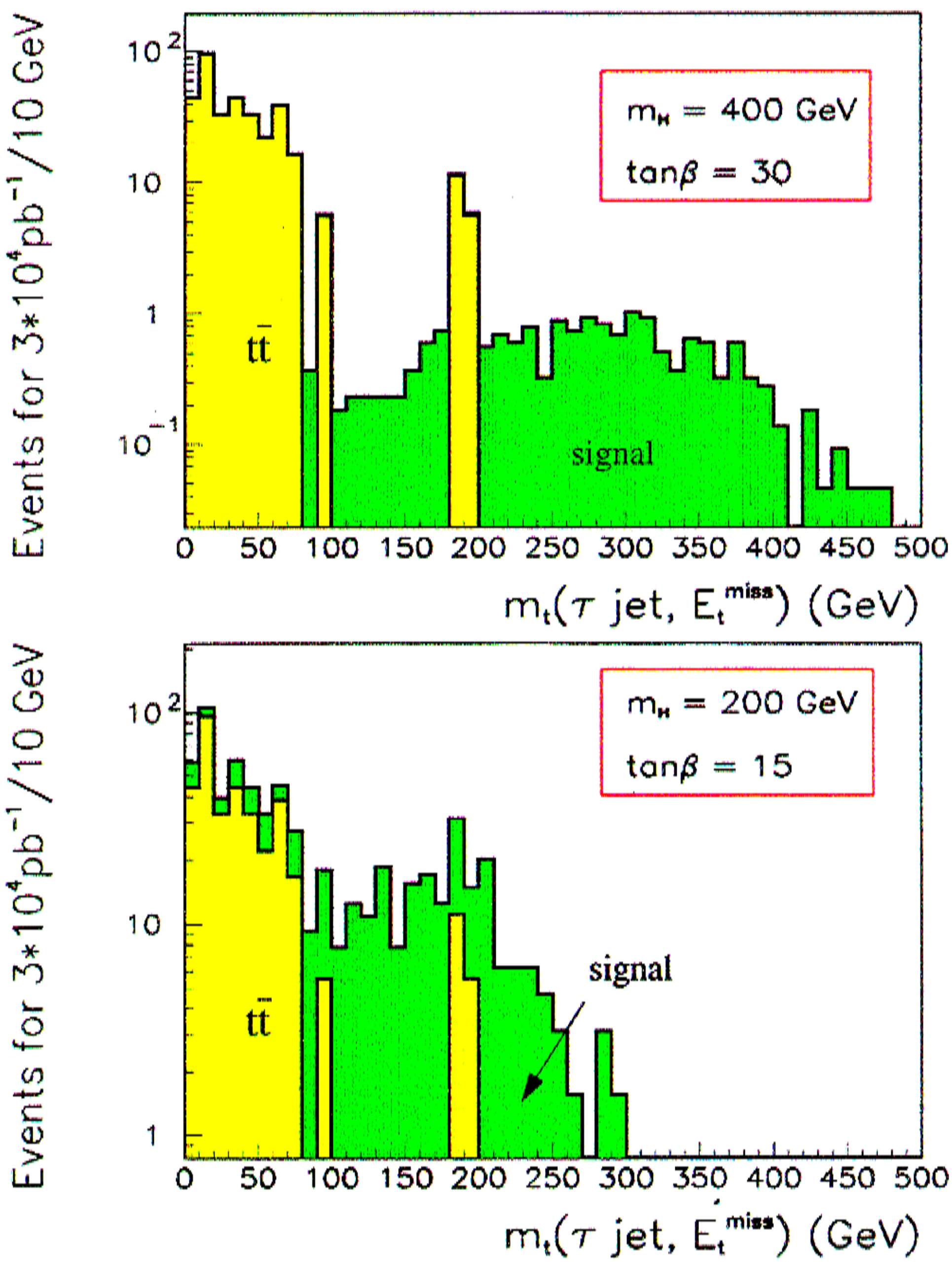
$H^{\pm}$ signal visibility in transverse mass $\tau - E_t^{miss}$ for $H^{\pm} \to \tau\nu$ mode

$m_t(\tau\ \text{jet}, E_t^{miss})$

signal / background for $3 * 10^4\ pb^{-1}$

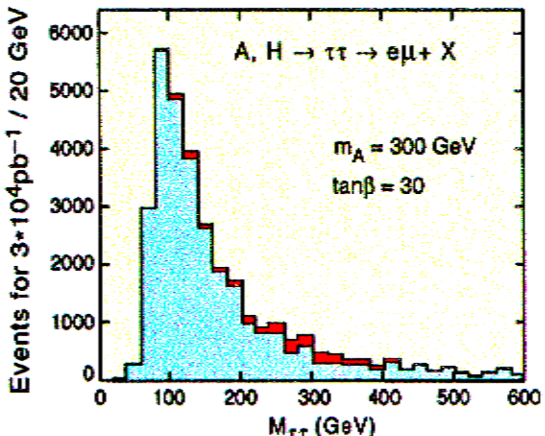
no $\Delta\phi(\tau\ \text{jet}, E_t^{miss})$ cut

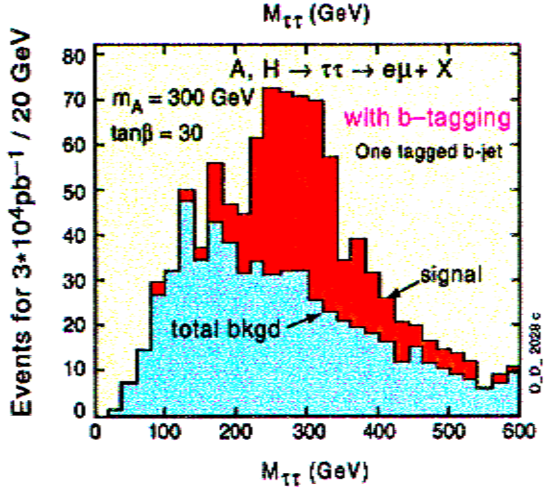
$pp \to tH^{\pm}, H^{\pm} \to \tau\nu,\ t \to qqb$



$H_{SUSY} \rightarrow \tau\tau \rightarrow e^+ + \mu^- + X$

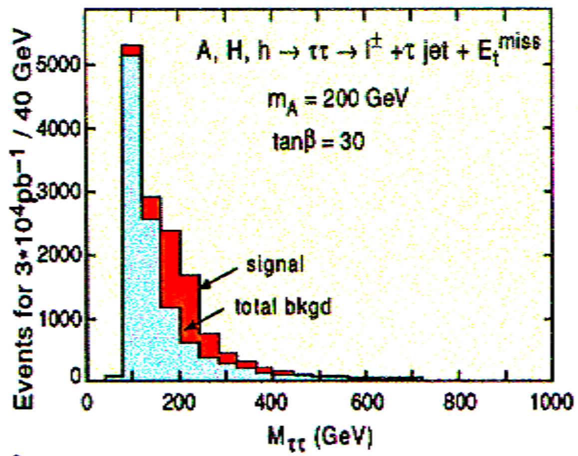
Events selected as:
$p_t^{e,\mu} > 20$ GeV, isolated leptons, $\Delta\phi(e,\mu) < 175^o$

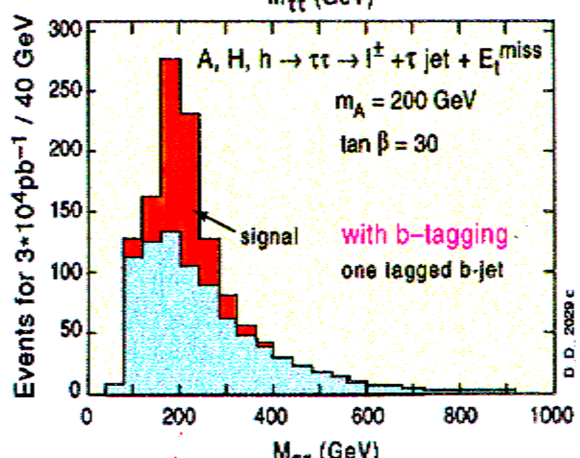




$H_{SUSY} \rightarrow \tau\tau \rightarrow l^{\pm} + h^{\mp} + X$

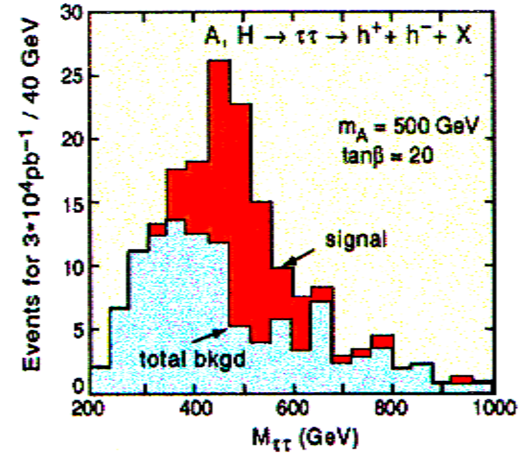
Events selected as : $E_t^{jet} > 40$ GeV,
$p_t^{l} > 15$ GeV, $\Delta\phi(jl) < 175^o$, $E_{miss} > 20$ GeV



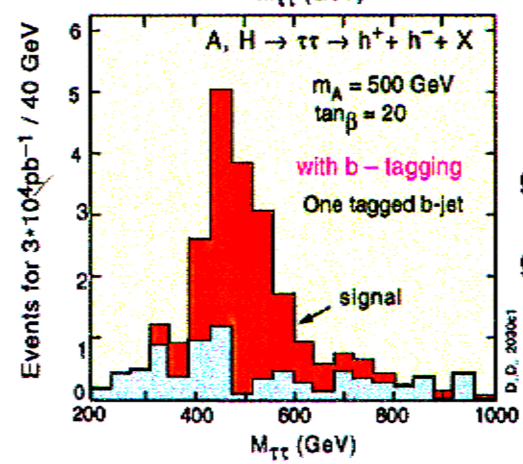


$H_{SUSY} \rightarrow \tau\tau \rightarrow h^+ + h^- + X$

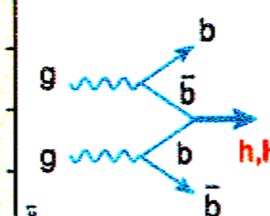
Events selected as: $E_t^{jet} > 60$ GeV
$p_t^{h} > 40$ GeV, $\Delta\phi(jj) < 175^o$, $E_t^{miss} > 40$ GeV



Inclusive H_{SUSY} search



Search in bbH_{SUSY} channels:



Fermilab 9

18

Discovery in MSSM

- For MSSM (heavy SUSY particles) whole plane covered with 100 fb^{-1}
- Much of parameter space:
  - More than 1 channel
  - % level precision on masses and $\tan\beta$
- Intermediate $\tan\beta$ most difficult
  - Only h detected
  - Difficult to tell SM from SUSY in decoupling limit

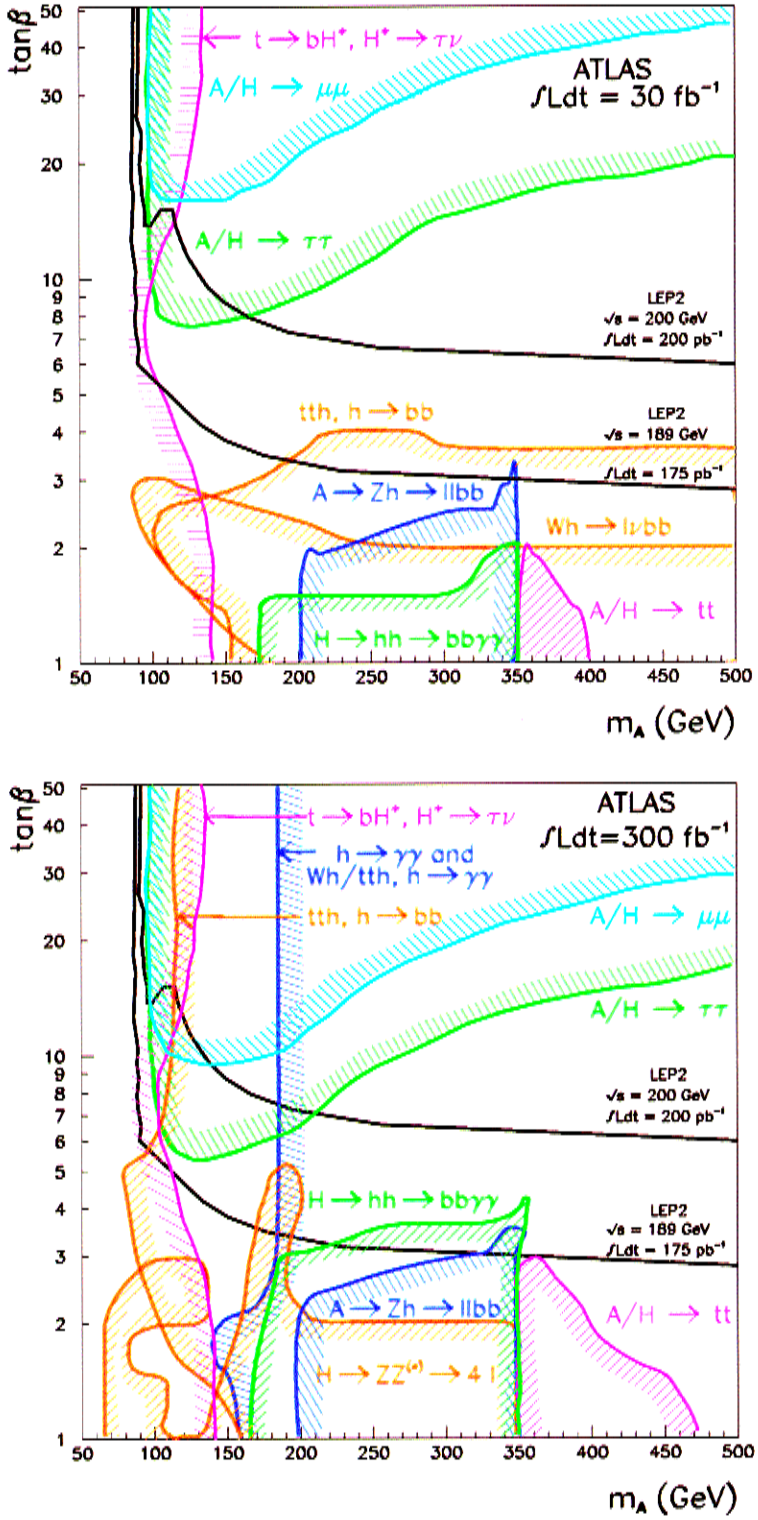


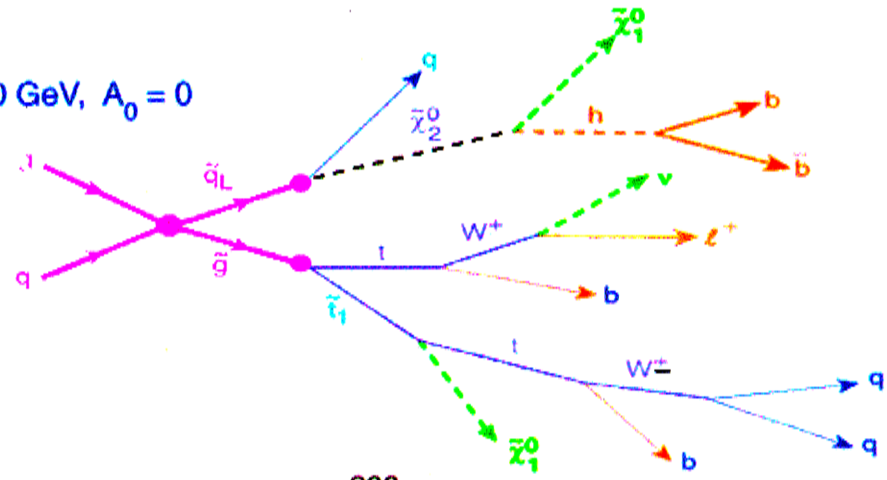
Figure 19-II ATLAS sensitivity for the discovery of MSSM Higgs bosons (in the case of minimal mixing). The 5σ discovery contour curves are shown in the (m_A, tanβ) plane for individual channels and for integrated luminosities of 30 fb^{-1} (top) and 300 fb^{-1} (bottom). Also included are the present LEP2 limit (for an integrated luminosity of 175 pb^{-1} per experiment) and the expected ultimate LEP2 limit (for an integrated luminosity of 200 pb^{-1} per experiment at a centre-of-mass energy of 200 GeV).

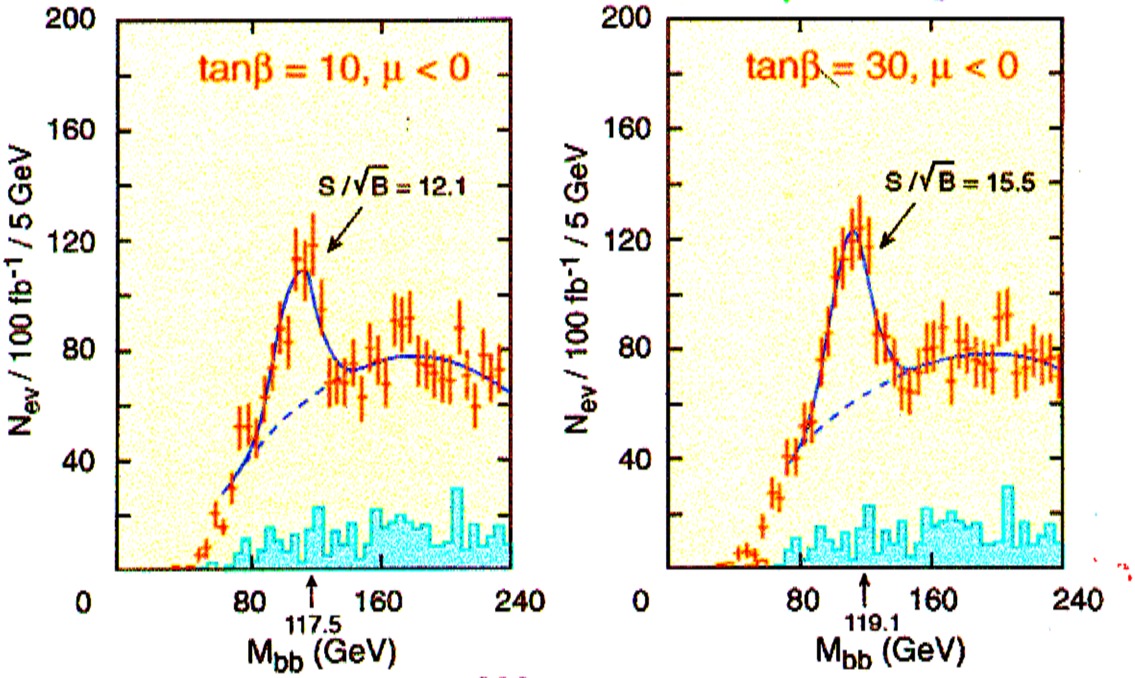
$h \rightarrow b\bar{b}$ production in massive $\tilde{q}$ and $\tilde{g}$ cascade decays

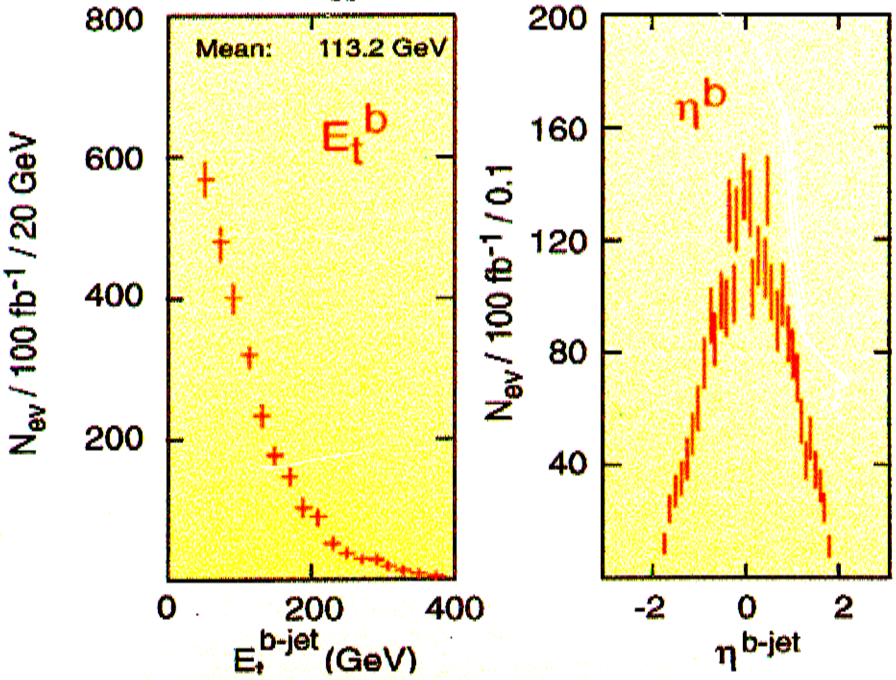
mSUGRA

$m_0 = 500$ GeV, $m_{1/2} = 500$ GeV, $A_0 = 0$

event topology:





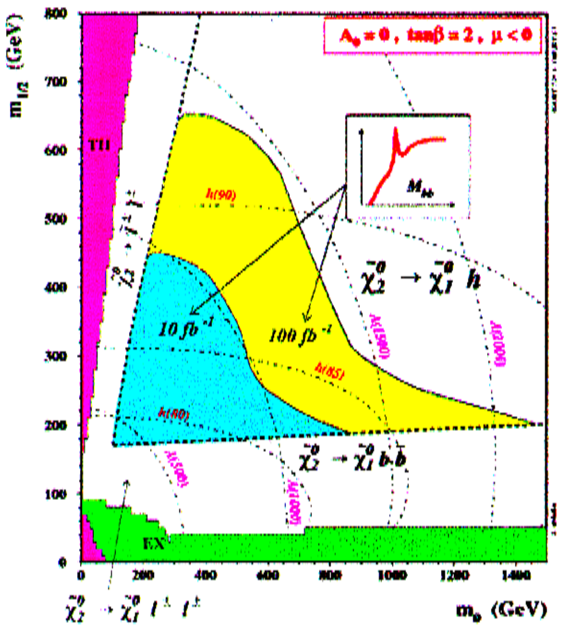


→ b-jets are hard and very central

CMS Coll. Meeting 99-28

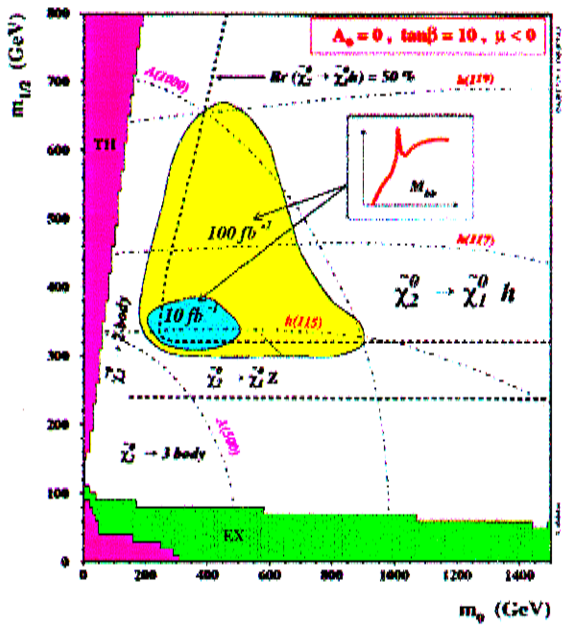
Domains of visibility of the $h \to b\bar{b}$ peak with nominal CMS performance in mSUGRA-SUSY

$S/\sqrt{B} > 5$



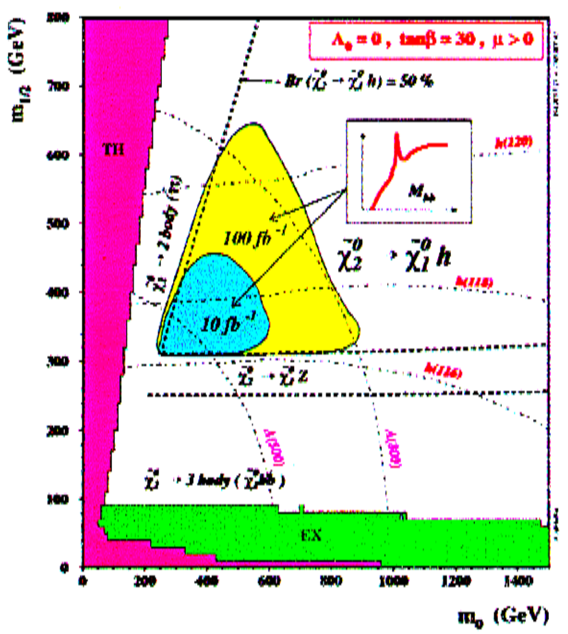
Domains of visibility of the $h \to b\bar{b}$ peak with nominal CMS performance in mSUGRA-SUSY

$S/\sqrt{B} > 5$



Domains of visibility of the $h \to b\bar{b}$ peak with nominal CMS performance in mSUGRA-SUSY

$S/\sqrt{B} > 5$



CMS NOTE 1997/070

Higgs with Open Channels for Sparticle Decay

Ability to see heavy Higgs compromised in many scenarios where they decay to sparticles

- Lost in the "background" of SUSY
- As masses increase, production rate decreases
- Some regions of parameter space, it IS possible to see signals. But in others it is not.

In general, previous results for h not affected significantly

May need an NLC to see the heavy higgs if $m_H > 2M_{SUSY}$

SUSY at the LHC

If weak-scale SUSY exists, then LHC is a SUSY factory

- Rate dominated by pair production of strongly coupled sparticles
- In many cases, production of weakly coupled particles dominated by cascade decays of $\tilde{q}$ and $\tilde{g}$
- Isolation of a SUSY dominated sample based on simple kinematic cuts possible in al cases
- But all SUSY processes contribute at once

The background to SUSY is SUSY

To understand sensitivity must generate all processes at once within context of a consisten SUSY model

Models characterised by mechanisms of SUSY breaking

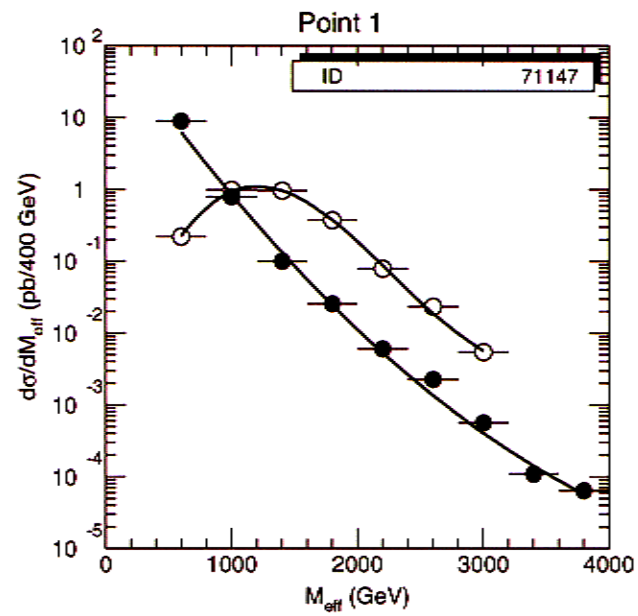
- Gravity Mediation (SUGRA)
  - SUSY breaking via gravitational interactions at GUT scale
  - Parameterized in terms of m_0, $m_{1/2}$, $\tan\beta$, A_0, $sign(\mu)$
  - R-parity a good symmetry $\rightarrow$ missing E_T
- Gauge Mediation
  - SUSY breaking via gauge interactions with messenger sector
  - Parameterized in terms of Λ, M_m, N_5, $\tan\beta$, $sign(\mu)$ and C_{grav}
  - True LSP is almost massless Gravatino
  - NLSP decays to LSP with lifetime that depends on C_{grav}
    ct can be large or small compared to detector radius
  - If NLSP short lived, no missing E_T
- Anomoly Mediation
  - Simplest version produces tachyonic sleptons
  - Need additional SUSY breaking to build realistic model
    * mAMSB: Universal $\tilde{q}$ masses
    * DAMSB: Heavy new fields

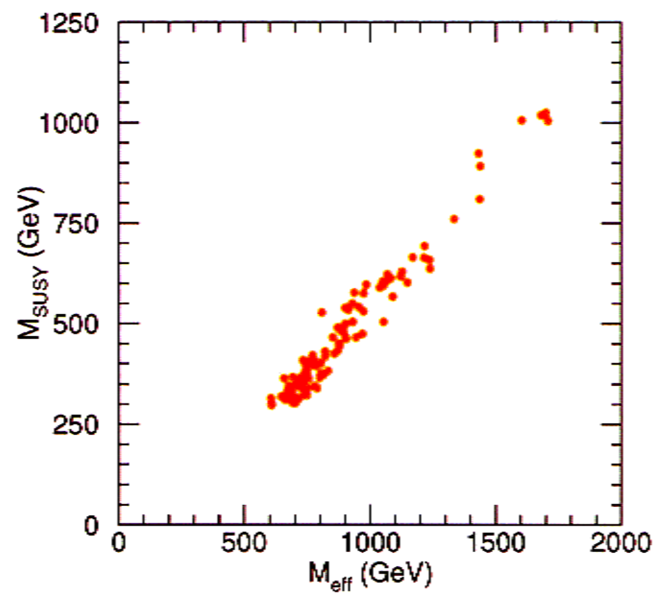
Establishing the SUSY scale

Select events with at least 4 jets and Missing E_T

A simple variable :

$$M_{\text{eff}} = P_{t,1} + P_{t,2} + P_{t,3} + P_{t,4} + \not{E}_T$$





SUSY signal emerges from QCD background

M_{eff} correlates with M_{SUSY}

Following decays chains in SUGRA

Both $\widetilde{q}$ and $\widetilde{g}$ produced; one decays to the other

- Weak gauginos ($\widetilde{\chi_i^0}, \widetilde{\chi_i^\pm}$) then produced in their decay. *e.g.* $\widetilde{q_L} \to \widetilde{\chi}_2^0 q_L$
- Two generic features
  $\chi_2^0 \to \chi_1^0 h$ or
  $\chi_2^0 \to \chi_1^0 \ell^+ \ell^-$ possibly via $\chi_2^0 \to \widetilde{\ell^+} \ell^-$
  Former tends to dominate if kinematically allowed.
- Use these charateristic decays as a starting point
- Many SUSY particles can then be identified

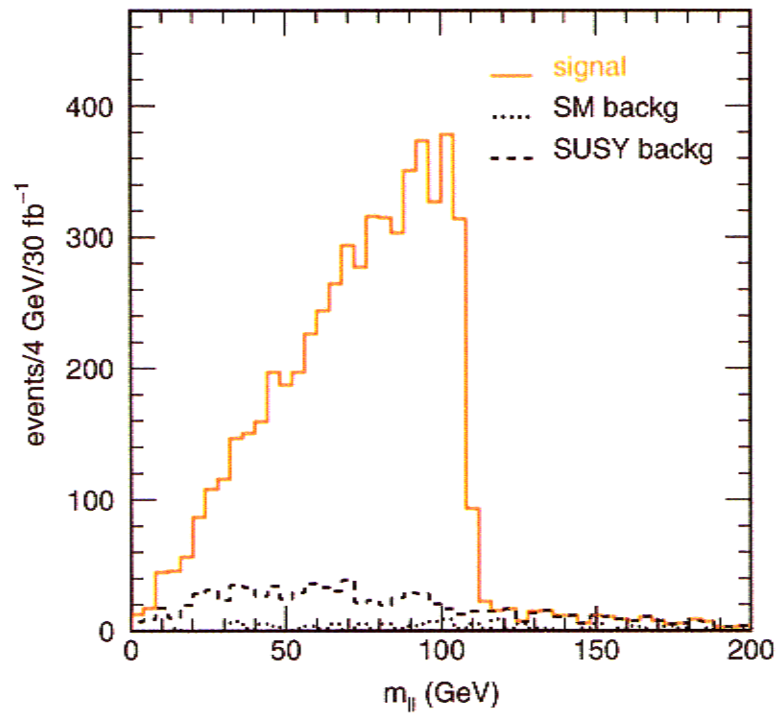
Case with h in cascade already discussed

Will give lepton example here (”SUGRA point 5”)

Example of $\chi_2 \to \widetilde{\ell}_R^+ \ell^- \to \chi_1 \ell^+ \ell^-$ – "Point 5"

$E\!\!\!/_T > 300$ GeV; ≥ 2 jets with $p_t > 150$ GeV;

2 isolated opposite sign, same flavor leptons, $p_t > 10$ GeV. Plot $m_{\ell\ell}$:



end point at $m_{\tilde{\chi}_2^0} \sqrt{1 - \frac{M_{\tilde{\ell}}^2}{M_{\tilde{\chi}_2^0}^2}} \sqrt{1 - \frac{M_{\tilde{\chi}_1^0}^2}{M_{\tilde{\ell}}^2}} = 108.1$ GeV

Very little SM background

Many such measurements $\to$ deduce SUSY parameters

Characteristics of Gauge Mediated Models

Lightest superpartner is unstable and decays to Gravitino ($\tilde{G}$)

- Either neutral:
  $\chi_1^0 \rightarrow \gamma\tilde{G} : c\tau \sim C^2(100\ \mathrm{GeV}/M_{\chi_1^0})^5(\Lambda/180\mathrm{TeV})^2(M_M/180\mathrm{TeV})^2\mathrm{mm}$
  $\Rightarrow$ extra photons ("G1a") or similar signals to SUGRA ("G1b") depending on lifetime

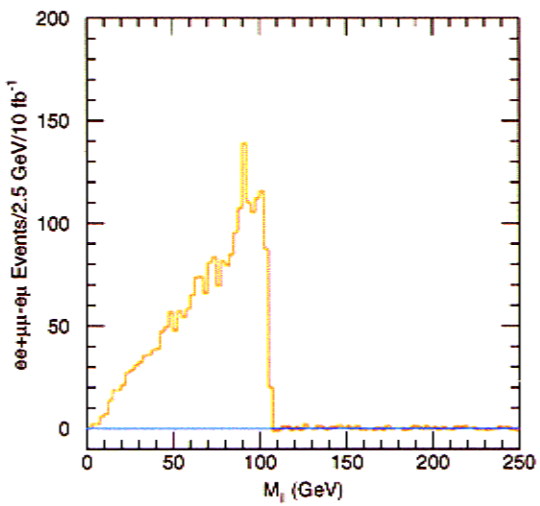
- Or charged:
  - Almost always slepton: $\tilde{e}_R \rightarrow e\widetilde{G}$
  - No Missing E_T if $c\tau$ large, events have a pair of massive stable charged particles ("G2b")
  - Large lepton multiplicity if $c\tau$ small ("G2a").

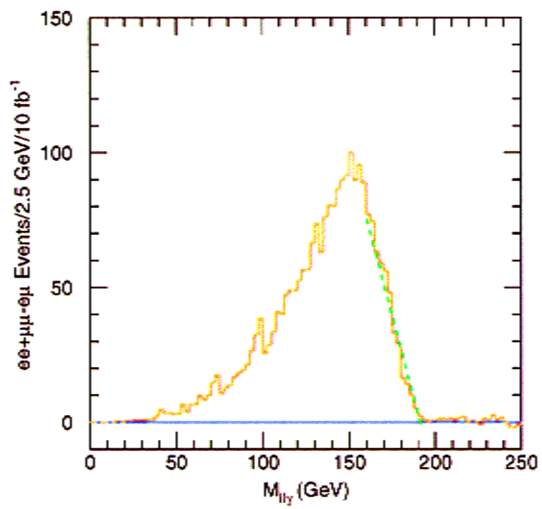
Discovery and measurement in these cases is same as or easier than SUGRA

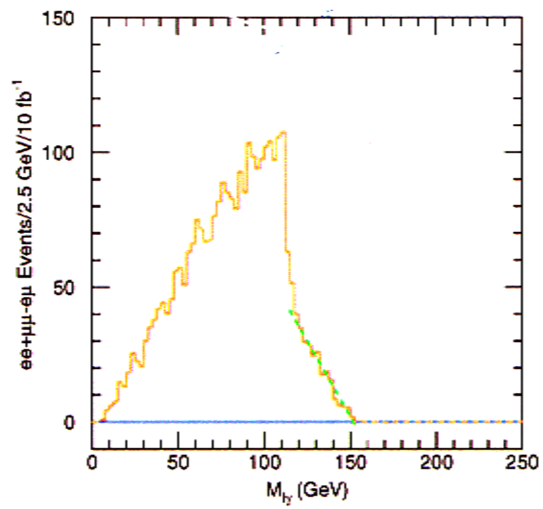
- In case "G2b", every decay product can be measured
- In case "G1a" $\widetilde{G}$ momenta can be inferred and events fully reconstructed.

An Example: GMSB in Models with Photons (G1a)

Decay $\tilde{\chi}_2^0 \to \ell^+\ell^-\tilde{\chi}_1^0 \to \ell^+\ell^-\gamma\tilde{G}$ is key (Lifetime of $\tilde{\chi}_1^0$ is short)







- Dilepton mass, flavor subtracted $(e^+e^- + \mu^+\mu^- - e^\pm\mu^\mp)$ End is at $M_{\tilde{\chi}_2^0}\sqrt{1-\left(\frac{M_{\tilde{\ell}_R}}{M_{\tilde{\chi}_2^0}}\right)^2}\sqrt{1-\left(\frac{M_{\tilde{\chi}_1^0}}{M_{\tilde{\ell}_R}}\right)^2} = 105.1\,\mathrm{GeV}$.
- Form Dilepton-gamma mass and take smallest combination Linear vanishing at $\sqrt{M_{\tilde{\chi}_2^0}^2 - M_{\tilde{\chi}_1^0}^2} = 189.7\,\mathrm{GeV}$.
- Form $\ell^\pm\gamma$ mass also. Two structures at $\sqrt{M_{\tilde{\ell}_R}^2 - M_{\tilde{\chi}_1^0}^2} = 112.7\,\mathrm{GeV}$ and $\sqrt{M_{\tilde{\chi}_2^0}^2 - M_{\tilde{\ell}_R}^2} = 152.6\,\mathrm{GeV}$

These measurements sufficient to determine the $\tilde{\chi}_2^0$, $\tilde{\ell}_R$, $\tilde{\chi}_1^0$ masses without assuming a model

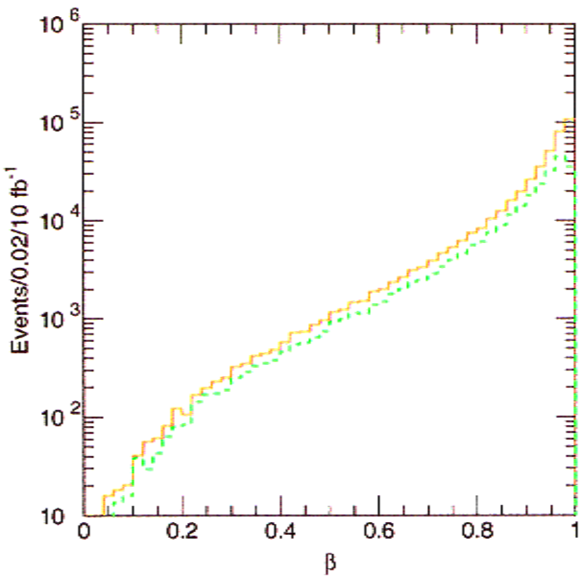
An Example: Charged NLSP ("G2b")

Sleptons are produced at the end of decay chains $\Rightarrow$ large velocity

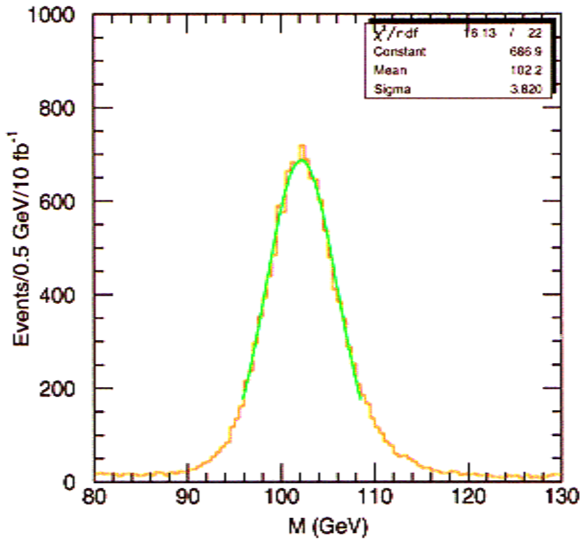
Most of these will pass the Muon Trigger

Measure the velocity using TOF in Muon system, then infer mass

- Time resolution ~ 65 ns
- $\Rightarrow \Delta M/M \sim 3\%$ for $M = 100$ GeV



velocity



$\Delta M/M$ (Atlas)

Note: In case of neutral NLSP, can use Dalitz decays and photon pointing to determine lifetime

General SUSY Conclusions

- If weak-scale SUSY exists, it will be observed at LHC
- Mechanism of SUSY-breaking reflected in phenomenology of model
  - Large missing E_T?
  - Extra photons?
  - Many b's?
  - Many τ's?
  - Long lived charged or neutral particles?
  - $\chi_2 \rightarrow \chi_1 + \ell\ell$ or $\chi_1 h$?
- Once general characteristics understood, can analyze data in the context of a model
  - Best case: all parameters of underlying model well measured - precise predictions fo[r] all masses
  - Worst case: a few parameters measured well, but underlying model underconstrained
- Model independent conclusions difficult (except for extraction of SUSY scale)

Extra Dimensions

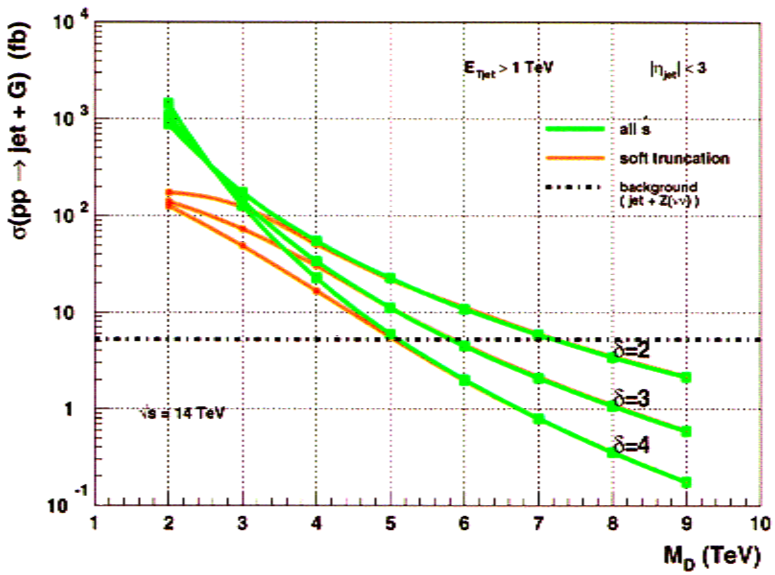
Two classes of Model

- Large Extra Dimensions
  - Gauss's Law

$$\frac{1}{M_P^2 r^2} \longrightarrow \frac{1}{M_D^{\delta+2} r^{\delta+2}}$$

    for δ extra dimensions
  - Signatures: Extra dimensions give tower of massive states (each with gravitationa coupling), but many states G_n
    * $gg \to gG_n$, $q\bar{q} \to \gamma G_n$ give missing energy signals
    * Exchange of G_n can distort scattering
    * Model dependent effects (gravitational, other interactions) when energy $\sim M_D$
- Warped Extra Dimensions: (Randall-Sundrum models)
  - SM on one brane, gravity on the other
  - Graviton excited states
  - Signature:
    * Simple models have narrow, weakly coupled excited states

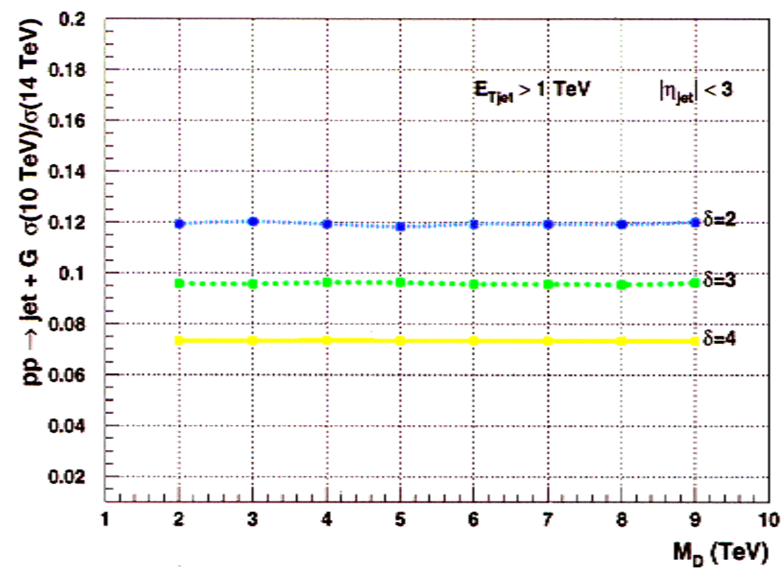
Large Extra Dimension Signals



δ	M_D^{min} (TeV)	M_D^{max} (TeV)	$R_{compact}$
2	~ 4	7.5	10 μm
3	~ 4.5	5.9	300 pm
4	~ 5	5.3	1 pm

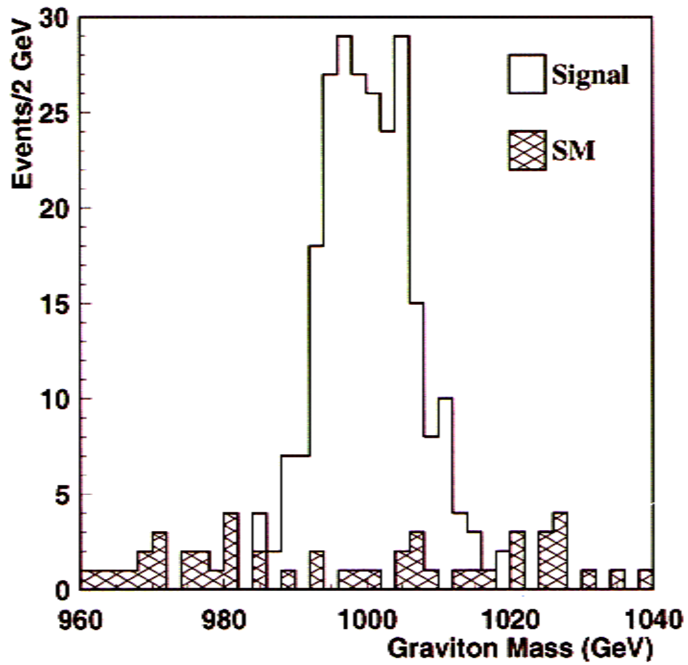
Difficult to distinguish M_D from δ at given s

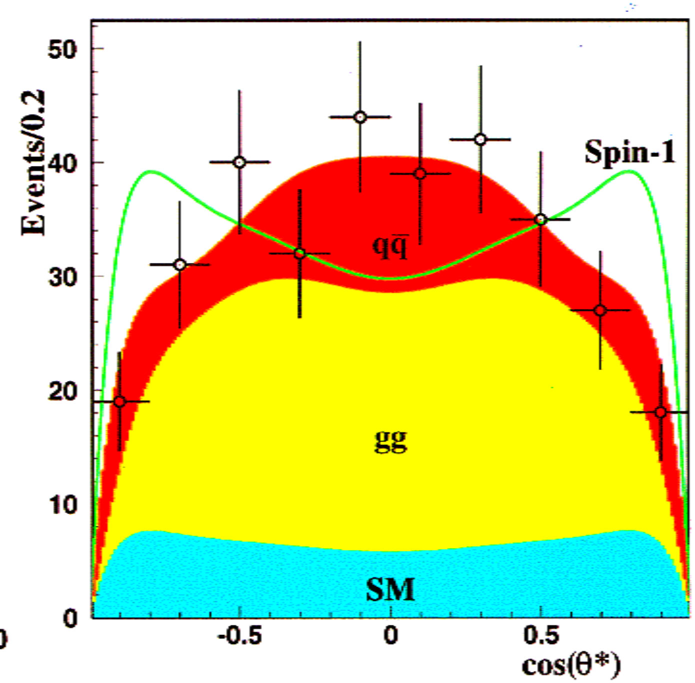
Comparison of rates at 10 TeV and 14 TeV helps



Warped Extra Dimensions

- Look for a resonance in dilepton final state, eg $gg \rightarrow e^+e^-$, $qq \rightarrow e^+e^-$
  - Discovery Limit is ~ 1.8 TeV for 100 fb^{-1}





- Resonance is Spin-2. Confirm by looking at angular distribution
  - Can determine spin for $M < 1.4$ TeV for 100 fb^{-1}

Beyond the Baseline LHC

No firm plans for LHC running beyond the baseline exist

But CERN management is begining to think about the future

Atlas and CMS asked to study what they could do under 2 possible scenarios

- Factor of 10 Luminosity Upgrade (10^{35})
- Factor of 2 Energy Upgrade (28 TeV)

First studies presented to management

- Existing detectors not fully functional at 10^{35} (Upgrades???)
- Physics case for increased energy a slam dunk
  - SM and SUSY Higgs measurements at LHC rate limited: Higher energy means more rate
  - Ditto for SUSY
  - Increased reach for strongly coupled EWSB models
  - Increased sensitivity for extra dimensions
  - Etc

Conclusions

- Case for new physics at the TeV scale is strong
- Wide range of possibilities
- Independent of what the true solution is, LHC will provide a wealth of important measurements
  - SM Higgs:
    - ∗ Discovery ($> 5\sigma$) for full mass range
    - ∗ Mass measurement to 0.1%
    - ∗ Ratios of BR and couplings at 15% to 30% level
  - SUSY Higgs
    - ∗ Whole MSSM plane covered with 100 fb^{-1}
    - ∗ For much of parameter space, more than 1 channel and precise measurements o mass and $\tan\beta$
    - ∗ Moderate $\tan\beta$: h only
    - ∗ Heavy Higgs difficult in some models with decays to SUSY particles
  - SUSY
    - ∗ Discovery to $M_{SUSY} > 2.5$ TeV

- * Measurements of $\tilde{q}$ and $\tilde{g}$ masses
- * Pattern of decays indicative of mechanism of SUSY breaking
- * Following decay chains allows precision determination of SUSY breaking parameters in a wide array of models

– Extra Dimensions

- * Large extra dimensions visable if $M_D < 5$ to 7.5 TeV for $\delta = 4$ to 2
- * Warped extra dimensions visable is resonances < 1.8 TeV mass

Still, things LHC is likely NOT to do:

– Spin and CP of the Higgs

– Observation and separation of all the Higgs in SUSY models

– Precision Higgs coupling measurements

– Masses and Couplings of ALL SUSY particles

Lot's to do; Lot's to learn

Plenty of work for us all!