CDF Exotics Searches with Photons

Run I & II

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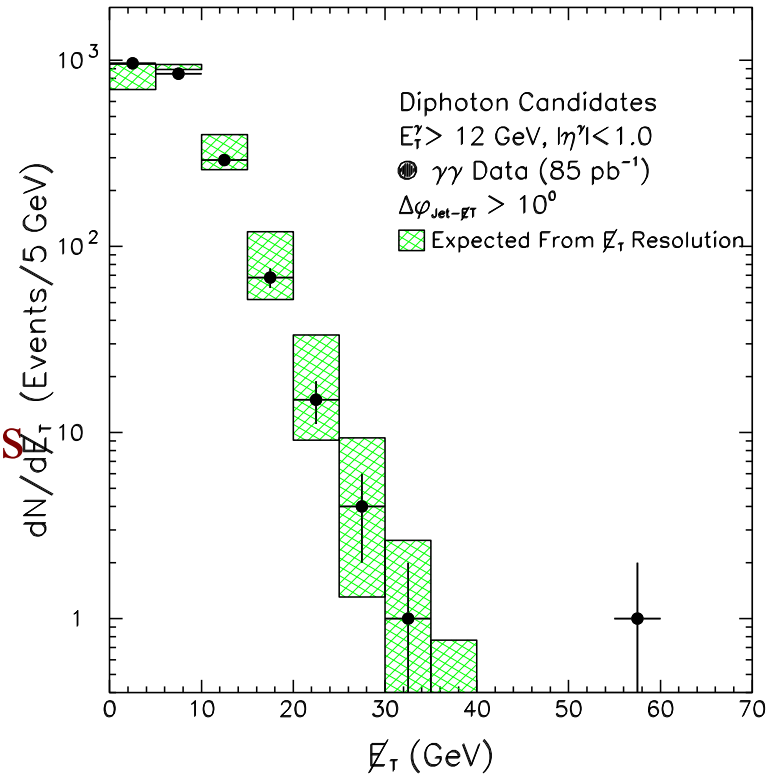
Search for Diphotons and Missing Et

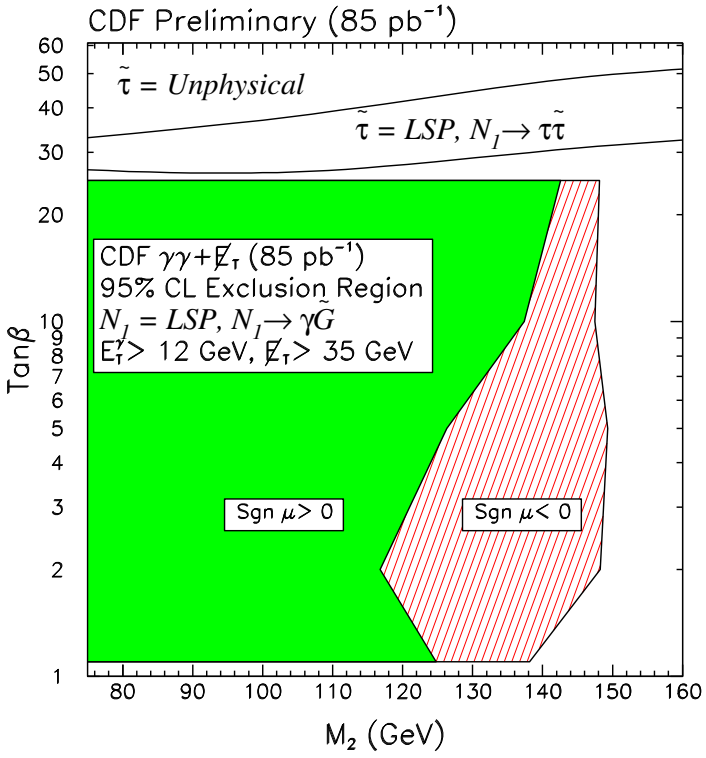
85 pb $^{-1}$ $\gamma\gamma$ triggers

- 2 isolated γ
- $|\eta| < 1$
- $E_t > 12$ GeV
- $\not\!\!E_t$ >35 GeV for limits

Search for $\gamma\gamma$+X

$ee\gamma\gamma\not\!\!E_t$ at E_t=35GeV





Gauge-Mediated SUSY Breaking

Production of $\chi_1^{\pm}\ \chi_2^0$

$\chi \to \chi_1^0$ X

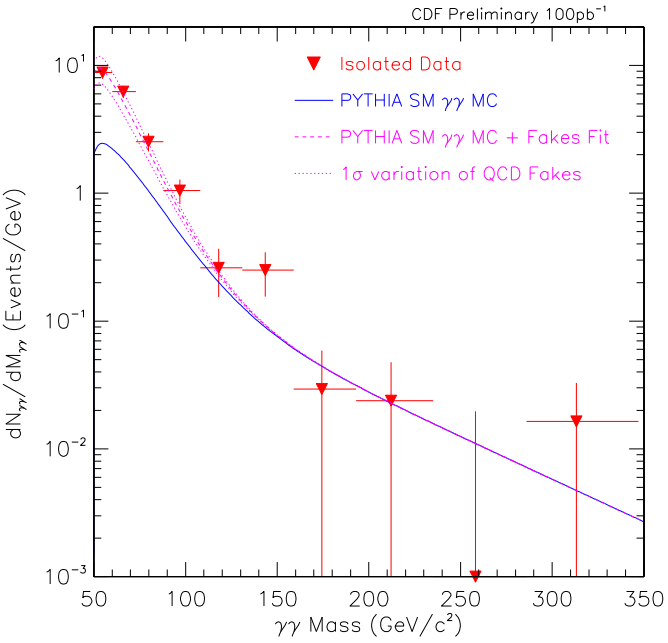
$\chi_1^0 \to \gamma$ G

PRL 81:1791 (1998) PRD 59: 092002 (1999)

Search for Narrow Diphoton Resonances

85 pb $^{-1}$ high-Et $\gamma\gamma$ triggers

- 2 isolated γ, $|\eta| < 1$
- $E_t > 22$ GeV



Bosephilic Higgs Search

-Fit mass for inclusive

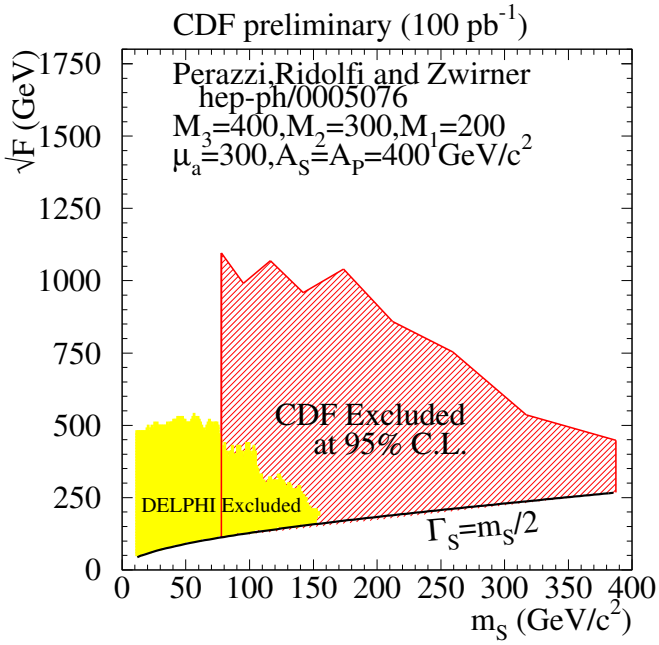
-Search for e, μ,

Jets, $\not\!\!E_t$ for W/Z + h^0

- limit at 82GeV

SGoldstino Search

- S.M. mass associated to SUSY breaking
- Single particle production to narrow resonance



PRD 64: 092002 (2001)

Search for Photon and B-jet

85 pb $^{-1}$ Inclusive photon triggers,

One photon, $|\eta| < 1$

Photon $E_t > 25$ GeV

Jet $E_t > 30$ GeV

Silicon Detector

b-quark tag

$\not\!\!E_t > 40$ GeV

GMSB $\chi^0 \rightarrow \gamma$ G, h G,

(not sensitive)

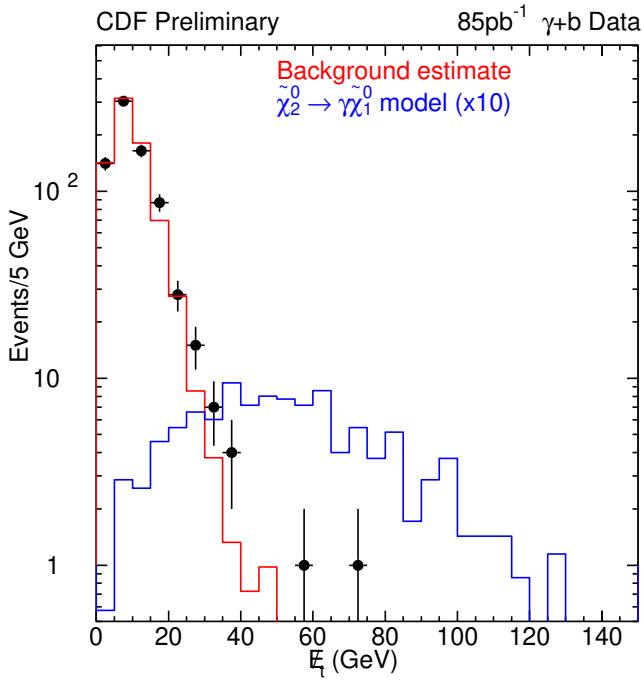
MSSM $\chi_2{}^0 \rightarrow \gamma \chi_1{}^0$,

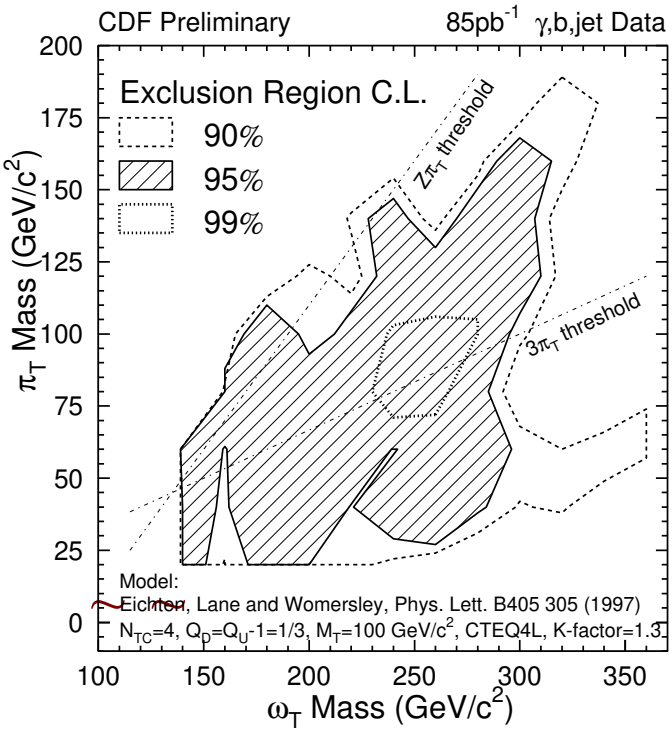
via $\tilde{q}$, $\tilde{g} > 245$ GeV

Technicolor Limits

$\omega_T \rightarrow \gamma \pi_T$, $\pi_T \rightarrow$ bb

require 2nd jet





PRD 65: 052006 (2002) *PRL 83: 3124 (1999)*

Search for Photon and Lepton

86 pb^{-1} of inclusive e, μ, or photon triggers

γ E_t> 25 , e or μ, E_t> 25,

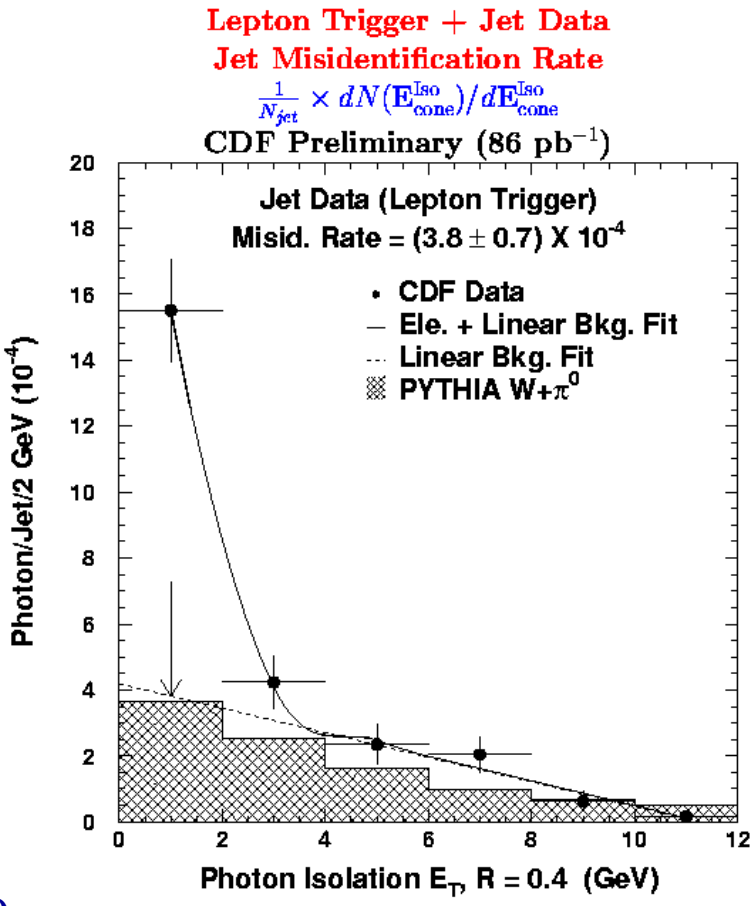
consider no $\not\!\!E_t$, or $\not\!\!E_t$ > 25 GeV

backgrounds mostly W/Z + γ and lepton+fake γ

	eγMet	μγMet	e/μγMet
Mean Rate μ_{SM}	3.41 ± 0.34	4.23 ± 0.46	7.64 ± 0.71
CDF Data N_0	5	11	16
$P(N \geq N_0 \mid \mu_{SM})$	0.26	0.0054	0.0072

Unique photon background subtraction via isolation

No model limits



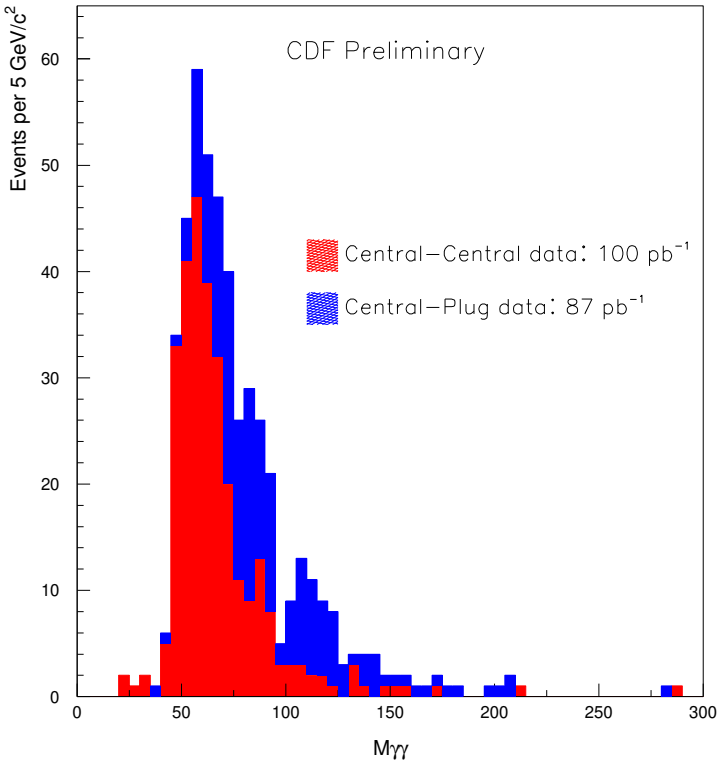
Submitted to PRL and PRD

Search for LED with Diphotons

Large Extra Dimensions can lead to s-channel production of KK tower of Gravitons

- Two γ with $E_t > 22$ GeV
- Include events with a central ($|\eta| < 1$) and plug ($1<|\eta| < 2.4$) photon

287 Central-Central events,
192 Central-Plug events



$M_S > 823 / 899$ GeV (λ=+1/-1, Hewett)

Combined with central-central e^+e^- :

$M_S > 814 / 900$ GeV (λ=+1/-1, Hewett)

Search for Photon and Missing Et

See the next talk by Peter Onyisi!

Photons at CDF in Run II

Central calorimeter remains the same

Tracking rebuilt, 3D coverage to $|\eta| < 2$

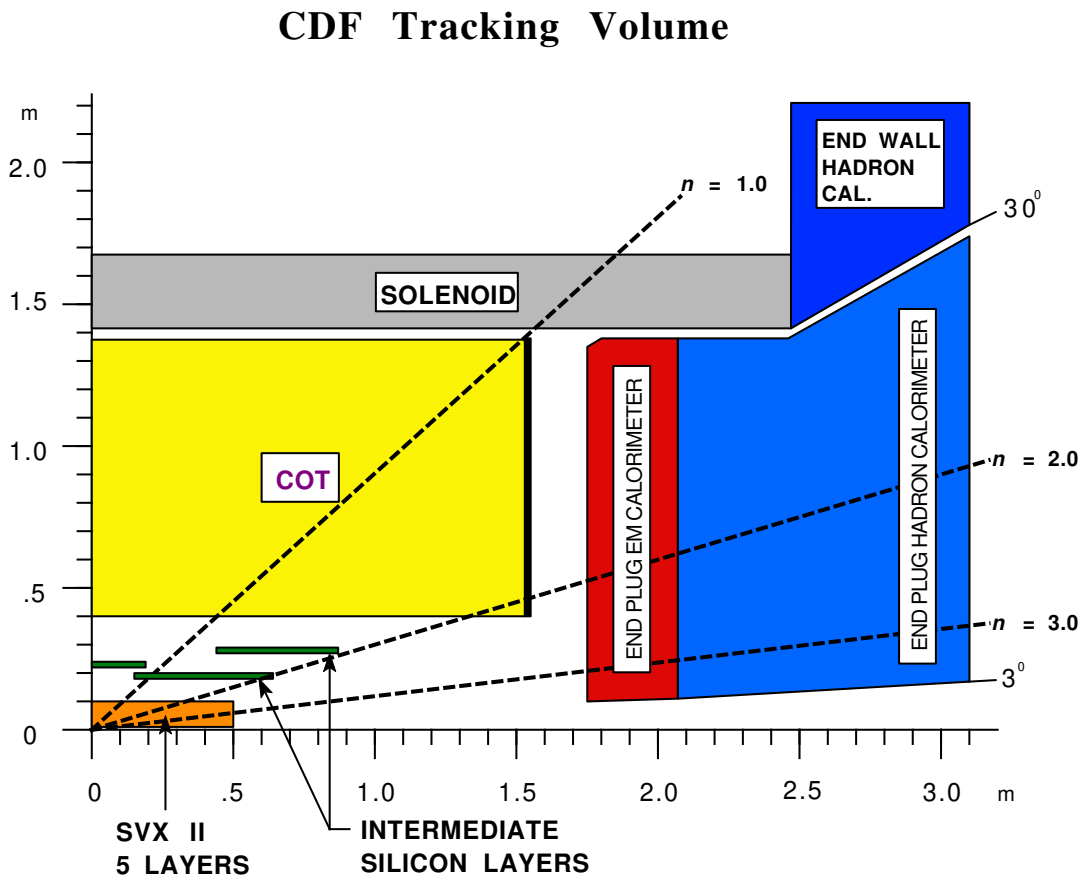
Plug detector rebuilt, extended to 3^o

$1 < |\eta| < 2.1$ $\Delta\eta$=0.1-0.18, $\Delta\phi = 7.5^o$

$2.1 < |\eta| < 3.6$ $\Delta\eta$=0.2-0.6, $\Delta\phi = 15^o$

$16/\sqrt{E}$ + 1% resolution

2D shower max, 5mm pitch

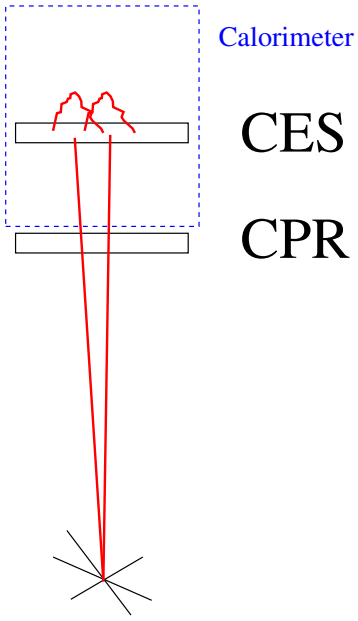


Plan to include $1 < |\eta| < 2$ in all photon searches

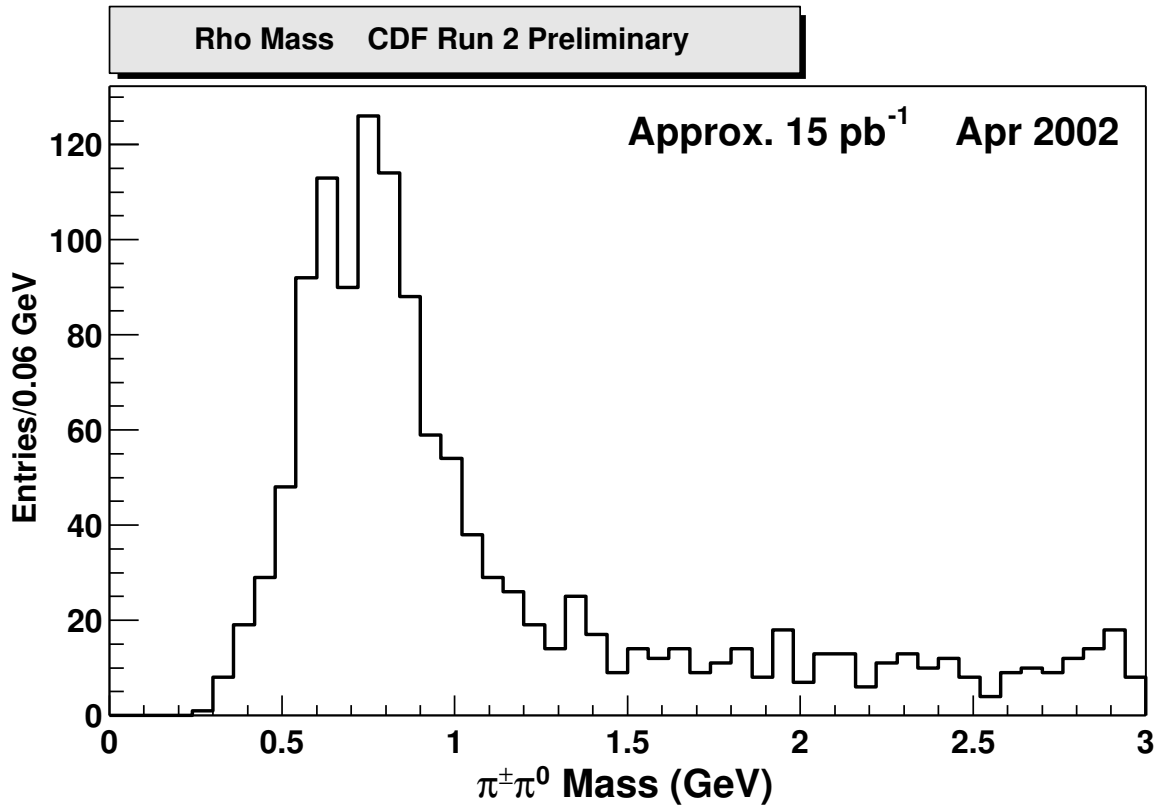
Background Subtraction Calibration

Ways to measure fake photons

- Isolation
- CES shape for $E_t < 35$ GeV
  (could be done with PES?)
- CPR preradiator hits



$\rho \rightarrow \pi^{\pm} \pi^{0}$ is a source of π^{0}



More Calibration Samples

Method:

Select single EM clusters

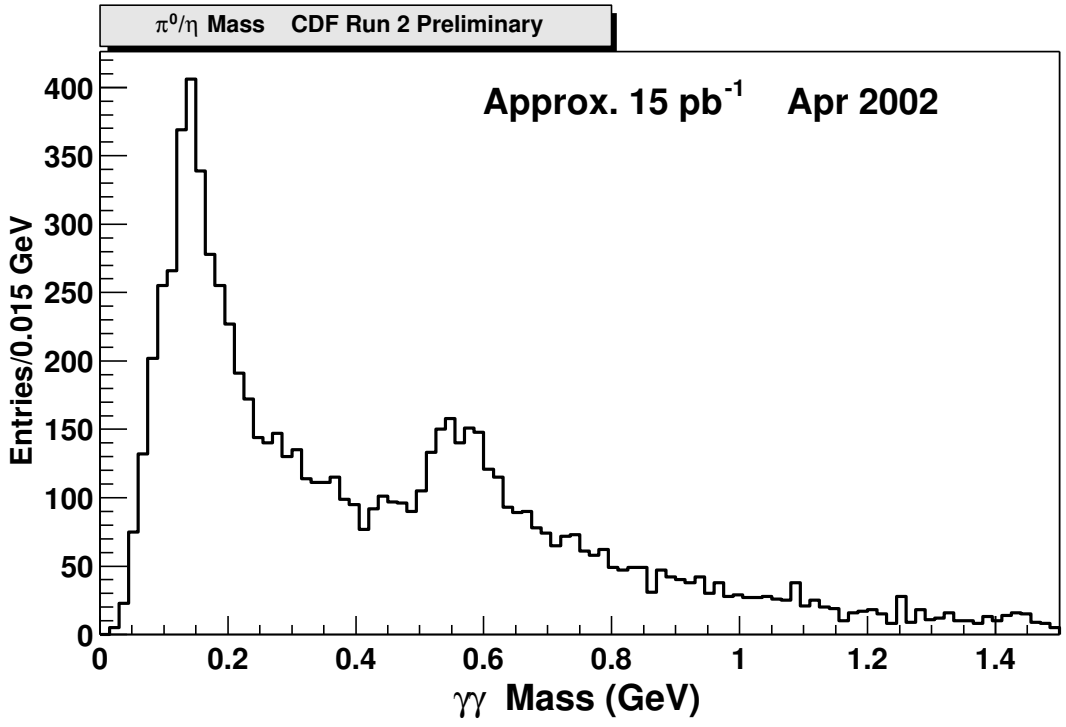
Require two separated CES clusters

Require each CES in a different tower

(not necessary, several variations)

Another source of π^0

Measure η/π^0 rate for details of CES shape



Optimization, fits underway

Inclusive Photon Sample

Data from Aug 8 - Feb 5, 8 pb^{-1}

All current data is available!

Inclusive photon trigger:

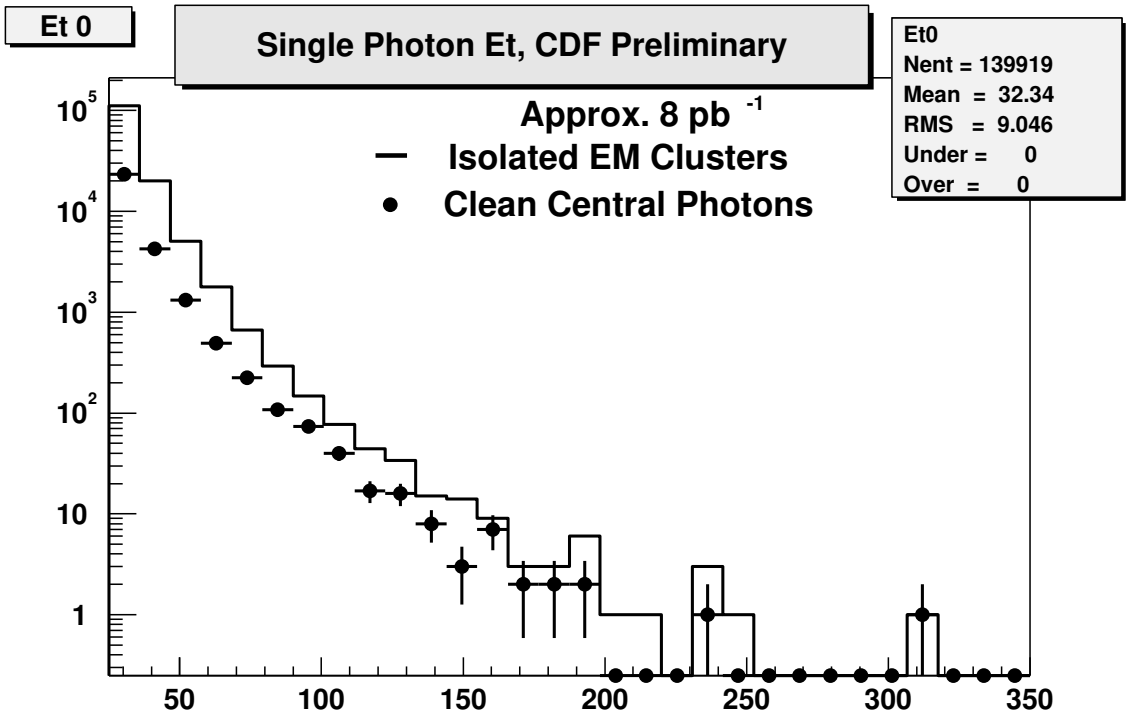
$E_t > 25$ GeV, $|\eta|<3.6$, cal iso,

Had/EM, CES for $|\eta|<1.0$

Clean sample:

confirm cuts, require $|\eta|<1.0$

add tracking isolation



Result is similar to Run 1B

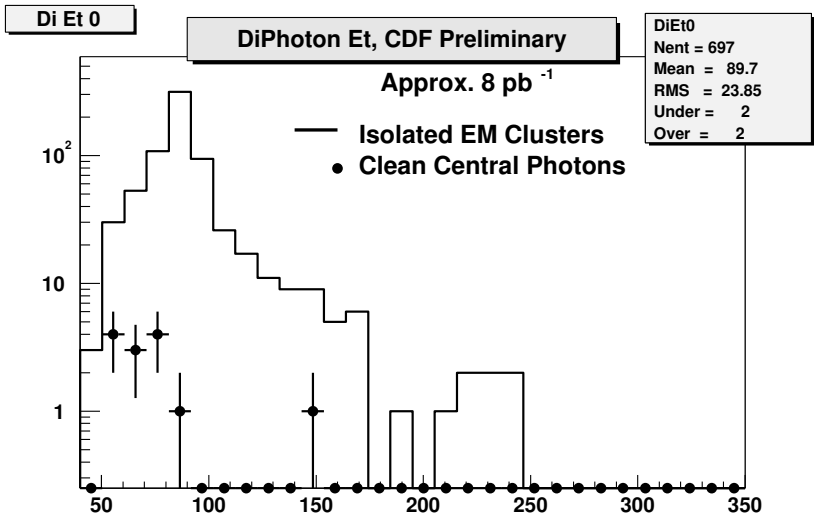
Inclusive Diphoton Sample

Inclusive photon trigger,

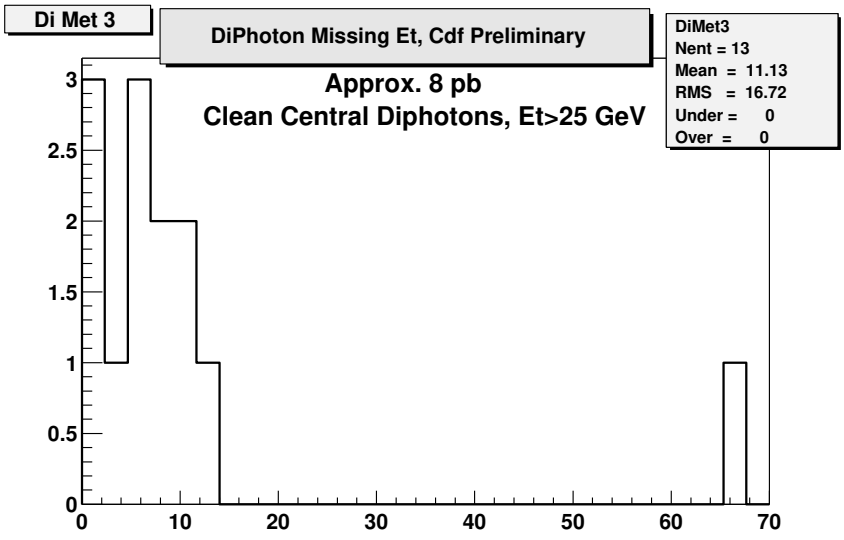
require 2 photons, $E_t > 25$ GeV,

same requirements as single photon

Diphoton Mass



Missing E_t



Diphoton triggers, $E_t > 12$ GeV available since 1/15

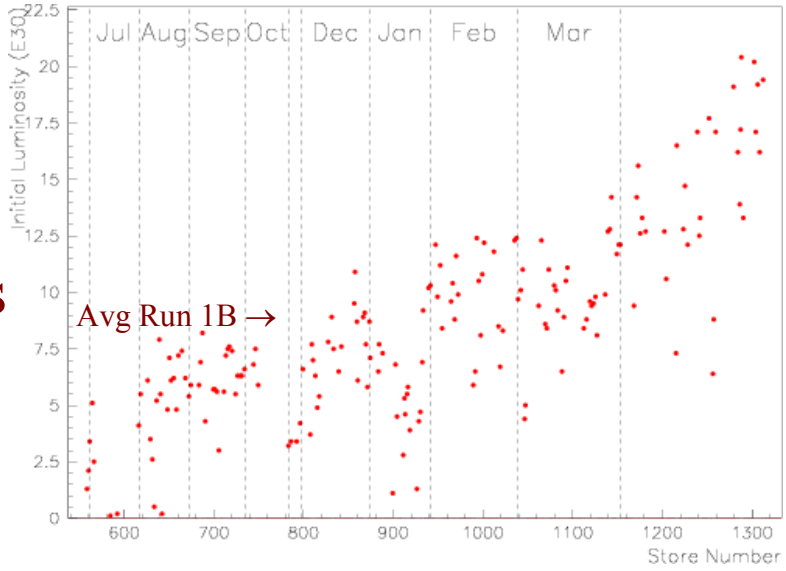
Last Slide

Many triggers, samples

- All are central and plug
- Inclusive, $E_t > 25$, with isolation
- Inclusive, $E_t > 50$, with no isolation
- Diphoton, $E_t > 12$, with isolation
- Diphoton, $E_t > 18$, with no isolation
- Triphoton, $E_t > 10$, with no isolation
- Photon, $E_t > 16$ + muon
- Photon, $E_t > 16$ + 2jets (W/Z γ)
- Photon, $E_t > 10$ + displaced SVT track

Many Studies started

- Trigger, monitor
- Background studies
- Simulation



Data processing fast, access is good...

The search is underway!