Physics cuts / Trigger

1) $H \to \gamma\gamma$

- Two isolated photons, $E_t(\gamma_1) > 40$ GeV, $E_t(\gamma_2) > 25$ GeV in $|\eta| < 2.5$

  isolation: no track with $p_t > 2.5$ GeV in cone $R = 0.3$ and $E_t^{em\ cell}$ in $R < 0.3$ less that 2.5 GeV

2) WH, ttH $\to \ell\gamma\gamma + X$

- Two isolated photons, $E_t(\gamma_1) > 40$ GeV, $E_t(\gamma_2) > 25$ GeV
- one isolated lepton: $p_t^{\ell} > 20$ GeV, $|\eta^{e,\mu}| < 2.5, 2.4$;
- $E_t^{miss} > 20$ GeV

3) $H (\to \gamma\gamma) +$ jets

- Two isolated photons, $E_t(\gamma_1) > 40$ GeV, $E_t(\gamma_2) > 25$ GeV
- $E_t(\gamma_1 + \gamma_2) > 50$ GeV
- 2 jets: $E_t^j > 40$ GeV if $|\eta| < 2.4$

  $E^j > 800$ GeV if $|\eta| > 2.4$
- ΔR (γ-jet) > 1.5

4) $W (\to \ell\ \nu)\ H (\to bb)$

- one isolated lepton: $p_t^{\ell} > 20$ GeV, $|\eta^{e,\mu}| < 2.5, 2.4$;
- $E_t^{miss} > 20$ GeV
- only two central jets with $E_t > 25$ GeV in $|\eta^j| < 2.5$

  both jets b-tagged
- no other jets with $E_t > 25$ GeV in $|\eta^j| < 4.5$

5) $tt (\to \ell\nu + X)\ H (\to bb)$

- one isolated lepton: $p_t^{\ell} > 20$ GeV, $|\eta^{e,\mu}| < 2.5, 2.4$;
- $E_t^{miss} > 20$ GeV
- 6 central jets with $E_t > 25$ GeV in $|\eta^j| < 2.5$

  4 jets b-tagged

Physics cuts / Higgs - II

6) $H \to ZZ^* \to 4\ell^{\pm}$

- 4 isolated leptons (in $\Delta R = 0.2$ no track with $p_t > 2.5$ GeV)

  $E_t^e > 20,15,10,10$ GeV; $p_t^{\mu} > 20,10,5,5$ GeV; $|\eta^{e,\mu}| < 2.5, 2.4$;
- $m_{\ell\bar{\ell}} = m_Z \pm 6$ GeV
- $(IP/\sigma)_{max} < 3$

7) $H \to Z\gamma$

- Two isolated leptons: $p_t^{\mu} > 10$ GeV, $p_t^e > 15$ GeV

  in $|\eta^{e,\mu}| < 2.5, 2.4$;
- one isolated photon: $E_t^{\gamma} > 30$ GeV, $|\eta^{\gamma}| < 2.5$

8) $H \to WW \to \ell\nu\ell\nu$

- Two isolated leptons: $p_t^{\ell_1} > 30$ GeV, $p_t^{\ell_2} > 20$ GeV
- $m_{\ell\bar{\ell}} > 10$ GeV
- Veto central jets with $E_t > 25$ GeV in $|\eta^j| < 3.5$

9) $H \to ZZ \to 4\ell^{\pm}$

- 3 isol. leptons, E_t^e, $p_t^{\mu} > 20,15,10,10$ GeV, $|\eta^{e,\mu}| < 2.5, 2.4$
- $m_{\ell\bar{\ell}} = m_Z \pm 6$ GeV
- for high m_H : $p_t(Z) > 50$ GeV, $p_t(ZZ) > 30$ GeV

10) $h,H,A \to \tau\tau \to e^{\pm} + \mu^{\mp} + X$

- 2 isolated leptons (in $\Delta R = 0.2$ no track with $p_t > 2.5$ GeV)

  $E_t^e > 20$ GeV; $p_t^\mu > 20$ GeV; $|\eta^{e,\mu}| < 2.5, 2.4$;
- $70^0 < \Delta\phi(e,\mu) < 175^0$

11) $h,H,A \to \tau\tau \to \ell^{\pm} + h^{\mp} + X$

- one isolated lepton: $p_t^\ell > 15$ GeV, in $|\eta^{e,\mu}| < 2.5, 2.4$;
- one "τ jet": $E_t^j > 40$ GeV, $|\eta^\gamma| < 2.4$
- one isol. hard track $p_t^h > 15$ GeV pointing to τ jet: $R < 0.1$
- $60^0 < \Delta\phi(\tau\text{-jet, lepton}) < 175^0$
- $E_t^{miss} > 20$ GeV

τ-jet:

collimation:

$$\Sigma E_t^{ECAL\ cells}(R = 0.13)/\Sigma E_t^{ECAL\ cells}(R = 0.4) > 0.95$$

isolation:

no trig. tower with $E_t > 2$ GeV in $0.13 < \Delta R$(tower/jet axis) < 0.4

12) $h,H,A \to \tau\tau \to h^{\pm} + h^{\mp} + X$

- two jets with $E_t > 60$ GeV in $|\eta| < 2.5$
- one isol charged hadron $p_t^h > 40$ GeV pointing to each jet: ΔR (h/jet axis) < 0.1

  track isolation in cone $R = 0.4$
- $E_t^{miss} > 40$ GeV

13) $h,H,A \to \mu\mu$

- two isolated muons: $p_t^\mu > 10$ GeV, in $|\eta^\mu| < 2.4$;
- ≤ 1 jet of $E_t^j > 40$ GeV in $|\eta| < 2.4$

Physics cuts / Higgs - IV

14) $H \to ZZ \to \ell\,\ell\,\nu\nu$

- Two isolated leptons: $p_t > 20$ GeV, $p_t^{\ell\ell} > 60 - 100$ GeV
- $E_t^{miss} > 100 - 200$ GeV
- 1 tagging jet, $E^j > 1$ TeV in $|\eta| > 2.0$ for $m_H \sim 1$ TeV

15) $H \to WW \to \ell\,\nu$ jet jet

- One isolated lepton: $p_t > 50 - 100$ GeV
- $E_t^{miss} > 150$ GeV
- ≤ 2 central jets, $E_t^j > 40 - 100$ GeV in $|\eta| < 3.0$
- 2 tagging jets, $E^j > 400$ GeV, $E_t^j > 20$ GeV in $|\eta| > 2.4$

16) $H \to ZZ \to \ell\,\ell$ jet jet

- Two isolated leptons: $p_t^{\ell} > 50$ GeV; $p_t(Z) > 150$ GeV
- $m_{\ell\bar{\ell}} = m_Z \pm 10$ GeV
- ≤ 2 central jets, $E_t^j > 40 - 100$ GeV in $|\eta| < 3.0$
- 2 tagging jets, $E^j > 400$ GeV, $E_t^j > 20$ GeV in $|\eta| > 2.4$

17) bbH ($\to \gamma\gamma$) (for light Higgs - still under study)

- Two isolated photons, $E_t(\gamma_1) > 30$ GeV, $E_t(\gamma_2) > 25$ GeV
- only two central jets with $E_t > 20$ GeV in $|\eta^j| < 2.5$
  ≥ 1 b-tagged

Physics cuts / sparticle searches

18) $\tilde{\chi}_i^{\pm}\tilde{\chi}_j^{0}$ production:

Search in: $3\ell^{\pm}$ and no jets + (E_t^{miss}) events

- Three isolated leptons: $p_t^{\ell} > 15$ GeV
- Veto central jets with $E_t > 25$ GeV in $|\eta^j| < 3.5$
- $m_{\ell\bar{\ell}} < 81$ GeV or $m_{\ell\ell} \neq m_Z \pm 10$ GeV
- E_t^{miss} : no cut

19) Slepton pair production (mass range from 100 to 400 GeV):

Search in: $\ell\bar{\ell}$ + E_t^{miss} events

- 2 same flavour leptons, $p_t^{\ell} >$ 20 - 50 GeV
- $E_t^{miss} >$ 50-100 GeV
- Central jet veto, no jet with $E_t > 25$ GeV in $|\eta| < 3.5$
- relative azimut. cut E_t^{miss} vs leptons: $\Delta\phi(E_t^{miss}, p_t^{\ell\ell}) > 120^0$

20) Squark/gluino pair production (R_p conserving) :

(these are generic cuts, mass rang from 350 to 2500 GeV)

Search in: jets + E_t^{miss} + any number of $\ell^{\pm}$

- 2 or more central jets, $E_t^j > 40$ - 150 GeV in $|\eta| < 3.0$
- $E_t^{miss} >$ 100 - 200 GeV
- isolated e, μ and non-isolated μ: $p_t^{\mu} > 10$ GeV, $E_t^e > 20$ GeV

  isolation: no track with $p_t > 2$ GeV in cone R = 0.3
  and ΣE_t^{cell} in ring $0.05 < R < 0.3$ less that 10% of p_t^{ℓ}

Physics cuts / sparticle searches II

21) Squark/gluino pair production/R_p violating - preliminary !

Search in: jets + E_t^{miss} + $\ell^{\pm}$

- $\geq$ 2 isolated e, μ : $p_t^{\mu} > 5$ GeV, $E_t^{e} > 10$ GeV

  isolation: no track with $p_t > 2$ GeV in cone R = 0.3
  and ΣE_t^{cell} in ring $0.05 < R < 0.3$ less that 10% of p_t^{ℓ}

- 2 or more central jets, $E_t^{j} > 30 - 100$ GeV in $|\eta| < 3.0$

- E_t^{miss} : no cuts

  "τ-jets" could be desirable or even required

22) Sparticle production/ GMSB scenarios - preliminary!

- $\geq$ 2 isolated γ : $E_t^{\gamma} > 20$ GeV

- $E_t^{miss} > 20 - 100$ GeV (depends on mass range)

- $\geq$ 1 isolated e, μ : $p_t^{\mu} > 5$ GeV, $E_t^{e} > 10$ GeV (desirable)