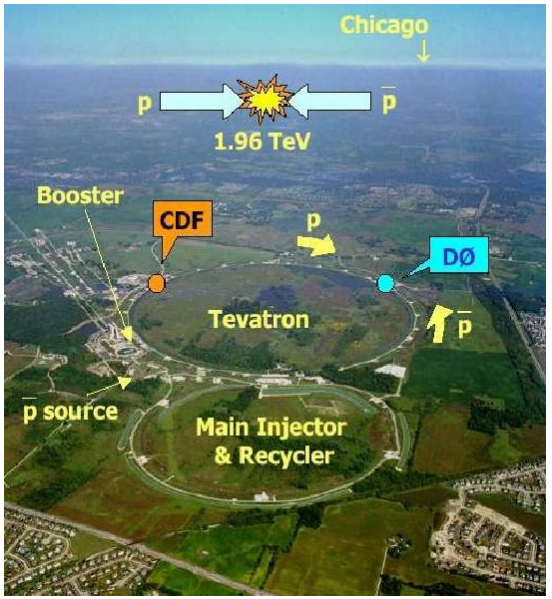
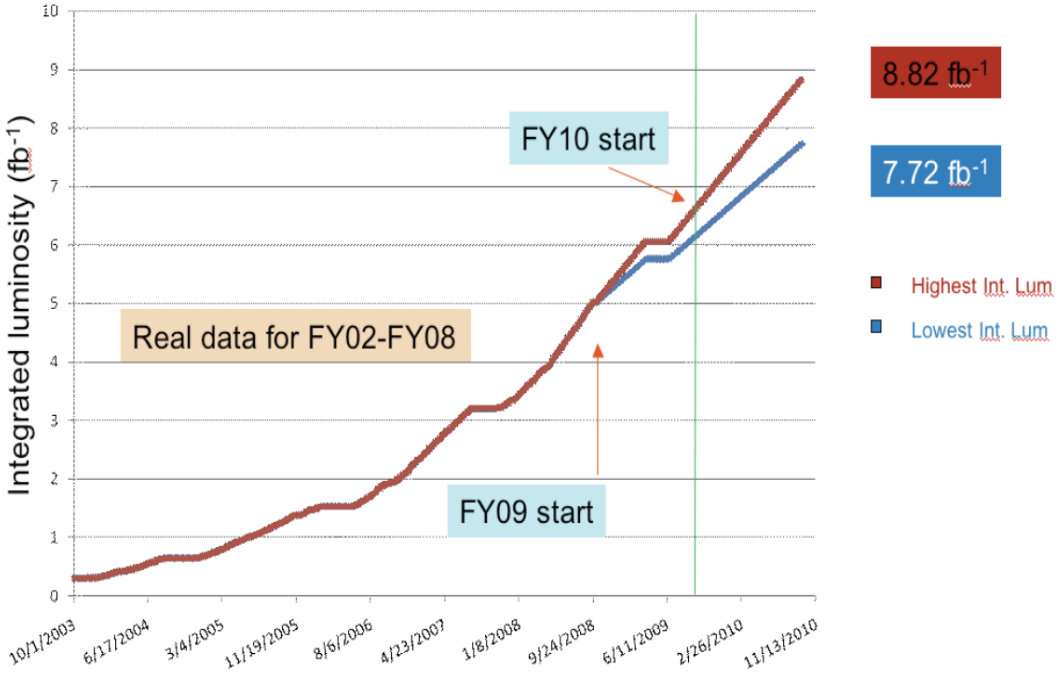
Tevatron Accelerator

	Run I	Run IIa	**Run IIb**
Bunches in Turn	6 × 6	36 × 36	**36 × 36**
√s (TeV)	1.8	1.96	**1.96**
Typical L ($cm^{-2}s^{-1}$)	1.6×10^{30}	$1x10^{32}$	**2.8×10^{32}**
∫ Ldt (pb^{-1}/week)	3	15-20	**50-60**
Bunch crossing (ns)	3500	396	**396**
Interactions/crossing	2.5	2.5	**7.0**





Excellent performance:

- Typical instantaneous luminosity: >$3.0x10^{32}$ $cm^{-2}s^{-1}$
- Integrated lum./week: ~60-70 pb^{-1}
- Delivered ~6 fb^{-1}
- Project ~7.7-8.8 fb^{-1} by end of FY10…

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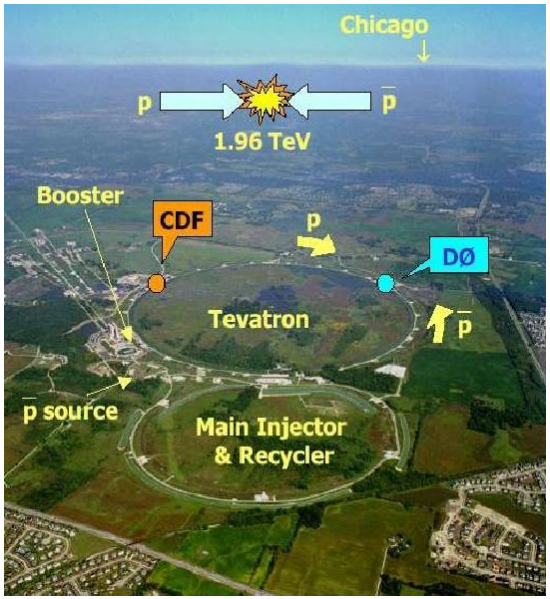

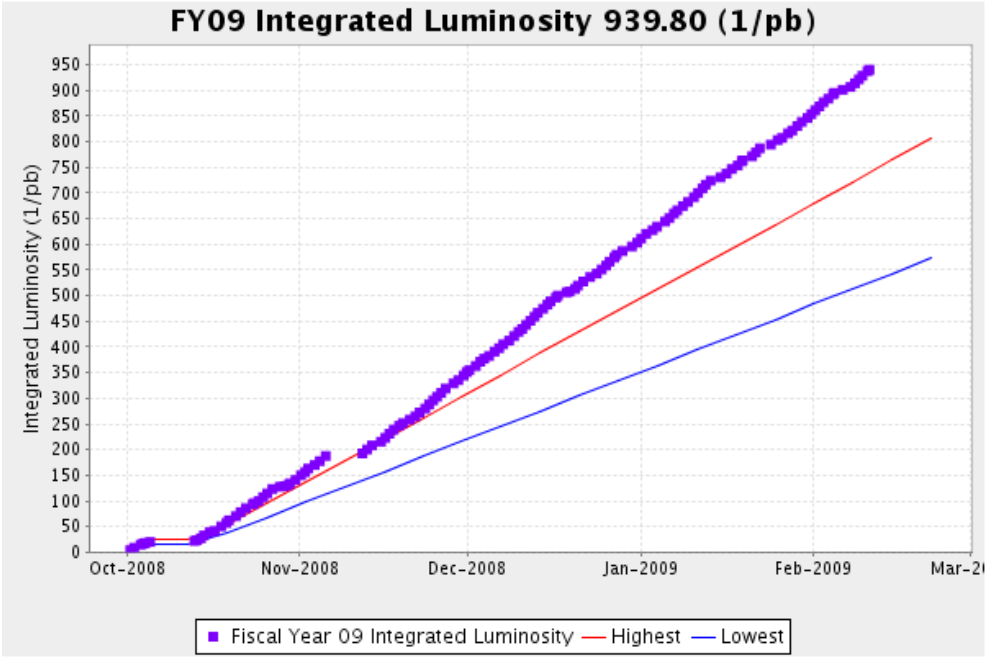

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  …but in end of FY08 and beginning of FY09 better slope than "Highest Lum" projection!

Tevatron Accelerator

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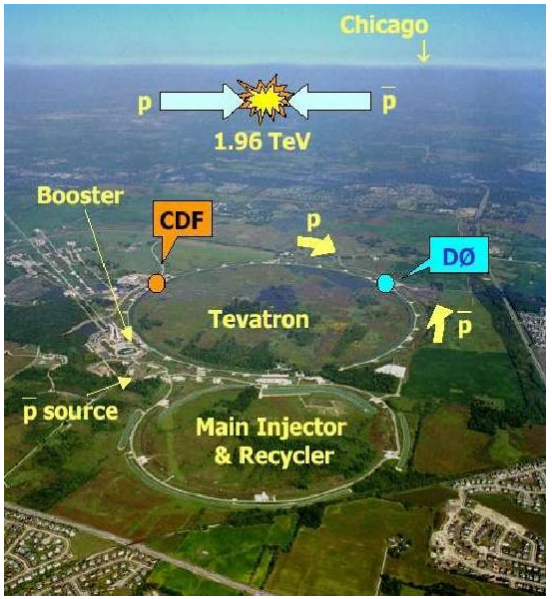
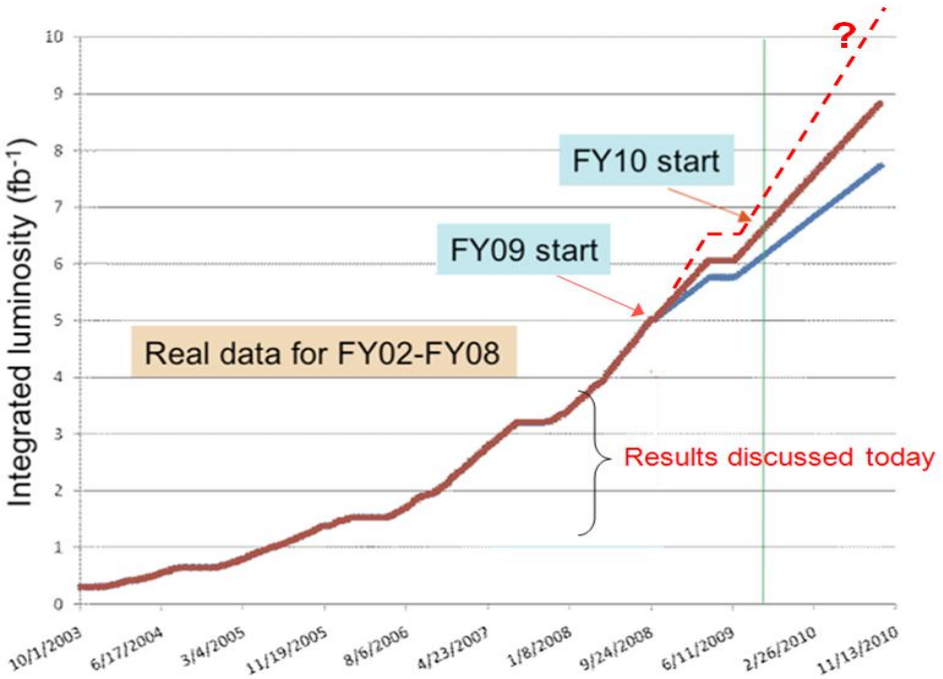




Excellent performance:

- Typical instantaneous luminosity: >3.0×10^{32} $cm^{-2}s^{-1}$
- Integrated lum./week: ~60-70 pb^{-1}
- Delivered ~6 fb^{-1}
- My expectation:
  - By LP2009: ~7.0 fb^{-1}
    ➔ results with ≥5 fb^{-1}
  - By end of FY10: ~10 fb^{-1}
  - By end of FY11: ~13 fb^{-1}
    ➔ results with ~10 fb^{-1}

SM Higgs at the Tevatron

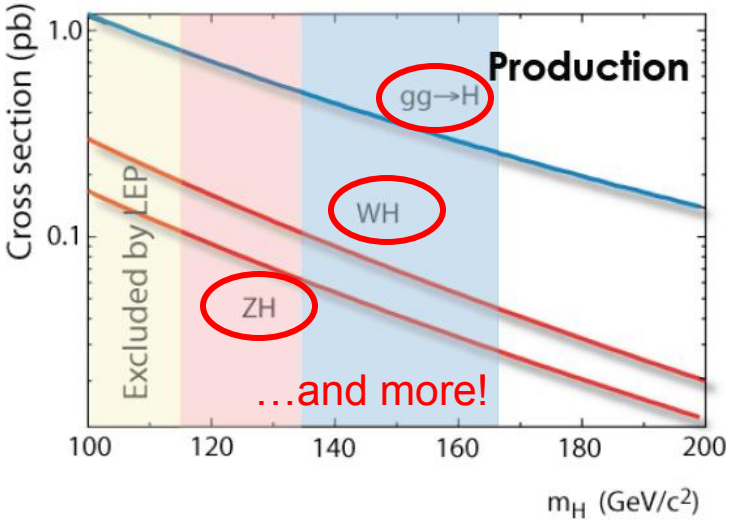
- Current experimental information (limits @ 95% CL):
  - SM LEP direct search: m_H>114.4 GeV
  - SM indirect constraint: m_H<154 GeV
    + LEP direct search: m_H<185 GeV

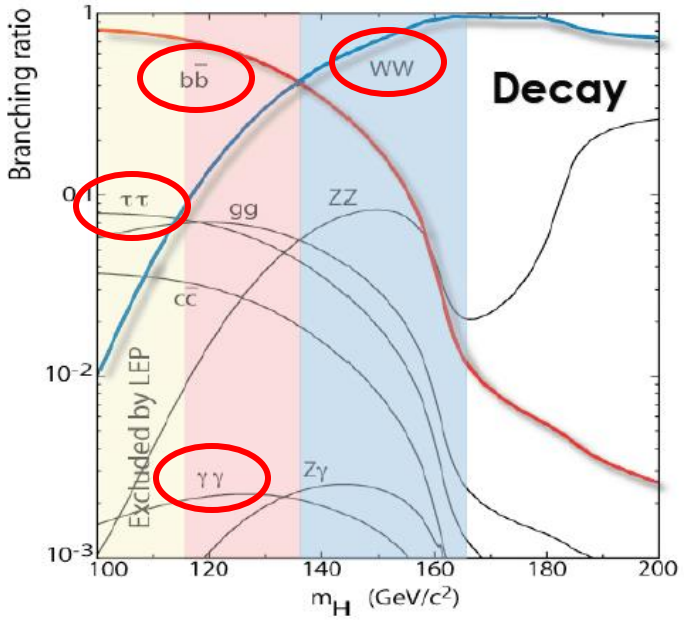
➔ Tevatron is sensitive over whole "interesting" mass range.

- Main production mechanisms (115<m_H<180 GeV):
  - Gluon fusion (gg→H): σ~0.8-0.2 pb
  - Associated production (VH, V=W,Z): σ~0.2-0.03 pb

- Dominant decay channels:
  - m_H<135 GeV: H→bb
  - m_H>135 GeV: H→WW$^{(*)}$

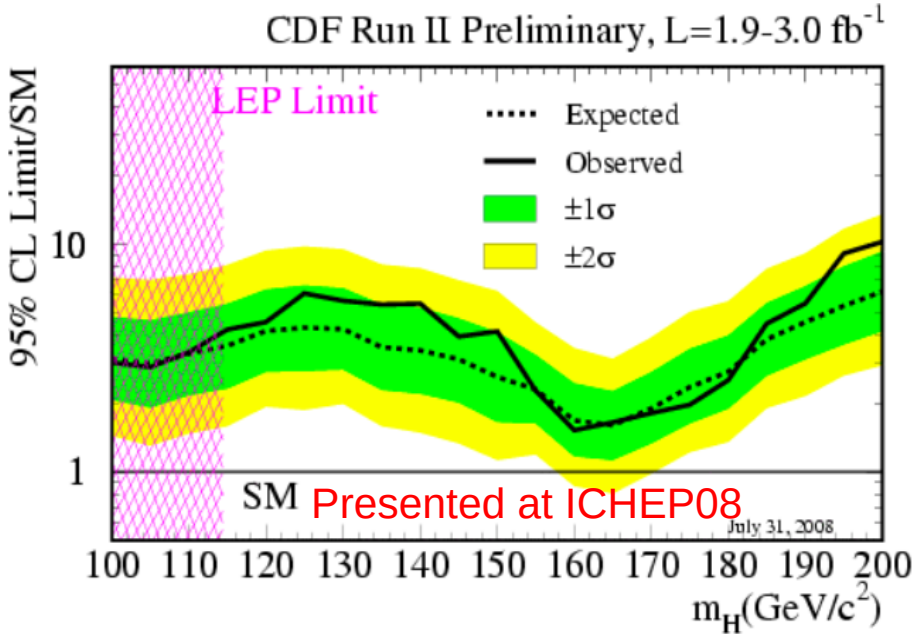
- Search strategy:
  - Low mass region:
    dominated by WH→lνbb, ZH →l^+l^-bb, ZH→ννbb
  - High mass region:
    dominated by gg→H→WW$^{(*)}$→ $l^+νl'^-ν$
  - Complement with many other channels:
    VBF production, VH→qqbb, H→ττ(with 2jets), H→γγ, WH->WWW, ttH,…

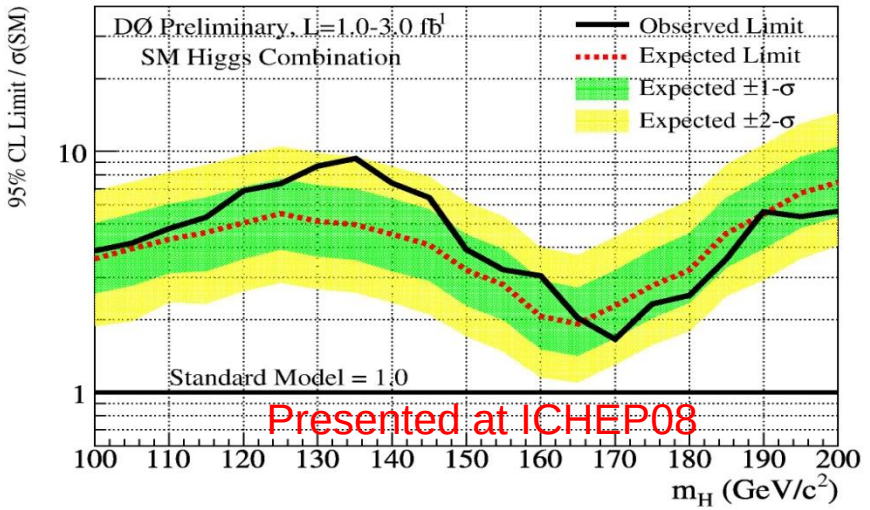




SM Higgs Combined Limits

- Calculation of limits and combination:
  - Using Bayesian and CLs approaches.
  - Incorporate systematic uncertainties (including correlations) using pseudo-experiments.
  - Some uncertainties are effectively constrained by data.





At m_H = 115 GeV:

Exp. limit: 3.6 x SM
Obs. limit: 4.2 x SM

At m_H = 165 GeV:

Exp. limit: 1.6 x SM
Obs. limit: 1.6 x SM

At m_H = 115 GeV:

Exp. limit: 4.6 x SM
Obs. limit: 5.3 x SM

At m_H = 165 GeV:

Exp. limit: 1.9 x SM
Obs. limit: 2.0 x SM

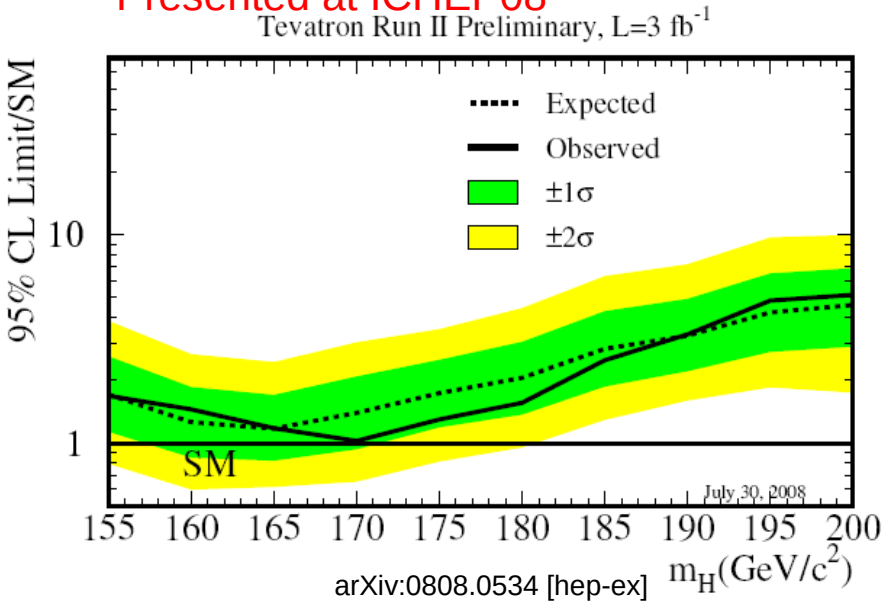
Tevatron SM Higgs Combination

Excluded m_H = 170 GeV @ 95% CL

95%CL Limits/SM

M_Higgs(GeV)	160	165	**170**	175
Method 1: Exp	1.3	1.2	1.4	1.7
Method 1: Obs	1.4	1.2	**1.0**	1.3
Method 2: Exp	1.2	1.1	1.3	1.7
Method 2: Obs	1.3	1.1	**0.95**	1.2

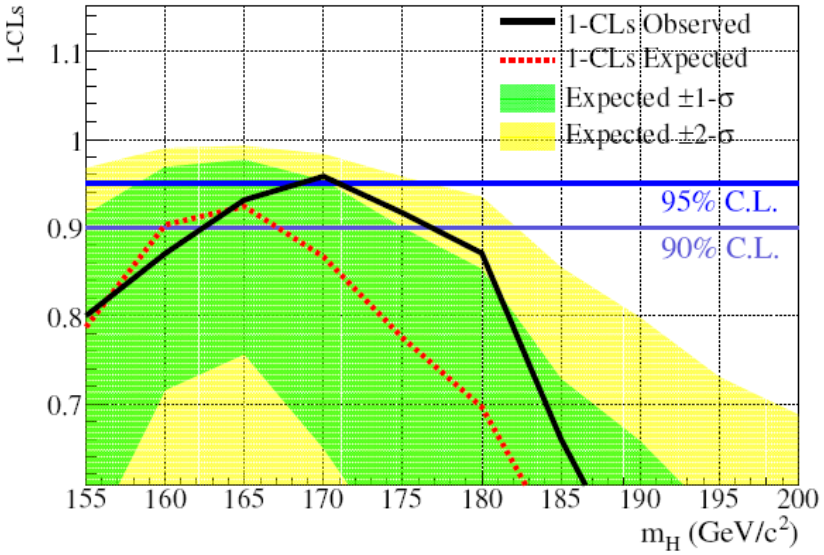
Presented at ICHEP08



arXiv:0808.0534 [hep-ex]

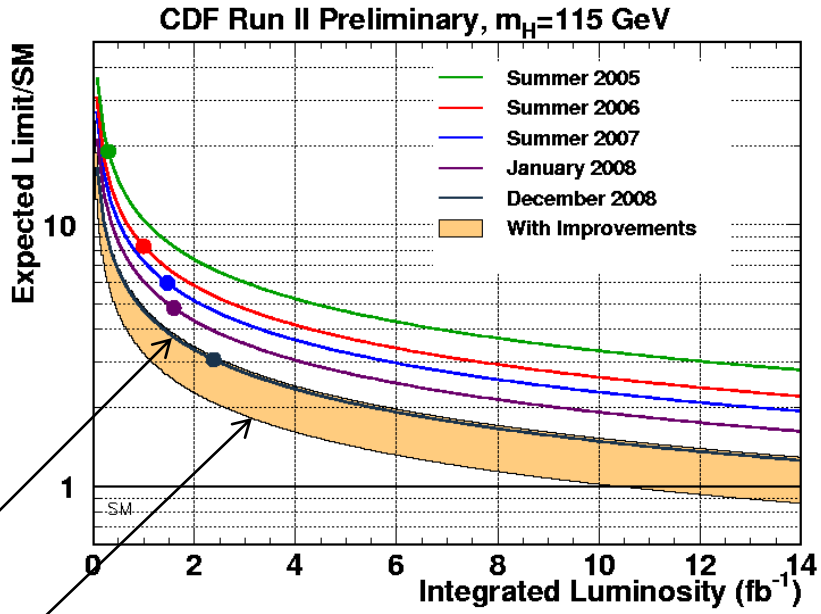
- First direct exclusion since LEP II.
- Verified using two independent methods (CLs, Bayesian).
- Low mass Tevatron combination not available as of ICHEP08:
  - Challenging owing to the large number of channels (~70).
  - Expected sensitivity: < 3.0xSM @ m_H=115 GeV.
- Tevatron combination by Moriond 2009: stay tuned!

Presented at ICHEP08



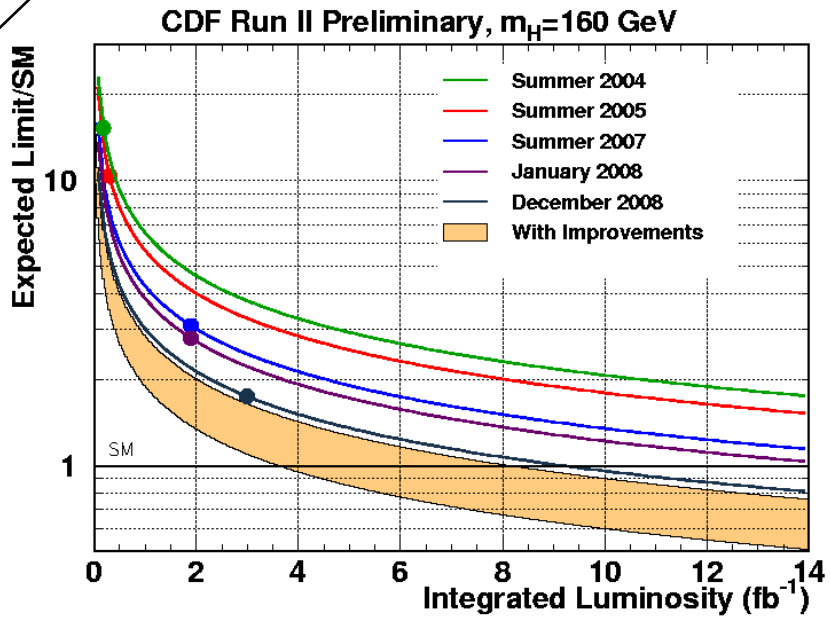
SM Higgs Prospects

- Limits have improved faster than 1/√L due to analysis improvements.
- Major effort underway to continue to improve sensitivity:
  - Optimized object identification/resolution
  - Optimized selections and signal-to-bckg discrimination
  - Reduced systematic uncertainties
  - Adding new channels
  - Adding more data!



x1.5 improvement relative to Summer 2007

x2.25 improvement relative to Summer 2007



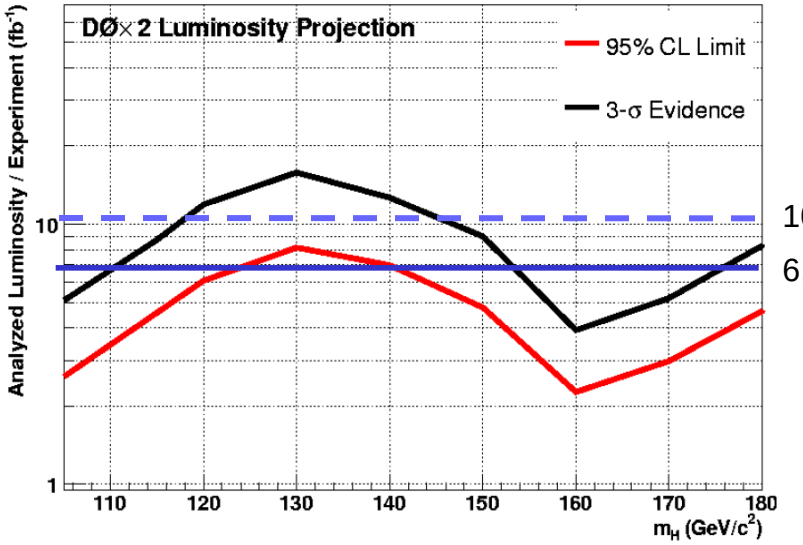
SM Higgs Prospects

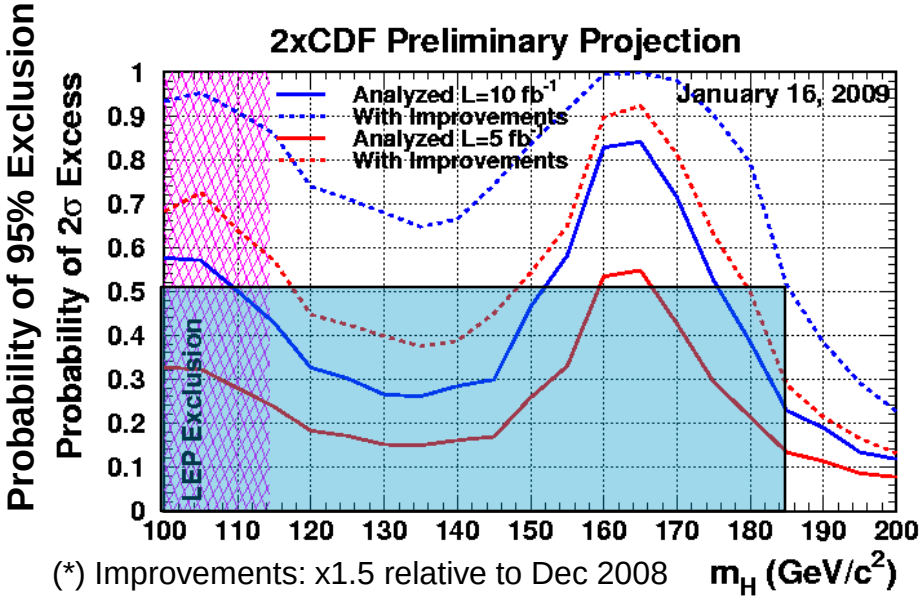
- Median projected reach as a function of analyzed (=0.8 x delivered) integrated luminosity:

  ** Does NOT include current observed limit **

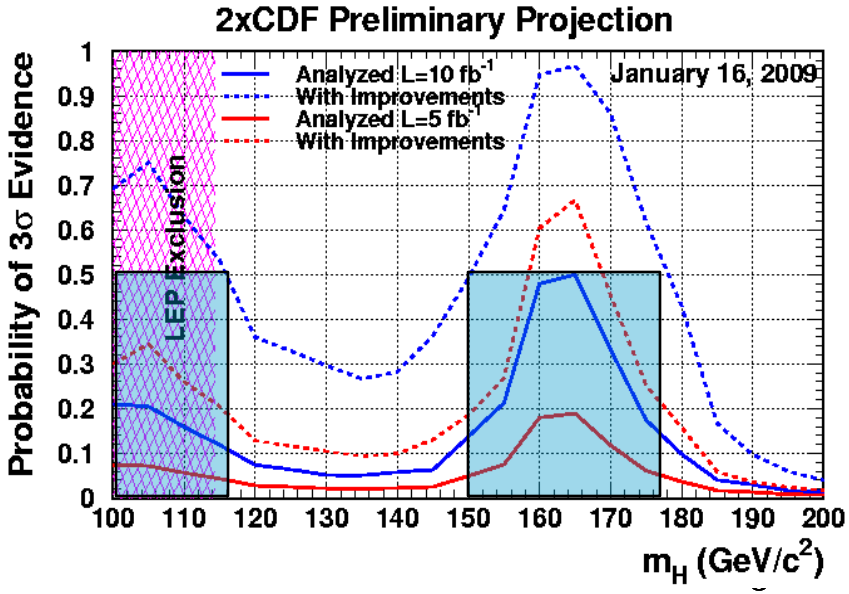
  With 10 fb^{-1} /experiment:

  - Exclude at 95% CL for m_H<185 GeV.
  - 3σ evidence at low and high mass.
  - There is a band of possibilities around these lines.





(*) Improvements: x1.5 relative to Dec 2008



➔ Tevatron complements LHC at low mass.