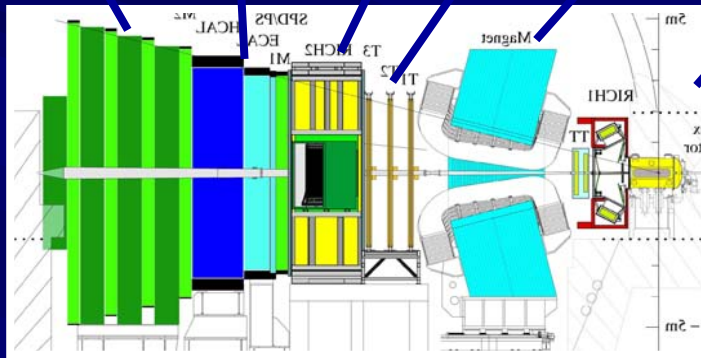


Muon Calorimeters RICH2 Trackers Magnet RICH1
VELO



Jets Study and

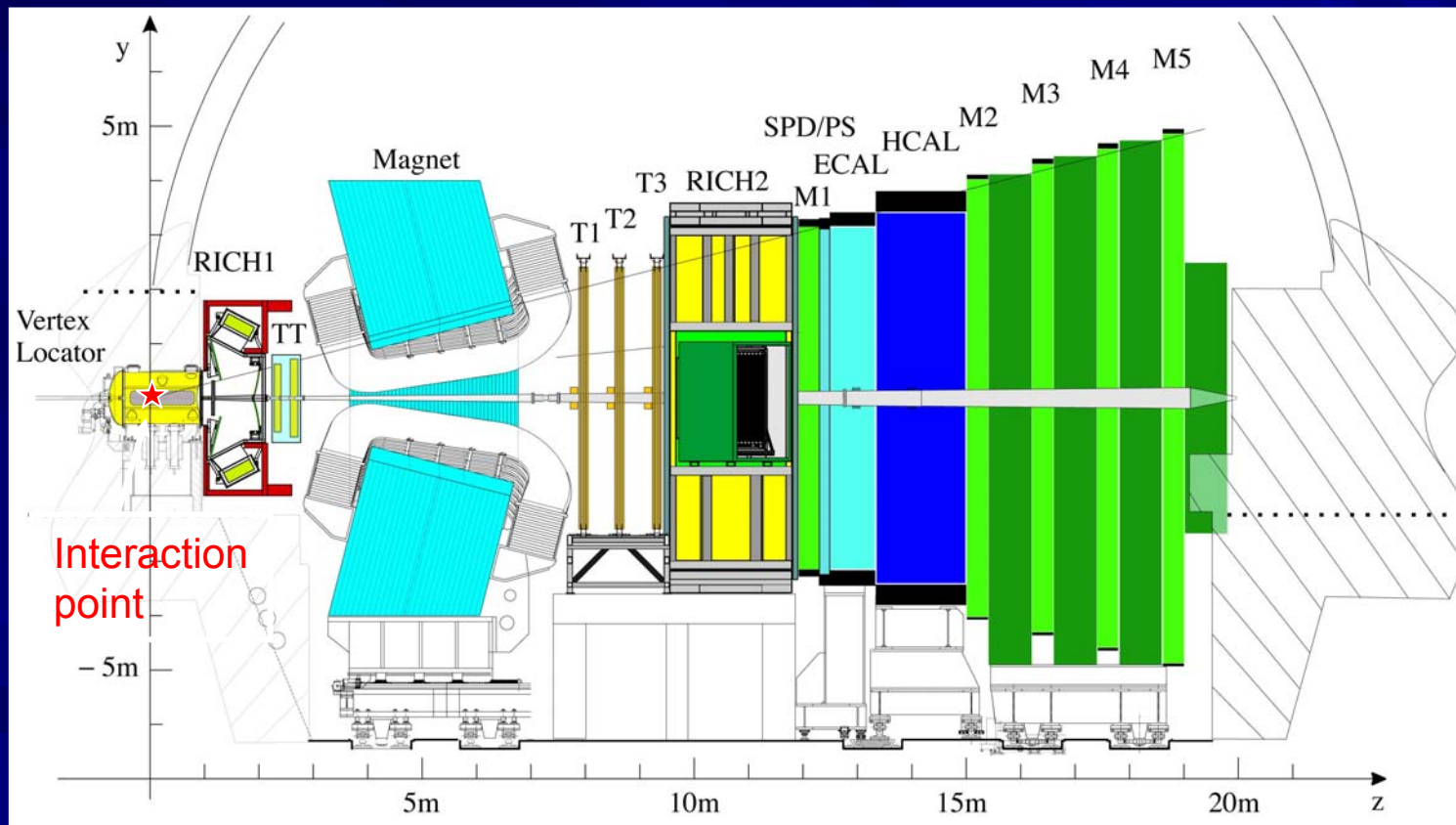
Comparison of Different Generators

Nelli Pukhaeva

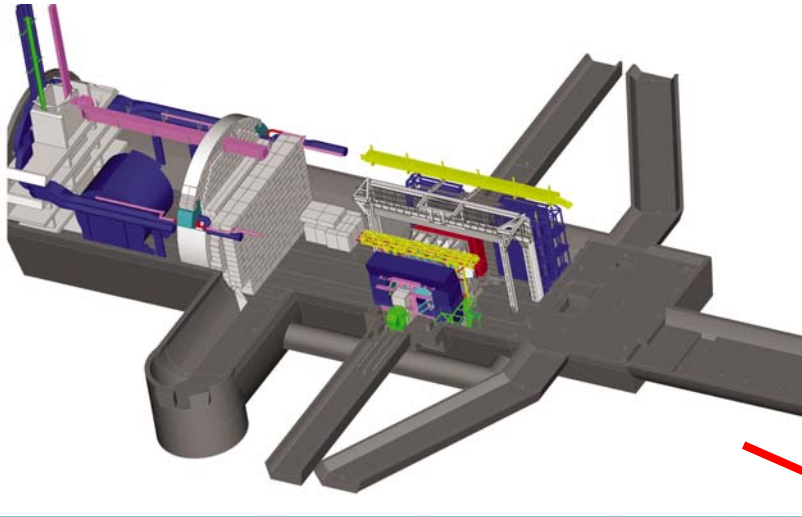
The LHCb experiment



LHCb is dedicated to the Search for New Physics in CP violation and Rare B decays



LHCb Collaboration: 14 countries, 47 institutions, ~600 people



Final focus



LHCb
ГЧСР

The LHCb experiment

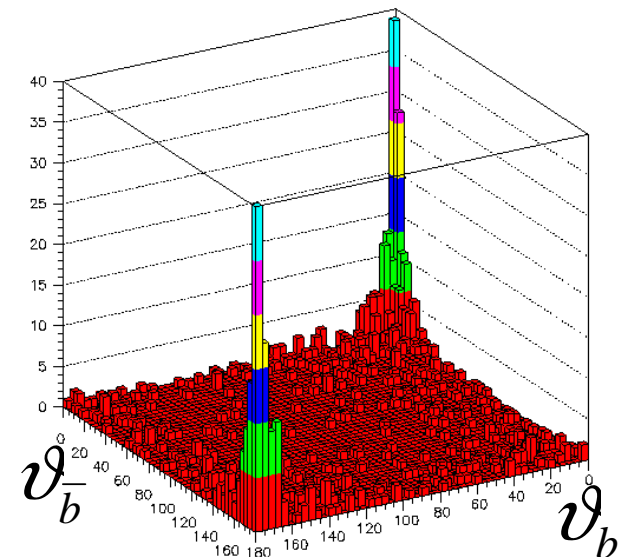
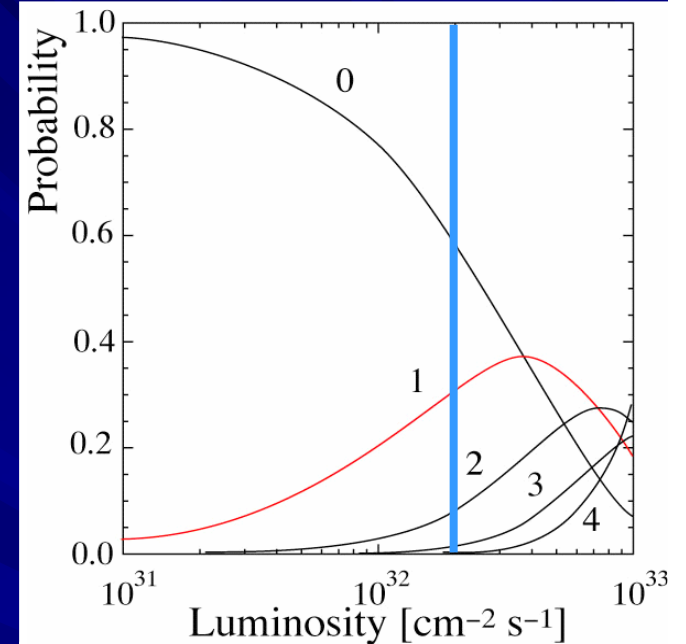


- LHCb experiment is designed for triggering and high-precision measurement of b-hadron decays
- The detector covers the acceptance in forward region (15 – 300 mrad)
- Average luminosity = $2 \times 10^{31} \text{ cm}^{-2} \text{ s}^{-1} = 0.2 \text{ nbarn s}^{-1}$
- LHCb event size $\sim 35 \text{ kByte}$
- Data rate $\sim 70 \text{ MByte/s} \sim 6.0 \text{ TByte/day}$

B production at the LHCb



- In the forward region ($4.9 > \eta > 1.9$):
- bb production correlated and sharply peaked forward-backward
- bb cross-section large ($\sim 500 \mu\text{b}$)
(but total b $\sim 100 \text{ mb}$)
- Luminosity $\mathcal{L} = 2 \times 10^{32} \text{ cm}^{-2} \text{ s}^{-1}$
- $\Rightarrow 10^{12}$ B hadrons in 10^7 sec
- All species of B hadrons produced
(B_{\pm} , B_d , B_s , B_c , b-baryons)
- B's have large momentum
 $\langle p_B \rangle_{\text{acc}} \sim 80 \text{ GeV}/c$
Mean flight path of B's $\sim 7 \text{ mm}$.



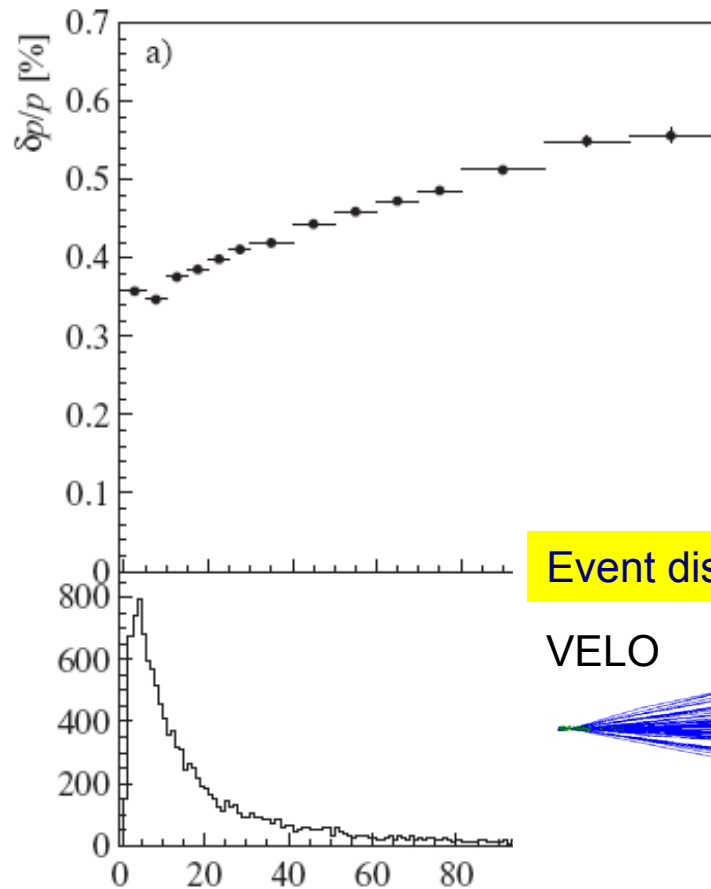
Tracking performance at LHCb



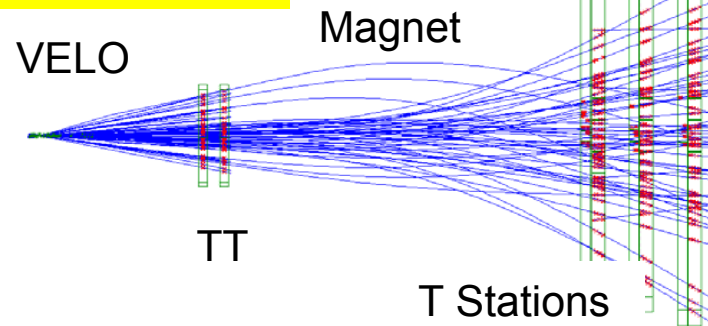
Momentum Resolution

- Track fit: bi-directional Kalman fit
- Tracking efficiency >95%
- Ghost rate <7% $p > 12 \text{ GeV}$

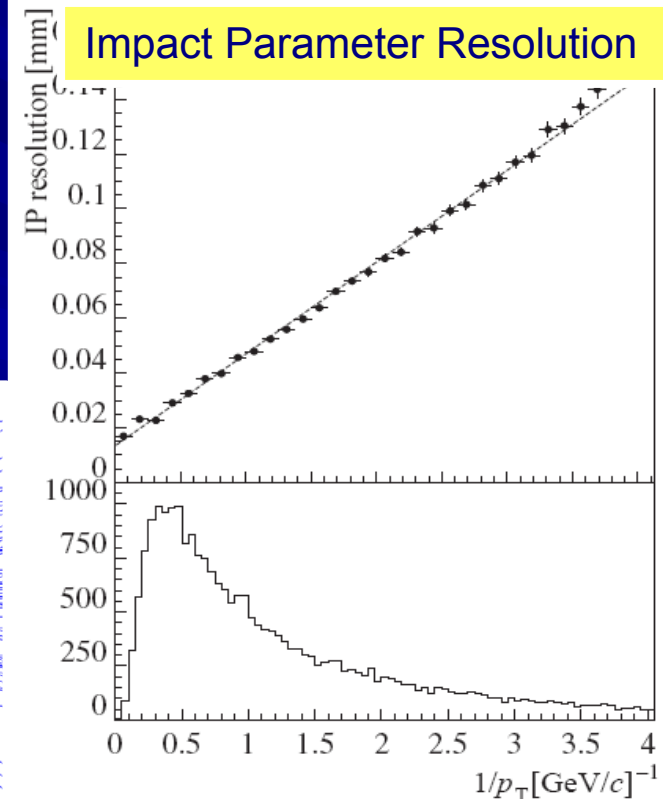
- Vertex resolution
 - $\sim 10 \mu\text{m}$ in x,y; $50 \mu\text{m}$ in z
- Proper time resolution $\sim 40 \text{ fs}$
- B Mass resolution $\sim 15 \text{ MeV}$
(depending the channel)



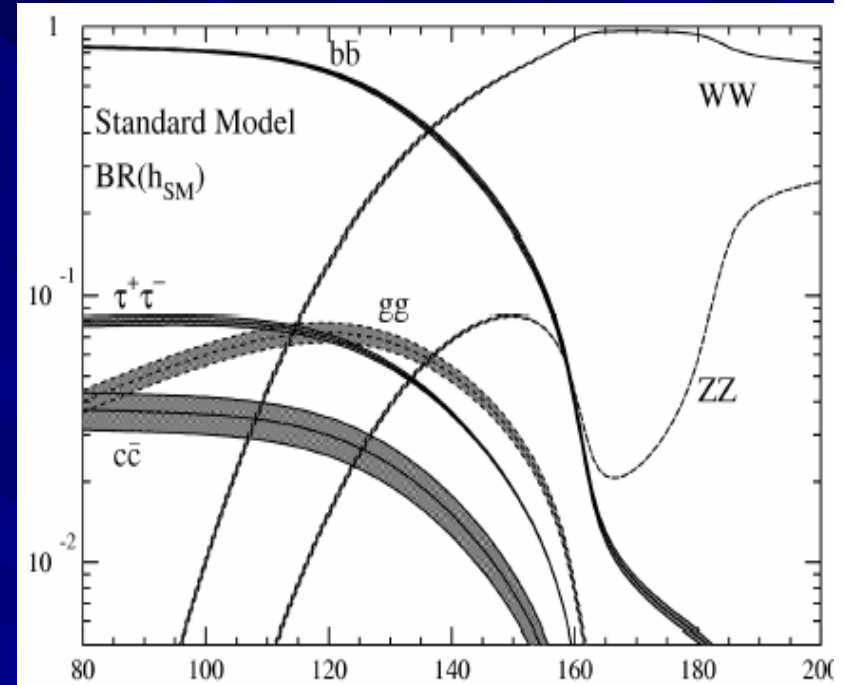
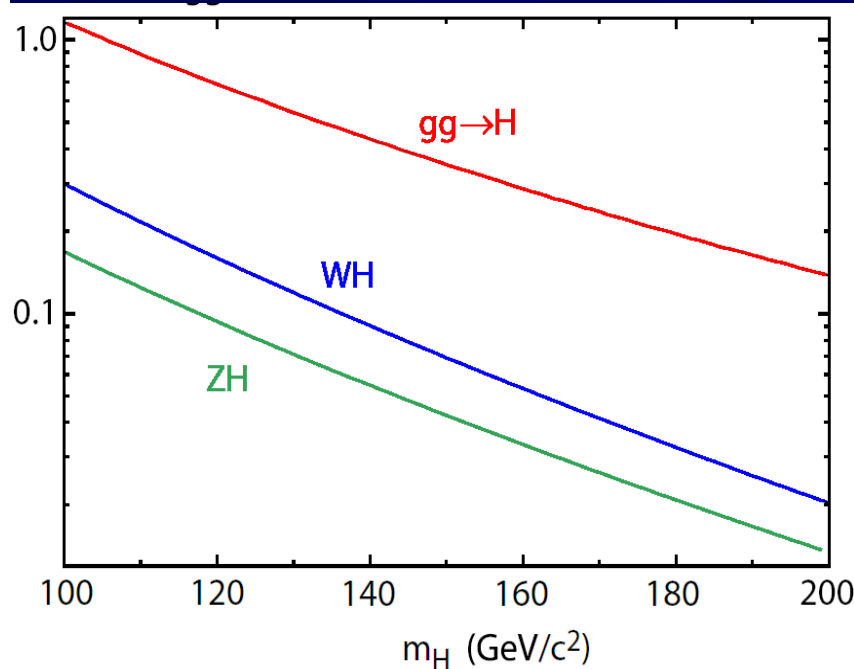
Event display



Impact Parameter Resolution



SM Higgs production



Production cross section

- in the 1.0-0.2 pb range for $gg \rightarrow H$
- in the 0.2-0.03 pb range for associated vector boson production

Dominant Decays

- $b\bar{b}$ for $M_H < 135 \text{ GeV}$
- WW^* for $M_H > 135 \text{ GeV}$

Search strategy:

- $M_H < 135 \text{ GeV}$ associated production WH and ZH with $H \rightarrow b\bar{b}$ decay
Backgrounds: top, $Wb\bar{b}$, $Zb\bar{b}$...
- $M_H > 135 \text{ GeV}$ $gg \rightarrow H$ production with decay to WW^*
Backgrounds: electroweak WW production...

Experimental Limits on Higgs Mass

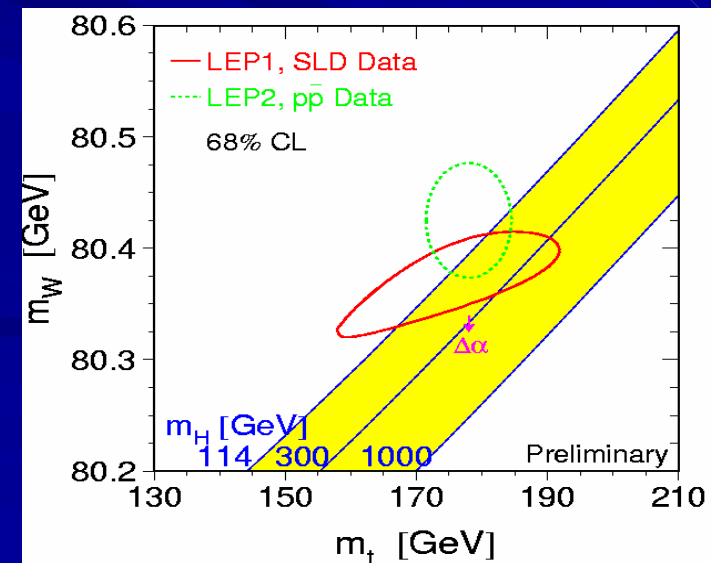
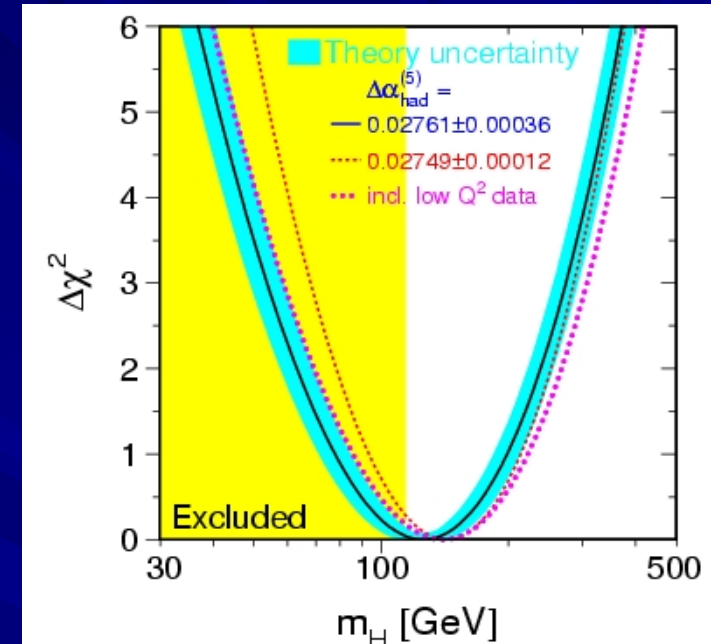


->Direct searches at LEP
 $M > 114 \text{ GeV}$ at 95% C.L.

->Precision EW fits:
 $M = 126^{+73}_{-48} \text{ GeV}$
 $M < 219 \text{ GeV}$ at 95% C.L.

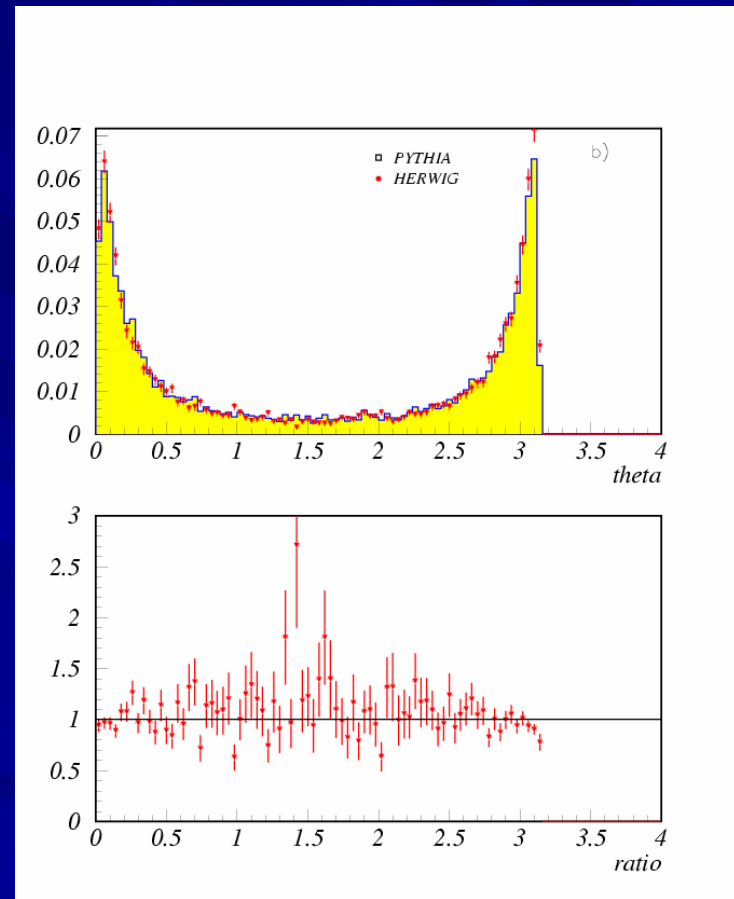
->Light Higgs favored

Direct searches:
→ SM Higgs
→ non-SM Higgs



SM Higgs at LHCb

- 30% SM Higgs events are in LHCb acceptance
- Higgs $M = 125\text{GeV}$
- $pp \rightarrow Z/W H$
 - ↓ ↓
 - $ll (\nu l)$ bb
 - (l in LHCb acceptance)

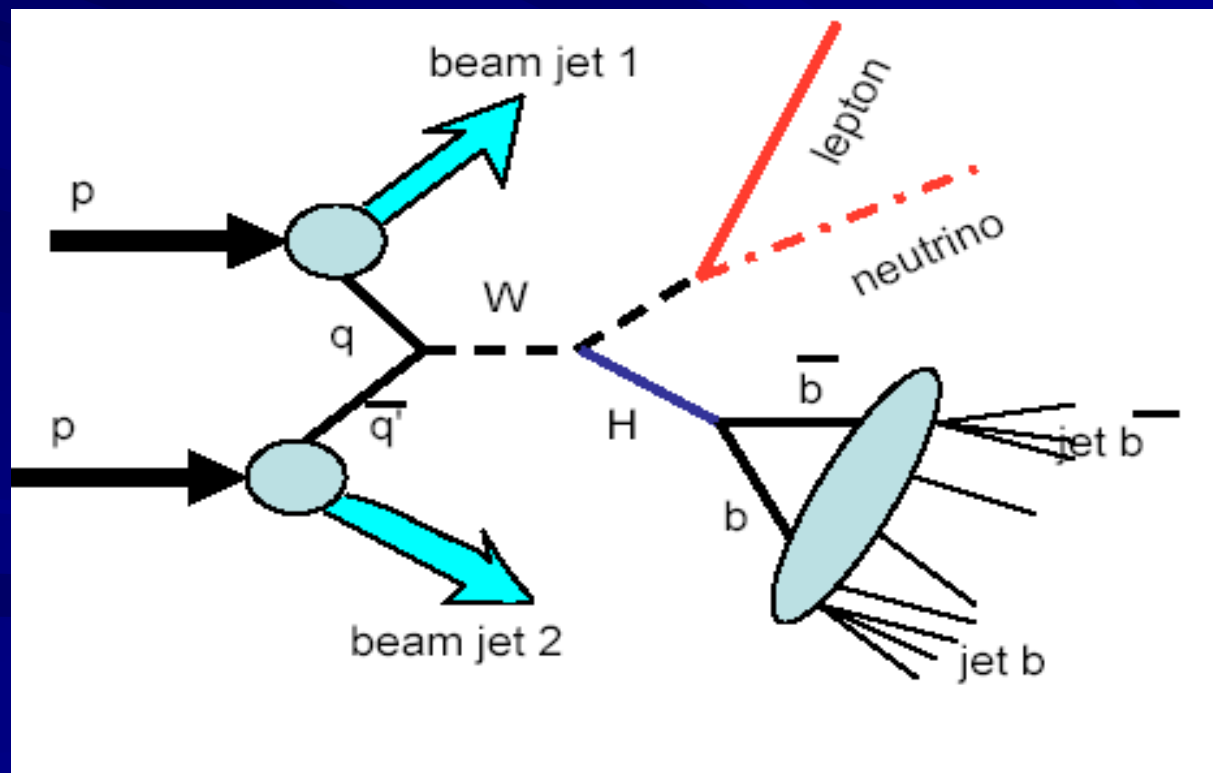


SM Higgs at LHCb

- Search for events with:

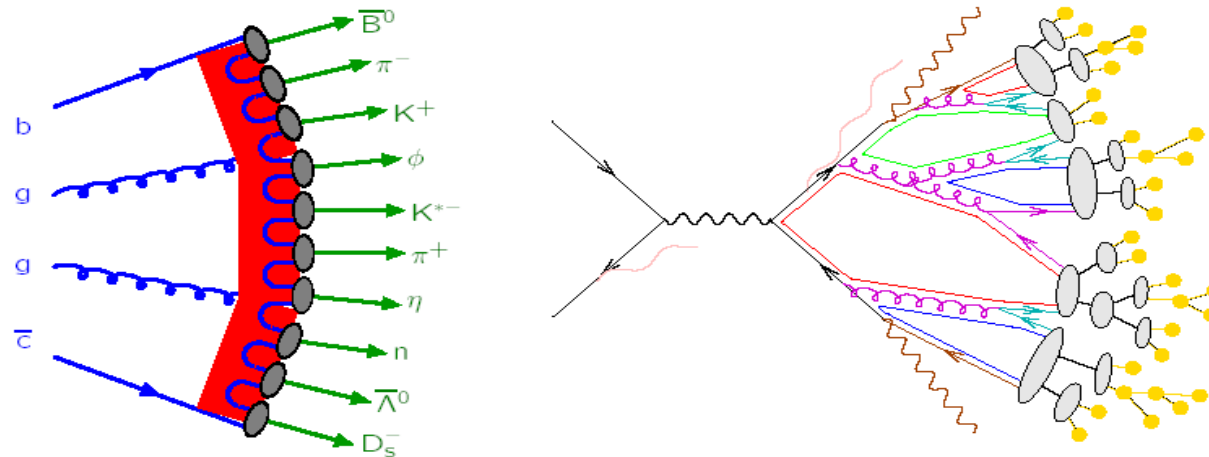
One isolated, high pt lepton (from $Z/W \rightarrow l \nu$)

Two jets with beauty inside (two b-jets from H)



Comparison Pythia and Herwig Higgs production

String vs. Cluster



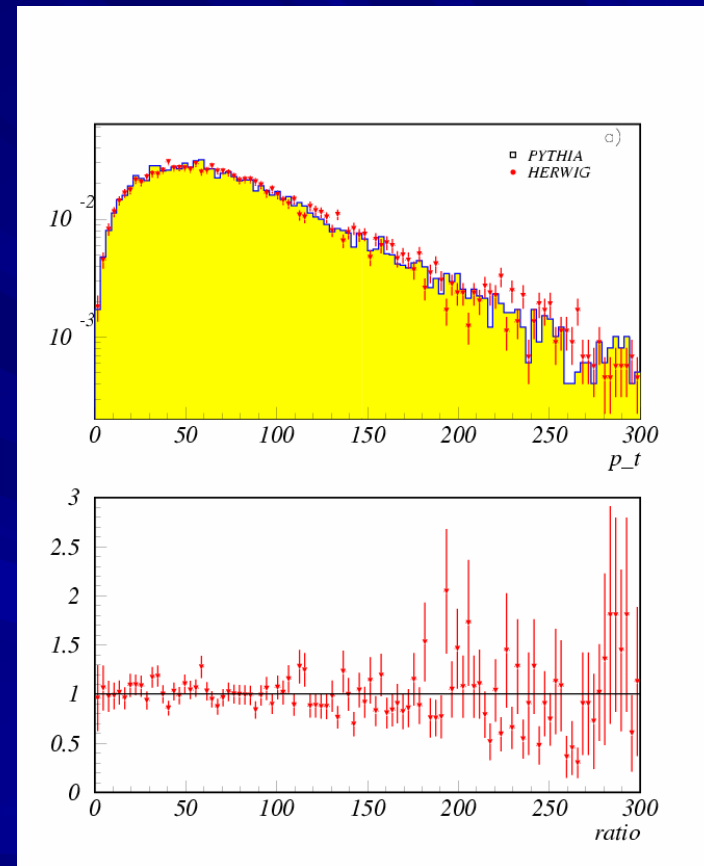
program model	PYTHIA string	HERWIG cluster
energy-momentum picture	powerful	simple
parameters	predictive	unpredictive
flavour composition	few	many
parameters	messy	simple
	unpredictive	in-between
	many	few

“There ain’t no such thing as a parameter-free *good* description”

Comparison Pythia & Herwig Higgs production



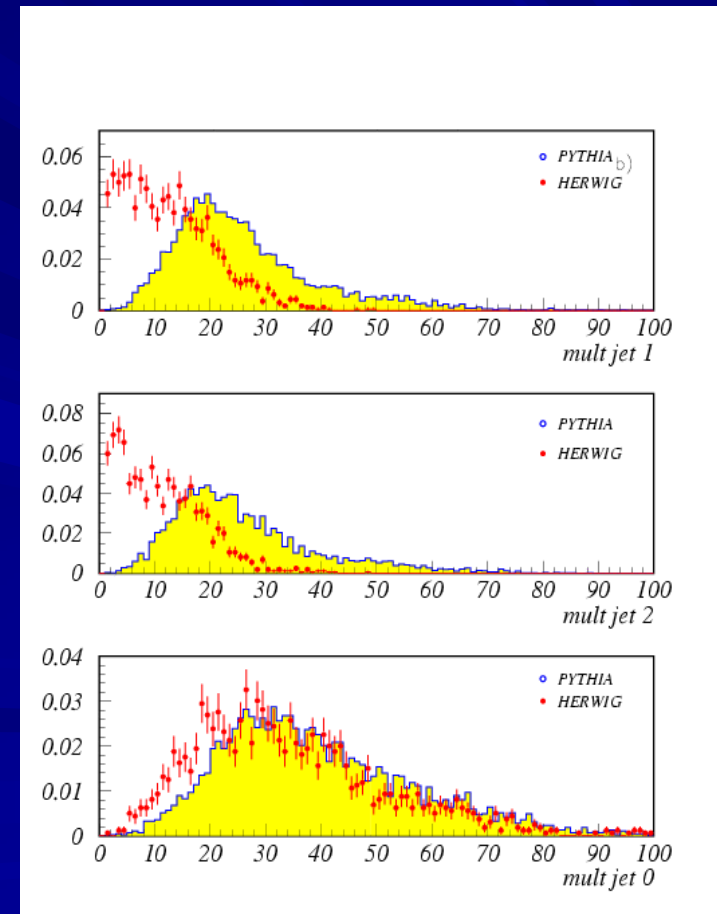
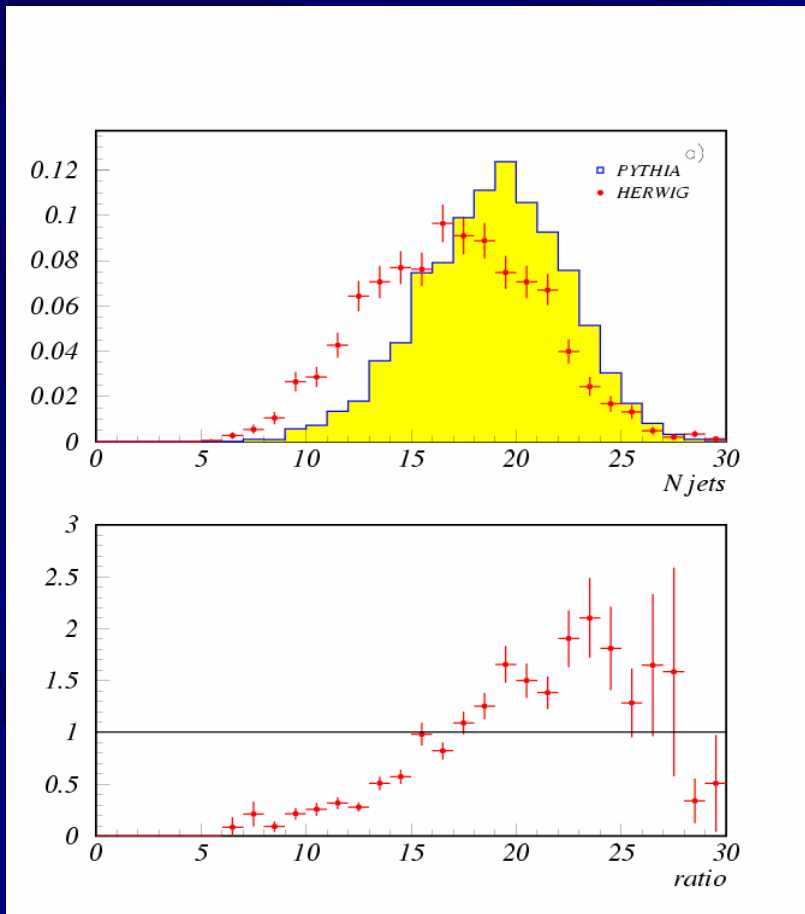
- Events inside the LHCb acceptance
 $15 > \Theta > 300$, $E_t > 3\text{GeV}$
- Lepton from Z or W is inside LHCb acceptance
- Jets reconstructed by Kt algorithm
- Tracks are forced in two jets, rest of tracks are in third jets



Comparison Pythia & Herwig Higgs production



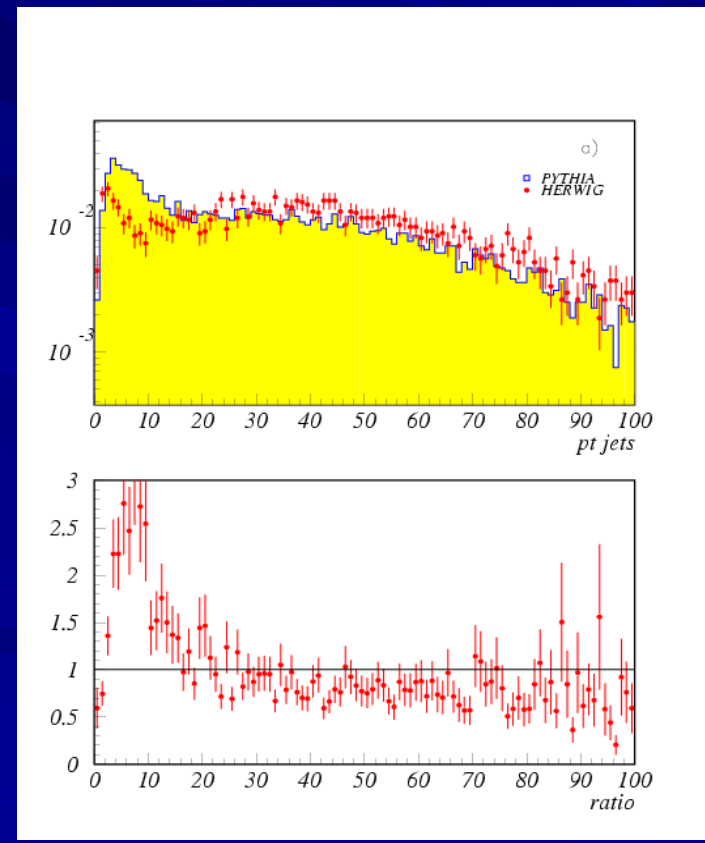
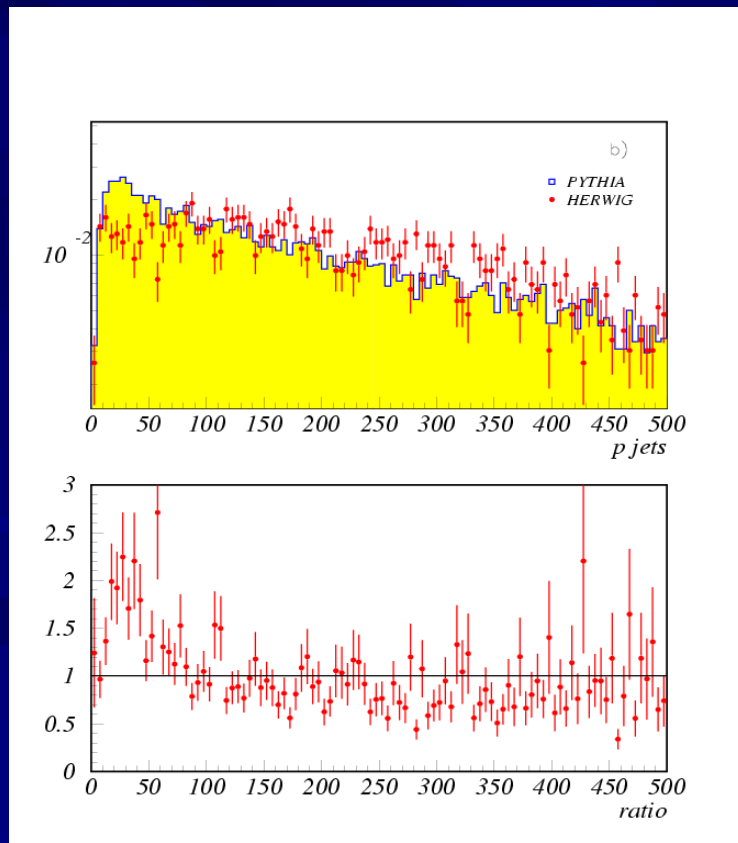
■ Number of reconstructed jets ■ Multiplicity of jets



Comparison Pythia & Herwig Higgs production

■ pt distributions for jets

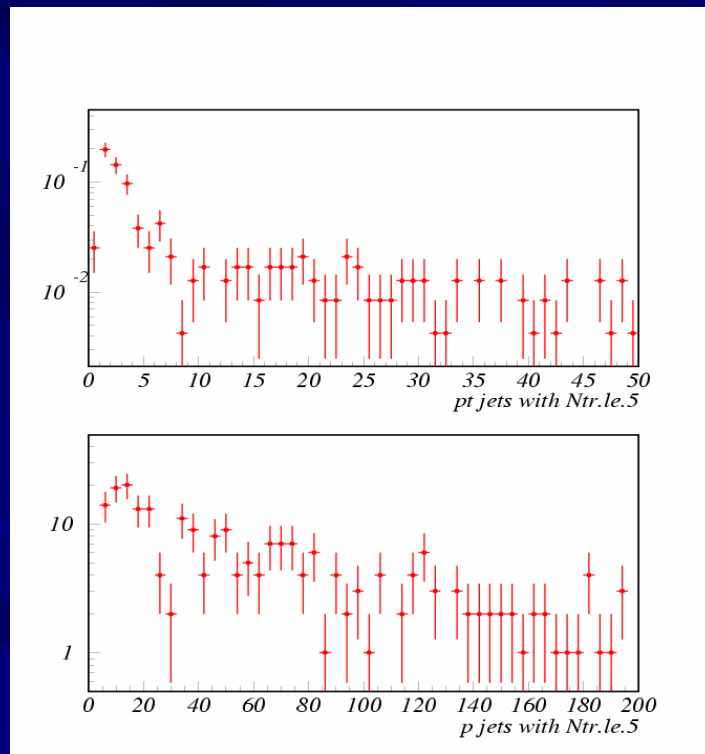
■ Momentum distributions for jets



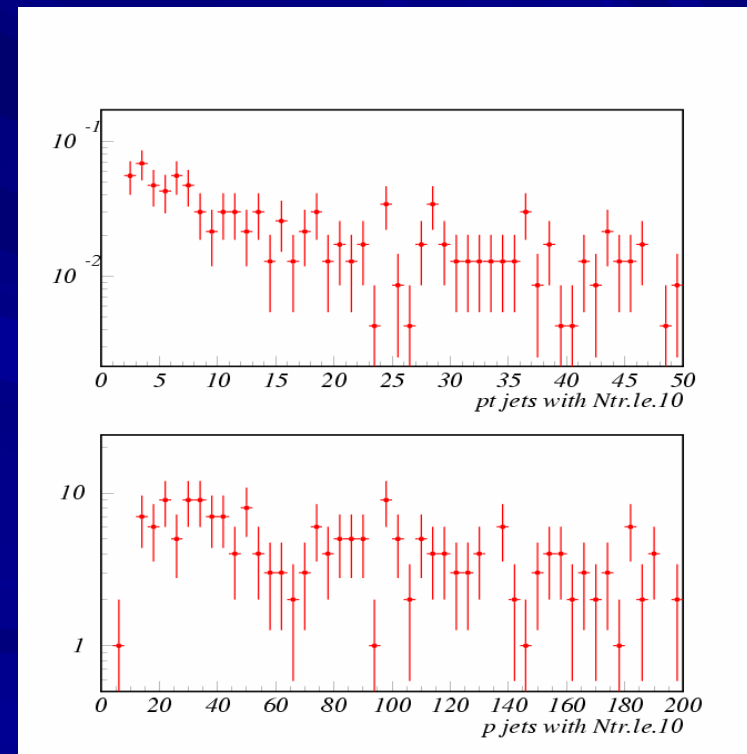
Comparison Pythia & Herwig Higgs production



- pt and p for jets with $N_{tr} > 5$



- pt and p for jets with $5 > N_{tr} > 10$

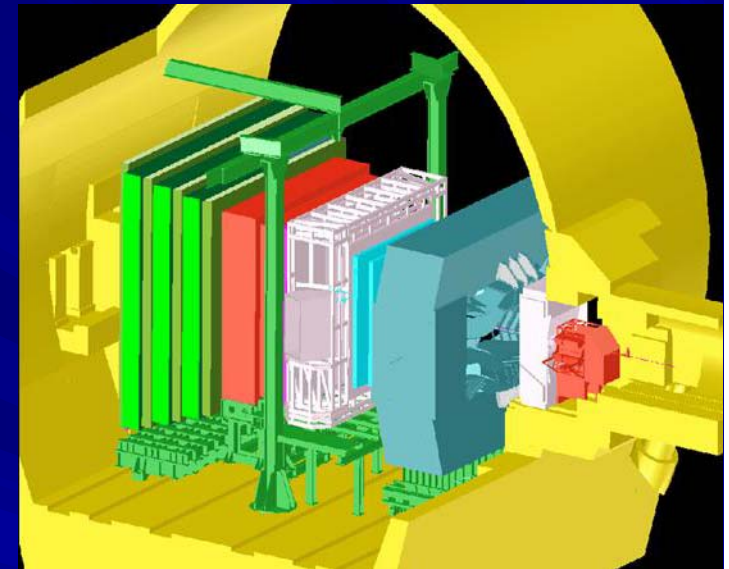


Conclusion



The LHCb detector construction and installation is near completion

- Starting commissioning phase, ready for pilot run in 2007 and physics data in 2008



Very close future:

- Very many new and exciting physics results in flavour physics
 - And maybe even a few discoveries
- New Physics, Higgs, ????

A very busy time in the LHCb cavern

