$q\bar{q}$ Resonances below Threshold

Example: $b\bar{b}$ at CESR

CLEO, PRL 44 (80) 1108

CUSB, PRL 44 (80) 1111

$\Upsilon(1S)$

$\Upsilon(2S)$

$\Upsilon(3S)$

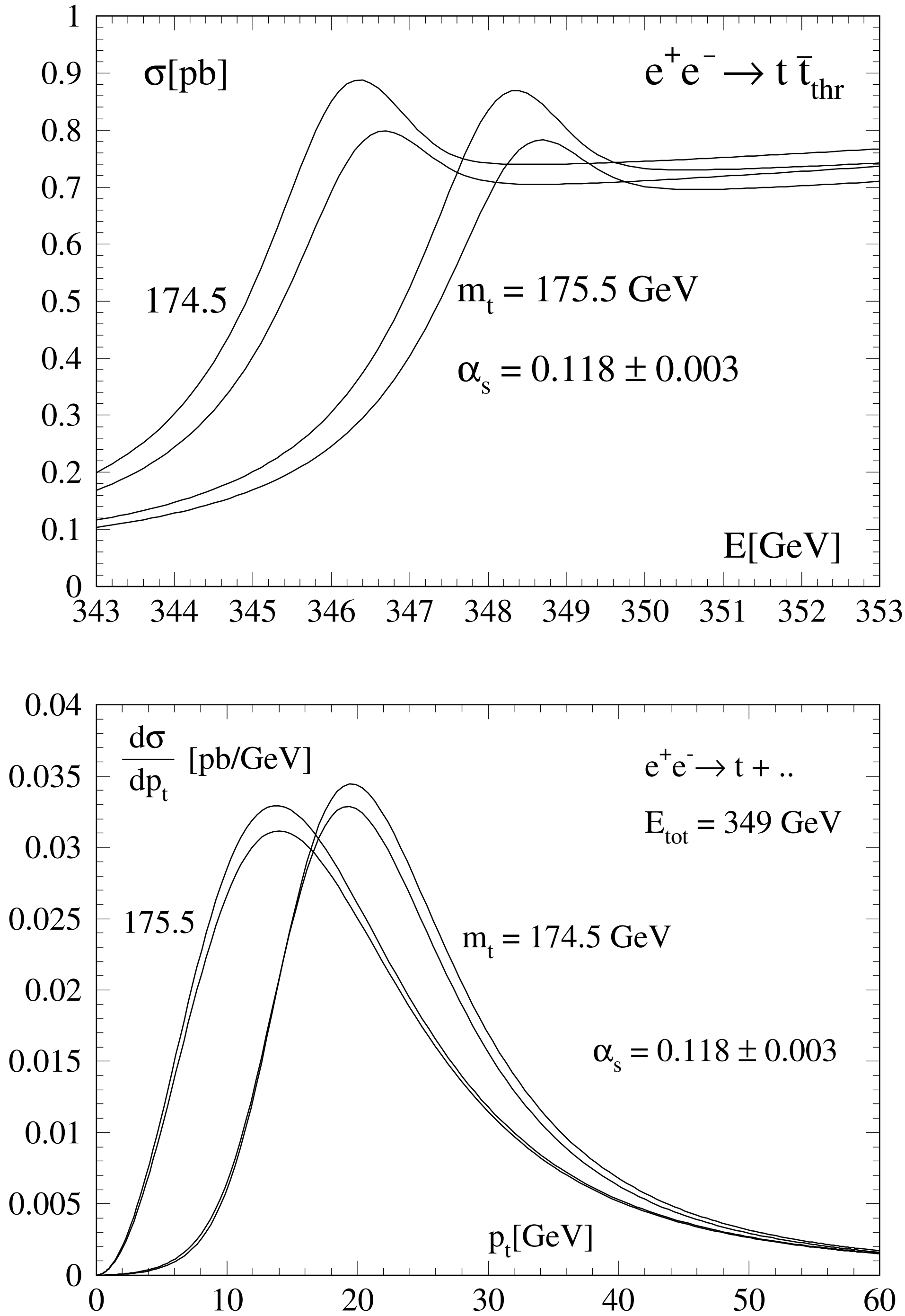
$\Upsilon(4S)$

CLEO, PRL 45 (80) 219

CUSB, PRL 45 (80) 222

Top Production Near Threshold

Unlike $J/\psi = (c\bar{c})$ and $\Upsilon = (b\bar{b})$, top quarks decay too quickly to form a vector meson



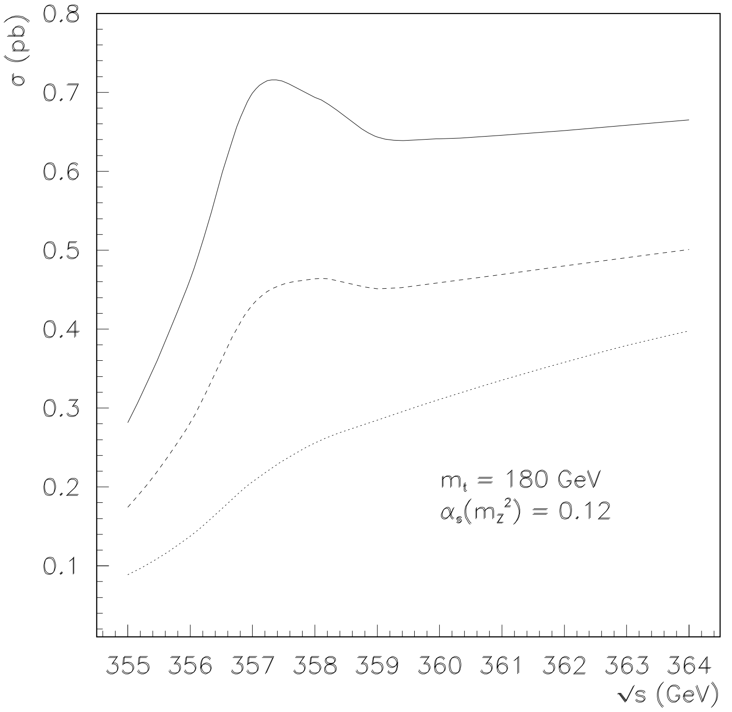
No resonance enhancement at threshold

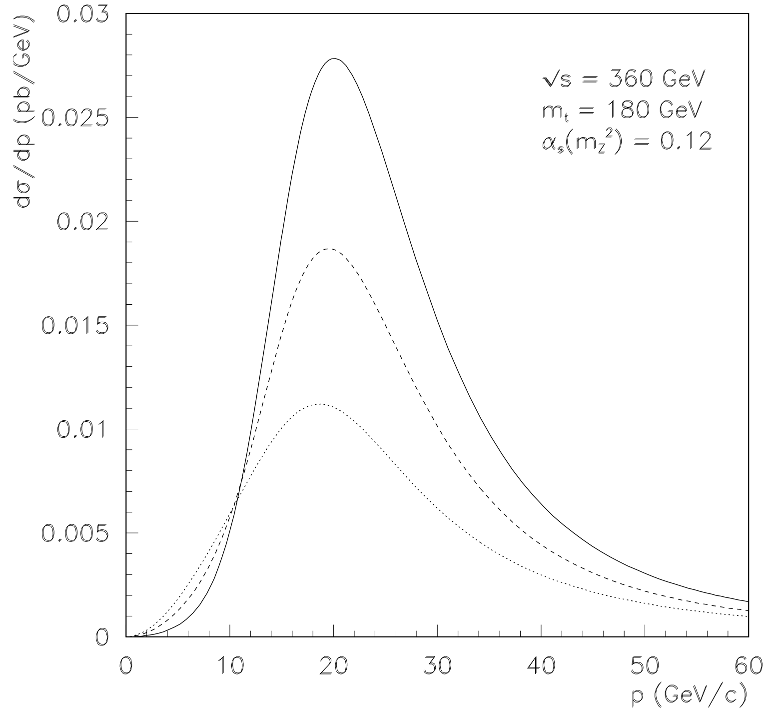
Top Xsection and Momentum Distribution

Threshold washed out by ISR and beamstrahlung

Comas et al.

DESY 96-123D





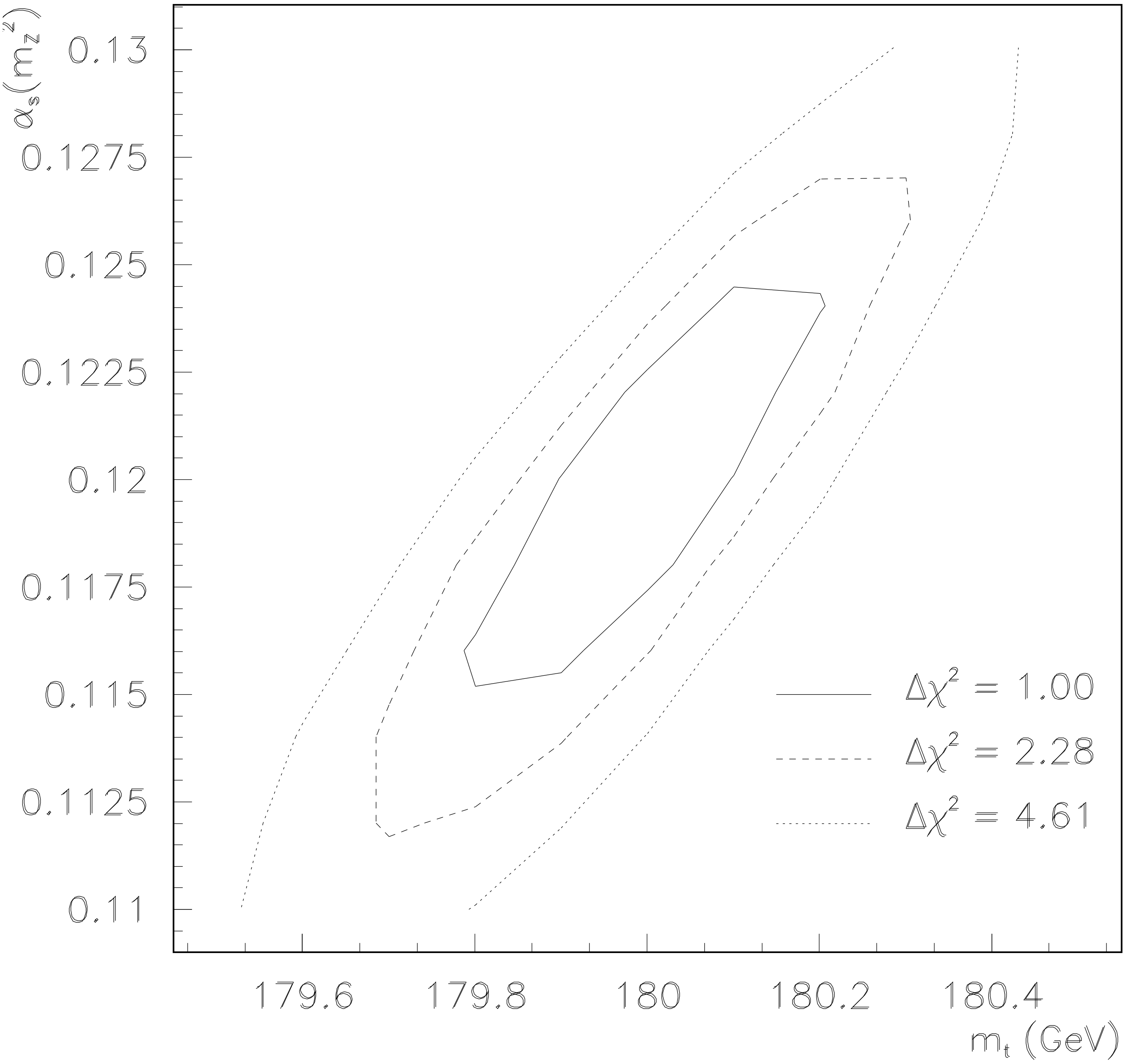
Top selection by leptonic decay t $\rightarrow$ WX $\rightarrow$ lνX
Top momentum from hadronic decay t $\rightarrow$ Wq $\rightarrow$ qqq

Top Mass Determination

Threshold scan with 9 equally spaced points:

$356 < \sqrt{s} < 364$ GeV, 5 fb^{-1} per point

Comas et al., DESY 96-123D

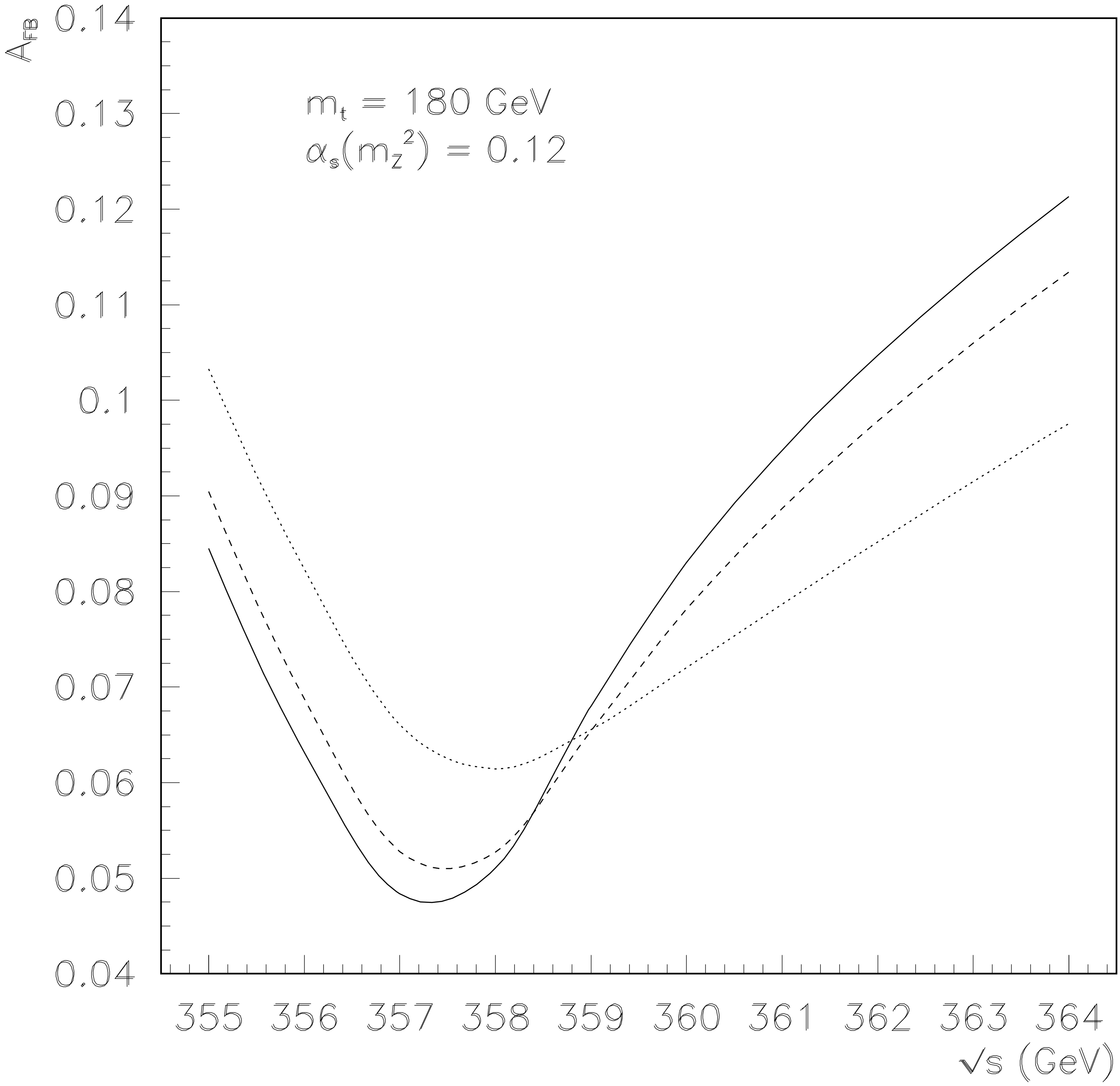


Mass accuracy $\simeq$ 200 MeV

Top Forward-Backward Asymmetry

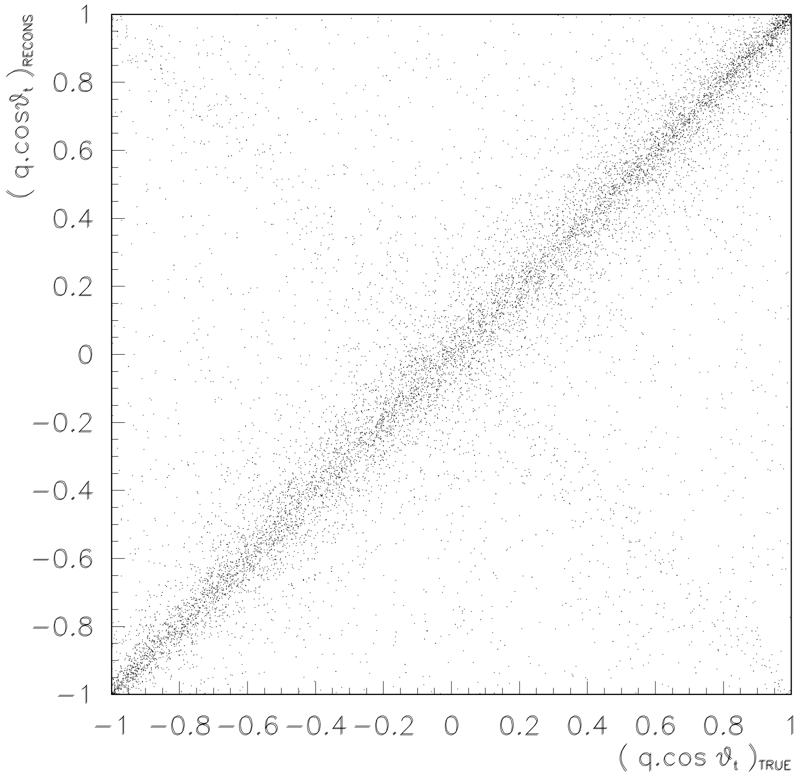
Large top width → interference S-P-states → forward-backward asymmetry at threshold

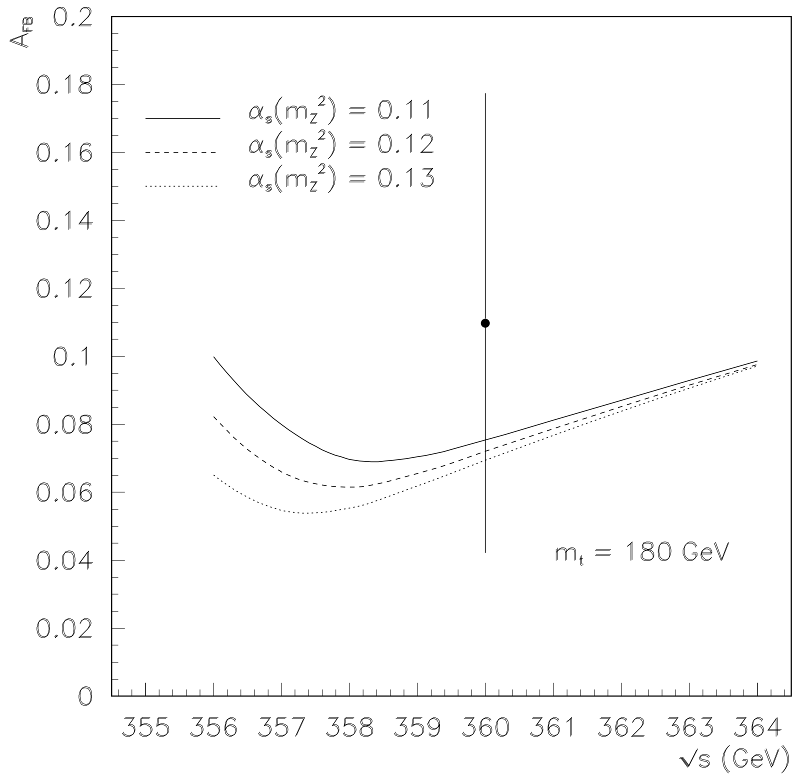
Comas et al., DESY 96-123D



Top Forward-Backward Asymmetry

Comas et al., DESY 96-123D



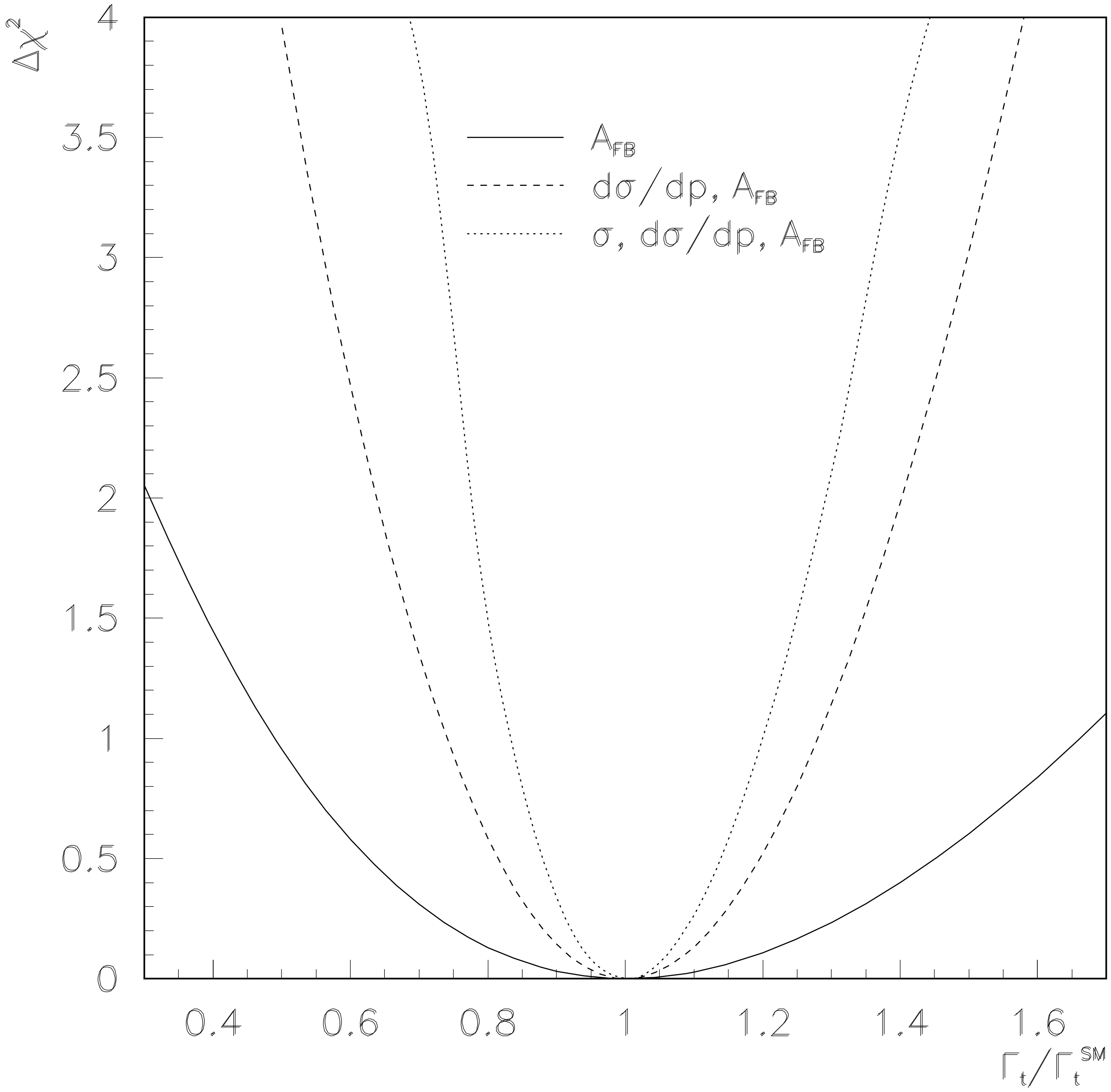


Top Width Measurement

Threshold scan with 9 equally spaced points:

$356 < \sqrt{s} < 364$ GeV, 5 fb^{-1} per point

Comas et al., DESY 96-123D



Width accuracy $\simeq 20\%$

Top Quark Properties

Almost no $t\bar{t}$ resonance, sizeable strong interaction corrections.

Nevertheless:

- measure cross section and quark velocity close to threshold
- measure t quark mass to 200 MeV accuracy (LHC: expect 2 GeV accuracy)
- measure couplings of t quark to
  - photon: static electromagnetic properties
  - Z boson: weak neutral current production properties
  - W boson: weak charged current decay properties
- measure $Ht\bar{t}$ coupling

Experimental signatures:

- very high particle multiplicity
- many jets and leptons in final state
- need high resolution, fine granularity detector