Technicolor

See the related review(s):

Dynamical Electroweak Symmetry Breaking: Implications of the H^0

The latest unpublished results are described in "Dynamical Electroweak Symmetry Breaking" review.

MASS LIMITS for Resonances in Models of Dynamical Electroweak Symmetry Breaking

VALUE (GeV)	CL%	DOCUMENT ID		TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •					
>3900	95	[1] AAD	20AM	ATLS	top-color Z'
		[2] AAD	20W	ATLS	$\rho_T \rightarrow W\pi_T \rightarrow \ell\nu q\overline{q}$
		[3] AAD	16W	ATLS	color octet vector resonance
>2400	95	[4] KHACHATRY...	16E	CMS	top-color Z'
		[5] AAD	15AB	ATLS	$h \rightarrow \pi_V \pi_V$
>1800	95	[6] AAD	15AO	ATLS	top-color Z'
		[7] AAD	15BB	ATLS	$pp \rightarrow \rho_T/a_{1T} \rightarrow Wh$ or Zh
		[8] AAD	15Q	ATLS	$h \rightarrow \pi_V \pi_V$
		[9] AAIJ	15AN	LHCB	$h \rightarrow \pi_V \pi_V$
>1140	95	[10] KHACHATRY...	15C	CMS	$\rho_T \rightarrow WZ$
		[11] KHACHATRY...	15W	CMS	$H \rightarrow \pi_V \pi_V$
none 200–700, 750–890	95	[12] AAD	14AT	ATLS	$pp \rightarrow \omega_T \rightarrow Z\gamma$
none 275–960	95	[12] AAD	14AT	ATLS	$pp \rightarrow a_T \rightarrow W\gamma$
		[13] AAD	14V	ATLS	color singlet techni-vector
$>$ 703		[14] AAD	13AN	ATLS	$pp \rightarrow a_T \rightarrow W\gamma$
$>$ 494		[15] AAD	13AN	ATLS	$pp \rightarrow \omega_T \rightarrow Z\gamma$
none 500–1740	95	[16] AAD	13AQ	ATLS	top-color Z'
>1300	95	[17] CHATRCHYAN	13AP	CMS	top-color Z'
>2100	95	[16] CHATRCHYAN	13BM	CMS	top-color Z'
		[18] BAAK	12	RVUE	QCD-like technicolor
none 167–687	95	[19] CHATRCHYAN	12AF	CMS	$\rho_T \rightarrow WZ$
$>$ 805	95	[16] AALTONEN	11AD	CDF	top-color Z'
$>$ 805	95	[16] AALTONEN	11AE	CDF	top-color Z'
		[20] CHIVUKULA	11	RVUE	top-Higgs
		[21] CHIVUKULA	11A	RVUE	techini-π
		[22] AALTONEN	10I	CDF	$p\overline{p} \rightarrow \rho_T/\omega_T \rightarrow W\pi_T$
none 208–408	95	[23] ABAZOV	10A	D0	$\rho_T \rightarrow WZ$
		[24] ABAZOV	07I	D0	$p\overline{p} \rightarrow \rho_T/\omega_T \rightarrow W\pi_T$
$>$ 280	95	[25] ABULENCIA	05A	CDF	$\rho_T \rightarrow e^+e^-, \mu^+\mu^-$
		[26] CHEKANOV	02B	ZEUS	color octet techni-π
$>$ 207	95	[27] ABAZOV	01B	D0	$\rho_T \rightarrow e^+e^-$
none 90–206.7	95	[28] ABDALLAH	01	DLPH	$e^+e^- \rightarrow \rho_T$

		[29] AFFOLDER	00F	CDF	color-singlet techni-ρ, $\rho_T \to W\pi_T$, $2\pi_T$
$>$ 600	95	[30] AFFOLDER	00K	CDF	color-octet techni-ρ, $\rho_{T8} \to 2\pi_{LQ}$
none 350–440	95	[31] ABE	99F	CDF	color-octet techni-ρ, $\rho_{T8} \to \overline{b}b$
		[32] ABE	99N	CDF	techni-ω, $\omega_T \to \gamma\overline{b}b$
none 260–480	95	[33] ABE	97G	CDF	color-octet techni-ρ, $\rho_{T8} \to$ 2jets

[1] AAD 20AM search for a top-color Z' decaying to $t\overline{t}$ in pp collisions at $\sqrt{s}$ = 13 TeV. The quoted limit is for $\Gamma_{Z'}/M_{Z'}$ = 0.01. The limit becomes $M_{Z'} >$ 4700 GeV for $\Gamma_{Z'}/M_{Z'}$ = 0.03.

[2] AAD 20W search for techni-ρ decaying to $\pi_T W$ in pp collisions at $\sqrt{s}$ = 13 TeV. See their Fig. 5a for limits on $\sigma\cdot B$.

[3] AAD 16W search for color octet vector resonance decaying to bB in pp collisions at $\sqrt{s}$ = 8 TeV. The vector like quark B is assumed to decay to bH. See their Fig.3 and Fig.4 for limits on $\sigma \cdot B$.

[4] KHACHATRYAN 16E search for top-color Z' decaying to $t\overline{t}$. The quoted limit is for $\Gamma_{Z'}/m_{Z'}$ = 0.012. Also exclude $m_{Z'} <$ 2.9 TeV for wider topcolor Z' with $\Gamma_{Z'}/m_{Z'}$ = 0.1.

[5] AAD 15AB search for long-lived hidden valley π_V particles which are produced in pairs by the decay of a scalar boson. π_V is assumed to decay into dijets. See their Fig. 10 for the limit on σB.

[6] AAD 15AO search for top-color Z' decaying to $t\overline{t}$. The quoted limit is for $\Gamma_{Z'}/m_{Z'}$ = 0.012.

[7] AAD 15BB search for minimal walking technicolor (MWT) isotriplet vector and axial-vector resonances decaying to Wh or Zh. See their Fig. 3 for the exclusion limit in the MWT parameter space.

[8] AAD 15Q search for long-lived hidden valley π_V particles which are produced in pairs by the decay of scalar boson. π_V is assumed to decay into dijets. See their Fig. 5 and Fig. 6 for the limit on σB.

[9] AAIJ 15AN search for long-lived hidden valley π_V particles which are produced in pairs by the decay of scalar boson with a mass of 120GeV. π_V is assumed to decay into dijets. See their Fig. 4 for the limit on σB.

[10] KHACHATRYAN 15C search for a vector techni-resonance decaying to WZ. The limit assumes M_{π_T} = (3/4) M_{ρ_T} − 25 GeV. See their Fig.3 for the limit in $M_{\pi_T} - M_{\rho_T}$ plane of the low scale technicolor model.

[11] KHACHATRYAN 15W search for long-lived hidden valley π_V particles which are produced in pairs in the decay of heavy higgs boson H. π_V is assumed to decay into $\ell^+\ell^-$. See their Fig. 7 and Fig. 8 for the limits on σB.

[12] AAD 14AT search for techni-ω and techni-a resonances decaying to $V\gamma$ with $V = W(\to \ell\nu)$ or $Z(\to \ell^+\ell^-)$.

[13] AAD 14V search for vector techni-resonances decaying into electron or muon pairs in pp collisions at $\sqrt{s}$ = 8 TeV. See their table IX for exclusion limits with various assumptions.

[14] AAD 13AN search for vector techni-resonance a_T decaying into $W\gamma$.

[15] AAD 13AN search for vector techni-resonance ω_T decaying into $Z\gamma$.

[16] Search for top-color Z' decaying to $t\overline{t}$. The quoted limit is for $\Gamma_{Z'}/m_{Z'}$ = 0.012.

[17] CHATRCHYAN 13AP search for top-color leptophobic Z' decaying to $t\overline{t}$. The quoted limit is for $\Gamma_{Z'}/m_{Z'}$ = 0.012.

[18] BAAK 12 give electroweak oblique parameter constraints on the QCD-like technicolor models. See their Fig. 28.

[19] CHATRCHYAN 12AF search for a vector techni-resonance decaying to WZ. The limit assumes M_{π_T}= (3/4) M_{ρ_T} − 25 GeV. See their Fig. 3 for the limit in $M_{\pi_T}-M_{\rho_T}$ plane of the low scale technicolor model.

[20] Using the LHC limit on the Higgs boson production cross section, CHIVUKULA 11 obtain a limit on the top-Higgs mass > 300 GeV at 95% CL assuming 150 GeV top-pion mass.

[21] Using the LHC limit on the Higgs boson production cross section, CHIVUKULA 11A obtain a limit on the techinipion mass ruling out the region 110 GeV $< m_P < 2m_t$. Existence of color techni-fermions, top-color mechanism, and $N_{TC} \geq 3$ are assumed.

[22] AALTONEN 10I search for the vector techni-resonances (ρ_T, ω_T) decaying into $W\pi_T$ with $W \rightarrow \ell\nu$ and $\pi_T \rightarrow b\overline{b}$, $b\overline{c}$, or $b\overline{u}$. See their Fig. 3 for the exclusion plot in $M_{\pi_T} - M_{\rho_T}$ plane.

[23] ABAZOV 10A search for a vector techni-resonance decaying into WZ. The limit assumes $M_{\rho_T} < M_{\pi_T} + M_W$.

[24] ABAZOV 07I search for the vector techni-resonances (ρ_T, ω_T) decaying into $W\pi_T$ with $W \rightarrow e\nu$ and $\pi_T \rightarrow b\overline{b}$ or $b\overline{c}$. See their Fig. 2 for the exclusion plot in $M_{\pi_T} - M_{\rho_T}$ plane.

[25] ABULENCIA 05A search for resonances decaying to electron or muon pairs in $p\overline{p}$ collisions. at $\sqrt{s}$ = 1.96 TeV. The limit assumes Technicolor-scale mass parameters $M_V = M_A$ = 500 GeV.

[26] CHEKANOV 02B search for color octet techni-π P decaying into dijets in ep collisions. See their Fig. 5 for the limit on $\sigma(ep \rightarrow ePX)\cdot$B$(P \rightarrow 2j)$.

[27] ABAZOV 01B searches for vector techni-resonances (ρ_T,ω_T) decaying to e^+e^-. The limit assumes $M_{\rho_T} = M_{\omega_T} < M_{\pi_T} + M_W$.

[28] The limit is independent of the π_T mass. See their Fig. 9 and Fig. 10 for the exclusion plot in the M_{ρ_T}–M_{π_T} plane. ABDALLAH 01 limit on the techni-pion mass is $M_{\pi_T} > 79.8$ GeV for N_D=2, assuming its point-like coupling to gauge bosons.

[29] AFFOLDER 00F search for ρ_T decaying into $W\pi_T$ or $\pi_T\pi_T$ with $W \rightarrow \ell\nu$ and $\pi_T \rightarrow \overline{b}b$, $\overline{b}c$. See Fig. 1 in the above Note on "Dynamical Electroweak Symmetry Breaking" for the exclusion plot in the $M_{\rho_T}-M_{\pi_T}$ plane.

[30] AFFOLDER 00K search for the ρ_{T8} decaying into $\pi_{LQ}\pi_{LQ}$ with $\pi_{LQ} \rightarrow b\nu$. For $\pi_{LQ} \rightarrow c\nu$, the limit is $M_{\rho_{T8}}$ >510 GeV. See their Fig. 2 and Fig. 3 for the exclusion plot in the $M_{\rho_{T8}}-M_{\pi_{LQ}}$ plane.

[31] ABE 99F search for a new particle X decaying into $b\overline{b}$ in $p\overline{p}$ collisions at E_{cm}= 1.8 TeV. See Fig. 7 in the above Note on "Dynamical Electroweak Symmetry Breaking" for the upper limit on $\sigma(p\overline{p} \rightarrow X)\times$B$(X \rightarrow b\overline{b})$. ABE 99F also exclude top gluons of width Γ=0.3M in the mass interval 280 <M< 670 GeV, of width Γ=0.5M in the mass interval 340 <M< 640 GeV, and of width Γ=0.7M in the mass interval 375 <M< 560 GeV.

[32] ABE 99N search for the techni-ω decaying into $\gamma\pi_T$. The technipion is assumed to decay $\pi_T \rightarrow b\overline{b}$. See Fig. 2 in the above Note on "Dynamical Electroweak Symmetry Breaking" for the exclusion plot in the $M_{\omega_T}-M_{\pi_T}$ plane.

[33] ABE 97G search for a new particle X decaying into dijets in $p\overline{p}$ collisions at E_{cm}= 1.8 TeV. See Fig. 5 in the above Note on "Dynamical Electroweak Symmetry Breaking" for the upper limit on $\sigma(p\overline{p} \rightarrow X)\times$B$(X \rightarrow 2j)$.

REFERENCES FOR Technicolor

AAD	20AM	JHEP 2010 061	G. Aad *et al.*	(ATLAS Collab.)
AAD	20W	JHEP 2006 151	G. Aad *et al.*	(ATLAS Collab.)
AAD	16W	PL B758 249	G. Aad *et al.*	(ATLAS Collab.)
KHACHATRY...	16E	PR D93 012001	V. Khachatryan *et al.*	(CMS Collab.)
AAD	15AB	PR D92 012010	G. Aad *et al.*	(ATLAS Collab.)
AAD	15AO	JHEP 1508 148	G. Aad *et al.*	(ATLAS Collab.)
AAD	15BB	EPJ C75 263	G. Aad *et al.*	(ATLAS Collab.)
AAD	15Q	PL B743 15	G. Aad *et al.*	(ATLAS Collab.)

AAIJ	15AN	EPJ C75 152	R. Aaij *et al.*	(LHCb Collab.)
KHACHATRY...	15C	PL B740 83	V. Khachatryan *et al.*	(CMS Collab.)
KHACHATRY...	15W	PR D91 052012	V. Khachatryan *et al.*	(CMS Collab.)
AAD	14AT	PL B738 428	G. Aad *et al.*	(ATLAS Collab.)
AAD	14V	PR D90 052005	G. Aad *et al.*	(ATLAS Collab.)
AAD	13AN	PR D87 112003	G. Aad *et al.*	(ATLAS Collab.)
Also		PR D91 119901 (errat.)	G. Aad *et al.*	(ATLAS Collab.)
AAD	13AQ	PR D88 012004	G. Aad *et al.*	(ATLAS Collab.)
CHATRCHYAN	13AP	PR D87 072002	S. Chatrchyan *et al.*	(CMS Collab.)
CHATRCHYAN	13BM	PRL 111 211804	S. Chatrchyan *et al.*	(CMS Collab.)
Also		PRL 112 119903 (errat.)	S. Chatrchyan *et al.*	(CMS Collab.)
BAAK	12	EPJ C72 2003	M. Baak *et al.*	(Gfitter Group)
CHATRCHYAN	12AF	PRL 109 141801	S. Chatrchyan *et al.*	(CMS Collab.)
AALTONEN	11AD	PR D84 072003	T. Aaltonen *et al.*	(CDF Collab.)
AALTONEN	11AE	PR D84 072004	T. Aaltonen *et al.*	(CDF Collab.)
CHIVUKULA	11	PR D84 095022	R.S. Chivukula *et al.*	
CHIVUKULA	11A	PR D84 115025	R. S. Chivukula *et al.*	
AALTONEN	10I	PRL 104 111802	T. Aaltonen *et al.*	(CDF Collab.)
ABAZOV	10A	PRL 104 061801	V.M. Abazov *et al.*	(D0 Collab.)
ABAZOV	07I	PRL 98 221801	V.M. Abazov *et al.*	(D0 Collab.)
ABULENCIA	05A	PRL 95 252001	A. Abulencia *et al.*	(CDF Collab.)
CHEKANOV	02B	PL B531 9	S. Chekanov *et al.*	(ZEUS Collab.)
ABAZOV	01B	PRL 87 061802	V.M. Abazov *et al.*	(D0 Collab.)
ABDALLAH	01	EPJ C22 17	J. Abdallah *et al.*	(DELPHI Collab.)
AFFOLDER	00F	PRL 84 1110	T. Affolder *et al.*	(CDF Collab.)
AFFOLDER	00K	PRL 85 2056	T. Affolder *et al.*	(CDF Collab.)
ABE	99F	PRL 82 2038	F. Abe *et al.*	(CDF Collab.)
ABE	99N	PRL 83 3124	F. Abe *et al.*	(CDF Collab.)
ABE	97G	PR D55 5263	F. Abe *et al.*	(CDF Collab.)