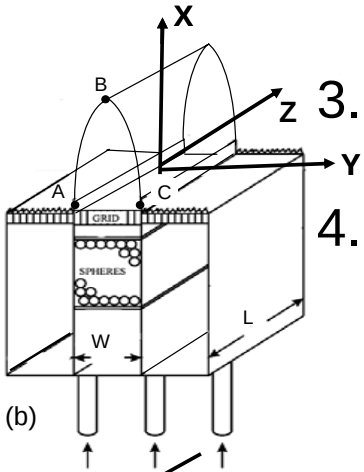
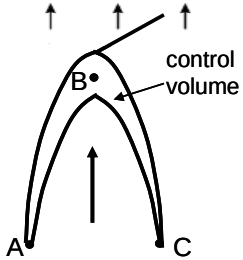
Turbulent Burning Velocities

(a)

(b)



(c)



1. Global Consumption Speed $S_T = m_R \ / \ \rho_R A_F$ recommended

2. Local Consumption Speed (burning integral) recommended

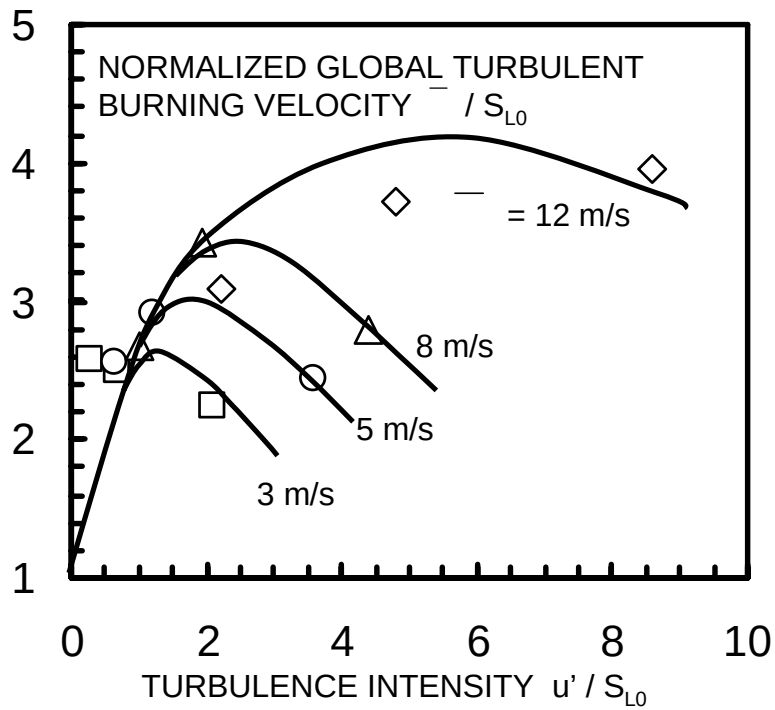
3. Global Displacement Speed (flame angle) recommended

4. Local Displacement Speed $(\underline{V}_F - \underline{V}_G) \cdot \underline{N}$ not recommended

$$m_R = \rho_R S_T A_F$$

$$A_F = P L$$

Large burner = long flame = merging = bending



For Envelope Flames:

Global consumption speed depends on:

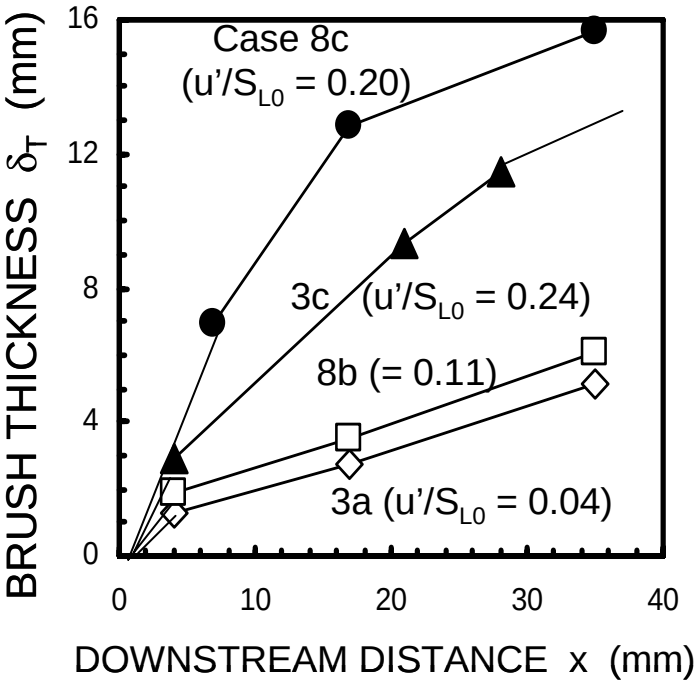
u', S_{L0}, integral scale ℓ and

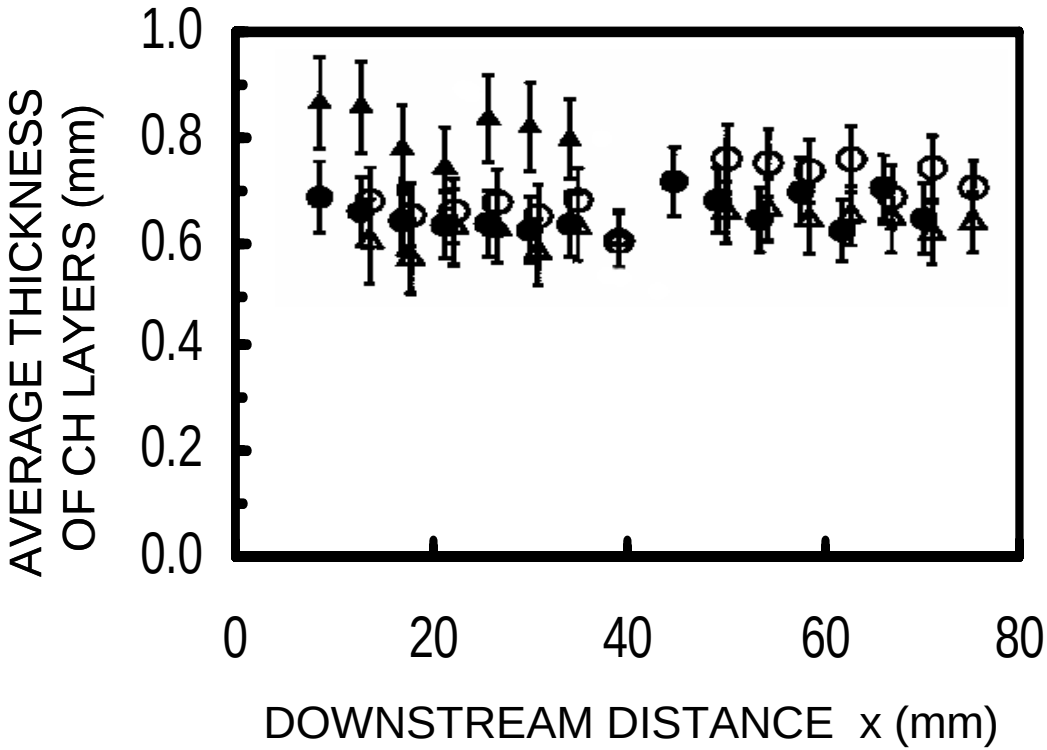
Mean velocity U
Burner width W

$$S_T / S_{L0} = 1 + B_1 [(u'/ S_{L0}) - B_2 (u'/ S_{L0})^2]^{1/2} (W/\ell)^{1/2} (U \ell/\alpha)$$

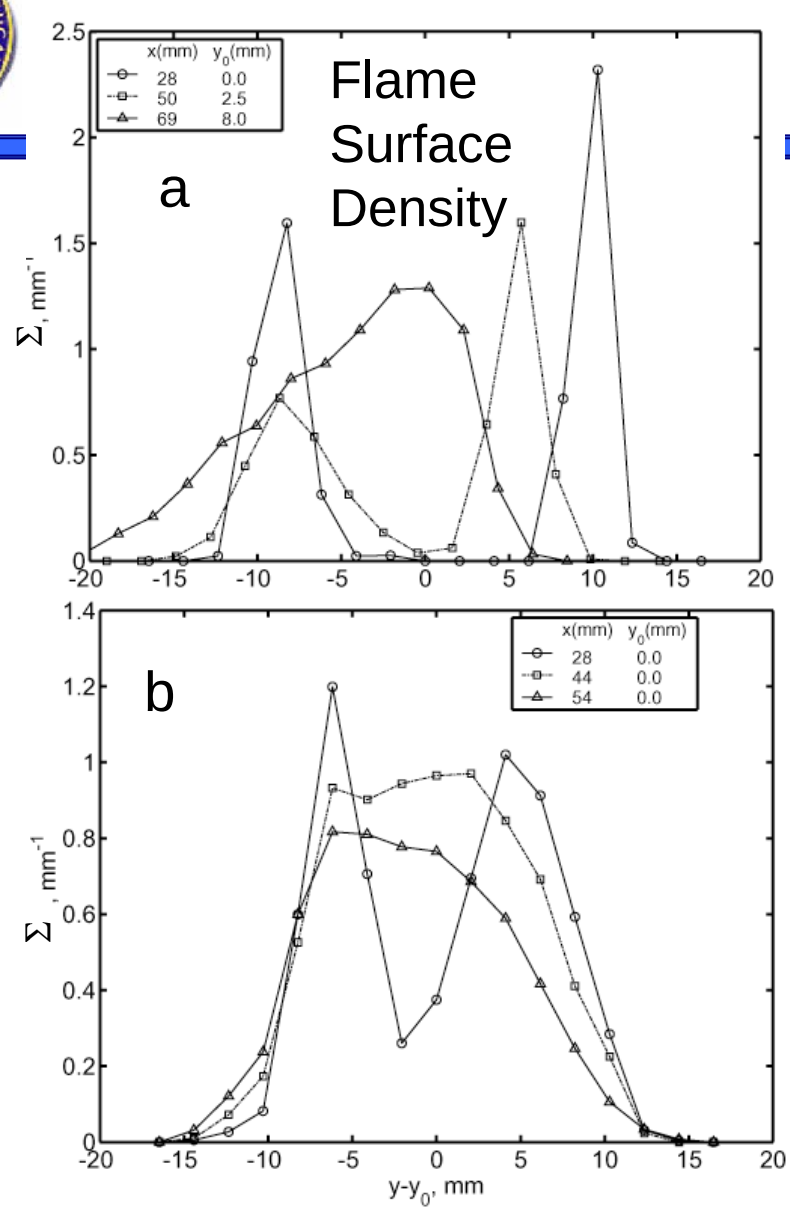
For envelope flames ONLY

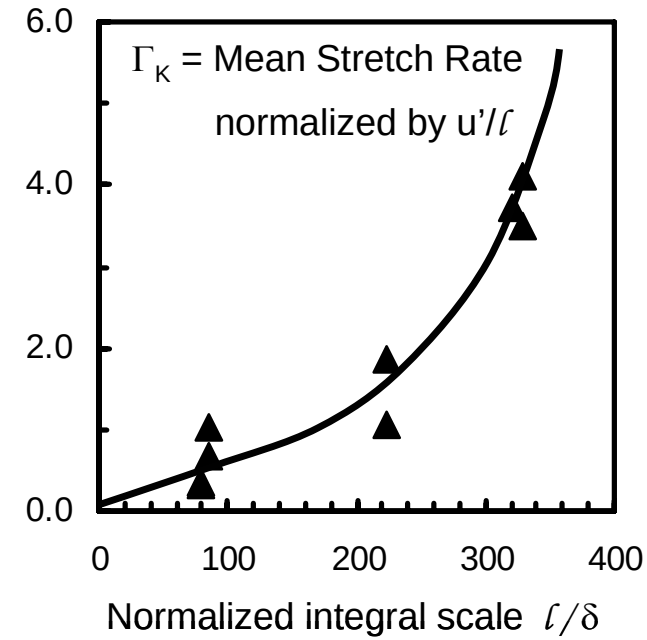
Brush Thickness, CH Layer Thickness

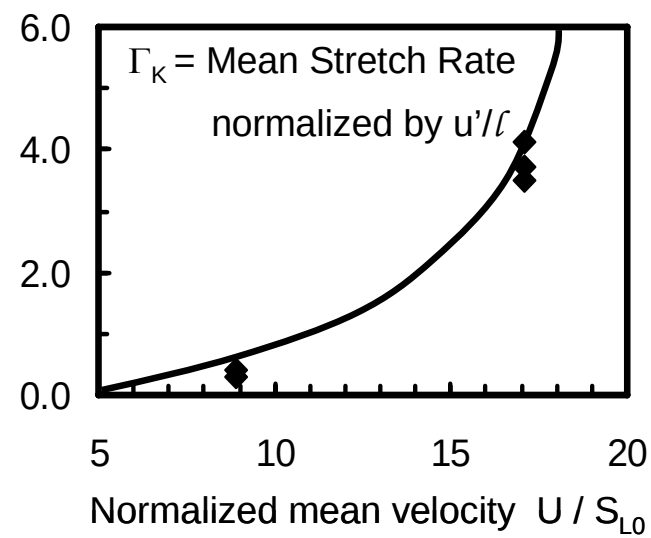


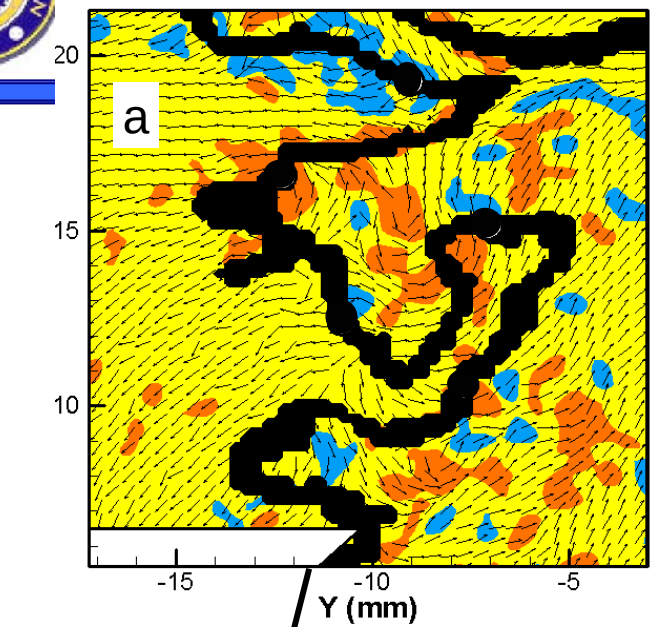


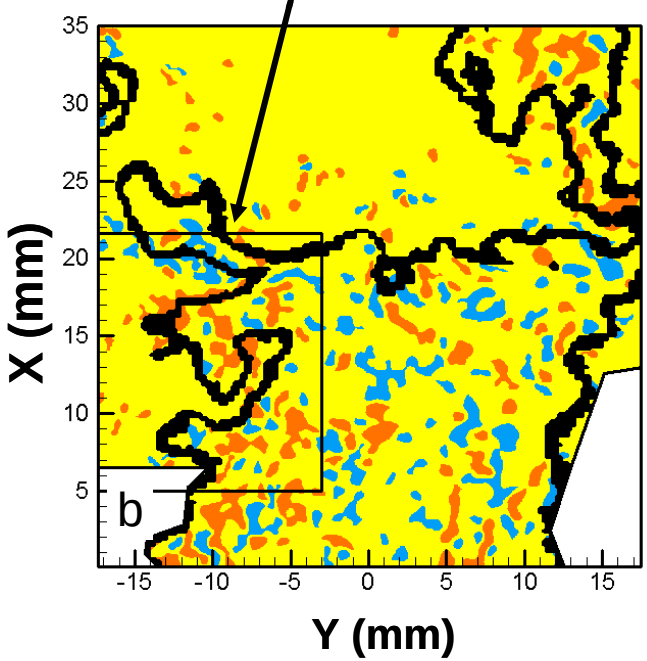
Stretch Efficiency Function

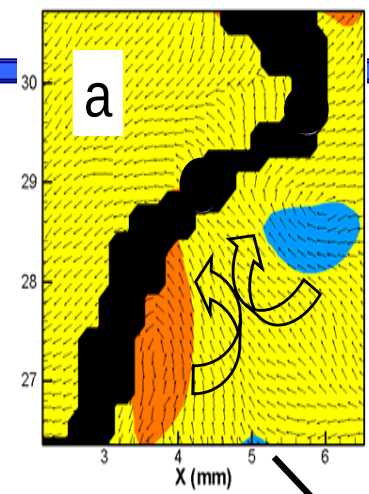


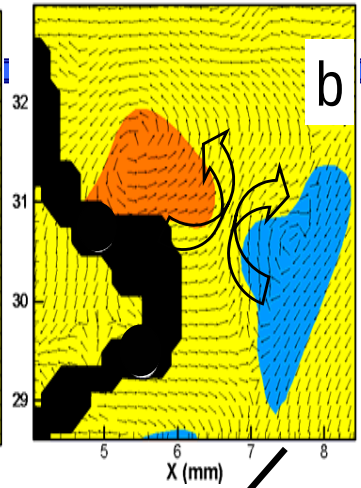


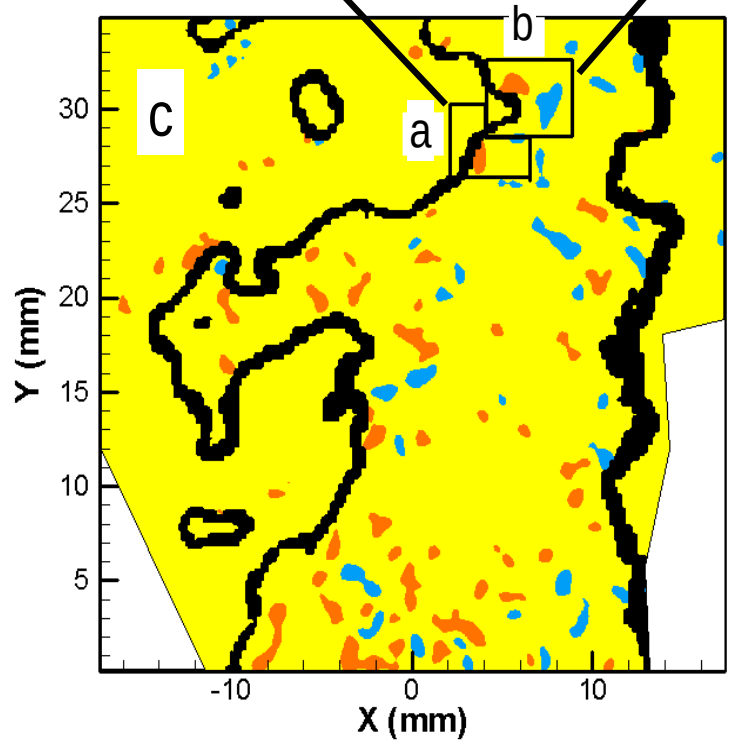



a
20
15
10
-15
-10
-5
Y (mm)


b
35
30
25
20
15
10
5
X (mm)
-15
-10
-5
0
5
10
15
Y (mm)

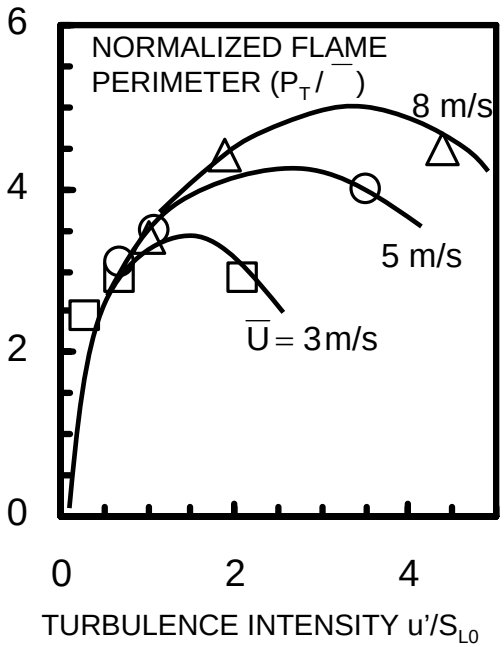

a
30
29
28
27
3
4
5
6
X (mm)


b
32
31
30
29
5
6
7
8
X (mm)


c
b
a
30
25
20
15
10
5
Y (mm)
-10
0
10
X (mm)

Case	$\overline{U}$ (m/s)	$U_{CL,0}$ (m/s)	$u'/U_{CL,0}$	u'/S_{L0}	integral scale ℓ (mm)
3a	3.0	2.7	0.04	0.28	-
3b	3.0	2.7	0.10	0.69	3.3
3c	3.0	3.4	0.24	2.14	3.1
5a	5.0	4.7	0.05	0.68	-
5b	5.0	4.4	0.10	1.12	-
5c	5.0	5.9	0.23	3.57	-
8a	8.0	7.3	0.05	1.00	-
8b	8.0	6.5	0.11	1.88	12.8
8c	8.0	8.5	0.20	4.47	8.7
12a	12.0	11.0	0.07	2.17	-
12b	12.0	11.4	0.16	4.80	-
12c	12.0	13.0	0.25	8.55	-

Case	x (mm)	$\overline{K}$ (s^{-1})	$\overline{K}_s$ (s^{-1})	$\overline{K}_c$ (s^{-1})	$\overline{K}_c/\overline{K}$	σ (s^{-1})	σ_s (s^{-1})	σ_c (s^{-1})	Stretch Efficiency Function Γ_K
3b	21	56	76	-20	-0.36	339	229	250	0.68
3b	56	84	94	-10	-0.12	416	278	310	1.03
3c	13	85	165	-80	-0.94	723	581	430	0.32
3c	31	91	141	-50	-0.55	517	361	370	0.34
8b	26	196	226	-30	-0.15	1194	1106	450	3.48
8b	61	209	239	-30	-0.14	947	849	420	3.72
8b	96	231	241	-10	-0.04	896	816	370	4.11
8c	26	366	386	-20	-0.05	1023	909	470	1.87
8c	61	208	238	-30	-0.14	1180	1107	410	1.06


NORMALIZED FLAME
PERIMETER (P_T /)
8 m/s
5 m/s
$\overline{U}$ = 3m/s
6
4
2
0
0
2
4
TURBULENCE INTENSITY u'/S_{L0}