

Supplementary Materials

The Supervision of Dough Fermentation Using Image Analysis Complemented by a Continuous Discrete Extended Kalman Filter

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Table S1. Measurements used for the extended Kalman filter.

Time [s]	Radius [m]
3	5.00929E-05
6	5.00929E-05
9	5.00929E-05
12	5.00929E-05
15	5.00000E-05
18	5.02779E-05
21	5.11539E-05
24	5.20022E-05
27	5.23456E-05
30	5.18288E-05
33	5.17708E-05
36	5.15667E-05
39	5.14200E-05
42	5.13316E-05
45	5.19156E-05
48	5.22601E-05
51	5.21744E-05
54	5.22601E-05
57	5.18288E-05
60	5.16835E-05
63	5.18288E-05
66	5.22601E-05
69	5.21744E-05
72	5.20884E-05
75	5.24308E-05
78	5.29087E-05
81	5.34560E-05
84	5.25026E-05
87	5.12224E-05
90	5.02830E-05
93	5.05208E-05
96	5.04301E-05
99	5.07911E-05
102	5.12397E-05
105	5.19450E-05
108	5.16000E-05
111	5.10103E-05
114	5.02267E-05
117	5.10103E-05
120	5.14590E-05
123	5.22744E-05
126	5.26198E-05
129	5.36694E-05
132	5.33406E-05

135	5.34469E-05
138	5.37176E-05
141	5.37176E-05
144	5.33650E-05
147	5.35859E-05
150	5.42383E-05
153	5.40288E-05
156	5.43484E-05
159	5.47952E-05
162	5.51839E-05
165	5.47169E-05
168	5.46645E-05
171	5.46084E-05
174	5.39598E-05
177	5.31285E-05
180	5.31397E-05
183	5.35996E-05
186	5.35186E-05
189	5.34373E-05
192	5.37610E-05
195	5.42135E-05
198	5.46068E-05
201	5.40830E-05
204	5.41543E-05
207	5.45696E-05
210	5.51549E-05
213	5.51549E-05
216	5.45696E-05
219	5.41543E-05
222	5.40830E-05
225	5.45286E-05
228	5.45286E-05
231	5.42135E-05
234	5.36804E-05
237	5.36804E-05
240	5.42135E-05
243	5.44501E-05
246	5.46849E-05
249	5.51232E-05
252	5.54286E-05
255	5.53526E-05
258	5.53526E-05
261	5.53526E-05
264	5.53526E-05
267	5.53526E-05
270	5.52763E-05
273	5.55802E-05
276	5.58066E-05
279	5.68859E-05
282	5.80078E-05
285	5.82874E-05
288	5.75079E-05
291	5.67413E-05
294	5.64491E-05
297	5.61540E-05
300	5.62281E-05
303	5.62281E-05
306	5.62281E-05

309	5.62281E-05
312	5.60798E-05
315	5.66686E-05
318	5.74834E-05
321	5.80459E-05
324	5.79062E-05
327	5.79062E-05
330	5.79062E-05
333	5.79062E-05
336	5.79062E-05
339	5.79062E-05
342	5.77886E-05
345	5.82565E-05
348	5.90210E-05
351	5.89529E-05
354	5.84638E-05
357	5.83912E-05
360	5.87803E-05
363	5.87122E-05
366	5.87122E-05
369	5.86439E-05
372	5.89162E-05
375	5.92978E-05
378	5.95645E-05
381	5.93852E-05
384	5.98343E-05
387	6.04600E-05
390	6.09587E-05
393	6.05276E-05
396	6.03539E-05
399	6.07864E-05
402	6.11496E-05
405	6.12345E-05
408	6.12768E-05
411	6.15928E-05
414	6.14668E-05
417	6.18865E-05
420	6.13974E-05
423	6.13662E-05
426	6.16925E-05
429	6.20039E-05
432	6.16593E-05
435	6.18362E-05
438	6.23614E-05
441	6.22570E-05
444	6.21953E-05
447	6.24415E-05
450	6.27872E-05
453	6.29263E-05
456	6.32761E-05
459	6.38489E-05
462	6.42477E-05
465	6.40306E-05
468	6.46561E-05
471	6.46296E-05
474	6.44358E-05
477	6.39158E-05
480	6.47054E-05

483	6.52039E-05
486	6.54948E-05
489	6.58791E-05
492	6.59427E-05
495	6.62593E-05
498	6.58472E-05
501	6.62035E-05
504	6.60155E-05
507	6.67392E-05
510	6.66465E-05
513	6.65286E-05
516	6.59026E-05
519	6.65997E-05
522	6.74371E-05
525	6.80183E-05
528	6.78738E-05
531	6.78738E-05
534	6.78202E-05
537	6.80339E-05
540	6.83345E-05
543	6.85453E-05
546	6.84023E-05
549	6.87101E-05
552	6.94222E-05
555	7.00631E-05
558	7.01796E-05
561	7.01288E-05
564	7.01288E-05
567	7.01648E-05
570	7.00202E-05
573	6.96734E-05
576	7.01305E-05
579	7.07425E-05
582	7.10026E-05
585	7.06672E-05
588	7.07173E-05
591	7.07173E-05
594	7.07173E-05
597	7.06170E-05
600	7.10165E-05
603	7.15757E-05
606	7.19658E-05
609	7.17843E-05
612	7.20722E-05
615	7.27364E-05
618	7.33344E-05
621	7.34419E-05
624	7.33947E-05
627	7.33947E-05
630	7.33947E-05
633	7.33474E-05
636	7.35361E-05
639	7.38019E-05
642	7.39885E-05
645	7.39420E-05
648	7.39420E-05
651	7.39420E-05
654	7.39420E-05

657	7.39420E-05
660	7.39420E-05
663	7.39420E-05
666	7.39420E-05
669	7.39420E-05
672	7.39420E-05
675	7.39420E-05
678	7.39420E-05
681	7.39420E-05
684	7.38953E-05
687	7.40815E-05
690	7.42977E-05
693	7.46658E-05
696	7.48791E-05
699	7.50610E-05
702	7.49360E-05
705	7.52534E-05
708	7.56989E-05
711	7.60107E-05
714	7.59330E-05
717	7.59330E-05
720	7.58881E-05
723	7.60672E-05
726	7.63196E-05
729	7.64969E-05
732	7.64084E-05
735	7.65853E-05
738	7.68786E-05
741	7.68347E-05
744	7.66405E-05
747	7.70207E-05
750	7.77121E-05
753	7.77534E-05
756	7.76058E-05
759	7.76781E-05
762	7.78514E-05
765	7.79809E-05
768	7.82244E-05
771	7.83956E-05
774	7.83528E-05
777	7.83101E-05
780	7.84809E-05
783	7.86475E-05
786	7.91127E-05
789	7.94865E-05
792	7.97779E-05
795	7.97052E-05
798	7.97361E-05
801	7.95391E-05
804	7.96541E-05
807	7.98692E-05
810	8.04786E-05
813	8.07715E-05
816	8.12494E-05
819	8.13297E-05
822	8.11165E-05
825	8.08130E-05
828	8.11977E-05

831	8.18010E-05
834	8.20420E-05
837	8.19718E-05
840	8.19718E-05
843	8.19718E-05
846	8.19317E-05
849	8.20921E-05
852	8.22785E-05
855	8.25965E-05
858	8.27811E-05
861	8.29387E-05
864	8.28993E-05
867	8.28599E-05
870	8.30173E-05
873	8.32393E-05
876	8.33955E-05
879	8.33955E-05
882	8.32393E-05
885	8.29780E-05
888	8.29780E-05
891	8.32002E-05
894	8.34733E-05
897	8.38094E-05
900	8.41816E-05
903	8.42965E-05
906	8.42582E-05
909	8.42582E-05
912	8.42582E-05
915	8.42582E-05
918	8.42582E-05
921	8.42582E-05
924	8.42582E-05
927	8.42582E-05
930	8.42199E-05
933	8.43047E-05
936	8.47930E-05
939	8.52893E-05
942	8.56703E-05
945	8.58159E-05
948	8.58612E-05
951	8.62764E-05
954	8.66755E-05
957	8.70895E-05
960	8.67863E-05
963	8.65972E-05
966	8.62951E-05
969	8.62951E-05
972	8.65234E-05
975	8.70440E-05
978	8.75128E-05
981	8.75934E-05
984	8.75570E-05
987	8.75570E-05
990	8.75570E-05
993	8.76221E-05
996	8.72958E-05
999	8.71866E-05
1002	8.72958E-05

1005	8.75206E-05
1008	8.78610E-05
1011	8.84315E-05
1014	8.87956E-05
1017	8.88392E-05
1020	8.90418E-05
1023	8.91843E-05
1026	8.90850E-05
1029	8.94030E-05
1032	8.95363E-05
1035	8.93190E-05
1038	8.87743E-05
1041	8.89809E-05
1044	8.93718E-05
1047	8.95625E-05
1050	8.97173E-05
1053	9.02780E-05
1056	9.04764E-05
1059	9.01976E-05
1062	8.99099E-05
1065	8.99732E-05
1068	8.99099E-05
1071	9.01626E-05
1074	9.04837E-05
1077	9.08728E-05
1080	9.10073E-05
1083	9.11457E-05
1086	9.11733E-05
1089	9.09243E-05
1092	9.05067E-05
1095	9.04719E-05
1098	9.10281E-05
1101	9.14378E-05
1104	9.16505E-05
1107	9.18101E-05
1110	9.18507E-05
1113	9.21996E-05
1116	9.27389E-05
1119	9.31173E-05
1122	9.30229E-05
1125	9.30229E-05
1128	9.30229E-05
1131	9.30229E-05
1134	9.30229E-05
1137	9.30229E-05
1140	9.30229E-05
1143	9.29621E-05
1146	9.32320E-05
1149	9.34067E-05
1152	9.37640E-05
1155	9.37697E-05
1158	9.41586E-05
1161	9.41987E-05
1164	9.42438E-05
1167	9.42172E-05
1170	9.43057E-05
1173	9.42172E-05
1176	9.41241E-05

1179	9.46436E-05
1182	9.48747E-05
1185	9.47097E-05
1188	9.44839E-05
1191	9.49685E-05
1194	9.54352E-05
1197	9.56382E-05
1200	9.55467E-05
1203	9.56773E-05
1206	9.58619E-05
1209	9.59918E-05
1212	9.59594E-05
1215	9.59594E-05
1218	9.59006E-05
1221	9.61352E-05
1224	9.64660E-05
1227	9.66984E-05
1230	9.66404E-05
1233	9.66404E-05
1236	9.66404E-05
1239	9.66404E-05
1242	9.65757E-05
1245	9.68340E-05
1248	9.71980E-05
1251	9.74537E-05
1254	9.73899E-05
1257	9.73899E-05
1260	9.73899E-05
1263	9.73899E-05
1266	9.73579E-05
1269	9.74537E-05
1272	9.77612E-05
1275	9.80671E-05
1278	9.81618E-05
1281	9.81302E-05
1284	9.81302E-05
1287	9.80727E-05
1290	9.83025E-05
1293	9.86266E-05
1296	9.88543E-05
1299	9.87974E-05
1302	9.88543E-05
1305	9.86266E-05
1308	9.82136E-05
1311	9.83969E-05
1314	9.86703E-05
1317	9.89287E-05
1320	9.89041E-05
1323	9.93132E-05
1326	9.94329E-05
1329	9.95572E-05
1332	9.95261E-05
1335	9.94384E-05
1338	9.97888E-05
1341	1.00283E-04
1344	1.00630E-04
1347	1.00543E-04
1350	1.00543E-04

1353	1.00543E-04
1356	1.00543E-04
1359	1.00543E-04
1362	1.00543E-04
1365	1.00543E-04
1368	1.00543E-04
1371	1.00543E-04
1374	1.00543E-04
1377	1.00543E-04
1380	1.00482E-04
1383	1.00728E-04
1386	1.01074E-04
1389	1.01262E-04
1392	1.01424E-04
1395	1.01738E-04
1398	1.01959E-04
1401	1.01874E-04
1404	1.02025E-04
1407	1.02106E-04
1410	1.01934E-04
1413	1.01610E-04
1416	1.01519E-04
1419	1.01488E-04
1422	1.01732E-04
1425	1.02076E-04
1428	1.02317E-04
1431	1.02257E-04
1434	1.02287E-04
1437	1.02166E-04
1440	1.01909E-04
1443	1.02130E-04
1446	1.02642E-04
1449	1.02981E-04
1452	1.02896E-04
1455	1.02896E-04
1458	1.02836E-04
1461	1.03022E-04
1464	1.03578E-04
1467	1.04152E-04
1470	1.04190E-04
1473	1.03967E-04
1476	1.03848E-04
1479	1.03878E-04
1482	1.03878E-04
1485	1.03878E-04
1488	1.03878E-04
1491	1.03878E-04
1494	1.03848E-04
1497	1.03967E-04
1500	1.04136E-04
1503	1.04255E-04
1506	1.04225E-04
1509	1.04225E-04
1512	1.04225E-04
1515	1.04195E-04
1518	1.04284E-04
1521	1.04570E-04
1524	1.04796E-04

1527	1.05065E-04
1530	1.05634E-04
1533	1.05931E-04
1536	1.05882E-04
1539	1.05786E-04
1542	1.05798E-04
1545	1.05576E-04
1548	1.05433E-04
1551	1.05469E-04
1554	1.05469E-04
1557	1.05469E-04
1560	1.05469E-04
1563	1.05440E-04
1566	1.05558E-04
1569	1.05695E-04
1572	1.05959E-04
1575	1.05979E-04
1578	1.05930E-04
1581	1.05701E-04
1584	1.06117E-04
1587	1.06288E-04
1590	1.06517E-04
1593	1.06614E-04
1596	1.06609E-04
1599	1.05941E-04
1602	1.05540E-04
1605	1.05735E-04
1608	1.06131E-04
1611	1.06331E-04
1614	1.06542E-04
1617	1.06649E-04
1620	1.06912E-04
1623	1.06931E-04
1626	1.06883E-04
1629	1.06737E-04
1632	1.06766E-04
1635	1.06737E-04
1638	1.06853E-04
1641	1.06966E-04
1644	1.07291E-04
1647	1.07556E-04
1650	1.07763E-04
1653	1.07711E-04
1656	1.07682E-04
1659	1.07798E-04
1662	1.07961E-04
1665	1.08077E-04
1668	1.08071E-04
1671	1.07979E-04
1674	1.07797E-04
1677	1.07912E-04
1680	1.08228E-04
1683	1.08406E-04
1686	1.08469E-04
1689	1.08580E-04
1692	1.08928E-04
1695	1.09076E-04
1698	1.09119E-04

1701	1.08954E-04
1704	1.08954E-04
1707	1.09039E-04
1710	1.09344E-04
1713	1.09505E-04
1716	1.09378E-04
1719	1.09491E-04
1722	1.09553E-04
1725	1.09700E-04
1728	1.09592E-04
1731	1.09769E-04
1734	1.09880E-04
1737	1.10211E-04
1740	1.10154E-04
1743	1.10079E-04
1746	1.10126E-04
1749	1.10268E-04
1752	1.10239E-04
1755	1.10239E-04
1758	1.10239E-04
1761	1.10239E-04
1764	1.10239E-04
1767	1.10217E-04
1770	1.10306E-04
1773	1.10403E-04
1776	1.10547E-04
1779	1.10912E-04
1782	1.11343E-04
1785	1.11511E-04
1788	1.11567E-04
1791	1.11726E-04
1794	1.11865E-04
1797	1.11726E-04
1800	1.11567E-04
1803	1.11455E-04
1806	1.11483E-04
1809	1.11483E-04
1812	1.11483E-04
1815	1.11405E-04
1818	1.11717E-04
1821	1.12158E-04
1824	1.12496E-04
1827	1.12307E-04
1830	1.12149E-04
1833	1.12037E-04
1836	1.12037E-04
1839	1.12149E-04
1842	1.12307E-04
1845	1.12419E-04
1848	1.12363E-04
1851	1.12474E-04
1854	1.12632E-04
1857	1.12742E-04
1860	1.12715E-04
1863	1.12742E-04
1866	1.12554E-04
1869	1.12784E-04
1872	1.12801E-04

1875	1.12700E-04
1878	1.12285E-04
1881	1.12474E-04
1884	1.12554E-04
1887	1.12974E-04
1890	1.13383E-04
1893	1.13690E-04
1896	1.13641E-04
1899	1.13531E-04
1902	1.13325E-04
1905	1.13383E-04
1908	1.13799E-04
1911	1.14124E-04
1914	1.14344E-04
1917	1.14276E-04
1920	1.14109E-04
1923	1.13885E-04
1926	1.13961E-04
1929	1.13802E-04
1932	1.13816E-04
1935	1.14121E-04
1938	1.14362E-04
1941	1.14377E-04
1944	1.14292E-04
1947	1.14843E-04
1950	1.15400E-04
1953	1.15811E-04
1956	1.15708E-04
1959	1.15735E-04
1962	1.15599E-04
1965	1.15554E-04
1968	1.15599E-04
1971	1.15735E-04
1974	1.15756E-04
1977	1.15563E-04
1980	1.15239E-04
1983	1.15288E-04
1986	1.15417E-04
1989	1.15288E-04
1992	1.15239E-04
1995	1.15563E-04
1998	1.15756E-04
2001	1.15735E-04
2004	1.15627E-04
2007	1.15397E-04
2010	1.15638E-04
2013	1.15900E-04
2016	1.15880E-04
2019	1.15805E-04
2022	1.16174E-04
2025	1.16126E-04
2028	1.15949E-04
2031	1.16243E-04
2034	1.16718E-04
2037	1.16457E-04
2040	1.16437E-04
2043	1.16809E-04
2046	1.17238E-04

2049	1.17143E-04
2052	1.17143E-04
2055	1.17143E-04
2058	1.17116E-04
2061	1.17224E-04
2064	1.17377E-04
2067	1.17484E-04
2070	1.17457E-04
2073	1.17457E-04
2076	1.17457E-04
2079	1.17383E-04
2082	1.17681E-04
2085	1.18074E-04
2088	1.18477E-04
2091	1.18555E-04
2094	1.18688E-04
2097	1.18555E-04
2100	1.18430E-04
2103	1.18189E-04
2106	1.18172E-04
2109	1.18189E-04
2112	1.18430E-04
2115	1.18555E-04
2118	1.18635E-04
2121	1.18715E-04
2124	1.18865E-04
2127	1.18971E-04
2130	1.18945E-04
2133	1.18945E-04
2136	1.18924E-04
2139	1.18980E-04
2142	1.19202E-04
2145	1.19434E-04
2148	1.19573E-04
2151	1.19334E-04
2154	1.19033E-04
2157	1.18819E-04
2160	1.18846E-04
2163	1.18953E-04
2166	1.19050E-04
2169	1.19323E-04
2172	1.19831E-04
2175	1.20094E-04
2178	1.20069E-04
2181	1.20010E-04
2184	1.20057E-04
2187	1.19881E-04
2190	1.19776E-04
2193	1.19776E-04
2196	1.19855E-04
2199	1.20063E-04
2202	1.20504E-04
2205	1.20847E-04
2208	1.21007E-04
2211	1.20934E-04
2214	1.21065E-04
2217	1.21109E-04
2220	1.21065E-04

2223	1.20934E-04
2226	1.20961E-04
2229	1.20961E-04
2232	1.20914E-04
2235	1.21100E-04
2238	1.21383E-04
2241	1.21441E-04
2244	1.21466E-04
2247	1.21621E-04
2250	1.21931E-04
2253	1.22032E-04
2256	1.22136E-04
2259	1.22110E-04
2262	1.22110E-04
2265	1.22110E-04
2268	1.22064E-04
2271	1.22249E-04
2274	1.22509E-04
2277	1.22693E-04
2280	1.22621E-04
2283	1.22725E-04
2286	1.22872E-04
2289	1.23001E-04
2292	1.22872E-04
2295	1.22725E-04
2298	1.22595E-04
2301	1.22725E-04
2304	1.22846E-04
2307	1.23053E-04
2310	1.23174E-04
2313	1.23303E-04
2316	1.23174E-04
2319	1.22981E-04
2322	1.23035E-04
2325	1.23450E-04
2328	1.23649E-04
2331	1.23664E-04
2334	1.23727E-04
2337	1.23673E-04
2340	1.23389E-04
2343	1.23205E-04
2346	1.23205E-04
2349	1.23389E-04
2352	1.23648E-04
2355	1.23784E-04
2358	1.23921E-04
2361	1.24198E-04
2364	1.24256E-04
2367	1.24280E-04
2370	1.24504E-04
2373	1.24479E-04
2376	1.24358E-04
2379	1.24433E-04
2382	1.24705E-04
2385	1.24479E-04
2388	1.24221E-04
2391	1.24039E-04
2394	1.24110E-04

2397	1.23956E-04
2400	1.23996E-04
2403	1.24264E-04
2406	1.24581E-04
2409	1.24666E-04
2412	1.25018E-04
2415	1.25195E-04
2418	1.25069E-04
2421	1.24945E-04
2424	1.25161E-04
2427	1.25090E-04
2430	1.25203E-04
2433	1.25501E-04
2436	1.25809E-04
2439	1.25693E-04
2442	1.25918E-04
2445	1.25948E-04
2448	1.26052E-04
2451	1.26082E-04
2454	1.26306E-04
2457	1.26261E-04
2460	1.26306E-04
2463	1.26101E-04
2466	1.25949E-04
2469	1.25914E-04
2472	1.26016E-04
2475	1.26170E-04
2478	1.26449E-04
2481	1.26526E-04
2484	1.26363E-04
2487	1.26133E-04
2490	1.26046E-04
2493	1.26414E-04
2496	1.26760E-04
2499	1.26737E-04
2502	1.26615E-04
2505	1.26702E-04
2508	1.26634E-04
2511	1.26609E-04
2514	1.26803E-04
2517	1.26778E-04
2520	1.26710E-04



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