

## Supplementary Materials

### 1. Test conclusions

The FCGS algorithm includes four test situations, covering various types of molecular markers and different application environments for various detection platforms. We used the test result data information to generate two graphs: comparison time and average comparison time. The comparison time graph shows the relationship between the number of comparison results (horizontal axis) and the time consumed (vertical axis). It is used to demonstrate that the comparison time increases linearly as the number of comparisons increases. The average comparison time graph represents the relationship between the number of records of the comparison results (horizontal axis) and the average time consumed on the results of a single fingerprint comparison (vertical axis). The average time spent showed the results of a single comparison gradually decreases as the total number of results increases and approaches a stable value. For each test, these two kinds of figure show that the FCGS algorithm performs well in both the total time and average time aspects.

### 2. Results

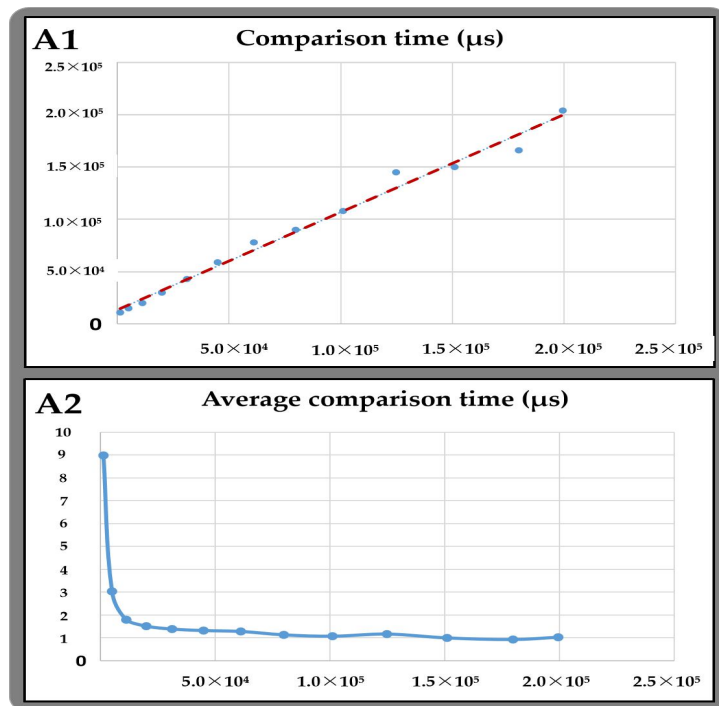
#### 2.1. Fingerprint Test Results 1–Indel from the Capillary Electrophoresis Platform

This test mainly analyzes the performance of the FCGS algorithm in the case of low throughput loci and small-scale data.

**Table 1.** Comparison results of 50 to 632 fingerprint data from 30 InDel markers (Unit:  $\mu$ S).

Test fingerprints num	Comparative fingerprint num	Average number of difference loci	Number of comparison results	Comparison time ( $\mu$ S)	Average comparison time ( $\mu$ S)
50	50	14	1225	11000	8.979592
100	100	14	4950	15000	3.030303
150	150	14	11175	20000	1.789709
200	200	14	19900	30000	1.507538
250	250	14	31125	43000	1.381526
300	300	14	44850	59000	1.315496
350	350	14	61075	78000	1.277118

400	400	14	79800	90000	1.127820
450	450	14	101,025	108,000	1.069042
500	500	14	124,750	145,000	1.162325
550	550	14	150,975	150,000	0.993542
600	600	14	179,700	166,000	0.923762
632	632	14	199,396	204,000	1.023090
AVERAGE		14		AVERAGE	1.967759



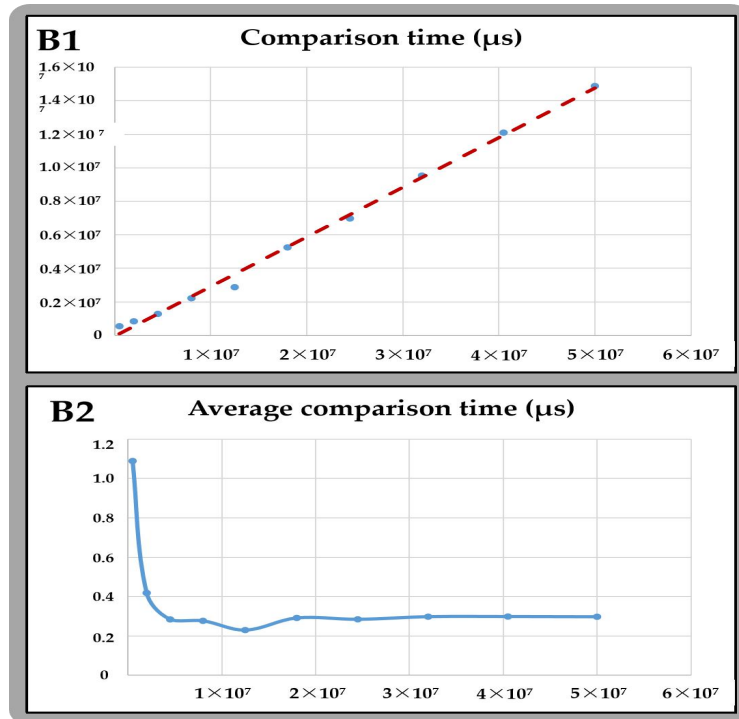
**Figure 1. Fingerprint comparison results (InDel-CE).** The data in Figure 1 suggest that when comparing small-scale fingerprint data with low-throughput loci, the FCGS algorithm presents a positive linear correlation between the comparison scale and the total comparison time. The average comparison time of single comparison results gradually decreases and approaches a stable value, which indicates that the FCGS algorithm has good stability when comparing small-scale fingerprint data with low-throughput loci.

## 2.2. Fingerprint Test Results 2–Microsatellite from the Capillary Electrophoresis Platform

This test mainly analyzes the performance of the FCGS algorithm in large-scale data calculation of low-throughput loci.

**Table 2.** Comparison results of 1,000 to 10,000 fingerprint data from 40 microsatellite markers (Unit:  $\mu$ s).

Test fingerprints num	Comparative fingerprint num	Average number of difference loci	Number of comparison results	Comparison time ( $\mu$ s)	Average comparison time ( $\mu$ s)
1000	1000	29	499,500	544,000	1.089089
2000	2000	30	1,999,000	837,000	0.418709
3000	3000	30	4,498,500	1,279,000	0.284317
4000	4000	30	7,998,000	2,215,000	0.276944
5000	5000	30	12,497,500	2,874,000	0.229966
6000	6000	30	17,997,000	5,249,000	0.291660
7000	7000	30	24,496,500	6,976,000	0.284775
8000	8000	30	31,996,000	9,536,000	0.298037
9000	9000	30	40,495,500	12,099,000	0.298774
10000	10000	30	49,995,000	14,882,000	0.297670
	AVERAGE	30		AVERAGE	0.376994



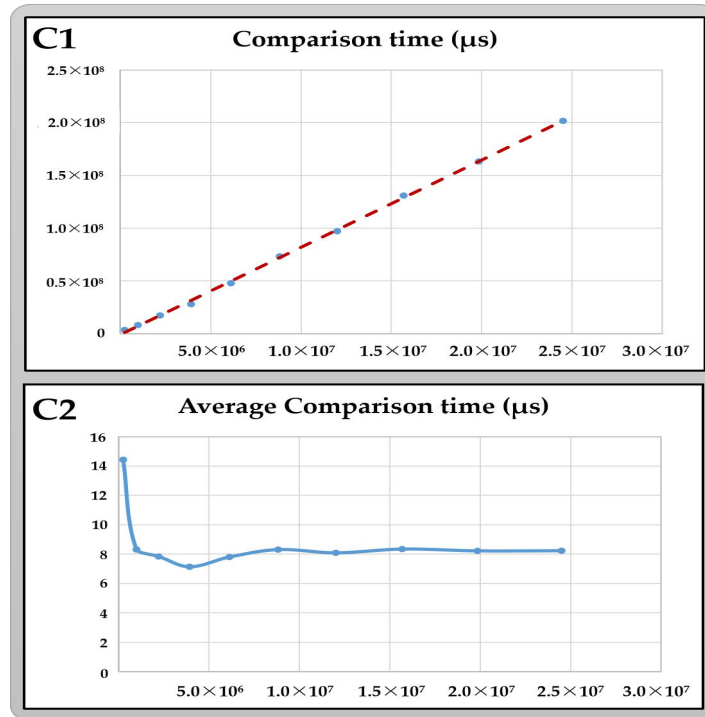
**Figure 2. Fingerprint comparison results (microsatellite-CE).** The data in Figure 2 suggest that when comparing large-scale microsatellite fingerprint data with low-throughput loci, the FCGS algorithm presents a positive linear correlation between the comparison scale and the total comparison time. The average comparison time of single comparison results gradually decreases and approaches a stable value, which indicates that the FCGS algorithm has good stability when comparing small-scale fingerprint data with low-throughput loci.

### **2.3. Fingerprint Test Results 3–Snp from the Kompetitive Allele Specific PCR Platform**

This test mainly analyzes the performance of the FCGS algorithm in the case of comparing large–scale SNP labeled data of medium and low–throughput loci.

**Table 3.** Comparison results of 700 to 7,000 fingerprint data from 384 SNP markers (Unit:  $\mu$ s).

<b>Test fingerprints num</b>	<b>Comparative fingerprint num</b>	<b>Average number of difference loci</b>	<b>Number of comparison results</b>	<b>Comparison time (<math>\mu</math>s)</b>	<b>Average comparison time (<math>\mu</math>s)</b>
700	700	226	244,650	3,532,000	14.436951
1400	1400	227	979,300	8,146,000	8.318186
2100	2100	231	2,203,950	17,287,000	7.843644
2800	2800	231	3,918,600	27,980,000	7.140305
3500	3500	231	6,123,250	47,806,000	7.807292
4200	4200	233	8,817,900	73,297,000	8.312297
4900	4900	238	12,002,550	97,119,000	8.091531
5600	5600	240	15,677,200	130,883,000	8.348621
6300	6300	242	19,841,850	163,213,000	8.225695
7000	7000	243	24,496,500	201,699,000	8.233789
	AVERAGE	234		AVERAGE	8.675831



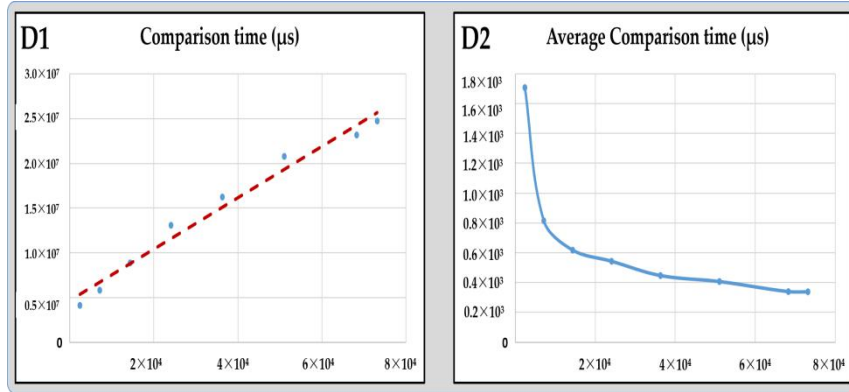
**Figure 3. Fingerprint comparison results (SNP-KASP).** The data in Figure 3 suggest that when comparing large-scale SNP fingerprint data, the FCGS algorithm presents a positive linear correlation between the comparison scale and the total comparison time. The average comparison time of single comparison results gradually decreases and approaches a stable value, which indicates that the FCGS algorithm has good stability when comparing large-scale SNP fingerprint data.

#### 2.4. Fingerprint Test Results 3–SNP from the SNP–array Platform

This test mainly analyzes the performance of the FCGS algorithm in the case of SNP–arrays data of high–throughput loci.

**Table 4.** Comparison results of 70 to 383 fingerprint data from 61,224 SNP markers (Unit:  $\mu\text{s}$ ).

Test fingerprints num	Comparative fingerprint num	Average number of difference loci	Number of comparison results	Comparison time ( $\mu\text{s}$ )	Average comparison time ( $\mu\text{s}$ )
70	70	29680	2415	4,124,000	1707.660455
120	120	29392	7140	5,816,000	814.565826
170	170	28993	14365	8,869,000	617.403411
220	220	29113	24090	13,078,000	542.880863
270	270	29322	36315	16,234,000	447.032907
320	320	29603	51040	20,772,000	406.974922
370	370	29616	68265	23,166,000	339.353988
383	383	29706	73153	24,727,000	338.01758
	AVERAGE	29428		AVERAGE	651.736244



**Figure 4. Fingerprint comparison results (SNP–arrays).** The data in Figure 4 indicate that when comparing SNP fingerprint data with high–throughput loci, the FCGS algorithm presents a positive linear correlation between the comparison scale and the total comparison time. The average comparison time of single comparison results gradually decrease and approaches a stable value, which indicates that FCGS algorithm has good stability when comparing SNP fingerprint data with high–throughput loci.