

# *Qsep* 系列

全自动毛细管电泳仪在高通量测序、  
多重检测和抗体质控中的应用

杭州厚泽生物科技有限公司

喻放

# Qsep系列全自动毛细管电泳仪



**Qsep1 lite**



**Qsep1/Advance**



**Qsep100**



**Qsep400/Advance**



**Qsep100 Advance**

仪器可在江苏省常州市江苏光鼎工厂生产，其中Qsep1,100,400可选择有医疗器械注册证型号

## 仪器型号推荐

**Qsep1:** 可单次检测单个样本，适合样本数不大的用户，8孔、12孔模块可选，可升级19孔，最多一次检测16个样本。适合小样本量客户。具备高通量测序文库分析功能。

**Qsep100:** 可单次检测1-100任意个数样本，通量灵活。

**Qsep400:** 4通道卡夹，检测速度更快，适合大样本量用户。

**Qsep1, 100, 400 Advance:** 正常的核酸检测功能，更优的蛋白检测功能



**Qsep1/Advance**



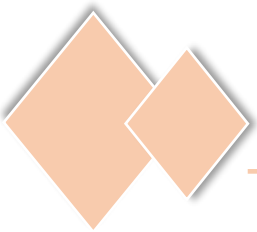
**Qsep100**



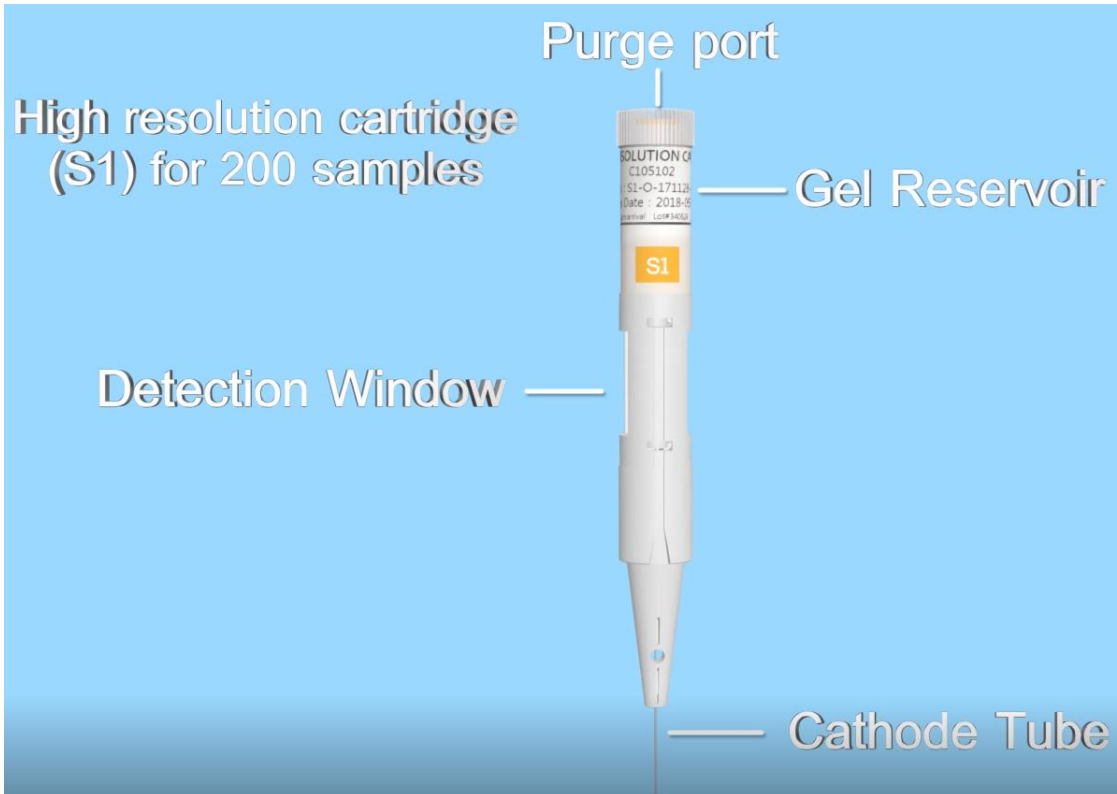
**Qsep400/Advance**



**Qsep100 Advance**



# 卡夹信息

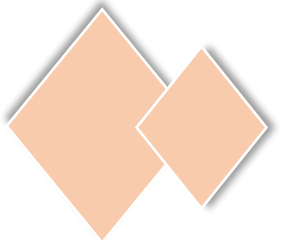


4通道卡夹

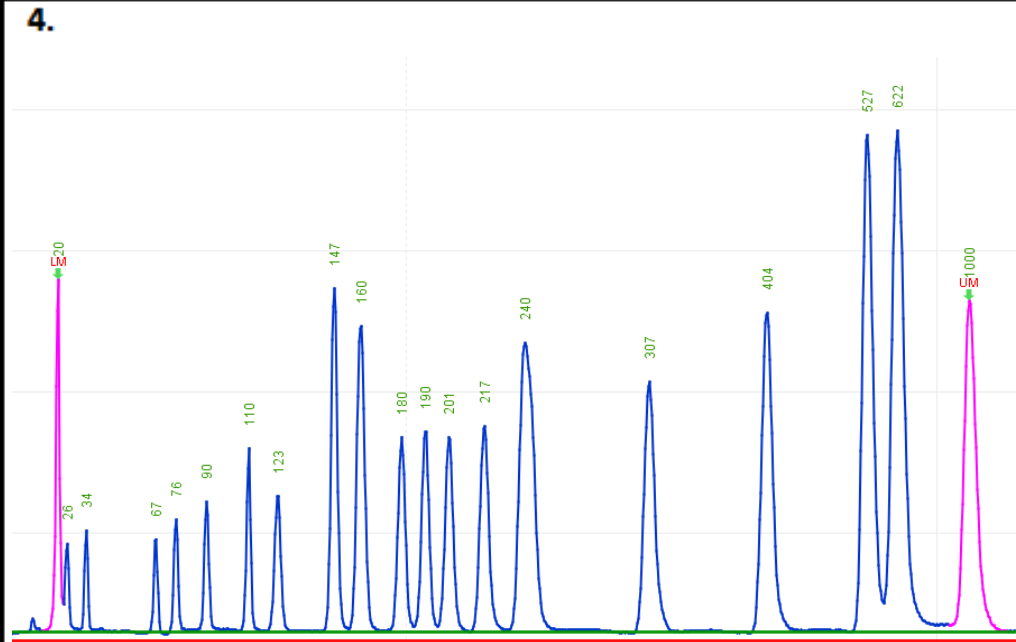
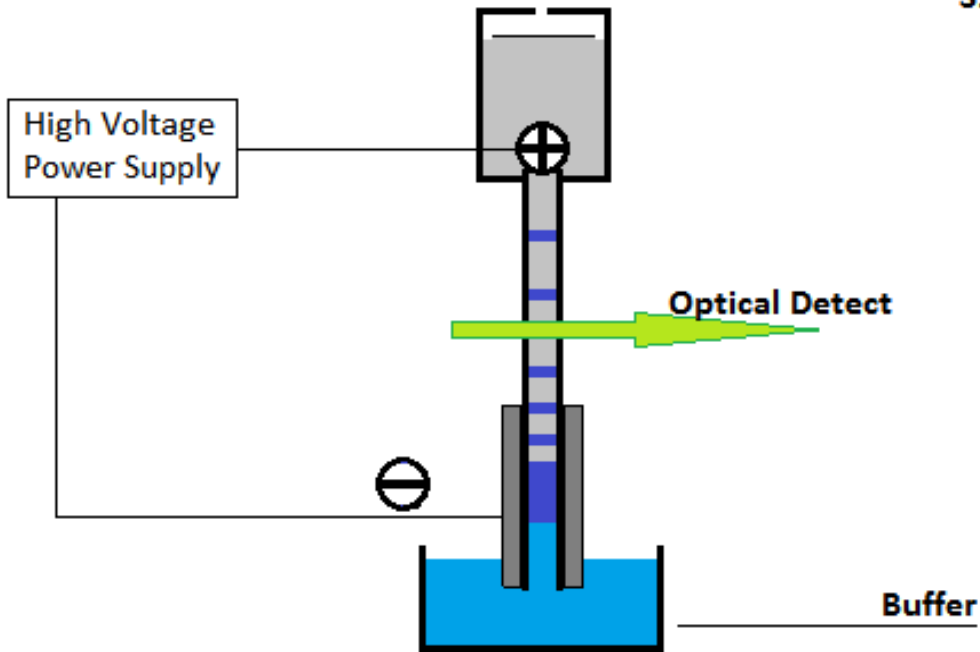
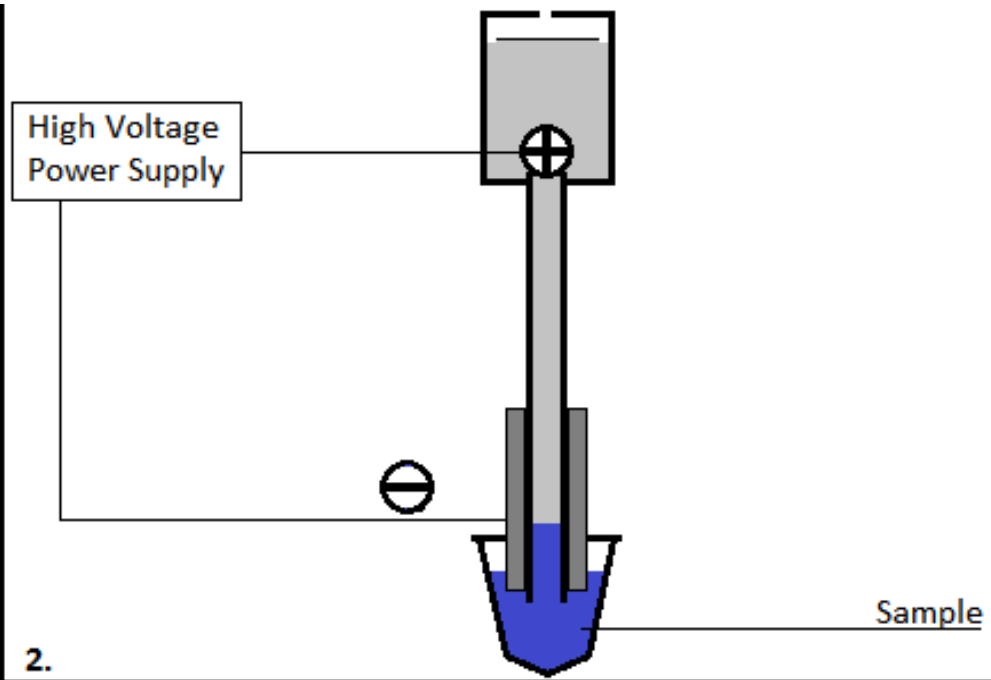
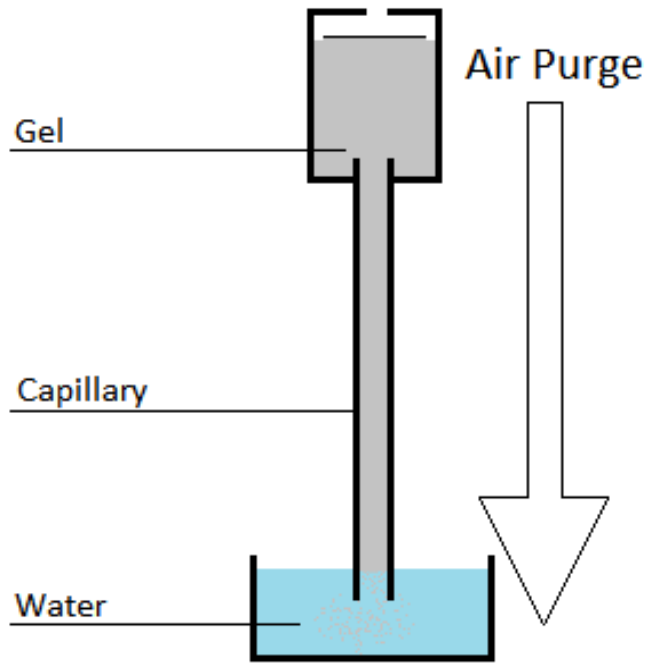


单通道预制胶卡夹

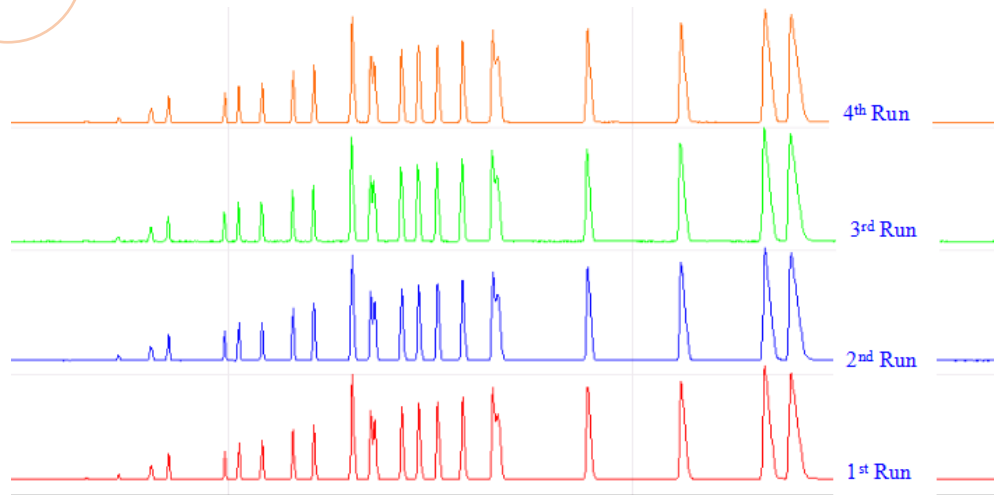




# 检测原理



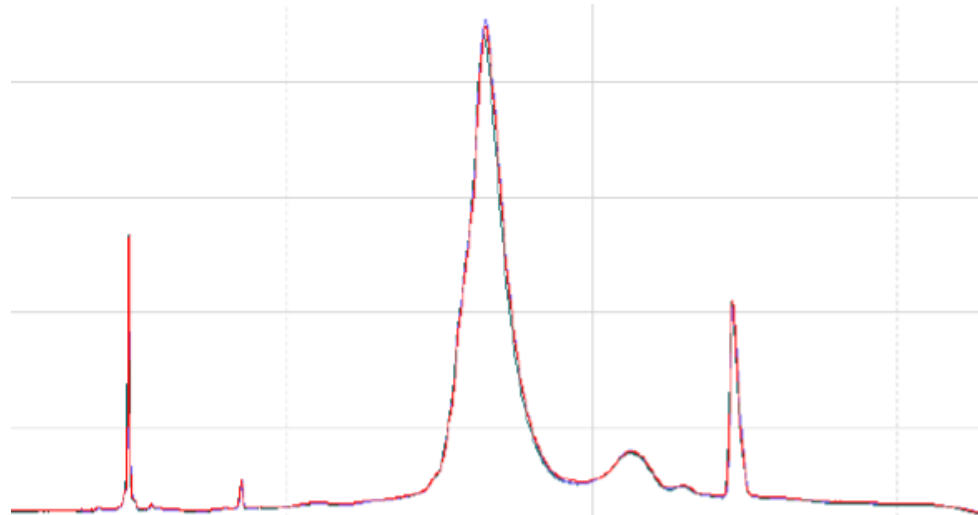
01 重复性：同一个marker跑4次



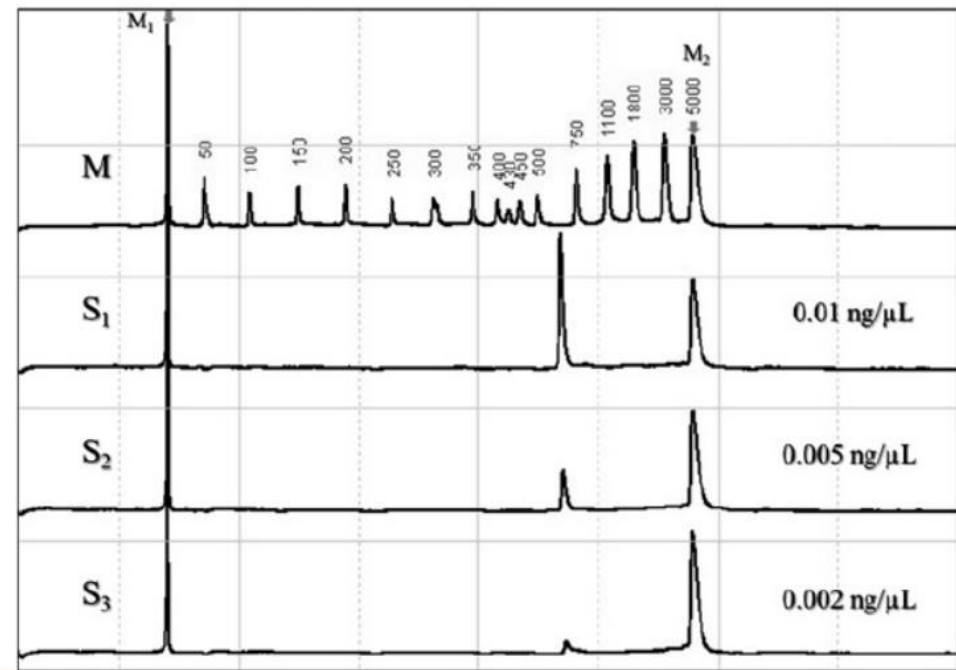
03 分辨率：500bp之内区分1-4bp



02 稳定性：同一样本三个不同时间点测试

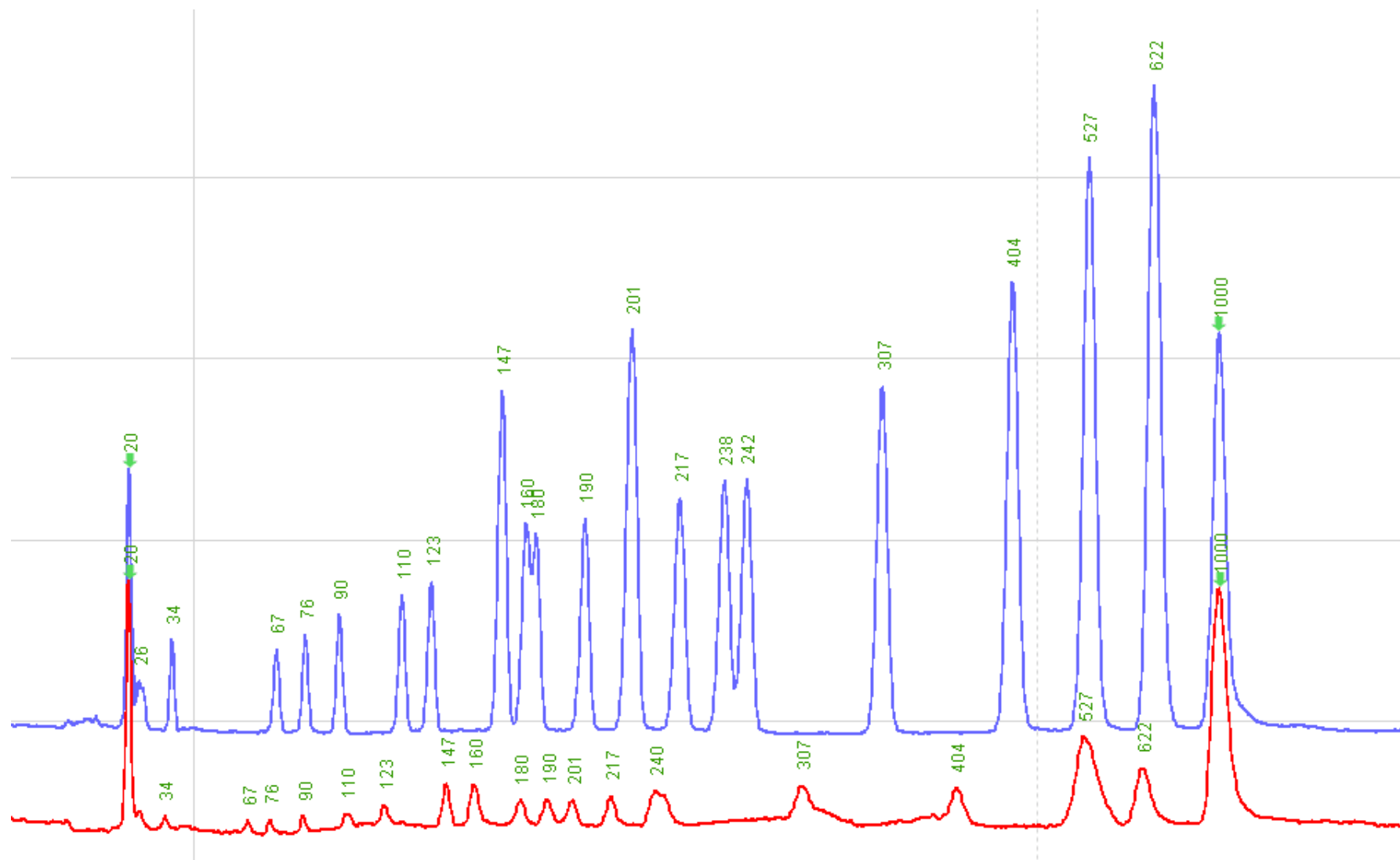


04 灵敏度：标准卡夹可检测到5pg/ul



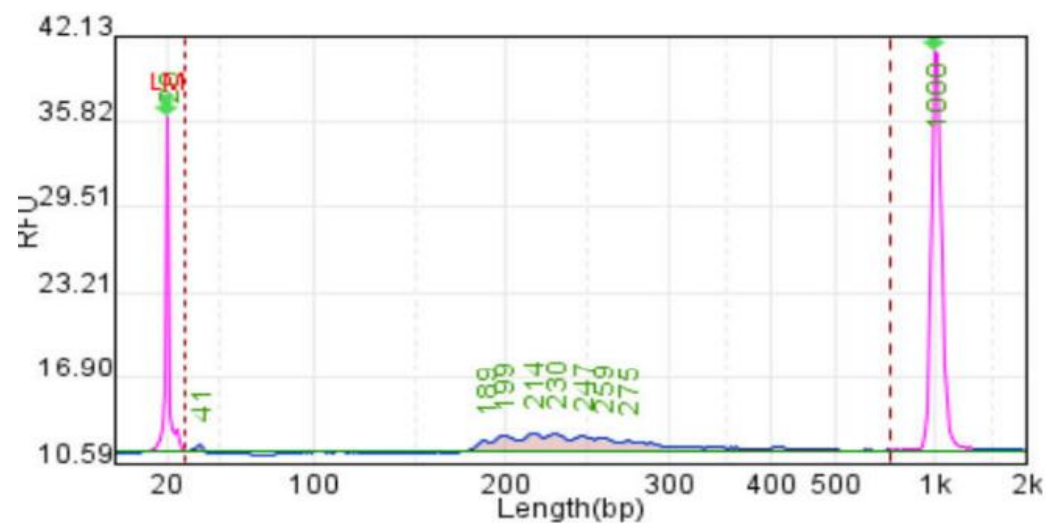
仪器性能

# 灵敏度测试 (N1 vs S2)

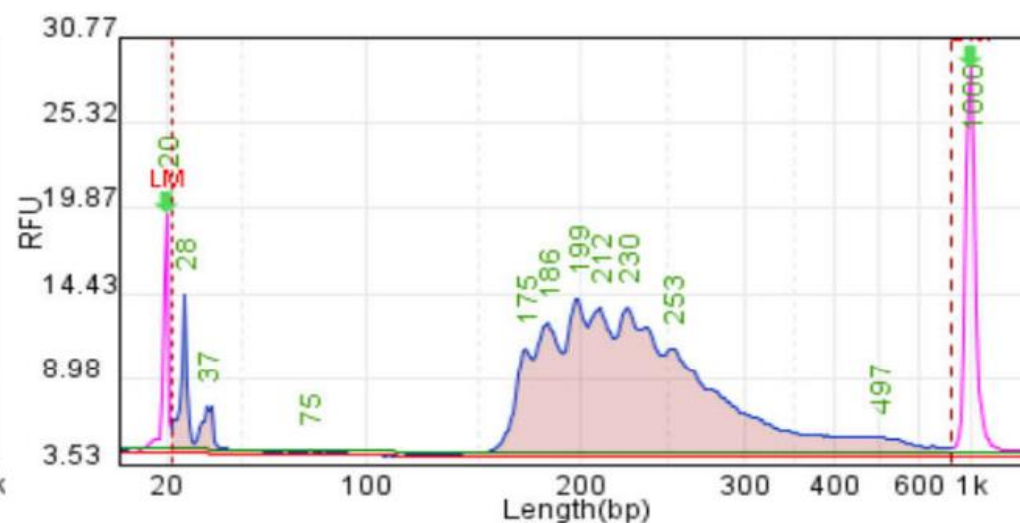




# 灵敏度测试：实际样品检测结果对比



S2卡夹



N1卡夹





## 应用方向

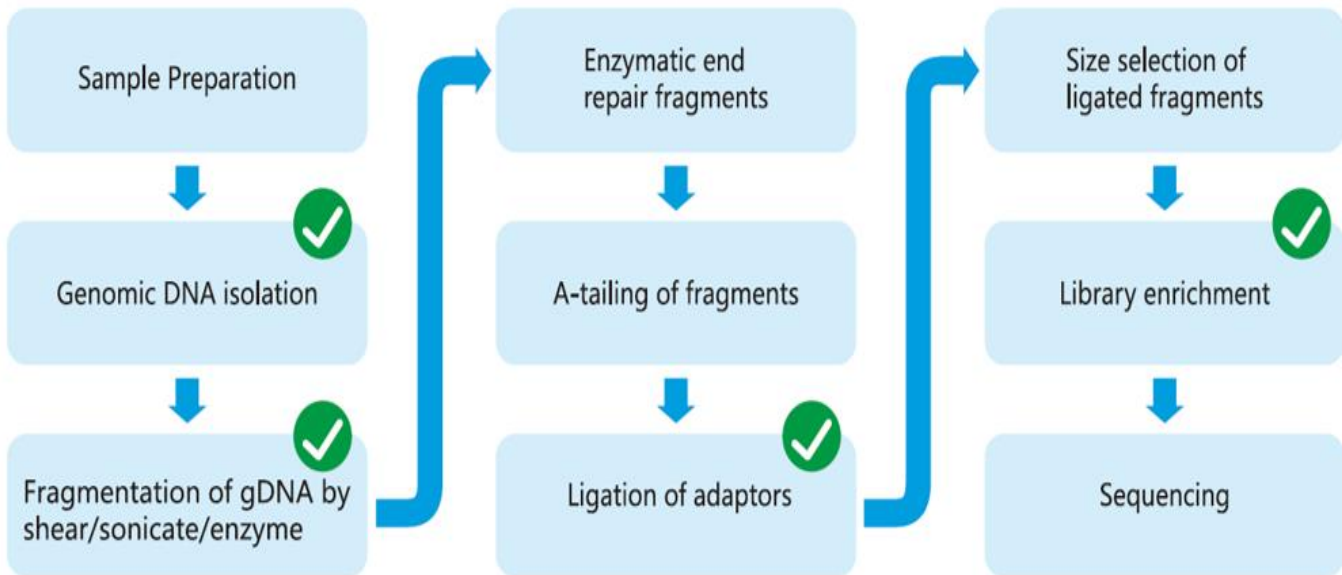
- 核酸提取后质控：gDNA、Total RNA、ct/cf DNA等
- 二代、三代测序质控：FFPE样本、打断样本、文库、cDNA等
- 普通PCR产物、高分辨率多重PCR产物检测：多重病原菌检测，血液病毒分型、呼吸道病毒分型、基因分型、核酸检测试剂盒研发、SSR、STR等
- 辅助荧光定量PCR进行快速检测：新冠病毒检测
- mRNA、cDNA、引物、探针、micro RNA等样本的质控
- 蛋白样本质控：抗体纯度检测



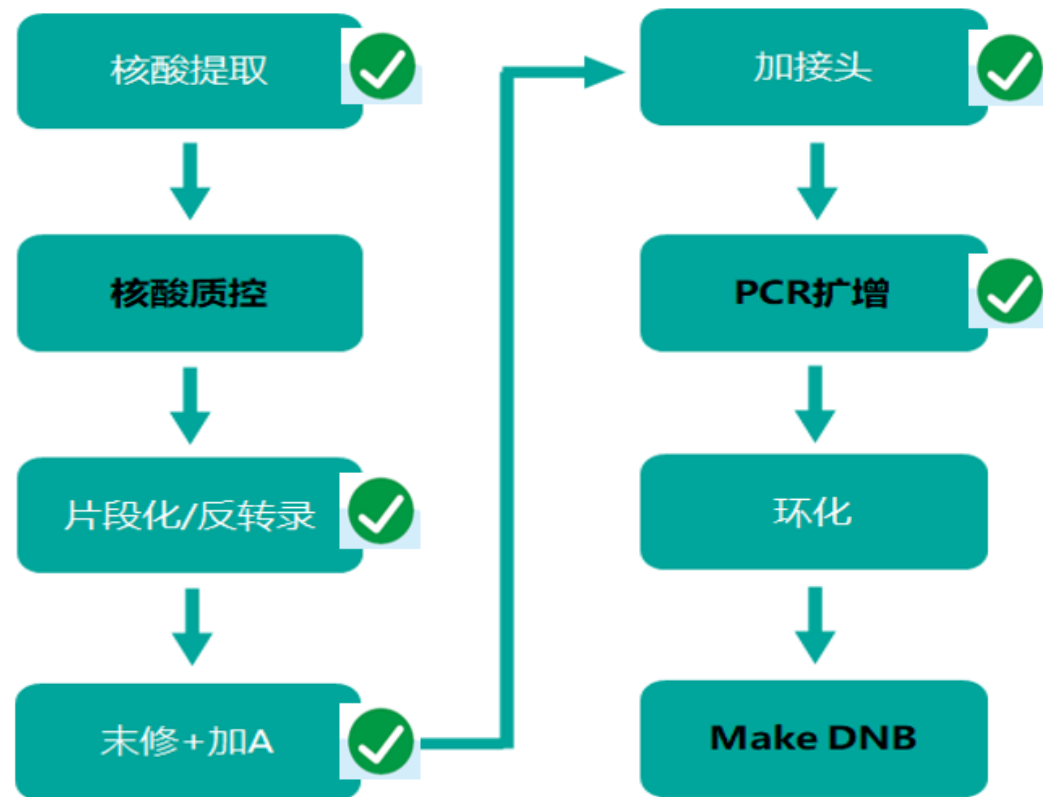
# 高通量测序应用

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# NGS建库流程



A平台建库流程



B平台建库流程

Qsep系列全自动毛细管电泳仪适用于标记  的环节

# 1. 起始样本的质控

总量

Qubit (荧光)

Drop (紫外)

qPCR

纯度

A260/230

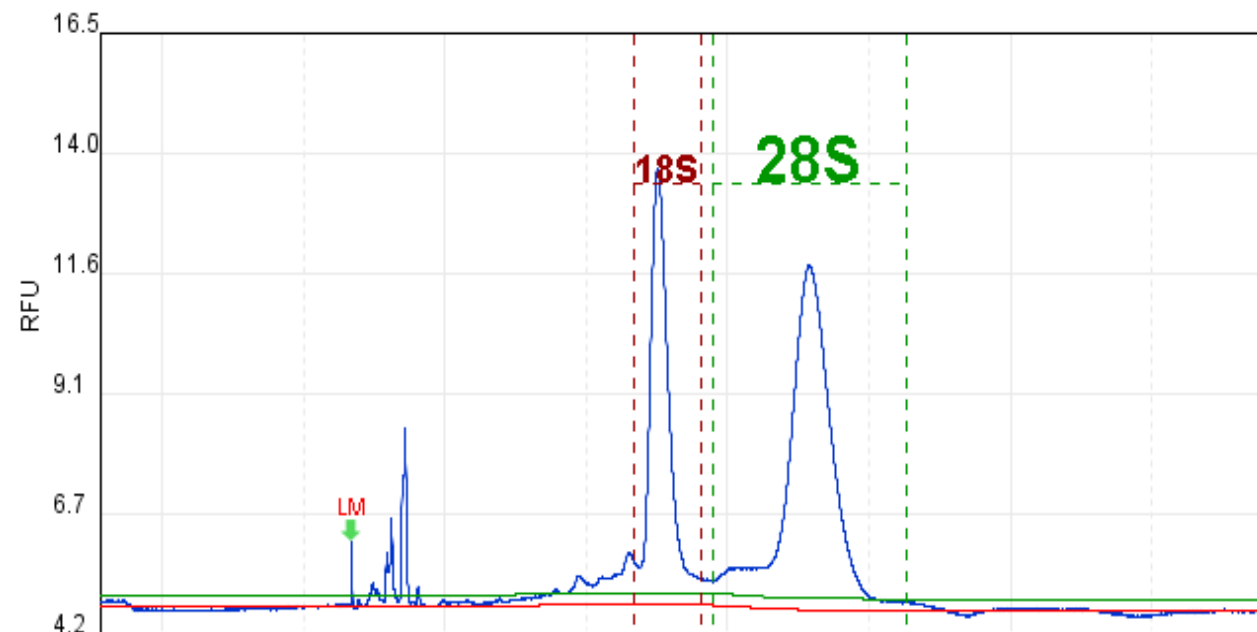
A260/280

完整性

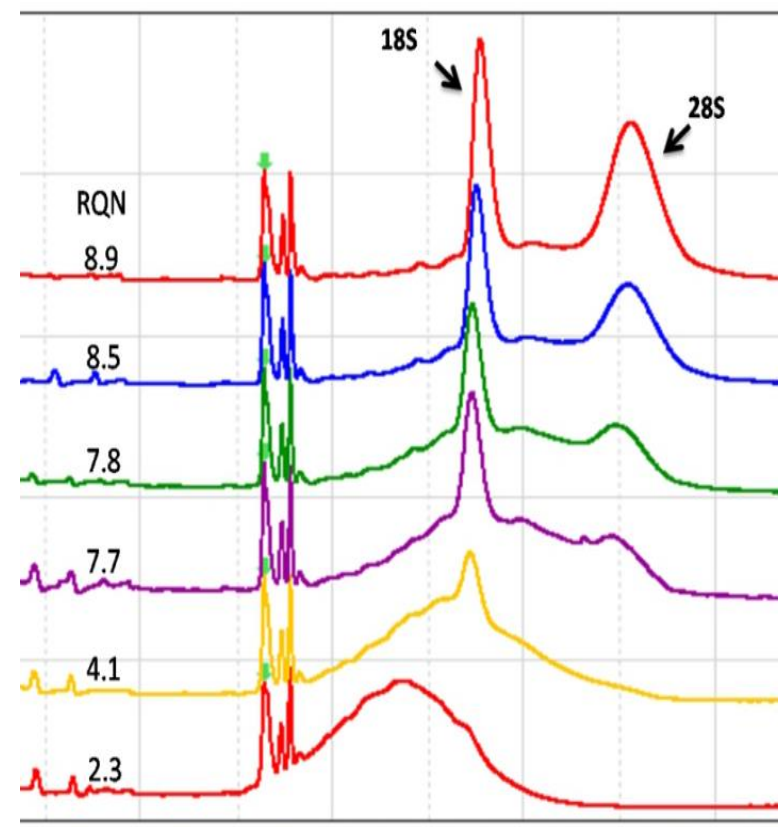
琼脂糖电泳

全自动电泳  
(Qsep系列)

# 1.1 起始样本质控-RNA

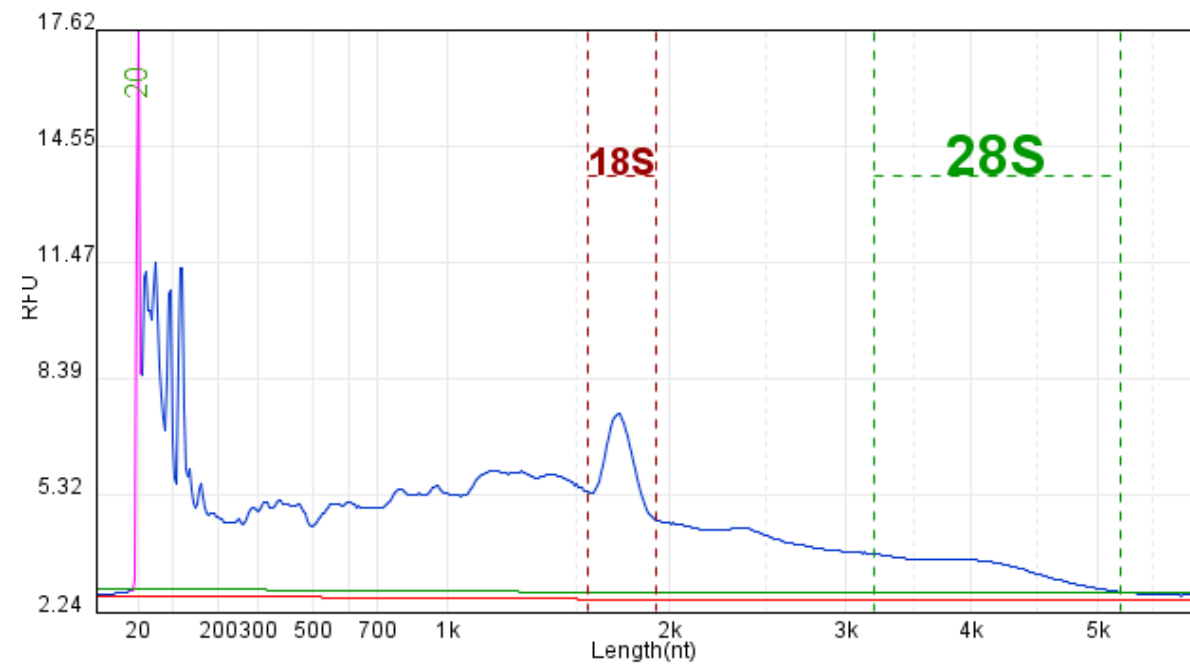


Total RNA

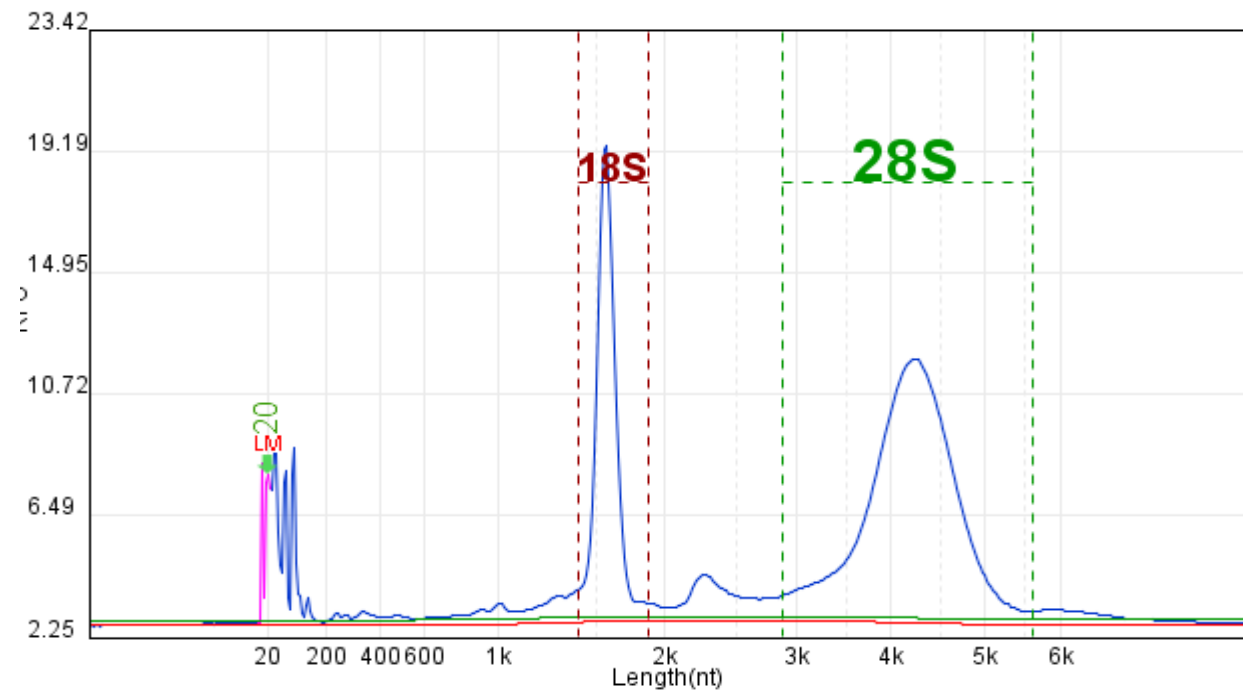


不同降解程度的  
Total RNA的RQN值

# RQN的应用



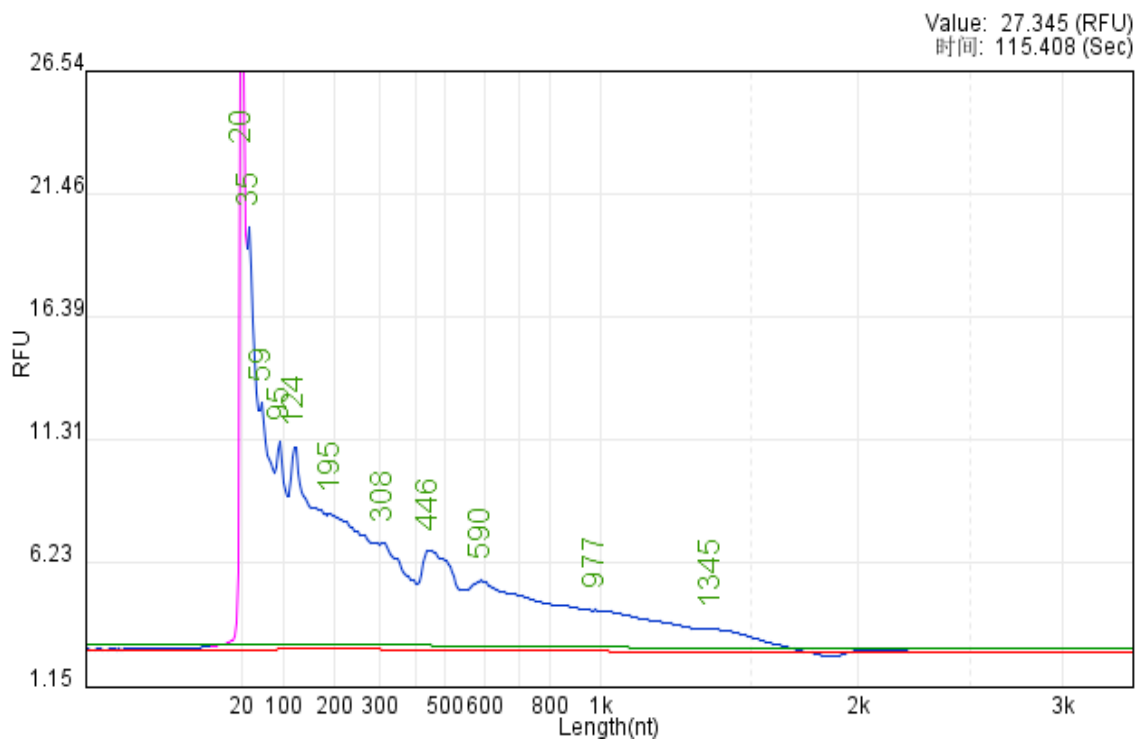
RQN:5.03



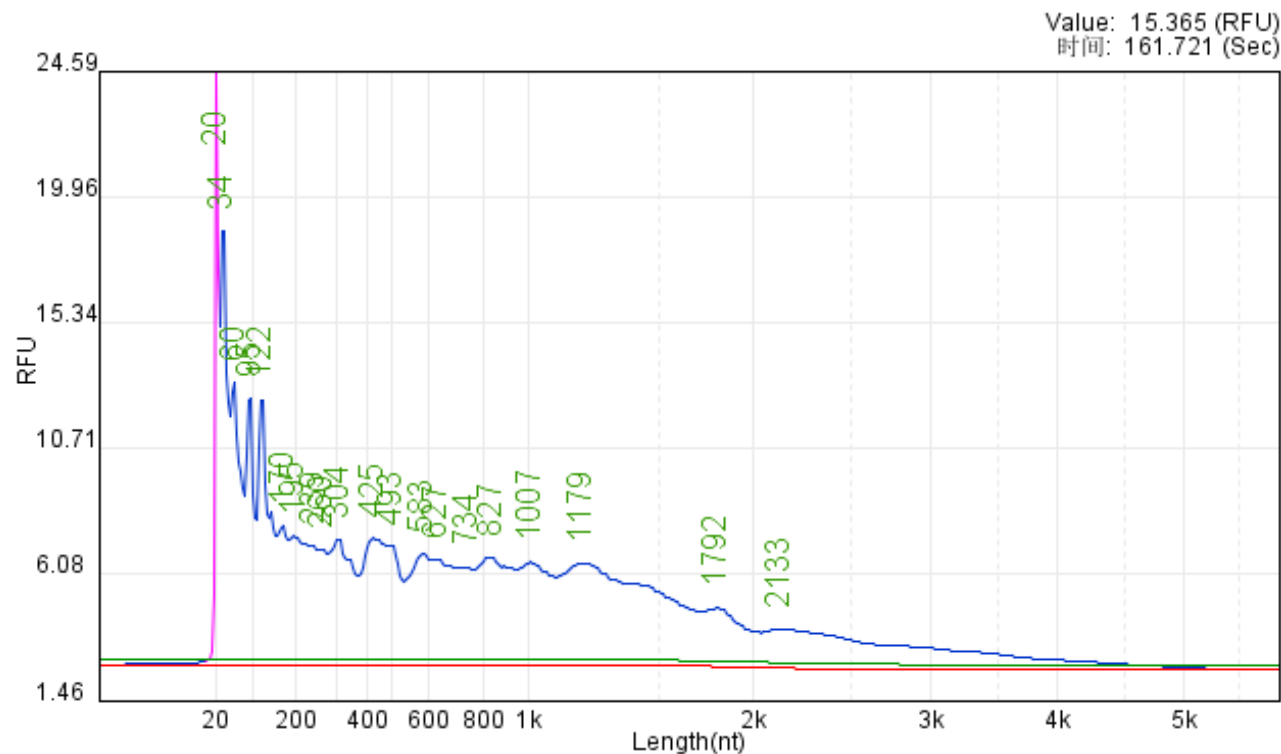
RQN:9.8

RNA样本完整性可以通过RQN(RAN Quality Number)来定义

# DV200的应用-FFPE RNA



**DV200:59.1%**

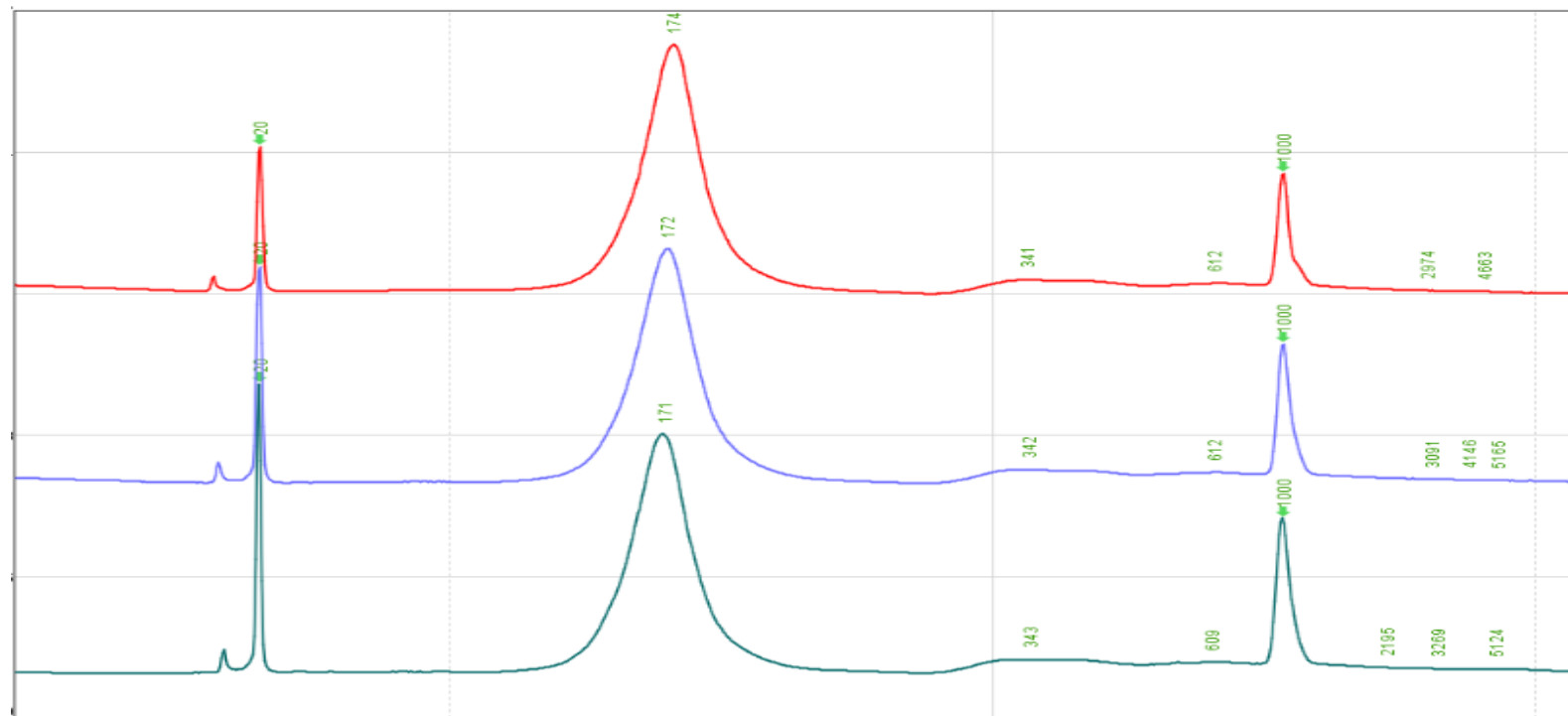


**DV200:76.4%**

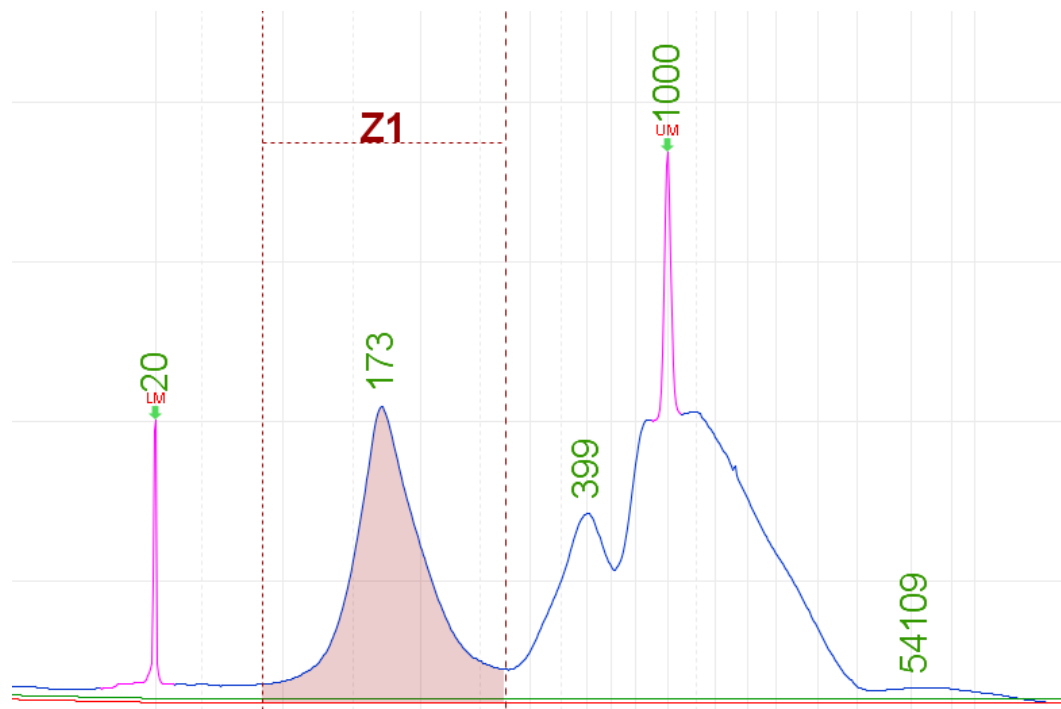
石蜡切片提取的RNA样本，RNA降解严重，RQN值无法准确定义样本完整程度，建议使用DV200（大于200nt的片段比例）进行质控。



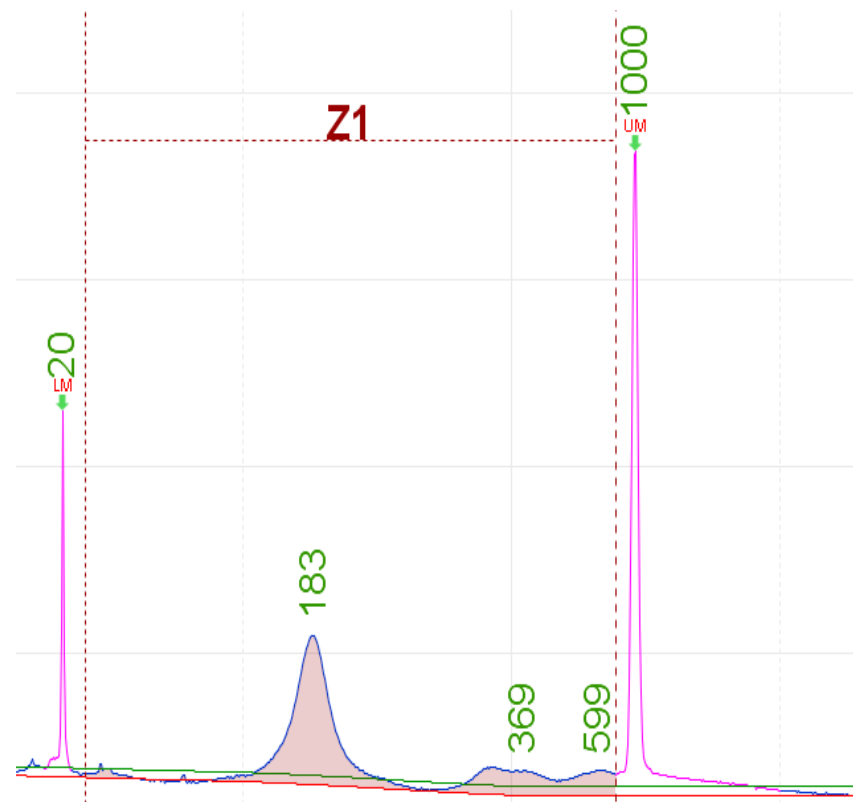
## 1.2 起始样本质控-cf/ctDNA



cfDNA: 0.07 ng/ul

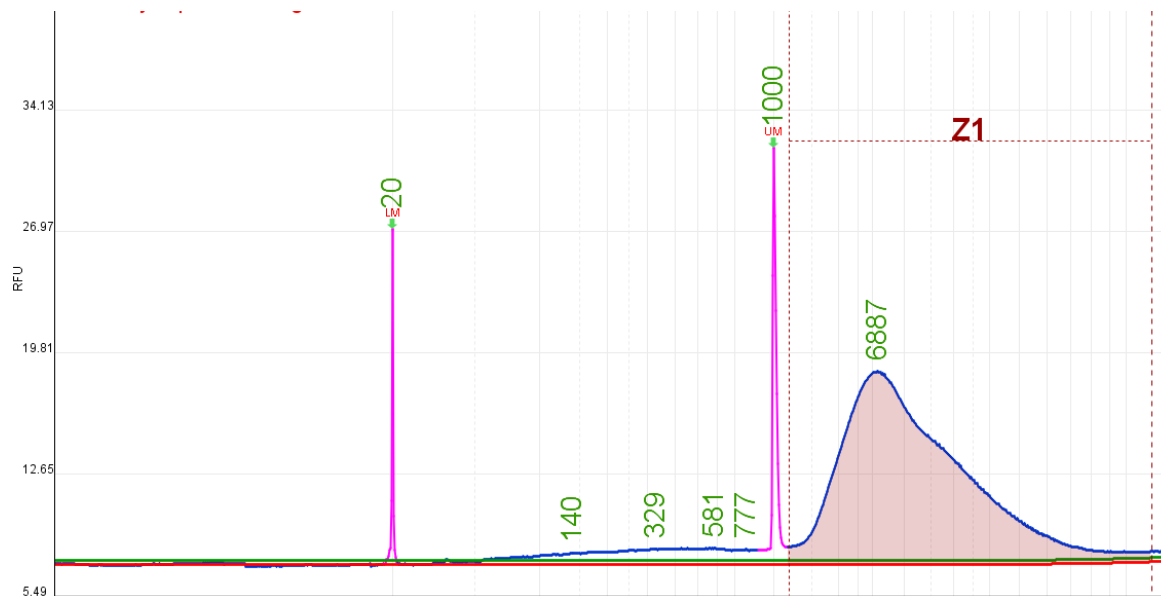


有大片段污染的cfDNA

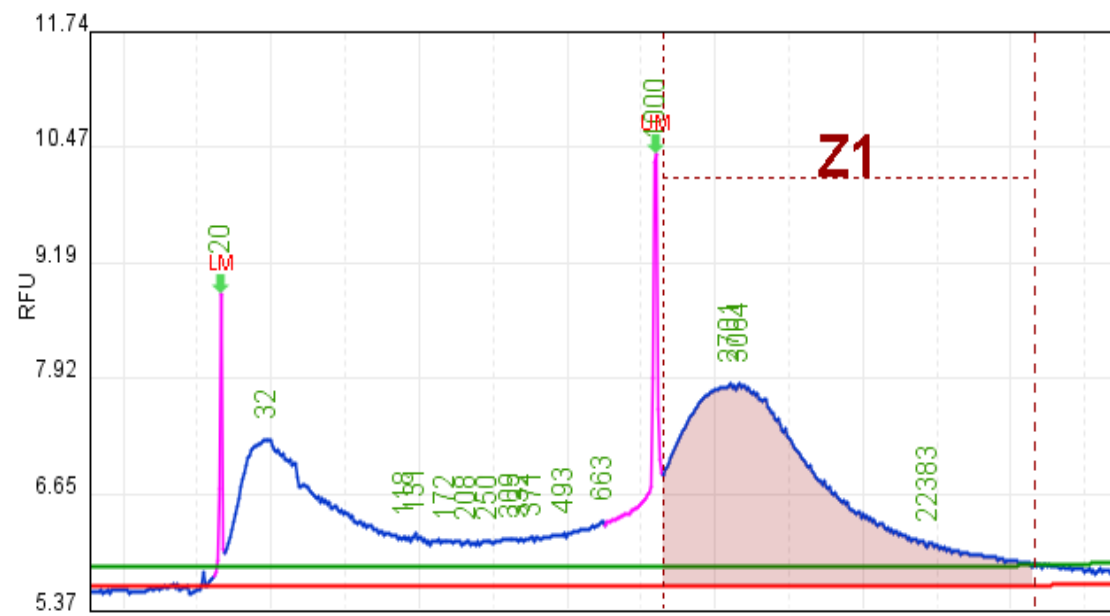


质量较高的cfDNA

# 1.3 起始样本质控-gDNA



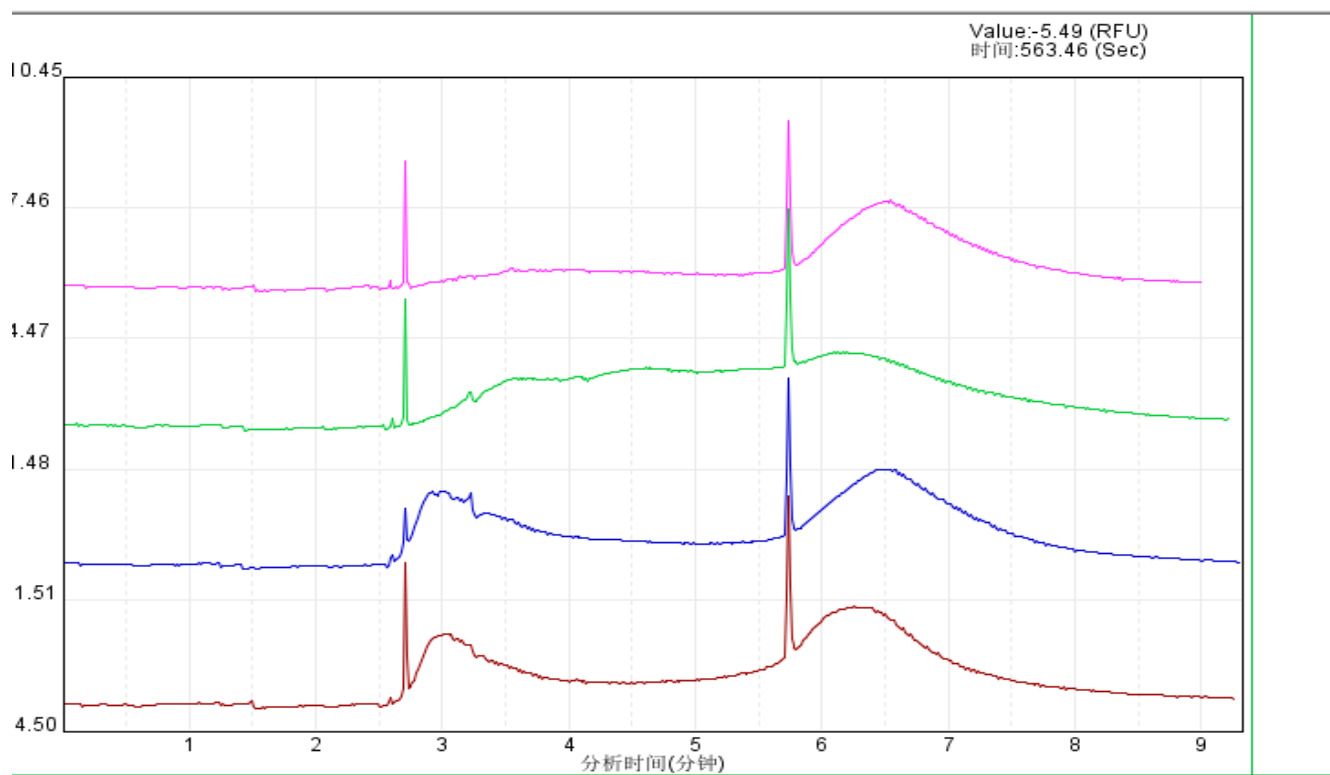
DQN: 8.9



DQN: 6.0

量化的质控值，利于生物样本库大量样本的数据化管理

# DQN的应用



以1K为界

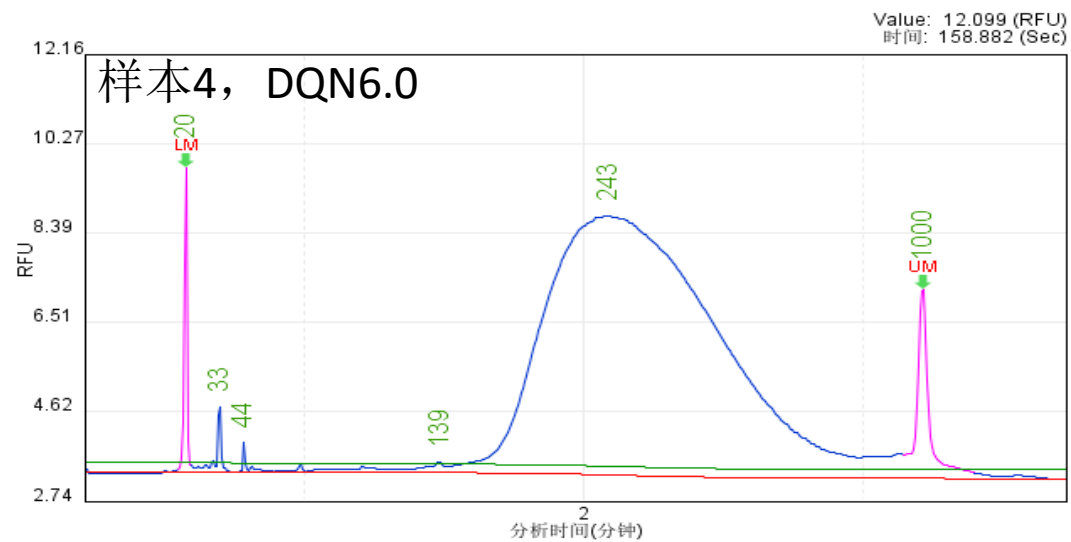
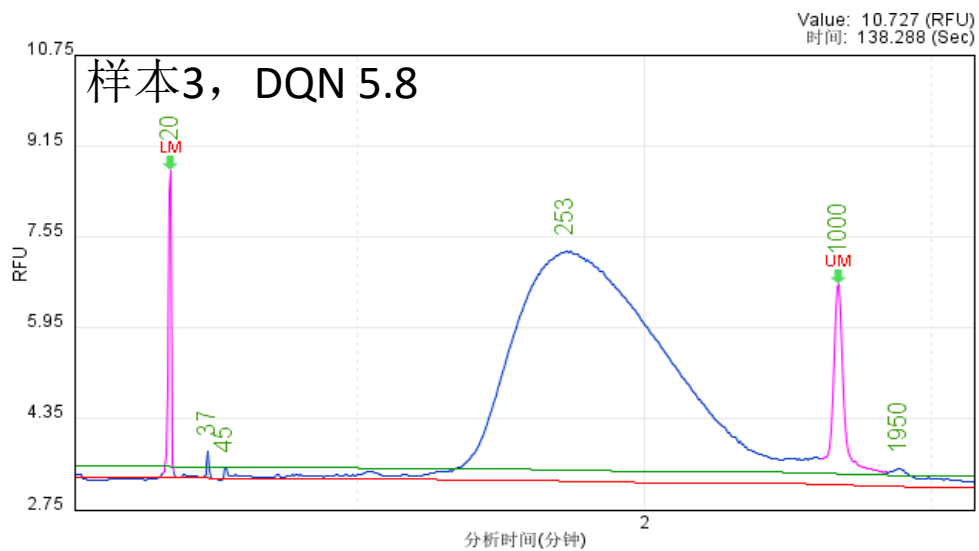
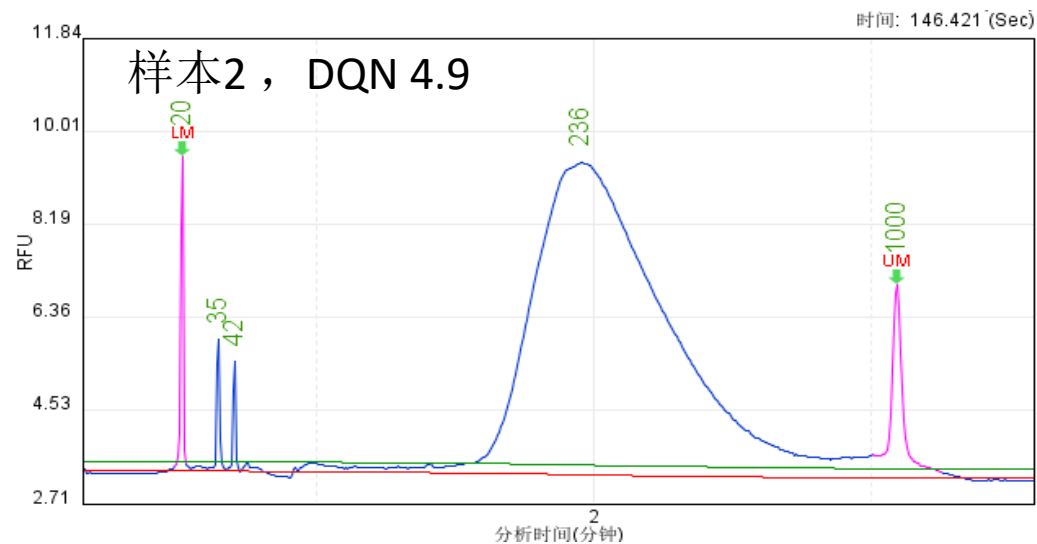
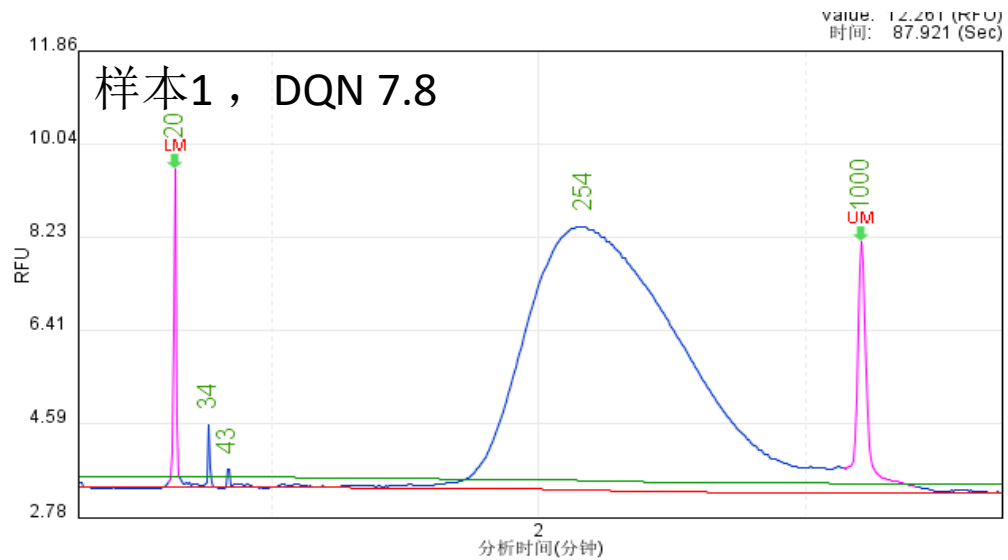
DQN:7.8

DQN:4.9

DQN:5.8

DQN:6.0

# DQN值应用



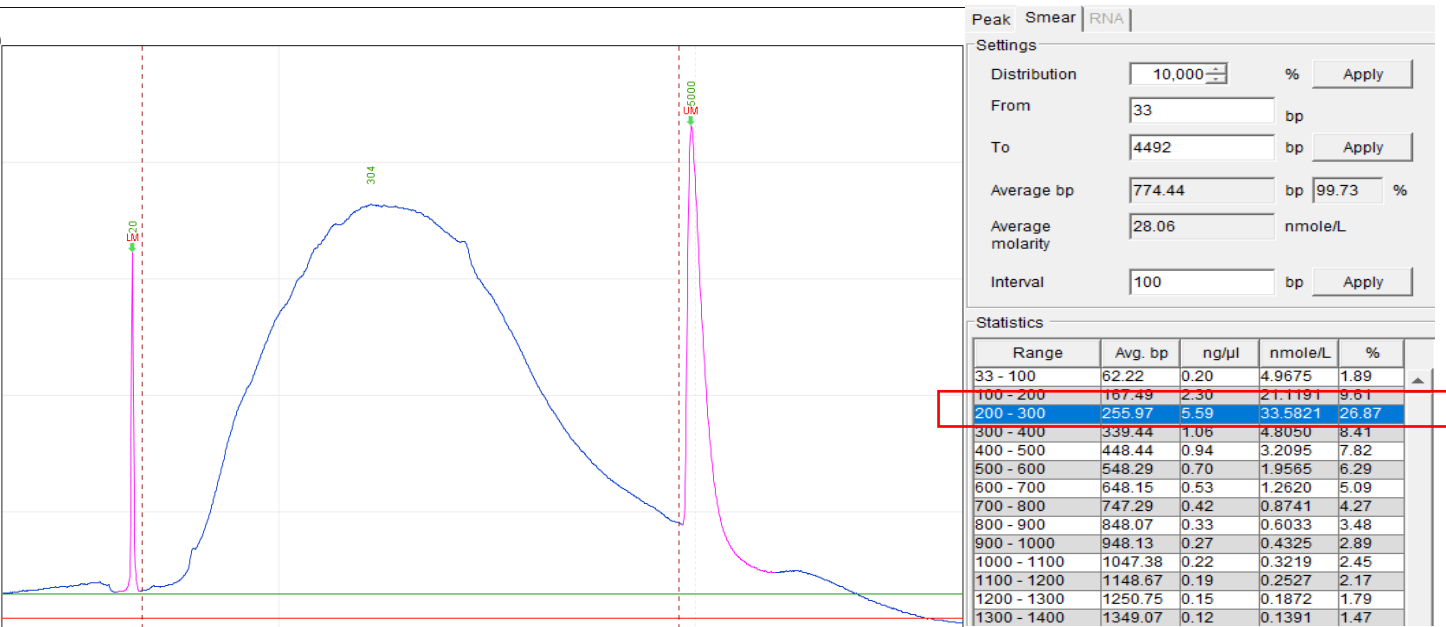
# DQN值应用

各组捕获文库平均片段（单位：bp）

DQN	样本	小组1	小组2	小组3	小组4	小组5	小组6	平均
7.8	1	291.7	312.2	301.5	293.9	302.7	299.4	300.2
4.9	2	268.1	291.7	273.8	264.9	275.0	272.6	274.4
5.8	5	297.4	309.8	302.0	294.5	304.0	302.1	301.6
6.0	6	281.5	290.2	289.2	278.8	293.5	288.7	287.0

DQN值评分较低的2号样本文库平均片段显著偏低

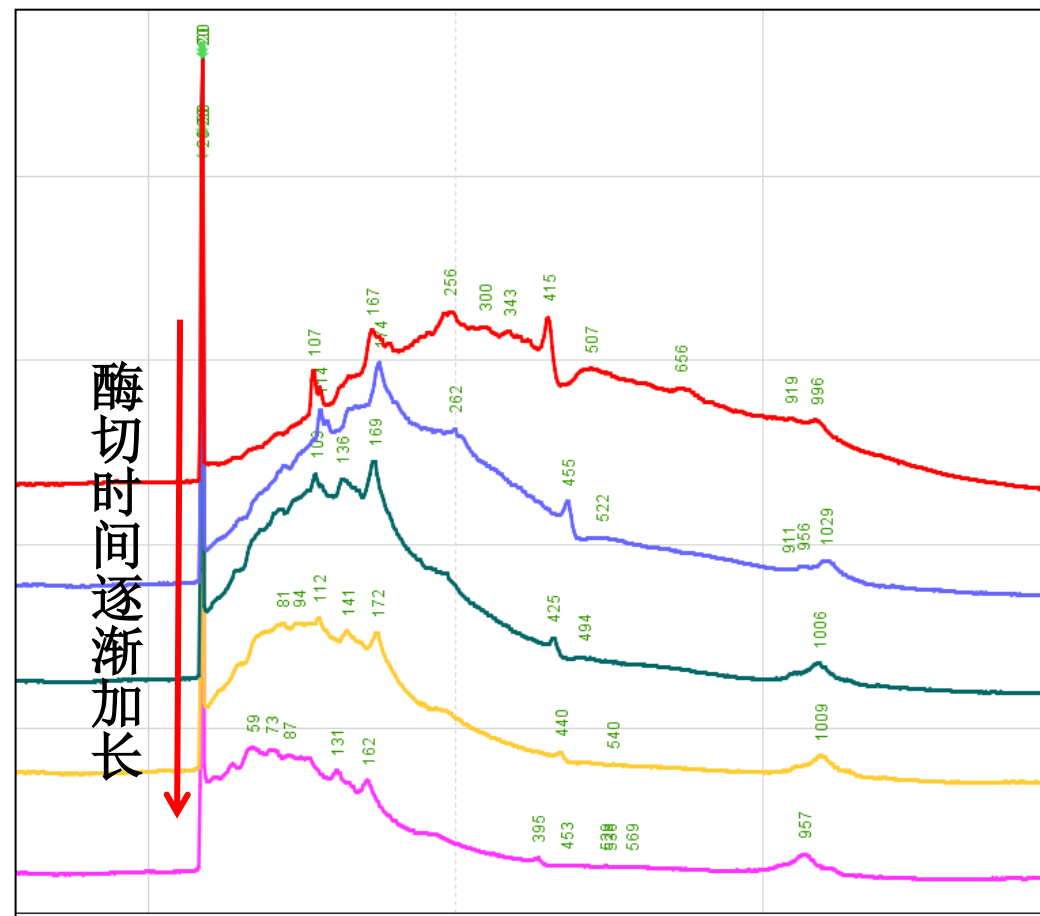
## 2. 片段化核酸的质控



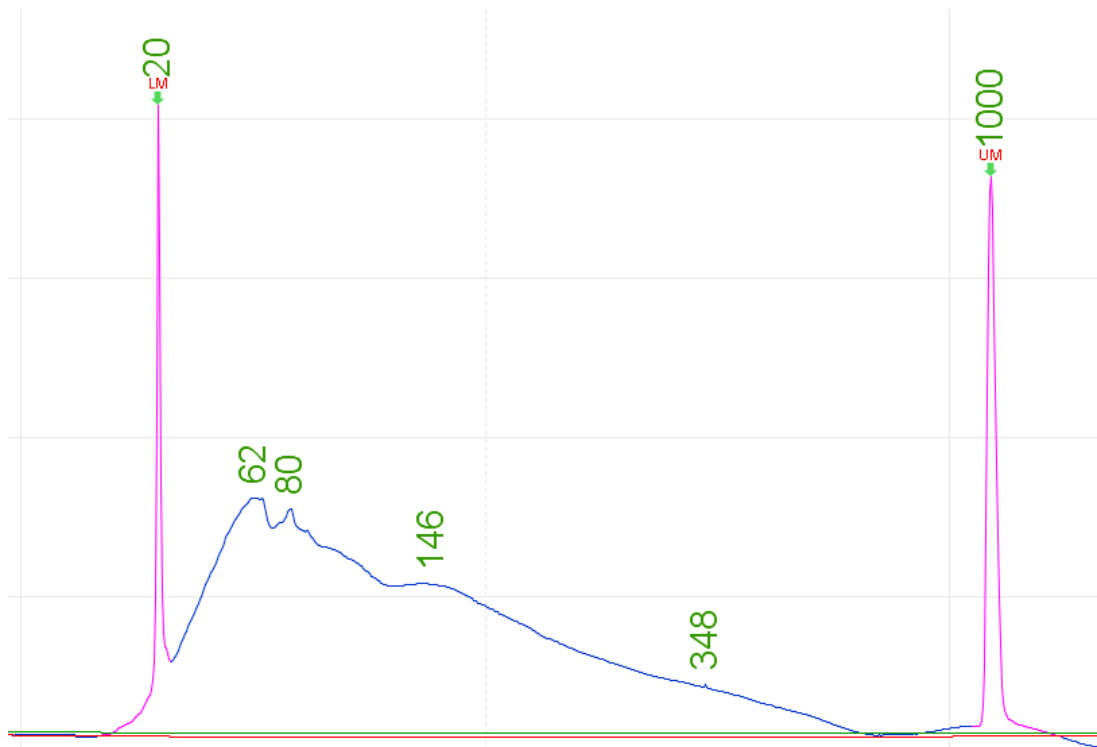
片段化DNA: 200-300bp

酶打断  
超声打断

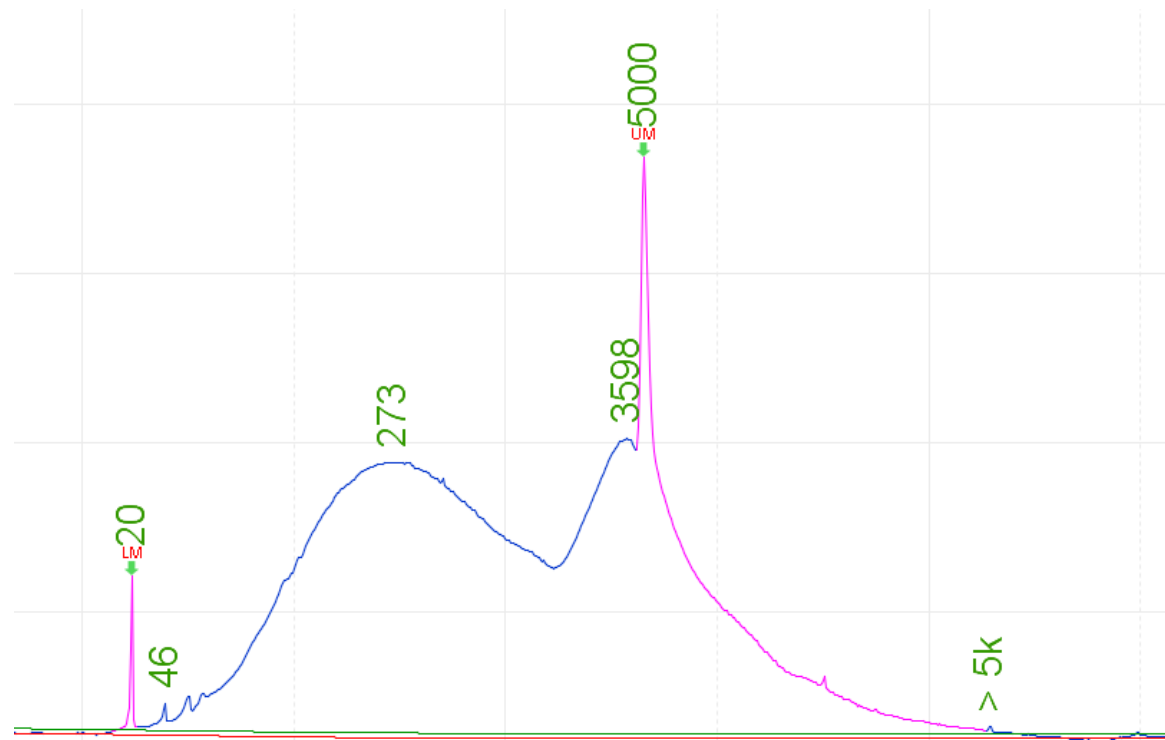
## 片段化RNA





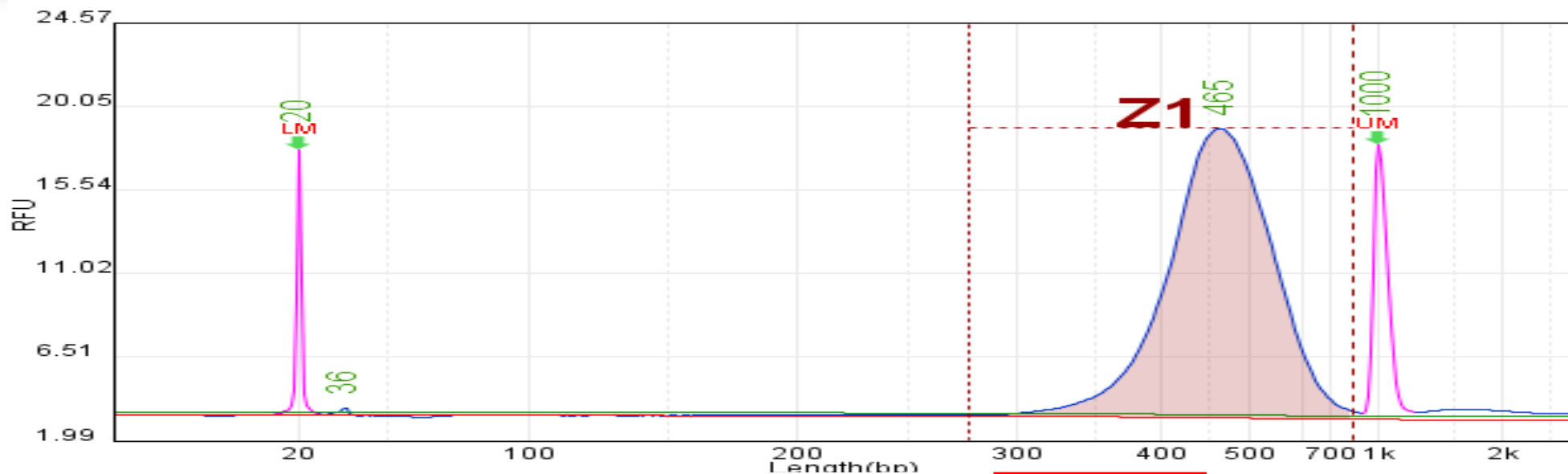


打断时间过长/功率过高



打断时间太短/功率太小

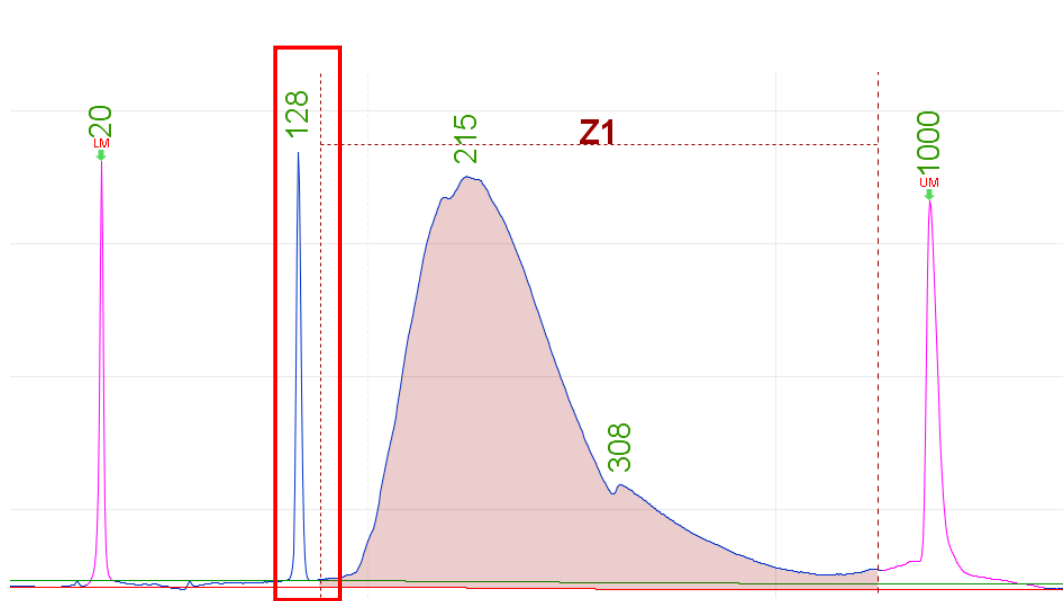
### 3. 文库质控



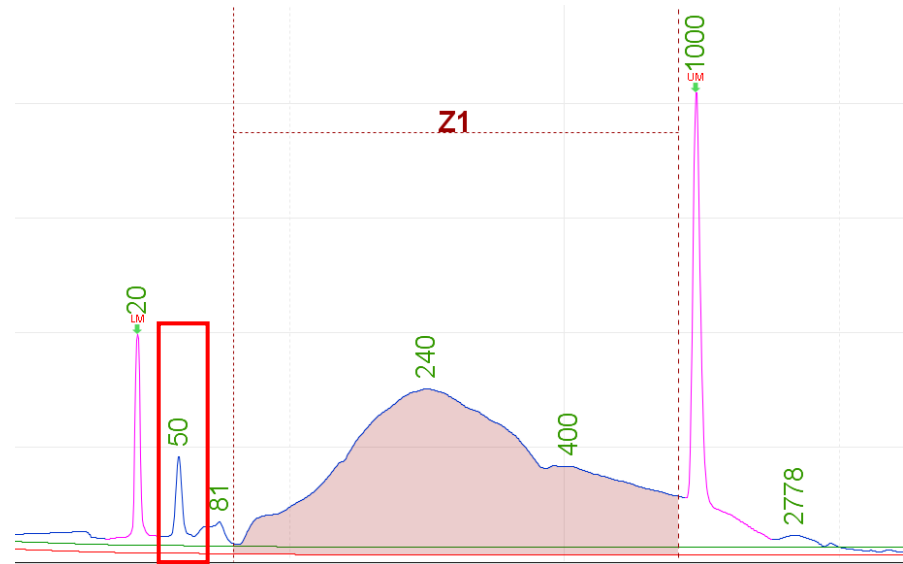
Distribution: 99.0 %  
From: 277 bp  
To: 823 bp  
Average Size: 469.7 bp  
Average Molarity: 61.32 nmole/L  
DQN: 9.9

Range	Avg. bp	ng/μl	nMole / L	Percent
277 - 300	290.0	0.06	0.30	0.2
300 - 400	372.5	2.51	10.35	12.1
400 - 500	452.9	11.28	38.30	59.2
500 - 600	533.3	4.15	11.96	23.5
600 - 700	632.7	0.56	1.37	3.0
700 - 800	741.9	0.15	0.32	0.8
800 - 823	813.2	0.02	0.04	<0.1

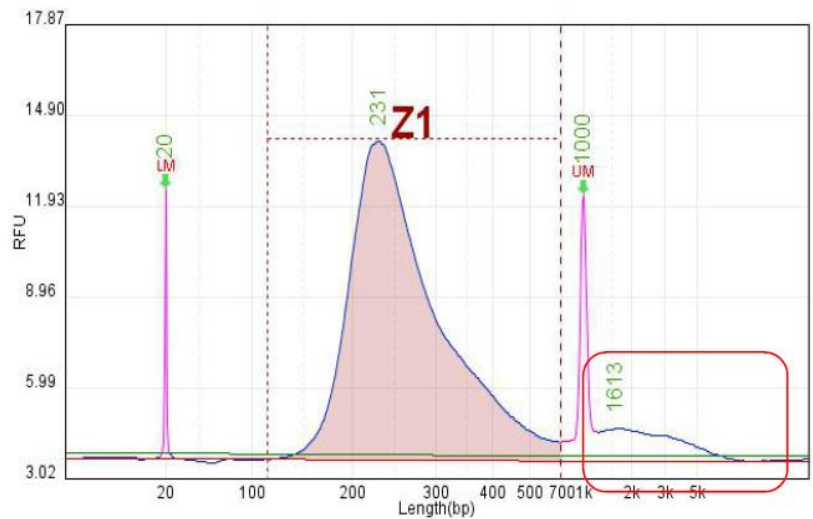
可通过Smear分析确定文库的占比，主要片段分布区域，以及其平均片段长度



接头残留

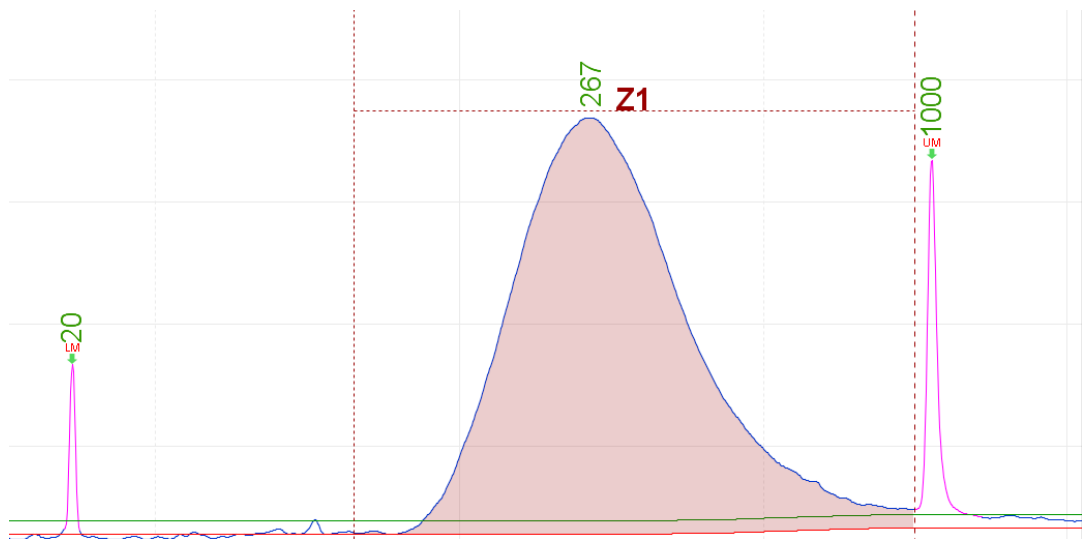


引物残留

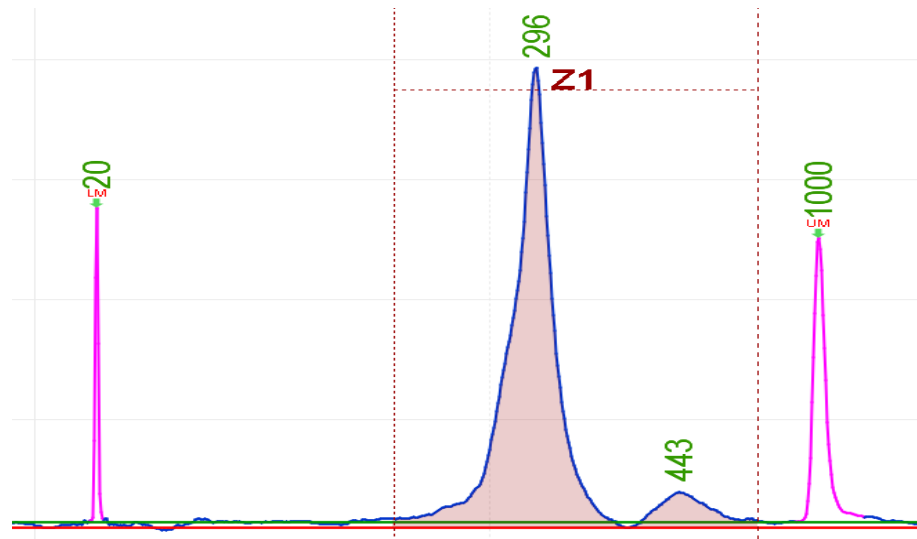


大片段残留

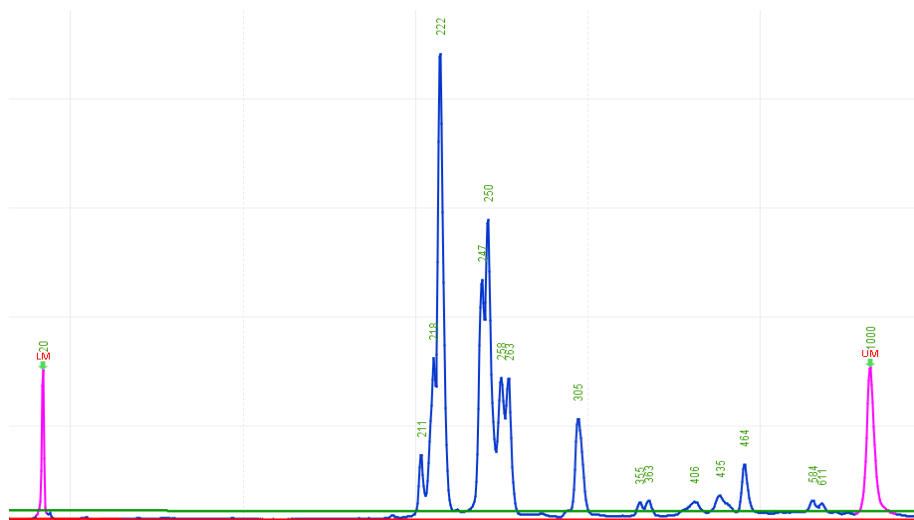
# 常见文库类型



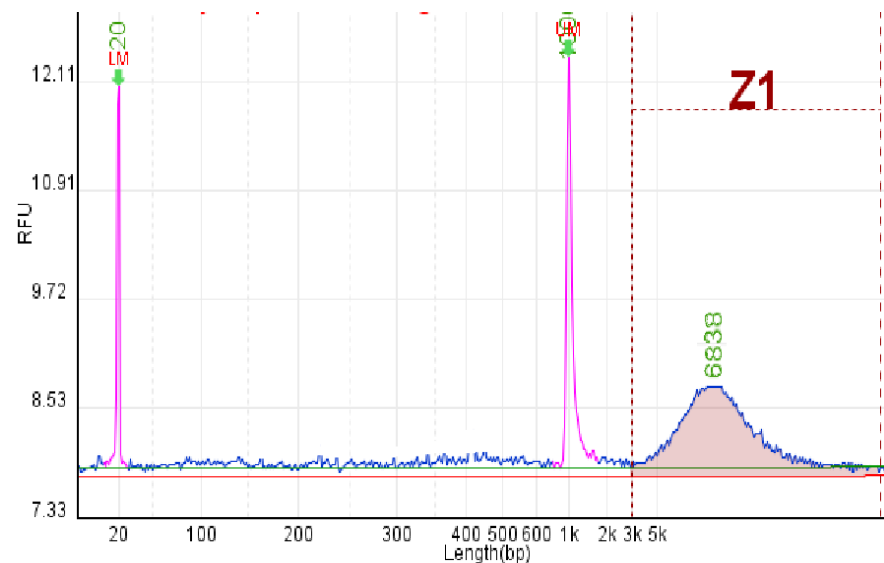
gDNA捕获文库



cfDNA文库

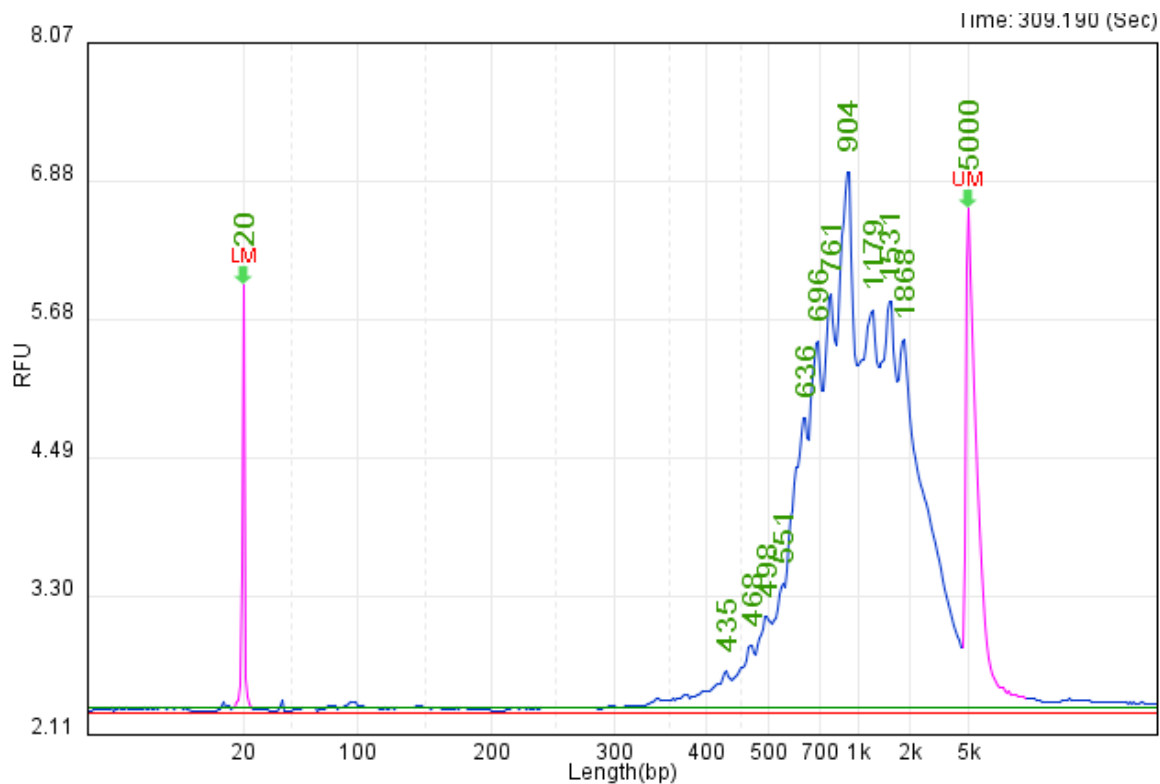


多重扩增子文库

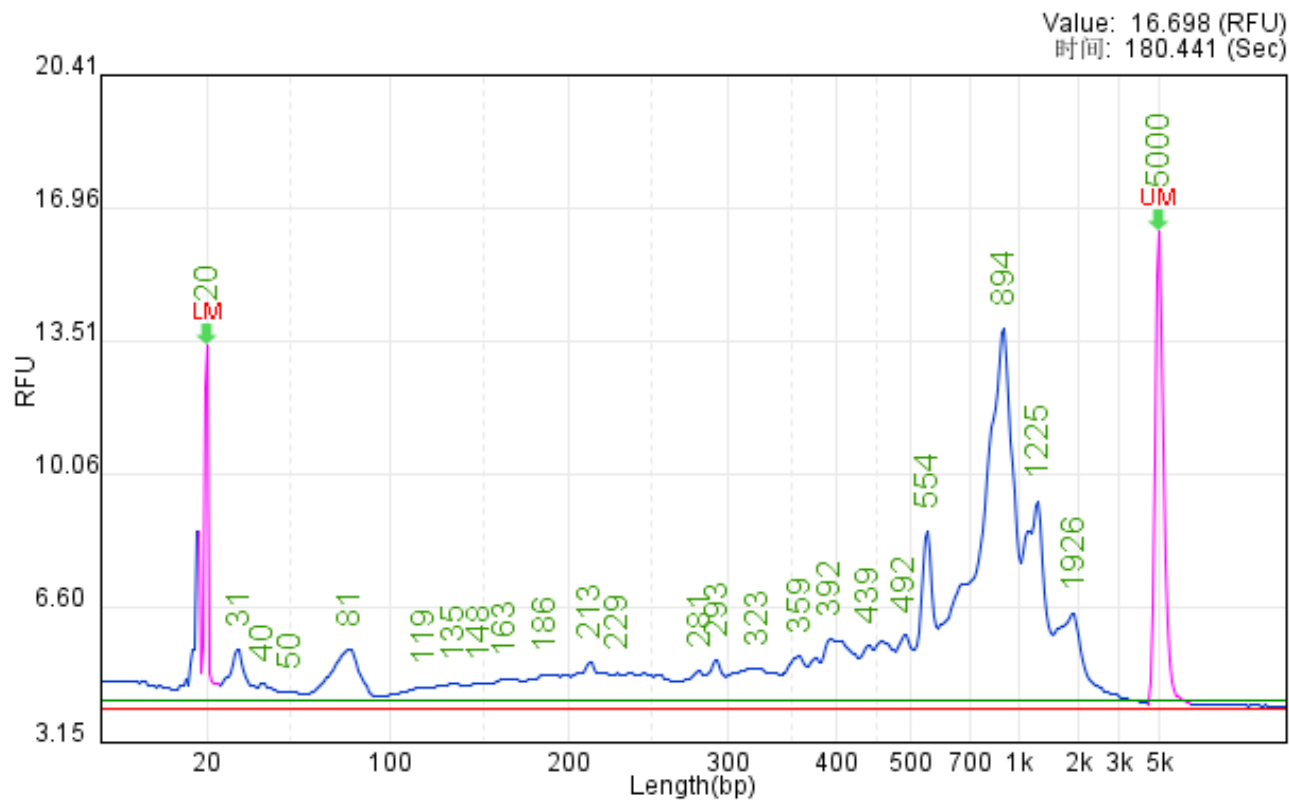


Nanopore三代测序文库

# 单细胞测序cDNA质控

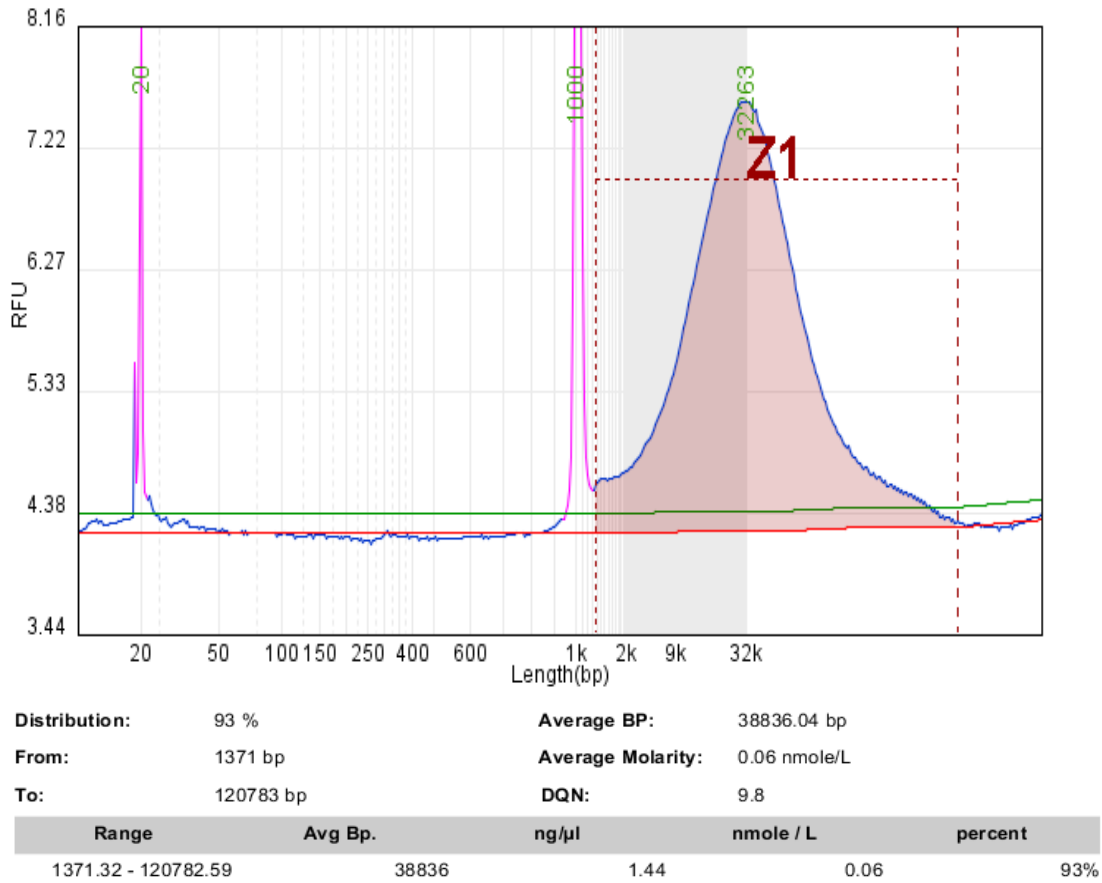


片段分布集中cDNA

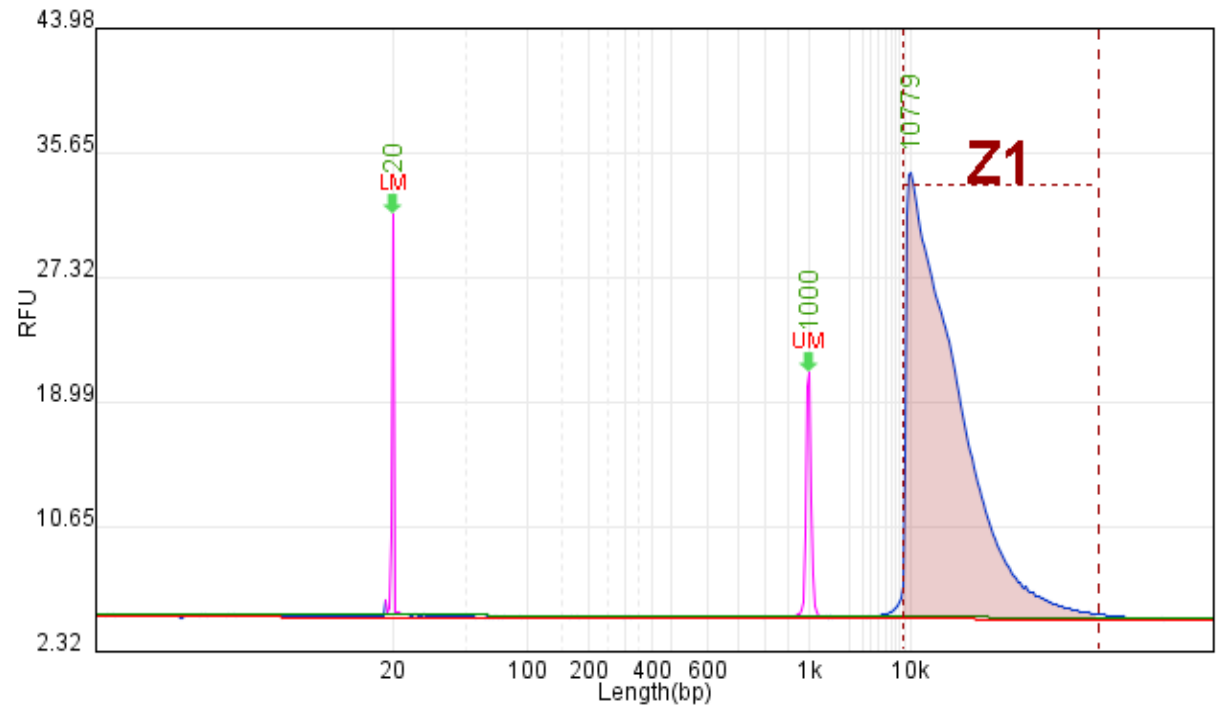


片段弥散型cDNA

# 三代测序质控

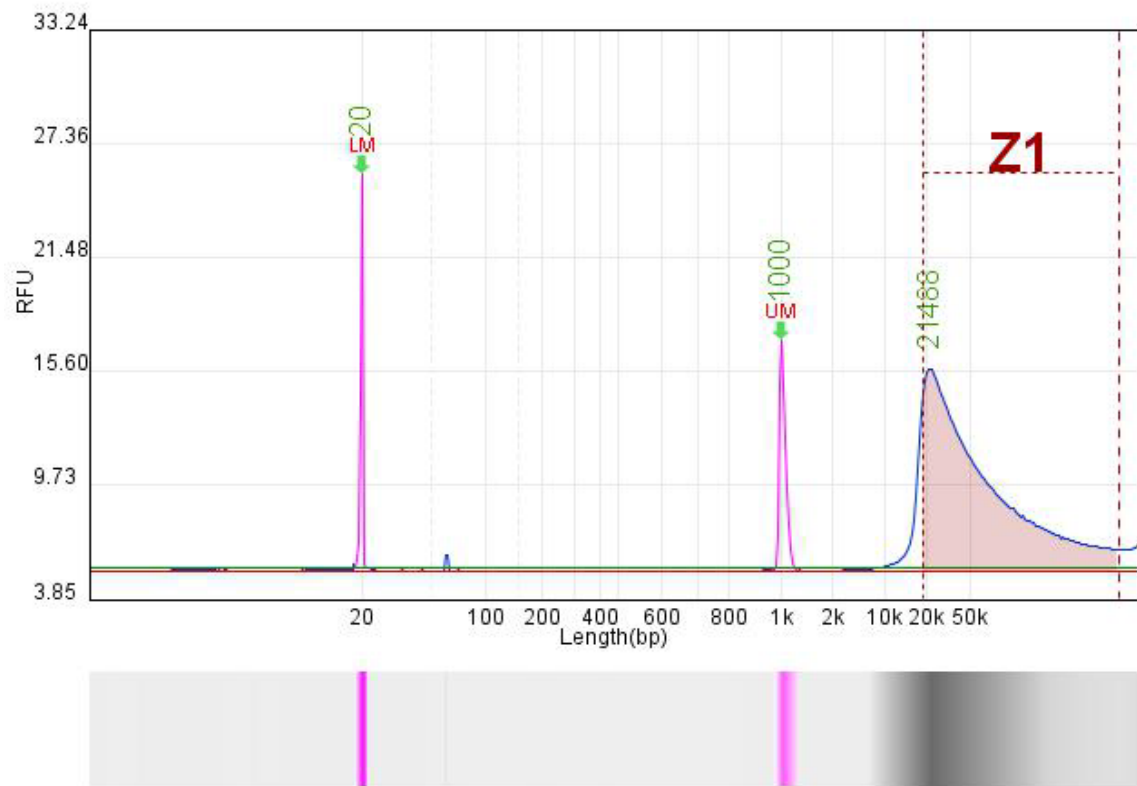


gDNA

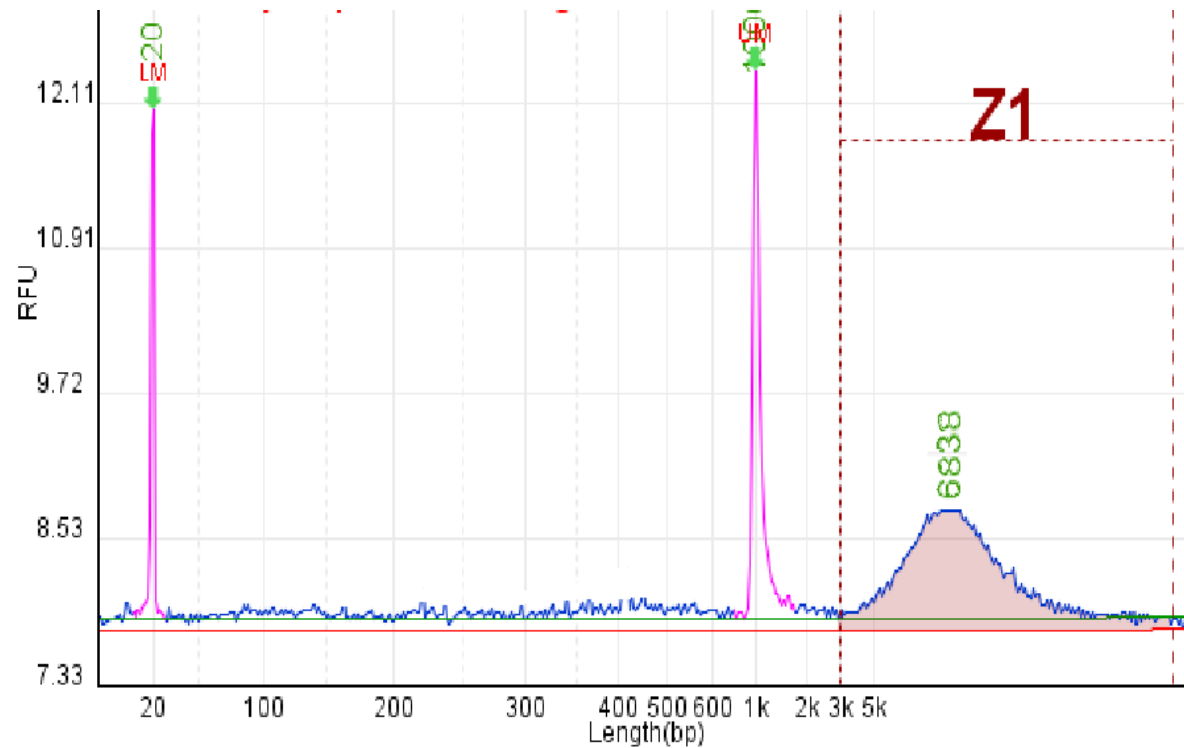


10K切胶后片段检测结果

# 三代测序质控



Pacbio文库



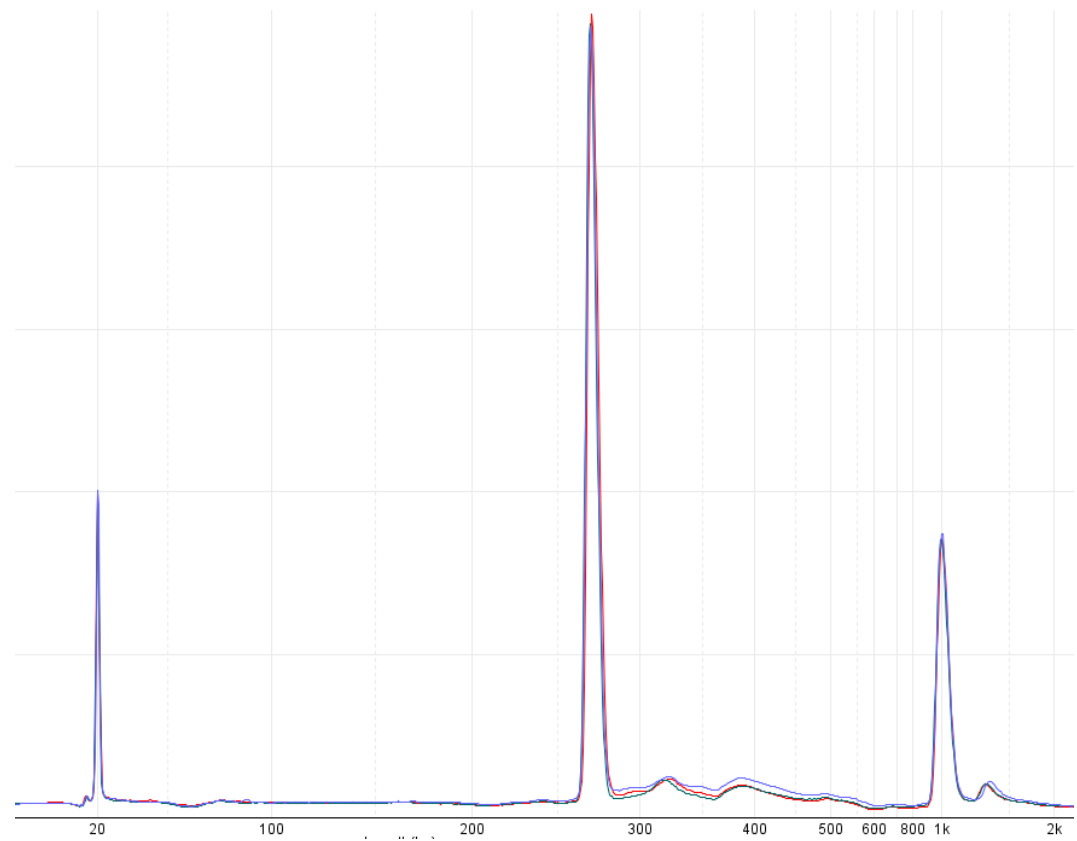
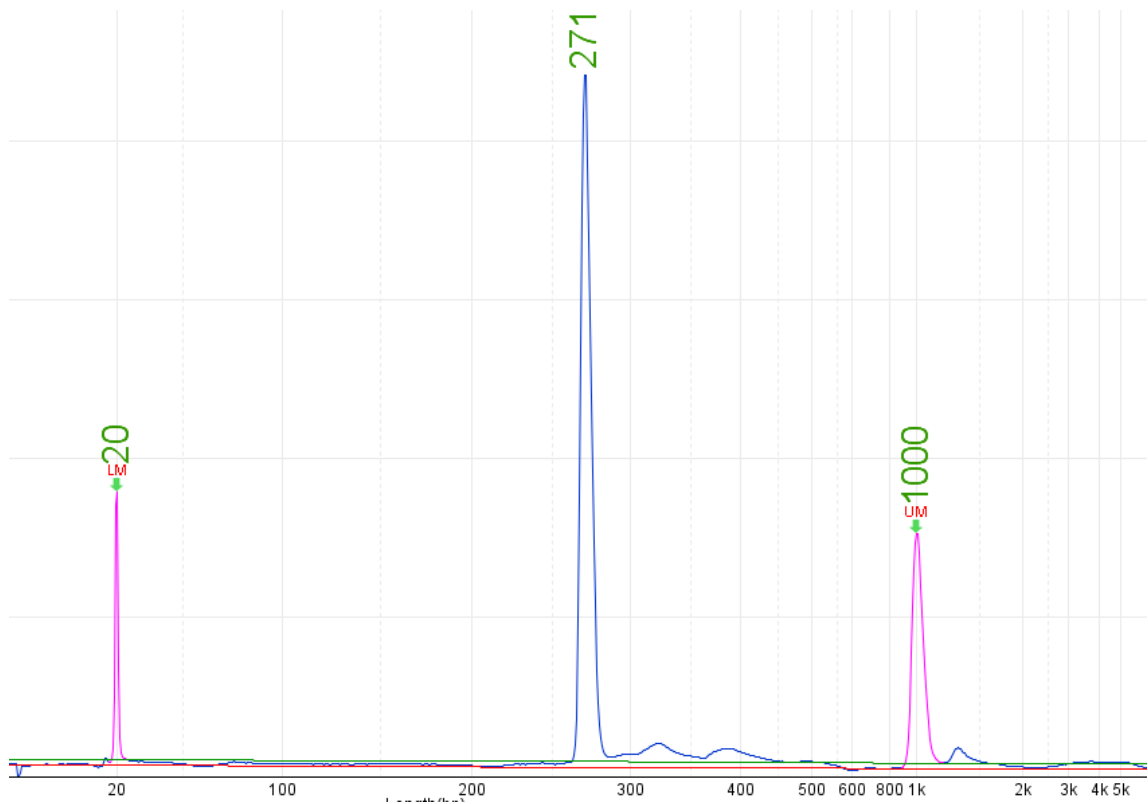
Nanopore文库





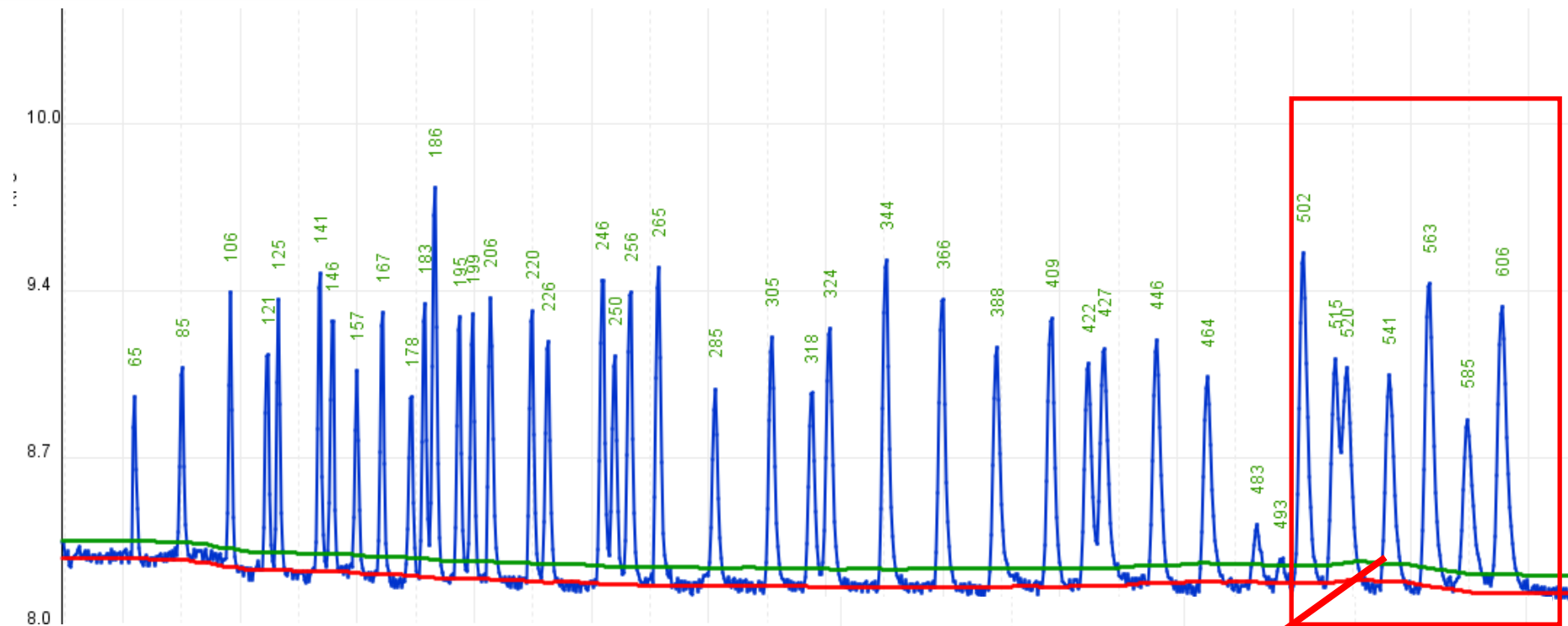
## 多重核酸检测/极高分辨率应用

# 1. 单重PCR产物分析

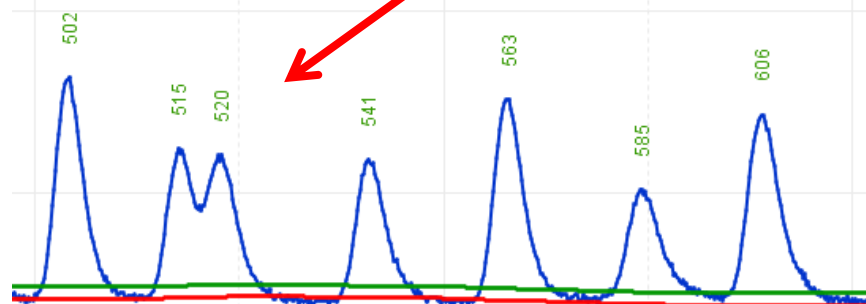


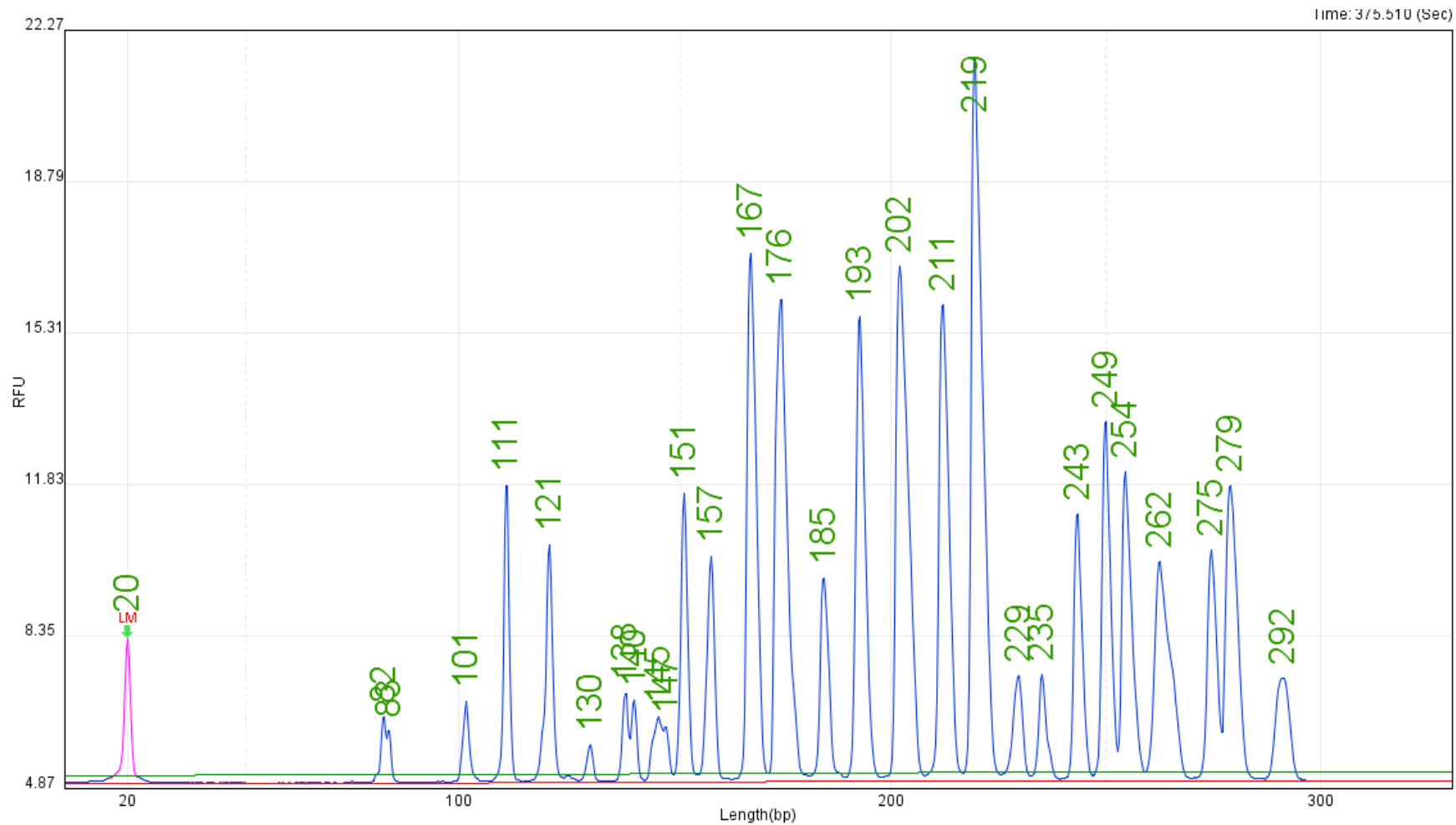
单重扩增产物

## 2. 极高分辨率

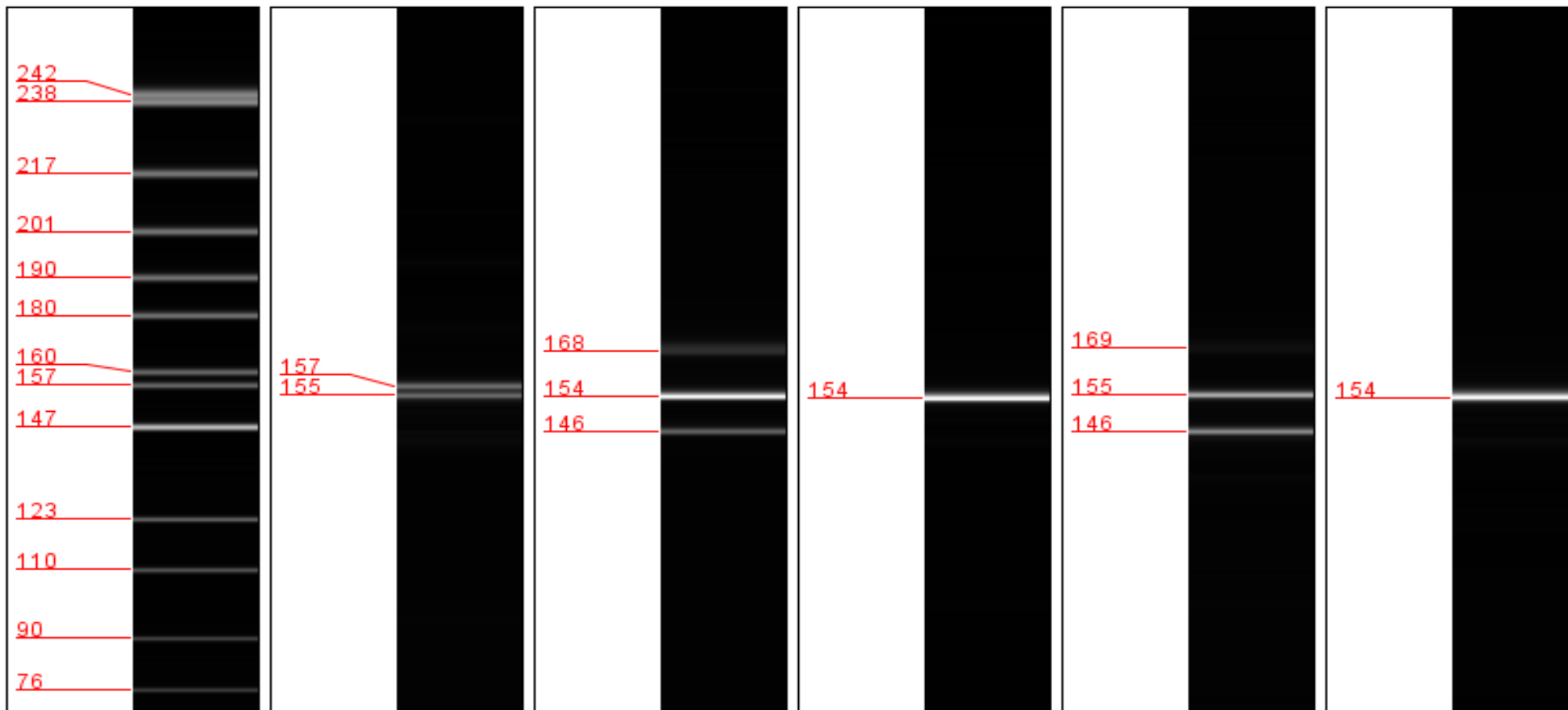


长度500-600bp的片段相差5bp可以有效明确区分



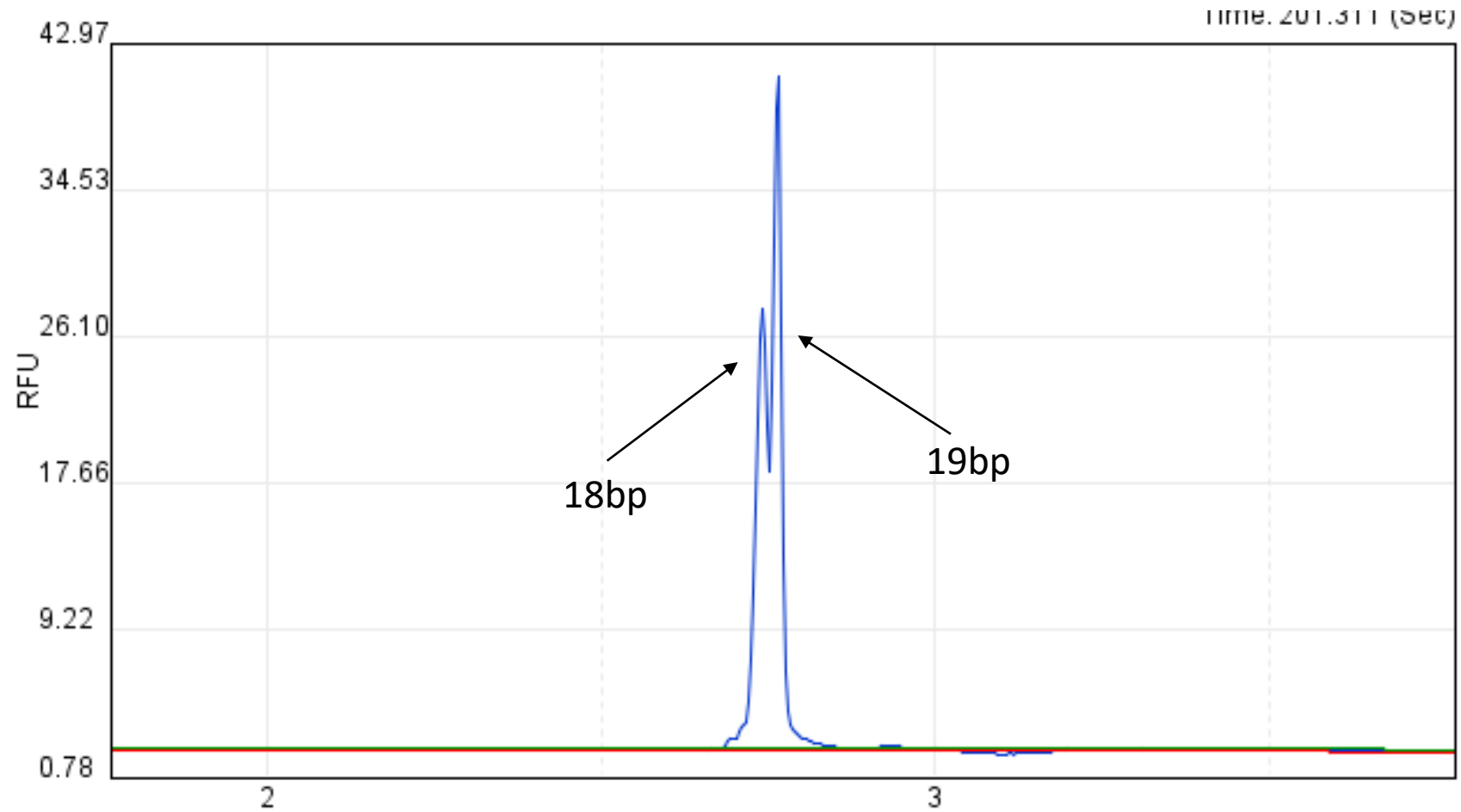


法医鉴定



SSR标记开发—物种鉴定、DNA指纹图谱

# 相差1bp的引物

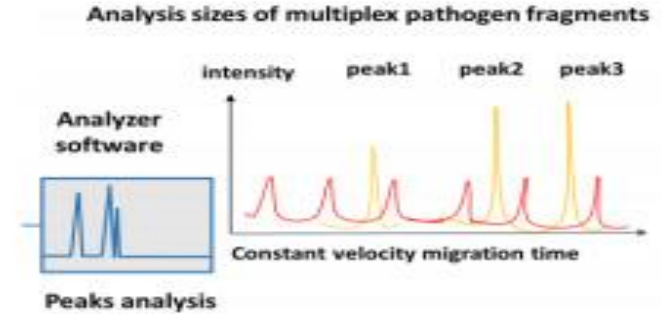
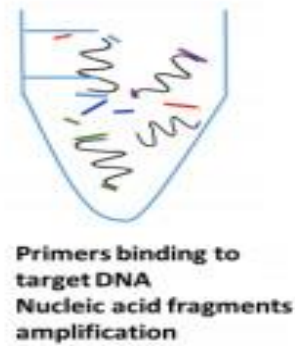
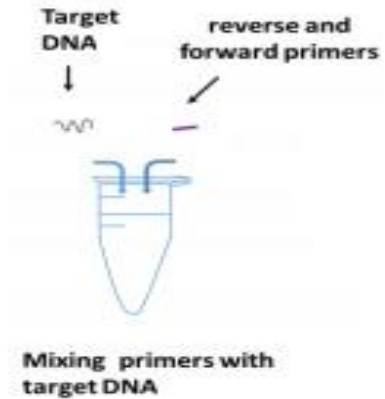


### 3. 多重核酸检测

## 细菌多重鉴定试剂盒

编号	产品名称	包装规格	样本类型	医疗器械注册证号
1	9种细菌鉴定试剂盒	20人份/盒	痰液、尿液、外周全血培养物、胸水、腹水、脑脊液	渝械注准20212400029
2	20种细菌鉴定试剂盒	20人份/盒	痰液、尿液、外周全血培养物、胸水、腹水、脑脊液	/

# 检测原理



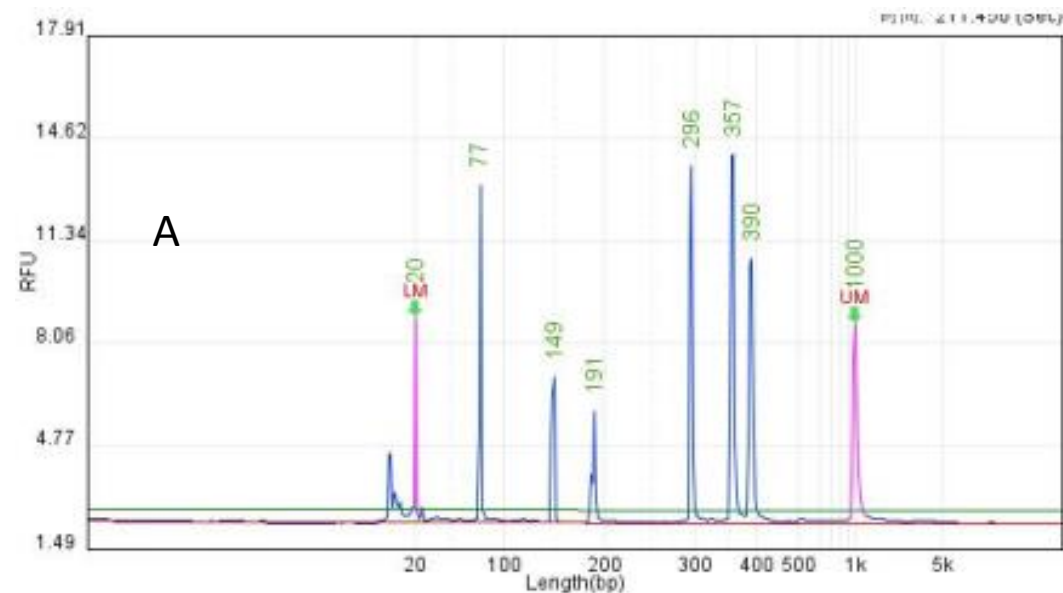
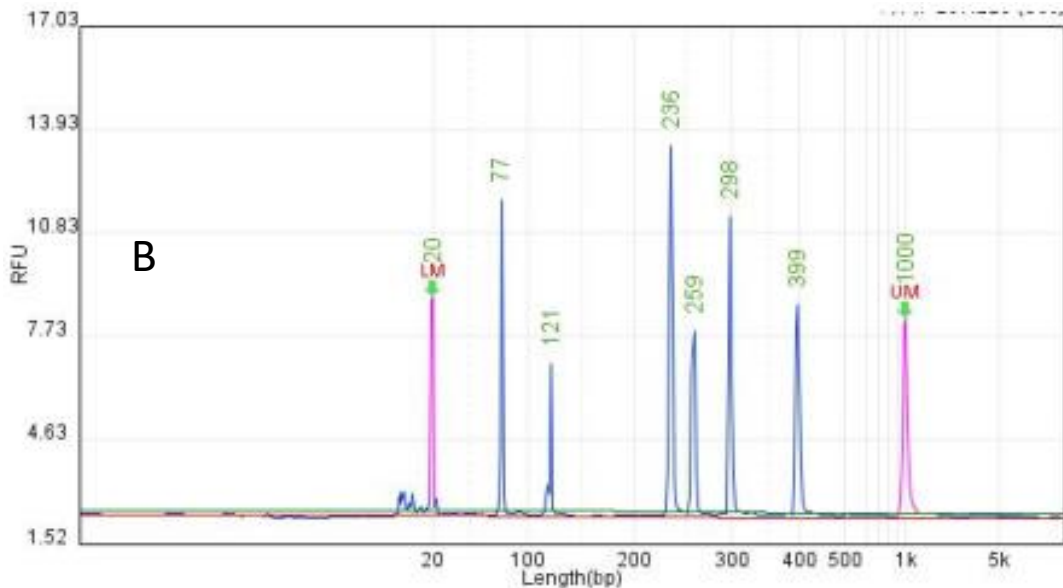
直扩，无需核酸提取，全程检测时间最快2h完成

多重扩增目标病原菌靶标，通过全自动毛细管分析仪分析检测结果，从而鉴定出病原菌种类





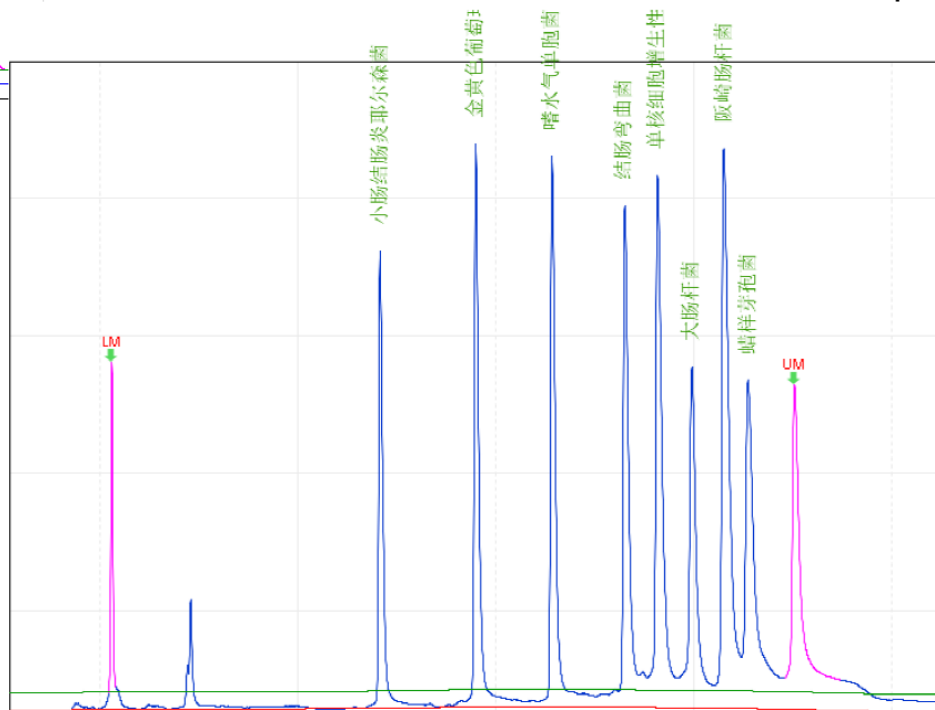
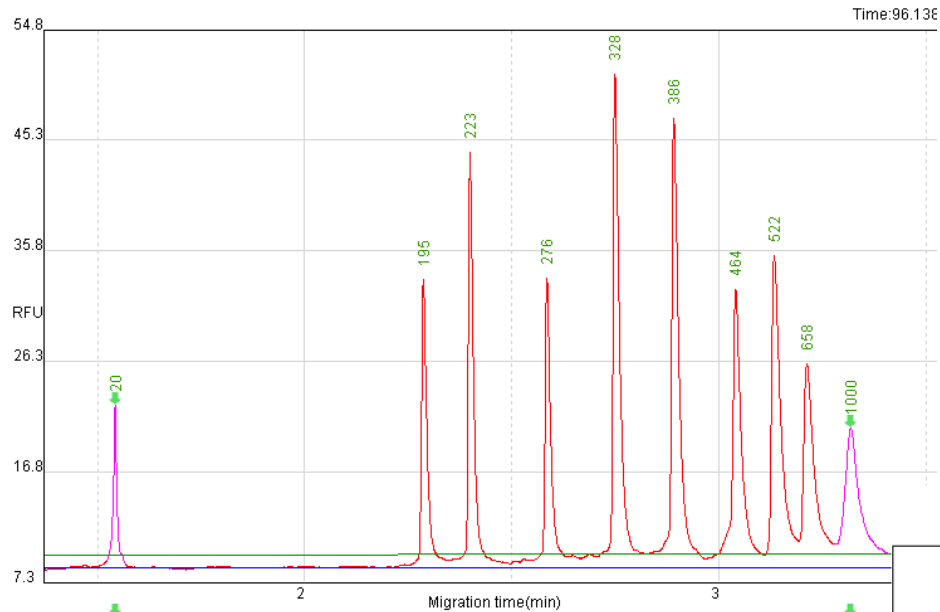
# 9 种细菌鉴定试剂盒



微生物种类（反应液 A）	片段大小	微生物种类（反应液 B）	片段大小
铜绿假单胞菌	143-156bp	流感嗜血杆菌	112-125bp
表皮葡萄球菌	182-195bp	大肠埃希菌 2	228-242bp
嗜麦芽窄食单胞菌	288-301bp	肺炎链球菌	249-265bp
肺炎克雷伯菌	347-366bp	大肠埃希菌 1	294-305bp
鲍曼不动杆菌	374-391bp	阴沟肠杆菌	382-399bp

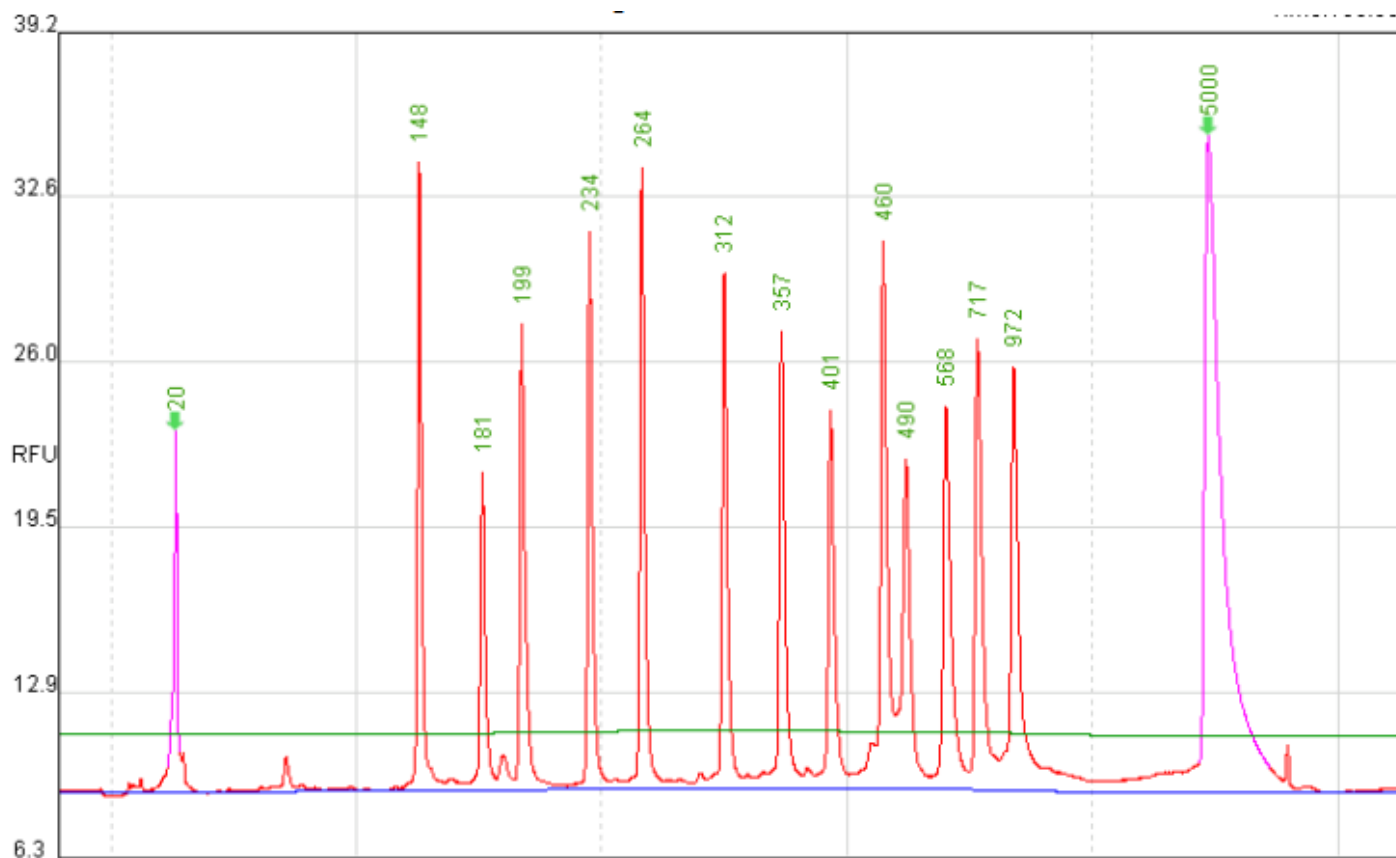
# 15种食源性致病菌检测试剂盒 (PCR-毛细管电泳法)

(1) M0102-A 和 M0102-B 反应体系检测的目标病原体、对应靶标和产物大小范围



扩增体系	目标病原体	检测靶标	峰显示大小 (bp)
M0102-A	小肠结肠炎耶尔森菌	<i>ail</i>	185-195
	金黄色葡萄球菌	<i>nuc</i>	250-260
	嗜水气单胞菌	<i>aerA</i>	305-315
	结肠弯曲菌	<i>ctdA</i>	380-390
	单增李斯特菌	<i>hlyA</i>	420-430
	大肠杆菌	<i>uidA</i>	460-480
	阪崎肠杆菌	<i>ompA</i>	510-540
	蜡样芽孢杆菌	16S rRNA	610-660
M0102-B	大肠杆菌 O157	<i>rfbE</i>	190-200
	副溶血弧菌	<i>tlh</i>	220-240
		<i>taxR</i>	270-290
	沙门氏菌	<i>invA</i>	320-340
	志贺氏菌	<i>ipaH</i>	380-400
	变形杆菌	16S rRNA	460-480
	霍乱弧菌	<i>ctxA</i>	510-540
	空肠弯曲菌	<i>hipO</i>	640-680

# 致泄性大肠埃希氏菌核酸多重检测 (PCR-毛细管电泳法)



目标病原体	通检及毒力基因靶标 (bp)		阳性结果判定组合
	通检	毒力基因靶标	
EPEC	<i>esc</i> (560-600)	<i>uidA</i> (900bp-1000bp) +	典型: <i>bfpB</i> (+), <i>esc</i> (-) ; 非典型: <i>esc</i> (+) <i>bfpB</i> (-) ;
	<i>bfpB</i> (480-500)		
EIEC	<i>invE</i> (230-240)	<i>uidA</i> (900bp-1000bp) +	<i>invE</i> (+)
ETEC	<i>elt</i> (260-270)	<i>uidA</i> (900bp-1000bp) +	<i>elt</i> (+), <i>estIa</i> (-), <i>estIb</i> (-) ; <i>elt</i> (+), <i>estIa</i> (+), <i>estIb</i> (-) ; <i>elt</i> (+), <i>estIa</i> (-), <i>estIb</i> (+) ; <i>elt</i> (-), <i>estIa</i> (-), <i>estIb</i> (+) ;
	<i>estIa</i> (175-185)		
	<i>estIb</i> (195-210)		
EAEC	<i>aggR</i> (350-365)	<i>uidA</i> (900bp-1000bp) +	<i>aggR</i> (+), <i>astA</i> (+/-) ; <i>pic</i> (+/-)
	<i>astA</i> (140-150)		
	<i>pic</i> (700-740)		
EHEC	<i>stx1</i> (430-460)	<i>uidA</i> (900bp-1000bp) +	<i>escV</i> (+/-), <i>stx1</i> (+), <i>stx2</i> (-) ; <i>escV</i> (+/-), <i>stx1</i> (-), <i>stx2</i> (+) ; <i>escV</i> (+/-), <i>stx1</i> (+), <i>stx2</i> (+) ;
	<i>stx2</i> (310-320)		
	<i>esc</i> (560-600)		
O157:H7	<i>stx1</i> (430-460)	<i>uidA</i> (900bp-1000bp) +	<i>rfbE</i> (+), <i>escV</i> (+/-), <i>stx1</i> (+), <i>stx2</i> (-) ; <i>rfbE</i> (+), <i>escV</i> (+/-), <i>stx1</i> (-), <i>stx2</i> (+) ; <i>rfbE</i> (+), <i>escV</i> (+/-), <i>stx1</i> (+), <i>stx2</i> (+) ;
	<i>stx2</i> (310-320)		
	<i>rfbE</i> (390-410)		
	<i>esc</i> (570-600)		

# 结合分歧杆菌多重检测 (PCR-毛细管电泳法)



Qsep<sub>1</sub>



Qsep<sub>100</sub>



Qsep<sub>400</sub>

### 3 全自动结核分枝杆菌VNTR分型分析仪

**设备小巧随心放置** ★ 便携压缩装置, 无需氮气钢瓶, 无需后期灌气

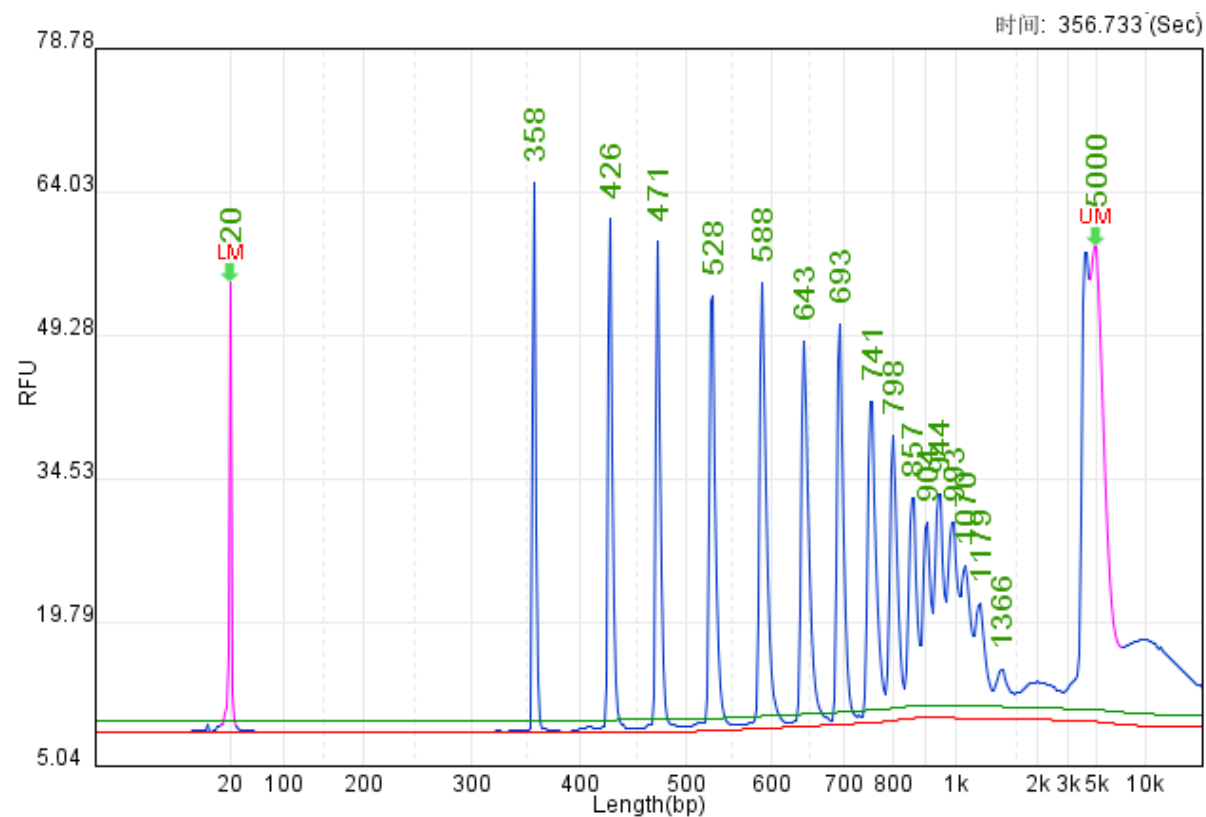
**操作简便自动完成** ★ 用预装式卡夹, 即插即用  
★ 无须人工制胶、灌胶、上样  
★ 无须人工清洗、更换毛细管  
★ 无须人工添加染料

**检测结果个性设置** ★ 电泳胶图、峰图、片段大小等结果形式可选  
★ PDF、WORD、JPG等报告格式完整打印输出

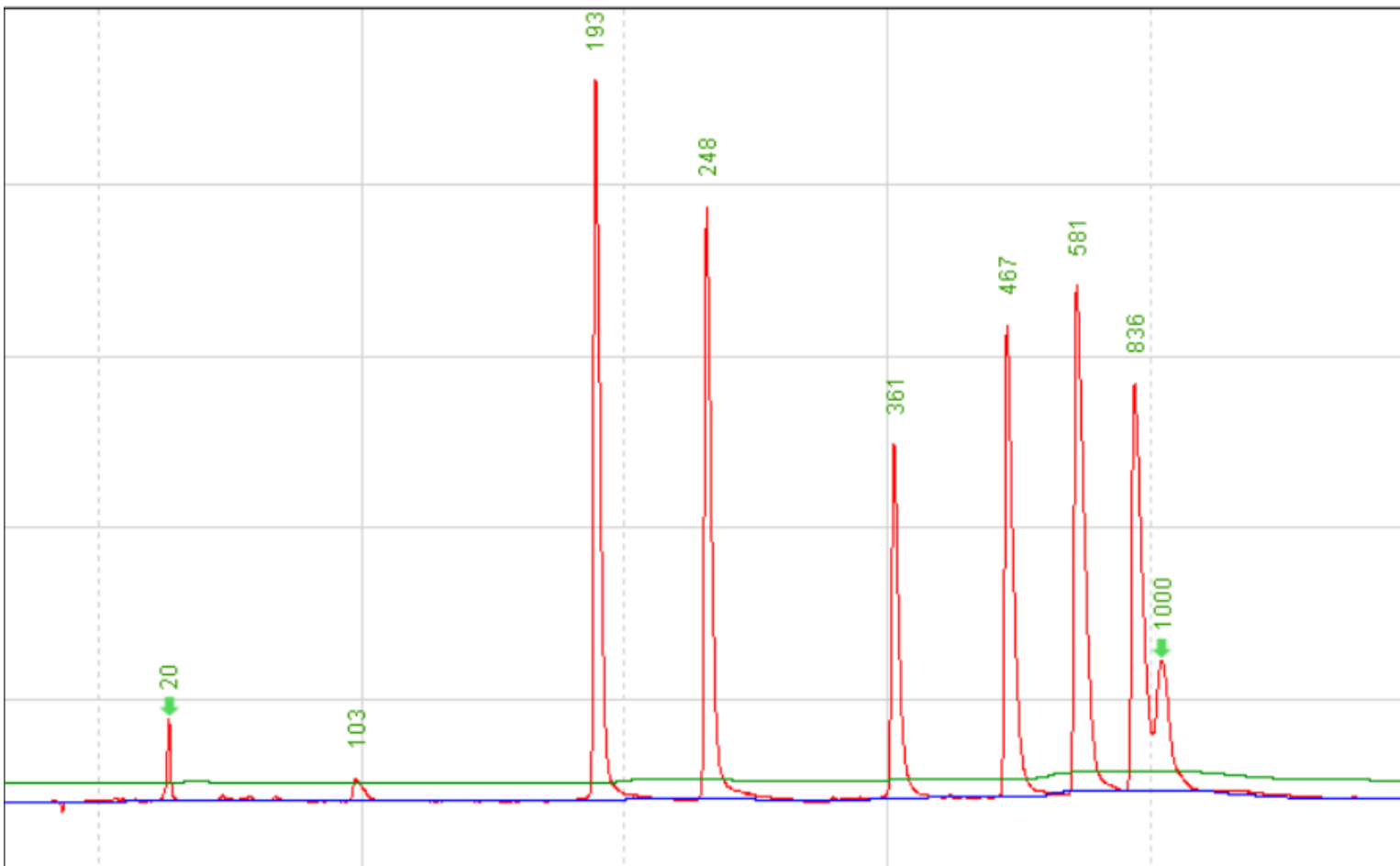
**产品参数**

型号	Qsep <sub>1</sub>	Qsep <sub>100</sub>	Qsep <sub>400</sub>
功能	采用毛细管电泳原理, 对结核分枝杆菌进行VNTR分型检测		
光源	LED, 高灵敏度的光电倍增管检测		
通量	8/12/16孔模块	1-100个样本	1-400个样本
样本上机量	最低样品需求体积1μl		
分析速度	可达1分钟内/样本		可达1分钟内/4样本
检测范围	15bp-50kb, 可检测大于50 kb的片段, 最大可达165 kb		
灵敏度	1μg/μl		
分辨率	1-4bp (500bp以内)		

结核分枝杆菌MIRU-VNTR分型检测试剂盒 (毛细管电泳法)



# 病毒分型多重检测



肠道病毒	194 bp
副流感病毒4	249 bp
间质肺病毒	351 bp
乙型流感病毒	455 bp
博卡病毒1/2/3/4	579 bp

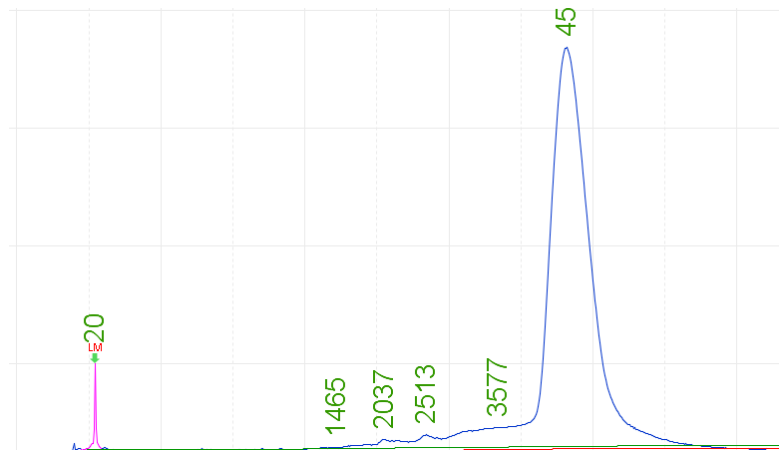


## 其他类型核酸样本应用

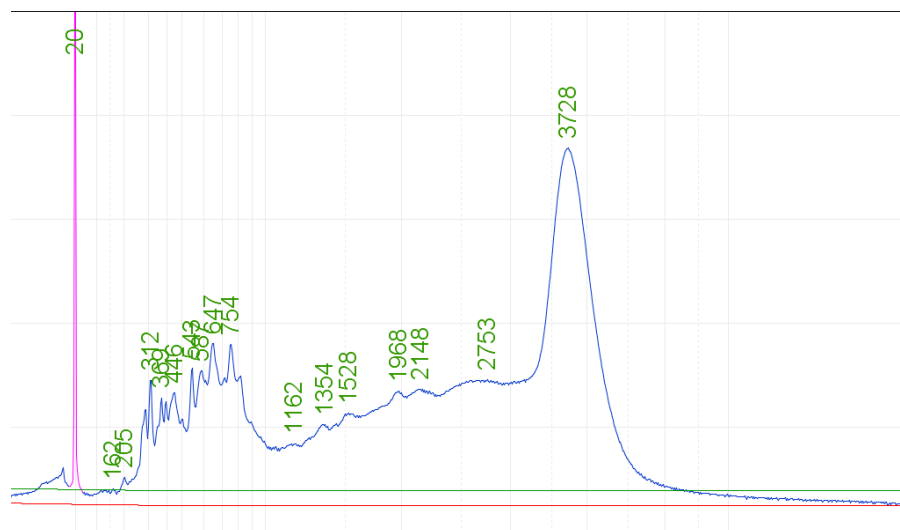
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# 1. 核酸疫苗质检

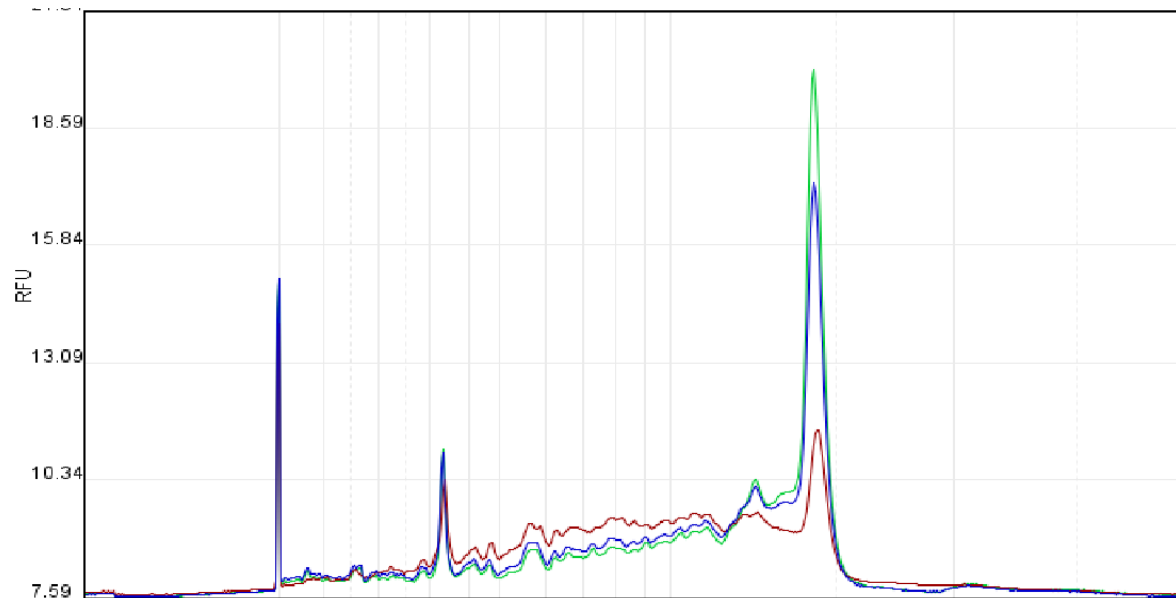
## 1.1 核酸疫苗mRNA完整性检测



合格的mRNA样本

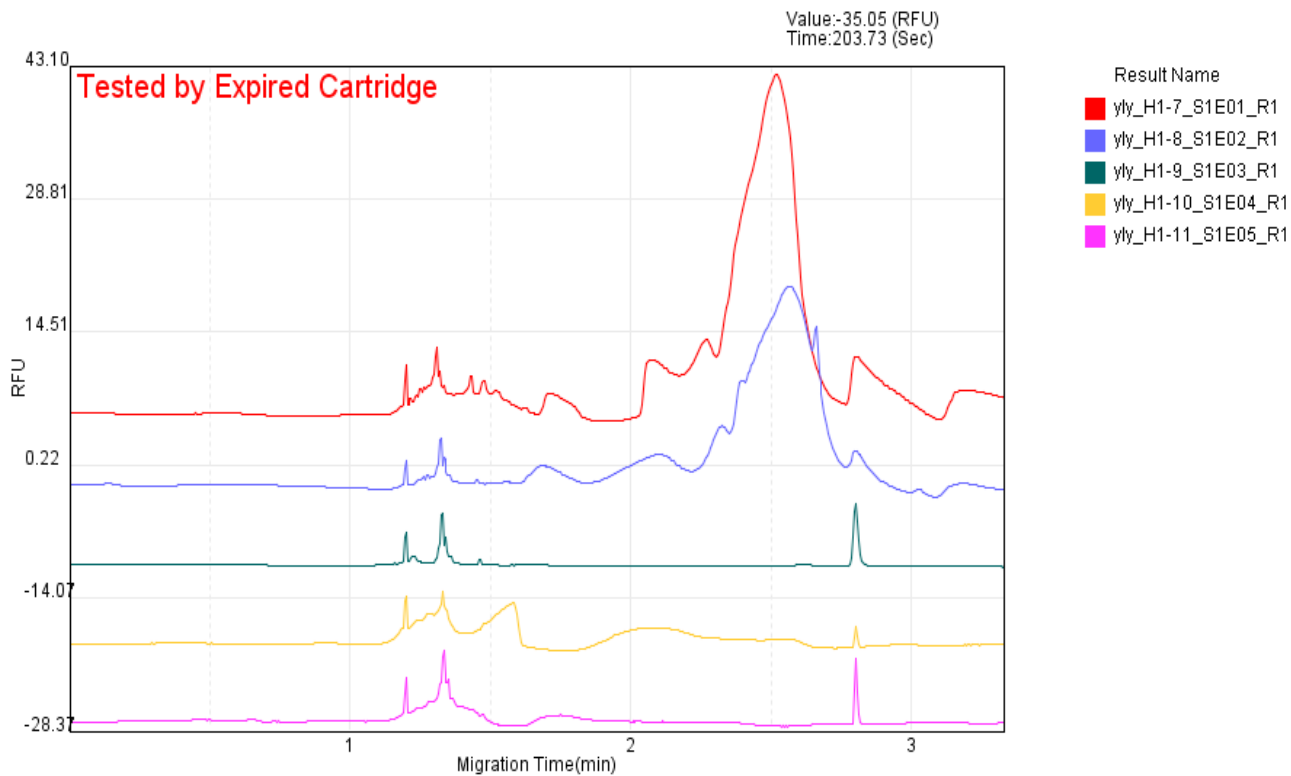
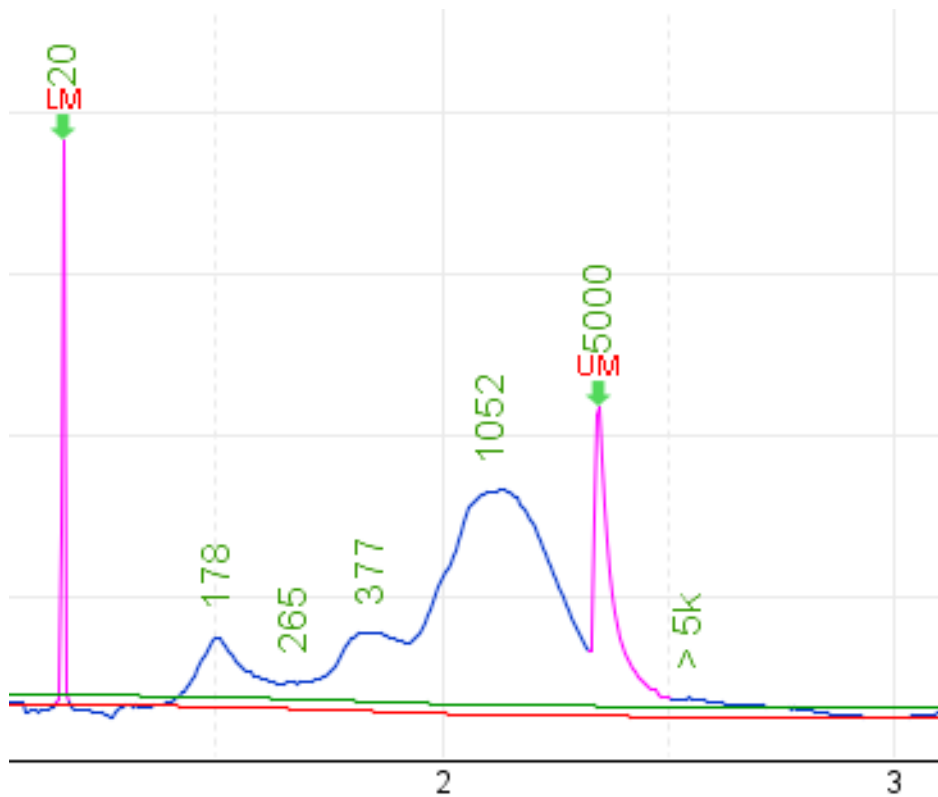


降解严重的合格的mRNA样本



储存5d, 10d, 30d后 mRNA质量变化

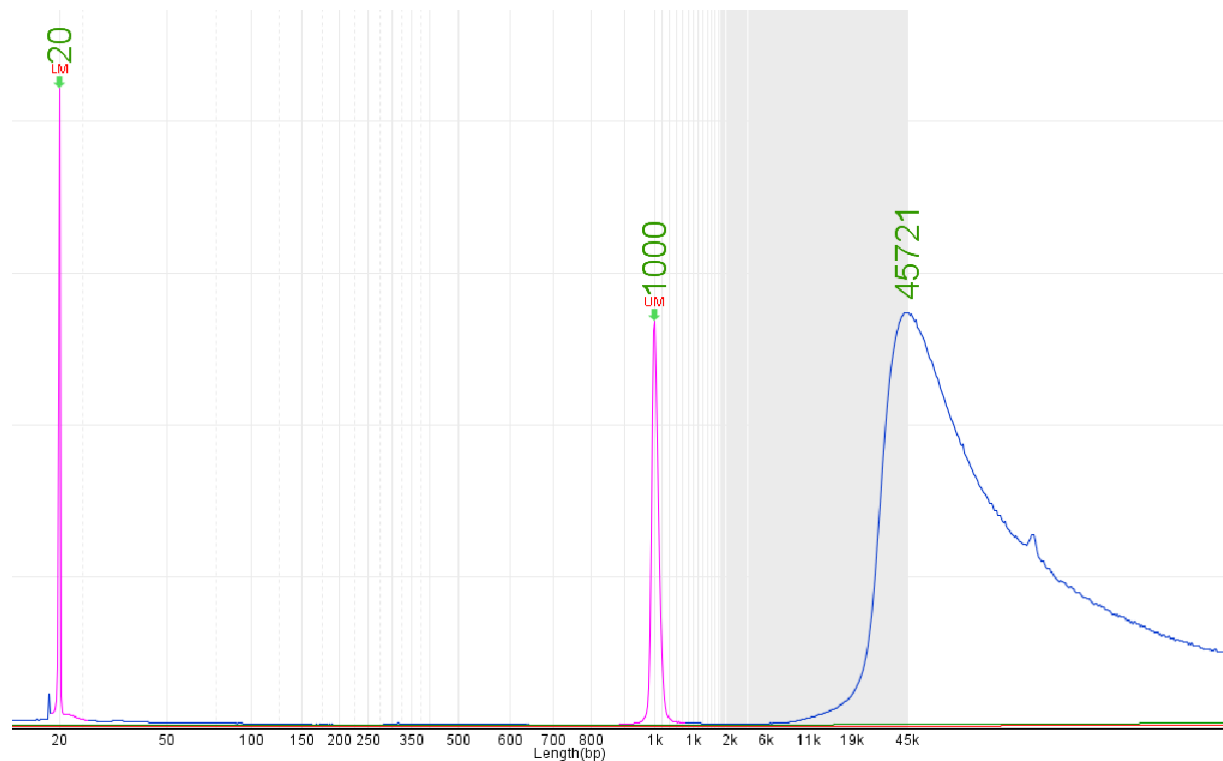
## 1.2 疫苗宿主DNA残留检测



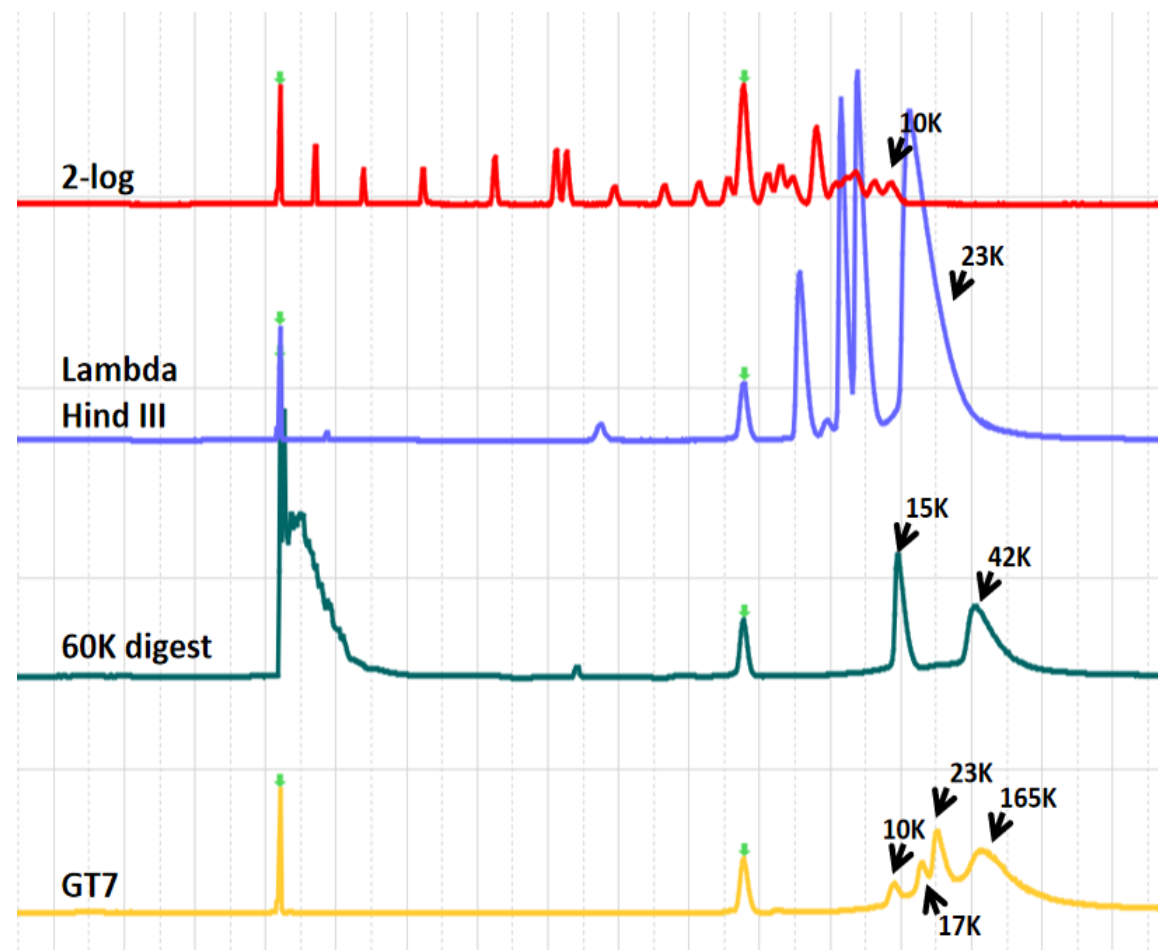
yty\_H1-7, 8, 9, 10, 11依次为加入核酸酶, 逐渐纯化的样本, 片段大小逐渐变小, 浓度变低



## 2. 大片段样本质控



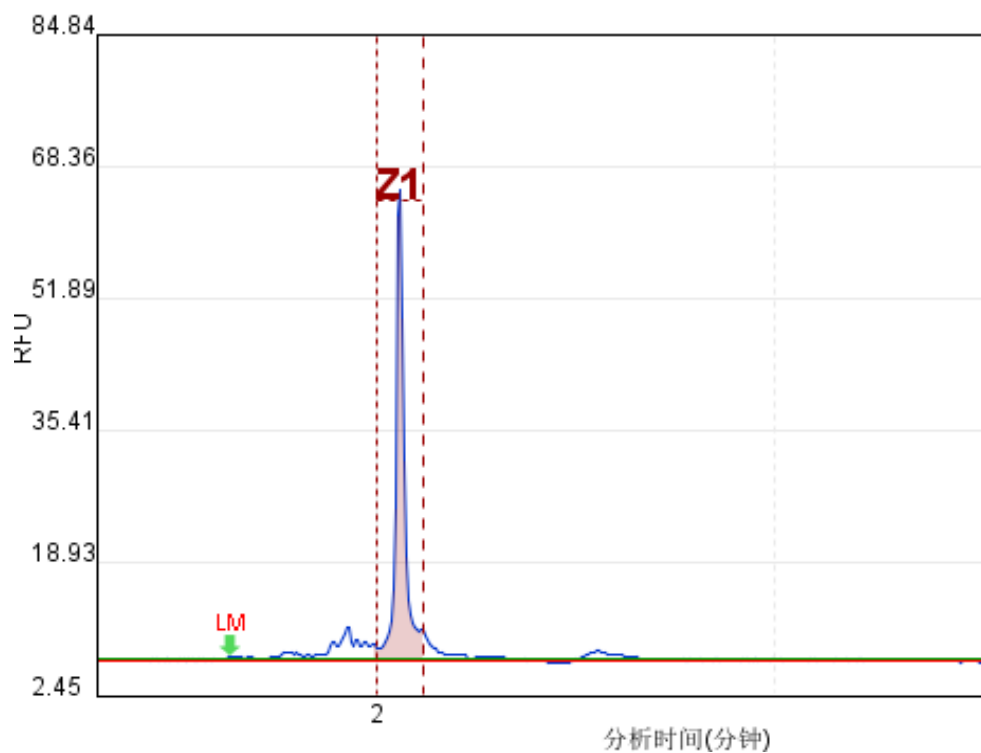
三代测序文库



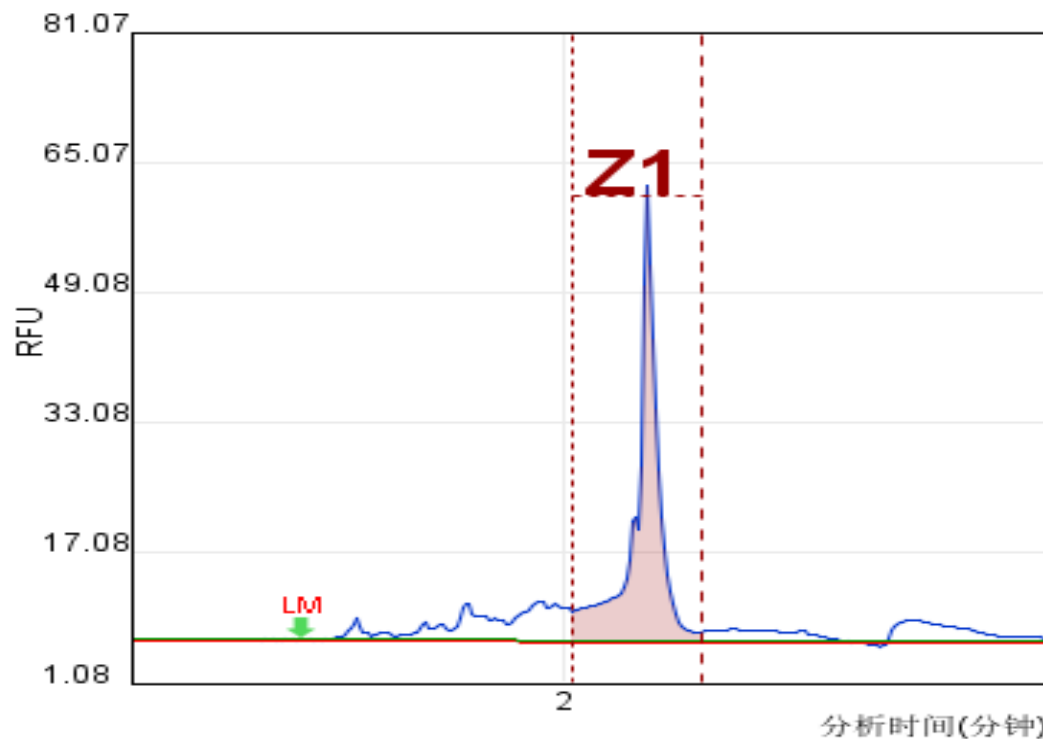
超大片段

# 3. 小片段样本质控

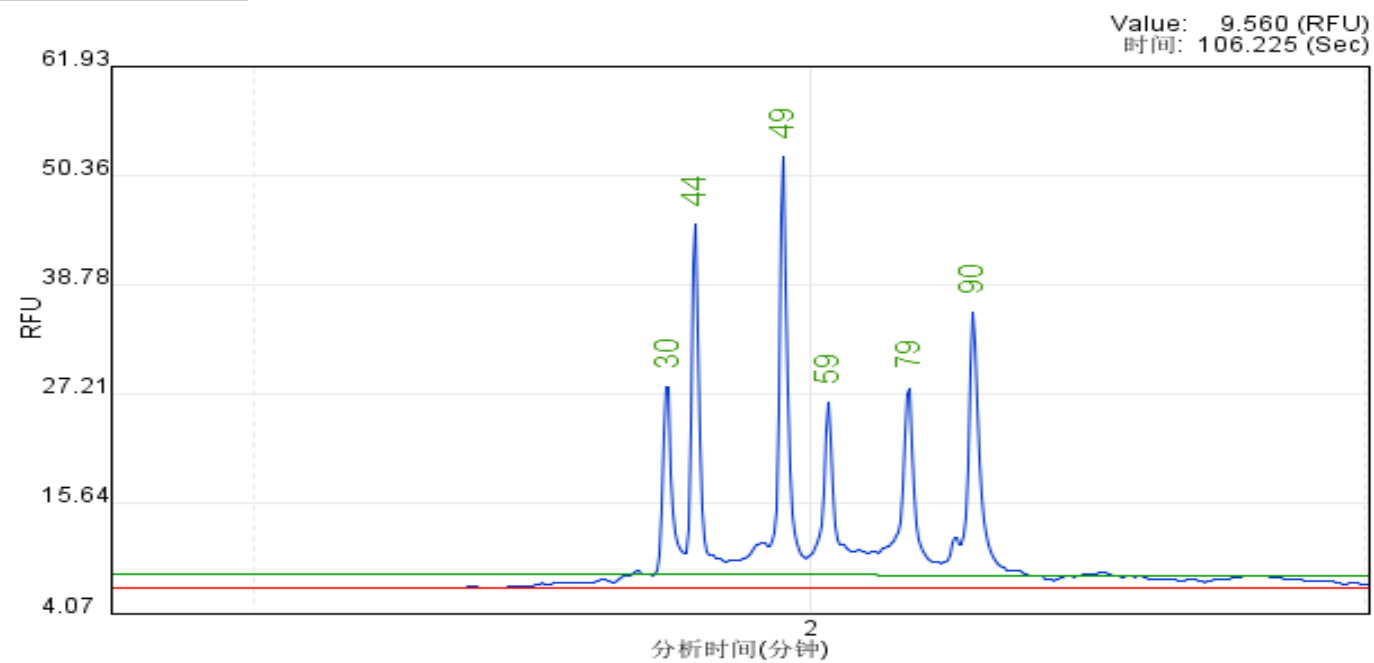
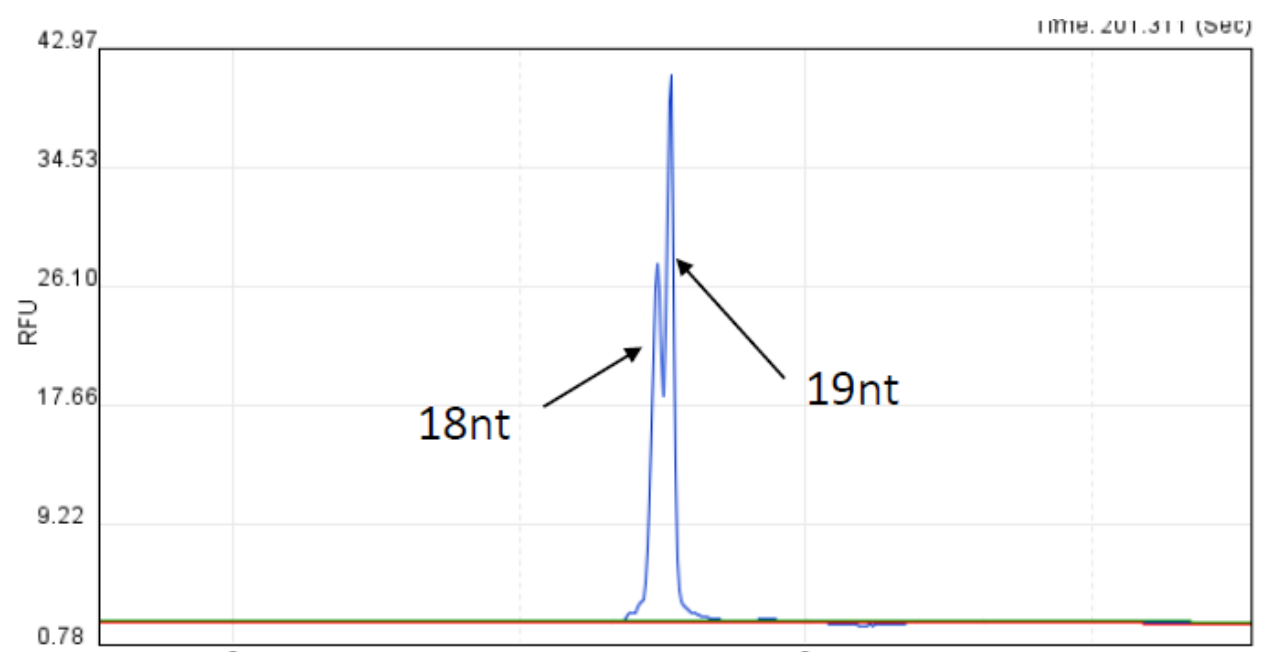
## 3.1 引物



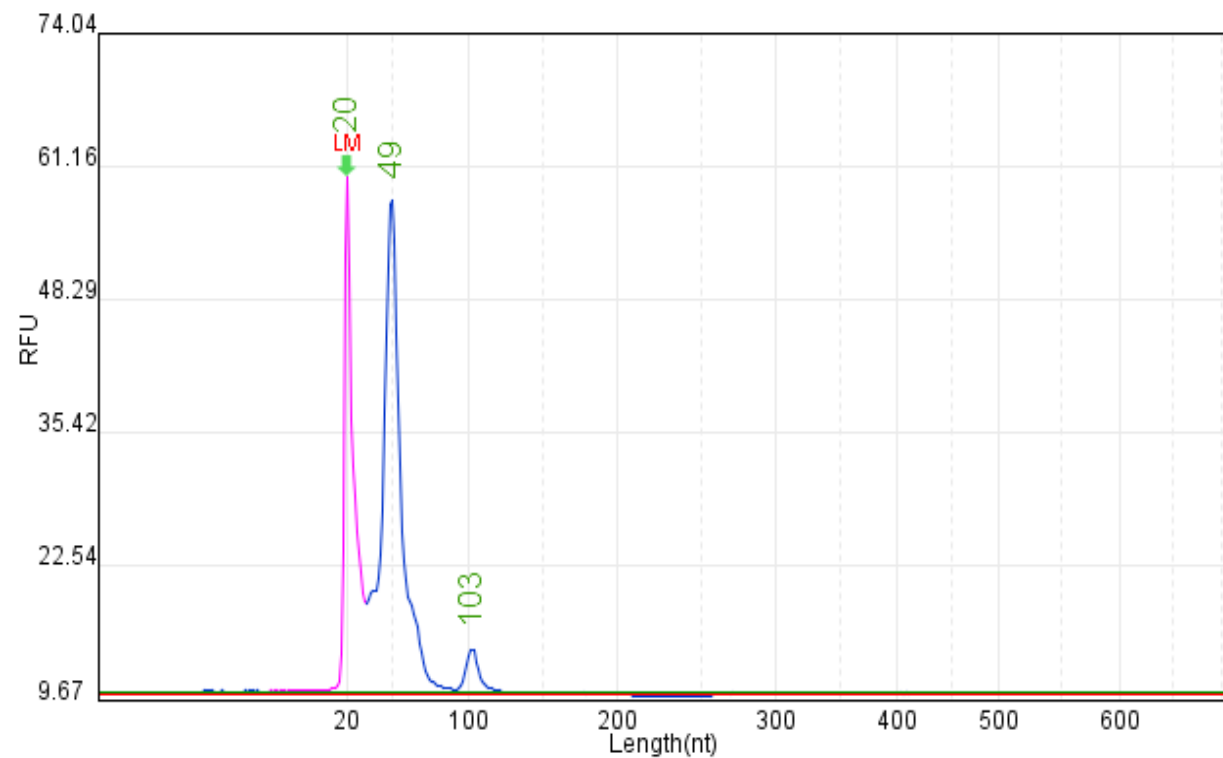
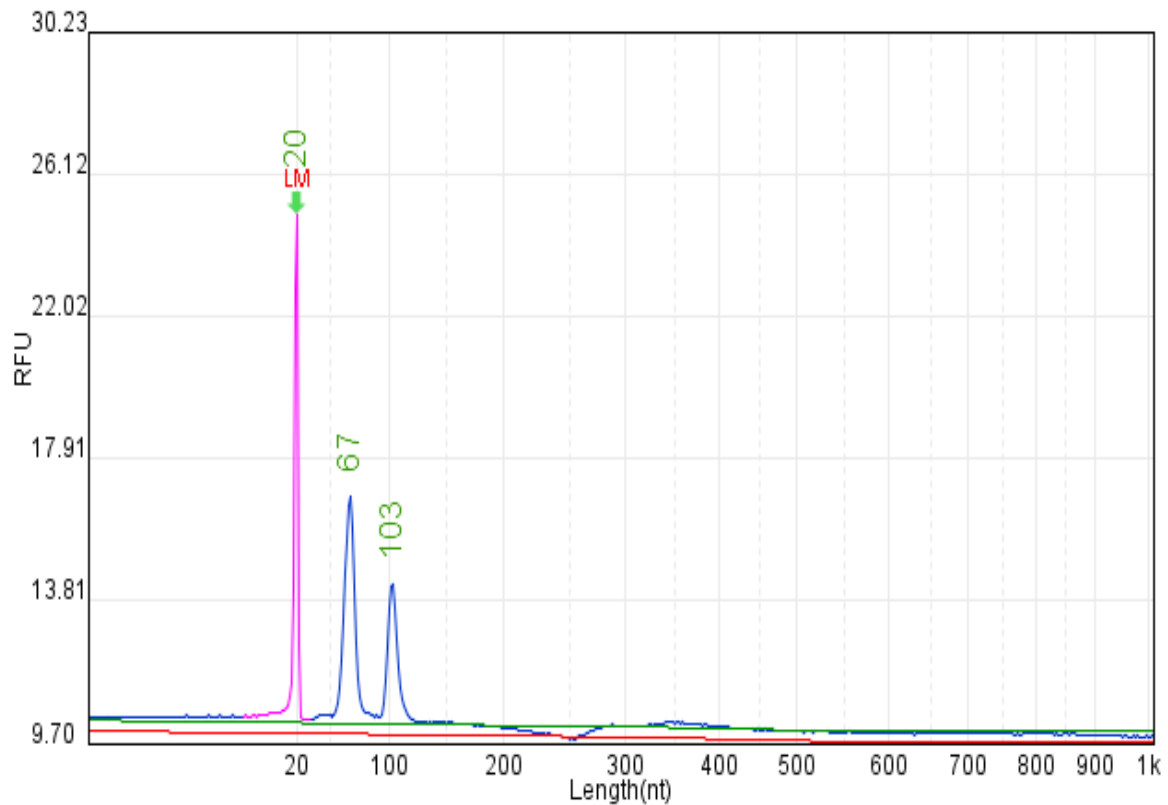
片段占比: 74.0 %



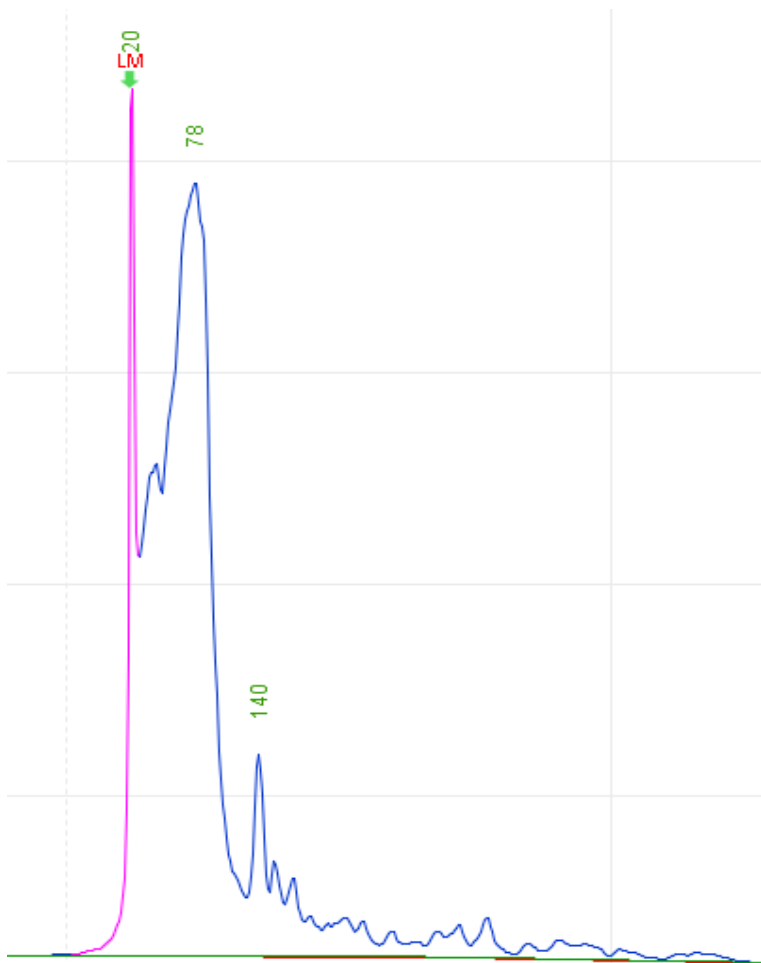
片段占比: 59.0 %



## 3.2 探针



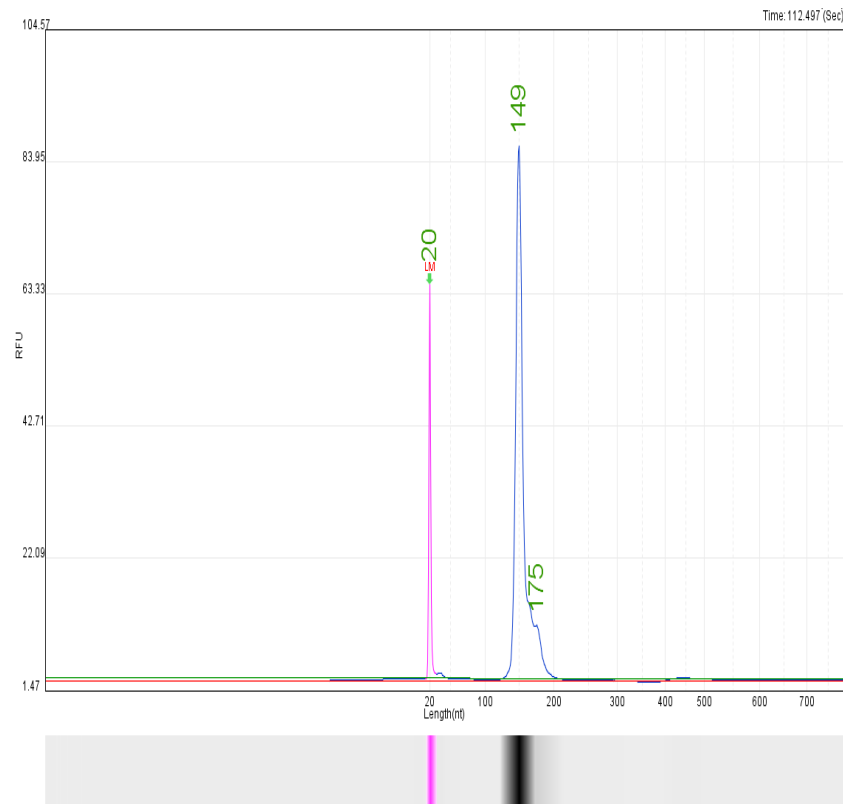
# 3.3 小RNA



外泌体RNA

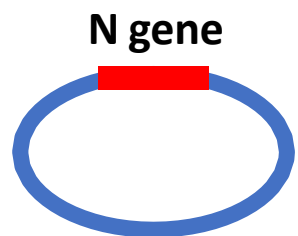


microRNA

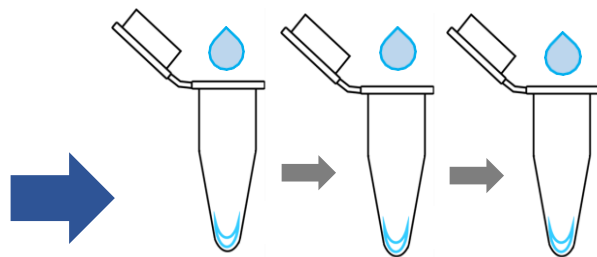


sgRNA

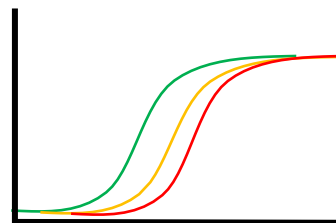
## 4. 新冠检测



含有COVID-19N  
基因的质粒

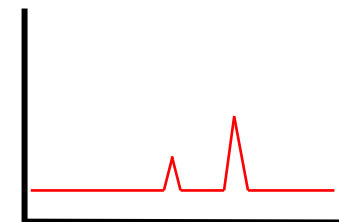


将质粒稀释到低拷  
贝数



实时 PCR(SYBRGreen)

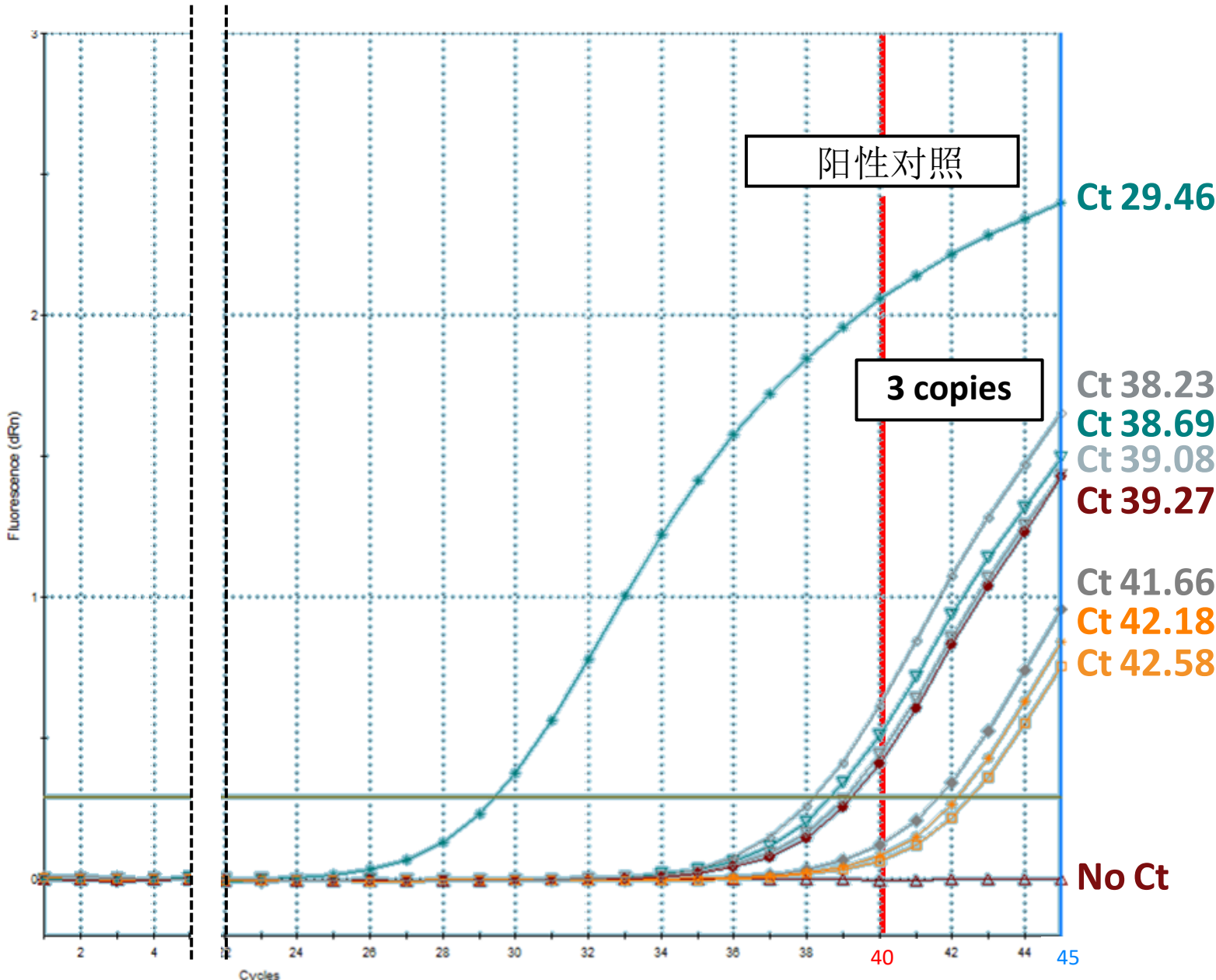
1. 目的条带大小: 138bp.
2. Bio-Rad i Taq Universal SYBR Green(带 ROX)
3. 引物 (日本):
  - NIID\_2019-nCOV\_N\_F2
  - NIID\_2019-nCOV\_N\_R2



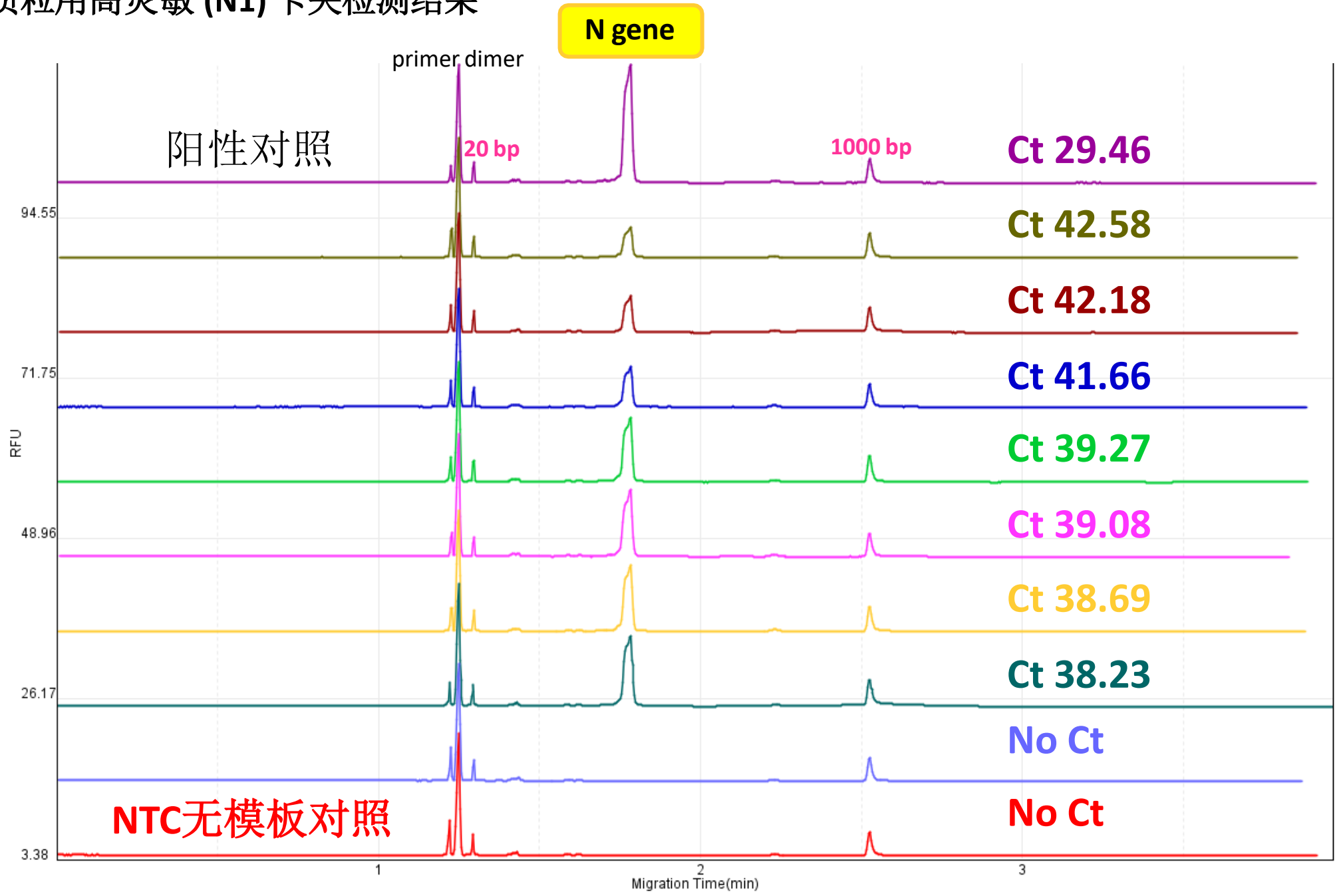
Qsep 系列检  
测Qsep100

1. N1/S1 卡夹
2. 使用 0.1X TE buffer 稀释10倍

每个反应 3 个拷贝质粒

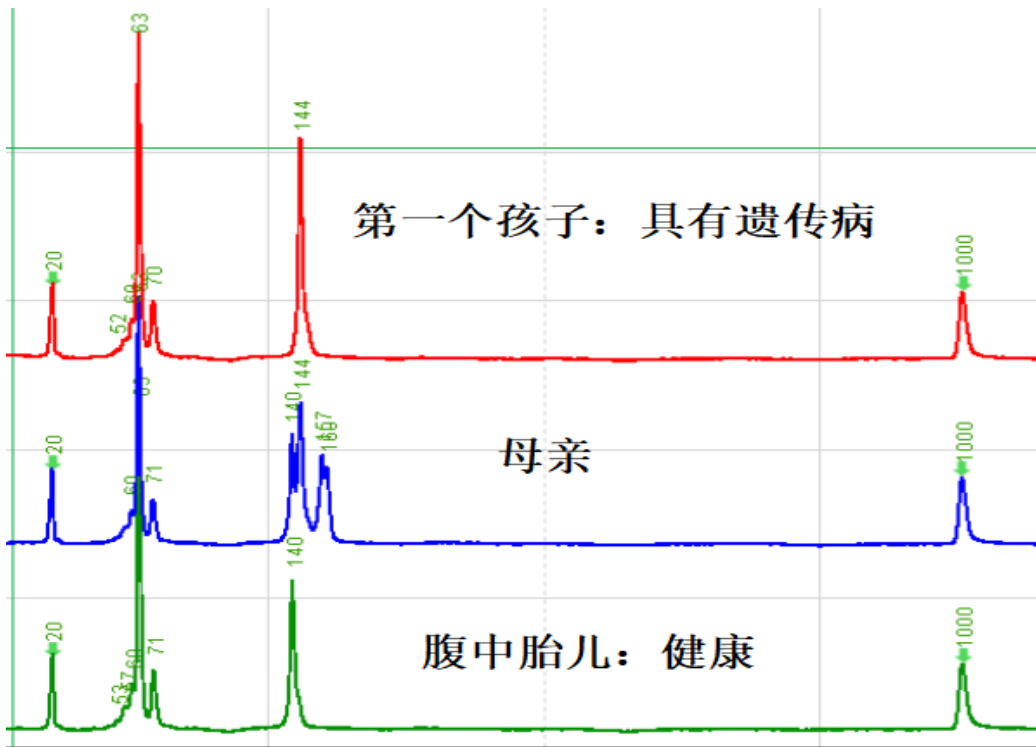


# 每反应3拷贝质粒用高灵敏 (N1) 卡夹检测结果

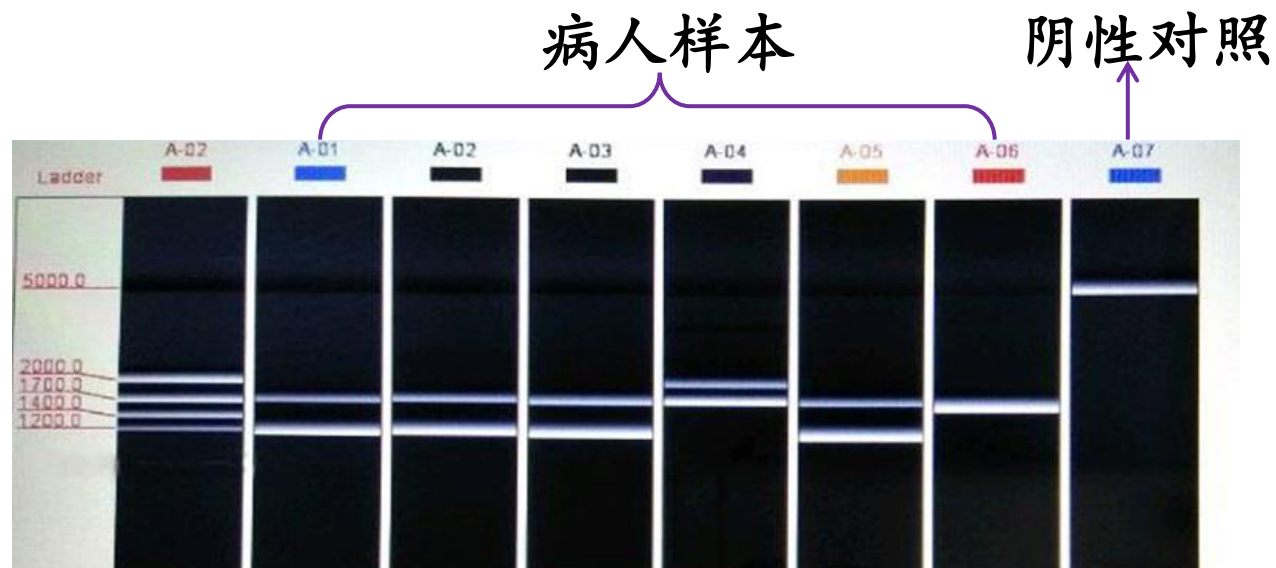




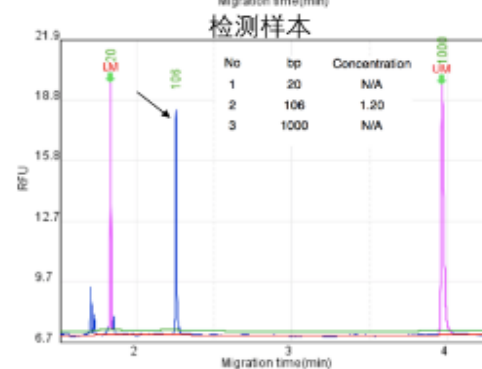
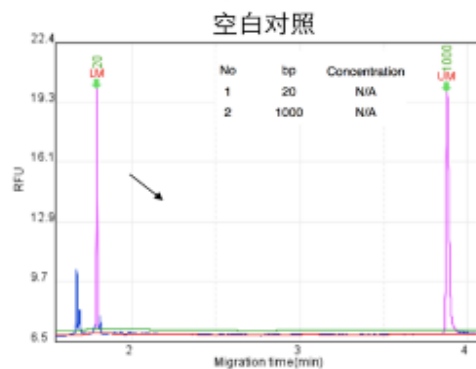
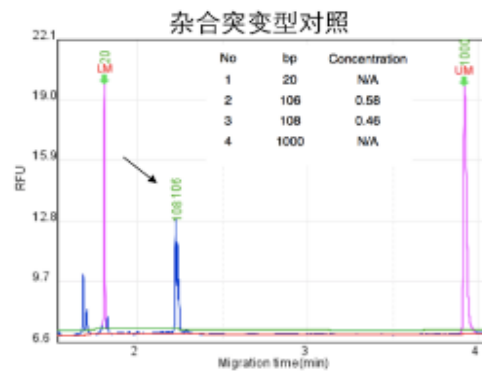
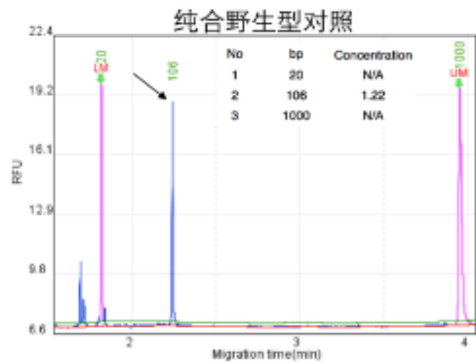
# 5. 临床应用



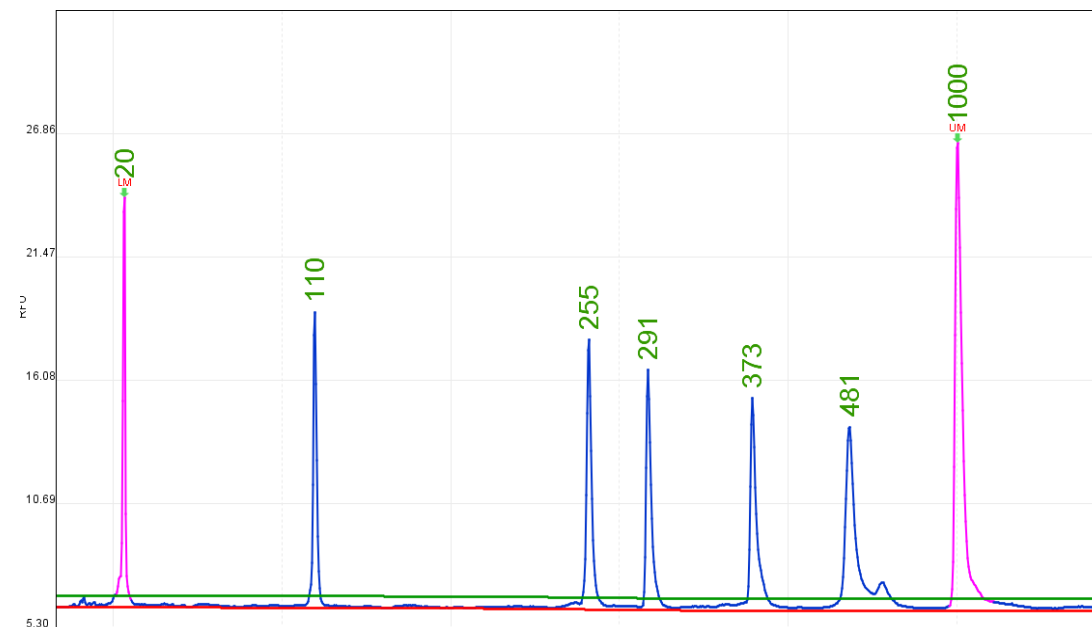
家族遗传病检测



地中海贫血基因分型研究



## 伊立替康药物代谢基因多态性检测

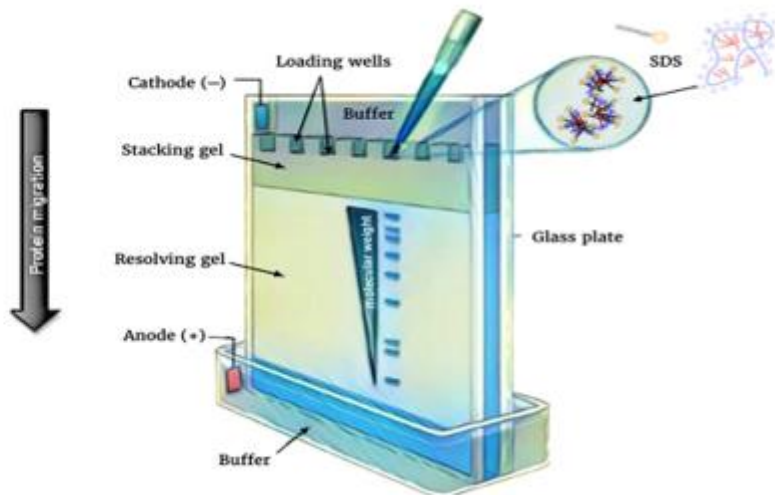
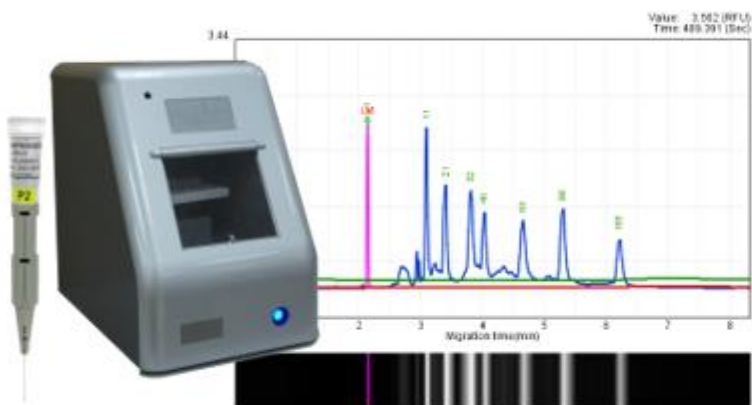


## Y染色体微缺失——反应液I



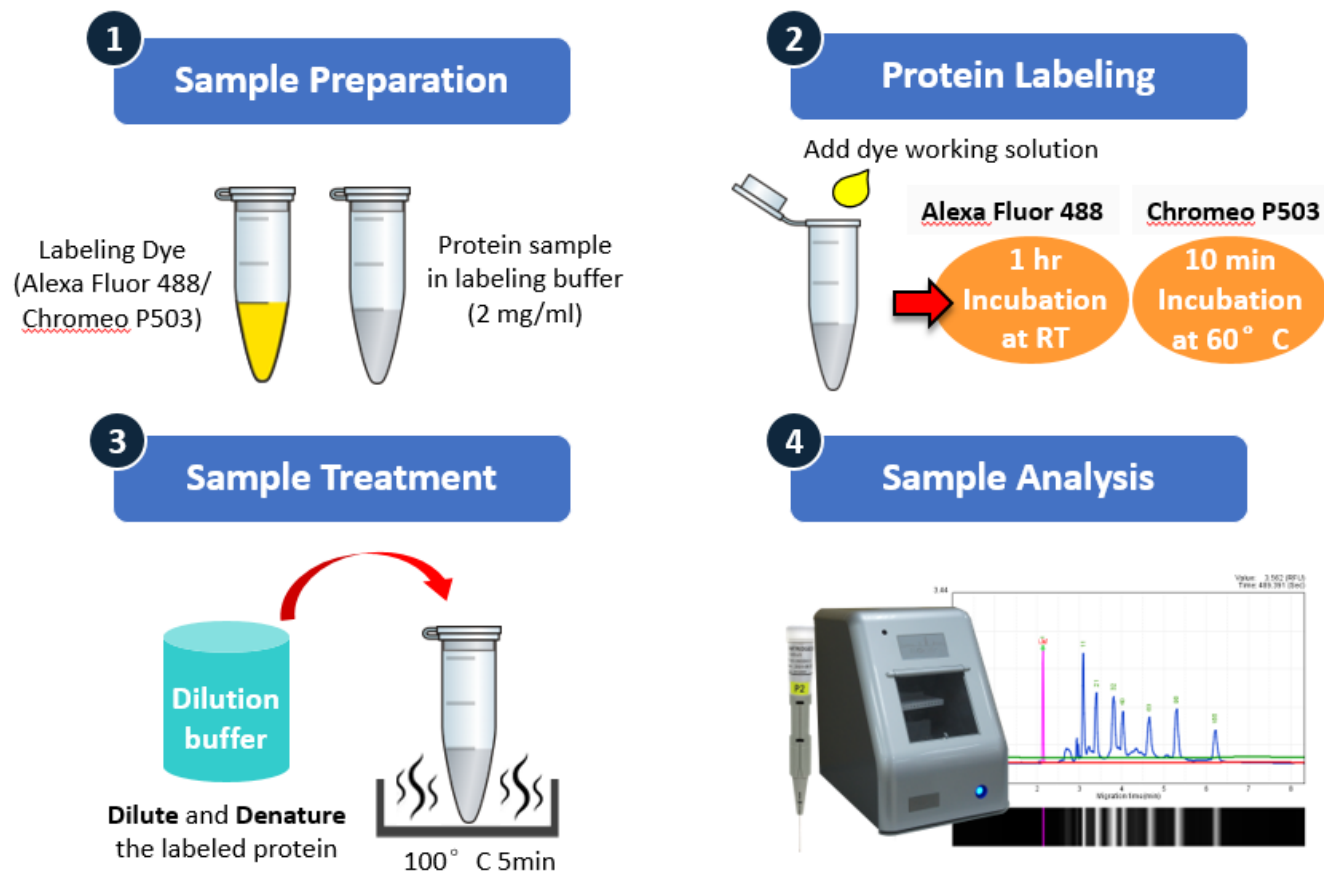
## 蛋白/抗体质控应用

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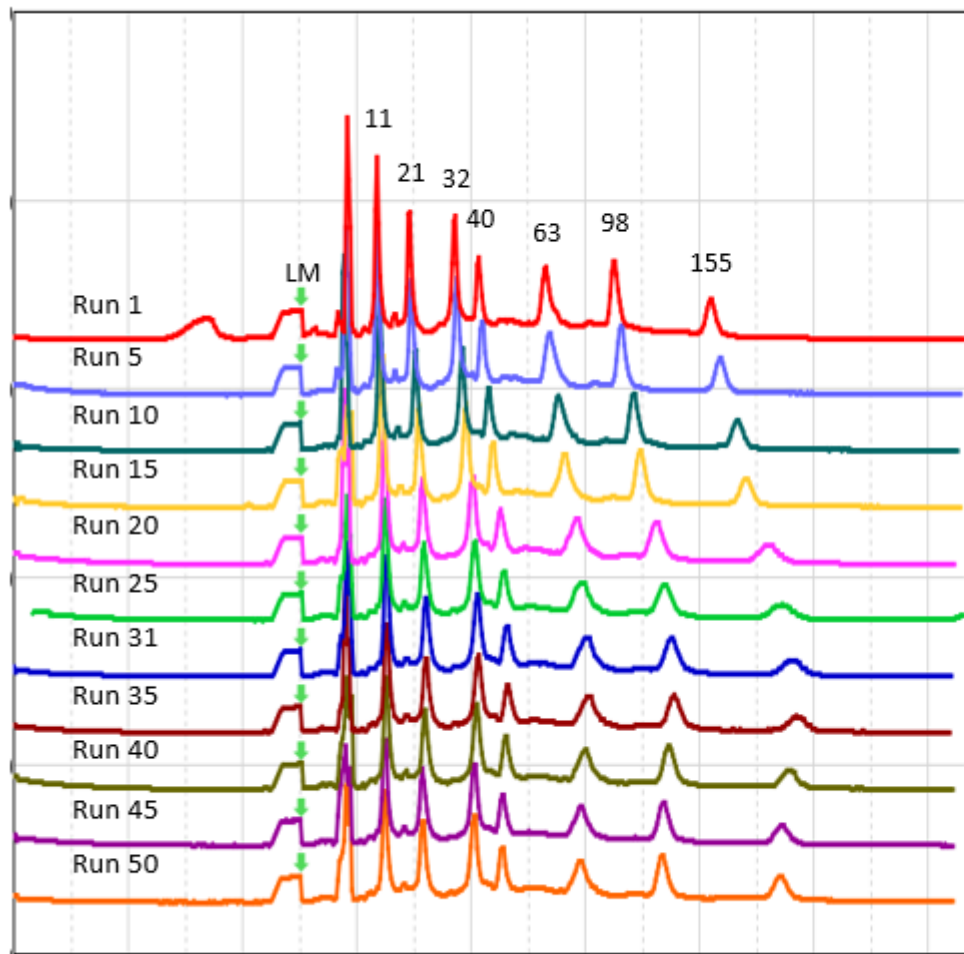
SDS-CGE	SDS-PAGE
<ul style="list-style-type: none"> <li>✓ 无需配胶，全自动上样，操作简单无毒</li> <li>✓ 确定的分子量</li> <li>✓ 高分辨率和灵敏度</li> <li>✓ 精确的纯度分析</li> <li>✓ 结果多样呈现（数据表、峰图、胶图、报告等）</li> </ul>	<ul style="list-style-type: none"> <li>✓ 操作繁琐（配胶、染色、脱色）且有毒性（聚丙烯酰胺）</li> <li>✓ 分子量只能估算</li> <li>✓ 分辨率和灵敏度较低</li> <li>✓ 结果输出模式单一</li> </ul>

## Qsep毛细管电泳仪 VS SDS-page

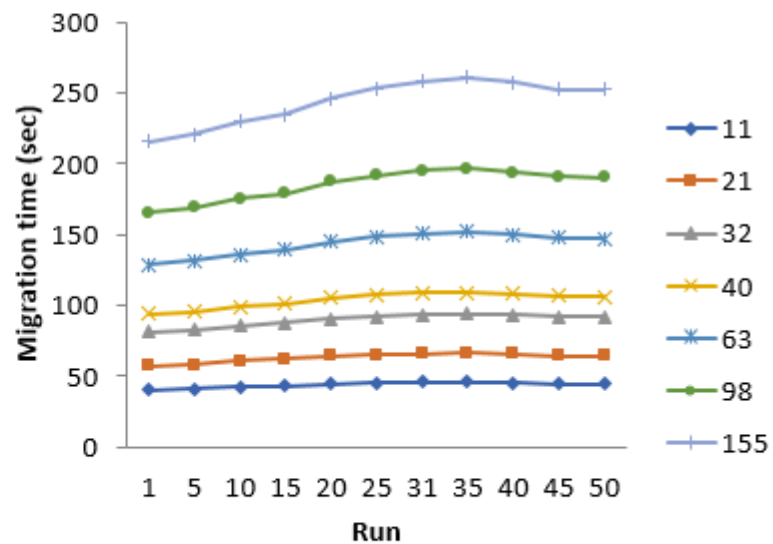


抗体质控流程图

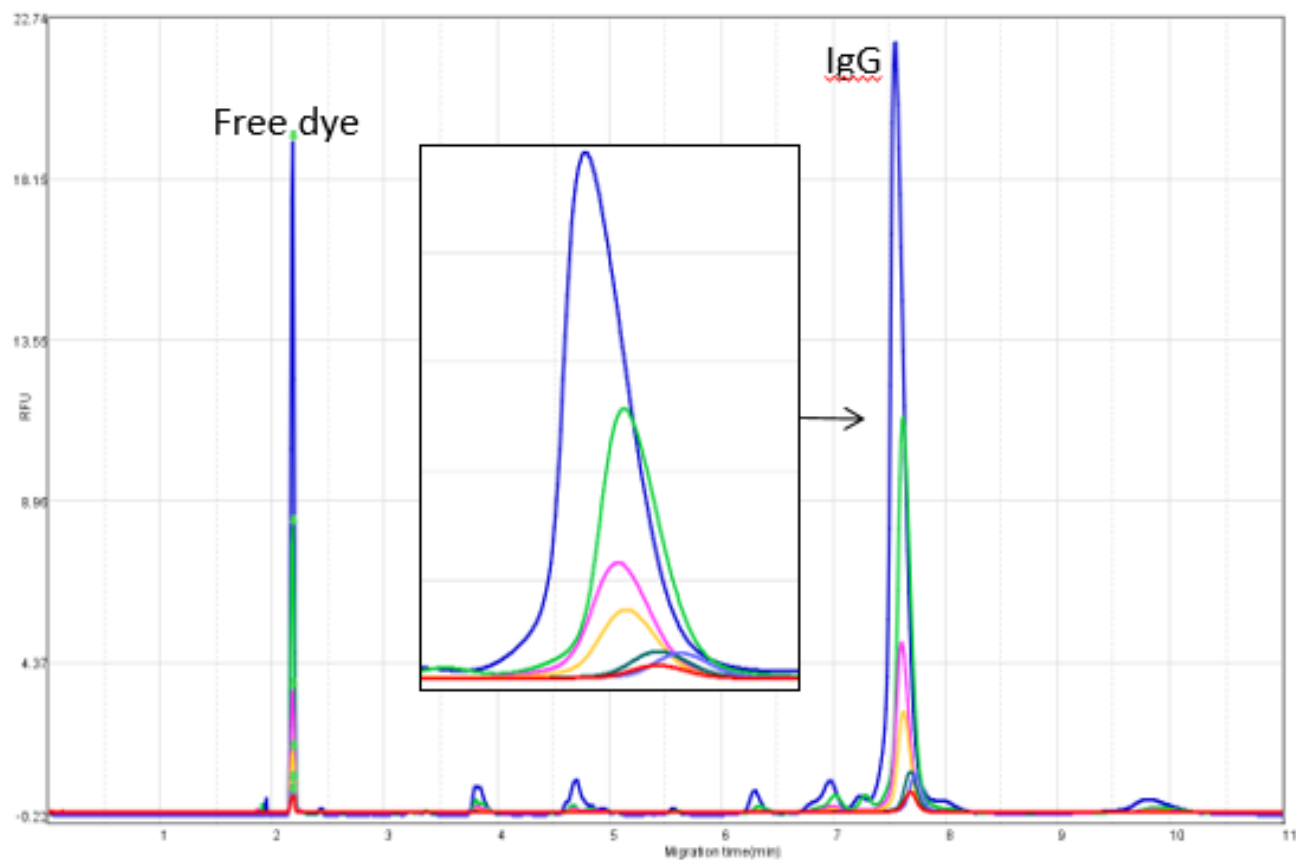
# 稳定性



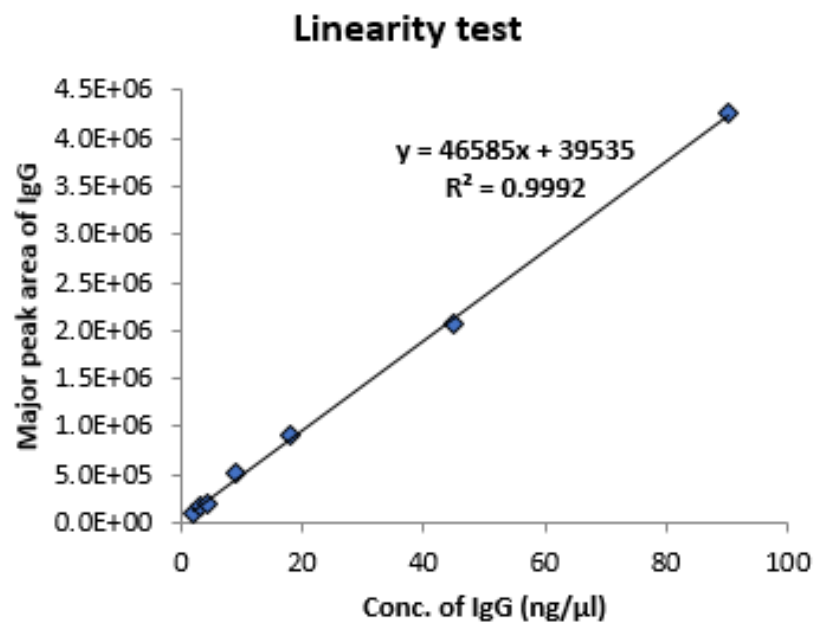
M.W. (kDa)		11	21	32	40	63	98	155
$\Delta T$ (Protein-IS) (sec)	AVG	43.79	63.08	89.33	103.74	143.21	184.87	243.78
	STDEV	1.93	3.14	4.50	5.43	8.11	11.03	15.85
	CV (%)	4.40	4.98	5.04	5.24	5.66	5.97	6.50



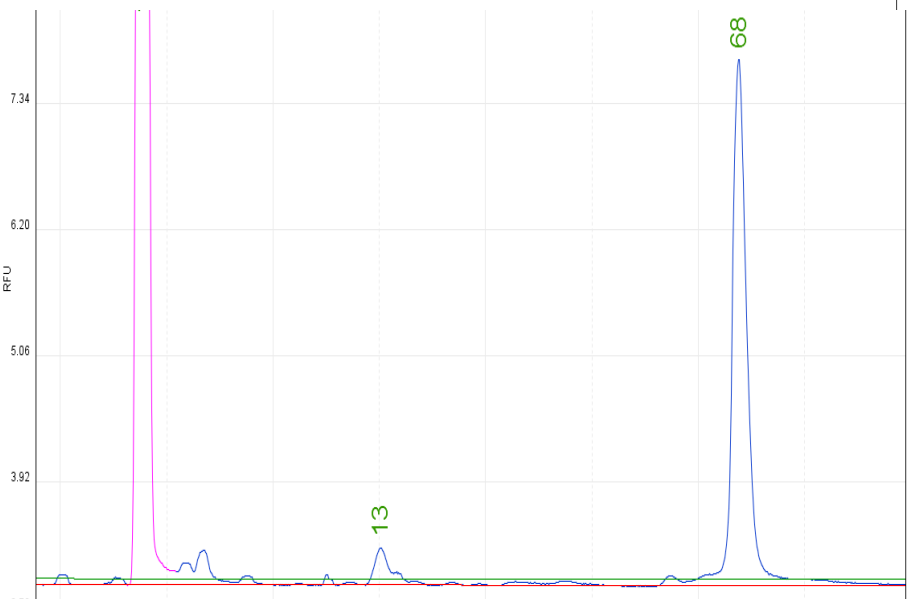
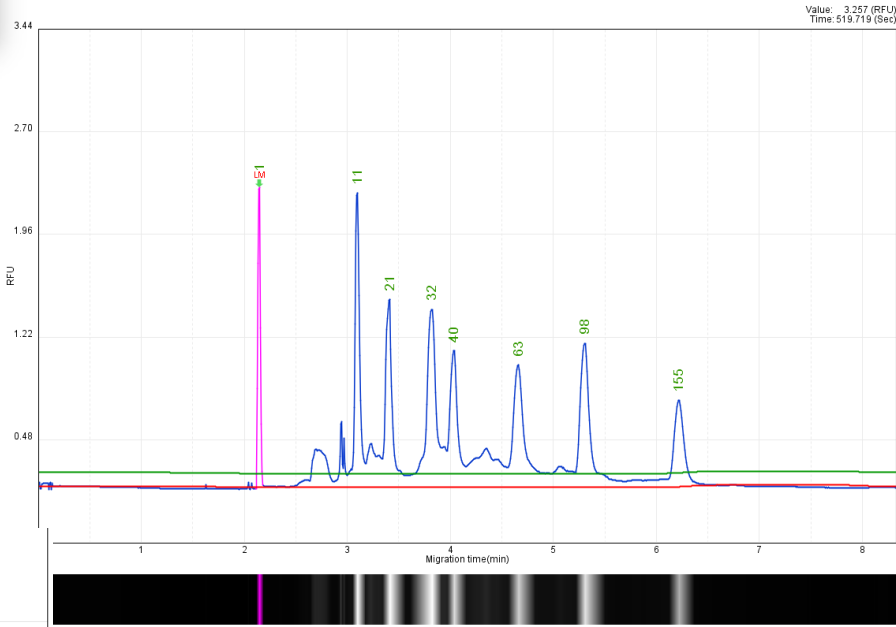
# 检测限



Conc. (ng/μl)	1.8	3	4.5	9	18	45	90
Peak area (E+06)	0.098	0.19	0.21	0.53	0.90	2.08	4.25



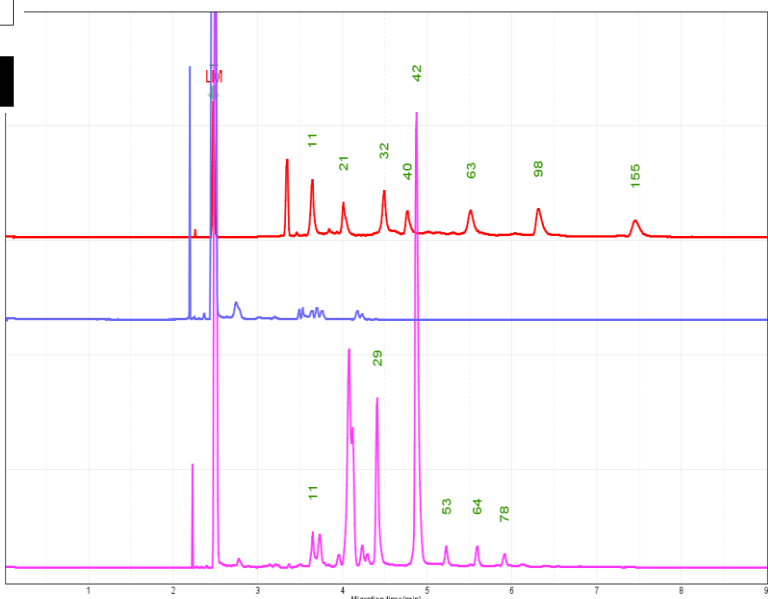
# 1. 蛋白分子量检测



66.7kDa



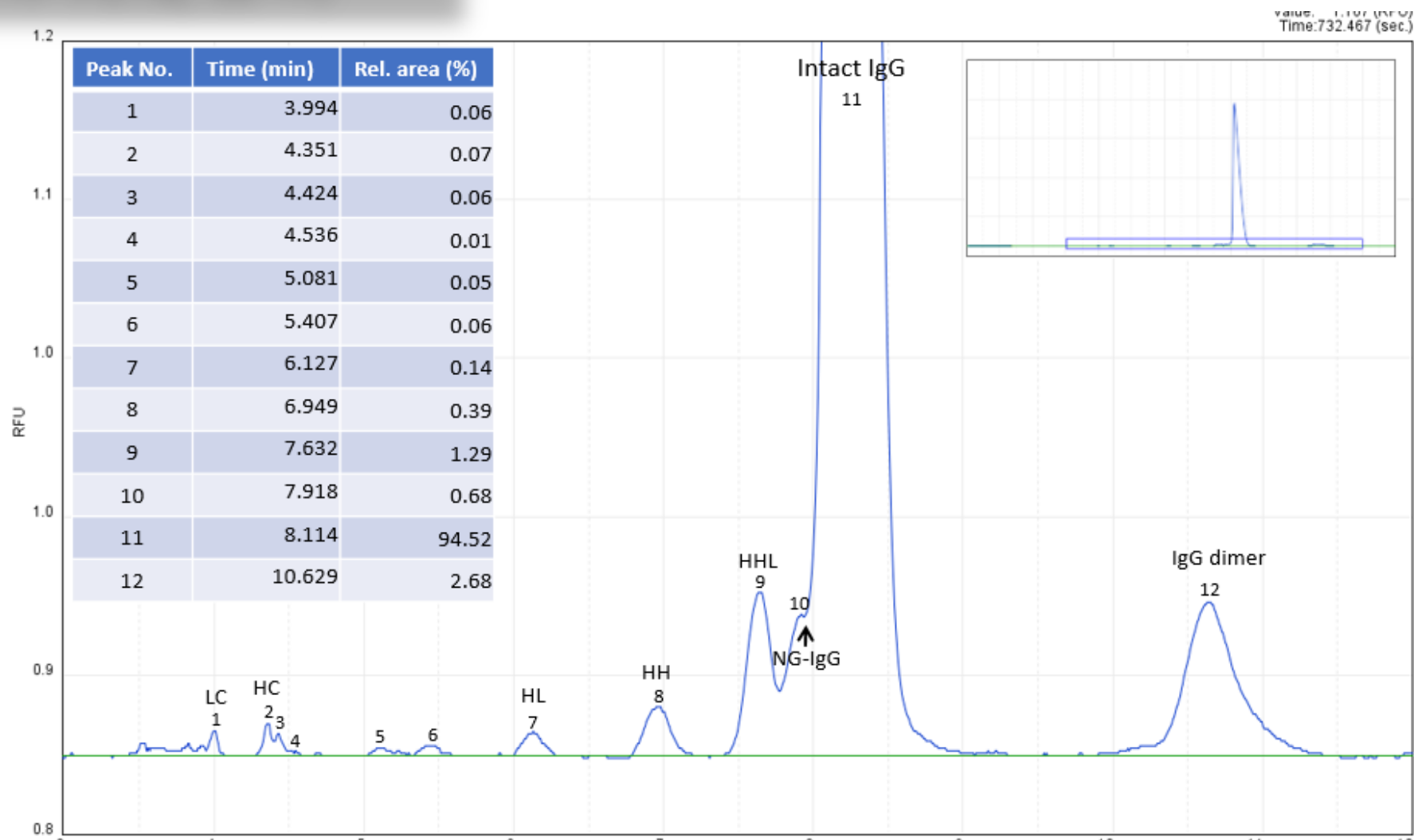
Ladder



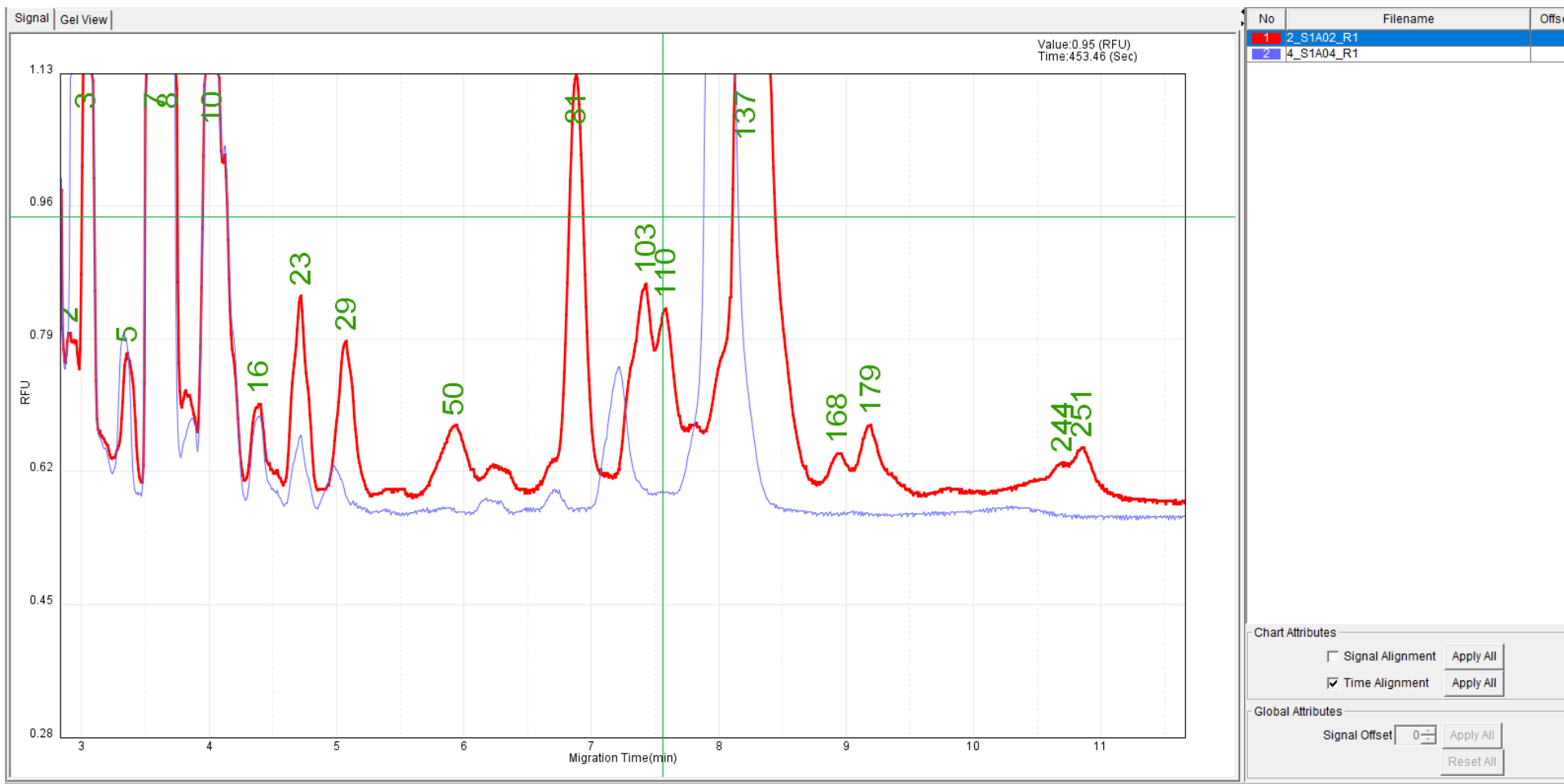
44.4kDa



## 2. 抗体纯度检测

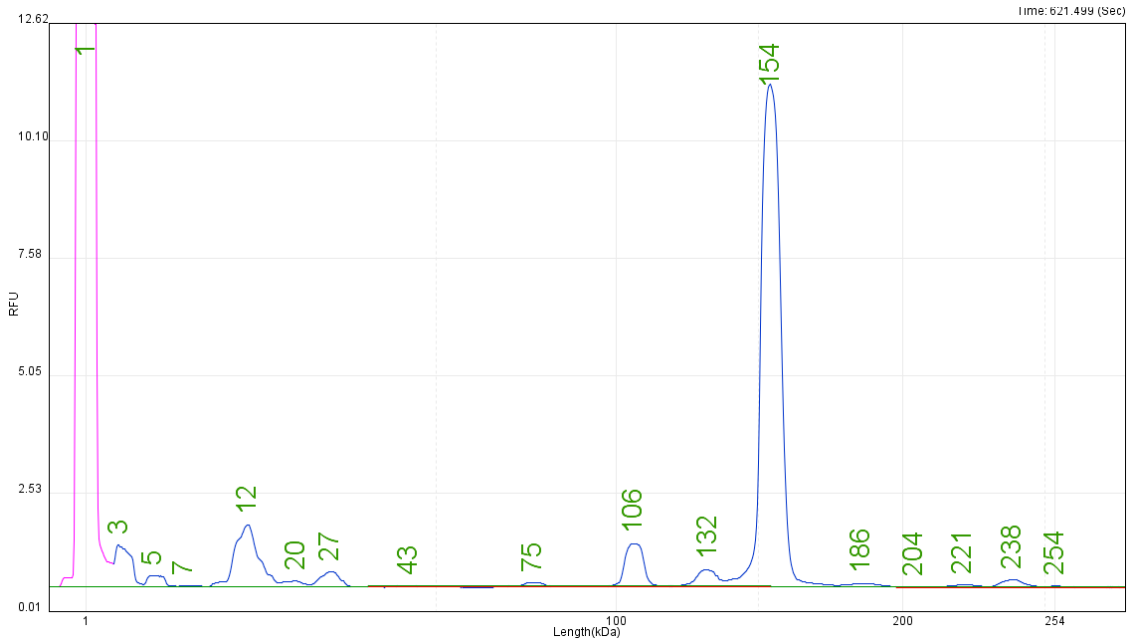


在非还原性免疫球蛋白IgG样本的纯度质控中，**0.1%**的杂带含量也可检测到

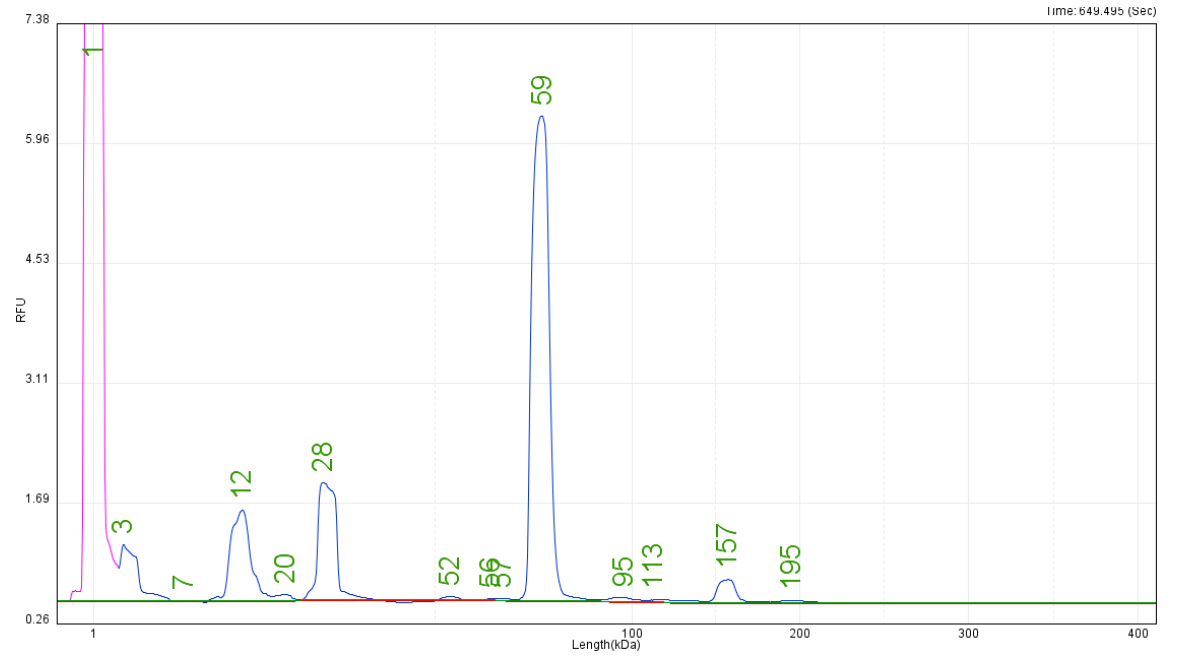


抗体纯化前后对比

### 3. 还原与非还原抗体检测

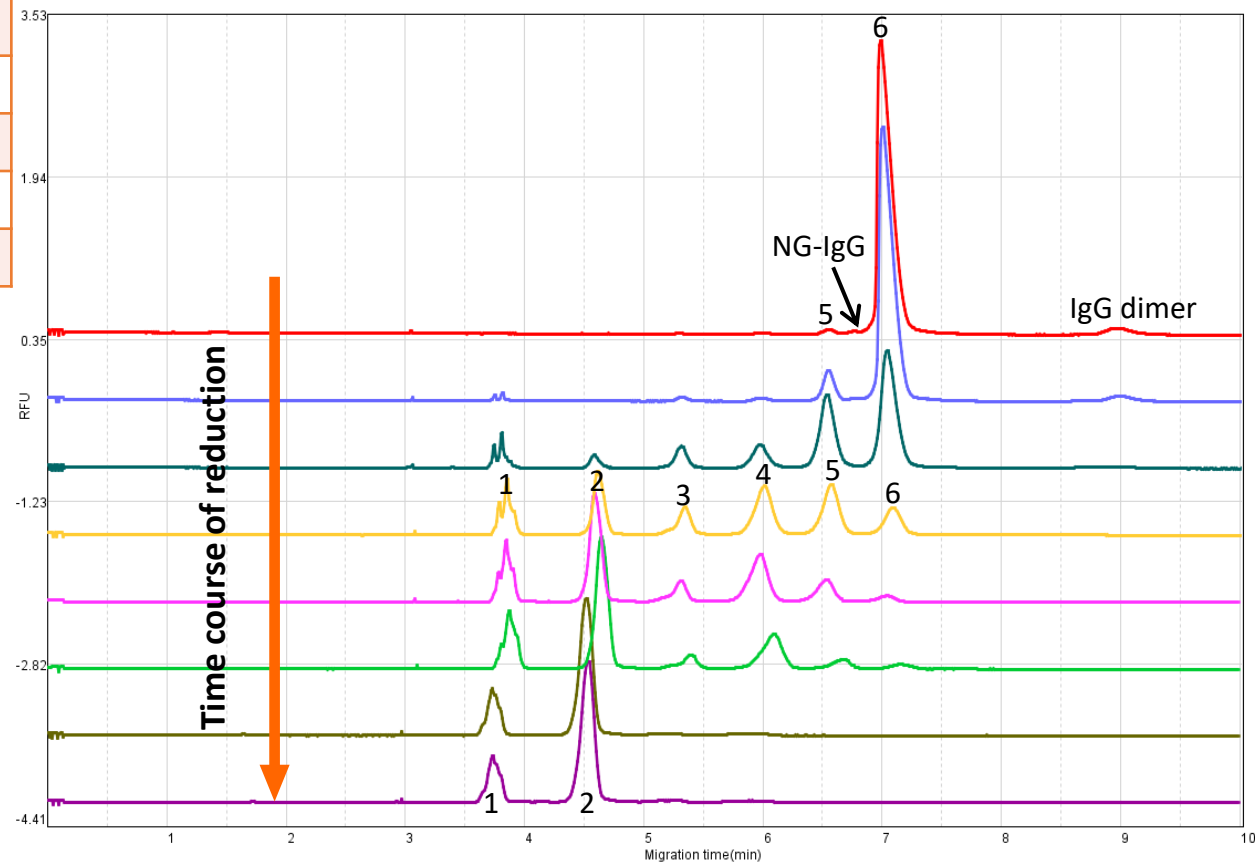
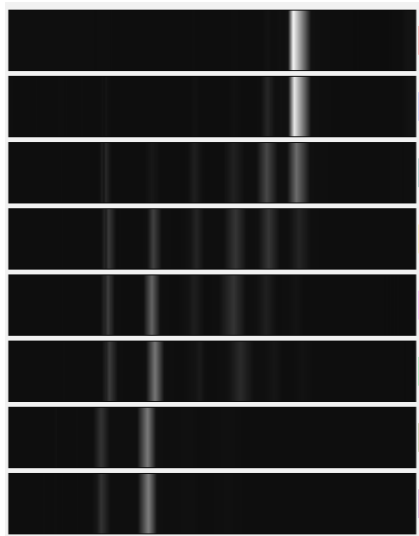


还原前



还原后

Peak NO.	IgG form
1	Light chain (LC)
2	Heavy chain (HC)
3	1 heavy 1 light chain (HL)
4	2 heavy chain (HH)
5	2 heavy 1 light chain (HHL)
6	Intact IgG (2H2L)
NG-IgG	Non-glycosylated IgG



## 抗体还原过程追踪

# 4. 食品检测



## CERTIFICATE OF ANALYSIS

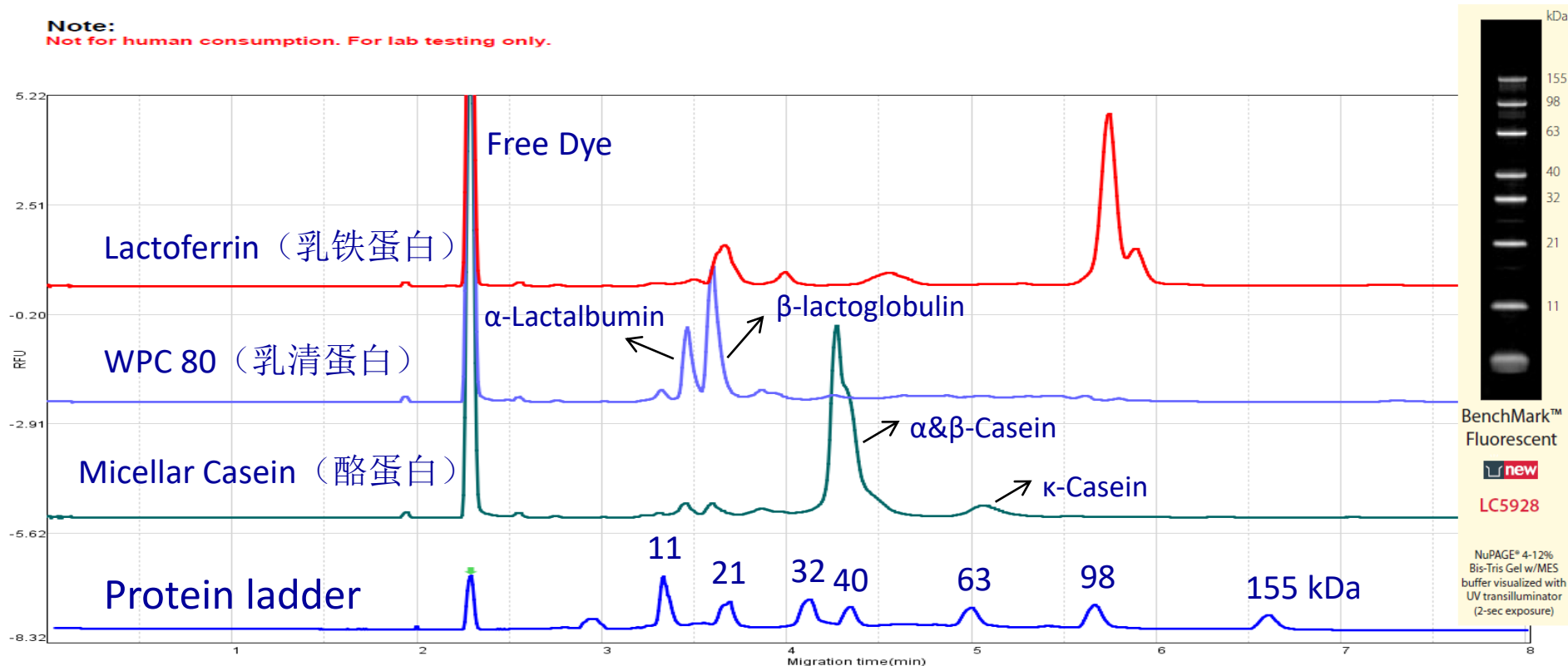
TO: BiOptic, Inc.  
 (23141) 4F., No.108-3  
 Minquan Rd., Xindian District.  
 New Taipei City  
 Taiwan (R.O.C.)

Attn: Ming-Jhy Hseu  
 Tel: +886-2-2218-8726#311  
 E-mail: mingjhy@bioptic.com.tw

PRODUCT: Whey Protein, Micellar Casein  
 Ship Date: 10/12/2018

Product Description	Production Date	Pallet #	Quantity Sent (g)	Protein (%)	TS (%)	PDB (%)	pH	Fat (%)	Ash (%)	Ca (mg%)	K (mg%)	Mg (mg%)	Na (mg%)	P (mg%)
Lactoferrin	7/25/2018	N/A	10	95.21	96.00	99.18	6.43	<0.1	0.25	3.18	0.78	0.33	60.98	4.92
WPC 80	9/25/2018	55932024	45	78.38	95.55	82.03	7.01	5.24	3.84	-	-	-	-	-
Micellar Casein	3/24/2018	50755671	42	84.73	94.70	89.47	6.82	1.49	7.04	2224.00	258.80	101.00	56.83	1381.00

**Note:**  
 Not for human consumption. For lab testing only.



部分发表文章

Contents lists available at ScienceDirect

Journal of Chromatography A



Ma et al. Behavioral and Brain Functions 2013, 9:19  
<http://www.behavioralandbrainfunctions.com/content/9/1/19>



A new (MLM) sample Ultragen electrophoresis P2 Pa

Electrophoresis 2014, 35, 379–384

Research Article

**RE** Nóra Németh<sup>1</sup>  
 Fernando et al. Parasites & Vectors (2017) 10:289  
 DOI 10.1186/s13071-017-2226-1

Márta  
 Mária  
 Zsolt  
 András

Parasites & Vectors

**RES** [www.impactjournals.com/oncotarget/](http://www.impactjournals.com/oncotarget/) Oncotarget, 2017, Vol. 8, (No. 22), pp: 36354-36367

Genetic Evaluation of Natural Populations of the Endangered Conifer *Thuja koraiensis* Using Microsatellite Markers by Restriction-Associated DNA Sequencing

Observational Study

Shu Jian

Medicine<sup>®</sup>

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Analysis with population genomics




Article

A new (MLM) sample

**Genetic Evaluation of Natural Populations of the Endangered Conifer *Thuja koraiensis* Using Microsatellite Markers by Restriction-Associated DNA Sequencing**

## Qsep系列优势总结

- 省时省力：全自动上样，无需配胶加染料等操作，毛细管自动清洗
- 通量灵活：可实现1-100（Qsep100）通量任意样本数上样，无浪费
- 灵敏度极高：检测极限可达到1 pg/ $\mu$ L
- 分辨率极高：500 bp之内，可区分1-4bp，200 bp可区分2 bp
- 样本需求量低：仅需提供1  $\mu$ L样本，每次消耗量小于0.1  $\mu$ L
- 上手快：软件操作简单，培训后可快速上手
- 结果多样呈现：数字数据/凝胶图/峰图；可导出为Word/PDF/Excel等格式
- 售后周到：全国多地办事处



郑玲燕-杭州厚泽生物



谢谢  
赏观

