

# GeoEast 特色解释技术

## 反演系列

**题目：测井数据预处理—异常值剔除、曲线拼接及校正**

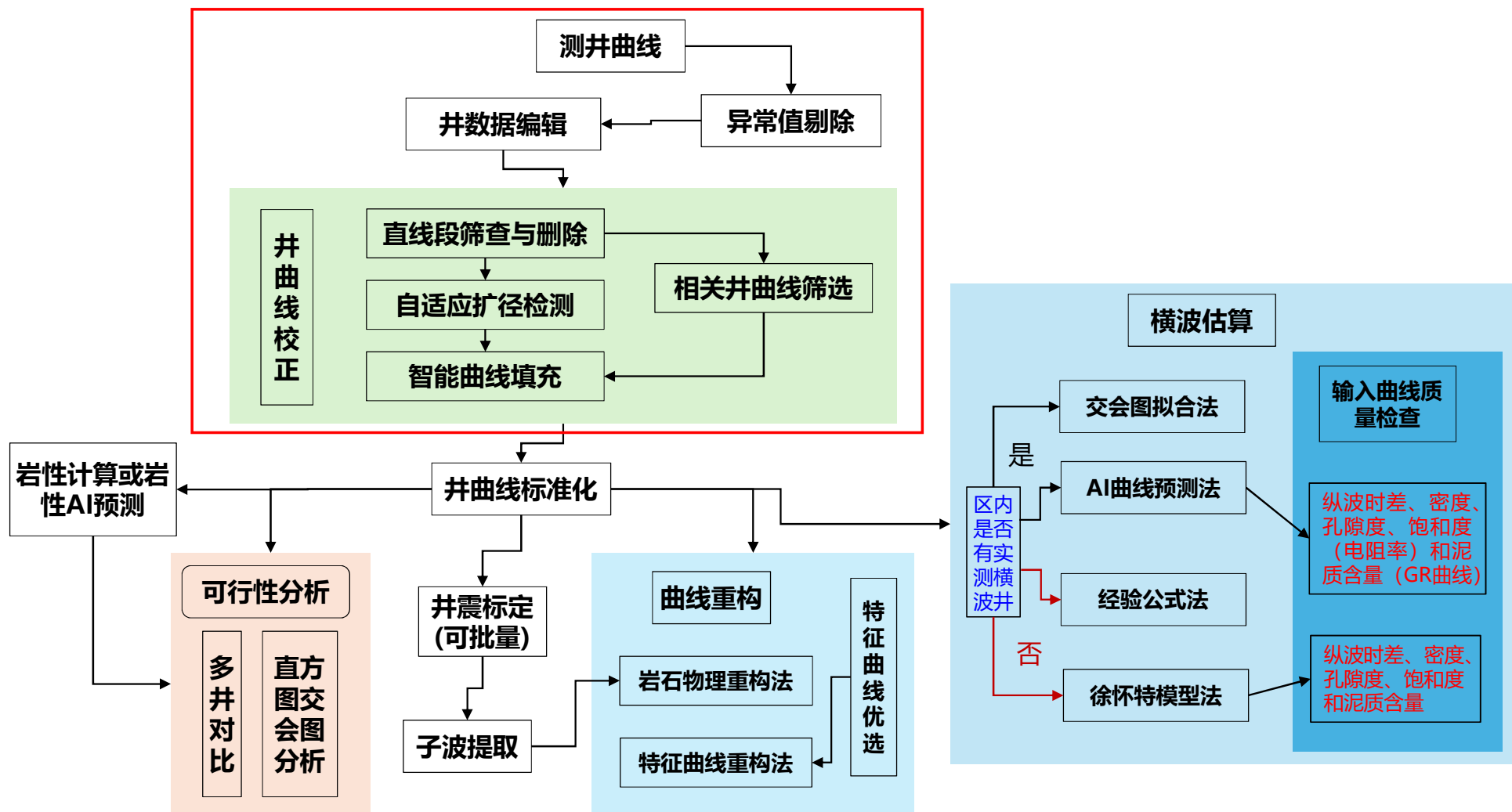
**汇报人：李静叶**

**会议时间：2026年1月13日16:00 – 16:30**

GeoEast



# 测井数据预处理——推荐流程图





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异常值剔除

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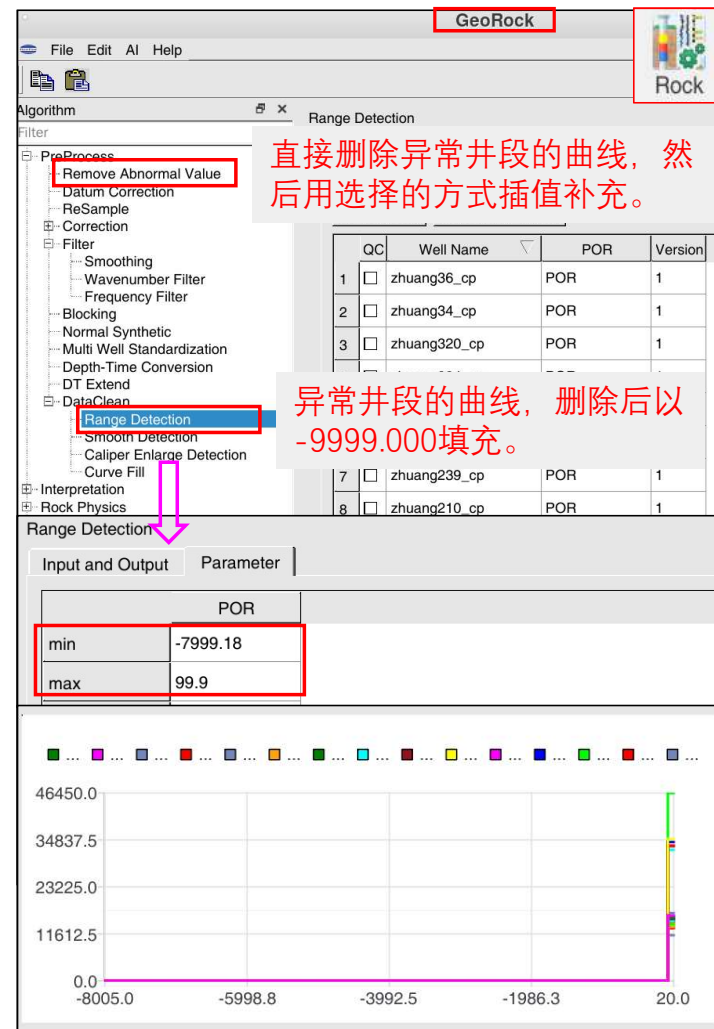
井曲线校正



# 一、异常值剔除

Well	Look for: POR				in	Log Name	  		<input checked="" type="checkbox"/> Real-time	<input type="checkbox"/> Exact Math	
Count: 41	Well Name	Log Name	Log Type	Version	Range	Interval	Domain	Sample Count	Curve Min Value	Curve Max Value	
Filter:	1	pantan1_cp	POR	POR	1	0.103 ~ 5806.73	0.125	Depth	46454	0.001	11.357
<div>ban92_cp</div> <div>hetan14_cp</div> <div>hetan28_cp</div> <div>long27-23_cp</div> <div>long27-24_cp</div> <div>long27-26_cp</div> <div>ning5_cp</div> <div>ning8_cp</div> <div>ning41_cp</div> <div>ning42_cp</div> <div>pantan1_cp</div> <div>pou43_cp</div> <div>zhuang27_cp</div> <div>zhuang29_cp</div> <div>zhuang34_cp</div> <div>zhuang36_cp</div> <div>zhuang110_cp</div> <div>zhuang111_cp</div> <div>zhuang112_cp</div> <div>zhuang113_cp</div> <div>zhuang114_cp</div> <div>zhuang115_cp</div> <div>zhuang117_cp</div> <div>zhuang118_cp</div> <div>zhuang119_cp</div> <div>zhuang120_cp</div> <div>zhuang121_cp</div> <div>zhuang122_cp</div> <div>zhuang138_cp</div> <div>zhuang139_cp</div> <div>zhuang151_cp</div> <div>zhuang158_cp</div> <div>zhuang159_cp</div> <div>zhuang171_cp</div>	2	zhuang114_cp	POR	POR	1	0 ~ 1901.13	0.125	Depth	15210	0	22.225
	3	ning42_cp	POR	POR	1	0.1 ~ 1678.97	0.125	Depth	13432	0	20.8954
	4	ning8_cp	POR	POR	1	0 ~ 1950	0.125	Depth	15601	0	22.651
	5	zhuang112_cp	POR	POR	1	0 ~ 1839.88	0.125	Depth	14720	0	19.315
	6	zhuang27_cp	POR	POR	1	0 ~ 1980	0.125	Depth	15841	0	99.9
	7	zhuang111_cp	POR	POR	1	0.1 ~ 1960.85	0.125	Depth	15687	-7999.1797	22.9406
	8	pou43_cp	POR	POR	1	0.075 ~ 1959.95	0.125	Depth	15680	-5999.3598	22.7422
	9	zhuang110_cp	POR	POR	1	489.325 ~ 1921.2	0.125	Depth	11456	0.001	23.9866
	10	hetan28_cp	POR	POR	1	0.1 ~ 4176.85	0.125	Depth	33415	0	14.5586
	11	ning41_cp	POR	POR	1	0.05 ~ 1783.8	0.125	Depth	14271	0	27.1138
	12	zhuang36_cp	POR	POR	1	0.05 ~ 1868.92	0.125	Depth	14952	0	22.9854
	13	zhuang115_cp	POR	POR	1	0.1 ~ 1919.35	0.125	Depth	15355	0	21.459
	14	zhuang113_cp	POR	POR	1	0.05 ~ 1969.42	0.125	Depth	15756	0	22.9878
	15	zhuang29_cp	POR	POR	1	0 ~ 1929	0.125	Depth	15433	0	64.727
	16	zhuang34_cp	POR	POR	1	0.05 ~ 1978.92	0.125	Depth	15832	0	20.744
	17	long27-26_cp	POR	POR	1	0 ~ 4050.38	0.125	Depth	32404	0	12.13
	18	ban92_cp	POR	POR	1	0.025 ~ 2059.78	0.125	Depth	16479	0.1	24.0806
	19	long27-23_cp	POR	POR	1	0 ~ 4293.88	0.125	Depth	34352	0	7.904

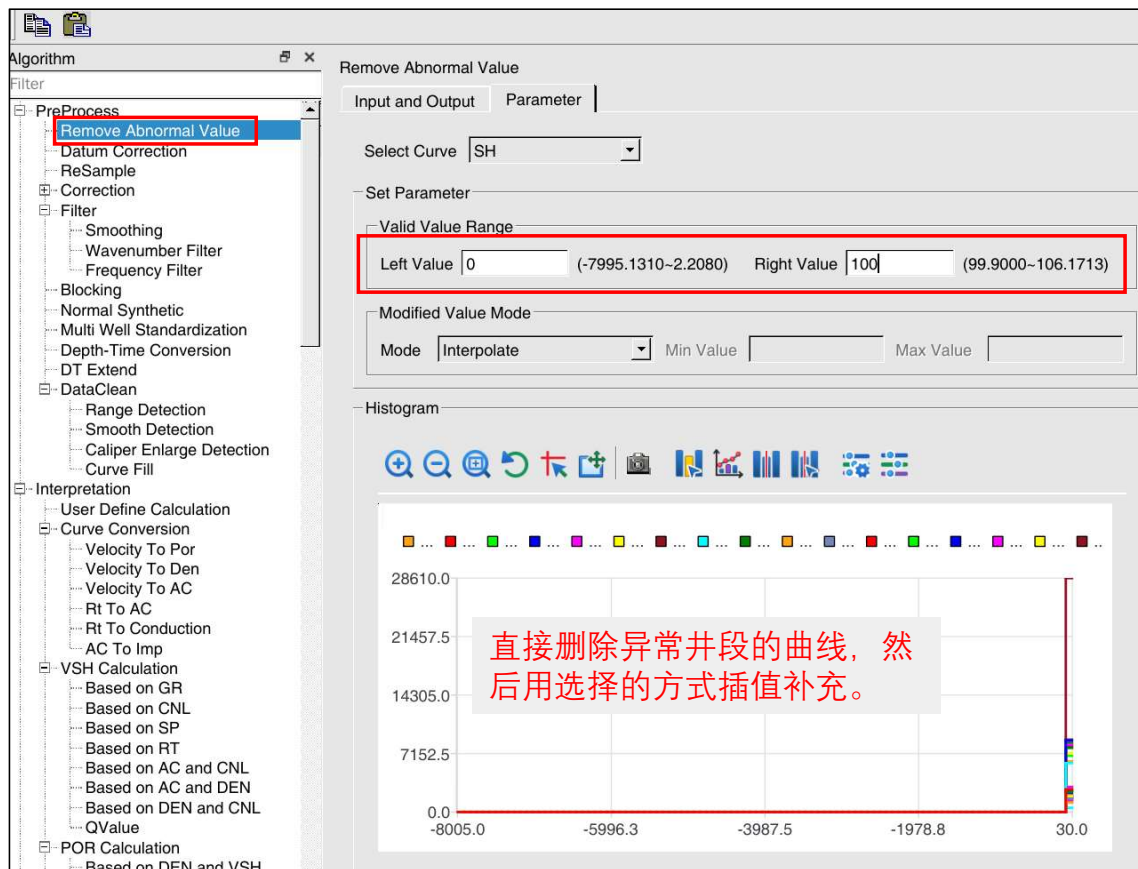
在进行其他处理之前首先剔除原始曲线中所包含的异常值。可以通过主控直接查看原始曲线的最大、最小值判断曲线是否存在异常值。



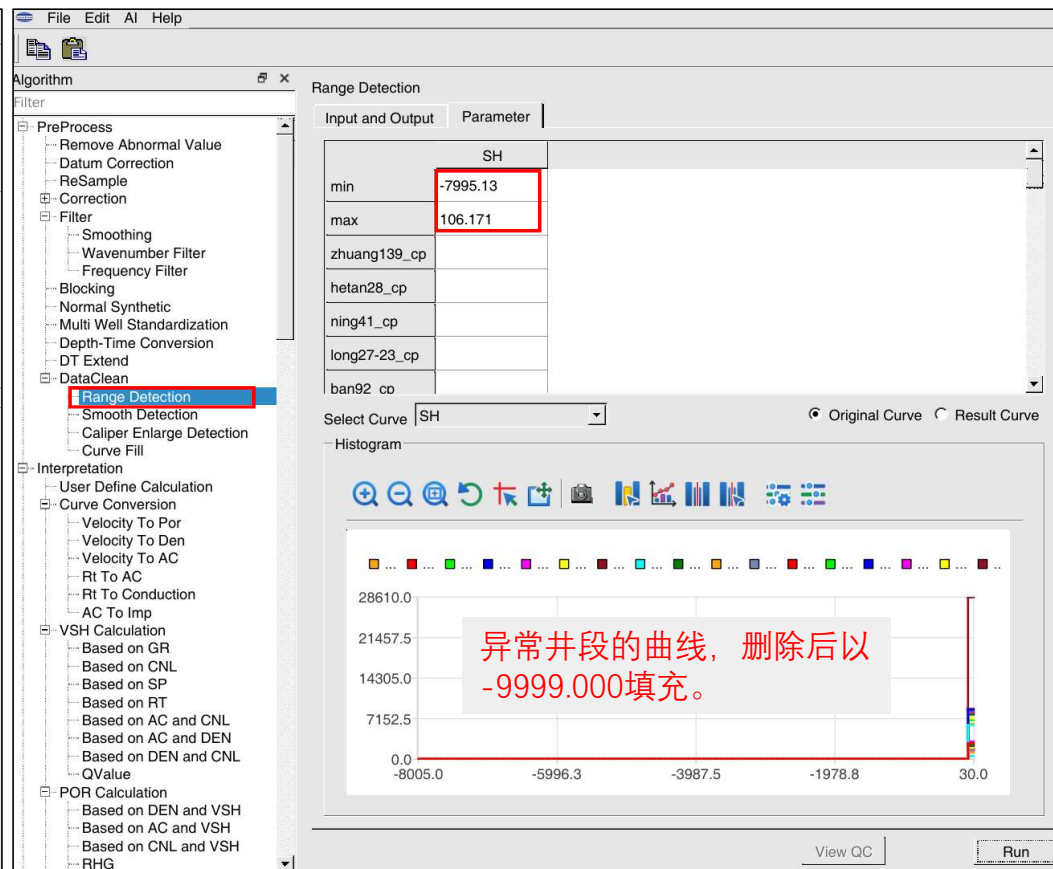




# 一、异常值剔除



用于少量异常值断续存在的情况



用于大量异常值连续存在的情况，后续可以采用人工智能进行曲线补偿



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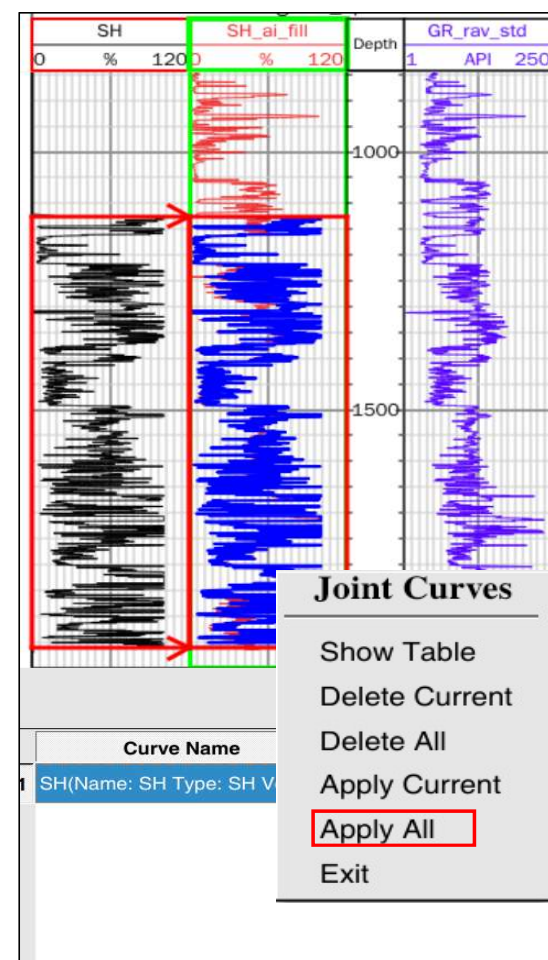
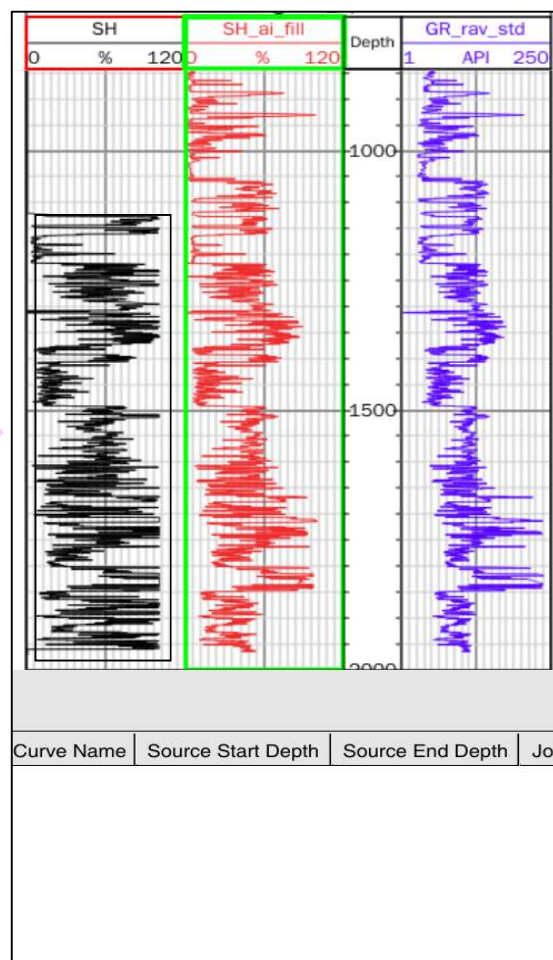
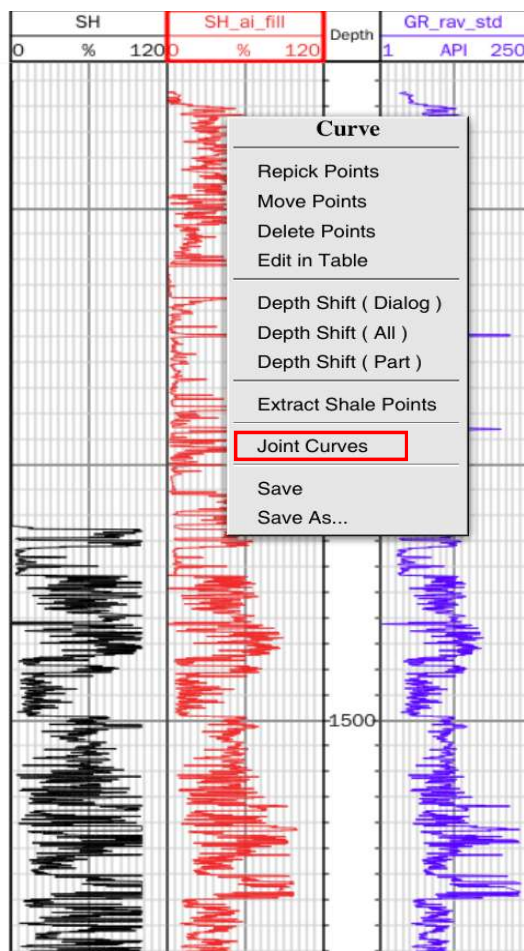
井曲线校正



## 二、曲线拼接



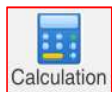
### 1、单井曲线拼接



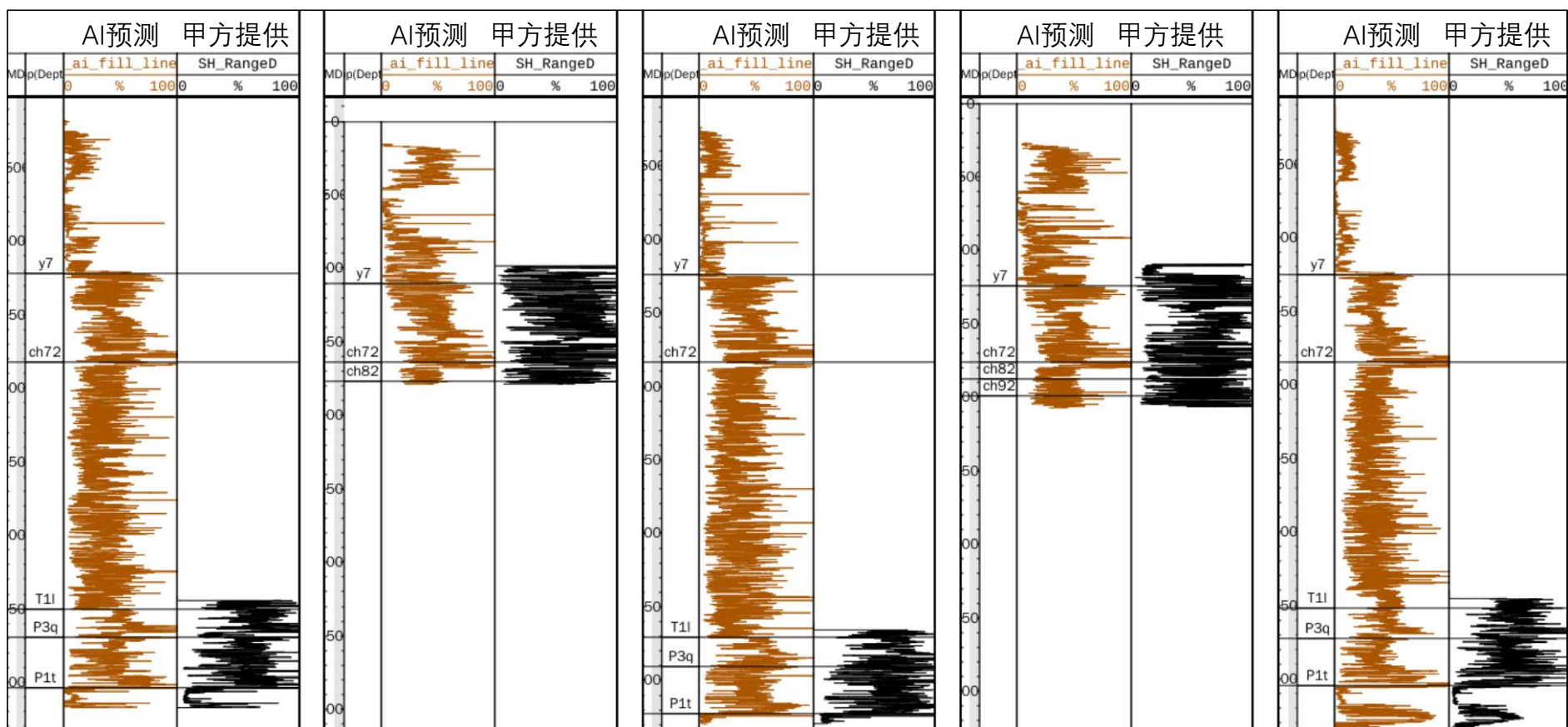


## 二、曲线拼接

### 2、多井批量曲线拼接



异常值批量剔除→曲线填充→光滑性检测→在计算器中进行逻辑运算







## 二、曲线拼接

### 2、多井批量曲线拼接

异常值批量剔除→**曲线填充**→光滑性检测→在计算器中进行逻辑运算

Filter

- PreProcess
  - Remove Abnormal Value
  - Datum Correction
  - ReSample
  - Correction
    - Filter
      - Smoothing
      - Wavenumber Filter
      - Frequency Filter
    - Blocking
    - Normal Synthetic
    - Multi Well Standardization
    - Depth-Time Conversion
    - DT Extend
  - DataClean
    - Range Detection
    - Smooth Detection
    - Caliper Enlarge Detection
  - Curve Fill**
  - Interpretation
    - User Define Calculation
  - Curve Conversion
    - Velocity To Por
    - Velocity To Den
    - Velocity To AC
    - Rt To AC
    - Rt To Conduction
    - AC To Imp
  - VSH Calculation
    - Based on GR
    - Based on CNL
    - Based on SP
    - Based on RT
    - Based on AC and CNL
    - Based on AC and DEN
    - Based on DEN and CNL
    - QValue
  - POR Calculation
    - Based on DEN and VSH
    - Based on AC and VSH
    - Based on CNL and VSH
    - RHG

Input and Output | Parameter

Input

Select Well...

**需要填充的曲线**

**较长的井曲线**

Remove Clear

QC	Well N	SH_RangeD	Version	PP_IMP	Version
1	hetan28_cp	SH_RangeD	1	PP_IMP_ssi	1
2	ning41_cp	SH_RangeD	1	PP_IMP_ssi	1
3	long27-23...	SH_RangeD	1	PP_IMP_ssi	1
4	ban92_cp	SH_RangeD	1	PP_IMP_ssi	1
5	hetan14_cp	SH_RangeD	1	PP_IMP_ssi	1
6	long27-24...	SH_RangeD	1	PP_IMP_ssi	1
7	long27-26...	SH_RangeD	1	PP_IMP_ssi	1
8	ning8_cp	SH_RangeD	1	PP_IMP_ssi	1
9	ning42_cp	SH_RangeD	1	PP_IMP_ssi	1
10	zhuang11...	SH_RangeD	1	PP_IMP_ssi	6
11	ning5_cp	SH_RangeD	1	PP_IMP_ssi	1

尽量选择井上最长的曲线，如果所有曲线都不够长，可以沿井轨迹从地震数据中抽取一条。

Select All Select Reversed Select Invalid Well Name Filter Curve Name Filter

Vertical Range

Extraction Mode All

Output

Curve Name Prefix + Current Curve Name + \_fill

Curve Interval As Original Curve

Curve Version Overlay Last Version Cover Last Version

曲线填充的目的是增加曲线的长度，使需要拼接的两条原始曲线拥有相同的起止深度，便于后续在计算器中进行计算。

填充模式选择均值或中值法插值就可以

Input and Output | Parameter

Filling model

☐ Regression ☒ Interpolate ☐ Iterative Imputer

mean

mean

median

most\_frequent

ffill

bfill

linear

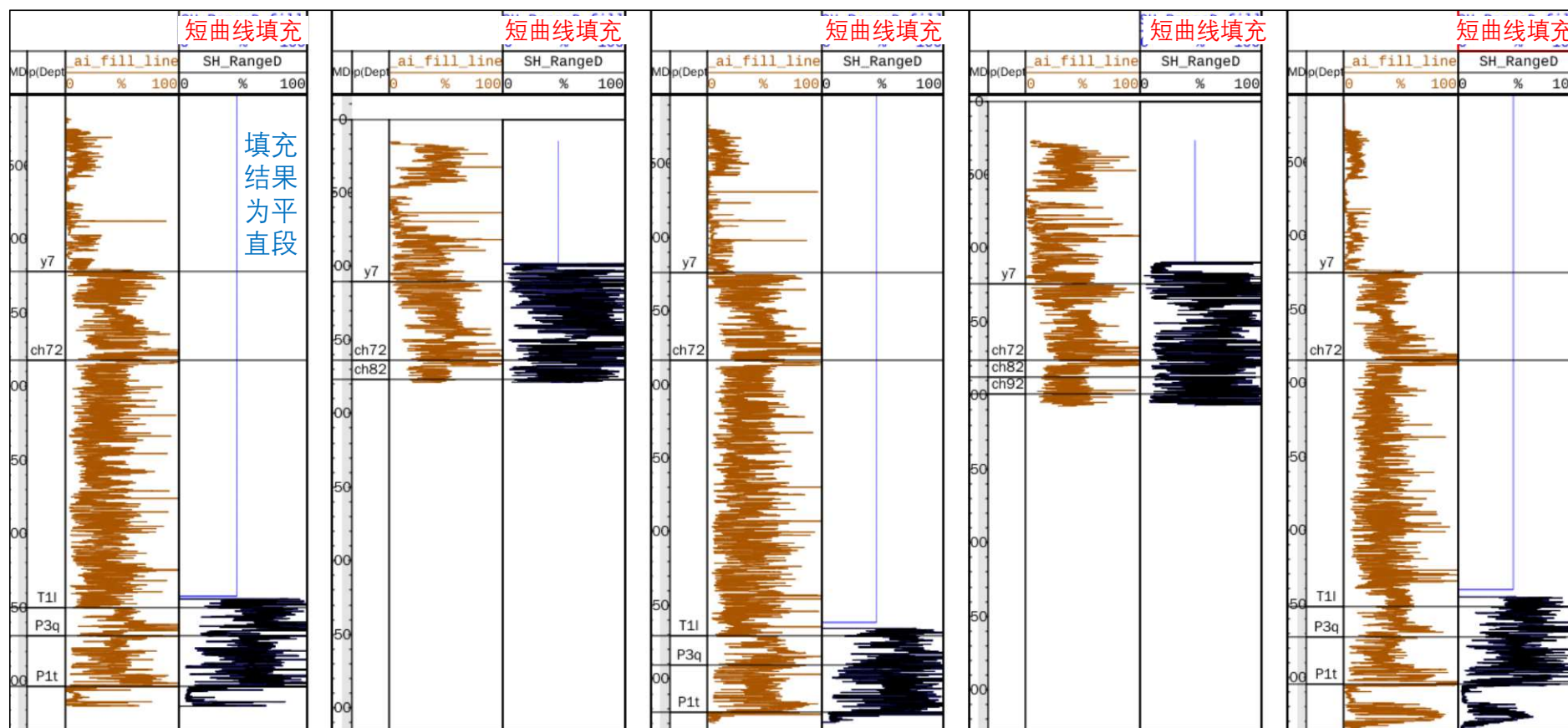


## 二、曲线拼接



### 2、多井批量曲线拼接

异常值批量剔除→**曲线填充**→光滑性检测→在计算器中进行逻辑运算





## 二、曲线拼接



### 2、多井批量曲线拼接

异常值批量剔除→曲线填充→光滑性检测→在计算器中进行逻辑运算

Algorithm

Filter

- PreProcess
  - Remove Abnormal Value
  - Datum Correction
  - ReSample
  - Correction
    - Filter
      - Smoothing
      - Wavenumber Filter
      - Frequency Filter
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    - Normal Synthetic
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    - DT Extend
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    - Caliper Enlarge Detection
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    - User Define Calculation
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      - Velocity To Por
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      - Velocity To AC
      - Rt To AC
      - Rt To Conduction
      - AC To Imp
    - VSH Calculation
      - Based on GR
      - Based on CNL
      - Based on SP
      - Based on RT
      - Based on AC and CNL
      - Based on AC and DEN
      - Based on DEN and CNL
      - QValue
    - POR Calculation

Smooth Detection

Input and Output | Parameter

SH	
min	0.001
max	99.9
hetan28_cp	
ning41_cp	
long27-23_cp	
ban92_cp	

可手动更改最大、最小值

Set Parameter

Smooth detect method: ☒ Linear\_smooth ☐ NonLinear\_smooth

Tolerance\_value: 0.00001 (0~1) Connected Window Size: 5

Select Curve: SH ☒ Original Curve ☐ Result Curve

Histogram

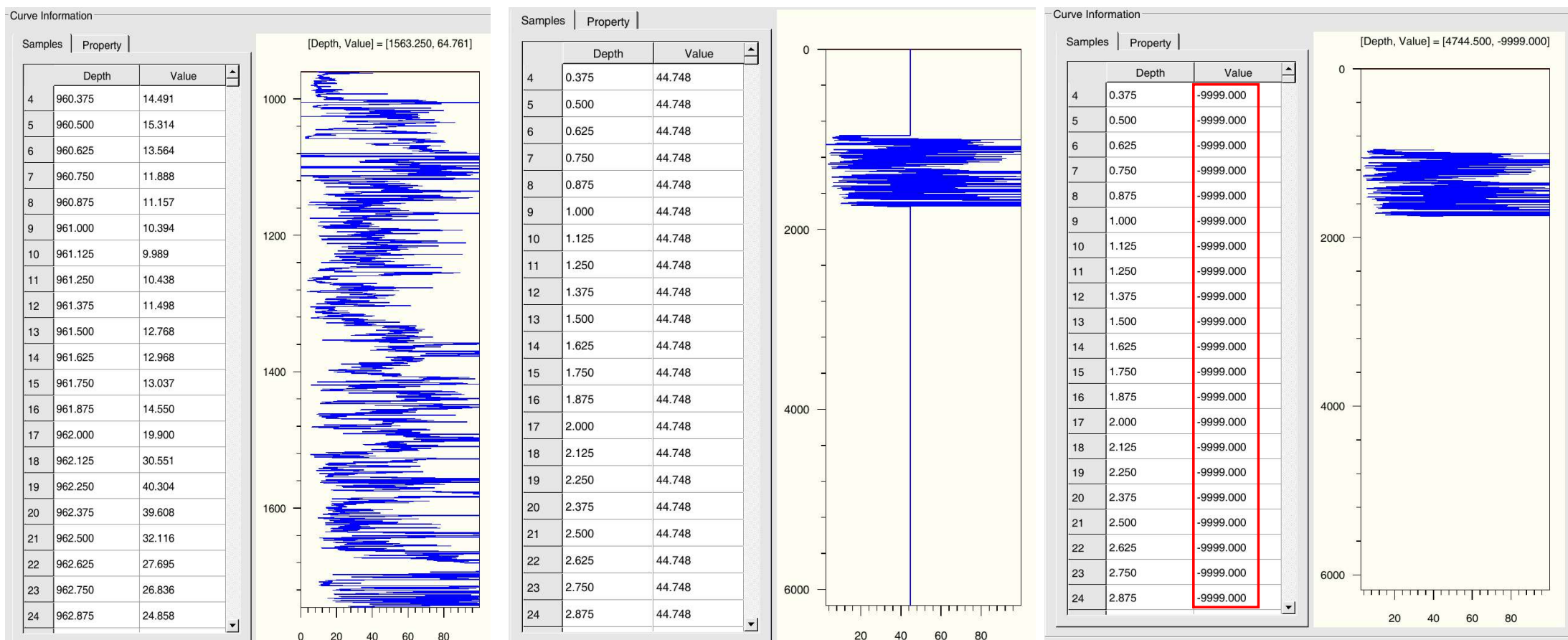
光滑性检测可以  
自动识别曲线的平直  
段，将其填充为-9999。  
-9999与实际的  
曲线值有了明显区别。



## 二、曲线拼接

### 2、多井批量曲线拼接

异常值批量剔除→曲线填充→**光滑性检测**→在计算器中进行逻辑运算







## 二、曲线拼接



### 2、多井批量曲线拼接

异常值批量剔除→曲线填充→光滑性检测→在计算器中进行逻辑运算

Expressions Calculator

Type: well log Survey: Set Input & Output Data ...

Data & Alias: Public Parameters:

**Set Input & Output Well Log Curve Data**

Well Set: 41wells\_cp

Wells & Curves

Well	Curve 1	Curve 2	Start Z	End Z
1	par SH_ai_fill_linear(V1)	SH_RangeD_fill2(V1)	1273.48	OK
2	het SH_ai_fill_linear(V1)	SH_RangeD_fill2(V1)	100	OK
3	het SH_ai_fill_linear(V1)	SH_RangeD_fill2(V1)	100.1	OK
4	lon SH_ai_fill_linear(V1)	SH_RangeD_fill2(V1)	100	OK
5	lon SH_ai_fill_linear(V1)	SH_RangeD_fill2(V1)	100	OK
6	lon SH_ai_fill_linear(V1)	SH_RangeD_fill2(V1)	100	OK
7	bar SH_ai_fill_linear(V1)	SH_RangeD_fill2(V1)	268.025	OK
8	nin SH_ai_fill_linear(V1)	SH_RangeD_fill2(V1)	149.05	OK
9	nin SH_ai_fill_linear(V1)	SH_RangeD_fill2(V1)	250.1	OK
10	nin SH ai fill linear(V1)	SH RangeD fill2(V1)	100.1	OK

Filter:

Output Data

Name: SH\_merge Resampling Interval of Selected Curves in Individual Well: User Define 0.125

Nature: Log Curve Curve Type: SH Version: auto set

OK Cancel

Thread Number: 8 (1 ~ 16)

OK Apply Cancel Help

Expressions Calculator

Type: well log Survey: Set Input & Output Data ...

Data & Alias: Public Parameters:

Alias	Remark
1 C1	Data of <b>Curve 1</b> column in table of Wells & Curves within the windows of Set Input & Output Well Log Curve Data
2 C2	Data of <b>Curve 2</b> column in table of Wells & Curves within the windows of Set Input & Output Well Log Curve Data

Result Name: SH\_merge

Result Remark: Nature:Log Curve, Curve Type:SH, Version:auto set

Define Expressions:

Type	Expressions
1 if	isNull( C2 )
2 y =	C1
3 else y =	C2

Signs & Functions:

- b isInf( r )
- b isNan( r )
- b isNull( A )
- r log10( r )
- r loge( r )
- r max( r1, r2 )
- r min( r1, r2 )
- r pow( r1, r2 )
- r sin( r )

Import Expressions ... Null Value Flag of Result: Y\_NULL= -9999

Save Expressions

Thread Number: 8 (1 ~ 16)

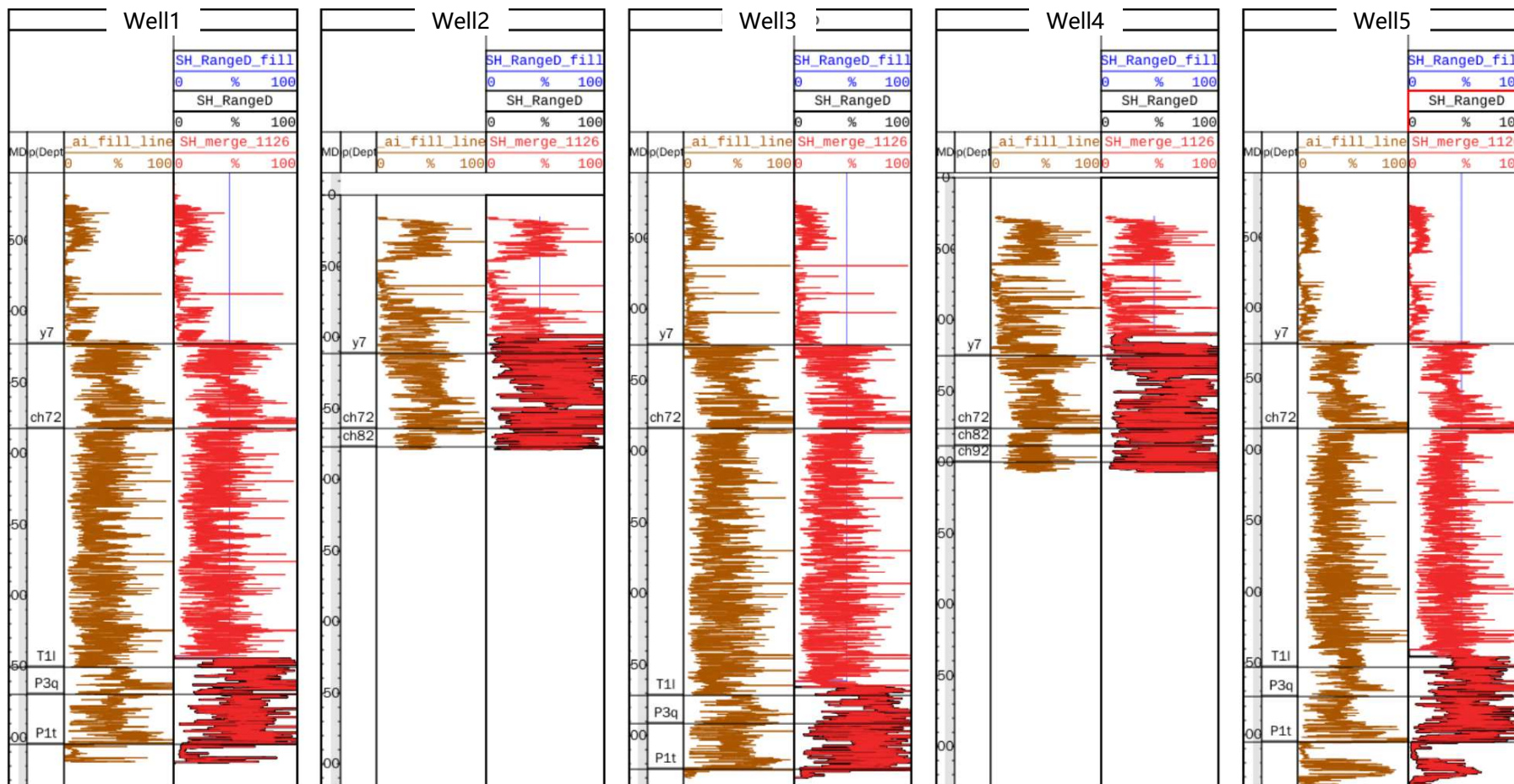
OK Apply Cancel Help



## 二、曲线拼接

### 2、多井批量曲线拼接

异常值批量剔除→曲线填充→光滑性检测→在计算器中进行逻辑运算





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井曲线校正

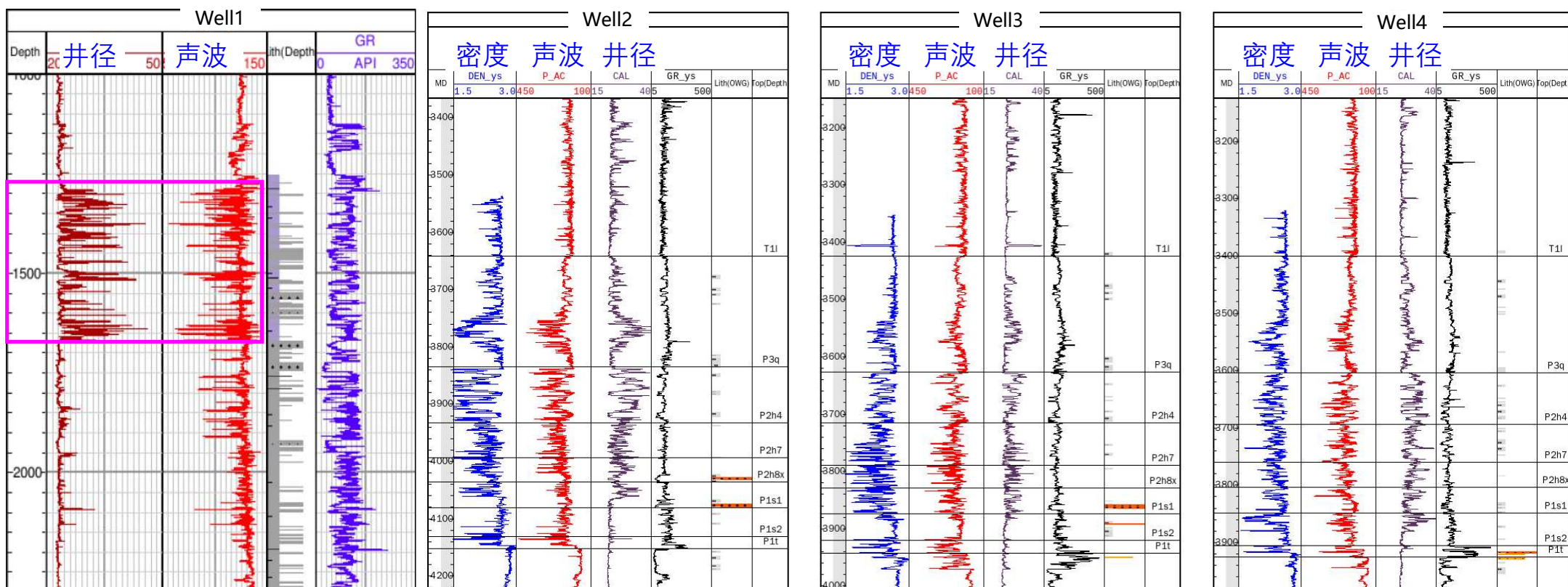


## 三、井曲线校正

### 1、常规井径校正方法（适用于砂泥岩地层）



在钻井过程中，井眼垮塌会引起测井曲线异常，需要对扩径曲线进行校正。







## 三、井曲线校正

### 1、常规井径校正方法（适用于砂泥岩地层）

Algorithm

Filter

- PreProcess
  - Remove Abnormal Value
  - Datum Correction
  - ReSample
- Correction
  - Condition
    - GR Borehole
    - AC Borehole**
    - DEN Borehole
    - Acoustic...
  - TVD Deviated Well Correction
  - SP Baseline Drift Correction
- Filter
  - Blocking
  - Normal Synthetic
  - Multi Well Standardization
  - Depth-Time Conversion
  - DT Extend
- DataClean
- Interpretation
  - Rock Physics
  - Statistic
  - Extraction
  - Data Set
  - GeoMechanical

AC Borehole

Input and Output | Parameter

Input

Select Well...

声波时差 伽马（必须剔除异常值） 井径

	QC	井 Na	P_AC	Version	GR	Version	CAL	Version
17	<input type="checkbox"/>	lo...	P_AC	1	GR_final	1	CAL	1
18	<input type="checkbox"/>	lo...	P_AC	1	GR_final	1	CAL	1
19	<input type="checkbox"/>	lo...	P_AC	1	GR_final	1	CAL	1
20	<input type="checkbox"/>	lo...	P_AC	1	GR_final	1	CAL	1
21	<input type="checkbox"/>	lo...	P_AC	1	GR_final	1	CAL	1
22	<input type="checkbox"/>	lo...	P_AC	1	GR_final	1	CAL	1
23	<input type="checkbox"/>	lo...	P_AC	1	GR_final	1	CAL	1
24	<input type="checkbox"/>	lo...	P_AC	1	GR_final	1	CAL	1
25	<input type="checkbox"/>	lo...	P_AC	1	GR_final	1	CAL	1
26	<input type="checkbox"/>	he...	P_AC	1	GR_final	1	CAL	1
27	<input type="checkbox"/>	he...	P_AC	1	GR_final	1	CAL	1
28	<input type="checkbox"/>	he...	P_AC	1	GR_final	1	CAL	1
29	<input type="checkbox"/>	he...	P_AC	1	GR_final	1	CAL	1
30	<input type="checkbox"/>	he...	P_AC	1	GR_final	1	CAL	1
31	<input type="checkbox"/>	Q...	P_AC	1	GR_final	1	CAL	1

Select All | Select Reversed | Select Invalid | Well Name Filter

Vertical Range

Extraction Mode | All

声波时差井径校正原理：根据GR计算出地层的泥质含量，即砂、泥岩在地层中的百分比；然后结合参数页面中填写的砂、泥岩声波时差，根据体积模型计算出声波时差，用以校正扩径段的声波测井曲线。

AC Borehole

Input and Output | Parameter

Set Parameter

Tsh 300 泥岩声波 (us/m) Tma 220 砂岩声波 (us/m)

Bits 10 钻头尺寸 (in) Space 0.5 校正界限 (in)

C 2.0 经验系数

泥岩及砂岩的声波时差：可以先采用默认值进行试验，如果不合适，后续可以根据需要动态调整。增大这两项的参数值，扩径段的校正结果会相应增大，减小这两个参数值校正结果会相应减小。

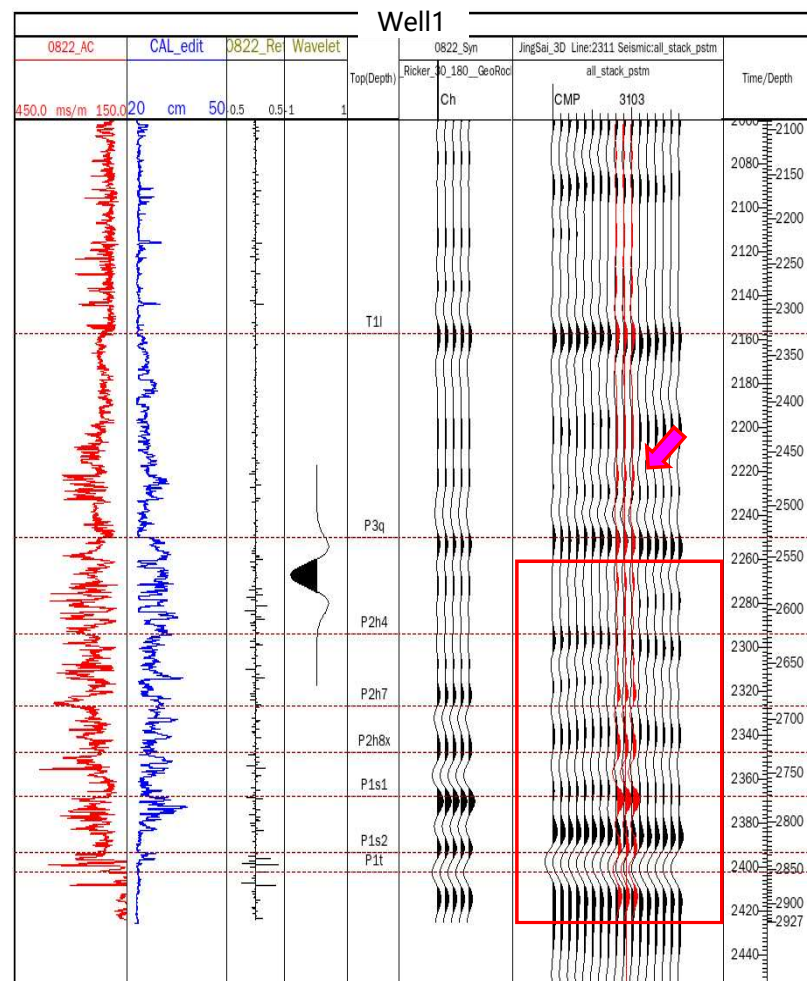
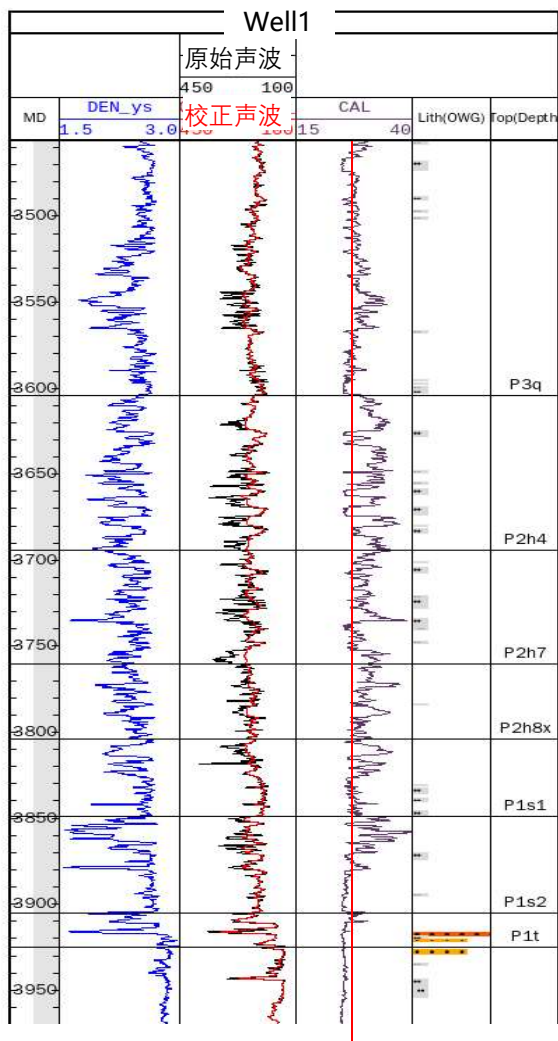
钻头尺寸：由井径曲线读取，钻头尺寸变化后，须进行分段校正；

校正界限：井径曲线值大于钻头尺寸+校正界限时，对曲线进行校正；

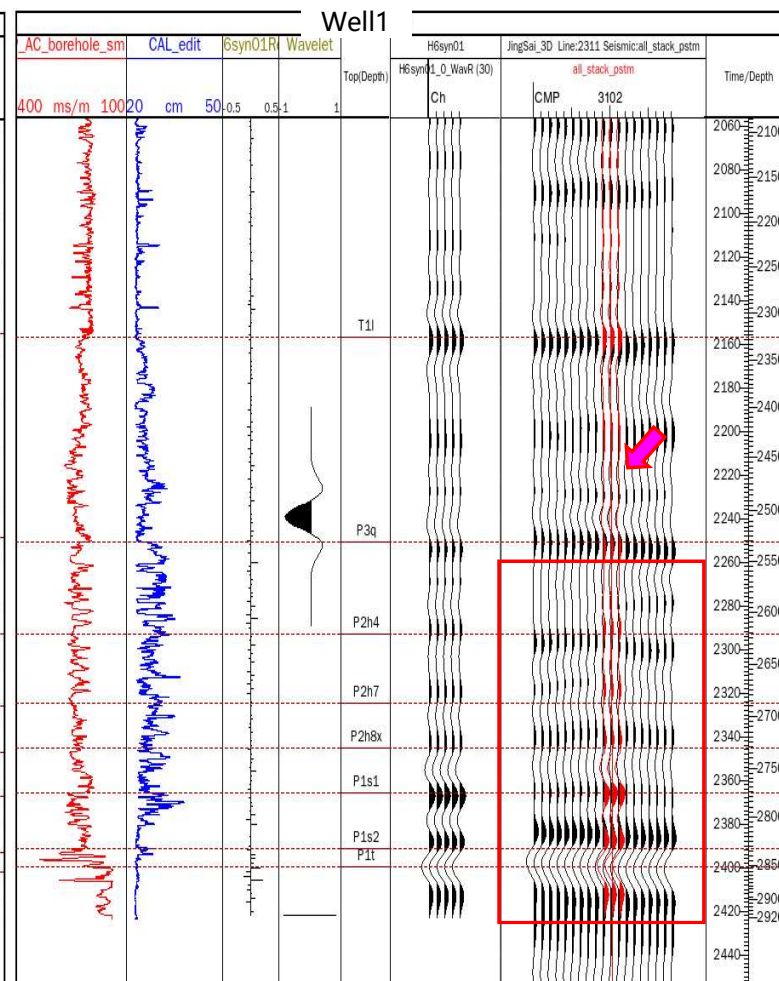
C为经验系数：以上第三系为界，老地层为2，新地层为3.7。



### 三、井曲线校正



声波曲线校正前的合成记录



声波曲线校正后的合成记录



### 三、井曲线校正

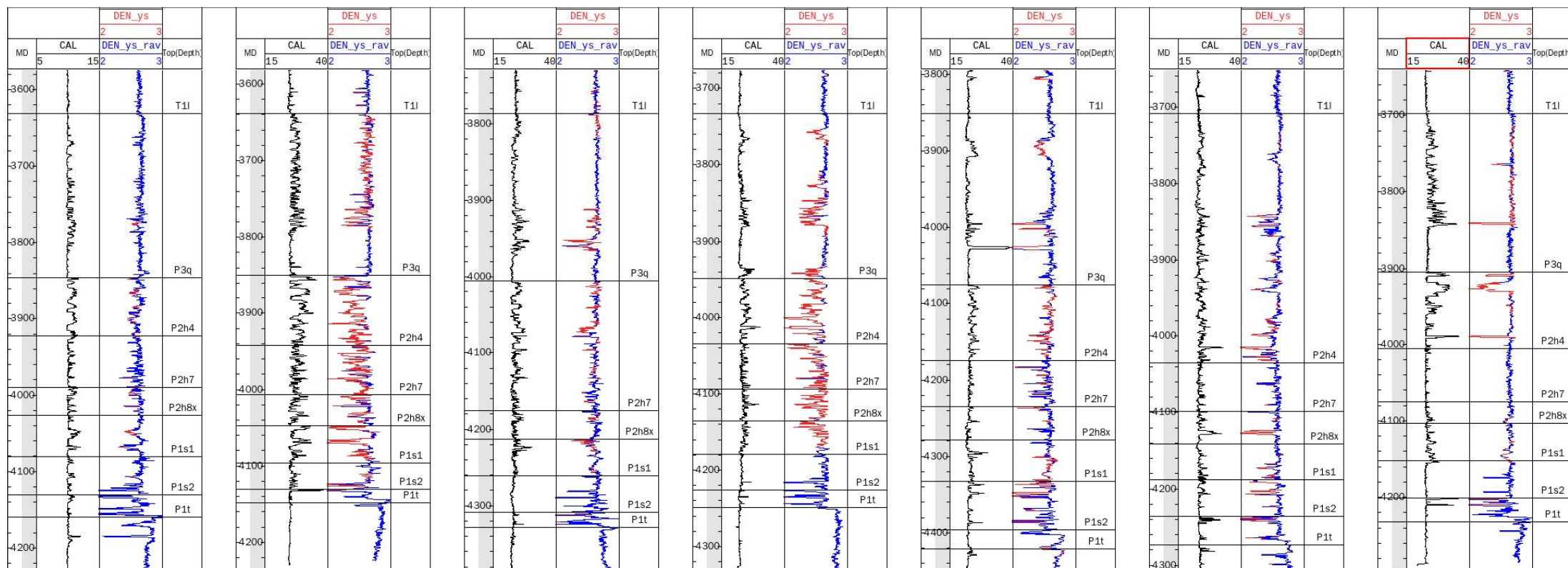
#### 2、AI方法 (适用于所有岩性)



自适应扩径检测

原始密度曲线

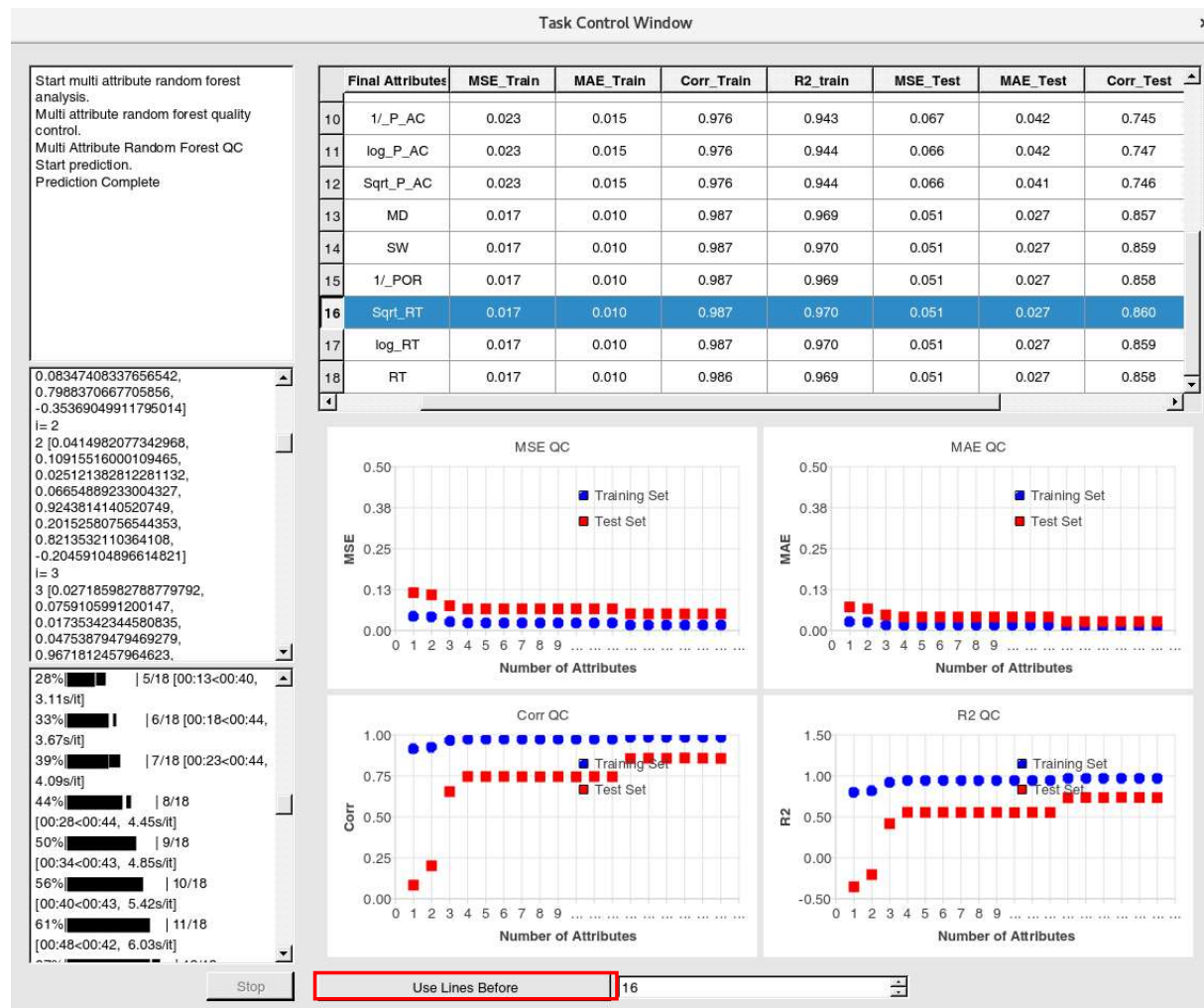
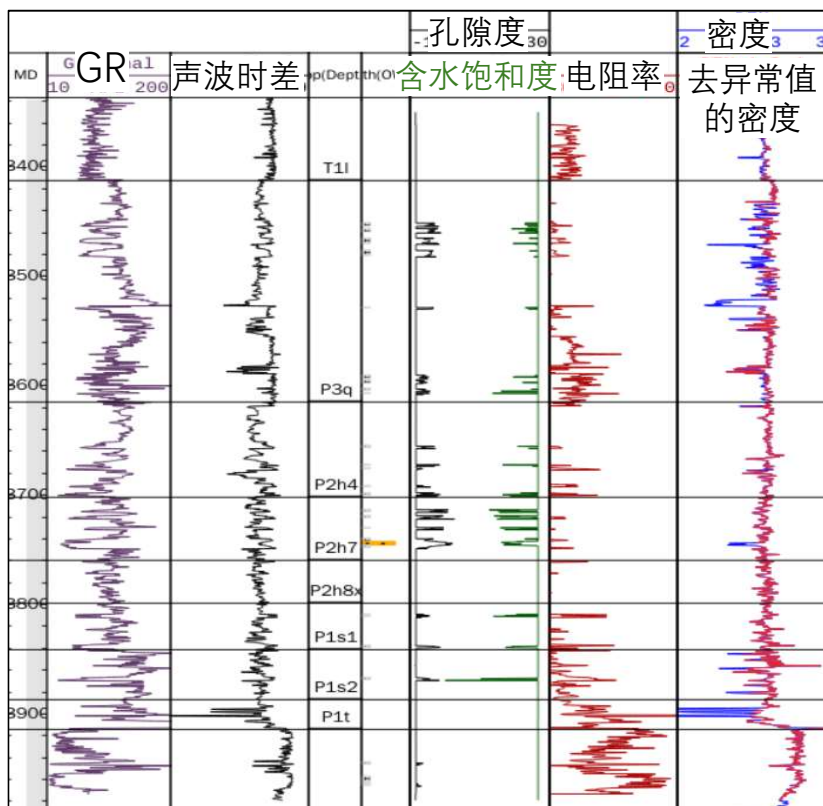
扩径段删除后







筛选质量比较高的其他测井曲线，以去除异常值后的待校正曲线为标签，进行深度学习，根据AI建立的待校正曲线与其他高质量测井曲线之间的关系，补充待校正曲线在扩径井段的曲线值。



以密度曲线校正为例，可以选取GR、孔隙度、声波时差、电阻率、含水饱和度等曲线进行AI学习。





### 三、井曲线校正

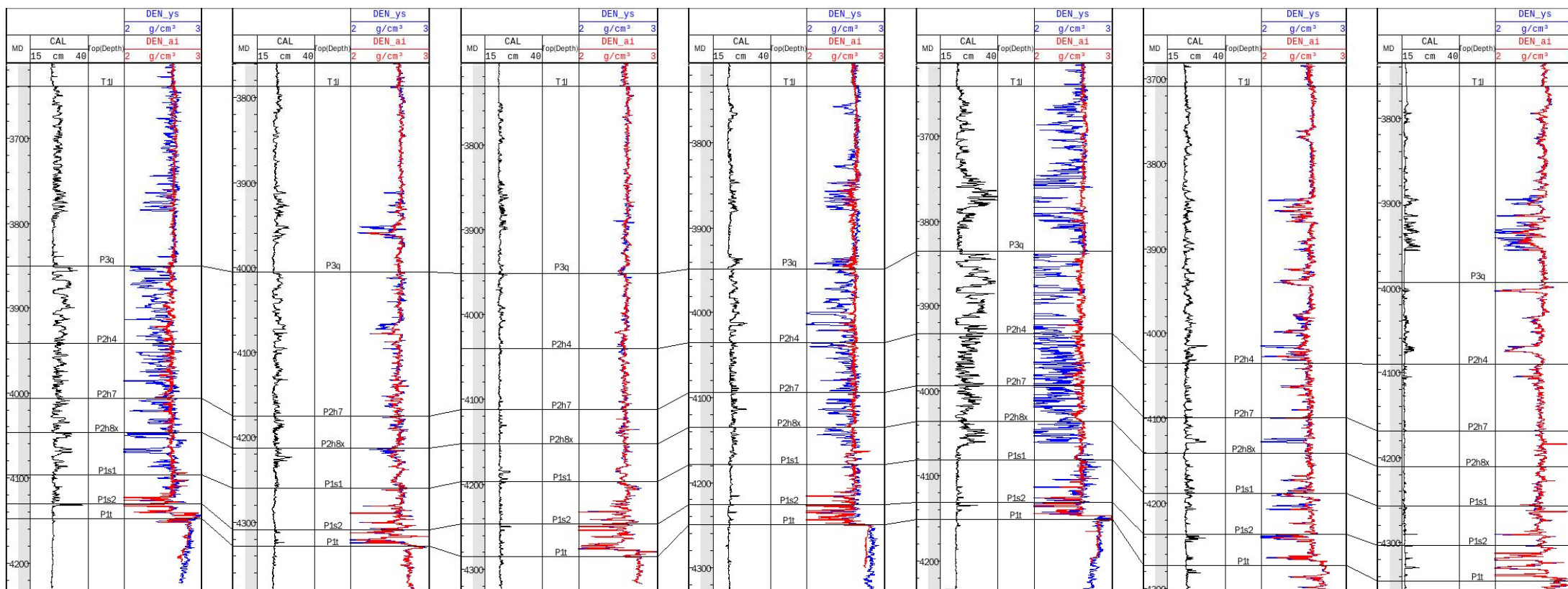


## 2、AI方法 (适用于所有岩性)

智能曲线填充

原始密度曲线

智能井径校正后

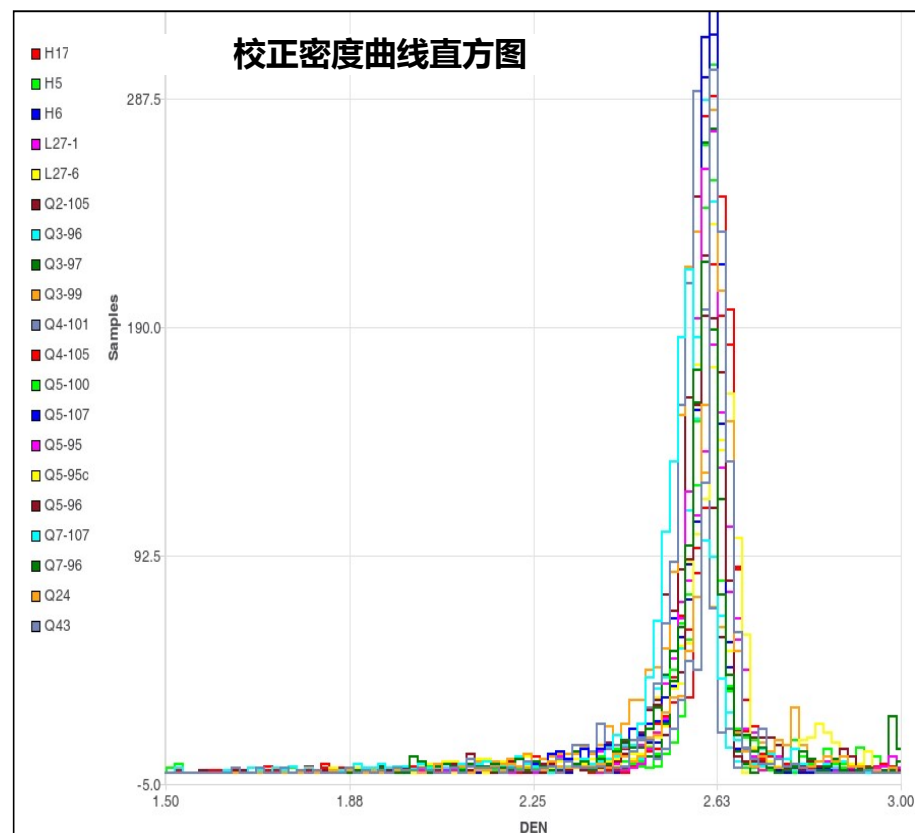
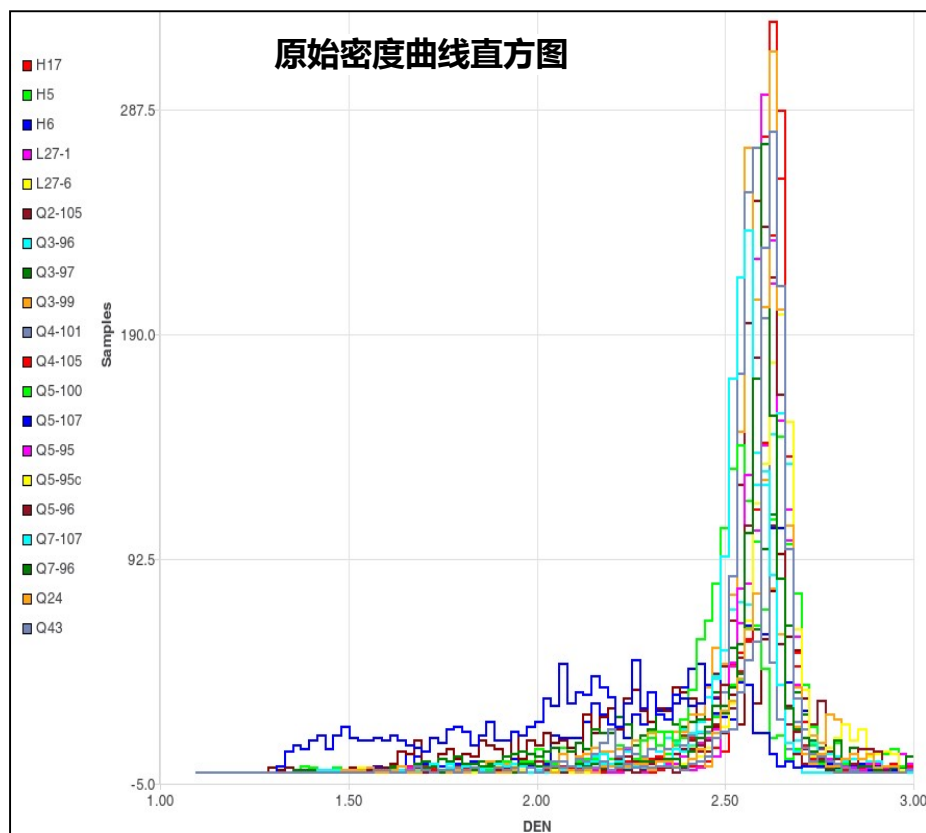




### 三、井曲线校正

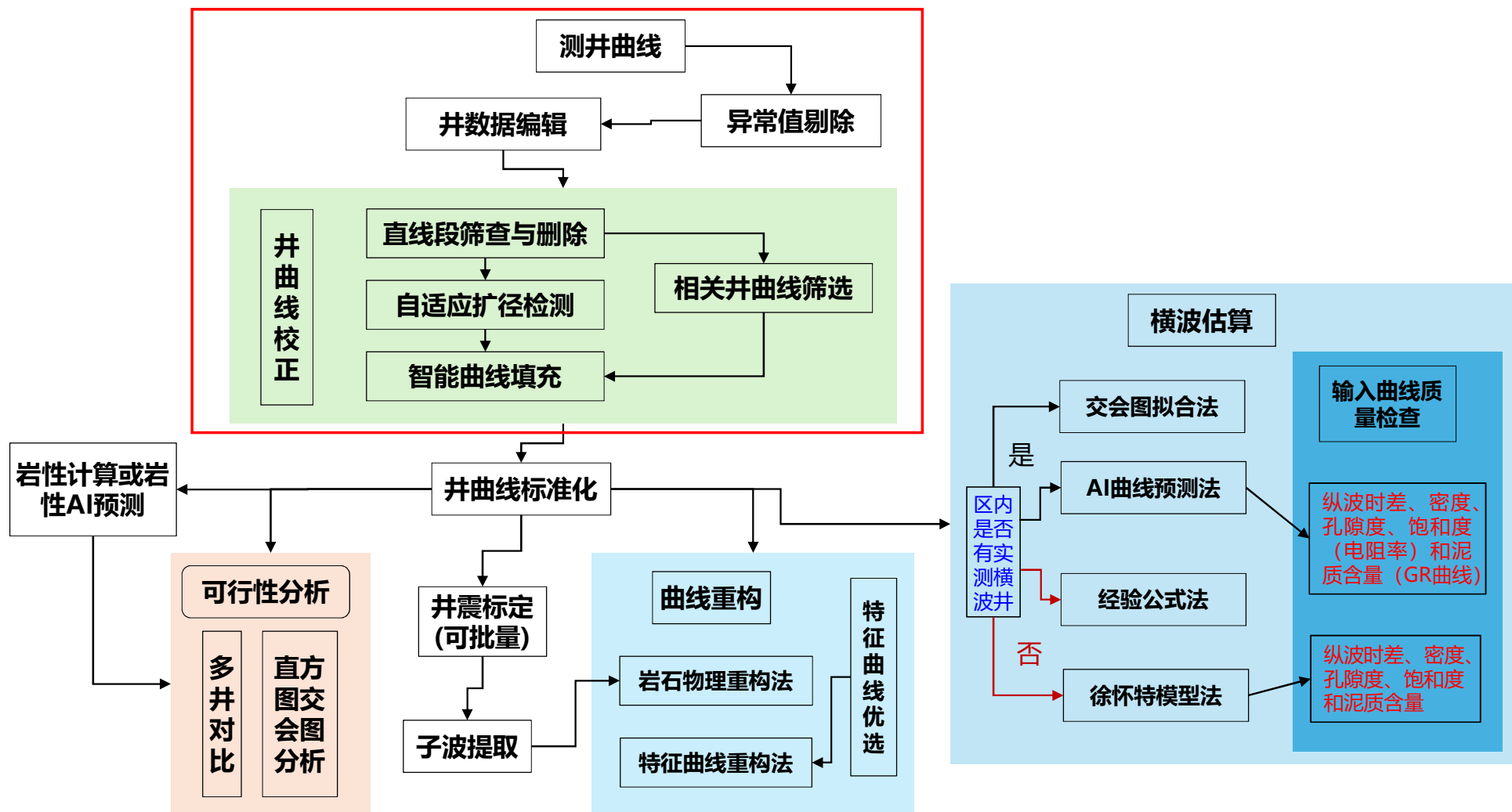


#### 2、AI方法 (适用于所有岩性)





# 测井数据预处理——推荐流程图





# 感谢大家对GeoEast软件的 信任和支持!

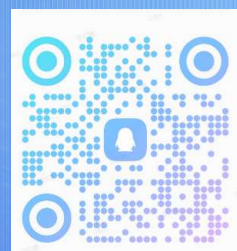
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