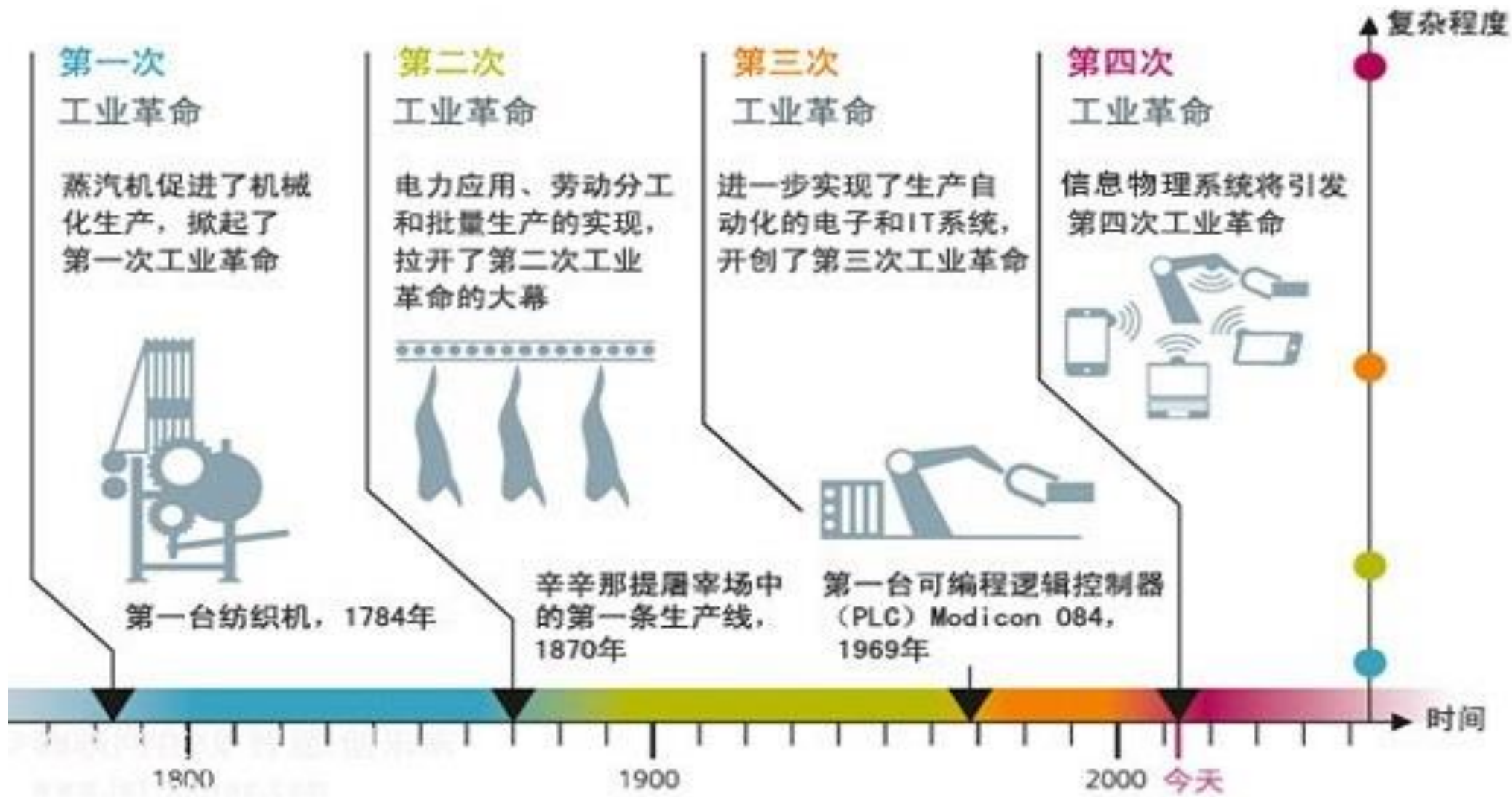


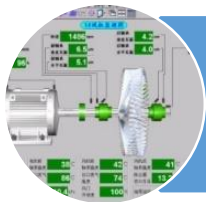
iEM System 培训

(一) 基础

2019

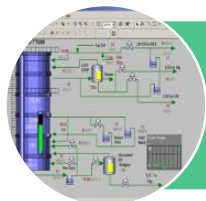


工业设备管理现状



实时监控系统：DCS/SCADA/TDM

单参数



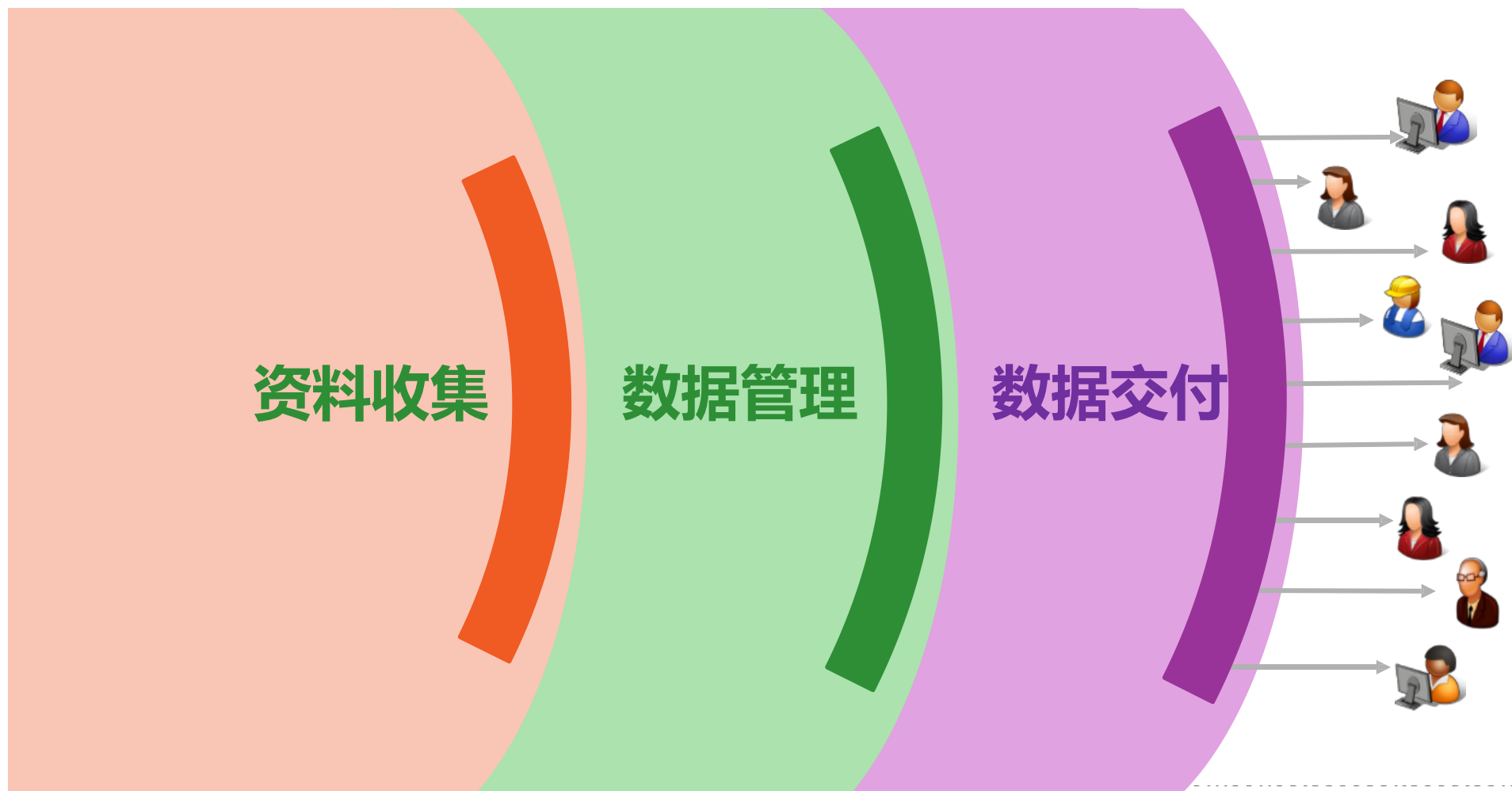
实时信息系统：RTDBMS/MES/PIMS

人工

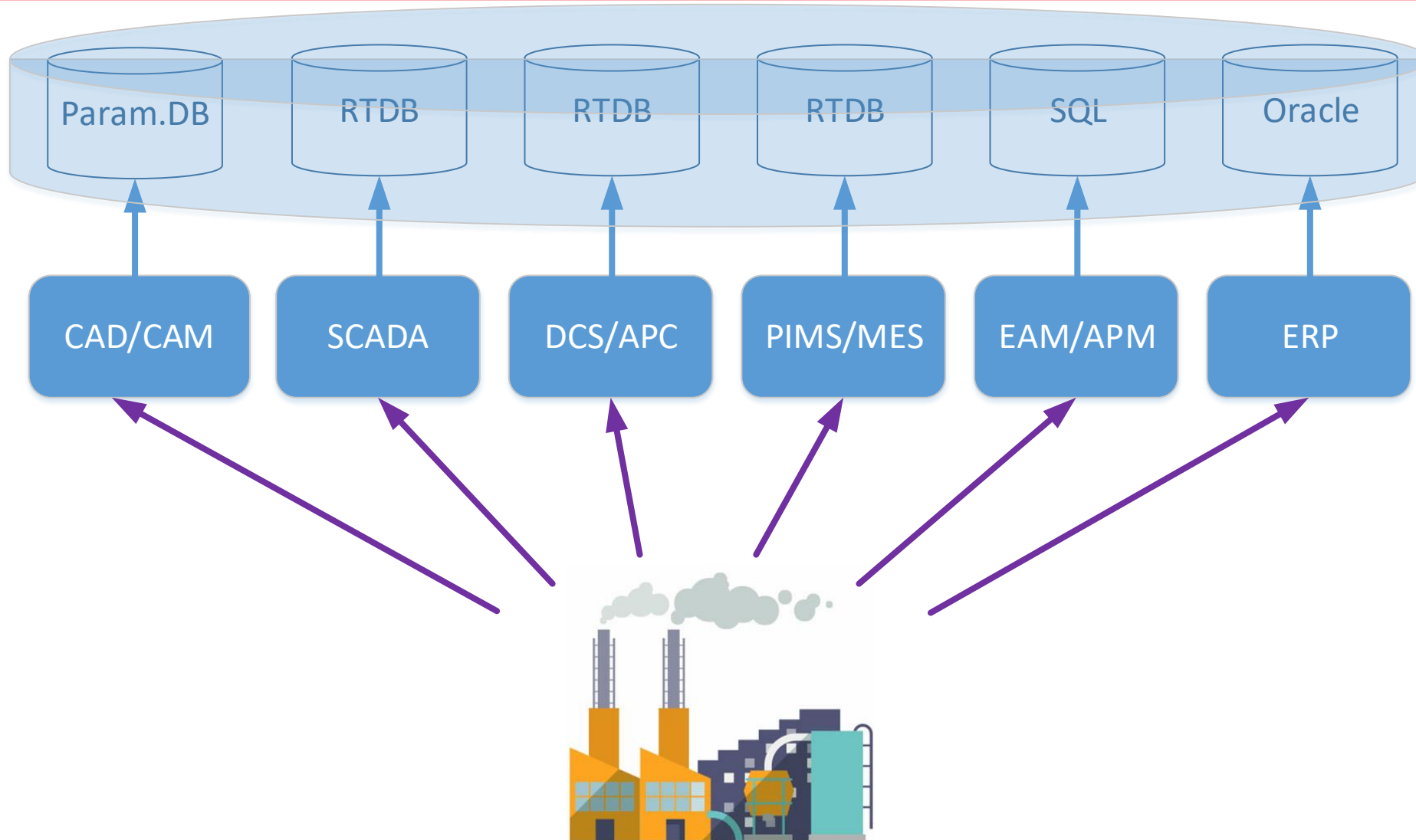


资产管理系统：EAM/巡检点检系统

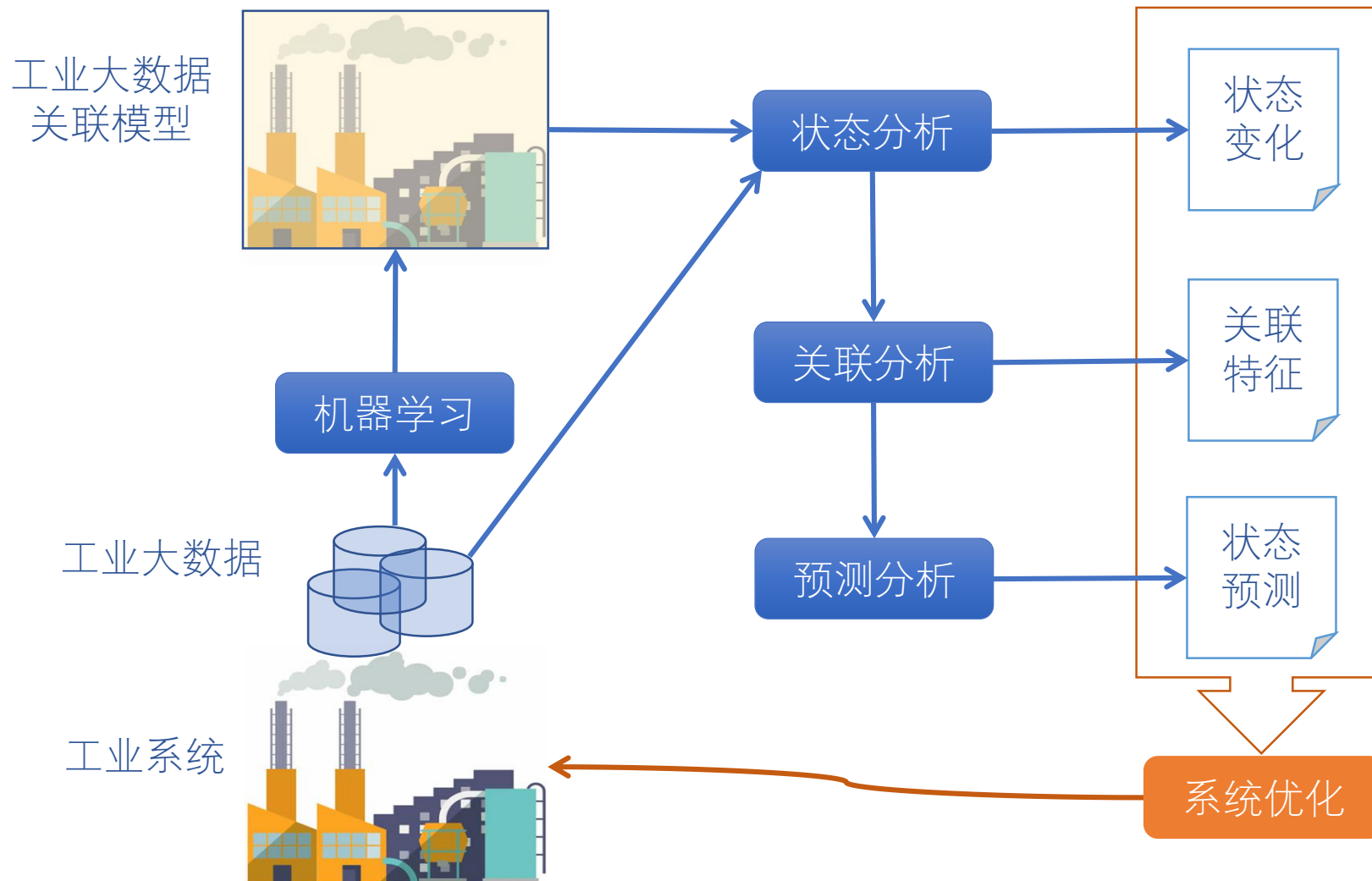
事后



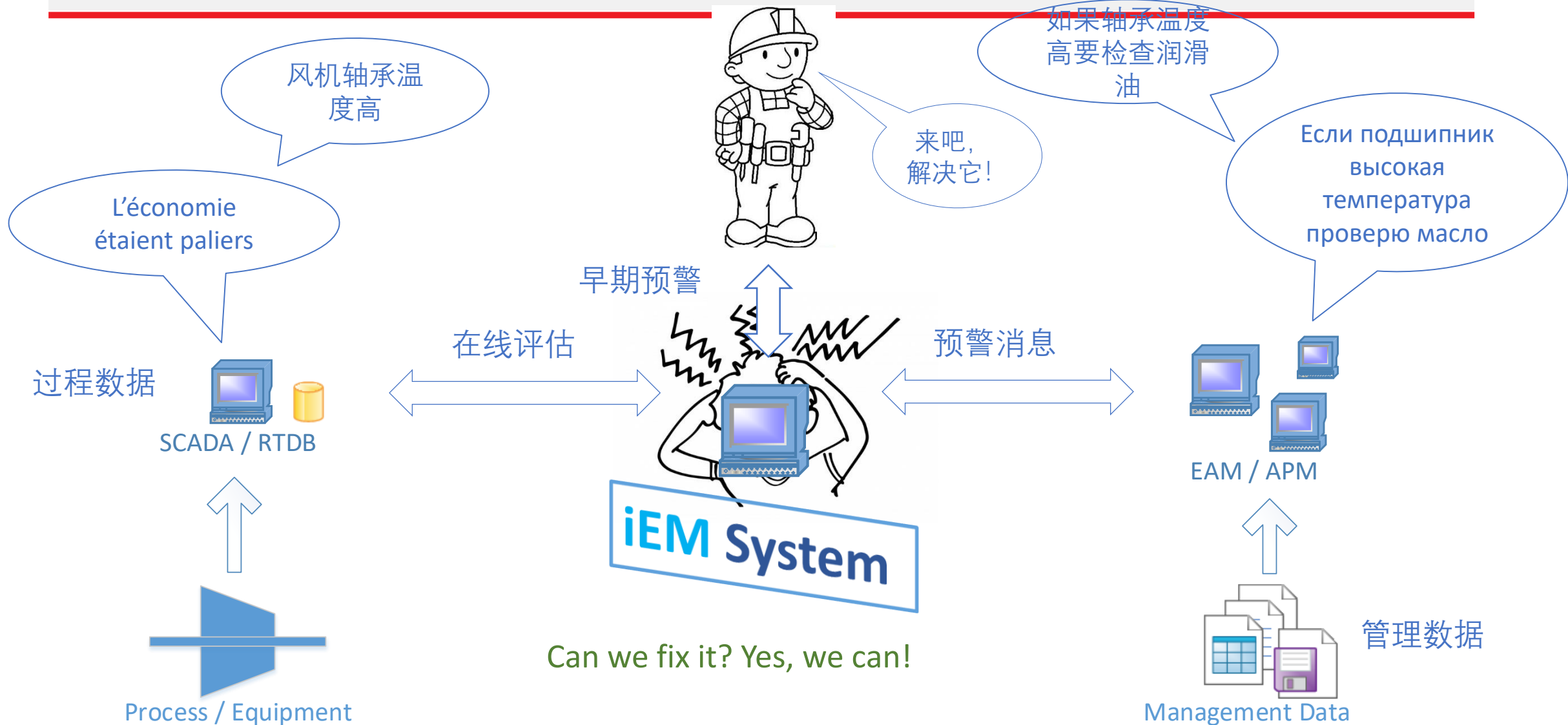
工业大资料的主要来源



工业大数据技术解决什么问题



iEM System 打通孤立系统



iEM System 启动数据资产



3年



5年



8年



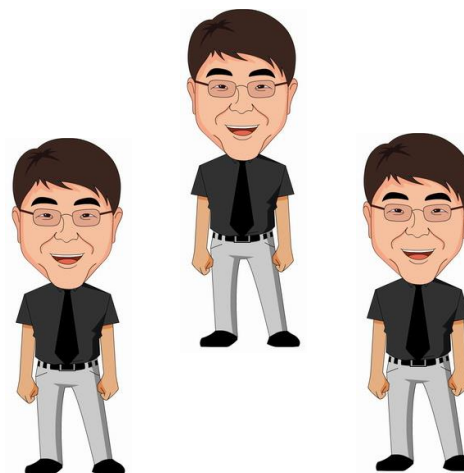
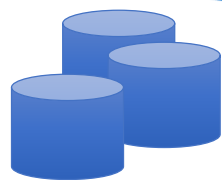
学习听懂机器的话

机器在说话



iEM System

基本经验
一年数据

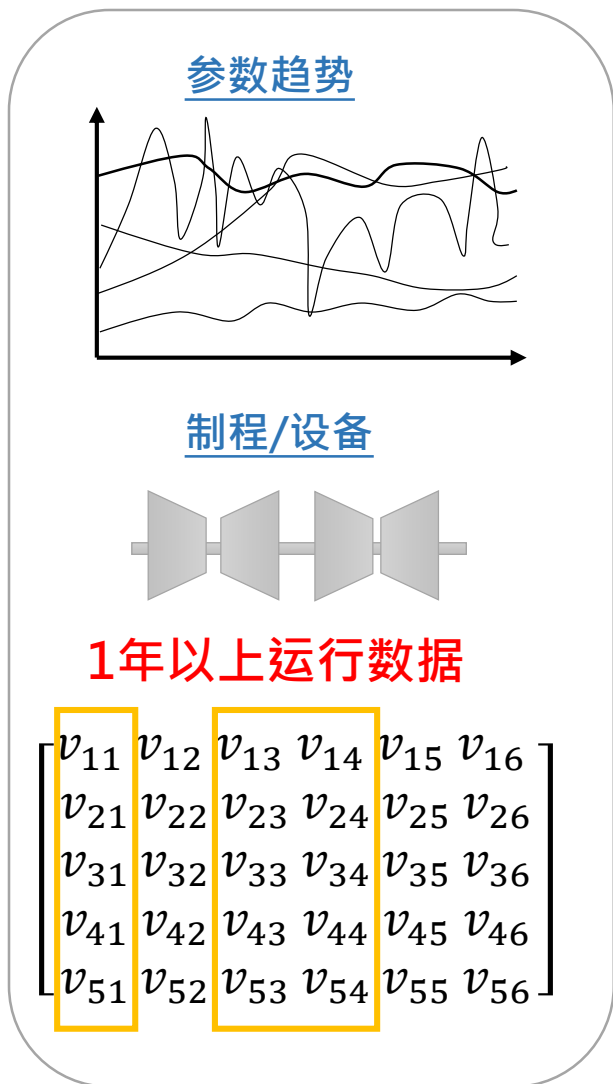


让普通人快速成为专家

机器学习
知识归集
感知模型

“超球” 发明专利工业大数据技术

参数视角



$$H_v = 80\%$$

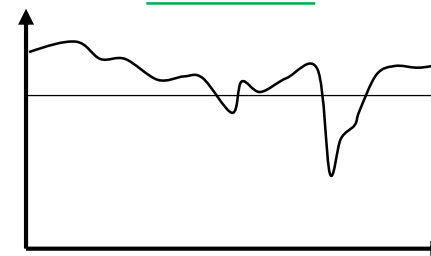
在线评估

$$\begin{bmatrix} v_1 \\ v_2 \\ v_3 \\ v_4 \\ v_5 \end{bmatrix}$$

超球建模

历史资料

HPI 趋势



$$\begin{bmatrix} C_1 \\ C_2 \\ C_3 \\ C_4 \\ C_5 \end{bmatrix}$$

$$H_{th} = 97\%$$

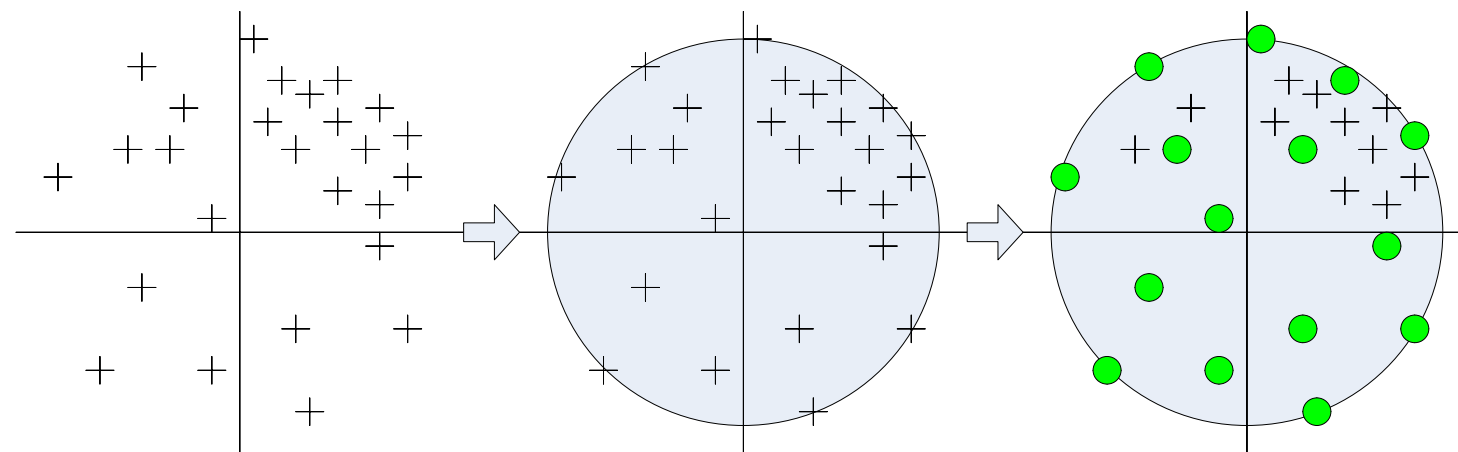
超球模型



$$\begin{bmatrix} v_{11} & v_{13} & v_{14} \\ v_{21} & v_{23} & v_{24} \\ v_{31} & v_{33} & v_{34} \\ v_{41} & v_{43} & v_{44} \\ v_{51} & v_{53} & v_{54} \end{bmatrix}$$

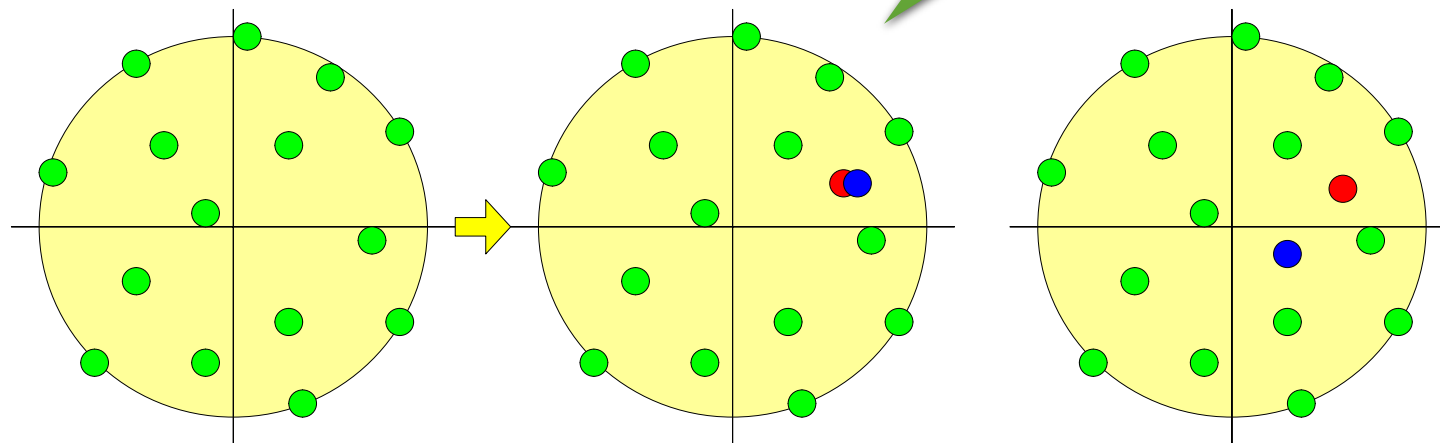
工业大数据
视角

超球相似原理



在线实时评估

历史资料建模



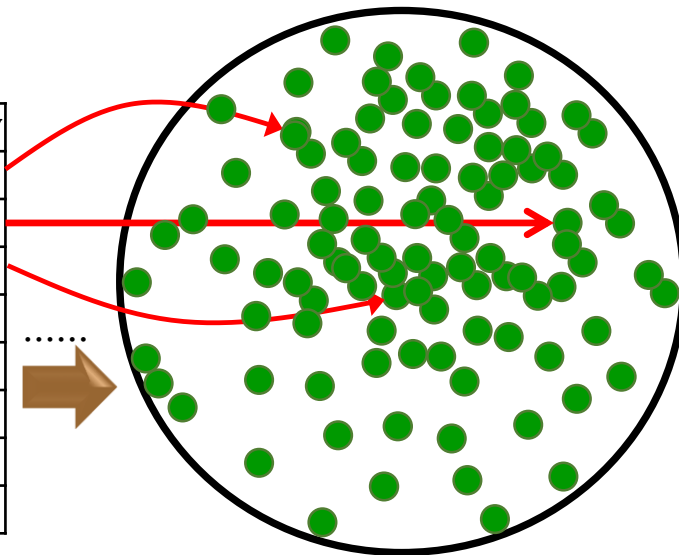
intelligent Equipment Management System (iEM系统) (中瑞泰科技专利)

超球模型建模步骤一：

将清洗后同一时间控制点数据视为一个状态点，投射至空间中。

时间	MBUO_FR2201.PV	MBUO_FR2202.PV	MBUO_PE2110.PV	MBUO_FFICR2208.PV
2016/11/15 01:00:00	6804.48	8198.4	41.827	1.198
2016/11/15 01:05:00	6802.43	8196.6	41.938	1.20227
2016/11/15 01:10:00	6805.92	8176	41.8652	1.1976
2016/11/15 01:15:00	6800.01	8206.8	41.909	1.20233
2016/11/15 01:20:00	6800.96	8224.6	41.7425	1.1992
2016/11/15 01:25:00	6797.86	8244.8	41.8422	1.2026
2016/11/15 01:30:00	6803.34	8216.2	41.8465	1.1988
2016/11/15 01:35:00	6800.29	8234.4	41.847	1.202

⋮

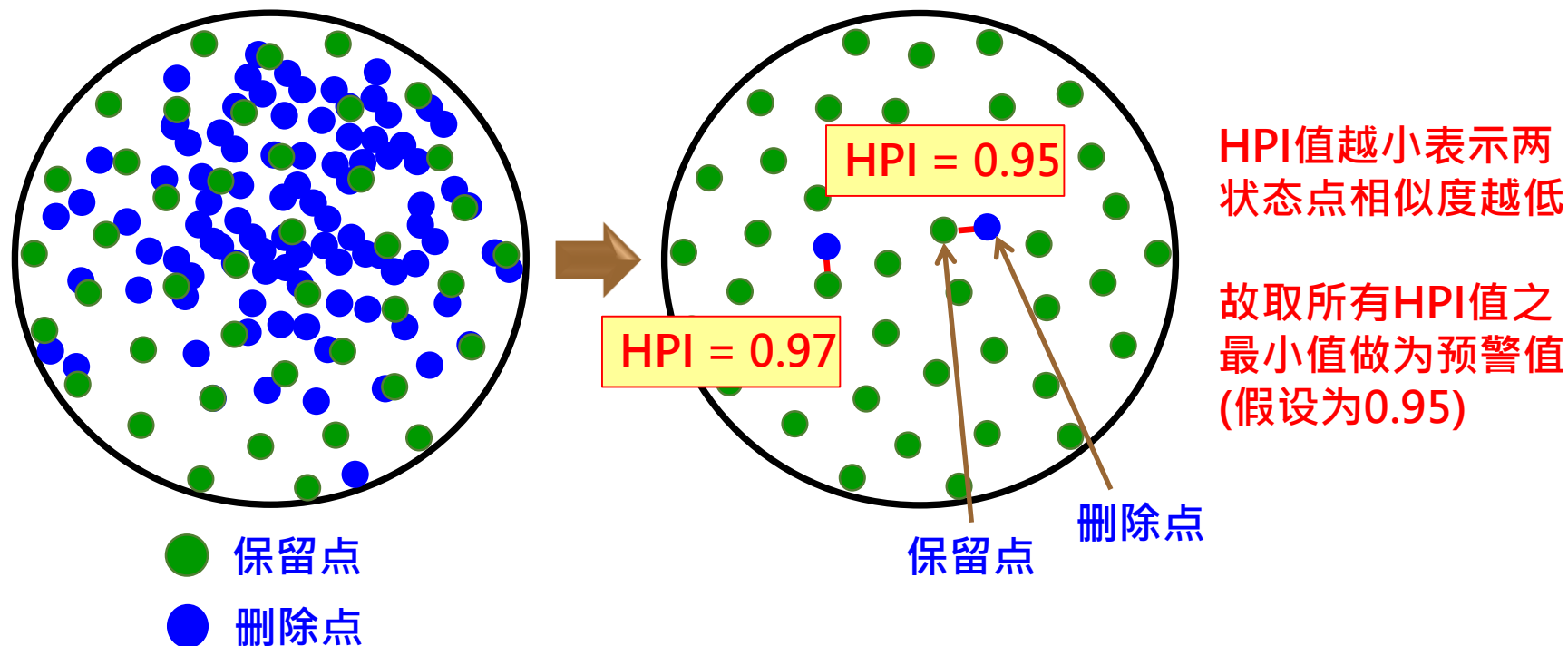


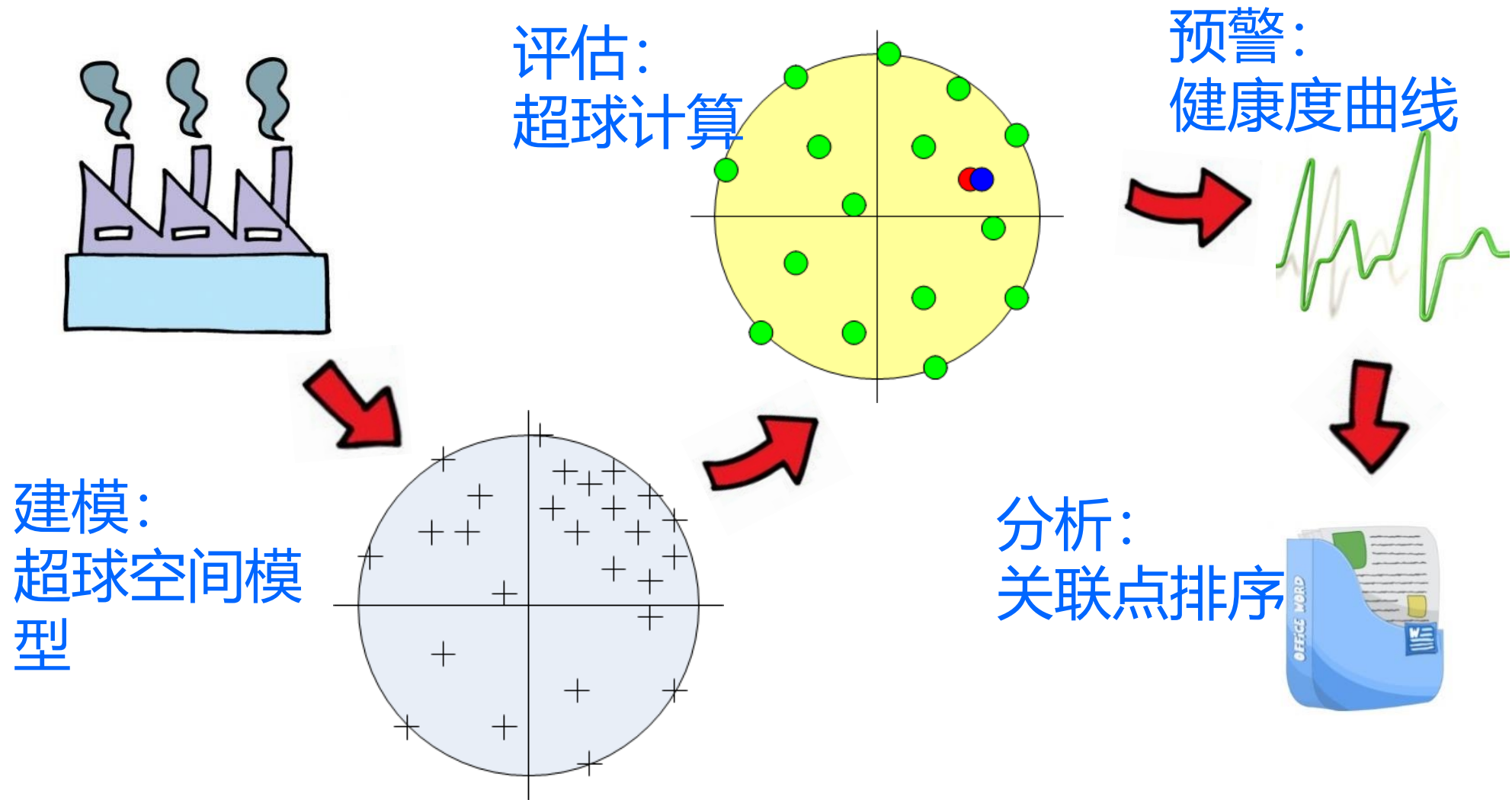
超球模型建模步骤二：

模型将自己于空间中均匀选择保留状态点(删除掉7成状态点)。

超球模型建模步骤三：

将所有删除掉的状态点进行回填，计算所有回填状态点的**健康度(HPI)**数值(范围0-1)。



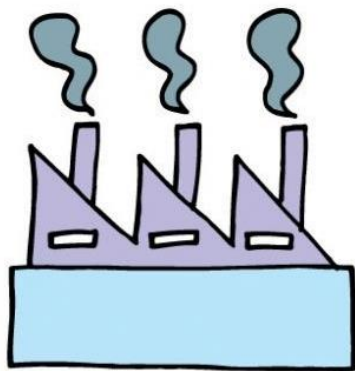


iEM System 实现



在线评估设备状态

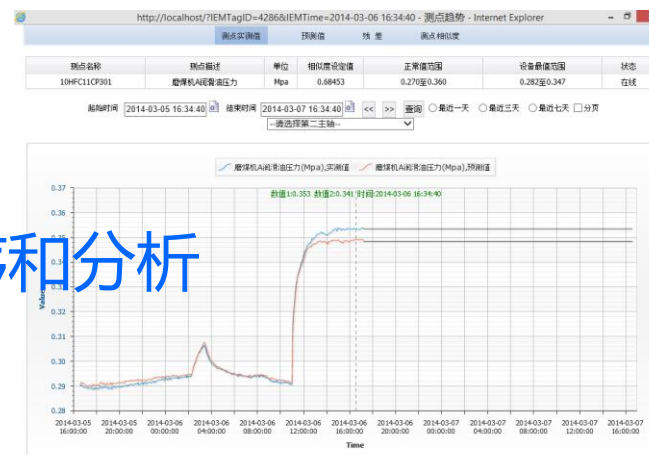
一条相似度曲线

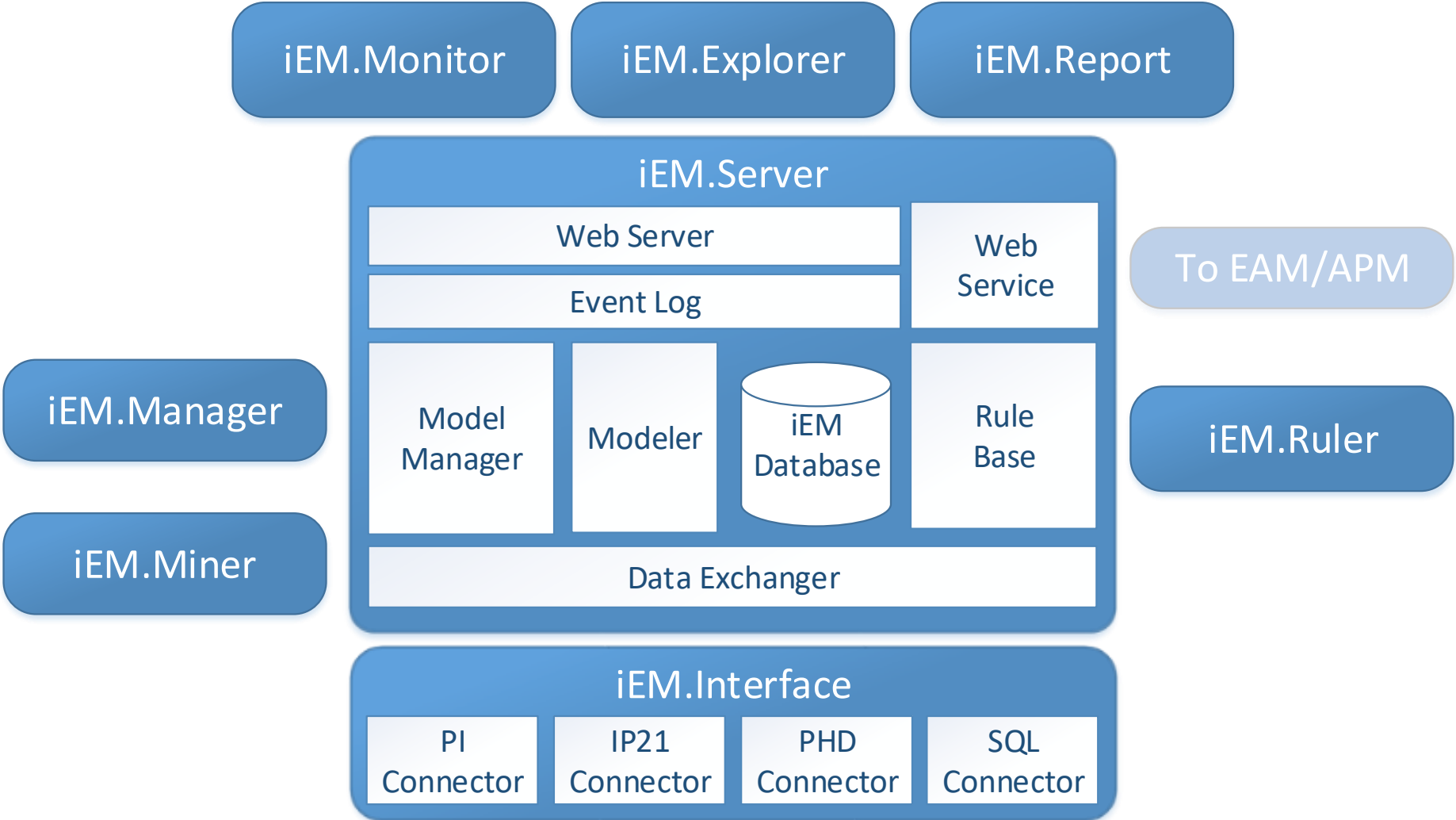


测点名称	测点描述	单位	相似点	正常范围	设备数值范围	状态
10#FC1C091	磨煤机入口磨盘压力	Mpa	0.68453	0.270至0.360	0.282至0.347	在线

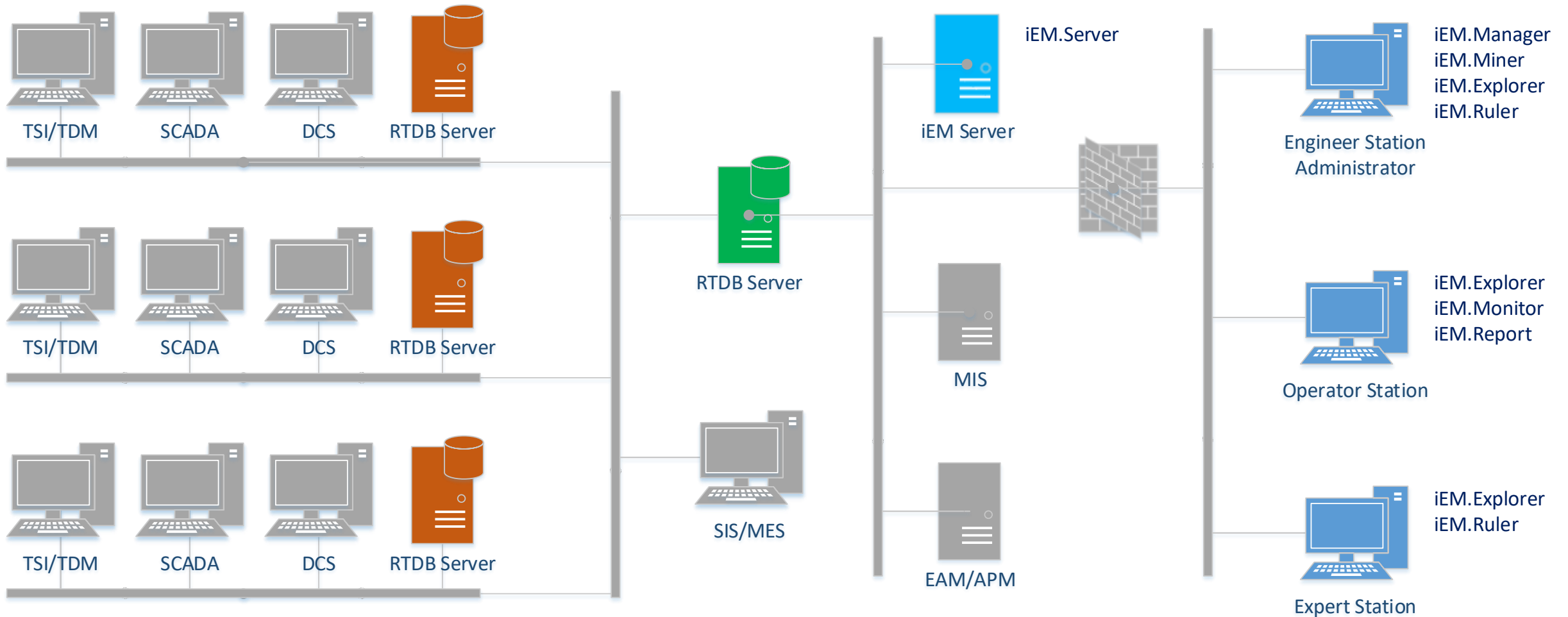
根据设备测点的历史资料建模

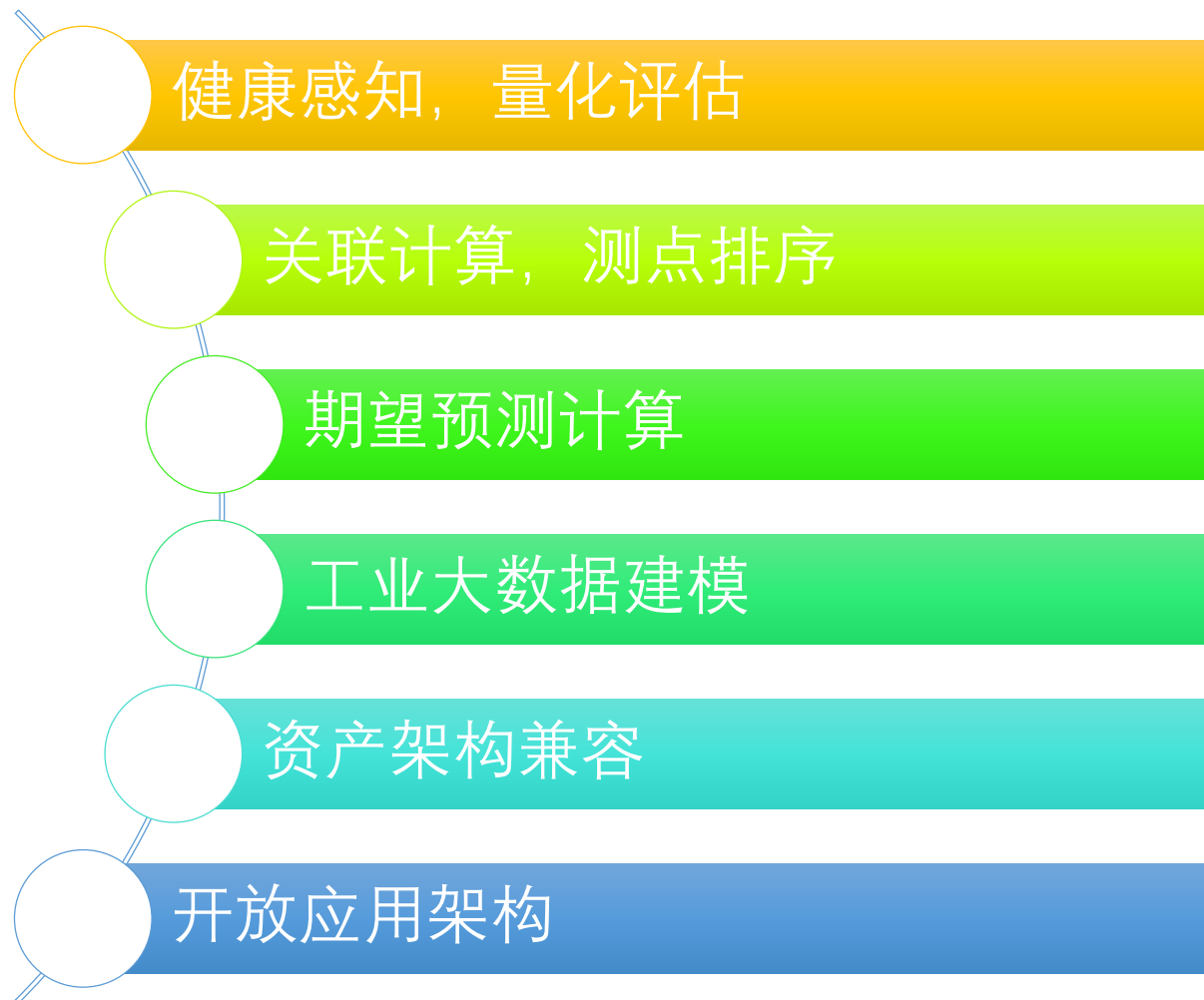
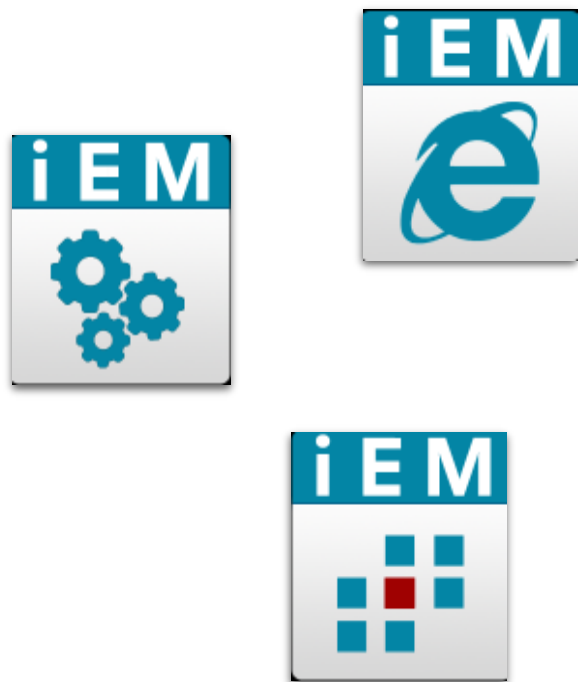
关联点排序和分析



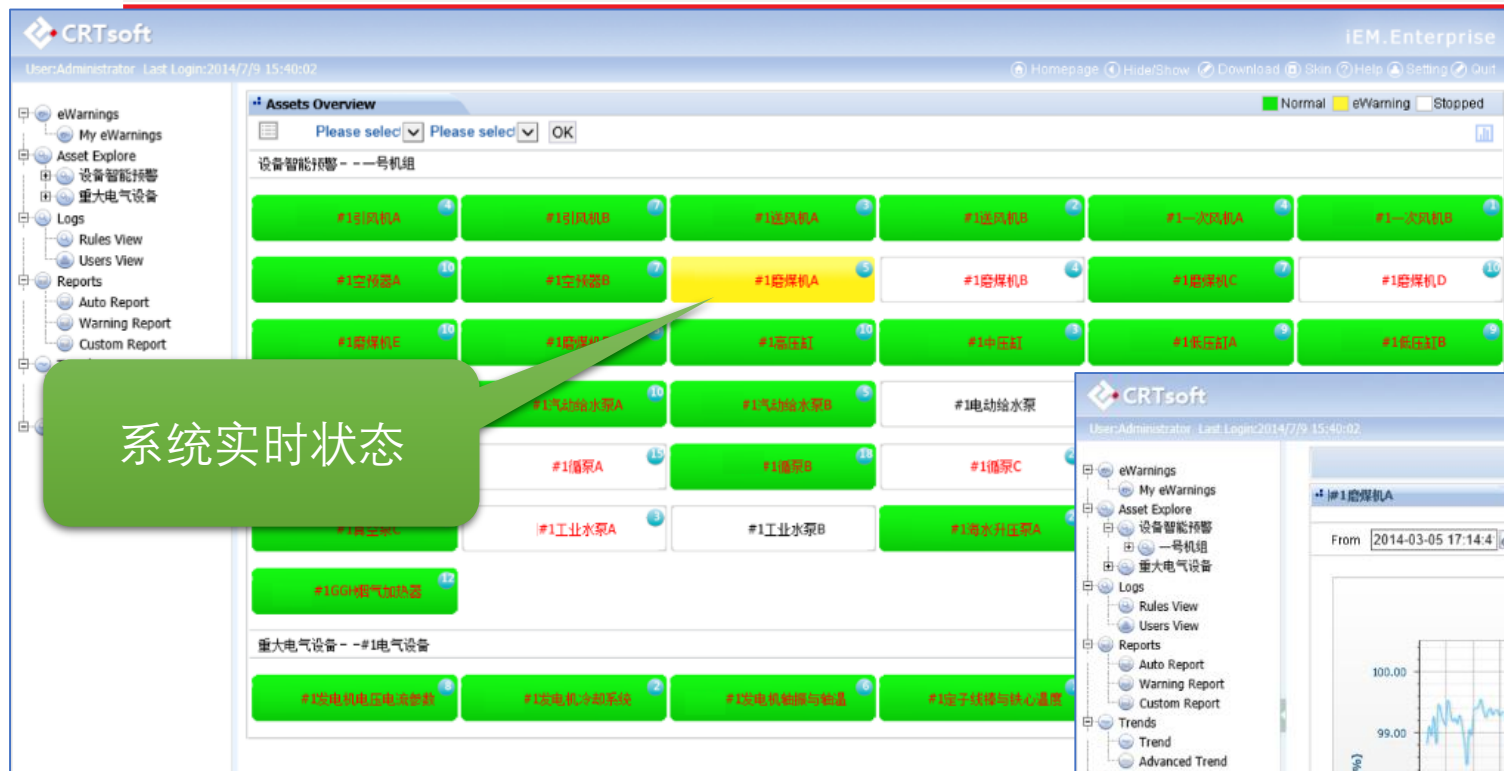


iEM System 系统架构





技术特点：健康感知，量化评估



- 在线健康感知

- 健康度量量化评估



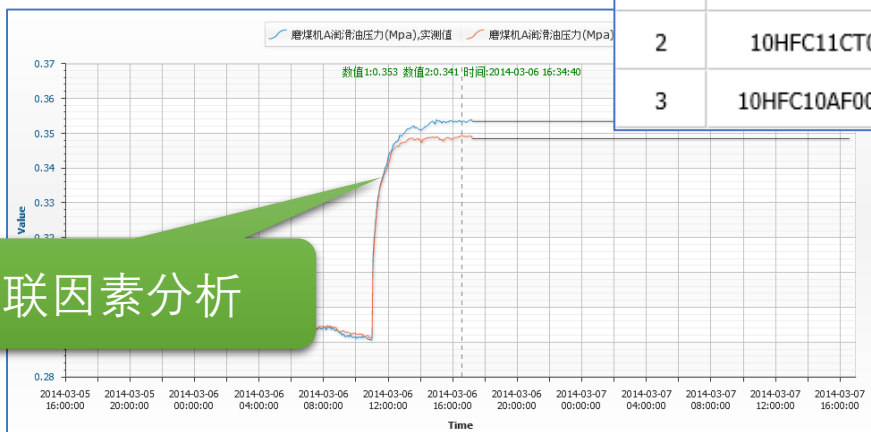
技术特点：关联计算，测点排序



- 关联因素识别
- 主关联测点排序
- 关联测点分析

关联点详情

序号	测点名称	测点描述	单位	测量值	正常值范围	模型最佳范围	状态	时间	趋势显示
1	10HFC11CP301	磨煤机A润滑油压力	Mpa	0.353	0.27至0.36	0.282至0.347	在线	2014-03-06 16:34:40	趋势查询
2	10HFC11CT002	磨煤机A润滑油温度	DEG	31.386	29至48	32.395至45.541	在线	2014-03-06 16:34:40	趋势查询
3	10HFC10AF001CS	磨煤机A动态分离器电机转速	rpm	811.035	740至1048	784.18至1003.448	在线	2014-03-06 16:34:40	趋势查询



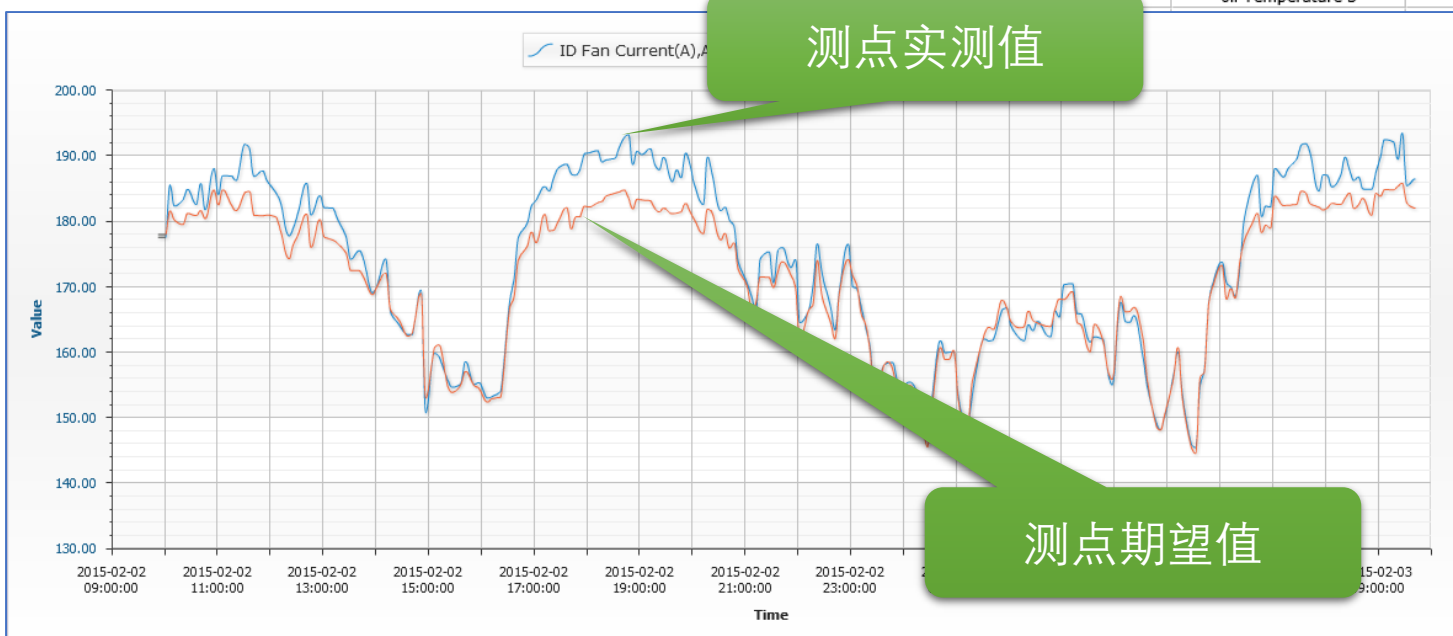
关联因素排序

技术特点：期望值计算

- 设备期望状态
- 测点期望值

No.	Select	Tag Name	Description	Unit	Actual	Expected	Allowed Range	Range	State	Trends	Settings
1	<input type="checkbox"/>	DCS01:FC1006DYFJ1	ID Fan Current	A	183.223	178.804	61 to 200	70.426 to 188.496	Online		
2	<input type="checkbox"/>	DCS01:FC1003DYFJ1	ID Fan Outlet Pressure	kPa	1.848	1.873	-1 to 2	-0.028 to 1.941	Online		
3	<input type="checkbox"/>	DCS01:1ECS012:AIN11216_6.PNTYFJ1	ID Fan Horizontal Vibration	mm/s	1.608	1.5	0.01 to 7	0.712 to 6.828	Online		
4	<input type="checkbox"/>	DCS01:1ECS012:AIN11213_3.PNTYFJ1	ID Fan Vertical Vibration	mm/s	0.922	0.912	0.01 to 7	0.012 to 6.028	Online		
5	<input type="checkbox"/>	DCS01:RT1074707YFJ1	ID Fan Electromotor Bearing Temperature 1	DEG C	41.66	42.387	11 to 67	11.000 to 66.474	Online		
6	<input type="checkbox"/>	DCS01:RT1074807YFJ1	ID Fan Electromotor Bearing Temperature 2	DEG C	43.953	43.456	3 to 67	3.000 to 66.474	Online		
7	<input type="checkbox"/>	DCS01:T3915HYFJ1	ID Fan Electromotor Stator Coil Temperature 1	DEG C	67.771	67.393	20 to 85	28.707 to 77.514	Online		
8	<input type="checkbox"/>	DCS01:T3930HYFJ1	ID Fan Electromotor Stator Coil Temperature 2	DEG C	65.693	65.487	24 to 85	33.405 to 78.956	Online		
9	<input type="checkbox"/>	DCS01:T3931HYFJ1	ID Fan Electromotor Stator Coil Temperature 3	DEG C	66.693	66.577	22 to 83	31.395 to 76.592	Online		
					66.485	66.21	21 to 80	29.97 to 76.202	Online		
					66.251	66.109	26 to 86	34.658 to 77.39	Online		
					68.538	68.166	19 to 78	27.968 to 77.813	Online		
					58.976	58.664	22 to 76	25.239 to 75.761	Online		
					59.431	58.963	16 to 76	24.701 to 75.825	Online		
					58.47	58.001	15 to 77	24.279 to 75.683	Online		
					53.481	54.139	15 to 78	18.679 to 71.616	Online		
					57.288	57.436	15 to 78	18.796 to 72.292	Online		

设备期望状态

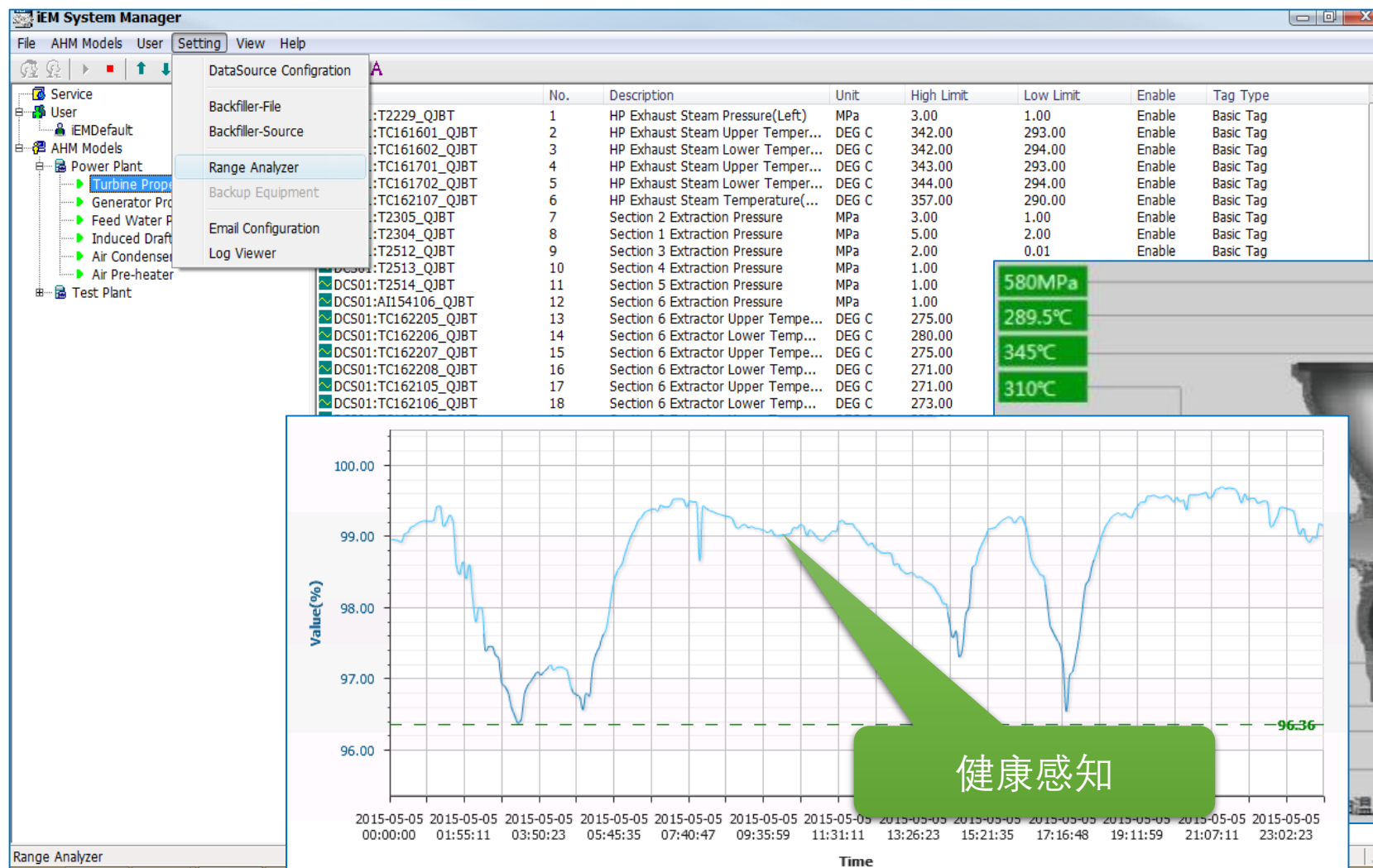


测点实测值

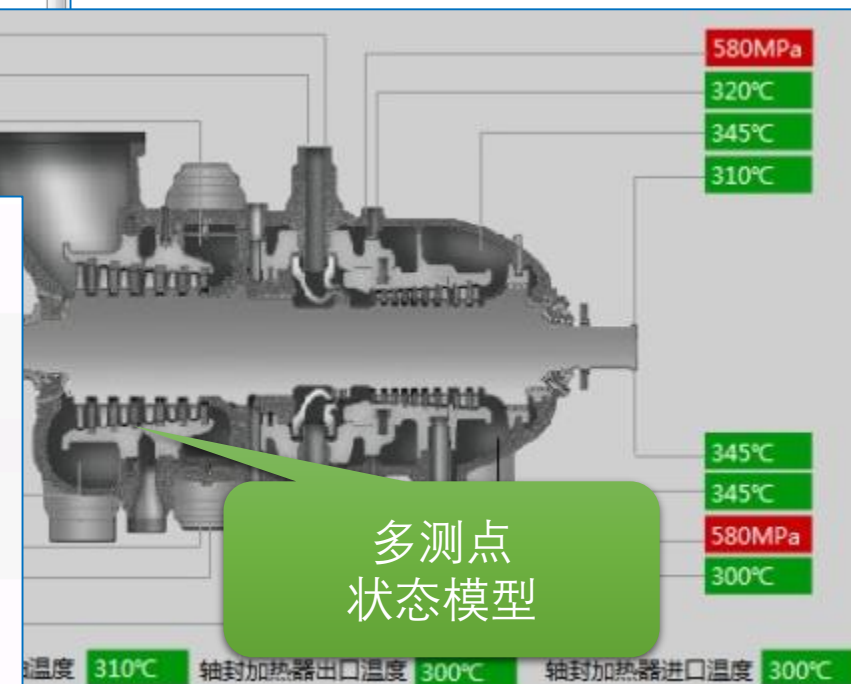
测点期望值

- 在线期望值

技术特点：工业大数据建模



- 基于工业大数据
- 状态感知模型



技术特点：资产架构兼容

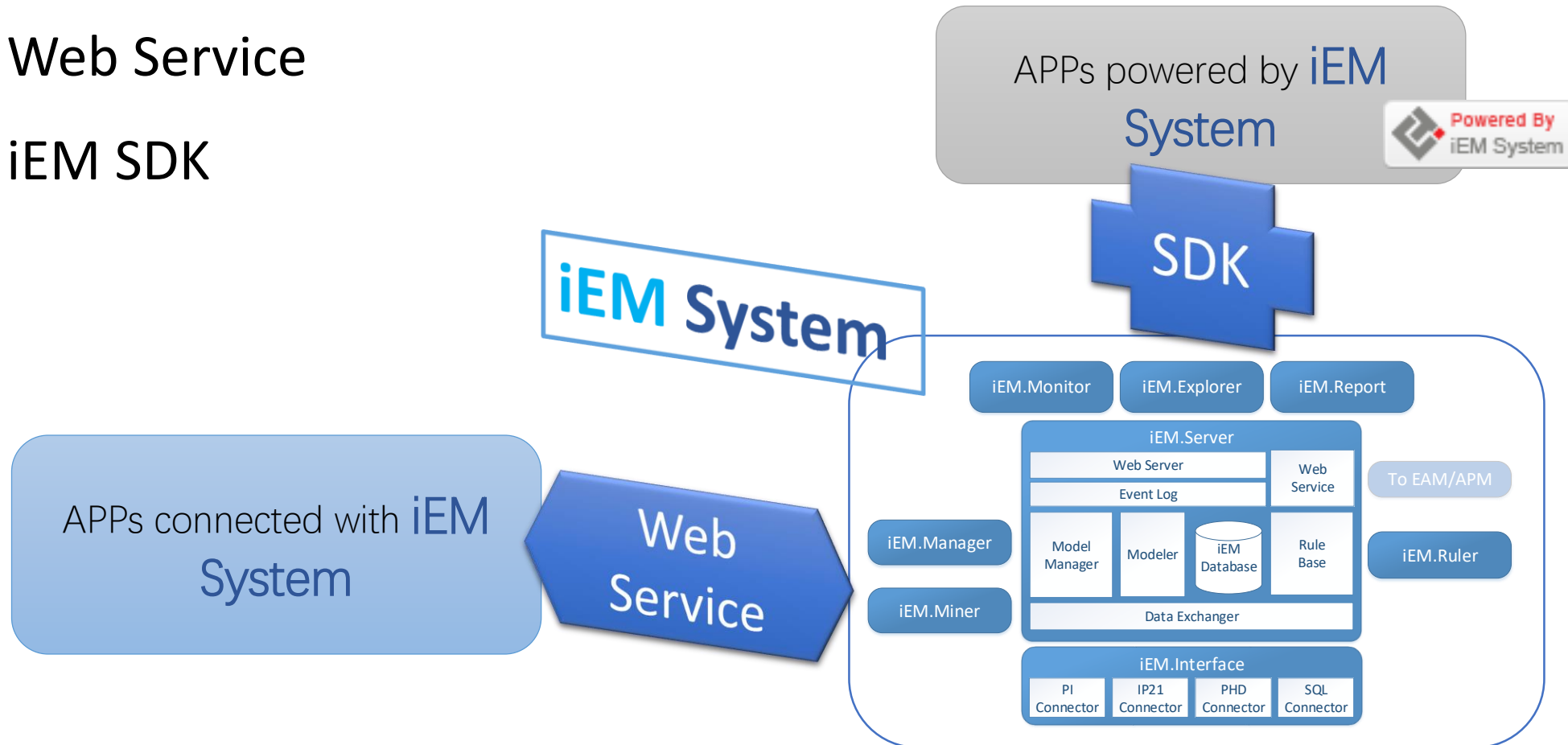
The screenshot displays the iEM System Manager application and its corresponding web interface. The System Manager window shows a tree view of assets for '铜街子水电站' (Tongjieshan Hydropower Station), including '11号机组' (Unit 11) and '12号机组' (Unit 12), with sub-items like '11号水轮机' (Turbine) and '11号发电机' (Generator). A red box highlights this tree structure. The web interface shows a table of monitoring points (测点) with columns for name, serial number, description, source name, main label, upper limit, and lower limit. A second red box highlights the '11号机组' and '12号机组' sections in the web interface's asset tree, demonstrating how the system maintains a consistent hierarchical structure across different layers.

测点名称	序号	测点描述	源测点名称	主次标识	稳态值上限	稳态值下限
TJZ11_005	1	水导X向摆度(μm)	TJZ11_005	因变测点	652.00	114.00
TJZ11_006	2	水导Y向摆度(μm)	TJZ11_006	因变测点	732.00	127.00
TJZ11_013	3	顶盖X向水平振动(μm)	TJZ11_013	因变测点	108.00	-16.00
TJZ11_014	4	顶盖Y向水平振动(μm)	TJZ11_014	因变测点	178.00	0.68
TJZ11_015	5	顶盖Z向垂直振动(μm)	TJZ11_015	因变测点	133.00	-9.00
TJZ11_022	6	蜗壳进口压力(kPa)	TJZ11_022	因变测点	373.00	292.00
TJZ11_023	7	尾水管出口压力(kPa)	TJZ11_023	因变测点	169.00	133.00
TJZ11_025	8	顶盖下压力(kPa)	TJZ11_025	因变测点	3.00	0.48
TJZ11_027	9	蜗壳差压(kPa)	TJZ11_027	因变测点	8.00	-0.53

- 资产视角
- 多层架构

技术特点：开放应用架构

- Web Service
- iEM SDK



中瑞泰科技



Q&A

