

# 研究生考核报告

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专业：计算机技术  
时间：2025.4.29

# 主要内容

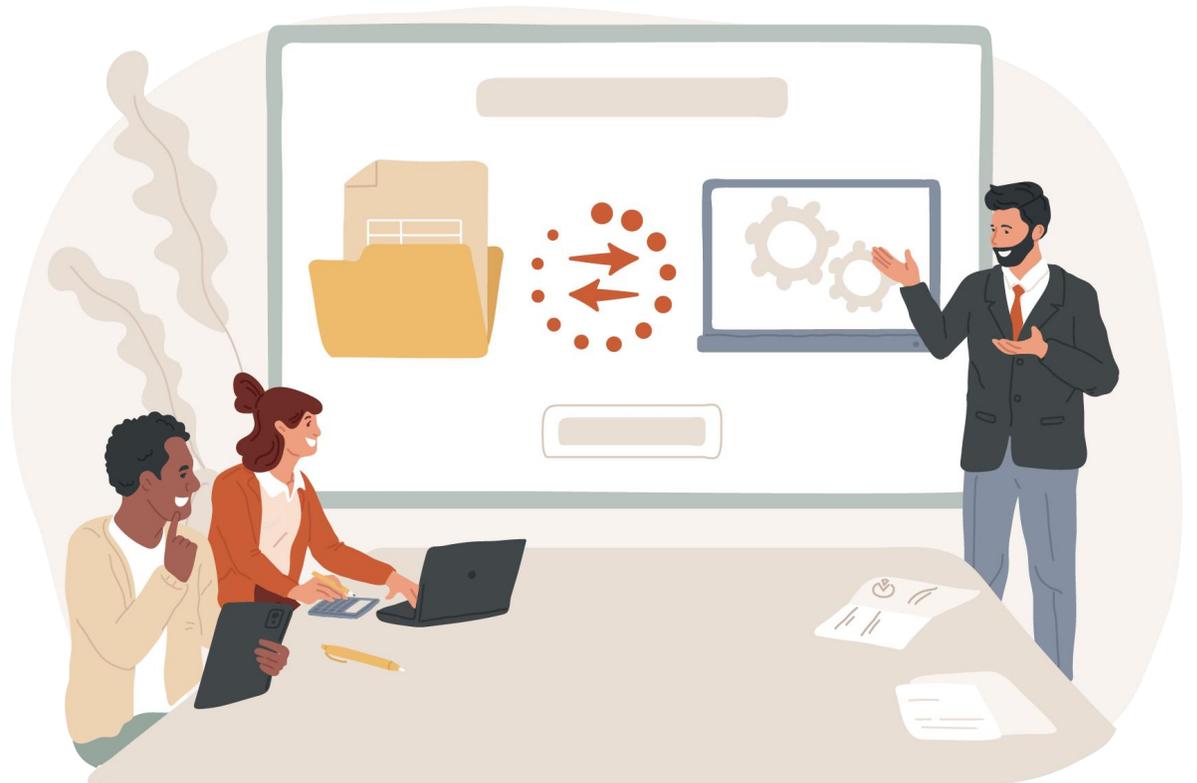
## ■ 一. 工程应用

- JUNO SIM 开发
- JUNOShift 更新
- TDC 联调、开发与测试

## ■ 二. 课题研究

- Schephy资源监测模块开发
- 实现新架构下WFCTA的运行
- 参加杭州LHAASO智能化会议

## ■ 三. 下一步计划



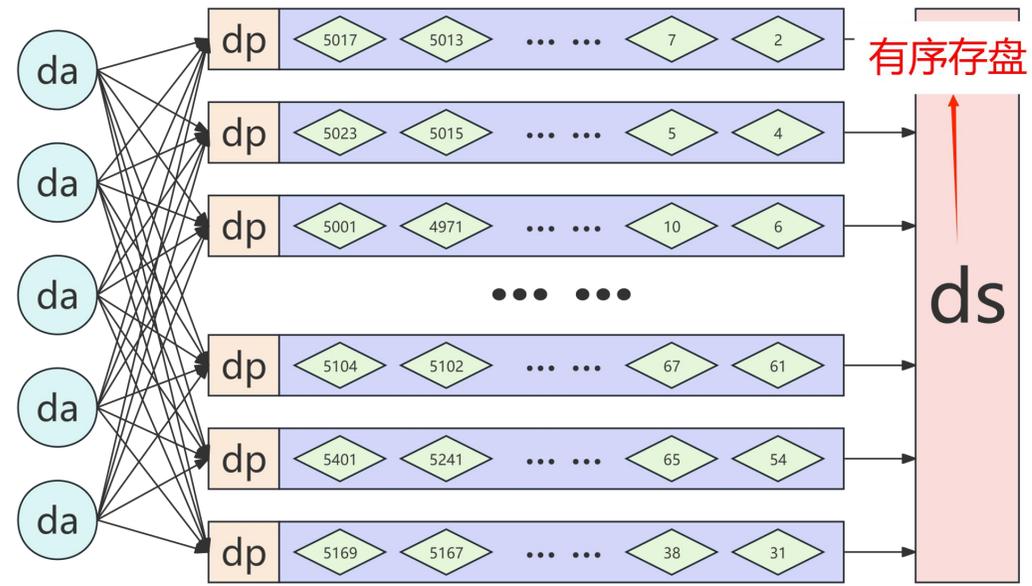
```
zhangmx@hunt01:~/work/test_juno/sim-juno$ python3 main.py
['/home/zhangmx/work/test_juno/sim-juno', '/usr/lib/python310.zip', '/usr/lib/python3.10', '/usr/lib/python3.10/lib-dynload', '/usr/lib/python3/dist-packages']
0:00:00.010000
EB节点初始化完成
PS节点初始化完成
ES节点初始化完成
虚拟时钟初始化完成
请输入想要模拟运行的时间（单位为小时）：24
模拟开始时间： 2025-04-28 18:37:36.596067
模拟结束时间： 2025-04-29 18:37:36.596067
实际结束时间： 2025-04-28 19:11:17.960984
加速比： 42.743394902144594
PS节点信息：
PS_node 1: PS_id=1, buffer_length=200, using_buffer_length=27, dealing_buffer_length=27, buffer_using_perc=13.5
PS_node 2: PS_id=2, buffer_length=200, using_buffer_length=19, dealing_buffer_length=28, buffer_using_perc=9.5
PS_node 3: PS_id=3, buffer_length=200, using_buffer_length=26, dealing_buffer_length=27, buffer_using_perc=13.0
PS_node 4: PS_id=4, buffer_length=200, using_buffer_length=27, dealing_buffer_length=27, buffer_using_perc=13.5
...
PS_node 32: PS_id=32, buffer_length=200, using_buffer_length=25, dealing_buffer_length=25, buffer_using_perc=12.5
PS_node 33: PS_id=33, buffer_length=200, using_buffer_length=26, dealing_buffer_length=26, buffer_using_perc=13.0
PS_node 34: PS_id=34, buffer_length=200, using_buffer_length=22, dealing_buffer_length=22, buffer_using_perc=11.0
PS_node 35: PS_id=35, buffer_length=200, using_buffer_length=21, dealing_buffer_length=21, buffer_using_perc=10.5
 saves 占用内存MB: 9088.445602416992
```

## 系统初始化

加速比43

空间占用

程序运行状态

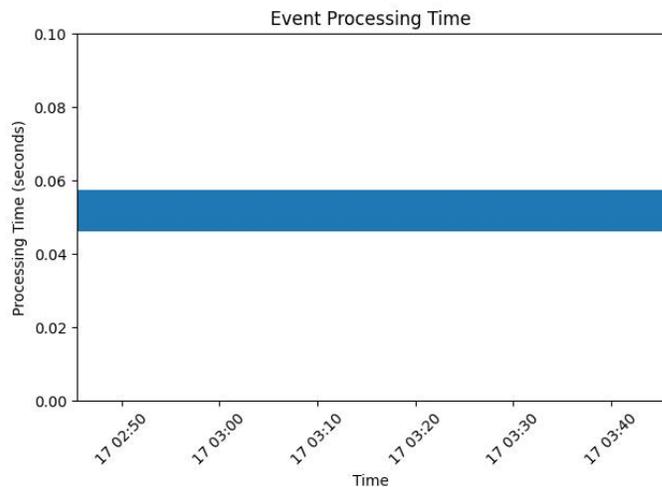


JUNO SIM的程序流程图

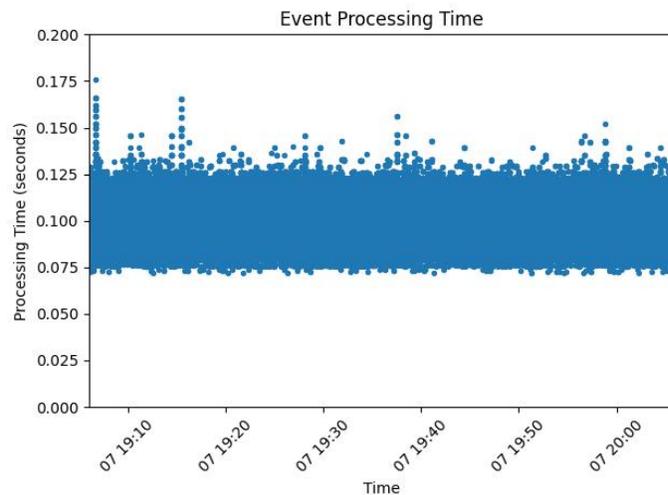
- 可配置参数
  - 时间片大小
  - buffer大小
  - event处理速度
  - 存盘速度
  - 节点数量（当前：da:5, dp:35, dfm:1, ds:1）

- 运行效率及所需空间
  - 运行效率：约为正常JUNO运行时间的40-80倍
  - 运行空间大小：约400MB/h（模拟），16GB-32GB/h（真实时间）
  - 运行一年模拟所需空间：3.5TB
  - 运行一年模拟所需时间：4-8天

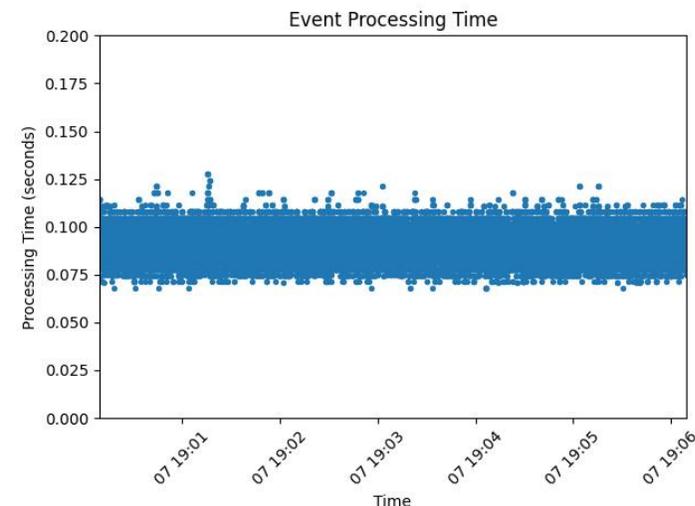
- 模拟存在的问题
  - 模拟和现实存在很多因素上的差异，很难进行全面的模拟
  - JUNO也在不断进行优化



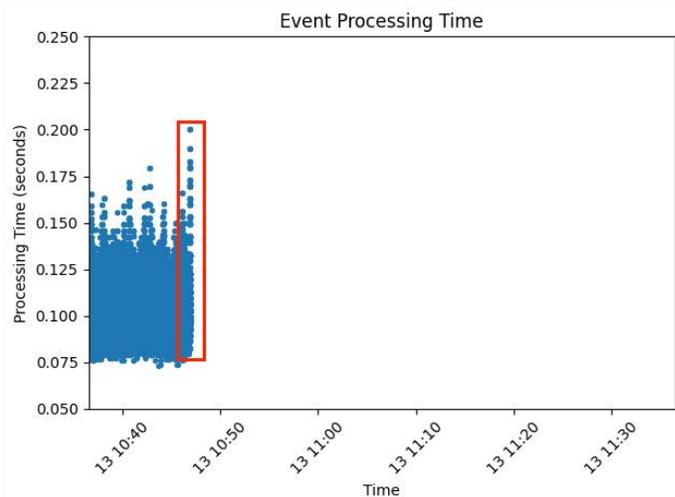
理想状态



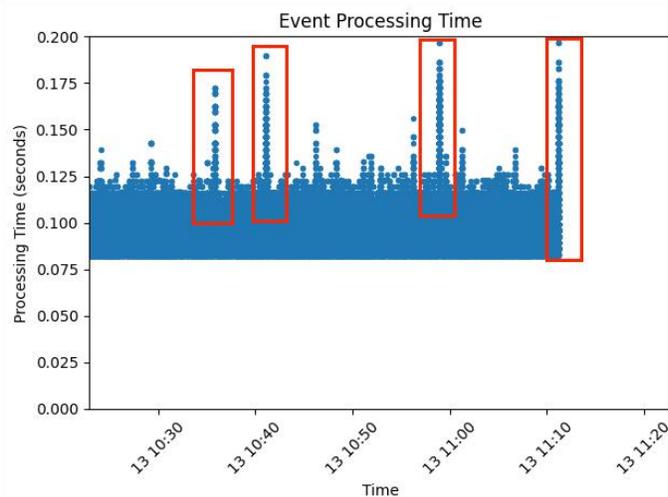
buffer适中、dp处理速度适中



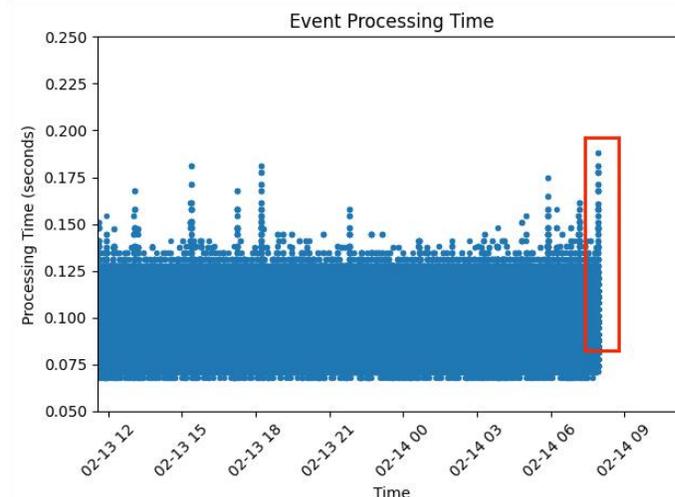
buffer适中、dp处理速度较快



buffer过大、dp处理速度适中



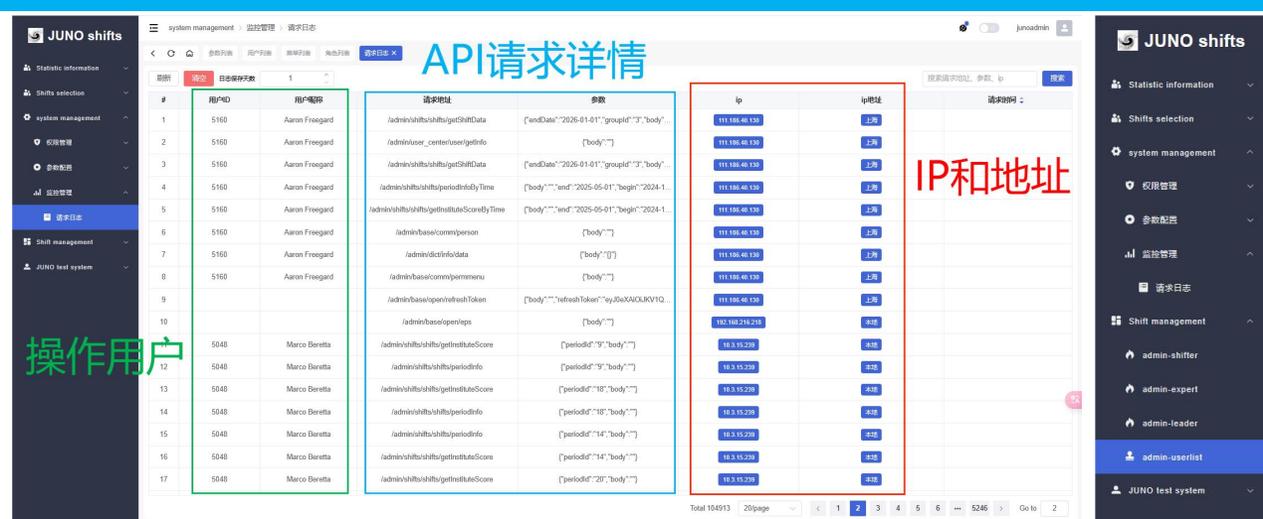
buffer过小、dp处理速度适中



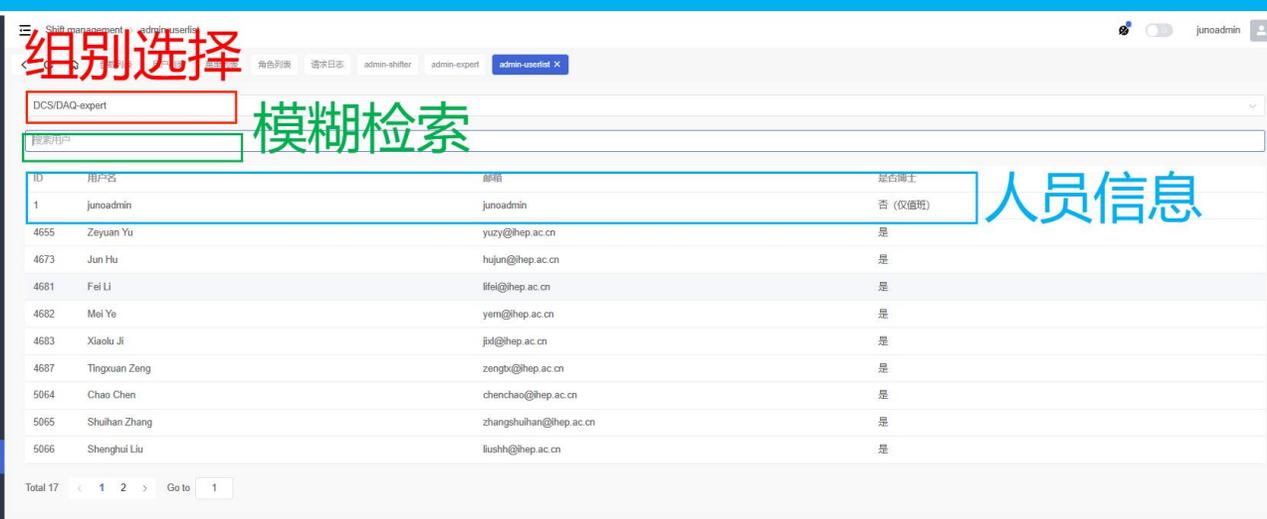
buffer适中、dp处理速度较慢

# JUNO Shift 更新

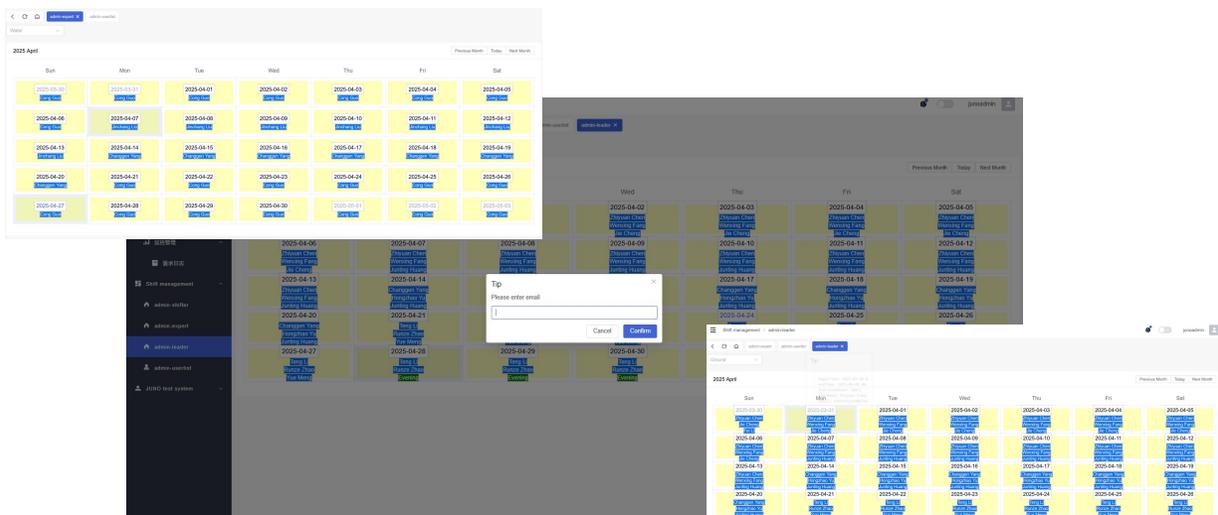
# 2月



日志系统



人员信息系统



管理员班次系统

## JUNO Shift更新（管理员系统）

- 日志系统
- 人员信息系统
- 管理员班次系统

• 包括普通值班页面、专家值班页面、领导值班页面共三个子页面，可代替人员进行选班、删班的操作

- 根据新版数据帧格式，修改解码函数
- 替换新版码密度表、依据新版积分算法修改读取码密度表函数
- 改bug、测试

|                      | 7                                  | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
|----------------------|------------------------------------|---|---|---|---|---|---|---|
| Header               | Packet Type<br>(0x 5A)             |   |   |   |   |   |   |   |
|                      | Board ID<br>(IP address - 0)       |   |   |   |   |   |   |   |
|                      | Channel [6:0]                      |   |   |   |   |   |   |   |
|                      | 0x0                                |   |   |   |   |   |   |   |
| Second<br>Time stamp | 0x0                                |   |   |   |   |   |   |   |
|                      | PPS_pulse[24:17]                   |   |   |   |   |   |   |   |
|                      | PPS_pulse[16:9]                    |   |   |   |   |   |   |   |
|                      | PPS_pulse[8:1]                     |   |   |   |   |   |   |   |
| Coarse_time          | PPS_pulse[0], Coarse_time [28:22]  |   |   |   |   |   |   |   |
|                      | Coarse_time [21:14]                |   |   |   |   |   |   |   |
|                      | Coarse_time [13:6]                 |   |   |   |   |   |   |   |
| Fine_time            | Coarse_time [5:0], Fine_time [9:8] |   |   |   |   |   |   |   |
|                      | Fine_time [7:0]                    |   |   |   |   |   |   |   |

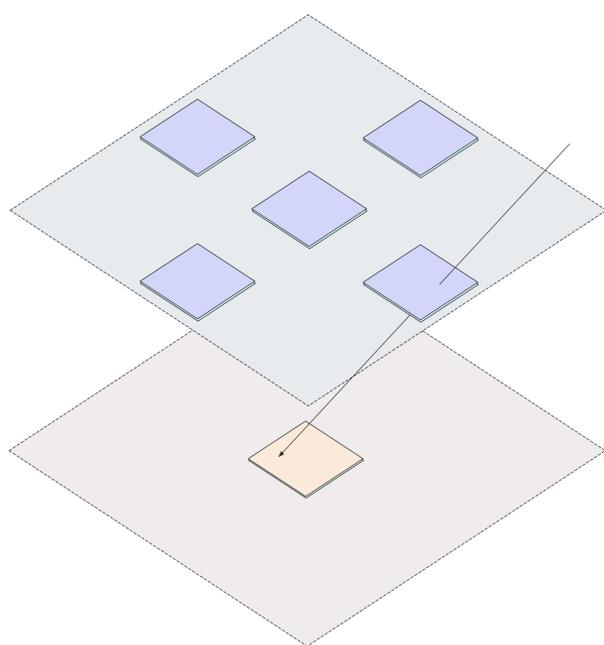
数据帧格式 (旧)



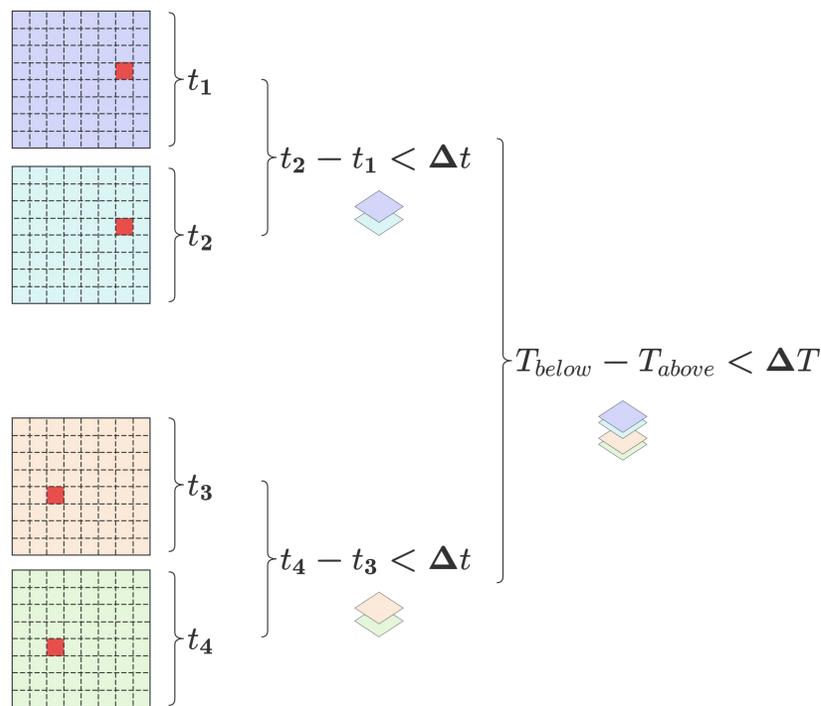
|             | 7                             | 6             | 5 | 4 | 3 | 2 | 1 | 0 |
|-------------|-------------------------------|---------------|---|---|---|---|---|---|
| Header      | Packet Type<br>(0x 5A)        |               |   |   |   |   |   |   |
|             | Board ID<br>(IP address - 20) |               |   |   |   |   |   |   |
|             | Trigger Rate [31:24]          |               |   |   |   |   |   |   |
|             | Trigger Rate [23:16]          |               |   |   |   |   |   |   |
|             | Data Length                   |               |   |   |   |   |   |   |
| Width       | Pre/Post                      | Channel [6:0] |   |   |   |   |   |   |
|             | Trigger Rate [15:8]           |               |   |   |   |   |   |   |
|             | Trigger Rate [7:0]            |               |   |   |   |   |   |   |
| Coarse_time | Coarse_time [47:40]           |               |   |   |   |   |   |   |
|             | Coarse_time [39:32]           |               |   |   |   |   |   |   |
|             | Coarse_time [31:24]           |               |   |   |   |   |   |   |
|             | Coarse_time [23:16]           |               |   |   |   |   |   |   |
|             | Coarse_time [15:7]            |               |   |   |   |   |   |   |
| Fine_time   | Coarse_time [7:0]             |               |   |   |   |   |   |   |
|             | Fine_time [10:8]              |               |   |   |   |   |   |   |
|             | Fine_time [7:0]               |               |   |   |   |   |   |   |

数据帧格式 (新)

- 编写了一套TDC的软件触发算法，用于对接收到的event进行定位与存储



算法示意图



算法流程图

```
Predecessor_ID: 21032, Successor_ID: 21033, Predecessor_time: 3639736894966910464, Successor_time: 3639736894966912000, abs_time: 1536
Pr 8, Successor_time: 3639777089640871936, abs_time: 2048
Pr 2, Successor_time: 3639819075098871808, abs_time: 1536
Pr 8, Successor_time: 3639866312924321792, abs_time: 1024
Pr 4, Successor_time: 3639878784167472128, abs_time: 1024
Predecessor_ID: 21032, Successor_ID: 21033, Predecessor_time: 3639913170877661184, Successor_time: 3639913170877662208, abs_time: 1024
Predecessor_ID: 21032, Successor_ID: 21033, Predecessor_time: 3639936629789800960, Successor_time: 3639936629789801472, abs_time: 512
Predecessor_ID: 21032, Successor_ID: 21033, Predecessor_time: 3639996564954841600, Successor_time: 3639996564954842112, abs_time: 512
Predecessor_ID: 21032, Successor_ID: 21033, Predecessor_time: 3640013094273210880, Successor_time: 3640013094273211904, abs_time: 1024
Predecessor_ID: 21032, Successor_ID: 21033, Predecessor_time: 364005751530160640, Successor_time: 364005751530162176, abs_time: 1536
Predecessor_ID: 21032, Successor_ID: 21033, Predecessor_time: 3640056207346040320, Successor_time: 3640056207346042368, abs_time: 2048
Predecessor_ID: 21032, Successor_ID: 21033, Predecessor_time: 3640144049750061568, Successor_time: 3640144049750062592, abs_time: 1024
Predecessor_ID: 21032, Successor_ID: 21033, Predecessor_time: 3640149136494610944, Successor_time: 3640149136494612480, abs_time: 1536
Predecessor_ID: 21059, Successor_ID: 21051, Predecessor_time: 3639226502344238400, Successor_time: 3639226502344231036, abs_time: 1536
Predecessor_ID: 21052, Successor_ID: 21053, Predecessor_time: 36378001245983199744, Successor_time: 36378001245983200768, abs_time: 1024
Predecessor_ID: 21052, Successor_ID: 21053, Predecessor_time: 3637286217271598400, Successor_time: 3637286217271591936, abs_time: 1536
Predecessor_ID: 21052, Successor_ID: 21053, Predecessor_time: 3637410054996789760, Successor_time: 3637410054996792320, abs_time: 2560
Predecessor_ID: 21052, Successor_ID: 21053, Predecessor_time: 3637426067619800576, Successor_time: 3637426067619802112, abs_time: 1536
Predecessor_ID: 21052, Successor_ID: 21053, Predecessor_time: 3638024149320820224, Successor_time: 3638024149320821760, abs_time: 1536
Predecessor_ID: 21052, Successor_ID: 21053, Predecessor_time: 3638198077793866080, Successor_time: 3638198077793861632, abs_time: 1024
Predecessor_ID: 21052, Successor_ID: 21053, Predecessor_time: 3638586031931380224, Successor_time: 3638586031931380736, abs_time: 512
Predecessor_ID: 21052, Successor_ID: 21053, Predecessor_time: 3639064267857841152, Successor_time: 3639064267857841664, abs_time: 512
Predecessor_ID: 21052, Successor_ID: 21053, Predecessor_time: 3639092863576200704, Successor_time: 3639092863576201728, abs_time: 1024
Predecessor_ID: 21052, Successor_ID: 21053, Predecessor_time: 3639158327363730944, Successor_time: 3639158327363731456, abs_time: 512
Predecessor_ID: 21052, Successor_ID: 21053, Predecessor_time: 3639386280737440768, Successor_time: 3639386280737442304, abs_time: 1536
Predecessor_ID: 21052, Successor_ID: 21053, Predecessor_time: 3639523433017480704, Successor_time: 3639523433017482240, abs_time: 1536
Predecessor_ID: 21052, Successor_ID: 21053, Predecessor_time: 3639643763179410432, Successor_time: 3639643763179411456, abs_time: 1024
Predecessor_ID: 21052, Successor_ID: 21053, Predecessor_time: 3639744016150980096, Successor_time: 3639744016150982144, abs_time: 2048
Predecessor_ID: 21052, Successor_ID: 21053, Predecessor_time: 3639970108227039744, Successor_time: 3639970108227042304, abs_time: 2560
```

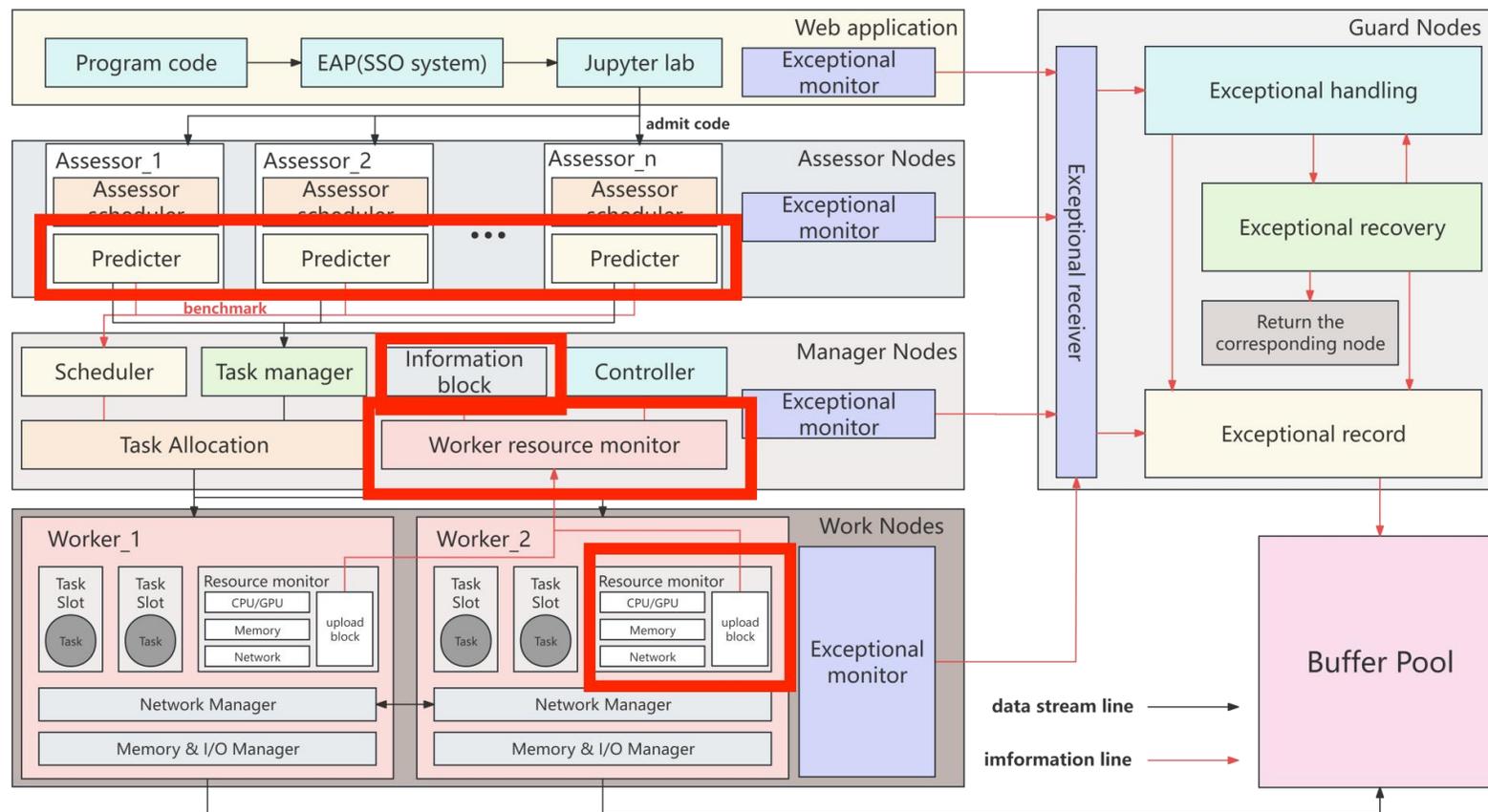
第一级软件触发得到的有效event

```
DAQ Events:
584, Successor_board_time: 363978901640817008, board_diff_time: 39424
480, Successor_board_time: 363983139724071424, board_diff_time: 18944
416, Successor_board_time: 3641581583679980032, board_diff_time: 47616
392, Successor_board_time: 3641608757690841600, board_diff_time: 30208
664, Successor_board_time: 364173954512289792, board_diff_time: 48128
Predecessor_board_ID: 20041, Successor_board_ID: 20040, Predecessor_board_time: 3641767983306741760, Successor_board_time: 3641767983306778432, board_diff_time: 28672
Predecessor_board_ID: 20041, Successor_board_ID: 20040, Predecessor_board_time: 3641794325873802752, Successor_board_time: 3641794325873820160, board_diff_time: 17488
Predecessor_board_ID: 20041, Successor_board_ID: 20040, Predecessor_board_time: 3641917081022031360, Successor_board_time: 3641917081022041600, board_diff_time: 10240
Predecessor_board_ID: 20041, Successor_board_ID: 20040, Predecessor_board_time: 3641938279898130944, Successor_board_time: 3641938279898170880, board_diff_time: 39936
Predecessor_board_ID: 20041, Successor_board_ID: 20040, Predecessor_board_time: 364194555762421760, Successor_board_time: 36419455576246072, board_diff_time: 38912
Predecessor_board_ID: 20041, Successor_board_ID: 20040, Predecessor_board_time: 36420154843362176, Successor_board_time: 36420154843382144, board_diff_time: 19968
Predecessor_board_ID: 20041, Successor_board_ID: 20040, Predecessor_board_time: 364206016071731968, Successor_board_time: 364206016071780608, board_diff_time: 48640
Predecessor_board_ID: 20041, Successor_board_ID: 20040, Predecessor_board_time: 3642098309711272448, Successor_board_time: 3642098309711300608, board_diff_time: 28160
Predecessor_board_ID: 20041, Successor_board_ID: 20040, Predecessor_board_time: 3642112008501712384, Successor_board_time: 3642112008501741956, board_diff_time: 28672
Predecessor_board_ID: 20041, Successor_board_ID: 20040, Predecessor_board_time: 3642318443055841792, Successor_board_time: 3642318443055851908, board_diff_time: 9216
Predecessor_board_ID: 20041, Successor_board_ID: 20040, Predecessor_board_time: 3642327671111601152, Successor_board_time: 3642327671111609856, board_diff_time: 8704
```

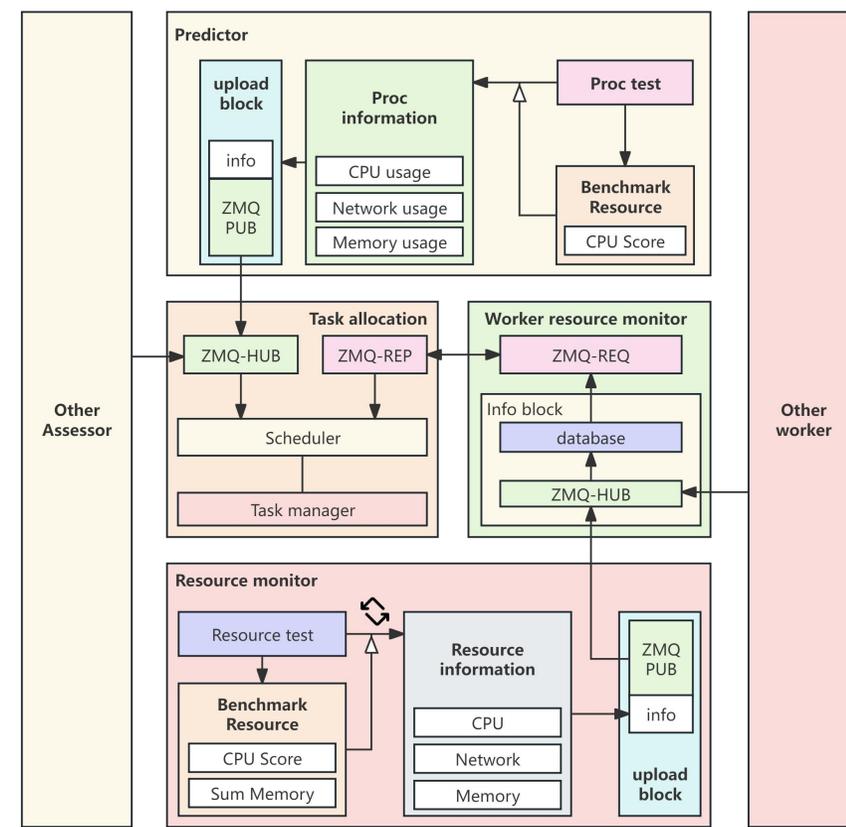
第二级软件触发得到的有效event

软件界面

- 使用ZeroMQ进行跨节点进程间通信，完成Schephy中资源监测模块的开发



Schephy程序框图



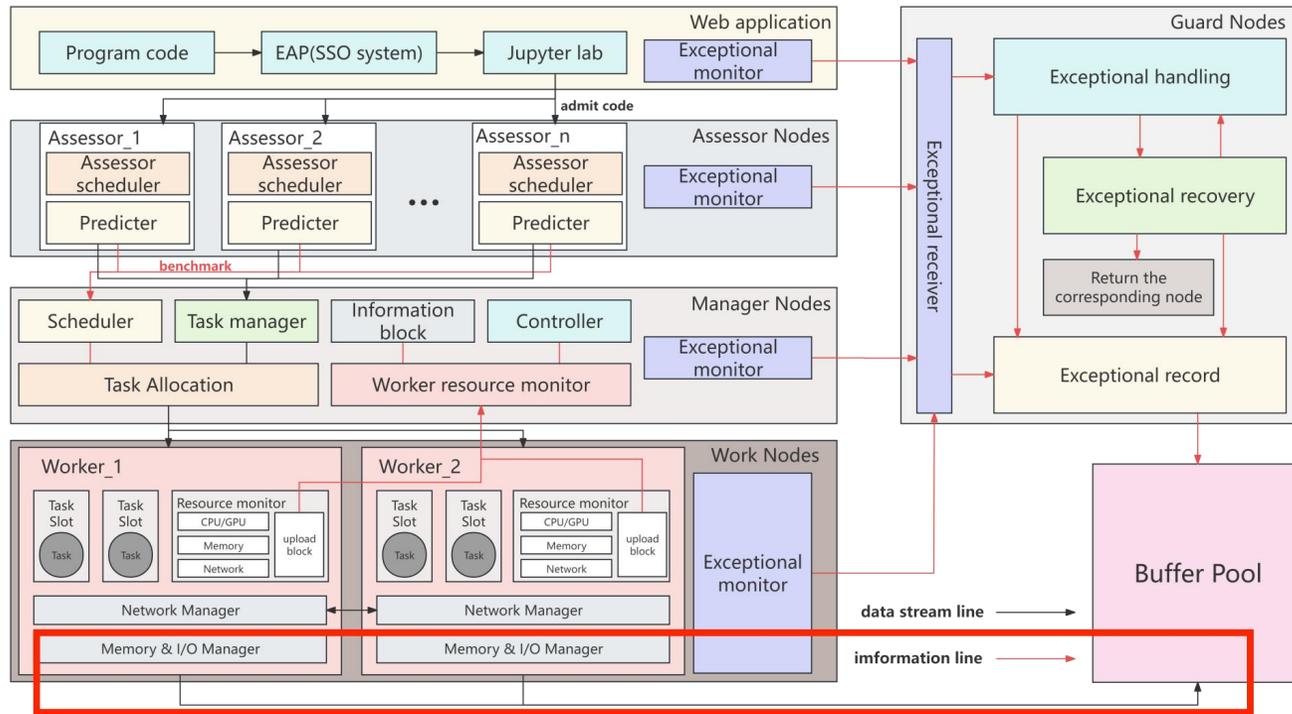
Schephy-资源检测模块程序框图

# 实现新架构下WFCTA的运行

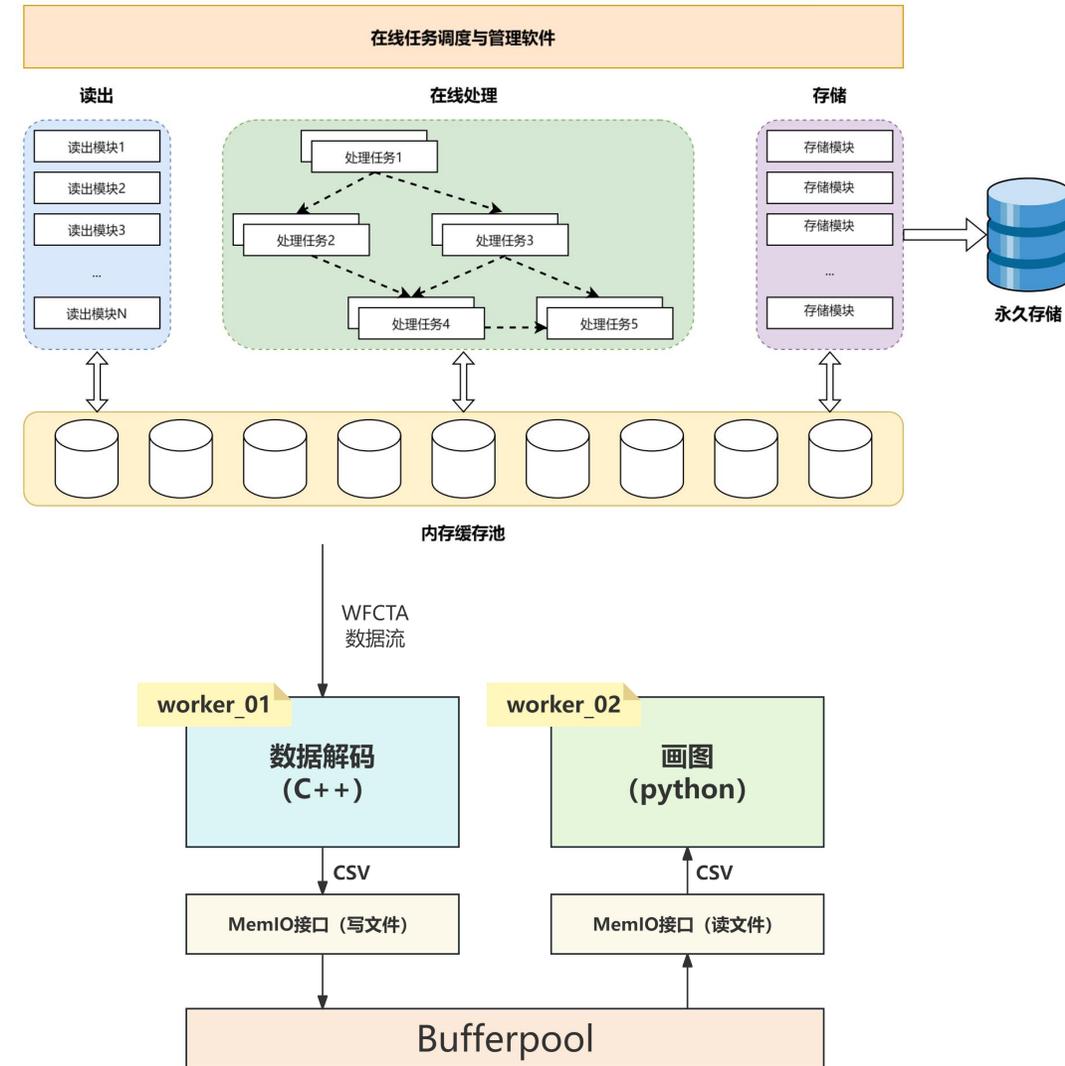
4月

## ■ Schephy-bufferpool的特性（用户角度）

- 不同探测器来源的数据可以进行数据融合
- 同一个任务之间的数据处理完全解耦



Schephy程序框图

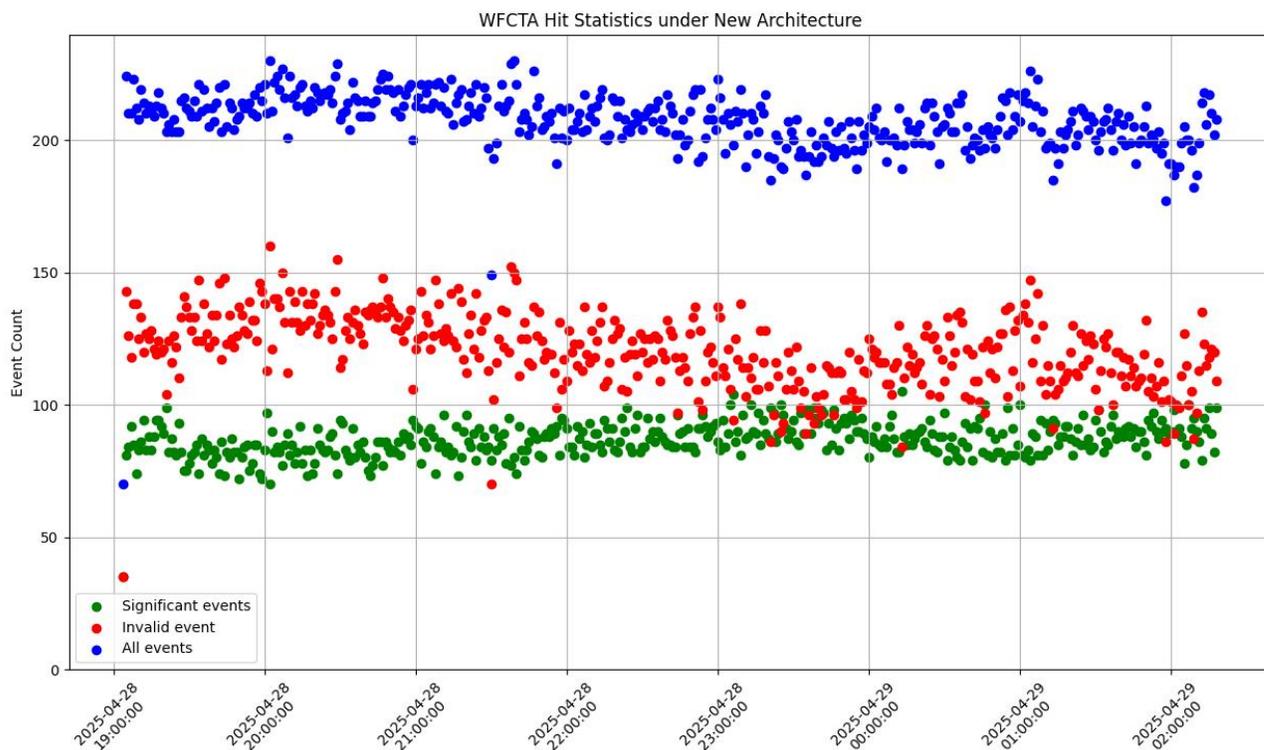


新架构运行流程图

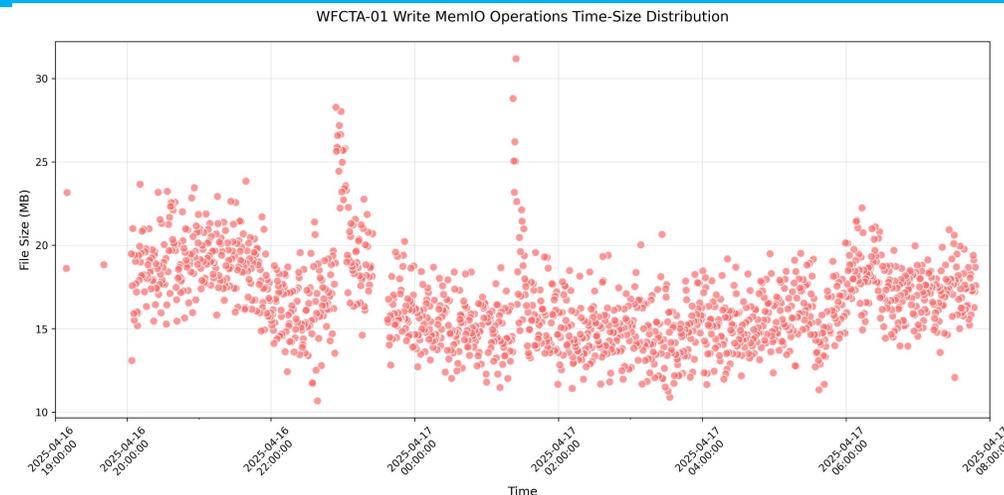
# 实现新架构下WFCTA的运行

4月

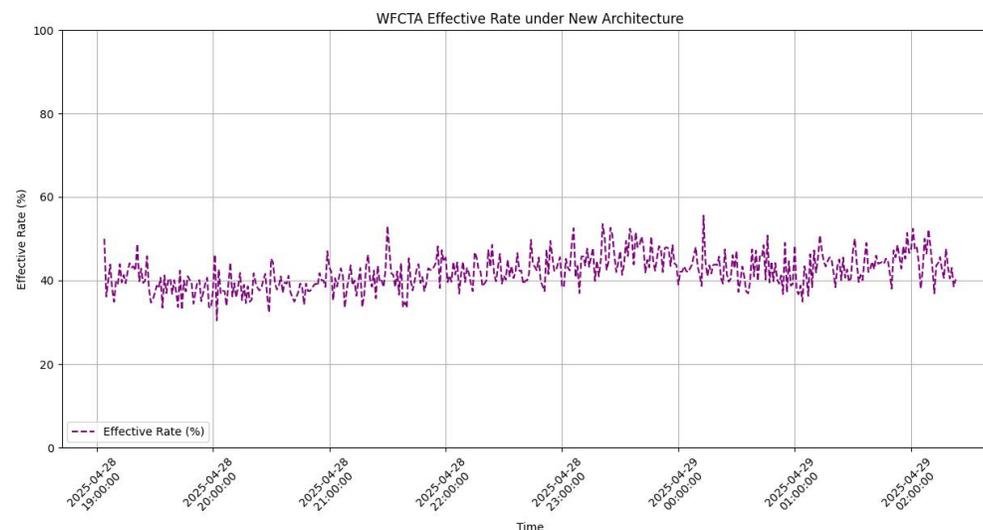
## WFCTA基于Schephy-bufferpool新架构的一些运行结果



WFCTA的事例统计

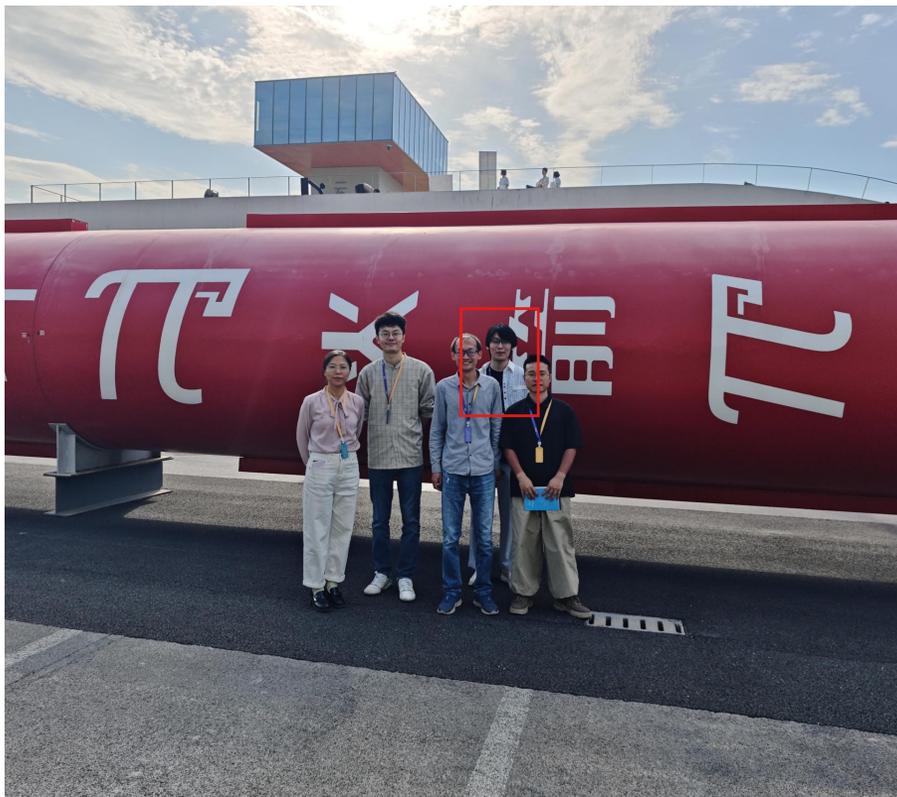


memoIO文件统计 (张航畅绘制)

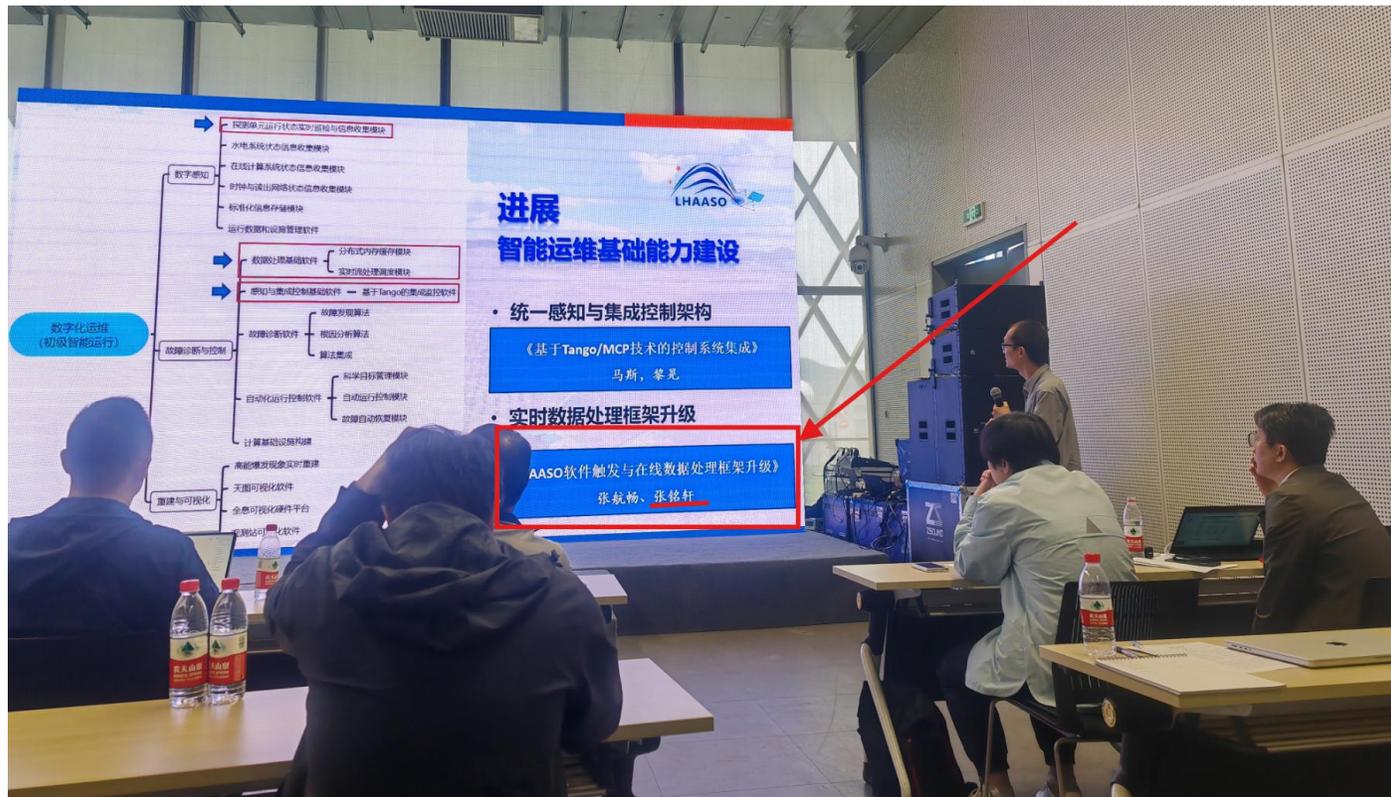


WFCTA的有效事例率统计

- 前往杭州参加LHAASO智能化会议，与张航畅师兄基于新架构制作了一张PPT，由师兄进行汇报。



会议合影



会议现场

## ■ LHAASO架构升级

- WFCTA数据较为复杂，理解波形算法后尝试在线绘制root
- 除了WFCTA外，将KM2A、WCDA也接入新架构运行
- 为用户提供python的memIO接口

## ■ 课题研究

- 完成schephy的其他模块部分
- 完成上述大部分内容后，以WFCTA为例子，基于schephy-bufferpool架构发表一篇小论文

请老师们批评指正