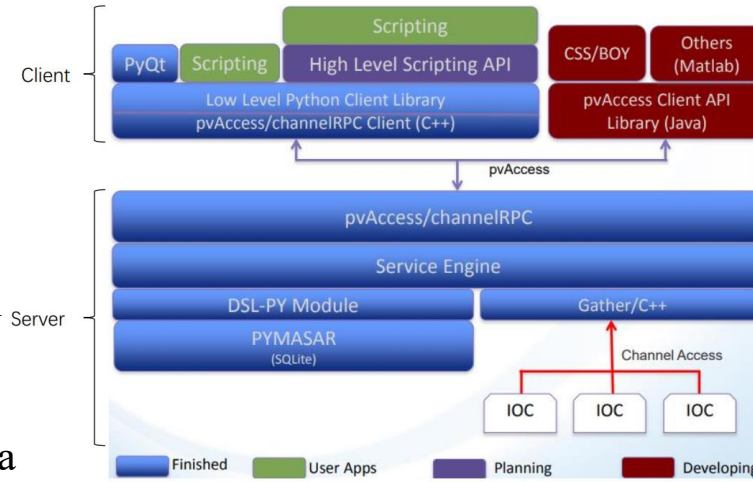


## MASAR

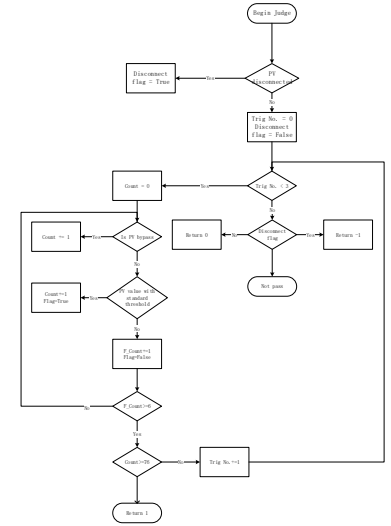
- Epics V4 service
  - C++
  - Python
- Archiving, comparison and restore of machine snapshots
- Data archiving and data retrieval.



MASAR Architecture

## BPMs judgment process

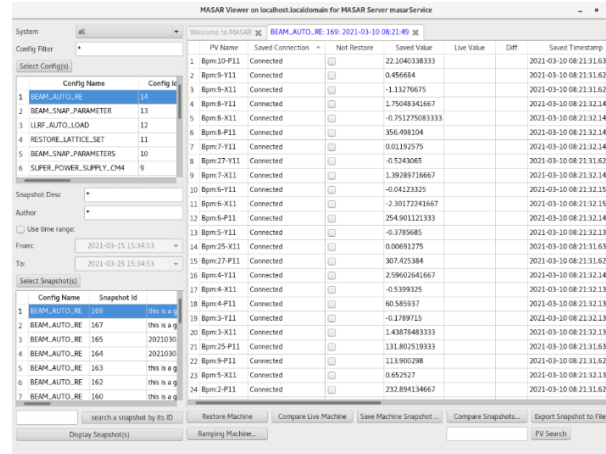
- PV connection
- PV is bypassed (Not join the MPS)
- PV's value in within the standard threshold
- Number of PV meeting the conditions



BPM judgment process

## Beam fast recovery

- The purpose of beam fast recovery is, when faults occur to the machine, the beam is recovered in a short time.
- The machine faults should be judged before the recovery action by MPS.



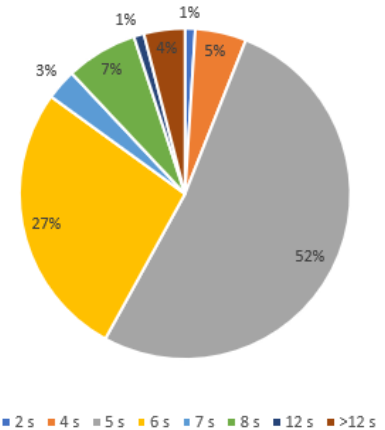
MASAR view

## Conclusion

### Test results

Parameters	Value	Unit
Beam energy	17.272±0.034	MeV
Average current intensity	7.2966±0.0244	mA
Beam power	126.0	kW
Total test time	108	h
RF superconducting system availability	98	%
Machine availability	93.5	%

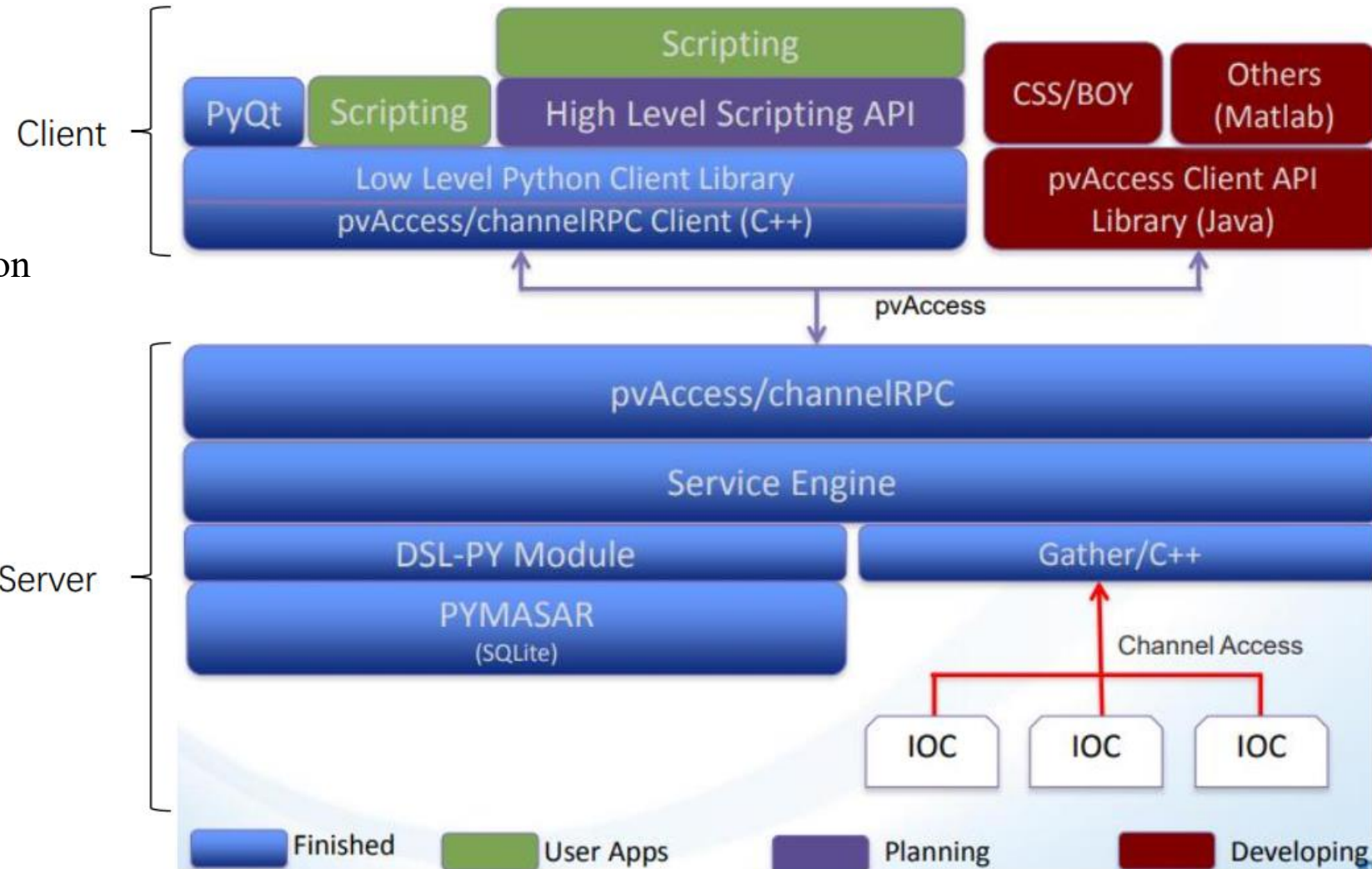
- Machine Availability ~ 93.5%
- Recovery time within 6 s takes higher than 80%



The time required for beam recovery

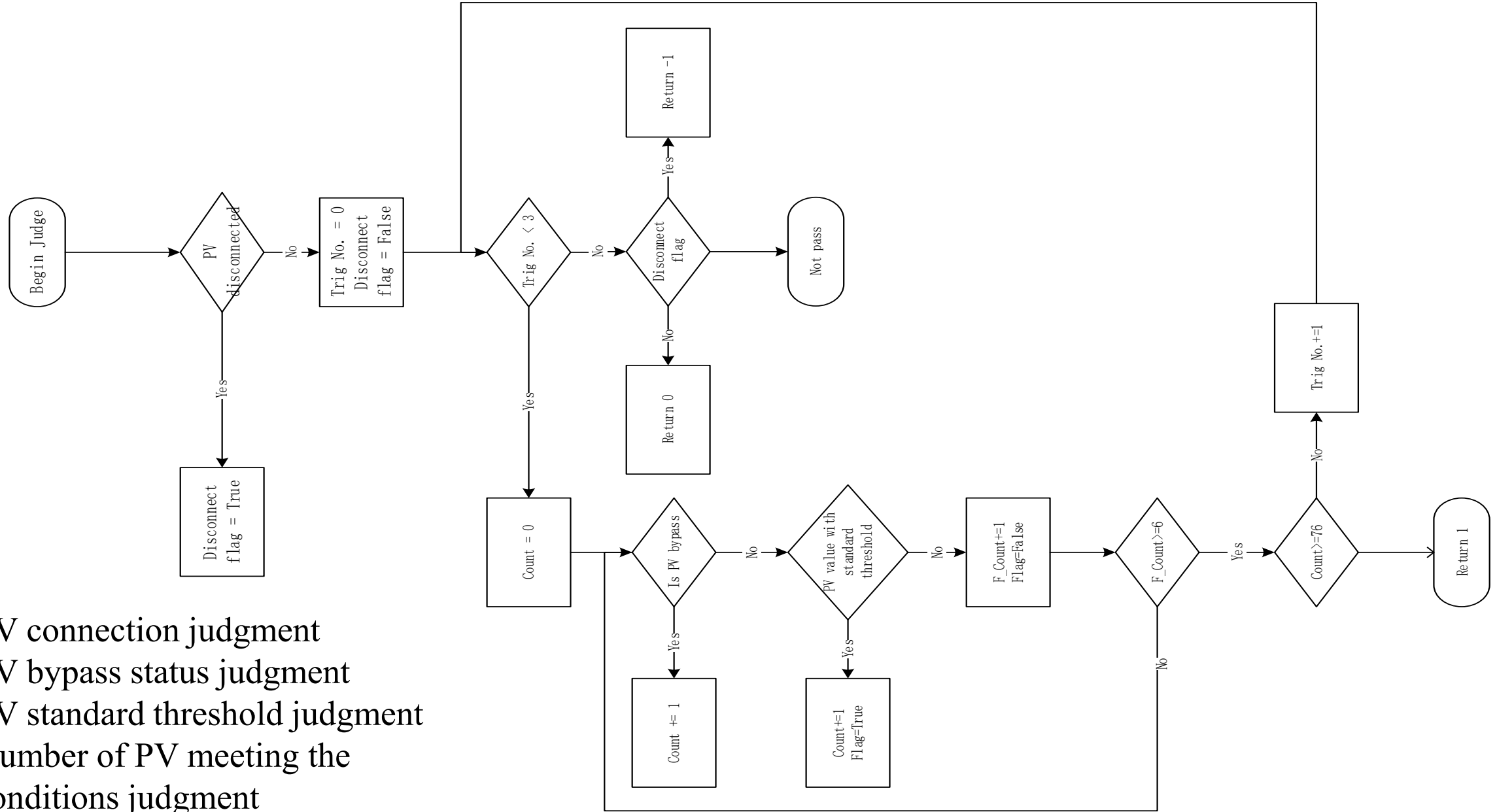
# MASAR (MACHINE Snapshots, Archiving and Retrieval)

- EPICS V4 service
  - C++
  - python
- Function
  - Archiving, comparison and restoration of machine snapshots
  - Data archiving and data retrieval
- Architecture
  - Client
    - ✓ can be used by both Python Server scripting and the GUI.
  - Server
    - ✓ Service communication control
    - ✓ Service
    - ✓ Channel Access Client
    - ✓ DSL (data source layer)



MASAR Architecture

# BPMs judgment process



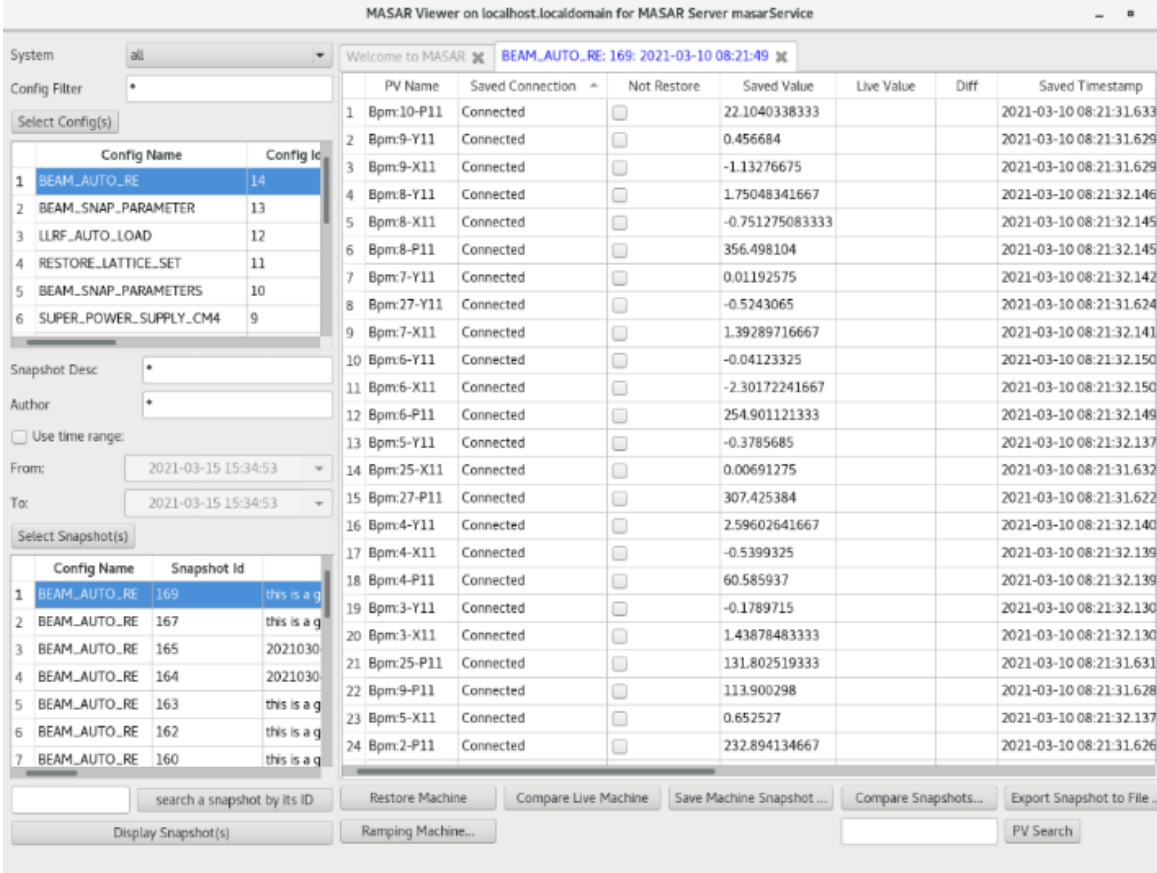
- PV connection judgment
- PV bypass status judgment
- PV standard threshold judgment
- Number of PV meeting the conditions judgment

BPM judgment process

# Beam fast recovery

Beam fast recovery experiment is based on MASAR. Considering various recoverable faults, a series of orderly automatic recovery measures are taken. When BPMs (Beam Position Monitor) detect abnormal beam status, the beam will be stopped quickly; when all system returns to normal, the beam will be quickly restored.

- The beam fast recovery system includes the operation, monitoring and judgment of MPS (Machine Protection System), BPS (Bypass Control System), timing and LLRF systems.
- The optimization of existing hardware improves the reliability and recovery speed.
- Main manual operation are replaced by the control system, without losing machine safety at the same time.
- During beam recovery, it is necessary to judge the beam status and BPM status. We used MASAR to take the machine snapshot about the relevant information of BPM beam.



MASAR Viewer on localhost.localdomain for MASAR Server masarService

Welcome to MASAR x BEAM\_AUTO\_RE: 169: 2021-03-10 08:21:49 x

PV Name	Saved Connection	Not Restore	Saved Value	Live Value	Diff	Saved Timestamp
1 Bpm:10-P11	Connected	<input type="checkbox"/>	22.1040338333			2021-03-10 08:21:31.633
2 Bpm:9-Y11	Connected	<input type="checkbox"/>	0.456684			2021-03-10 08:21:31.629
3 Bpm:9-X11	Connected	<input type="checkbox"/>	-1.13276675			2021-03-10 08:21:31.629
4 Bpm:8-Y11	Connected	<input type="checkbox"/>	1.75048341667			2021-03-10 08:21:32.146
5 Bpm:8-X11	Connected	<input type="checkbox"/>	-0.751275083333			2021-03-10 08:21:32.145
6 Bpm:8-P11	Connected	<input type="checkbox"/>	356.498104			2021-03-10 08:21:32.145
7 Bpm:7-Y11	Connected	<input type="checkbox"/>	0.01192575			2021-03-10 08:21:32.142
8 Bpm:27-Y11	Connected	<input type="checkbox"/>	-0.5243065			2021-03-10 08:21:31.624
9 Bpm:7-X11	Connected	<input type="checkbox"/>	1.39289716667			2021-03-10 08:21:32.141
10 Bpm:6-Y11	Connected	<input type="checkbox"/>	-0.04123325			2021-03-10 08:21:32.150
11 Bpm:6-X11	Connected	<input type="checkbox"/>	-2.30172241667			2021-03-10 08:21:32.150
12 Bpm:6-P11	Connected	<input type="checkbox"/>	254.901121333			2021-03-10 08:21:32.149
13 Bpm:5-Y11	Connected	<input type="checkbox"/>	-0.3785685			2021-03-10 08:21:32.137
14 Bpm:25-X11	Connected	<input type="checkbox"/>	0.00691275			2021-03-10 08:21:31.632
15 Bpm:27-P11	Connected	<input type="checkbox"/>	307.425384			2021-03-10 08:21:31.622
16 Bpm:4-Y11	Connected	<input type="checkbox"/>	2.59602641667			2021-03-10 08:21:32.140
17 Bpm:4-X11	Connected	<input type="checkbox"/>	-0.5399325			2021-03-10 08:21:32.139
18 Bpm:4-P11	Connected	<input type="checkbox"/>	60.585937			2021-03-10 08:21:32.139
19 Bpm:3-Y11	Connected	<input type="checkbox"/>	-0.1789715			2021-03-10 08:21:32.130
20 Bpm:3-X11	Connected	<input type="checkbox"/>	1.43878483333			2021-03-10 08:21:32.130
21 Bpm:25-P11	Connected	<input type="checkbox"/>	131.802519333			2021-03-10 08:21:31.631
22 Bpm:9-P11	Connected	<input type="checkbox"/>	113.900298			2021-03-10 08:21:31.628
23 Bpm:5-X11	Connected	<input type="checkbox"/>	0.652527			2021-03-10 08:21:32.137
24 Bpm:2-P11	Connected	<input type="checkbox"/>	232.894134667			2021-03-10 08:21:31.626

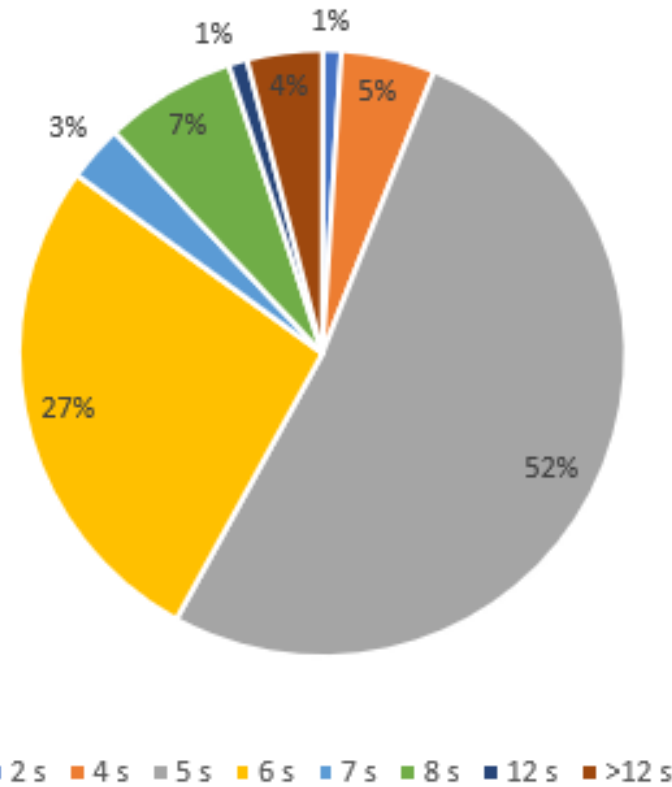
MASAR view

# Conclusion

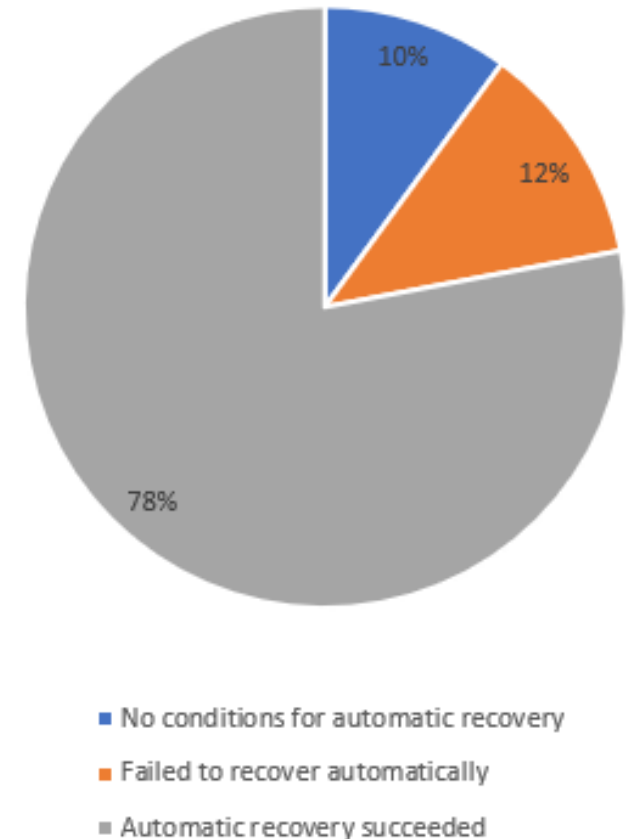
## Test results

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Total test time	108	h
RF superconducting system availability	98	%
Machine availability	93.5	%

- Machine Availability ~ 93.5% with BFR
- Recovery time within 6 s > 80%
- The frequency statistics
  - 90% have the condition for automatic recovery
  - 78% are successful
- The system verifies the possibility for high current beam fast recovery in CiADS.



The time required for beam recovery



The automatic recovery times