

# Overview of current workflow

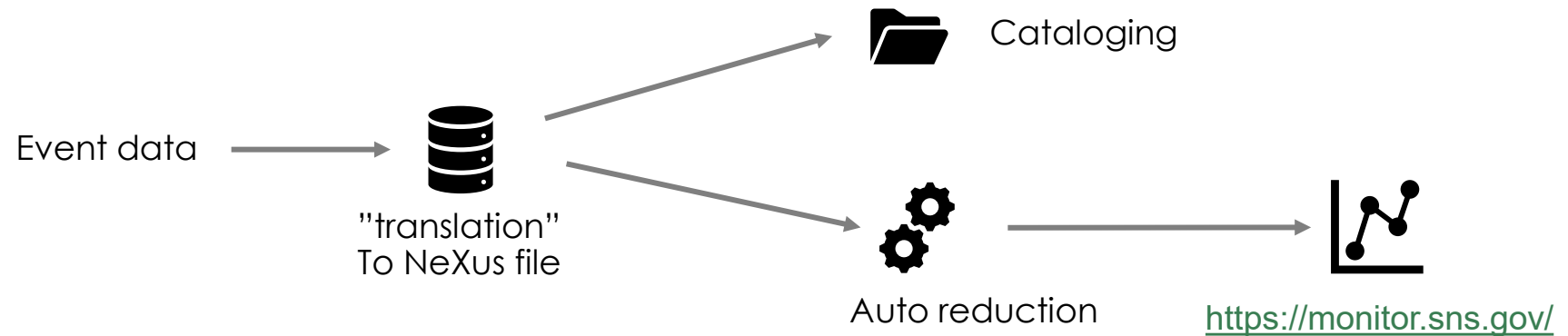
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# Timeline



- The first DAS implementation at SNS only dealt with histograms
  - “Translation” to Nexus files was done after a run completed and took a lot of time
- Around 2012, the ADARA project changed everything to event streaming
  - “Translation” now starts at the beginning of the run.
- As part of that effort, the automated reduction workflow was created
  - The web monitor was initially a diagnostics tool for developers but quickly became popular
- The scope of how we use the auto-reduction and what we want it to do has changed since it was designed and implemented.

[https://github.com/neutrons/data\\_workflow](https://github.com/neutrons/data_workflow)

# Plan for the next few weeks

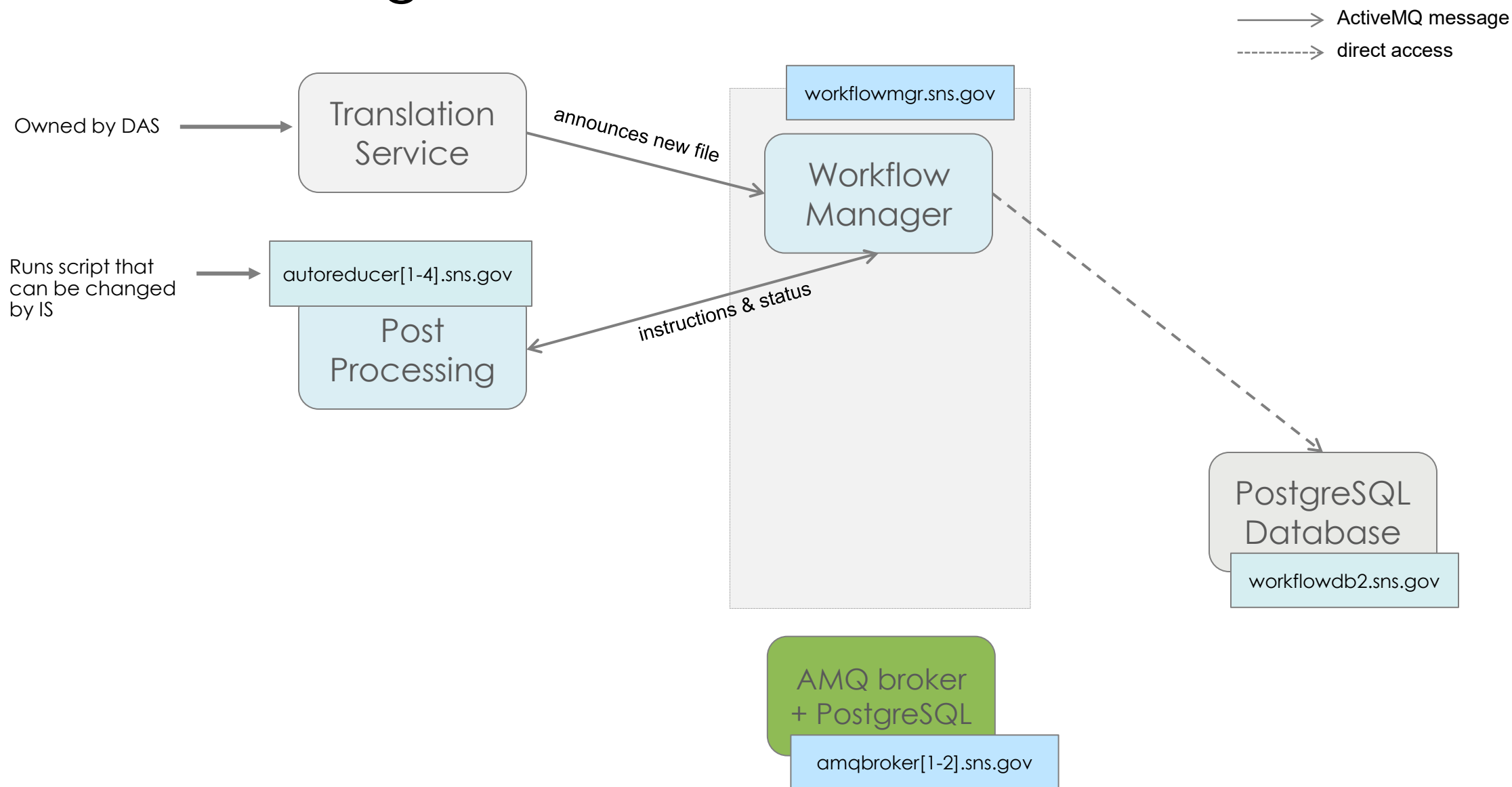
## Test environment:

New RHEL8 machines are being set up so we can install them together

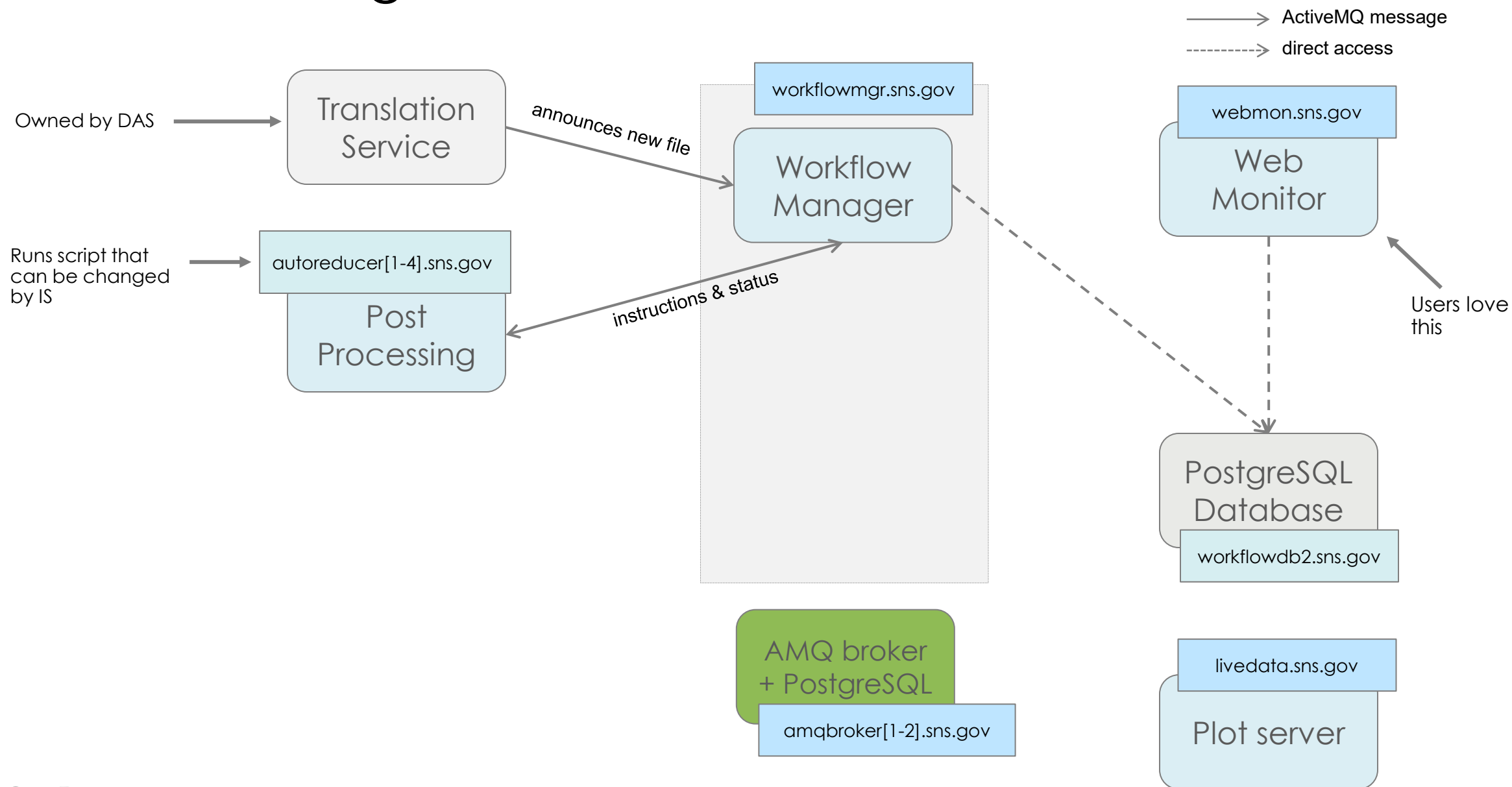
## Topics to cover:

1. General overview [this presentation]
2. Workflow manager and DASMON listener – Installation & maintenance
3. Web monitor – Installation and maintenance
4. Autoreduction service – Installation and maintenance
5. Autoreduction setup through webmon – how-to and future vision
6. The IHC call – when things go wrong & recovery strategies
7. Vision for the future – what I would do differently

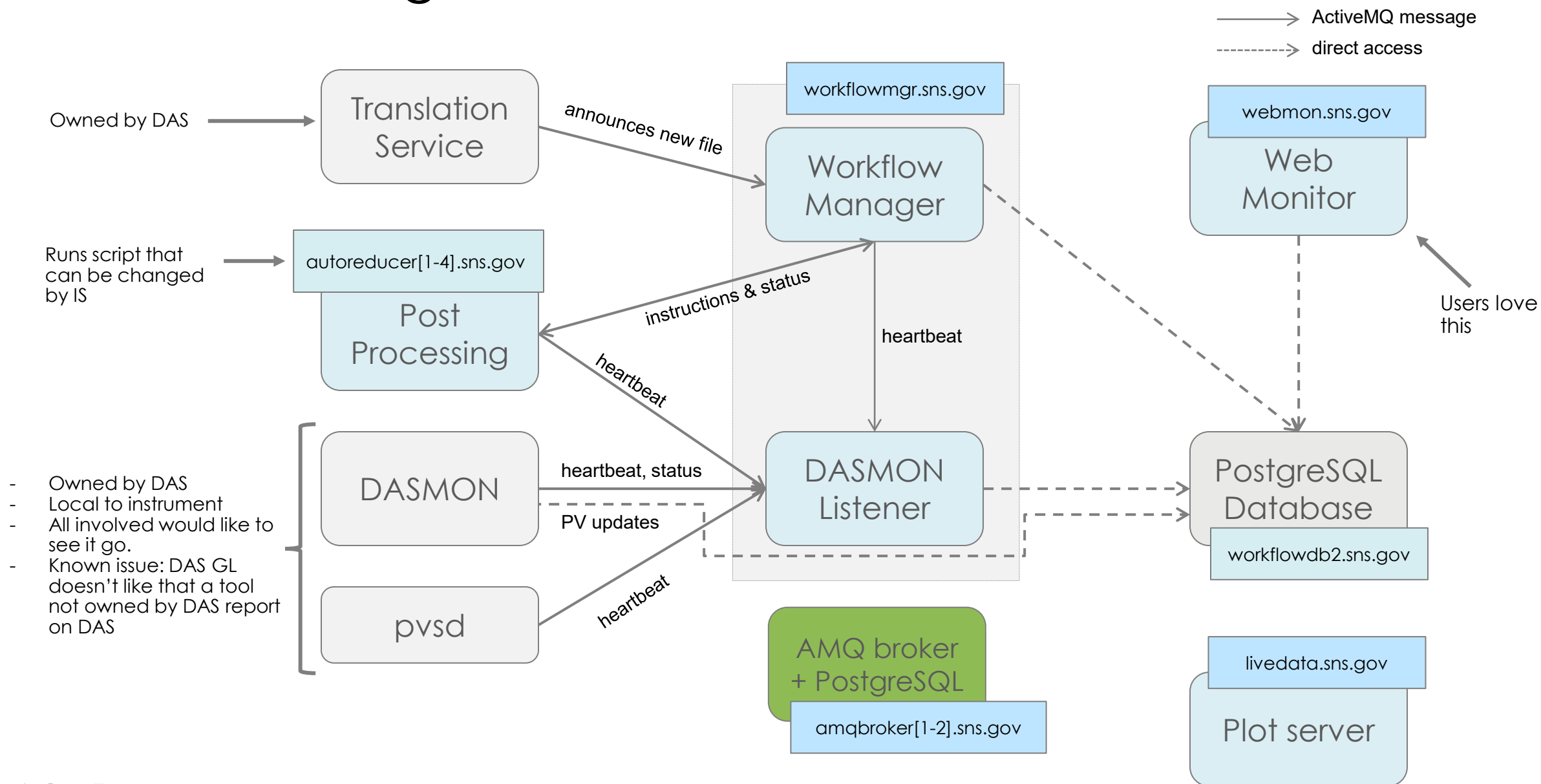
# Post-Processing Architecture



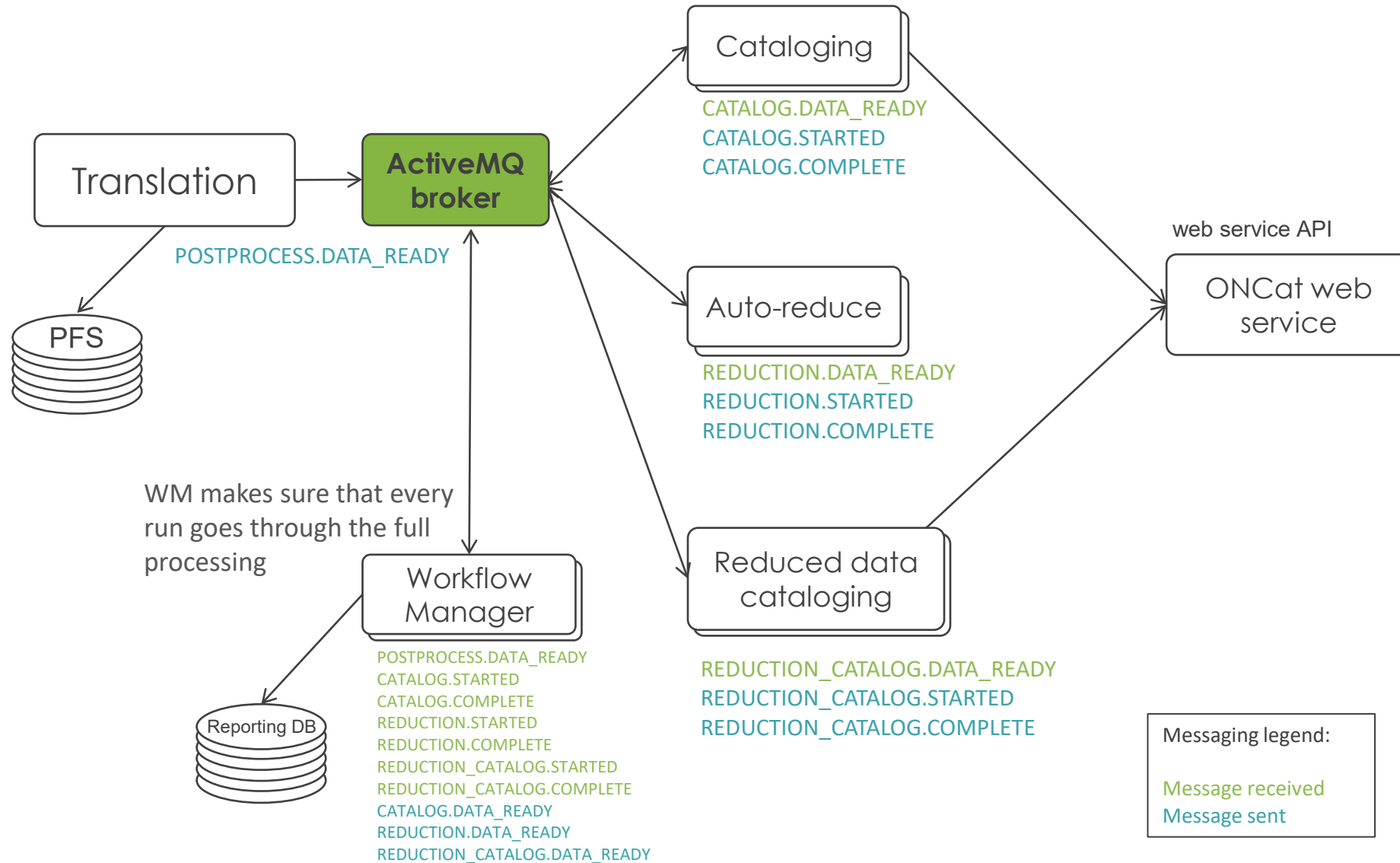
# Post-Processing Architecture



# Post-Processing Architecture

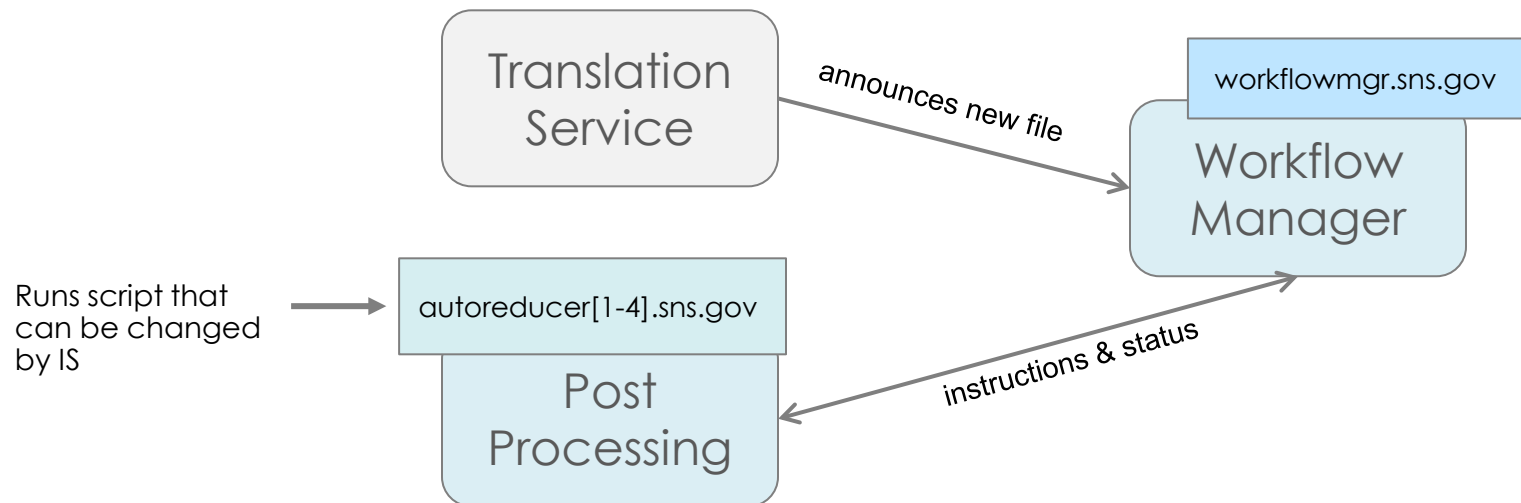


# ActiveMQ Communication Flow



# Workflow Manager

- Single instance runs as a service on workflowmgr.sns.gov
  - A python AMQ client
  - A state machine
  - States/tasks are defined in a DB
  - Work is getting done by AR processes elsewhere (next slide)
  - State is written in a DB
  - All transactions are logged in the DB
  - Sends a heartbeat that is logged by another process
- The initial message from the DAS is, at a minimum, a file path.
  - The system will also understand (prefers) a json package containing:
    - Instrument name
    - IPTS
    - Facility (SNS or HFIR)
    - File path



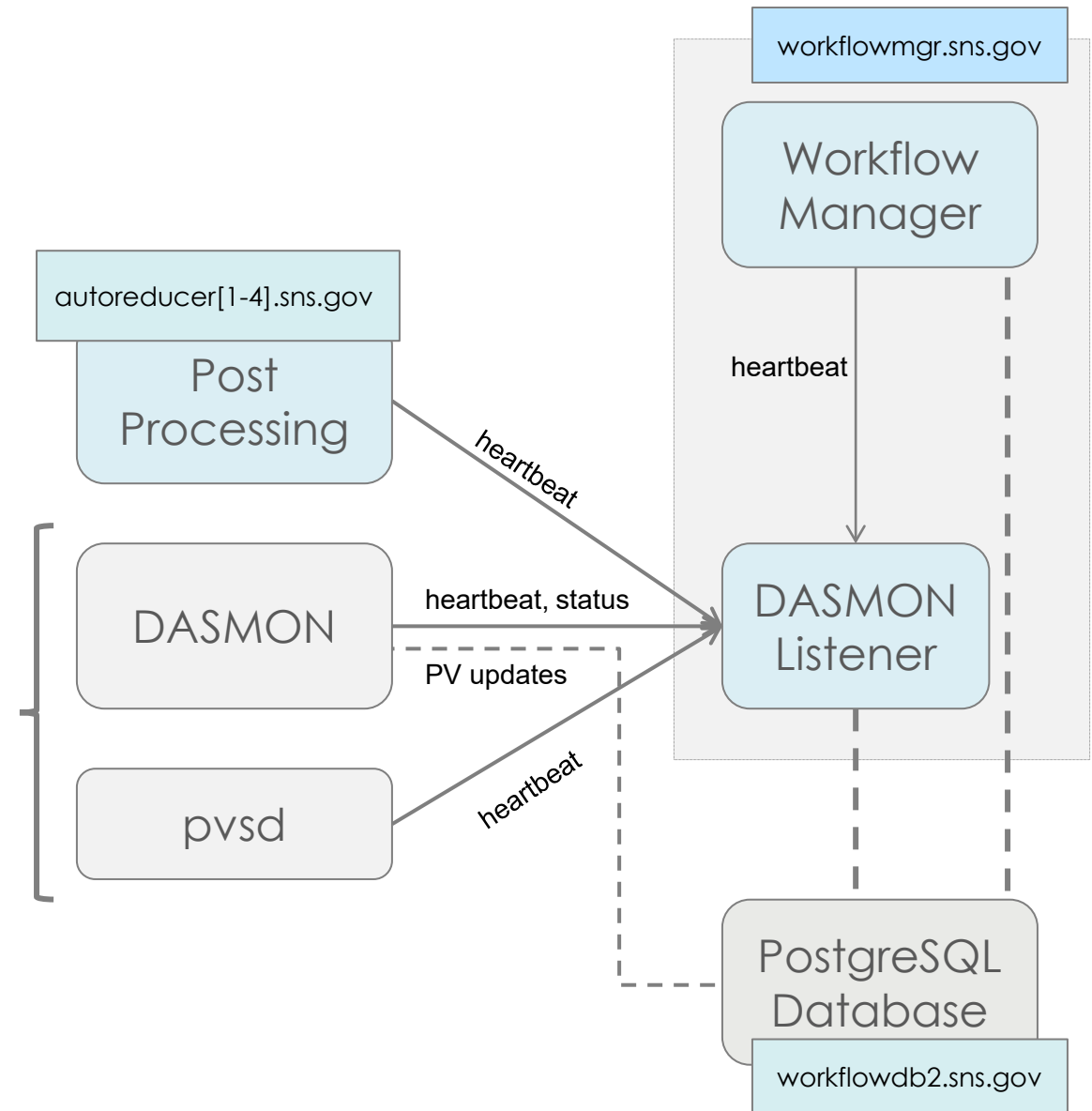


# Service on AR nodes

- Python AMQ client running as a service on dedicated nodes with access to /SNS and /HFIR
- No DB connection
- It spawns a process for each task
- Started out with a static design for the list of tasks it could handle.
- Now “processors” can be written that automatically register themselves and create new available tasks
- Not a batch system. The “queue” is the AMQ server...
- It can be configured to limit the number of jobs it can run per instrument at any given time.
- When the limit is reached, it throws the request back to AMQ...
- ... which then loses the order the requests came in as
- The script that is run can be modified by IS
- It upload plot data (HTML block) to [livedata.sns.gov](https://livedata.sns.gov)

# DASMON listener

- Listens to AMQ for instrument status info and logs it
- That info is then displayed on the web monitor
- Not a critical process...
- ... but users, IS, and IHCs use the web monitor
- In addition to listening to DAS info, it receives heartbeats from all services



# Web Monitor

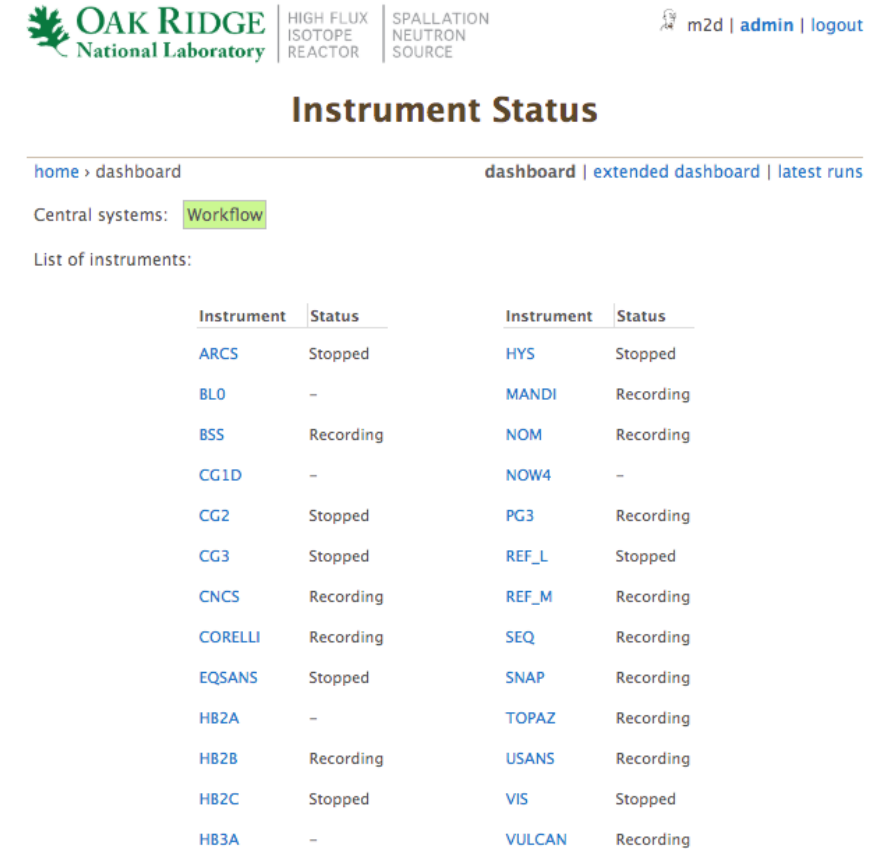
[https://github.com/neutrons/data\\_workflow/](https://github.com/neutrons/data_workflow/)

- Landing page is used by IHCs
- With the number of instruments increasing, this is slower to load than we would like

Reduced data plots are kept in a separate DB at [livedata.sns.gov](http://livedata.sns.gov)

Code is here:

[https://github.com/neutrons/live\\_data\\_server](https://github.com/neutrons/live_data_server)



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m2d | [admin](#) | [logout](#)

### Instrument Status

[home](#) > [dashboard](#) | [dashboard](#) | [extended dashboard](#) | [latest runs](#)

Central systems: [Workflow](#)

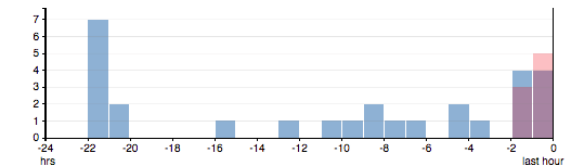
List of instruments:

Instrument	Status	Instrument	Status
<a href="#">ARCS</a>	Stopped	<a href="#">HYS</a>	Stopped
<a href="#">BL0</a>	–	<a href="#">MANDI</a>	Recording
<a href="#">BSS</a>	Recording	<a href="#">NOM</a>	Recording
<a href="#">CG1D</a>	–	<a href="#">NOW4</a>	–
<a href="#">CG2</a>	Stopped	<a href="#">PG3</a>	Recording
<a href="#">CG3</a>	Stopped	<a href="#">REF_L</a>	Stopped
<a href="#">CNCS</a>	Recording	<a href="#">REF_M</a>	Recording
<a href="#">CORELLI</a>	Recording	<a href="#">SEQ</a>	Recording
<a href="#">EQSANS</a>	Stopped	<a href="#">SNAP</a>	Recording
<a href="#">HB2A</a>	–	<a href="#">TOPAZ</a>	Recording
<a href="#">HB2B</a>	Recording	<a href="#">USANS</a>	Recording
<a href="#">HB2C</a>	Stopped	<a href="#">VIS</a>	Stopped
<a href="#">HB3A</a>	–	<a href="#">VULCAN</a>	Recording

# Instrument Status

## HYS Monitor

[home](#) > [hys](#) > [monitor](#) live monitoring: [status](#) | [runs](#) | [PVs](#)










Align:Hu & SM in, 27 meV, check FR with flip 6.6 and comp 12.9 M off

Proposal: IPTS-22351 Run: 0  
Status: Stopped Count rate: 22

Systems: [Workflow](#)

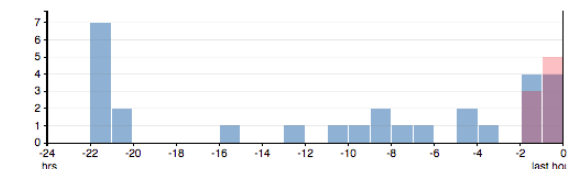
Last run: 245710 from IPTS-22351 created on Jan. 10, 2020, 10:50 a.m.

Signal/PV	Value	History	Last Updated
EnergyRequest	27		Jan. 10, 2020, 9:28 a.m.
FermiSpeed	120.017		Jan. 10, 2020, 11:31 a.m.
FlipOn	0		Jan. 10, 2020, 10:49 a.m.
magnetfield	0		Dec. 5, 2019, 6:27 a.m.
omega	-0.000191351		Jan. 10, 2020, 11:32 a.m.
s2	35.0002		Jan. 10, 2020, 11:31 a.m.
sampletemp	100.21		Jan. 10, 2020, 11:32 a.m.

Key	Value	Last Updated
count_rate	22	Jan. 10, 2020, 11:32 a.m.
has_states_count	0	Jan. 10, 2020, 10:51 a.m.
monitor_count_1	0	Oct. 31, 2019, 4:05 p.m.
monitor_count_2	0	Jan. 10, 2020, 11:32 a.m.
monitor_count_3	0	Nov. 16, 2019, 11:43 a.m.
paused	false	Jan. 10, 2020, 10:51 a.m.
recording	false	Jan. 10, 2020, 10:51 a.m.
scan_index	0	Jan. 10, 2020, 10:51 a.m.
scanning	false	Jan. 10, 2020, 10:51 a.m.
system_dasmon	0	Jan. 10, 2020, 11:32 a.m.
system_pvsd	0	Jan. 10, 2020, 11:32 a.m.
total_charge	9.72322e+10	Jan. 10, 2020, 10:51 a.m.
total_counts	1715	Jan. 10, 2020, 10:51 a.m.
total_time	70.1039	Jan. 10, 2020, 10:51 a.m.

## HYS Monitor

[home](#) > [hys](#) > [monitor](#) live monitoring: [status](#) | [runs](#) | [PVs](#)



Align:Hu & SM in, 27 meV, check FR with flip 6.6 and comp 12.9 M off

Proposal: IPTS-22351 Run: 0  
Status: Stopped Count rate: 20

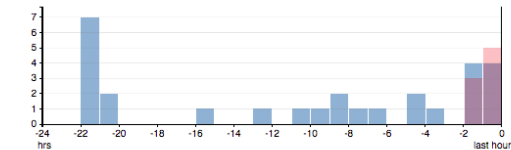
Systems: [Workflow](#)

Last run: 245710 from IPTS-22351 created on Jan. 10, 2020, 10:50 a.m.

List of latest runs:			
Show:	25	Search:	
Run	Created on	Status	Reduce
245710	Jan. 10, 2020, 10:50 a.m.	error	<a href="#">reduce</a>
245709	Jan. 10, 2020, 10:47 a.m.	error	<a href="#">reduce</a>
245708	Jan. 10, 2020, 10:40 a.m.	error	<a href="#">reduce</a>
245707	Jan. 10, 2020, 10:36 a.m.	error	<a href="#">reduce</a>
245706	Jan. 10, 2020, 10:28 a.m.	error	<a href="#">reduce</a>
245705	Jan. 10, 2020, 10:24 a.m.	error	<a href="#">reduce</a>
245704	Jan. 10, 2020, 10:23 a.m.	error	<a href="#">reduce</a>
245703	Jan. 10, 2020, 10:20 a.m.	error	<a href="#">reduce</a>
245702	Jan. 10, 2020, 8:09 a.m.	complete	<a href="#">reduce</a>
245701	Jan. 10, 2020, 7:09 a.m.	complete	<a href="#">reduce</a>
245700	Jan. 10, 2020, 7:04 a.m.	complete	<a href="#">reduce</a>
245699	Jan. 10, 2020, 4:58 a.m.	complete	<a href="#">reduce</a>
245698	Jan. 10, 2020, 3:58 a.m.	complete	<a href="#">reduce</a>
245697	Jan. 10, 2020, 2:57 a.m.	complete	<a href="#">reduce</a>
245696	Jan. 10, 2020, 2:47 a.m.	complete	<a href="#">reduce</a>
245695	Jan. 10, 2020, 1:35 a.m.	complete	<a href="#">reduce</a>
245694	Jan. 10, 2020, 12:35 a.m.	complete	<a href="#">reduce</a>
Showing 17 of 17 records			
			Previous <b>1</b> Next

## HYS Process Variables

[home](#) > [hys](#) > [monitor](#) live monitoring: [status](#) | [runs](#) | [PVs](#)



Align:Hu & SM in, 27 meV, check FR with flip 6.6 and comp 12.9 M off

Proposal: IPTS-22351 Run: 0  
Status: Stopped Count rate: 18

Systems: [Workflow](#)

Last run: 245710 from IPTS-22351 created on Jan. 10, 2020, 10:50 a.m.

Key	Value	Last Updated
BL148:Chop:Skf1:PhaseLocked	1	Jan. 10, 2020, 9:29 a.m.
BL148:Chop:Skf2:PhaseLocked	1	Jan. 10, 2020, 9:28 a.m.
BL148:Chop:Skf3:PhaseLocked	1	Jan. 10, 2020, 9:29 a.m.
BL148:Chop:Skf4:PhaseLocked	1	Jan. 10, 2020, 9:29 a.m.
BL148:Chop:Skf4:SpeedSet	120	Jan. 10, 2020, 9:28 a.m.
BL148:Chop:Skf4:SpeedUserReq	120	Jan. 10, 2020, 9:28 a.m.
BL148:CS:Energy:EI	27	Jan. 10, 2020, 9:30 a.m.
BL148:CS:Energy:EIReq	27	Jan. 10, 2020, 9:28 a.m.
BL148:CS:Scan:Active	0	Jan. 10, 2020, 10:51 a.m.
BL148:Det:TH-BM1:TrigDelay	9124	Jan. 10, 2020, 9:28 a.m.
BL148:Det:TH-BM2:TrigDelay	9573.28	Jan. 10, 2020, 9:28 a.m.
BL148:Det:TH-BM3:TrigDelay	10270.9	Jan. 10, 2020, 9:28 a.m.
BL148:Det:TH-DlyDet-SegEI	27	Jan. 10, 2020, 9:28 a.m.
BL148:Det:TH-DSP1:TrigDelay	11595.1	Jan. 10, 2020, 9:28 a.m.
BL148:Det:TH-DSP2:TrigDelay	11595.1	Jan. 10, 2020, 9:28 a.m.
BL148:Mot:bst	21	Jan. 10, 2020, 11:32 a.m.
BL148:Mot:bst.RBV	21	Jan. 10, 2020, 10:47 a.m.
BL148:Mot:bst:Status	0	Jan. 10, 2020, 11:32 a.m.
BL148:Mot:collInput:collDown	0	Jan. 10, 2020, 9:08 a.m.
BL148:Mot:m1hu	14.6599	Jan. 10, 2020, 9:29 a.m.
BL148:Mot:m1hu.RBV	14.6585	Jan. 10, 2020, 9:29 a.m.
BL148:Mot:m1hu:Status	0	Jan. 10, 2020, 9:29 a.m.
BL148:Mot:m2mel	571.3	Jan. 10, 2020, 8:54 a.m.
BL148:Mot:m2mel.RBV	571.308	Jan. 10, 2020, 8:54 a.m.
BL148:Mot:m2mel:Status	0	Jan. 10, 2020, 8:54 a.m.
BL148:Mot:m3hu	1.19333	Jan. 10, 2020, 9:29 a.m.
BL148:Mot:m3hu.RBV	1.196	Jan. 10, 2020, 9:29 a.m.
BL148:Mot:m3hu:Status	0	Jan. 10, 2020, 9:29 a.m.
BL148:Mot:msd	1803.43	Jan. 10, 2020, 11:32 a.m.
BL148:Mot:msd:Status	2	Jan. 10, 2020, 11:32 a.m.
BL148:Mot:s1	0	Jan. 10, 2020, 11:32 a.m.
BL148:Mot:s1:Status	0	Jan. 10, 2020, 11:32 a.m.

# Status of a Run

- The status page for a run is only available to users for that experiment and IS
- Data pulled from [livedata.sns.gov](https://livedata.sns.gov)
- Meta data is pulled from ONCat
- IS can resubmit a job

Meta data from  
data catalog

Reduced data

AR workflow  
AMQ log

Some tasks can  
be requested

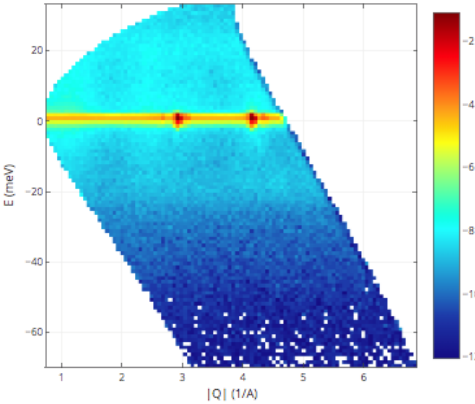
OAK RIDGE National Laboratory HIGH FLUX ISOTOPE REACTOR SPALLATION NEUTRON SOURCE

m2d | admin | logout

## HYS Run 245701

[home](#) > [hys](#) > [ipts-22351](#) > [run 245701](#) live monitoring: [status](#) | [runs](#) | [PVs](#)  
[previous](#) | [next](#)

Run title: Hi Entropy, UnPol, 35 meV Ei 360 Hz S2 +40, 300 K  
Run start: Jan. 10, 2020, 7:09 a.m.  
Run end: Jan. 10, 2020, 8:09 a.m.  
Duration: 3606.06591797  
Total counts: 1735036  
Proton charge: 5.00115147116e+12



Data files:  
/SNS/HYS/IPTS-22351/nexus/HYS\_245701.nxs.h5

Message	Information	Time
reduction_catalog.complete	autoreducer1.sns.gov	Jan. 10, 2020, 8:10 a.m.
reduction_catalog.started	autoreducer1.sns.gov	Jan. 10, 2020, 8:10 a.m.
reduction_catalog.data_re		Jan. 10, 2020, 8:10 a.m.
reduction.complete	Unverified HTTPS request is being made. Adding certificate verification is strongly advised. See: <a href="https://urlib3.readthedocs.org/en/latest/secure">https://urlib3.readthedocs.org/en/latest/secure</a>	Jan. 10, 2020, 8:10 a.m.
catalog.oncat.complete	autoreducer2.sns.gov	Jan. 10, 2020, 8:10 a.m.
catalog.oncat.started	autoreducer2.sns.gov	Jan. 10, 2020, 8:10 a.m.
reduction.started	autoreducer1.sns.gov	Jan. 10, 2020, 8:10 a.m.
catalog.complete		Jan. 10, 2020, 8:10 a.m.
reduction_catalog.complete		Jan. 10, 2020, 8:10 a.m.
catalog.oncat.data_ready		Jan. 10, 2020, 8:10 a.m.
catalog.complete		Jan. 10, 2020, 8:10 a.m.
reduction.data_ready		Jan. 10, 2020, 8:10 a.m.
reduction_catalog.complete		Jan. 10, 2020, 8:10 a.m.
postprocess.data_ready		Jan. 10, 2020, 8:10 a.m.
sms	Translation Succeeded - Run 245701 successfully translated	Jan. 10, 2020, 8:10 a.m.
sms	SMS run stopped	Jan. 10, 2020, 8:09 a.m.
sms	SMS Start Run Sent to STC	Jan. 10, 2020, 7:09 a.m.
sms	SMS run started	Jan. 10, 2020, 7:09 a.m.

Submit for post-processing: [catalog](#) | [reduction](#) | [all post-processing](#)

# Setting up the auto-reduction

- IS can modify their reduction script at
  - /SNS/<instrument>/shared/autoreduce/reduce\_<instrument>.py
- They can also use a custom form on the web monitor
- This avoids typos...

## CNCS Configuration





[home](#) > [cncs](#) > configuration

### Configuring the automated reduction

Instrument team members can use this page to generate a new automated reduction script.

- Click the submit button to create a new automated reduction script.
- Click the reset to populate the form with default values.
- The *reduce\_CNCS.py* will automatically be overwritten once you click the submit button.

List of parameters for CNCS reduction template:

Raw vanadium	<input type="text" value="/SNS/CNCS/IPTS-22728/nexus/CNCS_326713.nxs.h5"/>		
Processed vanadium	<input type="text" value="van_326713.nxs"/>		
Output directory	<input type="text"/>		
Vanadium integration	min <input type="text" value="49500.0"/>	max <input type="text" value="50500.0"/>	
Motor names	<input type="text" value="omega"/>		
Temperature names	<input type="text" value="SampleTemp,sampletemp,SensorB,SensorA,temp5,temp8,sensor0normal,Se"/>		
Grouping file	<input type="text" value="8 x 1"/>		
Create elastic nxspe	<input checked="" type="checkbox"/>		
Create MD nxs	<input type="checkbox"/>		
Energy in meV	<input type="checkbox"/>		
Energy binning	E <sub>min</sub> <input type="text" value="-0.1"/>	E <sub>step</sub> <input type="text" value="0.005"/>	E <sub>max</sub> <input type="text" value="0.95"/>
TOF offset	t <sub>0</sub> <input type="text"/>	Auto-fit t <sub>0</sub> to get E=0 at elastic peak <input type="checkbox"/>	
Time independent bck	min <input type="text"/>	max <input type="text"/>	
UB matrix	a <input type="text" value="1.0"/>	b <input type="text" value="1.0"/>	c <input type="text" value="1.0"/>
	alpha <input type="text" value="1.0"/>	beta <input type="text" value="1.0"/>	gamma <input type="text" value="1.0"/>
	u_vector <input type="text" value="1,0,0"/>	v_vector <input type="text" value="0,1,0"/>	
Masked Bank	Masked Tube	Masked Pixel	
<input type="text"/>	<input type="text"/>	<input type="text" value="121-128"/>	
<input type="text"/>	<input type="text"/>	<input type="text" value="1-8"/>	
<input type="text" value="36-50"/>	<input type="text"/>	<input type="text"/>	

Latest post-processing log entries for CNCS:

No recent changes

# Online Diagnostics

- A diagnostics page allows us to verify the health of the system.
- Pinpoints the issue for common problems.
- The system tries to self-diagnose as much as possible.
- DASMION and PVSD status are typically hidden by request of the DAS GL.

## CNCS Diagnostics

[home](#) > [cnscs](#) > [diagnostics](#)

live monitoring: [status](#) | [runs](#) | [PVs](#)

Systems: [Workflow](#)

### DASMION diagnostics:

Last status: 0  
Last status update: Jan. 10, 2020, 11:44 a.m.  
Last PV update: Jan. 10, 2020, 11:40 a.m.  
Last AMQ update: Jan. 10, 2020, 11:44 a.m.

### PVSD diagnostics:

Last status: 0  
Last status update: Jan. 10, 2020, 11:44 a.m.

### Workflow diagnostics:

Last status: 0  
Last status update: Jan. 10, 2020, 11:44 a.m.  
Dasmon listener PID 22488: Jan. 10, 2020, 11:43 a.m.

### Cataloging & Reduction diagnostics:

autoreducer1.sns.gov: Jan. 10, 2020, 11:44 a.m.  
autoreducer1.sns.gov PID 12642: Jan. 10, 2020, 11:44 a.m.  
autoreducer2.sns.gov: Jan. 10, 2020, 11:44 a.m.  
autoreducer2.sns.gov PID 10081: Jan. 10, 2020, 11:44 a.m.  
autoreducer3.sns.gov: Jan. 10, 2020, 11:44 a.m.  
autoreducer3.sns.gov PID 50701: Jan. 10, 2020, 11:44 a.m.  
autoreducer4.sns.gov: Jan. 10, 2020, 11:44 a.m.  
autoreducer4.sns.gov PID 38937: Jan. 10, 2020, 11:44 a.m.

# Thoughts on Transition

- The monitor present both post-processing status and instrument status.
  - We get IHC calls when the instrument status info is down.
  - The instrument status monitoring is clunky and should not be in our scope.
  - Our workflow system would be leaner without the DAS info.
  - Would suggest dropping PV monitoring, and DAS STC message monitoring.
  - High-level instrument monitoring is crucial, so we might want to develop a phased approach to shed that functionality.



# Failure Rates

- Web monitor: never
- AR clients: never
- Workflow manager: < 2/yr
- AMQ brokers: once per 2-3 months
- Workflow DB: almost never, but the disk can get full
- DASMOM listener: once per quarter, due to high traffic and WorkflowDB IO problems.