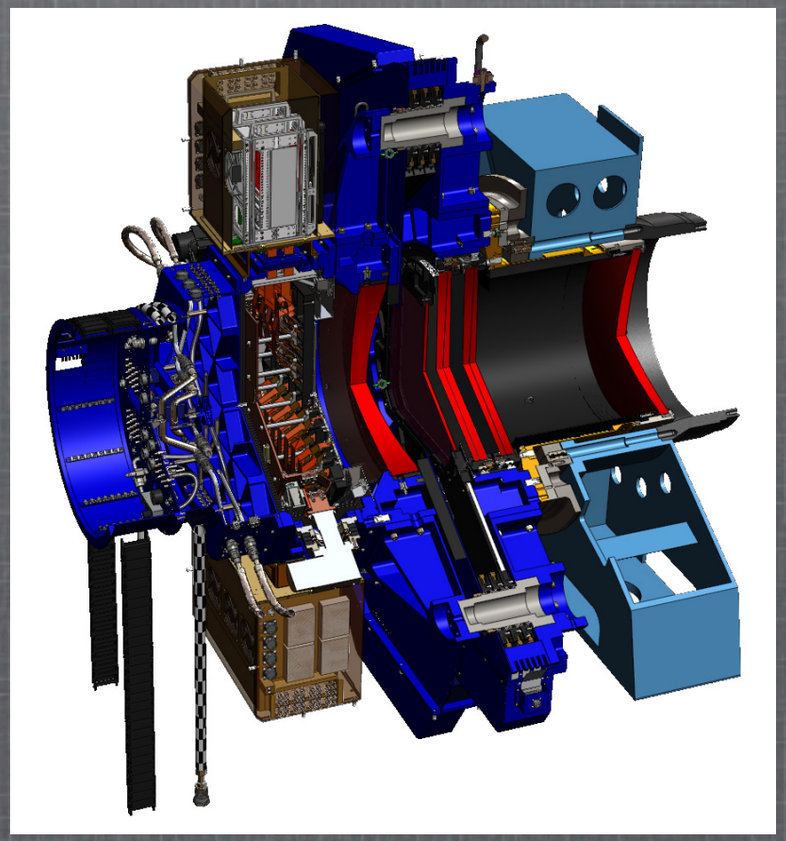
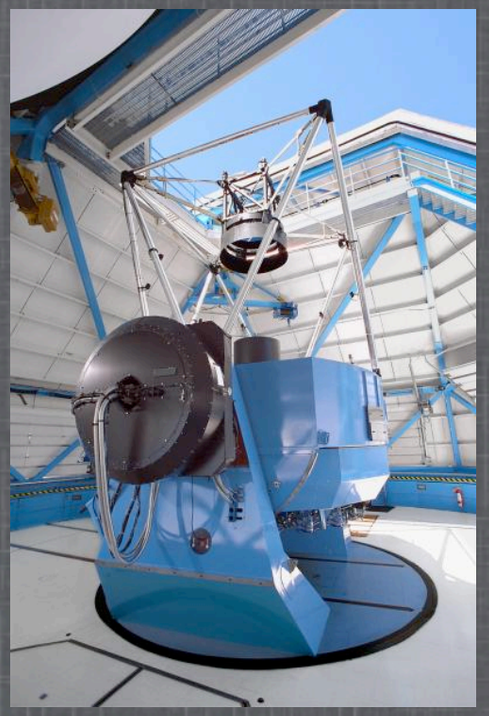
WIYN ODI:
Observing Process, Data Analysis and Archiving





Pierre Martin

AAS, Pasadena, June 2009

ODI:
Scientific Challenges

- ODI is designed to take advantage of the best seeing conditions at WIYN.

- ODI is a general facility instrument; Scientific programs will go from one single exposure to large-scale surveys and time-domain programs.

- Optimization of ODI scientific output requires high observing efficiency, sophisticated calibrations and long-term availability of the data products.

ODI:
Operational Challenges

- ODI offers five different acquisition modes including the default mode (e.g. full OTA correction) which requires a large number (~200) of guide stars.

- ODI individual raw images are large (~ 2 Gbytes/ image) and the (calibrations + scientific) data volume will be considerable (up to ~ 4 Tbytes per night).

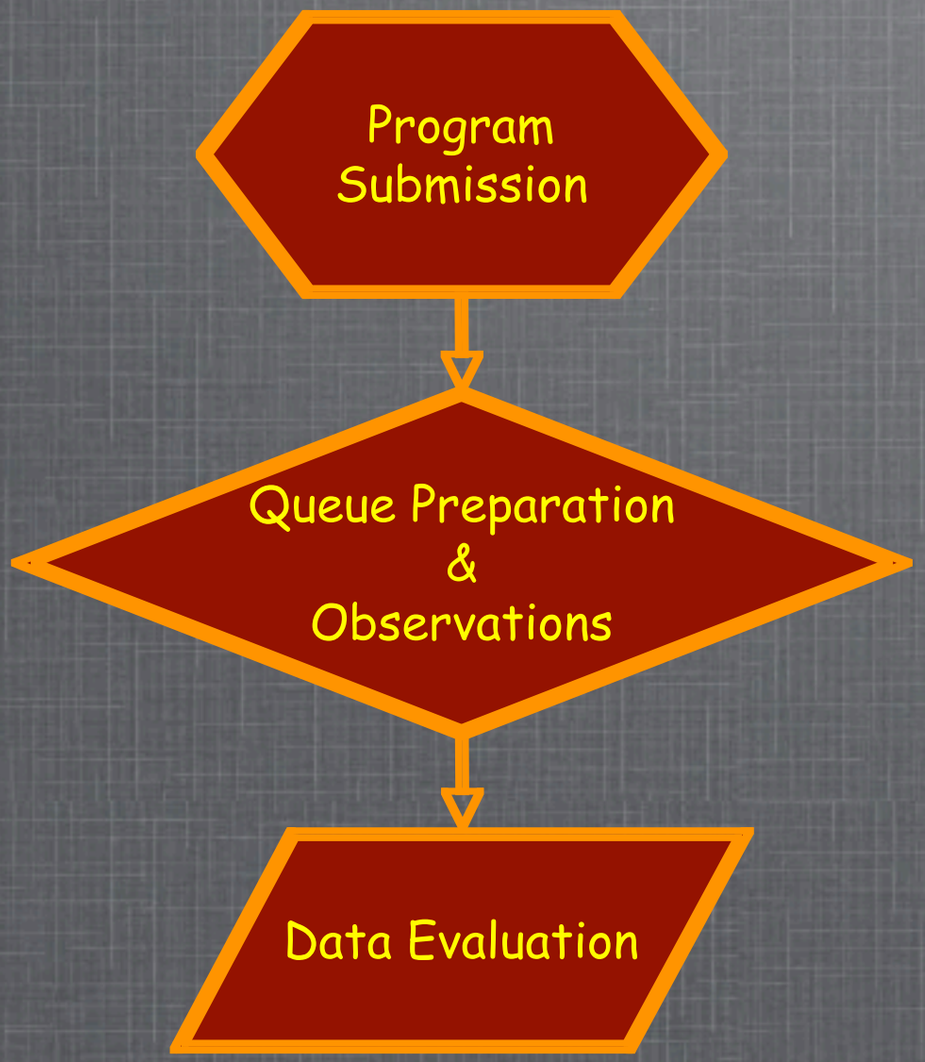
- Data reduction will be complex, CPU intensive, and likely to evolve with time to achieve better and better results.

ODI:
The Observing Process ?

- WIYN is planning to eventually offer queue observing
- Some advantages of queue observing :
  - Adapting to sky conditions
  - Benefits highly ranked science
  - Well-suited for very short and long-term programs
  - Facilitates time-constrained programs
  - Provides high observing efficiency
  - Need photometry? You got it!
  - Balancing time between partners
  - Optimizes dark/gray/bright telescope time
  - More complete and controlled calibrations
  - Metadata add value to data

E.g. The CFHT Queued Service Observing (QSO)

QSO: Three Steps Process

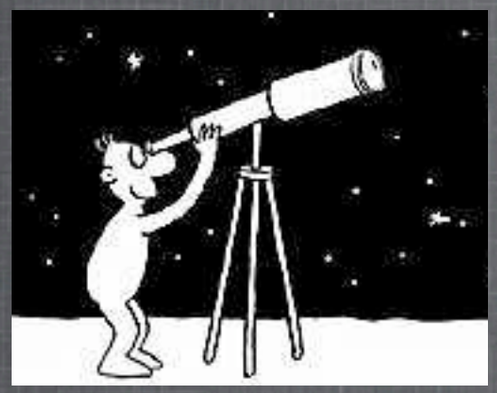


- Phase I (CADC) + TAC
- Phase II (PH2)
- Program Reviews and Prep

- Planning and Scheduling
- Night Queues (4-5)
- Observing Process
- Calibration Plan

- Data Quality Assessment
- Validation Cascade

WIYN ODI QUEUE:
The Concept?



Phase 2 Tier
(Web client ?)

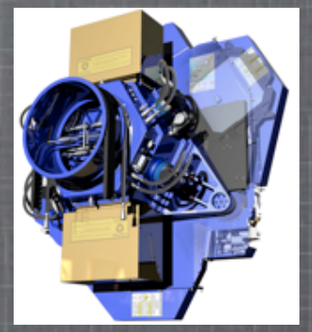
WOQ
Db

WOQ Tools

Scheduler

Obs Tool

LogBook



The Daily Jigsaw Puzzle: Queuing!

	RunID	PI Name	Agency	Grade	Ra...	Prg Type	Prg Status	Label	OG Status	Priority	Filter
3	07AQ87	QSO Team	Calibration	A: must do	2	CALIBRATION	OBSERVED	OG11	NOT_STARTED	*Medium*	H
4	07AQ87	QSO Team	Calibration	A: must do	2	CALIBRATION	OBSERVED	OG12	NOT_STARTED	*Medium*	Ks
5	07AH34	David Sanders	UH	A: must do	1	REGULAR	STARTED	OG57	NOT_STARTED	*Medium*	Ks
6	07AH34	David Sanders	UH	A: must do	1	REGULAR	STARTED	OG58	NOT_STARTED	*Medium*	Ks
7	07AH34	David Sanders	UH	A: must do	1	REGULAR	STARTED	OG59	NOT_STARTED	*Medium*	Ks
8	07AH34	David Sanders	UH	A: must do	1	REGULAR	STARTED	OG60	NOT_STARTED	*Medium*	Ks
9	07AH34	David Sanders	UH	A: must do	1	REGULAR	STARTED	OG61	NOT_STARTED	*Medium*	Ks
10	07AH34	David Sanders	UH	A: must do	1	REGULAR	STARTED	OG62	NOT_STARTED	*Medium*	Ks
11	07AC20	Chris Willott	NRC	A: must do	1	REGULAR	STARTED	OG24	NOT_STARTED	*Medium*	Ks
12	07AC20	Chris Willott	NRC	A: must do	1	REGULAR	STARTED	OG25	NOT_STARTED	*Medium*	Ks
13	07AC20	Chris Willott	NRC	A: must do	1	REGULAR	STARTED	OG35	OBSERVED	*Medium*	J
14	07AC20	Chris Willott	NRC	A: must do	1	REGULAR	STARTED	OG36	NOT_STARTED	*Medium*	J
15	07AC20	Chris Willott	NRC	A: must do	1	REGULAR	STARTED	OG37	NOT_STARTED	*Medium*	J
16	07AC20	Chris Willott	NRC	A: must do	1	REGULAR	STARTED	OG38	NOT_STARTED	*Medium*	J
17	07AC20	Chris Willott	NRC	A: must do	1	REGULAR	STARTED	OG39	NOT_STARTED	*Medium*	J
18	07AC20	Chris Willott	NRC	A: must do	1	REGULAR	STARTED	OG40	NOT_STARTED	*Medium*	J
19	07AF22	Jerome Bouvier	CNRS	A: must do	2	REGULAR	STARTED	OG5	OBSERVED	**High**	H;H;J
20	07AF22	Jerome Bouvier	CNRS	A: must do	2	REGULAR	STARTED	OG6	NOT_STARTED	**High**	Y;H;J;Y
21	07AQ87	QSO Team	Calibration	A: must do	2	CALIBRATION	OBSERVED	OG21	OBSERVED	*Medium*	Y
22	07AQ87	QSO Team	Calibration	A: must do	2	CALIBRATION	OBSERVED	OG22	OBSERVED	*Medium*	J

The Daily Jigsaw Puzzle: Queuing!

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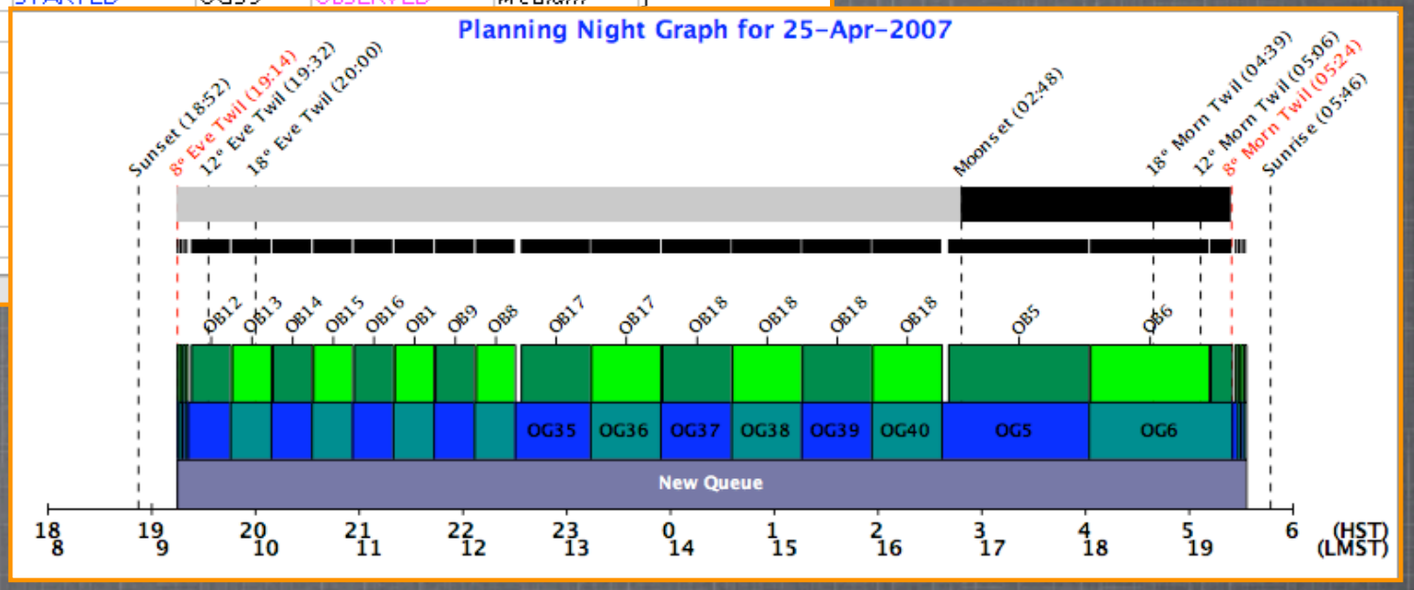
16	07AC20	Chris Willott	NRC	A: must do	1	REGULAR					
17	07AC20	Chris Willott	NRC	A: must do	1	REGULAR					
18	07AC20	Chris Willott	NRC	A: must do	1	REGULAR					
19	07AF22	Jerome Bouvier	CNRS	A: must do	2	REGULAR					
20	07AF22	Jerome Bouvier	CNRS	A: must do	2	REGULAR					
21	07AQ87	QSO Team	Calibration	A: must do	2	CALIBRATION					



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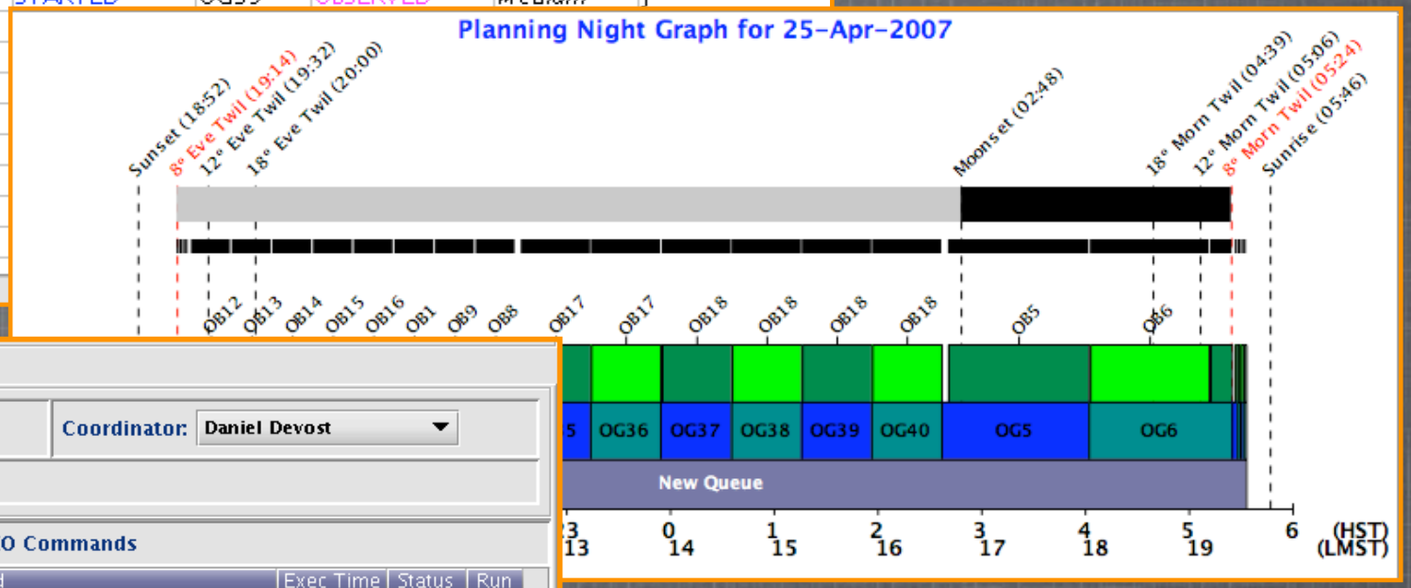

Active Queue | Pending Queue | Night Graph | Messages

Queue RunID: 07AQ04 : WIRCAM : Mar-27 to Apr-05 | Observer: Pierre Martin | Coordinator: Daniel Devost

QUEUE: Q1 : 27-Apr-2007 | Comment: Q < 0.65".

Observing Group/Block Selection

- Q1
  - OG9 : 07AQ87 : QSO Team : 1 min, 4 sec
    - OB9 : High : > 1.20 : 1 min, 4 sec
      - FT3 : FS14
      - I1: Y : 4 x 6 sec
        - cube (T:1) 1 of 4
        - cube (T:1) 2 of 4
        - cube (T:1) 3 of 4
        - cube (T:1) 4 of 4
  - OG10 : 07AQ87 : QSO Team : 1 min, 4 sec
    - OB10 : High : > 1.20 : 1 min, 4 sec
      - FT3 : FS14
      - I2: J : 4 x 6 sec
        - cube (T:1) 1 of 4
        - cube (T:1) 2 of 4
        - cube (T:1) 3 of 4
        - cube (T:1) 4 of 4
  - OG11 : 07AQ87 : QSO Team : 1 min, 4 sec
    - OB11 : High : > 1.20 : 1 min, 4 sec
      - FT3 : FS14

all

NEO Commands

	Command	Exec Time	Status	Run
90	@header sequence WDP1[1/4] - Ref + [-277.000000 -277.000...		IDLE	
91	@nheader 10003.1 TRGTYPE "TARGET" "Target Type"		IDLE	
92	ocoords abs t -277.000000 -277.000000		IDLE	
93	go etype=OBJECT micro=1 nexp=1 etime=6.0 raster="FULL" file...		IDLE	
94	@say_ logonly: END_OFF 30000100000000000596		IDLE	
95	@say_ logonly: BEG_OFF 30000100000000000597 2:[-277.000...		IDLE	
96	@nheader 10001.8 QOFFID 30000100000000000597		IDLE	
97	@header sequence WDP1[2/4] - Ref + [-277.000000 382.0000...		IDLE	
98	@nheader 10003.1 TRGTYPE "TARGET" "Target Type"		IDLE	
99	ocoords abs t -277.000000 382.000000		IDLE	
100	go etype=OBJECT micro=1 nexp=1 etime=6.0 raster="FULL" file...		IDLE	
101	@say_ logonly: END_OFF 30000100000000000597		IDLE	
102	@say_ logonly: BEG_OFF 30000100000000000598 3:[382.0000...		IDLE	
103	@nheader 10001.8 QOFFID 30000100000000000598		IDLE	
104	@header sequence WDP1[3/4] - Ref + [382.000000 382.0000...		IDLE	
105	@nheader 10003.1 TRGTYPE "TARGET" "Target Type"		IDLE	
106	ocoords abs t 382.000000 382.000000		IDLE	
107	go etype=OBJECT micro=1 nexp=1 etime=6.0 raster="FULL" file...		IDLE	
108	@say_ logonly: END_OFF 30000100000000000598		IDLE	
109	@say_ logonly: BEG_OFF 30000100000000000599 4:[382.0000...		IDLE	
110	@nheader 10001.8 QOFFID 30000100000000000599		IDLE	
111	@header sequence WDP1[4/4] - Ref + [382.000000 -277.0000...		IDLE	
112	@nheader 10003.1 TRGTYPE "TARGET" "Target Type"		IDLE	
113	ocoords abs t 382.000000 -277.000000		IDLE	
114	go etype=OBJECT micro=1 nexp=1 etime=6.0 raster="FULL" file...		IDLE	
115	@say_ logonly: END_OFF 30000100000000000599		IDLE	
116	@say_ logonly: END_PAT 10000900000000000097		IDLE	

The Daily Jigsaw Puzzle: Queuing!

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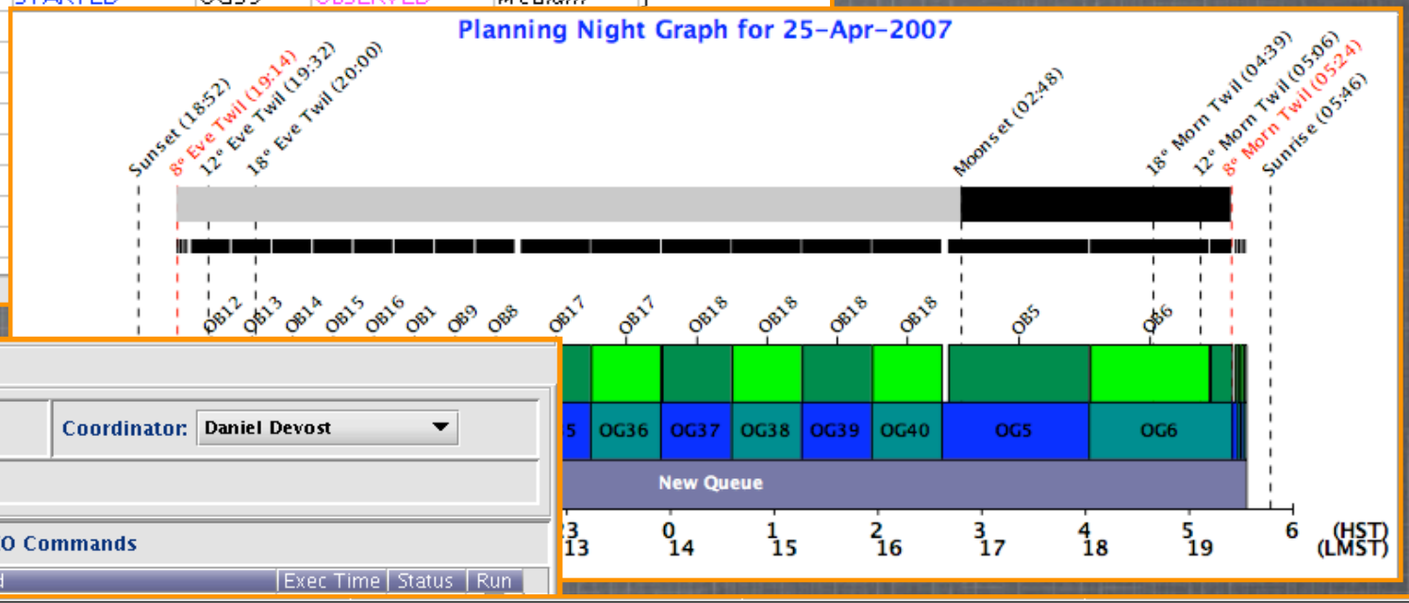

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    - OB11 : High : > 1.20 : 1 min, 4 sec
      - FT3 : FS14

all

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	Command	Exec Time	Status	Run
90	@header sequence WDP1[1/			
91	@nheader 10003.1 TRGTYP			
92	ocoords abs t -277.000000			
93	go etype=OBJECT micro=1 r			
94	@say_ logonly: END_OFF 300			
95	@say_ logonly: BEG_OFF 300			
96	@nheader 10001.8 QOFFID			
97	@header sequence WDP1[2/			
98	@nheader 10003.1 TRGTYP			
99	ocoords abs t -277.000000			
100	go etype=OBJECT micro=1 r			
101	@say_ logonly: END_OFF 300			
102	@say_ logonly: BEG_OFF 300			
103	@nheader 10001.8 QOFFID			
104	@header sequence WDP1[3/			
105	@nheader 10003.1 TRGTYP			
106	ocoords abs t 382.000000			
107	go etype=OBJECT micro=1 r			
108	@say_ logonly: END_OFF 300			
109	@say_ logonly: BEG_OFF 300			
110	@nheader 10001.8 QOFFID			
111	@header sequence WDP1[4/			
112	@nheader 10003.1 TRGTYP			
113	ocoords abs t 382.000000			
114	go etype=OBJECT micro=1 r			
115	@say_ logonly: END_OFF 300			
116	@say_ logonly: END_PAT 100			

	Elongation	Flag	Exp Date(HST)	RunID	PI	OG Label	Exp File	Exp Type	Exp Status	Pho
134	1.39		Apr-04 23:46:48	07AT19	Lihwai Lin	OG4	904233o	OBJECT	VALIDATED	
135	1.43		Apr-04 23:50:35	07AT19	Lihwai Lin	OG4	904234o	OBJECT	VALIDATED	
136	1.44		Apr-04 23:54:19	07AT19	Lihwai Lin	OG4	904235o	OBJECT	VALIDATED	
137	1.43		Apr-04 23:57:53	07AT19	Lihwai Lin	OG4	904236o	OBJECT	VALIDATED	
138	1.4		Apr-05 00:01:45	07AT19	Lihwai Lin	OG4	904237o	OBJECT	VALIDATED	
139	1.42		Apr-05 00:05:21	07AT19	Lihwai Lin	OG4	904238o	OBJECT	VALIDATED	
140	1.48		Apr-05 00:09:02	07AT19	Lihwai Lin	OG4	904239o	OBJECT	VALIDATED	
141	1.46		Apr-05 00:12:40	07AT19	Lihwai Lin	OG4	904240o	OBJECT	VALIDATED	
142	1.47	*	Apr-05 00:16:27	07AT19	Lihwai Lin	OG4	904241o	OBJECT	VALIDATED	
143	1.49		Apr-05 00:20:03	07AT19	Lihwai Lin	OG4	904242o	OBJECT	VALIDATED	
144	1.49		Apr-05 00:23:44	07AT19	Lihwai Lin	OG4	904243o	OBJECT	VALIDATED	
145	1.47		Apr-05 00:27:32	07AT19	Lihwai Lin	OG4	904244o	OBJECT	VALIDATED	
146	1.43		Apr-05 00:31:08	07AT19	Lihwai Lin	OG4	904245o	OBJECT	VALIDATED	
147	1.47	*	Apr-05 00:34:44	07AT19	Lihwai Lin	OG4	904246o	OBJECT	VALIDATED	
148	1.33		Apr-05 00:38:26	07AT19	Lihwai Lin	OG4	904247o	OBJECT	VALIDATED	
149	1.48	*	Apr-05 00:42:00	07AT19	Lihwai Lin	OG4	904248o	OBJECT	VALIDATED	
150	1.16	*	Apr-05 00:45:38	07AT19	Lihwai Lin	OG14	904249a	ACQUIRE	OBSERVED	

Description	Value
Exp Val/Req	16/16
Eval	1
IC Label	I1
IC Status	VALIDATED
IC Val/Req	1/1
IC O-Time	14.93
OB Label	OB4
OB Type	OBJECT
OB Status	VALIDATED
OB Val/Req	1/1
OB O-Time	14.93
OG Status	VALIDATED
OG Val/Req	6/16
OG O-Time	0.93
Prg Type	REGULAR
Prg Grade	A: must do
Prg Rank	3
Prg Status	STARTED
Prg O-Time	7.10
Target	GOODSN14

E Time: 60.0 (Req) 60.0 (Act) | Filter: J | IQ: Between 0.65 and 0.8 (Req) 0.8 (Act) | Sky BG: Median (Req) Median (Act) | AirM: 1.5 (Req) 1.36 (Act)

N Exp: 3 (Req) 3 (Act) | Slice: 03: IQ=0.82, Sky BG=125, Sky LVL=7509, E=1.39, Abs=0.03 | Type: TARGET | Elong: 1.39

Observer Comments: 0.6"

Coordinator Comments: IQ measured by hand is 0.6", excellent

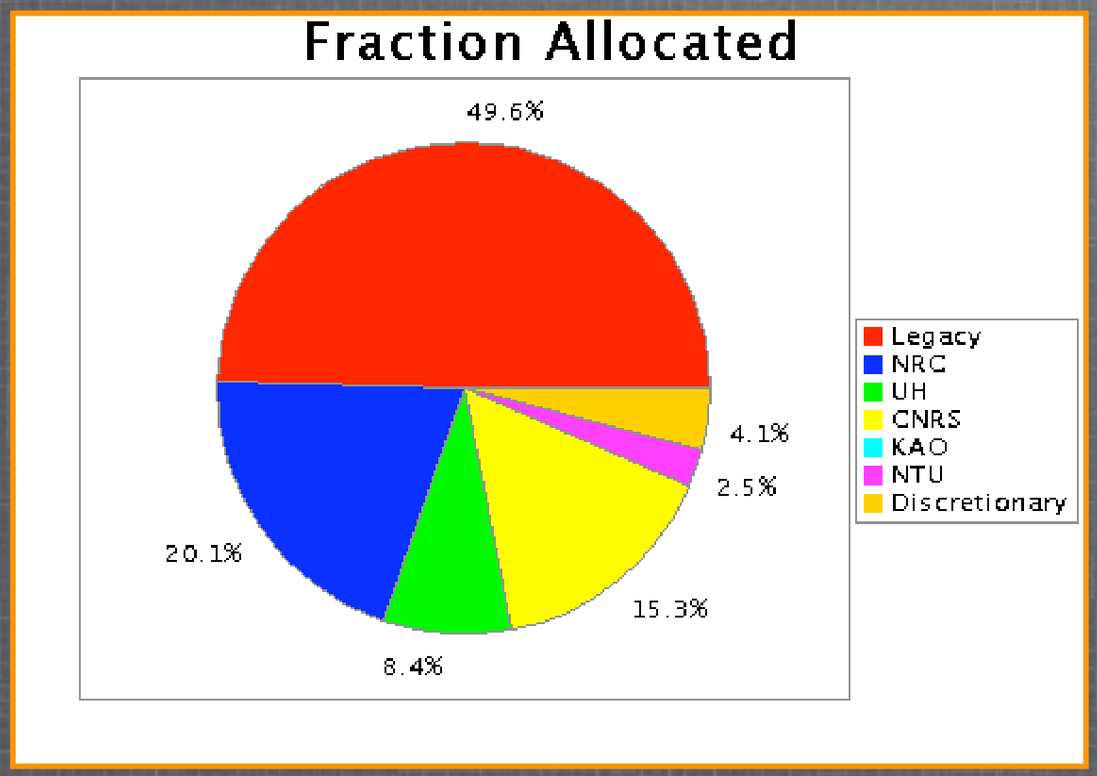
1 2 3 4 5 | Photometric | Validate: | Update

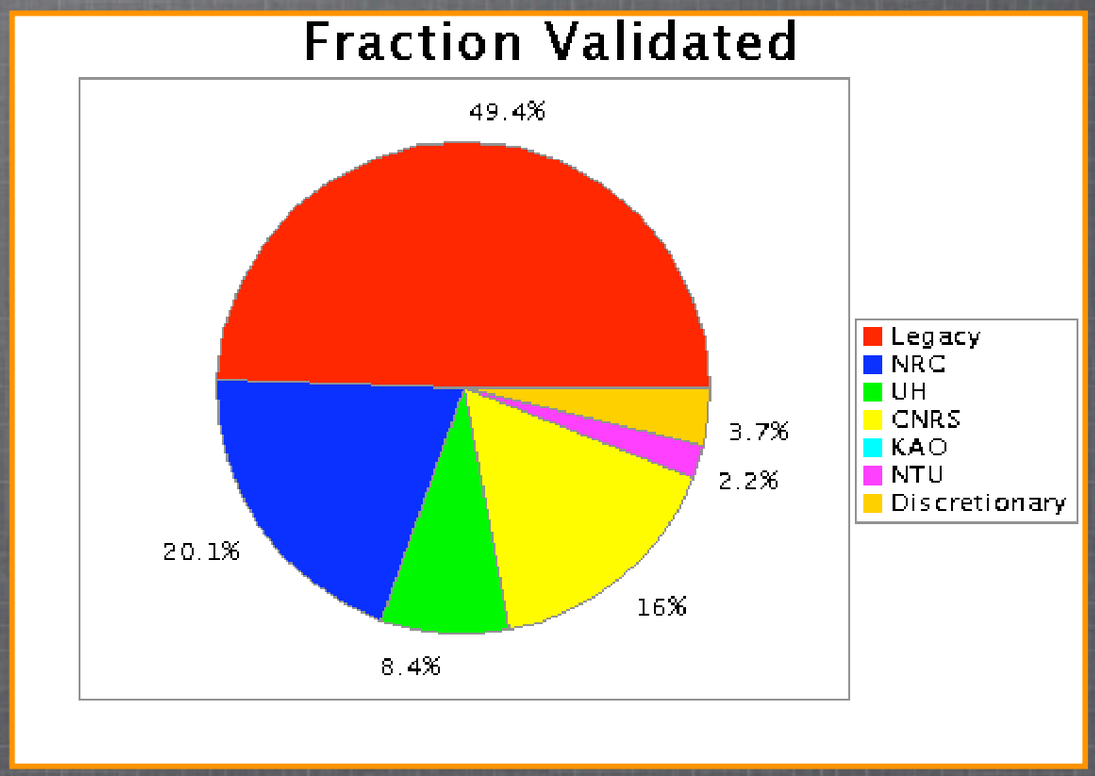
Some CFHT QSO results :

A Programs : Completion >> 90%
B Programs : Completion > 75%

Validation rate: 92-95%

Agency time balance: (e.g. MegaCam 2006B semester)





Caveat:
Queue WORKS but it is not cheap ...

ODI:
Data Analysis and Archiving ?

- WIYN is in the process of evaluating the development of a scientific data reduction pipeline and long-term archiving system for ODI

- Main Challenges:

  - ODI data will be complex to analyze and calibrate
  - ODI data volume will be very large
  - ODI science programs will explore the time-domain

A process in several steps :

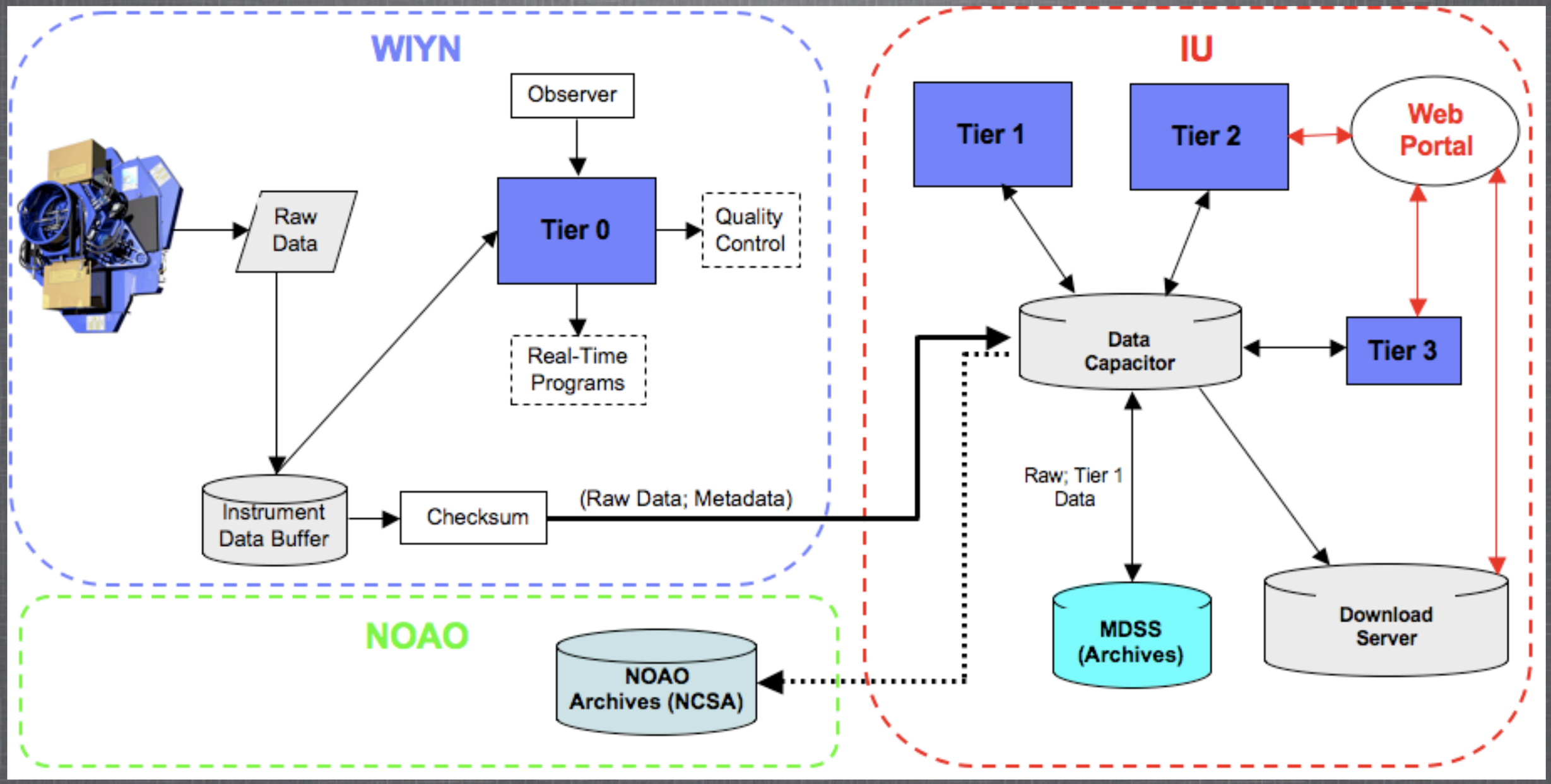
- **Tier 0**
  Quick look analysis for observers and time-domain programs: basic analysis done on site on local machines. [Included in ODI Project]

- **Tier 1**
  End-of-run, removal of instrument signatures and more advanced spectrometric and photometric calibrations on individual images. Updated master calibration products.

- **Tier 2**
  Production of optimum science products: Image stacking, high-accuracy astrometric and photometric solutions, PSF re-sampling, cosmic ray removal, fringing correction, etc. Fine-tuning on image stacking and catalogs.

- **Tier 3**
  Image manipulation (e.g. filtering, image arithmetic), display, photometry, etc.

A possibility: The "WIYN/IU" Model:



PanSTARRS IPP, adapted to ODI and *Teragrid ?*

Tier2+3; Data Mining through Web portal

WIYN Actualities:

- *Now:* Pipeline and Archiving Science Requirements Document (PASRD)

- *Now:* Design work continues on the "WIYN/IU" model

- *Aug./Sep.:* PDR on pipeline proposal(s)

- *Aug./Sep.:* Operational Plan for 2010 and beyond; inclusion of queue observing and support for pipeline

Conclusion

ODI is going to be a very sophisticated camera, designed to provide large volume of complex data for diverse scientific endeavors

Optimizing ODI Scientific Output :

Priority 1: Scientific Pipeline & Archiving
Priority 2: Queue/Service Observing Mode

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WIYN is working on those !