



Quick Intro to Gemini IRAF

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Gemini Data Format

- Multi-extension FITS (MEF)
- Once “prepared”, the extensions are named and versioned. (EXTNAME, EXTVER)
- SCI = Science; VAR = Variance; DQ = Data Quality; MDF = Mask Definition File
- Use fxhead (fitsutil package) to see what it looks like



Gemini Data Format

GMOS dataset

Raw dataset

```
gmos> fxhead S20080220S0078
```

EXT#	EXTTYPE	EXTNAME	EXTVE	DIMENS	BITPI	INH	OBJECT
0		S20080220S0078.fits			16		ZZ Ori
1	IMAGE		-1	1056x512	16	F	
2	IMAGE		-1	1056x512	16	F	
3	IMAGE		-1	1056x512	16	F	

```
gmos>
gmos>
gmos>
gmos>
gmos>
gmos>
gmos>
gmos> fxhead gS20080220S0078
```

EXT#	EXTTYPE	EXTNAME	EXTVE	DIMENS	BITPI	INH	OBJECT
0		gS20080220S0078.fit			16		ZZ Ori
1	IMAGE	SCI	1	1056x512	16	F	
2	IMAGE	SCI	2	1056x512	16	F	
3	IMAGE	SCI	3	1056x512	16	F	

```
gmos>
```

Prepared dataset



Gemini Data Format

GMOS longslit dataset

Raw dataset

```
gmos> fxhead S20031121S0107
EXT#  EXTTYPE      EXTNAME      EXTVE DIMENS  BITPI  INH  OBJECT
0      S20031121S0107.fits      -1  1056x1024  16    F    H600
1      IMAGE              -1  1056x1024  16    F
2      IMAGE              -1  1056x1024  16    F
3      IMAGE

gmos>
gmos>
gmos>
gmos> fxhead gsS20031121S0107
EXT#  EXTTYPE      EXTNAME      EXTVE DIMENS  BITPI  INH  OBJECT
0      gsS20031121S0107.fi      1  64x3      8      H600
1      BINTABLE      MDF          1  3108x1024 -32    F
2      IMAGE          SCI          1  3108x1024 -32    F
3      IMAGE          VAR          1  3108x1024 -32    F
4      IMAGE          DQ           1  3108x1024  16    F    H600

gmos>
```

Processed and
mosaiced dataset
with variance
and DQ



GMOS MOS dataset

Raw dataset

Processed and cut MOS dataset with variance and DQ

```
gmos> fxhead N20011221S140
```

EXT#	EXTTYPE	EXTNAME	EXTVE	DIMENS	BITPI	INH	OBJECT
0		N20011221S140.fits			16		Abell1851
1	IMAGE		-1	2080x4608	16	F	
2	IMAGE		-1	2080x4608	16	F	
3	IMAGE		-1	2080x4608	16	F	

```
gmos>
gmos>
gmos>
gmos> fxhead gsN20011221S140
```

EXT#	EXTTYPE	EXTNAME	EXTVE	DIMENS	BITPI	INH	OBJECT
0		gsN20011221S140.fit			16		Abell1851
1	BINTABLE	MOD	1	118x37	8		
2	IMAGE	SCI	1	6218x101	-32	F	148
3	IMAGE	VAR	1	6218x101	-32	F	Abell1851
4	IMAGE	DQ	1	6218x101	16	F	Abell1851
5	IMAGE	SCI	2	6218x85	-32	F	138
6	IMAGE	VAR	2	6218x85	-32	F	Abell1851
7	IMAGE	DQ	2	6218x85	16	F	Abell1851
8	IMAGE	SCI	3	6218x41	-32	F	80
9	IMAGE	VAR	3	6218x41	-32	F	Abell1851
10	IMAGE	DQ	3	6218x41	16	F	Abell1851
...							
...							
95	IMAGE	SCI	32	6218x130	-32	F	3515
96	IMAGE	VAR	32	6218x130	-32	F	Abell1851
97	IMAGE	DQ	32	6218x130	16	F	Abell1851
98	IMAGE	SCI	33	6218x130	-32	F	3463
99	IMAGE	VAR	33	6218x130	-32	F	Abell1851
100	IMAGE	DQ	33	6218x130	16	F	Abell1851
101	IMAGE	SCI	34	6218x72	-32	F	3302
102	IMAGE	VAR	34	6218x72	-32	F	Abell1851
103	IMAGE	DQ	34	6218x72	16	F	Abell1851

```
gmos>
```



Gemini Data Format

- The gemini tasks handle and **expect** MEF files.
- To access PHU and extensions in IRAF:
 - `imheader S20100719S0001[0]`
 - `imstat S20100719S0001[3]`
 - `display rgS20100719S0001[SCI,2]`
- To see what is in the MDF:
 - `tread gS20100719S0001[MDF]`



Data Reduction Package – Objective

For all Gemini facility instruments, provide the tools necessary to remove instrument and atmospheric signatures from data.



Gemini IRAF package

- The package currently supports the following instruments:
 - GMOS [imaging, longslit, MOS, IFU] (gmos package)
 - NIRI [imaging, longslit] (niri and gnirs package)
 - GNIRS [longslit, XD, IFU] (gnirs package)
 - NIFS [IFU] (nifs and gnirs package)
 - Michelle [imaging, longslit] (midir and gnirs package)
 - T-ReCS [imaging, longslit] (midir and gnirs package)



Gemini IRAF package

- All raw frame must be “prepared”, even if you are going to use your own software afterwards.

Eg. gprepare will add the correct values for GAIN and RDNNOISE.

Eg. saturation level and non-linearity level will be added.

Eg. The MDF will be added.



Gemini IRAF package

- Want an overview of how to reduce? Start with the “info” script.

```
gmos> gmos
gmos> ?
  gbias          gfresponse      gmosinfoifu     gsdrawslits
  gbpm           gfskysub       gmosinfoimag    gsextract
  gdark          gftransform    gmosinfospec    gsflat
  gdisplay       ggain          gnscombine      gsquick
  gfapsum        giflat         gnsdark         gsreduce
  gfcombine      gifringe       gnsskysub      gssdist
  gfcopy         giillum       gprepare        gsskysub
  gfcube         gireduce      gsappwave       gsslitfunction
  gfdisplay      girmfringe    gscalibrate     gsstandard
  gfextract      gmosaic       gscrmask        gstransform
  gfquick        gmosexamples  gscrrej         gswavelength
  gfreduce       gmosinfo      gscut           mostools.
```



Gemini IRAF package

- Want an example reduction script? Try the “examples” script.

```
xterm
DESCRIPTION

A few example scripts are provided for the GMOS package.
GMOSEXAMPLE prints these to the screen. The examples use real data
and have all been use for data reduction. The users will need to
modify directory and image names for their own use. The example
files are located in gmos$doc.

Example      File
-----
imaging      imaging_example.cl
spec-std     specstd_example.cl
longslit     longslit_example.cl
MOS          mos_example.cl
NSMOS        nsmos_example.cl
NS-longslit  ns_example.cl
IFU-1        ifu1_example.cl
IFU-2        ifu2_example.cl
IFU-specstd  ifu_specstd_example.cl
-----

To print the example of reduction of imaging data, including fringe
correction if needed:

cl> gmosexamples imaging

gmosexamples-(45%)-line 44-file 1 of 1
```




Gemini IRAF package

- Want to know about a specific task? Read the help page.

`phelp wmeff`

```
Untitled
WMEF (Oct2001)          gemini.gemtools          WMEF (Oct2001)
NAME
  wmeff -- convert individual FITS or PLIO (.pl) files to a MEF file
USAGE
  wmeff input output
PARAMETERS
  input
    A comma separated list of input files ...
  ...
  ...
DESCRIPTION
  WMEF is a task that creates a Multi-Extension Fits (MEF) (output)
  from individual files, input.
  ...
  ...
EXAMPLES
  1. Create a MEF file with three NIR1 files containing the data, the
  variance and the data quality information:
  ...
  cl> wmeff data.fits,var.fits,dq.pl niridata
  ...
BUGS
SEE ALSO
  fxdummy, fxinsert, fxheader
```



Gemini IRAF package

- Gemini package tasks you should be aware of
 - gemarith and gemexpr
 - Arithmetic on MEF files (akin to imarith and imexpr)
 - gemcombine
 - Average, sum, median combine MEF files (akin to imcombine)
 - wmef
 - From single FITS files, build a MEF file
 - gemlist
 - Cute little tool to make list of gemini datasets using the standard naming convention: N20100719S0001
- Bottom line, check the gemtools package.



Heads-up – Python's coming

- As of v1.10, the package is PyRAF compatible.
- New development work is done in Python.
- We are working on a new, more automated, data reduction system called the Recipe System.
- At the center of the Recipe System is AstroData. This will be of interest to astronomers coding in Python.