JDDPS Stubs, Data, and Activities

Eric H. Neilsen, Jr.

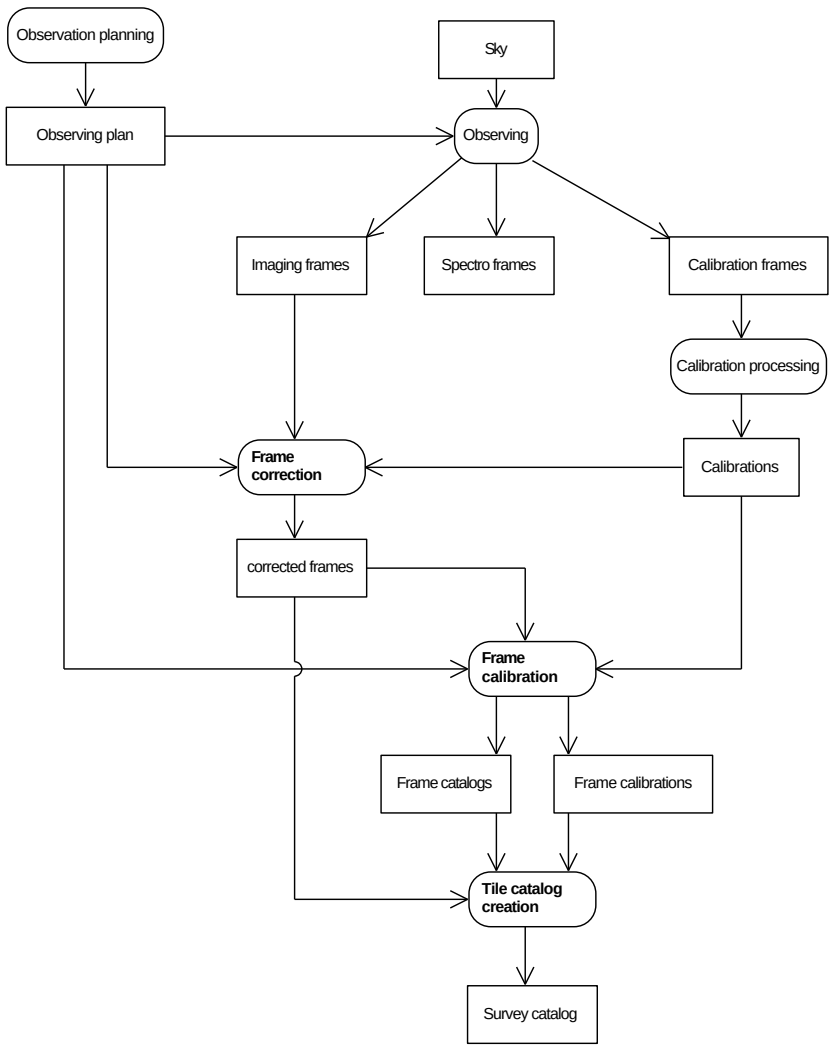
FNAL

16 June 2010

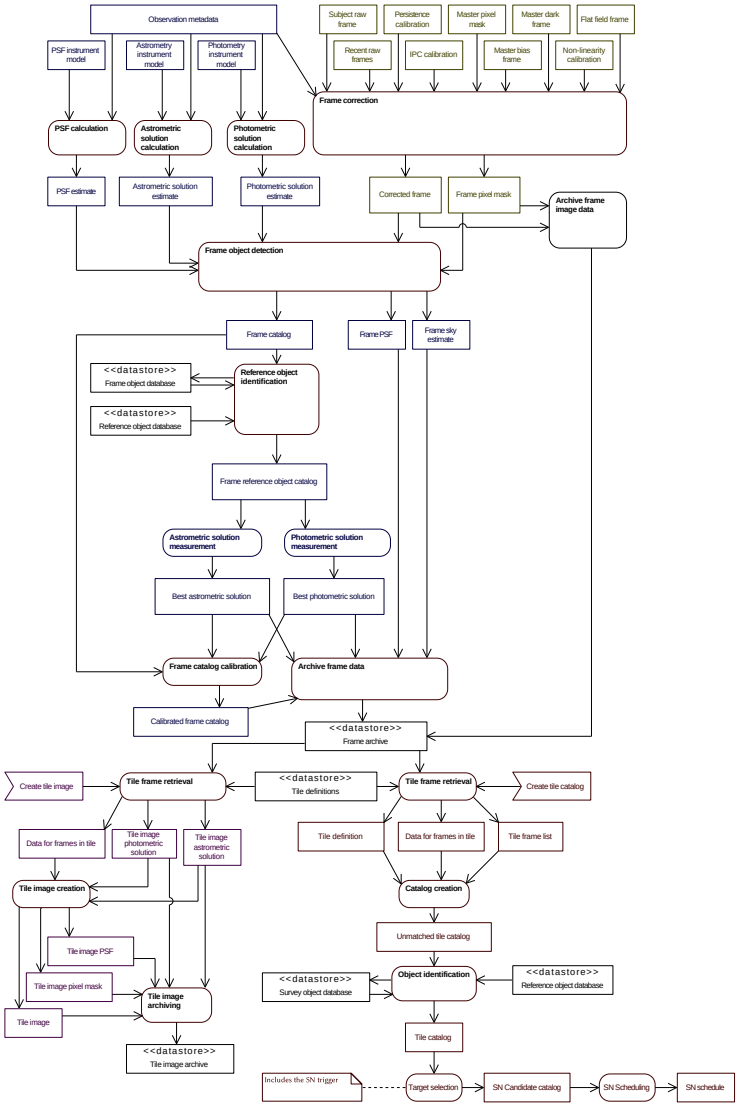
Outline

- NIR imaging object flow diagram
- Description of the universal stub.
- Database schema

High level


Observation planning
Sky
Observing plan
Observing
Imaging frames
Spectro frames
Calibration frames
Calibration processing
Frame correction
Calibrations
corrected frames
Frame calibration
Frame catalogs
Frame calibrations
Tile catalog creation
Survey catalog

Lower level


Observation metadata
Subject raw frame
Persistence calibration
Master pixel mask
Master dark frame
Flat field frame
PSF instrument model
Astrometry instrument model
Photometry instrument model
Recent raw frames
IPC calibration
Master bias frame
Non-linearity calibration
Frame correction
PSF calculation
Astrometric solution calculation
Photometric solution calculation
PSF estimate
Astrometric solution estimate
Photometric solution estimate
Corrected frame
Frame pixel mask
Archive frame image data
Frame object detection
Frame catalog
Frame PSF
Frame sky estimate
<<datastore>>
Frame object database
Reference object identification
<<datastore>>
Reference object database
Frame reference object catalog
Astrometric solution measurement
Photometric solution measurement
Best astrometric solution
Best photometric solution
Frame catalog calibration
Archive frame data
Calibrated frame catalog
<<datastore>>
Frame archive
Create tile image
Tile frame retrieval
<<datastore>>
Tile definitions
Tile frame retrieval
Create tile catalog
Data for frames in tile
Tile image photometric solution
Tile image astrometric solution
Tile definition
Data for frames in tile
Tile frame list
Tile image creation
Catalog creation
Tile image PSF
Unmatched tile catalog
Tile image pixel mask
<<datastore>>
Survey object database
Object identification
<<datastore>>
Reference object database
Tile image archiving
Tile image
Tile catalog
<<datastore>>
Tile image archive
Includes the SN trigger
Target selection
SN Candidate catalog
SN Scheduling
SN schedule

- The stub for each actor must read one or more files, and write one or more files.
- The format details for these files are determined by the data model.
- A single program capable of reading the data model should therefore be able to act as a stub for any actor.

Actor configuration

In the SDSS pipeline, configuration took the form of two files:

- a plan file, which held configuration data likely to be different for each execution (the names of the input data files, for example), and
- a "param" file, which held other, more stable tunable parameters.

SDSS used Yanny par files, which are convenient but obscure.
I use yaml files, which much more common and also relatively easy for a human to read and write with a simple text editor.

Sample plan and param files

Plan

```
parameters: findObjectsParam-v12.yml
inputDataDir: /data2/foo/bar
frameId: 102
mjd: 56921
```

Param

```
detThresh: 5 #detection threshhold in noise sigma
minArea: 3 #the minimum pixels an object must cover
```

Execution

```
bash$ findObjects findObjectsPlan-102.yml
```

Supplementing the param for a universal actor

PLAN

```
parameters: findObjectsParam-v12.yml
inputDataDir: /data2/foo/bar
frameId: 102
mjd: 56921
```

PARAM

```
dataModel: /foo/bar/dataModel.yml
detThresh: 5 #detection threshhold in noise sigma
minArea: 3 #the minimum pixels an object must cover

inputFiles:
  - fitsType: correctedFrame

outputFiles:
  - fitsType: imFrameCatalog
  - fitsType: skyFrame
```

EXECUTION

```
bash$ universalStub correctFramePlan.yml
```

```
frameCatalog:
  nameTemplate: frameCatalog-%d.fits
  nameParams:
    - name: frameId
      sampleValue: 1234
  header:
    - keyword: FRAMEID
      sampleValue: 1234
      comment: the unique ID of the corrected frame
    - keyword: MJD
      sampleValue: 59201
      comment: the MJD of observation
```

```
HDUs:
  - name: frameCat
    header:
      - keyword: FRAMEID
        sampleValue: 1234
        comment: the unique ID of the corrected frame
      - keyword: MJD
        sampleValue: 59201
        comment: the MJD of observatino
    table:
      - name: objRow
        format: 1D
        units: pixels
        sampleValue: 42.4
      - name: objColumn
        format: 1D
        units: pixels
        sampleValue: 42.4
```

```
simpleDataElements:
  - &frameId
    name: frameId
    keyword: FRAMEID
    type: int
    format: 1J
    sampleValue: 1234
    comment: the unique ID of the corrected frame
  - &mjd
    name: mjd
    keyword: MJD
    type: int
    units: days
    sampleValue: 59000
    comment: the Modified Julian Date of the observation
  - &objRow
    name: objRow
    format: 1D
    type: double
    units: pixels
    sampleValue: 42.4
    comment: the row in of the center of the object
  - &objColumn
    name: objColumn
    format: 1D
```

```
FitsFiles:
  frameCatalog:
    nameTemplate: frameCatalog-%d.fits
    nameParams:
      - *frameId
    header:
      - *frameID
      - *mjd
    HDUs:
      - name: frameCat
        header:
          - *frameId
          - *mjd
        table:
          - *objRow
          - *objColumn
```

```
modelPsf:
  nameTemplate: mpsf-%d-%d.fits
  nameParams:
    - *psfModelId
    - *frameId
  header:
    - *psfModelId
    - *frameId
  HDUs:
    - name: psfComponents
      headerQuery: |
        SELECT psfModelId, frameId, exposureId, detectorId, mjd,
               startTime, exposureTime, filter
        FROM frameModelPsfs
        NATURAL JOIN frames NATURAL JOIN exposures NATURAL JOIN detectors
      header:
        - *frameId
        - *exposureId
        - *detectorId
        - *mjd
        - *startTime
        - *exposureTime
        - *filter
      query: |
        SELECT frameId, psfModelId, psfComponent, psfComponentWeight
```

These queries can be the basis if views to ease table/file conversion:

```
CREATE VIEW modelComponentHdu AS
SELECT frameId, psfModelId, psfComponent, psfComponentWeight
FROM frameModelPsfs NATURAL JOIN psfs NATURAL JOIN psfComponents
```

File creation can then be accomplished by selecting the rows specified in the table, filtering on the parameters provided by nameParams:

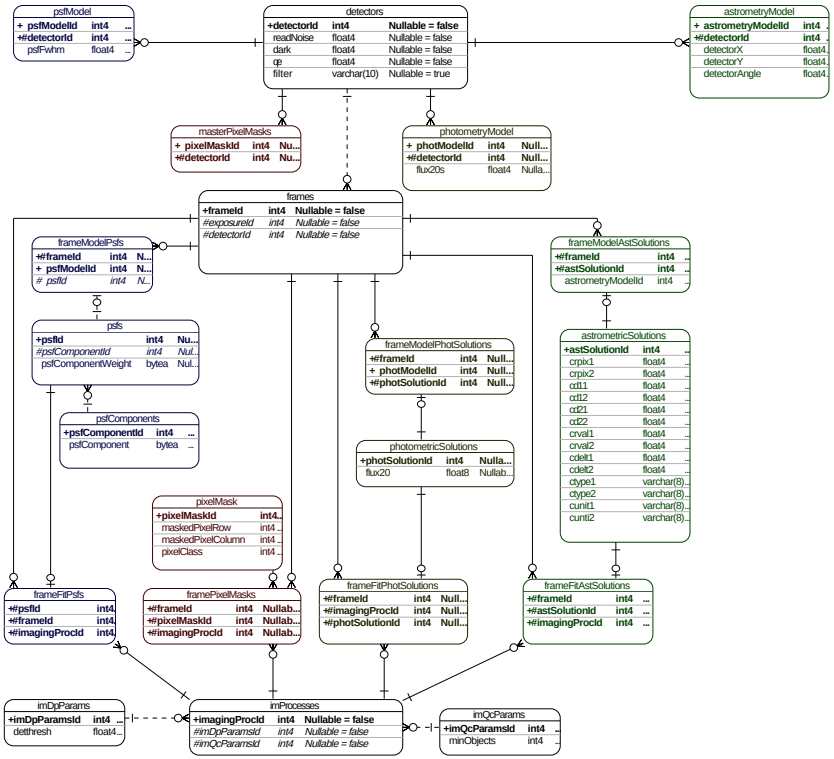
```
SELECT psfComponent, psfComponentWeight
FROM modelComponentHdu
WHERE psfModelId=33 AND frameId=203
```

Comments on database schema

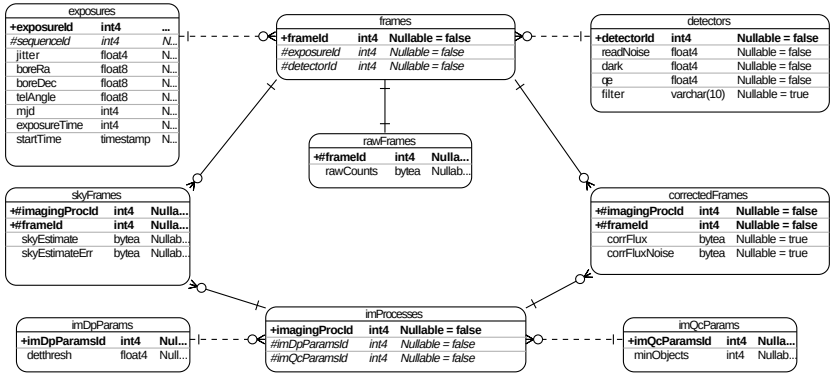
In its current form, the database schema is probably "over-normalized:" mappings between tables in the schema and the needed FITS files represented in the activity diagrams and the tables from Steve Kent's spectroscopy document are possible, but perhaps not well optimized or conceptually clear.

The current diagrams represent the image data itself as being in the database, but it is more likely that the database will only contain references to images on a filesystem.

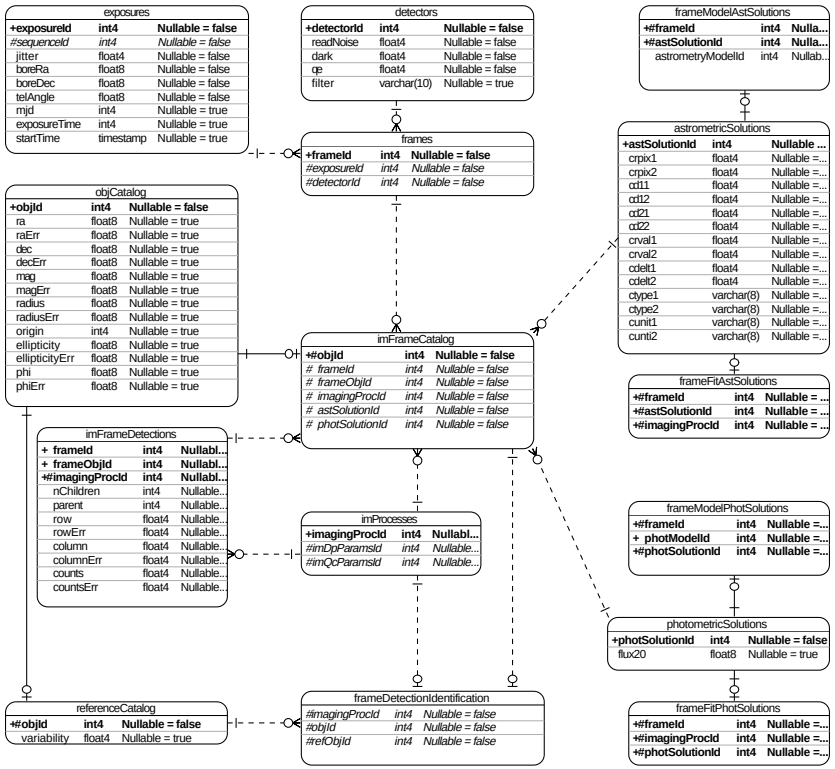
Imaging calibration



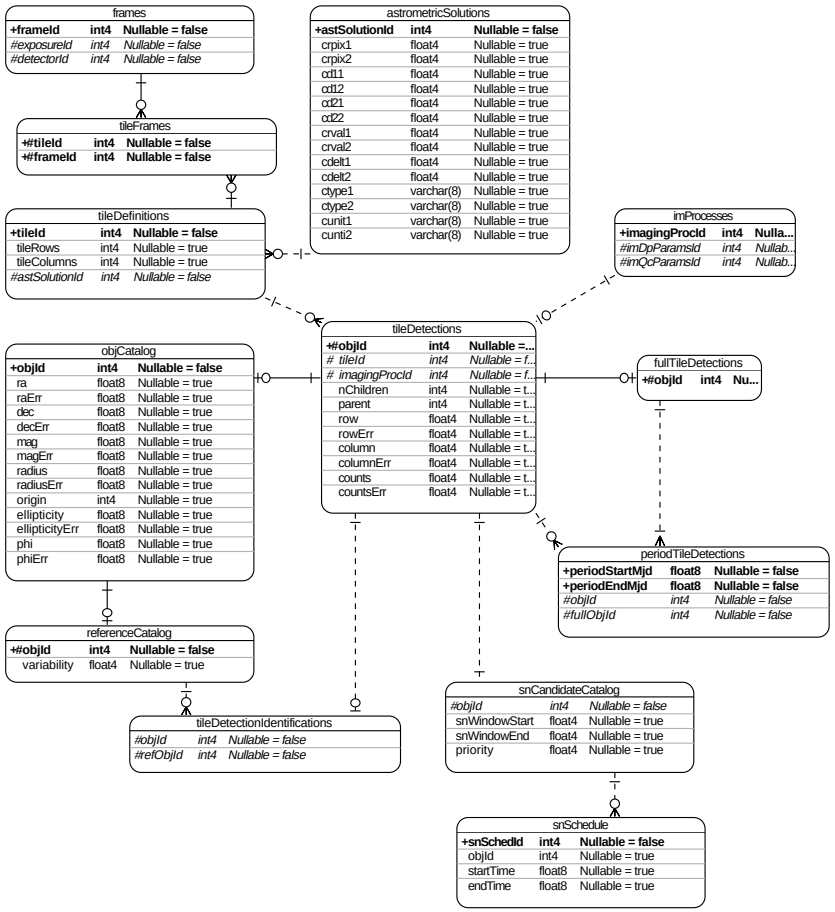
Imaging images

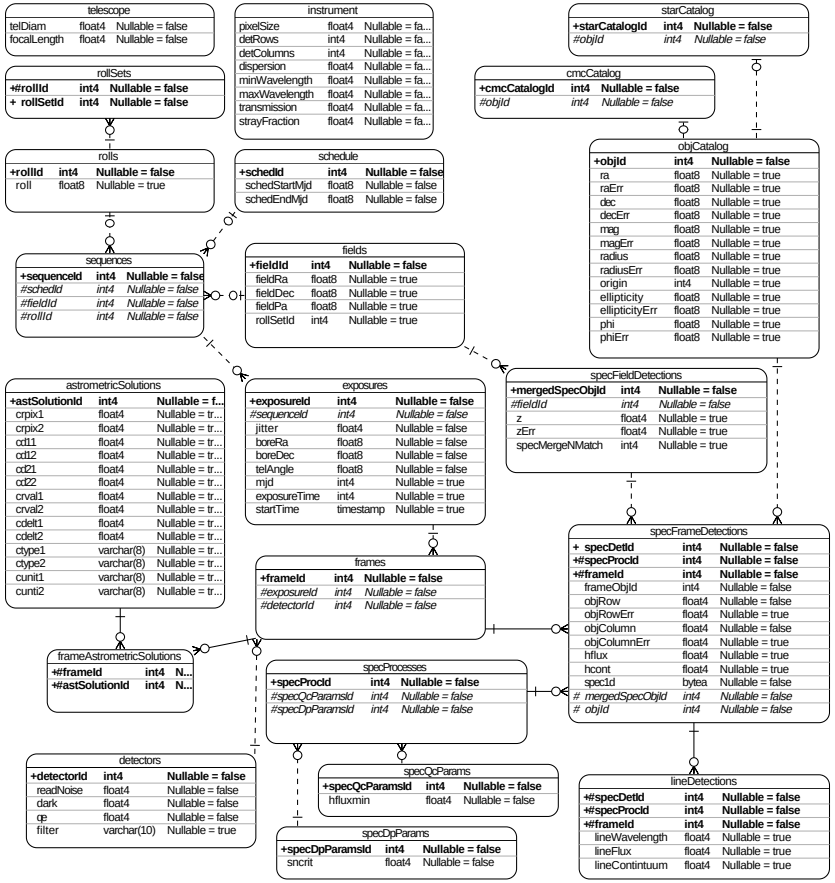


Imaging catalogs



Imaging tiles




telescope
telDiam float4 Nullable = false
focalLength float4 Nullable = false
instrument
pixelSize float4 Nullable = fa...
detRows int4 Nullable = fa...
detColumns int4 Nullable = fa...
dispersion float4 Nullable = fa...
minWavelength float4 Nullable = fa...
maxWavelength float4 Nullable = fa...
transmission float4 Nullable = fa...
strayFraction float4 Nullable = fa...
starCatalog
+starCatalogId int4 Nullable = false
#objId int4 Nullable = false
rollSets
+#rollId int4 Nullable = false
+ rollSetId int4 Nullable = false
cmcCatalog
+cmcCatalogId int4 Nullable = false
#objId int4 Nullable = false
rolls
+rollId int4 Nullable = false
roll float8 Nullable = true
schedule
+schedId int4 Nullable = false
schedStartMjd float8 Nullable = false
schedEndMjd float8 Nullable = false
objCatalog
+objId int4 Nullable = false
ra float8 Nullable = true
raErr float8 Nullable = true
dec float8 Nullable = true
decErr float8 Nullable = true
mag float8 Nullable = true
magErr float8 Nullable = true
radius float8 Nullable = true
radiusErr float8 Nullable = true
origin int4 Nullable = true
ellipticity float8 Nullable = true
ellipticityErr float8 Nullable = true
phi float8 Nullable = true
phiErr float8 Nullable = true
sequences
+sequenceId int4 Nullable = false
#schedId int4 Nullable = false
#fieldId int4 Nullable = false
#rollId int4 Nullable = false
fields
+fieldId int4 Nullable = false
fieldRa float8 Nullable = true
fieldDec float8 Nullable = true
fieldPa float8 Nullable = true
rollSetId int4 Nullable = true
astrometricSolutions
+astSolutionId int4 Nullable = f...
crpix1 float4 Nullable = tr...
crpix2 float4 Nullable = tr...
cd11 float4 Nullable = tr...
cd12 float4 Nullable = tr...
cd21 float4 Nullable = tr...
cd22 float4 Nullable = tr...
crval1 float4 Nullable = tr...
crval2 float4 Nullable = tr...
cdelt1 float4 Nullable = tr...
cdelt2 float4 Nullable = tr...
ctype1 varchar(8) Nullable = tr...
ctype2 varchar(8) Nullable = tr...
cunit1 varchar(8) Nullable = tr...
cunit2 varchar(8) Nullable = tr...
exposures
+exposureId int4 Nullable = false
#sequenceId int4 Nullable = false
jitter float4 Nullable = false
boreRa float8 Nullable = false
boreDec float8 Nullable = false
telAngle float8 Nullable = false
mjd int4 Nullable = true
exposureTime int4 Nullable = true
startTime timestamp Nullable = true
specFieldDetections
+mergedSpecObjId int4 Nullable = false
#fieldId int4 Nullable = false
z float4 Nullable = true
zErr float4 Nullable = true
specMergeNMatch int4 Nullable = true
frames
+frameId int4 Nullable = false
#exposureId int4 Nullable = false
#detectorId int4 Nullable = false
specFrameDetections
+ specDetId int4 Nullable = false
+#specProcId int4 Nullable = false
+#frameId int4 Nullable = false
frameObjId int4 Nullable = false
objRow float4 Nullable = false
objRowErr float4 Nullable = true
objColumn float4 Nullable = false
objColumnErr float4 Nullable = true
hflux float4 Nullable = true
hcont float4 Nullable = true
spec1d bytea Nullable = false
mergedSpecObjId int4 Nullable = false
objId int4 Nullable = false
frameAstrometricSolutions
+#frameId int4 N...
+#astSolutionId int4 N...
specProcesses
+specProcId int4 Nullable = false
#specQcParamsId int4 Nullable = false
#specDpParamsId int4 Nullable = false
detectors
+detectorId int4 Nullable = false
readNoise float4 Nullable = false
dark float4 Nullable = false
qe float4 Nullable = false
filter varchar(10) Nullable = true
specQcParams
+specQcParamsId int4 Nullable = false
hfluxmin float4 Nullable = false
specDpParams
+specDpParamsId int4 Nullable = false
sncrit float4 Nullable = false
lineDetections
+#specDetId int4 Nullable = false
+#specProcId int4 Nullable = false
+#frameId int4 Nullable = false
lineWavelength float4 Nullable = true
lineFlux float4 Nullable = true
lineContintuum float4 Nullable = true