



Introduction to Using the GES Science Archive

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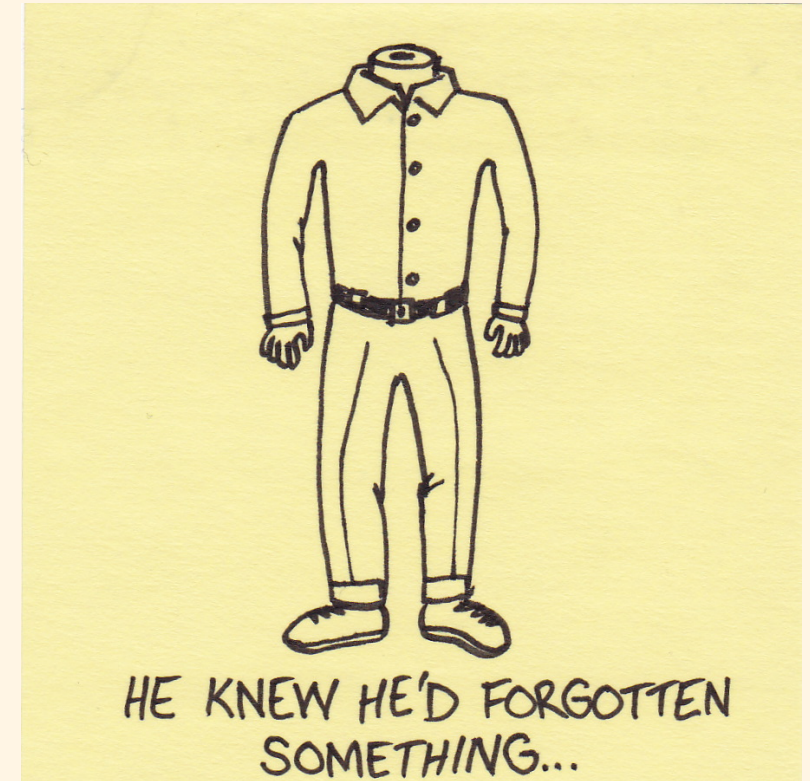
GES 2014: Gaia-ESO Survey Second Science Meeting

Introduction

- The workshop is a hands-on introduction to using the archive:
 - won't turn you into an expert,
 - but enough to get going.
- Structure of the workshop:
 - quick recap on the basics of the archive,
 - logging on,
 - brief introduction to SQL,
 - then...
- Using the archive to:
 - query target stars,
 - query spectra,
 - retrieve copies of spectra,
 - query recommended analyses,
 - query other analyses,
 - query atomic and molecular line lists.

Pre-requisites

- Registered as a user of the archive, and have your:
 - username,
 - password,
 - community.
- Have your own laptop,
 - with wireless access enabled.
- The laptop should have a Web browser installed,
 - Firefox recommended, but most should be ok.
- Additional software that is useful but not necessary:
 - TOPCAT (for viewing FITS tables),
 - fv (for viewing spectrum files in FITS format).



Archive Basics

- Archive contains:
 - reduced spectra from those GES-acquired observations that are part of the release,
 - 'metadata' describing these spectra,
 - abundances and physical parameters derived from both newly-acquired and archival spectra,
 - atomic data used in the analyses.
- There are a series of releases, each in its own database:
 - we'll use iDR2 (and iDR3 will be very similar).
- The Spectra are held as FITS files in a Unix directory structure.
- The tabular data are held in a relational database management system (RDBMS):
 - Microsoft SQL Server,
 - accessed or queried using SQL (Standard Query Language).

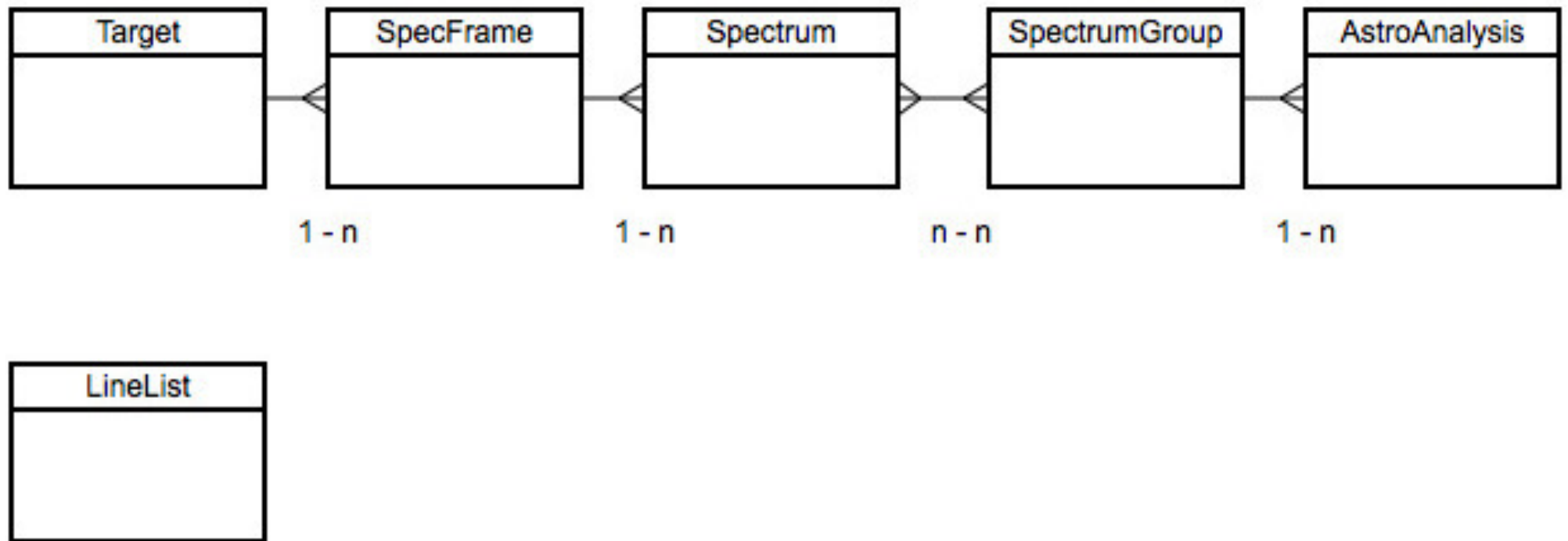
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 - we'll use iDR2 (and iDR3 will be very similar).
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Important Tables


- **Target**
 - list of stars observed as part of the survey.
- **SpecFrame**
 - list of frames, fields or observing blocks.
- **Spectrum**
 - list of spectra (potentially several per target)
- **AstroAnalysis**
 - list of analyses (usually several per spectrum)
- **Linelist**
 - list of atomic and molecular lines

Relation Between Tables




Getting Started

<http://ges.roe.ac.uk>



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- Data access
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- Freeform SQL
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Gaia-ESO Survey Science Archive

The **Gaia-ESO Survey** science archive comprises calibrated one- and two-dimensional spectra for stars observed in the **Gaia-ESO Survey** (GES), and a variety of astrophysical parameters (heliocentric radial velocity, effective temperature, surface gravity, metallicity *etc*) derived from these spectra.

GES is a public spectroscopic survey of approximately 100,000 stars, systematically covering all the major components of the Milky Way, from the halo to star-forming regions and providing the first homogeneous overview of the distributions of kinematics and elemental abundances. The target stars were observed using the **FLAMES spectrograph** on the **ESO VLT** at Paranal in Chile. The survey was conducted in support of the **ESA Gaia** astrometric satellite, but will have numerous other uses.

Release notes give details of the **latest release** and the history of archive releases, updates and bug fixes is recorded under the **release history** page.

Please note that all use of parameters obtained from the archive in publications and analyses leading to publications must conform with the **PI Policy Statement** on the use of iDR2 parameters and abundances.


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ges-support@roe.ac.uk
15/7/2014

Accessing the Archive



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Logging in to the Archive



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GES Login

Only registered users are allowed to access GES data prior to their public release. To register for access to proprietary data releases you must be part of the GES Consortium and you should ask your community contact, who will normally be a GES co-investigator working at your institute and nominated as the person responsible for administering usernames/passwords for access by Consortium members at your institute. If you do not know who your institution-based community contact is, or you don't have one and wish to volunteer, please contact Clare Worley ccworley@ast.cam.ac.uk and Anna Hourihane aph@ast.cam.ac.uk in the first instance.

Enter your username and password. If you do not login your queries will be directed to any world accessible databases that contains data no longer within their propriety period. Note that usernames and passwords are case sensitive.

Username:

Password:

Community:


☐ Accept - By logging in to gain access to Gaia-ESO survey products stored in the GES Science Archive, you are agreeing to the rules contained within the consortium's [Publication Policy](#) and [Private Data Policy](#). **Note in particular** the [PI Policy Statement](#) on the use of iDR2 parameters and abundances.

List of communities


Login sessions time-out after 4 hours if inactive. The login status is shown at the top of Web forms which query the archive. New browser windows that have been opened from within a logged in browser should be passed the login status.

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Freeform SQL Query

This form allows you to submit an SQL query to the GES database ([notes and tips](#)).

An [enhanced version of this form](#) allows the upload of a file to a temporary database table. This table (#userTable) can then form part of the query being executed.

Programme: GES (GAIA-ESO Survey)

Database release to use:

Upload SQL query from file into this form: No file selected.

or enter SQL statement:

```
SELECT TOP 10 cname, ra, dec, bmag FROM Target;
```

ensure one of the file formats is selected below if you want to save your results.

SQL: Querying the Archive

- Search (or 'query') the archive to find spectra and results of interest.
- Currently only SQL queries are supported.
- SQL is the standard language for querying relational databases.
- But beware: most relational database management systems come with their own dialect of SQL;
 - SQL Server has T-SQL.
- Powerful and flexible once you get used to it...
- ...but most astronomers are not familiar with SQL.
- Plenty of examples and help are available on the Web site.

SQL: Querying the Archive

- Some simple SQL queries, using table Target:

```
SELECT COUNT(*) FROM Target;
```

```
SELECT * FROM Target;
```


```
SELECT TOP 10 * FROM Target;
```

```
SELECT TOP 10 cname, ra, dec, bmag FROM Target;
```


```
SELECT TOP 10 cname, ra, dec, bmag FROM Target  
WHERE bmag > 18.0 AND bmag < 18.5;
```

```
SELECT TOP 10 cname, ra, dec, bmag FROM Target  
WHERE bmag > 18.0 AND bmag < 18.5  
ORDER BY bmag;
```


Schema Browser



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Retrieve Table as a FITS File

or enter
SQL statement:

```
SELECT TOP 10 cname, ra, dec, bmag FROM Target;
```

ensure one of the file formats is selected below if you want to save your results.

Email Address: the results of long running queries will be sent by email.

Data Format:

- ☐ HTML table summary (results are NOT saved to file)
- ☐ ASCII FILE (downloadable with HTML table summary on-screen)
- ☒ FITS FILE (downloadable with HTML table summary on-screen)
- ☐ VOTable FILE (downloadable with HTML table summary on-screen)

(**The number of rows written to the downloadable files is subject to an upper limit see data access**)

File Compression: ☐ (none) ☒ GZIP

HTML rows: Number of rows written to HTML table summary (maximum 100)

Timeout (seconds): your query will be halted after this time (max 10800)

Retrieve Table as a FITS File

Connecting to gesiDR2 database

QUERY STARTED: Fri Nov 07 15:42:44 GMT 2014 [1 active, 77 total]

Please keep this browser window open and wait for your results or further information to appear below...

timeout: 3600

Connected to database

Submitted query: SELECT TOP 10 cname, ra, dec, bmag FROM Target;

... OK

	cname	ra	dec	bmag
1	NONE	-9.9999950E008	-9.9999950E008	-9.999995E008
2	16153746-0822162	+243.9060833	-8.3711667	-9.999995E008
3	19013537-0028186	+285.3973750	-0.4718333	+18.435000
4	19013631-0027447	+285.4012917	-0.4624167	+17.888000
5	19013651-0027021	+285.4021250	-0.4505833	+18.188000
6	19013910-0027114	+285.4129167	-0.4531667	+18.036000
7	19013997-0028213	+285.4165417	-0.4725833	+18.324000
8	19014004-0028129	+285.4168333	-0.4702500	+17.948000
9	19014127-0026444	+285.4219583	-0.4456667	+17.955000
10	19014194-0028172	+285.4247500	-0.4714444	+18.118000

(Query returned 10 result rows, all rows are shown in the displayed table.)

Please check the gesiDR2 entry in the [release history](#) for documentation pertaining to this release



[Download Results File](#), your results in a gzipped FITS file (Contains **10 rows**, 970 bytes)



[Launch file in Topcat](#) (requires Java 1.5 and Java Web Start, approx 12Mb download for Topcat application)

QUERY FINISHED: Fri Nov 07 15:42:47 GMT 2014

Reprise: Types of Query

- The workshop will cover using the archive to:
 - query target stars,
 - query spectra,
 - retrieve copies of spectra,
 - query recommended analyses,
 - query other analyses,
 - query atomic and molecular line lists.

Queries on Target Stars

- Column Target.cname contains star 'names' in the ESO standard format:

hhmmsssss±ddmmsss

- Is a star in the archive?

```
SELECT * FROM Target WHERE cName ='11053303-7700120';
```

- Which of a list of stars are in the archive?

```
SELECT * FROM Target WHERE cName IN ('11034945-7700101',  
'11044460-7706240');
```

- List the stars in a range of RA and Dec:

```
SELECT * FROM Target WHERE (ra BETWEEN 70 AND 80) AND  
(dec BETWEEN -45 AND -30);
```

Queries on Spectra

- Spectra are tabulated in table Spectrum.

- Which spectra are available for a given star?

```
SELECT * FROM Spectrum WHERE cName ='11053303-7700120';
```

- Which of a list of stars are in the archive?

```
SELECT * FROM Spectrum WHERE cName IN ('11034945-7700101',  
'11044460-7706240');
```

- How many spectra are available for each of a given list of stars?

```
SELECT cName, count(cName) AS no_of_spectra FROM Spectrum  
WHERE cName IN ('11034945-7700101',  
'11044460-7706240')  
GROUP BY cName ORDER BY cName;
```


Identifiers in Archive Tables

- In the Target table stars are identified by their cName, but also by a unique numeric identifier, targetID

```
SELECT TOP 10 cName, targetID, ra, dec FROM Target;
```

- Similarly table Spectrum contains column specID which uniquely identifies spectra.

```
SELECT TOP 10 specID FROM Spectrum;
```

- The Spectrum table also lists the targetID of the star from which the spectrum was observed. This feature allows the Target and Spectrum to be unambiguously and efficiently joined:

```
SELECT TOP 10 sp.specID, tg.cName, tg.targetID  
FROM Spectrum sp, Target tg  
WHERE sp.targetId = tg.targetId;
```

- Many of the archive tables contain such identifiers and you will often use them to join tables when formulating queries.

Queries on Spectra

- As we've seen, spectra are tabulated in table Spectrum.
- All the GES spectra are acquired by multi-object spectrographs and the details of the 'frames' (or 'fields' or 'observing blocks') of spectra obtained by these instruments are held in table SpecFrame.
- SpecFrame tabulates the details common to all the spectra in the frame (eg. the spectrograph used).
- Column SpecFrame.specFrameID identifies each frame,
- and is also tabulated in Spectrum to allow the tables to be joined.
- So, for example, to list the instrument used to observe each spectrum:

```
SELECT TOP 10 spec.cName, frame.instrument  
FROM Spectrum spec, SpecFrame frame  
WHERE spec.specFrameID = frame.specFrameID;
```

Retrieve Copies of Spectra

- The archive contains two types of files:

SingleSpec: contains a single stacked spectrum,

ManySpec: contains all the spectra in a stacked frame.

- The names of these files are tabulated in different tables:

Type of file	Table	Column
SingleSpec	SpectrumGroup	fileName
ManySpec	SpecFrame	fileName

- Table SpectrumGroup is used to group the files that are analysed together (we'll come to that next) and includes the SpecID.

Retrieve Copies of Spectra

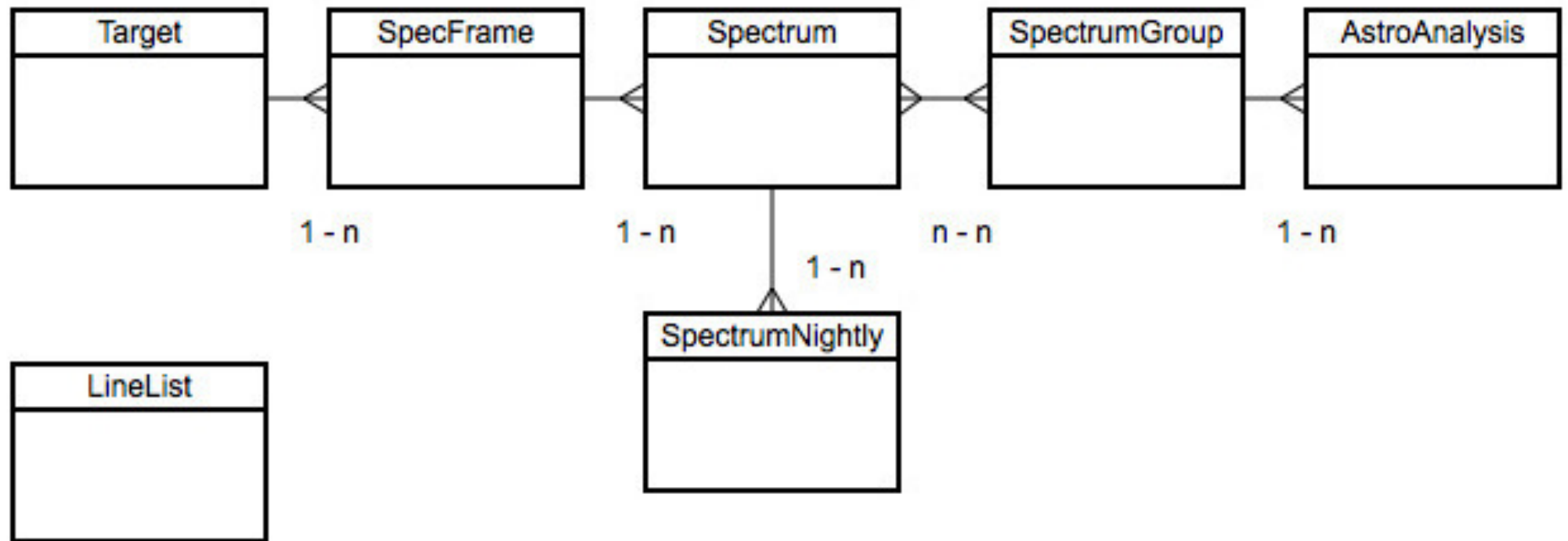
- So to retrieve the file names:

```
SELECT DISTINCT TOP 10  
spec.cName, spec.specID, spg.specID, spg.fileName  
FROM Spectrum spec, SpectrumGroup spg  
WHERE spec.specID = spg.specID;
```

- To facilitate retrieving large numbers of files:

```
SELECT DISTINCT TOP 10  
spec.cName, spec.specID, spg.specID, spg.fileName,  
dbo.fWgetCmd(spg.fileName)  
FROM Spectrum spec, SpectrumGroup spg  
WHERE spec.specID = spg.specID;
```

Queries on NightlySpectra



- Queries like:

```
SELECT TOP 10 spec.cName, sn.vel, sn.velErr
FROM Spectrum spec, SpectrumNightly sn
WHERE spec.specID = sn.specID;
```

Queries on Recommended Analyses

- To recap, the Consortium produces analyses on the spectra to derive element abundances and astrophysical parameters.
- Analyses are typically performed on a group of spectra of the same star,
- often a red-blue pair.
- Several sets of parameters are produced for each spectrum:-
- Recommended parameters
 - the final, overall, homogenised parameters produced by WG15 from the results of the other working groups.
- Recommended parameters produced by the individual WGs 10-14.
- Parameters produced by each of the individual nodes with each of the WGs.
- All these parameters are stored in table AstroAnalysis.

Queries on Recommended Analyses

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Queries on Recommended Analyses

- A series of 'views' (or subsets) are defined on table AstroAnalysis corresponding to the various types of parameter:

View	Description
AstroAnalysis	Table: all results.
RecommendedAstroAnalysis	WG15 parameters and abundances
WgRecommendedAstroAnalysis	WG parameters and abundances
WpNaAstroAnalysis	Node abundances, WG parameters
NpNaAstroAnalysis	Node abundances, node parameters

- Reiterate: usually use RecommendedAstroAnalysis.

Queries on Recommended Analyses

- To list recommended analysis parameters:

```
SELECT TOP 10 cName, wg, teff, logg, feh, li1, c1  
FROM RecommendedAstroAnalysis;
```

- To list recommended analysis parameters for a given star:

```
SELECT cName, wg, teff, logg, feh, li1, c1  
FROM RecommendedAstroAnalysis  
WHERE cName ='11053303-7700120';
```

Queries on Recommended Analyses

- To list recommended analysis parameters alongside information about the spectra from which they were obtained:
- need to join view RecommendedAstroAnalysis with table Spectrum,
- but recall that spectra are analysed in groups (eg. red-blue pair),
- therefore they cannot be joined directly,
- but rather they use an intermediate table SpectrumGroup:

```
SELECT TOP 10 * from SpectrumGroup;
```

Queries on Recommended Analyses

- So, to list recommended analysis parameters for a given star:

```
SELECT
  racc.cName, racc.teff, racc.logg, racc.feh,
  sp.expTime, sp.snr,
  spg.fileName
FROM
  RecommendedAstroAnalysis racc,
  SpectrumGroup spg,
  Spectrum sp
WHERE racc.specGroupld = spg.specGroupld
      AND spg.specld = sp.specld
      AND racc.cName = '11053303-7700120';
```

Queries WG Recommended and Node Analyses

- The recommended parameters will usually be used but...
- to use the WG recommended or node analyses simply:
 - replace 'RecommendedAstroAnalysis' with the name of the appropriate view,
 - perhaps add a selection for the WG or node required.

- For example:

```
SELECT cName, wg, nodeName, teff, logg, feh, li1, c1  
FROM NpNaAstroAnalysis  
WHERE cName ='11053303-7700120' and wg='WG11'  
ORDER BY nodeName;
```

Here we are:

- selecting WG11,
- ordering the results by the names of the individual nodes.

Queries on Line Lists

- All the atomic and molecular data are held in table LineList.
- Again there are a set of views for different sorts of data:

View	Description
LineList	Table: all lines
LineAtomHfs	Atomic lines with hyperfine splitting
LineAtomNoHfs	Atomic lines without hyperfine splitting
LineMol	Molecular lines with hyperfine splitting
LineMolAtomHfs	Molecular lines without hyperfine splitting

Queries on Line Lists

- Simply query the appropriate table or the whole view.
- Which lines are available in a given wavelength range?

```
SELECT * FROM LineAtomHfs  
WHERE lambda BETWEEN 4500 AND 4800  
ORDER BY lambda ASC;
```

- Which lines are available for a given species?

```
SELECT * FROM LineAtomHfs  
WHERE name1 = 'Al' and ion = 1  
ORDER BY lambda ASC;
```



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