# Comparison and Standardization of VO Cone Search Validation Services

# Introduction

Currently three sites run validation tests of VO services world-wide: VOParis, ESA and the HEASARC which uses validators developed at the NCSA.

This document compares the validation tests for the VO-Paris, ESA and NCSA/HEASARC cone search validator and tries to suggest a common nomenclature for use in describing specific tests. For each site the tests run are described using existing inputs files. Each test is prefixed with a suggested standard name in brackets **[]**. In a number of cases a test at one site combines what is done at multiple tests in another site. The ‘standard’ tests are defined at the finest granularity so that the combining test will show all of its components in brackets.

The standard name combines a prefix denoting the standard, the section of the standard in which the requirement is mandated, and if multiple requirements are mandated in a single section a letter suffix to distinguish different requirements. So the text defining requirement CS 2.3.1a should be the first mandate in section 2.3.1 of the Cone Search standard. Some tests use the prefix G. This indicates generic tests such as the existence of the web site, or the validity of the returned XML which is assumed by the standard.

Some tests are run in specific contexts where the context is the kind of query that is made using the protocol. Three contexts are used here (not at all centers):

N: The normal context is in a query which is expected to generate at least one resulting row of output.

Z: The zero context is a query which is expected to generate 0 rows of output but not generate errors. For cone search queries this is typically done by specifying SR=0. Note however that the cone search protocol does not require that this return 0 rows. Specifically, the standard notes: *There may also be other sources outside the cone -- the service implementor may decide on the exact search criterion used internally to the service to select the sources [IVOA Cone Search 1.03, 2.2]*

E: The error context is a query which is required to generate an error.

The same test may be run in multiple contexts. The context in which a test is run is given in parentheses in the test ID area. If no context is specified then the test is run in all contexts used at the given site.

E.g., **CS 2.2.3a (N)** refers to a test of the first requirement found in section 2.2.3 of the Cone Search standard run in the Normal context. **CS 2.2.1c (Z,N)**  indicates that a test of the third requirement defined in section 2.2.1 and that this test is run in both the zero results and normal contexts. **CS 2.2.1c** without the context flags indicates that this test is run in whatever contexts are normally tested at this site.

Non requirements are shown in gray rather than black.

For each center the standard nomenclature is inserted into a list provided by the site which gives the local understanding of the test. These lists are not in the same format.

# VO Paris Cone Search

Tests are run in the Normal and Error contexts.

### Inherited Tests

**[G 2b] VOTable XML validation** VOTable must be valid against the **VOTable 1.0** schema.

### Cone Search Specific Tests

**[CS 2.1a, CS 2.1b (N)] RESOURCE** The VOTable must contain exactly one RESOURCE which must contain exactly one TABLE.

**[CS 2.2.1a (N)] 2.2.1** The TABLE must contain exactly one FIELD with ucd='ID\_MAIN'.

**[CS 2.2.2a (N)] 2.2.2** The TABLE must contain exactly one FIELD with ucd='POS\_EQ\_RA\_MAIN'.

**[CS 2.2.3a (N)] 2.2.3** The TABLE must contain exactly one FIELD with ucd='POS\_EQ\_DEC\_MAIN'.

**[CS 2.3a, CS 2.3b (E)] 2.3** In case of service error, an error message must appear in a valid result VOTable with name “Error” either in a VOTABLE/INFO or RESOURCE/INFO or RESOURCE/PARAM or DEFINITIONS/PARAM.

# NCSA/HEASARC Cone Search Validator Tests

Tests are run in the normal and error contexts.

### Errors detected by the validation software

**[CS 2.1a] 2.1a** VOTable must contain only one RESOURCE.

**[CS 2.1b] 2.1b** The RESOURCE element must contain exactly one TABLE.

**[CS 2.2.1a (N)] 2.2.1a** The TABLE must contain exactly one FIELD with ucd='ID\_MAIN'.

**[CS 2.2.1b (N)] 2.2.1b** The ID\_MAIN column must have datatype='char'.

**[CS 2.2.1c (N)] 2.2.1c** The ID\_MAIN column must have a string-appropriate arraysize (recommend '\*').

**[CS 2.2.1d (N)] 2.2.1d** Values in the ID\_MAIN column must be unique.

**[CS 2.2.2a (N)] 2.2.2a** The TABLE must contain exactly one FIELD with ucd='POS\_EQ\_RA\_MAIN'.

**[CS 2.2.2b (N)] 2.2.2b** The POS\_EQ\_RA\_MAIN column must have datatype='double'.

**[CS 2.2.2c (N)] 2.2.2c** The POS\_EQ\_RA\_MAIN column must not provide arraysize (non-empty) attribute.

**[CS 2.2.3a (N)] 2.2.3a** The TABLE must contain exactly one FIELD with ucd='POS\_EQ\_DEC\_MAIN'.

**[CS 2.2.3b (N)] 2.2.3b** The POS\_EQ\_DEC\_MAIN column must have datatype='double'.

**[CS 2.2.3c (N)] 2.2.3c** The POS\_EQ\_DEC\_MAIN column must not provide arraysize (non-empty) attribute.

**[CS 2.2.4 (N)] 2.2.4a** VOTABLE can not contain both a PARAM and a FIELD with ucd='OBS\_ANG-SIZE'.

**[CS 2.3a (E)] 3a** Error message must appear in an INFO or PARAM with name='Error' in required location.

**[CS 2.3b (E)] 3b** Error response should only contain one PARAM.

### Errors thrown by the HEASARC testing framework:

Could not find a tester class for this service [indicates an error in HEASARC metadata regarding the service]

Could not find proper handler [indicates an error in HEASARC metadata regarding the services]

**[G 1, G 2a, G 2b]** Apparent communication error produced an exception inside the validator [indicates and error commicating with either the validtor service or the underlying cone search capability]

unknown error [Unhandled exception]

# ESA Validation Tests

Tests are run in the Normal, Zero and Error contexts. The following lines show the SQL that populates the test metadata.

### Cone search tests

**[G 1]** INSERT INTO validation\_criterion(cap\_type, code, criterion\_type, weight, description) VALUES('cs:ConeSearch', '.on', 'REQUIREMENT', 1000, 'The service is ON');

**[G 2a]** INSERT INTO validation\_criterion(cap\_type, code, criterion\_type, weight, description) VALUES('cs:ConeSearch', '.zero.xml', 'REQUIREMENT', 100, 'The zero response is well-formed XML');

**[G 2b (Z)]** INSERT INTO validation\_criterion(cap\_type, code, criterion\_type, weight, description) VALUES('cs:ConeSearch', '.zero.xsd', 'EXTRA', 100, 'The zero response is XSD-valid XML');

**[G 2c (Z)]** INSERT INTO validation\_criterion(cap\_type, code, criterion\_type, weight, description) VALUES('cs:ConeSearch', '.zero.mime-legal', 'REQUIREMENT', 100, 'The MIME type of the zero response has a legal value (''text/xml'', ''text/xml;content=x-votable'' or ''text/xml;votable''');

**[G 2d (Z)]** INSERT INTO validation\_criterion(cap\_type, code, criterion\_type, weight, description) VALUES('cs:ConeSearch', '.zero.mime-should', 'RECOMMENDATION', 100, 'The MIME type of the zero response has the recommended value (''text/xml'')');

**[G 2e (Z)]** INSERT INTO validation\_criterion(cap\_type, code, criterion\_type, weight, description) VALUES('cs:ConeSearch', '.zero.mime-not-as-may', 'WARNING', 100, 'The MIME type of the zero response is not the optional value (''text/xml;content=x-votable'')');

**[G 2f (Z)]**INSERT INTO validation\_criterion(cap\_type, code, criterion\_type, weight, description) VALUES('cs:ConeSearch', '.zero.mime-not-as-borderline-may', 'RECOMMENDATION', 100, 'The MIME type of the zero response is not the strongly discouraged value (''text/xml;votable'')');

**[G 2a (N)]** INSERT INTO validation\_criterion(cap\_type, code, criterion\_type, weight, description) VALUES('cs:ConeSearch', '.effc.xml', 'REQUIREMENT', 100, 'The effective response is well-formed XML');

**[G 2b (N)]** INSERT INTO validation\_criterion(cap\_type, code, criterion\_type, weight, description) VALUES('cs:ConeSearch', '.effc.xsd', 'EXTRA', 100, 'The effective response is XSD-valid XML');

**[G 2c (N)]** INSERT INTO validation\_criterion(cap\_type, code, criterion\_type, weight, description) VALUES('cs:ConeSearch', '.effc.mime-legal', 'REQUIREMENT', 100, 'The MIME type of the effectie response has a legal value (''text/xml'', ''text/xml;content=x-votable'' or ''text/xml;votable''');

**[G 2d (N)]** INSERT INTO validation\_criterion(cap\_type, code, criterion\_type, weight, description) VALUES('cs:ConeSearch', '.effc.mime-should', 'RECOMMENDATION', 100, 'The MIME type of the effective response has the recommended value (''text/xml'')');

**[G 2e (N)]** INSERT INTO validation\_criterion(cap\_type, code, criterion\_type, weight, description) VALUES('cs:ConeSearch', '.effc.mime-not-as-may', 'WARNING', 100, 'The MIME type of the effective response is not the optional value (''text/xml;content=x-votable'')');

**[G 2f (N)]** INSERT INTO validation\_criterion(cap\_type, code, criterion\_type, weight, description) VALUES('cs:ConeSearch', '.effc.mime-not-as-borderline-may', 'RECOMMENDATION', 100, 'The MIME type of the effective response is not the strongly discouraged value (''text/xml;votable'')');

**[G 2g (Z)]** **2.2a-i** INSERT INTO validation\_criterion(cap\_type, code, criterion\_type, weight, description) VALUES('cs:ConeSearch', '2.2a-i', 'REQUIREMENT', 100, 'The service must respond with an XML document in the VOTable format [for the zero URL]');

**[G 2g (N)]** **2.2a-ii** INSERT INTO validation\_criterion(cap\_type, code, criterion\_type, weight, description) VALUES('cs:ConeSearch', '2.2a-ii', 'REQUIREMENT', 100, 'The service must respond with an XML document in the VOTable format [for the effective URL]');

[Note that I am unclear if this is actually required by the standard. See note in the introduction. TAM]

**[CS 2.2a (Z)] 2.2b-i** INSERT INTO validation\_criterion(cap\_type, code, criterion\_type, weight, description) VALUES('cs:ConeSearch', '2.2b-i', 'REQUIREMENT', 100, 'The zero response contains no data');

**[CS 2.2b (N)]** **2.2b-ii** INSERT INTO validation\_criterion(cap\_type, code, criterion\_type, weight, description) VALUES('cs:ConeSearch', '2.2b-ii', 'REQUIREMENT', 100, 'The effective response has to contain some data');

**[CS 2.2.1a, CS 2.2.1b, CS 2.2.1c (Z,N)]** **2.2c-i** INSERT INTO validation\_criterion(cap\_type, code, criterion\_type, weight, description) VALUES('cs:ConeSearch', '2.2c-i', 'REQUIREMENT', 100, 'The VOTable MUST comply with these conditions: [...] Exactly one FIELD must have ucd=''ID\_MAIN'', with an array character type (fixed or variable length)');

**[CS 2.2.2a, CS2.2.2b, CS 2.2.2c (Z,N)]** **2.2c-ii** INSERT INTO validation\_criterion(cap\_type, code, criterion\_type, weight, description) VALUES('cs:ConeSearch', '2.2c-ii', 'REQUIREMENT', 100, 'The VOTable MUST comply with these conditions: [...] Exactly one FIELD must have ucd=''POS\_EQ\_RA\_MAIN'', with type double');

**[CS 2.2.3a, CS2.2.3b, CS2.2.3c (Z,N)]** **2.2c-iii** INSERT INTO validation\_criterion(cap\_type, code, criterion\_type, weight, description) VALUES('cs:ConeSearch', '2.2c-iii', 'REQUIREMENT', 100, 'The VOTable MUST comply with these conditions: [...] Exactly one FIELD must have ucd=''POS\_EQ\_DEC\_MAIN'', with type double');

[Note that I do not believe the following two requirements are actually in the standard – though they are certainly sensible. TAM]

**[CS 2.3c (Z)]** **2.3b-i** INSERT INTO validation\_criterion(cap\_type, code, criterion\_type, weight, description) VALUES('cs:ConeSearch', '2.3b-i', 'REQUIREMENT', 100, 'no INFO elements with @name=''Error'' should appear in the zero response');

**[CS 2.3c (N)]** **2.3b-ii** INSERT INTO validation\_criterion(cap\_type, code, criterion\_type, weight, description) VALUES('cs:ConeSearch', '2.3b-ii', 'REQUIREMENT', 100, 'no INFO elements with @name=''Error'' should appear in the effective response');

**[CS 2.3a, CS 2.3b (E)] 2.3b** INSERT INTO validation\_criterion(cap\_type, code, criterion\_type, weight, description) VALUES('cs:ConeSearch', '2.3b', 'REQUIREMENT', 100, 'In the case of error, the service MUST respond with a VOTable that contains a single PARAM element or a single INFO element with name=''Error'', where [a] corresponding value attribute [should be present]');

# Comparison of Cone Search Tests

In the following table an **X** indicates that the test is performed but is not identified in a fashion associated with the standard. When rows are joined, the joined rows are all tested but a single result is returned. E.g., for tests G1, G2a and G2b, VOParis only checks G2b explicitly, but this implies the other two, the HEASARC checks all three, but reports a single result, ESA reports all of these tests independently.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Test** | **Description** | **VOParis** | **NCSA/HEASARC** | **ESA** |
| G1 | URL is visible | X | X | X |
| G2a | Result is well-formed XML | X |
| G2b | Result is XSD valid | X |
| G2c | Result has appropriate mime-type |  |  | X |
| G2d | Mime type is text/xml (recommended) |  |  | X |
| G2e | Mime type is not text/xml;content=x-votable |  |  | X |
| G2f | Mime type is not text/xml;votable |  |  | X |
| G2g | Result matches VOTable XSD |  |  | 2.2a-i |
| CS 2.1a | VOTable has single RESOURCE | X | 2.1a |  |
| CS 2.1b | VOTable has single TABLE | 2.1b |  |
| CS 2.2a | SR=0 returns 0 rows |  |  | 2.2b-i |
| CS 2.2b | Standard query returns >= 1 row |  |  | 2.2b-ii |
| CS 2.2.1a | One field with UCD ID\_MAIN | 2.2.1 | 2.2.1a | 2.2c-i |
| CS 2.2.1b | ID\_MAIN filed has type char |  | 2.2.1b |
| CS 2.2.1c | ID\_MAIN field has arraysize specified |  | 2.2.1c |
| CS 2.2.1d | ID\_MAIN values are unique |  | 2.2.1d |  |
| CS 2.2.2a | One field has UCD POS\_EQ\_RA\_MAIN | 2.2.2 | 2.2.2a | 2.2c-ii |
| CS 2.2.2b | RA field has type double |  | 2.2.2b |
| CS 2.2.2c | RA field does not have arraysize |  | 2.2.2c |
| CS 2.2.3a | One field has UCD POS\_EQ\_DEC\_MAIN | 2.2.3 | 2.2.3a | 2.2c-iii |
| CS 2.2.3b | Dec field has type double |  | 2.2.3b |
| CS 2.2.3c | Dec field does not have arraysize |  | 2.2.3c |
| CS 2.2.4 | At most one PARAM/FIELD with UCD obs\_ang-size |  | 2.2.4 |  |
| CS 2.3a | Errors are properly formatted | 2.3 | 2.3a | 2.3b |
| CS 2.3b | Error messages are unique | 2.3b |
| CS 2.3c | No INFO error messages in valid response |  |  | 2.3-ii |