Object Split

LSST Database

It is expected there will be cases where one object will later be seen as two objects (eg when seeing conditions are better), or vice versa: two objects will "become" one. A related query: dbQuery024?.

SDSS doesn't have a good solution for that. The only related thing is "parentId" in the PhotoObjAll table which points to a parent if object is deblended, or a bright detection if object has one, which only partly addresses the problem.

A proposal how to address this: let's keep objectId in Source table and use it for all regular cases where a single source belongs to one object. If a source belongs to more than one object, then objectId becomes NULL, and a table SourceToObject is used.

```
CREATE TABLE SourceToObject (
    objectId BIGINT NOT NULL,
    sourceId BIGINT NOT NULL,
    splitPerc TINYINT DEFAULT 100 -- split percentage
)
```

Example:

- time t1: source S1 is observed
    - Object O1 is created
    - S1's objectId points to O1
- time t2: source S2 and S3 are observed in the same spot
    - Objects O2 and O3 are created
    - S2's objectId points to O2, S3's objectId points to O3
    - entries in SourceToObject are created: (o2, s1, 50%), (o3, s1, 50%) to reflect the uncertainty associated with S1. Of course splitPercentage can be divided differently if there are good reasons to do it, they should add up to 100.
- time t3: source S4 is observed in the same spot
    - it is assumed it is O1
    - S4's objectId points to O1

This approach allows to capture the true history of what has been observed. Appropriate views can be created on top to allow selections like

- "objects that never split" (objects with sources which are not present in the Source2Object table)
- "objects that split"
- "objects that split and later become one object again"
- and so on

It has been suggested (Andy Becker, 11/30/2007) that by jointly addressing all the images simultaneously for object extraction, we move the problem out of the database regime and into the purview of the deep detection pipeline.

WFCAM implementation

The WFCAM Science Archive, described in ?http://arxiv.org/abs/0711.3593, has an association algorithm to perform what they call "source merging": identifying detections of the same astronomical object and combining their characteristics into a single record. That algorithm treats the object split problem described here in a somewhat simpler fashion. Whichever of s2 or s3 is closest to o1 (say, s3 without loss of generality) will typically be identified as o1; the other will become a new object (o2). A detection neighbor table is available that indicates that s2 and s3 are both close to s1.