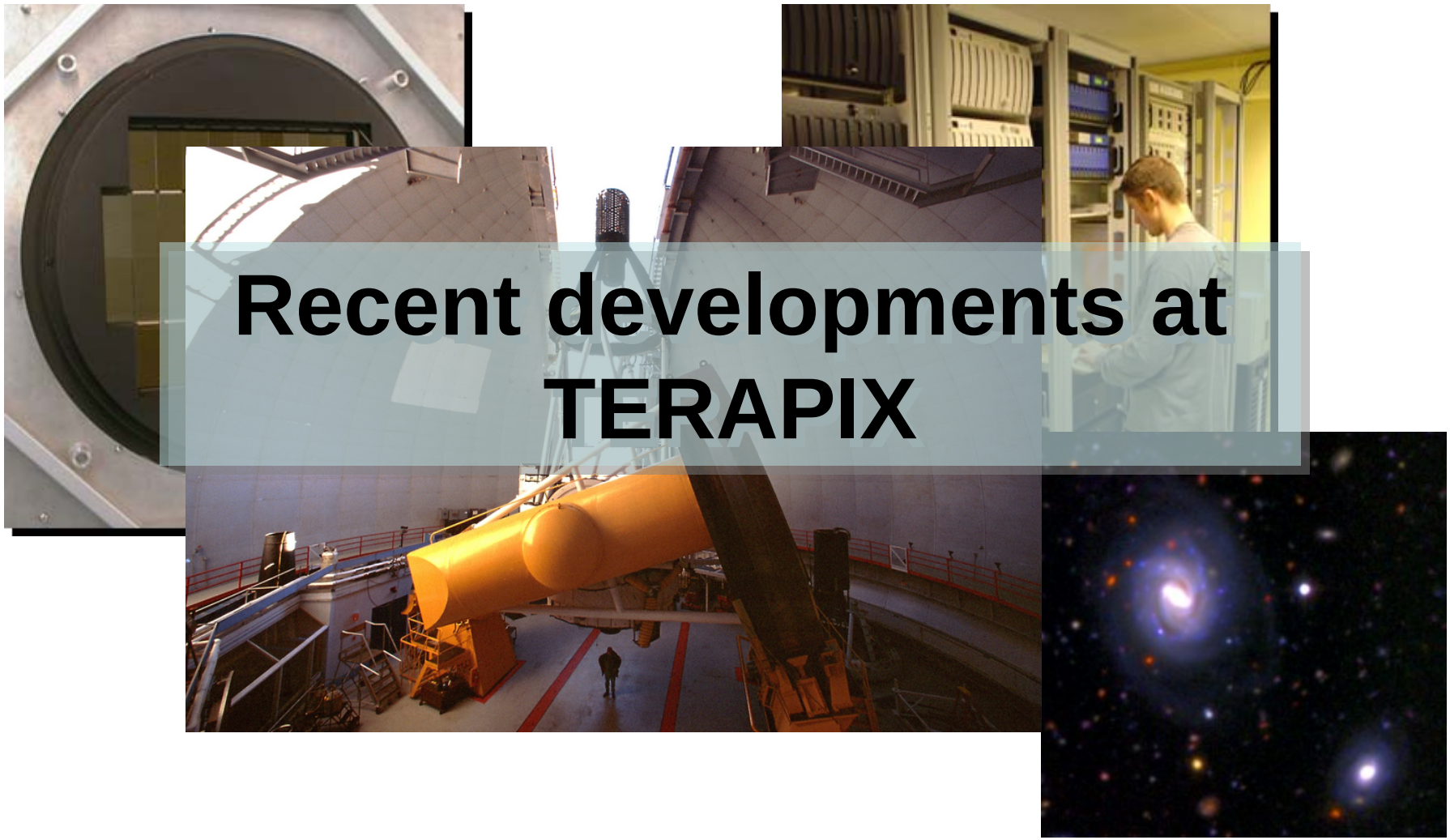


Recent developments at TERAPIX

E.Bertin, (IAP)

Outline

- TERAPIX and the CHTLS
- Access to software and support
- Development timeline
- New developments during 2006
  - Panorapix

The tasks of TERAPIX

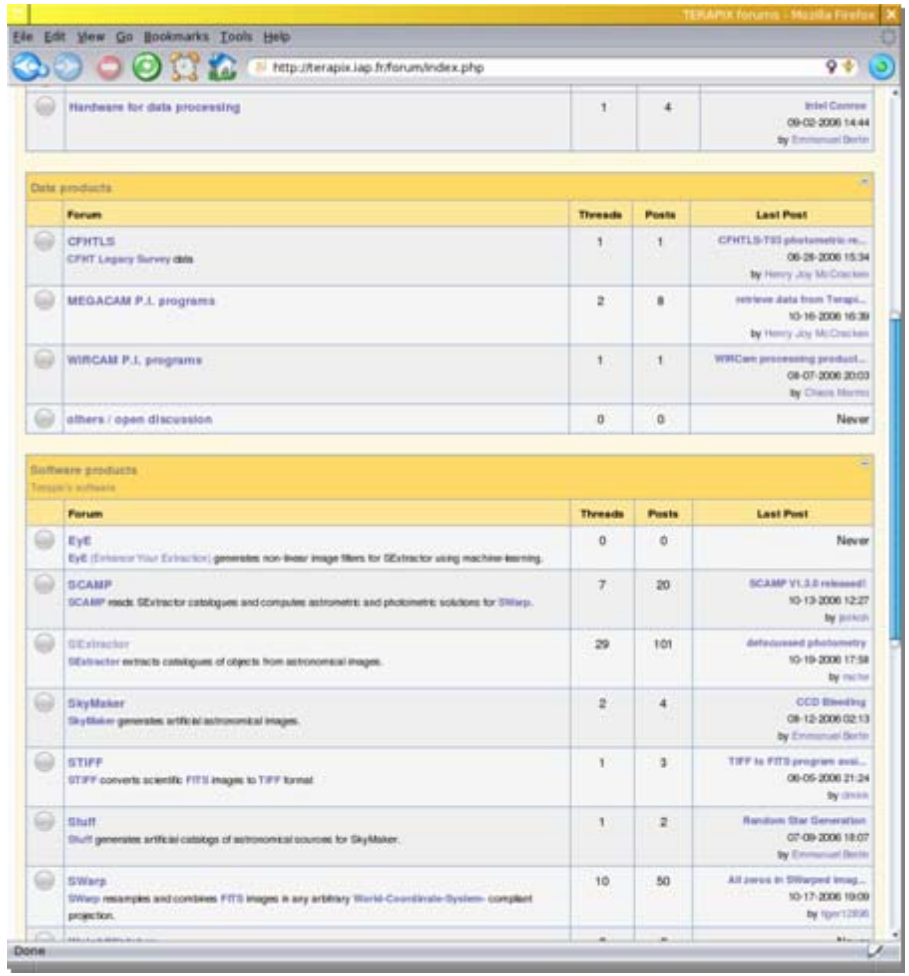
- Develop and distribute software tools required for the processing of MEGACAM data
  - Pre-processing done at CFHT (**Elixir**)
  - TERAPIX software is developed in-house and can be used on various kinds of data
  - Released as Open Source to the community
- Manage data and hardware
  - Compute/storage farm of 24 bi-, quad-, and octo-procs for processing
    - 240 Gflops peak
    - Direct access to the data with 100+TB of redundant storage
  - Cluster of 8 bi-pros available on request for data-intensive CFHTLS science
- Produce and release calibrated, resampled, co-added images, weight maps and catalogs on a regular basis.
  - 4th release (10TB) about to start
  - The achieved re-processing cycle time is presently 12 months
    - Goal is 6 months
  - Each release benefits from
    - Extended coverage
    - Complete re-calibration with increasing overlaps
    - Software upgrades and new features
  - The VeryWide part of the CFHTLS absorbs 75% of TERAPIX resources
- Provide support to members of the Canadian and French communities
  - Process P.I programs on request

Access to software

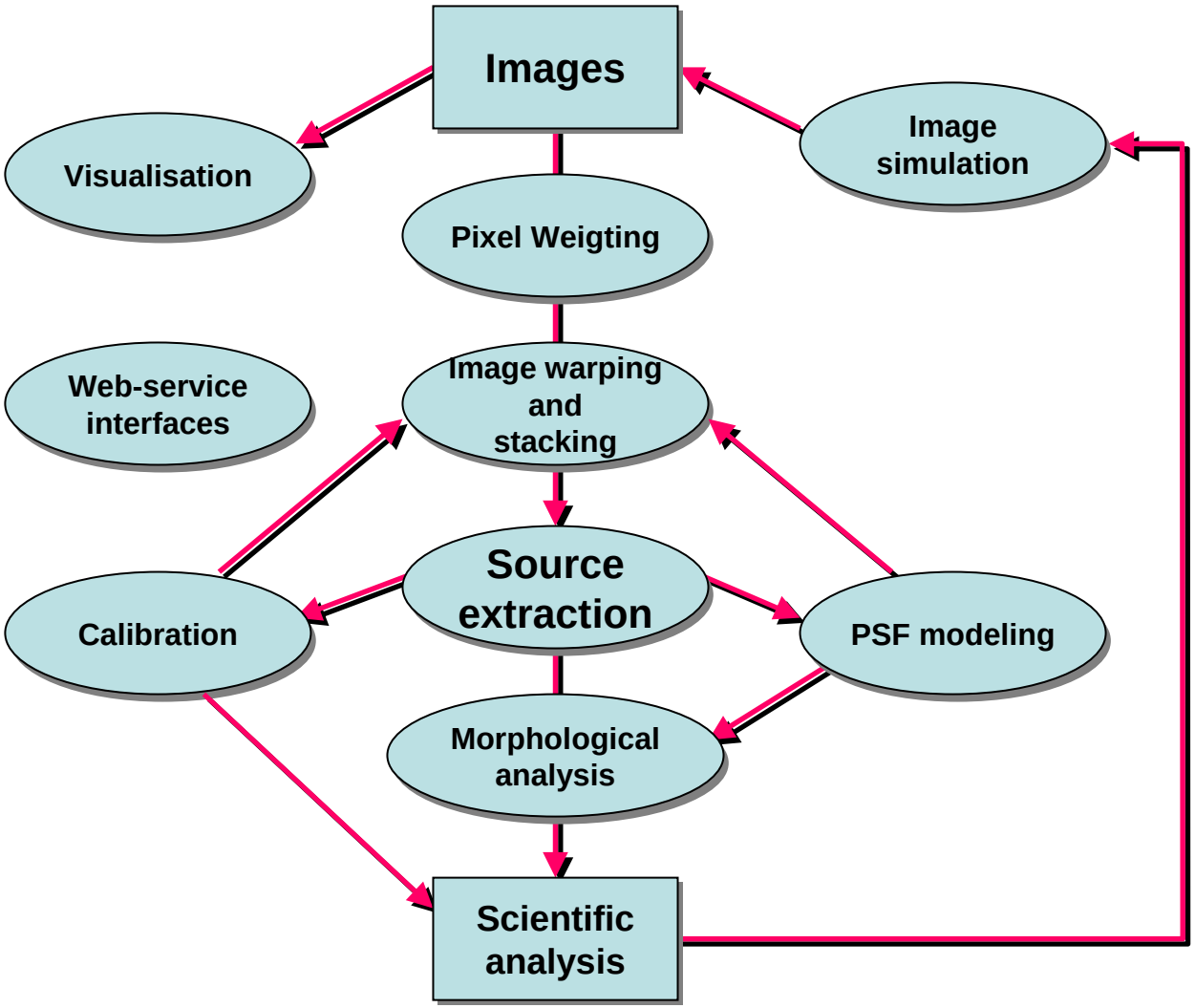
- What is distributed:
  - source packages
  - Binary, static Linux RPMs (both x86 32 et 64 bits, single and multi-threaded)
  - PDF documentation
- Public unstable versions:
  - accessible through our SubVersioN repository
  - http://terapix.iap.fr/wsvn
  - “on demand” re-packaging of intermediary versions

Getting help

- Discussion forums
  - http://terapix.iap.fr/forum
  - MEGACAM
    - CFHTLS
    - P.I.
  - WIRCAM
  - TERAPIX software
  - software for astronomy
  - hardware for astronomy
  - private forums
    - we can host private forums for CFHTLS members

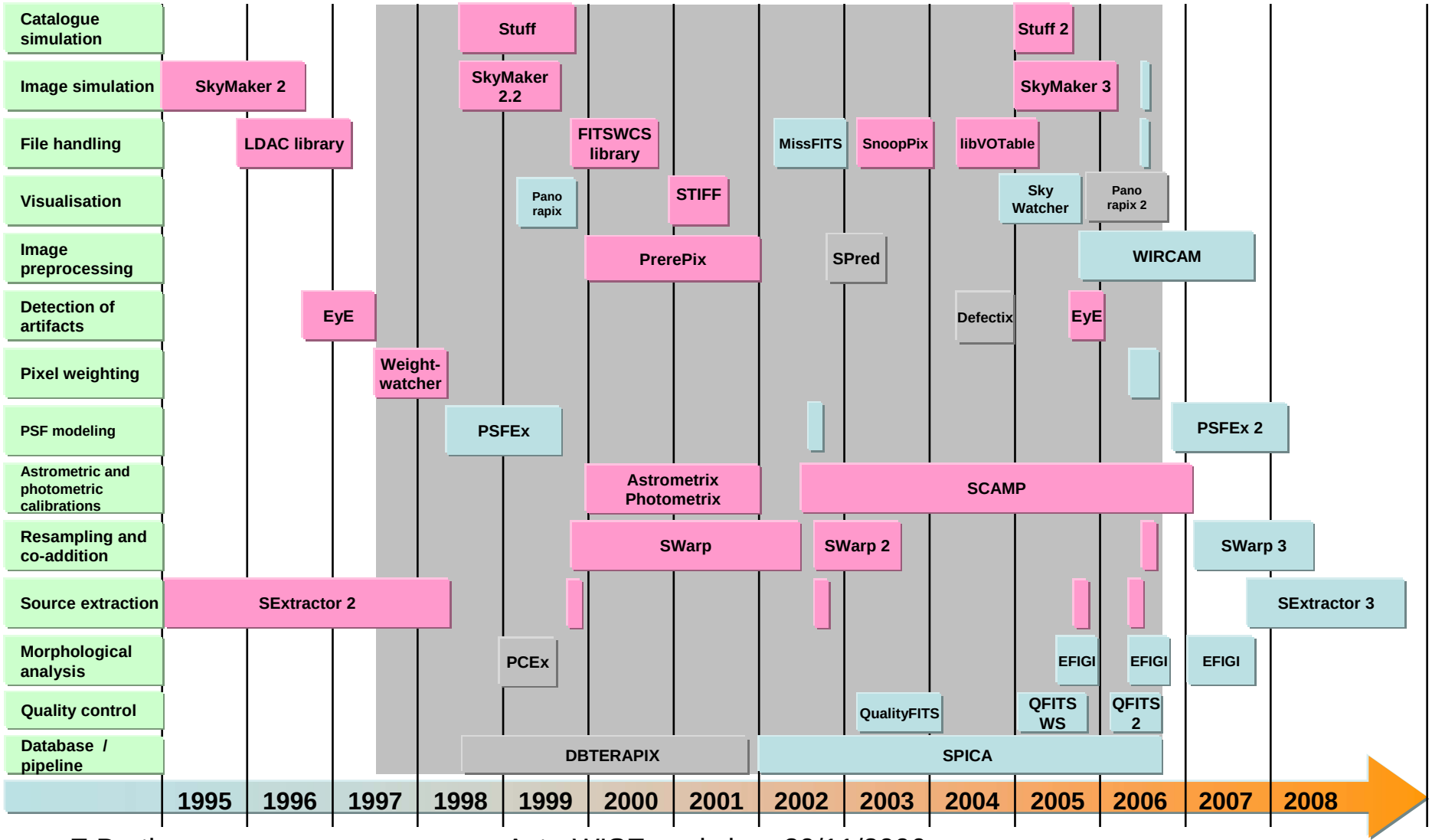


TERAPIX: An automated image analysis system



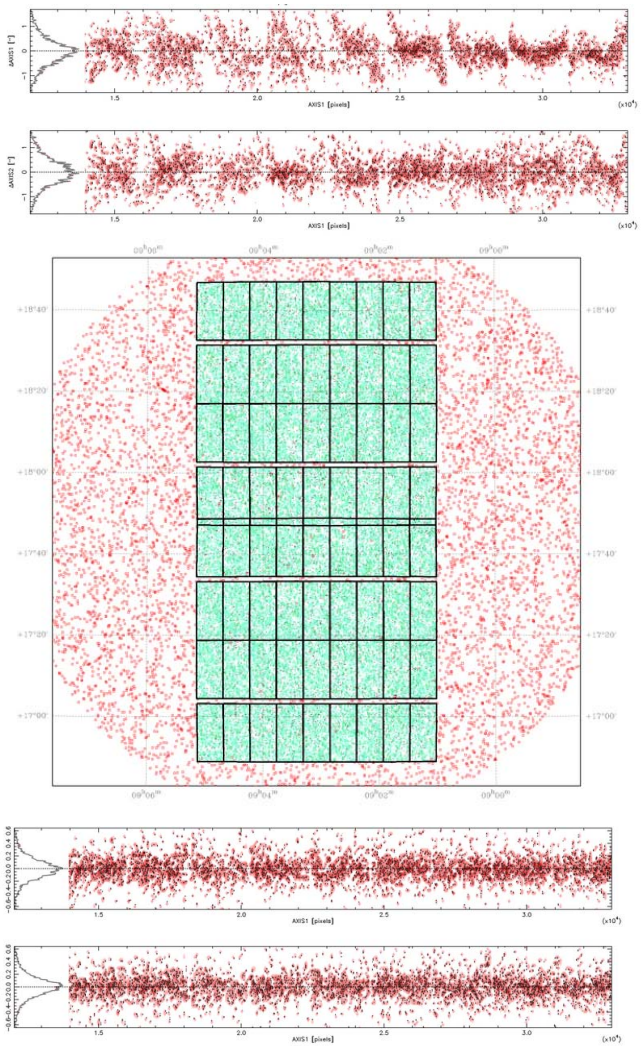
TERAPIX

Development timeline

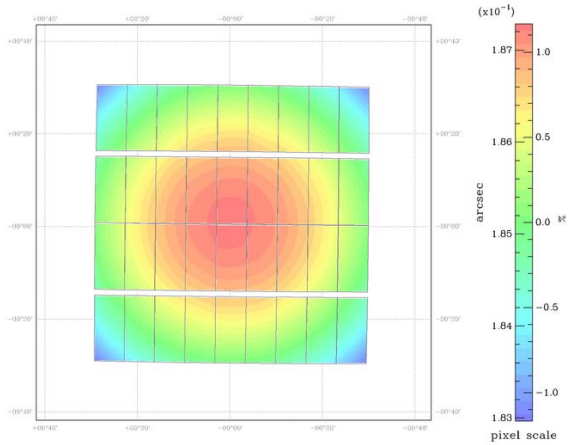


New developments during 2006

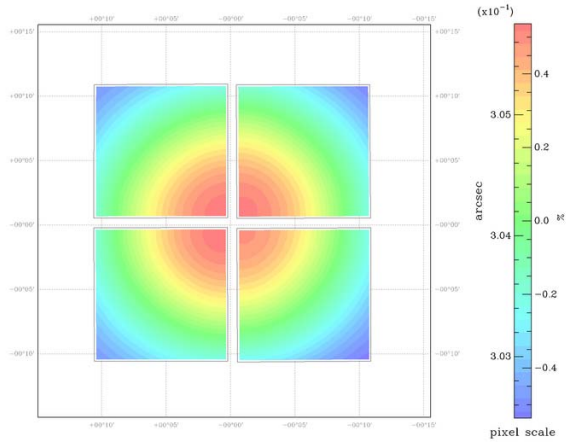
- Mostly improve robustness of the existing approaches
  - SCAMP (astrometric and photometric calibration software) released.
    - Average astrometric precision in T03:
      - 30mas RMS (pairwise) internal for sources with S/N > 100
        - » 67% quantile better than that
      - 280mas RMS (pairwise) with respect to USNO-B1
  - testing by other users helped find bugs and improve algorithms
    - V1.3.2: recipes tuned to offer more robust behaviour in crowded fields and observing programs with poor dithering patterns.
      - balancing between internal and external positional constraints
    - Proper motions / light curves computed but not yet available in output
    - WIRCAM processing (C.Marmo)
      - helped discovering bugs and provided
    - QualityFITS improved (F.Magnard & C.Marmo)
    - Move to ICRS (at last)
    - XML-VOTable output of metadata
    - TERAPIX software used for various data challenges



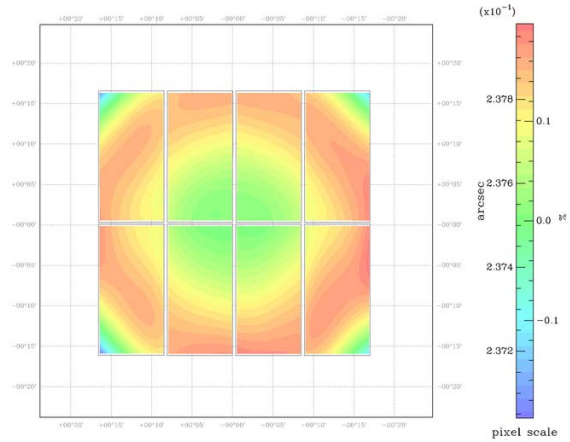
Some astrometric solutions by SCAMP



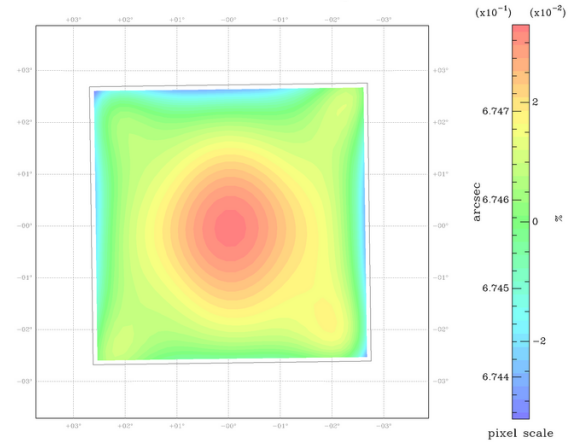
MEGACAM@CFHT-3.6m



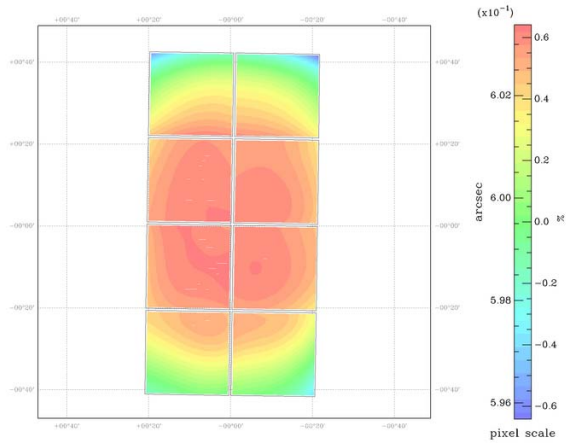
WIRCAM@CFHT-3.6m



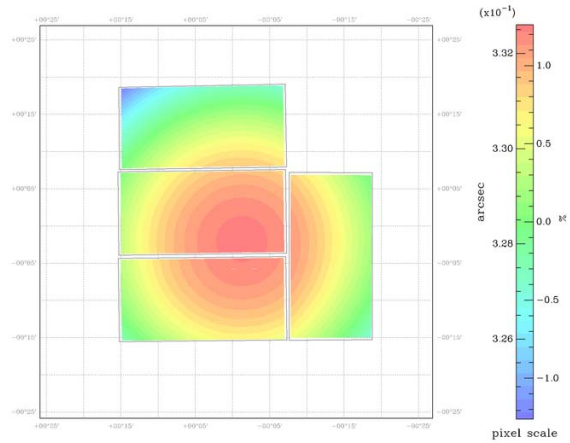
WFI@ESO-2.2m



ESO-Schmidt-plate@CAI



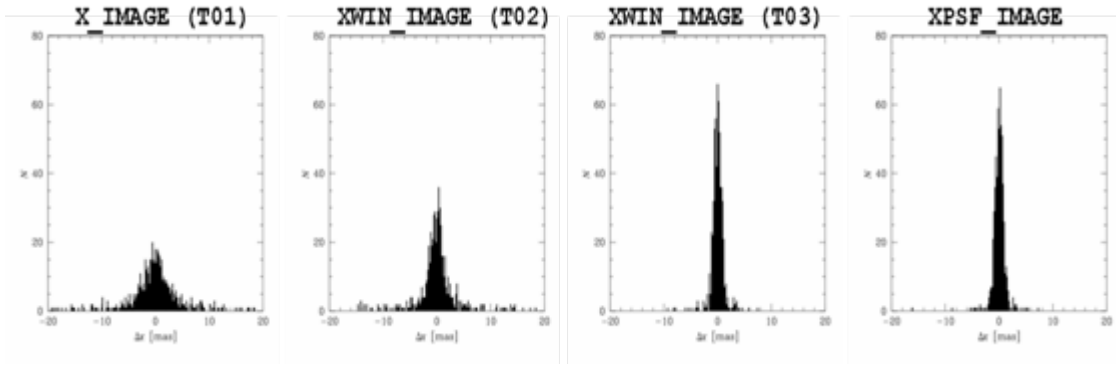
EROS_R@Marly-1m



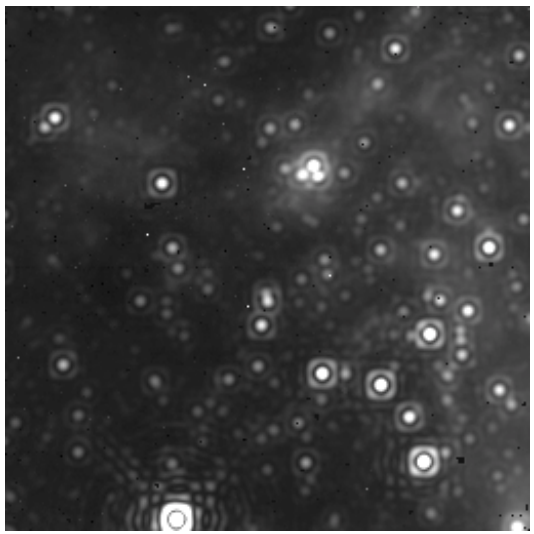
WFC@INT-2.5m

Ongoing software developments

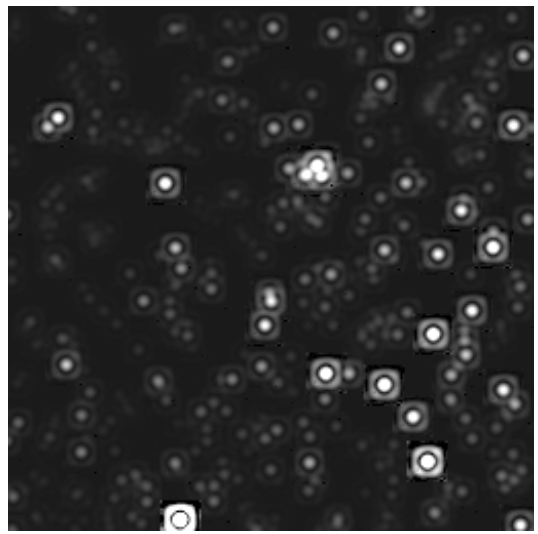
- PSF-fitting photometry
  - Mostly improve photometry
  - PSF modeling and fitting have been in there since 1999!
  - Improvements and testing done by the Grenoble team (Ph. Delorme)
  - Deblending issue: Extragalactic science vs galactic science
  - Clever filtering or use the current deblending algorithm
- Homogenisation of the PSF



original

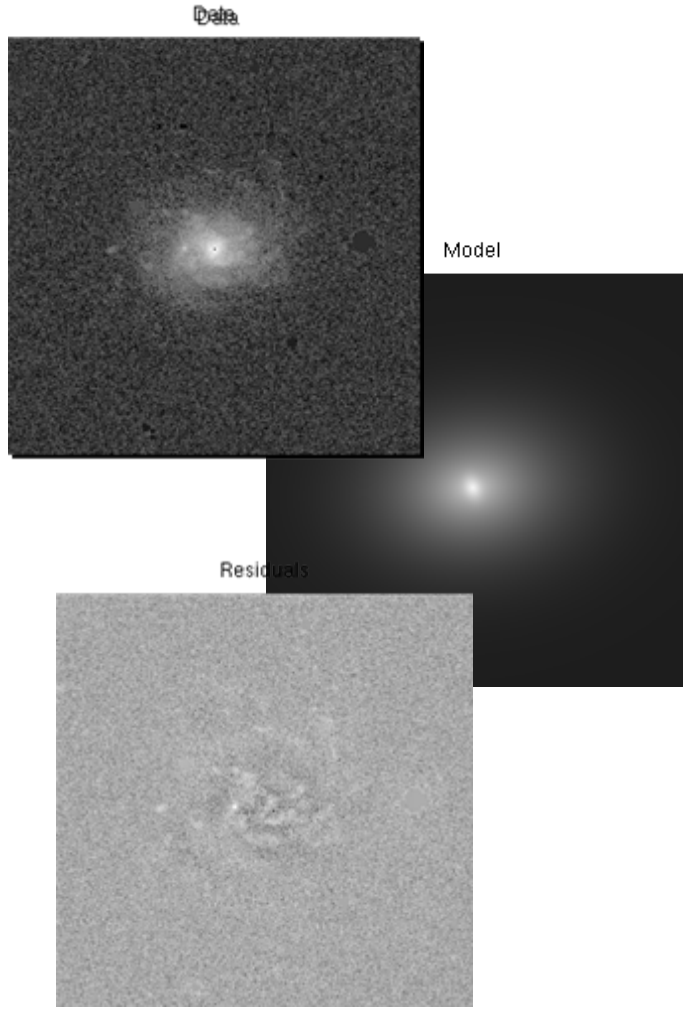


reconstructed



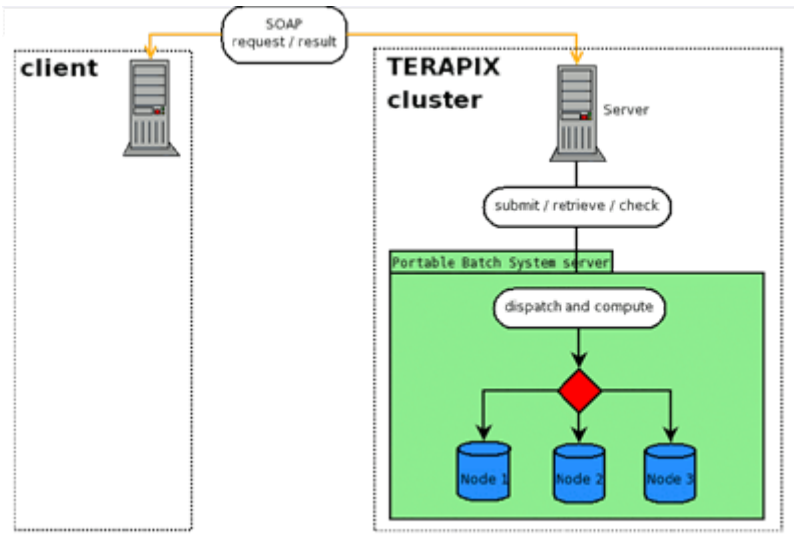
Ongoing software developments

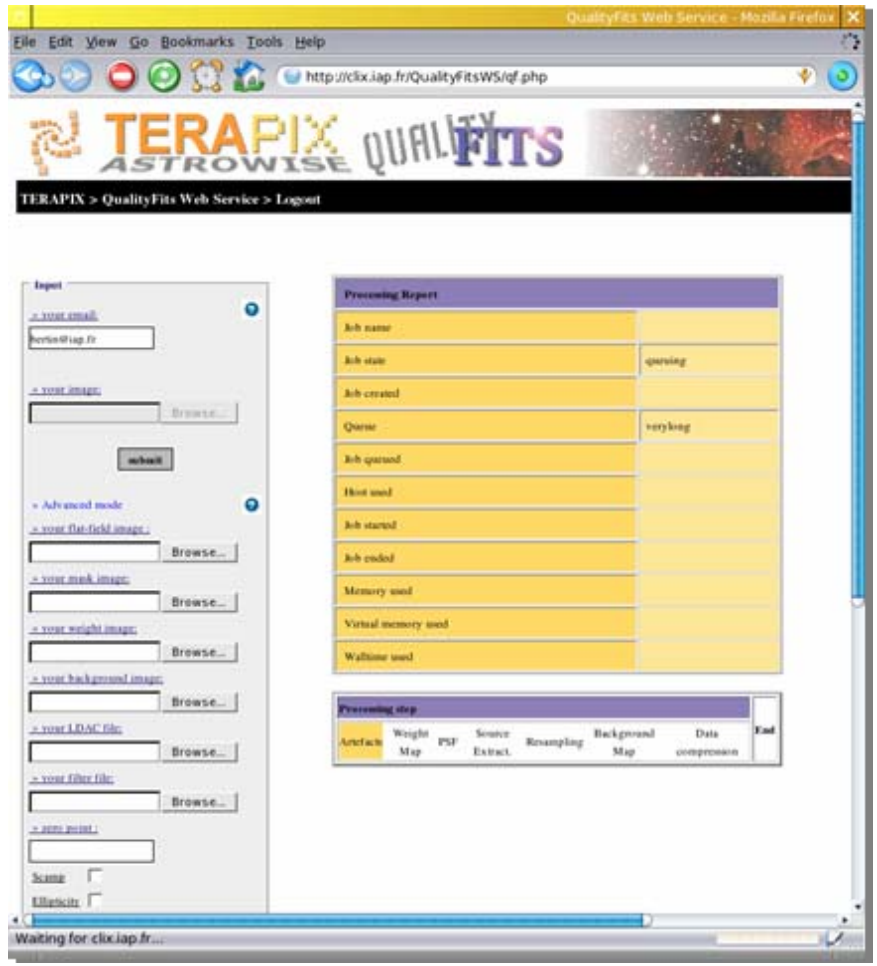
- Galaxy profile-fitting
  - Development done in the framework of the EFIGI project (with M. Arroyo@LTCI)
  - Analytical profiles
    - Single Sersic
    - Sersic + exponential (12 free parameters)
  - Currently a few seconds per 2GHz core
    - Goal is <100ms per core
  - Detection of additional morphological attributes later (Q4 2007)



Web Services

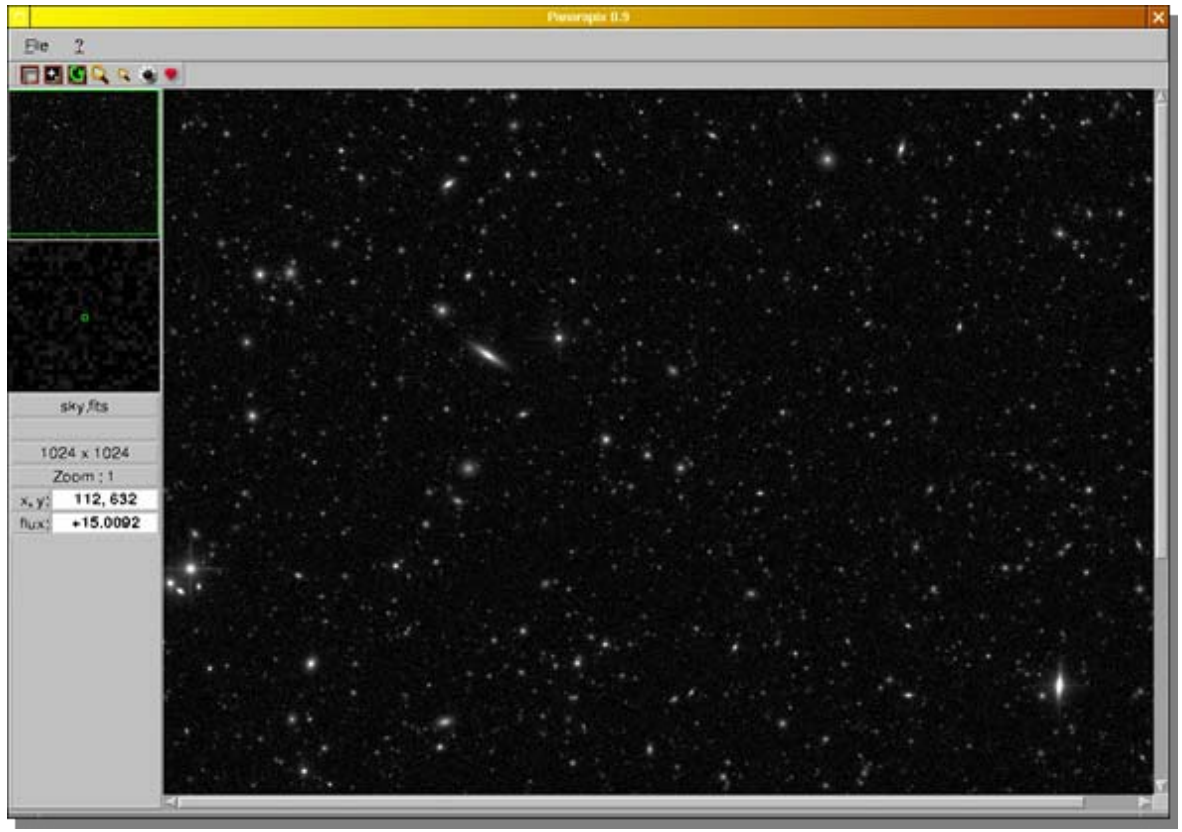
- Step towards an online pipeline
- Offer computing time available on the TERAPIX pipeline cluster between releases
- Make programs that require a complex installation easier to use.
- Gigabit connection expected at IAP
- V.O. compliancy
- Restricted to tasks with a reasonable amount of I/Os
  - no coaddition of distant data
- Prototype developed by J.-C. Malapert
- Release date depends on available manpower





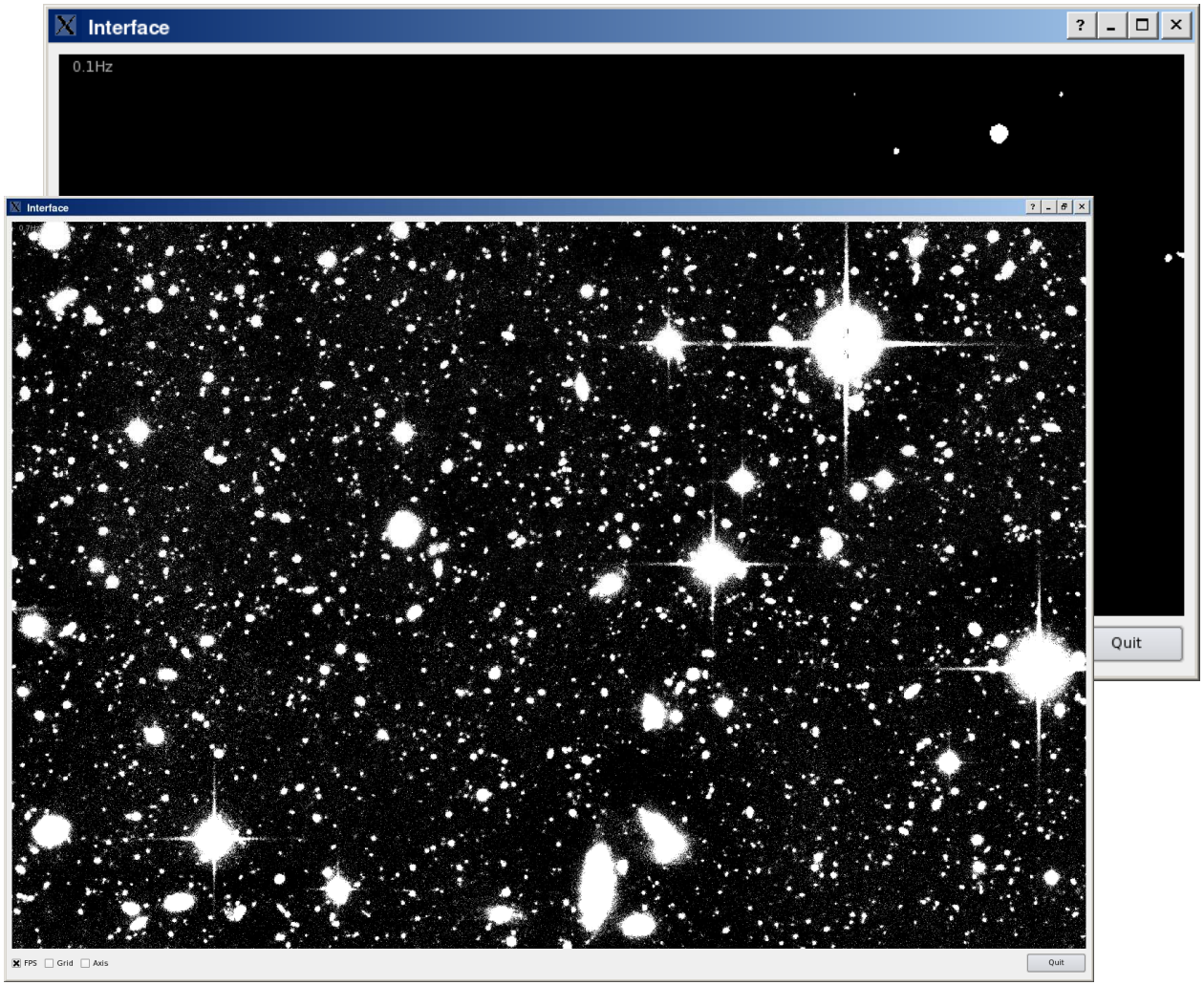
Panorapix

- Provide an optimized visualization tool.
  - project started out as a student training project in 1999
  - Original developer is **Nicolas de Coussemaker**
  - Written in C++, based on Qt
  - Maps the FITS file content in memory in real-time
  - it was decided to continue the project as part of the AstroWISE WP2 in 2002 (post-doc position)
    - **Frédéric Magnard** (first 25 months)
    - **Anis Rojbi** (last 11 months)
    - Solve portability problems (upgrade to Qt3/4) ✓
    - Fix remaining bugs ~
    - Add WCS ✓
    - Add support for MEFs ~
    - Investigate OpenGL implementation✓
    - Add overlays and query functionalities ☠
    - Add JPEG, PS,… outputs ~



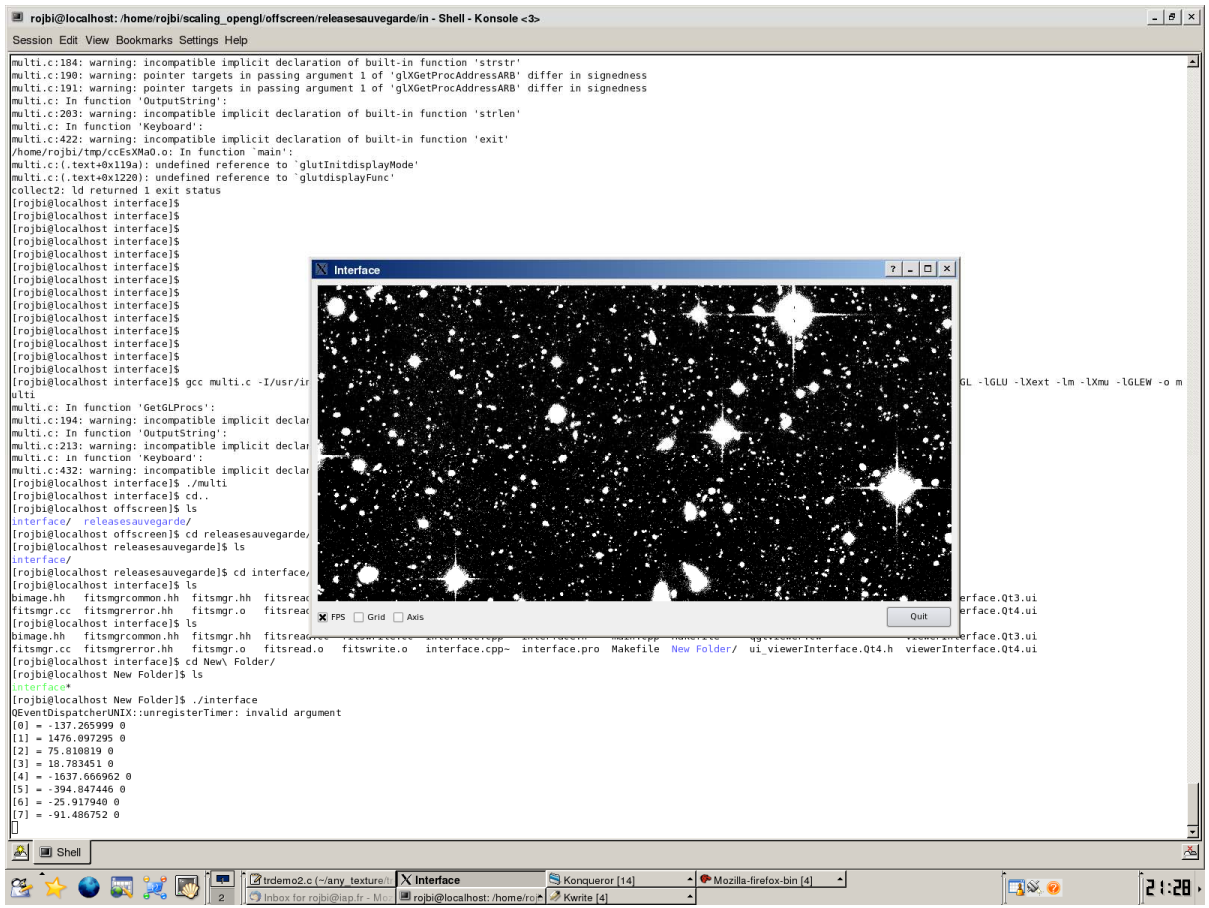
OpenGL

- Allow astrometric remapping to be done in real-time
  - Multiple extensions
  - Multiple images
  - Smooth zooming
- Recent (< 3 years old) graphic cards provide hardware support for floating point textures
  - CAN be manipulated through pixel shaders
    - e.g. nVidia's Cg
  - Allow real-time change of contrast, brightness, gamma, without quantization artifacts



Anis' OpenGL prototype

- Working with floats in OpenGL requires using pixel shaders
- For each pixel a vertex shader and a fragment shader are defined
  - portability can be maintained on nVidia and ATI cards.
  - refresh rate obtained with a 1024x1024 raster on the less powerful available nVidia card with support for floats (G5200) is in the range of a few fps
    - may certainly be improved
- raster size limited to 4096x4096



Why it failed short

- Anis could not find quickly enough a suitable way to load textures dynamically as one browses through a large image
  - Link with the original Panorapix implementation could not be made.
- So what do we have?
  - OpenGL + pixel shader prototype available.
  - Panorapix code has been cleaned up, auto-configured, and put on our SVN server
    - Besides current software limitations, the new features have brought further unstability
- This is definitely a job for an engineer with a solid experience in the field.

TERAPIX

terapix.iap.fr/forum