
The MPIA-UKIRT-Project

Software Installation Manual

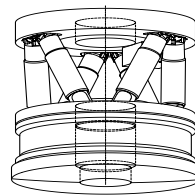
Stefan Hippler

Max-Planck-Institut für Astronomie

Heidelberg, Germany

May 1996

MPIA Release 1.0



Max-Planck-Institut für Astronomie
Königstuhl 17
69117 Heidelberg
Germany

<http://www.mpia-hd.mpg.de>

Table of Contents

Chapter 1 Introduction	5
1. Overview	5
Chapter 2 Installing Commercial Software	7
1. Notes on installing Solaris 2.4	7
2. Notes on installing VxWorks 5.1.1 and 5.2	9
3. Notes on installing the Occam 2 Toolset	11
4. Other commercial software	11
Chapter 3 Installing EPICS and ESO's INMOS Software for VxWorks	13
1. Notes on installing EPICS R3.12.x	13
2. Notes on installing ESO's INMOS software for VxWorks	14
Chapter 4 Installing MPIA Software	17
1. The MPIA Software Distribution	17

Table of Contents

Chapter 1: Introduction

1. Overview

MPIA Software Packages

MPIA's software distribution to the UKIRT upgrades programme consists of five major components:

- The Mirror Control Unit (*mcu*) software package controls the five axes secondary (hexapod) and its tip-tilt hardware
- The Bottom End Controller (*bec*) software package controls an eight axes motion/motor controller
- The Generic Camera Interface to the AstroCam 4201 camera system (*42gci*)
- The AstroCam User Interface (*au*) for VxWorks
- The AstroCam Graphical User Interface (*astroCam.tcl*)

This manual describes all required software packages and how to install them. Different types of software packages are used: commercial packages, public domain packages and software packages which are free of charge but require a special software license agreement e.g. the INMOS software on VxWorks.

Platforms

All software packages are installed and compiled on a SOLARIS workstation. Some software packages are cross-compiled on the workstation but run on a diskless VME-bus based system under VxWorks. All real-time input and output is handled by the VxWorks system. The Experimental Physics and Industrial Control System (EPICS) runs on top of VxWorks. In the following the VME-bus system is called an IOC (Input/Output Channel/Controller), that means software runs either on an IOC or on the workstation.

Commercial Software

MPIA software is coded as portable as possible. Version or release numbers below indicate under which versions the software was compiled, installed and tested.

- Solaris 2.4 (UNIX SYSVR4 based operating system, workstation)
- VxWorks 5.1.1 (real-time operating system, IOC)
- Sparcworks-Pro-C, release 3.0.1 (ANSI C-Compiler, workstation)
- INMOS D4305 OCCAM 2 Toolset for SUN workstations
- INMOS S514C B016 Package

Special Copyrighted Software

Special software packages used in the MPIA-UKIRT-Project are EPICS R3.12.Beta12 with edd/dm 2.1 and the ESO INMOS Software for VxWorks (LCUTRA-MAR95 tape distribution). Both packages are copyrighted and not allowed to use without permission. EPICS is distributed by Los Alamos National Laboratory, New Mexico. ESO INMOS Software for VxWorks is distributed by European Southern Observatory, München.

Free Software

The term "Free software" stands for programs or program packages like gnuplot which are free of charge but nevertheless have a copyright.

- gnumake 3.74
- gnuplot 3.5
- saoinage 1.07
- tcl 7.3
- tk 3.6
- tcl-dp 3.2
- blt 1.7
- tix3.6

Chapter 2: Installing Commercial Software

1. Notes on installing Solaris 2.4

Solaris is the standard UNIX operating system used in the MPIA-UKIRT-Project. Very little system specific settings are required to run all MPIA software packages. The following modifications require that you have **root** permission.

All references to the name **cola** indicate that this is the UNIX (Solaris) workstation. The Input/Output Channel/Controller (IOC) is referenced by the name **keahua**. On this machine runs VxWorks and on top of VxWorks runs EPICS. VxWorks is a single user operating system and therefore requires no special permissions to modify i.e. the boot parameters.

Solairs 2.4

1. Create a user account with the name **ukirt** and a user ID (uid) of **59999**. This can be done with the command:

```
/usr/sbin/passmgmt -a -u 59999 ukirt
```

On **cola** the corresponding entry in `/etc/passwd` should look similar to:

```
ukirt:x:59999:1:UKIRT:UKIRT:/sbin/tcsh
```

2. Create the home directory of the **ukirt** account with:

```
mkdir /work/ukirt; chown ukirt /work/ukirt
```

Please note that `/work/ukirt` is just an example and can be changed to any valid directory path.
3. Create a symbolic link so that `/UKIRT` points to the home directory of the **ukirt** account, e.g. `/UKIRT -> /work/ukirt`
4. Create a user account with the name **epics** and a valid user ID. This can be done with the command:

```
/usr/sbin/passmgmt -a -u 60000 epics
```

On **cola** the corresponding entry in `/etc/passwd` reads as follows:

```
epics:x:60000:60001:EPICS Guru:/EPICS/epics:/sbin/tcsh
```

5. Create the home directory of the epics account with:

```
mkdir /work/epics; chown epics /work/epics
```

Please note that /work/ukirt is just an example and can be changed to any valid directory path.
6. Create a symbolic link so that /EPICS points to the parent directory of the epics home directory, e.g. on cola /EPICS -> /work. The home directory of epics in this case is /EPICS/epics
7. Share all disks on cola where data from the tip-tilt sensor shall be stored with keahua. Share the home directory of the ukirt account with keahua. One way to share disks can be done with the following commands (all given on cola):
 - a. edit the file /etc/dfs/dfstab so that it reads like:

```
share -F nfs -o rw=keahua:keahua.mpia-hd.mpg.de "Tip-tilt data" /work
```
 - b. give the command /usr/sbin/shareall and check the result with
 - c. /usr/bin/showmount -e
This command should display the list of exported filesystems, e.g.:

```
export list for cola:  
/work keahua,keahua.mpia-hd.mpg.de  
...
```
8. Extract all tar archives from the MPIA-UKIRT-Project software distribution tapes (90m long 4mm DATs, compressed). Give the command:

```
cd /work/MPIA; tar xvf /dev/nrst4
```

Please note that the tape device /dev/nrst4 and the folder /work/MPIA on which the tape content are stored might be different on your system. After having extracted all archives onto disk you have to uncompress them with the GNU unzip program (e.g. `gunzip *.gz, gzip -d *.gz`). Then you see the following files in /work/MPIA:
 - THINNED.tar
 - TOOLS.tar
 - VLTROOT_FEB95.tar
 - astromed_v1.9.tar
 - b016_MAR95.tar
 - bec.tar
 - bsp.mv167.1993.tar
 - bsp.mv167.1994.tar
 - mcu.tar
 - r231193.tar
 - r231193.info
 - tcltk3.tar (or T3.tar)
 - ukirt.tar
 - ukirtAppl.tarFor a detailed description of all tar archives see chapters XX, YY, ZZ in this manual. It is also possible that parts of the tape distribution do *not* contain compressed tar archives but a single tar archive. That means that you can either extract the tape contents onto disk with "tar xf /dev/rst4" or you can copy the archive file onto disk e.g. with "dd if=/dev/rst4 of=mpiaArchive1 bs=10240". In case of doubt check out what is on the tape before you start extracting files.
9. Install your EPICS distribution under ~epics or create a symbolic link such that ~epics/R3.12.0Beta12 or ~epics/R3.12.2 contain at least the standard EPICS directories base, config and extensions.

2. Notes on installing VxWorks 5.1.1 and 5.2

VxWorks

Install VxWorks as described in the VxWorks Programmer's Guide. On `cola` some VxWorks related environment variables are set as follows:

```
VX_BSP_BASE=/vw  
VX_HOST_TYPE=solaris  
VX_HSP_BASE=/vw  
VX_INCLUDE=/vw/h  
VX_VW_BASE=/vw  
VXROOT=/vw  
VX_CPU_FAMILY=68k  
GCC_EXEC_PREFIX=/vw/solaris.68k/lib/gcc-lib/  
CPU=MC68040
```

Depending on where your VxWorks distribution is on `cola`, create a symbolic link such that `/vw` points to the VxWorks base directory.

If you already have a MVME 167 board support package installed skip this paragraph. To install the MVME 167 board support package (BSP) change your working directory to `/vw` and extract the `bsp.mv167.1994.tar` archive. Change your working directory to `/vw/config/all`, modify the file `config.all` in order to include the `nfs` package into VxWorks (`#define INCLUDE_NFS`) and increase the VxWorks shell stack size to 30000 (`#define SHELL_STACK_SIZE 30000`). It is also a good idea to include login security (`#define INCLUDE_SECURITY`, `#define LOGIN_USER_NAME`, `#define LOGIN_PASSWORD`) while modifying the file `config.all`. After these modifications change your working directory to `/vw/config/mv167` or `/vw/config/mv177` and give `make` (GNU make).

In order to test the new vxWorks boot image you have to create a file name `.rhosts` in the home directory of the `ukirt` account (`~ukirt/.rhosts`). Add the following two lines to this files (substitute `mpia-hd.mpg.de` with your domain name):

```
keahua ukirt  
keahua.mpia-hd.mpg.de ukirt  
Backup .rhosts, e.g. cp .rhosts rhosts.OK.
```

Now you can test the new vxWorks boot image. Connect a dumb terminal (e.g. `vt100`) or a laptop to the console port of the VME system `keahua` over a serial RS232 line with 9600 baud and switch the VME system on. You will see something similar to:

VxWorks System Boot

Copyright 1984-1993 Wind River Systems, Inc.

CPU: Motorola MVME167

Version: 5.1

BSP version: 1.0

Creation date: Mon Apr 11 20:15:24 PDT 1994

Press any key to stop auto-boot...

**Press a key on the
VME console!**

```
1  
[VxWorks Boot]: p
```

Chapter 2: Installing Commercial Software

Notes on installing VxWorks 5.1.1 and 5.2

```
boot device           : ei
processor number      : 0
host name             : cola
file name            : /vw/config/mv167/vxWorks
inet on ethernet (e) : 149.217.40.102:ffffff00
host inet (h)        : 149.217.40.16
gateway inet (g)     : 149.217.40.1
user (u)             : ukirt
flags (f)            : 0x8
target name (tn)     : keahua
startup script (s)   :
```

At the next prompt give either `help` or `c` to change the parameters above.

Enter help here

```
[VxWorks Boot]: help
?                - print this list
@                - boot (load and go)
p                - print boot params
c                - change boot params
l                - load boot file
g adrs          - go to adrs
d adrs[,n]      - display memory
m adrs          - modify memory
f adrs, nbytes, value - fill memory
t adrs, adrs, nbytes - copy memory
e                - print fatal exception
n netif         - print network interface device address
$dev(0,procnum)host:/file h=# e=# b=# g=# u=usr [pw=passwd] f=#
                  tn=targetname s=script o=other

Boot flags:
0x02 - load local system symbols
0x04 - don't autoboot
0x08 - quick autoboot (no countdown)
0x20 - disable login security
0x40 - use bootp to get boot parameters
0x80 - use tftp to get boot image
0x100 - use proxy arp
```

available boot devices: ei bp sm

Enter ^X to boot VxWorks

```
[VxWorks Boot]: ^X
Attaching network interface ei0... done.
Attaching network interface lo0... done.
Loading... 371632 + 103192 + 26534
Starting at 0x1000...
```

```
Attaching network interface ei0... done.  
Attaching network interface lo0... done.  
Loading symbol table from cola:/vw/config/mv167/vxWorks.sym ...done  
..... VxWorks Logo .....
```

3. Notes on installing the Occam 2 Toolset

OCCAM

The INMOS Occam 2 toolset is required only if you want to modify or recompile parts of the AstroCam software which run in the AstroCam electronics (DDE). Install the Occam 2 toolset as described in the "Occam 2 Toolset Delivery Manual" and create a symbolic link on `cola` such that `/OCCAM_ROOT` points to the parent directory of the Occam 2 toolset directory (usually `.../D4305`). On `cola` the command `"ls /OCCAM_ROOT"` shows `D4305` and `"ls /OCCAM_ROOT/D4305"` shows:

```
connect  
iterns  
license  
start_license.csh  
examples  
libs  
source  
tools
```

4. Other commercial software

Parts of the software described in this chapter might require other software packages that are not included within the MPIA-UKIRT software distribution. Please feel free to contact the author if you are not sure whether you will need this specific software to run the MPIA-UKIRT software

Chapter 3: Installing EPICS and ESO's INMOS Software for VxWorks

1. Notes on installing EPICS R3.12.x

EPICS is copyrighted by the Regents of the University of California and the University of Chicago Board of Governors. A guide to the EPICS software distribution is available on the world wide web at:

http://epics.aps.anl.gov/asd/controls/epics_home.html

Other starting points for EPICS documentation and distribution are:

- <http://www.atdiv.lanl.gov>
- <http://www.atdiv.lanl.gov/doc/epics/epicshm.html>
- http://csg.lbl.gov/EPICS_collaboration.html

The *EPICS Source/Release Control - How to Build and Develop EPICS Software* manual written by Matthew Needes, Janet Anderson and Marty Kraimer describes how to build and manage EPICS, e.g. "How to Build EPICS Base in Six Steps". A postscript version of this manual can be found at:

<http://epics.aps.anl.gov/asd/controls/epics/EpicsDocumentation/WWWPages/EpicsDocs/AppDevManuals/SrcRelCntrl/3.12/SRControl.ps>

At MPIA users get access to EPICS software through a c-shell script located at `~epics/etc/cshrc.R3.12.1`. After having given the command

```
source ~epics/etc/cshrc.R3.12.1
```

and after having set the environment variable `EPICS_DISPLAY_PATH` with

```
setenv EPICS_DISPLAY_PATH "/EPICS/ukirtAppl/May96/data"
```

users can run the Graphical User Interfaces, e.g. `dm mcugui.dl &`.

The minimum set of EPICS programs which are required to run all MPIA-UKIRT graphical user interfaces (GUI) are `dm`, `caRepeater` and `et_wish`. The graphical user interfaces are `mcugui.dl`, `becgui.dl`, `auigui.dl` and `astroCam.tcl` (`AstroCam/*`).

If you want to run the Bottom End Controller (bec) GUI give

```
dm becgui.dl &
```

2. Notes on installing ESO's INMOS software for VxWorks

The MPIA-UKIRT software requires a B016 driver for VxWorks. The B016 driver provides a fast mechanism to transfer data and commands between the INMOS B016 VME bus Transputer board and other Transputers connected to this board. In the MPIA-UKIRT environment three transputer links are used:

1. B016 Link 0 is connected to the AstroCam subsystem
2. B016 Link 1 is connected to the Mirror Control Unit (mcu)
3. B016 Link 2 is connected to the Bottom End Controller (bec)

The B016 software package is part of the Very Large Telescope (VLT) Software Release "February 1995". The European Southern Observatory (ESO) has kindly granted MPIA to use their VLT and B016 software. The *VLT Software Release 1 (Common Software) Overview and Installation Manual* describes the process of installing VLT Software. The *VLT Software - LCU - Transputer Interface Software - User Manual (Issue 1.1)* describes how to install the Interface software and make it ready for use.

The B016 board used in the MPIA-UKIRT Project uses ESO's T801 ROM software which has to be loaded into the B016 F-ROM. The installation of the B016 T801 ROM software is described in *VLT Software - IMS B016 Driver for VxWorks - User Manual*. A VxWorks shell script and the new F-ROM software can be found under `/B016_SW/LCUTRA/b016/ace/bin`. You need 3 B016 boards to re-program one B016 board (a link adaptor B016 board, a root transputer B016 board and the B016 board you want to re-program). The hardware configuration for this procedure is described in *IMS S514C - IMS B014 and IMS B016 Support Software - S514C Product Supplement* manual. B016 Jumper settings are described in *IMS F008A - IMS B016 Support Libraries (Installing the IMS B016)*. Please note that the B016 board that comes with the MPIA-UKIRT hardware already has the new F-ROM software installed.

More documentation about the INMOS software package for VxWorks can be found in:

- VLT Software - IMS B016 Driver for VxWorks - Acceptance Tests
- VLT Software - IMS B016 Driver for VxWorks - User Manual
- VLT Software - The INMOS Software Package for VxWorks - Performance Tests
- VLT Software - The INMOS Software Package for VxWorks - Maintenance Manual
- VLT Software - Interface Control Document between CCD LCU and ACE Software
- VLT Software - The INMOS Software Package for VxWorks - User Manual

These manuals can also be found at <ftp://tel.hq.eso.org/vlt/pub>.

A basic check whether the B016 software and hardware are operational can be done with the `vxworks` command `inmosCheck`.

The output of `inmosCheck` should look similar to:

Using `/bxvi00 inmosCheck 3.0`

```
# Part rate Mb Bt [ Link0 Link1 Link2 Link3 ]
0 T16 -20 1.75 1 [ 1:0 HOST ... ... ]
1 T2 -20 1.20 0 [ 0:0 ... ... ... ]
```

The printout shows that the B016 (HOST) is connected to a T16 (TRAM) transputer. Link 1 of the T16 transputer goes into link 0 of the B016 host. Remember that the B016 host has 4 channels and the first channel connects to the AstroCam subsystem. The T16 (TRAM) transputer connects via its link 0 to another T2 (link 0) transputer. This transputer is located inside the AstroCam electronics (DDE). The printout also shows the link speed (rate) between the transputers of 20 MBit/s. The next column shows the estimated transfer rate (Mb) between the T16 and the B016 host of 1.75 MByte/s and between the T16 and the T2 of 1.2 MByte/s. The last 4 columns show for example that Link0 of the T16 is connected to part #1 link 0 (1:0).

The `inmosCheck` command corresponds to the program `ispy` of the Unix version

The `inmosCheck` command given without parameters opens the port defined by the vxWorks environment variable `TRANSPUTER`, e.g. `TRANSPUTER=/bxvi00`.

Chapter 4: Installing MPIA Software

1. The MPIA Software Distribution

MPIA Software is distributed on DAT tapes in standard Unix tar format. The tar archives include:

1. ukirtAppl.tar - contains the EPICS application directory and the VxWorks sources to control and operate the Mirror Control Unit including the Hexapod and the 8 axis motion controller (Bottom-end controller)
2. astromed_v1.9.tar - contains the AstroCam source and application directory including all OCCAM sources and the main astromed user interface program *auu*. This archive also contains the configuration files for the AstroCam CCD camera
3. ukirt.tar - contains a backup of the *ukirt* Solaris account used at MPIA as login account to operate the entire MPIA-UKIRT-Project system
4. T3.tar - contains a backup of all necessary TCL/TK software to run *astroCam.tcl* and all other TCL/TK programs

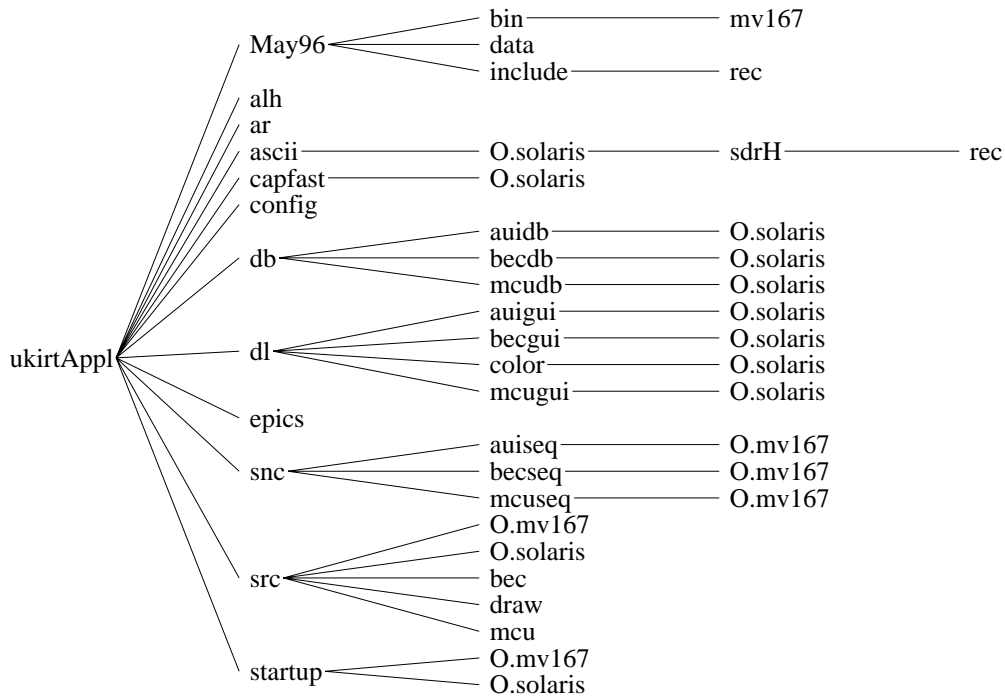
The ukirtAppl tree

To install the ukirtAppl archive give `cd /EPICS; tar xf ukirtAppl.tar` or in case the archive is on DAT give `cd /EPICS; tar xf /dev/rmt/0`. The graphical tree below shows the resulting ukirtAppl directory tree.

The ukirtAppl directory tree was created with the *applSetup* command. EPICS database records are in the *db* subdirectory, EPICS display lists are in the *dl* subdirectory, EPICS sequencer programs are in the *snc* subdirectory and the primary vxWorks/EPICS startup sequence *startup.keahua* can be found in the startup directory. All executable application programs and all loadable databases can be found in the *May96/bin/mv167* and *May96/data* subdirectories.

The *ukirtAppl* directory contains a symbolic link to the startup script:
`startup.keahua -> May96/bin/mv167/keahua`

This link is important because it is referenced in the vxWorks boot ROM.



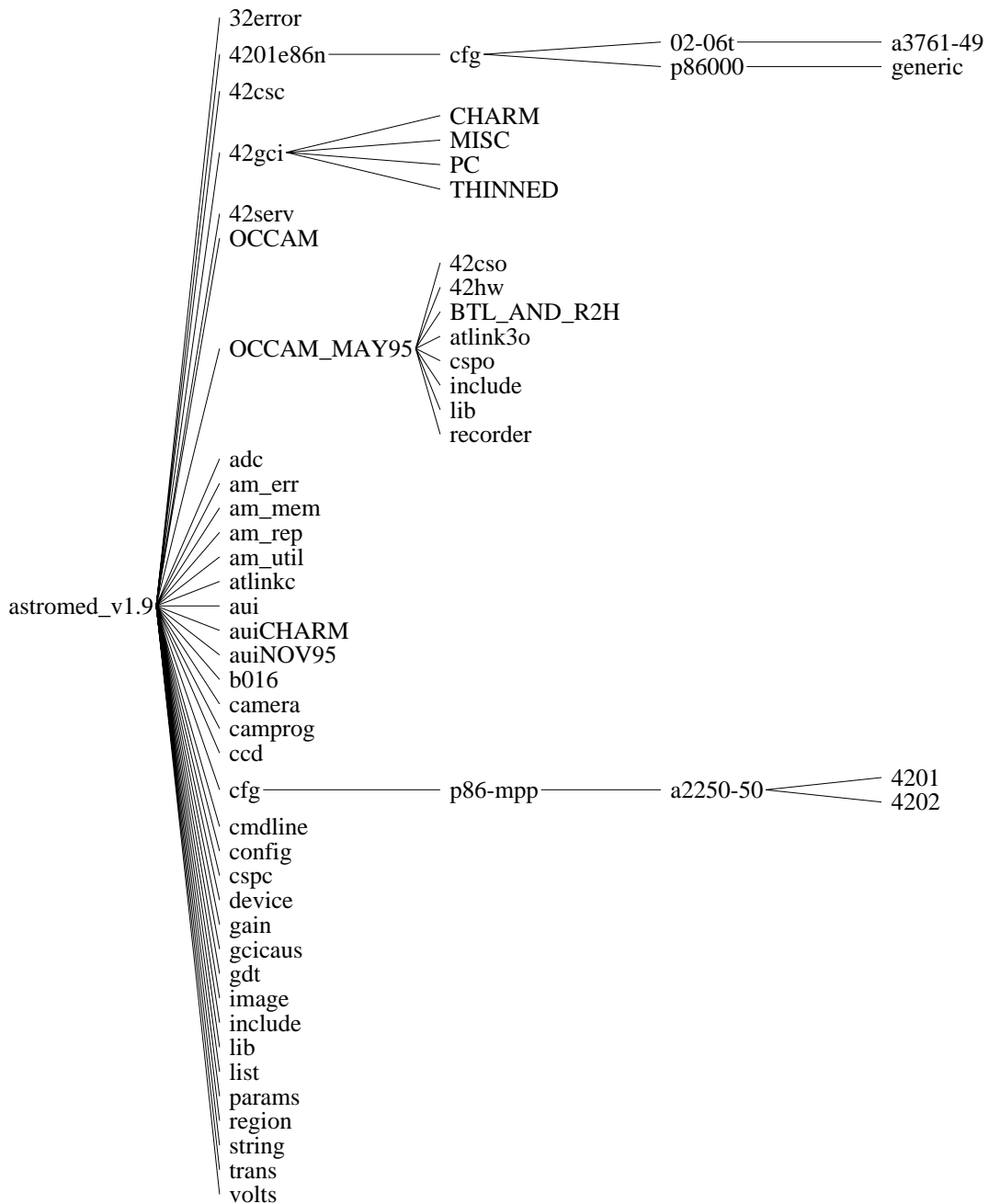
The astromed_v1.9 tree

To install the astromed_v1.9 archive give `cd /somewhere; tar xf astromed_v1.9.tar` or in case the archive is on DAT give `cd /somewhere; tar xf /dev/rmt/0`. The graphical tree below shows the resulting astromed_v1.9 directory tree.

The next step is to create a symbolic link `/ASTROMED` which points to `/somewhere/astromed_v1.9`

Important directories within the `/ASTROMED` directory tree are `au` and `42gci`. The latter one contains the 3rd vxWorks boot script `42gciInstall.sh`. The primary vxWorks boot script `/EPICS/ukirtAppl/startup.keahua` calls a second vxWorks shell script named `/vw/STARTUP.keahua` and this script then calls `/ASTROMED/42gci/42gciInstall.sh`

Please note that the output of some commands within `/vw/STARTUP.keahua` are redirected to ukirt's home directory. Check `/vw/STARTUP.keahua` and change or remove these redirections according to your setup.



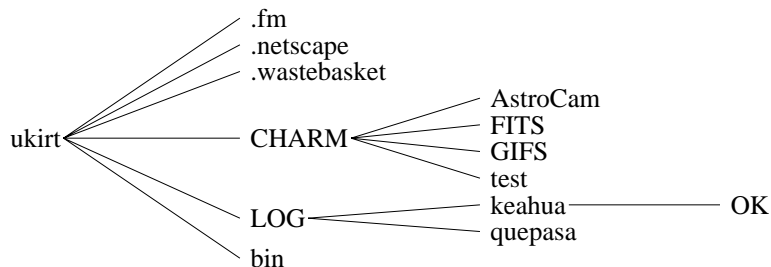
ukirt's home directory

To install the ukirt home directory archive give `cd /somewhere; tar xf ukirt.tar` or in case the archive is on DAT give `cd /somewhere; tar xf /dev/rmt/0m`. The graphical tree below shows ukirt's home directory. Create a symbolic in such a manner that /UKIRT points to ukirt's home directory (see also Chapter 2). Check the `.rhosts` file in the ukirt directory and compare/modify it according to the backup you have made earlier. Other files to change are `.cshrc` and `.vxworks.login`.

Chapter 4: Installing MPIA Software

The MPIA Software Distribution

One important shell environment variable is `WROOT` which is also used within the `astroCam.tcl` program.



Extracting the TCL/ TK stuff - T3.tar

Unpack the T3.tar archive with the command: `cd /somewhere; tar xf T3.tar` or in case the archive is on DAT give `cd /somewhere; tar xf /dev/rmt/0m`. You have to set the shell environment variables `TCL_LIBRARY` and `TK_LIBRARY` to `/somewhere/T3/lib/tcl` and `/somewhere/T3/lib/tk` respectively.

The `TIX_LIBRARY` variable has also to be modified inside the `astroCam.tcl` program, e.g. `set TIX_LIBRARY /somewhere/T3/lib/tix`.