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physics background

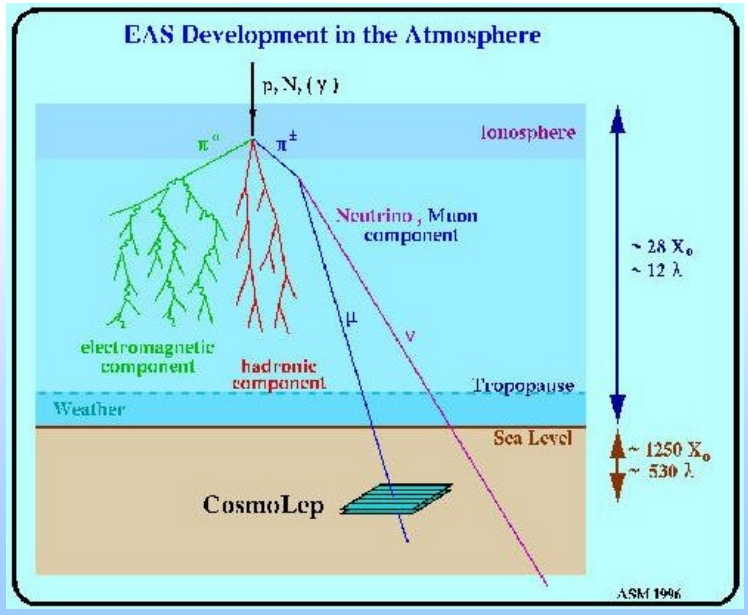
We propose to use part of the muon spectrometer of the L3 detector at LEP, CERN, to measure the cosmic ray muon spectrum in the momentum range between 20 and 2000 GeV/c with high precision.

In addition we shall get the angular dependence, the charge ratio, and the time variations of the muon momentum spectrum, as well as multimuon events.

physics goals

To-day the measured muon momentum spectrum in the range 10 to 1000 GeV/c has systematical uncertainties of the order of 25 %.

We propose a measurement at the %-level of precision in the same energy range. This can be achieved with the unique muon-spectrometer of the L3 detector, whose momentum resolution is unrivalled over such a large momentum range.

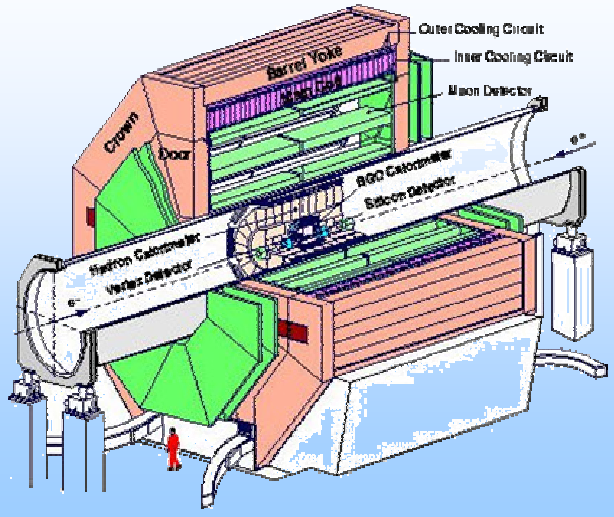


The L3 detector

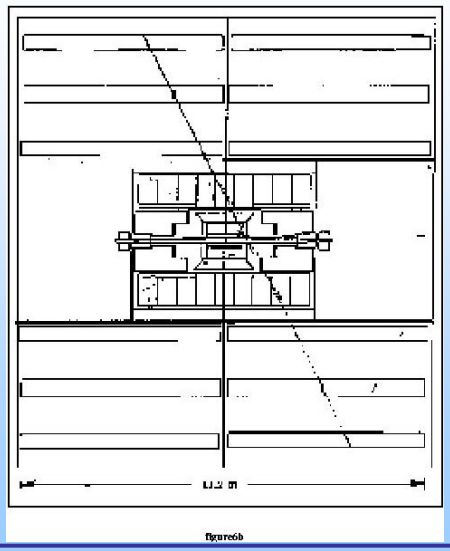
The L3 detector was designed to measure very accurately gamma , e and mu's produced in e+e- collisions. (Fig.3). It has a huge solenoidal magnet of 12 m diameter, 12 m length, with a field of 0.5 Tesla. Inside this magnetic cave of 1000 m3 a high precision muon detector is installed.

The central part of the detector consists of a sampling hadron calorimeter, a barrel shaped trigger scintillator system, a crystal electromagnetic calorimeter, and a vertex detector.

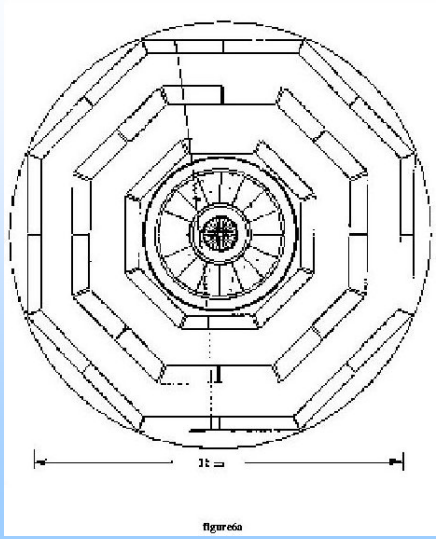
L3 detector



Cosmic particle track in the L3 detector



Cosmic particle track in the L3 detector



The new timing, trigger and acquisition system

In order to keep the excellent momentum resolution one needs the installation of an additional fast detector to get a T0 signal, replacing the beam crossing signal used in L3 collider mode.

Twelve scintillator modules with size 2 x 3 m^2 have been installed on top of the magnet (see Fig. 10). One module consists of six submodules, each of which contains 16 scintillator tiles.

Each tile has 2 x 4 wavelength shifting fibers along its top surface, and clear fibers running up to the phototubes. The size of one tile is 25 x 25 x 2 cm^3. In total 16 photomultipliers (2 per module) are used for the signal read-out.

t_0 - detector

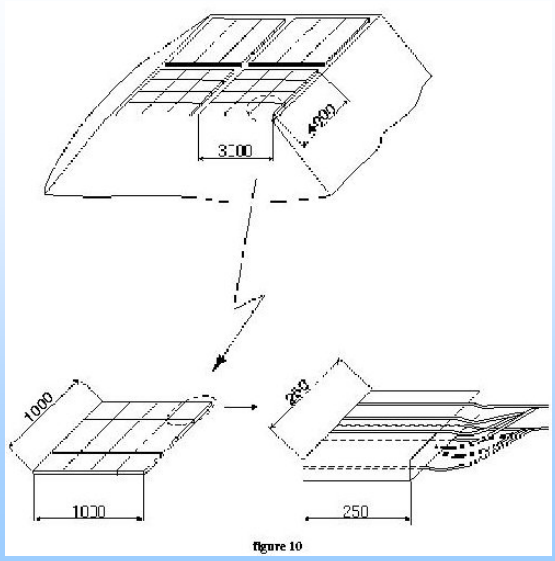


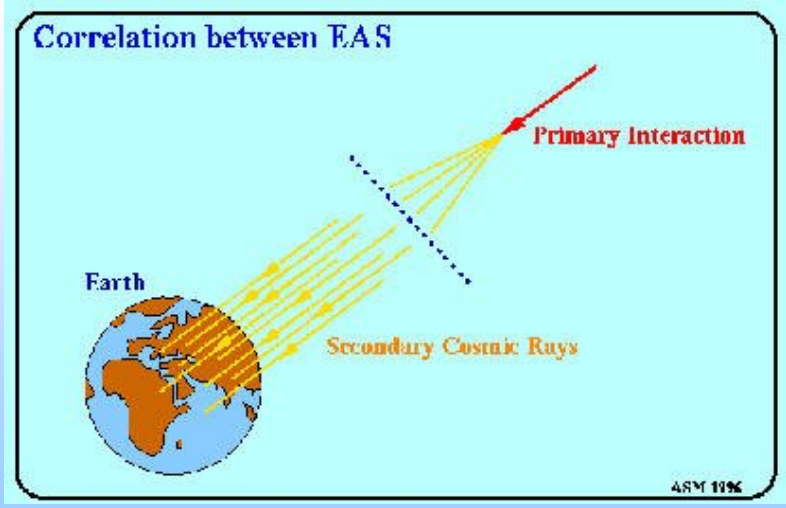
figure 10

COSMOLEP

COSMOLEP is a cosmic ray experiment with the aim to detect atmospheric muons at a depth of about 500 mwe (140 m underground). The intention is to look for coincidences between all four LEP experiments and several scintillator arrays, caused by cosmic ray events covering a larger area than conventional extensive air showers .

The present test setup (CosmoAleph) is located in and near the ALEPH cavern. Over an active area of 70 m**2 we are able to see muons with energies of a minimum of 70 GeV at the surface. Currently there are four stations equipped with scintillator arrays: Two directly in the ALEPH cavern (36/54 m away from ALEPH), one in the bypass of the ALEPH detector (about 250 m away from ALEPH) and one in an alcove of the LEP tunnel (about 900 m away from ALEPH). An other part of the setup is the hadron calorimeter of the ALEPH detector, which triggers on cosmic muons.

COSMOLEP



MU_CONOS task/goal

task

connection between the slow - controls of

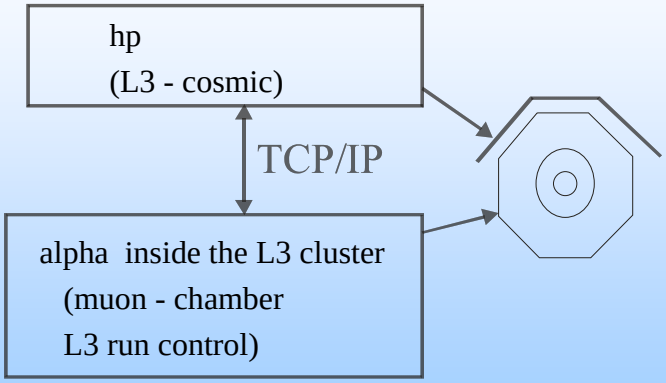
- muon chamber, L3 online cluster (alpha, VMS)

- L3 - cosmic (hp, UNIX)

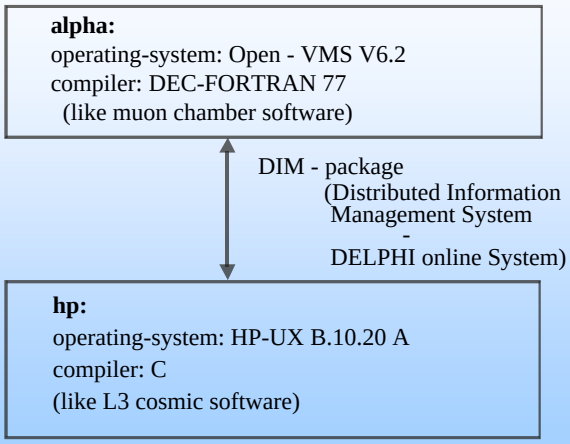
goal

- simple and stable program to get all necessary information from the muon chamber slow control and L3 online
- fast connection between the L3 cluster and the L3C run control

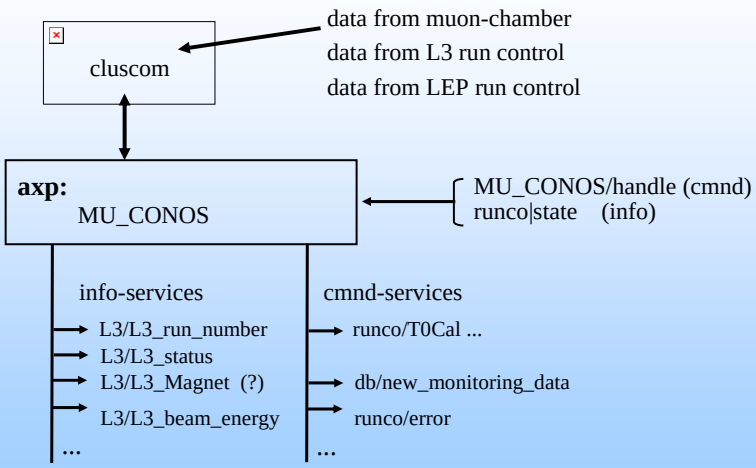
hardware - condition



software - condition



MU_CONOS - overview



DIM - Distributed Information Management

DIM is a framework for all interprocess communication on different architectures (VAX, alpha, hp, ...).

DIM is a tool, which provides primitives for interprocess communication.

In DIM terms there exist two types of processes:

- Servers:

  A server provides a set of services (information) and/or a set of commands, which can be requested by any client.

DIM

- Clients:

  A client can request a service in three different ways:

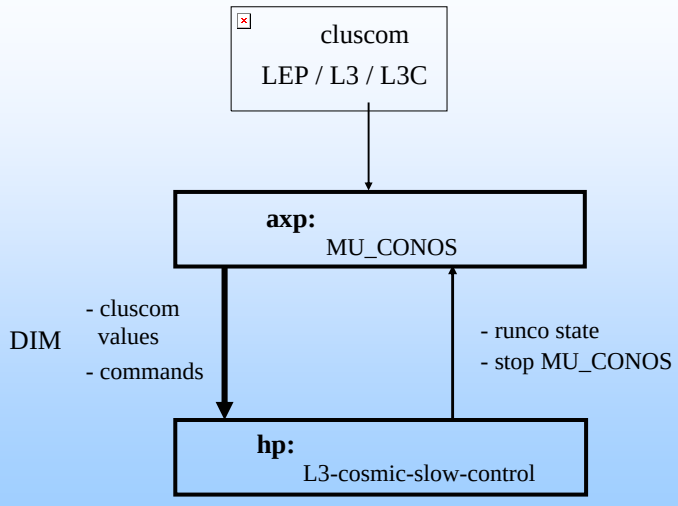
  - ONCE_ONLY: the service will only be provides once.
  - TIMED: The service will be provided with a given time interval.
  - MONITORED: The service will be provided every time the server providing this service updates it.

  A client can receive a service in two ways:

  - Buffer update: The value will be stored in a local variable.
  - Call-back routine: The arrival of the service will trigger the client to execute a routine.

  A client can also request a command from a server, this triggers the execution of a routine by the server.

data



MU_CONOS (axp)

- reads data from cluscom
- sends data to hp
- sends commands to hp
- gets runco-state from hp
- gets stop-command from outside (alpha or hp)
- writes a log-file
- reads an ini-file (next page)

ini-file

MU_CONOS uses the file MU_CONOS.INI from the directory INI_FILE (see MU_CONOS.INC) to read and set the following values without recompiling MU_CONOS:

variable	description	Possible values *(default)*
M_DBG	general debug flag: (output to the MU_CONOS start-window)	.TRUE./.*FALSE*.
SEND_DBG	send debug flag; display all values sending from MU_CONOS (output to the MU_CONOS start-window)	.TRUE./.*FALSE*.
GET_DBG	get debug flag; display all values receiving in MU_CONOS (output to the MU_CONOS start-window)	.TRUE./.*FALSE*.
LOG_FILE_FLG	log file flag; enable log-file (output to MU_CONOS.LOG)	.*TRUE*./.FALSE.
WINDOW_FLG	window flag; enable output to the start-window of MU_CONOS	.TRUE./.*FALSE*.
L3_polling_intervall	L3-cluscom polling interval (in seconds)	1...9999 / *60*
M_polling_intervall	MUONCHAMBER-cluscom polling intervall (in seconds)	1...9999 / *60*
LEP_polling_intervall	LEP-cluscom polling intervall (in seconds)	1...9999 / *60*

on hp

- all processes: get data and commands from MU_CONOS
- runco: send state to MU_CONOS
- process-watch-dog: test if MU_CONOS is running or not
- error - handler: gets error-messages from MU_CONOS

a hp-process and MU_CONOS

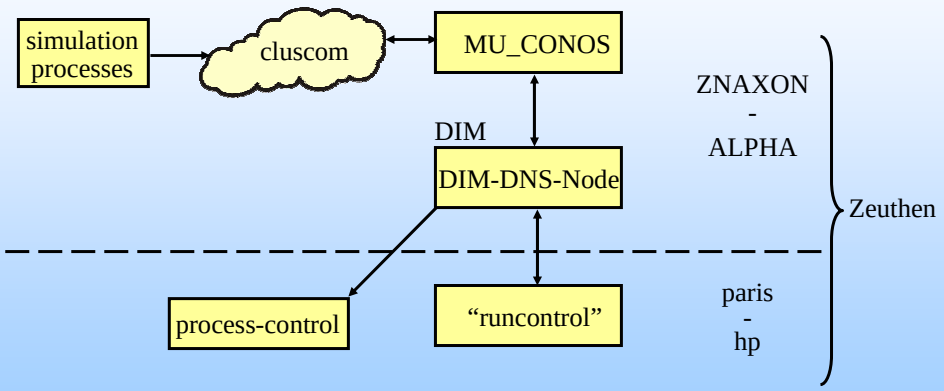
- MU_CONOS is running:
  - if a hp-process starts, it gets all the info_service data
  - if new info_service data: all running hp-processes get this data
- MU_CONOS is starting:
  - all running hp-processes get all data from MU_CONOS

summerary

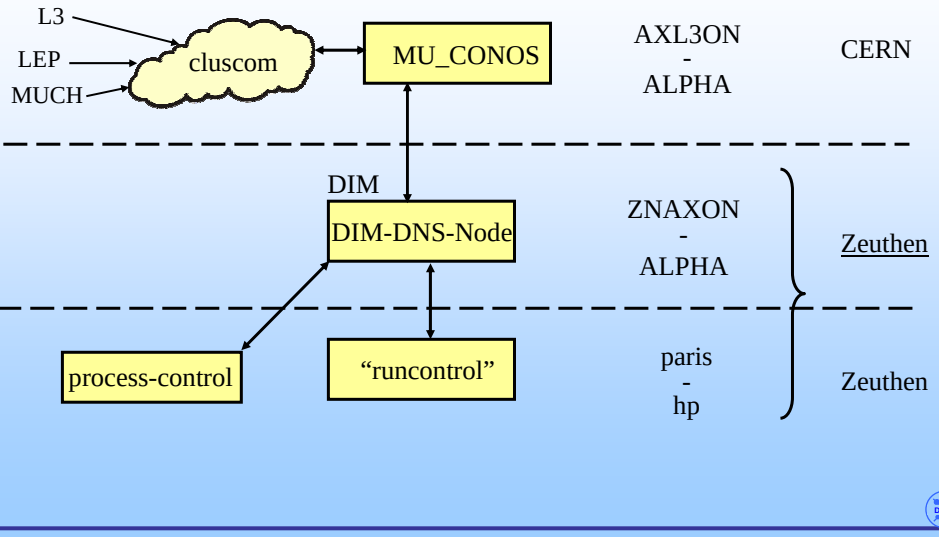
- MU_CONOS is a simple, stable, fast and stupid task
- is frozen in version 1.10 since the end of october 1998

environment for development and run

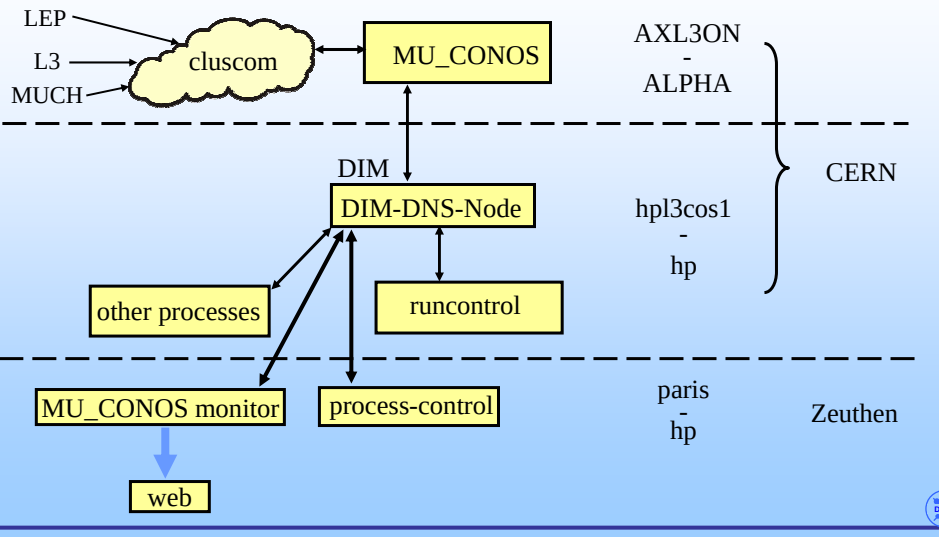
- Zeuthen (development)



Zeuthen - CERN (development)



CERN (run)



problems

- problems during development
  - DIM improvements during use
  - L3-cluscoms, old in an neglected state
    "data lost in cluscom space"
  - remote window (see next page)
  - communication between
    people at CERN and in Zeuthen
    (web!)

remote window

L3-cosmic window on the alpha (MUONCHAMBER runco):

If you kill this window on the remote terminal by klicking the x11-button in the left upper corner of the x11-window MU_CONOS crashes!

As a result of this problem MU_CONOS doesn't send from now on a window with status informations about l3-cosmic to a remote terminal (for the MUONCHAMBER runcontrol):

tasks

- MU_CONOS data transfer alpha to/from hp

task	finished
read the right value for L3/MUCH_status	no
read the right values for L3/L3_status	no

- MU_CONOS monitor

task	finished
put the MU_CONOS monitor on the hpl3cos1	no

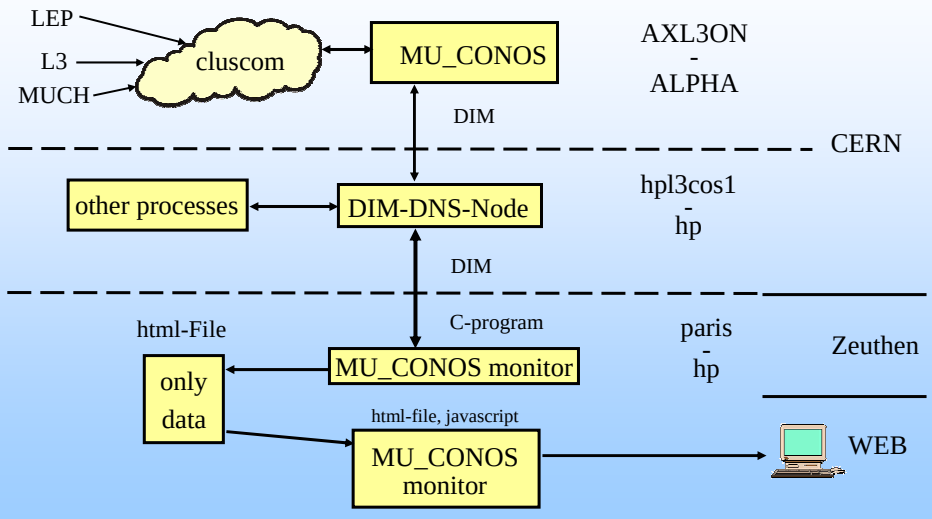
- MU_CONOS intern

task	finished
L3/MUCH_P/Z_steps makes net-load without sense	no see open problems/questions
structures for thresholds and steps	yes -see also
error-handler (STOP2 or ABORT1 by cluscom-errors)	yes -email
MUONCHAMBER-status by interrupt	no see open problems/questions

- MU_CONOS documentation

task	finished
documentation	is this html-file !
user information page (outside MU_CONOS)	here

MU_CONOS monitor



MU_CONOS monitor

MU_CONOS monitor

L3/LEP_state	physics	since:	23.10.1998 13:59:31
L3/L3_run_number:	733401	monitor source was started:	23.10.1998 10:08:53
L3/Beam_energy:	94501	page was updated:	23.10.1998 14:04:22
L3/MAGNET_current:	30377	last polling data:	23.10.1998 14:04:10
L3/MUCH_P_step:	18	last interrupt data:	23.10.1998 14:04:22
L3/MUCH_Z_step:	5		

show threshold values | show P/Z-step values

MU_CONOS is	available	since:	monitor restart
l3cosmic runcontrol on:	run	since:	23.10.1998 13:41:51

Netscape: MU_CONOS monitor

☺	L3/MUCH_DISC_thereshold		
Octant	P0	P1	Z
0	149	149	200
1	149	149	200
2	146	149	200
3	151	149	200
4	149	149	203
5	149	149	198
6	146	149	198
7	149	149	200

CLOSE WINDOW

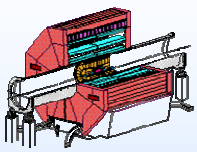
Netscape: MU_CONOS monitor

☺	L3/MUCH_P_steps						
Octant	MI	MM	MO	Octant	MI	MM	MO
M0	18	18	18	S0	18	18	18
M1	18	18	18	S1	18	18	18
M2	18	18	18	S2	18	18	18
M3	18	18	18	S3	18	18	18
M4	18	18	18	S4	18	18	18
M5	18	18	18	S5	18	18	18
M6	18	18	18	S6	18	18	18
M7	18	18	18	S7	18	18	18

☺	L3/MUCH_P_steps								
Octant	MII	MIM	MOM	MOO	Octant	MII	MIM	MOM	MOO
M0	5	5	5	5	S0	5	5	5	5
M1	5	5	5	5	S1	5	5	5	5
M2	5	5	5	5	S2	5	5	5	5
M3	5	5	5	5	S3	5	5	5	5
M4	5	5	5	5	S4	5	5	5	5
M5	5	5	5	5	S5	5	5	5	5
M6	5	5	5	5	S6	5	5	5	5
M7	5	5	5	5	S7	5	5	5	5

CLOSE WINDOW

MU_CONOS documentation



DESY Zeuthen - L3-cosmic - remarks

Bert Schöneich

Don't hesitate to send me (bert.schoeneich@ifh.de) an email if there is anything wrong or missing or if you have got any comments!

MU_CONOS now (29-Sep-1998) is frozen in version 1.09 up to the next request!

MU_CONOS shifttaker information page

MU_CONOS documentation contents

contents:(news are blinking!)

- cluscom_values to info_service
- ERROR - handling
- stop MU_CONOS
- ini-file
- remote window
- log-file
- tasks
- open problems/questions
- sources
- talks
- MU_CONOS monitor

www-pages:

- L3 cosmic home-page
- L3 cosmic online software
- Bert Petersen's error-handling-proposal
- Bert Petersen's L3-interface table
- MU_CONOS compile, link and run at CERN
- MU_CONOS test at CERN
- MU_CONOS test at DESY Zeuthen
- versions information page
- DIM - experiences
- Bert Schöneich's homepage
- Bert Petersen's check list

cluscom-value to info_service

A value from cluscom goes to info-service (hp) if and only if:

- at MU_CONOS start up on alpha
- a value has changed on alpha
- an hp-process starts

- LEP

cluscom:	nmr_ccid
cluscom file:	lepc$info:nmrc.mapcom
include-file:	NMR_CC.INC (for a moment my own *.INC-file!)
definiton of mode-values:	lep_modes.txt
access:	by polling every 60 seconds (default, or edit the ini-file)

cluscom		Info_service			implemented	tested
name	declaration	name	declaration	size		
lep_cc_mode	CHARACTER*20	L3/LEP_status	L	4	yes	yes, ok

cluscom-value to info_service

- L3

initialize with: CALL L3RUNDESC('L','I',STATUS)
read with: CALL L3RUNDESC('L','R',STATUS)
include-file: L3DAQ$MAP:l3rundesc.inc
definition of status values: L3DAQ$INC:L3STATES.INC
access: by polling every 60 seconds (default, or edit the ini-file)

cluscom		Info_service			implemented	tested
name	declaration	name	declaration	size		
L3_RUN_NB	INTEGER	L3/L3_run_number	L	4	yes	yes, ok
L3_RUN_STATE	INTEGER	L3/L3_status	L	4	yes	no, serious problem
L3_BEAM_ENER	INTEGER	L3/BEAM_energy	L	4	yes	yes, ok

web-pages

MU_CONOS documentation: http://www.ifh.de/~schoene/unter_texte/l3_cosmic.html

L3cosmic welcome: http://hpl3sn02.cern.ch/l3_cosmics/welcome.html
firststage L3cosmic: http://hpl3sn02.cern.ch/l3_cosmics/vered/firststep.html
Nijmegen L3 cosmics: http://www.hef.kun.nl/l3c/
DIM-docu:
http://delonline.cern.ch/d$onl/communications/dim/doc/www_manual/dim.html