A3

ARC ENERGY MEASUREMENT OPERATIONS
P.V. ~~3/1/1999~~ 6/3/99

- The ARC energy measurement is under EPICS control through a MEDM display. Two independent control systems are used: the beam bend angle measurement through the arc ("scanners") and the field integral of the arc ("integral").
- To measure the energy:
  -perform several angle measurements
  -perform an integral measurement
  -analyze the integral measurement and note the value of the arc field integral
  -analyze the angle measurements, average the results (proposed by the software), then ask for the energy calculation, enter the above arc field integral and you will get the beam energy computed from the average angle.

1-Computers and softwares used by scanners and integral:

	SCANNERS	INTEGRAL
Computer:	hac	pascal1 (IP=129.57.188.20)
type:	hp	sun
login under:	gougnaud	gougnaud
password:	see Arun	see Arun
Disk mounted on CUE?	yes (use cp for transfer)	no (use ftp or rcp)
.adl files directory:	~/arc2/adl/	~/EPICS/adl/
standard .adl file	ARC6.adl	arc_integral.adl (arc_ma
Directive files dir.:	~/arc2/ARC/	~/EPICS/ioc.mg/
standard directive file	data1234 (data56)	magnet.dir
output file:	~/arc2/ARC/scan_nnn.data	~/EPICS/ioc.mg/... ...integral/integral_nnn.data
analysis code	~/arc2/ARC/pascal/arc-scan.sun	~/pascal/arc-integral
result file	~/arc2/ARC/scan_nnn.data.log	
ioc name	arcioc(IP=129.57.188.24)	arcioc2 (IP=129.57.188.21)
type and RAM size	MVME162, 8Mo	MVME162, 4Mo
ioc boot file:	~/arc2/ioc/up	~/EPICS/ioc.mg/up
ioc boot save file:	~/arc2/ioc/upARC6	

2-Summary of ARC operations:

6 scanners of the same type, called "ARC scanner" and labelled from scanner #1 to #6, are installed on the Hall-A beamline. Scanners #1 to #4 are used for the ARC energy measurement and they are located on the Hall-A arc: #1 and #2 just upstream the arc, in the BSY, and #3 and #4 in the Hall-A tunnel, just upstream the Compton polarimeter. Scanners #5 and #6 are located between the Moller and the target to control the beam geometry on the target and their use will not be discussed here.

Each scanner has a motor/ball-screw/shaft-encoder/vacuum-penetrator system moving accurately
a set of 3 tungsten wires through the beam. Each time a wire crosses the beam a PMT located a few meters downstream records a signal due to the electromagnetic shower induced by the beam in the wire. Both forward and backward passes are recorded. The motion is a horizontal translation and, for a forward pass:

-the translation is from beam left to beam right,

-the two first wire crossing the beam are at 45deg from the vertical,

-the third wire, which is the only important for the ARC energy measurement, is vertical.

Recording, during the scan, the scanner position and the PMT output voltage allows us determine the beam position at each scanner location. Then, using calibration data not detailed here, we deduce the net beam bend angle through the arc. This result measured in dispersive arc tuning, along with the field integral of the arc dipoles, provides an accurate determination of the beam energy.

The list of the operations for an ARC energy measurement is given here and will be detailed after:

1/check the pulser (scanners)

2/check the HV (scanners)

3/check EPICS (scanners)

4/check space on disk(scanners)

5/check the integral (see "Details on integral system check" below)

6/ask for chicane off, put target in a safe position, ask ~5uA (achromatic)

7/perform a scan test in achromatic at ~5uA
-->solve the trips
-->final adjustment of gains of scanners #1 and #2
-->save the last (non saturated) scan

8/if everything is OK, ask for dispersive beam ~5uA

9/check dispersive beam:
-CW ~5uA
-Fast Feedback ON
-Energy Feedback ON <-------important
-Kresting ON
-arc's quads and steerers OFF
-beam stable at entrance and exit (Bscope)
(see the test plane of the dispersive mode in MCC)

10/perform a scan in dispersive at ~5uA (see details below)
-solve the trips

-finish the 4 gains adjustment
-perform and save 3 good scans

11/perform a field integral (see details below)

12/restore beam for the experiment
unmask the diagnostics, restore achromatic mode and chicane, quit MEDM and turn both HV channels OFF.

13/analyze scan data (dispersive only) and integral data

3-Preliminary details about MEDM

To fill or update an input field of MEDM, put the mouse cursor in the field, do the edit or change, and then PRESS CARRIAGE RETURN WHILE THE CURSOR IS STILL INSIDE THE FIELD!!!

4-Details on pulser check

A pulser is used to trig the scanner acquisition.
The ARC scanners pulse generator (middle counting room) must be adjusted on 1000Hz for CW beam (on "external trigger" in pulsed mode, for any scanner). Check the output with a scope.
Settings for CW mode
- -frequency: 1KHz
- -delay: not important in CW, should be always 0.
- -time width: 10us
- -level: 2.5V on 50 Ohm load, 5V on 1 MOhm, polarity: + (TTL)

5-Details on HV check

The energy measurement uses scanners #1 to #4 with PMT read out. One PMT (PMT0) is in the BSY reading scanners #1 and #2. One other is in the Compton region (PMT1), reading scanners #3 and #4. They both are energized by the "beam line HV module", card#1 channel#0 (PMT0) and channel#1 (PMT1), under EPICS control of the general Hall A control. Both voltages must be -1200V, make sure that "Meas. V" indicates this voltage. If needed, push on "enable/disable" or edit the "SET V" field.

6-Details on EPICS check (scanners)

-login as "gougnaud" on hac, you need to know her password, ask to Arun. If you connect by "cd ~gougnaud", you will not be able to edit the command file nor save the data.
hac> cd arc2/adl
hac> medm&
-on the medm access window, click on "file", and then "open"
-in the open file window, select "ARC6.adl", the ARC window must appear then
-on the medm access window, click on "execute"
-if then the ARC window remains partly blank, or if you have some doubt

about the identity of the program running in the ioc, go to the "reboot ioc" section below

7-Details on ioc reboot (scanners)

The network name of the scanner's ioc is "arcioc"
With "gougnaud" access rights:

```
        hac>cd ~gougnaud/arc2/ioc
        hac>cp upARC6 up
           answer "y" to the next question
```

Then reboot arcioc by pushing the "Beamline Arc Measurement VME Reset" green button (middle counting room): the arcioc is loaded from the "up" file
If the ARC window (in execute mode) was not blank, it becomes blank, then wait for 1 minute it returns to grey: the scanner is then operational.
You can also reboot by software through the network:

```
        hac>rlogin arcioc
        -> reboot  (the rlogin connection is then broken by the reboot)
```

10/98:The hard reboot (green button labelled "ARC") is temporarily connected also to another VME crate (e,p energy measurement), use it only if e,p is not working.

8-Details on disk space check (scanners)

Run the "quota -v" UNIX command under ~gougnaud/arc2/ARC:

```
Filesystem     usage  quota  limit    timeleft  files  quota  limit    timeleft
/u/home       119308 512000 512000                924     -1     -1
```

Do it several times, sometimes the answer is crazy!
In the above example you have about 400Mo free, a scan file of scanners #1 to #4 (energy measurement) occupies about 1Mo when unzipped and 300Ko when zipped, so you have room for ~400 unzipped files or ~1200 zipped files.

9-Details on running a scan

-On the MEDM screen load "data1234" as Command File.

Content of "data1234":

```
+1 P     5.
+2 P     5.
+3 P     5.
+4 P     5.
-1 P     5.
-2 P     5.
-3 P     5.
-4 P     5.
```

means: use scanners #1 to #4, do first the 4 forward pass and then the 4 backward ones (to let to the wires the time to cool down) at 5 turns/s=12.500 mm/s. Warning: lower velocity may cause the wire to melt.
An error message will be edited if the velocity is outside]0., 6.1 t/s[.
P is for PMT readout (S for Secondary emission for scanners #5 and #6).

The file is in ~gougnaud/arc2/ARC.
On the MEDM screen update CW/60Hz, beam current and DISPersive/ACHROmatic (for the record).
-Push "START" when ready, you can follow the operations by looking at:

-running command: the line of the "Command file" currently executed
-the cursor position of the scanner
-voltage versus position plot. The location of the 6 scanners on the MEDM window is the following:

#1	#2
#3	#4
#5	#6

The forward plot is green, the backward one is red. In case of saturation, redo the scan with lower gain (see details below). The only peak used for energy measurement is the rightmost one (H profile produced by the V wire): focus on this peak to adjust the gain, the 2 other peaks may saturate.
-the names on the top of the plots are the CEBAF device names of the scanners.

WARNING: operating at too high a beam current or too small a velocity may cause the wire to melt, with no opportunity to repare it before the next shutdown.
The total travel time is about 15s per scanner. During the travel, have a look to the beam current. If the beam trips, inquire why, correct if it was caused by the scan (set masks), and redo the scan (see details on trips below).
-Save the data (see details below).
-Print the MEDM window (see details below).
-you can plot the profile (see details below).

After the scan, check the peak (rightmost) quality: it must be compact (Gauss curve) with a good signal/noise ratio (>5)
If scan #1 and #2 are not compact: report to MCC and make sure that the fast feedback is ON. If scan #3 and #4 are not compact: report also to MCC and make sure that the energy feedback and the kesting are ON.

If the scan seems OK: start a field integral measurement (manual coming soon) and report to "saha@jlab.org" with as much details as possible (at least the file names) for data analysis and beam energy determination. Record the mail in the e-logbook.
Don't forget to save the files.

10-Details on MEDM window print

To print the MEDM window: put the mouse cursor somewhere in the background part of the ARC window (outside the plots), push the mouse right button, select print, release the button.
It should go on "chalhp" if you work from the counting house.

11-Details on profile plot

To plot the profile: use your favorite curve plotter (hvplot, xmgr...)
The scan file is an ASCII file with a line per acquisition (trigger) and two float per line: position in encoder unit (4096.0 per 2.500 mm or turn) and voltage after gain in V. First the

forward profile with increasing "x", then the backward one, with decreasing "x" (x=coordinate transverse to the beam and horizontal. Towards beam right for scanners #1 to #4, towards beam left for #5 and #6). Some lines are header lines. In this case the 1st character is a "!" seen as a comment line by hvplot (need to be changed for other plotters). The rightmost peak (high x values) was produced by the vertical wire (it is a pure horizontal profile), the 2 other peaks by the +45deg. and -45deg. wires.

12-Details on gain adjustment (scanners)

Adjust the gain of the signal amplifier to get]-10V, +10V[at the input of the ADC, range= 001, 002, 004,...128, 256.

Gain adjustment: in the ARC scanner MEDM window, click (right button at Jlab, left one when from any other place in the world!) on the gain command button located close to the plot of the profile of the scanner you want to adjust. Then select a gain and release the mouse.

After a scan:

-Select higher gain if the rightmost peak is <3V (in absolute value)

-Select lower gain if the scanner saturates. To know if the scanner saturates, do not believe the MEDM plot (on which several adjacent channels are averaged), trust the red diode associated to each scanner (close to the plot).

If you want to know what these diodes look like, click on "edit" on the MEDM access window: you will see the diodes. Then return to "execute".

Start with the gains (dispersive case):

scanner	gain
#1	4
#2	8
#3	32
#4	32

Note that the beam is dispersed at scanners #3 and #4 location, so they need a higher gain than #1 and #2.

To zoom on a peak, change the MEDM parameters of the window ("edit"):

-first determine the range (in mm) on which you want to zoom

-on the MEDM access window, push on "edit"

-on the ARC window, click anywhere inside the plot you want to change

-on the "Resource Palette", go down to "Axis Data", select it

-on the "Cartesian Plot Axis Data", in the "X Axis" part (X means horizontal), change "Axis Range" from "auto-scale" to "user-specified", then edit "Minimum Value" and "Maximum Value" to specify the horizontal range you want to look at, the unit is mm. If you used the "edit" facility of MEDM, it will suggest you to save the changes when killing the window. Do not save the changes!

-on the MEDM access window, push on "execute"

13-Details on file save (scanners)

To save the data in a disk file: push on "Save". The software builds automatically a name of the type: "scan_nnn.data", where nnn is the scan run number, incremented automatically. The current run number is stored on disk, so unless a disk crash, you can reboot the VME or delete a data file without resetting this number. Read the run number on the MEDM screen and record the file name in the e-logbook. The file will be stored in ~gougnaud/arc2/ARC. As the file is big (2*7000 channel histogram per scanner), purge or compress your own data files. ~gougnaud belongs both to hac and the CUE, thanks to Javier. So you do not need ftp to copy it inside the CUE, the cp command works as far as you have the good file access. Write in the e-logbook the final path of the file in the CUE.

14-Details on trip handling

Trips are frequent at 5uA, caused by scanners #3 and #4 and triggered by the Compton ion chamber or BLM, even with chicane OFF. They are invasive for the other halls. If a trip occurs, write in the e-logbook which scanner, forward/backward (for this, you have to monitor the beam current during the scan), beam current, arc tuning mode, which diagnostic tripped (ask to MCC), get a strip chart of this diagnostic (MCC). Contact the beamline coordinator (Arun Saha) or the hall leader (Kees) to allow MCC to mask the diagnostic. But in any case start with unmasked diagnostics to have all safety systems responding. If masking is impossible or not sufficient, reduce the beam current down to 1uA but the quality of the energy measurement will then be affected by the poor signal/noise ratio.
If the trip occurred from scanner #3 or #4 during the preliminary test in achromatic mode, leave this step and ask for dispersive mode. In this mode, due to the dispersion of the beam, the luminosity will be reduced and hopefully the trip will not occur. Nevertheless, the test in achromatic mode is usefull to check the system (including the trip protection!) and to anticipate a gain change for scanners #1 and #2.

15-Summary of field integral

The purpose is to measure in absolute the straight field integral of a "BA" 3m long dipole, called the 9th dipole and located in the "Dipole Shed". It is of the same type as the 8 arc dipoles and powered in series with them.
The ARC integral setup is basically made of a 3m long plate (the "probe") able to move inside the 9th dipole gap along the beam axis and carrying two field measurement devices: a pair of pick-up coils connected in series and a set of NMR probes. The coils are on both ends of the probe and the NMR's close to the center.

-at the "upstream" probe position, the "downstream" coil is close to the dipole center, the "upstream" is outside the dipole and the NMR's at one end of the dipole:

```
Door<---                    <--------DIPOLE-------->
             up coil      NMR       down coil
                <--------PROBE--------->
```

-at the "central" probe position, each coil is at one end of the 3m long dipole and the NMR's close to the dipole center:

```
Door<---                    <--------DIPOLE-------->
                         up coil      NMR       down coil
                            <--------PROBE--------->
```

-at the "downstream" probe position, the "upstream" coil is close to the dipole center, the "downstream" is outside the dipole and the NMR's at one end of the dipole:

```
Door<---                    <--------DIPOLE-------->
                                    up coil      NMR       down coil
                                       <--------PROBE--------->
```

We call upstream the position where the probe is the closest to the shed access door. Among the 3 above position, the only where the NMR can lock on the dipole field is the central one as in extreme position of the probe, the field homogeneity is not sufficient. The probe position is controlled by a linear encoder.

The integral measurement sequence is the following:

-from the current position (a priory arbitrary) move the probe upstream, up to a limit (optic) switch.
-move downstream by a few mm to cross the encoder index (encoder initialization)
-move to the central position to measure the central field by NMR, the system ch the NMR locks and if the reading is stable, it will be the "before" field
-move back to upstream position
-move to downstream position while integrating the flux through the coil system, this measurement will be called the "forward" integral (duration ~ 7s)
-move back to upstream position while integrating the flux through the coil syst this measurement will be called the "backward" integral (duration ~ 7s)
-move to the central position to measure the central field by NMR, the system ch the NMR locks and if the reading is stable, it will be the "after" field

In addition to the central field, 4 probe temperatures, a local excitation current measurement, the setting of the dipoles P.S,the readback of the dipoles and the probe position at NMR measurement time are recorded "before" and "after"

To perform an integral field measurement:
1-check if the system works (see "details on integral system check" below)
2-run the above integral sequence (see "details on integral run" below)
3-fix the error(s) if any (see "details on integral errors" below)
4-save the data in a file (see "details on integral data save" below)
5-analyze the data (see Arun)

16-Shed access and safety

For safety reasons, the access to the shed is limited to a list of authorized persons and the work inside the shed is regulated by an OSP (Operating Safety Procedure). To be added to the list, ask to the Hall-A leader. The standard operation mode of the integral measurement setup is the remote mode, through the network, from the counting hou In case of problem needing an access in the shed, unauthorized users must contac Arun.

17-Details on integral system check

1-From any workstation or X-terminal connected by telnet to pascal1 workstation, run MEDM with arc_master.adl data file (see Arun for the password of gougnaud on pascal1 and section 1 for the path of arc_master.adl).
If pascal1 is not responding, go in the shed and check UPS (see "Details on AC power (integral)" below).
If the UPS is not beeping, check the room temperature.

If the temperature is above 35C, the thermal protection of the workstation is probably activated, see "detail on temperatures" below.
If the temperature is below 35C, ask to the computer center to restart pascal1.

2-Check if the 4 temperatures and the 3 currents are stable, in agreement between them and if the beam energy computed from the current is realistic compared to what you know from MCC. In not, call Arun.
Note: the current/field ratio is about 1000A/1.98T and the energy/field ratio is 12.03 GeV/T. The current used by MCC for the accelerator tuning is the set current. The readback can be different from the set by 0.1A. The local current can be different from the set by 5A. For the temperatures see "detail on temperatures" below.

3-Check if the NMR is locked. If not see "details on NMR lock" below,

4-Check if the NMR reading is stable within 10-5 relative (P.S. stability).
If not, inquire about a recent or running setting change by the MCC.
If not, call Arun.

18-Details on NMR lock

-check if the probe is at a central position, corresponding to Zd~1604mm.
It should be at this position if no special motion was ordered since the previous integral measurement.
If not, enter 1604 RETURN in the "set Zd position" input field, wait for th end of the motion (look at cursor and position readback labelled "out") and for the NMR lock for up to 1 minute. Note: due to the software, the positio readback may be updated ~10 seconds after the real probe motion.
Zd~0mm is for the upstream position, ~1604mm for the central position and ~3208mm for the downstream position. If the probe does not obey, call Arun. If Arun is not available, reboot the ioc (see "integral ioc rebo below)

-check if the NMR probe selected is the good one. The system has 4 probes to cover the field/energy range [0.043T/0.517GeV,1.05T/12.63GeV].
The software selects automatically the probe from an estimated field and the following range table (from file "magnet.dir"):

mini T	maxi T	probe
0.043	0.1356	# 1
0.0784	0.271	# 2
0.159	0.547	# 3
0.30	1.05	# 4

The estimated field is computed from the "set" current and the coefficients given above. Note that there is an overlap between the range of each probe.
In the standard mode ("auto selection"), two selection algorithms are used:
-initial selection: select the probe in which the estimated field will be the most "centred"
-routine check: change the probe only if the estimated field is outside the selected probe range.
Initial selection is executed at boot time, at each integral start and when you leave the "manual selection" optional mode.
The routine check is performed periodically
In some cases in the past this algorithm did not select the best probe.
If it occurs again, force the probe selection by opening arc_nmr.adl medm screen,then switch to manual selection mode, click on the probe you want to select and wait for NMR lock. Don't forget to return to the

"auto selection" mode before leaving the integral measurement.
Report about the problem in the e-logbook.

-expert users can also use nonstandard search modes and DAC values as proposed by the arc_nmr.adl screen ("Dac Value", "Dac+-5%" and "All Probes Note that "Dac Value" needs a scope. They are asked to restore the standard mode ("SeLected Probe Range") at the end. The DAC to field relatio used by the software is linearly interpolated in the table (from file "magnet.dir"):

dac=0	dac=1000	dac=2000	dac=3000	dac=4095	
T	T	T	T	T	
.040362	.053885	.074430	.104184	.132404	probe # 1
.080713	.107771	.148845	.208340	.264790	probe # 2
.161430	.215539	.297680	.416680	.529570	probe # 3
.322870	.431112	.595471	.833455	1.059210	probe # 4

Note: as the 9th dipoles has an uniform field, there is no gradient coil around probes and the lock is in general easier to obtain than with the HRS dipoles. Nevertheless some difficulties may occur at low field due to the hysteresis grad The NMR system is the same as for the HRS (Metrolab) but the EPICS implementatio different. The field polarity is "+".

19-Details on integral run

To run the integral measurement sequence, call the "arc_integral.adl" medm scr on pascal1 (see "Details on integral system check" above), then:

-push "start" to start the full sequence

-look at the results displayed:

- -after the "before" NMR measurement: the "before" data set
- -after the "forward" integral pass: the forward velocity profile and the forw voltage-after-gain profile
- -after the "backward" integral pass: the backward velocity profile and the ba voltage-after-gain profile
- -after the "after" NMR measurement: the "after" data set

-if "BAD NMR" or "PDI saturation" flags are set, or if something is obviously wr in the data or plots, fix the problem (see "Details on integral error" below) and start a new integral run.

-data are ready to be saved (see "Details on integral data save" below)

20-Details on integral error

-"BAD NMR" flag is set if at least one of the 4 NMR status (locked and stable, b after) is wrong

- -the full NMR field measurement is made of 3 successive elementary measurement separated by a 5s delay.
- -the "lock" status is set to wrong if at least one of the 3 NMR measurements did not lock before a 100s timeout. The measurement sequence is aborted as as a measurement does not lock, so the maximum time one has to wait for a f NMR measurement is about 100s (in case of a zero current measurement for example)
- -the "stable" status is set to wrong if the 2nd or the 3rd field values differ the 1st by more than 5 10-4 relative. In any case, the field value returned is the last one.

-"In position" is set to false if the probe position was outside 1604.0+-0.1mm a NMR measurement time.

-"PDI saturation": the PDI (Mertolab's Precision Digital Integrator) consists in programmable amplifier and a VFC integrator working in the [-5V, +5V] input The PDI gain is the result of an automatic selection in the [1,2,5,10,...10

range, similar to the NMR probe selection.
In case of a wrong gain selection (maximum voltage after gain, as plotted in the MEDM screen, outside the [1.5V,5V[range), ca the "arc_pdi.adl" MEDM screen to switch the gain selection mode from "auto" "manual" and then select manuallay the gain. Return to "auto" mode before leaving the integral measurement.

-"before" and "after" data must be very close: <0.1 C difference for the tempera of a given probe, <0.1A for the currents and <10-5 for the field.

-plots: the blue curves are from forward pass, yellow ones for backward pass.
  - -the top plot gives the probe velocity (in m/s) as function of its position (in mm). The forward velocity should be +0.6m/s everywhere except at the c where it is reduced to +0.06m/s. The backward velocity plot should be the image of the forward ons (-0.6 and -0.06m/s)
  - -the bottom plot gives the coil voltage after gain (in V) as function of the position (in mm). It should be a null voltage everywhere except a set of oscillation at the center. The backward voltage plot should be the mirror image of the forward one (V-->-V). See "PDI saturation" above.
  - -to zoom a MEDM plot, see "Details on gain adjustment (scanners)" above.

21-Details on integral data save

The procedure to save the datafile from "arc-integral.adl" is the sane as for the scanners (see "Details on file save (scanners)" above), with an independent integral run number. The file name will be of the type "integral-nnn.data", stor on pascal1 in ~gougnaud/EPICS/ioc.mg/integral/. As pascal1 disk is not mounted on the CUE, use ftp or rcp to move the file to the CUE.
The size of a file is 207Ko.
The data file is made of:
-a header containing basically the "before" and "after" data
-the forward integral data
-the backward integral data
Forward end backward integral data are made of 3200 lines of 3 data each:
-a line per trigger, i.e. per mm of probe motion over the 3.2m of the total moti The first trigger line is missing.
-the first data of the line is the probe position in mm, it should be a round value from 1.000mm to 3199.000mm at forward pass and from 3199.000mm to 1.000mm backward pass,
-the 2nd data is the flux increment measured during the current step (i.e. betwe the previous trigger and the current one) in unit of 10-8Vs, corrected from the
-the 3rd data is the time of the trigger since the start, in microsecond unit.
These field increments,like the scan profiles, can be plotted by standard plo see "Details on profile plot" above. The curve plotted online in "arc-integral.adl" is the time derivative of the above flux data, multiplied by the gain to get the input VFC voltage after gain.

22-Integral ioc reboot

One of the VME boards (PMAC's motor board) has its own internal boot process triggered at "power on" time. So the usual boot procedure (red push button on the ioc or reboot command through the network) is not sufficient to make sure th the integral VME is correctly initialized. Thus, boot the VME by shitching OFF a ON the AC power of the VME crate. The AC power switch is located in the lower pa of the crate front panel.

23-Details on temperatures

The AC system of the shed is made of two cooling units, a heating unit

The UPS unit is located under a table, in front of the electronics rack. It has a display, a small keyboard and a beeper. The beeper activated means that some important message about the UPS is displayed. In this case, use the keys to scan the UPS memory, read the messages, record them in the e-logbook stop the beeper and inform Arun. Refer to the UPS manual (available in the shed) for details of operation.

25-Details on mechanics (integral)

The probe is able of a fast motion (~1m/s) and it is hazardous to access or to introduce something inside the device, under the altuglass covers, or to dismoun a cover. It is also hazardous to manipulate the motor shaft (see "Shed access an above). To do it safely, the user must first turn off the motor power box. The power box is located under the motor. It has two external switch: one contro the logics and one controlling the power:

```
                        Logics switch
                              |
(TOP VIEW)                    |
                              V
                           -------    --------------------------------------
                          |       |  |        <-------DIPOLE------>         |
           Power box-->   |       |  |                                      |
DOOR<---                  |   MOTOR- |                                      |
                          |       |<---Power switch                         |
                          |       |  |                                      |
                           -------    --------------------------------------
```

It is important NOT to switch off the logics (some data in memory will be lost), but to switch off the motor power (see the exact Power switch location above) pr to any intervention on the mechanics.
The detailed procedure is the following:

- -turn OFF the power switch
- -wait for ~1min to empty its buffer-capacitor
- -you can work safely on the mechanics
- -make sure that the path of the probe is free (tools...) and the covers in pos
- -turn back ON the power switch
- -reboot the VME (see "Integral ioc reboot" above)

The above procedure may be necessary if, for some reason, the probe went outside its allowed range limited by a pair of electric limit switches.
The probe range is limited by the following set of devices:

-upstream energy damper	for Zd in [-40.,-14.mm]
-upstream electric limit switch	for Zd<-7.5mm
-upstream optic limit switch	for Zd<-3.8mm
(operation range, 3.2m long)	
-downstream optic limit switch	for Zd>3200.8mm
-downstream electric limit switch	for Zd>3212.3mm
-downstream energy damper	for Zd in [3214.,3228.mm]

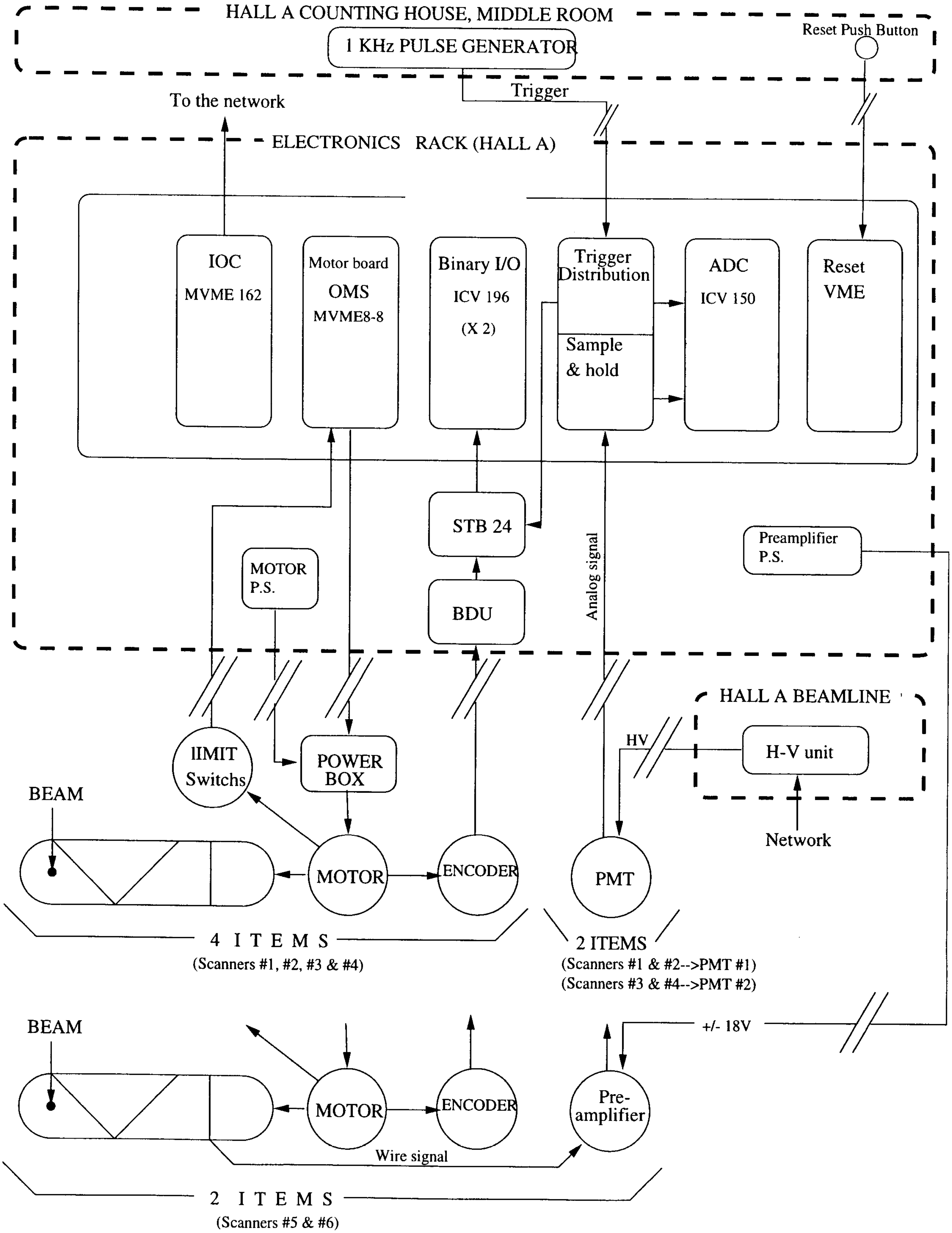
The current status of the 4 limit switches is given in the "arc-master.adl" scre Optic limit switch are used for the encoder initialization procedure (see "Summa of field integral" above). Electric limit switches should never be activated. But if this happends, then the motor control:

- -stops the motor
- -raises an error flag (the letted "d" for defect is displayed inside the power b the usual display being a vertical segment)
- -waits for a manual repositioning of the probe inside its allowed range and for a reboot of the VME.

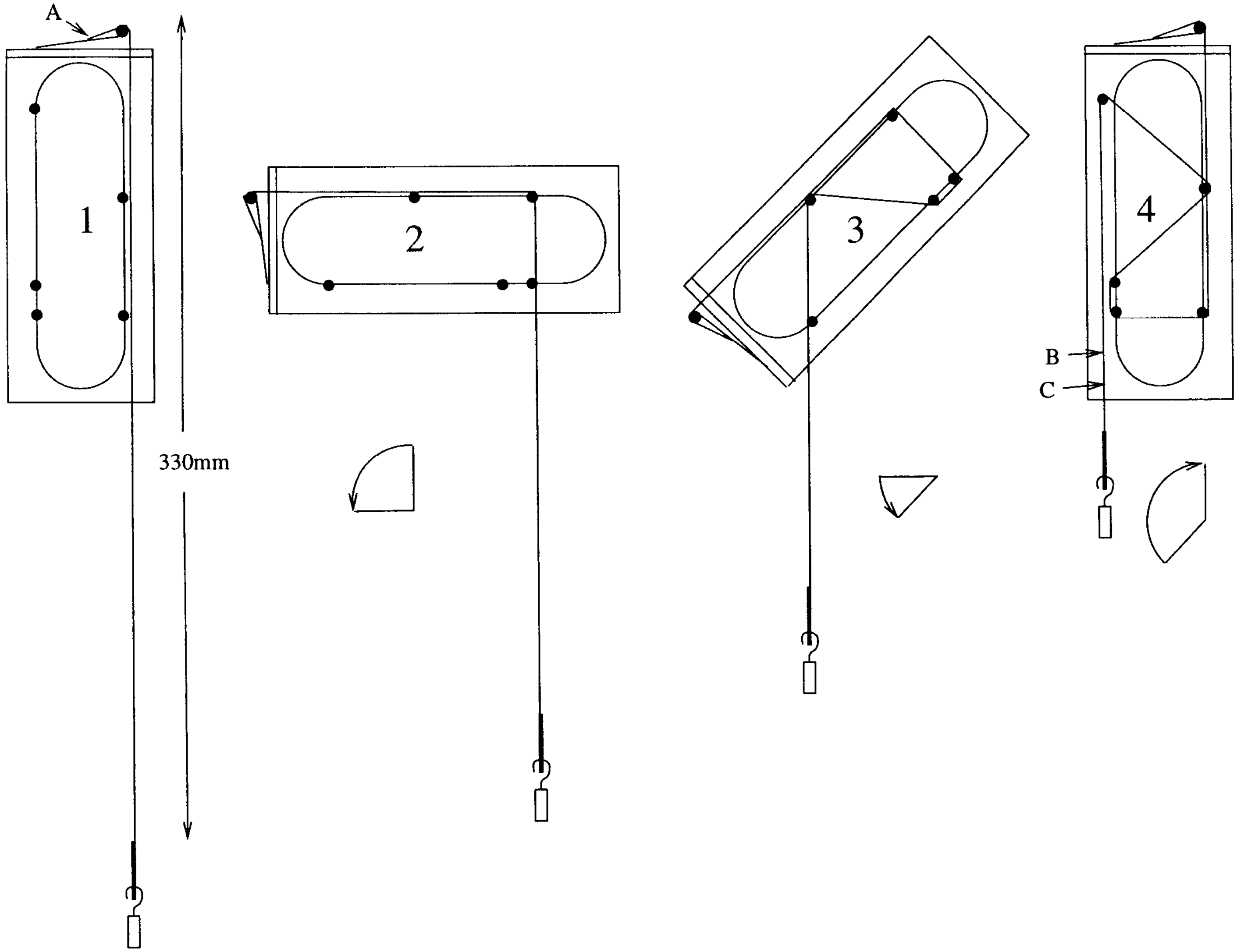
The manual repositioning of the probe inside its allowed range can be done safel by manipulating the motor shaft while the motor power is off, according to the above procedure.

End of the ARC manual

ARC Scanners Flow Chart

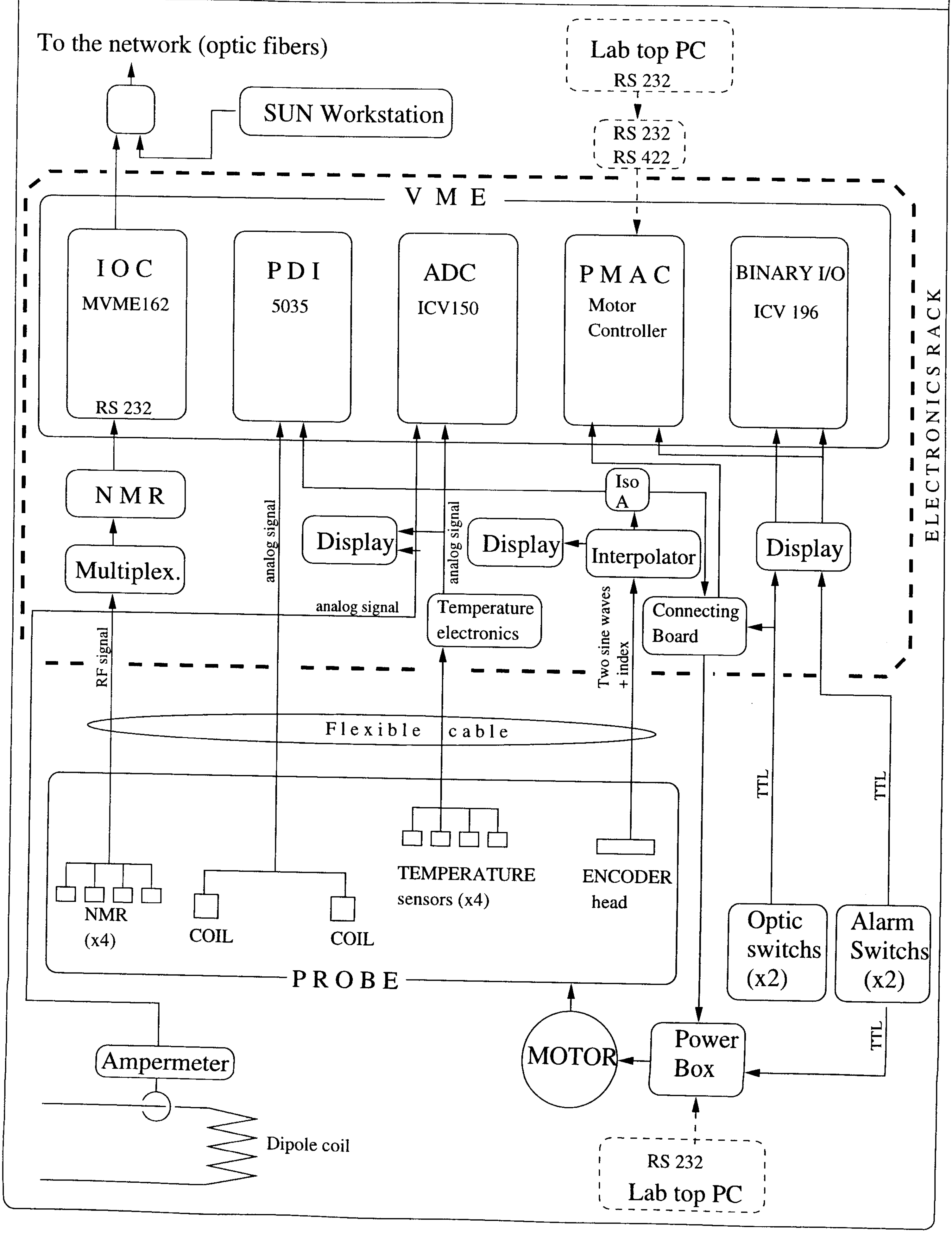


ARC scanner: mount a new wire.



Mount the cartridge on the special tool, allowing the cartridge to rotate around a horizontal axis (Fig.1).
Take a 330mm long and 20um diam. golden Tungsten + 3% Rhenium wire.
Glue at one end a plastic clamp on which will be fixed the weight.
Glue the other end on the spring at point A.
Mount the spring on the cartridge using the two 2mm diam. screws.
Fix the 30g weight on the plastic clamp.
Rotate the cartridge by +90deg. (Fig. 2).
Rotate the cartridge by +45deg.
Using the tool having a small weel, set the wire like in Fig.3.
Rotate the cartridge by -135deg. (Fig.4).
Glue the wire in C.
Glue the wire in A and B using silver loaded glue for electrical contact.

ARC Integral Flow Chart



Company	Name	#	Where?	Function	Comment
STC	MVME 162	#1	scanners/VME	ioc	8Mo RAM
STC	MVME 162	#2	integral/VME	ioc	4Mo RAM (8Mo soon)
STC	MVME 162	#3	spare	ioc	8Mo RAM
BICC-	KM6	#1	scanners	VME crate	
VERO	KM6	#2	integral	VME crate	
ADAS	ICV196	#1	scanners/VME	binary i/o	
ADAS	ICV196	#2	scanners/VME	binary i/o	
ADAS	ICV196	#3	integral/VME	binary i/o	
ADAS	ICV196	#4	spare	binary i/o	
ADAS	ICV150	#1	scanners/VME	scan ADC	
ADAS	ICV150	#2	integral/VME	scan ADC	
ADAS	ICV150	#3	spare	scan ADC	
ADAS	STB 24	#1 to 6	scanners/rack	encoder readout	
ADAS	STB 24	#7	spare	encoder readout	
OMS	VME8-8	#1	scanners/VME	step. motor board	
OMS	VME8-8	#2	spare	step. motor board	
Delta-	PMAC	#1	integral/VME	brush. motor board	
Tau	PMAC	#2	spare	brush. motor board	
BALDOR	Motor		integral/shed	Brushless motor	
Saclay	Powerbox		integral/shed	Motor Power Box	Includes BALDOR components
Metrol.	PDI5035	#1	integral/VME	digital integ.	PROM#
Metrol.	PDI5035	#2	spare (QMM)	digital integ.	PROM#
Metrol.	PDI5035	#3	spare (QMM)	digital integ.	PROM#
Metrol.	Teslameter		integral/rack	teslameter	(Hall-C has spare)
Saclay	P.S.	#1	scanners/rack	power supply	Schem. provided
Saclay	P.S.	#2	scanners/rack	power supply	Schem. provided
Saclay	Motor PS		scanners/rack	40V P.S.	Schem. provided
Saclay	Preamp. PS		scanners/rack	+/- 18V P.S.	Schem. provided
Saclay	Preamp.	#1 & 2	scanners/beam	Preamplifier	CEBAF design(Hall-C)
Saclay	Preamp.	#3 to 6	spare	Preamplifier	CEBAF design(Hall-C)
Saclay	Converter		scanners/rack	RS232-->RS422	
Saclay	Reset		scanners/VME	ioc reset board	Schem. provided
Saclay	Sampl/hold		scanners/VME	Sampler/Holder	Schem. provided
Saclay	Powerbox	#1 to 6	scanners/beam	Step. mot. power	Schem. provided
Saclay	Powerbox	#7	spare	Step. mot. power	On repair*******
CCC	Encoder	#1 to 6	scanners/beam	Absolute encoder	
CCC	Encoder	#7	spare	Absolute encoder	On repair*******

CCC	BDU #1 to 6	scanners/beam	Binary Data Unit	
CCC	BDU #7	see control box	Binary Data Unit	
SUPRADIS	Motor #1 to 6	scanners/beam	Stepper motor	
SUPRADIS	Motor #7	spare	Stepper motor	
HP	Pulse generator	Counting house (central room)	Trigger generation	From Jack Segal
Saclay	PMT #1	scanners/tunnel	Wire readout	
Saclay	PMT #2	scanners/tunnel	Wire readout	
Heiden-haim	Encoder	integral/probe	Linear encoder and interpolator	
Heiden-haim	Display	integral/rack	Encoder Display	
AOIP/ ELSAG-BAILAY	Temperature #1 to 4	integral/probe	Temperature sensor and readout electr.	
Chauvin-Arnoux	Ampermeter	integral/dipole	Local magnet current measurement	
VICTRON	Netpro 3000+	integral/shed	Uninterruptible Power Supply	

TOOLS:
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Zeiss	Theodolite	shed	scanner reference angle measurement	Type ETh2 with autocollimation
Zeiss	Battery #1	shed	battery for theod.	with autocoll.
Zeiss	Battery #2	spare/shed	battery for theod.	with autocoll.
Zeiss	Battery #3	spare/shed	battery for theod.	without autocoll.
Zeiss	Charger #1	shed	charger for battery	
Zeiss	Charger #2	spare/shed	charger for battery	
Zeiss	Tripode	ARC box	Theodolite support	
Saclay	Control box	ARC box	encoder readout and lamp P.S. for referance angle and scanner maintenance	Includes CCC's BDU
Saclay	Wire Change set	ARC box	Mechanics to change a wire on a cartridge	

COMPANIES:

Saclay: SIG, CEA-Saclay, 91191 GIF-SUR-YVETTE CEDEX, FRANCE
Fax : +33-(1)-69-08-63-01

SCT: Immeuble BALZAC, rue Paris, 93804 EPINAY SUR SEINE, FRANCE
Fax : +33-(1)-48-26-25-08

SUPRADIS AUTOMATISMES: 5 rue de Bellevue, 91400 ORSAY, FRANCE
Fax : +33-(1)-69-28-83-11

Carl Zeiss SA.:60, route de Sartrouville, 78230 LE PECQ, FRANCE
Fax : +33-(1)-34-80-20-01

ADAS: 9, rue G. Besse, ZAC du Fossθ Pate, 78330 FONTENAY Le FLEURY, FRANCE

BALDOR AUTOMATION: 2, rue du Vallon, 94440 MAROLLES EN BRI, FRANCE
and BALDOR ASR Gmbh, GERMANY

Computer Conversion Corporation (CCC):6 Dunton Court, East Northport,
NY 11731, USA

SYSERVO (OMS): 39, Ave F. Sebrechtslaan, BRUXELLES 1080 - BELGIUM

METROLAB instruments SA.: 110 ch. du Pont-du-Centenaire, CH-1228
GENEVA, SWITZERALND tel: +42-(22)-794-11-21, Fax: +42-(22)-794-11-20

Delta Tau Data System, Northridge CA, USA

VICTRON??????????

BICC VERO Electronics: Rue de l'Industrie, LD Le Tuel, 60000 BEAUVAIS, FRANCE

HEIDENHAIM??????

AOIP/ELSAG-BAILAY???????

CHAUVIN-ARNOUX?????????