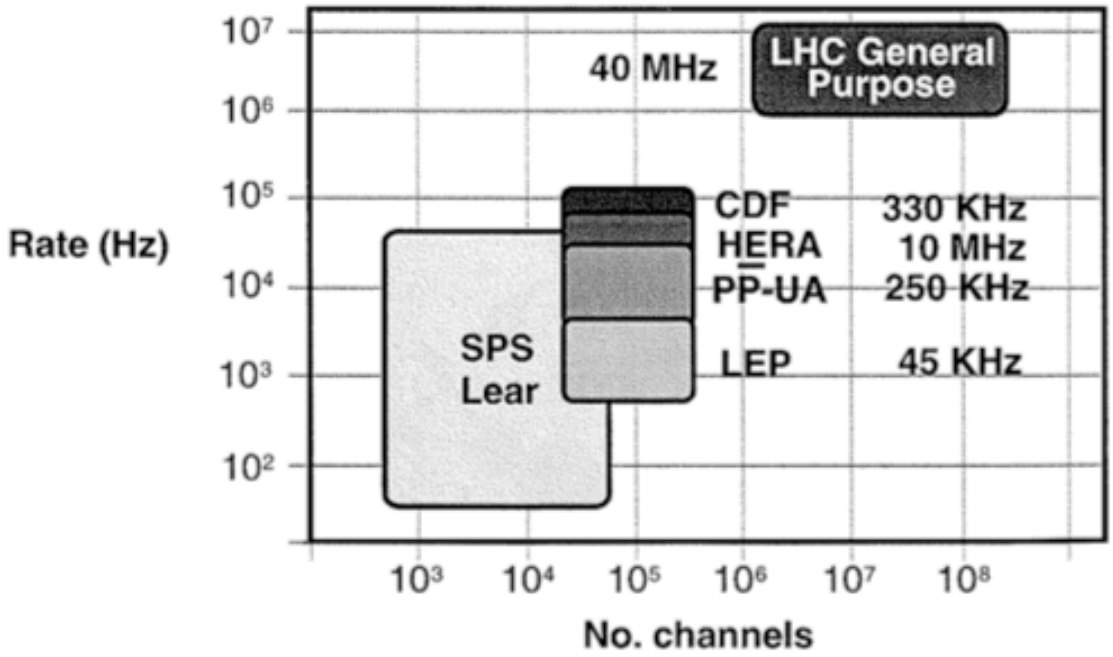
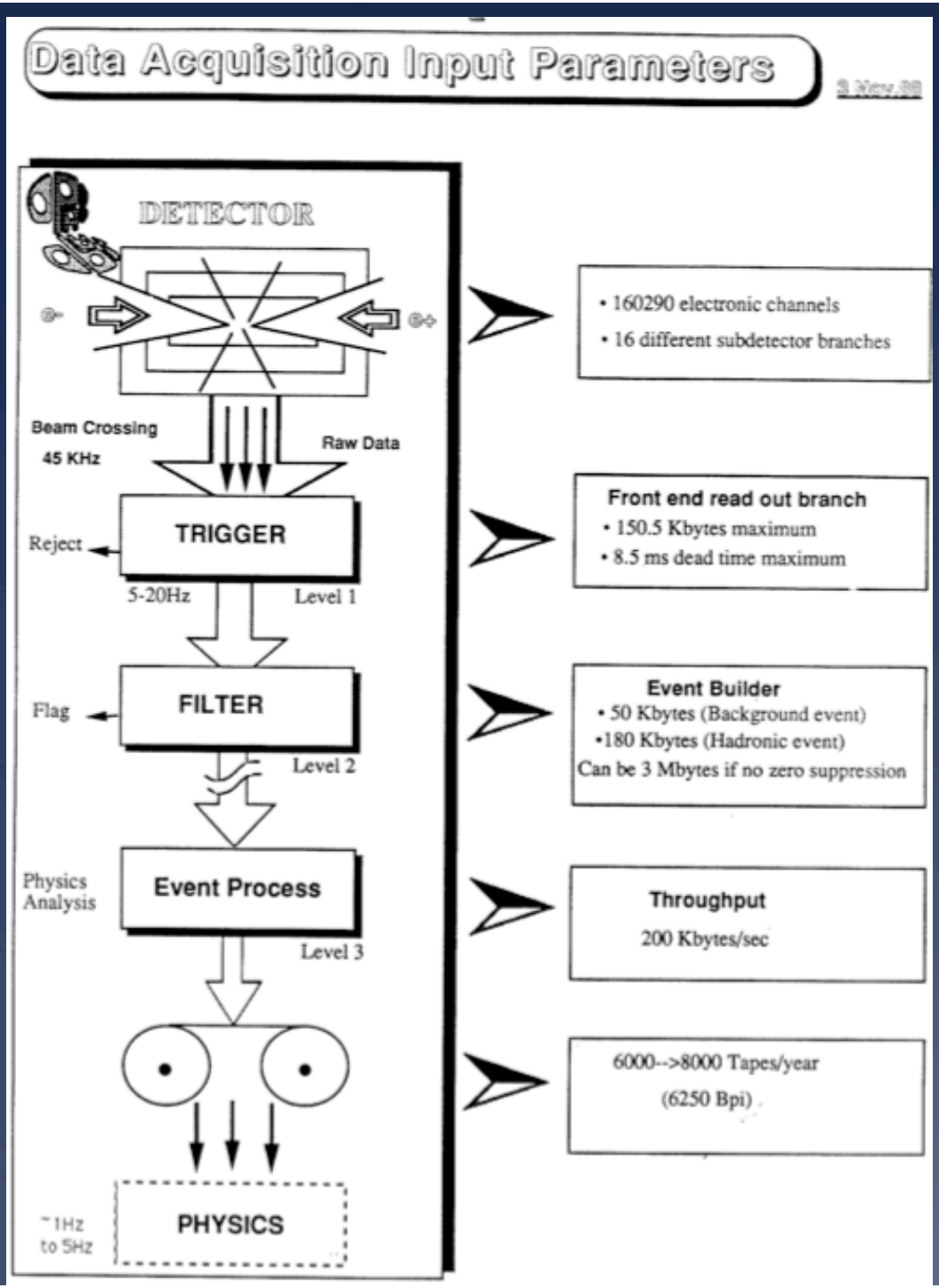
OPAL DAQ memories

"When our memories outweigh our dreams, we have grown old."

Bill Clinton

	LEP	SppS	HERA	LHC
BX period	22 μs	3.8 μs	96 ns	25 ns
Interactions/BX	<< 1	~1	<< 1	~ 20
% Intn to select	100 %	0.1 %	100 %	0.001%
# calo towers	~ 10^4	~ 10^3	~ 10^4	~ 10^5
# tracking chan.	~10^4	~10^4	~10^4	~10^7





Opal compared to Aleph ,Delphi, L3

- just 2 levels
- VME versus Fastbus

DAQ Who's Who ? ~1987

Received: by CERNVM (Mailer X1.24) id 5142; Wed, 09 Sep 87 15:50:48 GVA
Date: Wed, 09 Sep 87 15:50:27 GVA
From: Mette Decamp <OPALMAIL@CERNVM>
Subject: online

TO : ALL OPAL MEMBERS

Support of data-acquisition in microprocessors

Dear Colleagues,

The specification and implementation of a software system to support the microprocessor hardware above system crate level has always been the responsibility of the Saclay group. In the last few months, however, the various people at Saclay who were in charge of this work, (Successively Xavier Gentit and Victor Hajjar) have become unavailable, and most recently Messrs. Banner and Borgeaud, representing the Saclay management, have made it known to us that in spite of considerable effort on their part to look for a solution, they are no longer able to give the promised software support. They made it clear that the Saclay responsibility for the hardware as well as for all aspects of the trigger is unaffected.

In view of the unavailability, at this late stage, of anyone to take responsibility for this vital part of the OPAL detector, an emergency meeting was held at CERN this morning in order to try and find a way to proceed. The people present at this meeting were Norman Gee, Patrick LeDu, Ogmund Runolfsson, Per Scharff-Hansen, Hans von der Schmitt and ourselves.

After a presentation of the facts by Patrick, and a quick review of the options available, it was decided that the first priority was to formulate a minimal design and make an assessment of the software effort needed to realise it. At the same time one could proceed on getting people interested in helping with the implementation when a design exists.

The design team consists of the following:

Frank Beck
Norman Gee
Patrick LeDu
Per Scharff-Hansen
Hans von der Schmitt

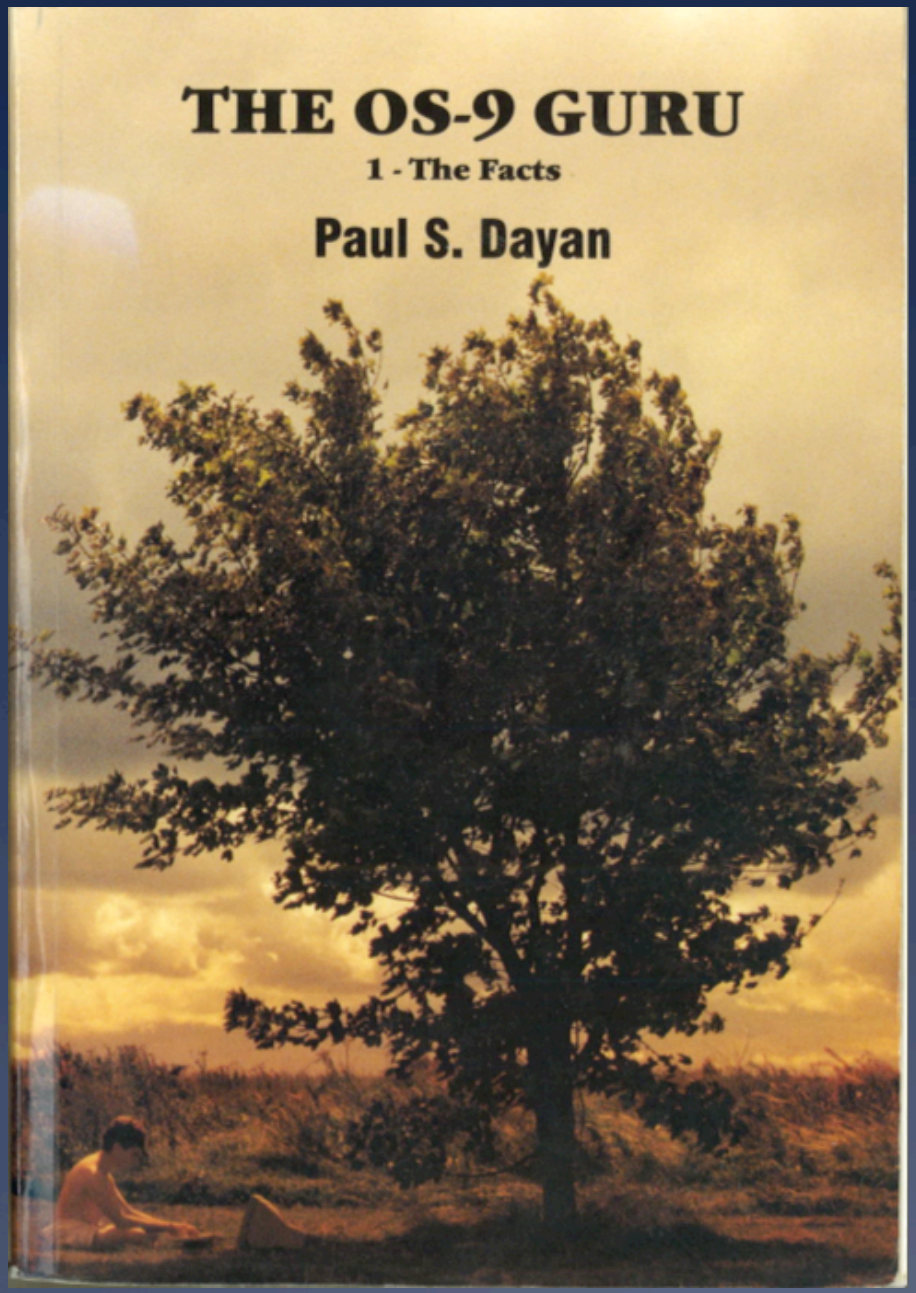
Lorne Levinson would be asked to join as soon as he is available, as would any prospective helpers. The matter will be discussed in OPAL week in an effort to get volunteers to help us over the crisis. It is hoped that a viable design can be drawn up on a time-scale of one month, and that this can then be submitted to the collaboration for approval.

In the meanwhile all members of OPAL are invited to think about ways in which we can assemble a team, resident at CERN, which would allow us to implement enough microprocessor software to give the Saclay-built hardware the minimal functionality it needs for commissioning work starting next Summer and the subsequent preparation for data-taking the following year. Suggestions and offers of help are urgently solicited.

We look forward to seeing you during OPAL week and hearing your opinion.

Sincerely,

Aldo Michelini Frank Beck

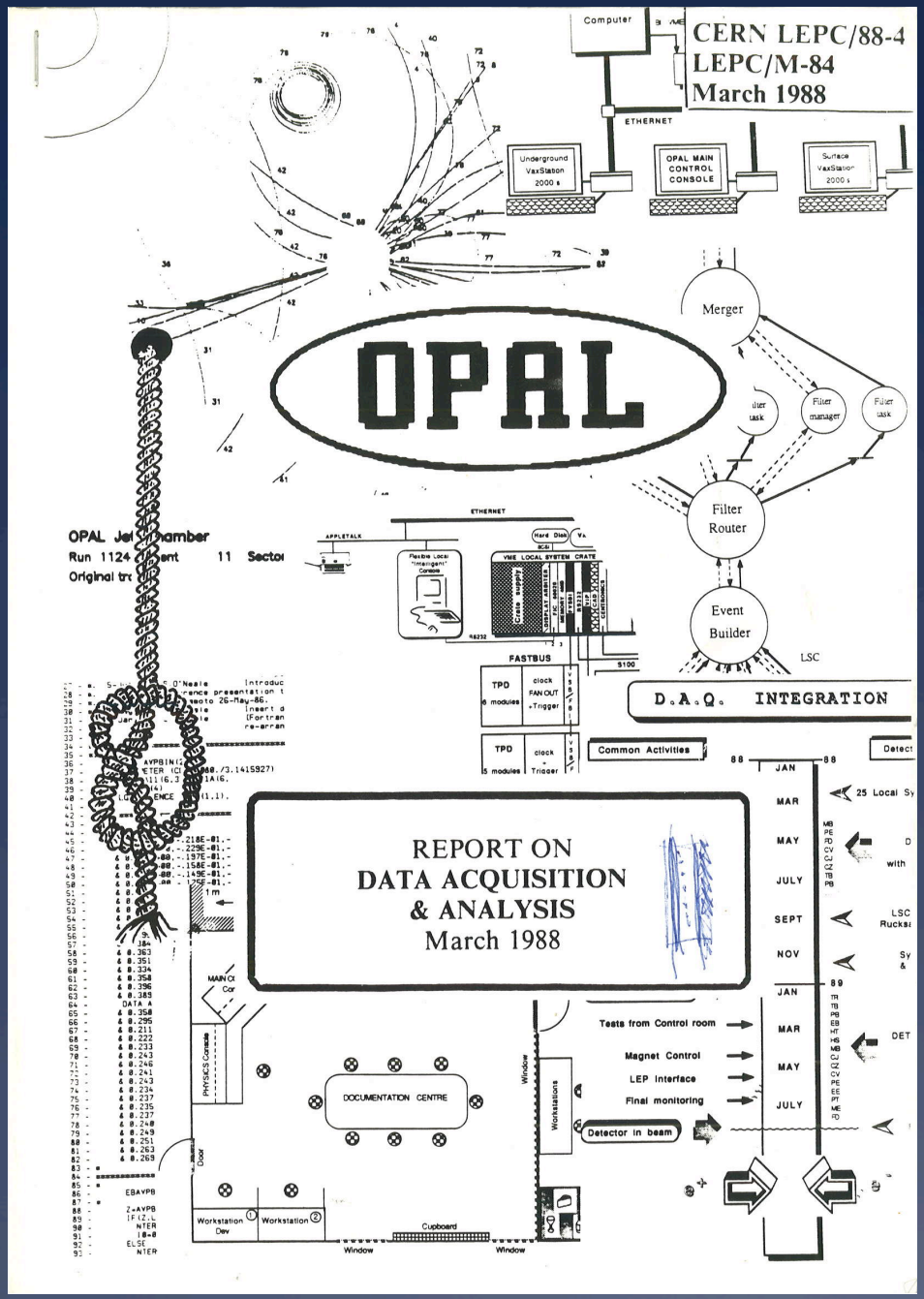

THE OS-9 GURU
1 - The Facts
Paul S. Dayan

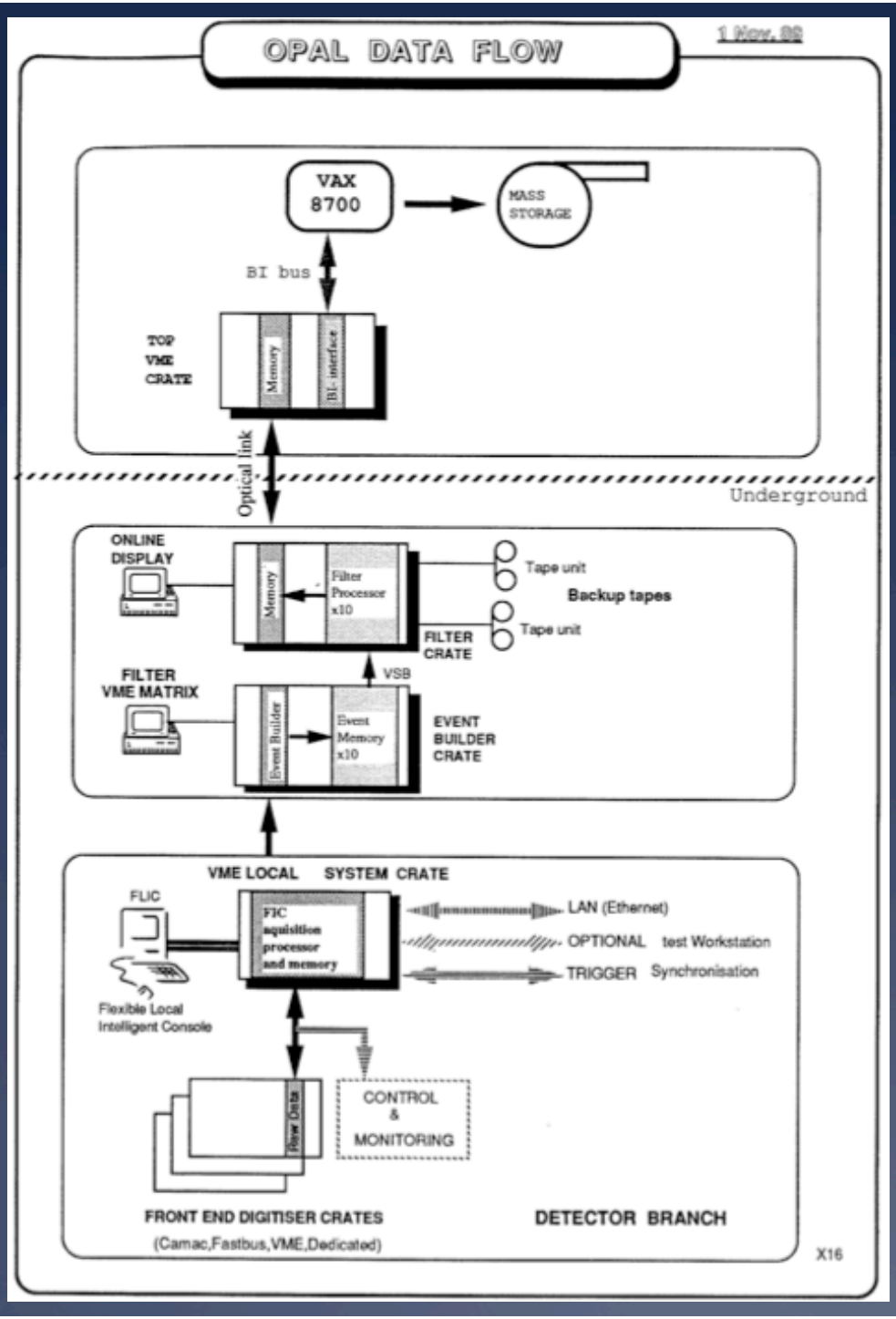
RTF/68K

Real-Time Fortran 77 for 68K Processors
Manual of Compiler and Run-Time Library
with an Appendix for OS-9

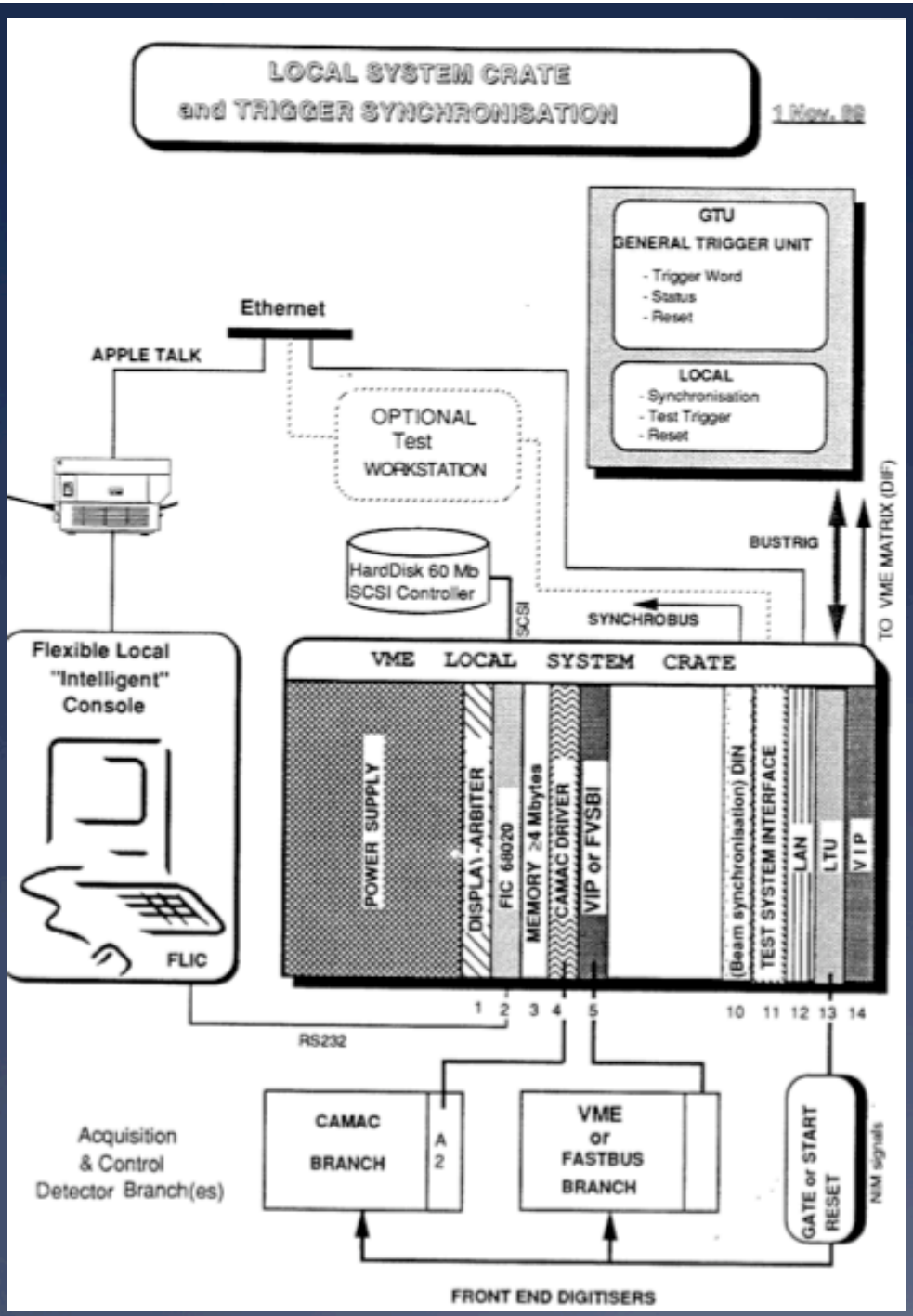
(Version 5.3)

H. von der Schmitt
Physikalisches Institut
Universität Heidelberg
January 28, 1993


CERN LEPC/88-4
LEPC/M-84
March 1988
OPAL
REPORT ON
DATA ACQUISITION
& ANALYSIS
March 1988
Computer
ETHERNET
Underground VaxStation 2000 s
OPAL MAIN CONTROL CONSOLE
Surface VaxStation 2000 s
Merger
Filter manager
Filter Router
Event Builder
LSC
FASTBUS
TPD 6 modules
clock FAN OUT +Trigger
TPD 5 modules
clock + Trigger
D.A.Q. INTEGRATION
Common Activities
JAN 88
MAR
MAY
JULY
SEPT
NOV
JAN 89
MAR
MAY
JULY
Tests from Control room
Magnet Control
LEP Interface
Final monitoring
Detector in beam
DOCUMENTATION CENTRE
PHYSICS Console
Workstations
Window
Door
Workstation Dev
Workstation
Cupboard


OPAL DATA FLOW
1 Nov. 88
VAX 8700
MASS STORAGE
BI bus
TOP VME CRATE
Memory
BI interface
Optical link
Underground
ONLINE DISPLAY
Memory
Filter Processor x10
Tape unit
Backup tapes
Tape unit
FILTER CRATE
FILTER VME MATRIX
VSB
Event Builder
Event Memory x10
EVENT BUILDER CRATE
VME LOCAL SYSTEM CRATE
FLIC
FIC aquisition processor and memory
LAN (Ethernet)
OPTIONAL test Workstation
TRIGGER Synchronisation
Flexible Local Intelligent Console
Raw Data
CONTROL & MONITORING
FRONT END DIGITISER CRATES
(Camac,Fastbus,VME,Dedicated)
DETECTOR BRANCH
X16

1989-1990


LOCAL SYSTEM CRATE
and TRIGGER SYNCHRONISATION
1 Nov. 92
GTU
GENERAL TRIGGER UNIT
- Trigger Word
- Status
- Reset
LOCAL
- Synchronisation
- Test Trigger
- Reset
Ethernet
APPLE TALK
OPTIONAL
Test
WORKSTATION
HardDisk 60 Mb
SCSI Controller
SCSI
BUSTRIG
SYNCHROBUS
TO VME MATRIX (DIF)
Flexible Local
"Intelligent"
Console
FLIC
VME LOCAL SYSTEM CRATE
POWER SUPPLY
DISPLAY-ARBITER
FIC 68020
MEMORY ≥4 Mbytes
CAMAC DRIVER
VIP or FVSBI
(Beam synchronisation) DIN
TEST SYSTEM INTERFACE
LAN
LTU
VIP
1 2 3 4 5 10 11 12 13 14
RS232
Acquisition
& Control
Detector Branch(es)
CAMAC
BRANCH
A
2
VME
or
FASTBUS
BRANCH
GATE or START
RESET
NIM signals
FRONT END DIGITISERS

MEMORANDUM

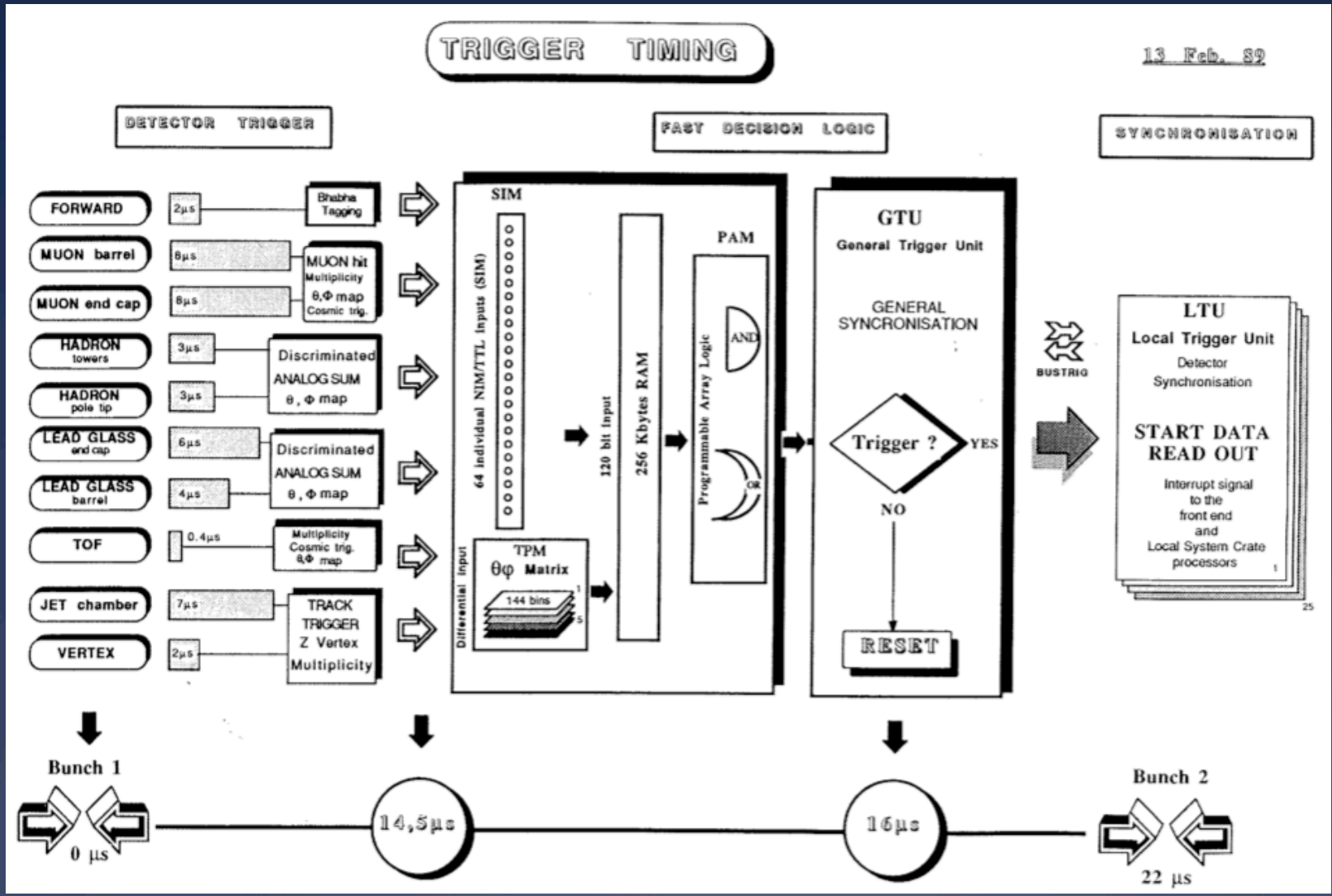
February 27, 1989

To: The OPAL Collaboration

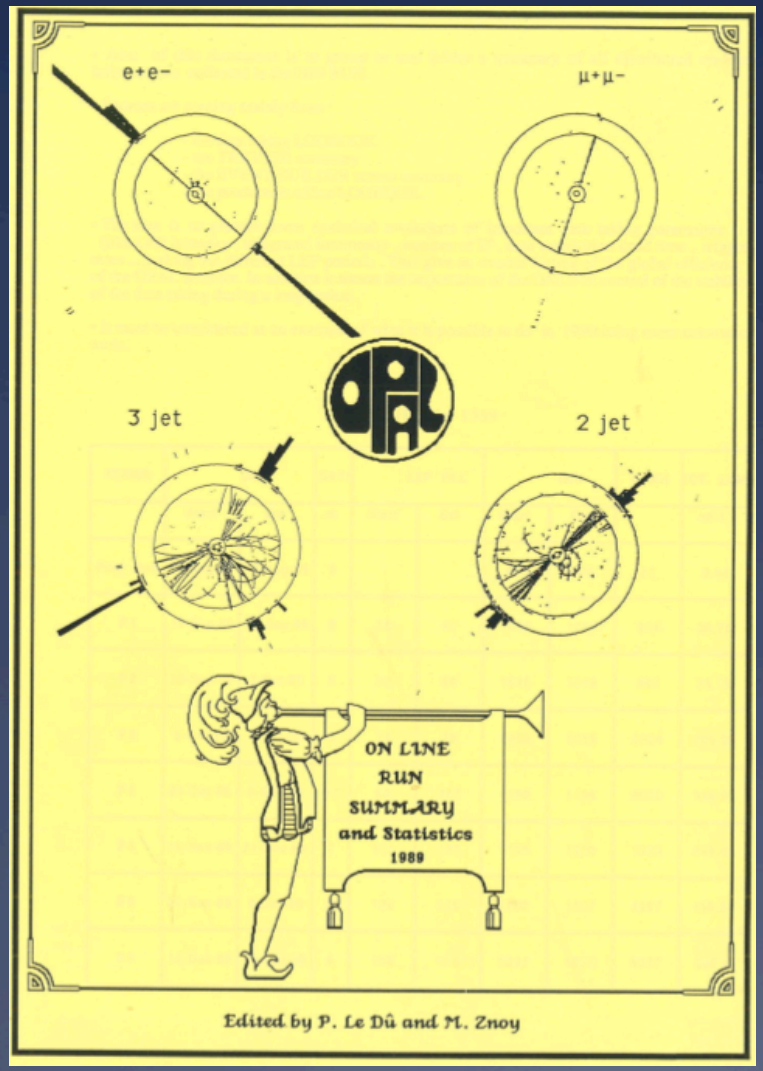
From: The CERN "Wednesday 17.00" Trigger Group: K. W. Bell, D. Charlton, M. Dittmar, P. Farthouat, R. D. Heuer, P. Le Du, G. Quast, P. Sherwood and C. Virtue

Subject: **A PROPOSAL TO GUARANTEE A WORKING TRIGGER SYSTEM FOR OPAL DAY ONE**

(One of) Aldo's worries


TRIGGER TIMING
13 Feb. 89
DETECTOR TRIGGER
FAST DECISION LOGIC
SYNCHRONISATION
FORWARD
2µs
Bhabha Tagging
MUON barrel
8µs
MUON hit Multiplicity θ,Φ map Cosmic trig.
MUON end cap
8µs
HADRON towers
3µs
Discriminated ANALOG SUM θ, Φ map
HADRON pole tip
3µs
LEAD GLASS end cap
6µs
Discriminated ANALOG SUM θ, Φ map
LEAD GLASS barrel
4µs
TOF
0.4µs
Multiplicity Cosmic trig. θ,Φ map
JET chamber
7µs
TRACK TRIGGER Z Vertex Multiplicity
VERTEX
2µs
SIM
64 individual NIM/TTL Inputs (SIM)
Differential Input
TPM θφ Matrix
144 bins
120 bit Input
256 Kbytes RAM
PAM
Programmable Array Logic
AND
OR
GTU
General Trigger Unit
GENERAL SYNCRONISATION
Trigger ?
YES
NO
RESET
BUSTRIG
LTU
Local Trigger Unit
Detector Synchronisation
START DATA READ OUT
Interrupt signal to the front end and Local System Crate processors
Bunch 1
0 µs
14,5µs
16µs
Bunch 2
22 µs

1989 - 1990


e+e-
μ+μ-
3 jet
2 jet
ON LINE
RUN
SUMMARY
and Statistics
1989
Edited by P. Le Dû and M. Znoy

RN2 fellows

1989

EE Test Report

OPAL

SILICON BOOK

US 65 / RN2

6-8-89 / 18-8-89

PILOT RUN

no guarantee that works!

Procedures for runstartup (eventbuilder)

in general: press RESET button on masterLSC

TB:
LOGIN GENTIT
LOCAL.COM
TBC-INIT TB_CONFIG.DAT
TB_DAQ TB_PROGS.DAT &
TBC-START GLOBAL <run#> BX
LOCMON@25

MB:
MBN_LOAD.GLOBAL (MBF.... for far side)
MBC-START.GLOBAL <run#> BX

EE:
NEE@/GLOBAL.LEFT
NEE0/CMDS/EEC_START GLOBAL <run#> BX

TT:
chx /M7/jh/cmds
NEWINIT
TTC_INIT_TT_CONFIG.VIP
TT_DAQ TT_PROGS.VIP &
TTC_START GLOBAL <run#> BX

CV:
CVC-INIT CV_CONFIG.VIP
CV_DAQ CV_PROGS.VIP &
CVC-START GLOBAL <run#> BX

CJ:
LOGIN JET, password MAC
PREP
START_GLOBAL <run#> BX

CZ:
START_BX

EB:
LOGIN SUPER
D1
D2
D3

HP:
LOGIN DANIEL, password HNOUNOUH
HP_READY
HP_RUN

FW:
CMD INITIALIZE_DAQ_CAL
CMD CONFIGURE_DAQ_CAL
CMD ENABLE_TRIG_GLOB BX

14[45] Switch to tape PR2108 because of tape error,
Pause Run to bring in FD and to allow TOF to change a module,
14[40] Continue Run PR2108 with all pilot detectors
14[50] Switch to tape PR2109 because of tape write error.

15[00] C. Kleinwort
15[25] FD in again
15[30] some $e^{\pm}$ in LEP
16[30] HP went out for calibration
16[40] HP back again
16[50] FD timed out
17[20] FD timed out again, dropped
17[30] tape error unit Ø
17[55] CV out, try to get FD in (failed, FD is still local)
↘ EVB got in state fatal_pnd, failed to resume from this,
beeped for 6. Quast (2x), no response (was on his way!!)
18[05] phoned Frans, resumed run with his help, FD dropped
CV in again
18[25] on request of EB random trigger rate changed
from 0.1 Hz to 0.05 Hz
18[45] HP hung, dropped, back in
19[00] tried to ask FD if they are ready to come back in again, but
nobody of FD was present in 603/4 and RN
19[30] both tape drives got errors, [redacted]
EE wants out for a laser run
19[40] FD wants to come back (run 443 event 14433), but timed out
again at first event
the 31 events (run 443, events 14199 14229) on PR2114
will be skipped (bad tape)
another tape will be used with this number!

20[20] 2Hz trigger rate, EE does laser run, but still is in 16 trigger
FD failed again to join
21[15] FD in

16257 EE, FD (few events earlier)

increase BKR rate from 0.05 Hz (scalar setting 00)
to 2.0 Hz (02)
(→ deadtime ≈ 33%) total rate ≈ 23 Hz.
TOF struct error 11 on trigno 16714

21[10] Random Bx now again at 0.05 Hz
ELT crashed.
PILOT Run Start
Tape PR2116 with 2 Hz data [redacted]

Tape PR2117 ended with Tape error → event 20388 on both tapes
(17+18)

23[00] H. Brenker
Tape 2120 (writing on)

trigno 23035 C2 F2 struct error.
23:20 first 2-jet seen in Central Calos
23:35 TT hang!
23:38 Running again
23:40 Pause FD gives too many triggers
C2 some structure errors in total 13 eg 25380, 387, 405, 416
23:45 Running again 23:50 Beam Out
0:05 LEPTAGE 1 [redacted] first Z seen by OPAL

13-08-1989

Premier Zo

observé à LEP

Run 443 Evt 22734

1 GeV (EB)

5 GeV (FD)

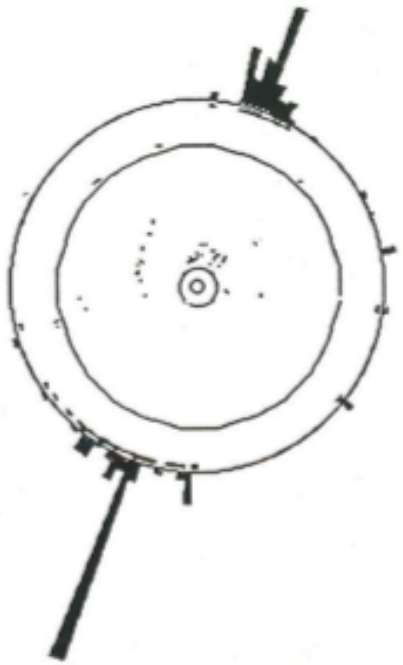
Total E(clus): 0.00 GeV
E(clus) EB : 31.79 GeV
E(clus) EEL: 0.00 GeV
E(clus) EER: 0.00 GeV

N(clusters) : 0
N(clus) EB : 13
N(clus) EEL: 0
N(clus) EER: 0

N(trk-IP) : 1
N(TOF IT) :3104
N(TOF-EB) :****
N(mu trk) :****

Trigger Bits
TPTO2
TOFOR
TOFMANY
EBTOTHI
TPTOCL
TPTO1

CV
CJ
CZ
TB
PB
EB
PE
EE
HP
MB
FD
TR
TT
FI



Filter Flags
E>4 • Ebal

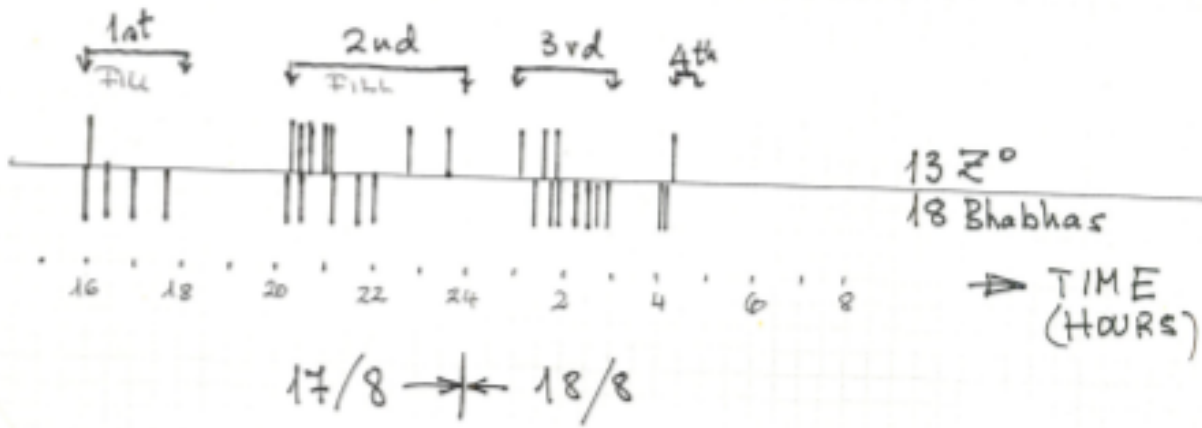
13/ 8/1989 23:09:57

18-8-89

6:00 Problem in LPI, No time estimate
Running on Cosmics Tape PR 2237

6:48 Start Tape PR 2238
8:10 " " PR 2239

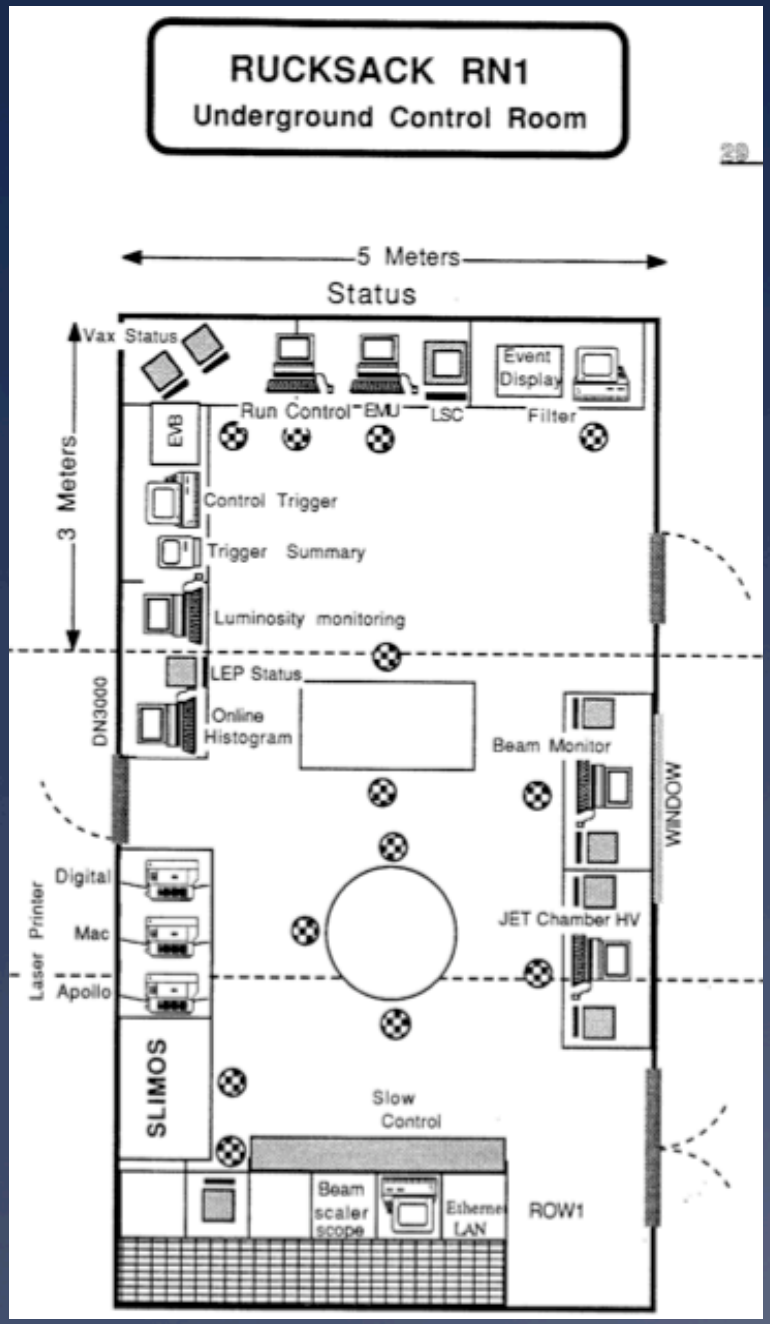
Aldo's Summary OPAL



9:00 Crash on CZ ; take them out
9:10 CZ back in
9:45 Start Tape PR 2240 Trigger EB out

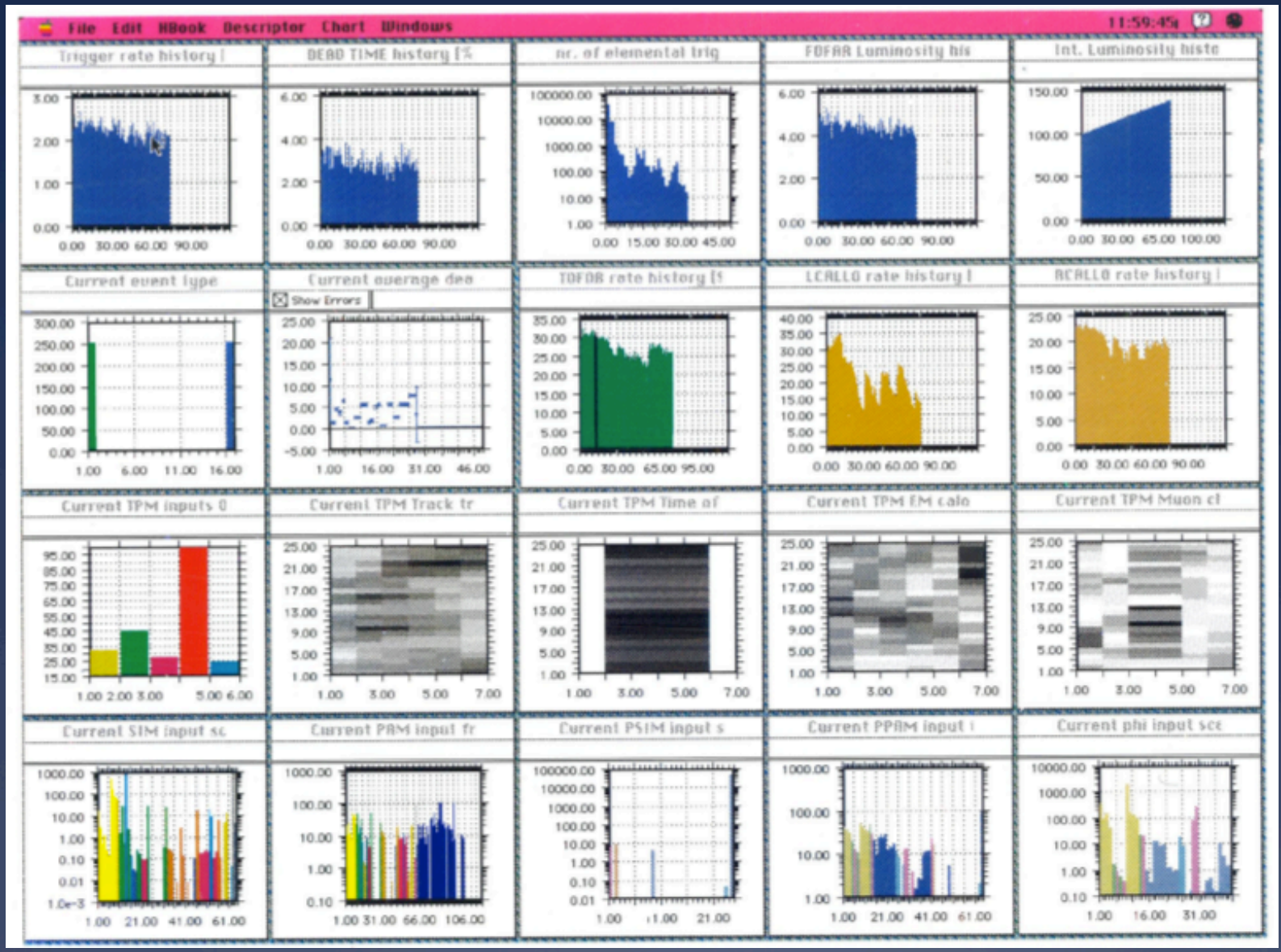

MICHELINI Aldo

18-08-1989


RUCKSACK RN1
Underground Control Room
5 Meters
Status
3 Meters
Vax Status
Event Display
Run Control
EMU
LSC
Filter
EVB
Control Trigger
Trigger Summary
Luminosity monitoring
LEP Status
DN3000
Online Histogram
Beam Monitor
WINDOW
Digital
Mac
Apollo
Laser Printer
JET Chamber HV
SLIMOS
Slow Control
Beam scaler scope
Ethernet LAN
ROW1


Friday Day Shift


Hotline



MAC histo presenter in control room

EVOLUTION

SOFTWARE AND COMPUTING IN THE OPAL EXPERIMENT AT LEP

STEPHEN W. O'NEALE
School of Physics and Space Research, University of Birmingham
Birmingham B15 2TT, United Kingdom

ABSTRACT

The OPAL experiment has overcome the complexity of software development at LEP through a well disciplined organisation of its software and data management. To assist in the explotation of new techniques we give a frank description of the problems we have faced and some comments on the solutions we employed.

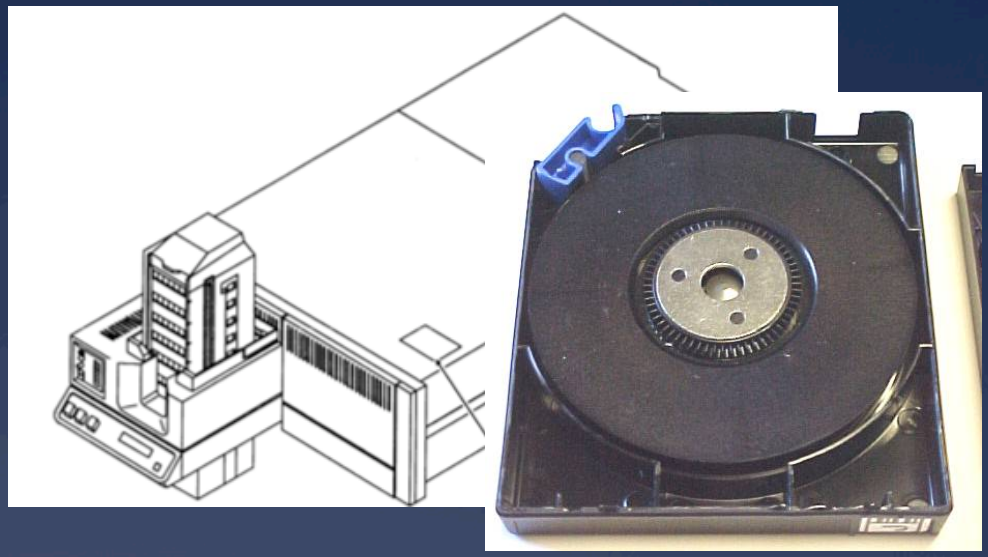
O'NEALE Steve

5. Production Computing Resources

The installed mainframe computing capacity was saturated by early 1990 and we were saved by the loan of an Apollo DN10K from the Microcosm project. Cartridges were read and written with STK4280 drives attached to a spare VMEbus-based OS-9 system. The emulator buffer manager was used to pipe data in and out of the DN10K. Shifts of physicists mounted cartridges (one every 10 minutes) with an efficiency equivalent to the loss of half of the processing capacity of the system. A data compression package for raw data (DD) was written during 1990.

Rope on DN10k 1990

"personal supercomputer"
4 SMP RISC 20 MHz, 32 Mbyte memory
~200 kSFR



Stand-alone computing "facility" in Green Barrack
Process Data cartridges written by VAX
Shifter loads cartridges

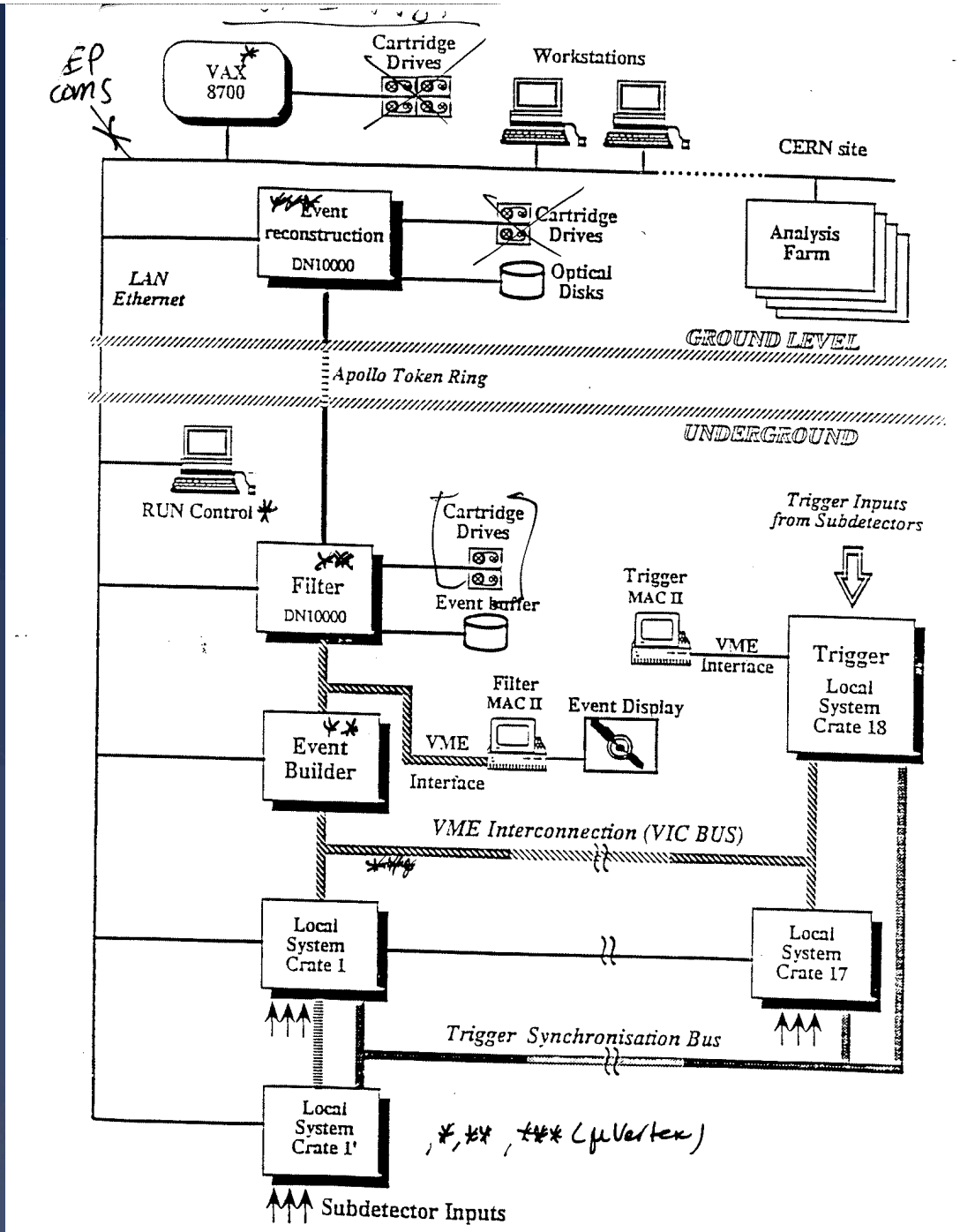
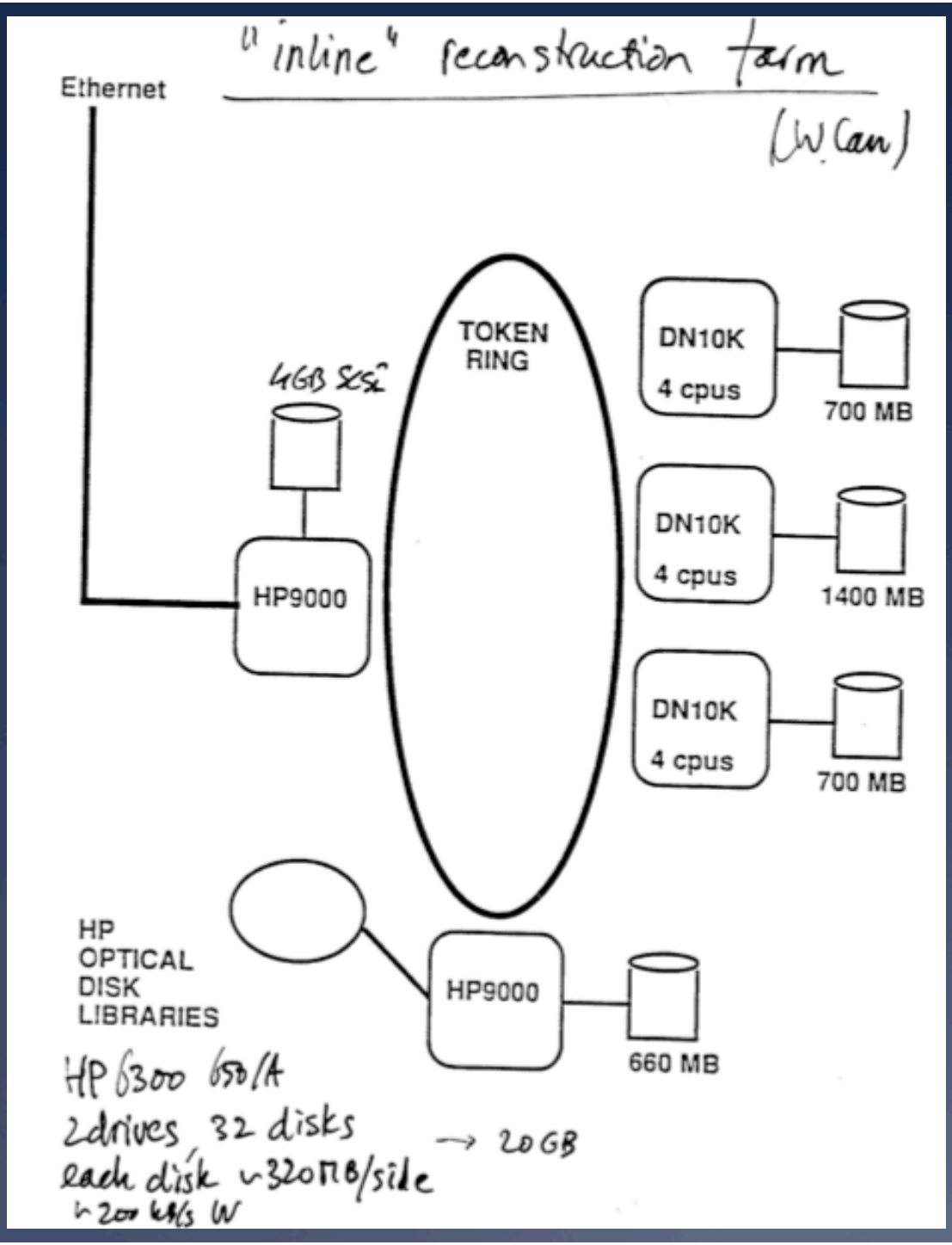


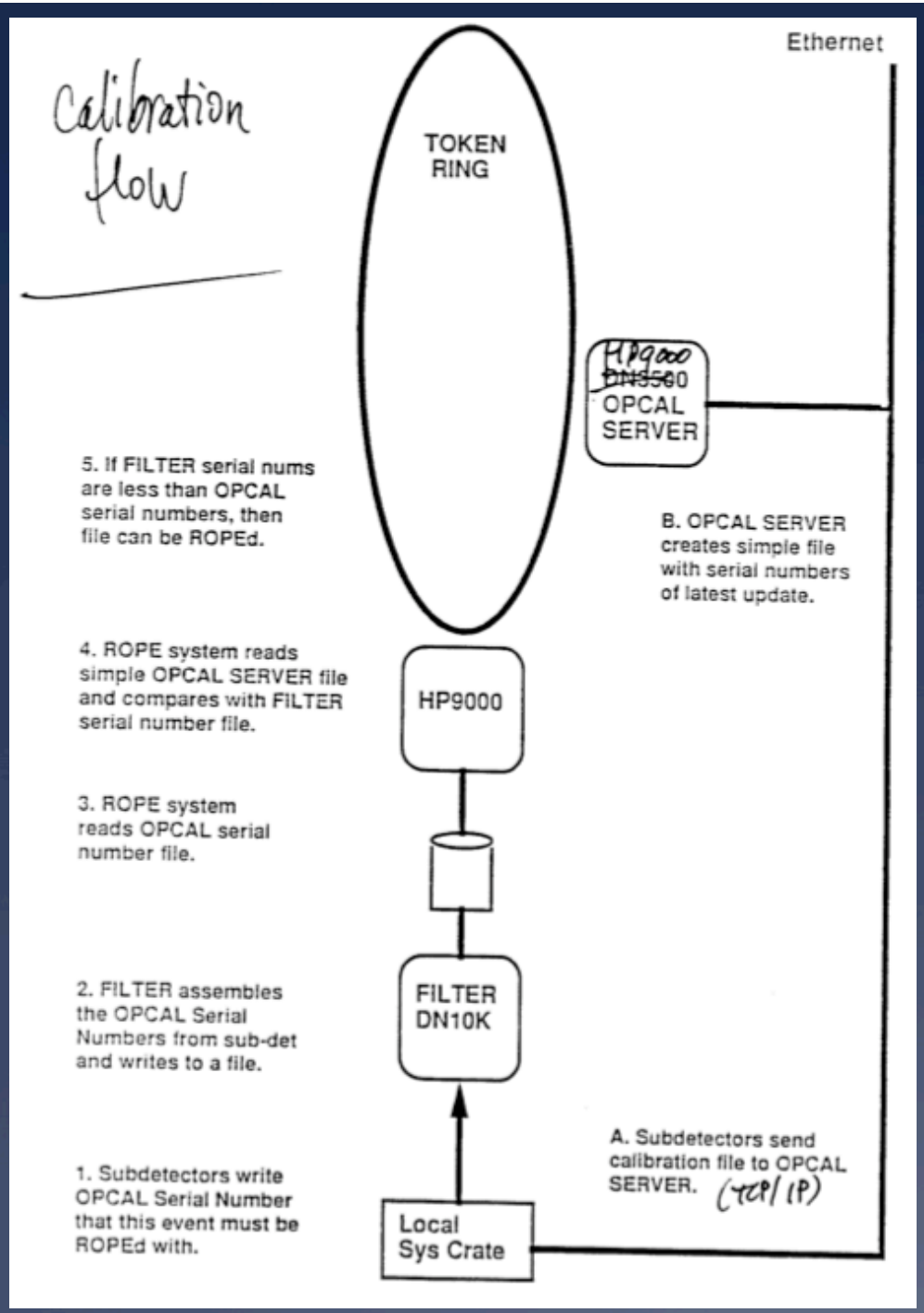
Fig. 1

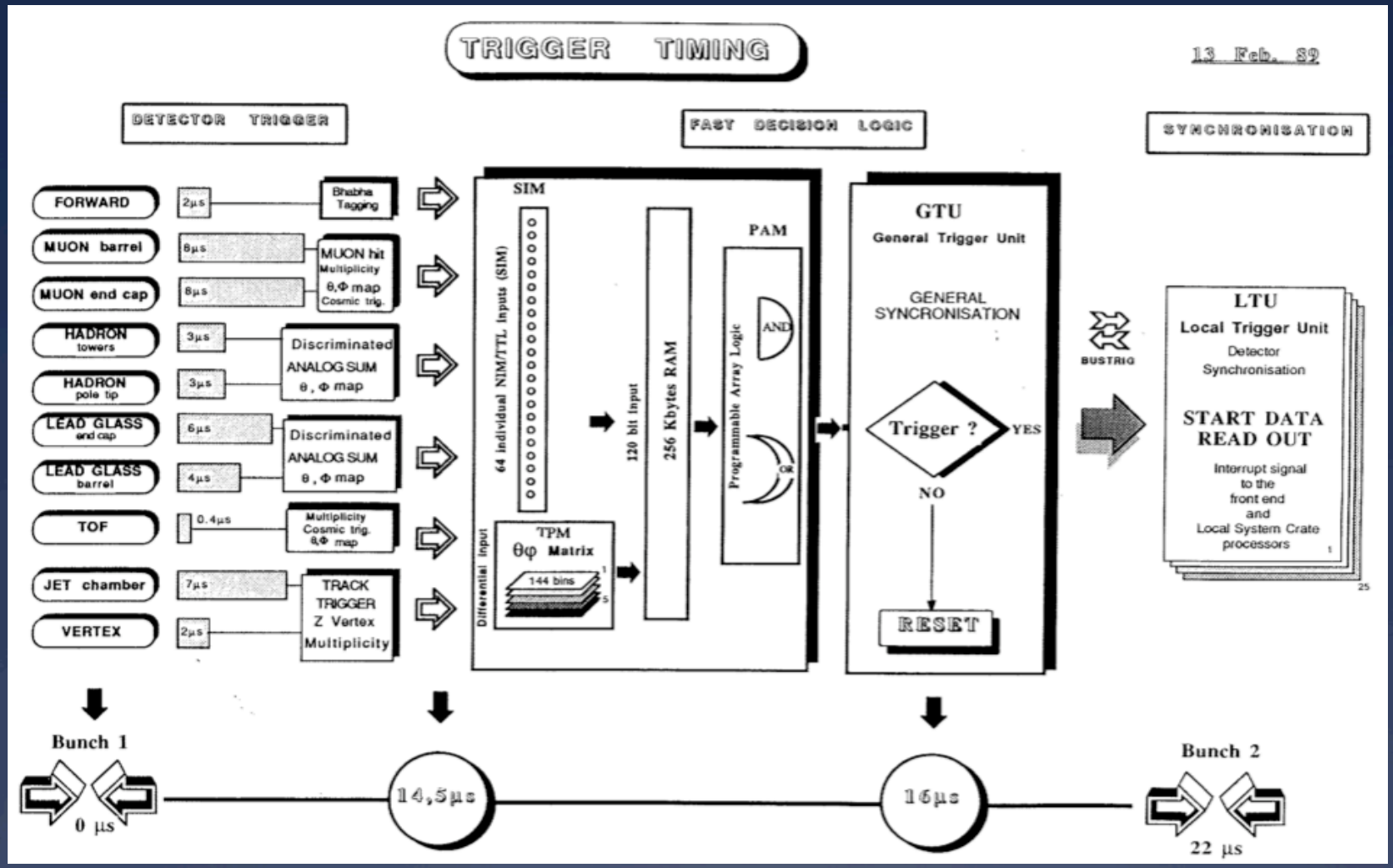
1991 – 1995

- Filter on DN10k
- "inline ROPE"
- recording on opt disks



West Canada
1991 onwards


Calibration flow
Ethernet
TOKEN RING
HP9000 DN3500 OPCAL SERVER
5. If FILTER serial nums are less than OPCAL serial numbers, then file can be ROPEd.
B. OPCAL SERVER creates simple file with serial numbers of latest update.
4. ROPE system reads simple OPCAL SERVER file and compares with FILTER serial number file.
HP9000
3. ROPE system reads OPCAL serial number file.
2. FILTER assembles the OPCAL Serial Numbers from sub-det and writes to a file.
FILTER DN10K
A. Subdetectors send calibration file to OPCAL SERVER. (TCP/IP)
1. Subdetectors write OPCAL Serial Number that this event must be ROPEd with.
Local Sys Crate



1989-1991: LEP-I 4x4
1992-1994: LEP-I 8x8 OPAL added Pre-Trigger
1995: LEP-I bunch trains
1996 -2000: LEP-II

PAINLESS BISECTION
or
The Relatively Easy Route to
Dual CPU Readout

Neil Geddes

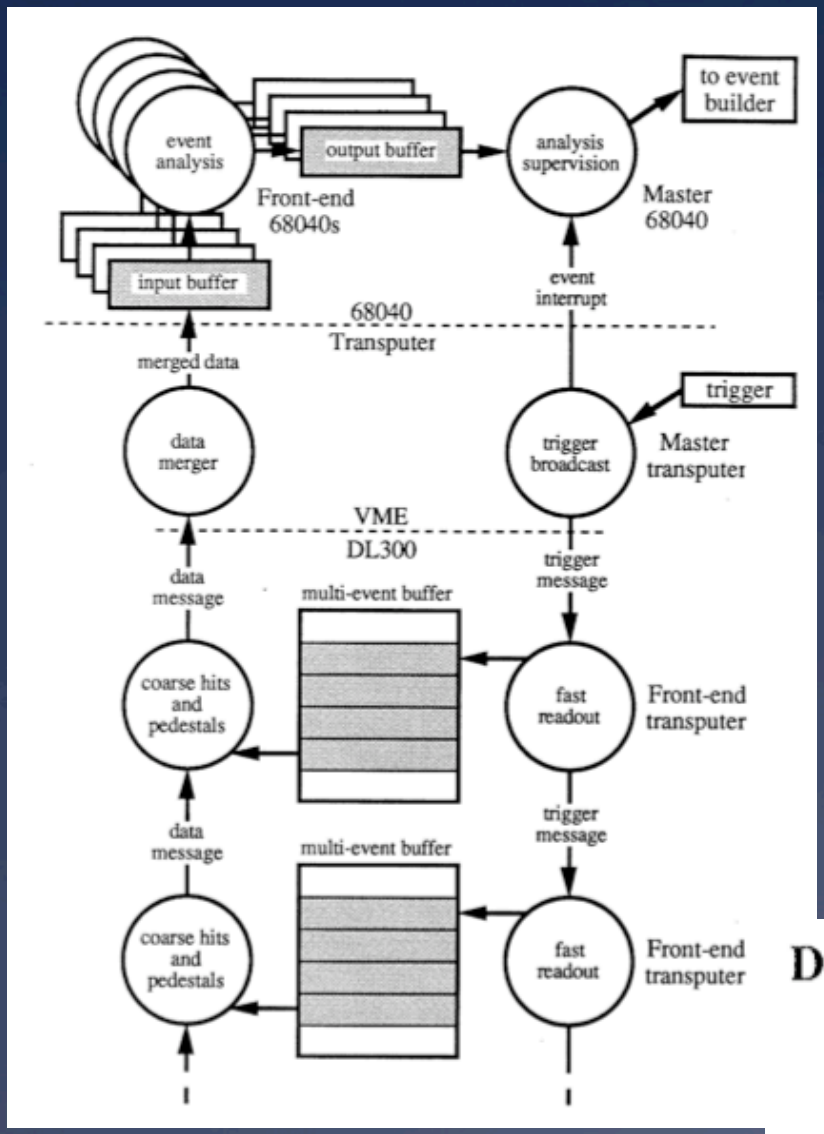
October, 1991

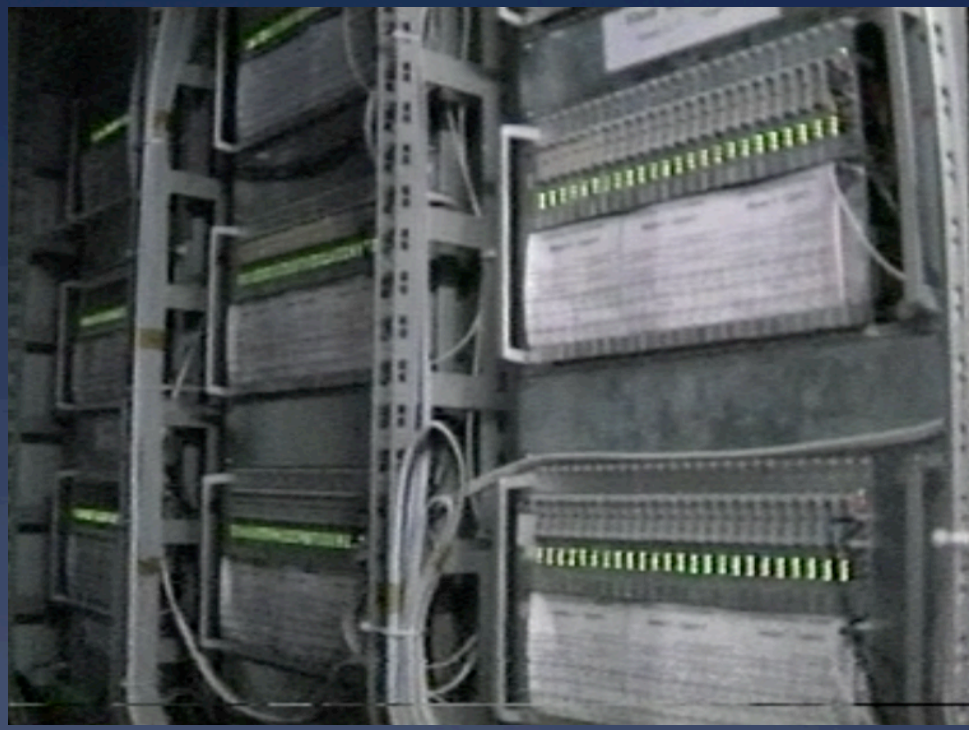
1 Introduction

This note is intended as a brief guide to assist in setting up a dual CPU readout system within the standard OPAL framework. It is hoped that it will stimulate wider discussion on this topic. Section two of the guide gives a step by step procedure for converting a single CPU system into a dual CPU one. The recipe is not intended to be the final word and will doubtless be improved (and programs changed/moved). It is also not guarrenteed to work ! The readout system that you end up with following section 2 is probably far from ideal and section 3 gives some hints and suggestions for improvements. A comprehensive prescription can not be given here due to the diverse requirements of the various subdetectors. Section 4 contains a list of current problems. Of course these should all be fixed soon ! For those readers who want more information the gory details of various bits and pieces are given in subsequent sections (so you only need to read the next two sections and the appendices !). The appendices give some useful program listings and a list of current problems.

Each LSC added MVME147 to CES FIC Single Board Computer
From 1992 onwards

CJ readout



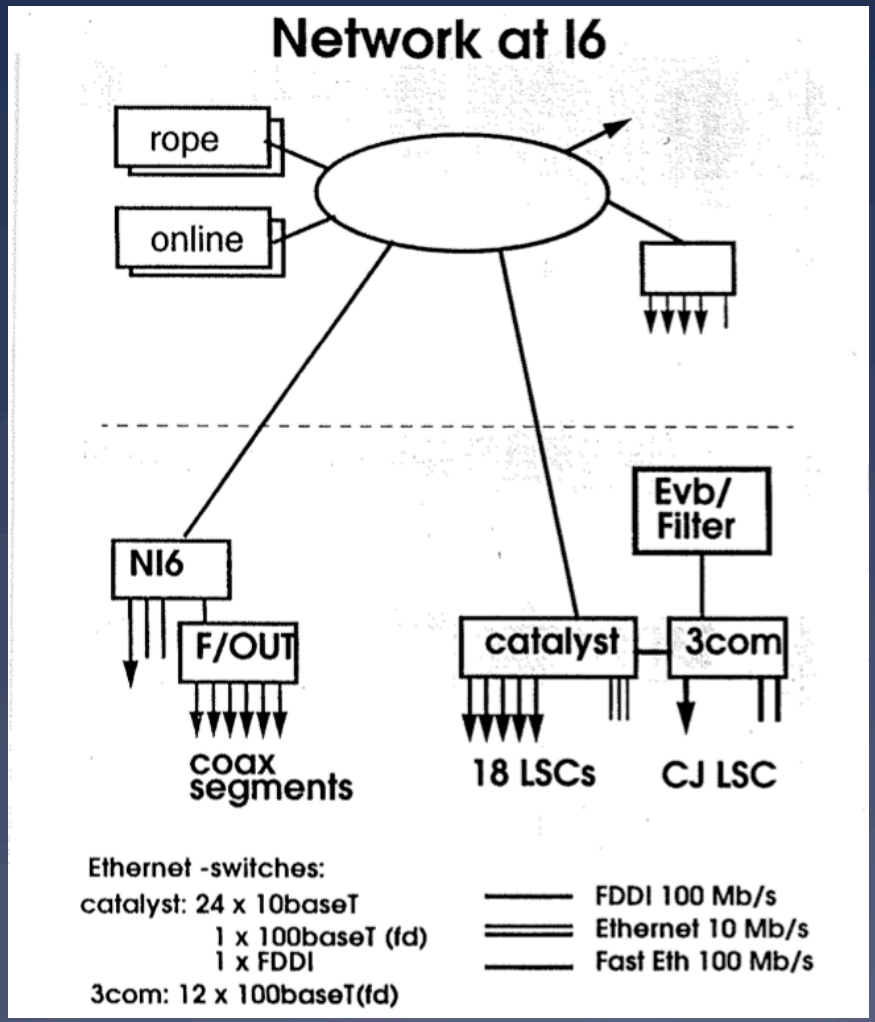


Description of the transputer based upgrade of the OPAL jet chamber readout system

Andreas Dieckmann, Martin Feuerstack, Holger Ihssen, Hans von der Schmitt, Steve Wotton (Heidelberg)

From 1992 onwards

Network EVB 1996 onwards



The OPAL Online VMS cluster will be closed down and definitely decommissioned by the end of January 1997.

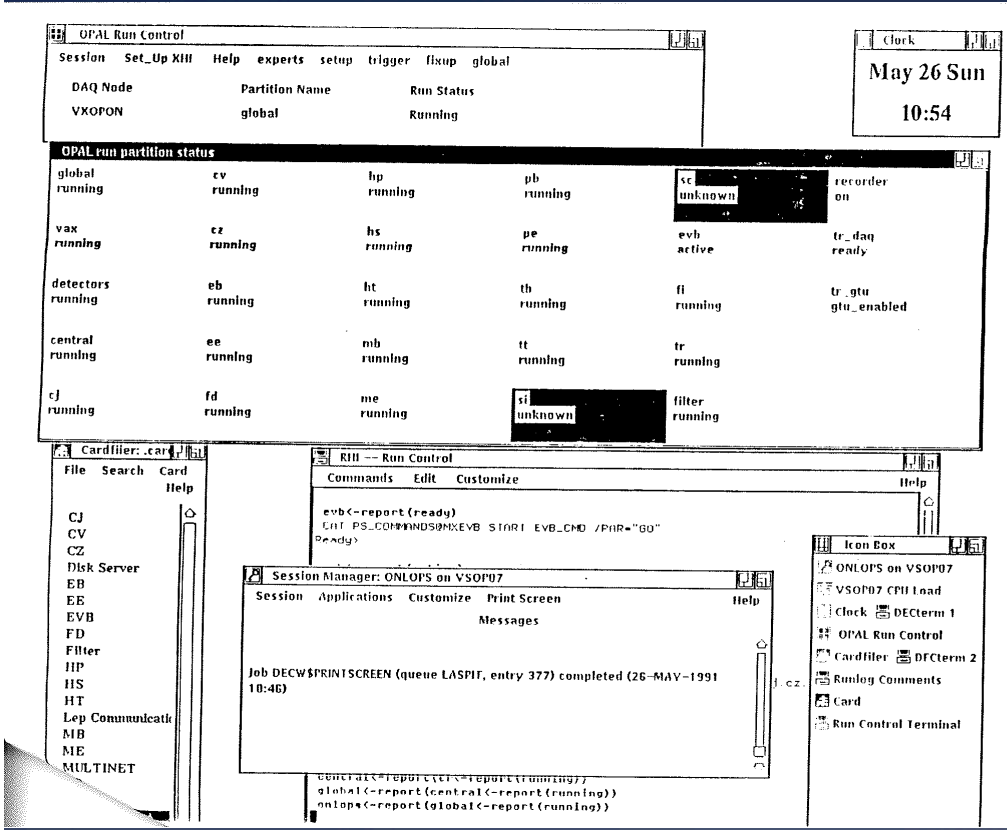
The service started on July 14th, 1987 with a Vax 8700 (VXOPON), when the green barrack was still on CERN main site, well before the first LEP data taking.
The cluster has been managing and controlling the OPAL data acquisition system for many years before being replaced by new technology.

The few users still working on the cluster are requested to migrate their files to a different system before the end of January.

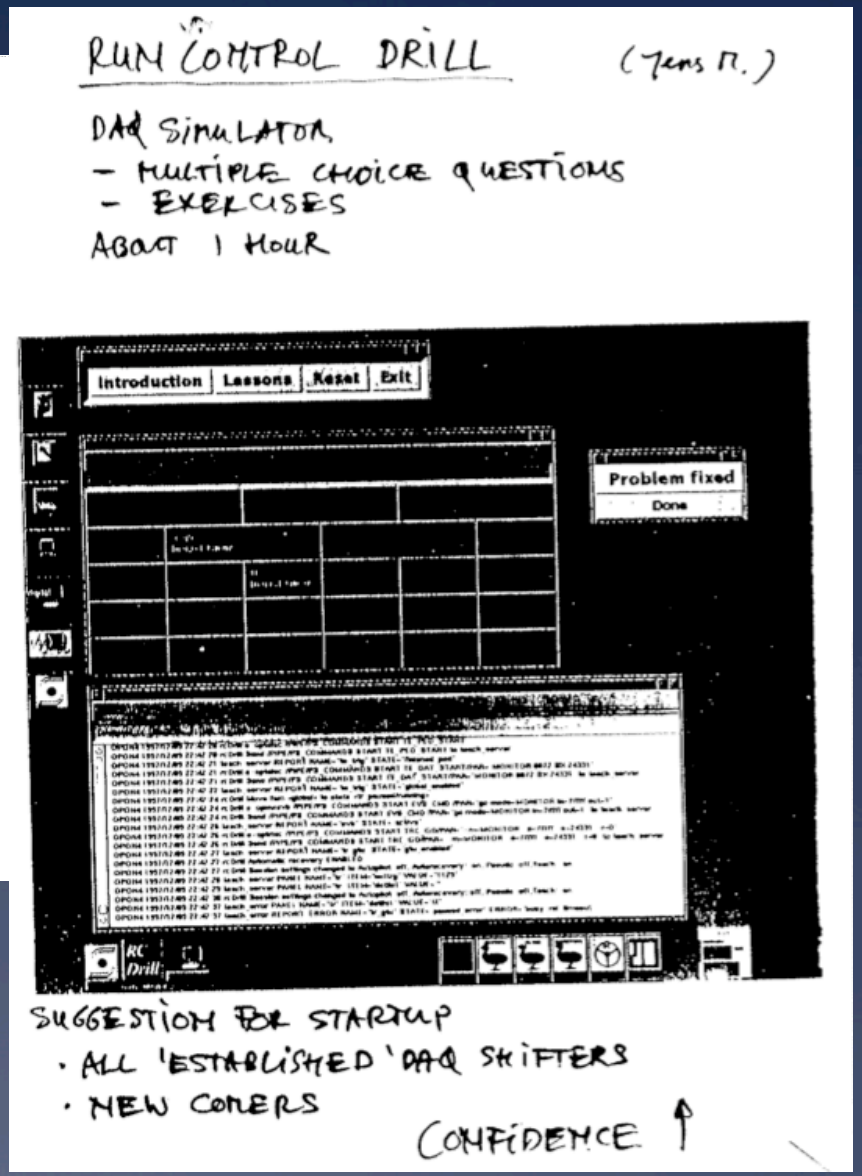
On behalf of OPAL, the spokesman wishes to thank all the people who contributed to develop and maintain the system over the years.

Gian Piero Siroli

Run control

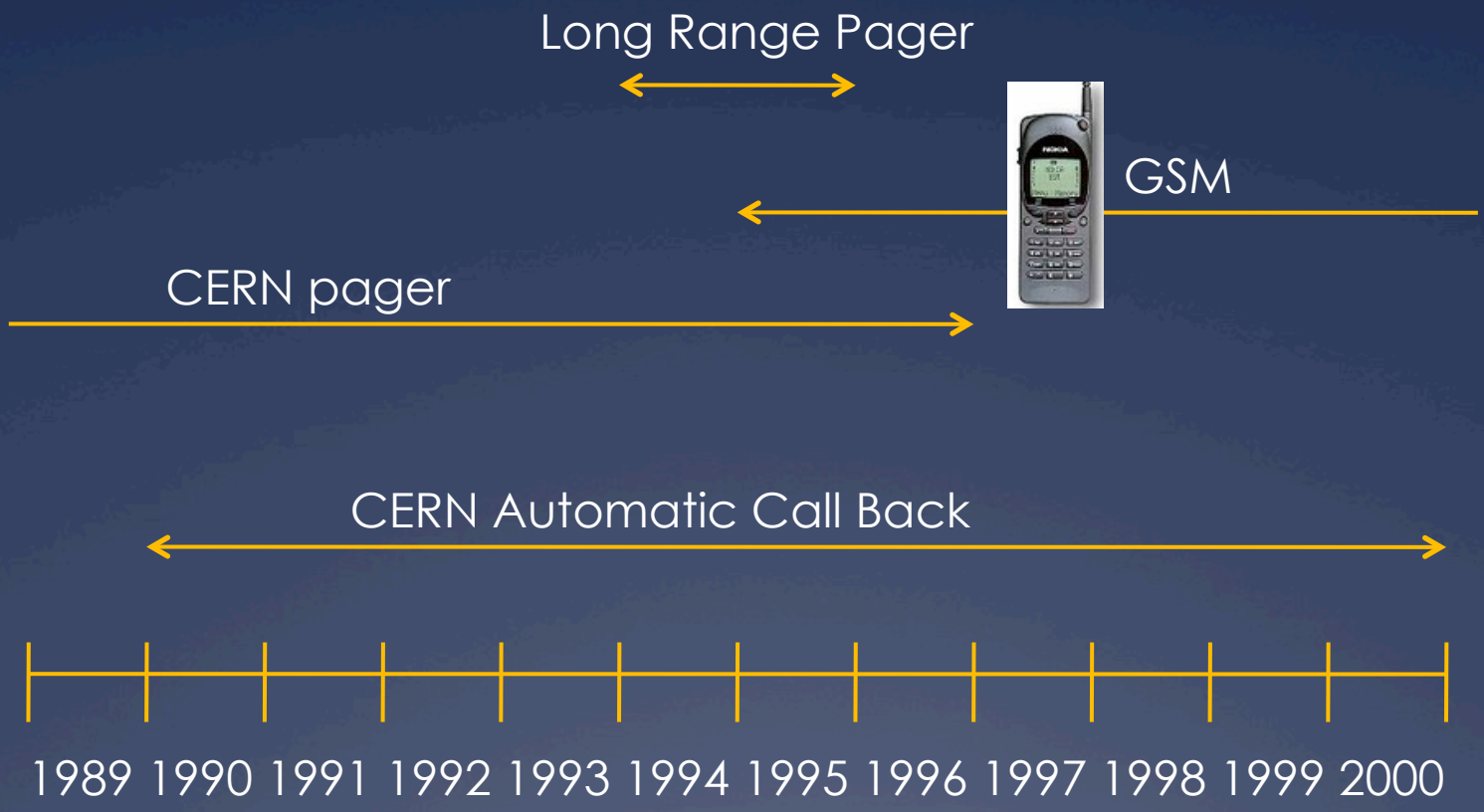


Run control moved from vax to hp-ux (S.Wotton)



On CALL..

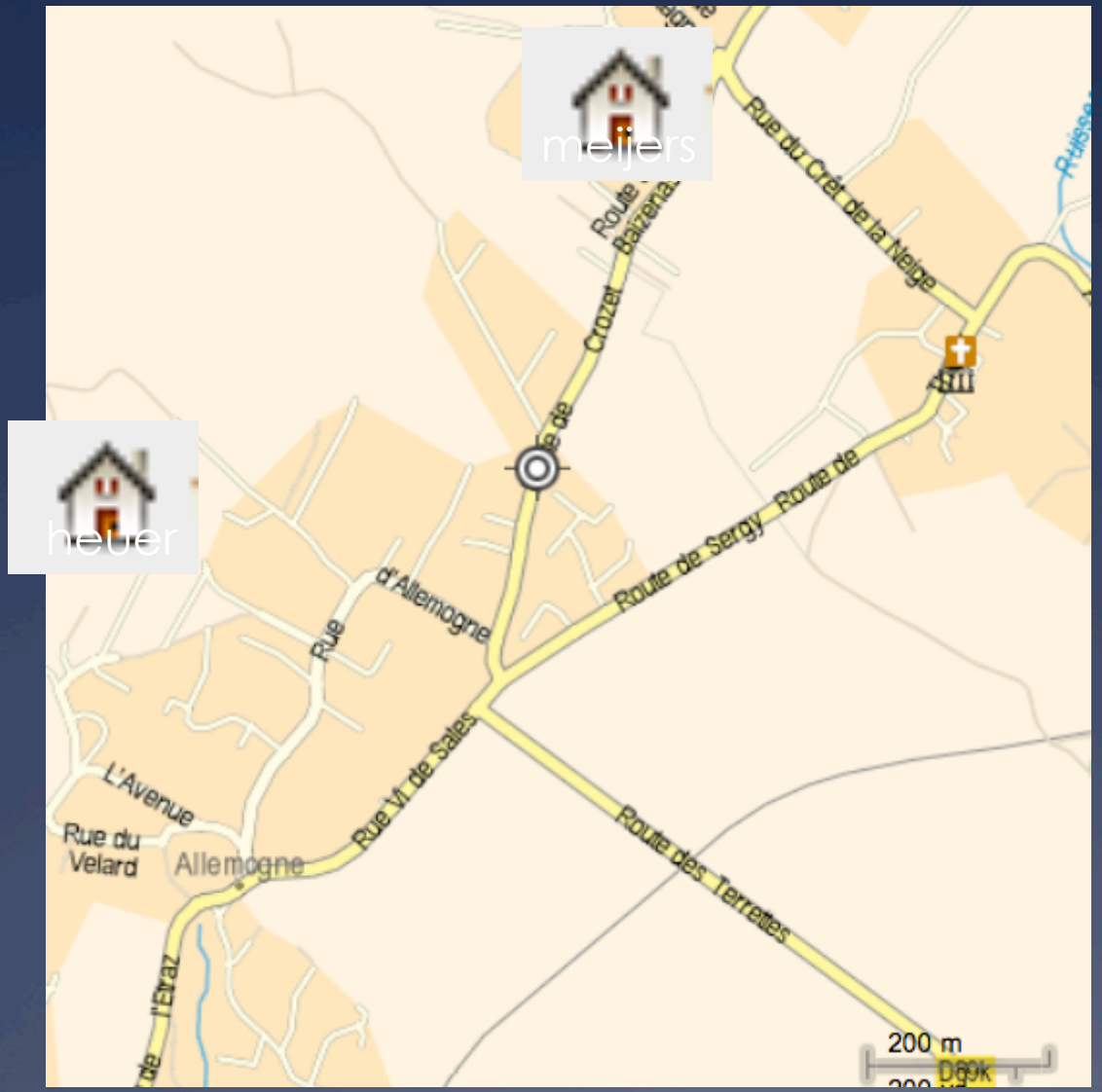
On-call ..


Long Range Pager
GSM
CERN pager
CERN Automatic Call Back
1989 1990 1991 1992 1993 1994 1995 1996 1997 1998 1999 2000

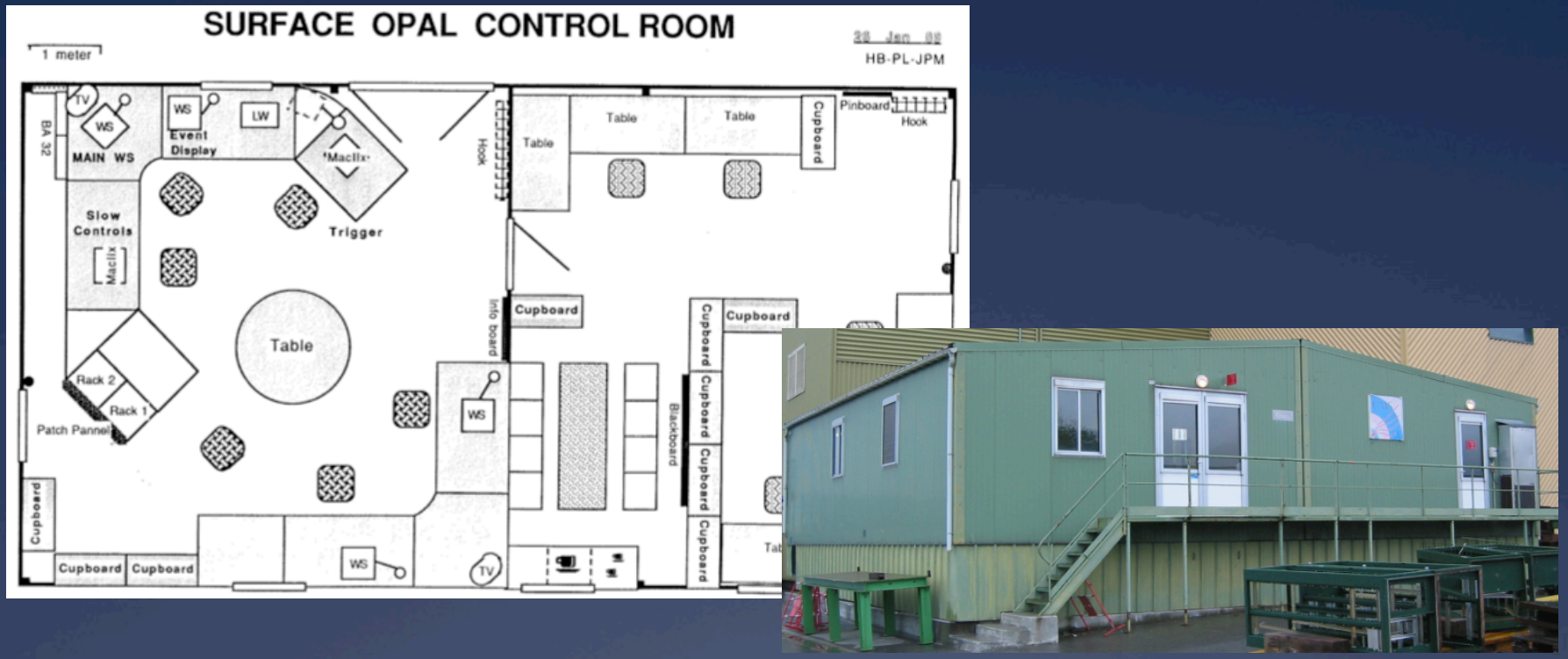
Vax CJ DAQ


CERN
PASSAGE
REGLEMENTE
ATTENTION
RESTRICTED

By foot ..


meijers
heuer
Rue du Crêt de la Neige
Route de Crozet
Route de Sergy
Rue d'Allemogne
Rue
L'Avenue
Rue du Velard
Allemogne
Rue Vr de Sales
Route des Terrettes
200 m

End-1994 control room debate



Document circulated with pro and con of move from RN1 to surface
About ~80 replies, ~50/50 pro/con

"I am VERY strongly in favour of moving the control room upstairs.
I think you already know my list of excellent reasons in favour of the move."

Tim Smith

"Hi Helfried,
First of all appreciation is due to you and fellow onliners for the very detailed and careful consideration given to the possible effects of the move. The news message you circulated was also of very high standard.
Personally, as an expert shifter and deputy run coordinator I'm in favour of the move upstairs. It would make my interaction with the experiment more pleasant and the improved working environment may indeed pay off in terms of better performance from shift crews and subdetector experts.
However, I do not feel that I am affected nearly as severely as the hard-core of central DAQ or subdetector experts."

Terry Wyatt

"To no-one's surprise I'm sure, I vote to leave the OPAL control room in RN1!
Because:

a) …
b) …
c) …

Having said that..

d) I have no doubt that control from the Green Barrack will work
e) I am quite ***disturbed*** at the ***vehemence*** of ***many online/DAQ experts*** in support of moving, and the threat of de-motivation if a decision is made to stay in RN1.
Sometimes even ***the best democracies must acknowledge their dependence on an elite group*** and .. "

Austin Ball