Control System

Kay Rehlich
DESY MVP2

- The ADC System for Diagnostics
- New Hardware and Software
- Ongoing Projects

The ADC System for Diagnostics

Hardware

Hardware is based on Multi-Channel Analog Digitizer VME boards from OMNIBYTE (FNAL development early 90th)

4 channels per board

12 bit resolution

2 MHz sampling

220 channels in use

New VME ADC board was developed in DESY (Hamburg and Zeuthen)

8 channels per board

14 bit resolution

10 MHz sampling

16 boards of prototype series are ready

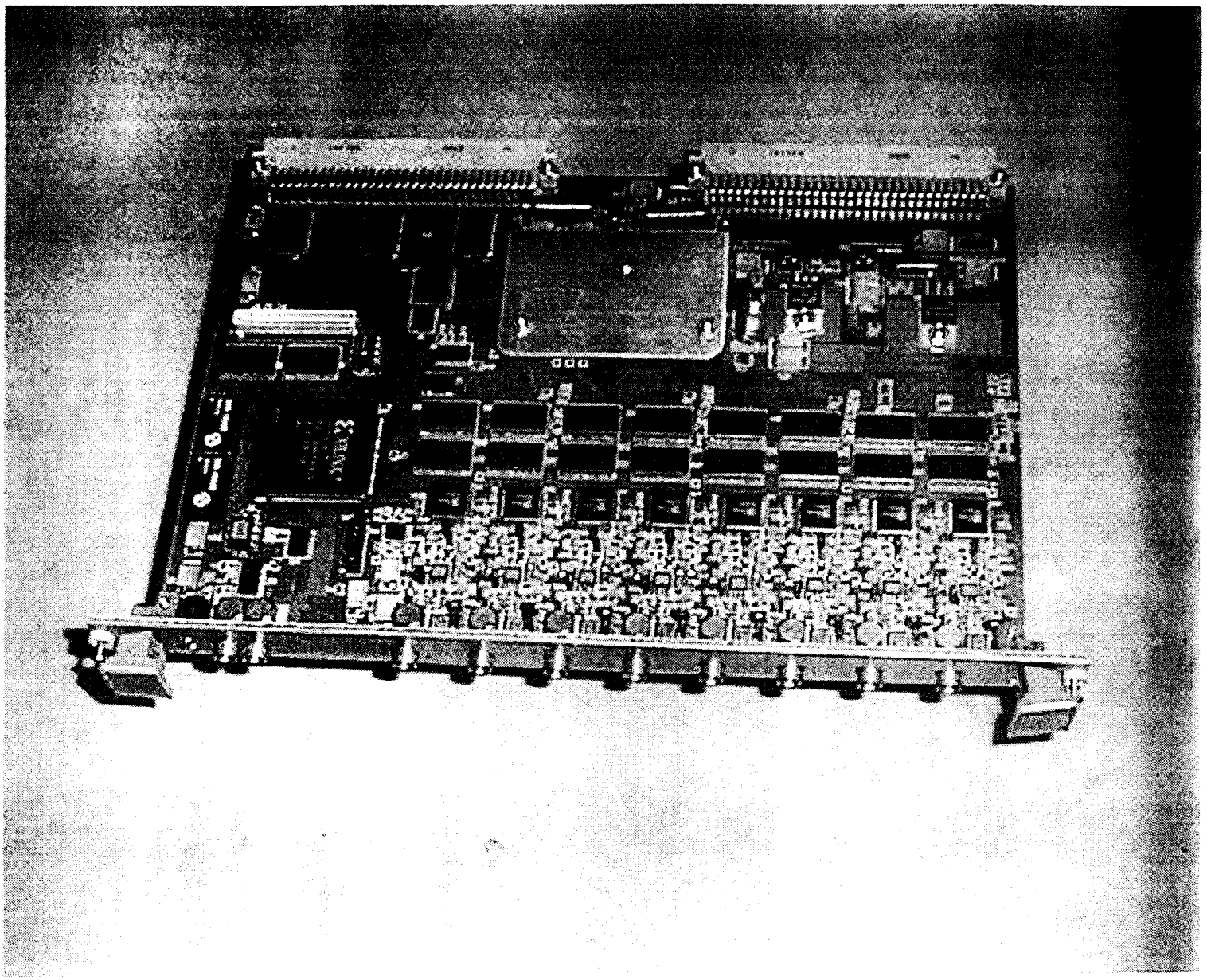
20 more boards ready in 1.2000

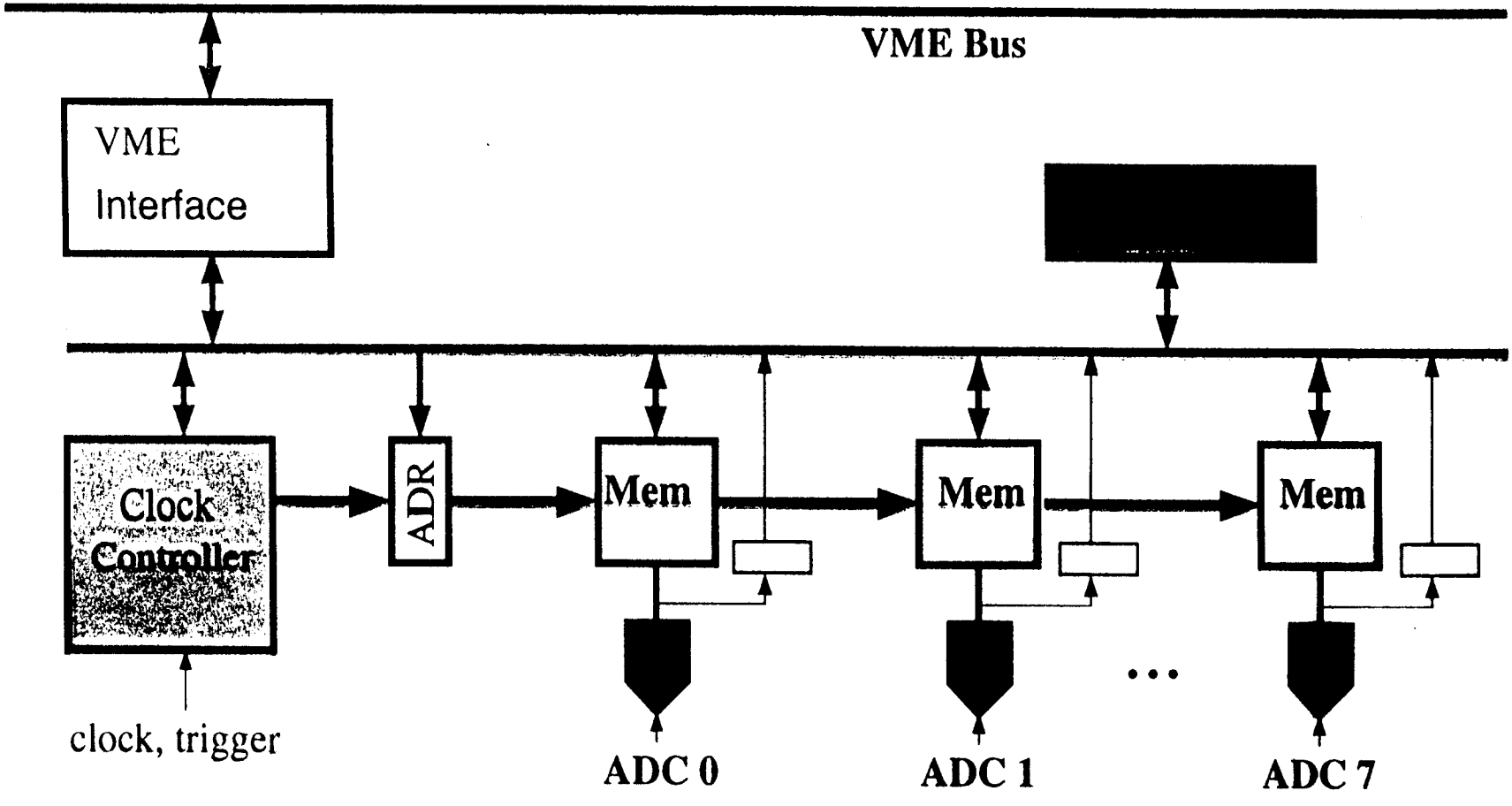
factor 3 cheaper than the old boards

1 sample per bunch (1 μs)

2048 samples per macro pulse (2ms @ 1 MHz)

32 macro pulses stored in onboard memory



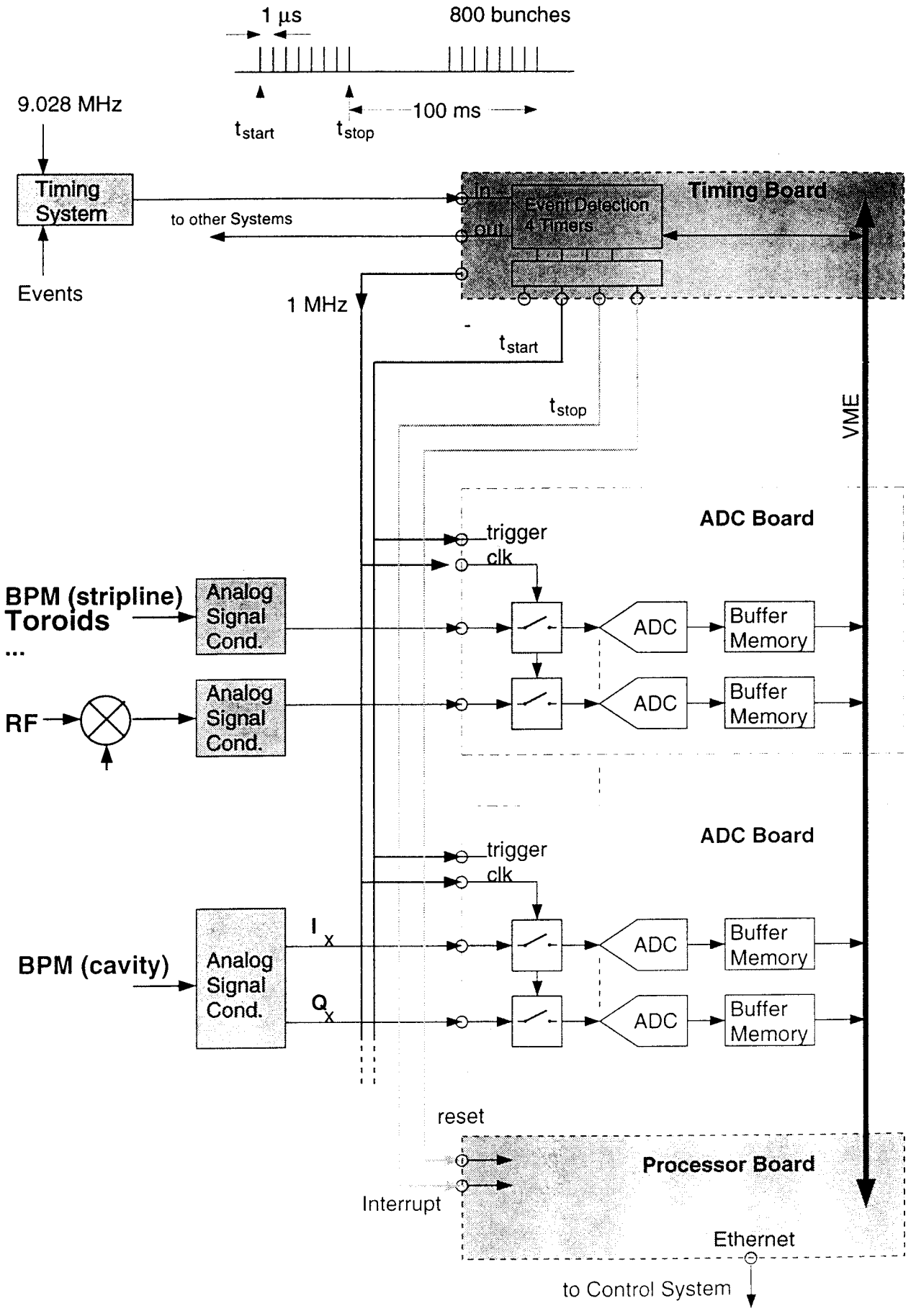


8 Channels of fast ADCs: up to 10 MHz sampling, 14 bit resolution, 128k word of memory
1 DSP port: for a link to a standard Ti C60 processor

New ADC Board Design for Diagnostics and Feedback Systems

Kay Rehlich
16. Aug. 1994

TTF Fast ADC System



The ADC System for Diagnostics

Software

Interrupt driven (1..10Hz) data processing

Identical user interface for both ADC types

3 operation modes:

"scope": normal sampling

"RF": calculates amplitude and phase from down converted signal

"BPM I/Q": calculates beam position from I and Q data of two channels

Online configuration of all parameters

Digital filter (variable parameters)

Archiving of selected samples (raw, amplitude, phase)

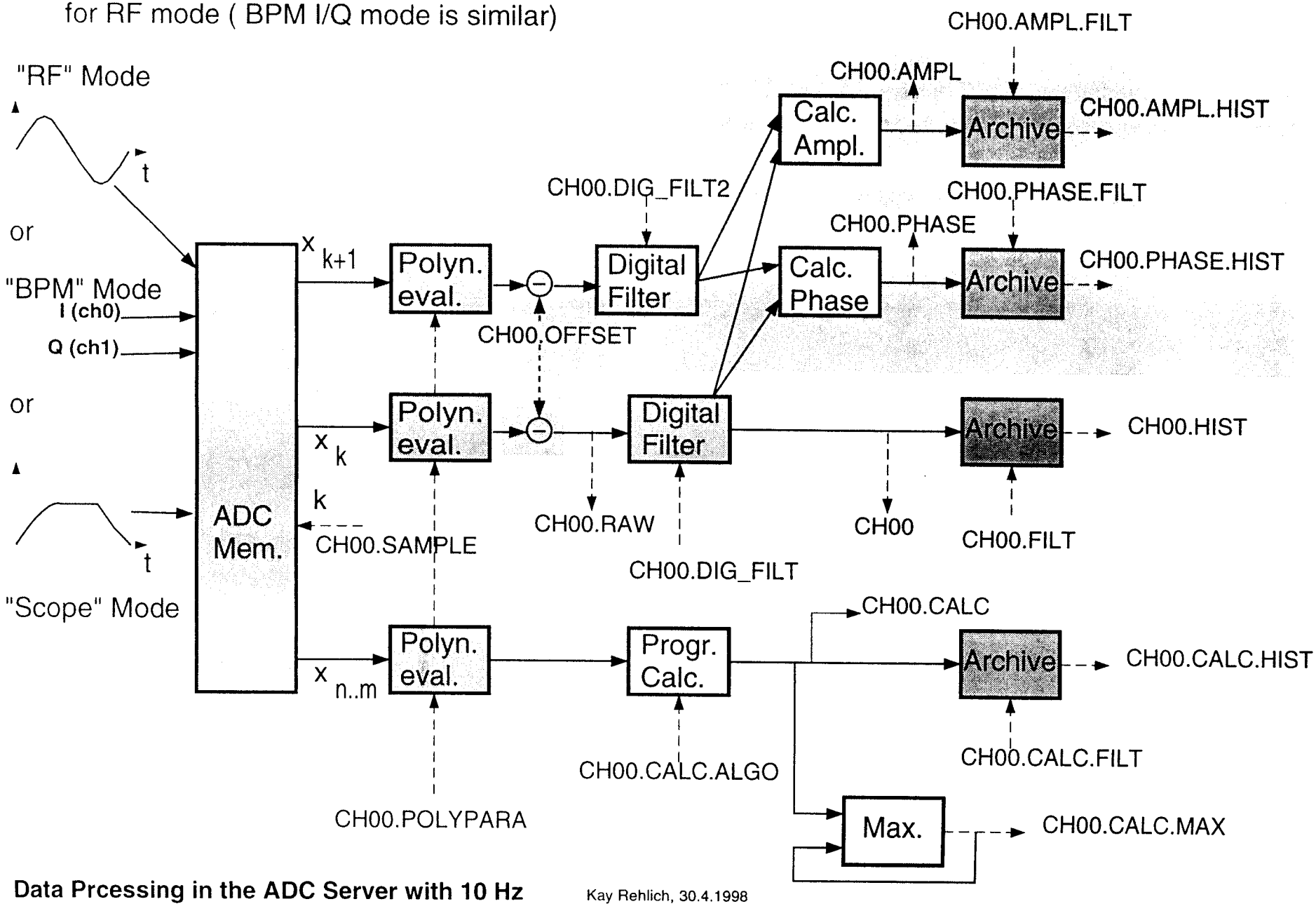
Access to the most recent 32 macro pulses

ADC memory is sychronized by a reset interrupt from the timing system NEW

Optional calculation of selected range of samples (max, min, mean, RMS, sum)

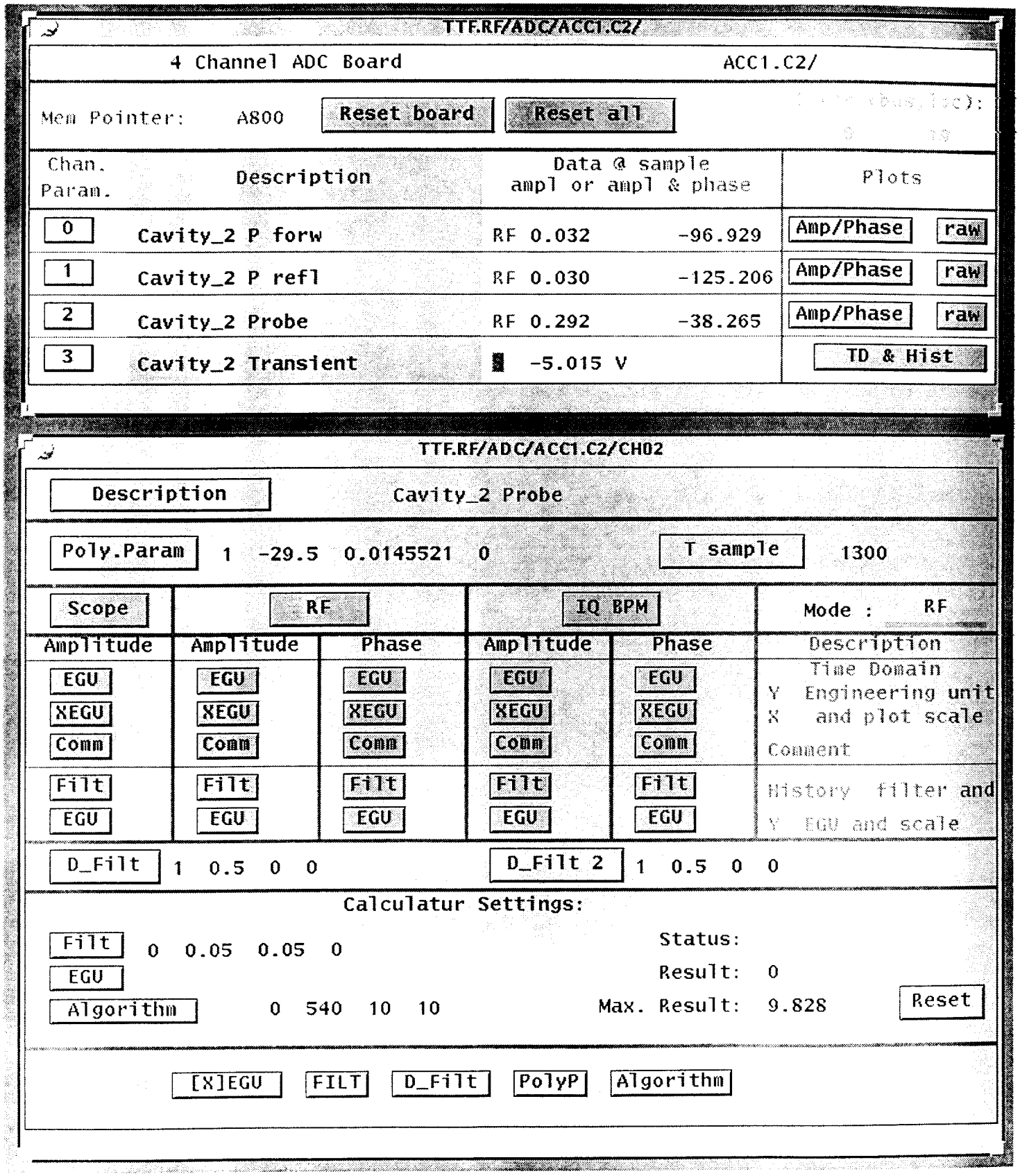
Client request of selected data ranges:

macro pulse, start sample, increment, number of samples or time range of historical data



Data Prcessing in the ADC Server with 10 Hz

Kay Rehlich, 30.4.1998


TTF.RF/ADC/ACC1.C2/
4 Channel ADC Board
ACC1.C2/
Mem Pointer: A800
Reset board
Reset all
Chan. Param.
Description
Data @ sample ampl or ampl & phase
Plots
0 Cavity_2 P forw RF 0.032 -96.929 Amp/Phase raw
1 Cavity_2 P refl RF 0.030 -125.206 Amp/Phase raw
2 Cavity_2 Probe RF 0.292 -38.265 Amp/Phase raw
3 Cavity_2 Transient -5.015 V TD & Hist
TTF.RF/ADC/ACC1.C2/CH02
Description
Cavity_2 Probe
Poly.Param 1 -29.5 0.0145521 0
T sample 1300
Scope
RF
IQ BPM
Mode : RF
Amplitude
Amplitude
Phase
Amplitude
Phase
Description
EGU
XEGU
Comm
Filt
EGU
Time Domain
Y Engineering unit
X and plot scale
Comment
History filter and
Y EGU and scale
D_Filt 1 0.5 0 0
D_Filt 2 1 0.5 0 0
Calculatur Settings:
Filt 0 0.05 0.05 0
EGU
Algorithm 0 540 10 10
Status:
Result: 0
Max. Result: 9.828
Reset
[X]EGU
FILT
D_Filt
PolyP
Algorithm

News

Frame Grabber

New frame grabber for fast printing

Triggered by beam event

0.3 sec. to create a standard raster file

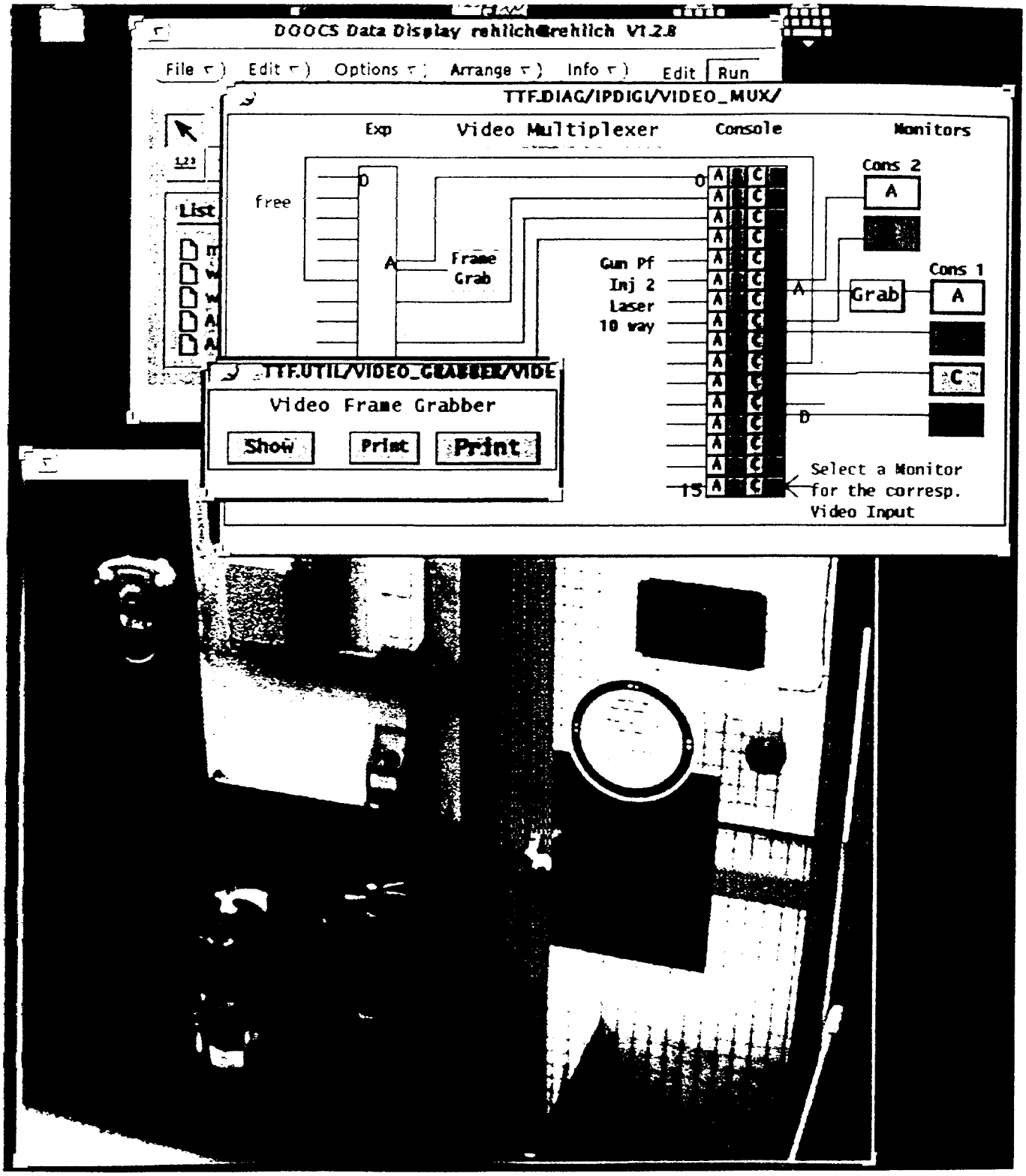
! Main video proc./OTR analysis is the INFN system !

TINE

Integration of the TINE protocol from HERA to read out the temp. BPMs of the undulator

Basic functions are part of the client library

All programs have access to the TINE controls


DOOCS Data Display rehlich@rehlich V1.2.8
File
Edit
Options
Arrange
Info
Edit
Run
TTF.DIAG/IPDIGI/VIDEO_MUX/
Exp
Video Multiplexer
Console
Monitors
free
Frame Grab
Gun Pf
Inj 2
Laser
10 way
Cons 2
Cons 1
Grab
Video Frame Grabber
Show
Print
Print
Select a Monitor for the corresp. Video Input

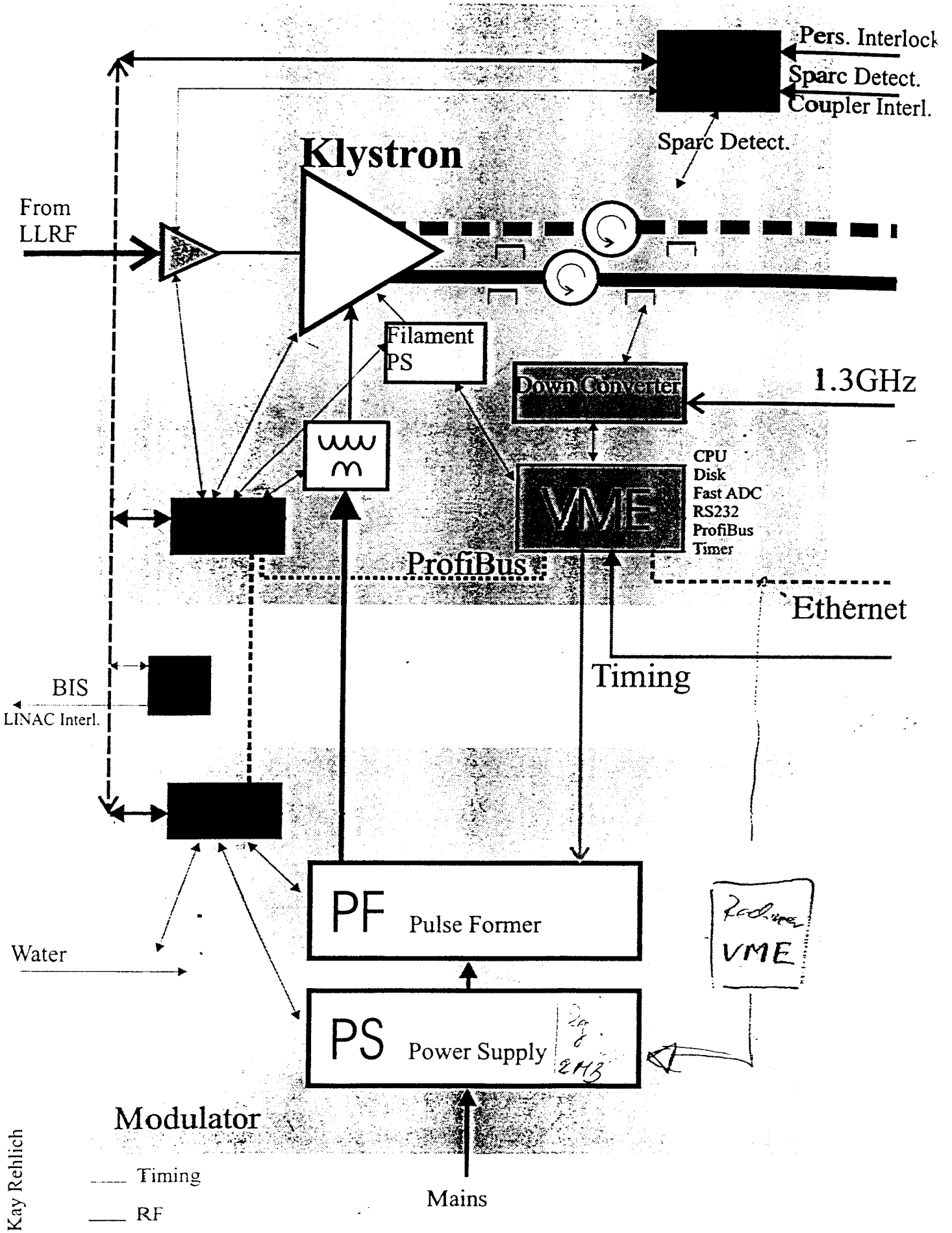
Work in Progress

New Modulator (Hardware and Software)

- PLC programs
- VME crate with Profibus, fast ADC and filament controls
- VME cate for 10 kV power supply controller

Year 2000

- Patches and operating system updates have to be done on > 80 Sun's
- FNAL klystrons and magnets: okay
- INFN OTR and view screens: okay
- Saclay/Orsay components for injector: okay
- DESY magnets: in progress
- Technical interlock: okay



Klystron/Modulator Building Blocks

Automated Procedures

Multithreaded state server library is ready

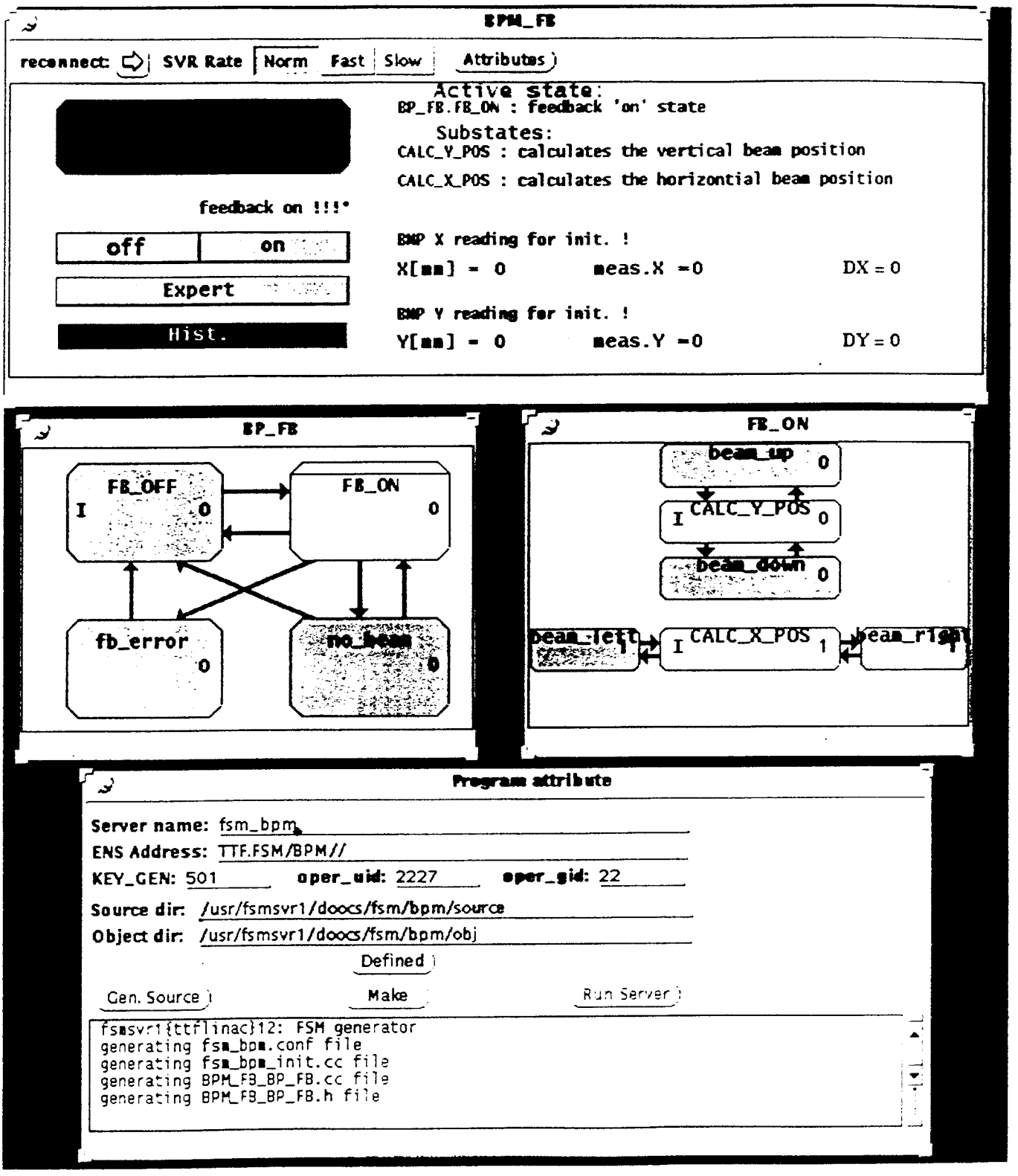
Client editor and code generator is ready

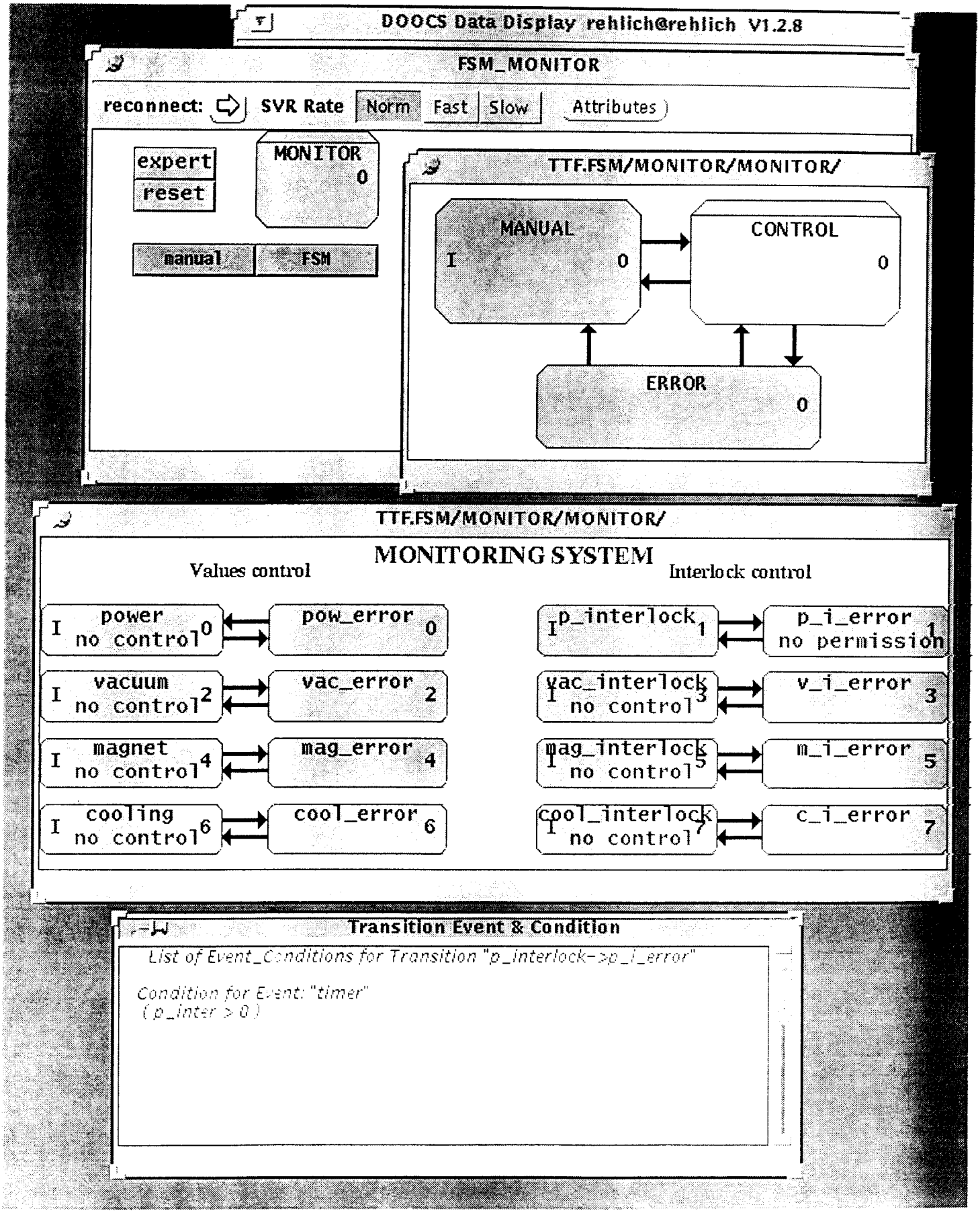
First prototypes of simple programs are ready:

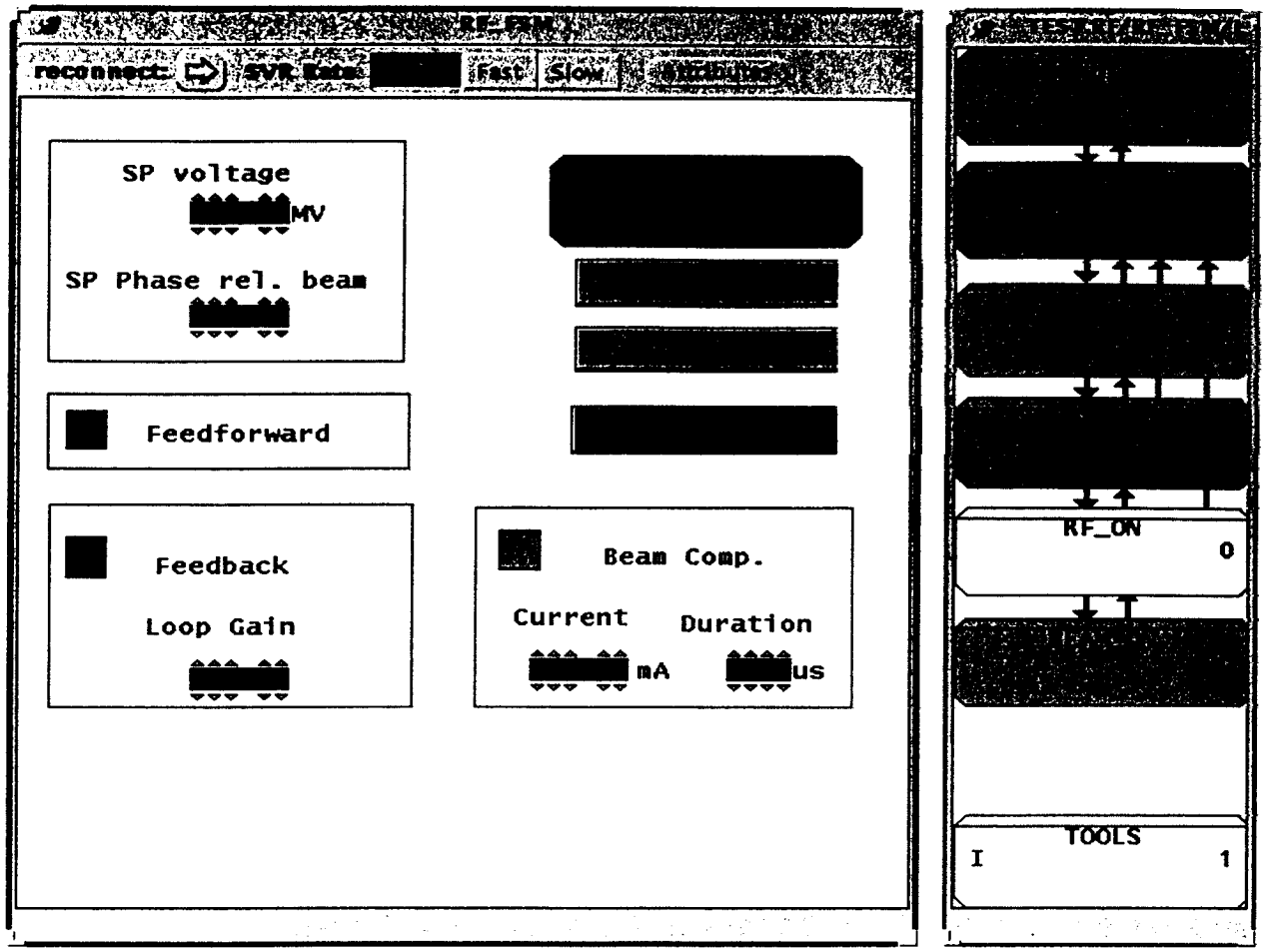
- Beam steering
- RF start-up
- Gun control

Finite State Machine design, debugging and runtime display is a fully integrated part of the DOOCS control system

Programs are running on a dedicated server


BPM_FB
reconnect:
SVR Rate
Norm
Fast
Slow
Attributes
Active state:
BP_FB.FB_ON : feedback 'on' state
Substates:
CALC_Y_POS : calculates the vertical beam position
CALC_X_POS : calculates the horizontial beam position
feedback on !!!*
off
on
Expert
Hist.
BMP X reading for init. !
X[mm] = 0
meas.X =0
DX = 0
BMP Y reading for init. !
Y[mm] = 0
meas.Y =0
DY = 0
BP_FB
FB_OFF
FB_ON
fb_error
no_beam
FB_ON
beam_up
CALC_Y_POS
beam_down
beam_left
CALC_X_POS
beam_right
Program attribute
Server name: fsm_bpm
ENS Address: TTF.FSM/BPM//
KEY_GEN: 501
oper_uid: 2227
oper_gid: 22
Source dir: /usr/fsmsvr1/doocs/fsm/bpm/source
Object dir: /usr/fsmsvr1/doocs/fsm/bpm/obj
Defined
Gen. Source
Make
Run Server
fsmsvr1{ttflinac}12: FSM generator
generating fsm_bpm.conf file
generating fsm_bpm_init.cc file
generating BPM_FB_BP_FB.cc file
generating BPM_FB_BP_FB.h file

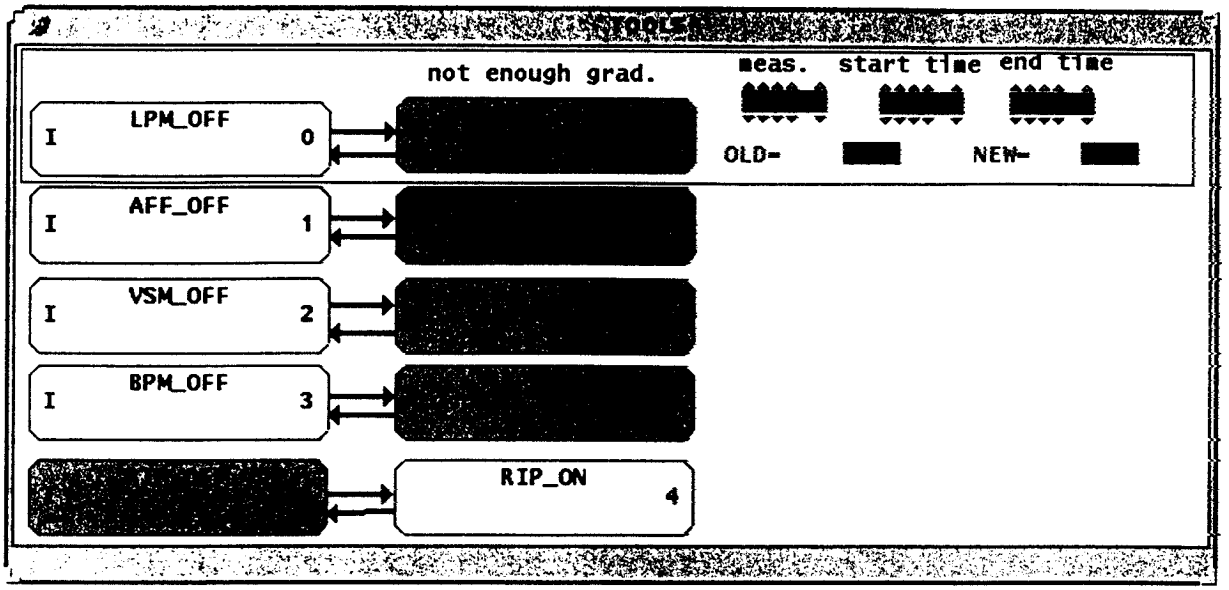

DOOCS Data Display rehlich@rehlich V1.2.8
FSM_MONITOR
reconnect:
SVR Rate
Norm
Fast
Slow
Attributes
expert
reset
MONITOR
0
manual
FSM
TTF.FSM/MONITOR/MONITOR/
MANUAL
I
0
CONTROL
0
ERROR
0
TTF.FSM/MONITOR/MONITOR/
MONITORING SYSTEM
Values control
Interlock control
power
no control
0
pow_error
0
p_interlock
1
p_i_error
no permission
1
vacuum
no control
2
vac_error
2
vac_interlock
no control
3
v_i_error
3
magnet
no control
4
mag_error
4
mag_interlock
no control
5
m_i_error
5
cooling
no control
6
cool_error
6
cool_interlock
no control
7
c_i_error
7
Transition Event & Condition
List of Event_Conditions for Transition "p_interlock->p_i_error"
Condition for Event: "timer"
(p_inter > 0)



RF_FSM is OFF - NULL

The main procedures for IDELE

start-up the RF system:
check ADC operational settings
if system is not running yet init DSPs and restore the previous
(or other desired) settings
check rotation matrizes of cavities 1-16
check setting: are they according to mode of operation?
TTF operation (straight secton) requires feedback on cavities 1-16
FEL operation (bunch compressor) requires feedback on cavities 1-8
set “SP voltage” limit according to calibration parameters



- LPM - loop phase measurement.
The tool is used to adjust the loop phase which must be set correctly before applying feedback. It must also be applied whenever the phase shifter to cavities are adjusted or the klystron voltage is changed. The loop phase tool will change the phase of the accelerating field by the delta by which the loop phase is changed. Change setpoint phase accordingly as needed.

- AFF - adaptive feedforword.
The tool is used to maximize the performance of the rf system. The feedforward table will be automatically (iterative process) be adjusted to achieve best possible agreement between measured vector-sum and set-point table. It can be used in open- and closed-loop configuration.

- BPM - beam phase measurement.
The tool measures phase of beam with respect to RF.

- VSM - vector-sum.
The tool calculate vector sum of modules separately.

-RIP - ripple.
The tool compensates the 250 kHz ripple on the measured vector-sum. It should be always applied before applying feedback and whenever the measured vector-sum or DAC signal show excessive ripple.