Multi-Channel Correlation Analyzer using Image Process

H.Sakaki, H.Yoshikawa, Y.Itoh, T.Hori, T.Asaka
SPring-8, Kamigori, Ako-gun, Hyogo, 678-12, JAPAN

1. introduction

When the Linac operate for injection, we have to supply the very stable beam which have the no fluctuation. However we are able to measure two type beam fluctuations on that. One is a beam energy fluctuation) other is a beam current fluctuation. These fluctuations are caused from many factor of the Linac components. It is a very complex problem. Therefore, we have to measure that why these beam fluctuation is happen and control it. The most convenient Linac monitor is the screen monitor which is based on video signal. And, we tried to designed the new type analyzer using it. This analyzer adopt the digital image process.

In this paper, we report the new type multi-channel correlation analyzer for the fluctuation factor, and shows one of the measurement data.

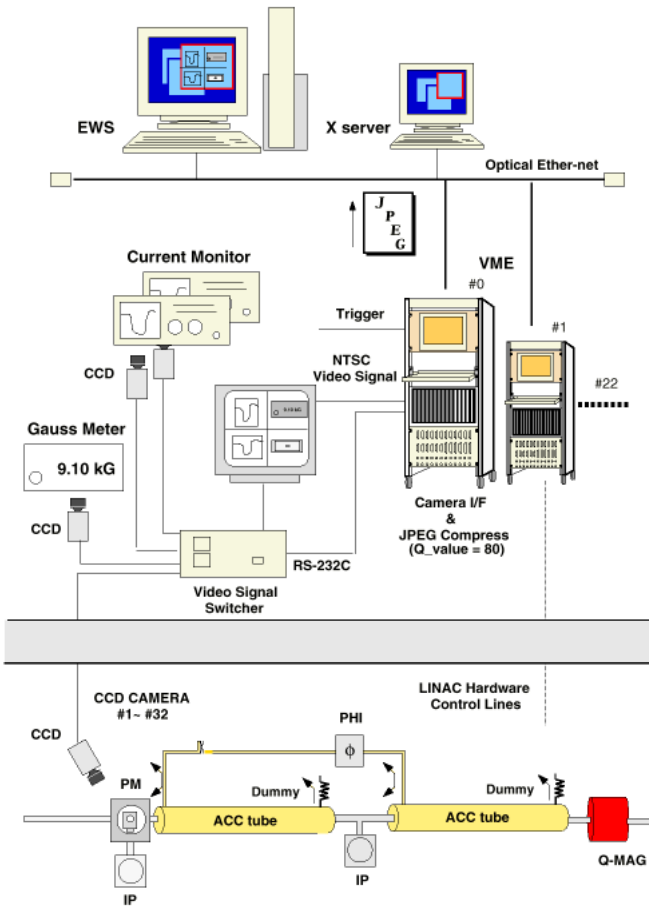

Fig. 1: Guideline of the analyzer system. It base on the distribution system.

2. Guideline of analyzer system

Figure 1 shows the guideline of system. The current monitor(OSC) and screen monitor are watched by CCD camera which made as NTSC (National Television System Committee) regulation. The video switch collects all NTSC video signal and send to the VME camera interface board. At the VME board, the video signal convert digital-value and compress JPEG (Joint Photographic Expert Group) data file. This data is send to EWS using the SCD (SPring-8 Linac Control Datagram). These system follow the Linac control concept [1].

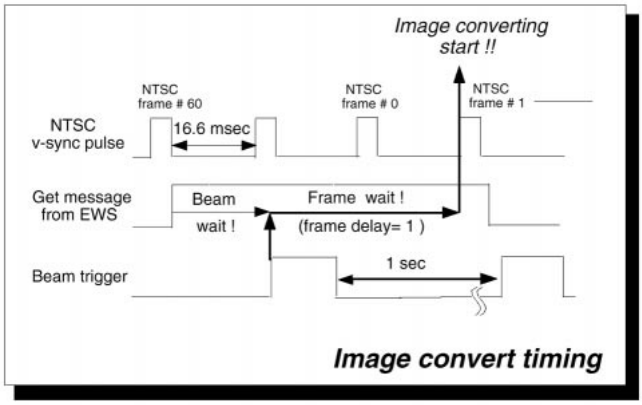

Fig. 2: Digital convert timing on VME bus. This timing coincide with the beam emission trigger.

3. Image convert timing

We designed new type image process board and made it. It works on VME bus, and the image convert timing is figure 2. First, the image measurement message is send from EWS to the board. If we want to get a few frame delay time, because of intensity saturation on the screen monitor, we can set the NTSC frame delay time. As, NTSC v-sync pulse constantly generate every 16.6msec (60Hz), the time is a multiple of 16.6msec. When the message and NTSC frame delay time coincide with the electron beam trigger, the conversion is started by the board. It times about ~ hundred m sec. Secondary, the VME board compress the getting image data into a JPEG data. It times about ~ hundred m sec, also. The JPEG Q-value is 80, and it com-

press a 491k byte image data into a 3k byte JPEG data. So it is not important to the LAN traffic. These all process are written by OS-9 on VME bus.

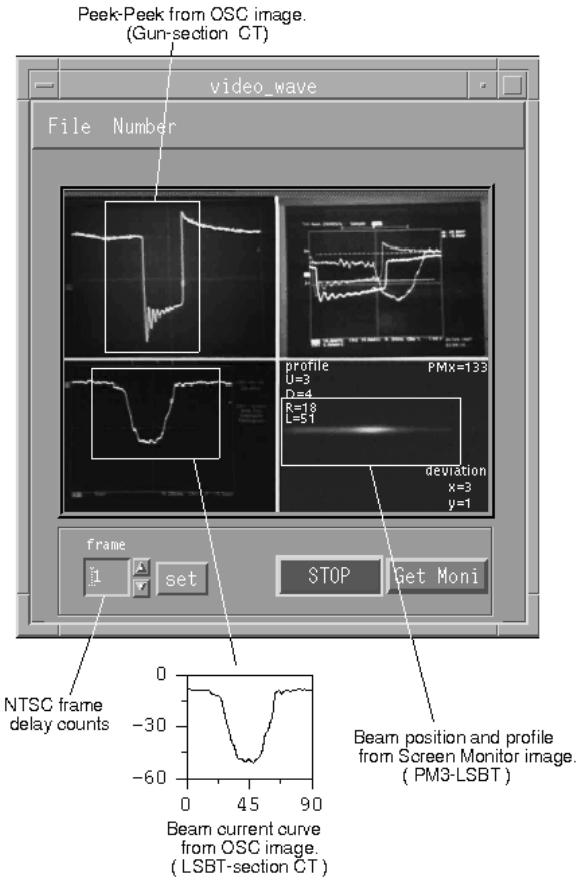

Fig. 3: Human interface of the correlation analyzer.

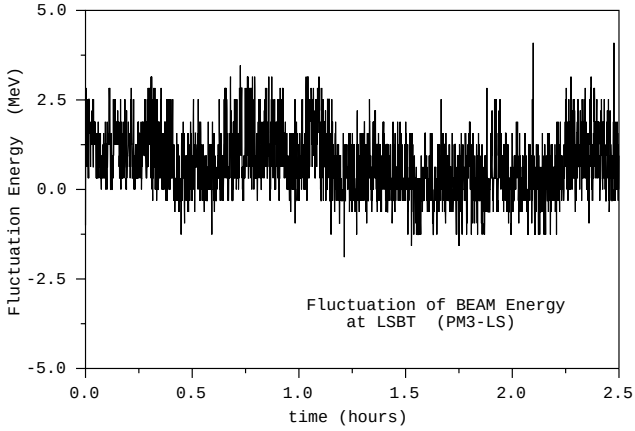

Fig. 4: Fluctuation of Beam Energy. This is established at the 1GeV bending magnet.

big fluctuations, then we can understand the beam energy also fluctuate. Figure 4 shows the measurement data of the beam energy fluctuation on PM3-LS. So that we can say that the energy fluctuation is under 0.3% at 1GeV.

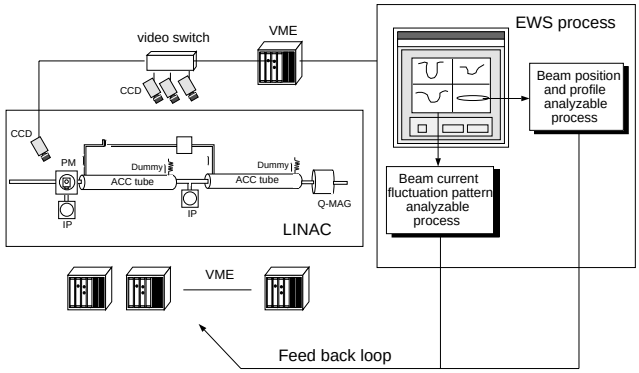

Fig. 5 Feed back loop using the analyzer.

4. Image process on EWS.

Figure 4 shows the human interface of the correlation analyzer. The image process on EWS was made from JPEG library and OSF-MOTIF. A JPEG data from the VME is analyzed using this process, and shows the digital beam position, profile. And the wave curve also analyze, and some wave data were recorded.

5. Measurement of fluctuation

At LSBT Screen Monitor (PM3-LS) which have CCD camera, we measured the beam energy fluctuation. At this monitor, the electron beam is accelerated just I GeV. The image process is recognize the highest intensity part on PM3-LS as the beam center part, and analyze it. If this part have

6. conclusion

We have designed and made the new type correlation analyzer using image process. This process is able to get many correlation of Linac component factors. Next step, we try to the Linac control for stable injection(fig 5) using this. And these next step system will be used some control theories[2][3].

References

[1] H.Sakaki et al. , Proc. of PAC'95,(1996).
[2] H.Sakaki et al., Proc. of ICALEPCS'95,(1997).
[3] H.Sakaki et al., Proc. of IWCSMSA96, (1996).