Outline of CAL Beam Test at KEK in March

Y.Fujii (KEK)

1. Purpose
   EMcal x 3
   Shower position detectors x 2
   Photo-detectors x 6

2. Participants
   1 from DESY, 6 from JINR and 23 Japanese (7 staff, 11 grad, 5 under-grad)

3. Schedule
   - Old Schedule
   - New Schedule

4. Detailed Measurement Senario
   - Detectors
   - Measurement Items

1. Purpose

a. EMcal

to establish performance of EM calorimeter modules (Tile/Strip/JINR)
- Energy measurment
- Position measurement (and shower angle measrement)
- Uniformity

b. Shower position detectors
- Position measurement with various photon detector candidates
- Uniformity

c. Photo-detectors
- examine various possibilities with shower position detectors
- APD as reference
- EBCCD
- HPD (61ch)
- HAPD (64ch)
- SiPM (from Erika)

2. Participants

N A M E		Staying Period (old)			N A M E	Staying Period
Kawagoe Kiyotomo		3/18-26, 3/10-11		**DESY**		
Takeshita Tohru		3/13-16, 3/18-25			Erika Garutti	3/2-27
Miyata Hitoshi		3/10-19, 3/23-26		**JINR**		
Kajino Fumiyoshi		3/11-12, 3/16-17			David Mjavia	3/3-27
Matsunaga Hiroyuki		not on 3/15-17			Zviadi Tsamalaidze	3/3-27
Kim Shinhong		at FNAL			Petr Evtoukhovitch	3/3-27
Kanzaki Junichi		always?			Valentin Samoilov	3/3-27
Fujii Yoshiaki		always			Walter Kallies	3/3-27
Nakajima Noriko	D	3/10-26	Niigata		Vladimir Kalinnikov	3/3-20
Allister Sanchez	D	3/10-26	Niigata			
Ono Hiroaki	M	3/10-27	Niigata			
Kishimoto Shin	M	3/10-26	Kobe			
Nakamura Ryuhei	M	3/10-26	Kobe			
Ito Saori	M	3/10-26,3/29-31	Shinshu			
Abe Tsukasa	M	3/20-27	Shinshu			
Matsumoto Takeshi	M	always?	Tsukuba			
Yamamoto Sumie	M	always?	Tsukuba			
Nagano Ai	M	always	Tsukuba			
Yamauchi Shin	M	always	Tsukuba			
Tamura Yuuki	4	3/10-26	Kobe			
Iba Sayaka	4	3/ ?- ?	Niigata			
Fujigaki Yoshimasa	4	3/ ?- ?	Niigata			
Nakamura Ryuuichi	4	always?	Tsukuba			
Nakamura Koji	4	always?	Tsukuba			

3. Schedule

Old Schedule ;
    - Belle PID until March 11 (Tur)
    - setup from March 11 (Thu)
    - beam from March 13 (Sat) to March 25 (Thu)
    - JPS from March 27 (Sat)

Monday, 3/1, D1 water leak was found.

    Most optimistic recovery time ; Beam from March 10 (Wed)
      First, Belle-PID runs until March 17 (Wed)
      Then our beam-time starts.

    For worse case ; Beam from around March 16.
   Now discussing with Belle-PID on **which runs first**.
        (DESY/JINR people will leave on March 27th)

    Situation will be clear on next Monday (3/8).

4. Detailed Measurement Senario

[I] Detectors to be tested

   1) NEM (Tile/Fiber EMcal ; 4:1)

   2) TEM (Strip Array EMcal; 4:2+2)

   3) KSMX (Fiber-readout Strip-Array)

     a) with bare-EBCCD readout

     b) with assembled-EBCCD readout

     c) with HPD readout

     d) with HAPD readout

   4) SSMX (Direct-readout Strip-Array SHmax)

     a) with APD readout

     b) with SiPM readout

   5) OEM (Organic semiconductor&solar-cell EMcal by Niigata)

   6) JEM (Tile/Fiber EMcal made by JINR/DLNP ; 2:1)
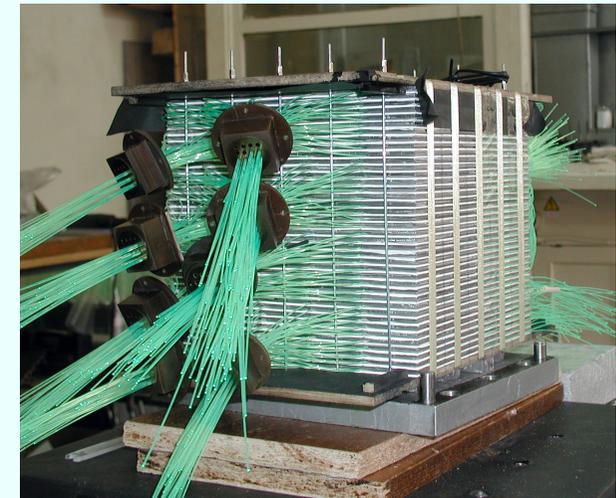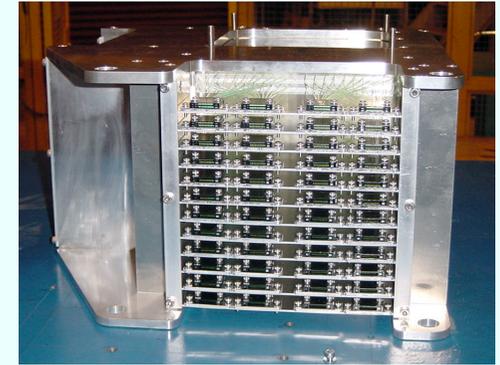
[II] Summary Table of Test Items and Estimated Shifts needed (based on old schedule)

sub-detector	NEM	TEM	KSMX	SSMX	OEM	JEM
Dedicated Shifts	7	7	5	3	1	4
1. Mu(pi) calibration	3hx2	3hx2	3hx4	3h		3h
2. Electron calib.	3h	5h				3h
3. Energy Response etc.	6h	4h	3hx4	12h	3h	6h
4. Mu(pi) Mapping	30h	30h				6h
*. Setup and tuning	8h	8h	4hx4	8h	4h	8h

[III] Time Chart of Measurements

Existed based on the old schedule. Now under re-configuration.

[IV] Various conditions for time estimation

1.Event rate and DAQ rate

  a.DAQ capability (=inclusive rate)
    T517 achieved = 10Hz average (used for T545 application)
    T545 base-line = 30Hz average (used for Kobe meeting)
    T545 stretch   = 60Hz average (if DMA available)
  b.electron rate
    T517 achieved = 1.5Hz average (3cm x 3cm T3, narrow slit)
    T545 base-line =   3Hz average (5cm x 5cm T3, wider slit)
  c.muon(MIP) rate
    T517 achieved = muon tagger -> ??% of DAQ capacity =??Hz average
    T545 baseline = MIP trigger -> 70% of DAQ capacity =20Hz average
    T545 stretch = MIP trigger -> 70% of DAQ capacity =40Hz average

2.Number of Necessary Events

  a.muon calibration = 2000muons/tile,strip =2minutes/point (base rate)
    sigma/mean(=30%) /sqrt(1000) = 1%, x2 margin
    for all tiles/strips
  b.electron calibration = 2000 electrons/tile,strip =12minutes/point
    sigma/mean(=15%) /sqrt(1000) = 0.5%, x2 margin
    only for near-center tiles/strips
  c.Energy Response = 5000 electrons/point = 30minutes/point
    E=1,2,3,4GeV
    Injection point=3(tile; module center, boundary, tile corner)
    Injection point=2(strip;module center, boundary)
  d.mapping with MIPs = 400k MIPs/point = 6hours/point (base rate)
    NEM; center, side x2(normal,fiber-hole), corner x2(on/off-WLS) =5points
    TEM; center, side, end x2, 4GeV-muon =5points

[IV] Necessary time for each module

1) NEM (Tile/Fiber EMcal)

   a.muon calib.; 7min x 25points = 3hours x twice (at beginning and at the end)

   b.elec calib.;17min x 8points = 2.5hours (central 9 towers only)

   c.energy res.;30min x 12points = 6hours

   d.MIP mapping; 6hrs x 5points =30hours

   *:setup-change+gain tuning   = 8hours

              total =53hours = 7shifts

2) TEM (Strip Array EMcal)

   a.muon calib.;11min x 14points = 2.5hours x2 (3strips at once with triple stat.)

   b.elec calib.;29min x 10points = 5hours (central 10 strips, 2strips at once)

   c.energy res.;30min x 8points = 4hours (need again without saturation)

   d.MIP mapping; 6hrs x 5points =30hours

   *:setup-change+gain tuning   = 8hours

              total =52hours = 7shifts

3) JEM (Tile/Fiber EMcal made by JINR/DLNP)

   a.muon calib.; 7min x 25points = 3hours (only at the beginning)

   b.elec calib.;17min x 8points = 2.5hours (central 9 towers only)

   c.energy res.;30min x 12points = 6hours

   d.MIP mapping; 3hrs x 3points = 9hours (just to see consistency with NEM)

   *:setup-change+gain tuning   = 8hours

              total =29hours = 4shifts

4) SSMX (Direct-readout Strip-Array SHmax)
  a) with **APD** readout (as reference)
  b) with **SiPM** readout ; both in one module.
    a.muon calib.;11min x14points = 2.5hours (Only at beginning, and 3strips at once)
    c.e/pi respo.;(30m x4)+(7m x4)= 3hours x2 (APD location and SiPM location)
    e.some additionals with SiPM = 6hours
    *:setup-change+gain tuning   = 8hours (could be struggling due to SiPM)
                    total =22hours = 3shifts

5) KSMX (Fiber-readout Strip-Array SHmax)
  a) with **bare-EBCCD** readout
    a.muon calib.; 9min x 2points = 1hour (Only at beginning, and 2strips at once)
    c.e/pi respo.;(30m x4)+(7m x4)= 3hours
    *:setup-change+gain tuning   = 4hours
                    total = 8hours = 1shift
  b) with **assembled-EBCCD** readout
    a.muon calib.; 9min x 2points = 1hour (Only at beginning, and 2strips at once)
    c.e/pi respo.;(30m x4)+(7m x4)= 3hours
    *:setup-change+gain tuning   = 4hours
                    total = 8hours = 1shift
  c) with **HAPD** readout
    a.muon calib.; 11minx14points = 2.5hours (Only at beginning, and 3strips at once)
    c.e/pi respo.;(30m x4)+(7m x4)= 2.5hours
    *:setup-change+gain tuning   = 8hours (HAPD needs tuning time)
                    total =13hours = 2shifts
  d) with **HPD** readout
    a.muon calib.; 11minx14points = 2.5hours (Only at beginning, and 3strips at once)
    c.e/pi respo.;(30m x4)+(7m x4)= 2.5hours
    *:setup-change+gain tuning   = 3hours(maybe quick to replace HAPD with HPD)
                    total = 8hours = 1shift

6) OEM (Organic Semiconductor EMcal)

c.e/pi respo.;(30m x4)+(7m x4)= 3hours

*:setup-change+gain tuning   = 4hours

total = 7hours = 1shifts