SL-MD Note 42

Instrumentation and Equipment for the Diffusion Experiment

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Summary

The intent of this note is to collect useful information concerning the operation of the instrumentation needed for a typical MD for diffusion studies.

Contents

1 Instruments not controlled via Consoles

1.1 Instruments running on Apollo

Type **Ctrl-F7** to get the normal keyboard layout under OPERA, type **Ctrl-F8** to go back.

1.1.1 Wire Scanner

Responsible:

- **Hardware**
  - J. Koopman 4876 – 5142
  - F. Ferioli 5583 – 5142 ⟨4224⟩
- **Control Software**
  - J.J. Gras 5121 – 5389 ⟨3772⟩
- **Application Software**
  - G. Crockford 5218 – 7500

Running the rotational or linear wire scanner:

- Use the *opera* account

Load first the right supercycle.

- Select Task
- SPS Control
- SPS Selection
- Supercycle
- load cycle 205

Then start wire scanner application.

- Select Task
- SPS Control
- SPS Beam Measurement
- SPS Wire Scanners

To change the attenuation for the BA4 linear wire scanner put in the nodal computer:

- IM(4) SE STEP(2)=0 for hor. plane ($8\mu m$ wire)
- IM(4) SE STEP(2)=1 for ver. plane ($34\mu m$ wire)

To change the gain for the BA4 linear wire scaner the voltage of the used PM can be changed:

- use a Apollo window (can be opened by Ctrl-F3 under OPERA)
- telnet bws40s
- login name is "bws"
- password is "bws"
- run program "hv" (high voltage)
- set2
- HV-1 (HV-2 not used)
- be careful that the voltage is in the range 800–1800

1.1.2 BOSC

Responsible:

- **Hardware**
  - H. Jakob 2973 – 3739
- **Control Software**
  - I. Milstead 8100 ⟨4381⟩
- **Application Software**
  - W. Fischer 5245
  - F. Schmidt 5245
- **Network**
  - P. Lienard 4495 ⟨4350⟩

To run BOSC for MD's use the *ether* account and type in any window:

- *boscmd*

The *Main menu* will appear in the upper left corner of the screen. For performing measurements choose the option *Measurements*. In this *Measurement* submenu one has a possibility of two different measurement types: phase space or lifetime measurement. The parameter files can be changed by going to the *Change parameter files* submenu. A postprocessing is possible in the *Analysis* submenu, to be choosen from the *Main menu*. For measurements and analysis the data will be automaticaly displayed in an extra *dataviewer* window. For archiving data choose the appropiate option in the *Measurement* submenu. For details concerning the control of BOSC including the parameters see [1].

For the crate *bosc2* a certain file must be loaded:

- *telnet bob30s*, login as bosc
- *cd /h0/DSC/bob30s*
- *cp rc.locsl.md rc.local*

- to change back to physics: *cp rc.local.norm rc.local*
- reboot the crate using *bootbi bob30s* from Apollo

To change and control the gain settings use:

- *bosc3_get_gain bo[a|b]30s channel (e.g. hor_1)*
- *bosc3_set_gain bo[a|b]30s channel (e.g. hor_1)*

There is a new possibility to init the crate *bosc2* and to change and control the gains:

- to init the crate for MD use: *bosc_init bob30s 1400 bob30s_md*
- to change back: *bosc_init bob30s 1400 bob30s*
- for internal gains:
  - *bosc_get_chan_gain bo[a|b]30s 1400 channel (e.g. hor_1)*
  - *bosc_set_chan_gain bo[a|b]30s 1400 channel (e.g. hor_1)*
- for external gains (only on *bob30s*):
  - *bosc_get_recv_gain bob30s 1400 channel (e.g. hor_1)*
  - *bosc_set_recv_gain bob30s 1400 channel (e.g. hor_1)*

The programs can be found in

- */user/milstead/bosc/appl/hpux* for HP-UX
- */user/milstead/bosc/appl/m68k* for Apollo Domain

Trouble shooting

- To stop a continuous BOSC measurement hit the **Ctrl-Q** in the *BOSCMD_programs* window.
- Network problems are common. Sometimes it helps to wait and/or logout and login again.
- It can happen that the measurement stops and in the first window one finds a continuously repeated error message about **sockets**. This is an unresolved problem with the Apollo operating system; the workstation has to be shut down!
- To reboot the BOSC creates type *bootbi bo[a|b|c]30s* in an Apollo window under *ether*.

1.2 Independent Instruments

1.2.1 Chart Recorder

Responsible:

- W. Fischer 5245
- F. Schmidt 5245

Using the Chart Recorder:

- The input for the amplifiers is in the front panel (upper row) and in the back of the rack (lower row).
- The polarity of the input signal can be changed:
  - Using a special connector (front panel input).
  - Using a switch or simply inverting the cables (rear panel).
- The amplifiers have three different types of input range:
  - From 0 to 6 Volts
  - From 0 to 10 Volts
  - From 5 to 10 Volts
- For the output there are three possibilities:
  - Total signal (upper position).
  - Reference signal (medium position).
  - Half the signal (lower position).
- The total signal and the half signal MUST have the same polarity. Make sure that you work with the proper polarity.
- There are three knobs for adjusting the output level with different precision.
- There are six independent pens. For each pen one should do the following:
  - Check carefully the polarity of the input signal. Great care must be taken with the connection of the ground.
  - Select the position of the knob that insert the filter:
    * 0 The pen is blocked.
    * A,B,C There should be a filter acting as a damper for the pen movement (not clear if it works).
  - Select the sensitivity of the chart recorder & the full scale range.
  - Check the position of the switch that multiplies the sensitivity & the full range scale by a factor hundred.
  - Select the fixed offset.
- Choose the speed of the paper. Remember that the knob has alternating active and inactive positions.

The cable could be connected in the following way:

- BCT upper row, front panel IN1 to No. 6 (red)
- PM upper row, front panel IN2 to No. 5 (blue)
- TAL IN lower row, rear panel IN2 to No. 3 (black)
- TAL UP lower row, rear panel IN3 to No. 4 (green)

1.2.2 Schottky

Responsible:

- T. Linnecar 4795 – 5187
- W. Scandale 4635

Starting up:

- RADIO FREQUENCY
- SCHOTTKY PICK-UP
- SET UP BOTH PICK–UP

Definition of filters:

- Go to SCHOTTKY PICK-UP
- SPECIAL PROGRAMS
- make sure that amplifier is on – ask operators
- FILTERS SWITCHING
- CHOOSE HORIZONTAL FILTER or CHOOSE VERTICAL FILTER
- FILTER **3** for $Q_h \approx .605$ or FILTER **4** for $Q_v \approx .538$

Hint: The local oscillator is set to 10.68MHz,
the revolution frequency appears at 10kHz=10.68MHz$-246 \cdot f_{rev}$.

1.2.3 BCT Sensitivity

Responsible:

- H. Jakob 2973 – 3739

To change the sensitivity of BOSC from MEDIUM to HIGH (and vice versa):

- in BA3, RACK 0334, change MSBCT in HSBCT (or HSBCT in MSBCT)
- in BCO, connect BCT cable in RACK 7410 either to module 6 or to module 7 for medium and high sensitivity BCT (description found in MD folder 2)

1.2.4 Cables for TAL motors and PM

Responsible:

- F. Ferioli 5583 – 5142 ⟨4224⟩

In BCO (Back room of the PCR) in RACK 7410:

- TPC and PM are found: Second module from the left (left row)
  - Dummy
  - PM BA1
  - TPCH 12102
  - TPCV 12102
- TAL 119 is found: Seventh module from the left (left row)
  - TAL I
  - TAL O
  - TAL U
  - TAL D
- Input cables for BOSC:
  - Cable 3 $\longrightarrow$ BOSC object name: avr_h_4
  - Cable 4 $\longrightarrow$ BOSC object name: avr_h_5
  - Cable 5 $\longrightarrow$ BOSC object name: avr_h_6
  - Cable 6 $\longrightarrow$ BOSC object name: avr_h_7

2 Instruments Controlled via Consoles

In our MD's for diffusion studies the following instruments are used via a console: *Fast Extraction Kicker* and *Tal119*.

2.1 Fast Extraction Kicker

Responsible:

- **General**
  - E. Carlier 5265 ⟨4337⟩
- **Kickstrength**
  - L. Ducimetiere 4638 ⟨4267⟩

Before starting to operate the Extraction Kicker, one has probably to release the interlock. Use the following NODAL command:

- IM(12) SE KDISE(1,#CH1)=0

- IM(12) SE KDISE(1,#CH2)=0
- IM(12) SE KDISE(1,#CH3)=0
- IM(12) SE KDISE(1,#CH4)=0
- IM(12) SE KDISE(1,#CH5)=0
- IM(12) SE KDISE(1,#CH6)=0

To avoid continuous kicks in coast mode a **ONE SHOT KICK** bottom has been introduced. In order to activate the kickers select on HP-UX:

- Select Task
- SPS CONTROL
- SPS EQUIPMENT CONTROL
- SPS KICKERS
- SPS FAST EXTRACTION KICKER
- Settings
- kick1
- One shot kick

For the moment use the program */user/spsabt/bin/oneshot* from a HP-UX instead of the one shot button.

The function **ONE SHOT KICK** has to be used **IN COAST ONLY!** Otherwise the kicker will assume a **STATUS 2** value. To recover from this situation, special actions have to be taken. One can see the status as variable **CycRst** using:

- SPS FAST EXTRACTION KICKER program
- Piquet
- BT equipment acess
- 1-2-3-9-4-1

To check the interlocks one can also use on NODAL:

- KICKERS
- SPS FAST/SLOW EXTRACTION
- EMERGENCY INTERLOCKS

2.2 TALS

To operate the scrapers (from NODAL):

- BEAM OBSTACLES
- SCRAPERS
- LSS1
- INDIVIDUAL MOVES

2.3 Servospill Quadrupole

Responsible:

- F. Ferioli 5583 – 5142 ⟨4224⟩
- J. Koopman 4876 – 5143
- J. Provost 4876 – 7006

To change the servospill quadrupole input (from the Apollo):

- Operations
- New Programs
- Servo Spill
- extraction must be off always
- switching on and off the servospill quadrupole is done by switching on and off "alim"
- FFT spare in the dataviewer is for outgoing signal
- FFT alim in the dataviewer is for incoming signal

2.4 Integration time for the photomultiplier PM BA1

Responsible:

- F. Ferioli 5583 – 5142 ⟨4224⟩

It is possible to change the integration time for the PMB1 from the NODAL console:

- **RU(LIB)** ⟨630⟩**LBD2**
- **1** – BA1
- **1** – horizontal
- **5** – modify
- **1** – Diviseur
- **ENTER THE NUMBER OF TURNS** (less than 100 not useful)
- **2** – START
- **0** – END
- In case of problems do:
  - **1** – INIT
  - If the programs comes back with 'EQUIPMENT ERROR' try: IM(7) DEFFAM(BBS)
  - If all fails ask operators to reboot the 'INJECTION' NORD Computer in BA1.

References

[1] W. Fischer and F. Schmidt, *Application Software for BOSC*, CERN SL/Note 93–64 (AP).

A Location of the instruments in the SPS lattice

In the following section are collected the location and the principal linear optics parameters concerning the position of relevant instruments.

A.1 Extraction Sextupoles

Extraction Sextupoles	Position [m]	β_H [m]	D_H [m]	μ_H [2π]	β_V [m]	μ_V [2π]
LSE106	190.684	97.736	2.879	0.738	21.799	0.728
LSE124	766.642	97.699	4.298	2.955	21.847	2.940
LSE206	1342.601	97.724	2.871	5.174	21.829	5.154
LSE224	1918.559	97.733	4.296	7.392	21.825	7.366
LSE406	3646.435	97.644	2.865	14.049	21.808	14.007
LSEN424	4222.383	97.740	4.288	16.268	21.891	16.220
LSE506	4798.353	97.656	2.883	18.488	21.779	18.435
LSE524	5374.311	97.757	4.293	20.707	21.898	20.648

A.2 Others

Element Name	Position [m]	β_H [m]	D_H [m]	μ_H [2π]	β_V [m]	μ_V [2π]
Servospill Quadrupole LQES.11454	461.959	59.868	2.104	1.753	39.373	1.810
Horizontal Q–Kicker MKQH.11653	524.686	64.175	–0.096	1.996	36.785	2.050
Vertical Q–Kicker MKQV.11679	535.771	33.196	–0.126	2.035	70.191	2.085
Scraper TAL.11972	627.065	53.488	–0.033	2.436	44.538	2.387
Scraper TPC.12102	670.537	21.900	0.610	2.567	97.355	2.588
Photomultiplier PM.BA1	671.952	20.275	0.663	2.577	103.889	2.591
Skew Quadrupole LQSA.12902	926.522	21.896	1.030	3.553	97.331	3.573
Horizontal Damper Kickers						
BDH.21437	1610.278	72.685	2.401	6.181	31.465	6.219
BDH.21451	1612.858	63.327	2.183	6.187	37.004	6.231
Vertical Damper Kickers						
BDV.21455	1614.578	57.556	2.037	6.191	41.164	6.238
BDV.21458	1616.298	52.159	1.891	6.196	45.696	6.245
Rotational Wire Scanner BWSD.21954	1773.531	38.620	–0.051	6.854	61.010	6.797
Linear Wire Scanner BWSL.21956	1774.117	39.998	–0.048	6.856	59.119	6.798

Element Name	Position [m]	β_H [m]	D_H [m]	μ_H [2π]	β_V [m]	μ_V [2π]
Vertical Pickup BPV.31509 (BOSC1-1)	2783.705	20.391	0.729	10.712	103.447	10.707
Horizontal Pickup BPH.31609 (BOSC1-1)	2815.703	103.361	−0.064	10.846	20.452	10.819
Vertical Pickup BPV.31709 (BOSC1-2)	2847.701	20.372	−0.152	10.958	103.311	10.953
Horizontal Pickup BPH.31809 (BOSC1-2)	2879.698	103.246	−0.452	11.092	20.517	11.065
Horizontal Pickup BPH.32009 (BOSC2)	2943.694	103.365	0.045	11.339	20.455	11.310
Vertical Pickup BPCN.32309 (BOSC2)	3039.665	20.412	2.017	11.698	103.414	11.690
High BCT BCT.41436	3913.542	74.808	2.445	15.055	30.379	15.070
Linear Wire Scanner BWS.41806	4031.586	103.086	−0.434	15.531	20.520	15.492
Medium BCT BCT.42192	4153.020	75.022	2.637	16.012	30.195	15.941
Fast Extraction Kicker MKEA.61435	6216.393	78.708	2.529	23.929	28.479	23.919

B List of preadjusted magnet settings

Element	Strength	Purpose
LSE106	+140.0A	Source of Non–Linearity
LSE124	+140.0A	
LSE206	+140.0A	
LSE224	+140.0A	
LSE406	–140.0A	
LSEN424	–140.0A	
LSE506	–140.0A	
LSE524	–140.0A	
LSFC	+23.88A	Linear Chromaticity Compensation
LSDB	–23.58A	
LSFA	+23.88A	
LSFB	+46.78A	
LSDA	–40.71A	
LQSA	+3.0A	Linear Coupling Compensation
LOF	2–3 m^{-3}	Stability
LOD	2–3 m^{-3}	Stability
LOF	–9.0 m^{-3}	Detuning Compensation
LOD	+2.7 m^{-3}	Detuning Compensation