

## START-UP SHORT

```
restart resets any earlier commands.
;setpath APPLICATIONPATH → sets the file paths to the dir. containing CoBOLD.exe.
;LoadDAnModule DAn_Standard.dll,Applicationpath loads DAn module.
LoadDAqModule DAq_TDC8HP.dll,Applicationpath → load hardware DAq module.
;LoadDAqModule DAq_TDC8PCI2.dll,Applicationpath
;LoadDAqModule DAq_HM1.dll,Applicationpath
```

```
; Parameters 0-999 used by RoentDek DAq modules
; Parameters 1000-2000 used by RoentDek DAn modules
; Do not use own parameters in this Range!!!
```

```
Parameter 1000,0 ; !!! Do not Modify this line !!! → internal DAn calibration parameter.
Parameter 2,2 ; Save TimeStamp ; 112 → 32/64 bit; 0 → aq. start
Parameter 32,8 ; number of Channels (reread during offline) → 8 channels to be read out.
Parameter 33,50 ; number of hits (reread during offline) → 50 hits / per channel to be read out.
```

### → ;DAq Parameter for TDC8HP:

```
Parameter 50,201102080000 ; check-ID (tests compatibility of CCF/DAq)
```

```
Parameter 53,1 ; display only every (n)th event (for high rate measurements) every 1 s.
```

```
Parameter 60,0 ; no file config read
Parameter 61,0x0000000 ; RisingEnable, 0 = none (e.g. 0x40 = channel 7)
Parameter 62,0x0ff1ff ; FallingEnable, Channel 1-9 on first TDC and channels 1-8 on seconds TDC
Parameter 63,0 ; TriggerEdge, 0 = falling
Parameter 64,8 ; TiggerChannel, channel 8 for trigger
Parameter 65,0 ; OutputLevel, 0 = false
Parameter 66,0 ; GroupingEnable, 1 = true = 25ps binsize and max. +-200 microseconds range
; 0 = false = 16ps binsize and max. +-32 milliseconds range
```

```
Parameter 67,0 ; AllowOverlap, 0 = false (0 = default)
Parameter 68,60 ; TriggerDeadTime, time in ns
Parameter 69,0 ; GroupRangeStart, time in ns
Parameter 70,50 ; GroupRangeEnd, time in ns. max = 200000
Parameter 71,0 ; External Clock, 0 = false (0 = default)
Parameter 72,1 ; OutputRollovers, 1 = true (1 = default)
```

```
Parameter 78,1 ; VHR (TDC8HP only: 0 = 100ps LSB, 1 = 25ps LSB)
Parameter 79,0.2 ; Group Timeout in seconds (default 0.2s)
Parameter 80,0 ; INL, 0 = false = do not read file (default)
Parameter 81,0 ; DNL, 0 = false = do not read file (default)
```

```
Parameter 86,1 ; MMXEnable (never set to 0, always 1)
Parameter 87,1 ; DMAEnable (never set to 0, always 1)
```

```
Parameter 88,7 ; time zero channel: → 7 → "so called time stamp"
; set all trigger times (see parameter 64) relative to last hit in this channel → time of first ion hit.
; please set to 0 if not used
; "Grouping" must be disabled (see parameter 66)
Parameter 89,0x00000000 ; Trigger channel mask (active only when parameter 66 is set to 0)
```

```
;Parameter 90,7
;Parameter 99,0
```

```
execute TDC8PCI2-DAq-Parameters.ccf
;execute TDC8-DAq-Parameters.ccf
;execute HM1-DAq-Parameters.ccf
```

```
; using the new command here to get all parameter information
; either from HARDWARE or File
new
```

### → ; The TDC Data:

```
UserFCall, SetDAqCoordinates, T1Ch??n, T1Ch??S??
```

Coordinate LevelInfo

32 33  
8 50

```

;////////////////////////
; Parameters for the analysis part:
;////////////////////////

```

Parameter 1050,201102080000 ; check-ID (tests compatibility of CCF/DAn)

```

Parameter 1000,2; // Parameter 1000 = Conversion Parameter for RAW data, 2 = Position in mm (standard)
Parameter 1002,0; // Parameter 1002 = Hex-Anode calculations
; // 0 = no Hex-Anode
; // 1 = Hex-Anode
Parameter 1003,2; // Parameter 1003 = for PHI conversion
; // 0 = RAD [-pi..pi]
; // 1 = RAD [0..2pi]
; // 2 = DEG [-180..180]
; // 3 = DEG [0..360]
Parameter 1004,0; // Parameter 1004 = DNL correction (GP1/HM1 only with default 0.31)
; // 0 = no DNL correction
; // 1 = Correction value (typically 0.31)
Parameter 1005,-1; // Parameter 1005 = Start of DAq Data for DAn (Start Coordinate)
; // -1 = automatic
Parameter 1006,-1; // Parameter 1006 = Start of DAn Data (Start Coordinate)
; // -1 = automatic
Parameter 1007,1; // Parameter 1007 = Analyze hit #
; //
Parameter 1010,1.29; // Parameter 1010 = pTPCalX = Time to Point calibration factor for x (mm/ns)
Parameter 1011,1.31; // Parameter 1011 = pTPCalY = Time to Point calibration factor for y (mm/ns)
Parameter 1012,1.; // Parameter 1012 = pTPCalZ = Time to Point calibration factor for z (mm/ns)
; //

```

```

parsemathcommand reset;
parsemathcommand p1013 = p1010*0.5*p20/(int(p20*1000)*0.001); // high resolution binning
parsemathcommand p1014 = p1011*0.5*p20/(int(p20*1000)*0.001); // high resolution binning
parsemathcommand p1015 = p1010*2*p20/(int(p20*1000)*0.001); // normal resolution binning
parsemathcommand p1016 = p1011*2*p20/(int(p20*1000)*0.001); // normal resolution binning
parsemathcommand p1017 = p1012*2*p20/(int(p20*1000)*0.001); // normal resolution binning
parsemathcommand p1018 = p1010*8*p20/(int(p20*1000)*0.001); // coarse resolution binning
parsemathcommand p1019 = p1011*8*p20/(int(p20*1000)*0.001); // coarse resolution binning
parsemathcommand execute;
; //

```

```

Parameter 1020,0; // Parameter 1020 = pCOx = Rotation Offset Center for x
Parameter 1021,0; // Parameter 1021 = pCOy = Rotation Offset Center for y
Parameter 1022,0; // Parameter 1022 = pRotA = Rotation Angle in mathematical direction
; // value in RAD if Parameter 1003 = 0 or 1
; // value in DEG if Parameter 1003 = 2 or 3

```

```

Parameter 1023,-1.6; // PosX-value of center for r/phi coordinates
Parameter 1024,3.0; // PosY-value of center for r/phi coordinates

```

```

Parameter 1025,0; // MCP channel for sum calculation sum = x1+x2-2*mcp, or sum = x1+x2 for para 1025 = 0
Parameter 1026,1; // channel number for x1
Parameter 1027,2; // channel number for x2
Parameter 1028,3; // channel number for y1
Parameter 1029,4; // channel number for y2
; Parameter 1030,0; // channel number for z1
; Parameter 1031,0; // channel number for z2
Parameter 1032,7; // channel number for TOF (0 if not used)

```

```

Parameter 1035,0; // Parameter 1035 = pOPx = Offset for x Point (x translation in 2D position histogram)
Parameter 1036,0; // Parameter 1036 = pOPy = Offset for y Point (y translation in 2D position histogram)
Parameter 1037,0; // Parameter 1037 = pOPw = Offset for w Point (w translation in w layer of hex anode)
Parameter 1038,0; // Parameter 1038 = pOSum = Offset for Sum/Diff calculations

```

```

Parameter 1039,1; // Anti-Moire (0 = no, 1 = yes)
Parameter 1040,1; // Reset EventCounter (1: reset after "new" command, 0: no reset)
Parameter 1041,1.; // integration time in seconds for "RealTriggerRate" coordinate
Parameter 1060,0; // Condition flag: value will appear as value in coordinate "condition1"

```

```

; DAn data:
;

```

```

Coordinate AbsoluteEventTime
Coordinate DeltaEventTime
Coordinate EventCounter
Coordinate True
Coordinate False
Coordinate ConsistencyIndicator

```

$T_2 - T_1$   
 event # since start or last event reset.  
 $\sim \sum_{i=1}^N U_i \cdot 2^{i-1}$  ;  $i = \# \text{ TDC channel}$

$$\begin{matrix} 1 - x_1 & 3 - x_1 + x_2 \\ 2 - x_2 & 5 - y_1 + x_1 \\ 4 - x_1 & 6 - y_1 + x_2 \\ 8 - y_2 & 7 - y_1 + x_1 + x_2 \end{matrix}$$

$$\begin{matrix} 9 - y_2 + x_1 & 11 - y_2 + x_1 + x_2 \\ 10 - y_2 + x_2 & 12 - y_2 + y_1 \\ 13 - y_2 + y_1 + x_1 & 14 - y_2 + y_1 + x_2 \\ 15 - y_2 + y_1 + x_2 + x_1 \end{matrix}$$

Coordinates

Coordinate PLLStatusLocked → must always be defined  
Coordinate RealTriggerRate (parameter 1041)  
Coordinate condition1

Coordinate n1,n2,n3,n4,n5,n6,n7,n8 → no. of hits in the TDC channels.

Coordinate x1,x2  
Coordinate y1,y2  
Coordinate z1,z2

Coordinate TOF

Coordinate raw\_x,raw\_y,raw\_w  
Coordinate raw\_sumx,raw\_sumy,raw\_sumw  
Coordinate raw\_sumxyw  
Coordinate raw\_diffxy

Coordinate sumx,sumy,sumw,sumxyw  
Coordinate diffxy  
Coordinate PosX,PosY  
Coordinate r,phi  
Coordinate Xuv,Yuv,Xuw,Yuw,Xvw,Yvw → only for hep-anode.  
Coordinate dX,dY

Coordinate reflection\_in\_MCP → time betw. 2nd & 1st hit in TDC channel 8 (ns)  
Coordinate reflection\_in\_x1,reflection\_in\_x2  
Coordinate reflection\_in\_y1,reflection\_in\_y2  
Coordinate reflection\_in\_z1,reflection\_in\_z2

Coordinate Const1,Const2,Const3,Const4,Const5,Const6,Const7,Const8

→ combines several coordinates in a group.  
try CoordinateSet n\_matrix\_y,T1Ch01n,T1Ch02n,T1Ch03n,T1Ch04n,T1Ch05n,T1Ch06n,T1Ch07n,T1Ch08n  
try CoordinateSet n\_matrix\_x,Const1,Const2,Const3,Const4,Const5,Const6,Const7,Const8

; definition of useful conditions

condition ConsistencyIndicator,14.5,15.5,four; true if x1,x2,y1 and y2 signals were registered  
condition sumx,46,49,sumx condition on-what, cond1, cond2, name of cond.  
condition sumy,44,46.5,sumy  
condition sumx,and,sumy,sumxy  
condition four,and,sumxy,sumplusfour  
condition diffxy,-0.5,4.0,diffs  
condition four,and,diffs,difffour  
condition TOF,-30000,-15000,tofcut1  
condition tofcut1,and,sumplusfour,tofcut  
condition r,2.5,6,radcut  
condition radcut,and,tofcut,radtof  
condition ConsistencyIndicator,11.5,13.5,two

; raw tdc data spectra number of hits

;try define1 0,32,1,T1Ch01n,,none,always,T1Ch01n  
;try define1 0,32,1,T1Ch02n,,none,always,T1Ch02n  
;try define1 0,32,1,T1Ch03n,,none,always,T1Ch03n  
;try define1 0,32,1,T1Ch04n,,none,always,T1Ch04n  
;try define1 0,32,1,T1Ch05n,,none,always,T1Ch05n  
;try define1 0,32,1,T1Ch06n,,none,always,T1Ch06n  
;try define1 0,32,1,T1Ch07n,,none,always,T1Ch07n  
;try define1 0,32,1,T1Ch08n,,none,always,T1Ch08n  
try define1 -2,40,1,ConsistencyIndicator,,none,always,ConsistencyIndicator  
;try define2 0,,9,,1,,n\_matrix\_x,,0,,8,,1,,h\_matrix\_y,,none,always,hit statistics

; raw tdc data spectra values for first hit (in channels)

;try define1 -12000,12000,1,T1Ch01S01,T1Ch01S01 (x1 raw),tofcut1,always,T1Ch01S01,,  
;try define1 -12000,12000,1,T1Ch02S01,T1Ch02S01 (x2 raw),tofcut1,always,T1Ch02S01,,  
;try define1 -12000,12000,1,T1Ch03S01,T1Ch03S01 (y1 raw),tofcut1,always,T1Ch03S01,,  
;try define1 -12000,12000,1,T1Ch04S01,T1Ch04S01 (y2 raw),tofcut1,always,T1Ch04S01,,  
;try define1 1000000,7200000,20000,T1Ch07S01,T1Ch07S01 (TOF raw),none,always,T1Ch07S01,,  
;try define1 -12000,12000,1,T1Ch08S01,T1Ch08S01 (Trigger),none,always,T1Ch08S01,,

define1 0,100000,1.0,AbsoluteEventTime,AbsoluteEventTime [s],none,tofcut,timmy,,  
define1 0,500000,1.0,AbsoluteEventTime,AbsoluteEventTime [s],none,always,AbsoluteTime,,  
define1 0,0.005,0.00001,DeltaEventTime,DeltaEventTime [s],none,always,Time between Events,,true  
define1 0,10000000,1000,EventCounter,,none,always,EventCounter  
define1 0,100000,10,RealTriggerRate,,none,always,RealTriggerRate,true

"try" → same as w/o try but with try gives no warning in case of an error. → simply ignores the error & continues.

Spectra  
0 →

```
;;define2 0,100000,100,AbsoluteEventTime,,0,100000,100,RealTriggerRate,,none,always,Rate (time)
;;define2 0,1000000,1000,EventCounter,,0,100000,100,RealTriggerRate,,none,always,Rate (eventnumber)
```

```
; optional 1D spectra definition "raw time", only calibrated for para 1010-1012 = 1
```

```
3 define1 -25,50,0.5,x1,ch1 'Position' [mm],none,four,ch1 (mm),,
4 define1 -25,50,0.5,x2,ch2 'Position' [mm],none,four,ch2 (mm),,
5 define1 -25,50,0.5,y1,ch3 'Position' [mm],none,four,ch3 (mm),,
6 define1 -25,50,0.5,y2,ch4 'Position' [mm],none,four,ch4 (mm),,
```

```
; calibrated spectra definitions
```

```
7 define1 0,70,0.2,sumx,,none,four,sumx (ns)
8 define1 -90000,-5000,500,TOF,,none,four,tof
;define1 0,70,0.03,sumx,,none,difffour,sumx (ns)
9 define1 0,70,0.2,sumy,,none,four,sumy (ns)
10 define1 -50,50,0.05,diffxy,diffxy Time [ns],none,four,diffxy (ns),,
```

```
; Position spectra definitions (mm = ns for para 1010-1012 = 1)
```

```
11 define1 -30,30,0.2,PosX,PosX [mm],none,tofcut,PosX (mm) clean,, ;changed bin from p1015
12 define1 -30,30,0.2,PosY,PosY [mm],none,tofcut,PosY (mm) clean,, ;"
;define2 -100,100,p1013,PosX,PosX [mm],-100,100,p1014,PosY,PosY [mm],none,always,PosX/PosY coarse (mm),true
;define2 -100,100,p1013,PosX,PosX [mm],-100,100,p1014,PosY,PosY [mm],none,four,PosX/PosY coarse clean (mm)
;define2 -100,100,p1015,PosX,PosX [mm],-100,100,p1016,PosY,PosY [mm],none,always,PosX/PosY (mm),true
;define2 -100,100,p1015,PosX,PosX [mm],-100,100,p1016,PosY,PosY [mm],none,four,PosX/PosY clean (mm)-1 ; clean_hit ; changed bin
from p1015,p1016
;define2 -100,100,p1015,PosX,PosX [mm],-100,100,p1016,PosY,PosY [mm],none,four,PosX/PosY clean (mm)-2 ; clean_hit ; changed bin
from p1015,p1016
13 define2 -20,20,0.1,PosX,PosX [mm],-20,20,0.1,PosY,PosY [mm],none,sumplusfour,PosX/PosY 0.1mm bins (mm)
;define2 -20,20,0.1,PosX,PosX [mm],-20,20,0.1,PosY,PosY [mm],none,four,PosX/PosY 0.1mm bins (mm)
14 define2 -20,20,0.1,PosX,PosX [mm],-20,20,0.1,PosY,PosY [mm],none,tofcut,PosX/PosY 0.1mm bins (mm)
15 define2 -10,5,0.25,PosX,PosX [mm],-5,10,0.25,PosY,PosY [mm],none,tofcut,PosX/PosY 0.25mm bin clean (mm)
16 define2 -10,5,0.1,PosX,PosX [mm],-5,10,0.1,PosY,PosY [mm],none,tofcut, X/Y 0.1mm bin clean (mm)
17 define1 -200,200,2,phi,phi [ deg],none,radtof,phi using center = (2,1),,
18 define2 -30,30,0.25,PosX,PosX [mm],-30,30,0.25,PosY,PosY [mm],none,sumplusfour,PosX/PosY 0.25mm bin clean (mm)
19 define2 -10,10,0.25,PosX,PosX [mm],-13,7,0.25,PosY,PosY [mm],none,four,PosX/PosY 0.25mm bin clean (mm)
20 definemulti mult, 11,12,8,15
21 ; control spectra
22 define2 -30,30,p1013,PosX,PosX [mm],0,40,1,sumx,sumx [ns],none,four,PosX/sumx (clean_hit)
23 define2 -30,30,p1014,PosY,PosY [mm],0,40,1,sumy,sumy [ns],none,four,PosY/sumy (clean_hit)
24 define2 -180,180,2,phi,phi[deg],0,7,0.1,r,radius[mm],none,tofcut,r v phi
```

```
; begin data acquisition
start
```

```
v 8
u 1s
```

```
;show status
```