%%%%%%%%%%%%%% Reading CO2 recording %%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%

%read the co2 files

studypath='D:\work\CVR\subject16';

subject='3TB0460';

date='05152013';

%outputfilename

outputfilename=[studypath filesep 'Physio\_' subject '\_' date '.txt'];

%times on timer1

zero\_on\_timer1='00:16:03'; % Take the (1st BOLD dynamic Start time - 25 sec) and input here

end\_on\_timer1='00:27:38'; % Take the (last BOLD dynamic end time + 2min 10sec) and input here

%for CO2 recording timing

co2\_filename=[studypath filesep subject '.txt'];

syn\_co2\_timer1='00:00:00'; % Timer synchronisation data : timer

syn\_co2\_co2='11:09:30'; % Timer synchronisation data : CO2 monitor

file\_start\_time='12:11:19'; % Time stamp from CO2 file

co2\_additional\_shift=+12; % sampling tubing delay = +12

co2\_sampling\_rate=48;

co2\_rate\_rate=1;

count=0; % count for each co2

clear co2curve % co2curve is the etCO2 value in real sampling

count\_rate=0;

clear co2rate

fid=fopen(co2\_filename);

line=fgetl(fid);

while ischar(line)

if line(1)=='c'

 count=count+1;

 co2curve(count)=str2num(line(2:3)); % read 'c90'

 line=fgetl(fid);

elseif line(1)=='-'

 count\_rate=count\_rate+1;

 co2rate(count\_rate)=str2num(line(7:9)); % read '-E\*091'

 line=fgetl(fid);

else

 line=fgetl(fid);

end

end

fclose(fid);

co2length=length(co2curve);

co2length\_rate=length(co2rate);

%sort out the timing

clear co2\_timeindex;

clear co2\_value;

count=0;

num\_file\_start\_time=str2num(file\_start\_time(1:2))\*60\*60+str2num(file\_start\_time(4:5))\*60+str2num(file\_start\_time(7:8));

num\_syn\_co2\_co2=str2num(syn\_co2\_co2(1:2))\*60\*60+str2num(syn\_co2\_co2(4:5))\*60+str2num(syn\_co2\_co2(7:8));

num\_syn\_co2\_timer1=str2num(syn\_co2\_timer1(1:2))\*60\*60+str2num(syn\_co2\_timer1(4:5))\*60+str2num(syn\_co2\_timer1(7:8));

num\_zero\_on\_timer1=str2num(zero\_on\_timer1(1:2))\*60\*60+str2num(zero\_on\_timer1(4:5))\*60+str2num(zero\_on\_timer1(7:8));

num\_end\_on\_timer1=str2num(end\_on\_timer1(1:2))\*60\*60+str2num(end\_on\_timer1(4:5))\*60+str2num(end\_on\_timer1(7:8));

firstpoint=round(((num\_zero\_on\_timer1-num\_syn\_co2\_timer1)-(num\_file\_start\_time-num\_syn\_co2\_co2)+co2\_additional\_shift)\*co2\_sampling\_rate);

count=count+1; % get the point, an accumulated number, when experiment starts

co2\_timeindex(count)=0;

co2\_value(count)=mean(co2curve(firstpoint-2:firstpoint+2)); % get 5 point average

tempindex=firstpoint+5;

while (tempindex+2)<co2length % caculate co2 averaged value and corresponding time

 count=count+1;

 co2\_timeindex(count)=co2\_timeindex(count-1)+5/co2\_sampling\_rate;

 co2\_value(count)=mean(co2curve(tempindex-2:tempindex+2));

 tempindex=tempindex+5;

end

%deal with breathing rate

clear co2\_timeindex\_rate;

clear co2\_value\_rate;

count\_rate=0;

firstpoint\_rate=round(((num\_zero\_on\_timer1-num\_syn\_co2\_timer1)-(num\_file\_start\_time-num\_syn\_co2\_co2)+co2\_additional\_shift)\*co2\_rate\_rate);

count\_rate=count\_rate+1;

co2\_timeindex\_rate(count\_rate)=0;

co2\_value\_rate(count\_rate)=co2rate(firstpoint\_rate);

tempindex=firstpoint\_rate+1;

while tempindex<co2length\_rate

 count\_rate=count\_rate+1;

 co2\_timeindex\_rate(count\_rate)=co2\_timeindex\_rate(count\_rate-1)+1/co2\_rate\_rate;

 co2\_value\_rate(count\_rate)=co2rate(tempindex);

 tempindex=tempindex+1;

end

exp\_end\_timeindex=num\_end\_on\_timer1-num\_zero\_on\_timer1;

figure;plot(co2\_timeindex,co2\_value);

fileid=fopen(outputfilename,'w');

fprintf(fileid,'co2\_value\_time ,co2\_value ,br\_time ,br');

fprintf(fileid,'\n');

co2length=length(co2\_timeindex);

co2length\_rate=length(co2\_timeindex\_rate);

maxlength=max([co2length,co2length\_rate]);

tempco2time=co2\_timeindex(1);

tempco2ratetime=co2\_timeindex\_rate(1);

i=1;

while (i<=maxlength)||(tempco2time<=exp\_end\_timeindex)||(tempco2ratetime<=exp\_end\_timeindex)

 if (i<=co2length)&&(tempco2time<=exp\_end\_timeindex)

 fprintf(fileid,'%1.2f ,',co2\_timeindex(i));

 fprintf(fileid,'%1.2f ,',co2\_value(i));

 else

 fprintf(fileid,' ,');

 fprintf(fileid,' ,');

 end

 if (i<=co2length\_rate)&&(tempco2ratetime<=exp\_end\_timeindex)

 fprintf(fileid,'%1.2f ,',co2\_timeindex\_rate(i));

 fprintf(fileid,'%1.2f ,',co2\_value\_rate(i));

 else

 fprintf(fileid,' ,');

 fprintf(fileid,' ,');

 end

 fprintf(fileid,'\n');

 i=i+1;

 if (i<=co2length)

 tempco2time=co2\_timeindex(i);

 else

 tempco2time=9999999999;

 end

 if (i<=co2length\_rate)

 tempco2ratetime=co2\_timeindex\_rate(i);

 else

 tempco2ratetime=9999999999;

 end

end

fclose('all');

%%%%%%%%%%%%%% End of reading CO2 recording %%%%%%%%%%%%%%%%%%%%%%%%%%%%%

%%%%%%%%%%%%%% Extracting EtCO2 %%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%

clear all;

f=[studypath filesep 'peaks2pick.txt'];

outf=[cwd filesep 'etco2.txt'];

t=1.37; % time of first CO2 peak

fid=fopen(f); %open file

d=textscan(fid,'%f%f'); % cell array created

fclose(fid);

x=[d{1} d{2}]; % convert to matrix

% find peaks

maxtime(1)=t;

index = find(x(:,1)==t); % find corres index

maxco2 = x(index,2); % found corres peak co2 value

i=t;

j = 2;

%i follows time, j follows the index of o/p array. incrementing

%i by 4secs in every iteration (or use old maxtime) and j by 1 (array element)

lastTime = max(x(:,1)); % find last time point

while(i+2<lastTime)

 index2=find((x(:,1)>=i+2)&(x(:,1)<=i+6)); % gets indices of all time points between these limits : eg., array [4 5 6 7 8]

 x1 = x(index2,:); %create new array (both columns) of only relevant indices x1=[4 8; 5 2; 6 12;..]

 maxco2(j)=max(x1(:,2)); % finds max co2 within those indices: 16.

 index3=min(find(x1(:,2)==maxco2(j))); % finds 1st occuring index of these values: 5 in new array (x1)

 maxtime(j)=x1(index3,1); % finds corresponding time

 i=maxtime(j); % new starting point is time for previous peak

 j=j+1; %increment j by 1 index

end

fid=fopen('etco2.txt','w'); % creates text file: w opens in write mode

fprintf(fid,'Time\t CO2:\n');

fprintf(fid, '%f\t%f\n',[maxtime;maxco2]);

fclose(fid);

%%%%%%%%%%%%%% End of extracting EtCO2 %%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%