TWatchDog

Introduction

Marek Otevrel

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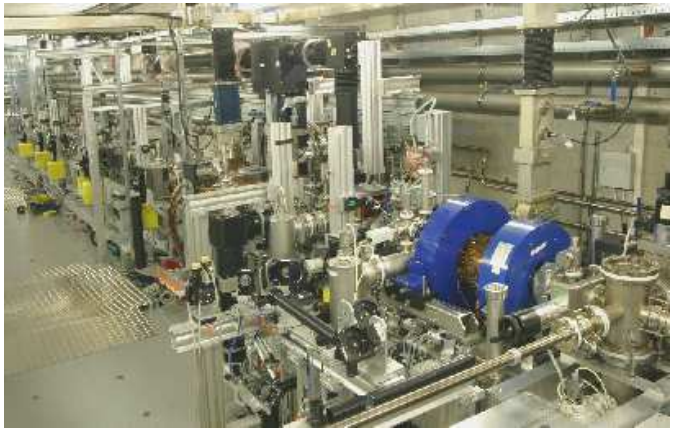

HELMHOLTZ ASSOCIATION

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DESY

TWatchDog purpose:

Manage the Temperature setpoint to to keep the gun overheated and at acceptable reflection during both ramp and steady state.

TWatchDog: *User Guide*

Launch TWatchDog:

1) Open MATLAB

2) Type **otetool twatch**

-> Alternatively: go to: *doocs/measure/Conditioning/_MatlabScripts*
run *twatchdog_2013.m*

Starting & Stopping:

-> Simply press the corresponding button

Switch modes:

TWatchDog: *Basic Idea*

The "Virtual Operator" Strategy:

-> Try to "algorithmize" the operator's actions as well as possible.

-> Based on run experience

Realization:

-> Monitor essential quantities

-> Define **when** *(Conditions) and* **how** *(Actions) the code should act.*

Consequent Advantages & Disadvantages:

+ Minimum inputs, no calibration needed.

+ Deals with any (slow) resonance temperature shift.

- Can not predict and test all possible situations

-> Potentially dangerous

TWatchDog: *Realization*

Important quantities:

-> Reflection [%%]

-> Temperature Setpoint [ºC]

-> Temperature Readback [ºC]

-> Auxiliary quantities:

Reflected-Power-Slope
Feed forward – logical
SP-Pforw
RF pulse length [µs]

TWatchDog: *Parameters*

Independent parameter: MinRefl [%%]

-> Specified by the user

-> Meaning: Kind of a goal (desired) reflection

Other important parameters and dependents:

-> MaxRefl [%%] = MinRefl+Constant**:** *Maximum tolerable reflection.*
-> CriticalRefl [%%] = *MinRefl*0.7: Dangerously low reflection*
-> time for rush actions
-> T0 [C]: *Initial temperature (will be set at the beginning of the ramp.)*
-> T00 [C]: *Absolute minimum (T will never be set lower than this.)*
-> T01 [C]: *Absolute maximum (T will never be set higher than this.)*

Other parameters like steps, delays, tolerances etc…

TWatchDog: *Actions & Conditions*

Action 1: Increase/Decrease SP-Temp if and only if the temperature readback is not too far from its setpoint

-> Condition:

a) Reflection < MinRefl → *Increase SP-T*

b) Reflection > MaxRefl → *Decrease SP-T*

TWatchDog: *Actions & Conditions*

Action 2: Increase SP-Temp even if the readback is not matching the setpont that well.

-> Condition:

a) Reflection < CriticalRefl & Slope positive → *Increase SP-T !*

b) Reflection < CriticalRefl & Slope negative → ***Increase SP-T !!!***

TWatchDog: *Actions & Conditions*

Action 3*: Increase SP-Temp even if the readback is far above the setpoint

-> Condition:

Reflection is above but fairly close to MinRefl but the T-SP is far below the T-RB (there is a formula, details beyond the scope of the lecture) ->

-> means that the current T-SP is very probably too low.

→ *Increase SP-T to* average(*T-RB,T-SP*)

*This condition is frequently fulfilled when ramping fast.

TWatchDog: *Modes*

Ramping mode:

-> Used when ramping (changing average power)

-> *MaxRefl = MinRefl+35*

Static mode:

-> Used for stable run (average power constant)

-> *MaxRefl = MinRefl+8*

TWatchDog: *The Static Mode*

The static mode has two phases:

1) Finding the goal temperature (T-goal):

First it "squeezes" the acceptable reflection interval (by setting MaxRefl = MinRefl +8 (instead of 35)) and then it measures 10 times the T-RB when Reflection is (very) close to the MinRefl.

2) Setting the goal temperature:

Slowly approaching the T-goal. T-goal is kept monitored and eventually the actualized value approached.

TWatchDog: *Next Steps*

-> Automatic recognizing the Ramping &Static modes

-> Implement to SMAC (?)

HAVE FUN!

… but hopefully not too much ;-)

TWatchDog: *Condition 3 – The formula*

Action 3*: Increase SP-Temp even if the readback is far above the setpoint

-> Condition:

Reflection is above but fairly close to MinRefl but the T-SP is far below the T-RB ->
-> means that the current T-SP is very probably too low.

→ *Increase SP-T to* average(*T-RB,T-SP*)

K2 = 0.8;
K1 = 1 + K2*(Trb-Tsp);

Reflection < K1*MinRefl