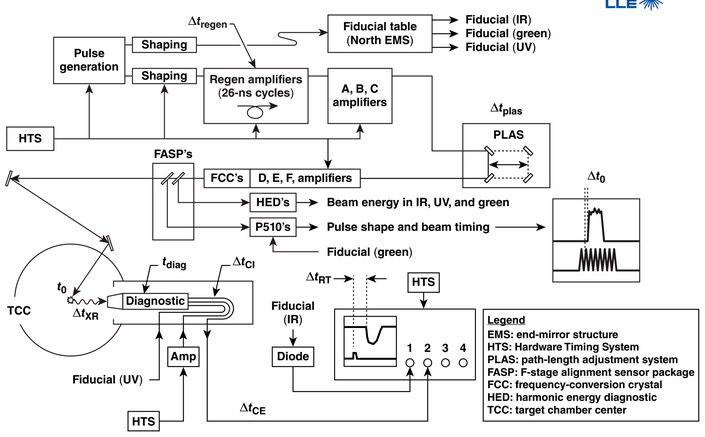
Target Diagnostic Timing Manager

W. J. ARMSTRONG, J. C. PUTH, and R. ROMBAUT

University of Rochester, Laboratory for Laser Energetics

Omega diagnostic timing



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TDTM features summary

- Previous procedures used two Excel spreadsheets and manually repetitive, error-prone steps to determine the proper timing; TDTM will replace the spreadsheets with a single automated application, controlled by the LLE Software Development Group
- Phase I has replaced the delay calculator spreadsheet, establishing proper timing for diagnostics to acquire the expected data on a target shot (2014)
- Phase II has replaced the separate diagnostic timing check (DTC) application, incorporating its functions and all timing data acquisition and archiving functions into TDTM (2015)
- Phase III will replace the timing checker spreadsheet, automating some timing-analysis functions and creating a mechanism for easy storage and retrieval of data
- TDTM has been designed to automate repetitive steps and use database tables to facilitate retrieval of historical information

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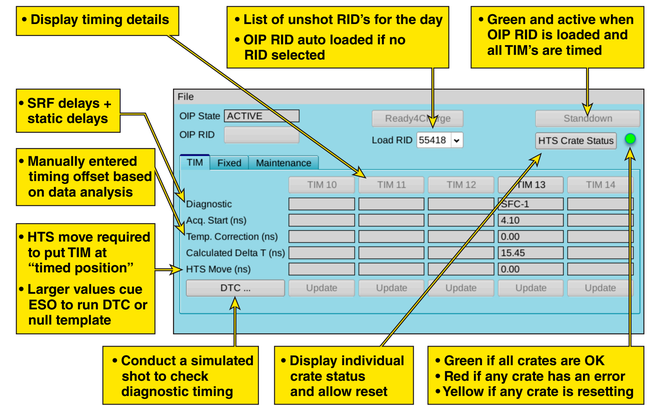
TDTM TIM diagnostics GUI



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Diagnostic timing—HTS, fiducial, and t_0

- Diagnostic trigger timing is controlled by the HTS and measured against a fiber-delivered laser fiducial pulse
- The HTS delivers synchronized trigger pulses to the OMEGA laser–driver line, amplifiers, and all target diagnostics
  - ten-inch manipulator (TIM)-based diagnostic triggers are either transistor–transistor logic (TTL) or amplified TTL pulses at t_0, t_0 – 10 s, or 0.1 Hz (continuous, every 10 s)
  - trigger delays are variable in 100-ps increments
- The fiducial laser pulse is generated from the OMEGA seed pulse to ensure stable timing
  - the fiducial pulse consists of eight peaks spaced at 548 ps
  - 1ω, 2ω, and 4ω (1054, 527, and 263 nm) fiducial signals are available
  - the timing monitor system uses the IR fiducial, directed into a photodiode, to generate oscilloscope reference pulses at a fixed time relative to t_0
- The nominal time that the main OMEGA drive beams reach the target is defined as t_0
  - beam timing can be varied by shifting driver timing or changing the path length of individual beams
  - time changes are specified in nanoseconds relative to t_0
  - the P510 streak cameras measure on-shot pulse timing versus the green fiducial

G10102

Requirements

- Measure firing times of TIM-based diagnostics to less than 100 ps
- Store configuration data in easy to update database
- Archive timing monitor scope traces in hierarchical data format (HDF) files
- Collect and archive data on-shot
- Allow for test firing of diagnostics without "burning a shot"
- Experimental system operator (ESO) client to accurately time diagnostics using TDTM
- Provide a visual display (e.g., plot/chart) of the scope traces from test fires and target shots
- Provide a dedicated client for TIM-based HTS channels

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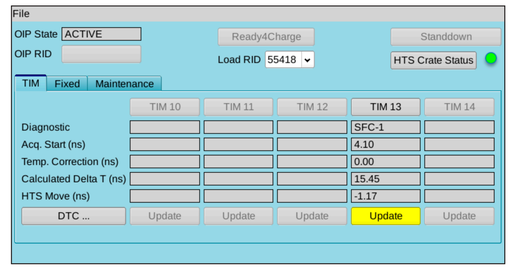
TDTM is operational on OMEGA and EP

- Calculates the expected Δt and HTS delay values
- Selects the correct timing parameters based on SRF configuration
- Calculates HTS delay values correctly and updates them as desired



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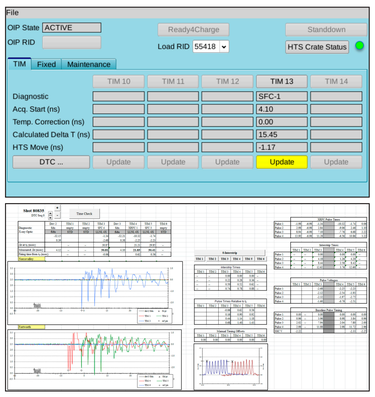
Current timing-management tools

- Target diagnostic timing manager (TDTM) stores reference information, calculates, and lists desired Δt for each diagnostic
- Values are calculated for each diagnostic as configured in the shot request form (SRF)
- The timing checker spreadsheet displays timing monitor scope traces, measures the on-shot Δt, and compares it to the calculated value



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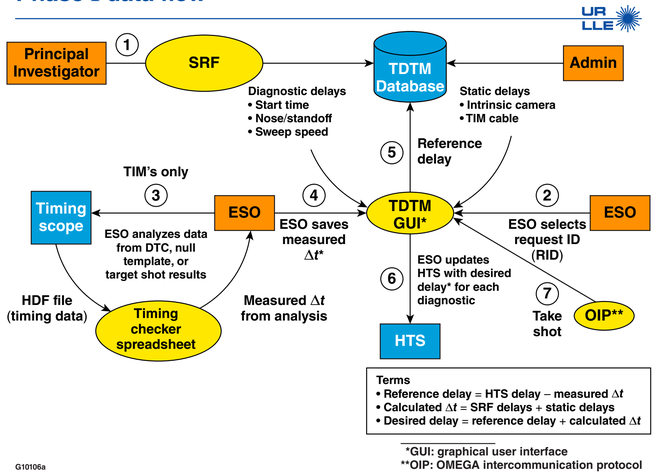
Phase I data flow



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TDTM software status

- Phase I is operational at the OMEGA and OMEGA EP ESO stations and has replaced the weekly "delay calculator" spreadsheet
- Phase II has replaced the "autolaunch" script and "DTC" application
- Phase III (future) will automatically update the "measured Δt" value from the timing scope and replace the "timing checker" spreadsheet
- A Microsoft-Access application has been created for Omega XOPS to maintain administrative tables in the database
- SRF diagnostic setup sheets have been changed to include standoff distances, in cm, for all timed diagnostics for TDTM x-ray time-of-flight calculations
- Updates are database driven; no code changes are required

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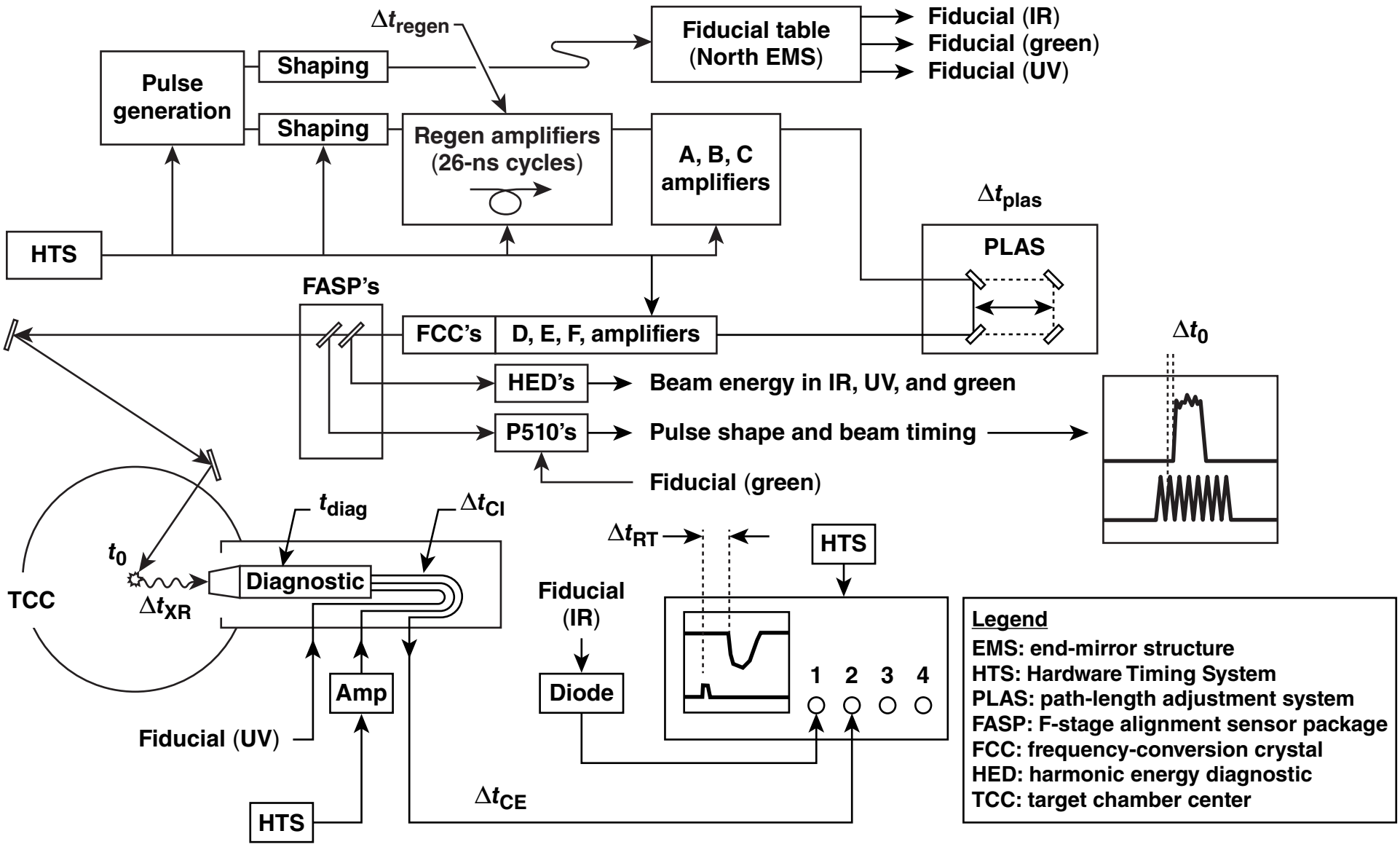
Omega diagnostic timing



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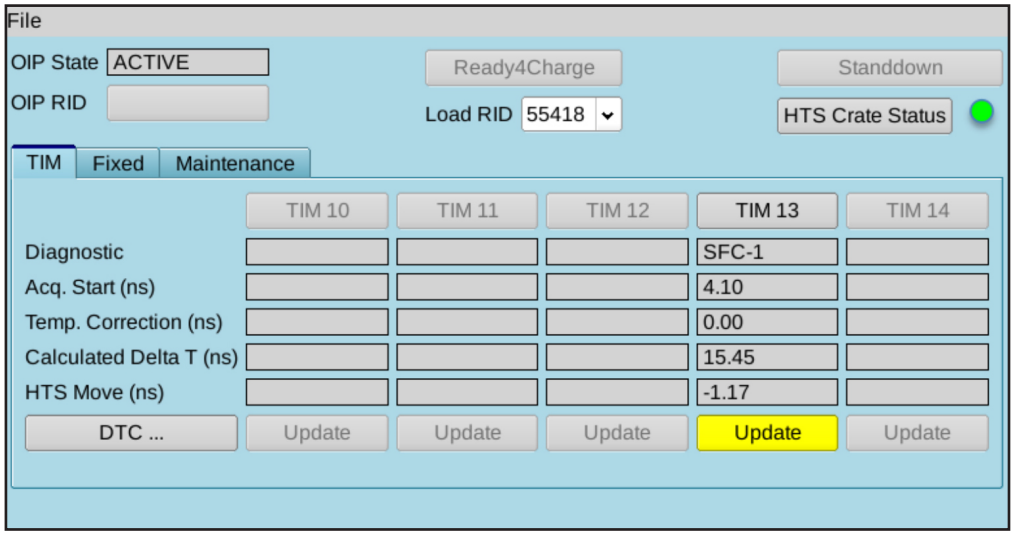

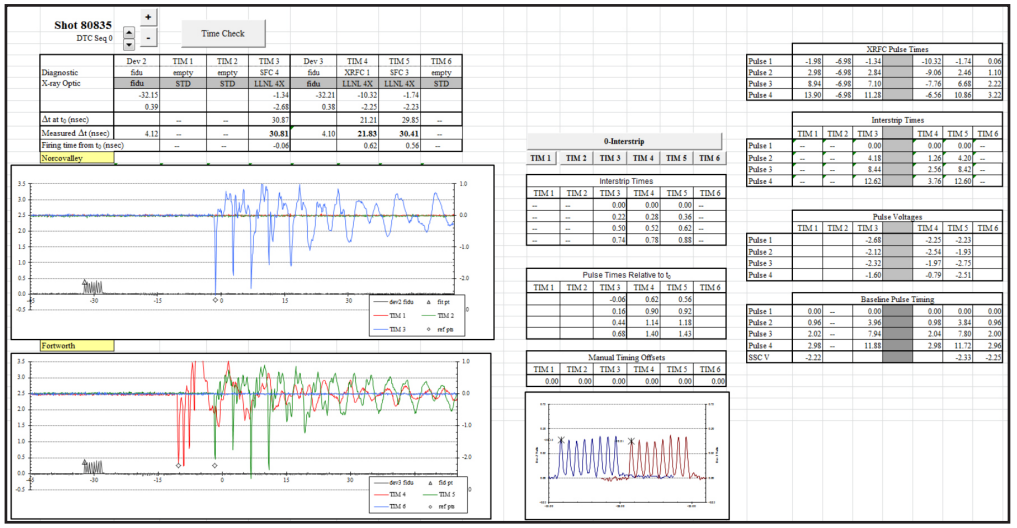

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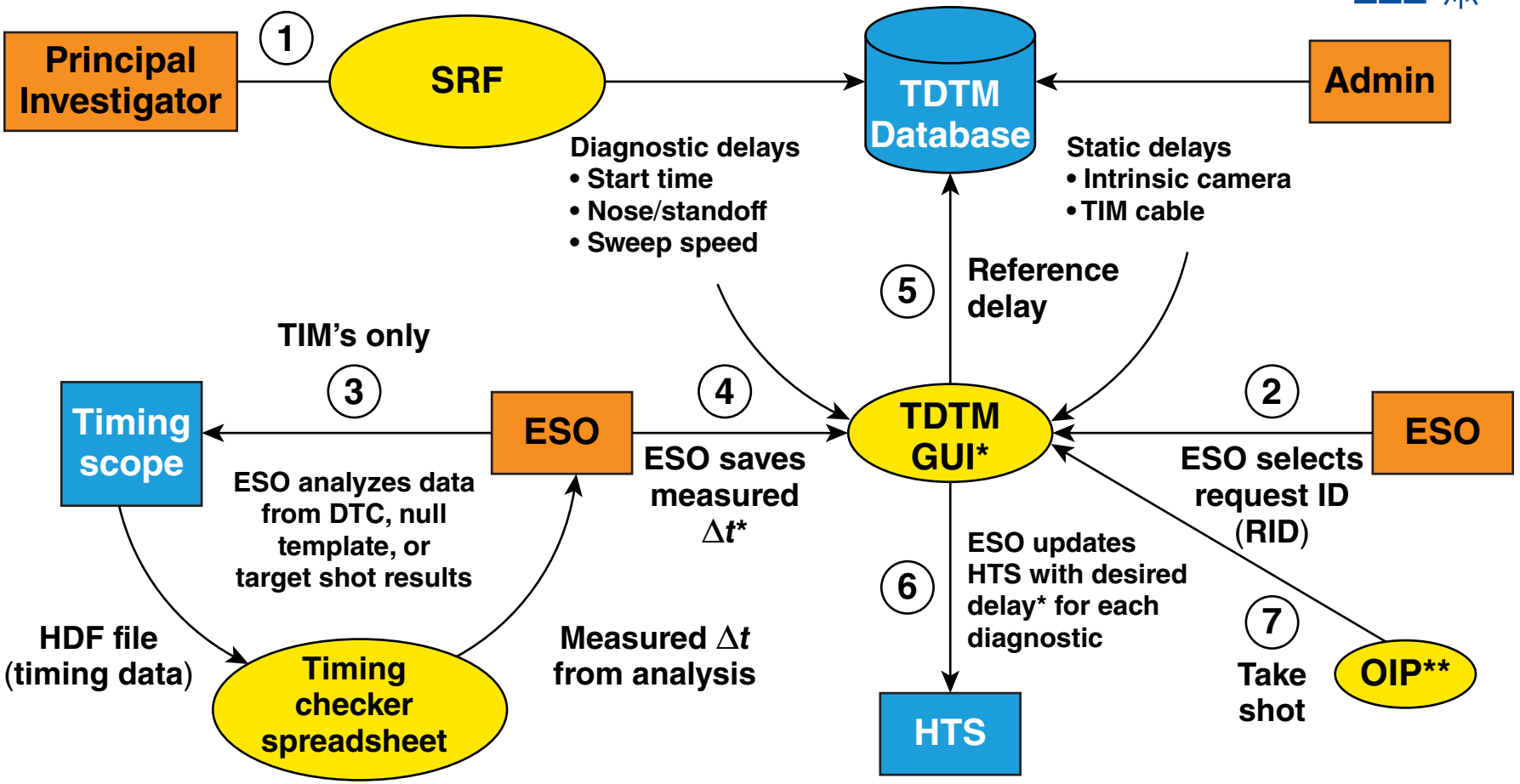

Terms
- Reference delay = HTS delay − measured Δt
- Calculated Δt = SRF delays + static delays
- Desired delay = reference delay + calculated Δt

*GUI: graphical user interface
**OIP: OMEGA intercommunication protocol

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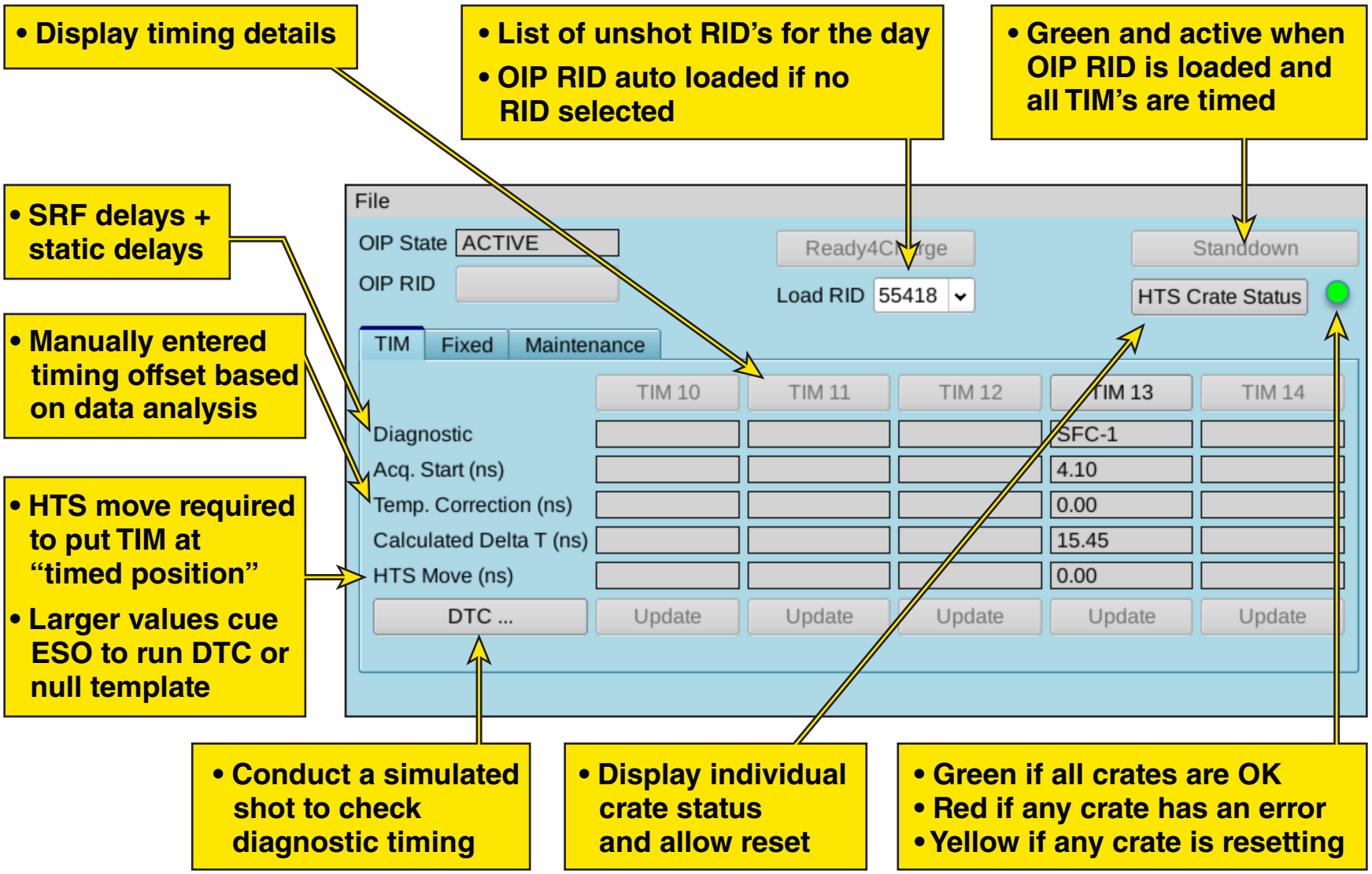

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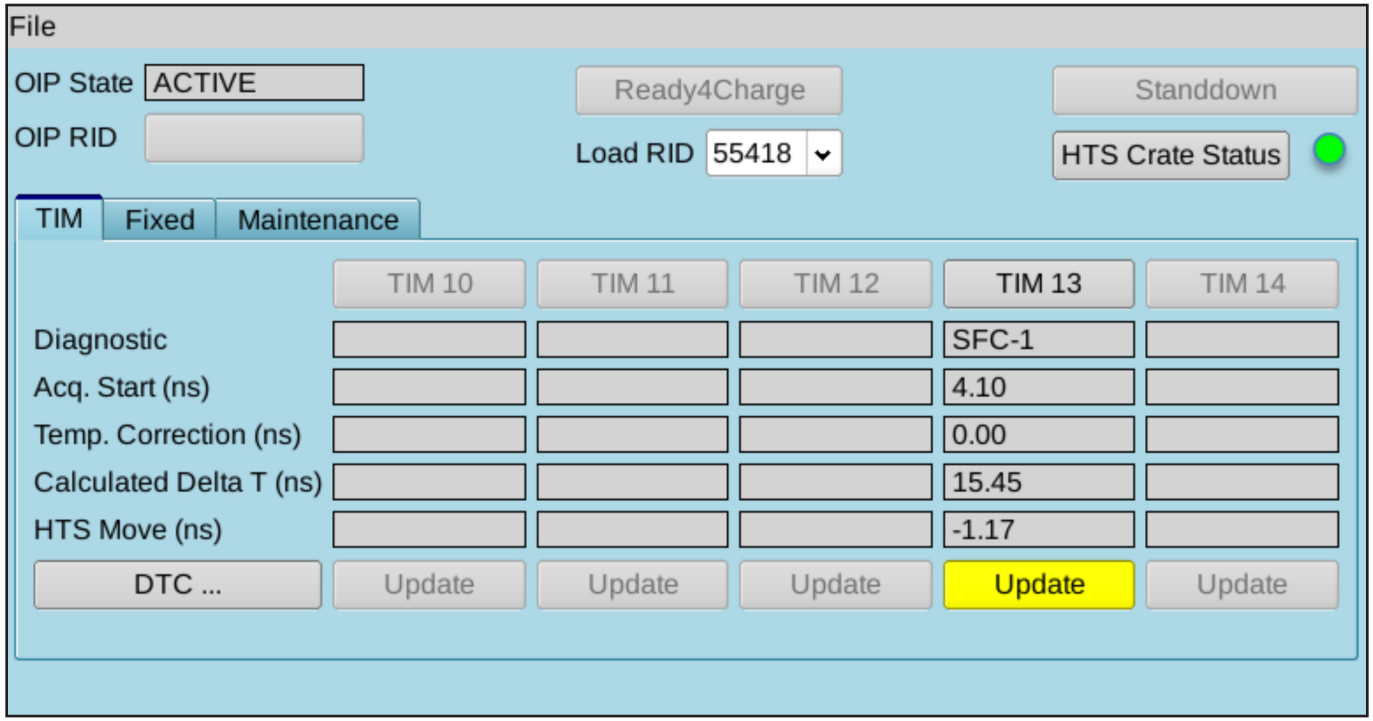

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