

# Zippy (literally and figuratively) New Features of Local-History Data-Storage

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# LH are Super for Monitoring, for Diagnostics, u.s.w. !

- Set-up your own Archive-System!
- Simple Configuration! z.B. Adding new properties
- Lots of Data Types: integers, floats, arrays, ...
- Tweak your Tolerances
- Limited only by the disk space Ulla gives you
- Use Archive Viewer GUIs – data from Local and Central storage are integrated “under the hood”
- Use API’s to add data-displays to your favorite GUI!

# Everything's Super!

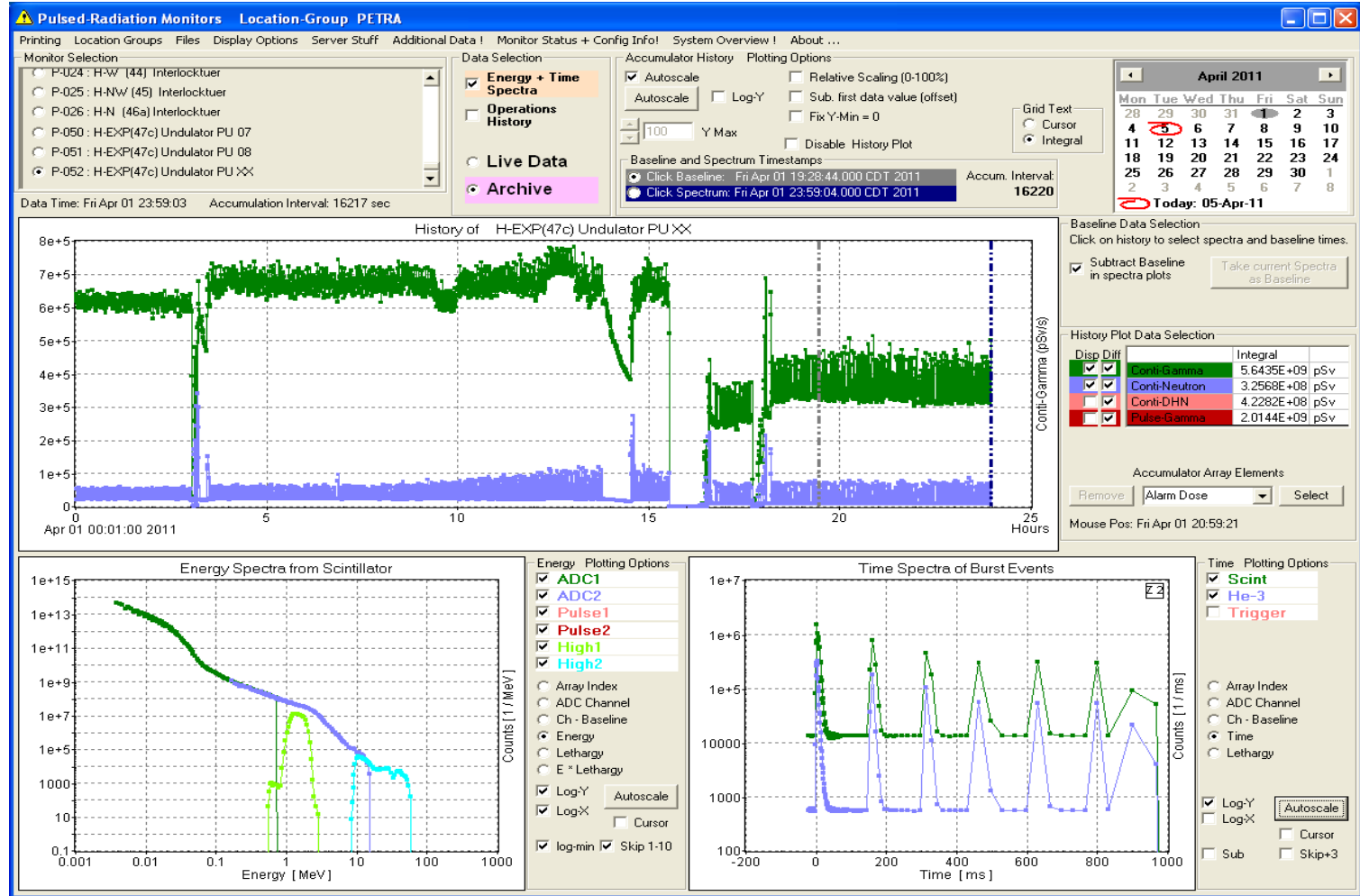
## So What's the #@&?\$ Problem??

- **Performance-Issues** in extreme use cases
  - Large files
  - Lots of large files
  - Lots of appending on lots of large files
  - Magic Ingredient: Server runs on Windows
- *FRAGMENTATION*
- To appreciate the wonderful solution, take a moment to look at “the problem”

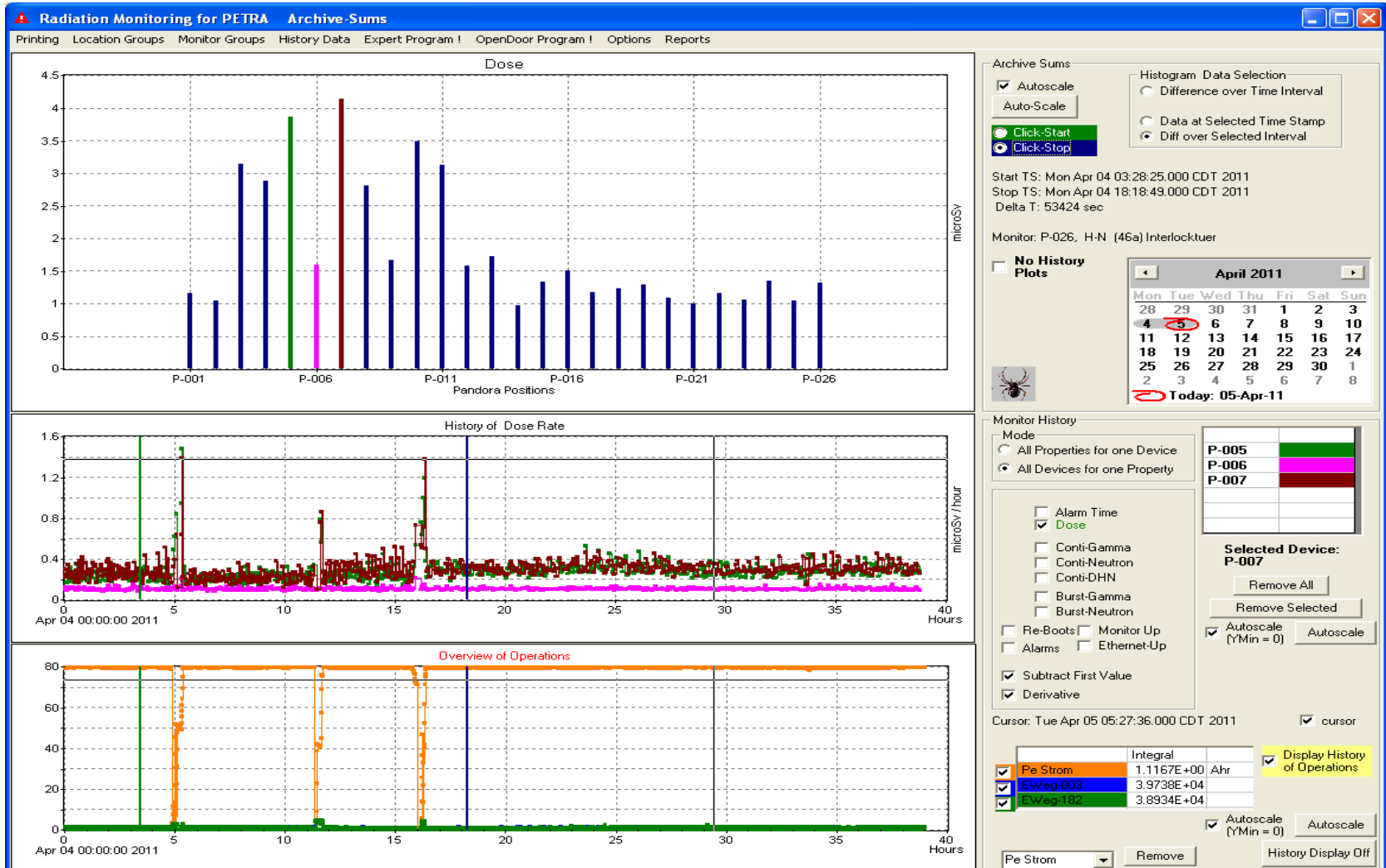
# Pandora Radiation Monitoring

- Middle layer collects data from 10-20 devices
- Data packet from each device at 0.5 Hz  
2000 doubles (16kB)
- “Re-package” data into Multi-Channel-Arrays for displays, archiving, ...
- Store raw-data for “expert” analysis
- Server running on XP

# Expert Mode: Raw Data for one monitor



# Overview Data: Multi-Channel Arrays



# Local History Data Storage (z.B. PETRA)

- Selected MCA data are stored in the Central Archiver (doses – kept forever) everything stored in Local Histories
- A total of ~150 files are “active” [updating “simultaneously”]
  - 6 files for each device (e.g. raw data) plus the “MCA” properties
- Max file size (“day files”): 28 MB
- Total storage space (for a few months) >250GB
- Maximum Save-to-File:  $1 / 10 \text{ sec} = \sim 8640$  “appends” per file, per day....

# Works wonderfully!!!!

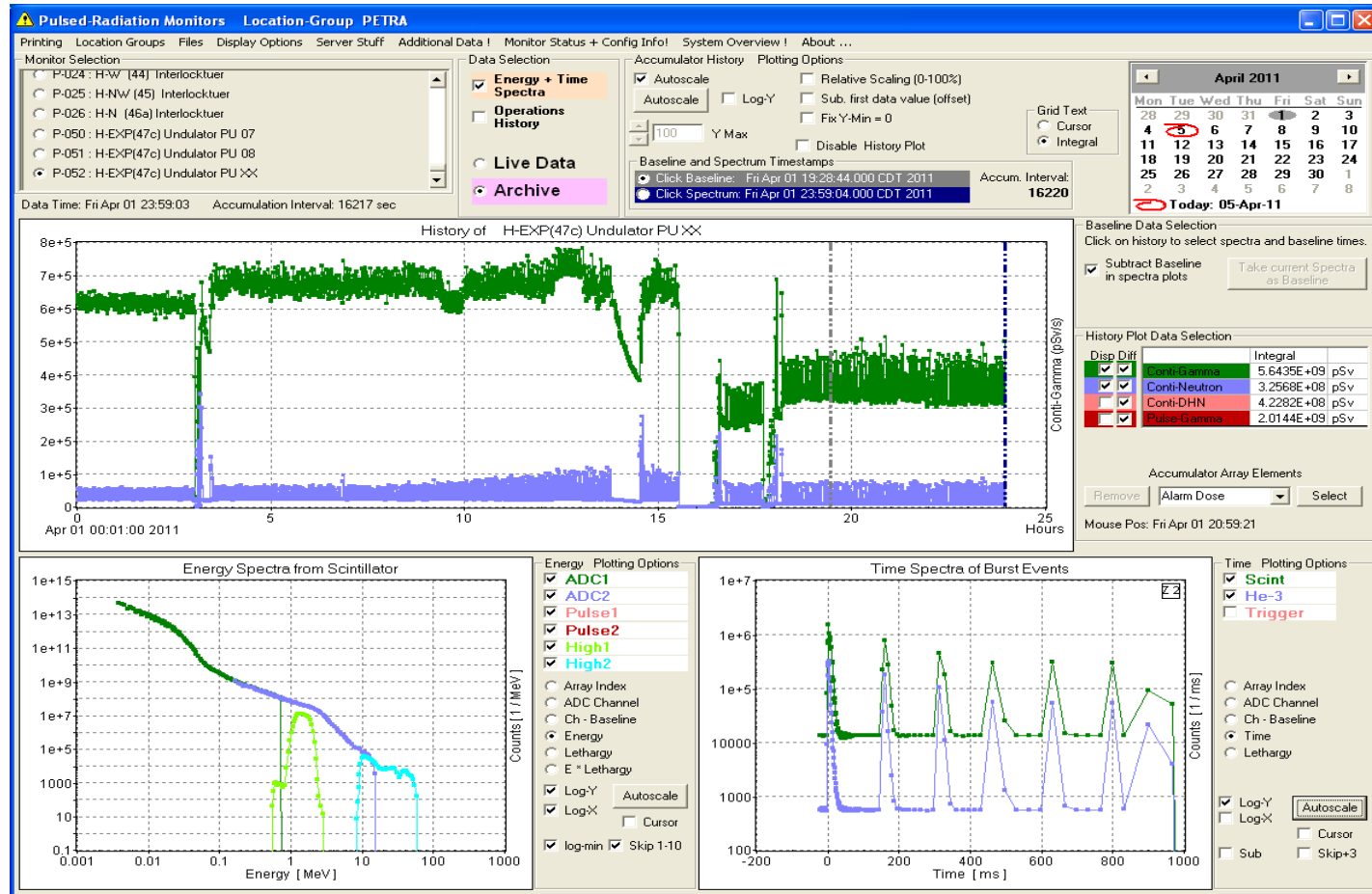
## So What's the #@&?\$ Problem??

- Data Access: Not SAVING, but Reading Back!
  - Energy Spectra at a time stamp? No Problem-O.
  - Trend Chart of an element of an array (z.B. Neutron Dose) over a long interval. “re-tries”!
- Deleting Old Files: ~midnight, server “hangs”! for (a) minute(s)!
- LH File Storage:
  - Writing: open file, “append” the data and close the file
  - With a Save-Rate of 1 / 10 sec = ~8640 “file-appends” per day, per file
  - Are the files “contiguous” on the disk? (are the data-pieces stored “next to” the previous data, or are the data “spread out” on the disk?)
  - Note that the Central Archiver does this, but does NOT have any problems!!
  - Depends on algorithm of File-System! WINDOWS! Fragmentation!



# What is the problem?

- Click on the GUI to get data, and you get a message box “Time-Out retrieving data – Retry?”



- For large files (with lots of appending), fragmentation can cause delays in data access, file deletion, u.s.w.

# Phil's Solution: Make (allocate) the file-space **In Advance** and **Re-use** it!

- Files don't "grow" with appending, and don't need to be deleted!
- Make enough files for the requested storage depth (z.B. 3 months - > need 4 complete "sets" of files)
- "recycle" the file-space from the "oldest" month
- Two important LH configurations: **polling rate** and **archiving rate**
- Based on the configured archiving rate (which is the MAXIMUM rate – typically 1/sec) one can get a "worst case" file size
  - The data are not stored at the polling or archiving rates – z.B. if data are NOT out-of-tolerance, and not a heart-beat, then data are NOT stored
- Add some "extra space" (spill-over)

# “Standard Files”

- BEFORE you start/use files, they need to be MADE!
- Use a handy-dandy command line tool: “mkhstfiles”
  - Reads history.csv, hstmf.csv
  - Convert data from “old” to “new” storage system
- for PETRA it took a couple of hours to “make” ~300 GBytes of files
  
- **Bonus Feature: Permanent Storage of (Temporary) LH Data**
  - While Phil was coding this, he added an extra feature:
  - Request from Users: How to “save data from being deleted”?
  - Central-Archive == “permanent storage”; LH == “temporary”
  - z.B. for the Pandoras, the data during “Long Bunch Train” Operation (“9 mA Runs” ~week of operations)
  - Don’t delete the data, but keep it “visible” for history-viewing

# SAVED Directory

- Want to keep LH data from a special time period? Just COPY the files to a “SAVED” subdirectory (of the Local History directory)
  - Not part of deleting/recycling system – so will be kept!
  - If you ask for a time range out of “sequence”, the LH-Server looks in the SAVED directory
- Pandora Data from 2009 Long-Bunch-Train-Run is available, as if it was yesterday!

# Conclusions

- For extreme cases of LH data storage, file-fragmentation can be a performance-issue (on Windows-based servers).
- If so, use “standard” files!
  - don’t forget to make the files in advance with the command line tool!
- Cuts down DRAMATICALLY on the access-time! Super!!!!
- As Phil knows: Zufriedenheit is fleeting. Research continues in the User Community on **Neu Beschwerden**