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PSI

WIR SCHAFFEN WISSEN – HEUTE FÜR MORGEN

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The Instrument User Interface Challenge

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Contents

- The Lay of The Land
- Survey of existing solutions
- UX Development
- Where do we want to go?
- A Suggestion
- Discussion

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UI Challenges: Lots of Data

- A complex instrument can easily have thousands of parameters
  - Filtering
  - But we get in trouble if we hide to much
  - Some parameters are more important then others
    - The importance of parameters may vary with the use case of the instrument
- Cluttered Interfaces
- Online graphics
  - Frequent updates are a problem
  - Requirements for interaction

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Latch to the Rescue

Latch

"Information may be infinite, however…The organization of information is finite as it can only be organized by LATCH: Location, Alphabet, Time, Category, or Hierarchy."

Wurman, 1996

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Latch

- Location: example: instrument components
- Alphabet: alphabetical listings
- Time: generated data files
- Category: all motors, counters, slits, whatever
- Hierarchy: tree views

UI Challenges: Action!

- We also want to run procedures against the instrument
  - counting, driving, and scanning
  - The ones we always tend to forget:
    - Alignment
    - Experiment planning
- Flexibility in the use of the instrument
  - Each instrument is unique
  - It must be easily possible to use the instrument in a different way

UI Challenges: Diverse User Community

- The Start/Stop user
  - Different communities with different IT abilities
- The advanced user/instrument scientist
- Maintenance staff

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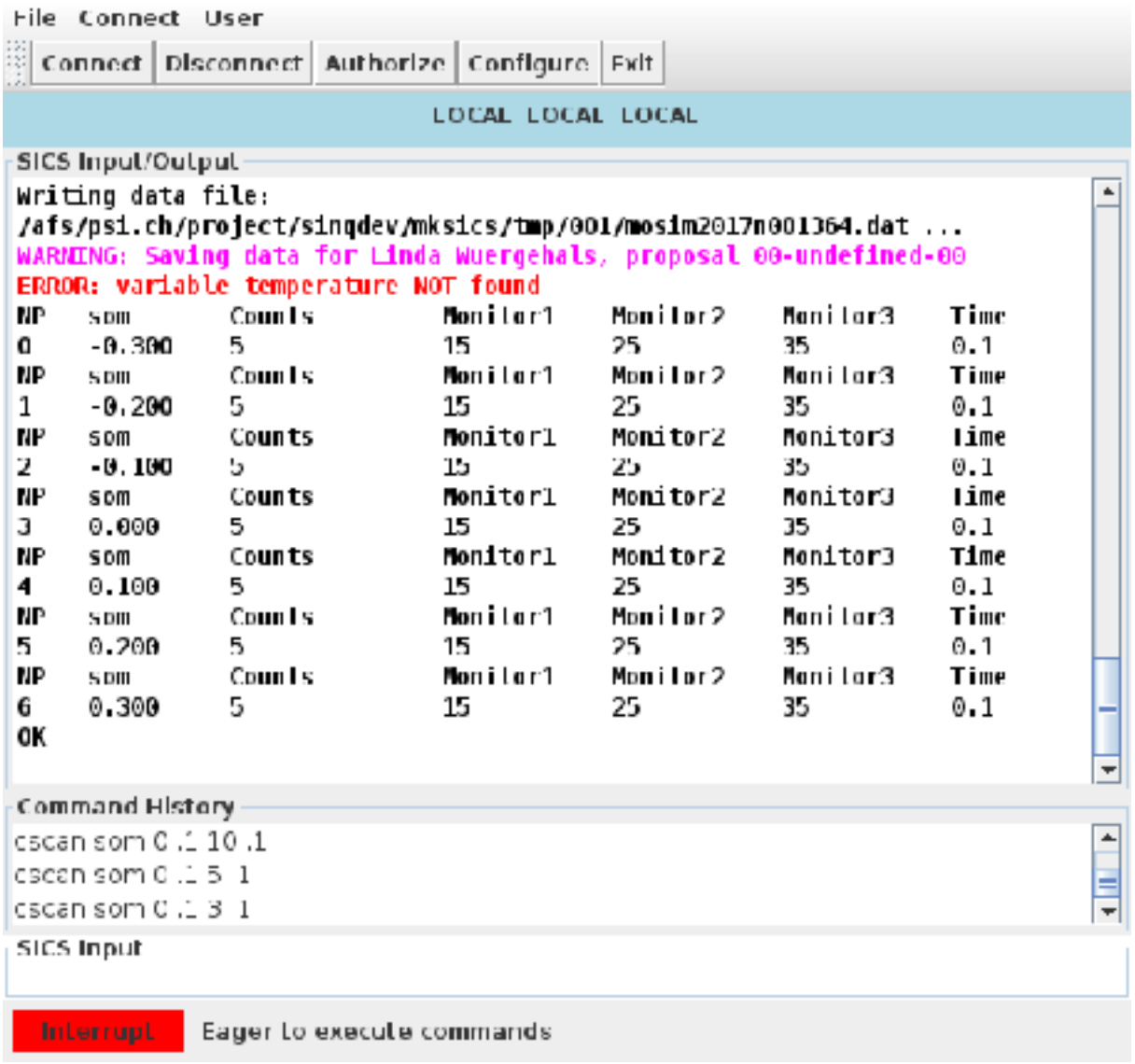
UI Challenges: Different Interfaces

- Interaction with humans
- A machine interface for computer clients
- NEW: workflow integration
- We need to program: batch processing

UI Challenges: Platforms

- Desktops of various OS
  - Linux
  - OSX
  - Windows (to my regret)
- Mobile
  - Android
  - iOS
- Speech: chinese, swedish, Schwitzerdütsch, danish, english, Klingon,…
- Watch

Solution 1: the Command Line



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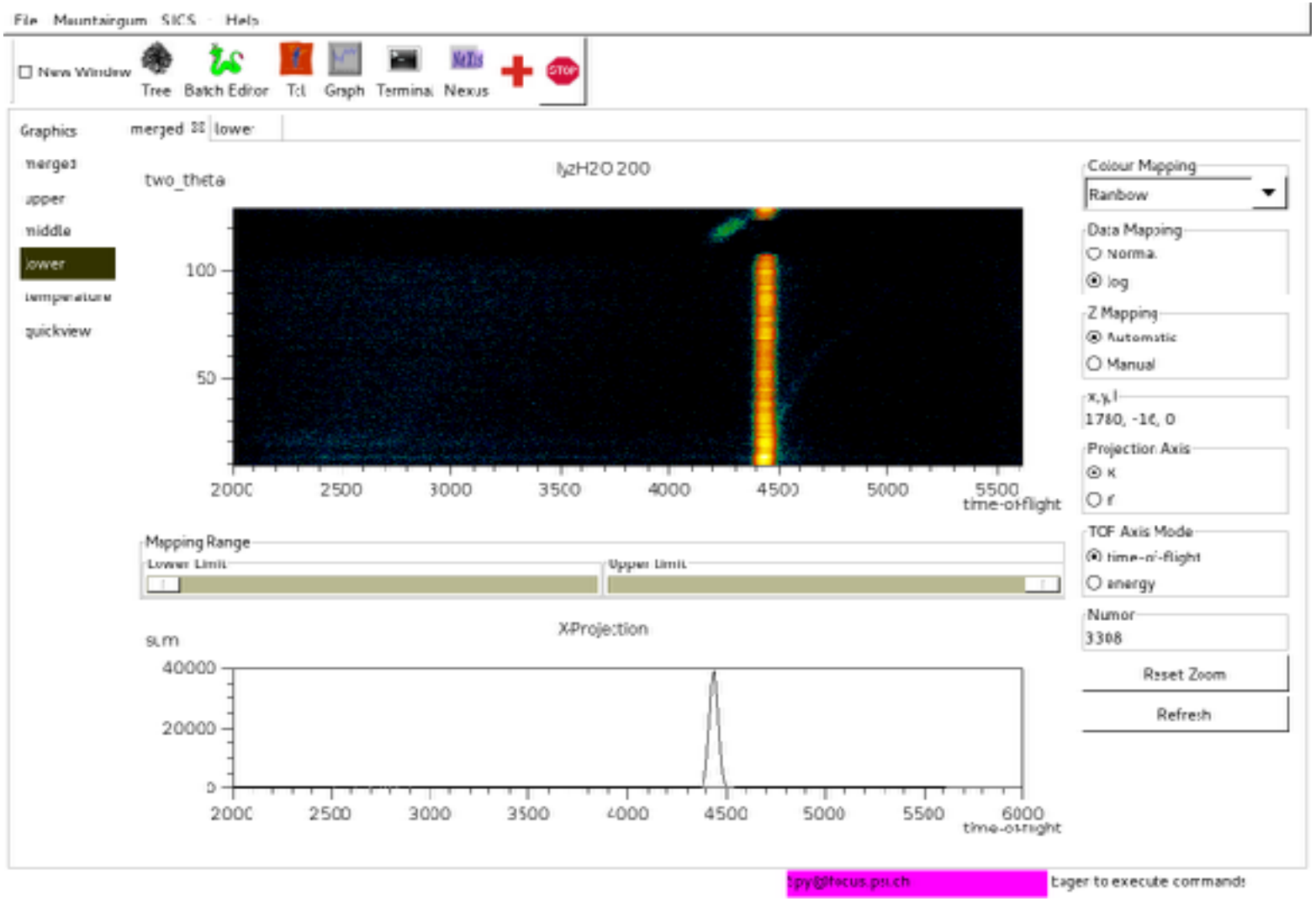
The Command Line

- Surprisingly popular even in the graphical 21st century
- Why?
  - Expressive
  - Fast
  - Needed anyway: batch processing
  - Two stages in an experiment:
    - Setup: knowledgable instrument scientist nearby
    - Experiment: only few commands required
- It can be improved:
  - Can someone remember the legendary VMS help system?

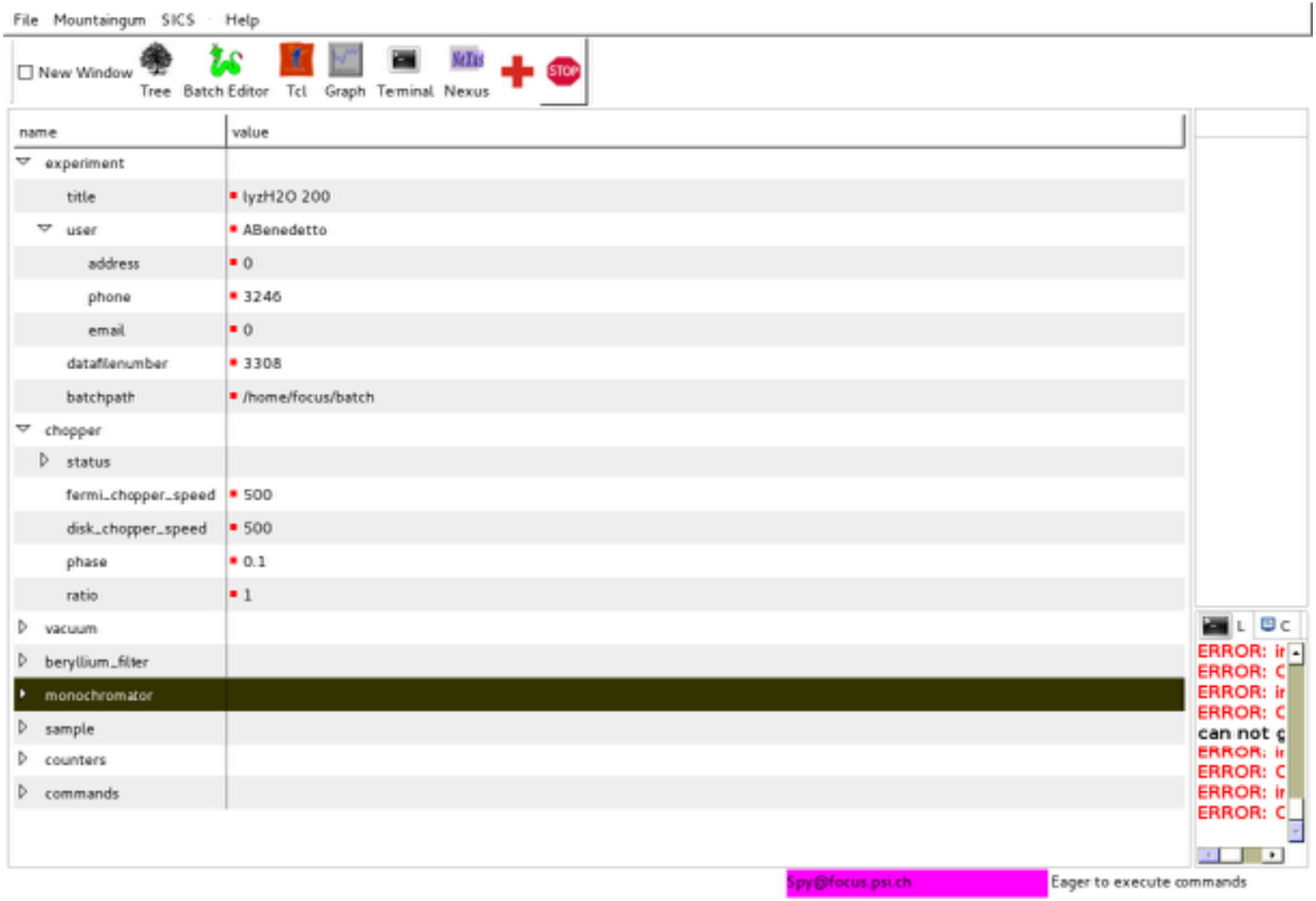
Solution 2: Specialized Online Data Display



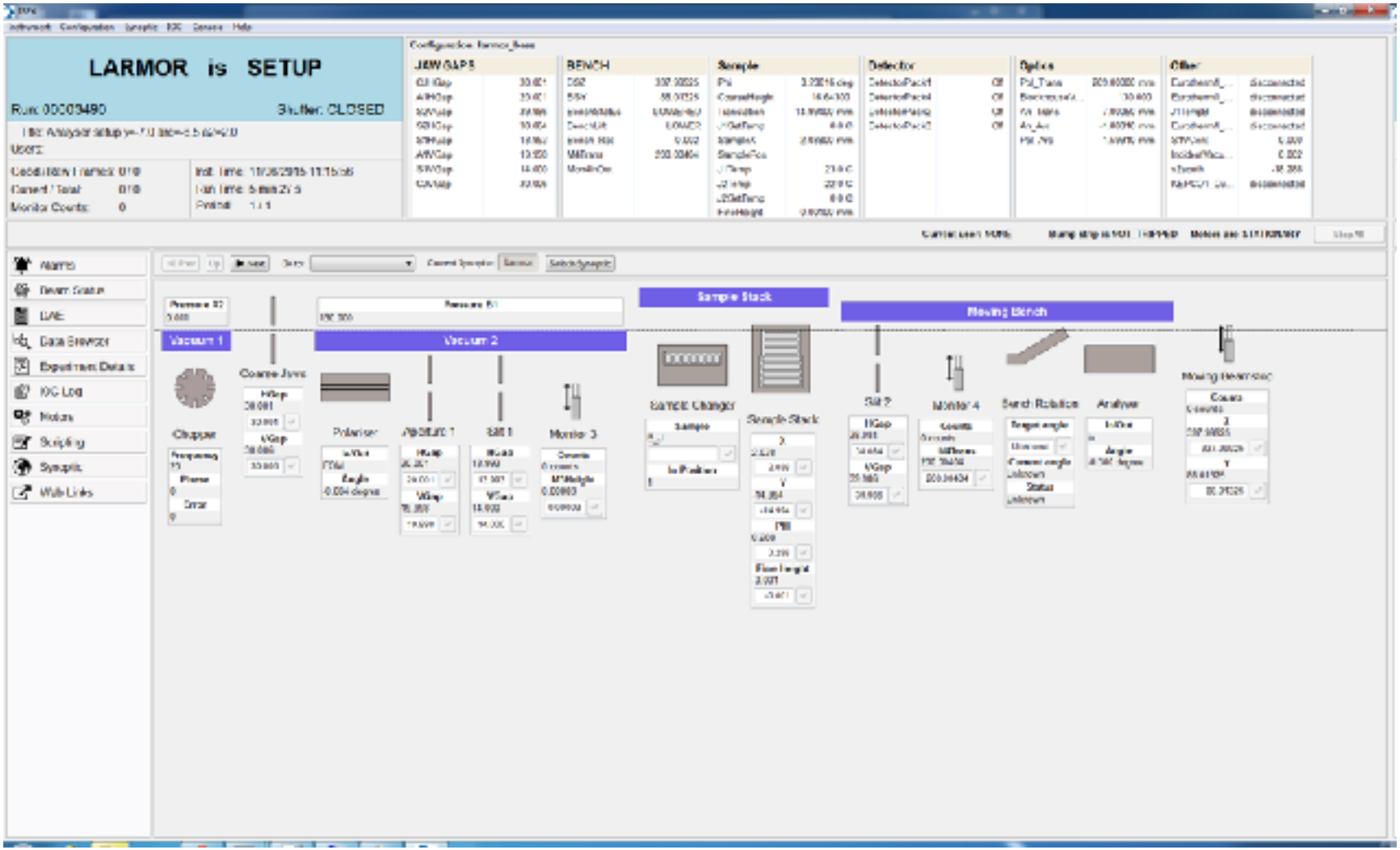
Online Data Displays

- Interaction is asked for:
  - Zooming
  - Changing plot characteristics: log, normal, color schemes
  - Projections
  - …
- An instrument usually has several plots on offer
- Scientists often ask for simple data analysis in this:
  - Determining centers
  - Fitting gaussians…
  - Comparing with old data

Solution 3: Parameter Tree Displays



Parameter Tree Display



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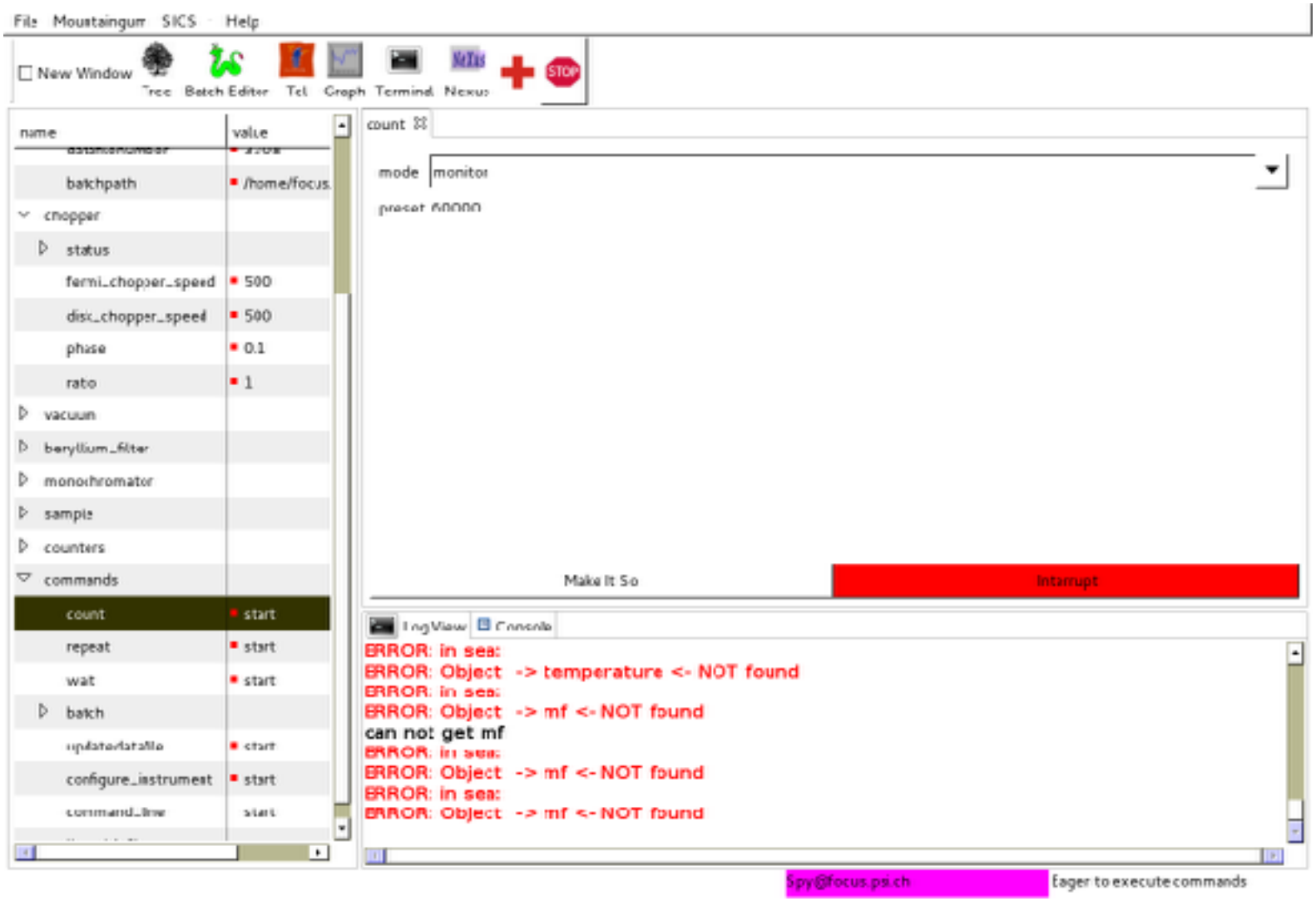
Parameter Tree Displays

- Good at organizing parameter space
- Caveat:
  - not easy to organize commands
  - no graphics
  - you may get into deep hierarchies
  - Bad at cross cutting concerns:
    - Show me all motors?
    - Show me all motors I am allowed to scan?
- Not the silver bullet either

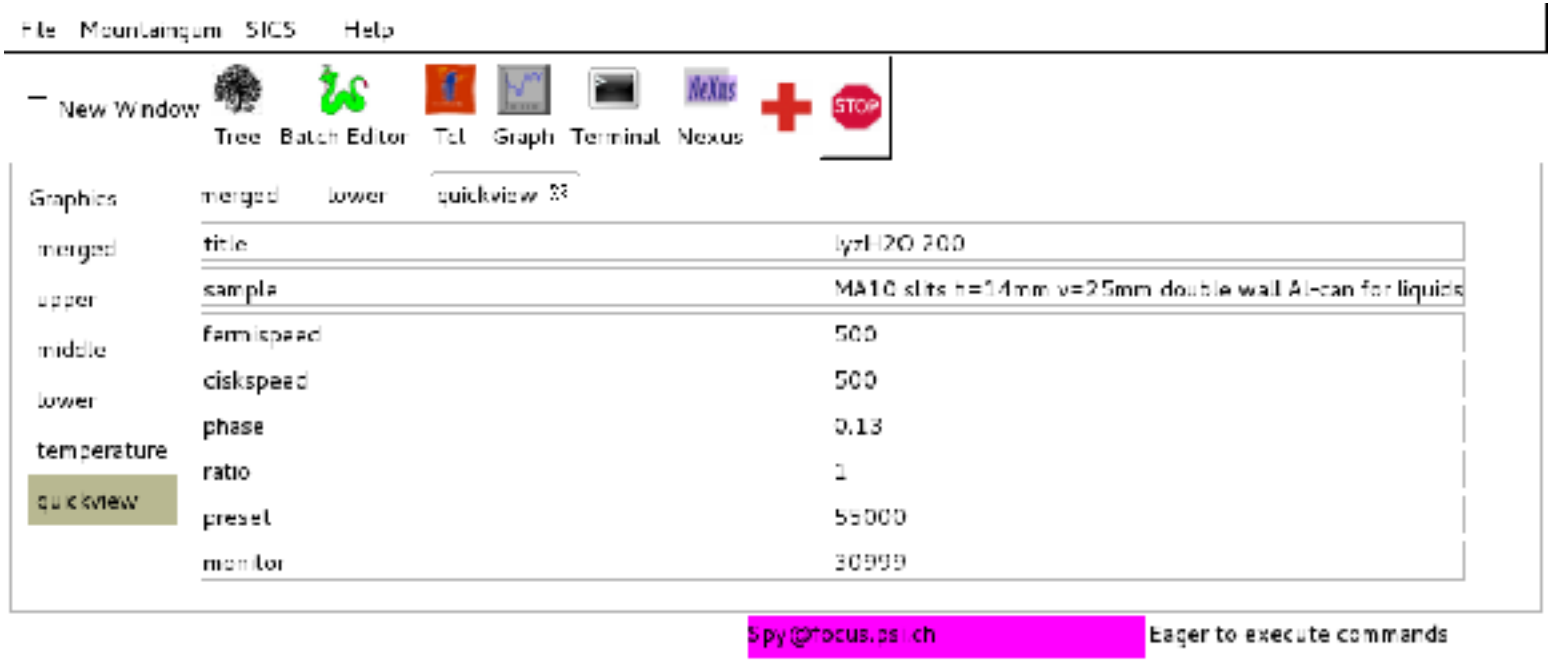
Shameless Advertising: Treepath Concept

- Invented between ANSTO and PSI
- Map commands and graphics data into the tree
- Use that tree as underlying model for the UI
- GumTree Swiss Edition and GumTree ANSTO Edition are built on top of this

More Shameless Advertising

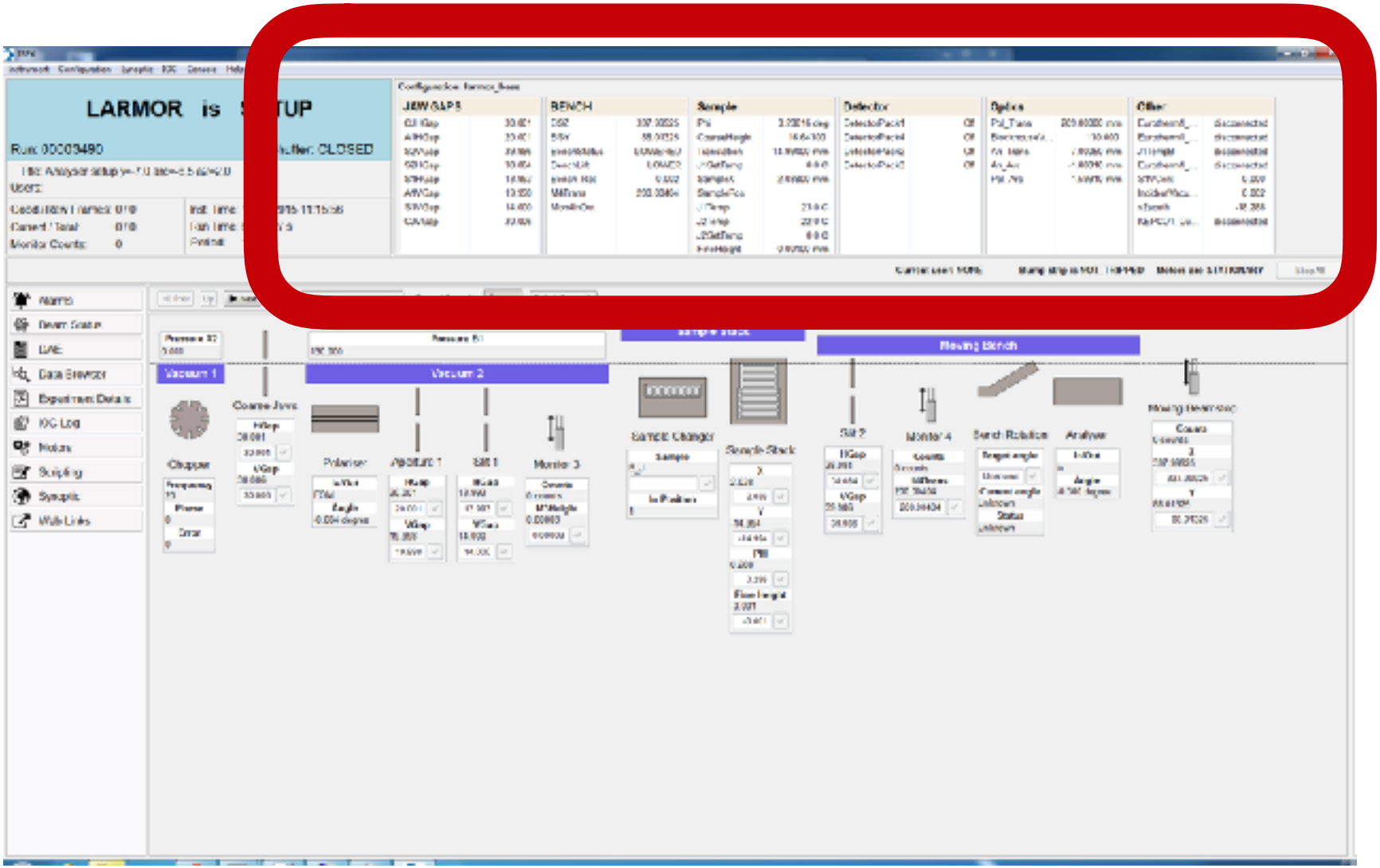


Solution 5: Dashboards



- Displays most important instrument parameters
- Instrument specific
- Configurable

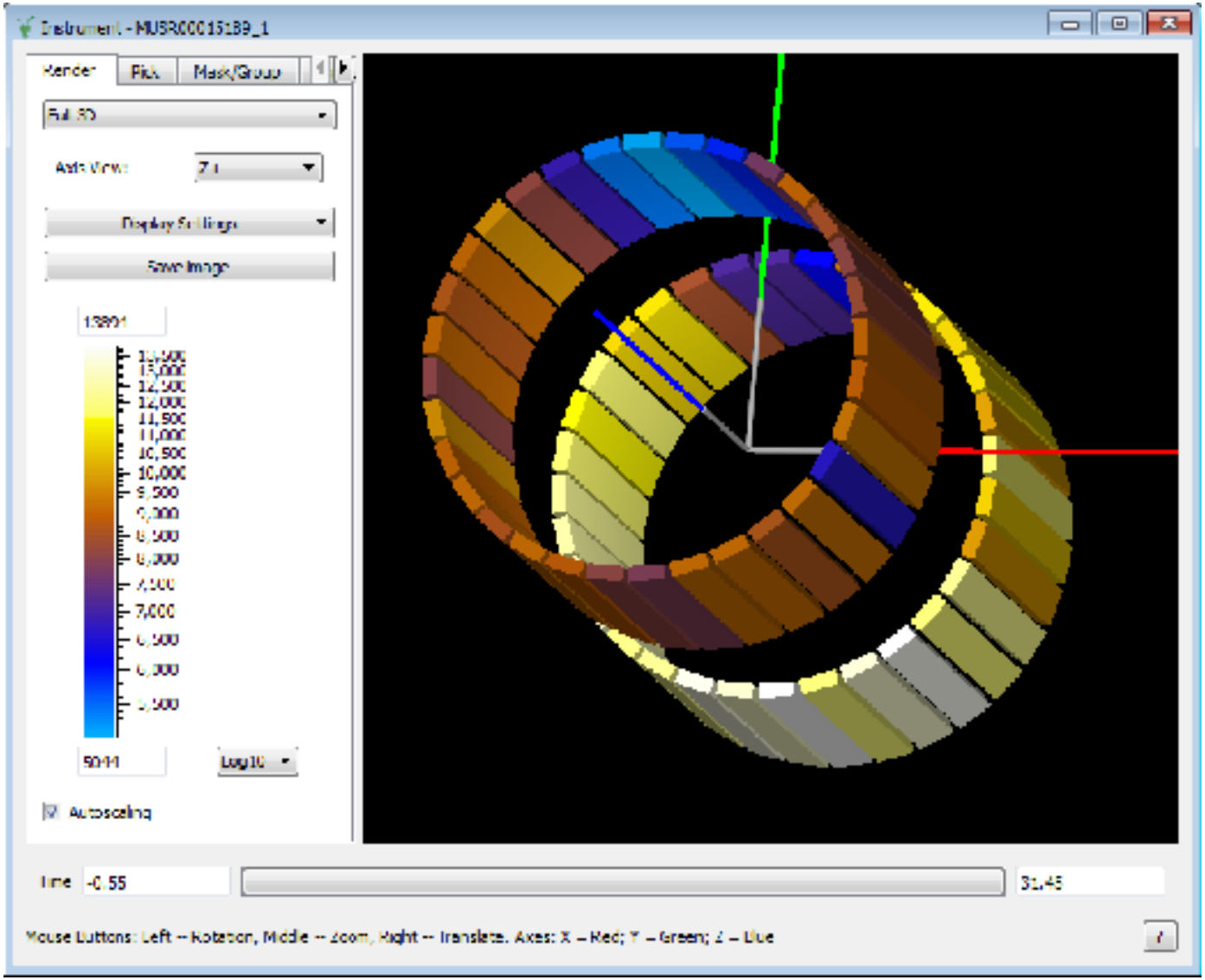
Solution 6: Control Blocks



Control Blocks

- As far as I know: only seen at ISIS
- A list of blocks for showing and modifying parameters
- Configurable:
  - List of Blocks
  - Content of Blocks

Solution 6: Graphical Instrument Views



3D Instrument Views

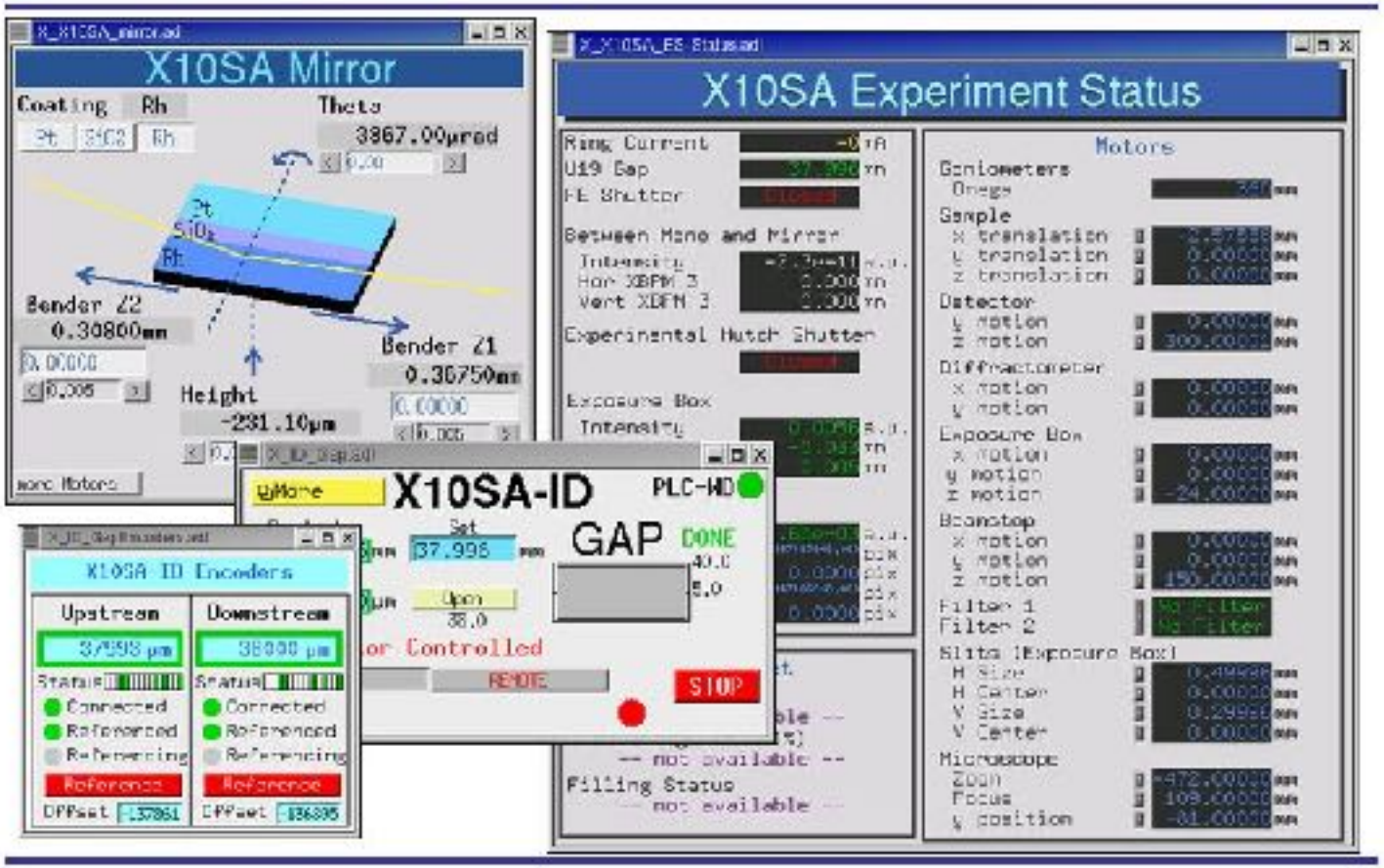
- Expensive to program
- Impresses managers and politicians
- IMHO:
  - Doubt about usefulness
  - ROI: Return On Investment?
  - Does not solve the parameter storm issue
  - No commands

Solution 7: Log and Alarm Viewers

- Often part of CLI interface
- But also separate, showing the instrument log
- Alarm Viewers: lifts potential problems out of the log message storm

Solution 8: MEDM or CSS

Examples: medm



MEDM or CSS

- Is what you get when you leave the EPICS people alone
- Interfaces ONLY to EPICS PV
- Succeeds at confusing users
- To be programmed for each instrument
- Changes require programming to accomplish

Solution 9: Search

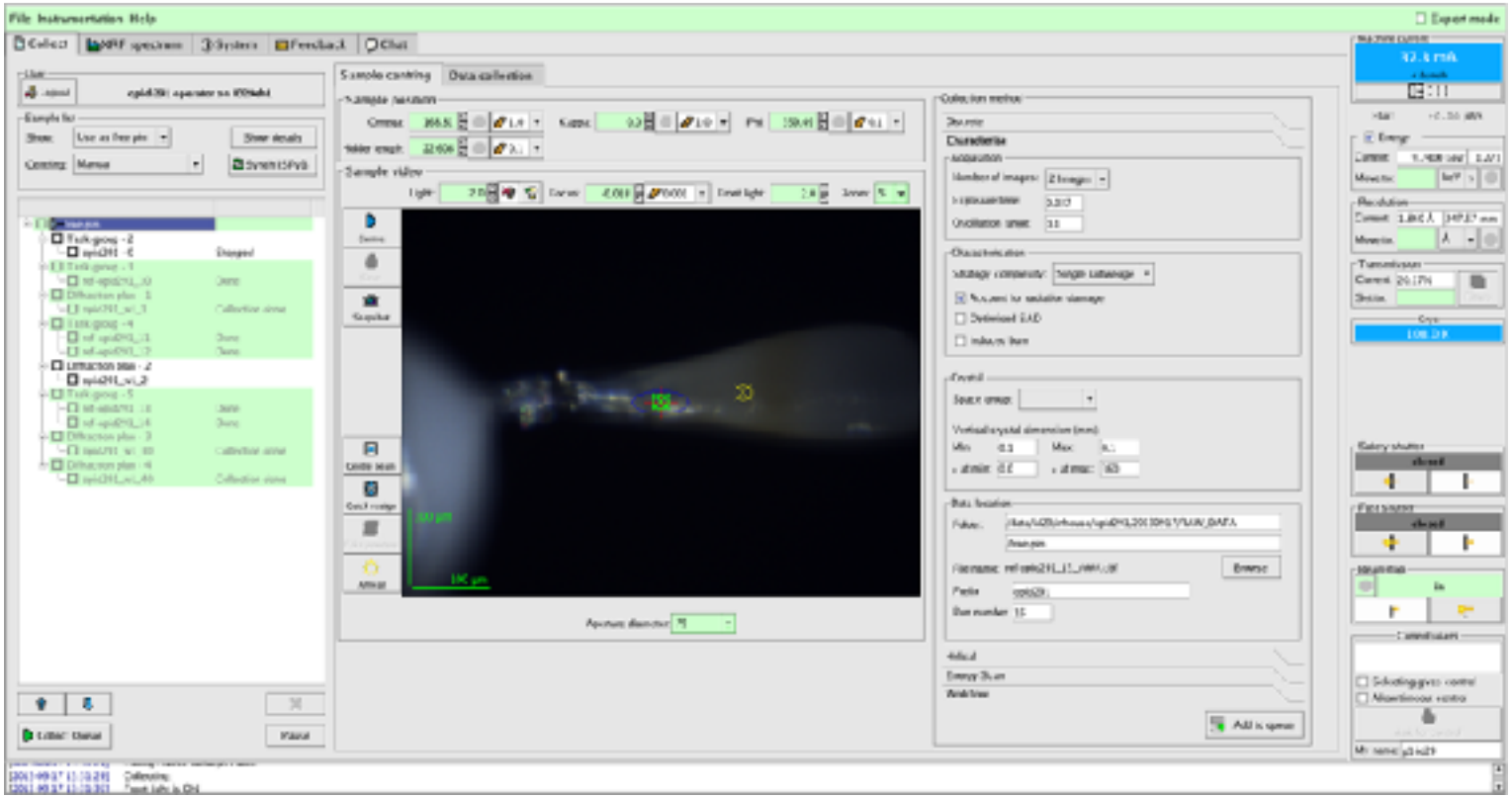
- When you used google you know how it works
- Has never been tried in the context of instruments
- Has been marketed for a while as the next big thing in user interfaces

Solution 10: Workflows

- Organise operation of instrument in workflows
  - Much like a wizard with branches
- User is guided along these workflows
- Has never been tried in the context of instruments

Solution 11: Instrument Specific UI

1 2 3 4



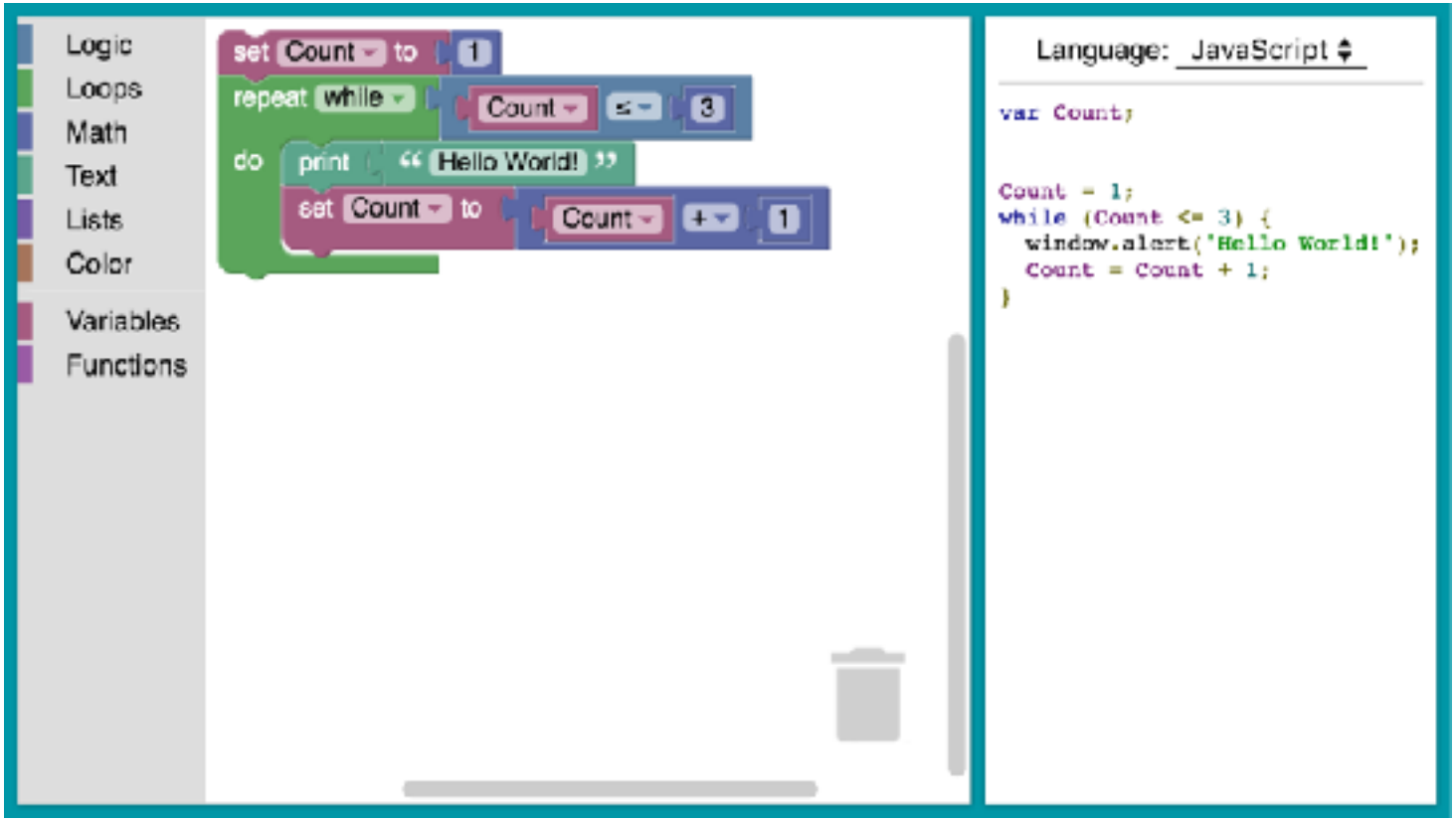
Instrument Specific UI

- Bespoke UI for a type of instrument
- Works for well standardized experimental procedures
- Limits you when doing non standard things
  - Often reduces this limit by clutter
- Dagobert Duck funding required

Batch Editing 1: Text Editors

- Emacs, Vim, TextEdit, …
- Users need to know syntax
- Should (MUST?) be accompanied by a simulation mode at the instrument
  - Otherwise your batch program dies 3 minutes after you left for the weekend
- Good news: NICOS does simulation

Batch Editing 2: Block Programming Language



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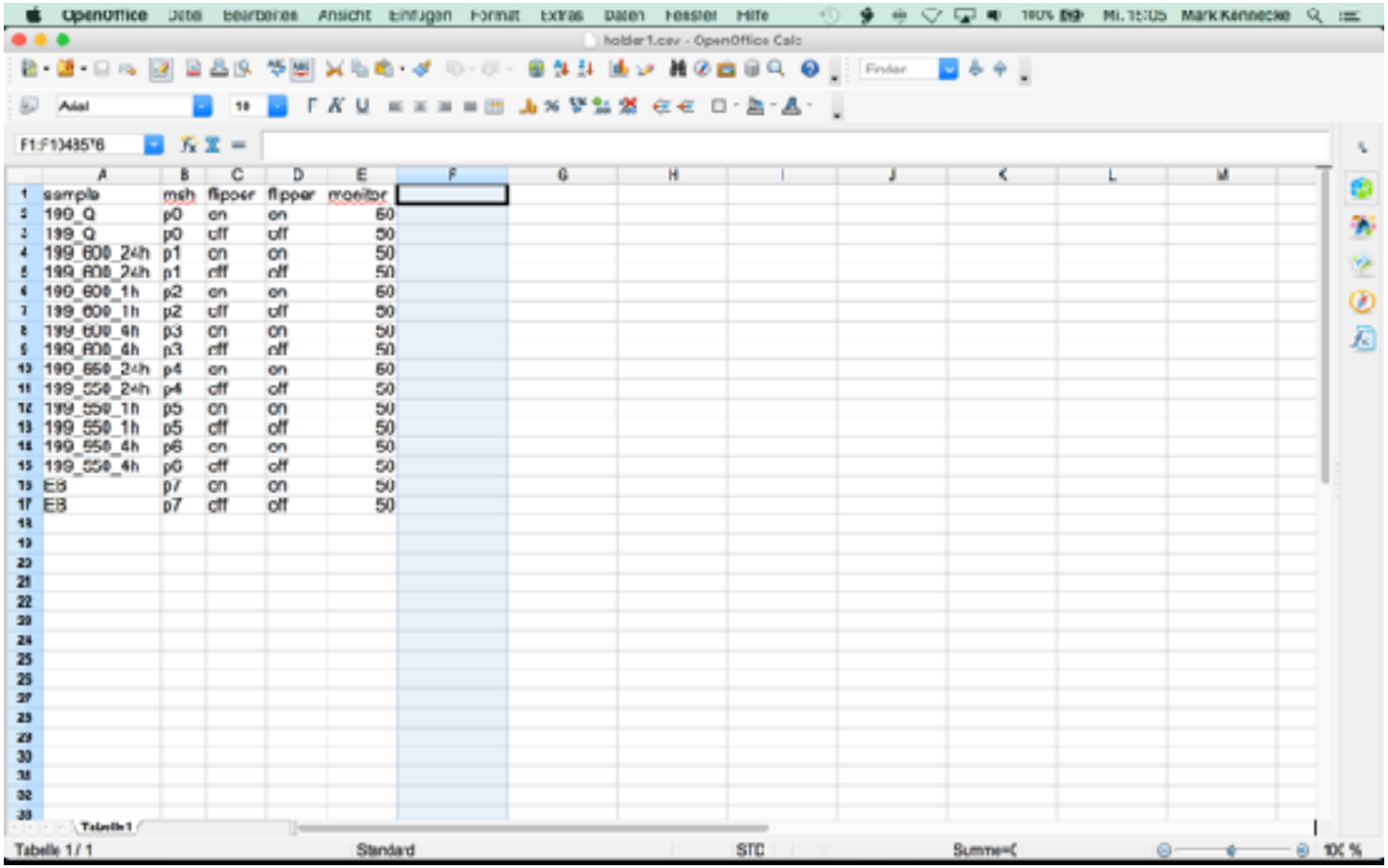
Block Programming

- You select items from a toolbox
- Simple logic possible
- Only seen so far in NOMAD from ILL

Batch Editing 3: Spreadsheets



holder1.csv - OpenOffice Calc

	A	B	C	D	E	F	G	H	I	J	K	L	M
1	sample	msh	flipper	flipper	monitor								
2	190_Q	p0	on	on	60								
3	190_Q	p0	off	off	50								
4	190_600_24h	p1	on	on	50								
5	190_600_24h	p1	off	off	50								
6	190_600_1h	p2	on	on	60								
7	190_600_1h	p2	off	off	50								
8	190_600_4h	p3	on	on	50								
9	190_600_4h	p3	off	off	50								
10	190_650_24h	p4	on	on	60								
11	190_550_24h	p4	off	off	50								
12	190_550_1h	p5	on	on	50								
13	190_550_1h	p5	off	off	50								
14	190_550_4h	p6	on	on	50								
15	190_550_4h	p6	off	off	50								
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Tabelle 1 / 1 Standard STD Summe=0 100 %

Table Editing

- Primarily loved by SANS community
- Looking at the workflow from a higher level of abstraction:
  - Instrument scientist provides template
  - User fills in the details
- Old user batch files are templates too!!
  - ESS should manage them

UI Challenges: Recapitulation

- Lots of diverse data
- Need for action
- Instrument control is programming
- Diverse user community
- Many platforms
- Timeline: 20-30 years

Which UI pattern do we want?

- One of the shown ones?
- Monolith or separate components?
- Do we try search?
- What about a phone like screen with various apps?
- Has someone got a better idea?
- Your suggestion here…

- We need a process to decide this

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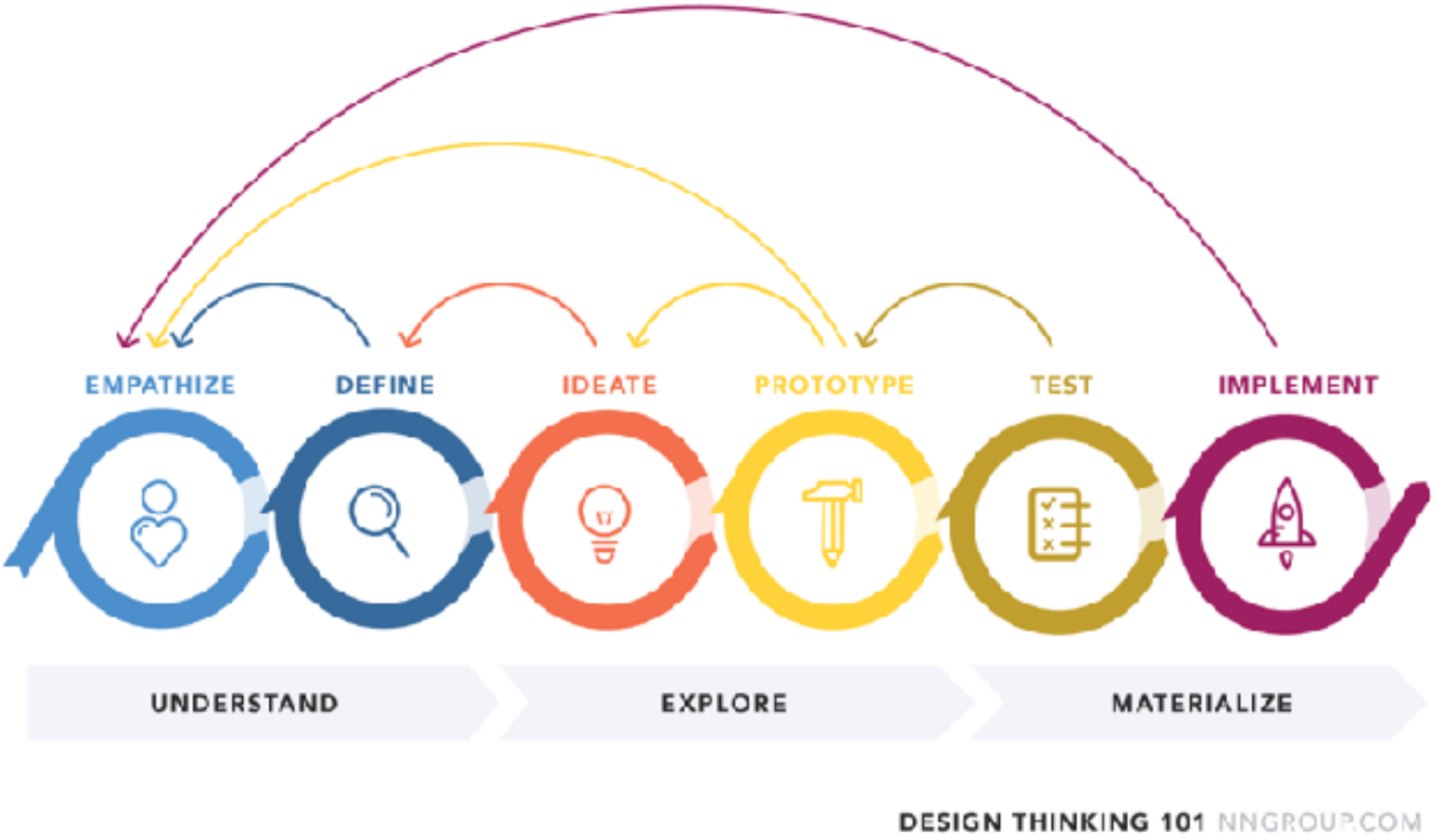
Which Technical Basis?

- We already considered WWW
  - Do we wish to reconsider? Graphics can be an issue.
- Javascript on the client side is unavoidable
  - Which of the ever increasing list of frameworks?
  - How do we go about evaluating them?
- Backend
  - If we already have to do javascript we could do node.js
  - Else: python
    - Which of the python WWW frameworks?
    - How do we decide?
  - Else: ??????
- Distribution of tasks between javascript client and backend

UX Design Process



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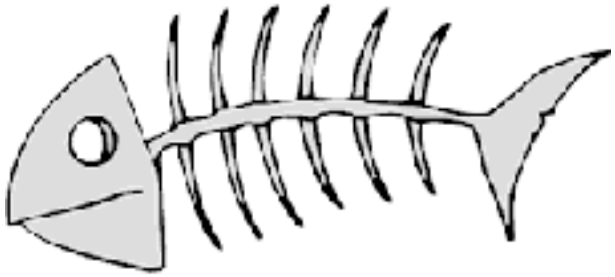
UX Design Process?

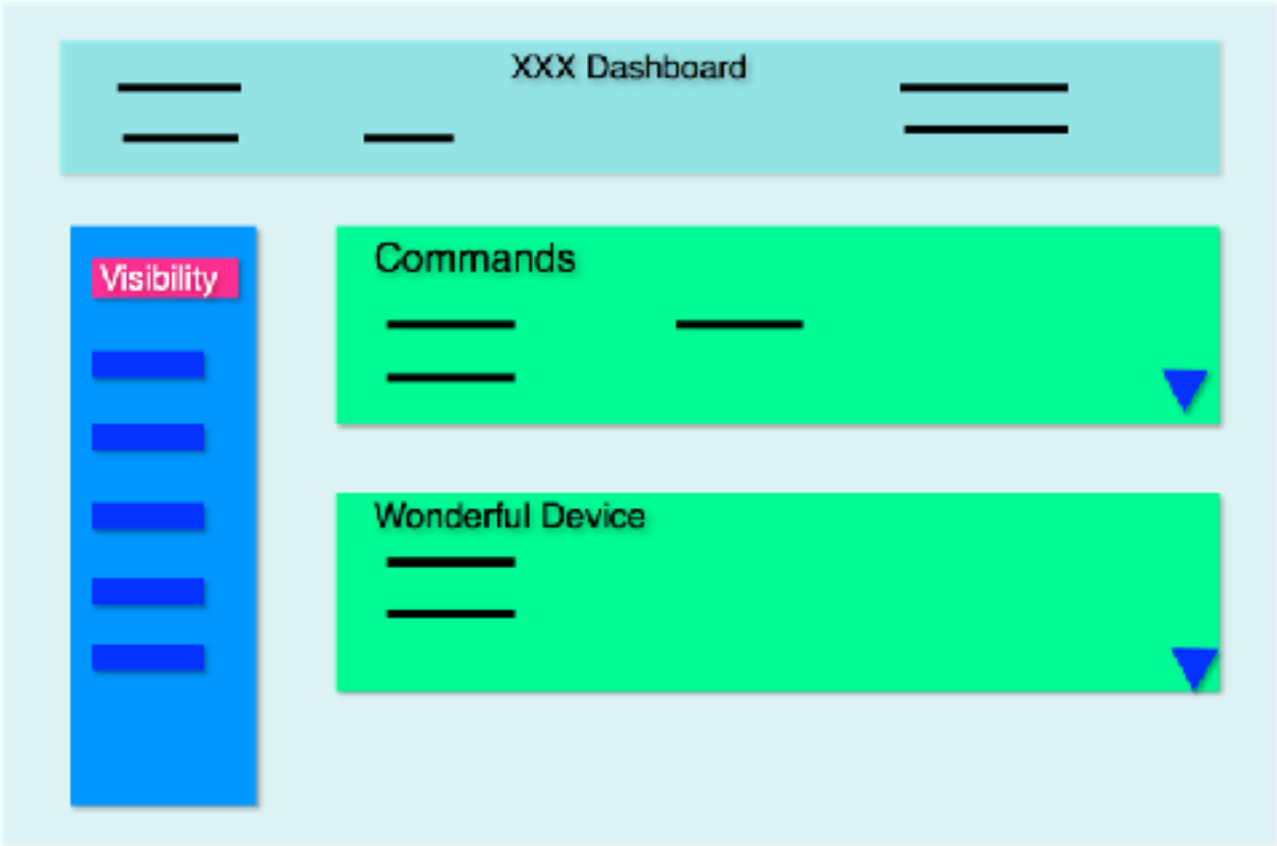
- Do we follow some or all steps of a UX design process?
- IMHO: Recommended
  - Saves money and time in the long run
  - We still have the time to do it

Bare Bones



- Command Line Interface
- Online Data Display (Mantid?)
- Some text editor (emacs) for batch files

My Suggestion



- Visibility Control, Meta data: How to display?
- Graphics is one the fields
- Block Programming for Batch Files

Discussion

- Which pattern do we want?
- Has anyone a better suggestion?
- How do we arrive at a decision?
- How do we decide on a technical basis?
- Do we intend to follow UX development methodology?
- BTW: How much screen real estate will there be at ESS Instruments?