SpecTcl Filter Output

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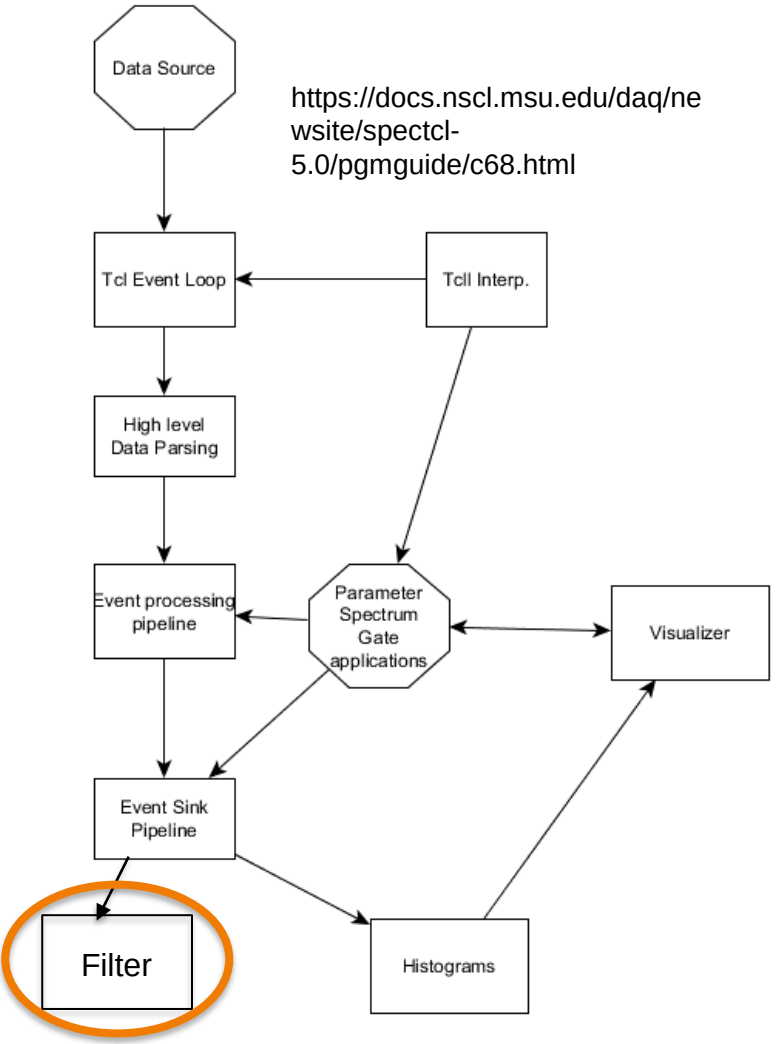
Outline

1. SpecTcl’s processing model
2. SpecTcl’s filtering utility and filtered event files
3. Changes to SpecTcl’s filtering utility
4. Creating filters
5. Uses of filtered data

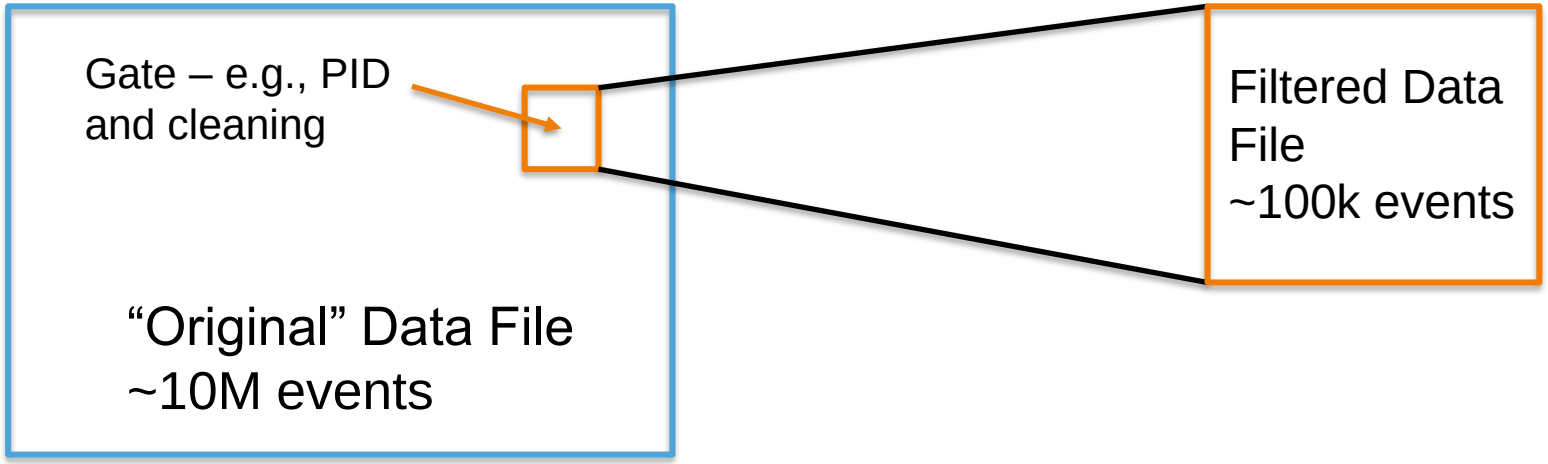
SpecTcl Processing Model



- SpecTcl's processing model is summarized below:
  - The **Tcl Event Loop** processes events that are taken from the Data Source (either Online or a .evt file) and dispatches them to the appropriate handlers
  - The **High Level Data Parsing** unpacks blocks of data into event units. These units are then passed one-by-one to the Event Processing Pipeline
  - The **Event Processing Pipeline** transforms the raw events into meaningful parameters. This step can consist of an arbitrary number of stages
  - Once the data has been passed through the Event Processing Pipeline, it is passed to the **Event Sink**. This is where Histograms and Filters live
  - From there, the **Histograms** interface with the Visualizer (Xamine or SpecTk), which concurrently has access to the Parameters
  - Describing the **Filters** is the focus of this presentation

Filtered Event Files

- The primary intention of the filter is to reduce large data files to more manageable sizes.
- However, this can be modified to extract specific information from SpecTcl – the purpose of this presentation.
- A filtered file will extract a subset of the ‘original’ file based on an event’s satisfaction of a user-defined gate.



“Out of the Box” SpecTcl Filters

- SpecTcl comes pre-built with a filter utility.
- This filter utility generates filtered files that SpecTcl is able to read (extension .flt).
- In order to use these filtered files, a Filtered Event Processing Pipeline must be established.
  - This requires a filter buffer decoder, as the filtered events cannot be parsed by the original data unpackers.
  - Without a separate processing pipeline, SpecTcl will be unable to reread the filtered events.
- The purpose of the CSVFilterOutputStage is to modify the Filter Output in the Event Sink to allow SpecTcl to generate (human) readable data files.
- Beginning with ARIS SpecTcl v.25, the necessary code has been added to generate readable event files.
  - A working Filtered Event Processing Pipeline has not yet been implemented.

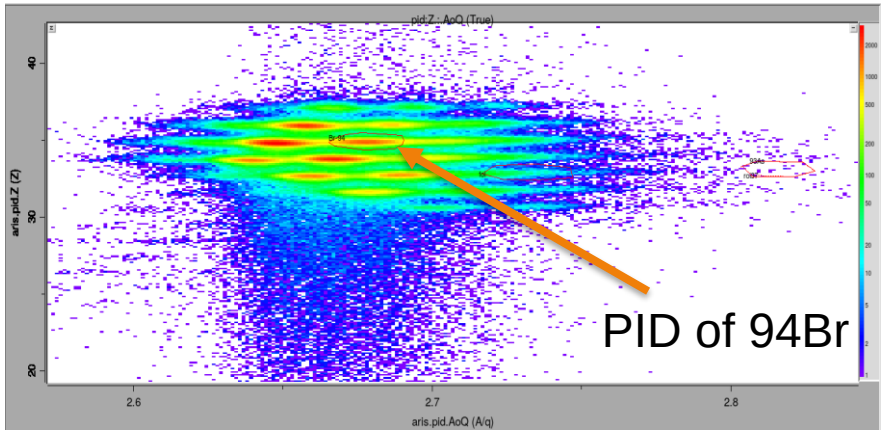
CSVFilterOutputStage

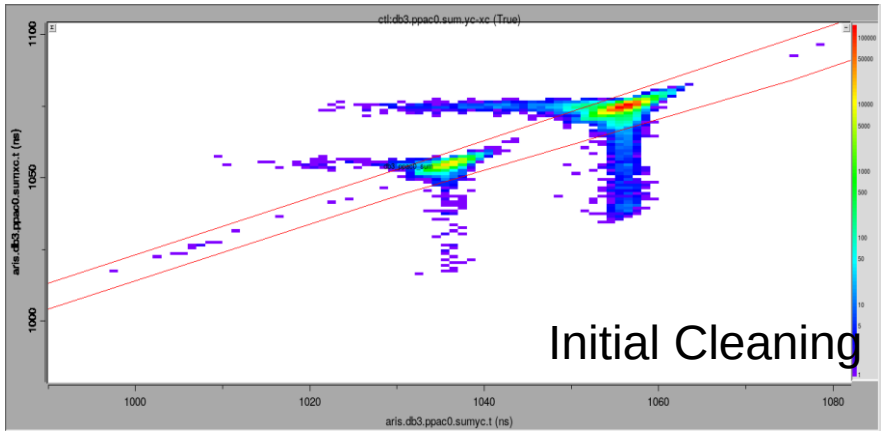
- The code that defines how SpecTcl should handle the data as it is being processed by the filter.
- It is a simple code that creates an arbitrary number of columns (equal to the number of parameters that need to be extracted) and places the events in rows.

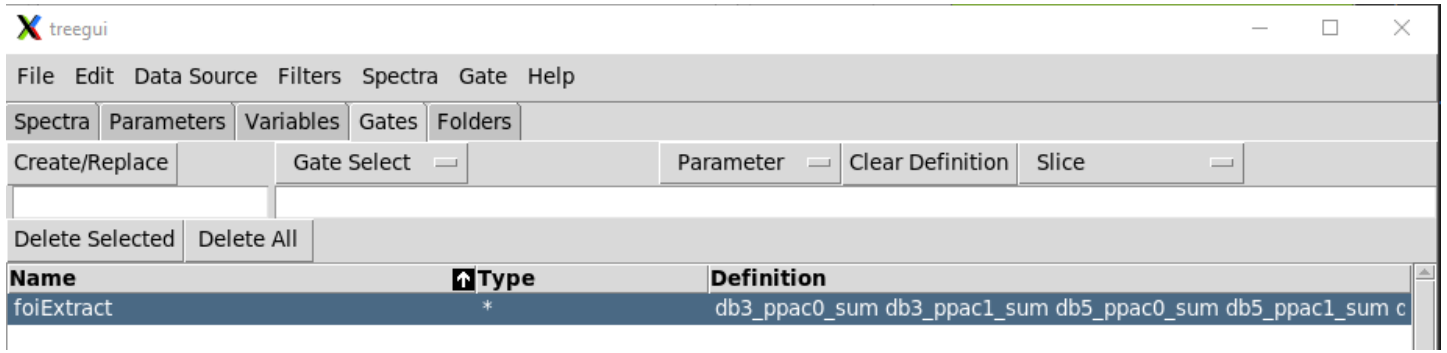
```
//Each event is described by parameter names and parameter IDs. If the piece of data is not the last one in the line,
//it's appended with ','; if it is, it's \n (new line).
void
CSVFilterOutputStage:: DescribeEvent(std::vector<std::string> parameterNames,
             std::vector<UInt_t>      parameterIds)
{
  for (int i = 0; i < parameterNames.size(); i++) {
    char delim = ',';                       // Delimeter for all but end.
    if ((i+1) == parameterNames.size()) {
      delim = '\n';                                 // Last one has a newline following it.
    }
    m_file << parameterNames[i] << delim;
  }

  m_params = parameterIds;
}
```

Creating SpecTcl Filters

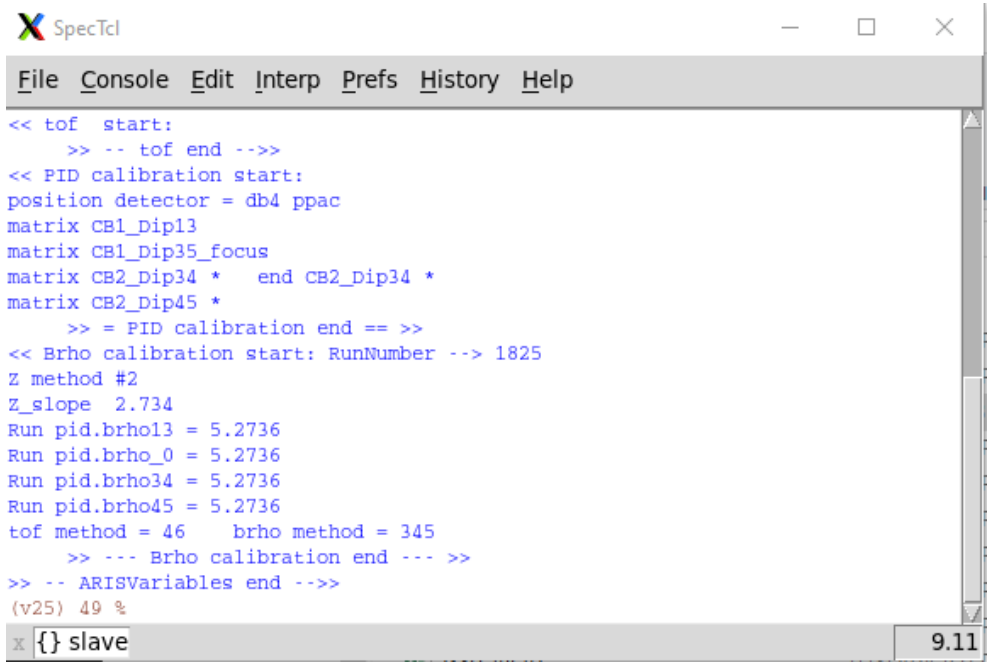
1. In SpecTcl, begin by reading in the data you wish to work with.
2. Apply any cleaning and calibrations to the data before continuing.
3. Create a gate(s) which will define which events are extracted.
   - The gate can be an AND gate, meaning the events must pass multiple requirements before being extracted
   - Normally, I name the gate-to-pass ‘foiExtract’







Creating SpecTcl Filters (Cont.)



4. Inside the SpecTcl console, type* the following series of commands (or run TCL batch file with them):

- filter –new [filter name] [gate name] {parameters}
  - » "filter –new 94Br_v1 foiExtract {**aris.db3.x aris.db3.a** …}"
  - » Note that the parameter names should match those in treegui.

- filter –file [file name] [filter name]
  - » "filter –file 94Br_v1.csv 94Br_v1"

- filter –format [filter name] csv
  - » "filter –format 94Br_v1 csv"

- filter –enable(disable) [filter name]

Filter Output

- Once the filter has been created and enabled, reopen the data file. As part of the Event Sink, the data points that satisfy the gate requirements will be extracted into a csv format.
- Below is an example of the filter output:

  - Note that the order in which you specify the parameters is the order in which they appear. The csv files are organized by row. Event 1 is the first row, with the associated parameters in the following columns. If an event is missing a parameter, then it will appear empty.
  - In this example, the original data file had 996,037 events. The filtered file (PID and first-pass cleaning) has only 82,329 events.

1	aris.db3.x	aris.db3.a	aris.db3.y	aris.db3.b	aris.db5.x	aris.db5.a	aris.db5.y	aris.db5.b	aris.pid.b	aris.db4.p	aris.db4.p	aris.db1.x	aris.db1.a	aris.db1.y	aris.db1.b
2	-0.17472	-4.22252	-1.32453	4.87663	-7.8732	-28.4301	-4.60181	-8.55637	0.532887	-10.6338	0.883345				
3	-6.25682	-5.56811	-0.77411	-0.04032	2.15927	5.32452	-3.07981	-7.37264	0.533664	0.297423	-0.03216				
4	12.065	29.6164	-0.25058	2.28246	-10.3988	-20.3391	-0.92337	-3.77772	0.532734	-20.9446	0.280654				
5	-2.28518	-7.47839	1.14501	-4.93327	-7.14201	-26.8926	0.973176	-2.85531	0.532251	-7.23521	-1.39242				
6	3.88073	4.03614	-1.34157	2.1904	-12.6891	-34.394	-2.95618	-4.66775	0.532063	-4.74386	0.50555				
7	-14.5125	-12.2183	2.37236	-8.11937	9.5435	27.9925	3.42415	0.355952	0.538363	8.69135	-3.20231				
8	6.26257	18.7143	-4.29713	10.5488	-5.3343	-9.20091	-7.7518	-11.2545	0.533628	-15.4384	3.36501				
9	-5.59505	-5.76575	-0.05218	2.26197	-1.53379	-5.30523	-2.2528	-5.59688	0.532066	-3.59779	-0.68854				
10	3.78417	13.0588	0.961121	-12.4221	-6.43681	-11.6185	6.10648	4.68669	0.533657	-6.81208	-3.93809				
11	0.482991	8.52205	-3.29862	3.5743	-2.67859	-3.69	-5.00183	-9.09985	0.533576	-7.08897	2.5122				
12	5.10082	16.1063	-3.57175	-1.9076	-5.99466	-11.1452	-3.0294	-6.5451	0.53336	-13.2905	1.63639				
13	-6.46504	-13.5128	-2.85624	4.34721	-1.69918	-11.9315	-4.593	-7.14337	0.532817	1.52004	1.79707				
14	-3.08611	-0.77025	3.00465	-10.6509	-1.30932	-3.3966	4.83353	1.77177	0.534489	-3.99236	-4.55974				

DB1 PPACs were not in

Filtered Data Uses

- Example of regression
- LISE Ray Reader for 2D/3D plots

Filter Features

- It is important to note that SpecTcl will have the filter enabled until SpecTcl is closed or it is disabled. This is a feature that allows you to run multiple data files through the filter quickly.
- The filter definitions are stored in the def file.
  - To delete filters, type “filter –delete [filter name]” in the command line
  - To see what filters you currently have, type “filter –list”
- Any number of gates can be used to define the filter. If one wishes to read out all the data in a run, then the ‘True’ gate may be used in the filter definition.

Final Comments

- Using the SpecTcl filter feature to extract event-by-event information has proven useful to run regressions on the data to extract transfer matrices.
- The CSVFilterOutputStage code created the formatting to allow SpecTcl to create csv files.
  - Using this file as a template, one could direct SpecTcl to create the output in any number of formats or extensions.
- A working Filtered Event Processor has not yet been implemented, but would greatly reduce the analysis time of large files.

Plotting data with LISE Ray Reader

- https://lise.nscl.msu.edu/download/download.html
  "LISE Ray Reader" by I.Richardson
  (https://lise.nscl.msu.edu/download/Windows/other/LISE_RayReader/Ray-Reader-BETA-1.0.exe)

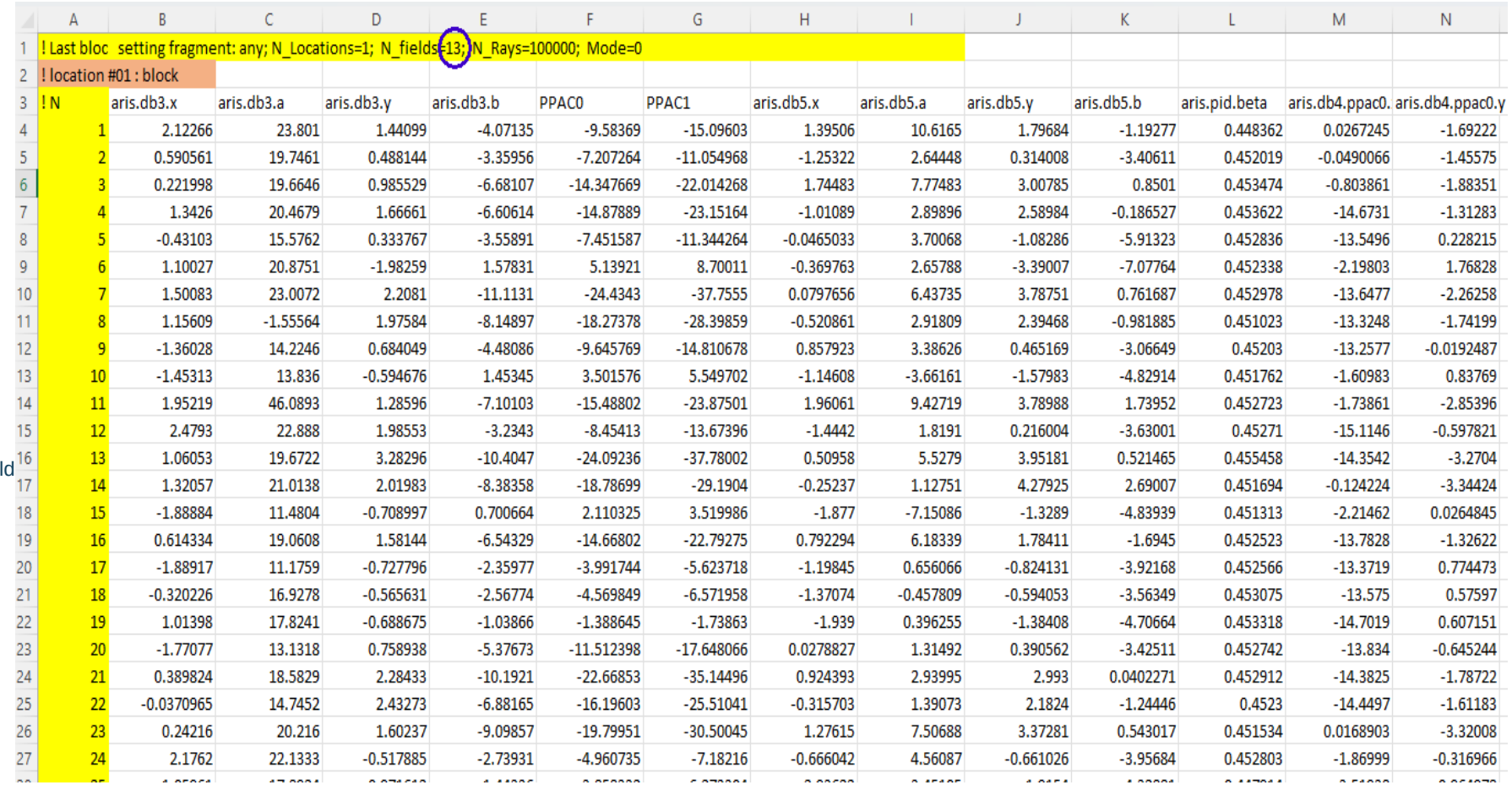
- It's beta-version. Serious improvement are still required, including the installation procedure

- LISE Ray Reader's documentation: https://lise.nscl.msu.edu/doc/ray-reader-documentation/

- Your data file (separated by comma) should be modified to "LISE ray reader" format (see next slide)

Input file for LISE Ray Reader

- One column and two rows (marked by yellow and red colors) should be inserted in your comma-separated data file
- Modify the number of fields corresponding to your format
(see blue open circle)
- Text file example



	A	B	C	D	E	F	G	H	I	J	K	L	M	N
1	! Last bloc setting fragment: any; N_Locations=1; N_fields=13; N_Rays=100000; Mode=0													
2	! location #01 : block													
3	! N	aris.db3.x	aris.db3.a	aris.db3.y	aris.db3.b	PPAC0	PPAC1	aris.db5.x	aris.db5.a	aris.db5.y	aris.db5.b	aris.pid.beta	aris.db4.ppac0.	aris.db4.ppac0.y
4	1	2.12266	23.801	1.44099	-4.07135	-9.58369	-15.09603	1.39506	10.6165	1.79684	-1.19277	0.448362	0.0267245	-1.69222
5	2	0.590561	19.7461	0.488144	-3.35956	-7.207264	-11.054968	-1.25322	2.64448	0.314008	-3.40611	0.452019	-0.0490066	-1.45575
6	3	0.221998	19.6646	0.985529	-6.68107	-14.347669	-22.014268	1.74483	7.77483	3.00785	0.8501	0.453474	-0.803861	-1.88351
7	4	1.3426	20.4679	1.66661	-6.60614	-14.87889	-23.15164	-1.01089	2.89896	2.58984	-0.186527	0.453622	-14.6731	-1.31283
8	5	-0.43103	15.5762	0.333767	-3.55891	-7.451587	-11.344264	-0.0465033	3.70068	-1.08286	-5.91323	0.452836	-13.5496	0.228215
9	6	1.10027	20.8751	-1.98259	1.57831	5.13921	8.70011	-0.369763	2.65788	-3.39007	-7.07764	0.452338	-2.19803	1.76828
10	7	1.50083	23.0072	2.2081	-11.1131	-24.4343	-37.7555	0.0797656	6.43735	3.78751	0.761687	0.452978	-13.6477	-2.26258
11	8	1.15609	-1.55564	1.97584	-8.14897	-18.27378	-28.39859	-0.520861	2.91809	2.39468	-0.981885	0.451023	-13.3248	-1.74199
12	9	-1.36028	14.2246	0.684049	-4.48086	-9.645769	-14.810678	0.857923	3.38626	0.465169	-3.06649	0.45203	-13.2577	-0.0192487
13	10	-1.45313	13.836	-0.594676	1.45345	3.501576	5.549702	-1.14608	-3.66161	-1.57983	-4.82914	0.451762	-1.60983	0.83769
14	11	1.95219	46.0893	1.28596	-7.10103	-15.48802	-23.87501	1.96061	9.42719	3.78988	1.73952	0.452723	-1.73861	-2.85396
15	12	2.4793	22.888	1.98553	-3.2343	-8.45413	-13.67396	-1.4442	1.8191	0.216004	-3.63001	0.45271	-15.1146	-0.597821
16	13	1.06053	19.6722	3.28296	-10.4047	-24.09236	-37.78002	0.50958	5.5279	3.95181	0.521465	0.455458	-14.3542	-3.2704
17	14	1.32057	21.0138	2.01983	-8.38358	-18.78699	-29.1904	-0.25237	1.12751	4.27925	2.69007	0.451694	-0.124224	-3.34424
18	15	-1.88884	11.4804	-0.708997	0.700664	2.110325	3.519986	-1.877	-7.15086	-1.3289	-4.83939	0.451313	-2.21462	0.0264845
19	16	0.614334	19.0608	1.58144	-6.54329	-14.66802	-22.79275	0.792294	6.18339	1.78411	-1.6945	0.452523	-13.7828	-1.32622
20	17	-1.88917	11.1759	-0.727796	-2.35977	-3.991744	-5.623718	-1.19845	0.656066	-0.824131	-3.92168	0.452566	-13.3719	0.774473
21	18	-0.320226	16.9278	-0.565631	-2.56774	-4.569849	-6.571958	-1.37074	-0.457809	-0.594053	-3.56349	0.453075	-13.575	0.57597
22	19	1.01398	17.8241	-0.688675	-1.03866	-1.388645	-1.73863	-1.939	0.396255	-1.38408	-4.70664	0.453318	-14.7019	0.607151
23	20	-1.77077	13.1318	0.758938	-5.37673	-11.512398	-17.648066	0.0278827	1.31492	0.390562	-3.42511	0.452742	-13.834	-0.645244
24	21	0.389824	18.5829	2.28433	-10.1921	-22.66853	-35.14496	0.924393	2.93995	2.993	0.0402271	0.452912	-14.3825	-1.78722
25	22	-0.0370965	14.7452	2.43273	-6.88165	-16.19603	-25.51041	-0.315703	1.39073	2.1824	-1.24446	0.4523	-14.4497	-1.61183
26	23	0.24216	20.216	1.60237	-9.09857	-19.79951	-30.50045	1.27615	7.50688	3.37281	0.543017	0.451534	0.0168903	-3.32008
27	24	2.1762	22.1333	-0.517885	-2.73931	-4.960735	-7.18216	-0.666042	4.56087	-0.661026	-3.95684	0.452803	-1.86999	-0.316966

"! Last block ""any""", setting fragment: any; N_Locations=1; N_field
! location #01 : block,,,,,
! N,aris.db3.x,aris.db3.a,aris.db3.y,aris.db3.b,PPAC0
1,2.12266,23.801,1.44099,-4.07135,-9.58369
2,0.590561,19.7461,0.488144,-3.35956,-7.207264
3,0.221998,19.6646,0.985529,-6.68107,-14.347669
4,1.3426,20.4679,1.66661,-6.60614,-14.87889
5,-0.43103,15.5762,0.333767,-3.55891,-7.451587

Plotting data with LISE Ray Reader: results