UT-BATTELLE

Fast Monte Carlo Simulations of SEQUOIA

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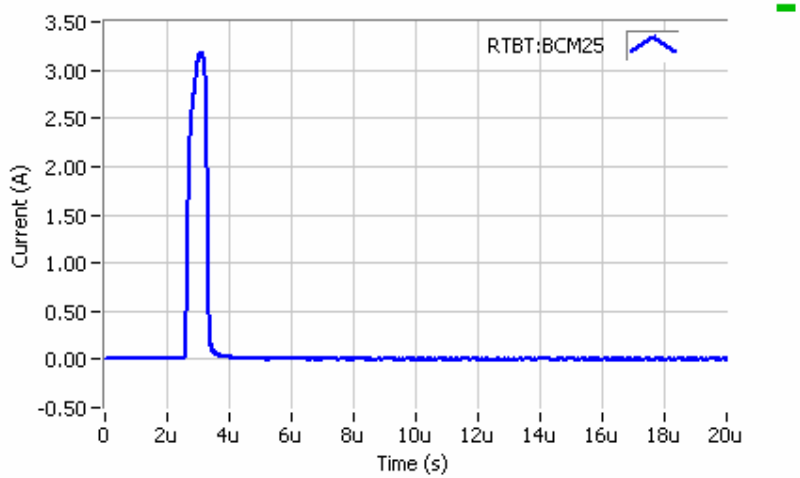
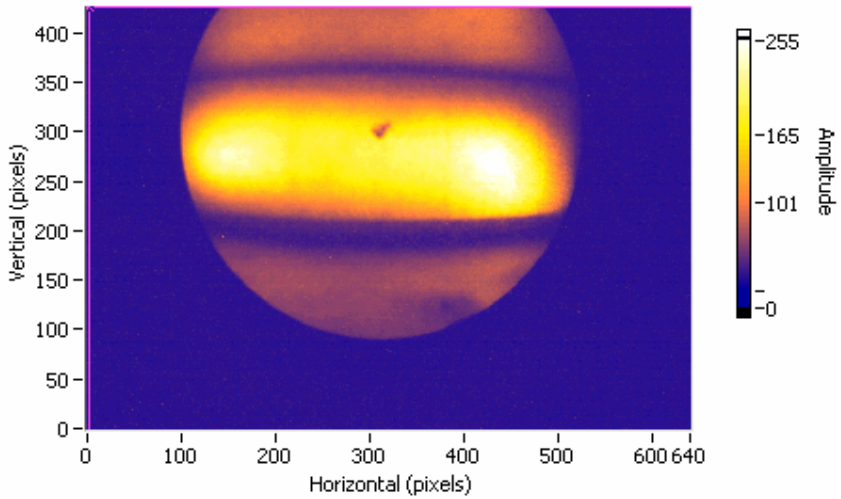
Outline

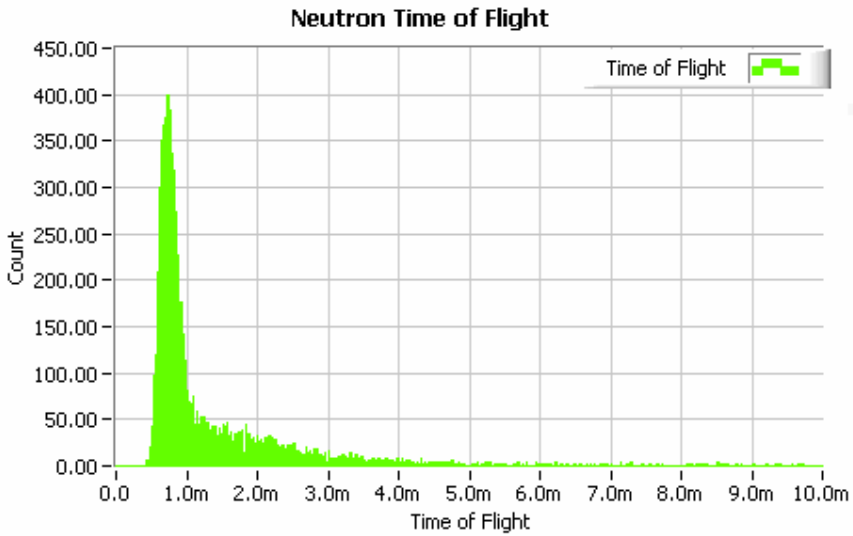
- **SNS status and overview**
- **SEQUOIA overview**
- **Specialized Monte Carlo Components**
- **Method of Parallelization**
- **Results**
- **Comments on Data Analysis**
- **Resolution tests**
- **Summary**

SNS site - Spring 2006

SNS first neutrons on April 28

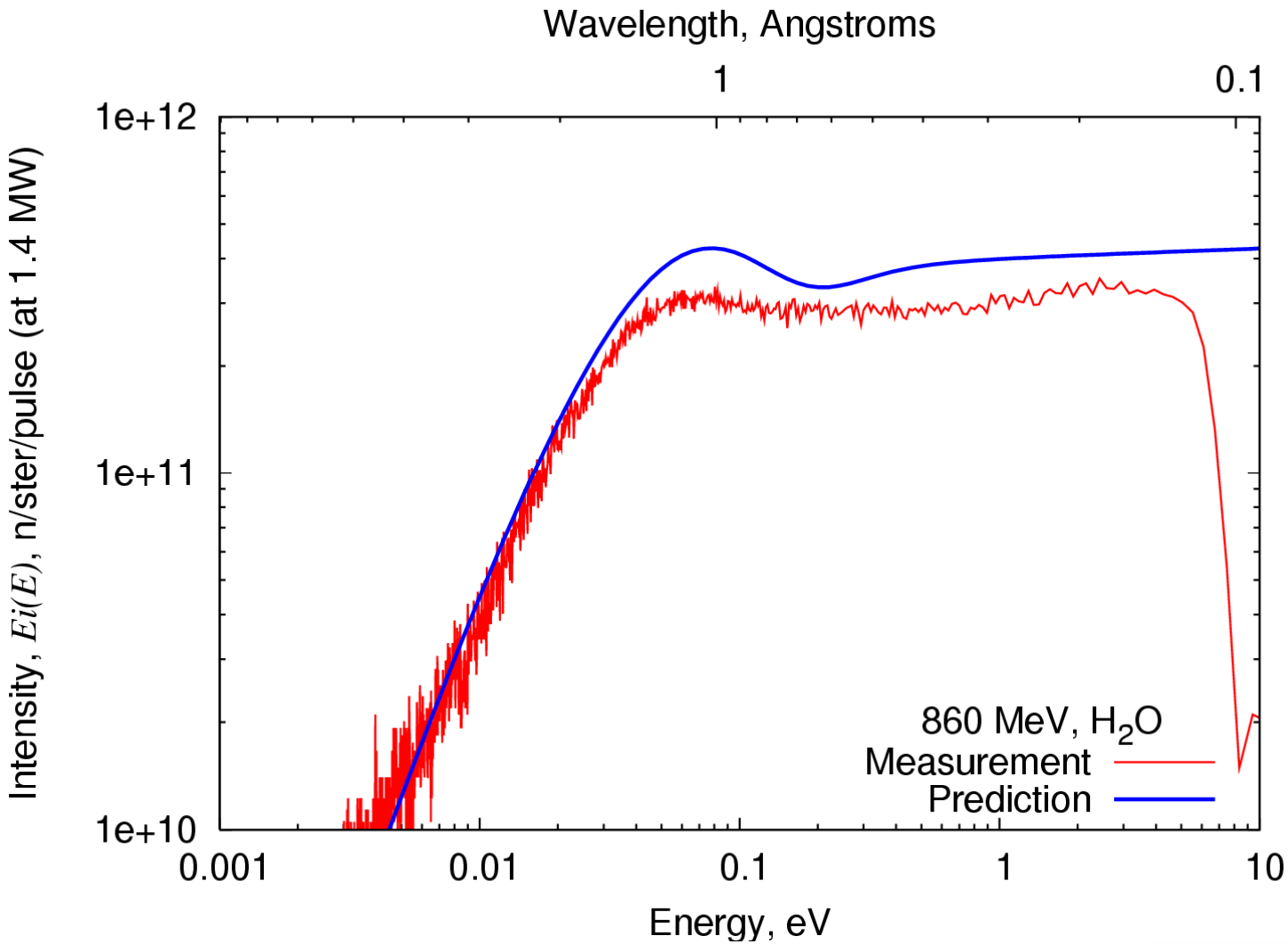




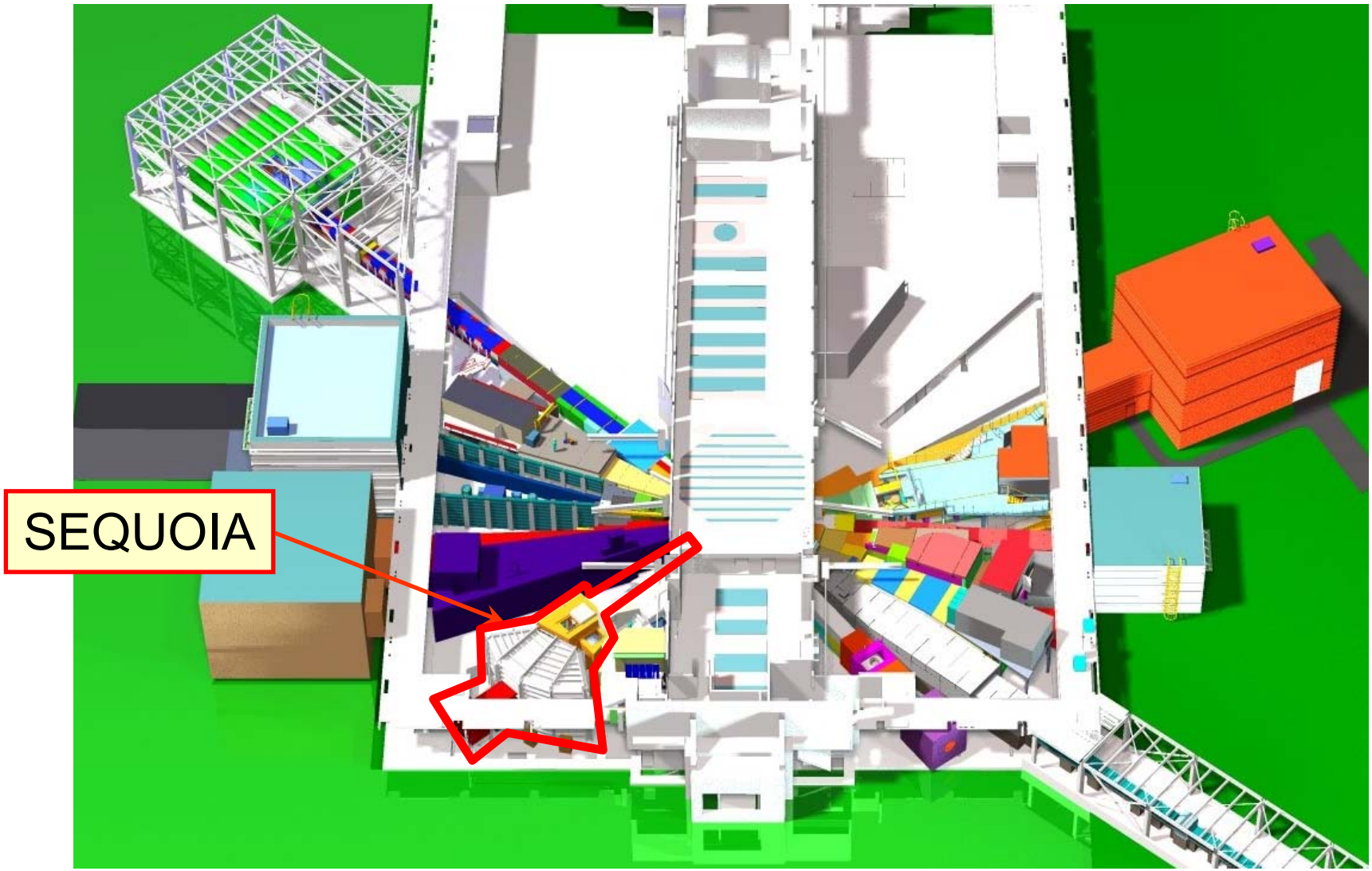


Protons	11.8T	10T Achieved
Total Protons	258T	
Charge (C)	1.90u	
1-eV Moderator Coupling (n/ster/eV/p)	2.15m	
PEP-Specified Neutronics Units (n/ster/p)	41.8m	5m Achieved

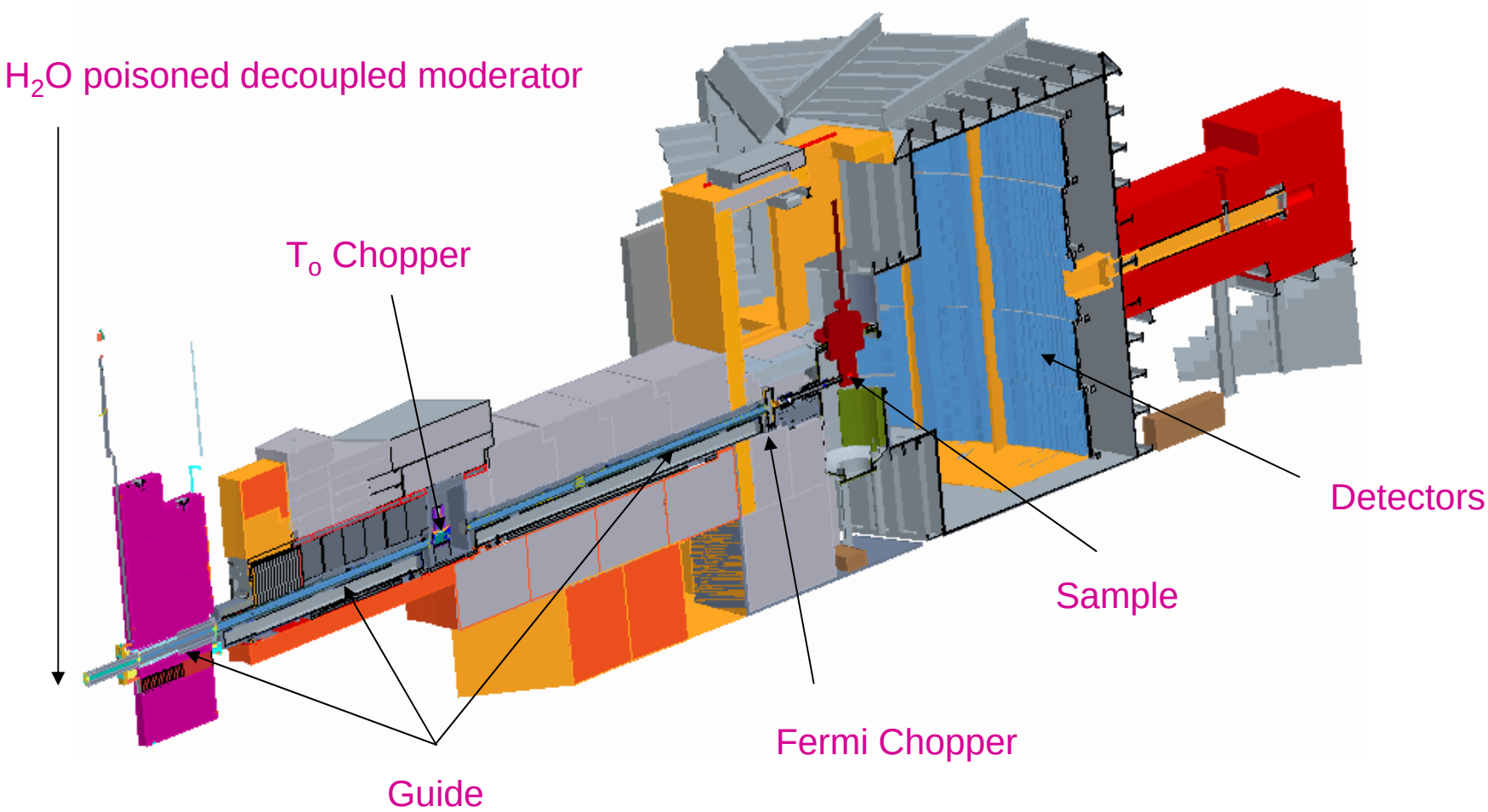
CD4
Beam Line 7 Intensity Measurement



SNS Instrument Suite



Overview


H_2O poisoned decoupled moderator
T_o Chopper
Detectors
Sample
Fermi Chopper
Guide

Parameters

- **Decouple poisoned ambient H_2O moderator**
- **Moderator to Fermi chopper distance 18 m**
- **Fermi chopper to sample distance 2m**
- **Sample to detector distance in horizontal 5.5m**
- **Narrow bandwidth vertical axis T_0 chopper at 10 m from moderator operates at multiples of 30 Hz up to 180 Hz**
- **Elliptical shaped guide with focal point after sample**
- **5 cm x 5 cm sample**
- **Fermi chopper, E_i = 100 meV, ν = 420 Hz, 2 mm slits, r_{curve} = 1.0048 m**
- **Detector y = 500, 12mm x ϕ = 360, 0.25° x t=2000, 5μs**
  360 x 500 x 2000 = 3.6 x 10^8 pixels!!

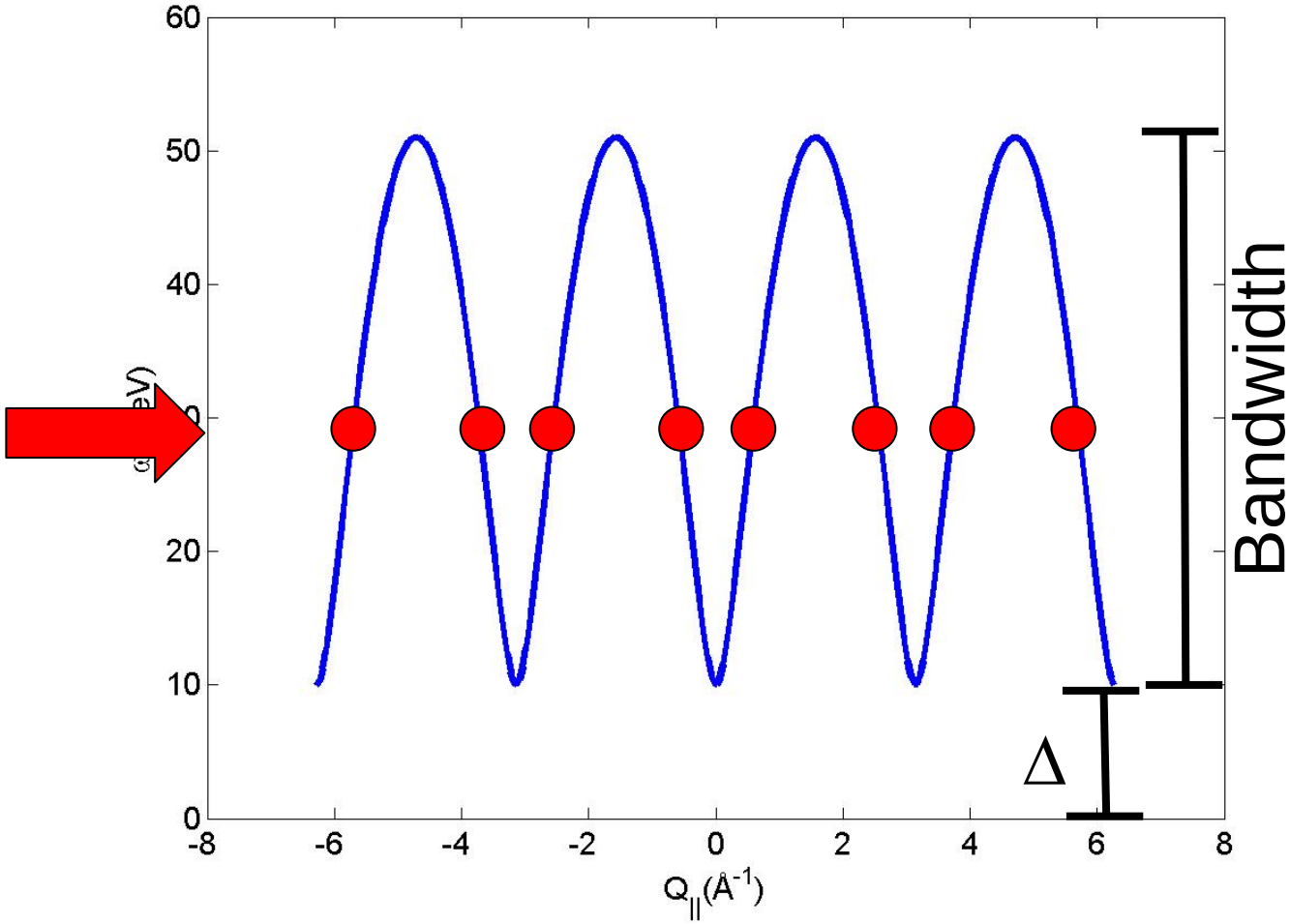
Specialized components

- **SNS Source – In current McStas release**
- **T_0 chopper**
- **Fermi chopper**

} Slit package can be changed with only a few lines of code

- **1-D Dispersion sample**
- **Cylindrical Event based detector**

1-D dispersion component

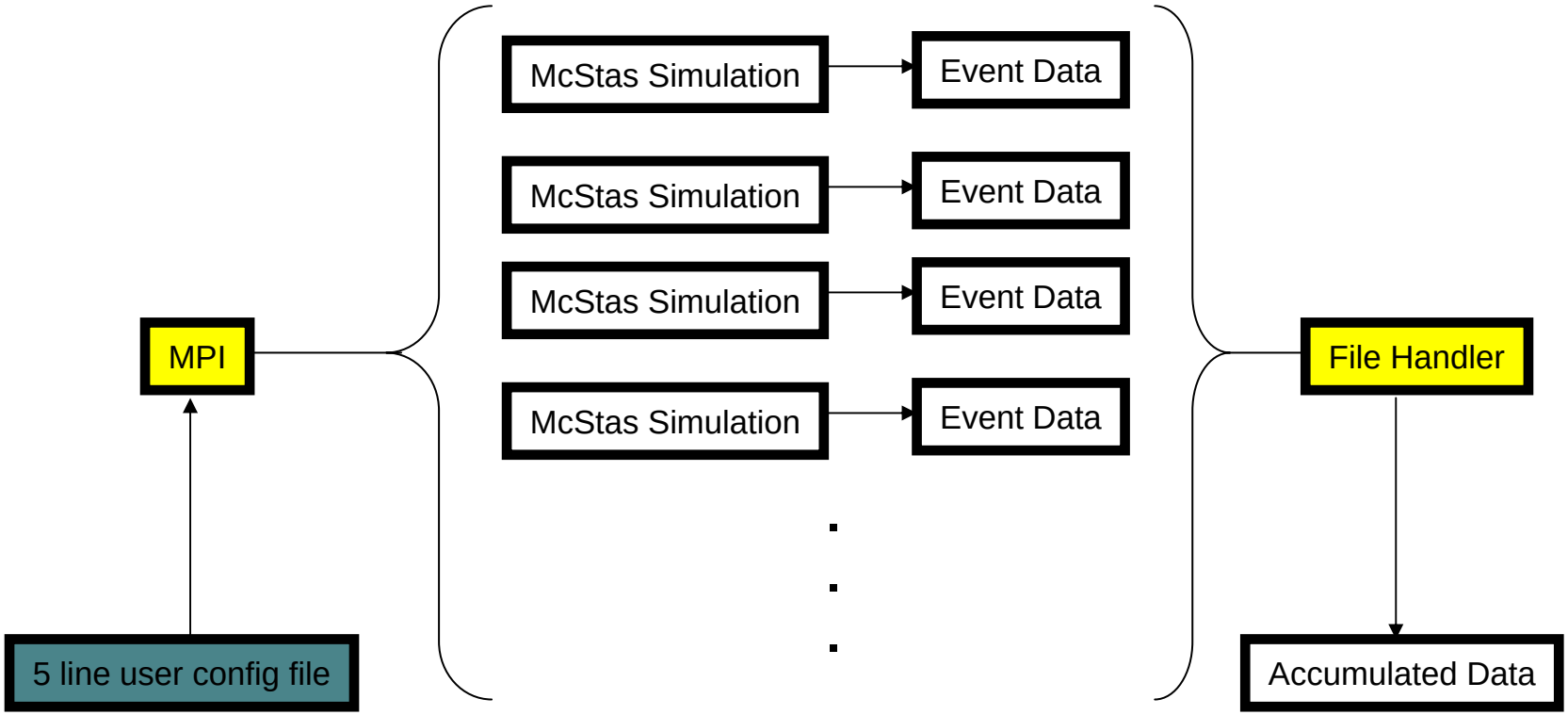


Event Detector Component

- **10^8 pixels is too many for standard cylindrical detectors**
- **Records Time, phi_bin, y_bin, and probability.**
- **Histogramming performed after simulation complete**
  - **Facilitates parallelization**

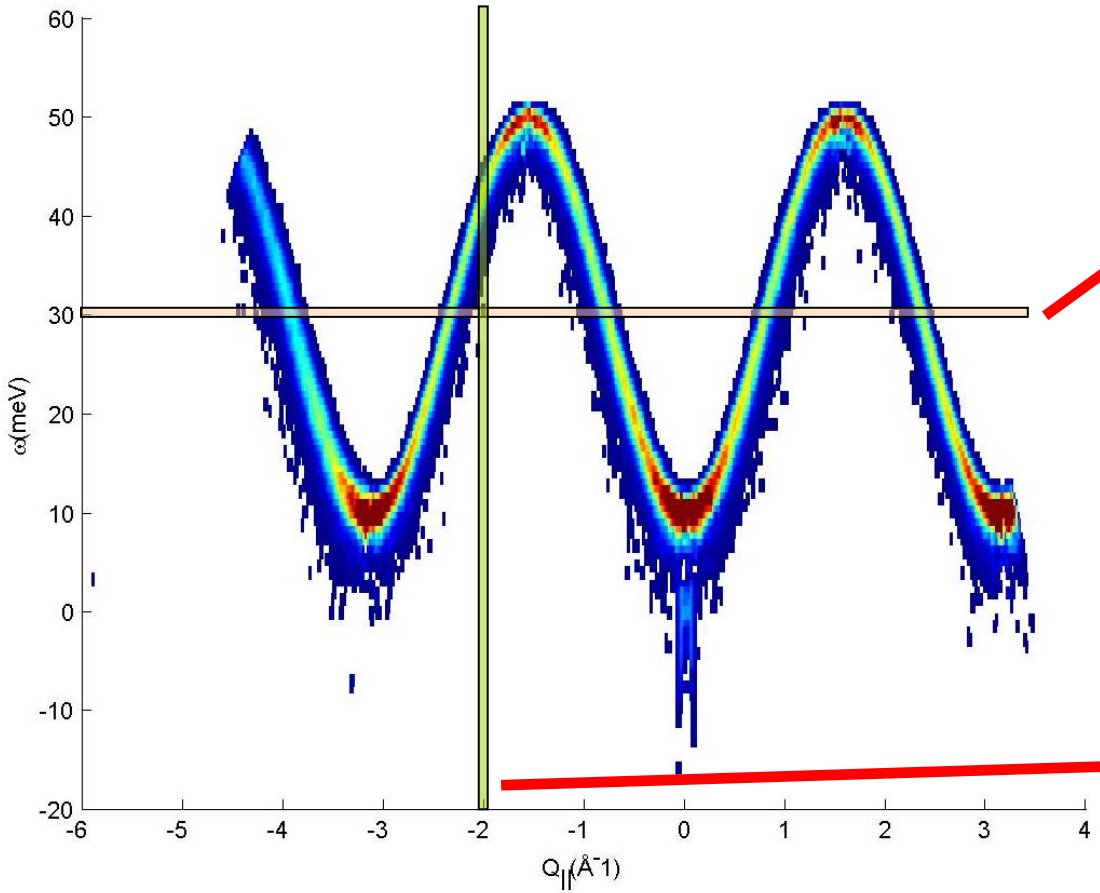
```
tunits: (mus)
philimits: -3.000000e+01 6.000000e+01
phibins: 360
ybins: 500
ylimits: -3.000000e+00 3.000000e+00
time phi_bin y_bin prob
6185.8 75 266 0.722748
6278.7 206 282 643.477
6310.9 33 273 446.827
6128.8 307 282 114.083
5932.2 28 276 265.99
6104.0 85 275 0.000450935
```

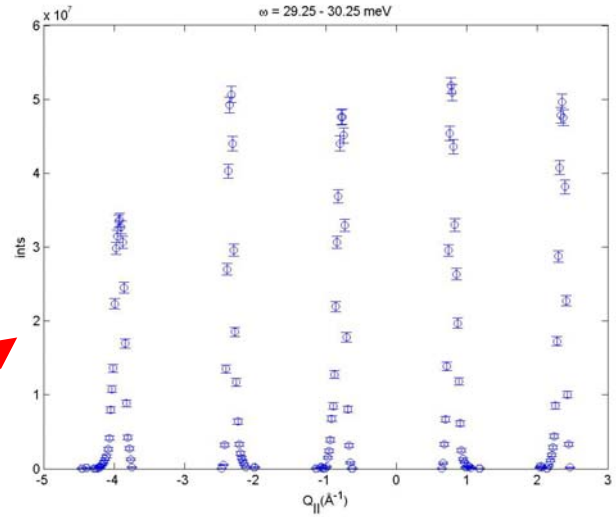
Processing diagram

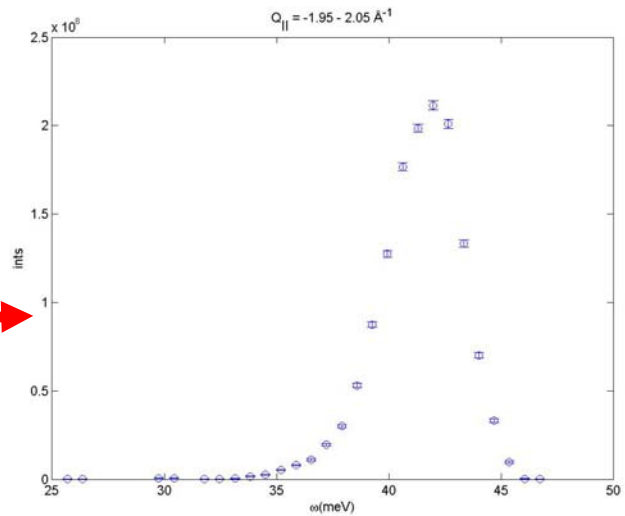


- $1x10^{10}$ n distributed over 21 processors
- ~ 3 hour calculation time
- useable on the Teragrid in the near future.
- Requires no knowledge of MPI, PVM, grid access, etc.

Results

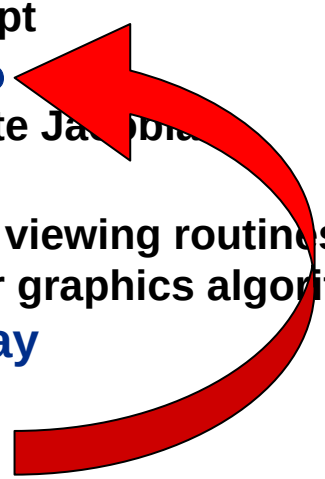




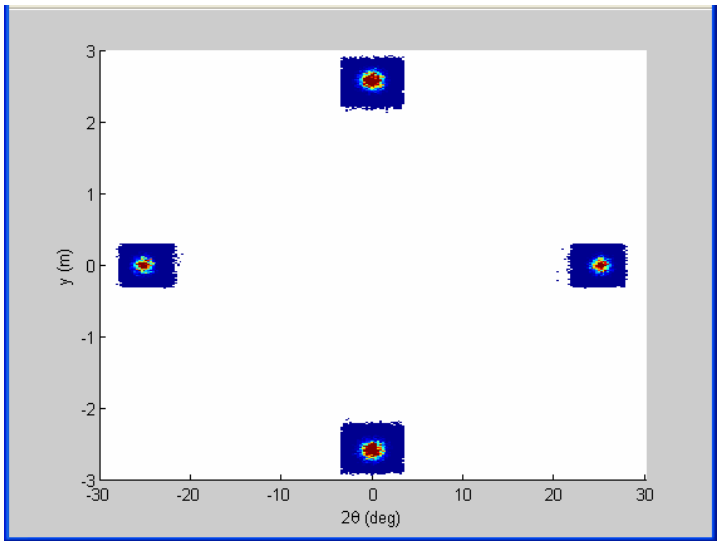


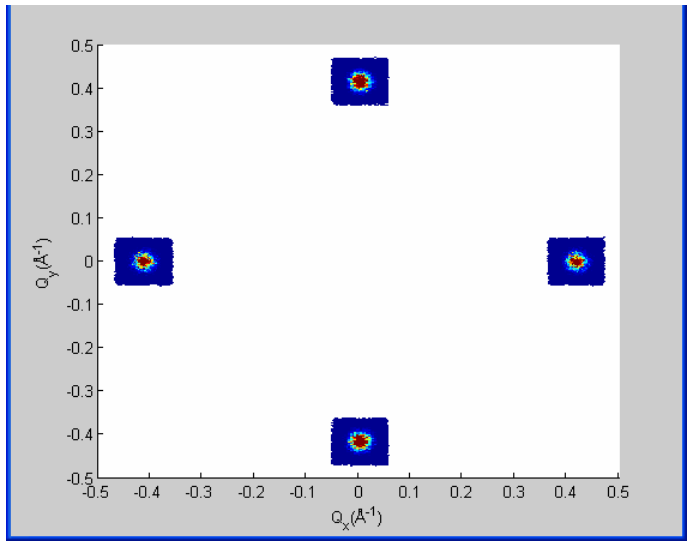
Used for Developing Data Analysis Algorithms

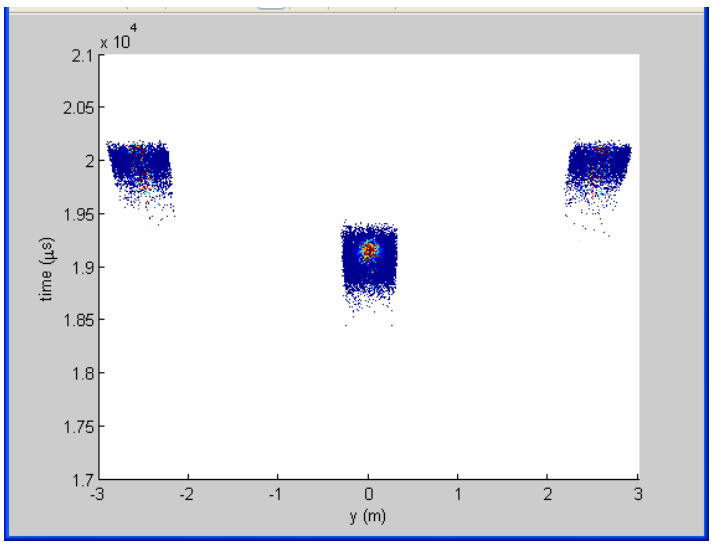
- **Results too large for mslice**
  - **1/5 of detector bank OK on high end linux machine (2003)**
- **Algorithms tested**
  1. **Event data read and histogrammed into t and ϕ bins**
     - **Pixels stored as vertices and connections (computer graphics standard)**
     - **Only pixels with events are kept**
  2. **Vertices converted to Q and ω**
     - **Note volume of pixel is discrete Ja[illegible]bia[illegible]**
  3. **Data projected into 2-D plane**
     - **3-D projection algorithms and viewing routines in progress**
     - **Plan to capitalize on computer graphics algorithms from this point**
  4. **Data gridded onto regular array**
  5. **Cuts made**
     - **Cuts from step 2 in progress**

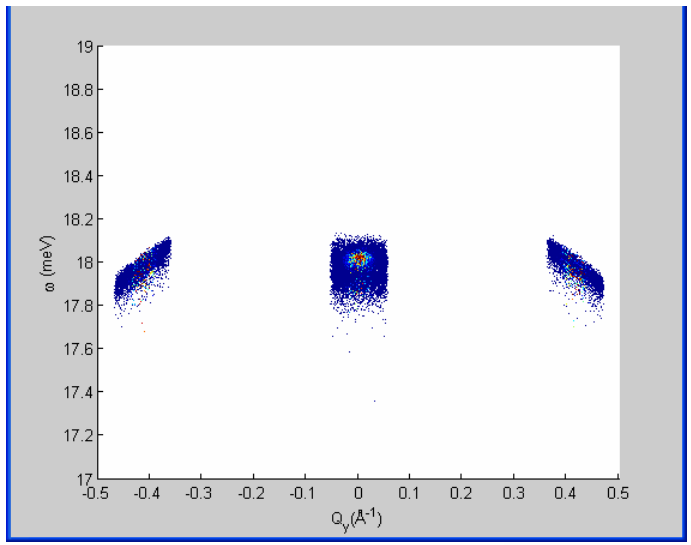


Views in t and ω

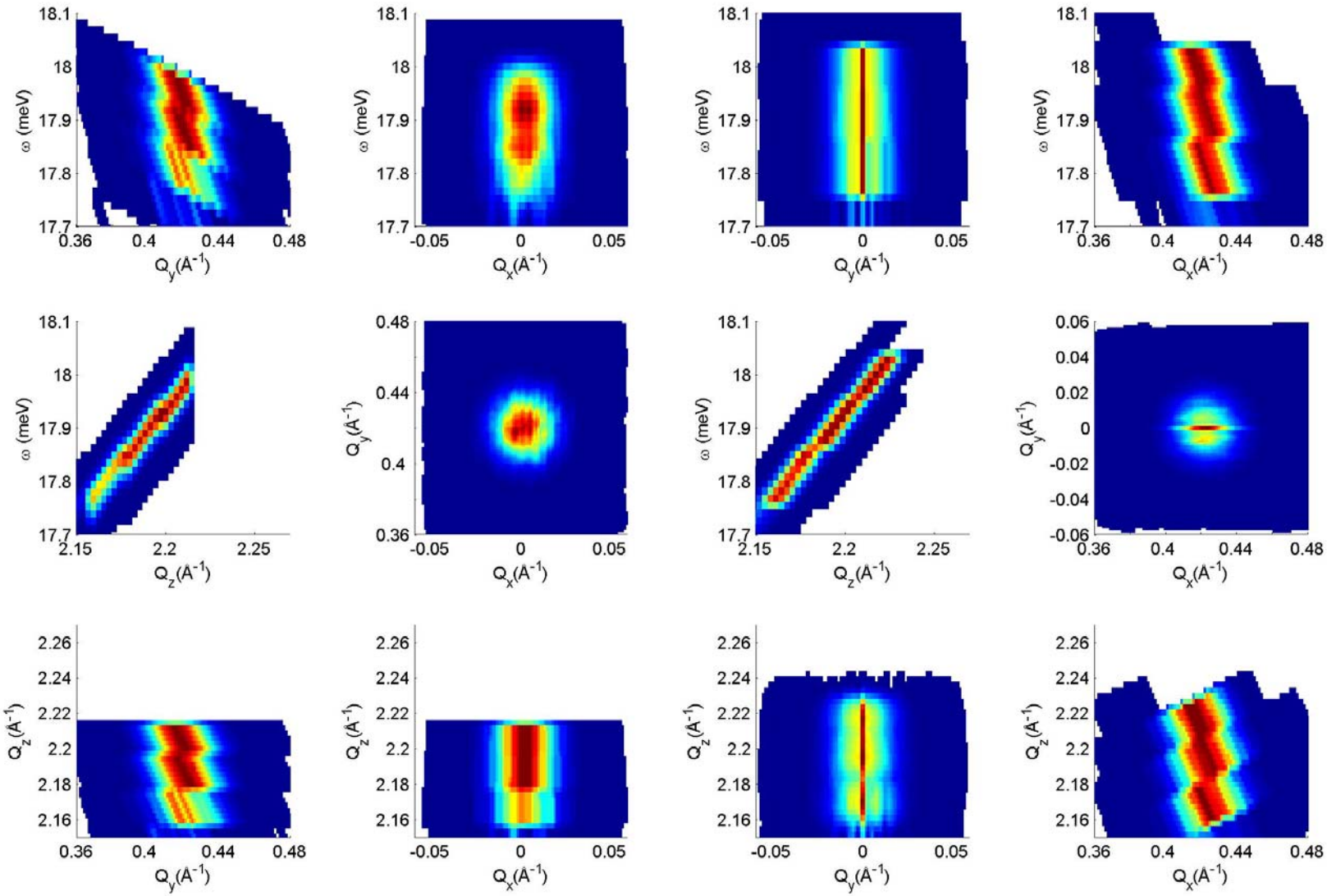




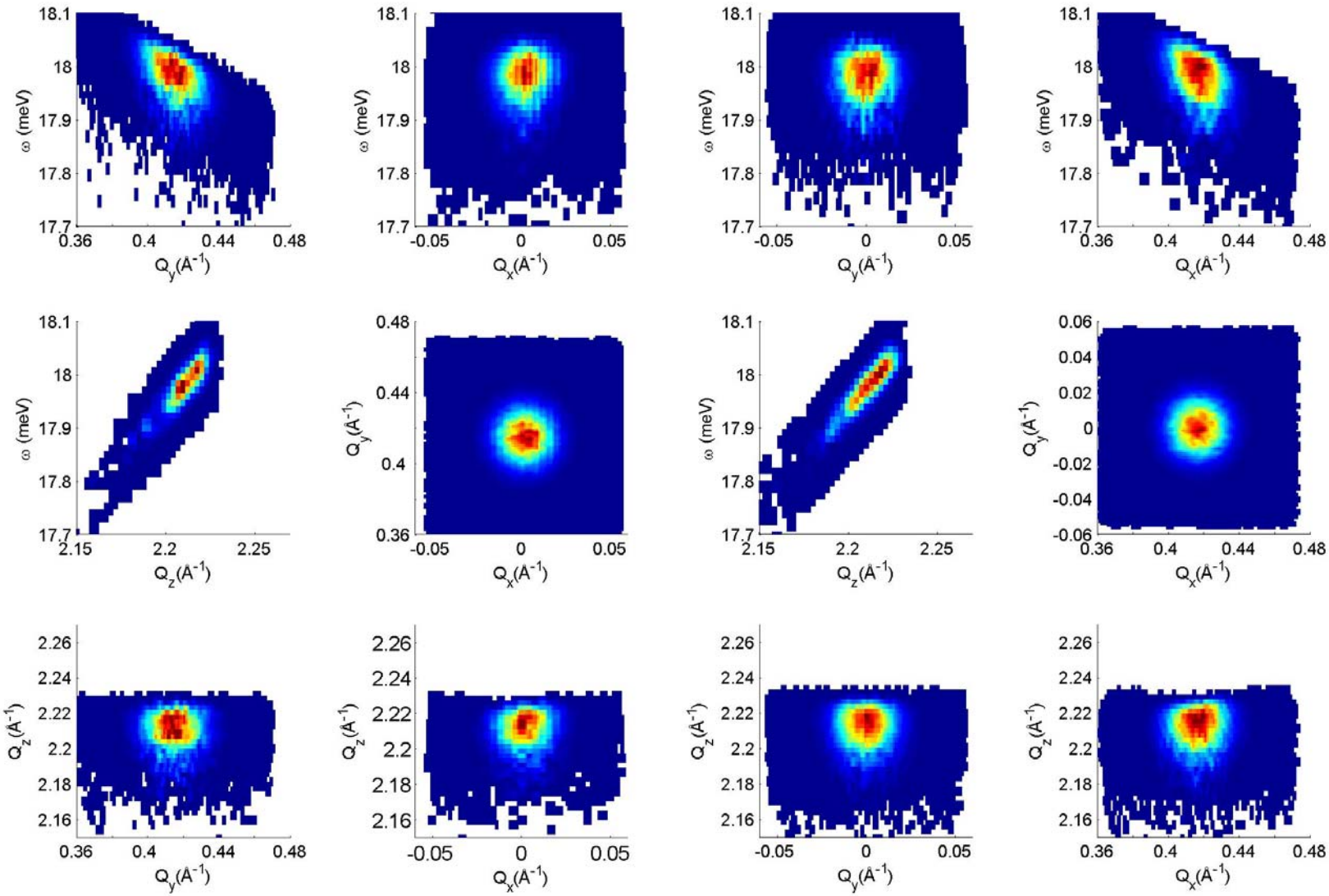




200 μs



5μs



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Summary

- **1-D dispersions have been measured using Mcstas**
- **Cluster simulations were performed in ~ 3 hr**
  - **All ~10^8 pixels included in simulation**
- **These results are useful for testing data analysis software**

Acknowledgements

- **ORNL Teragrid people**
  - **Meili Chen**
  - **John Cobb**
- **SEQUOIA Instrument Development Team**
  - **Steve Nagler, PI**
- **Other SNS people**
  - **Mark Hagen**
- **Funding sources**
  - **US – DOE (everything in this talk)**
  - **US – NSF (funds the Teragrid)**