



Australian Government



Advanced Workflow for Experimental Control

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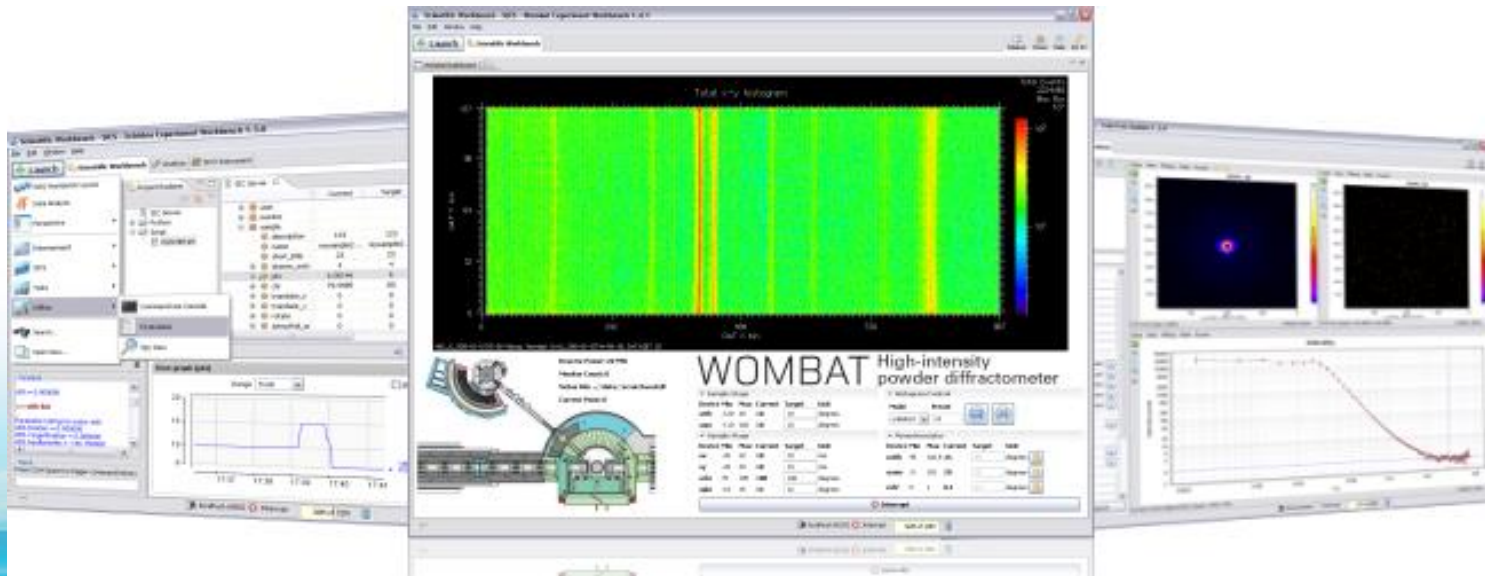
Overview

- **GumTree**
- **Expectations**
- **Implementation**
- **Future Opportunities**



GumTree

- **Open Source Project (on GitHub)**
- **Instrument Control and Data Acquisition**
- **Data Correction and Reduction**



Workflow

- **User Friendly Interface for Data Acquisition**
- **Multiple Samples, Configurations and Sample Environments**

Workflow

Example for Quokka:



Workflow

**Example for Quokka:
+3 Configurations**



Workflow

Example for Quokka:

+3 Configurations

+7 Samples



Workflow

Example for Quokka:

+3 Configurations

+7 Samples

+5 Temperatures



Workflow

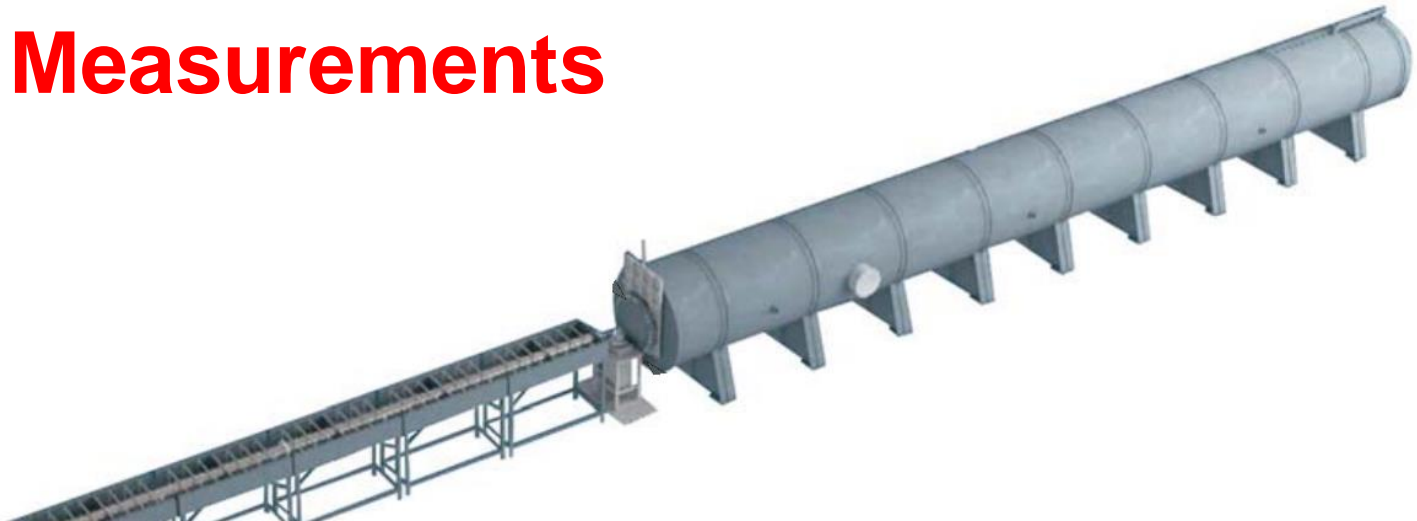
Example for Quokka:

+3 Configurations

+7 Samples

+5 Temperatures

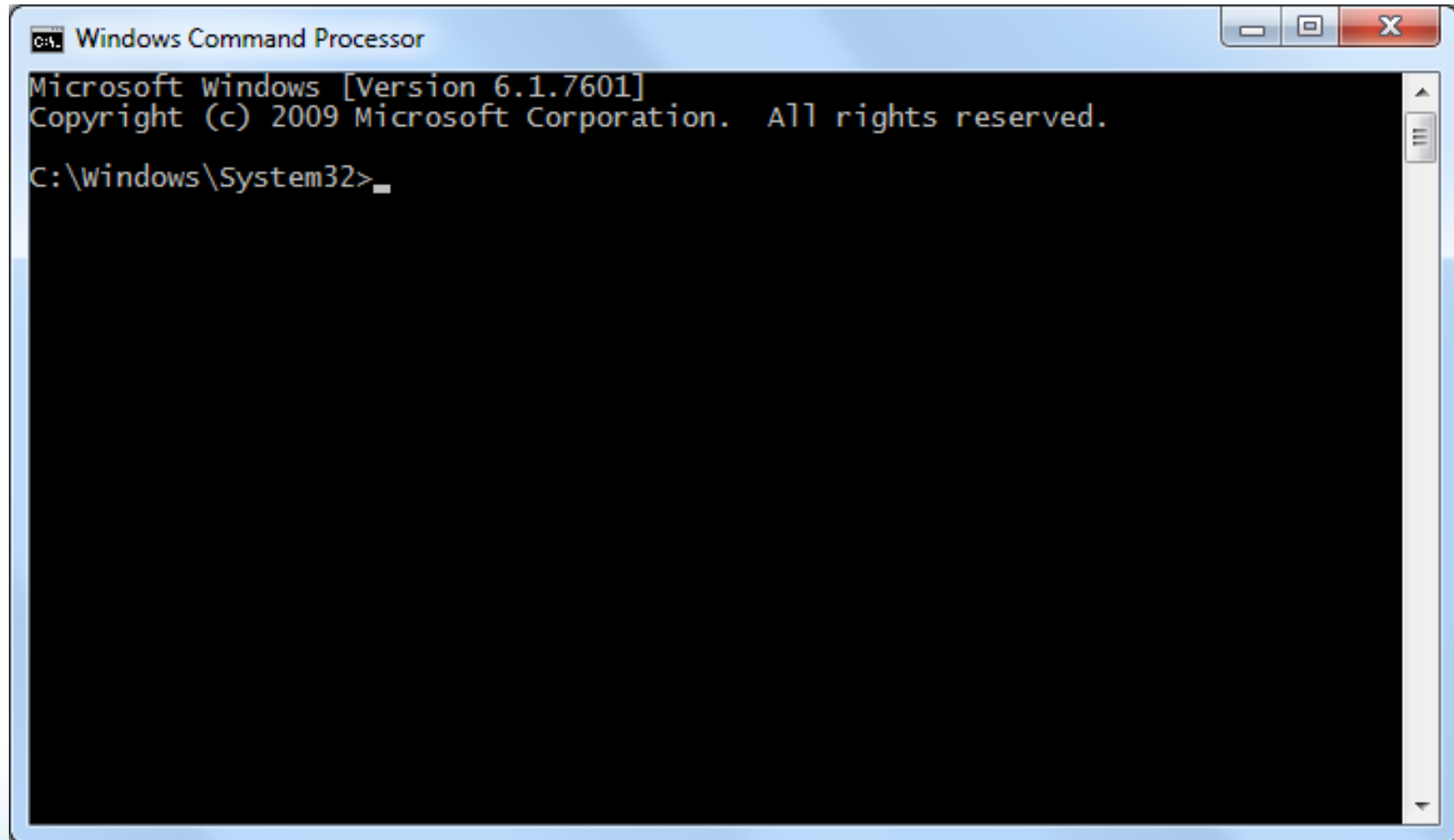
=105 Measurements



Input from Scientists

- **Has to be simple**
- **Maximum Flexibility**
- **Everything on one page**

Input from Scientists



A screenshot of a Windows Command Processor window. The title bar reads "C:\ Windows Command Processor". The window content displays the following text:

```
Microsoft Windows [Version 6.1.7601]  
Copyright (c) 2009 Microsoft Corporation. All rights reserved.  
C:\Windows\System32>
```

Input from Scientists

- **Different Experiences**
- **Contradicting Expectations**
- **Many corner cases**



Conclusion

Samples

- Sample Holders
- Properties

Configurations

- Config. Scripts
- Transmission
- Scattering

Environments

- Temperatures, Magnets etc.
- Multi Level

Acquisition

- Start and Stop
- Time Estimation
- Fine Tuning

Acquisition Tree						Progress
1 0p3T_L1=L2=20m_central_flux_proposal888						
1 Transmission		<input checked="" type="checkbox"/>	Time (sec):	600		
1 Sample 1	Position:	3				
2 Sample 2	Position:	4				
3 Sample 3	Position:	5				
4 BLOCKED_BEAM	Position:	8				
5 EMPTY_BEAM	Position:	9				
6 EMPTY_CELL	Position:	10				
2 Scattering		<input checked="" type="checkbox"/>	Time (sec):	6,000		
1 Sample 1	Position:	3				
2 Sample 2	Position:	4				
3 Sample 3	Position:	5				
4 BLOCKED_BEAM	Position:	8				
5 EMPTY_BEAM	Position:	9				
6 EMPTY_CELL	Position:	10				
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3 Sample 3	Position:	5				
4 BLOCKED_BEAM	Position:	8				
5 EMPTY_BEAM	Position:	9				
6 EMPTY_CELL	Position:	10				
3 10T_g4_4m_apx47_proposal888						
1 Transmission		<input checked="" type="checkbox"/>	Time (sec):	600		

Acquisition Tree					Progress
1	0p3T_L1=L2=20m_central_flux_proposal888				
1	Transmission	<input checked="" type="checkbox"/>	Time (sec):	600	
1	Sample 1	<input checked="" type="checkbox"/>	Position:	3	
2	Sample 2	<input checked="" type="checkbox"/>	Position:	4	
3	Sample 3	<input checked="" type="checkbox"/>	Position:	5	
	BLOCKED_BEAM	<input type="checkbox"/>	Position:	8	
5	EMPTY_BEAM	<input checked="" type="checkbox"/>	Position:	9	
6	EMPTY_CELL	<input checked="" type="checkbox"/>	Position:	10	
2	Scattering	<input checked="" type="checkbox"/>	Time (sec):	6,000	
1	Sample 1	<input checked="" type="checkbox"/>	Position:	3	
2	Sample 2	<input checked="" type="checkbox"/>	Position:	4	
3	Sample 3	<input checked="" type="checkbox"/>	Position:	5	
	BLOCKED_BEAM	<input type="checkbox"/>	Position:	8	
5	EMPTY_BEAM	<input checked="" type="checkbox"/>	Position:	9	
6	EMPTY_CELL	<input checked="" type="checkbox"/>	Position:	10	
2	0T_L1=L2=20m_central_flux_proposal888				
1	Transmission	<input checked="" type="checkbox"/>	Time (sec):	600	
1	Sample 1	<input checked="" type="checkbox"/>	Position:	3	
2	Sample 2	<input checked="" type="checkbox"/>	Position:	4	
3	Sample 3	<input checked="" type="checkbox"/>	Position:	5	
	BLOCKED_BEAM	<input type="checkbox"/>	Position:	8	
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2	Scattering	<input checked="" type="checkbox"/>	Time (sec):	600	
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2	Sample 2	<input checked="" type="checkbox"/>	Position:	4	
3	Sample 3	<input checked="" type="checkbox"/>	Position:	5	
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5	EMPTY_BEAM	<input type="checkbox"/>	Position:	9	
6	EMPTY_CELL	<input checked="" type="checkbox"/>	Position:	10	
3	10T_g4_4m_apx47_proposal888				

Model is very import

Implementation

- **Integration in existing infrastructure**
- **Realistic Time Estimations**
- **Headless Server / Thin Client**
- **Easy to maintain for multiple instruments**

Instrument Specific

Server

- Model Definition (XSD)
- Instrument Interaction (Python)

Client

- GUI Layout
- Binding to Model
- Send Commands

Instrument Independent

Server

- Model Database
- Communication Protocols
- Time Estimation
- ...

Client

- GumTree
- Model Framework

Patterns Used

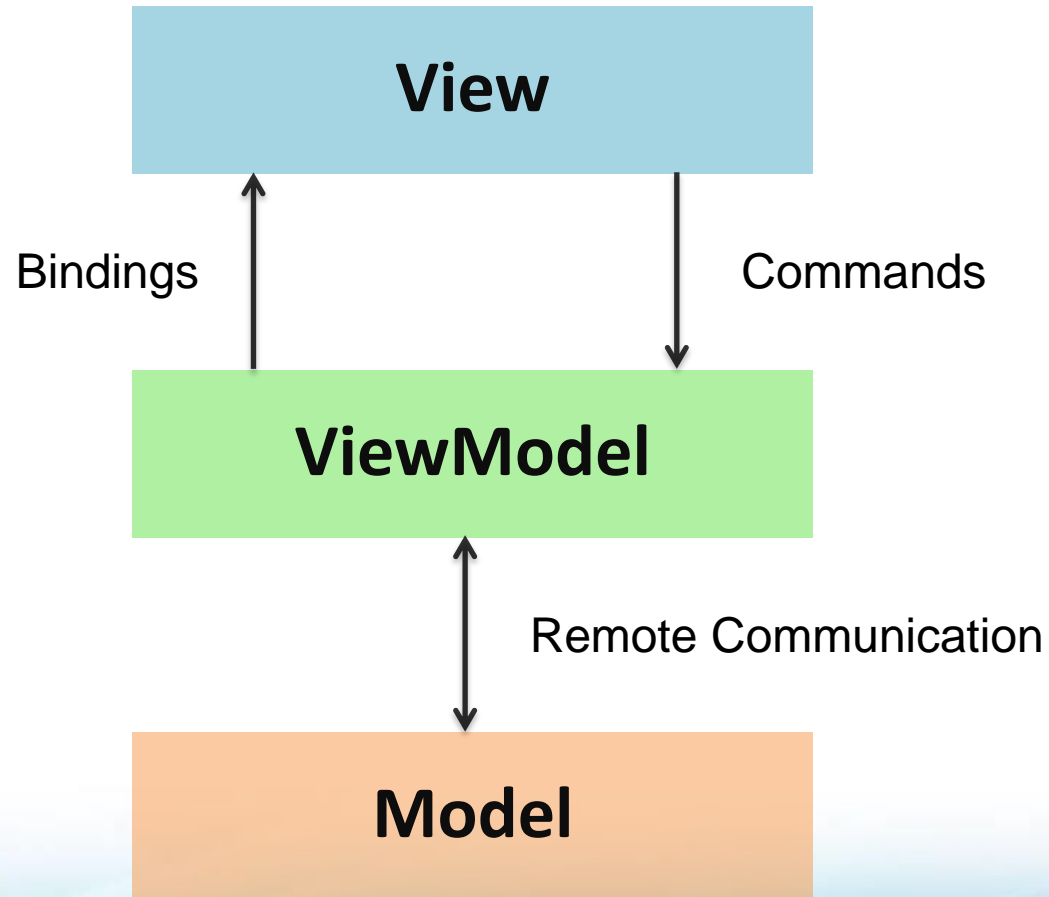
Command Pattern

- Only commands can influence model
- Easy to serialise and sent

Model View ViewModel (MVVM)

- Developed by Microsoft
- Separation between Model, ViewModel and View

MVVM Pattern



Time Estimation

- **Statistical Approach**

Time Estimation

- **Statistical Approach**
- **Commands which are**

Time Estimation

- **Statistical Approach**
- **Commands which are**
 - **State Independent Time**

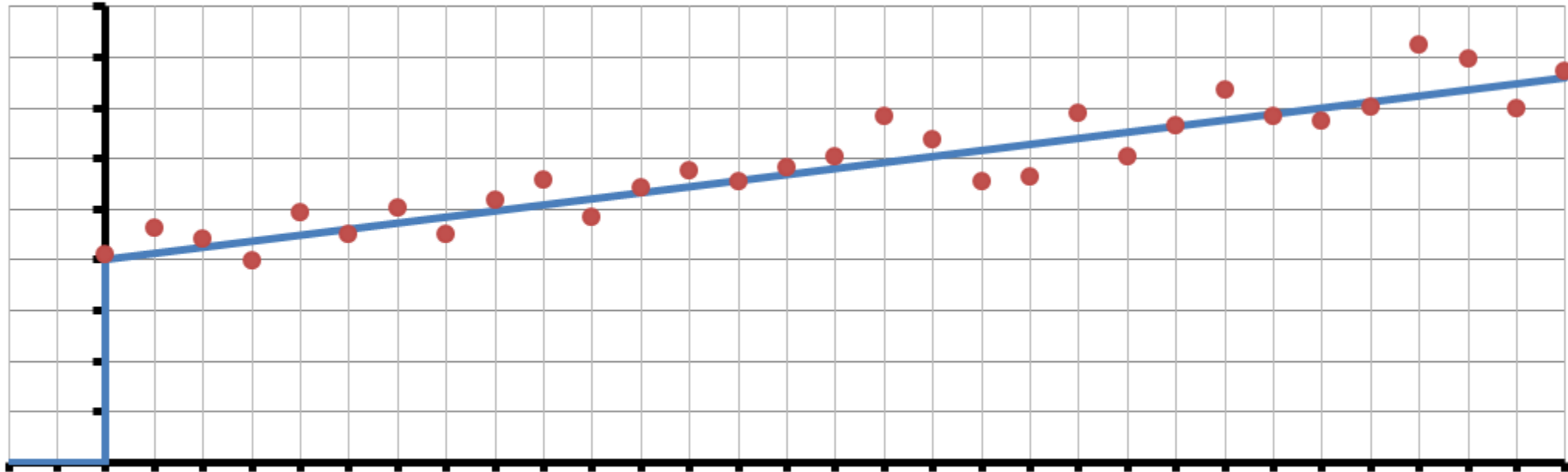
Time Estimation

- **Statistical Approach**
- **Commands which are**
 - **State Independent Time**
 - **State Dependent**

Time Estimation

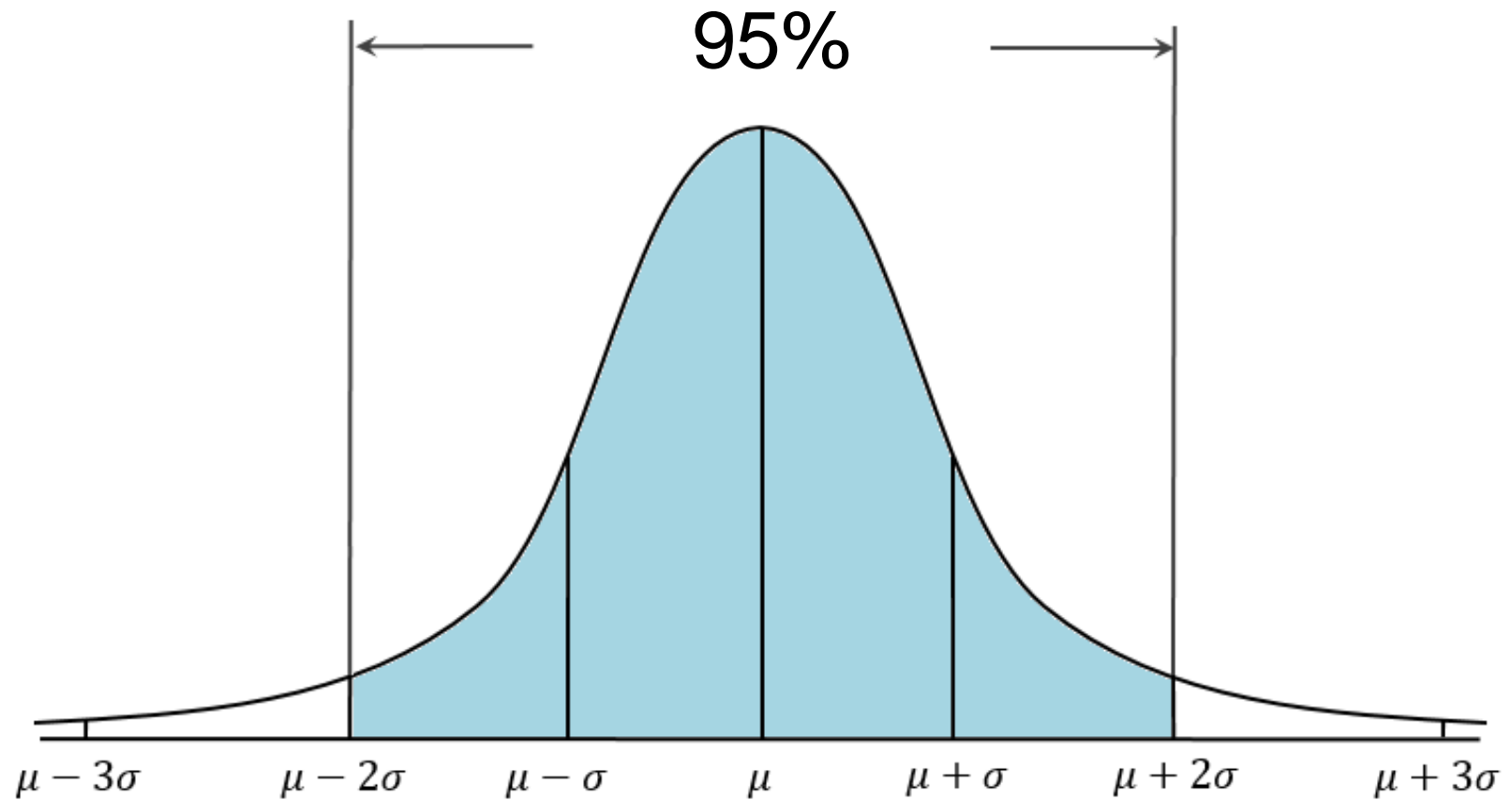
- **Statistical Approach**
- **Commands which are**
 - **State Independent Time**
 - **State Dependent**
 - **Linear State Dependent**

Time Estimation



Linear State Dependent

Time Estimation



Confidence Interval

Future

- **Fault detection**
- **Web Viewer**
- **Feedback Loop**

Future

- **Fault detection**
- **Web Viewer**
- **Feedback Loop**

Thank You



Multi Sample Workflow



Proposal Number:

Autofill






















Experiment Title:


Users

	<input type="checkbox"/>	Name	Phone	Email
	<input checked="" type="checkbox"/>	Nozomu Adachi		
	<input checked="" type="checkbox"/>	Yojiro Oba, Yoshikazu Todaka, Koji...		
	<input checked="" type="checkbox"/>	<u>E Gilbert</u>		

Multi Sample Workflow



	<input type="checkbox"/>	Name	Thickness	Description
	<input type="checkbox"/>	1	1.0	
	<input type="checkbox"/>	2	1.0	
	<input checked="" type="checkbox"/>	3 Sample 1	1.0	
	<input checked="" type="checkbox"/>	4 Sample 2	1.0	
	<input checked="" type="checkbox"/>	5 Sample 3	1.0	
	<input type="checkbox"/>	6	1.0	
	<input type="checkbox"/>	7	1.0	
	<input checked="" type="checkbox"/>	8 BLOCKED_BEAM	1.0	
	<input checked="" type="checkbox"/>	9 EMPTY_BEAM	1.0	
	<input checked="" type="checkbox"/>	10 EMPTY_CELL	1.0	
	<input type="checkbox"/>	11	1.0	
	<input type="checkbox"/>	12	1.0	
	<input type="checkbox"/>	13	1.0	
	<input type="checkbox"/>	14	1.0	
	<input type="checkbox"/>	15	1.0	
	<input type="checkbox"/>	16	1.0	
	<input type="checkbox"/>	17	1.0	
	<input type="checkbox"/>	18	1.0	
	<input type="checkbox"/>	19	1.0	
	<input type="checkbox"/>	20	1.0	

 Drive to load position

Multi Sample Workflow



		Name
<input checked="" type="checkbox"/>	1	Op3T_L1=L2=20m_central_flux_p...
<input checked="" type="checkbox"/>	2	0T_L1=L2=20m_central_flux_propo...
<input checked="" type="checkbox"/>	3	10T_g4_4m_apx47_proposal888

Configuration

Name: Op3T_L1=L2=20m_central_flux_proposal888 Group:

Scripts

Initialize Pre-Transmission Pre-Scattering

```
# Drive attenuator to safe value
driveAtt(330)
#sics.drive('nvs_lambda', 5.0)
# Drive detector to longest position
sics.set('/instrument/detector/detector_y/speed', 53)
driveDet(19250,0)
# Drive guide to ga config
driveGuide(guideConfig.ga)
# Drive entrance aperture to 150 (for ga)
driveEntRotAp(150)
#set sample ap to 7.5 mm
sics.drive('apx', -47)
# Drive beamstops up
selBs(1)
sics.set('beamcenterx', 96.07)
sics.set('beamcenterz', 92.89)
sics.execute('OxfordSetRate 0.8')
sics.execute('OxfordSetfield 0.3')
sics.execute('broadcast ready')
time.sleep(5)
sics.execute('broadcast ready')
```

Transmission

fixed attenuation

Min Time: sec

Monitor Counts:

Detector Counts:

Max Time: sec

Scattering

iterative attenuation

Min Time: sec

Monitor Counts:

Detector Counts:

Max Time: sec

Multi Sample Workflow



Acquisition Tree		Progress
1	0p3T_L1=L2=20m_central_flux_proposal888	
1	Transmission <input checked="" type="checkbox"/> Time (sec): 600	
1	1 Sample 1 Position: 3	
1	2 Sample 2 Position: 4	
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3	10T_g4_4m_apx47_proposal888	

Configuration Time + Acquisition Time = Total Time
▶ Run