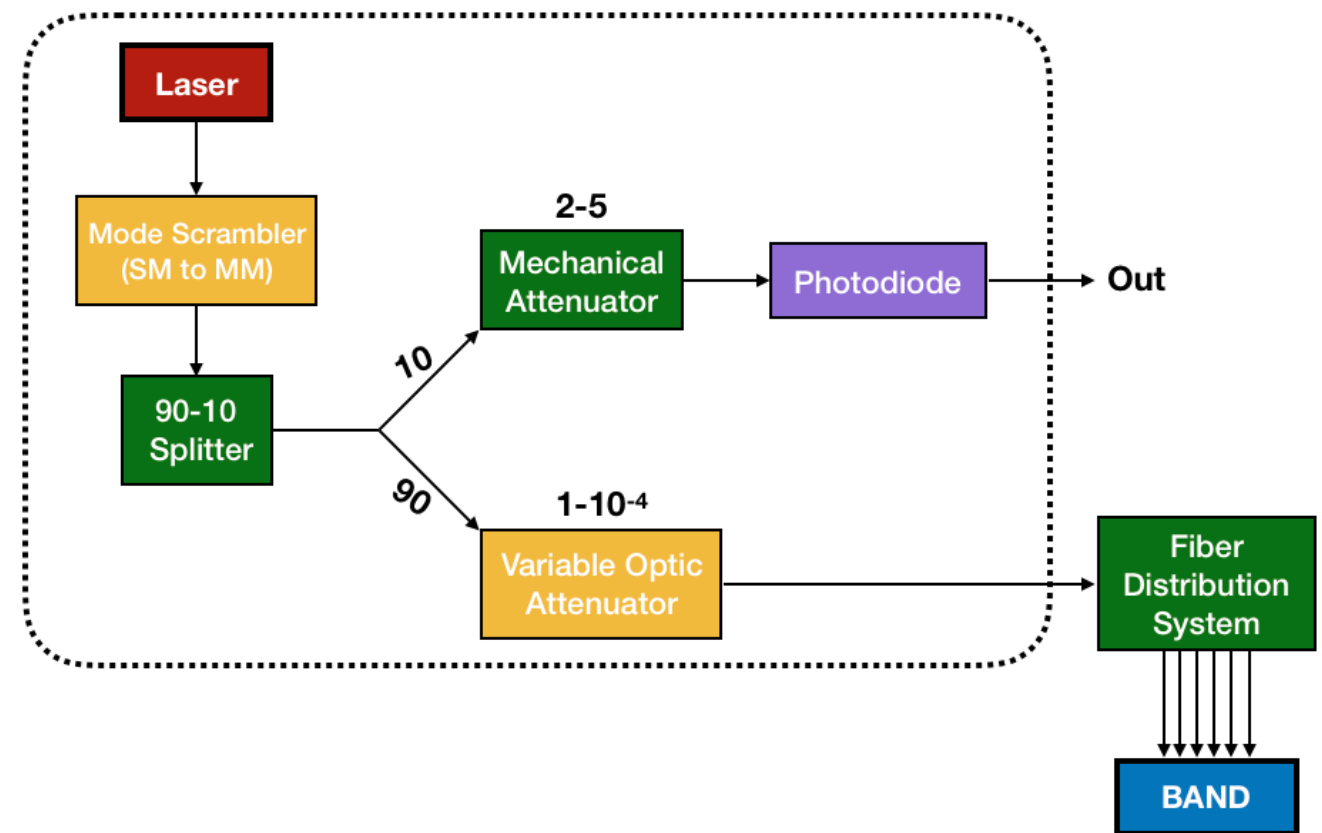
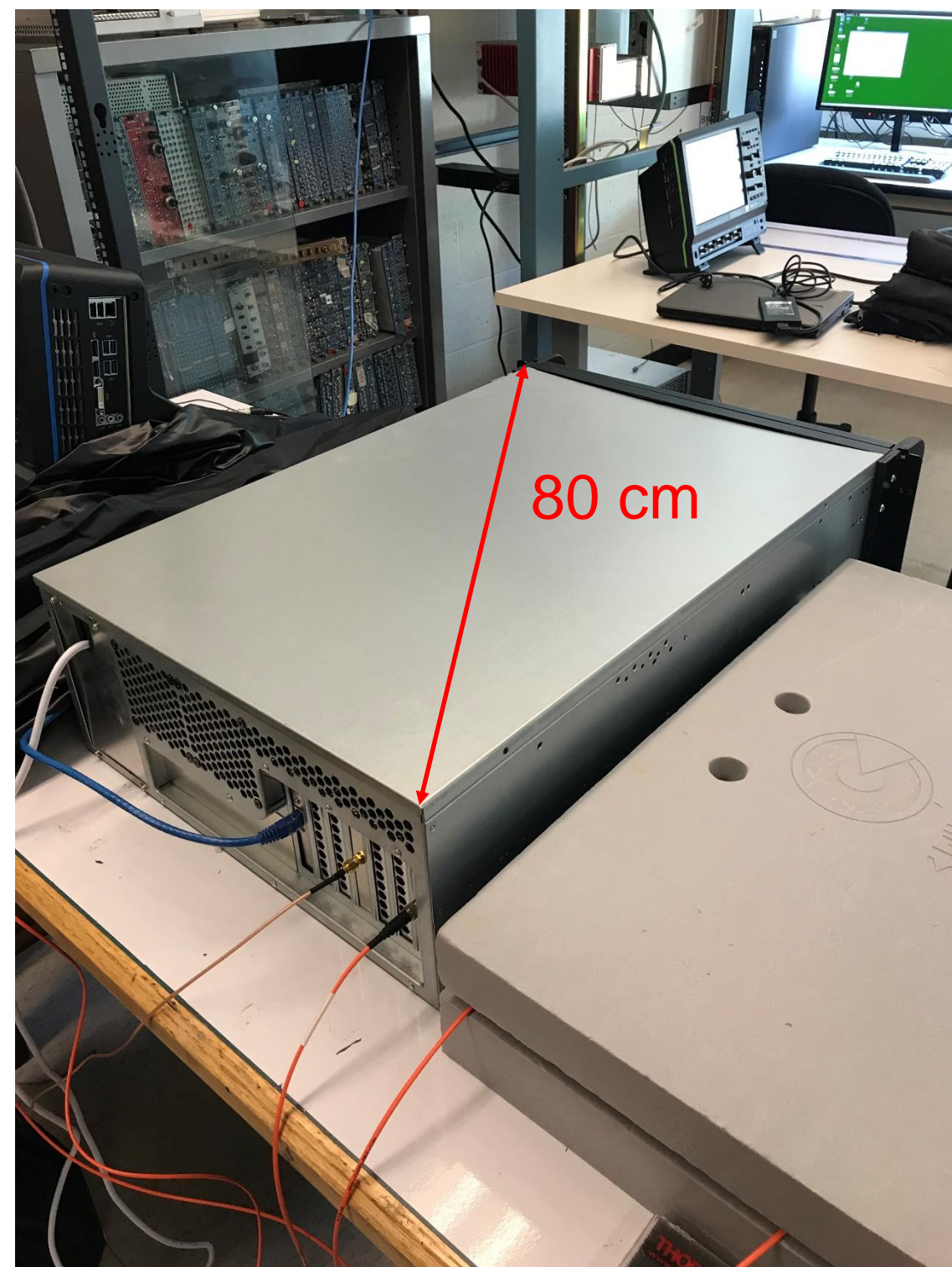


# BAND Laser Calibration System

Jackson Pybus  
Efrain Segarra, Florian Hauenstein  
CLAS Meeting 11/15/18

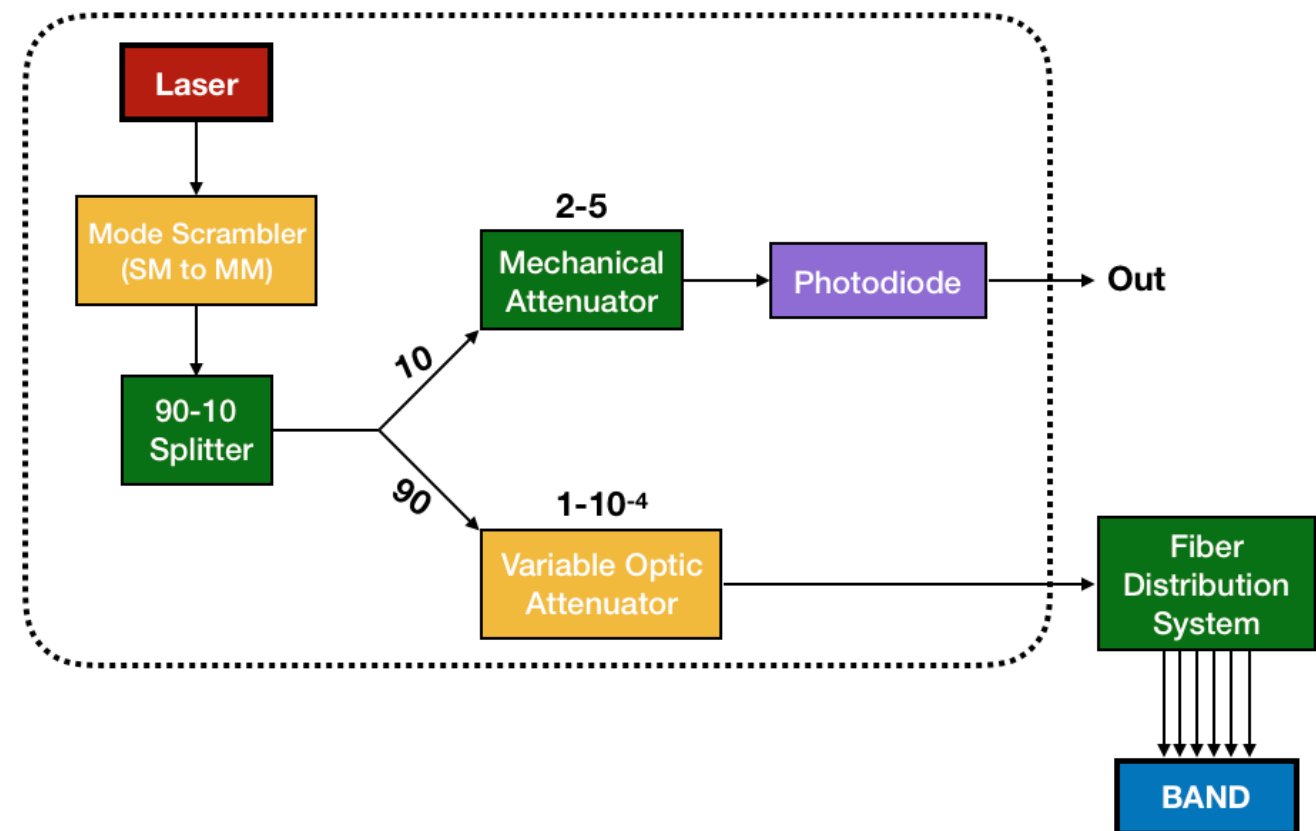
- System is intended for providing time-calibration for BAND detectors
- Controlled laser pulse of variable intensity
- Pulse split among 400 destinations
- Precise timing signal from internal photodiode
- Well-suited to determining amplitude-dependent time-response







- Laser emits pulse:
  - 355 nm
  - 300 ps
  - 10 Hz – 2 kHz
- Light passes through:
  - Mode Scrambler
  - 90/10 Splitter
  - 10% of light directed to Fast Photodiode (Rise time of 700 ps)
  - Variable Attenuator
- Light exits box to distribution system



- System controlled and monitored by Raspberry Pi, linked to online webpage providing:
  - Laser Driver Control
  - Signal Generator Control
  - Variable Attenuator Control
  - Temperature Monitoring



## Times

Suply	276:36	[H:M]
Emitting	276:28	[H:M]
<input type="button" value="Get current"/>		

## Temperatures

Diode	34	[C]
Cristal	28.01	[C]
Electronic sink	41	[C]
Heat sink	21	[C]

Control TEC1	<input type="button" value="ON"/>
Control TEC2	<input type="button" value="ON"/>

## Error Report

Error Reg. 1	0x00	[?]
Error Reg. 2	0x00	[?]
Error Reg. 3	0x00	[?]
Information Reg. 1	0x0C	[?]
Information Reg. 2	0x85	[?]
Information Reg. 3	0x2F	[?]

## Pulsing

Status	<input type="button" value="ON"/>
<input type="button" value="Get current"/>	
<input type="button" value="Turn ON"/>	
<input type="button" value="Turn OFF"/>	

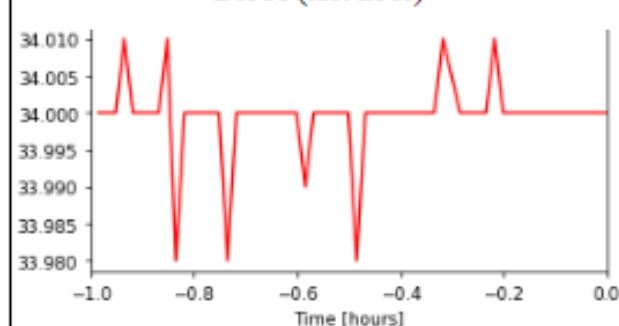
# Laser Driver Control

```
= Execution
=====
Request: las_act_all
```

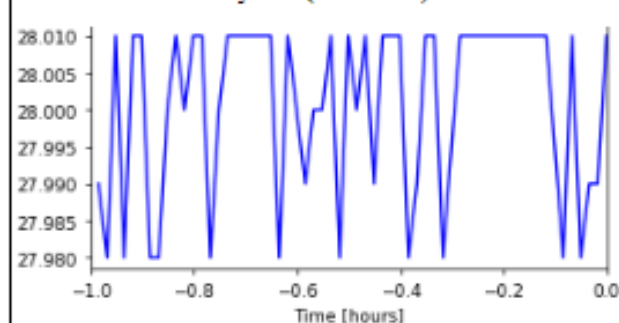
```
= Log
=====
```

## Laser Temperatures

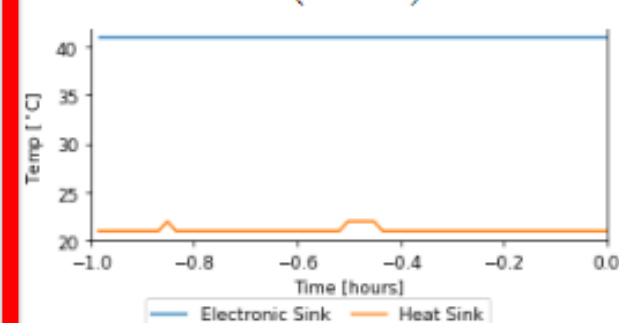
## Diode (last hour)



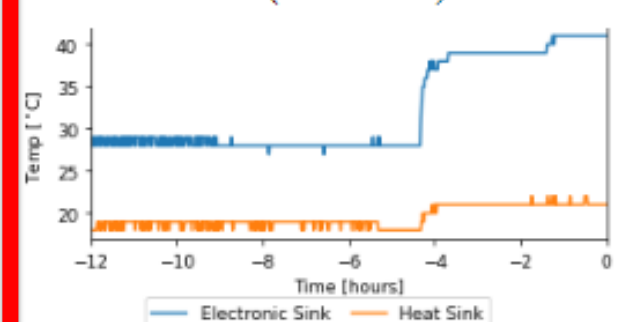
## Crystal (last hour)



## Sinks (last hour)



## Sinks (last 12 hours)



# Temperature Monitoring

## Signal Generator

## Channel 1

Wave	PULSE
Amplitude	5 [V]
Offset	2.5 [V]
Frequency	1000 [Hz]
Duty	10 [%]
Raise/Fall	20 [ns]
Signal	OFF

## Channel 2

# Signal Generator Control

```
= Execution
=====
Request: gen_act_all
```

```
= Log
=====
```

## Attenuator

Current db	10.50 [db]
<input type="button" value="Set db"/>	
-0.01	+0.01
-0.10	+0.10
-1.00	+1.00

Current Step	4030 [step]
--------------	-------------

# Attenuator Control

```
= Execution
=====
Request: att_act_get
```

```
= Log
=====
```

- User-proof against incorrect instructions
- Scheduling of instructions (within the week)





- Laser pulse exits laser box through optical fiber
- Fiber inserts to 400x splitter
- Splitter has 20 rows of output fibers
  - Each row contains 20 output connectors
- 383 fibers fall within designated insertion loss range

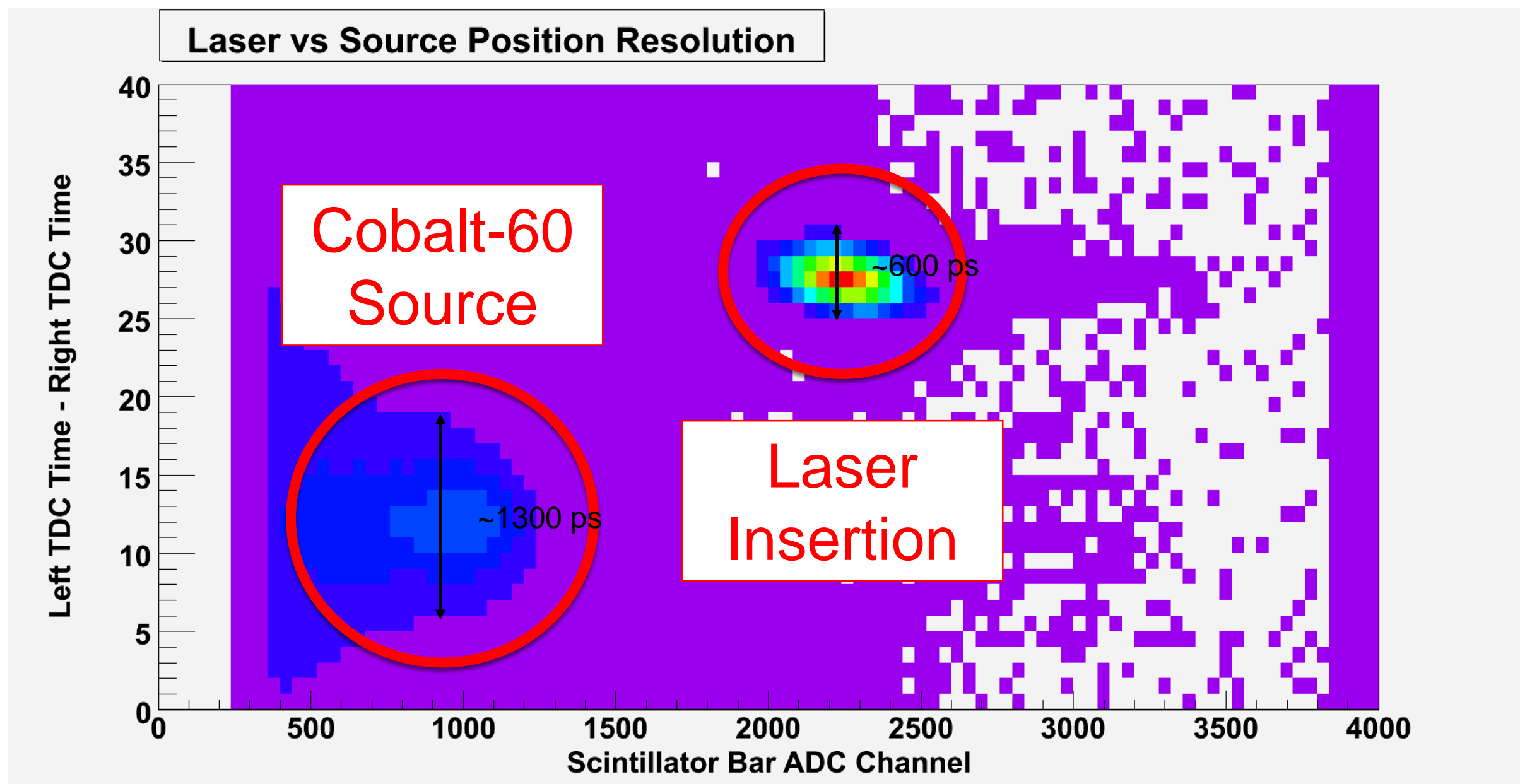




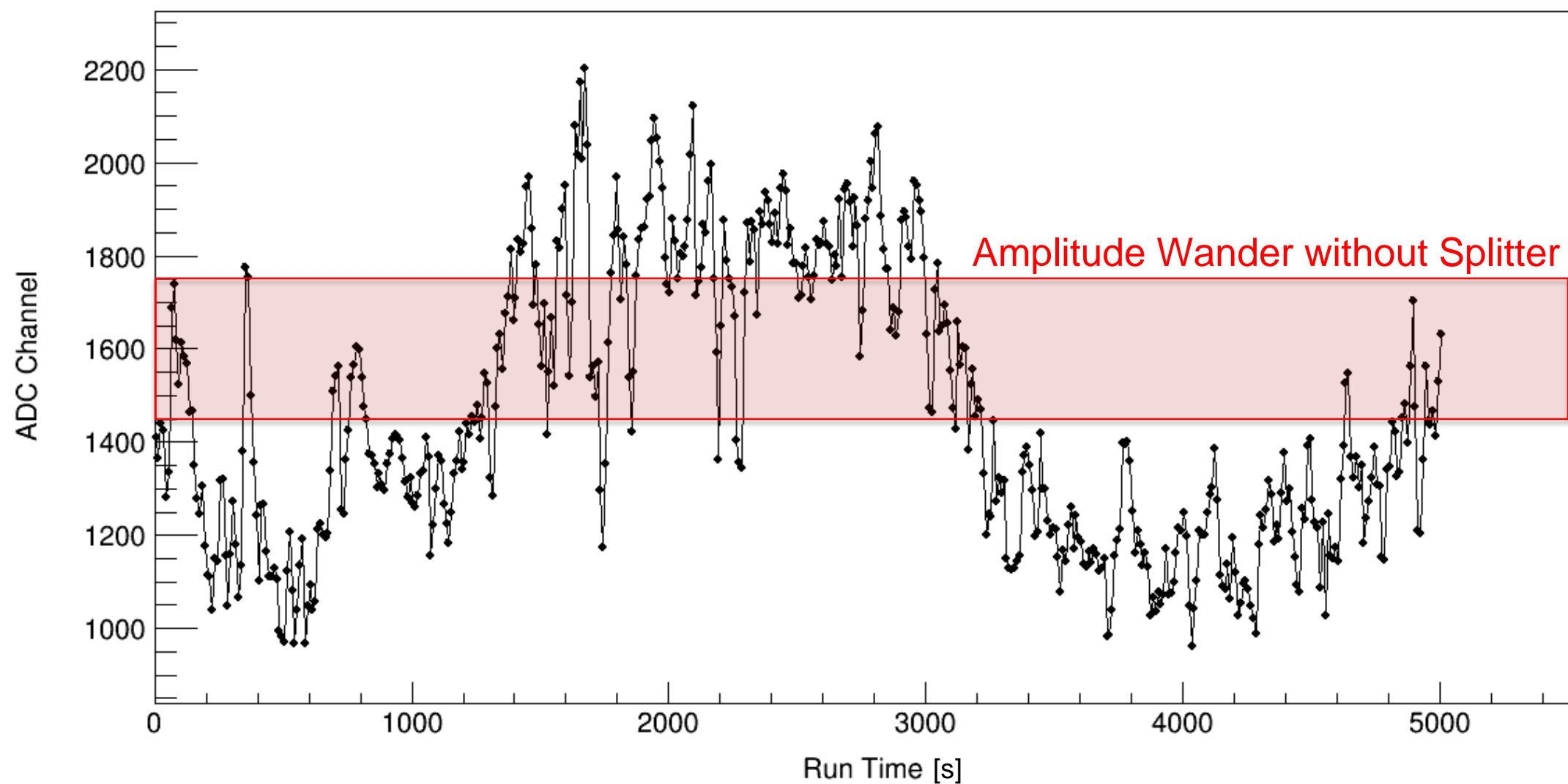
- Incision should be made in covering of scintillator bar, or windows pre-prepared
- Special fiber ends should be inserted into incision
- Fiber connection point should be secured and covered
- Connection should be checked for light leakage



1. Laser driver set to “Pulsing” mode
2. Wait 45 min - 1 hr for full temperature stability
3. Connect laser box output to fiber distribution System
4. Connect fiber output bank to scintillator input fibers
5. Set variable attenuator to desired setting
6. Set signal generator to desired frequency
7. Turn signal generator to “ON” setting



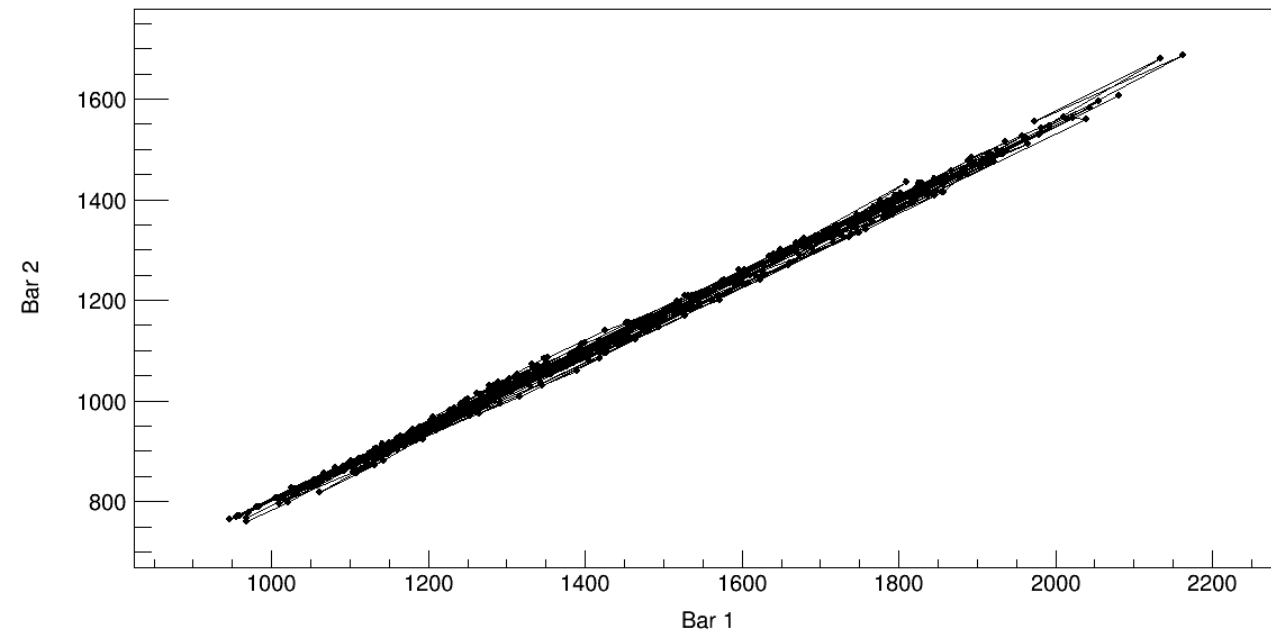
## Scintillator Amplitude Time Wander



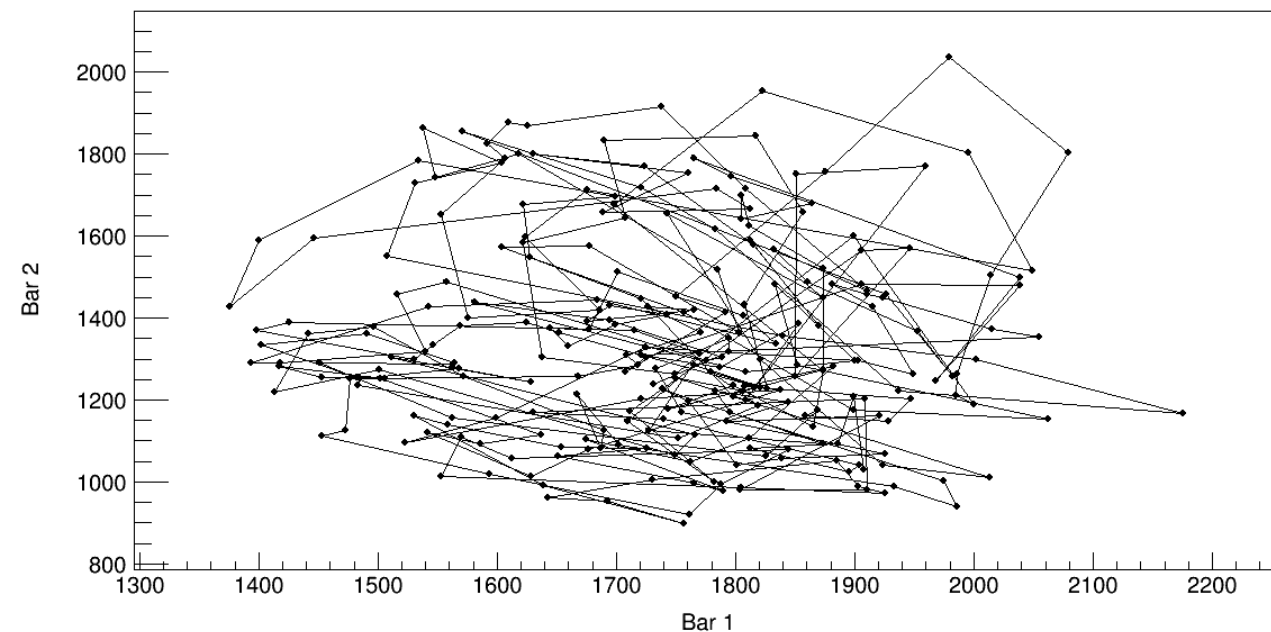


- 400x Splitter does not split pulse consistently
- Laser wandering decorrelates between output fibers
- System is not suitable for gain-matching

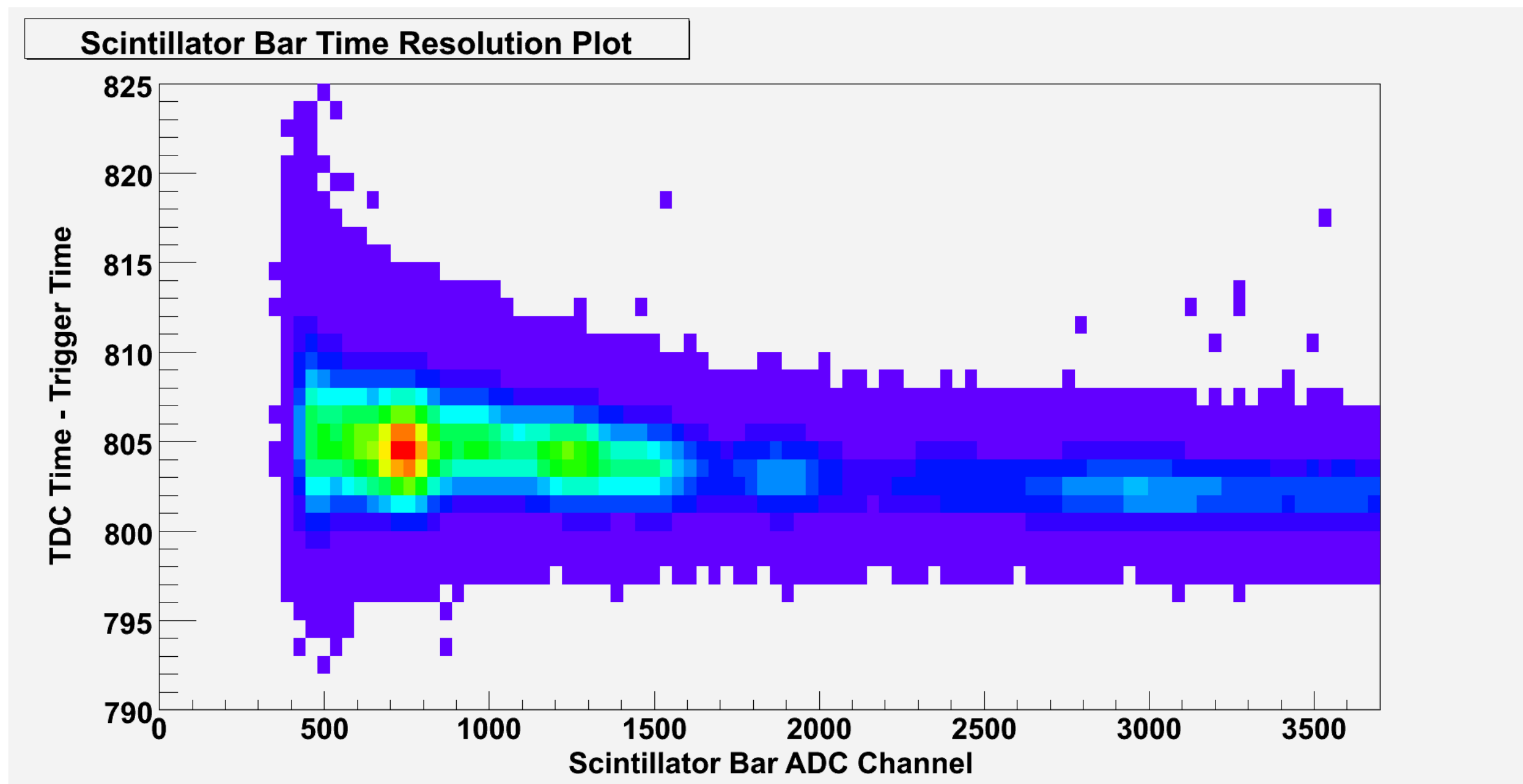
Scintillator Bar Amplitudes - Single Output Fiber



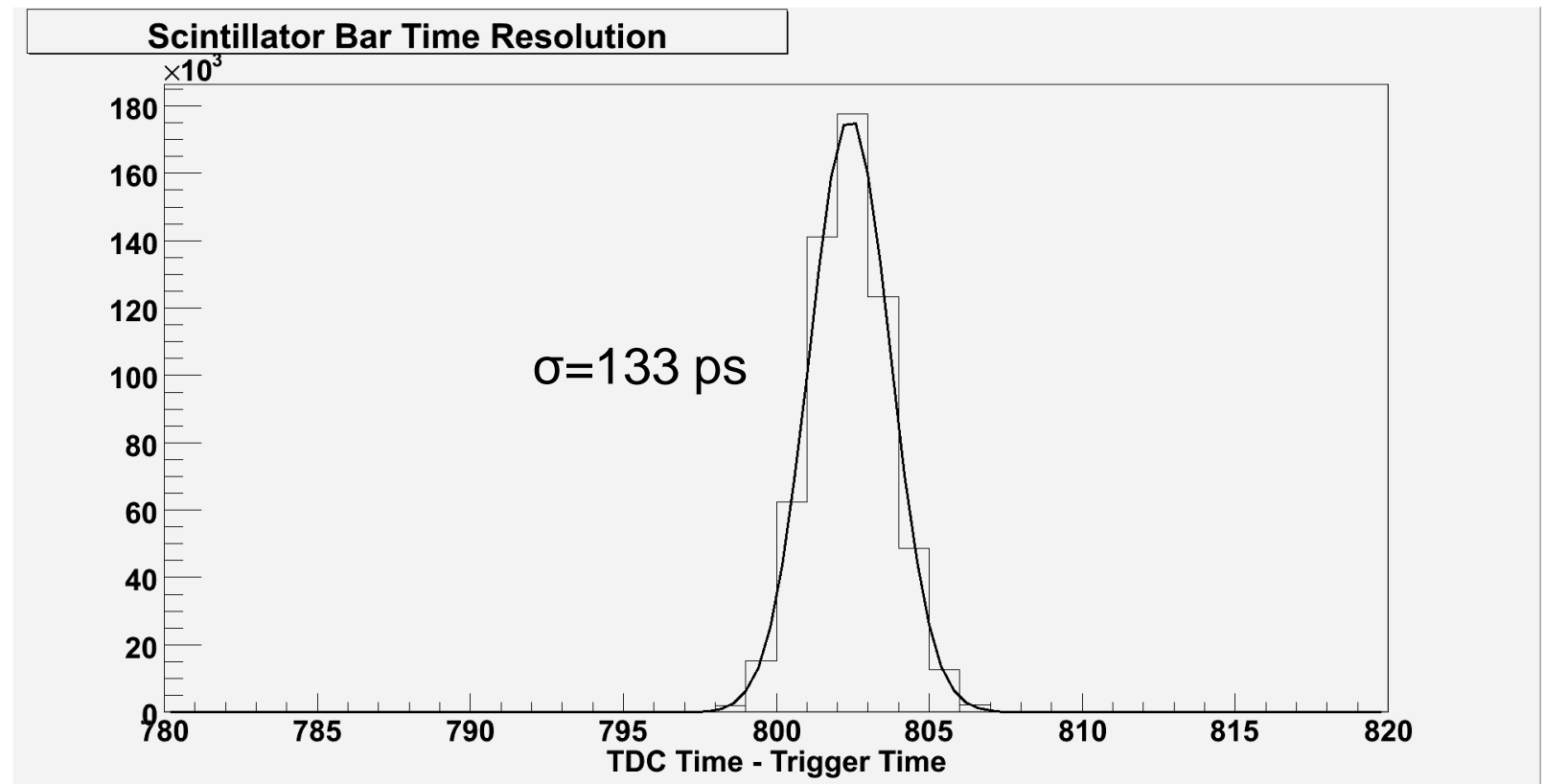
Scintillator Bar Amplitudes - Multiple Output Fibers



System can be used to make amplitude-dependent time-resolution plots



- Applying amplitude cuts, time resolution corresponds to scintillator bar resolution
- No uncertainty introduced from system itself



- Simple system for providing well-timed signal to large number of detectors
- Flexible adjustment of pulse frequency and intensity
- User-friendly to operate
- Amplitude wandering effects to resolve
- Suitable for providing timing calibration