Debugging in Xcode

Session 407

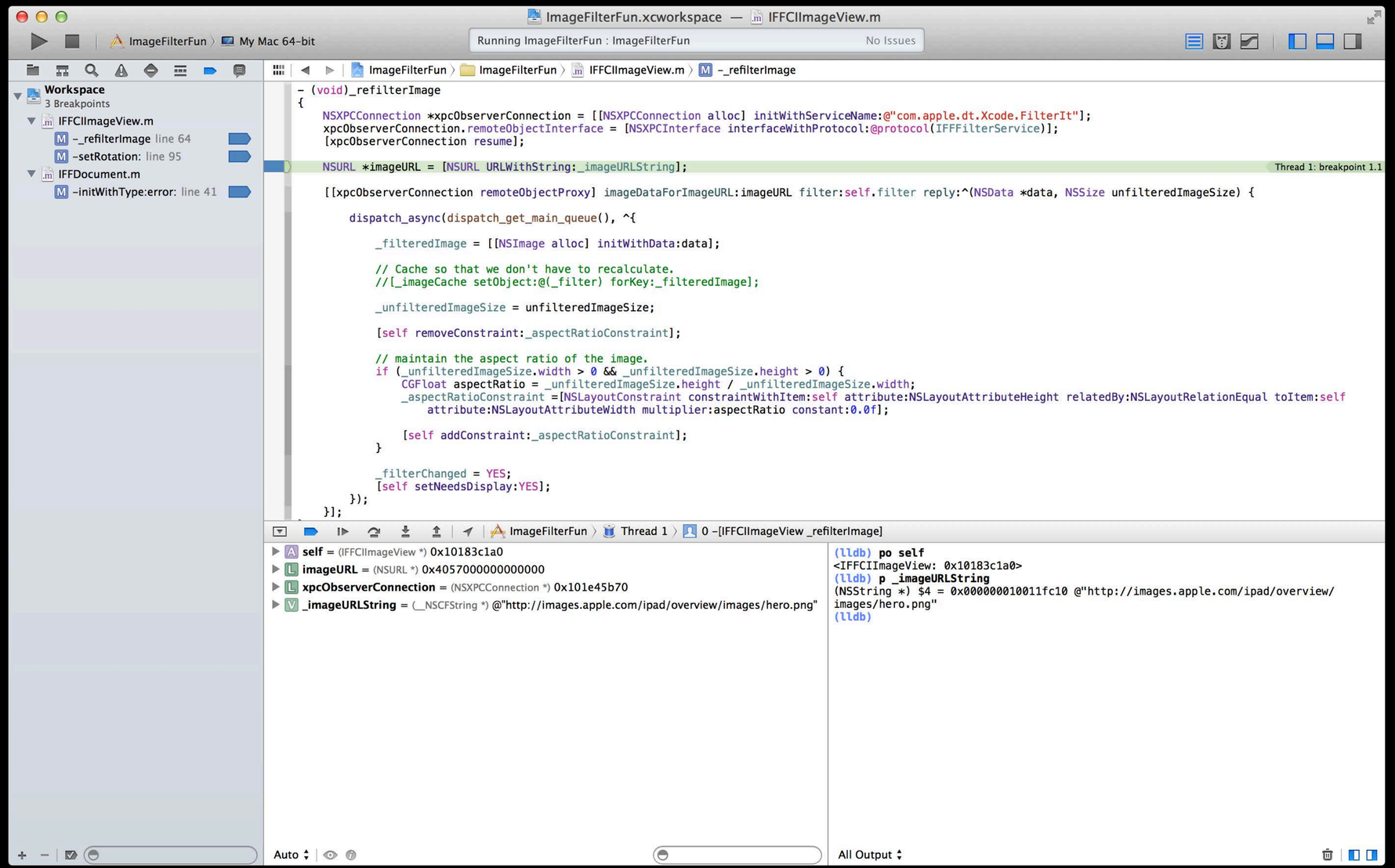
Troy Koelling
Xcode Debugger UI Engineer

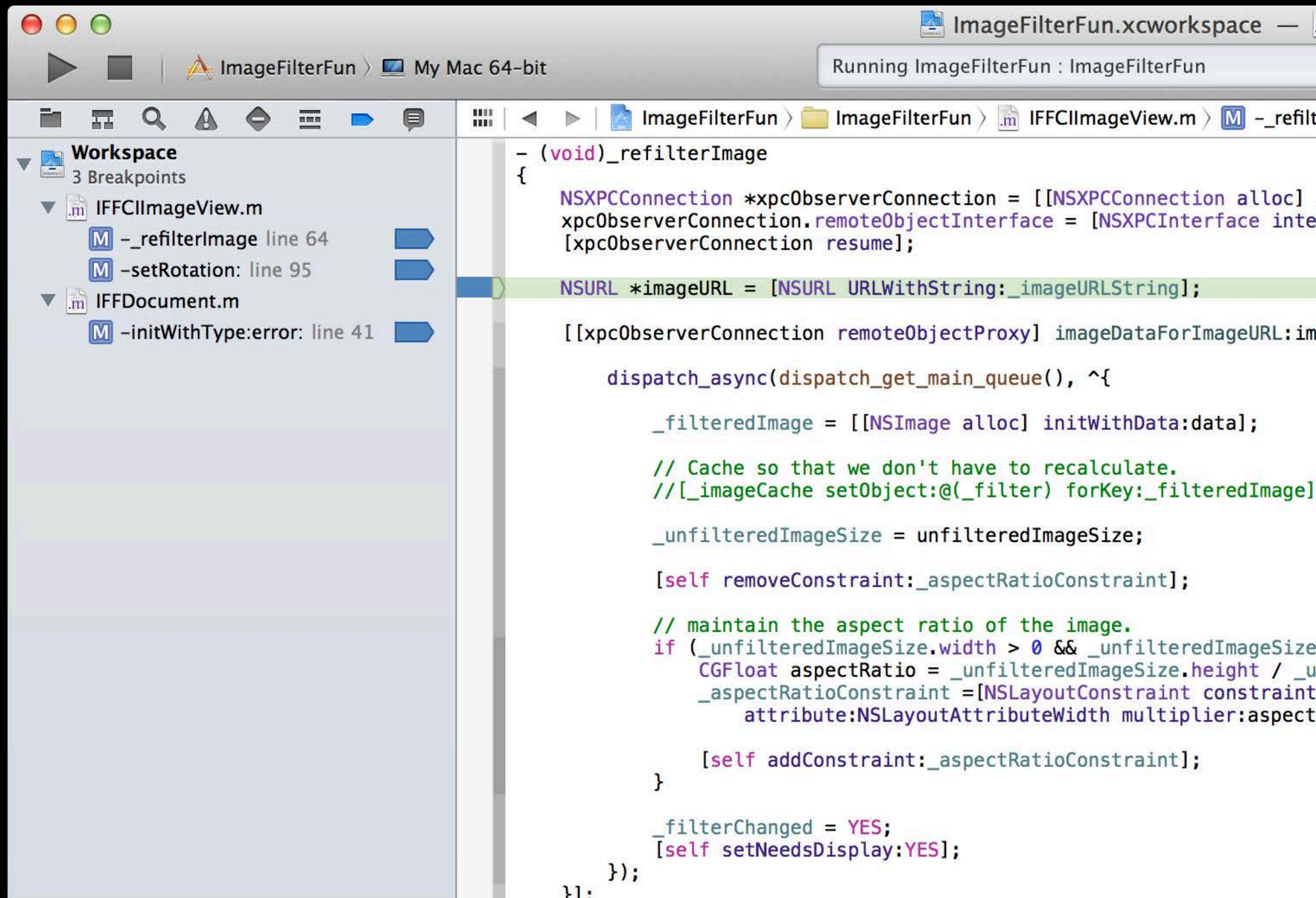
"Everyone knows that debugging is twice as hard as writing a program in the first place. So if you're as clever as you can be when you write it, how will you ever debug it?"

Brian Kernighan

Debugging in Xcode 5

Debugging in Xcode 5




ImageFilterFun.xcworkspace
ImageFilterFun 〉 My Mac 64-bit
Running ImageFilterFun : ImageFilterFun
ImageFilterFun 〉 ImageFilterFun 〉 IFFCIImageView.m 〉 M -_refilt
Workspace
3 Breakpoints
IFFCIImageView.m
M -_refilterImage line 64
M -setRotation: line 95
IFFDocument.m
M -initWithType:error: line 41
- (void)_refilterImage
{
NSXPCConnection *xpcObserverConnection = [[NSXPCConnection alloc]
xpcObserverConnection.remoteObjectInterface = [NSXPCInterface inte
[xpcObserverConnection resume];
NSURL *imageURL = [NSURL URLWithString:_imageURLString];
[[xpcObserverConnection remoteObjectProxy] imageDataForImageURL:im
dispatch_async(dispatch_get_main_queue(), ^{
_filteredImage = [[NSImage alloc] initWithData:data];
// Cache so that we don't have to recalculate.
//[_imageCache setObject:@(_filter) forKey:_filteredImage]
_unfilteredImageSize = unfilteredImageSize;
[self removeConstraint:_aspectRatioConstraint];
// maintain the aspect ratio of the image.
if (_unfilteredImageSize.width > 0 && _unfilteredImageSize
CGFloat aspectRatio = _unfilteredImageSize.height / _u
_aspectRatioConstraint =[NSLayoutConstraint constraint
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[self addConstraint:_aspectRatioConstraint];
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_filterChanged = YES;
[self setNeedsDisplay:YES];
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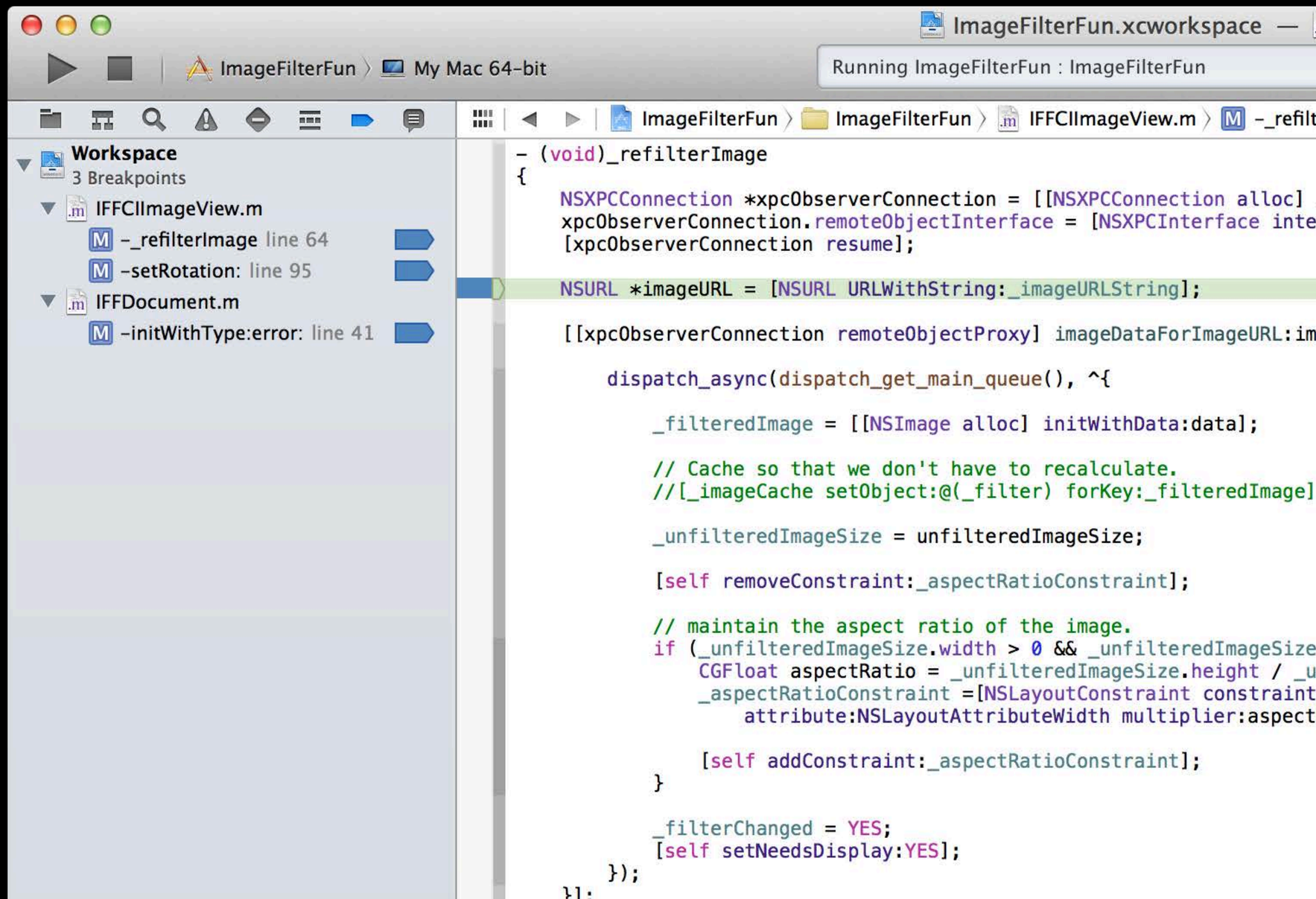
Breakpoints Navigator



M -initWithType:error: line 41

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ImageFilterFun 〉 Thread 1 〉 0 -[IFFCIImageView _refilterImage]

- A **self** = (IFFCIImageView *) 0x10183c1a0
- L **imageURL** = (NSURL *) 0x4057000000000000
- L **xpcObserverConnection** = (NSXPCConnection *) 0x101e45b70
- V **_imageURLString** = (__NSCFString *) @"http://images.apple.com/ipad/overview/images/hero.png"

```
(lldb) po self
<IFFCIImageView: 0x10183c1a0>
(lldb) p _imageURLString
(NSString *) $4 = 0x000000010011fc10 @"http://
images/hero.png"
(lldb)
```

Auto

All Output

M -initWithType:error: line 41

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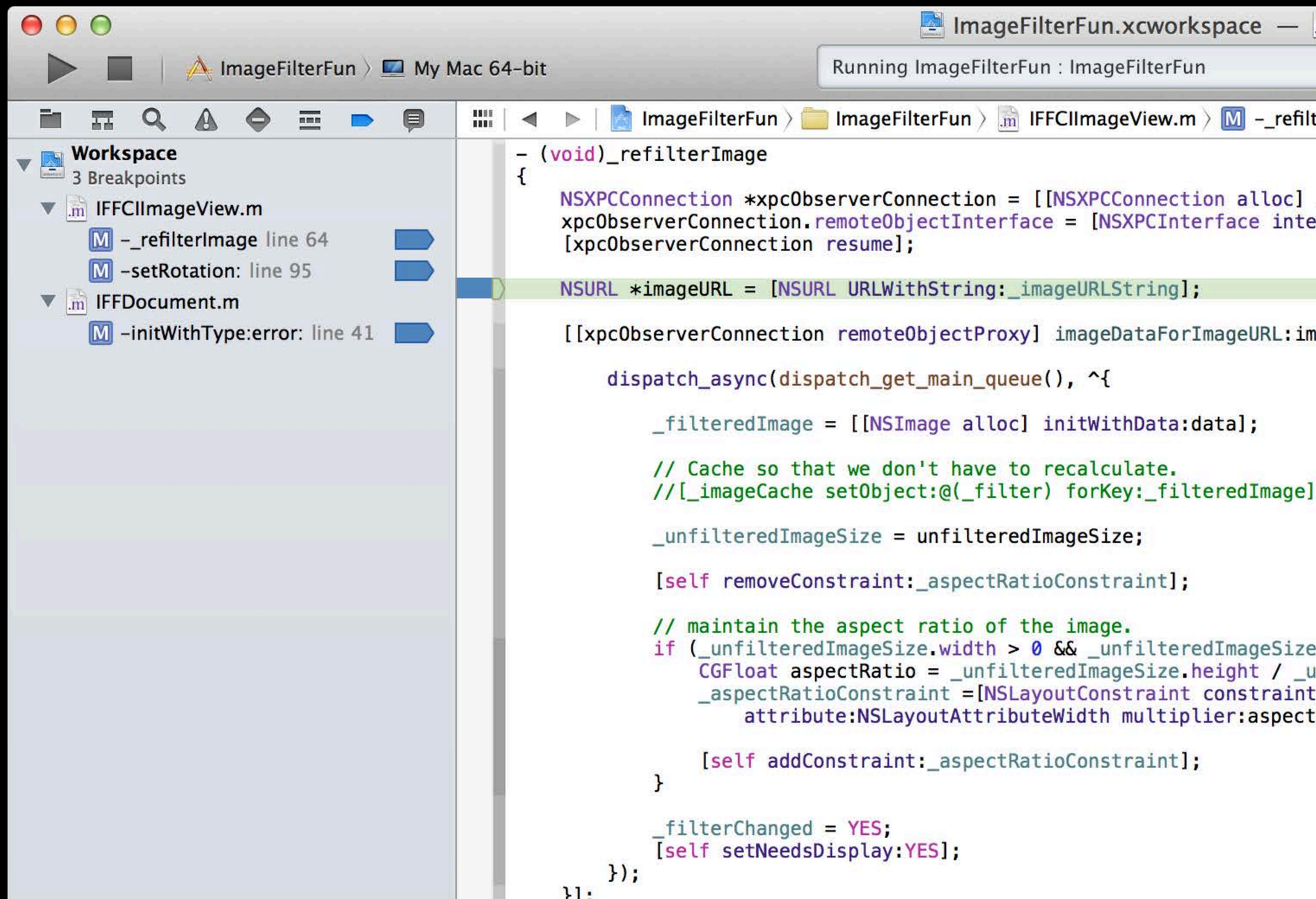
All Output

Breakpoints Navigator



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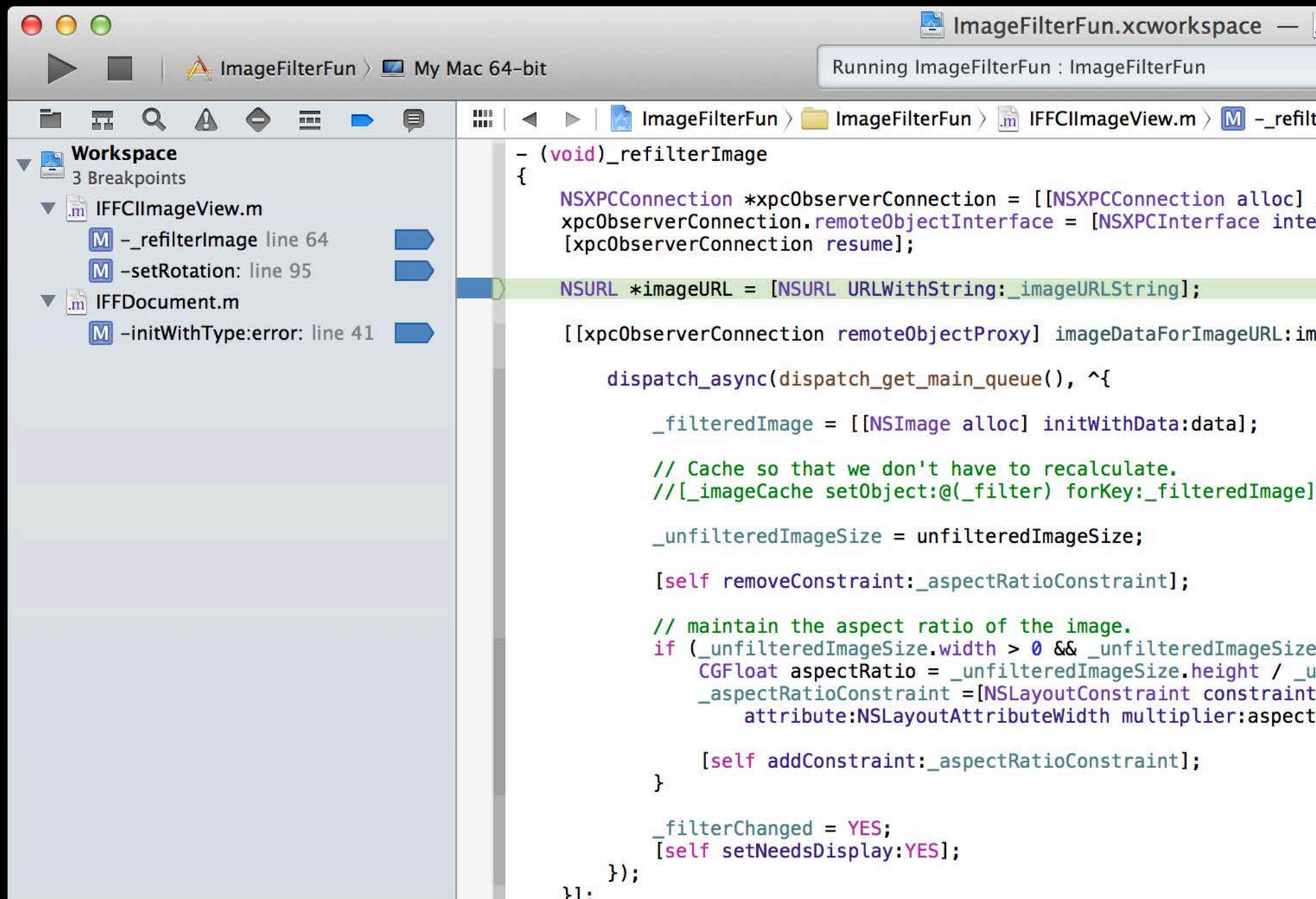

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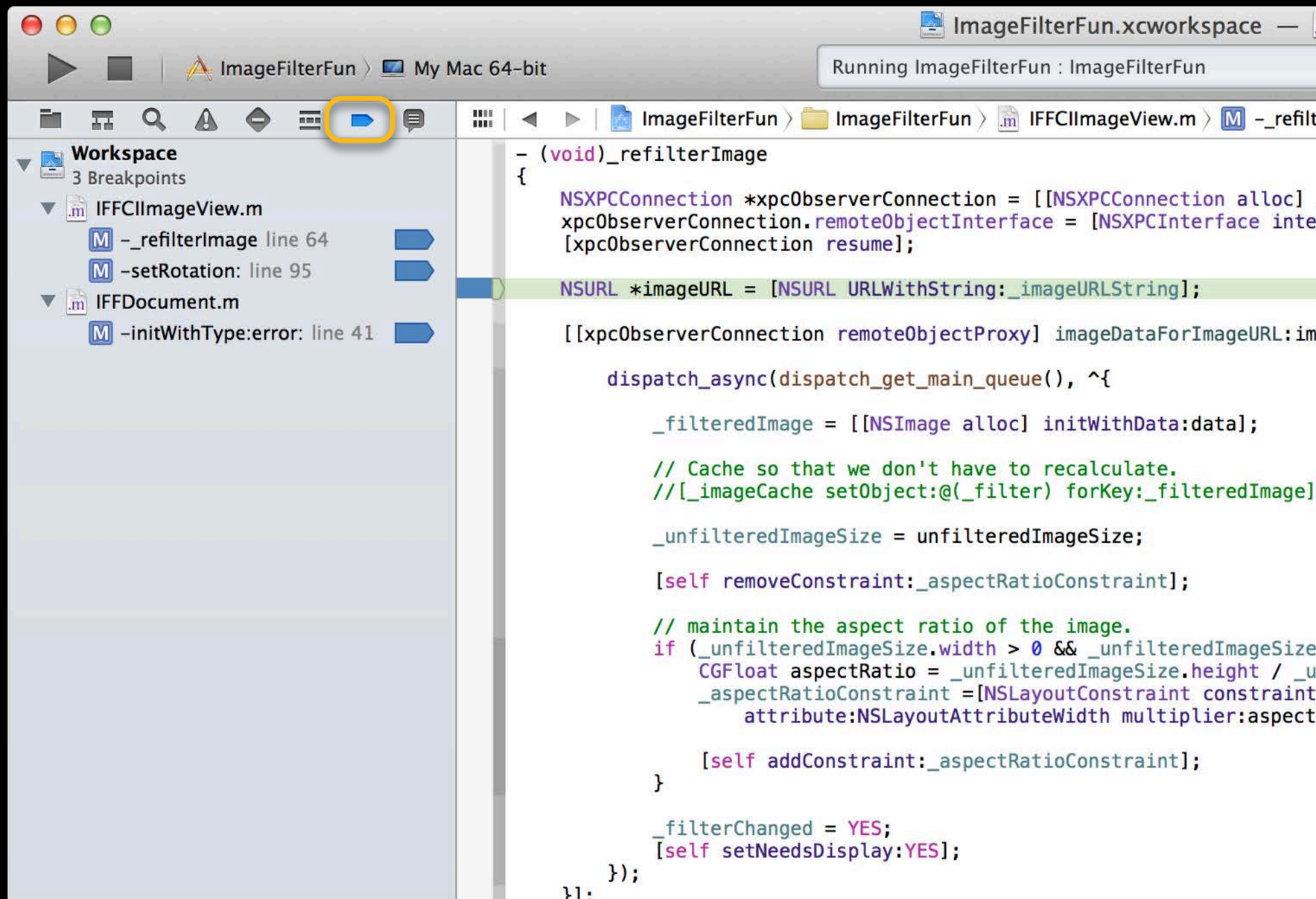

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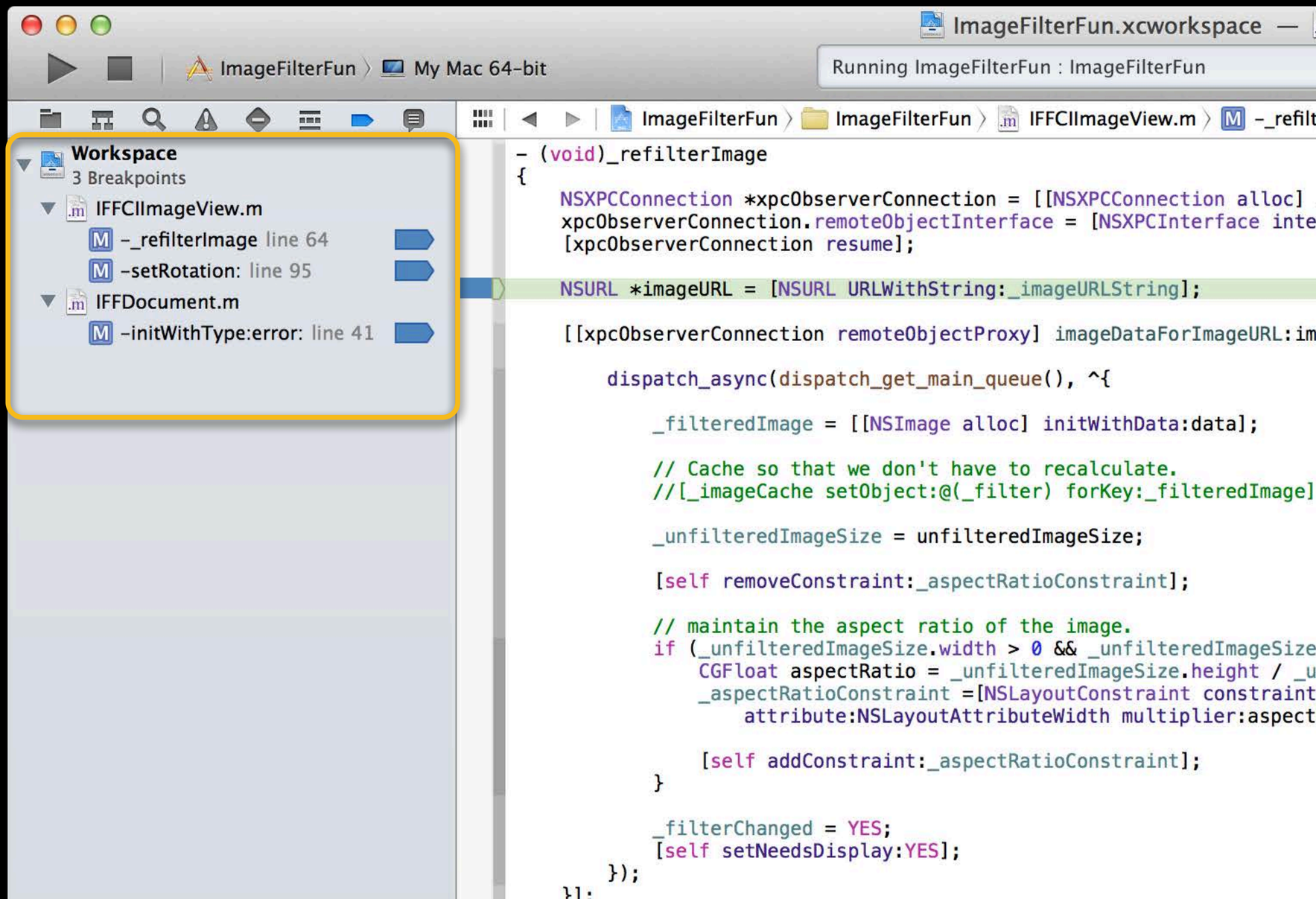

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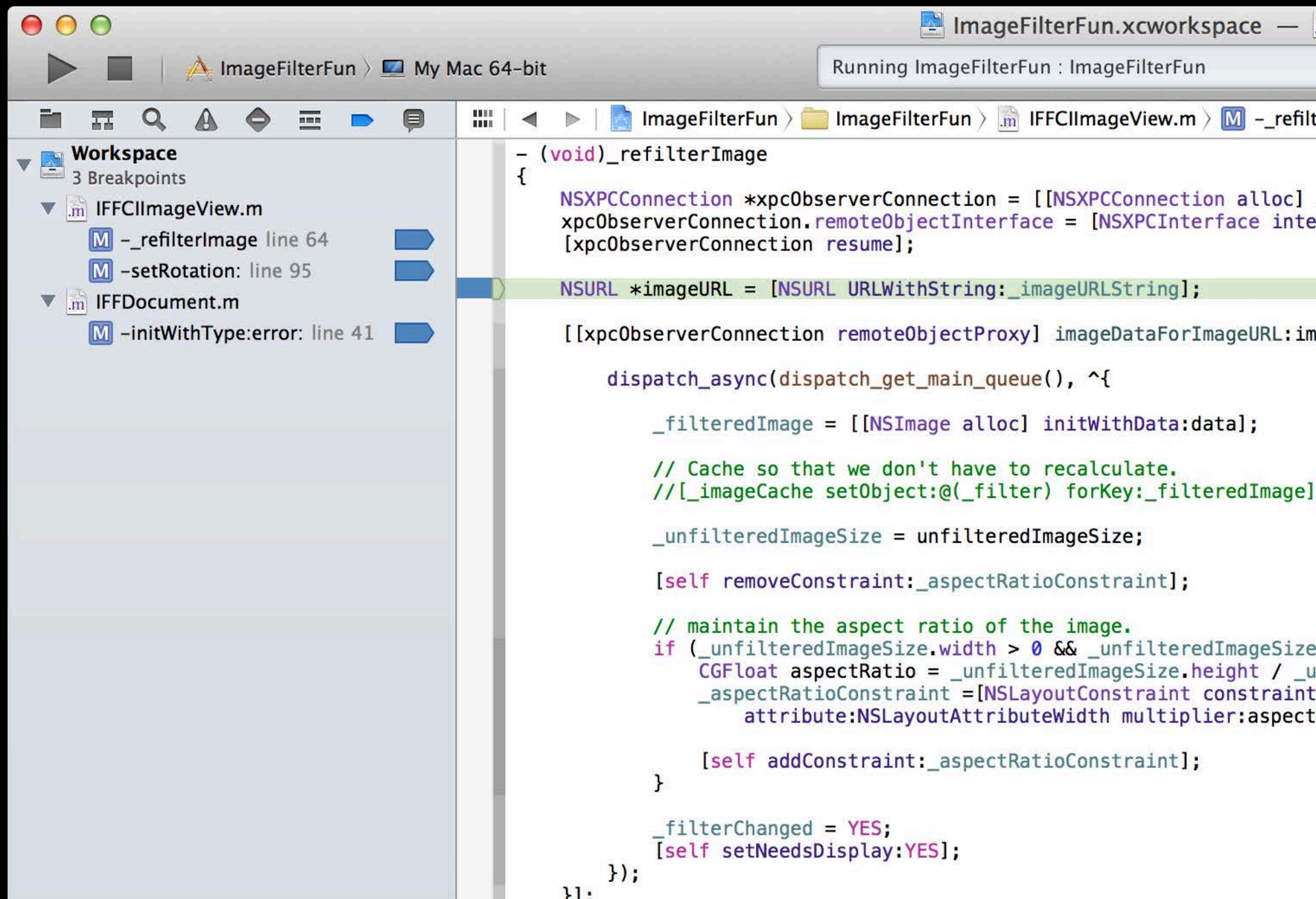

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Auto

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Auto

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Auto

Add Exception Breakpoint…
Add OpenGL ES Error Breakpoint…
Add Symbolic Breakpoint…
Add Test Failure Breakpoint…

```
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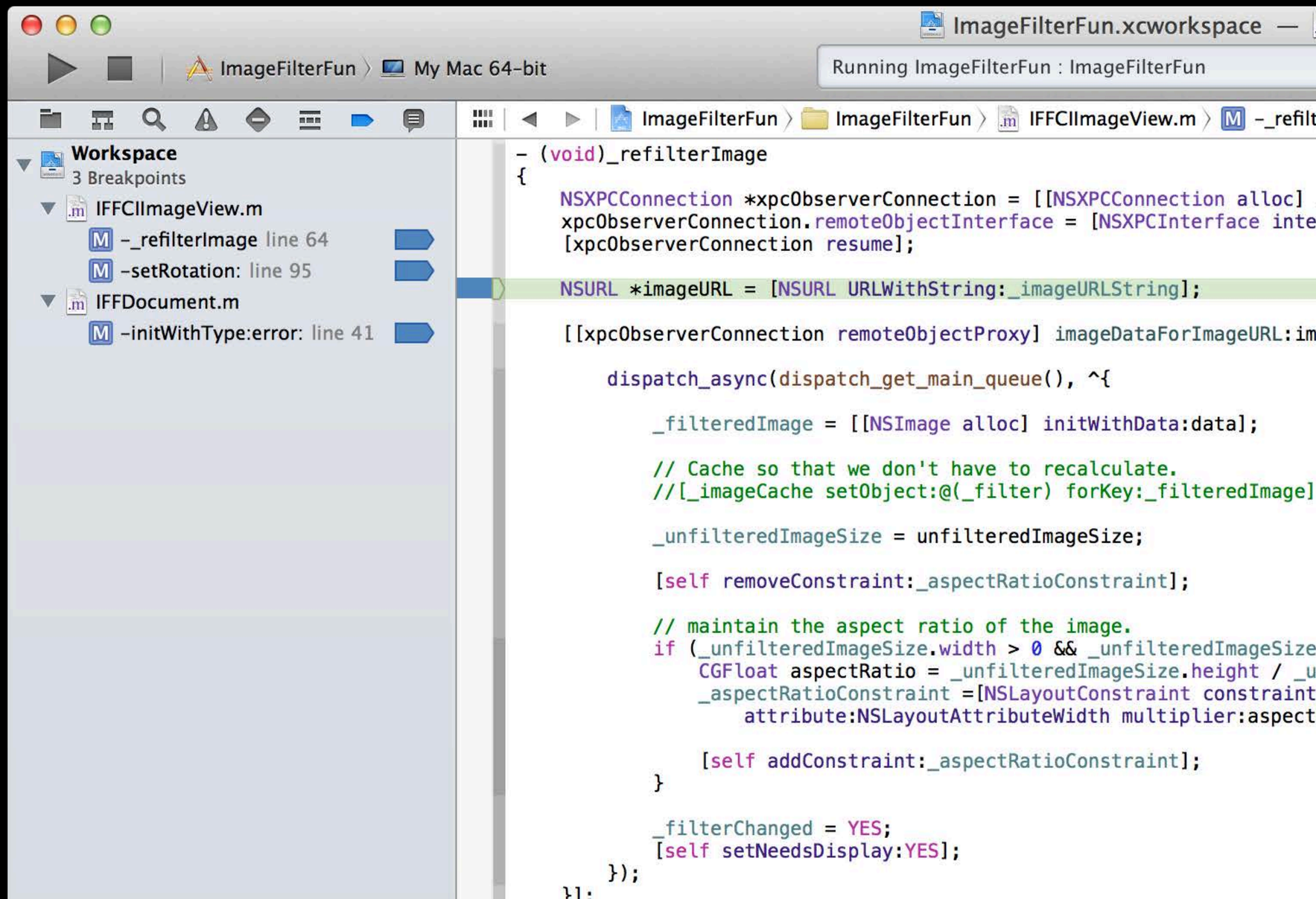
Breakpoints Navigator



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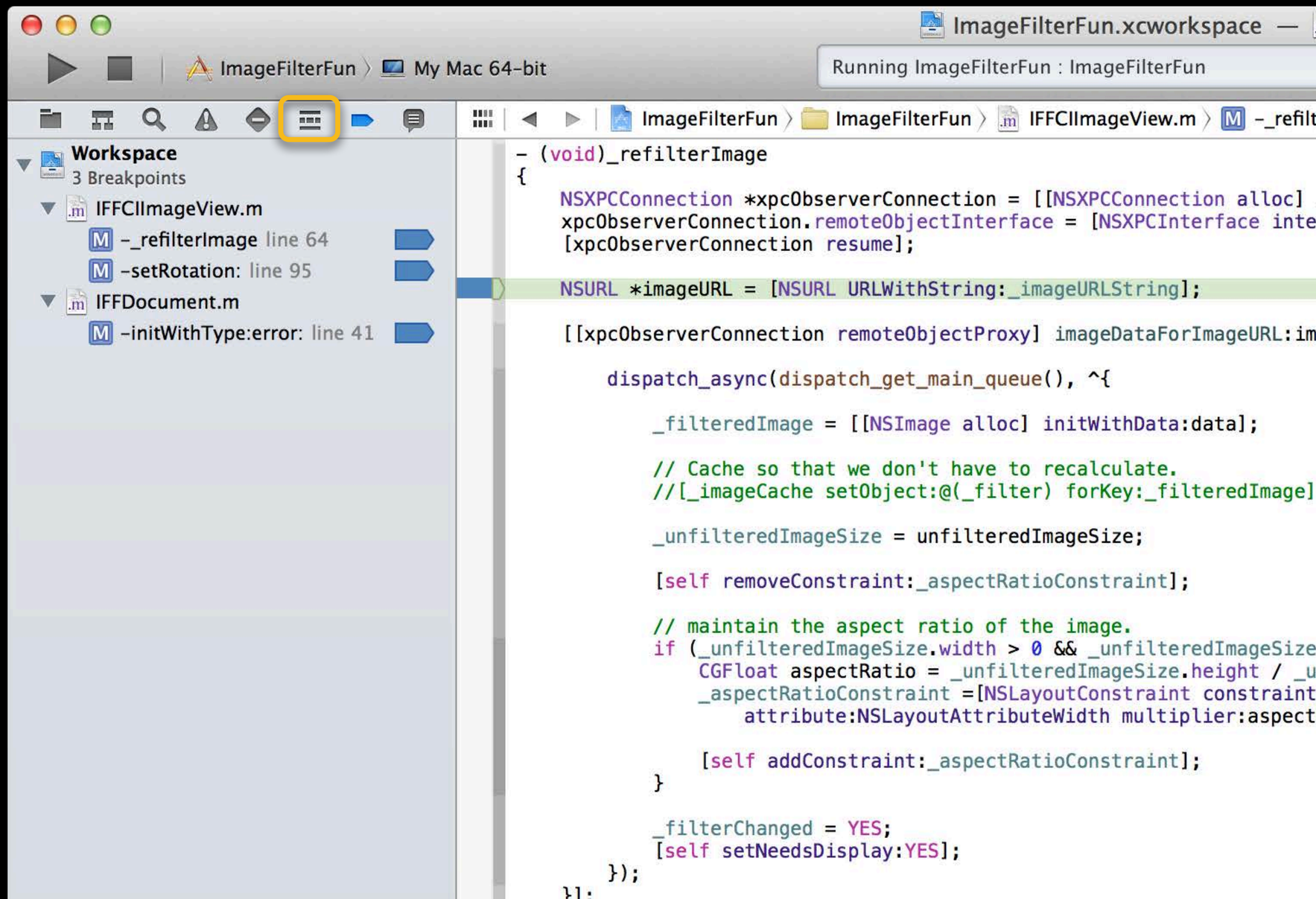
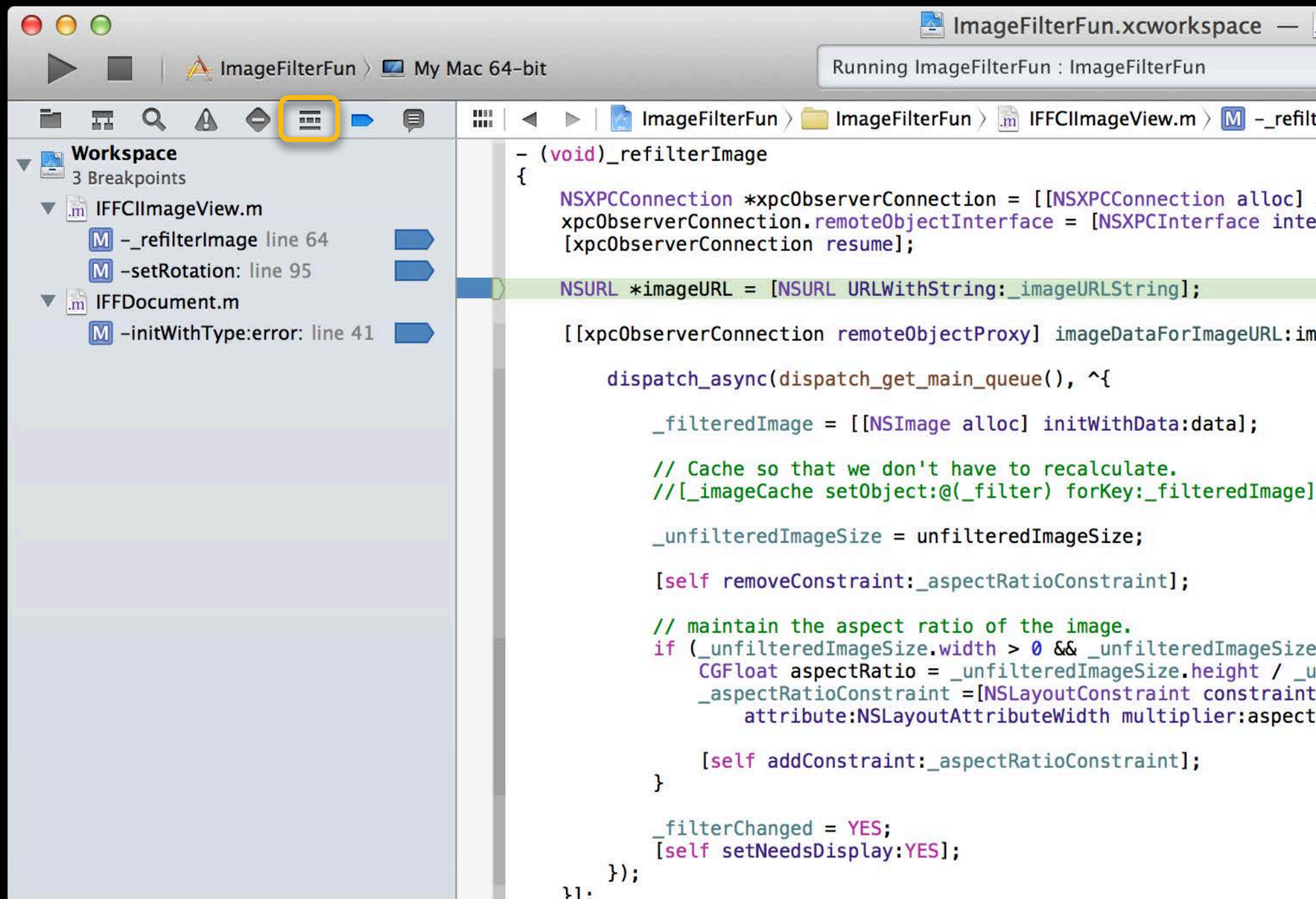


Debug Navigator



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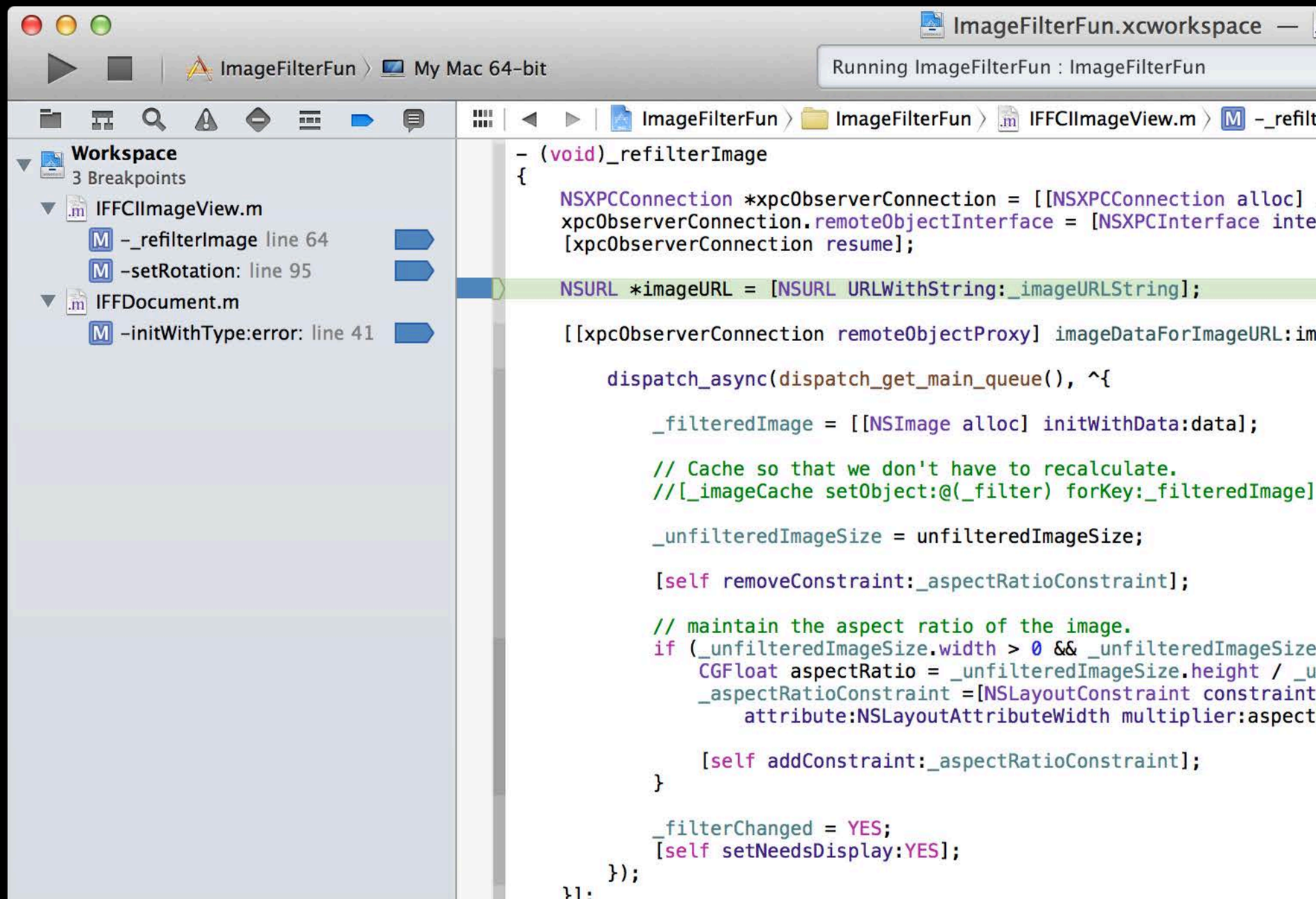

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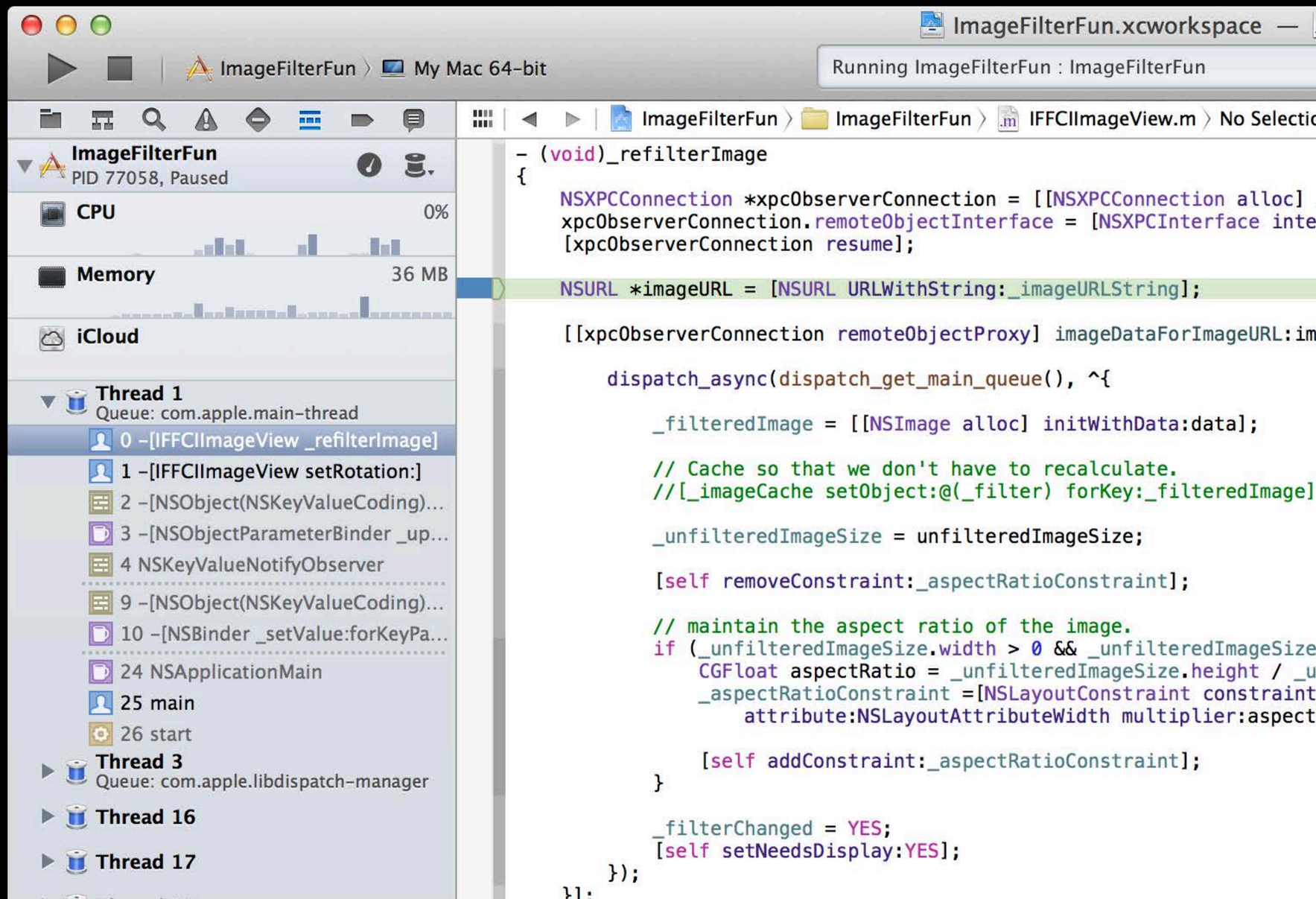

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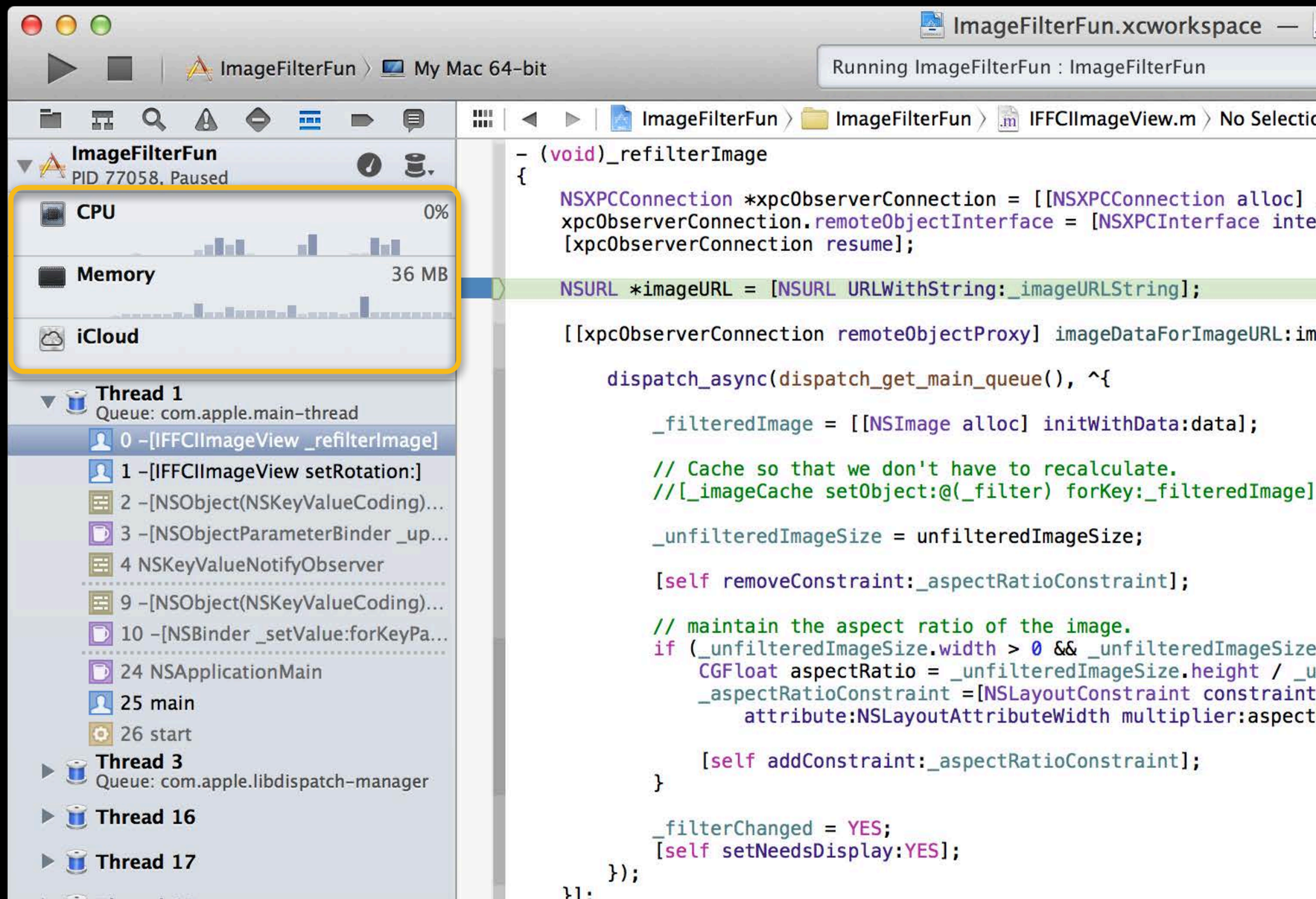

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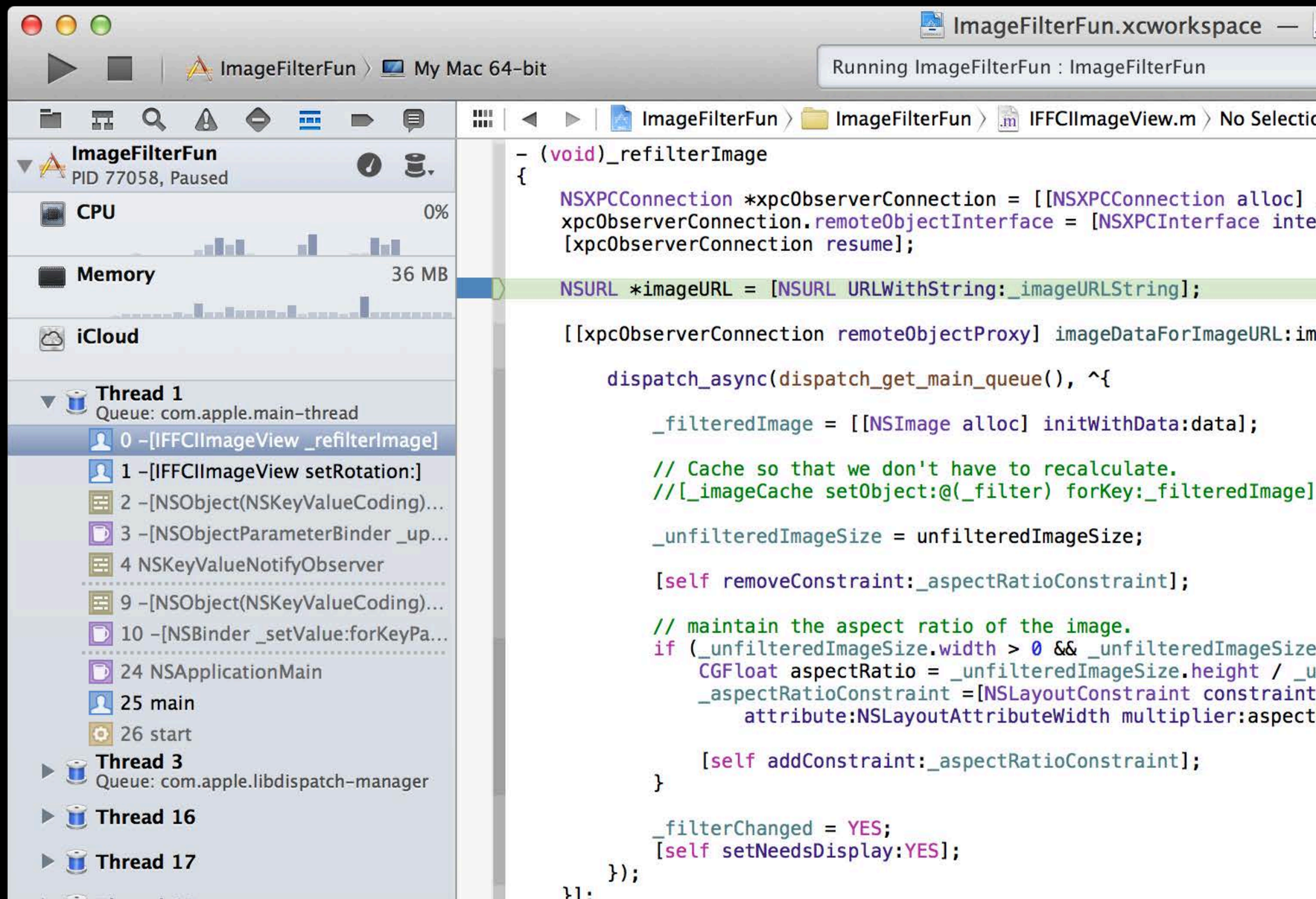

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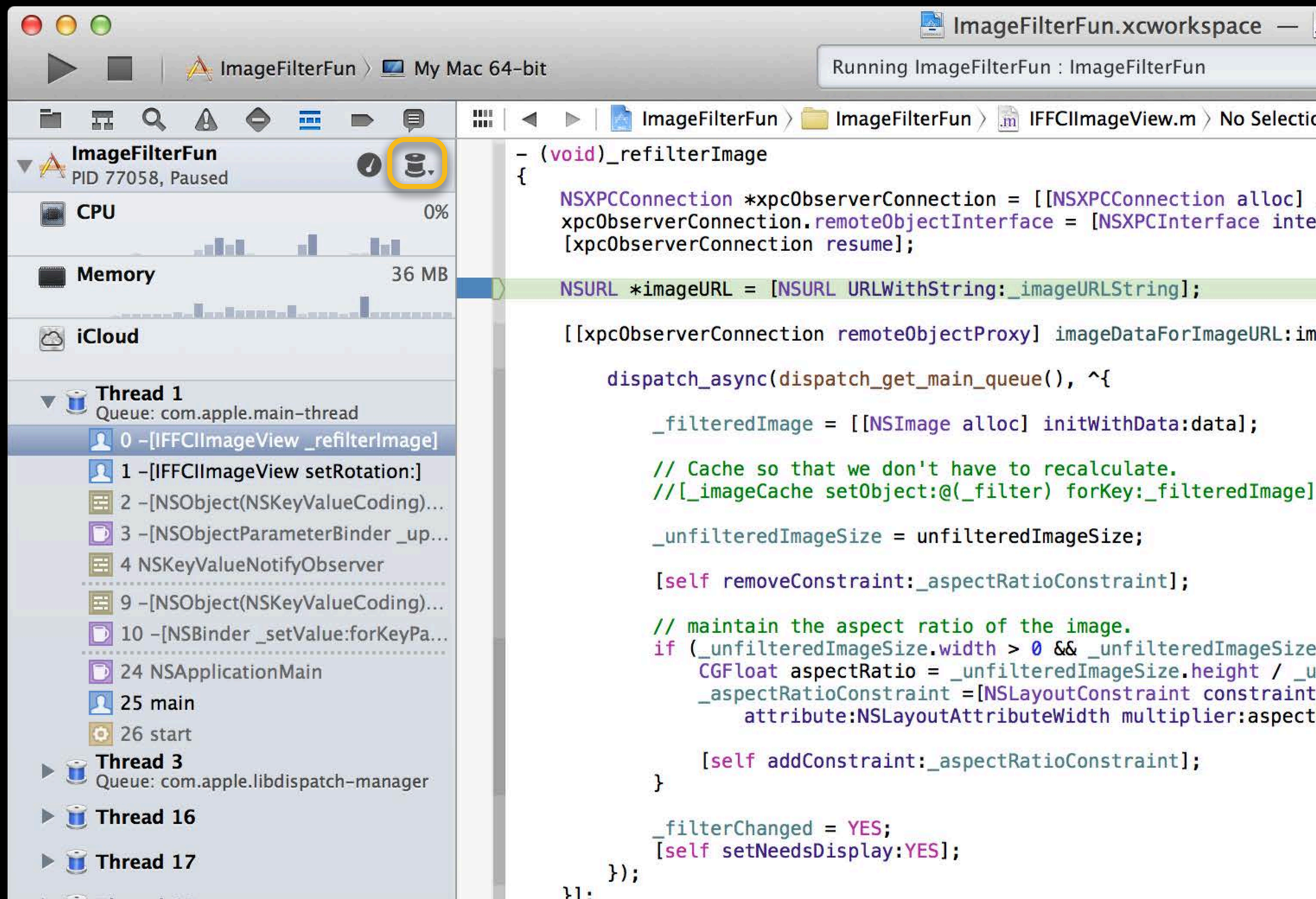

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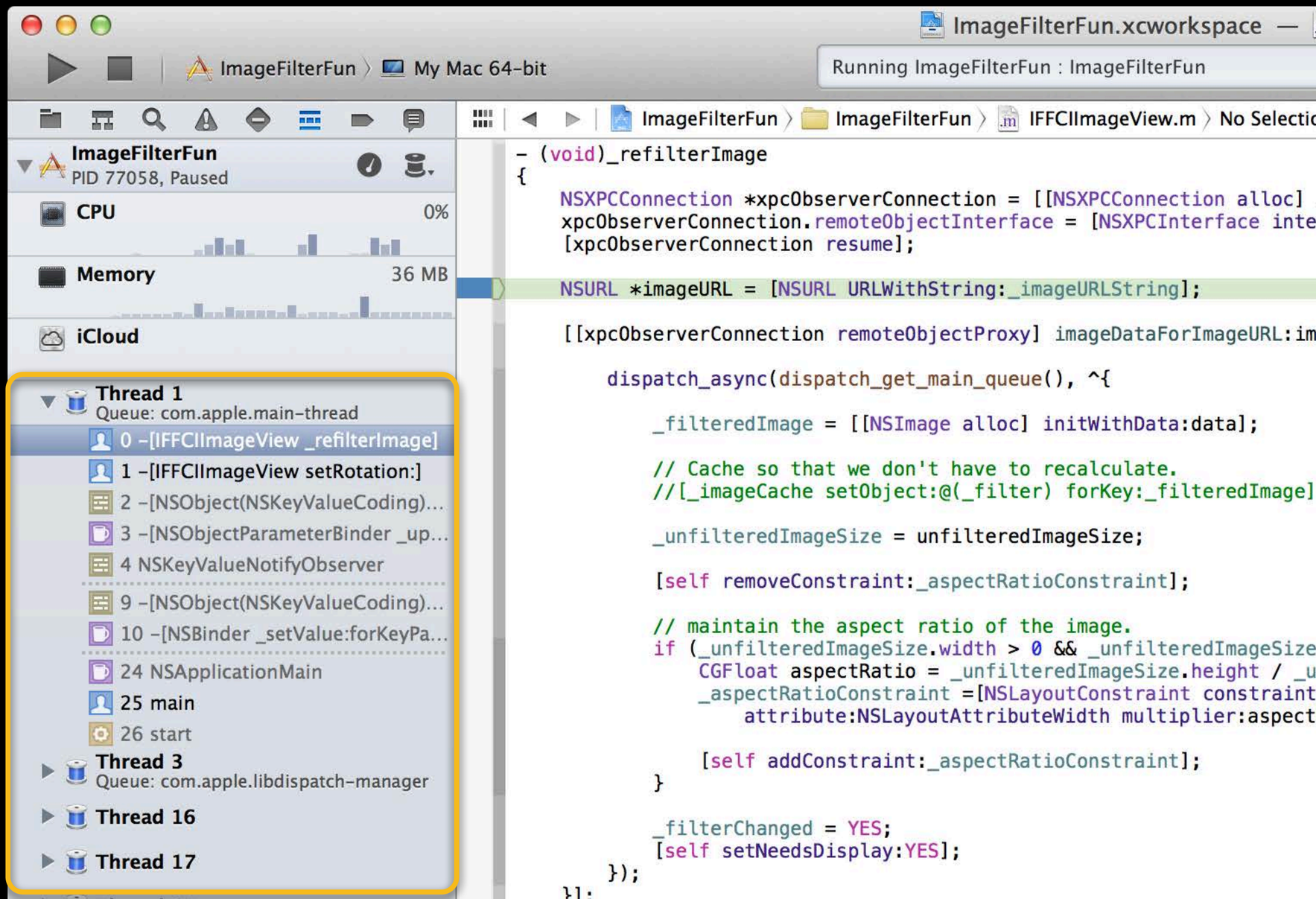

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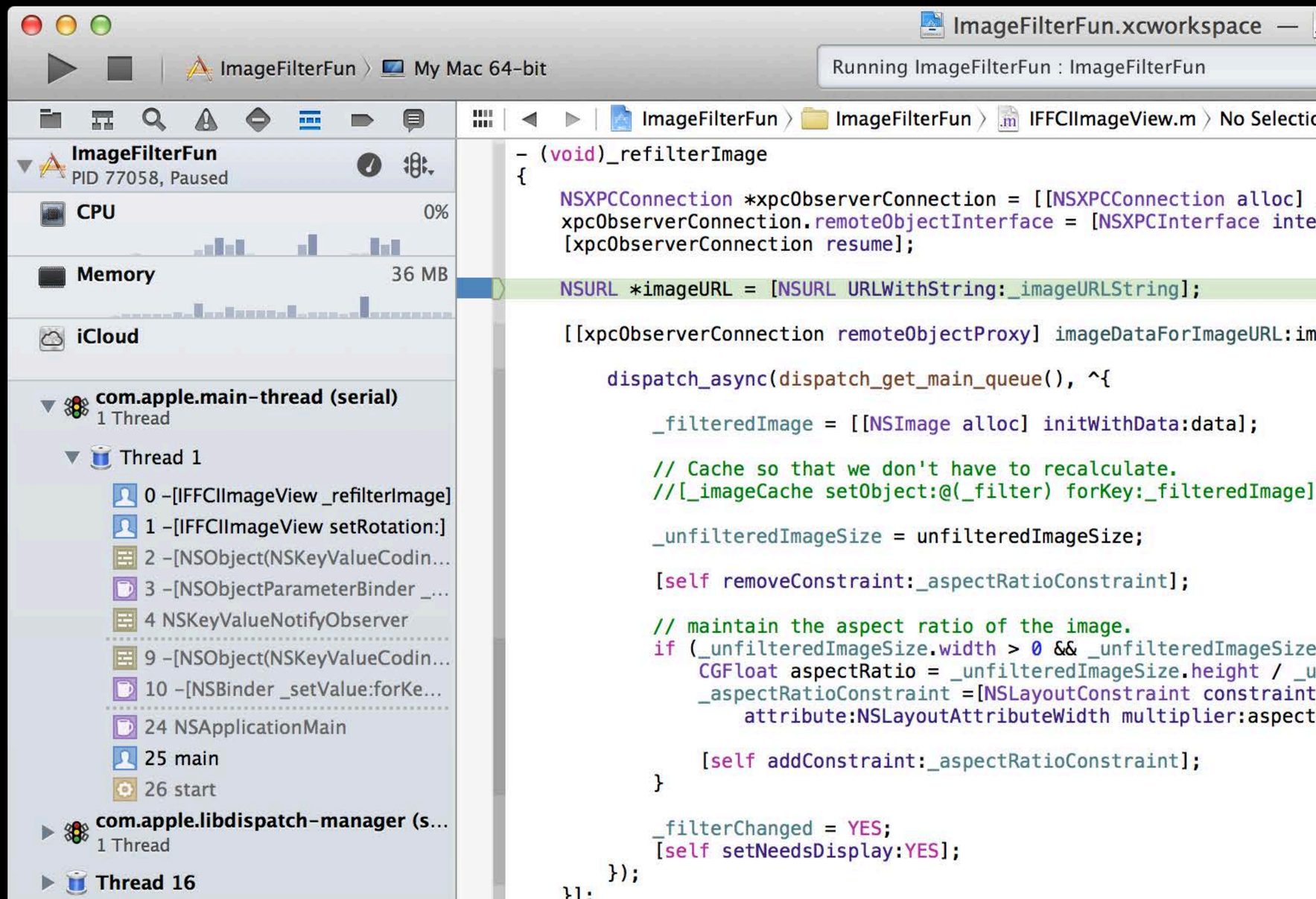

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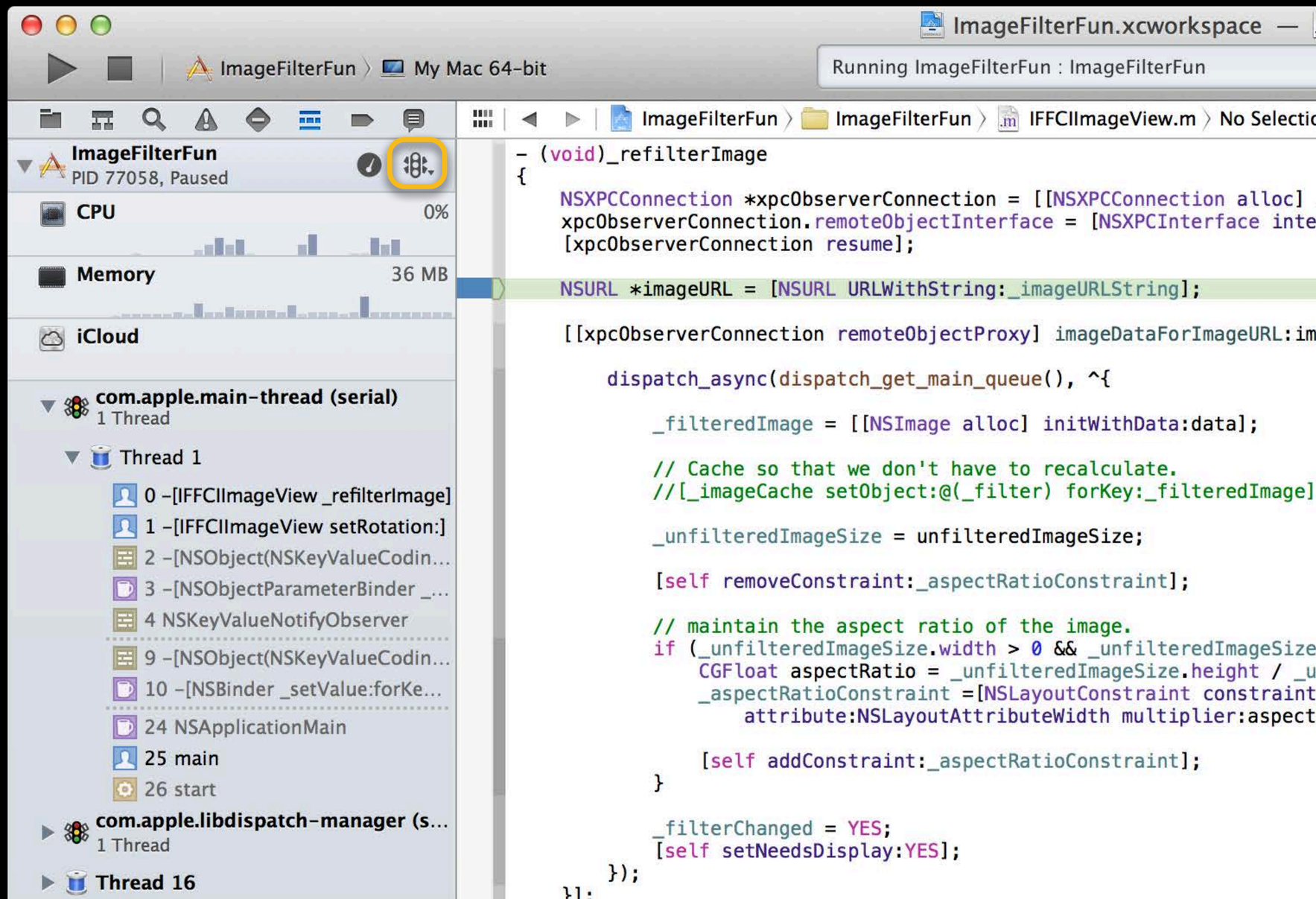

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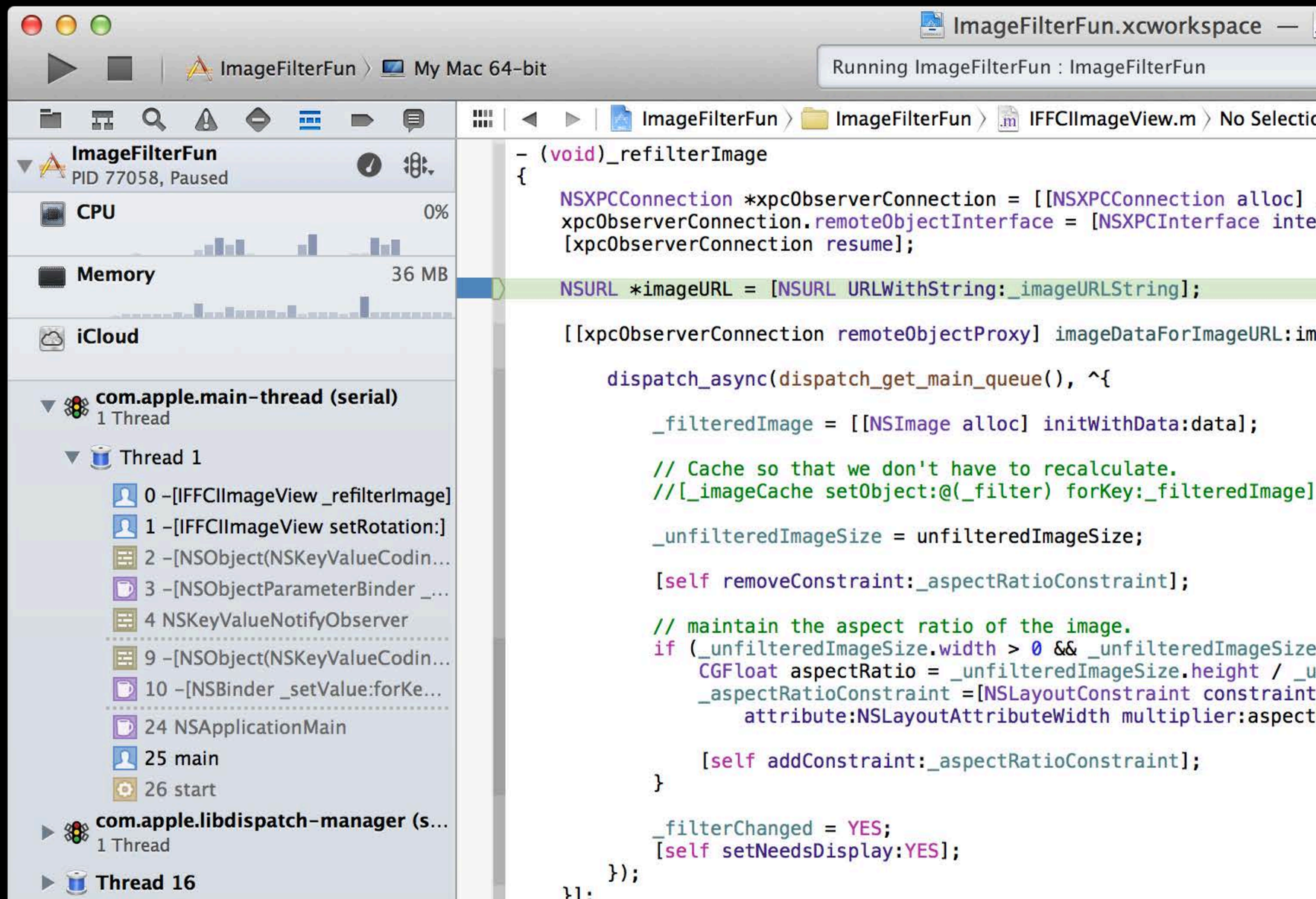

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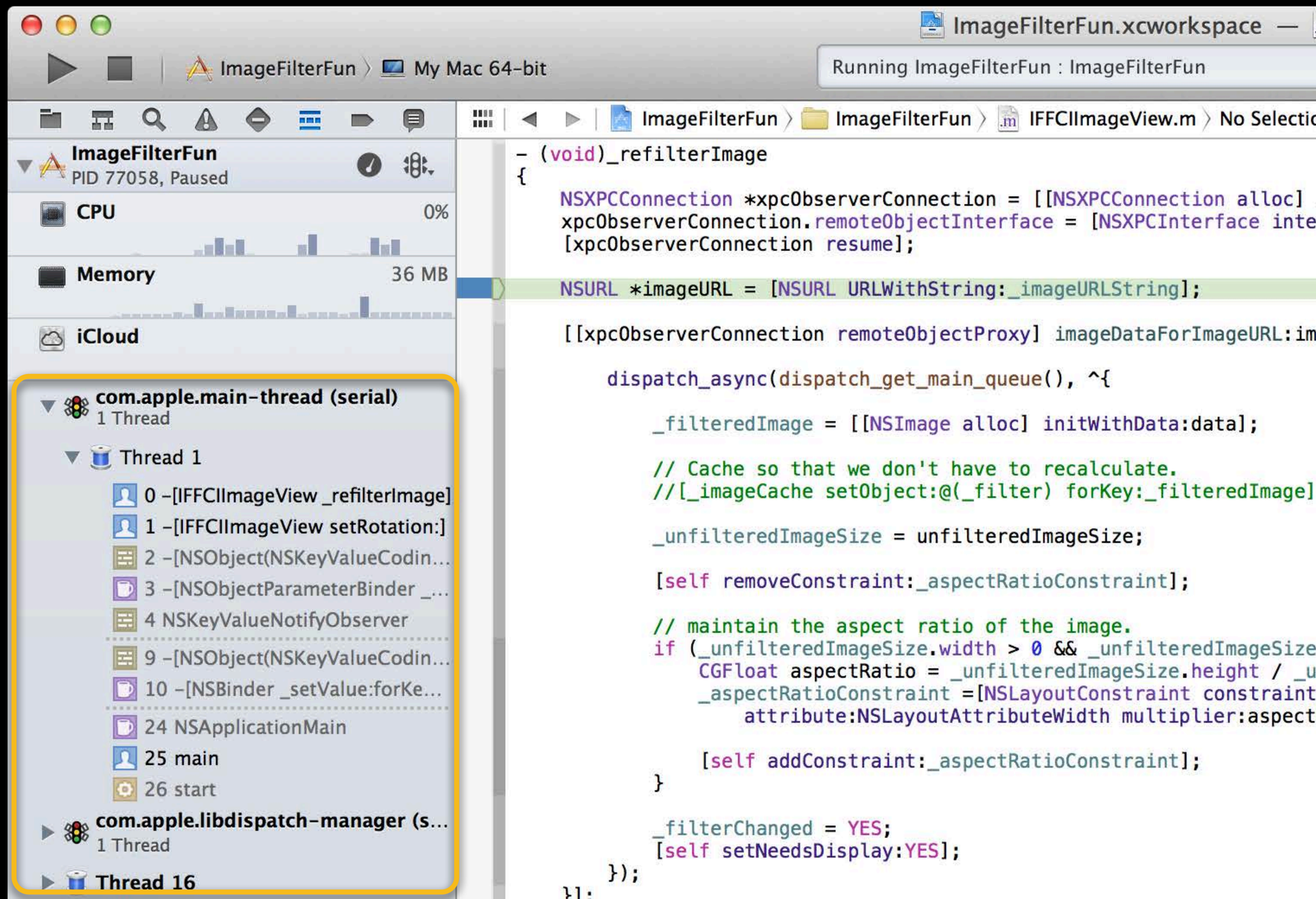

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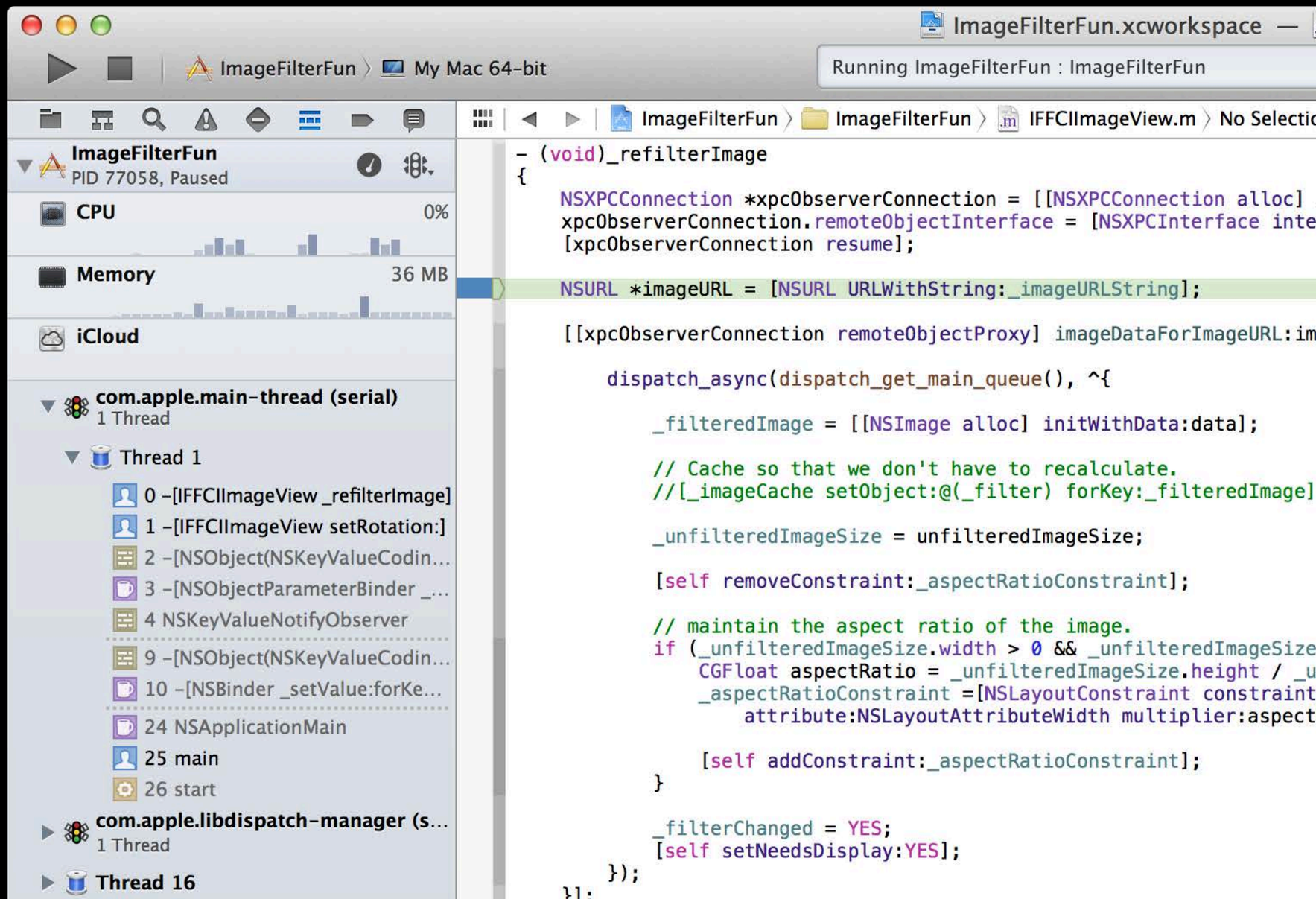
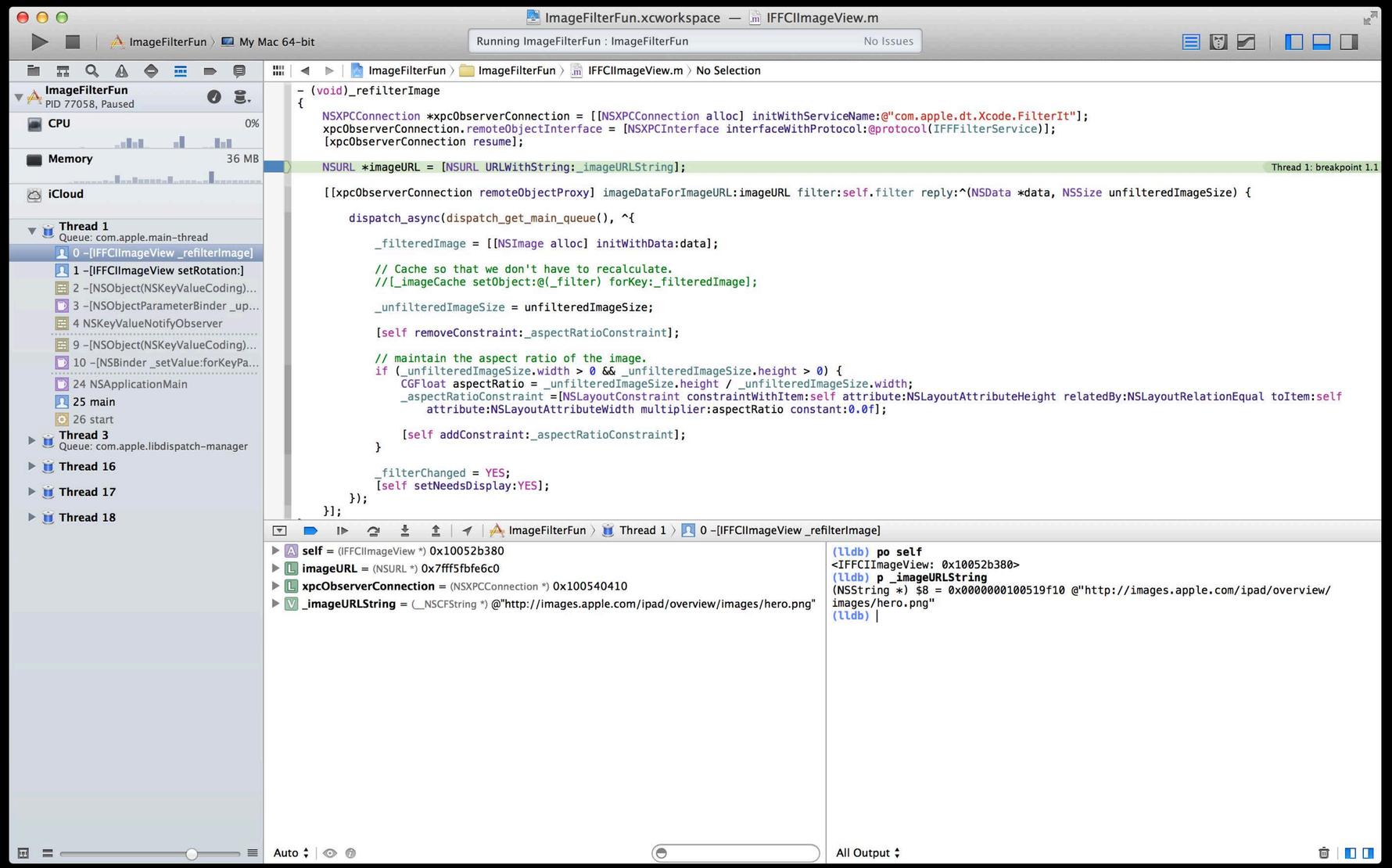


Variables View



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1 -[IFFCIImageView setRotation:]
2 -[NSObject(NSKeyValueCoding)...
3 -[NSObjectParameterBinder _up...
4 NSKeyValueNotifyObserver
9 -[NSObject(NSKeyValueCoding)...
10 -[NSBinder _setValue:forKeyPa...
24 NSApplicationMain
25 main
26 start

Thread 3
Queue: com.apple.libdispatch-manager

Thread 16

Thread 17

Thread 18

ImageFilterFun 〉 Thread 1 〉 0 -[IFFCIImageView _refilterImage]

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- **imageURL** = (NSURL *) 0x7fff5fbfe6c0
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- **_imageURLString** = (__NSCFString *) @"http://images.apple.com/ipad/overview/images/hero.png"

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Auto

All Output

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- **xpcObserverConnection** = (NSXPCConnection *) 0x100540410
- **_imageURLString** = (__NSCFString *) @"http://images.apple.com/ipad/overview/images/hero.png"

```
(lldb) po self
<IFFCIImageView: 0x10052b380>
(lldb) p _imageURLString
(NSString *) $8 = 0x0000000100519f10 @"http://images.ap
images/hero.png"
(lldb)
```

Auto

All Output

```
            // Cache so that we don't have to recalculate.
            //[_imageCache setObject:@(_filter) forKey:_filteredImage];

            _unfilteredImageSize = unfilteredImageSize;

            [self removeConstraint:_aspectRatioConstraint];

            // maintain the aspect ratio of the image.
            if (_unfilteredImageSize.width > 0 && _unfilteredImageSize.height > 0) {
                CGFloat aspectRatio = _unfilteredImageSize.height / _unfilteredImageSize.width;
                _aspectRatioConstraint =[NSLayoutConstraint constraintWithItem:self attribute:NSLayoutAttributeHeight relatedBy:NSLayoutRe
                    attribute:NSLayoutAttributeWidth multiplier:aspectRatio constant:0.0f];

                [self addConstraint:_aspectRatioConstraint];
            }

            _filterChanged = YES;
            [self setNeedsDisplay:YES];
        });
    }];
```

1 -[IFFCIImageView setRotation:]
2 -[NSObject(NSKeyValueCoding)...
3 -[NSObjectParameterBinder _up...
4 NSKeyValueNotifyObserver
9 -[NSObject(NSKeyValueCoding)...
10 -[NSBinder _setValue:forKeyPa...
24 NSApplicationMain
25 main
26 start

Thread 3
Queue: com.apple.libdispatch-manager

Thread 16

Thread 17

Thread 18

ImageFilterFun 〉 Thread 1 〉 0 -[IFFCIImageView _refilterImage]

- **self** = (IFFCIImageView *) 0x10052b380
- **imageURL** = (NSURL *) 0x7fff5fbfe6c0
- **xpcObserverConnection** = (NSXPCConnection *) 0x100540410
- **_imageURLString** = (__NSCFString *) @"http://images.apple.com/ipad/overview/images/hero.png"

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(lldb) po self
<IFFCIImageView: 0x10052b380>
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Auto

All Output

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            // Cache so that we don't have to recalculate.
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                [self addConstraint:_aspectRatioConstraint];
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            _filterChanged = YES;
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Thread 3
Queue: com.apple.libdispatch-manager

Thread 16

Thread 17

Thread 18

ImageFilterFun 〉 Thread 1 〉 0 -[IFFCIImageView _refilterImage]

- **self** = (IFFCIImageView *) 0x10052b380
- **_cmd** = (SEL) "_refilterImage"
- **xpcObserverConnection** = (NSXPCConnection *) 0x100540410
- **imageURL** = (NSURL *) 0x7fff5fbfe6c0
- **Exception State Registers**
- **Floating Point Registers**
- **General Purpose Registers**

```
(lldb) po self
<IFFCIImageView: 0x10052b380>
(lldb) p _imageURLString
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All

All Output

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        });
    }];
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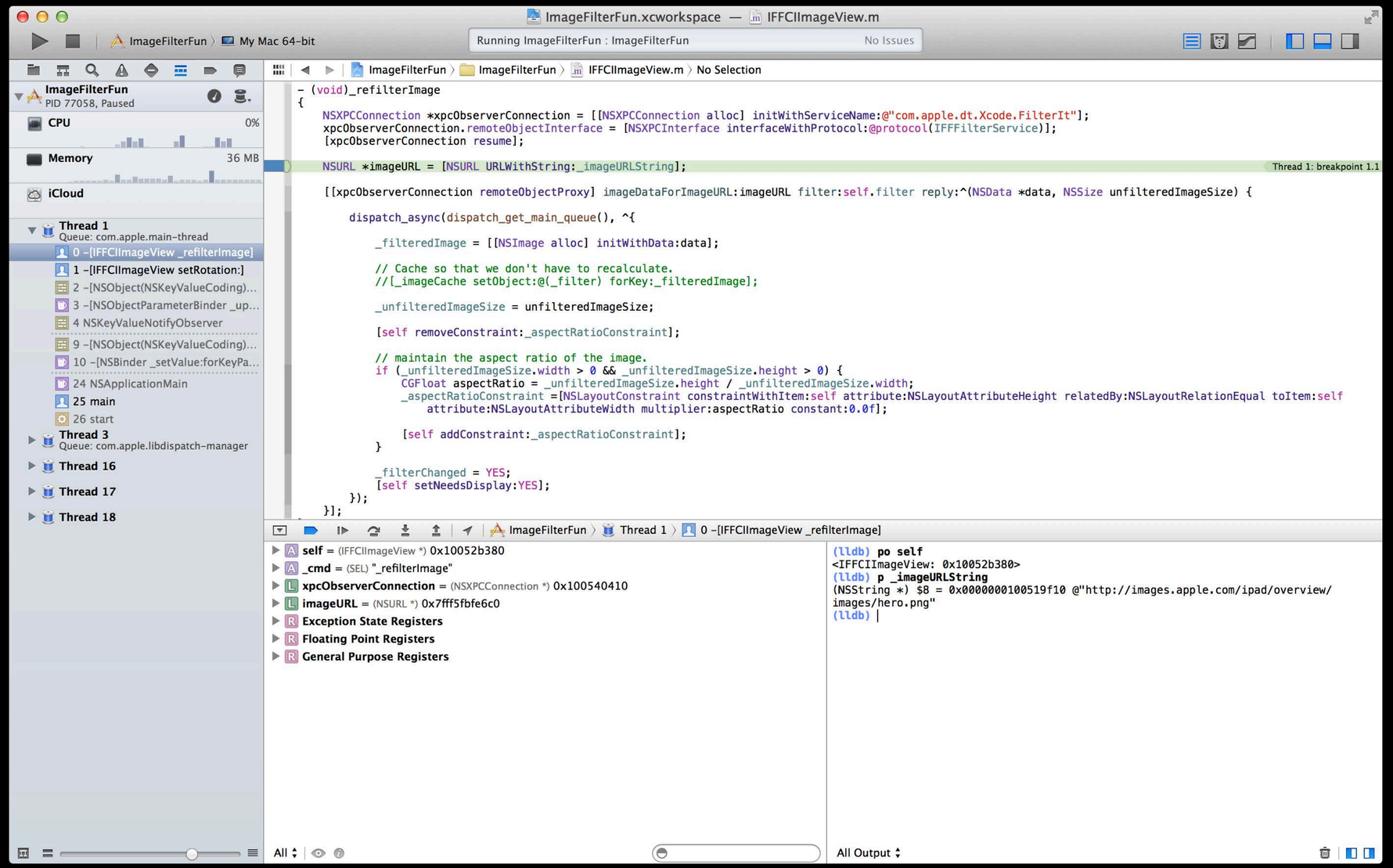
All Output

Debug Console



```
_filteredImage = [[NSImage alloc] initWithData:data];

// Cache so that we don't have to recalculate.
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ImageFilterFun 〉 Thread 1 〉 0 -[IFFCIImageView _refilterImage]

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```
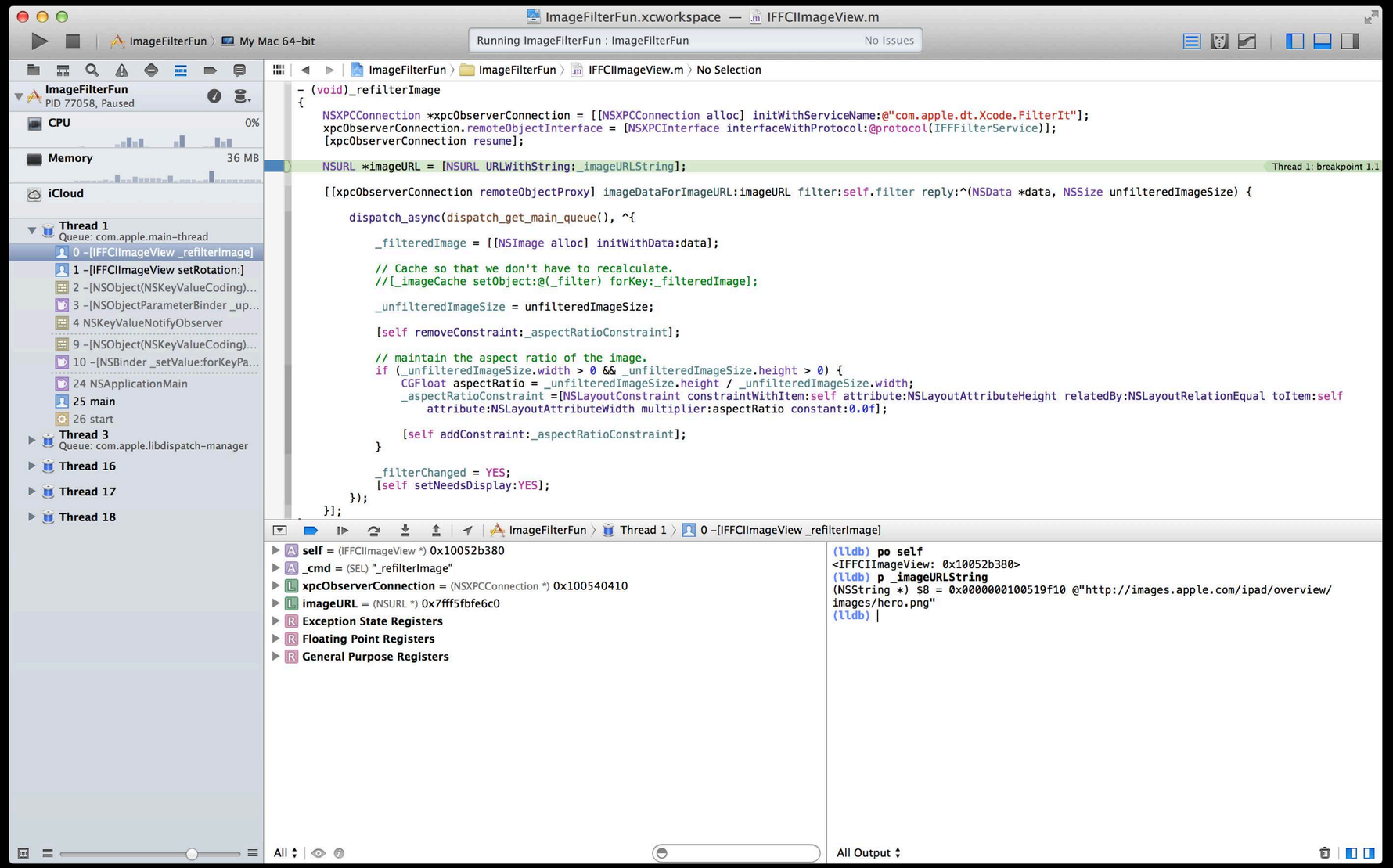

All Output

Debug Console



Xcode 5 Makes It Easier to Fix Bugs

- Debug gauges
- Debugging workflow
- XPC services

Understanding Performance

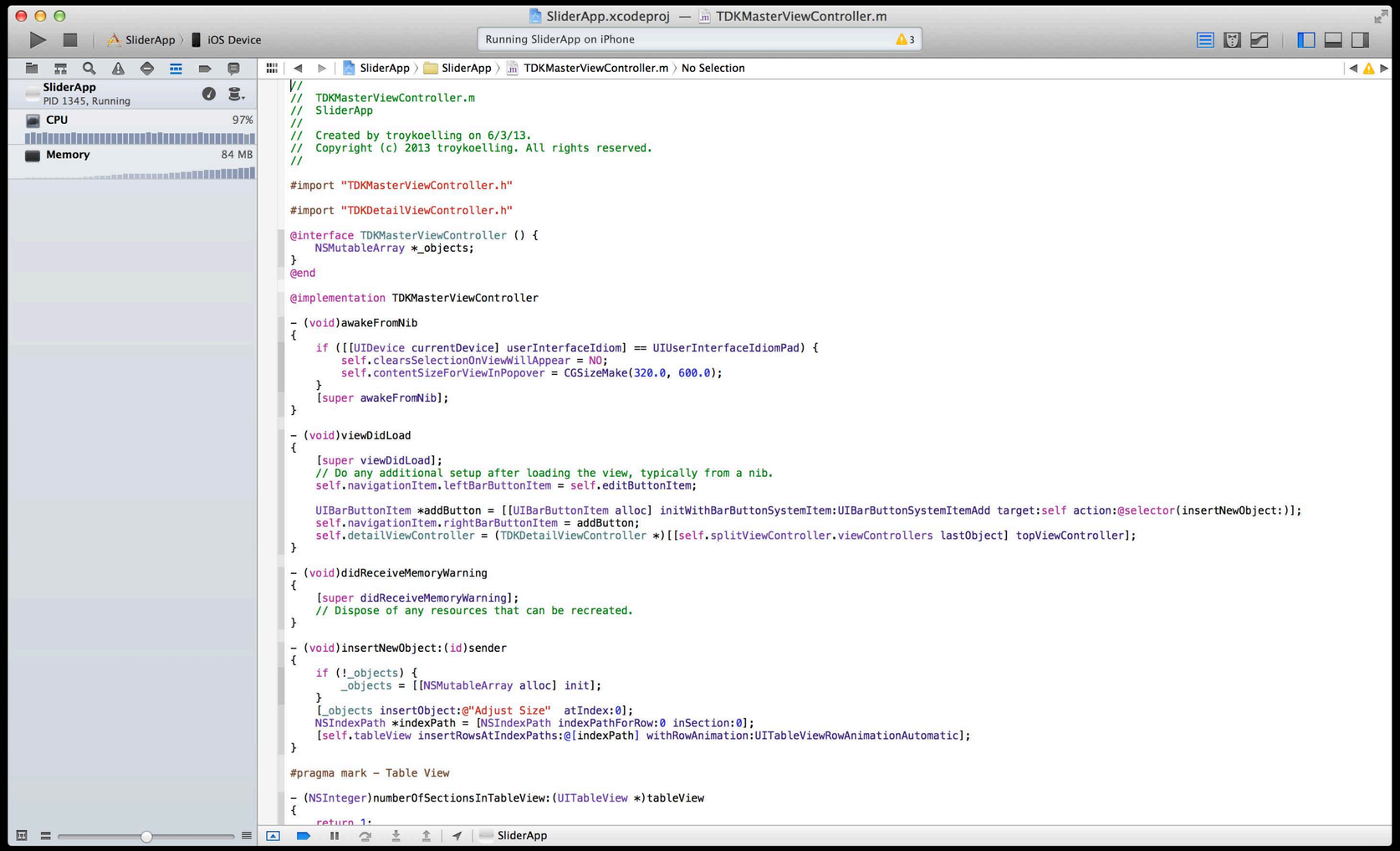
“We should forget about small efficiencies, say about 97% of the time: premature optimization is the root of all evil.”

Donald Knuth

Optimize when you measure a problem

Debug Gauges

- CPU
- Memory
- iCloud
- Energy
- OpenGL ES



Debug Gauges

- CPU
- Memory
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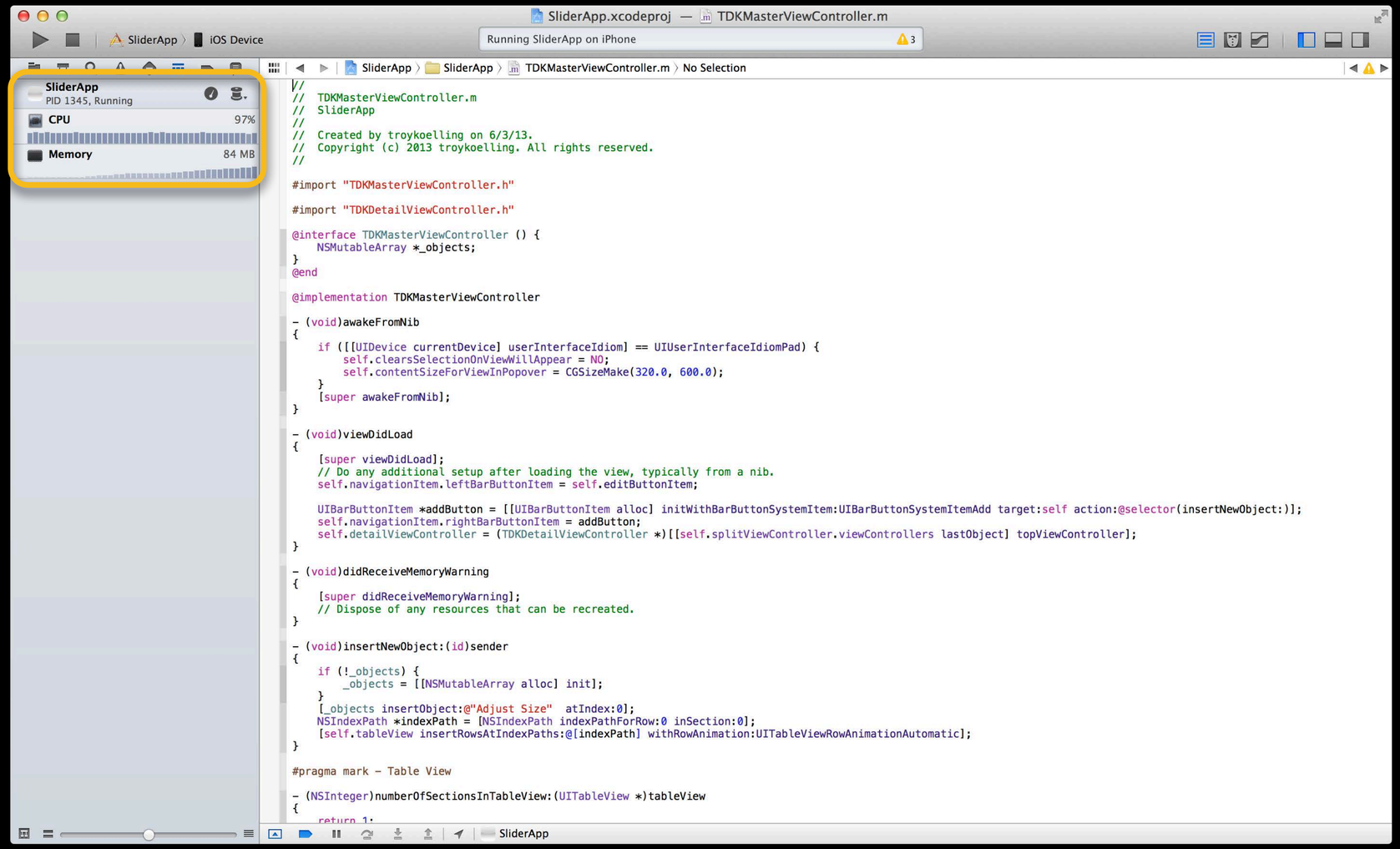
- OpenGL ES



Debug Gauges

- CPU
- Memory
- iCloud
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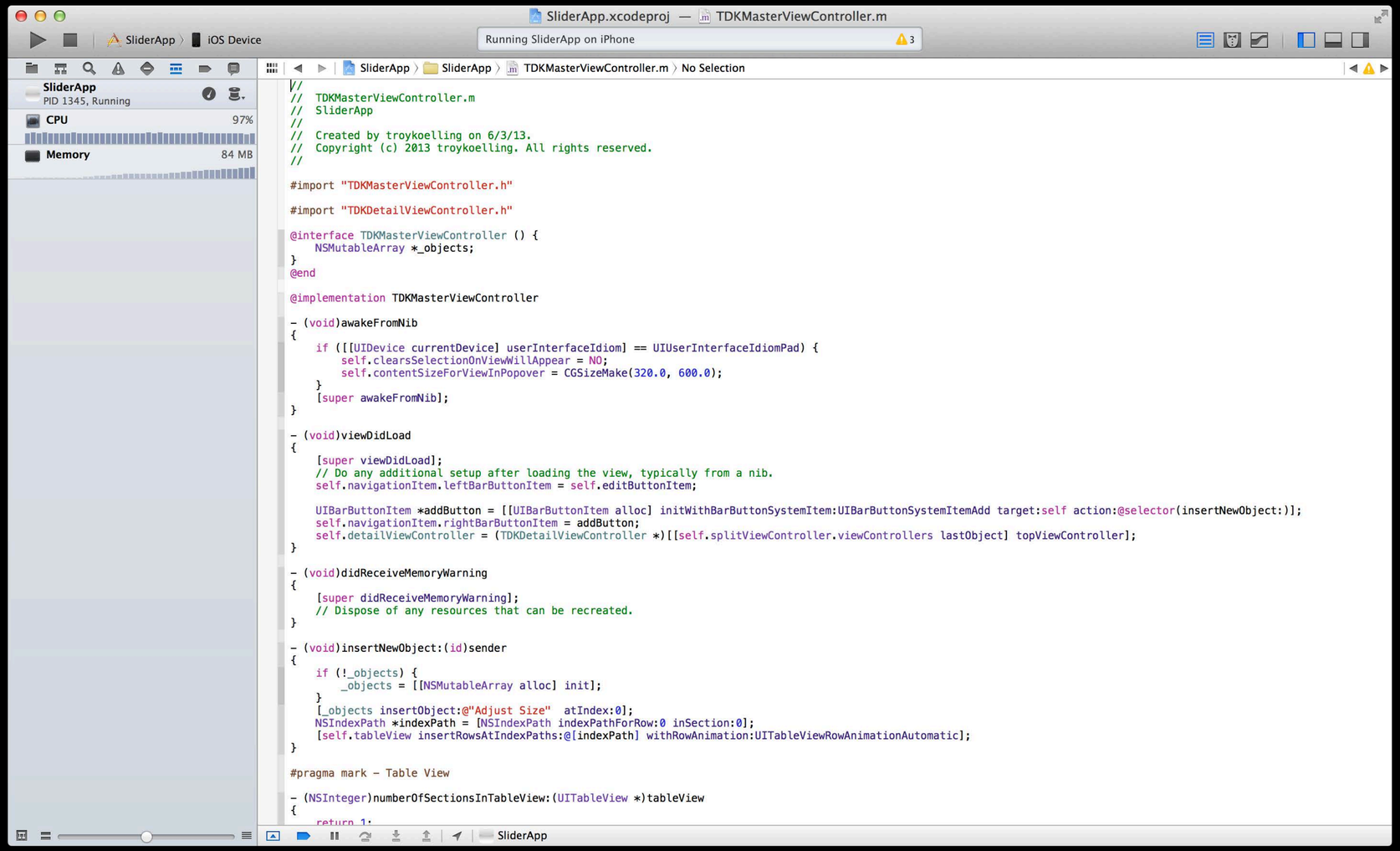
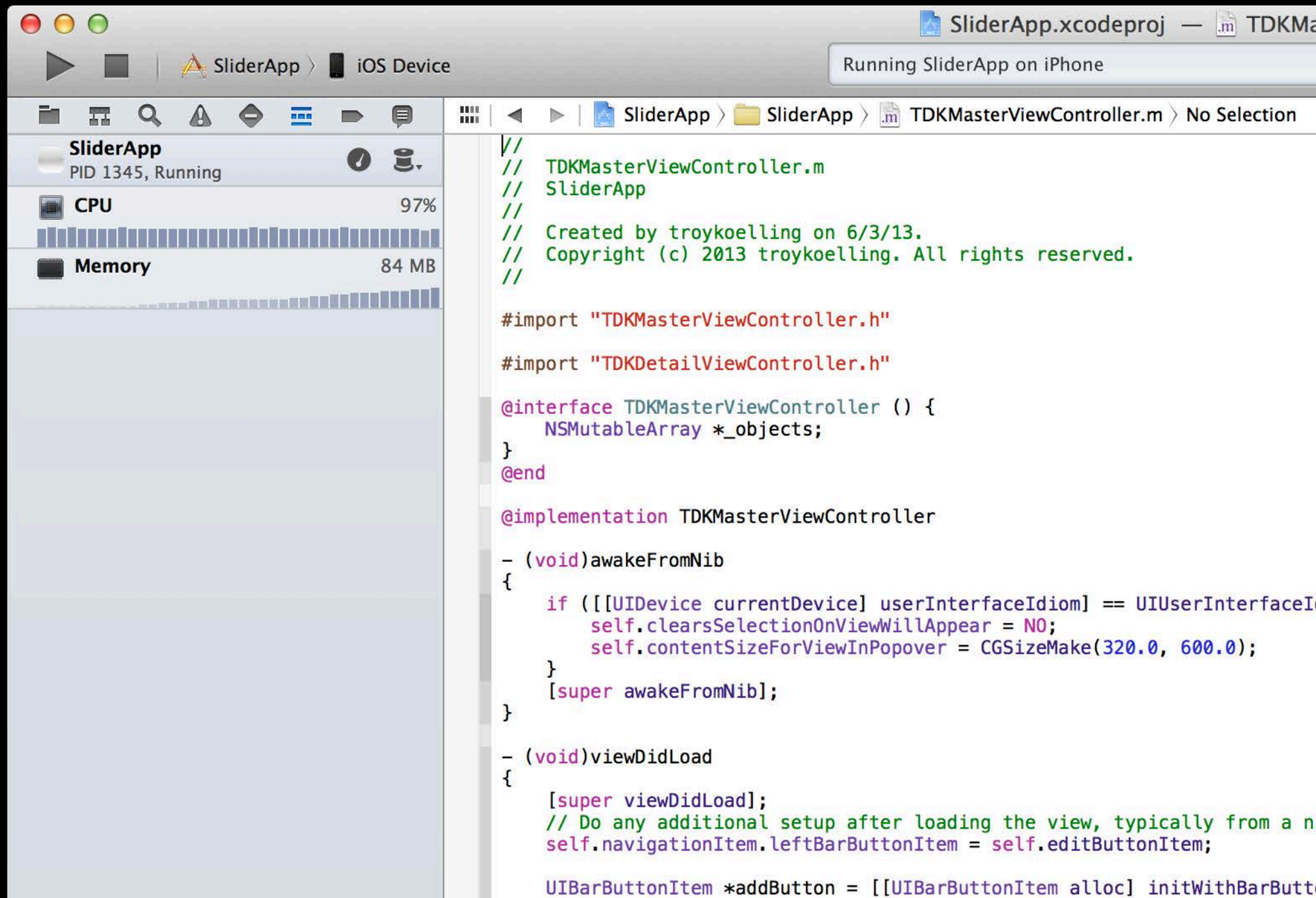
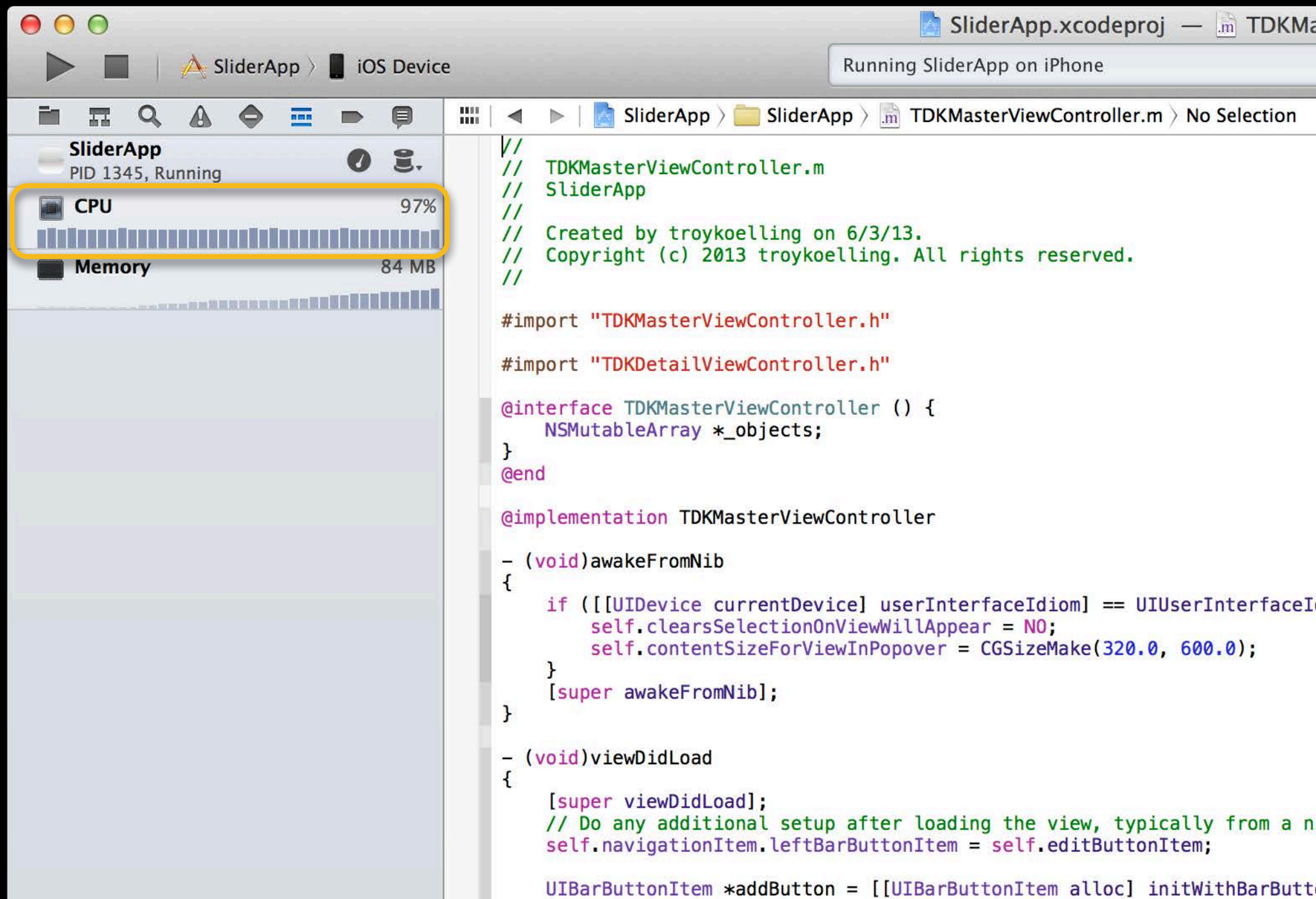
- OpenGL ES



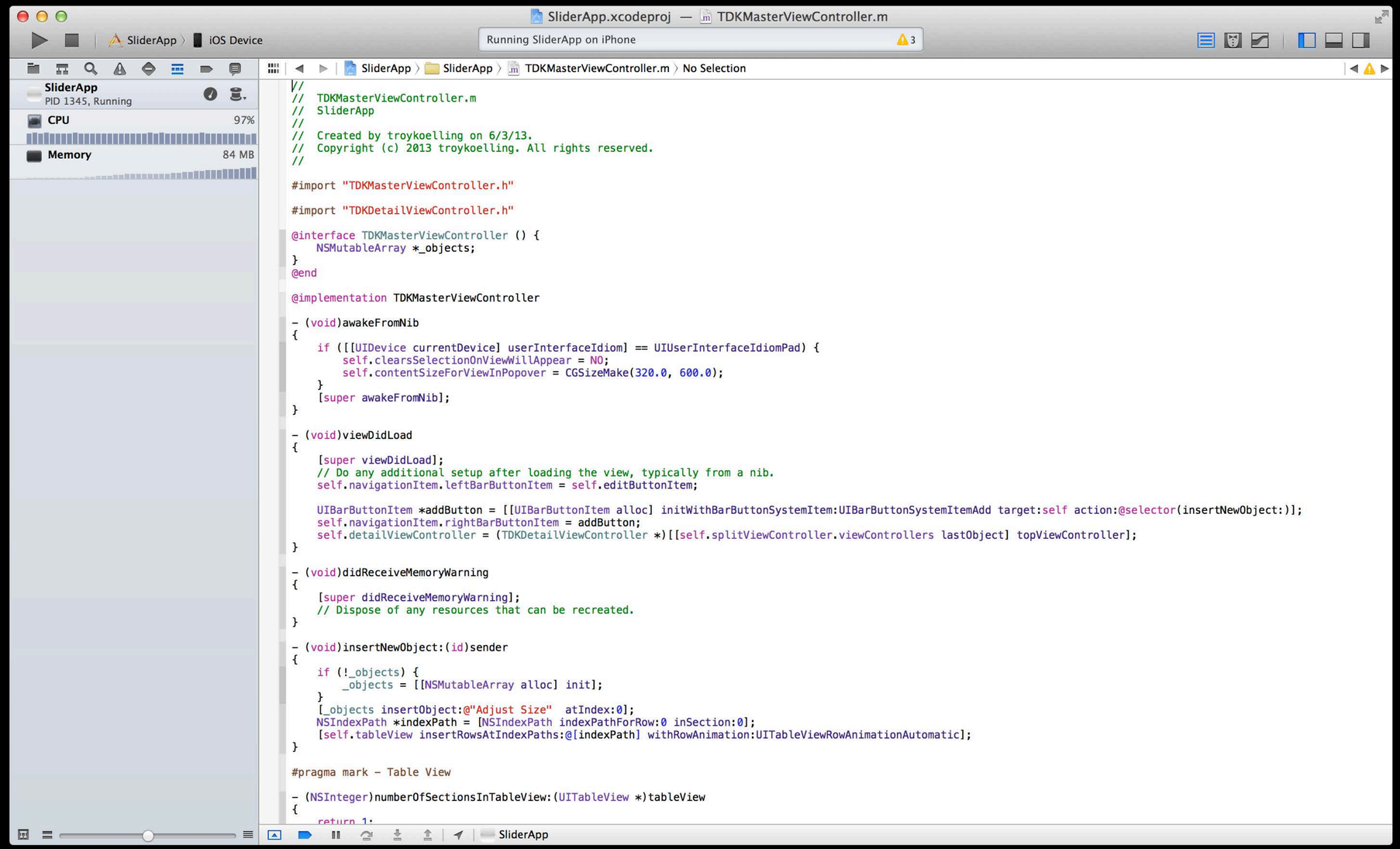
Understanding Performance



CPU Report


SliderApp.xcodeproj — TDKMa
SliderApp 〉 iOS Device
Running SliderApp on iPhone
SliderApp 〉 SliderApp 〉 TDKMasterViewController.m 〉 No Selection
SliderApp
PID 1345, Running
CPU 97%
Memory 84 MB
//
// TDKMasterViewController.m
// SliderApp
//
// Created by troykoelling on 6/3/13.
// Copyright (c) 2013 troykoelling. All rights reserved.
//
#import "TDKMasterViewController.h"
#import "TDKDetailViewController.h"
@interface TDKMasterViewController () {
NSMutableArray *_objects;
}
@end
@implementation TDKMasterViewController
- (void)awakeFromNib
{
if ([[UIDevice currentDevice] userInterfaceIdiom] == UIUserInterfaceI
self.clearsSelectionOnViewWillAppear = NO;
self.contentSizeForViewInPopover = CGSizeMake(320.0, 600.0);
}
[super awakeFromNib];
}
- (void)viewDidLoad
{
[super viewDidLoad];
// Do any additional setup after loading the view, typically from a n
self.navigationItem.leftBarButtonItem = self.editButtonItem;
UIBarButtonItem *addButton = [[UIBarButtonItem alloc] initWithBarButt

CPU Report


SliderApp.xcodeproj — TDKMasterViewController.m
SliderApp 〉 iOS Device
Running SliderApp on iPhone
3
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// Created by troykoelling on 6/3/13.
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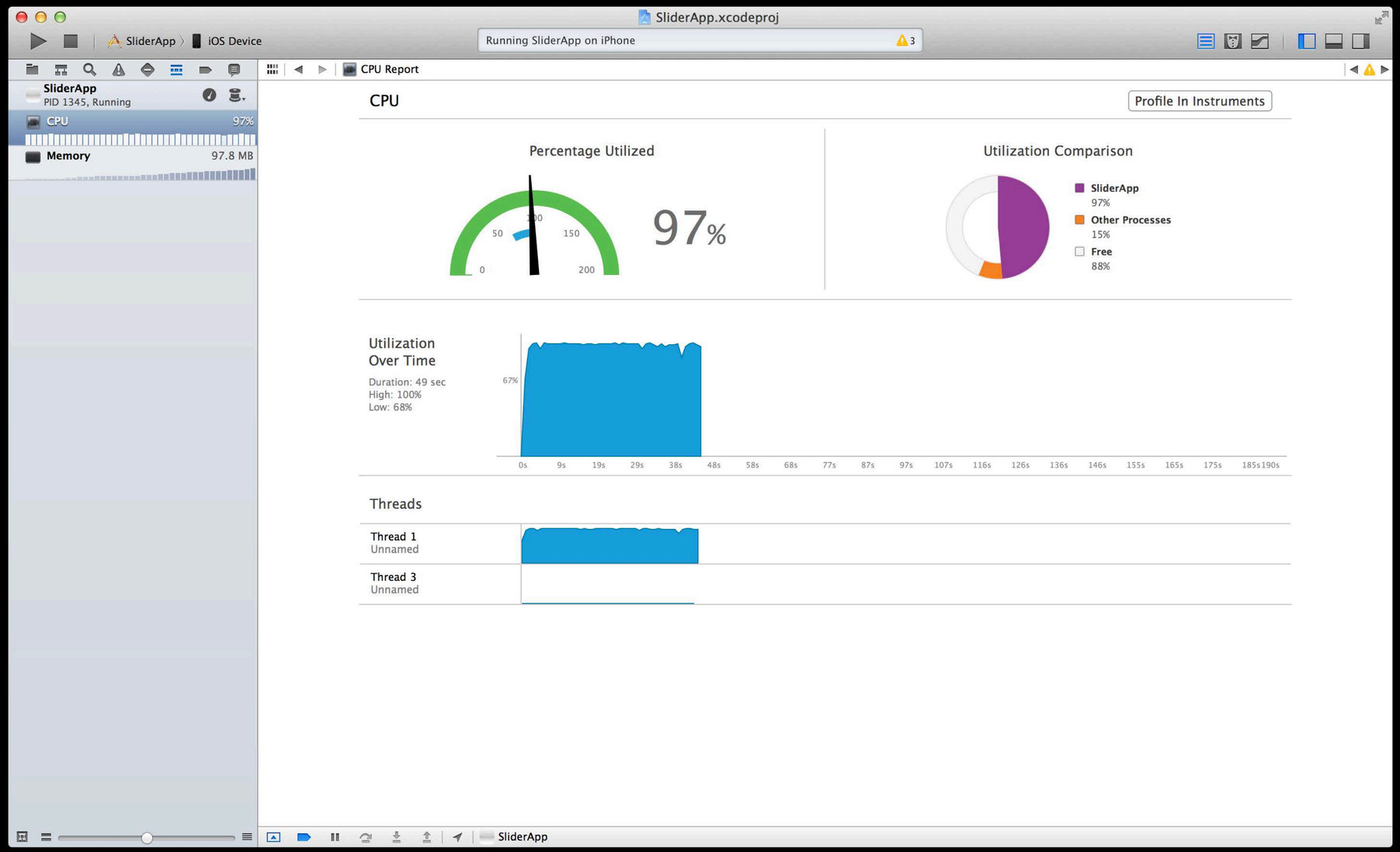
//
#import "TDKMasterViewController.h"
#import "TDKDetailViewController.h"
@interface TDKMasterViewController () {
NSMutableArray *_objects;
}
@end
@implementation TDKMasterViewController
- (void)awakeFromNib
{
if ([[UIDevice currentDevice] userInterfaceIdiom] == UIUserInterfaceIdiomPad) {
self.clearsSelectionOnViewWillAppear = NO;
self.contentSizeForViewInPopover = CGSizeMake(320.0, 600.0);
}
[super awakeFromNib];
}
- (void)viewDidLoad
{
[super viewDidLoad];
// Do any additional setup after loading the view, typically from a nib.
self.navigationItem.leftBarButtonItem = self.editButtonItem;
UIBarButtonItem *addButton = [[UIBarButtonItem alloc] initWithBarButtonSystemItem:UIBarButtonSystemItemAdd target:self action:@selector(insertNewObject:)];
self.navigationItem.rightBarButtonItem = addButton;
self.detailViewController = (TDKDetailViewController *)[[self.splitViewController.viewControllers lastObject] topViewController];
}
- (void)didReceiveMemoryWarning
{
[super didReceiveMemoryWarning];
// Dispose of any resources that can be recreated.
}
- (void)insertNewObject:(id)sender
{
if (!_objects) {
_objects = [[NSMutableArray alloc] init];
}
[_objects insertObject:@"Adjust Size" atIndex:0];
NSIndexPath *indexPath = [NSIndexPath indexPathForRow:0 inSection:0];
[self.tableView insertRowsAtIndexPaths:@[indexPath] withRowAnimation:UITableViewRowAnimationAutomatic];
}
#pragma mark - Table View
- (NSInteger)numberOfSectionsInTableView:(UITableView *)tableView
{
return 1;
SliderApp

CPU Report


SliderApp.xcodeproj
SliderApp
iOS Device
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3
SliderApp
PID 1345, Running
CPU
97%
Memory
97.8 MB
CPU Report
CPU
Profile In Instruments
Percentage Utilized
0
50
100
150
200
97%
Utilization Comparison
SliderApp
97%
Other Processes
15%
Free
88%
Utilization
Over Time
Duration: 49 sec
High: 100%
Low: 68%
67%
0s
9s
19s
29s
38s
48s
58s
68s
77s
87s
97s
107s
116s
126s
136s
146s
155s
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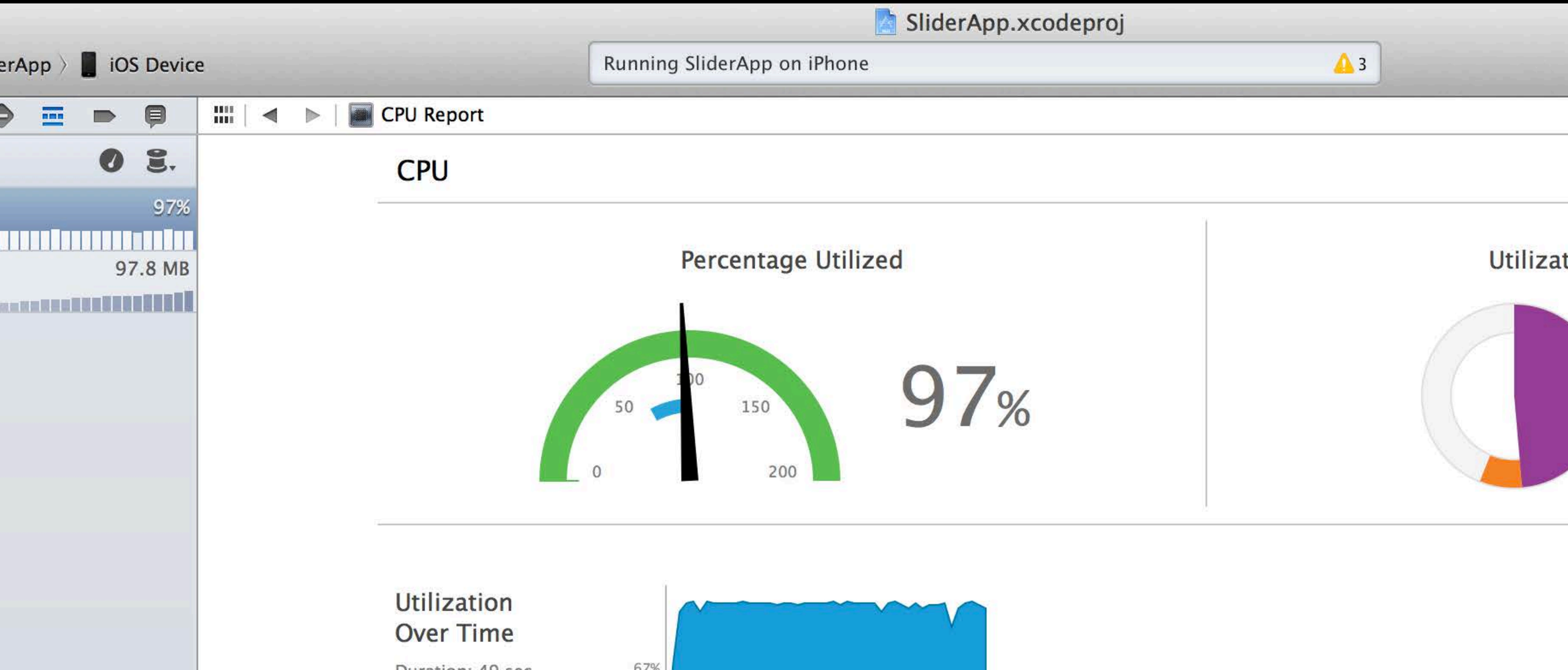
175s
185s
190s
Threads
Thread 1
Unnamed
Thread 3
Unnamed
SliderApp

CPU Report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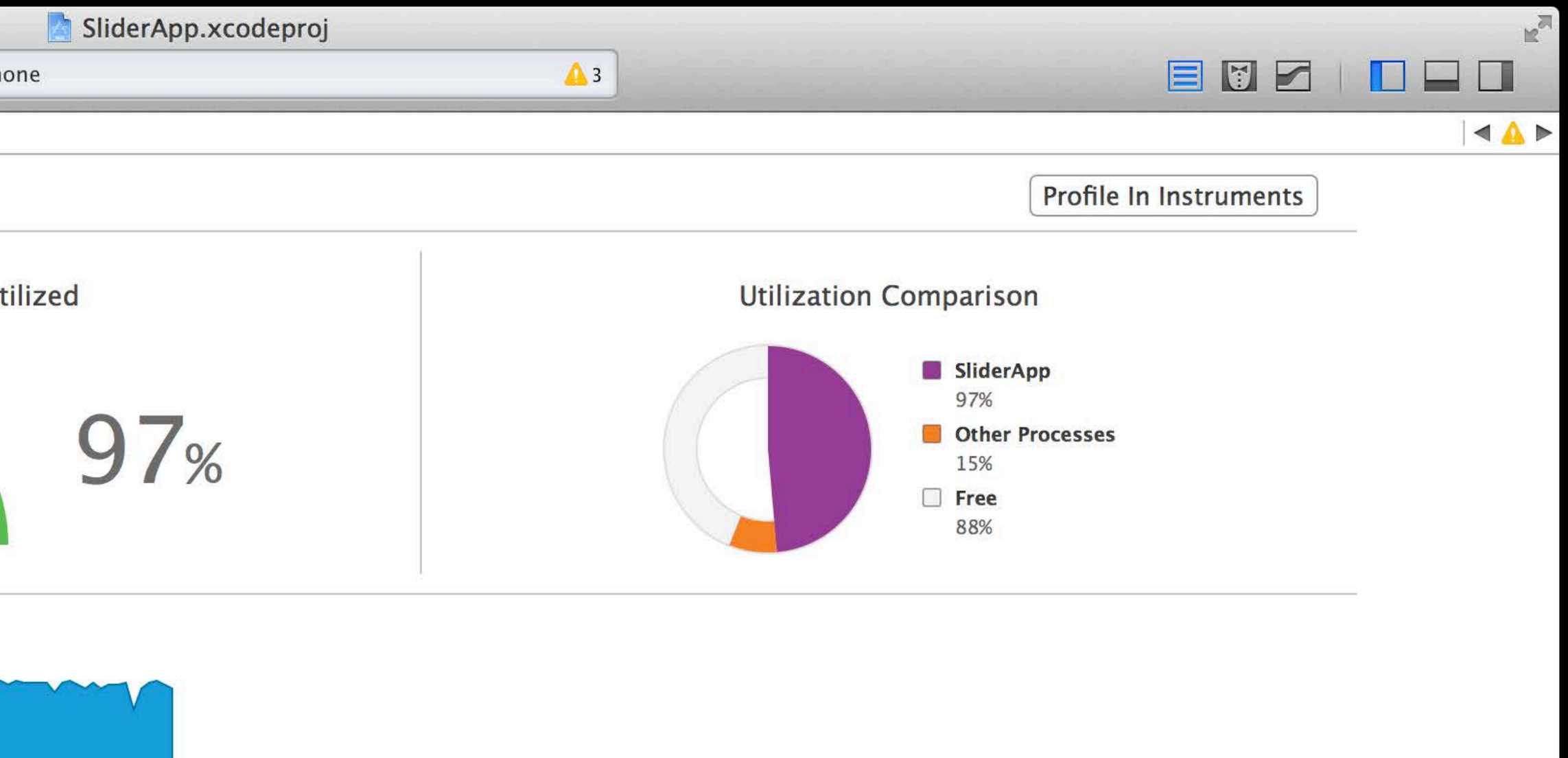
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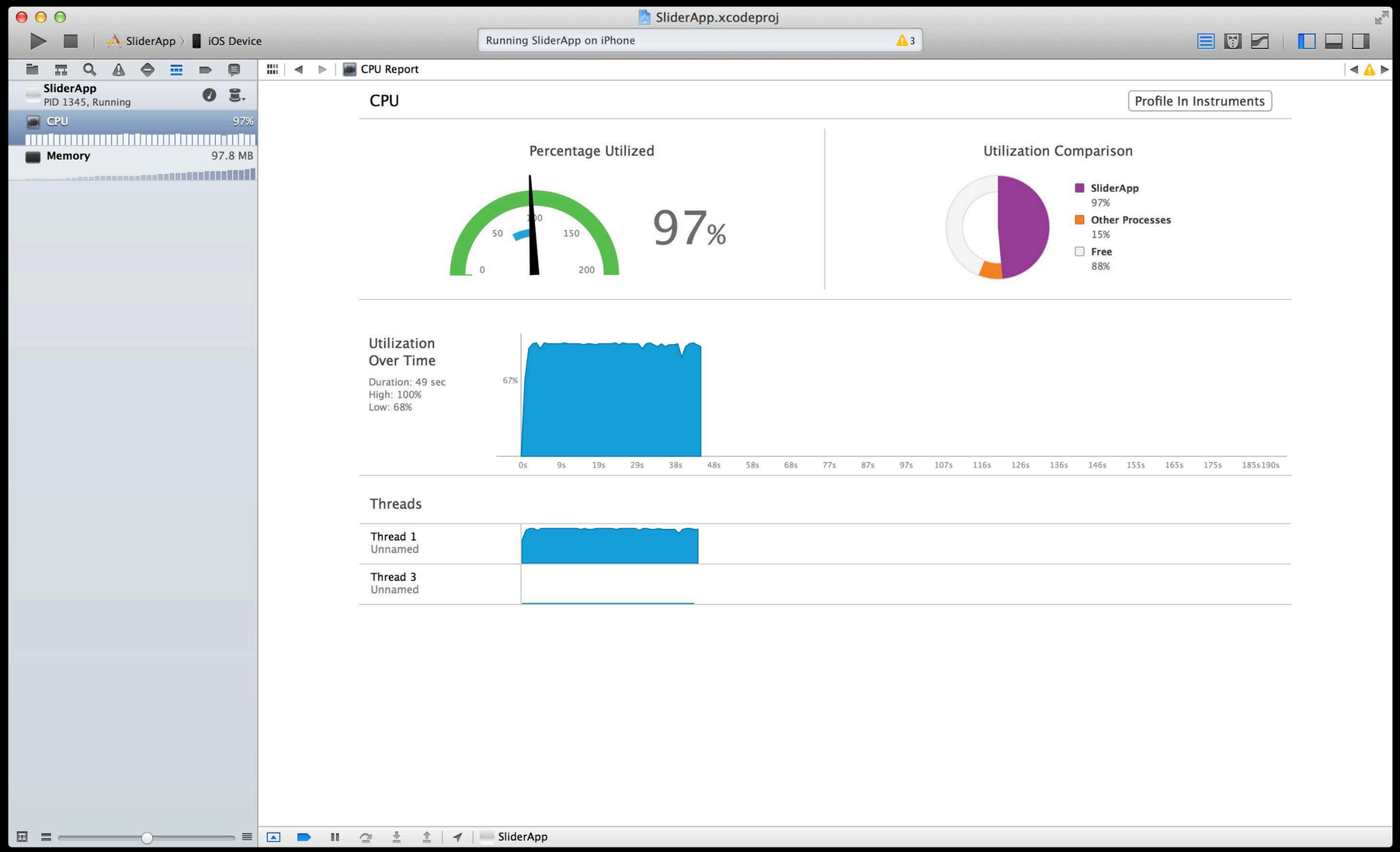
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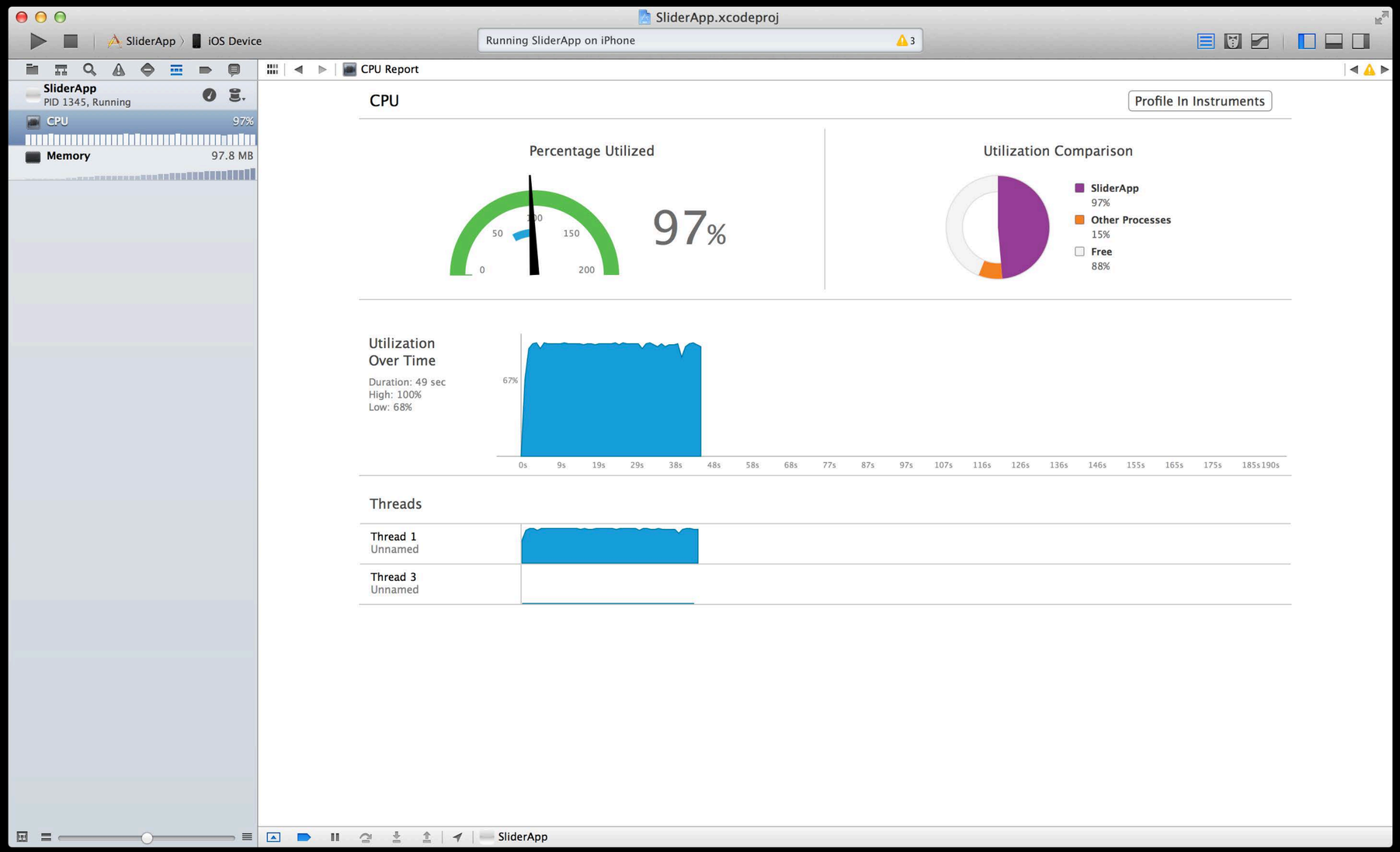
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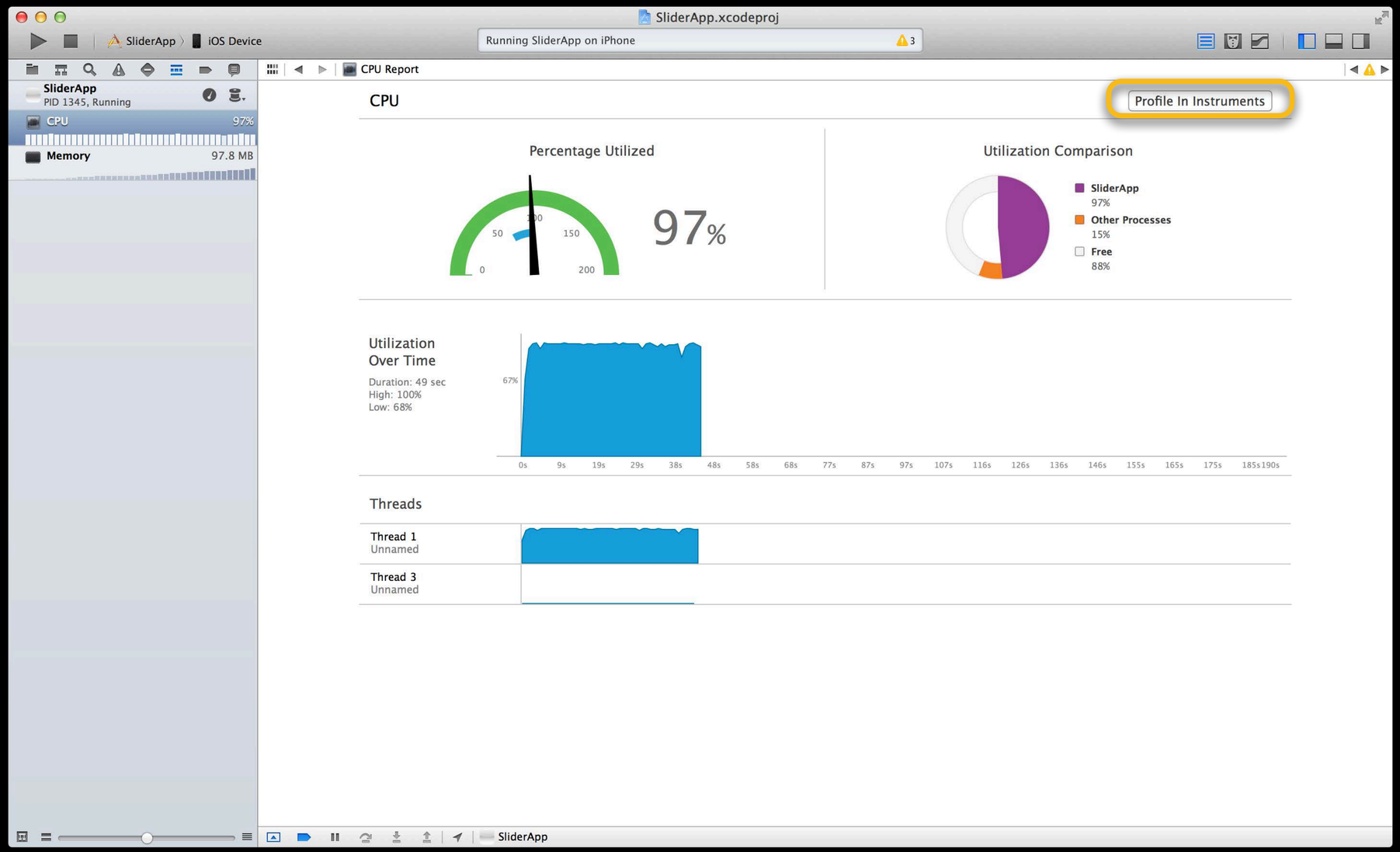
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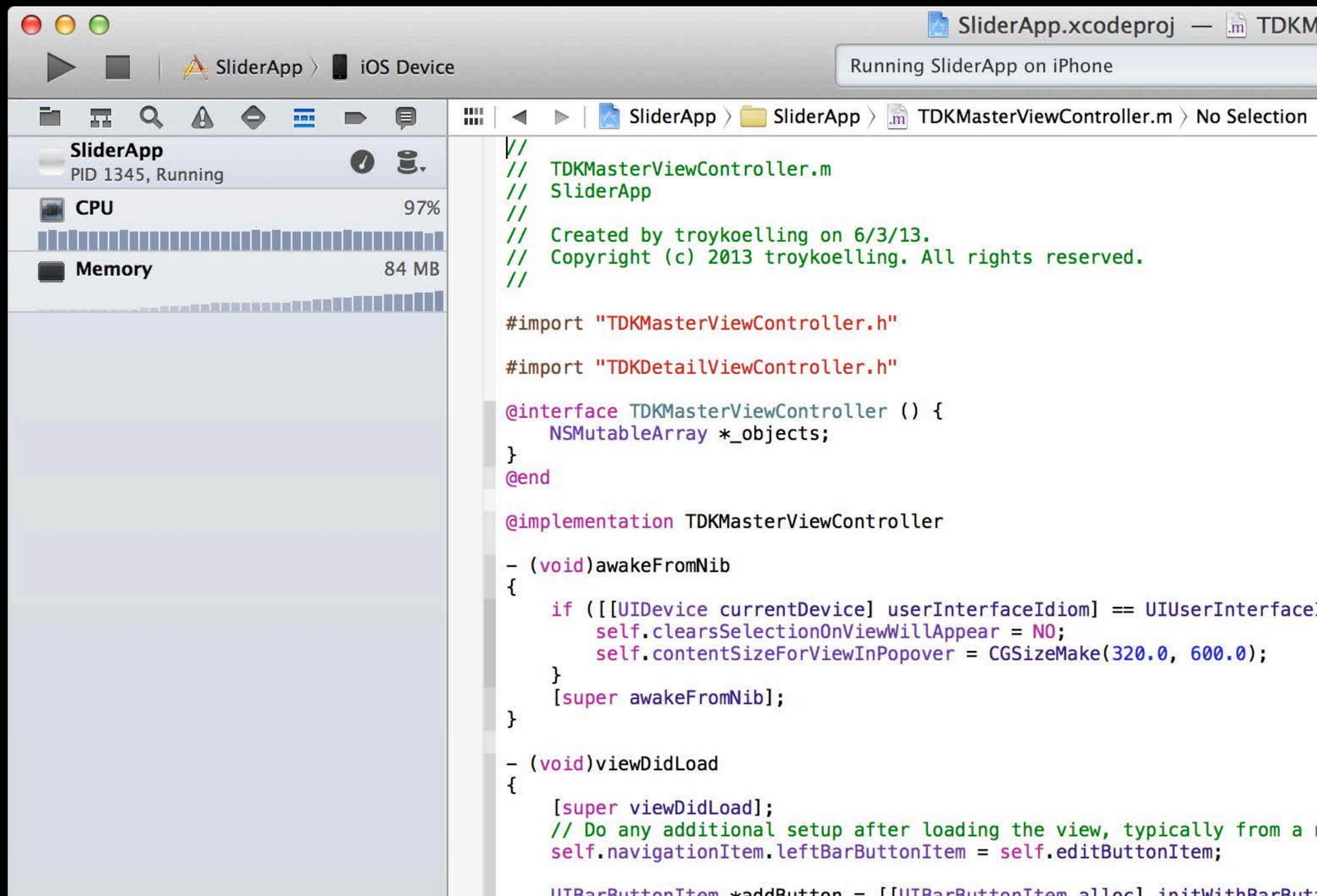
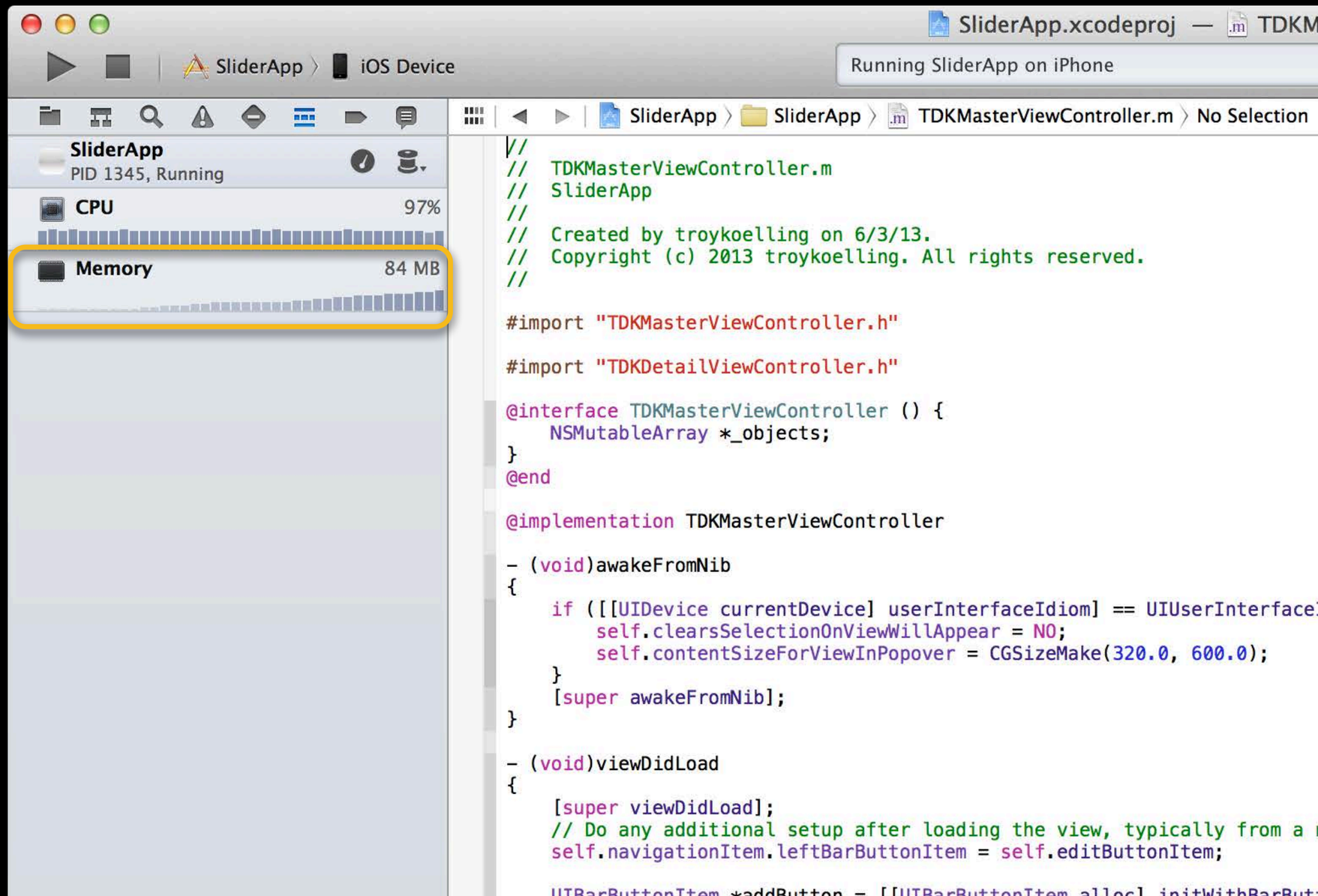


Memory Report



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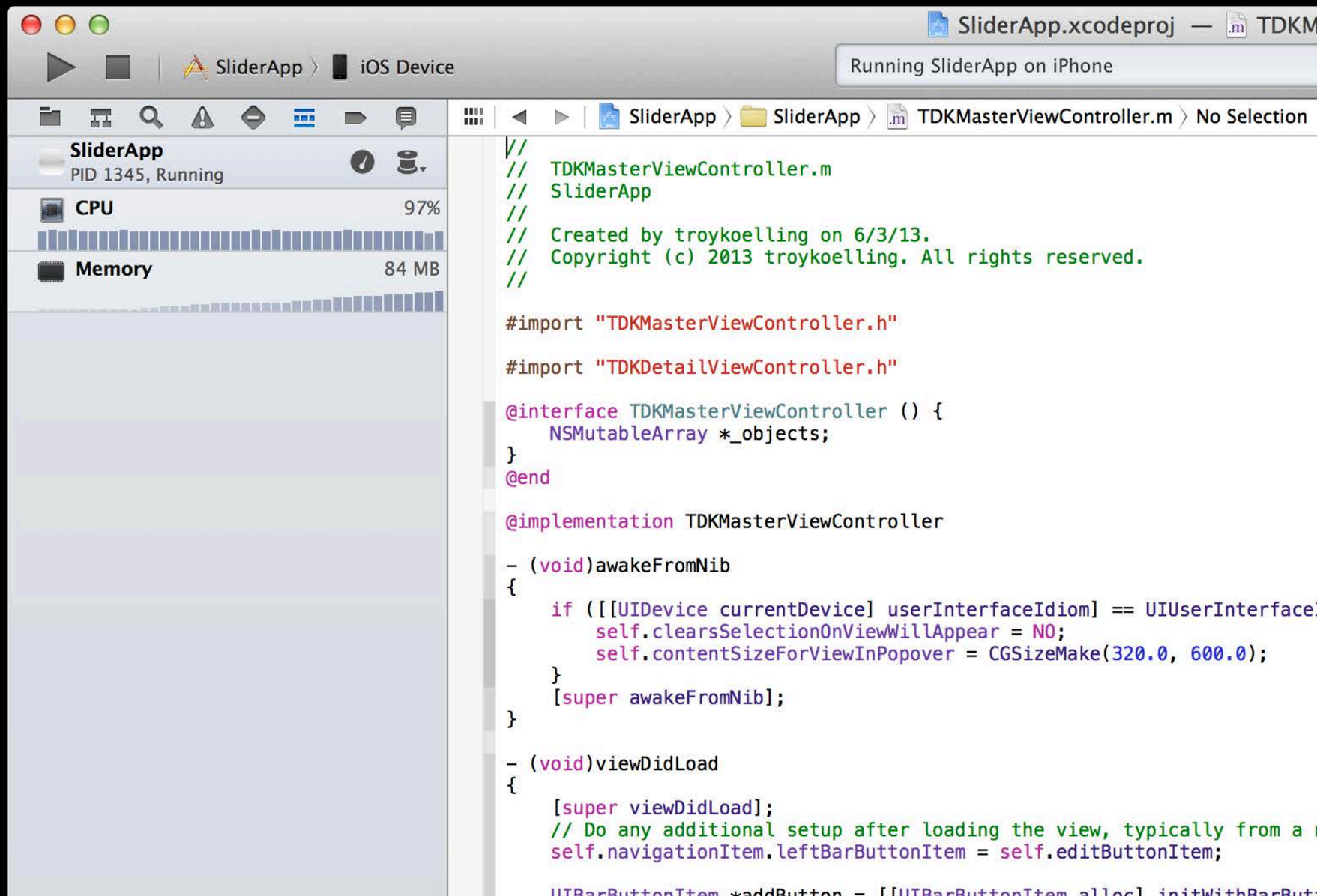

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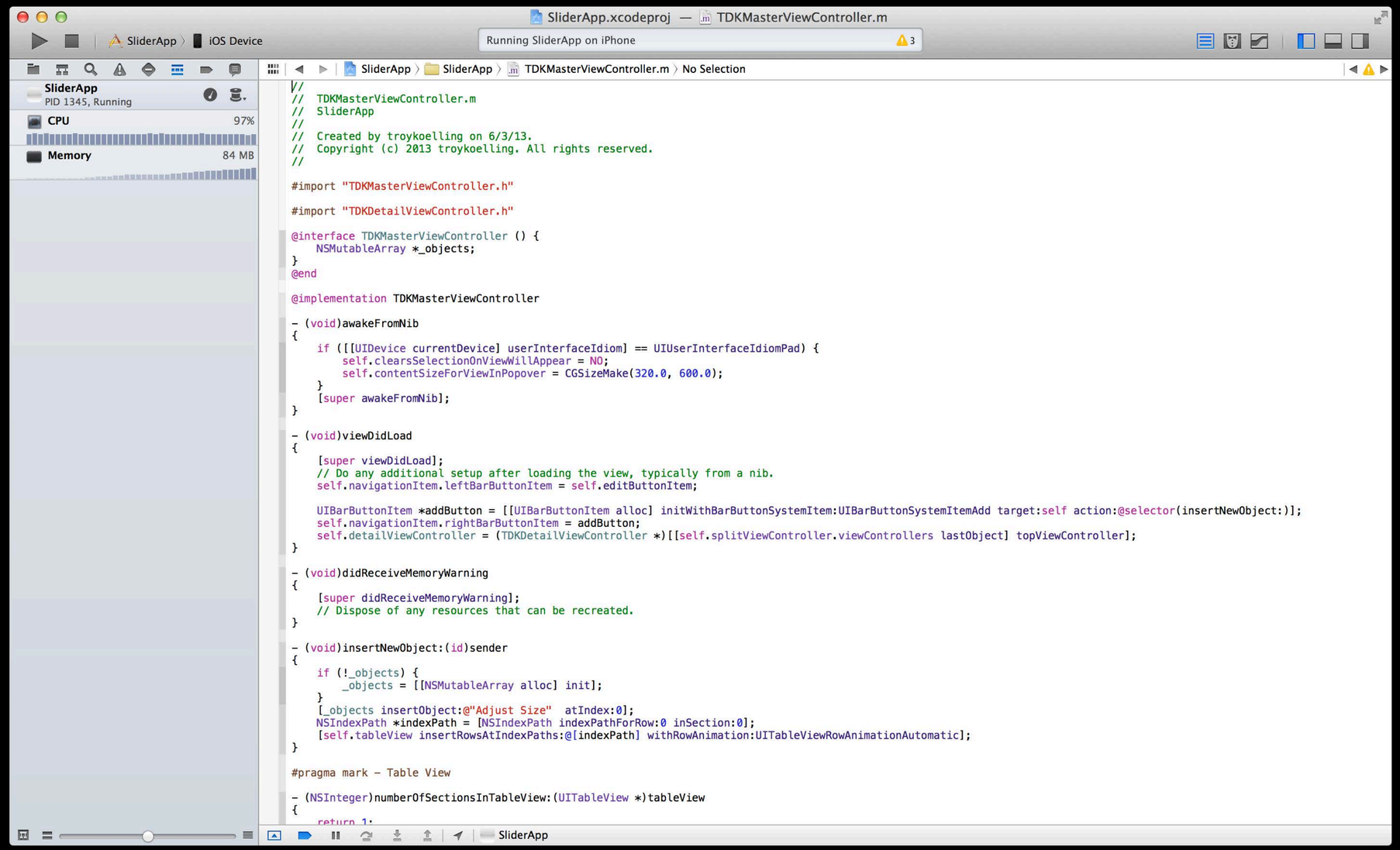

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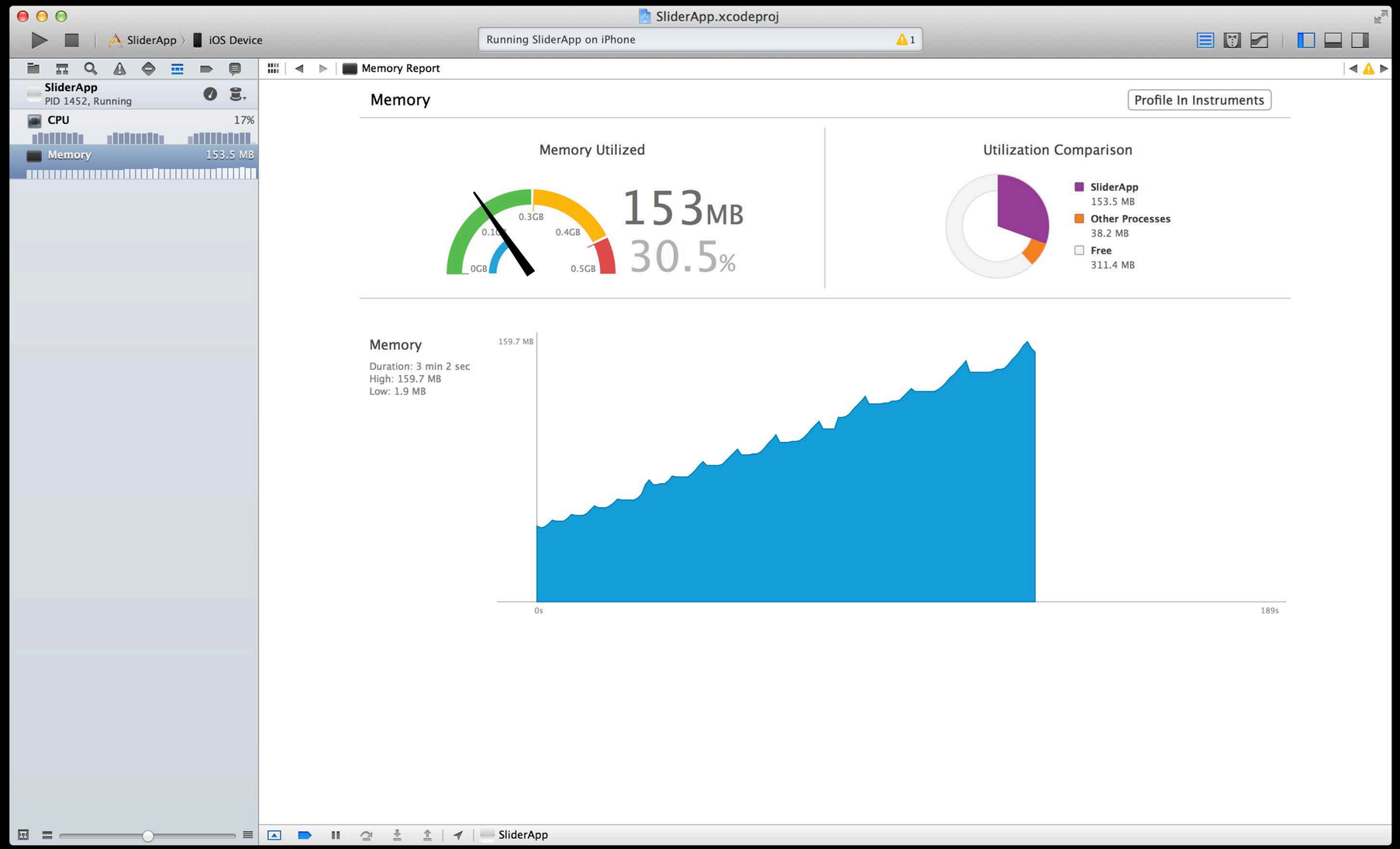
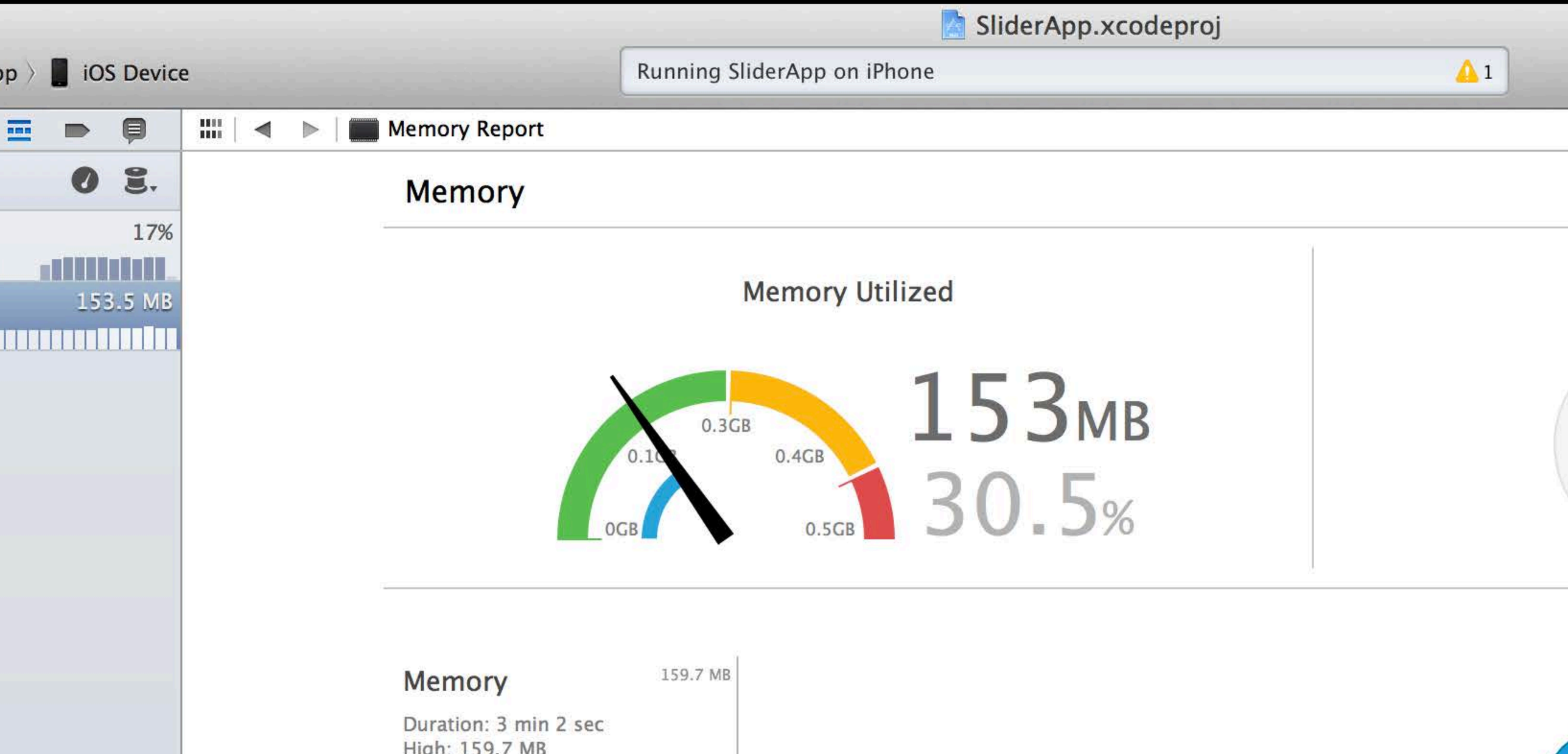
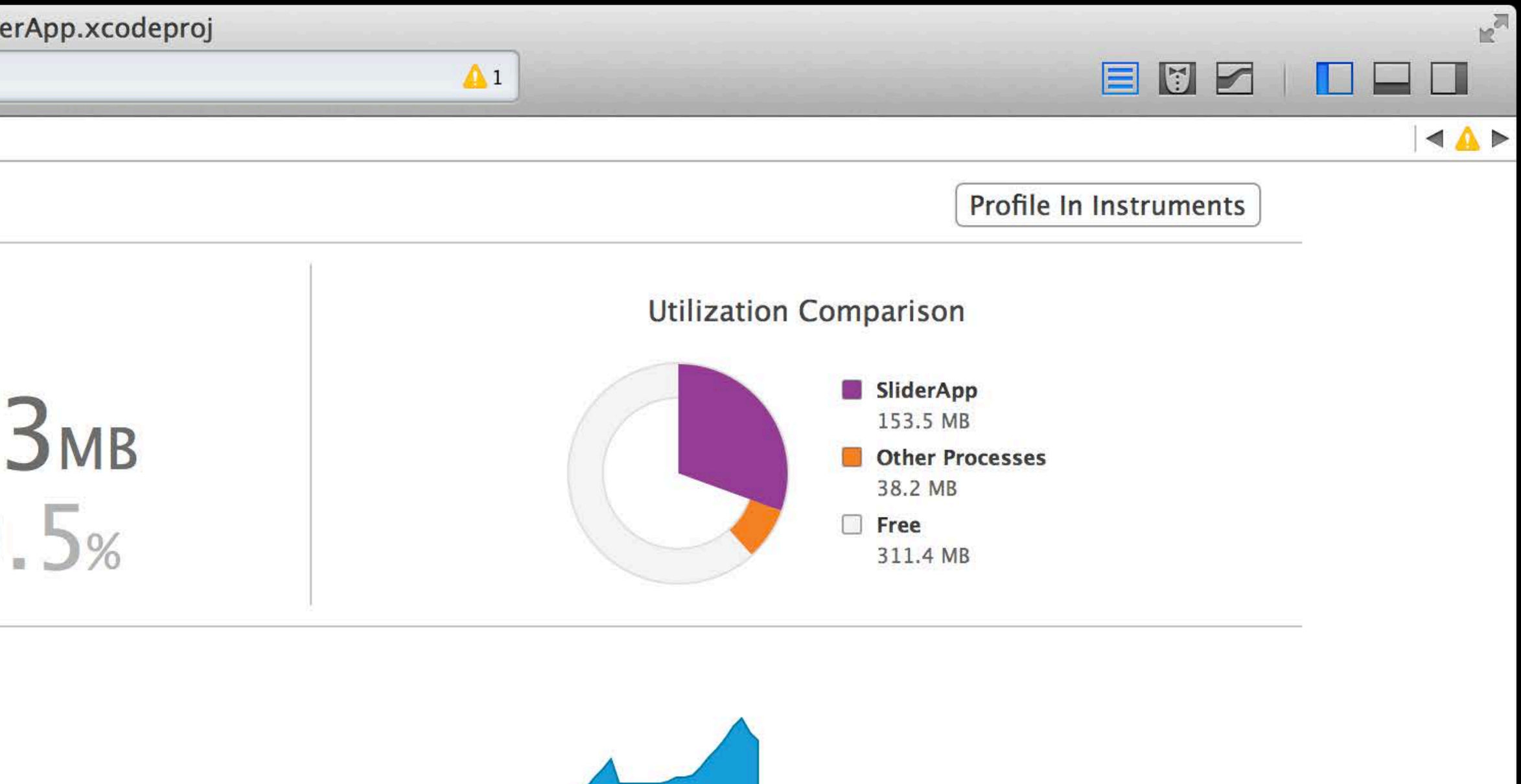


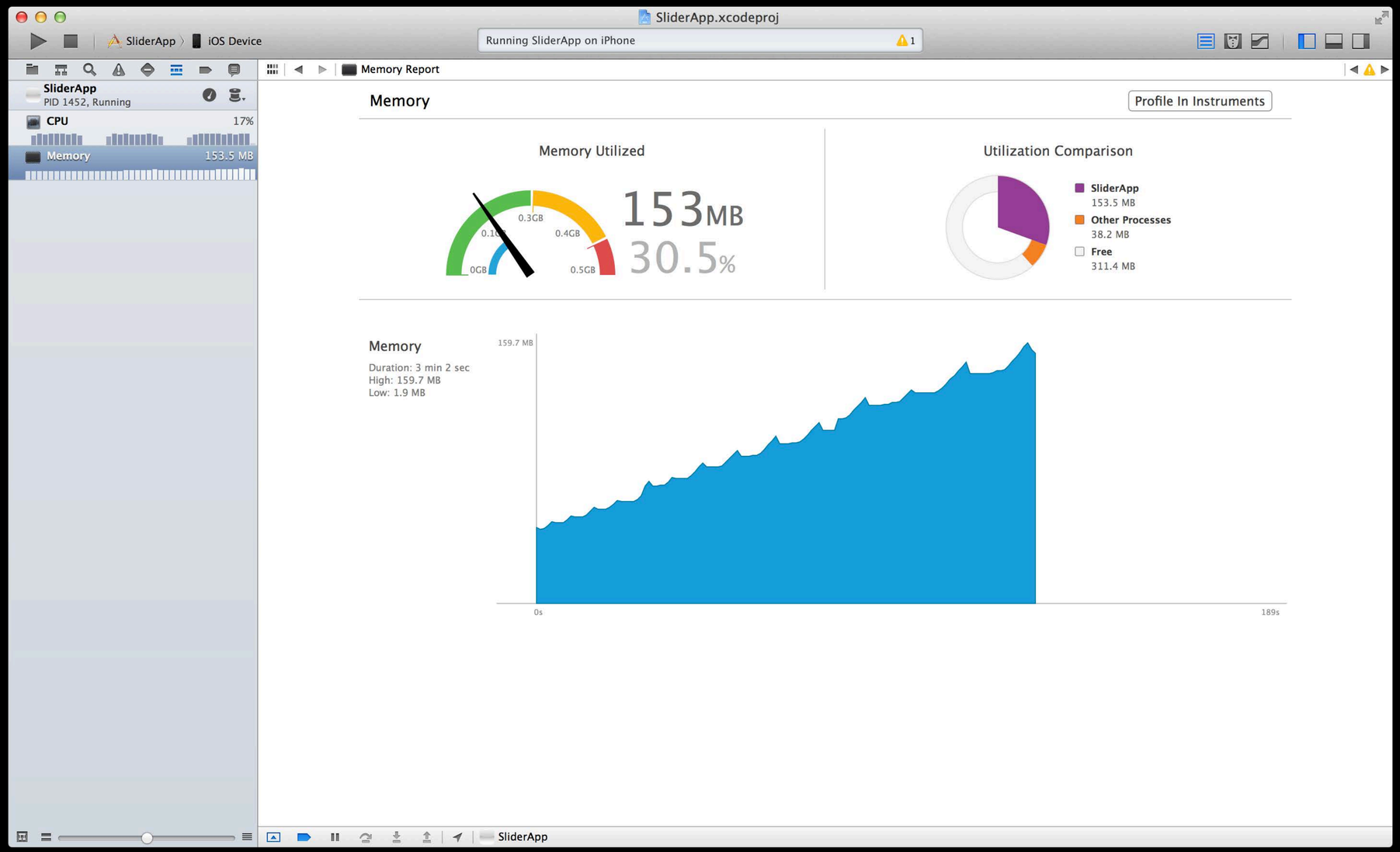
Memory Report



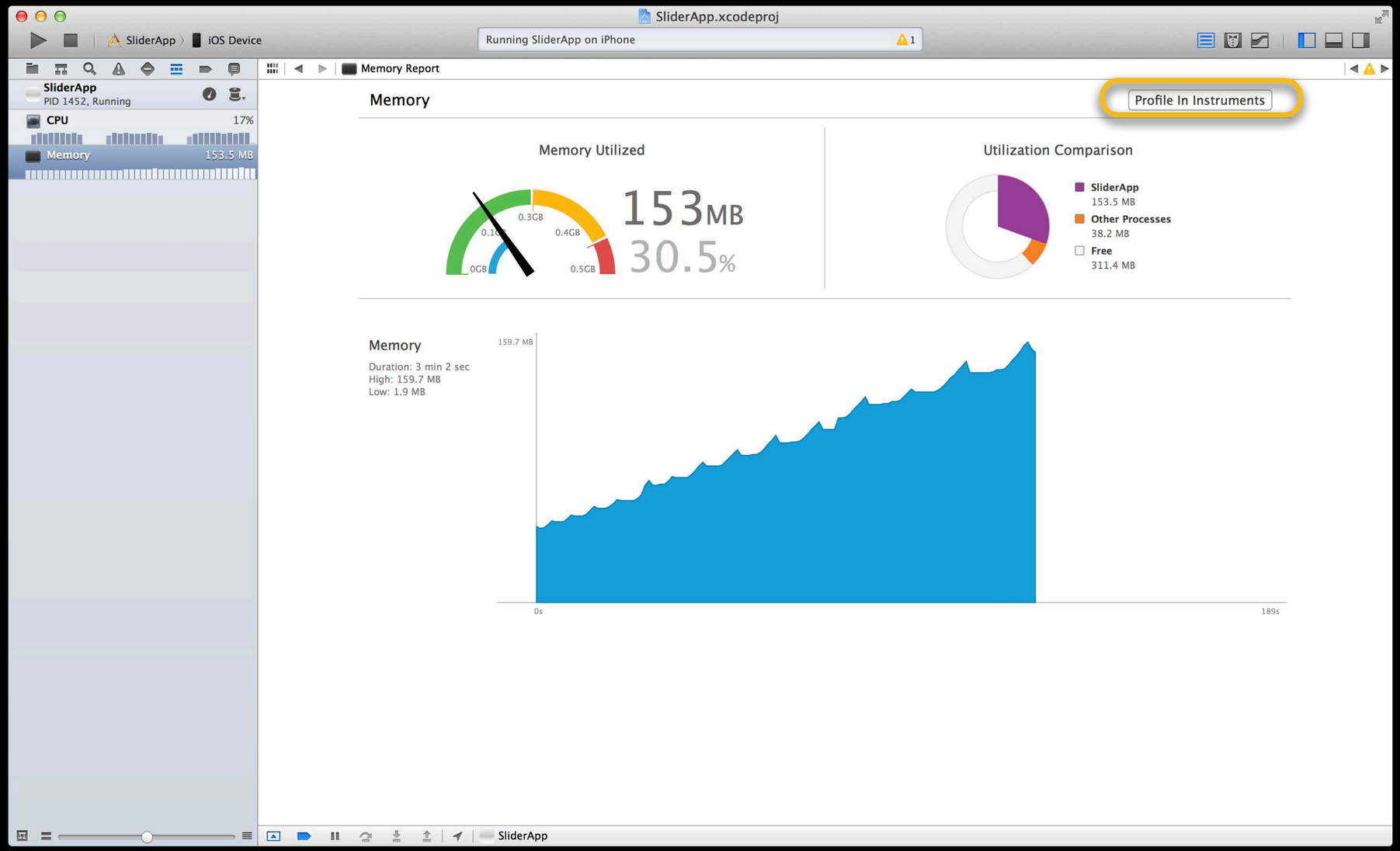
Memory Report



Memory Report



Memory Report



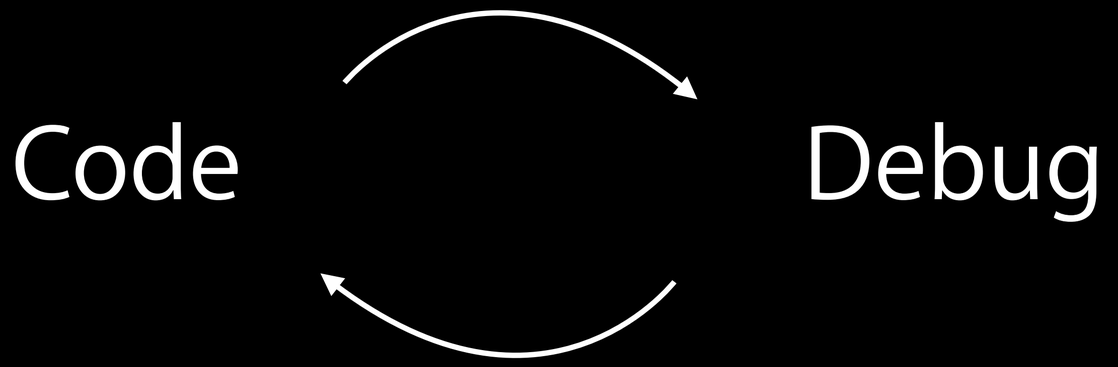
Demo

Xcode debugging reports

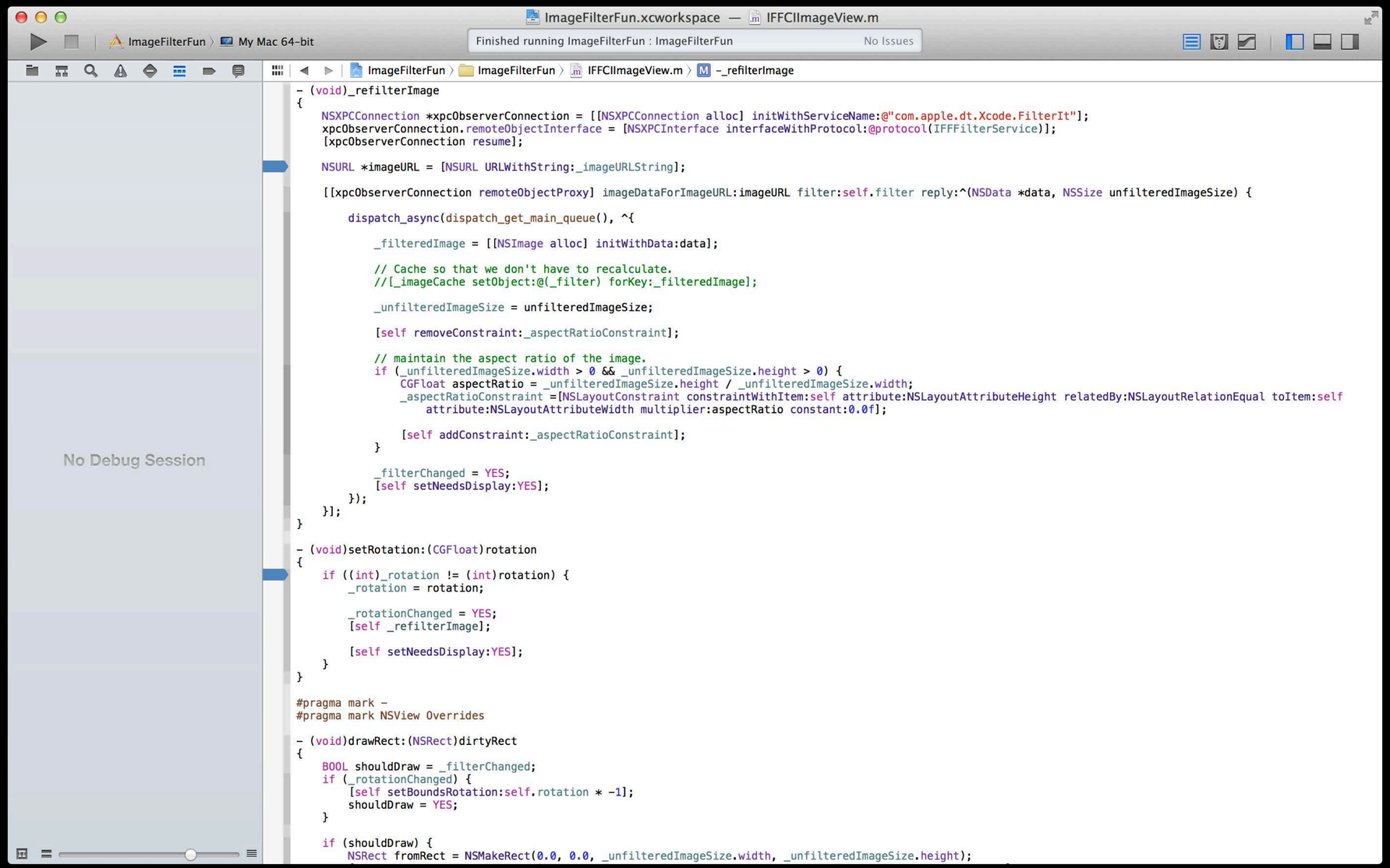
Han Ming Ong
Xcode Debugger UI Engineer

Data Tips and Quick Look

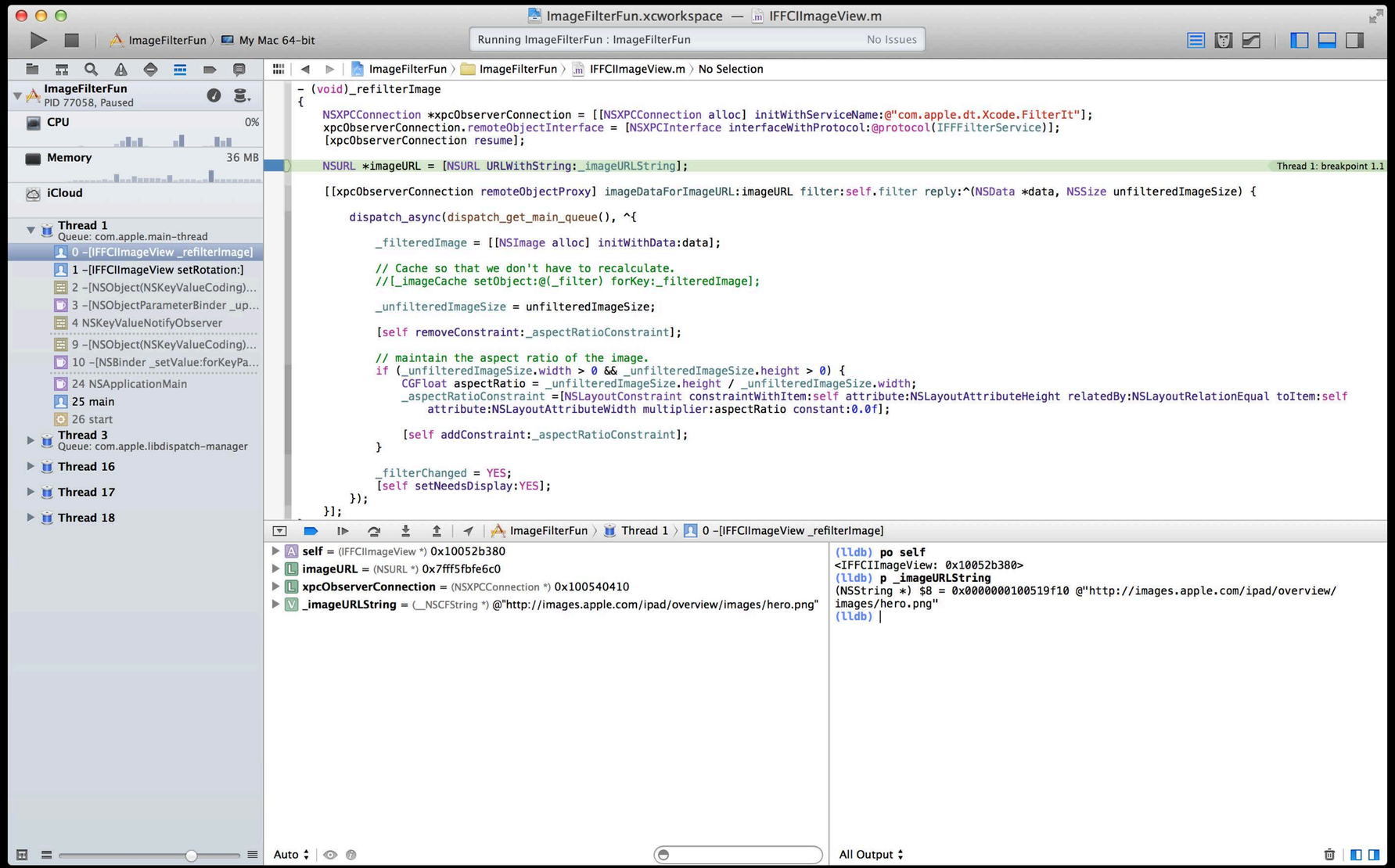
Workflows for Debugging



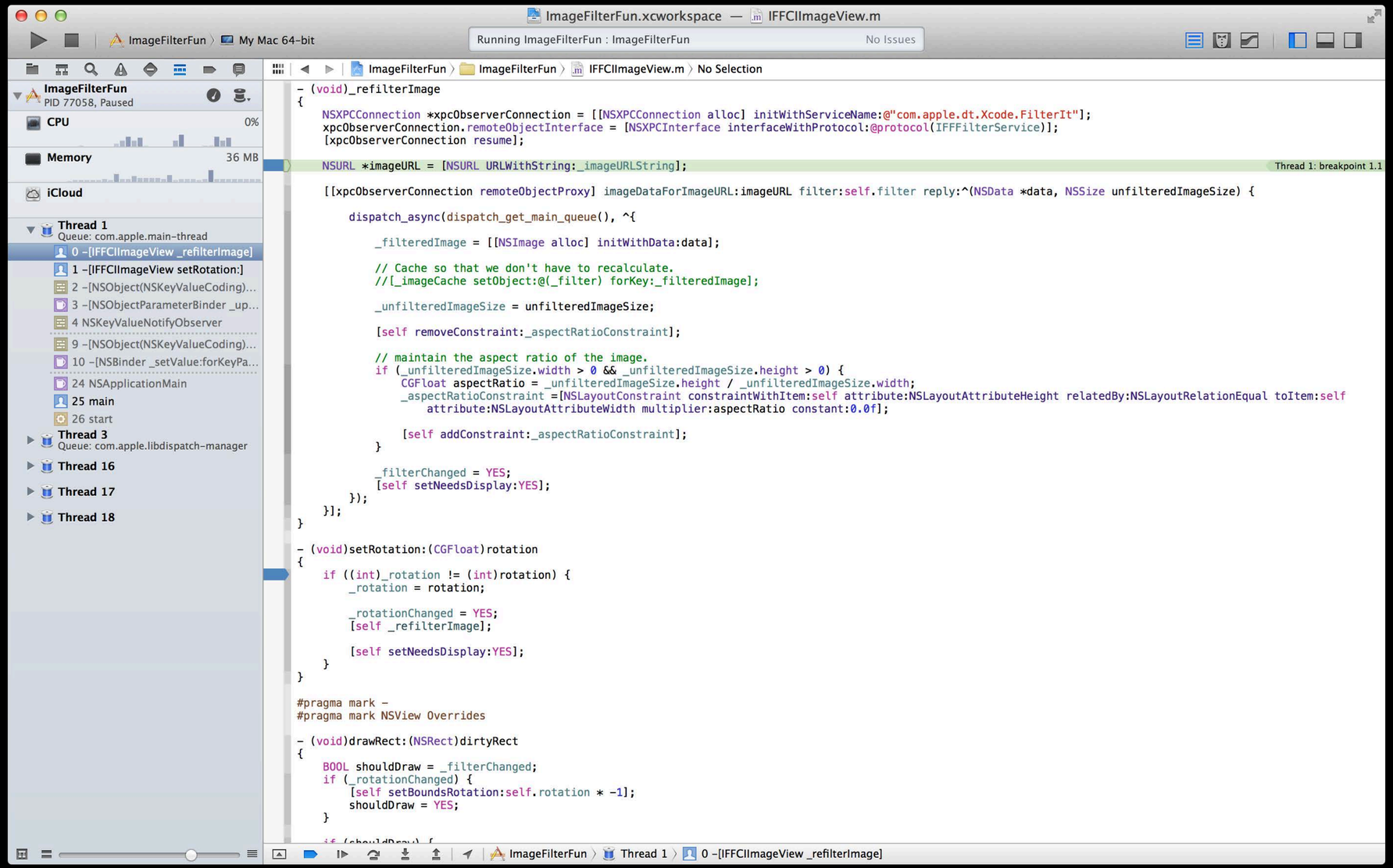
Debugging Your Code



Debugging Your Code



Debugging Your Code

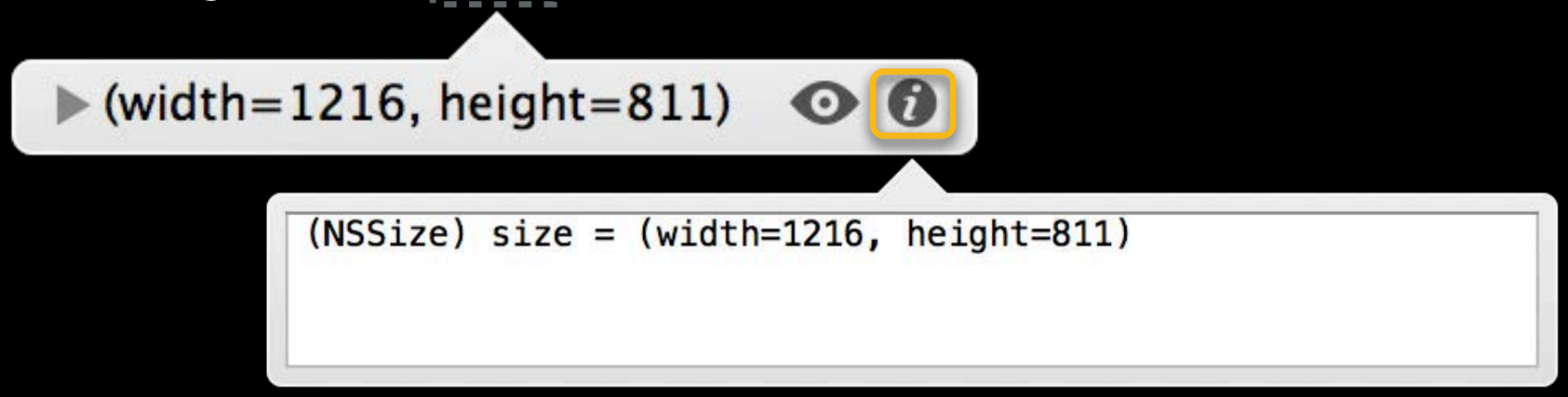


Data Tips

```
_unfilteredImageSize = size;
```

Data Tips

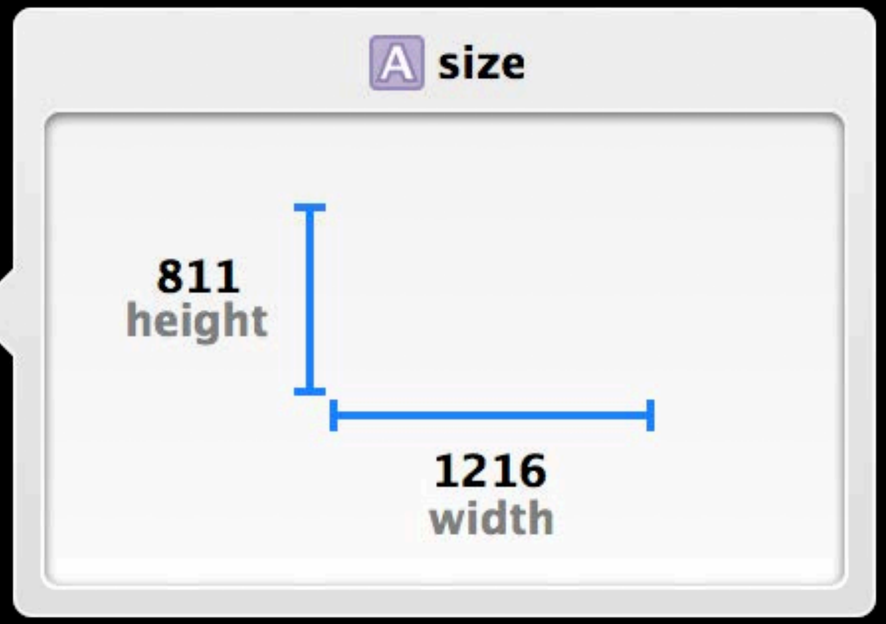
```
_unfilteredImageSize = size;
```



Quick Look of Variables

```
_unfilteredImageSize = size;
```

▶ (width=1216, height=811)



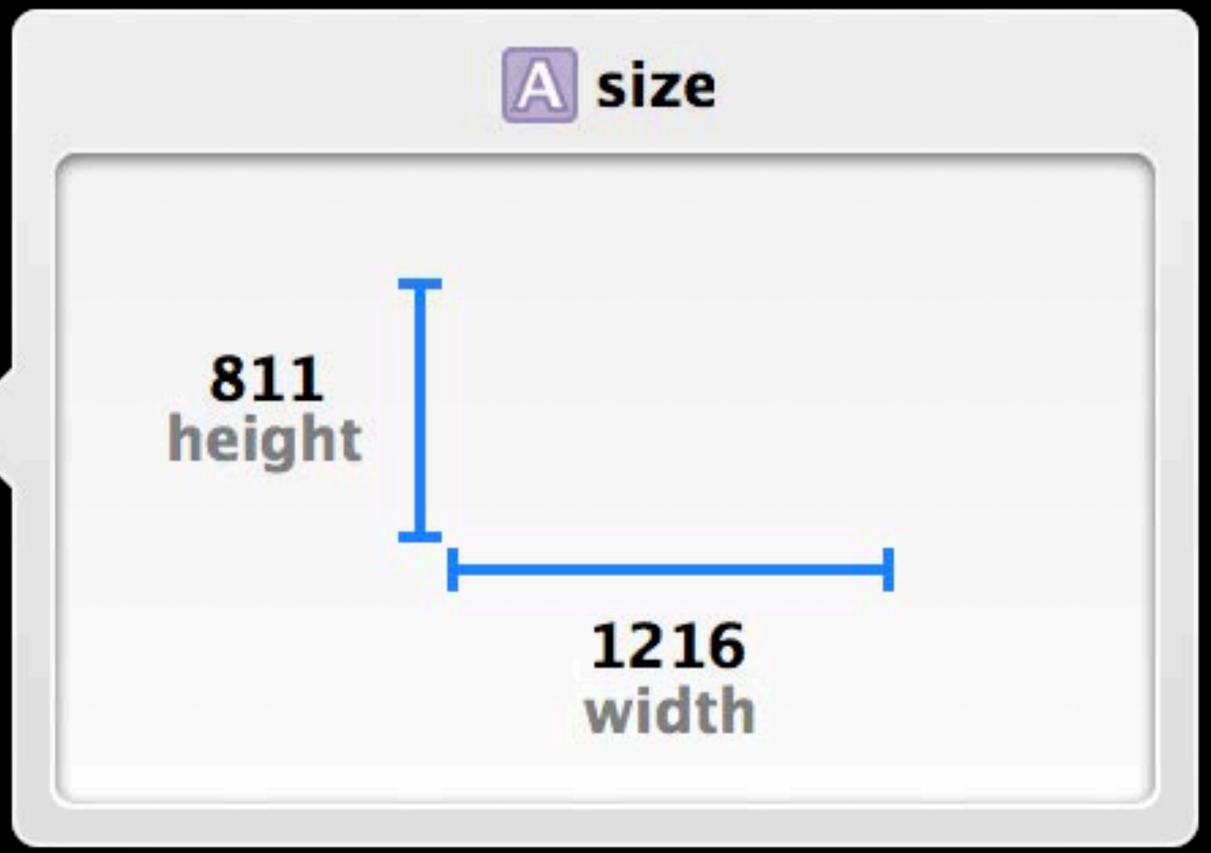
Demo

Data Tips and Quick Look

Christopher Friesen
Xcode Debugger UI Engineer

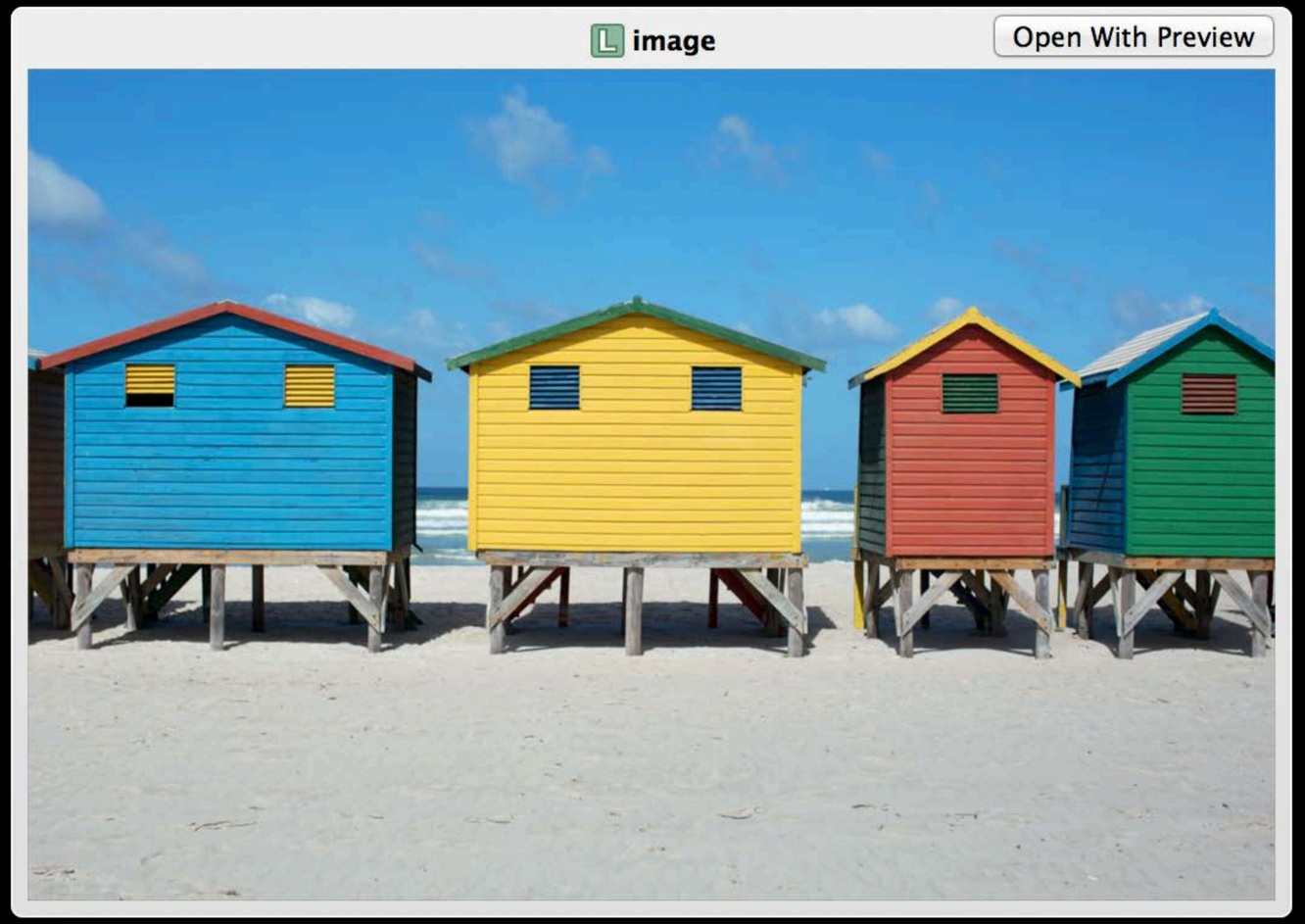
Quick Look in Xcode

NSSize and CGSize



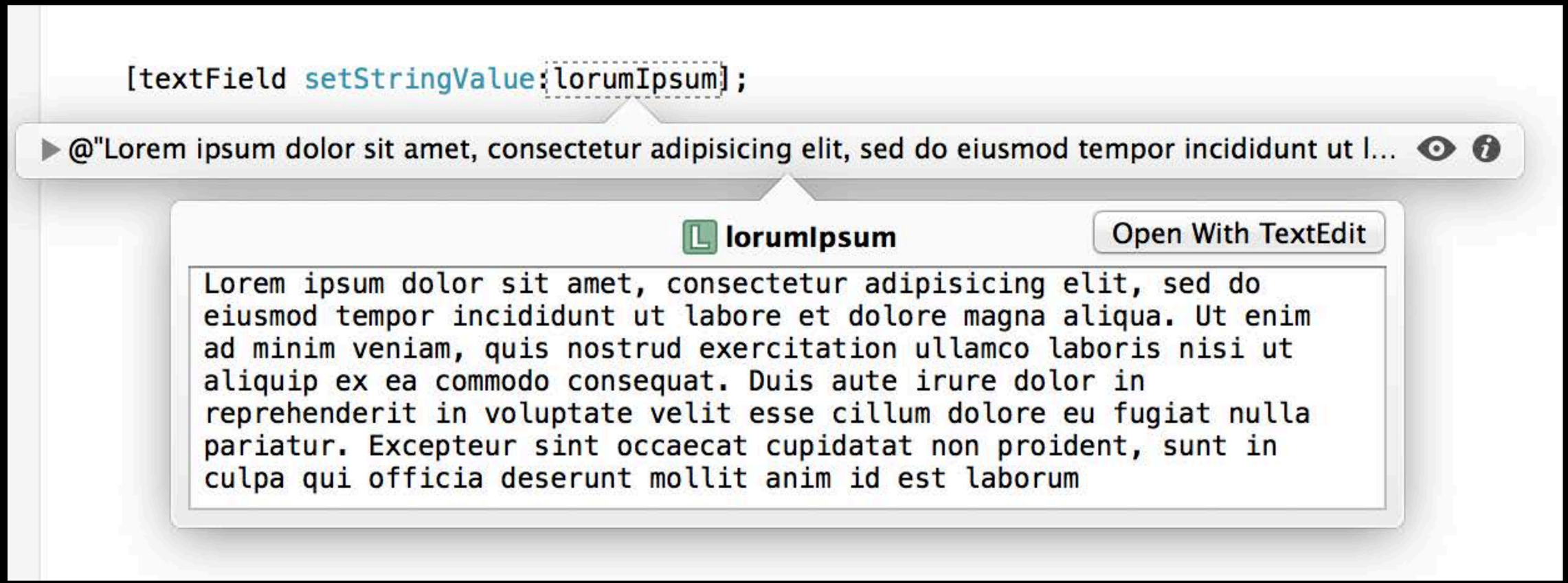
Quick Look in Xcode

UIImage, NSImage, CGImageRef, and CIImage



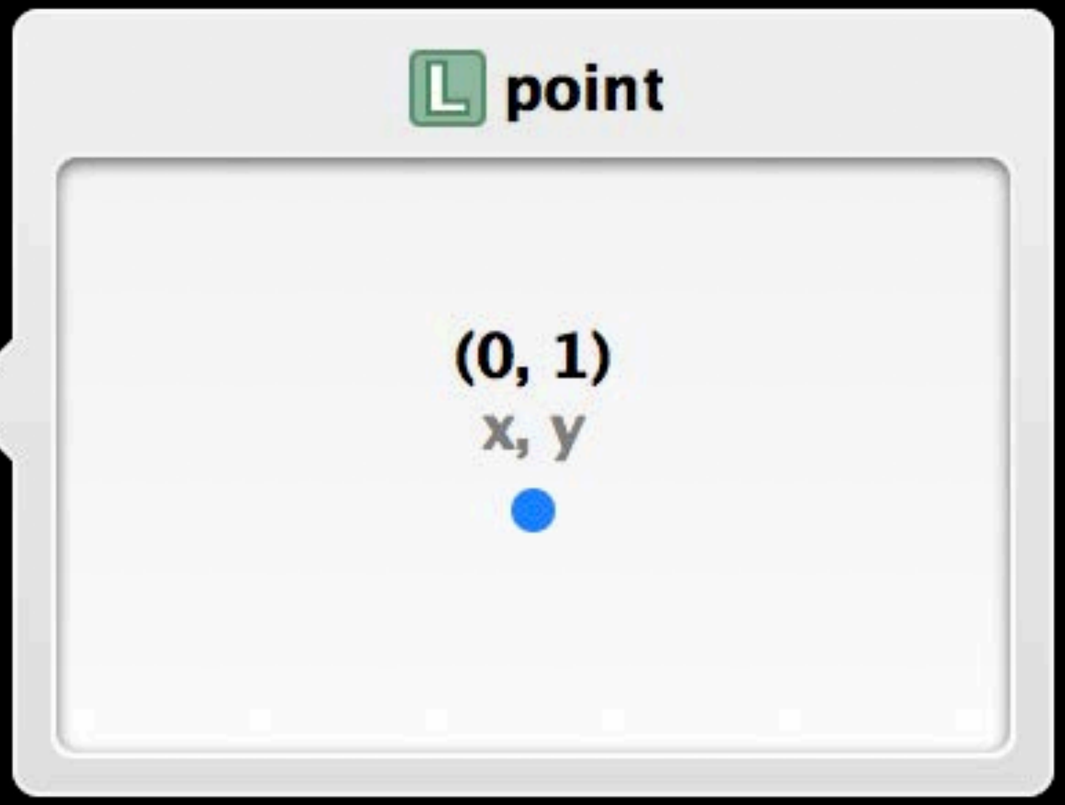
Quick Look in Xcode

NSString and NSAttributedString, including long text



Quick Look in Xcode

NSPoint and CGPoint



Quick Look in Xcode

NSData

data

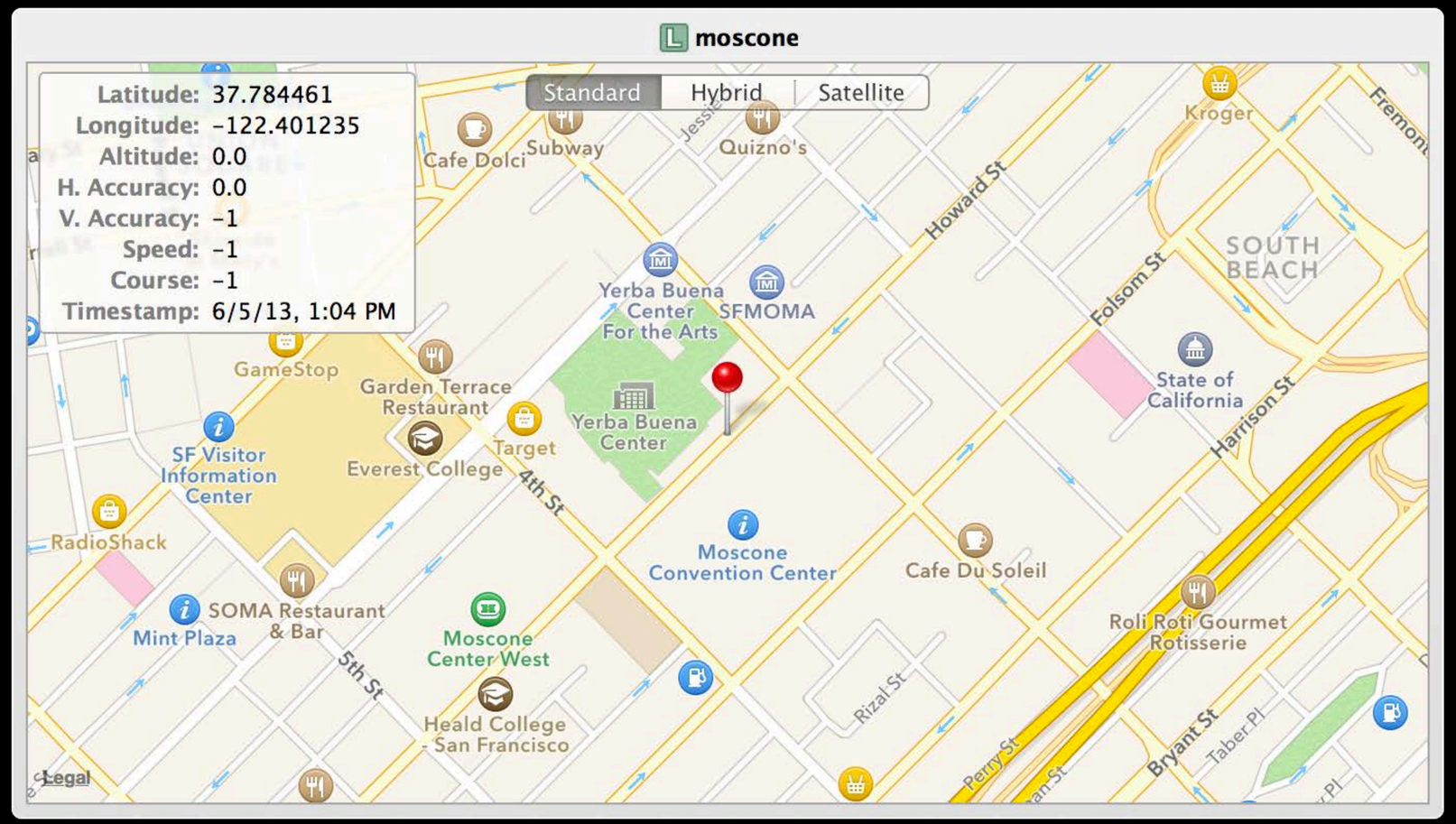
4519206912	3C	3F	78	6D	6C	20	76	65	72	73	69	6F	6E	3D	22	<?xml version="
4519206927	31	2E	30	22	20	65	6E	63	6F	64	69	6E	67	3D	22	1.0" encoding="
4519206942	55	54	46	2D	38	22	3F	3E	0A	3C	21	44	4F	43	54	UTF-8"?>.<!DOCT
4519206957	59	50	45	20	70	6C	69	73	74	20	50	55	42	4C	49	YPE plist PUBLI
4519206972	43	20	22	2D	2F	2F	41	70	70	6C	65	2F	2F	44	54	C "-//Apple//DT
4519206987	44	20	50	4C	49	53	54	20	31	2E	30	2F	2F	45	4E	D PLIST 1.0//EN
4519207002	22	20	22	68	74	74	70	3A	2F	2F	77	77	77	2E	61	" "http://www.a
4519207017	70	70	6C	65	2E	63	6F	6D	2F	44	54	44	73	2F	50	pple.com/DTDs/P
4519207032	72	6F	70	65	72	74	79	4C	69	73	74	2D	31	2E	30	ropertyList-1.0
4519207047	2E	64	74	64	22	3E	0A	3C	70	6C	69	73	74	20	76	.dtd">.<plist v
4519207062	65	72	73	69	6F	6E	3D	22	31	2E	30	22	3E	0A	3C	ersion="1.0">.<
4519207077	64	69	63	74	3E	0A	09	3C	6B	65	79	3E	46	69	6C	dict>..<key>Fil
4519207092	74	65	72	3C	2F	6B	65	79	3E	0A	09	3C	69	6E	74	ter</key>..<int
4519207107	65	67	65	72	3E	30	3C	2F	69	6E	74	65	67	65	72	eger>0</integer
4519207122	3E	0A	09	3C	6B	65	79	3E	49	6D	61	67	65	55	52	>..<key>ImageUR
4519207137	4C	53	74	72	69	6E	67	3C	2F	6B	65	79	3E	0A	09	LString</key>..
4519207152	3C	73	74	72	69	6E	67	3E	2F	56	6F	6C	75	6D	65	<string>/Volume
4519207167	73	2F	44	61	74	61	2F	48	6F	6D	65	2F	4C	69	62	s/Data/Home/Lib
4519207182	72	61	72	79	2F	44	65	76	65	6C	6F	70	65	72	2F	rary/Developer/

Bytes 1 – 512 of 7196589

Memory Page

Quick Look in Xcode

CLLocation, CLLocationCoordinate2D

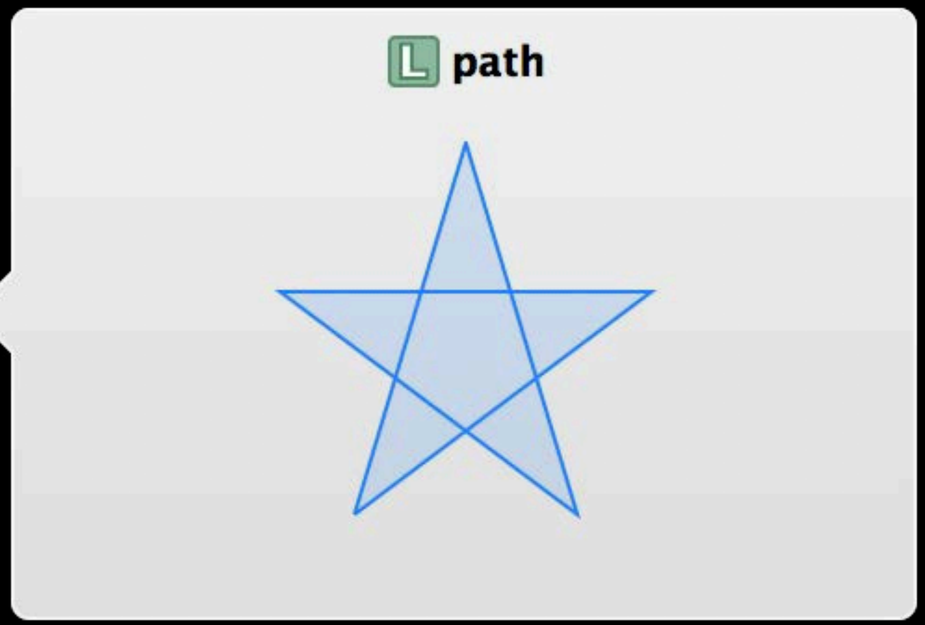


Quick Look in Xcode

UIColor, NSColor, and CGColor

Quick Look in Xcode

UIBezierPath and NSBezierPath

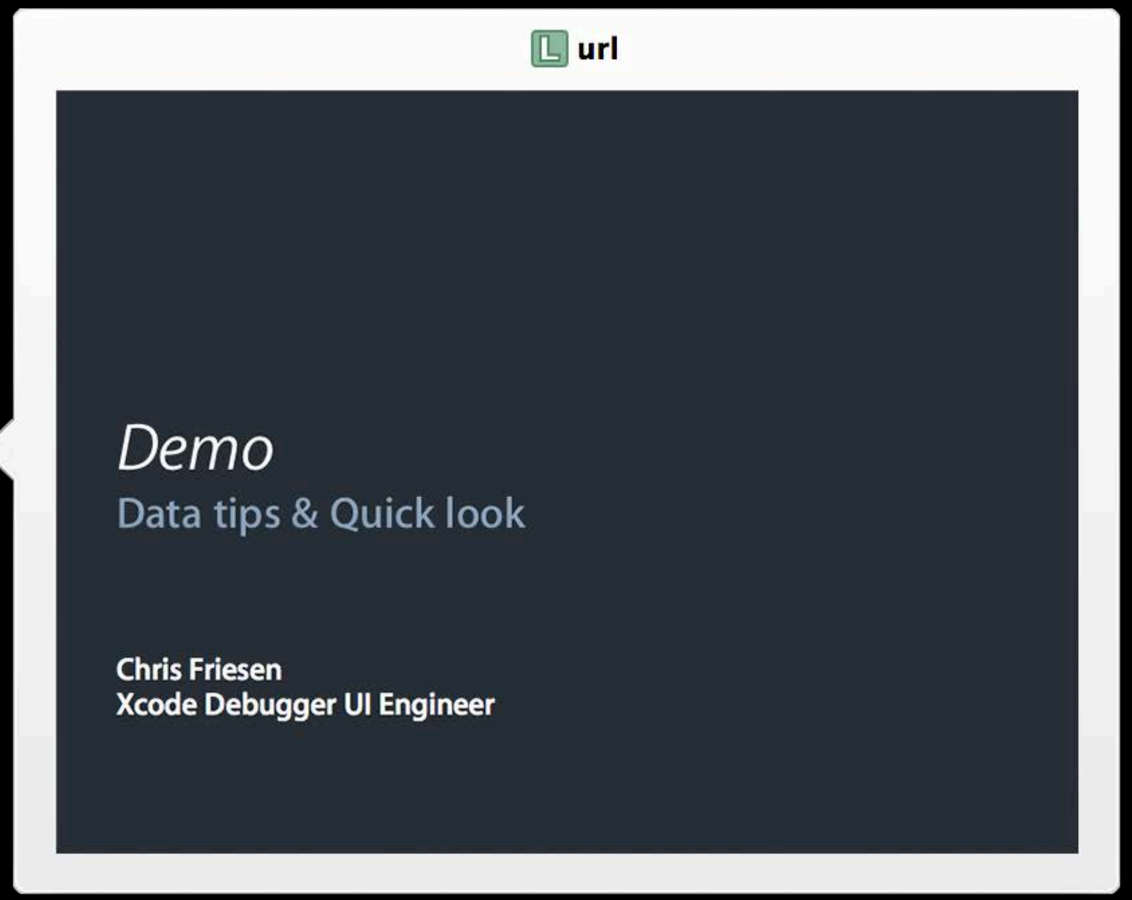


Quick Look in Xcode

NSURL

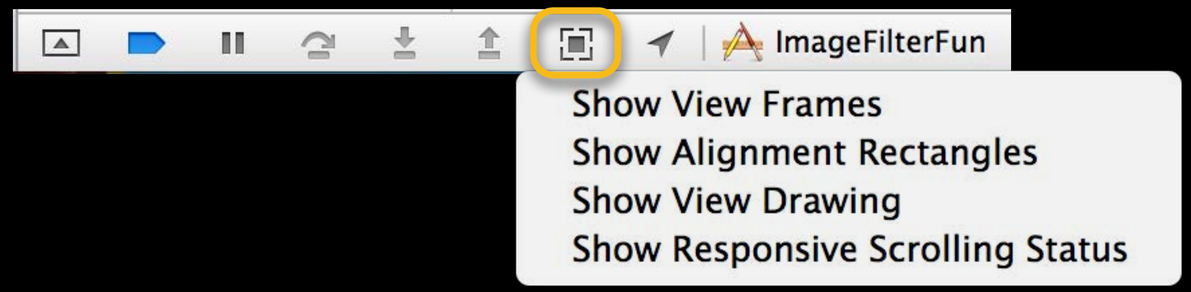
```
[pathControl setURL:url];
```

▶ (NSURL *) 0x101838bf0

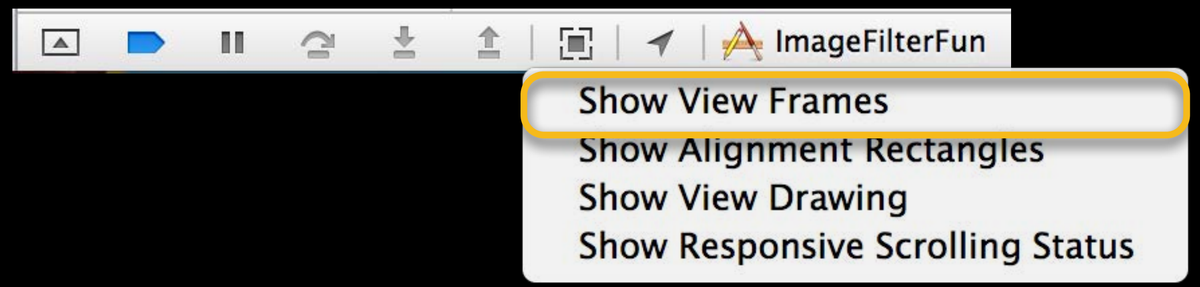


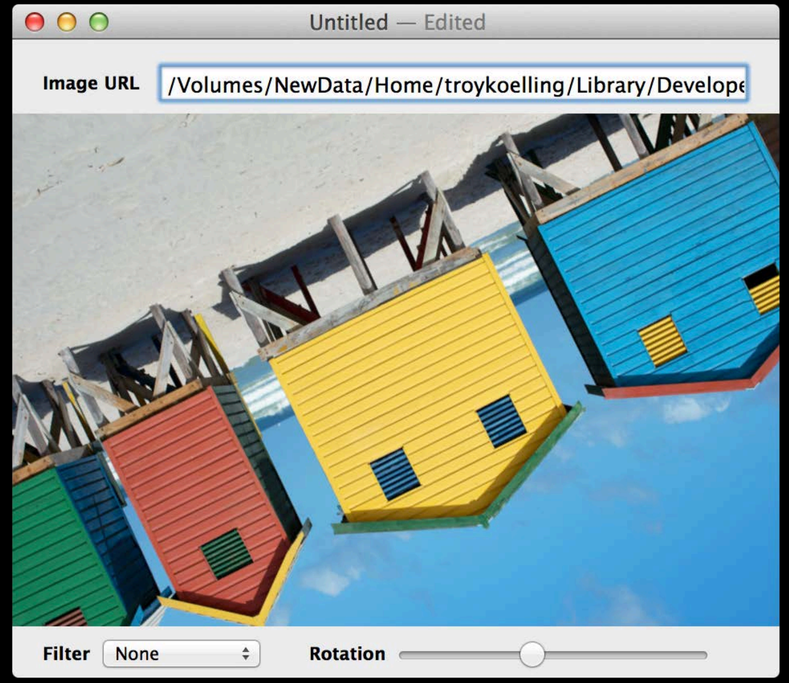
Drawing Diagnostics

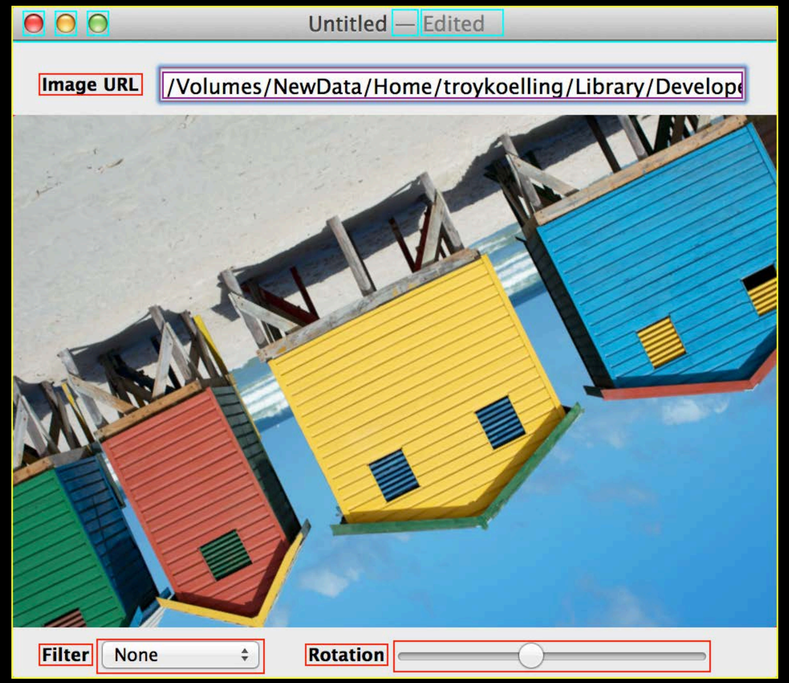
- Show View Frames
- Show Alignment Rectangles
- Show View Drawing
- Show Responsive Scrolling Status



Drawing Diagnostics (AppKit)







Printing a UIView's Hierarchy


```
(lldb)
```

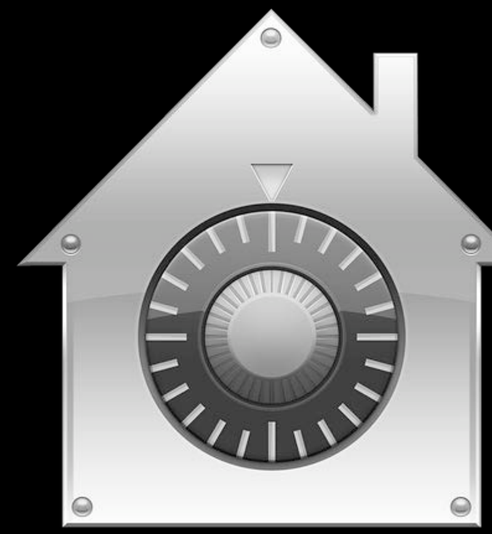
Printing a UIView's Hierarchy


```
(lldb) po [self.view recursiveDescription]
(id) $1 = 0x07b55860 <UIView: 0x6e60e90; frame = (20 20; 280 224); auto
   | <UIRoundedRectButton: 0x6e5f830; frame = (97 90; 86 44); opaque = N
   |    | <UIGroupTableViewCellBackground: 0x6e60150; frame = (0 0; 86 4
   |    | <UIImageView: 0x6e60b40; frame = (1 1; 84 43); opaque = NO; us
   |    | <UIButtonLabel: 0x6e60ba0; frame = (12 12; 62 19); text = 'Pus
(lldb)
```

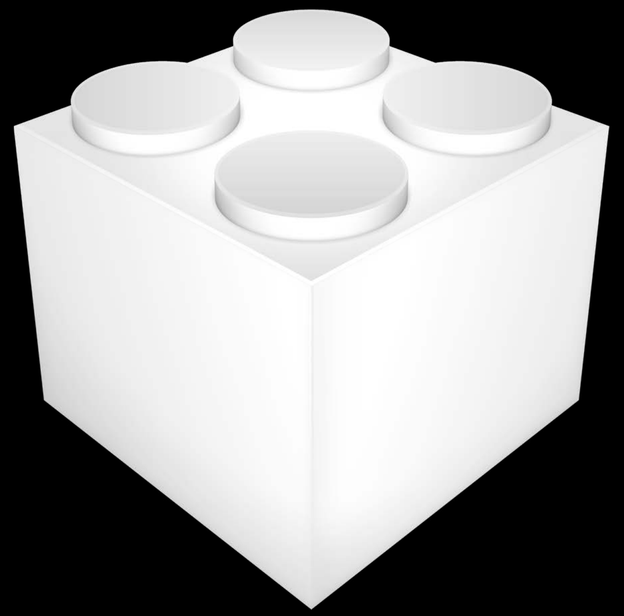
XPC

Debugging with Xcode 5

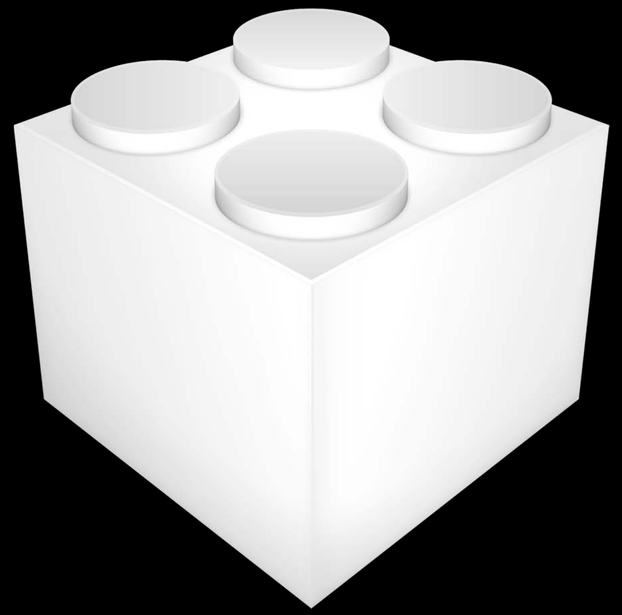
XPC



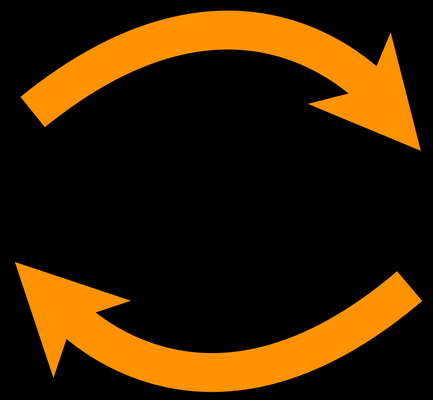
XPC

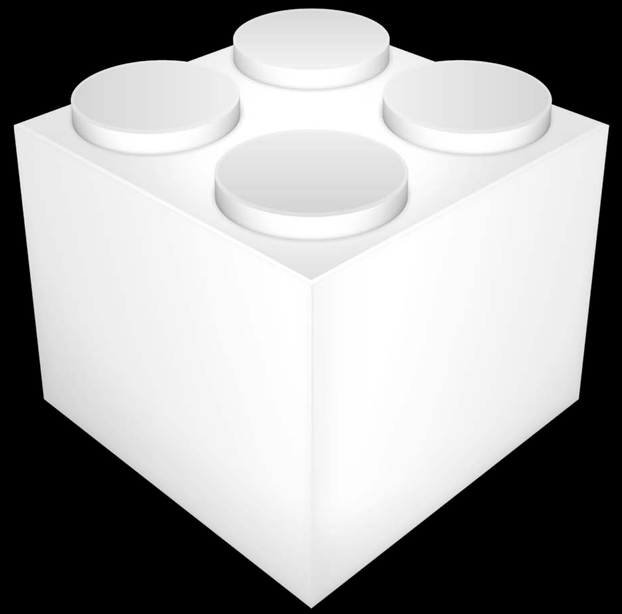


XPC

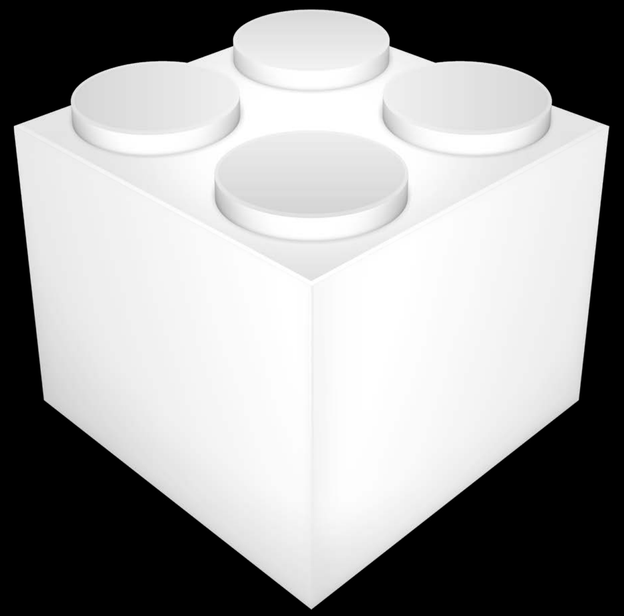


XPC





XPC

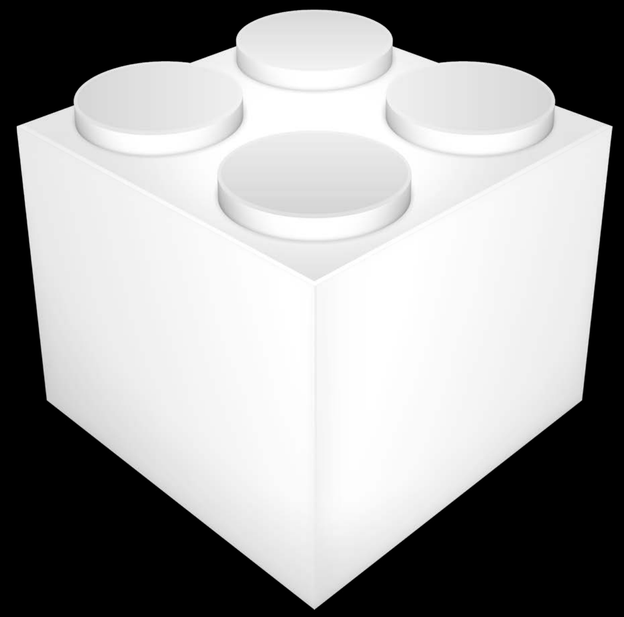


XPC

XPC

XPC

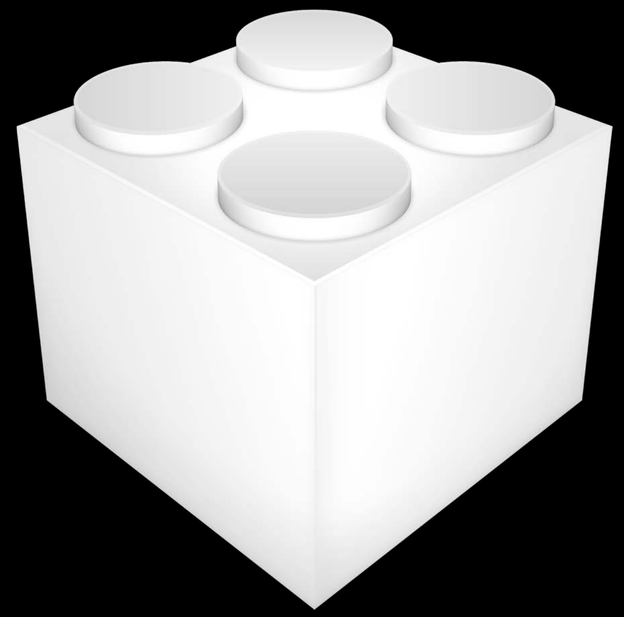
XPC



XPC

XPC

XPC

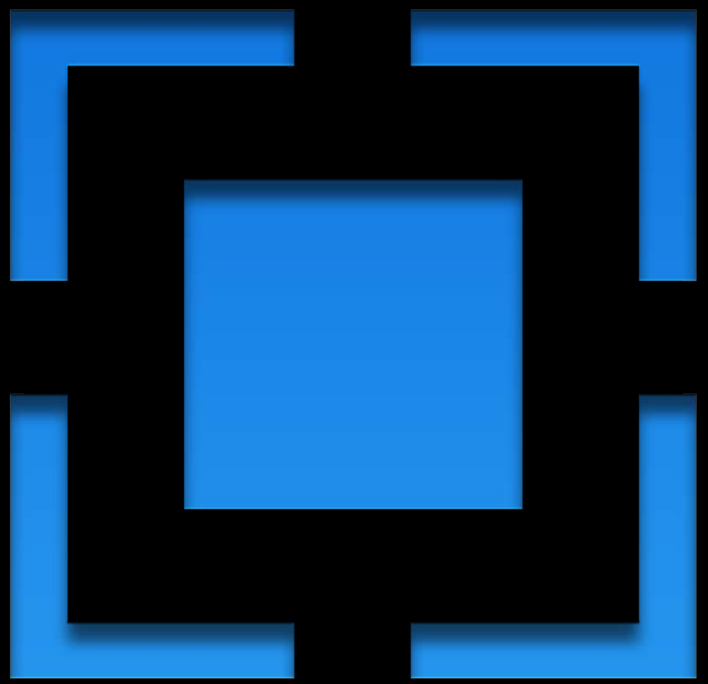


XPC

Demo

XPC debugging

Christopher Friesen
Xcode Debugger UI Engineer




Color palette
PROJECT: APPLICATION.AP
XCODE

More Information

Dave DeLong
App Frameworks and Developer Tools Evangelist
delong@apple.com

Documentation
Mac OS X Human Interface Guidelines
http://developer.apple.com/ue

Apple Developer Forums
http://devforums.apple.com

Related Sessions

Efficient Design with XPC	Russian Hill Tuesday 2:00PM
Advanced Debugging with LLDB	Pacific Heights Friday 9:00AM

Labs

Xcode Lab	Tools Lab A Thursday 2:00PM
Power and Performance for OS X Apps Lab	Tools Lab A Thursday 4:30PM
Xcode Lab	Tools Lab A Friday 9:00AM
LLDB and Instruments Lab	Tools Lab C Friday 10:15AM

WWDC2013