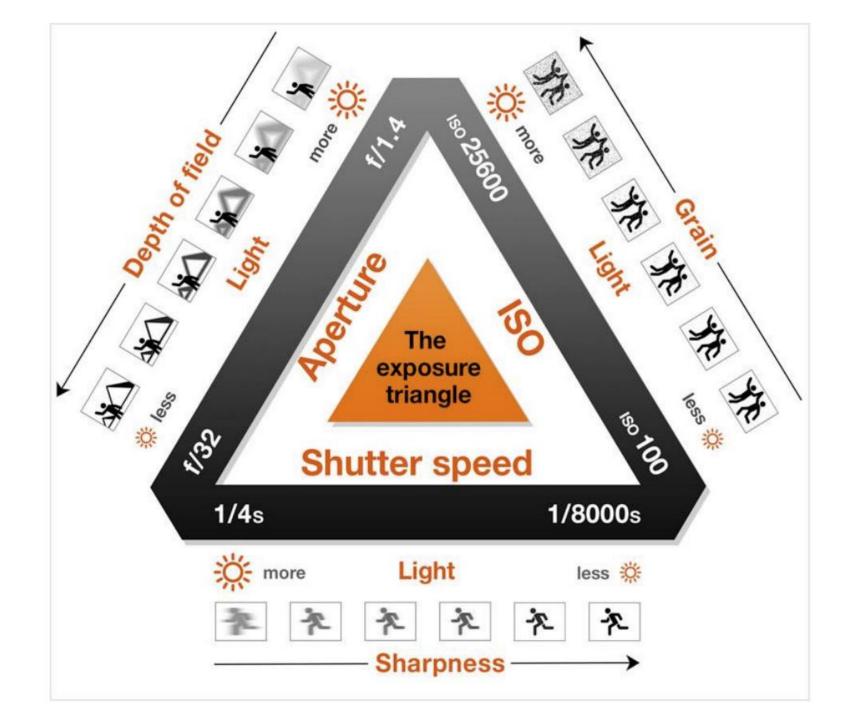
# Exposure and Camera Settings

**Dennis Fritsche and Larry Petterborg** 

June 15, 2023

# The technical nature of photography is mainly deciding between bad choices.

Dennis Fritsche 2022



# Depth of Field – Portion of the photograph in "acceptable focus"

- Depth of Field determined by
  - Focal length
  - Aperture
  - Distance to subject
- Depth of field calculators online and for phone
  - I use Depth of Field Master online <a href="https://www.dofmaster.com/dofjs.html">https://www.dofmaster.com/dofjs.html</a>
  - And "Digital Depth of Field" app on my phone

# Depth of Field (DOF) - Impact of Variables

Parameter	Focal Length	Aperture	Distance
Focal Length	Shorter = Greater DOF	Fixed	Fixed
Aperture	Fixed	Smaller = Greater DOF	Fixed
Distance to Subject	Fixed	Fixed	Longer = Greater DOF

### Shutter Speed

- For moving subjects
  - Slow shutter speed blurs motion
  - Fast shutter speed freezes motion
- Both are desirable depending on your intent.



1/2000 sec at f / 2.8



1/500 sec at f / 2.8



1/250 sec at f / 2.8







1/60 sec at f / 2.8

1/30 sec at f / 2.8

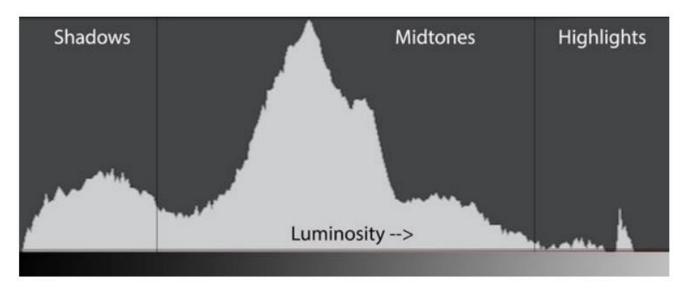
1/4 sec at f / 3.5

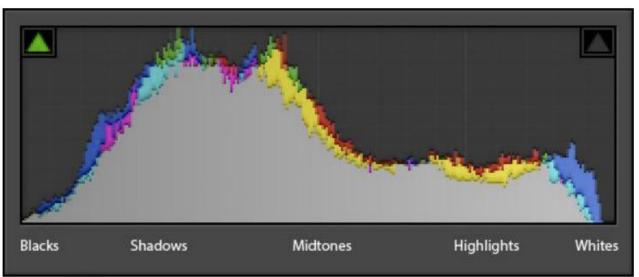
### Tripod, monopod or Handhold

- Always better results on a tripod
- Sometimes a tripod is not practical or I'm just lazy
- May have to let ISO go up
- For a heavy lens, a monopod is handy
- For handheld shutter speed = 1/focal length of the lens

- Modern cameras and software make high ISO less scary and problematic than in the early years
- Get the exposure right and deal with high ISO noise later
- People obsess on "noise" too much
- Auto ISO is a key part of camera setup I always have it ON when handholding and OFF on a tripod

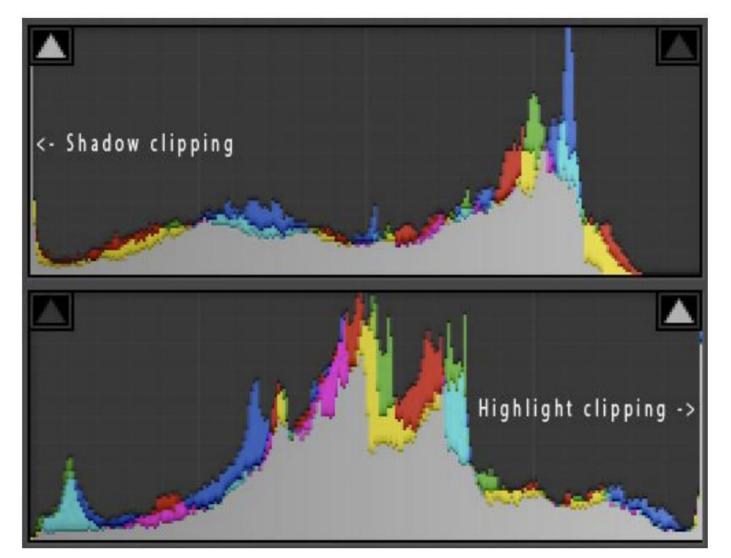
# HISTOGRAMS





# HISTOGRAMS

Not preferred, but workable



Bad

### Proper Exposure Settings

- Depends on the amount of light and your intent
- Don't worry about memorizing the following charts that computer in your camera knows all this.
- But it is best to check the work of the computer by looking at the histogram.

EV	Real-World Situation for Proper Exposure
-6	Nighttime landscape under quarter moon
-5	Aurora borealis of moderate brightness
-4	Nighttime landscape under gibbous moon
-3	Nighttime landscape under full moon
-2	Nighttime snow or beach landscape under full moon
-1	End of blue hour
0	Late in blue hour
1	Middle of blue hour
2	Distant cityscape at night
3	Indoor scene lit only by dim window light
4	Floodlit monuments or fountains at night
5	Typical artificial indoor light
6	Bright indoor lighting
7	Fairs and theme parks at night
8	Bright window displays and advertisements at night
9	Nighttime sporting events under bright light
10	Moment after sunset on a clear day
11	Daylight on a foggy day
12	Moment before sunset on a clear day
13	Typical subject on a bright, cloudy day
14	Typical subject on a day with hazy sunlight
15	Full sunlight on a cloudless day, typical subject
16	Full sunlight on a cloudless day, bright subject (i.e. the beach)
17	Full sunlight on a cloudless day, highly reflective subject (i.e. snow)
<sup>1</sup> This chart assumes ISO 100. Situ	ations adapted from my own photos and from Wikipedia.

<sup>1</sup>This chart assumes ISO 100. Situations adapted from my own photos and from Wikipedia.

### Aperture/Shutter Speed at **ISO 100**

- There are many ways to achieve the proper exposure
- Balance what is most important aperture or shutter speed.
- If you can't get what you want, adjust the ISO (at the expense of noise)
- Some choices are limited based on using a tripod or handholding
- Your camera knows all this and is here to help you.

	f/1.0	f/1.4	f/2	f/2.8	f/4	f/5.6	f/8	f/11	f/16	f/22
60 sec.	-6 EV	-5 EV	-4 EV	-3 EV	-2 EV	-1 EV	0 EV	1 EV	2 EV	3 EV
30 sec.	-5 EV	-4 EV	-3 EV	-2 EV	-1 EV	0 EV	1 EV	2 EV	3 EV	4 EV
15 sec.	-4 EV	-3 EV	-2 EV	-1 EV	0 EV	1 EV	2 EV	3 EV	4 EV	5 EV
8 sec.	-3 EV	-2 EV	-1 EV	0 EV	1 EV	2 EV	3 EV	4 EV	5 EV	6 EV
4 sec.	-2 EV	-1 EV	0 EV	1 EV	2 EV	3 EV	4 EV	5 EV	6 EV	7 EV
2 sec.	-1 EV	0 EV	1 EV	2 EV	3 EV	4 EV	5 EV	6 EV	7 EV	8 EV
1 sec.	0 EV	1 EV	2 EV	3 EV	4 EV	5 EV	6 EV	7 EV	8 EV	9 EV
1/2	1 EV	2 EV	3 EV	4 EV	5 EV	6 EV	7 EV	8 EV	9 EV	10 EV
1/4	2 EV	3 EV	4 EV	5 EV	6 EV	7 EV	8 EV	9 EV	10 EV	11 EV
1/8	3 EV	4 EV	5 EV	6 EV	7 EV	8 EV	9 EV	10 EV	11 EV	12 EV
1/15	4 EV	5 EV	6 EV	7 EV	8 EV	9 EV	10 EV	11 EV	12 EV	13 EV
1/30	5 EV	6 EV	7 EV	8 EV	9 EV	10 EV	11 EV	12 EV	13 EV	14 EV
1/60	6 EV	7 EV	8 EV	9 EV	10 EV	11 EV	12 EV	13 EV	14 EV	15 EV
1/125	7 EV	8 EV	9 EV	10 EV	11 EV	12 EV	13 EV	14 EV	15 EV	16 EV
1/250	8 EV	9 EV	10 EV	11 EV	12 EV	13 EV	14 EV	15 EV	16 EV	17 EV
1/500	9 EV	10 EV	11 EV	12 EV	13 EV	14 EV	15 EV	16 EV	17 EV	18 EV
1/1000	10 EV	11 EV	12 EV	13 EV	14 EV	15 EV	16 EV	17 EV	18 EV	19 EV
1/2000	11 EV	12 EV	13 EV	14 EV	15 EV	16 EV	17 EV	18 EV	19 EV	20 EV
1/4000	12 EV	13 EV	14 EV	15 EV	16 EV	17 EV	18 EV	19 EV	20 EV	21 EV
1/8000	13 EV	14 EV	15 EV	16 EV	17 EV	18 EV	19 EV	20 EV	21 EV	22 EV

# Scenarios 1 A and B - Bright Day/Typical Subject 24-70mm f/2.8

- A Isolate subject such as portrait
- Focal Length
- Aperture
- Shutter speed
- Tripod or No Tripod
- ISO

- B A landscape
- Focal Length
- Aperture
- Shutter speed
- Tripod or No Tripod
- ISO

EV	Real-World Situation for Proper Exposure
-6	Nighttime landscape under quarter moon
-5	Aurora borealis of moderate brightness
-4	Nighttime landscape under gibbous moon
-3	Nighttime landscape under full moon
-2	Nighttime snow or beach landscape under full moon
-1	End of blue hour
0	Late in blue hour
1	Middle of blue hour
2	Distant cityscape at night
3	Indoor scene lit only by dim window light
4	Floodlit monuments or fountains at night
5	Typical artificial indoor light
6	Bright indoor lighting
7	Fairs and theme parks at night
8	Bright window displays and advertisements at night
9	Nighttime sporting events under bright light
10	Moment after sunset on a clear day
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12	Moment before sunset on a clear day
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15	Full sunlight on a cloudless day, typical subject
16	Full sunlight on a cloudless day, bright subject (i.e. the beach)
17	Full sunlight on a cloudless day, highly reflective subject (i.e. snow)
<sup>1</sup> This chart assumes ISO 100. Situ	ations adapted from my own photos and from Wikipedia.

	f/1.0	f/1.4	f/2	f/2.8	f/4	f/5.6	f/8	f/11	f/16	f/22
60 sec.	-6 EV	-5 EV	-4 EV	-3 EV	-2 EV	-1 EV	0 EV	1 EV	2 EV	3 EV
30 sec.	-5 EV	-4 EV	-3 EV	-2 EV	-1 EV	0 EV	1 EV	2 EV	3 EV	4 EV
15 sec.	-4 EV	-3 EV	-2 EV	-1 EV	0 EV	1 EV	2 EV	3 EV	4 EV	5 EV
8 sec.	-3 EV	-2 EV	-1 EV	0 EV	1 EV	2 EV	3 EV	4 EV	5 EV	6 EV
4 sec.	-2 EV	-1 EV	0 EV	1 EV	2 EV	3 EV	4 EV	5 EV	6 EV	7 EV
2 sec.	-1 EV	0 EV	1 EV	2 EV	3 EV	4 EV	5 EV	6 EV	7 EV	8 EV
1 sec.	0 EV	1 EV	2 EV	3 EV	4 EV	5 EV	6 EV	7 EV	8 EV	9 EV
1/2	1 EV	2 EV	3 EV	4 EV	5 EV	6 EV	7 EV	8 EV	9 EV	10 EV
1/4	2 EV	3 EV	4 EV	5 EV	6 EV	7 EV	8 EV	9 EV	10 EV	11 EV
1/8	3 EV	4 EV	5 EV	6 EV	7 EV	8 EV	9 EV	10 EV	11 EV	12 EV
1/15	4 EV	5 EV	6 EV	7 EV	8 EV	9 EV	10 EV	11 EV	12 EV	13 EV
1/30	5 EV	6 EV	7 EV	8 EV	9 EV	10 EV	11 EV	12 EV	13 EV	14 EV
1/60	6 EV	7 EV	8 EV	9 EV	10 EV	11 EV	12 EV	13 EV	14 EV	15 EV
1/125	7 EV	8 EV	9 EV	10 EV	11 EV	12 EV	13 EV	14 EV	15-EV	16 EV
1/250	8 EV	9 EV	10 EV	11 EV	12 EV	13 EV	14.EV	15-EV	16 EV	17 EV
1/500	9 EV	10 EV	11 EV	12 EV	13 EV	14.EV	15-EV	16 EV	17 EV	18 EV
1/1000	10 EV	11 EV	12 EV	13 EV	14.EV	15 EV	16 EV	17 EV	18 EV	19 EV
1/2000	11 EV	12 EV	13 EV	14 EV	15.EV	16 EV	17 EV	18 EV	19 EV	20 EV
1/4000	12 EV	13 EV	14 EV	15.EV	16 EV	17 EV	18 EV	19 EV	20 EV	21 EV
1/8000	13 EV	14 EV	15 EV	16 EV	17 EV	18 EV	19 EV	20 EV	21 EV	22 EV

# Scenarios 1 A and B - Bright Day/Typical Subject 24-70mm f/2.8

- A Isolate subject such as portrait
- Focal Length 70mm
- Aperture 2.8-4
- Shutter speed from table
- Tripod or No Tripod either
- ISO 100

- B A landscape
- Focal Length 24mm
- Aperture 11-13
- Shutter speed from table
- Tripod or No Tripod either
- ISO 100

# Scenarios 2 A and B – Dim Day or Late/Typical Subject 24-70mm f/2.8

- A Isolate subject such as portrait
- Focal Length
- Aperture
- Shutter speed
- Tripod or No Tripod
- ISO

- B A landscape
- Focal Length
- Aperture
- Shutter speed
- Tripod or No Tripod
- ISO

EV	Real-World Situation for Proper Exposure
-6	Nighttime landscape under quarter moon
-5	Aurora borealis of moderate brightness
-4	Nighttime landscape under gibbous moon
-3	Nighttime landscape under full moon
-2	Nighttime snow or beach landscape under full moon
-1	End of blue hour
0	Late in blue hour
1	Middle of blue hour
2	Distant cityscape at night
3	Indoor scene lit only by dim window light
4	Floodlit monuments or fountains at night
5	Typical artificial indoor light
6	Bright indoor lighting
7	Fairs and theme parks at night
8	Bright window displays and advertisements at night
9	Nighttime sporting events under bright light
10	Moment after sunset on a clear day
11	Daylight on a foggy day
12	Moment before sunset on a clear day
13	Typical subject on a bright, cloudy day
14	Typical subject on a day with hazy sunlight
15	Full sunlight on a cloudless day, typical subject
16	Full sunlight on a cloudless day, bright subject (i.e. the beach)
17	Full sunlight on a cloudless day, highly reflective subject (i.e. snow)
<sup>1</sup> This chart assumes ISO 100. Situ	ations adapted from my own photos and from Wikipedia.

	f/1.0	f/1.4	f/2	f/2.8	f/4	f/5.6	f/8	f/11	f/16	f/22
60 sec.	-6 EV	-5 EV	-4 EV	-3 EV	-2 EV	-1 EV	0 EV	1 EV	2 EV	3 EV
30 sec.	-5 EV	-4 EV	-3 EV	-2 EV	-1 EV	0 EV	1 EV	2 EV	3 EV	4 EV
15 sec.	-4 EV	-3 EV	-2 EV	-1 EV	0 EV	1 EV	2 EV	3 EV	4 EV	5 EV
8 sec.	-3 EV	-2 EV	-1 EV	0 EV	1 EV	2 EV	3 EV	4 EV	5 EV	6 EV
4 sec.	-2 EV	-1 EV	0 EV	1 EV	2 EV	3 EV	4 EV	5 EV	6 EV	7 EV
2 sec.	-1 EV	0 EV	1 EV	2 EV	3 EV	4 EV	5 EV	6 EV	7 EV	8 EV
1 sec.	0 EV	1 EV	2 EV	3 EV	4 EV	5 EV	6 EV	7 EV	8 EV	9 EV
1/2	1 EV	2 EV	3 EV	4 EV	5 EV	6 EV	7 EV	8 EV	9 EV	10 EV
1/4	2 EV	3 EV	4 EV	5 EV	6 EV	7 EV	8 EV	9 EV	10 EV	11 EV
1/8	3 EV	4 EV	5 EV	6 EV	7 EV	8 EV	9 EV	10 EV	11 EV	12 EV
1/15	4 EV	5 EV	6 EV	7 EV	8 EV	9 EV	10 EV	11 EV	12 EV	13 EV
1/30	5 EV	6 EV	7 EV	8 EV	9 EV	10 EV	11 EV	12 EV	13 EV	14 EV
1/60	6 EV	7 EV	8 EV	9 EV	10 EV	11 EV	12 EV	13 EV	14 EV	15 EV
1/125	7 EV	8 EV	9 EV	10 EV	11-EV	12 EV	13 EV	14 EV	15 EV	16 EV
1/250	8 EV	9 EV	10 EV	11.EV	12 EV	13 EV	14 EV	15 EV	16 EV	17 EV
1/500	9 EV	10 EV	11.EV	12 EV	13 EV	14 EV	15 EV	16 EV	17 EV	18 EV
1/1000	10 EV	11.EV	12 EV	13 EV	14 EV	15 EV	16 EV	17 EV	18 EV	19 EV
1/2000	11 EV	12 EV	13 EV	14 EV	15 EV	16 EV	17 EV	18 EV	19 EV	20 EV
1/4000	12 EV	13 EV	14 EV	15 EV	16 EV	17 EV	18 EV	19 EV	20 EV	21 EV
1/8000	13 EV	14 EV	15 EV	16 EV	17 EV	18 EV	19 EV	20 EV	21 EV	22 EV

# Scenarios 2 A and B – Dim Day or Late/Typical Subject 24-70mm f/2.8

- A Isolate subject such as portrait
- Focal Length 70mm
- Aperture 2.8-4
- Shutter speed from table
- Tripod or No Tripod either
- ISO 100

#### B – A landscape

- Focal Length 24mm
- Aperture 11-13
- Shutter speed from table
- Tripod or No Tripod Tripod
- ISO or increase ISO

Scenarios 3 A and B – Typical Indoor Stadium such as Mesquite Rodeo 70-200mm f/2.8

### **A – Freeze Motion**

- Focal Length
- Aperture
- Shutter speed
- Tripod or No Tripod
- ISO

#### **B** – Blur Motion

- Focal Length
- Aperture
- Shutter speed
- Tripod or No Tripod
- ISO

		Real-World Sit	uation for Proper Exp	posure					f/1.0	f/1.4	f/2	f/2.8		f/4	f/4 f/5.6	f/4 f/5.6 f/8	f/4 f/5.6 f/8 f/11	f/4 f/5.6 f/8 f/11 f/16
		Nighttime land	dscape under quarter	moon				60 sec.	-6 EV	-5 EV	-4 EV	-3 EV		-2 EV	-2 EV -1 EV	-2 EV -1 EV 0 EV	-2 EV -1 EV 0 EV 1 EV	-2 EV -1 EV 0 EV 1 EV 2 EV
		Aurora borea	lis of moderate brigh	tness				30 sec.	-5 EV	-4 EV	-3 EV	-2 EV		-1 EV	-1 EV 0 EV	-1 EV 0 EV 1 EV	-1 EV 0 EV 1 EV 2 EV	-1 EV 0 EV 1 EV 2 EV 3 EV
		Nighttime land	lscape under gibbous	moon				50 500.										
		Nighttime la	andscape under full m	oon				15 sec.	-4 EV	-3 EV	-2 EV	-1 EV		0 EV	0 EV 1 EV	0 EV 1 EV 2 EV	0 EV 1 EV 2 EV 3 EV	0 EV 1 EV 2 EV 3 EV 4 EV
		Nighttime snow or	beach landscape unde	er full moon				8 sec.	-3 EV	-2 EV	-1 EV	0 EV	1	EV	EV 2 EV	EV 2 EV 3 EV	EV 2 EV 3 EV 4 EV	EV 2 EV 3 EV 4 EV 5 EV
		E	nd of blue hour					4 sec.	-2 EV	-1 EV	0 EV	1 EV	2	EV	EV 3 EV	EV 3 EV 4 EV	EV 3 EV 4 EV 5 EV	EV 3 EV 4 EV 5 EV 6 EV
		La	ate in blue hour					2 sec.	-1 EV	0 EV	1 EV	2 EV	3 E	V	V 4 EV	V 4 EV 5 EV	V 4 EV 5 EV 6 EV	V 4 EV 5 EV 6 EV 7 EV
		Mie	ddle of blue hour															
		Distar	nt cityscape at night					1 sec.	0 EV	1 EV	2 EV	3 EV	4 EV		5 EV	5 EV 6 EV	5 EV 6 EV 7 EV	5 EV 6 EV 7 EV 8 EV
		Indoor scene	it only by dim window	v light				1/2	1 EV	2 EV	3 EV	4 EV	5 EV		6 EV	6 EV 7 EV	6 EV 7 EV 8 EV	6 EV 7 EV 8 EV 9 EV
		Floodlit monu	ments or fountains at	night				1/4	2 EV	3 EV	4 EV	5 EV	6 EV		7 EV	7 EV 8 EV	7 EV 8 EV 9 EV	7 EV 8 EV 9 EV 10 EV
		Typical	artificial indoor light					1/8	3 EV	4 EV	5 EV	6 EV	7 EV		8 EV	8 EV 9 EV	8 EV 9 EV 10 EV	8 EV 9 EV 10 EV 11 EV
		Brig	ht indoor lighting					1/15	4 EV	5 EV	6 EV	7 EV	8 EV		9 EV	9 EV 10 EV	9 EV 10 EV 11 EV	9 EV 10 EV 11 EV 12 EV
		Fairs and	I theme parks at night	t														
		Bright window disp	lays and advertiseme	nts at night				1/30	5 EV	6 EV	7 EV	8 EV	9 EV		10 EV	10 EV 11 EV	10 EV 11 EV 12 EV	10 EV 11 EV 12 EV 13 EV
		Nighttime spor	ting events under brig	ıht light				1/60	6 EV	7 EV	8 EV	9 EV	10 EV		11 EV	11 EV 12 EV	11 EV 12 EV 13 EV	11 EV 12 EV 13 EV 14 EV
		Moment a	iter sunset on a clear o	day				1/125	7 EV	8 EV	9 EV	10 EV	11 EV		12 EV	12 EV 13 EV	12 EV 13 EV 14 EV	12 EV 13 EV 14 EV 15 EV
		Dayli	ght on a foggy day					1/250	8 EV	9 EV	10 EV	11 EV	12 EV	13	3 EV	3 EV 14 EV	3 EV 14 EV 15 EV	3 EV 14 EV 15 EV 16 EV
		Moment be	fore sunset on a clear	day				4/500			44.04	42.54						
		Typical subje	ect on a bright, cloudy	day				1/500	9 EV	10 EV	11 EV	12 EV	13 EV	14	EV	EV 15 EV	EV 15 EV 16 EV	EV 15 EV 16 EV 17 EV
			on a day with hazy su					1/1000	10 EV	11 EV	12 EV	13 EV	14 EV	1	5 EV	5 EV 16 EV	5 EV 16 EV 17 EV	5 EV 16 EV 17 EV 18 EV
			a cloudless day, typica					1/2000	11 EV	12 EV	13 EV	14 EV	15 EV	16	5 EV	5 EV 17 EV	5 EV 17 EV 18 EV	5 EV 17 EV 18 EV 19 EV
		Ill sunlight on a cloud						1/4000	12 EV	13 EV	14 EV	15 EV	16 EV	17	' EV	' EV 18 EV	7 EV 18 EV 19 EV	Y EV 18 EV 19 EV 20 EV
		sunlight on a cloudles		subject (i.e. snow)				1/8000	13 EV	14 EV	15 EV	16 EV	17 EV	1	8 EV	8 EV 19 EV	8 EV 19 EV 20 EV	8 EV 19 EV 20 EV 21 EV
rt assumes ISO 100. Situ	ations adapted from my o			200	400	000	1600											
		ISO	100	200	400	800	1600	3200	6400	128		25600						
		+ EV	0	1	2	3	4	5	6	7		8						

Scenarios 3 A and B – Typical Indoor Stadium such as Mesquite Rodeo 70-200mm f/2.8

#### A – Freeze Motion

- Focal Length 100 to 200mm
- Aperture 2.8
- Shutter speed 1/1000
- Tripod or No Tripod No Tripod maybe monopod
- ISO Auto 3200 to 6400

#### **B** – Blur Motion

- Focal Length 100 to 200mm
- Aperture 2.8
- Shutter speed 1/25 to 1/100
- Tripod or No Tripod No Tripod maybe monopod
- ISO Auto 320 600

## My Typical Camera Setup

- Aperture Priority I set aperture and camera calculates shutter speed. (Aperture mostly f/5.6 to f/11)
- On tripod ISO fixed at base (64)
- Handheld ISO Auto with minimum shutter speed set at 1/focal length of lens (with some extra for long lenses.)
- Use histogram to adjust exposure compensation for bright but no blown highlights
- Modern mirrorless systems often allow setting exposure compensation from the lens whiling viewing live histogram.

### Specialty setup

- Manual I set aperture and shutter speed
- On tripod ISO fixed at base (64)
- Handheld ISO Auto with shutter speed set depending on the need slow or fast subject
- Use histogram to adjust exposure compensation for bright but no blown highlights