Topics Today

- The “duhhh” stuff of a Theatrical Experience?
  - –Social / Technical
  - –What brings patrons to a theater?
- What sells TV’s?
- Can we measure a theater to tell what makes for a good presentation
  - –It’s about telling a story, not the specs
  - –The goal is to make pictures look good, not the numbers!
  - –Are the current theater specs sufficient?

Why Cinema?

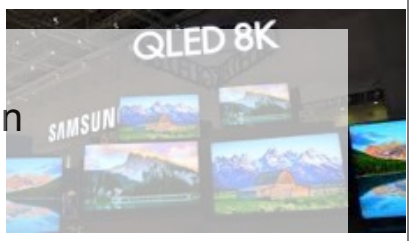
- Surrender Control (no escape)
- Communal Experience
- Better total experience
  - –Few distractions
  - –Dark surrounds
  - –Good picture/sound

What Drives MORE Visits?

1. It's about the movie. **CONTENT DRIVEN!**
2. Location of the theater - convenience and parking
3. Time of the presentation
4. Recliner seats
5. Assigned seating
6. Good food (and booze)
7. PLF (premium large format)
   - »Will drive higher ticket prices
   - »BIG screen / good picture
   - »Wall to wall screen
   - »Good sound

Assumed that the picture and sound are good enough. Not a big driver to increased visits. BUT when the image is better than average, customers notice.

Selling TVs



- Consumers love ‘better’
  - High Definition is better than Standard Definition
  - 65” is better than 55”
  - HDR is better than SDR
  - 8K is better than 4K
  - Brighter is better - 1,000nits is better than 500nits
  - Saturated colors are better
  - “Vivid Mode” sells at Best Buy / CostCo

  - Customers are buying the display, not the story
  - Cinemas sell a story

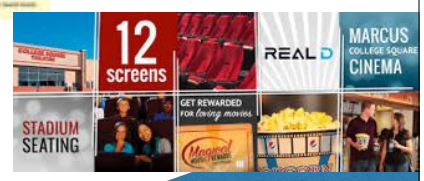
Attractions to Theaters

DOLBY CINEMA AT amc PRIME

MAX IS BELIEVING™

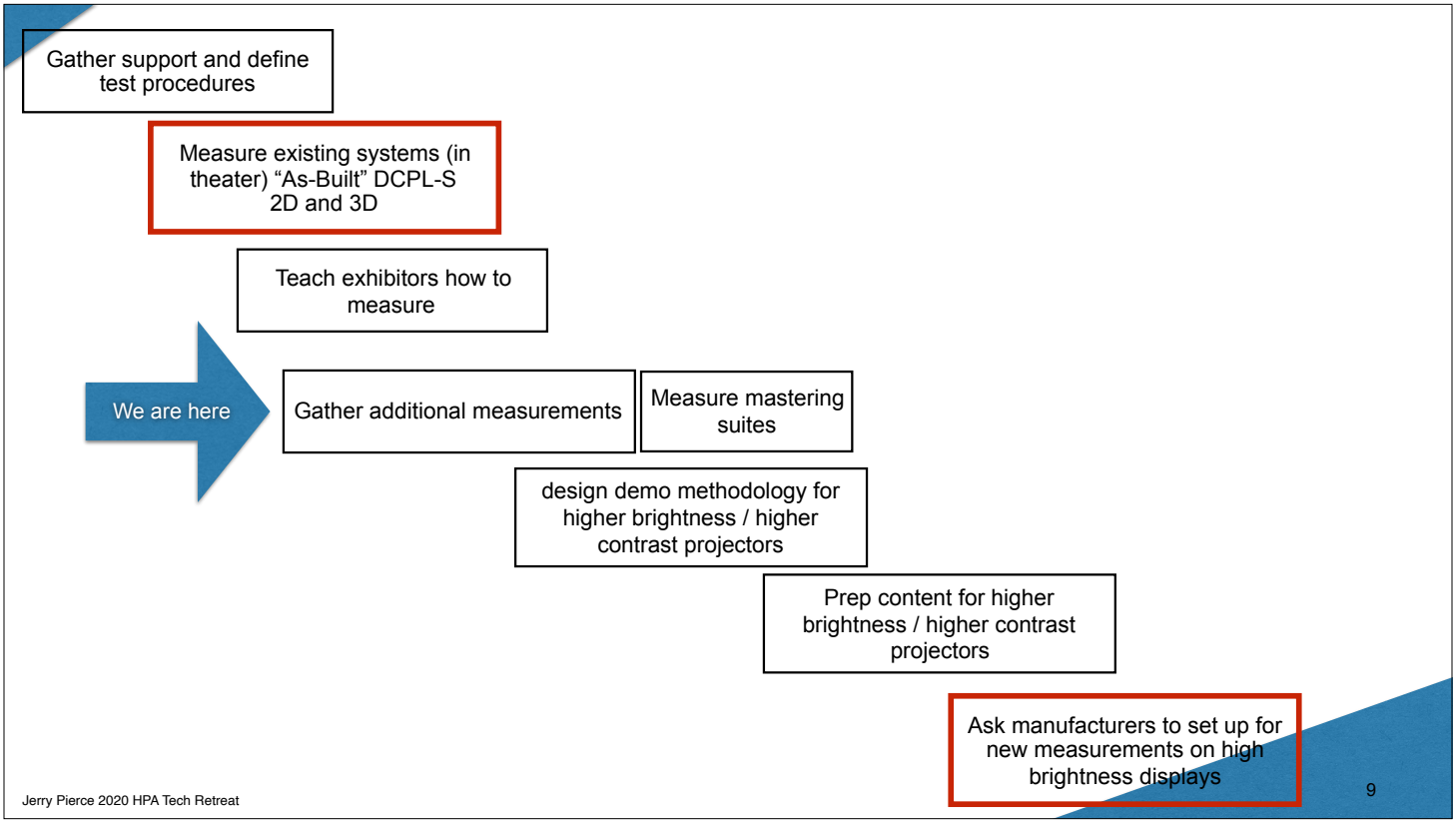
MARCUS THEATRES

MOVIE TAVERN



NATO DCPL…

- **Digital Cinema Picture Level Project** - a process to investigate theatrical display systems
- Working with in **partnership with ISDCF**
- Goals:
  - –Understand current projection performance
  - –**Identify the characteristics for higher brightness / dynamic range projectors/displays THAT MAKES A DIFFERENCE** for patrons and is achievable

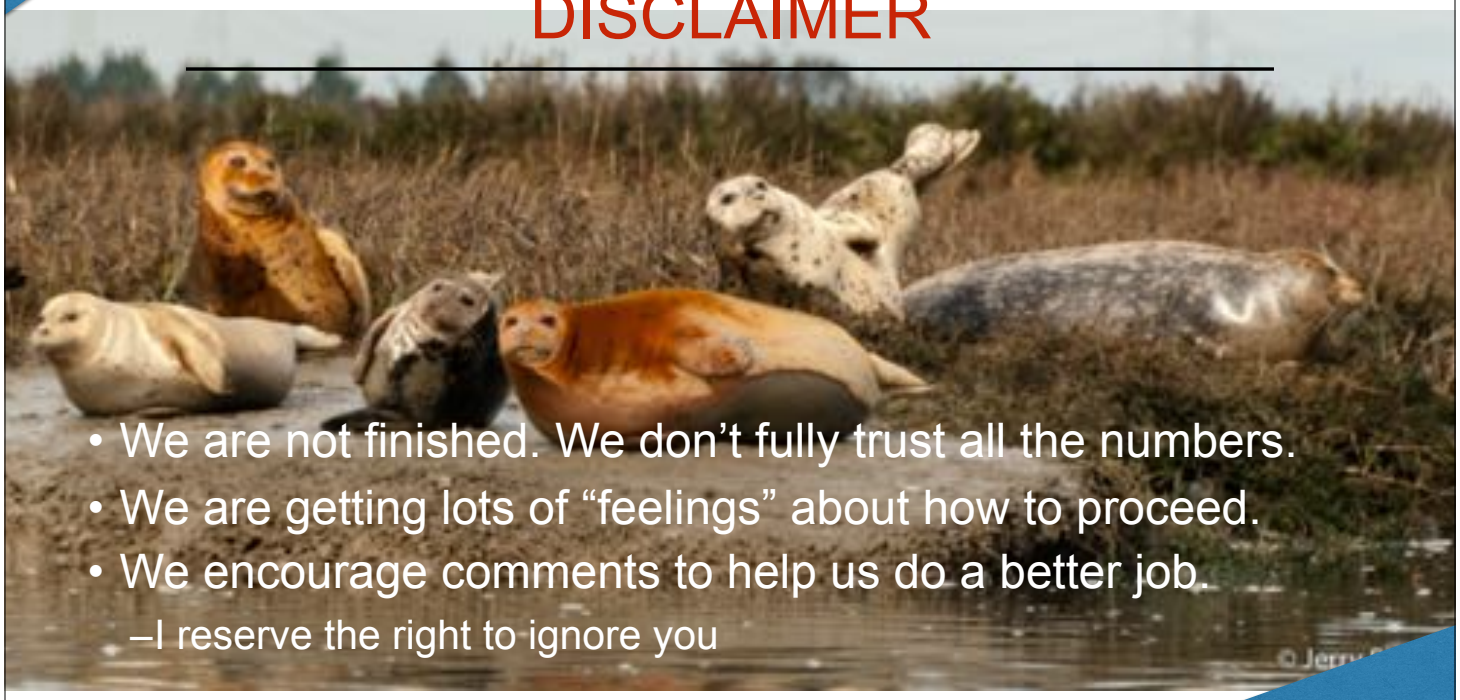


DCPL …

- Digital Cinema Picture Levels defines a range of performance objectives
  - DCPL-S is the current digital cinema standard
  - DCPL-H is the goal of the demonstrations for the short term
  - DCPL-E is in the future

Digital Cinema Picture Levels	**Name**	**Master**
DCPL-S	Standard	Standard Master
DCPL-Sc	Standard High Contrast	Standard Master
DCPL-H	High Brightness	High Brightness Master
DCPL-Hc	High Brightness High Contrast	High Brightness Master
DCPL-E	Extended Highlights	Extended Highlights Master

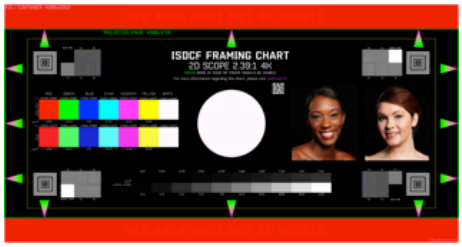
DISCLAIMER



- We are not finished. We don't fully trust all the numbers.
- We are getting lots of "feelings" about how to proceed.
- We encourage comments to help us do a better job.
  - –I reserve the right to ignore you

Test Patterns

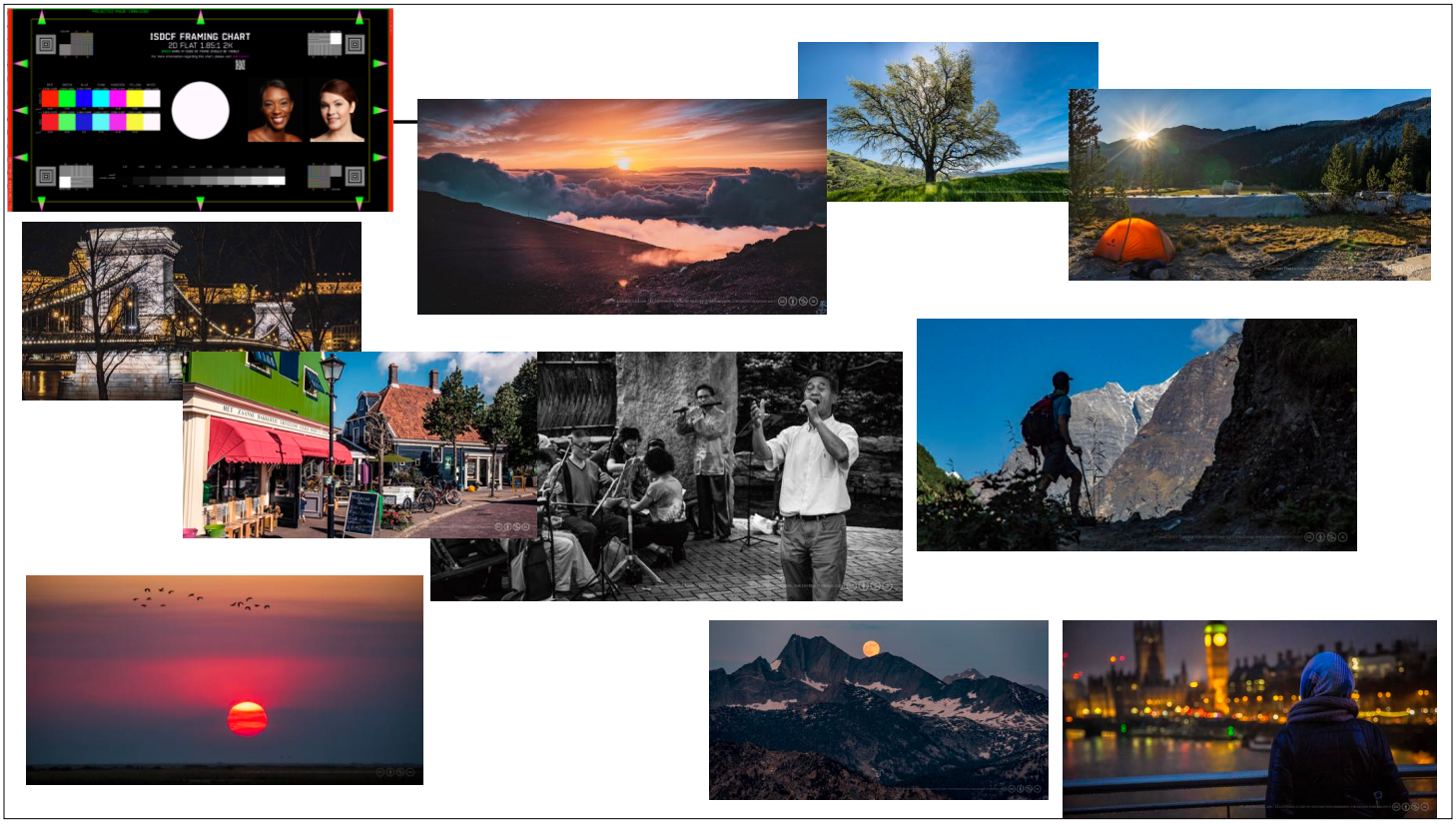
DCP of black and white



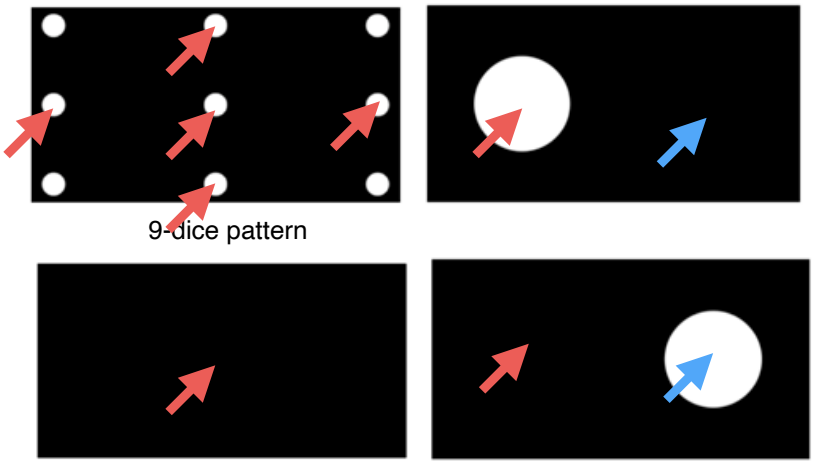
9-dice pattern

No projector - House lights at feature playback level and trailer/walk in level

DCP of DCIC - Digital Cinema Intraframe Contrast



Where to Measure



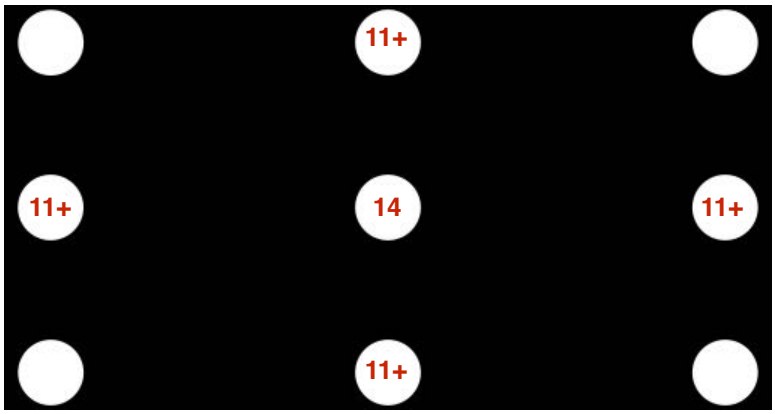
9-dice pattern

No projector or Projector Black - House lights at feature playback level

DCP of DCIC - a NATO invention - Digital Cinema Intraframe Contrast

The Standard SMPTE 196M-2003

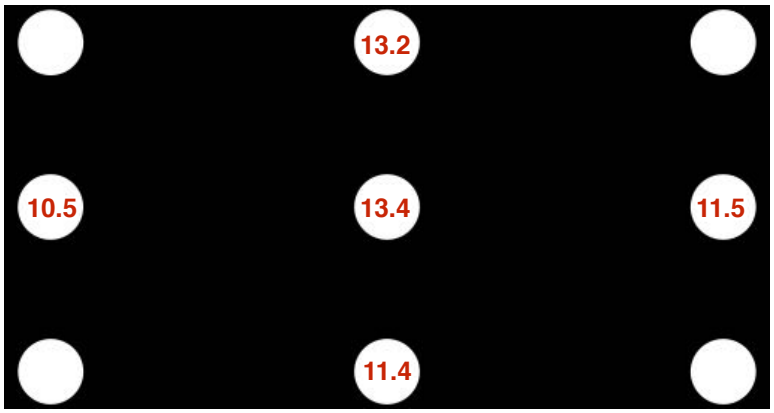
- Review room luminance
  - Review room screen luminance shall be **16 fL ± 2 fL** at the screen center. The luminance of the screen sides and corners, shall be at least 80% of the screen center reading.
- Theater luminance
  - Theater screen luminance at the screen center shall be between **12 fL and 22 fL**. Luminance at the screen sides shall be 75% to 90% of the screen center luminance, **but not less than 10 fL**.
- Theater Black
  - **Screen luminance due to stray light shall be less than 600:1 theater screen contrast ratio for review rooms and primary theaters. For all other theaters, the luminance due to stray light shall be less than 400:1**.



SMPTE Standard?

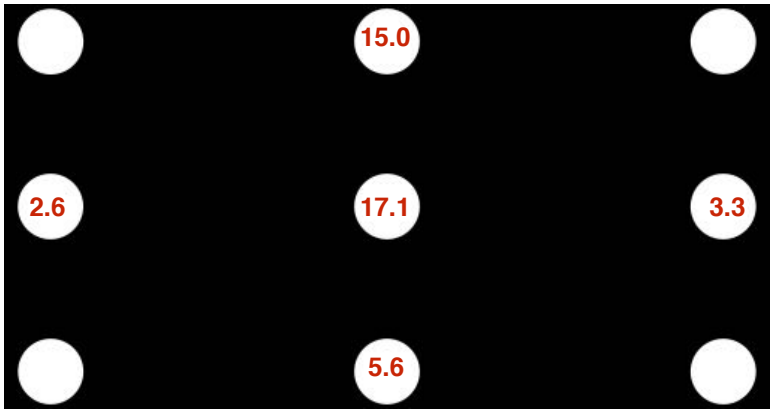
16fL / 0.6K:1?
14fL / 2K:1?

			SMPTE 16/.6K	14fL/2K
Center Brightness		fL	16	14
System Black (0.6K:1 or2K:1)		mNits	90	24
5 point average		fL	13.6	11.6
Theater Black		mNits		
Sequential Contrast			600	2,000
DCIC Contrast				



16’ screening room
Matt screen (no gain)

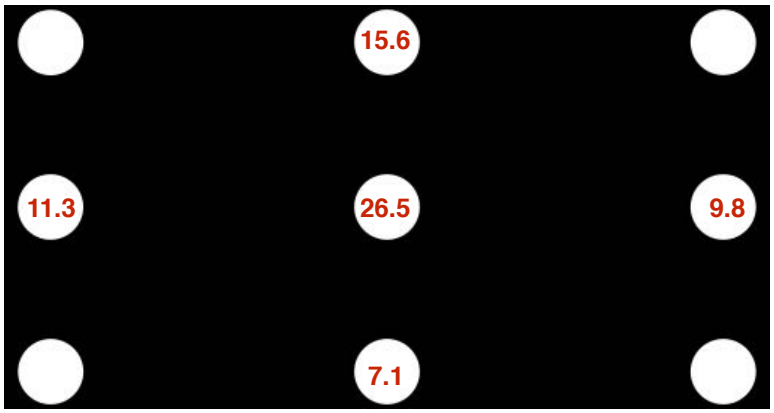
	20200114 4:30pm		SMPTE 16/.6K	14fL/2K
Center Brightness	13.4	fL	16	14
System Black (0.6K:1 or2K:1)	50	mNits	90	24
5 point average	12.0	fL	13.6	11.6
Theater Black	0.7	mNits		
Sequential Contrast	916		600	2,000
DCIC Contrast	527			



16’ screening room
Silver screen (gain = 3)

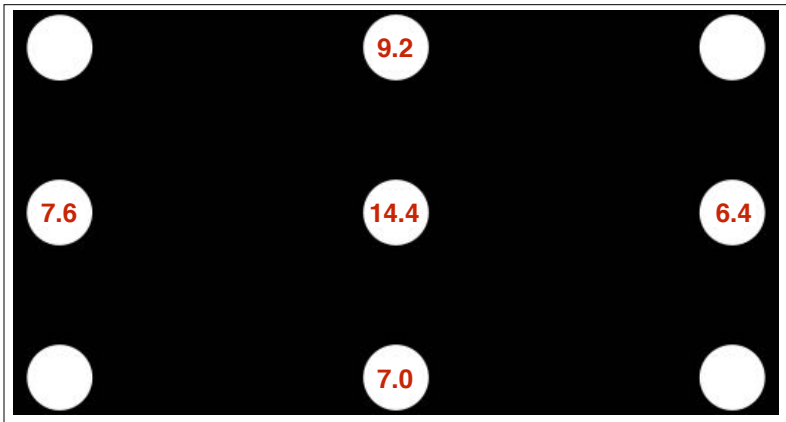
20200114 4:00pm

	Your Screen		SMPTE 16/.6K	14fL/2K
Center Brightness	17.1	fL	16	14
System Black (0.6K:1 or2K:1)	18.8	mNits	90	24
5 point average	8.8	fL	13.6	11.6
Theater Black	0.7	mNits		
Sequential Contrast	3,100		600	2,000
DCIC Contrast	677			



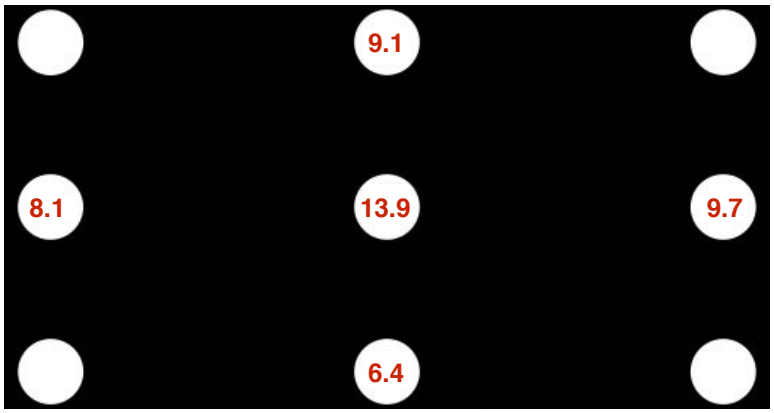
33’ wide screen
Silver screen (gain?)

	20200123 8:15am		SMPTE 16/.6K	14fL/2K
Center Brightness	26.5	fL	16	14
System Black (0.6K:1 or2K:1)	44	mNits	90	24
5 point average	14.1	fL	13.6	11.6
Theater Black	3.7	mNits		
Sequential Contrast	2,060		600	2,000
DCIC Contrast	1076			



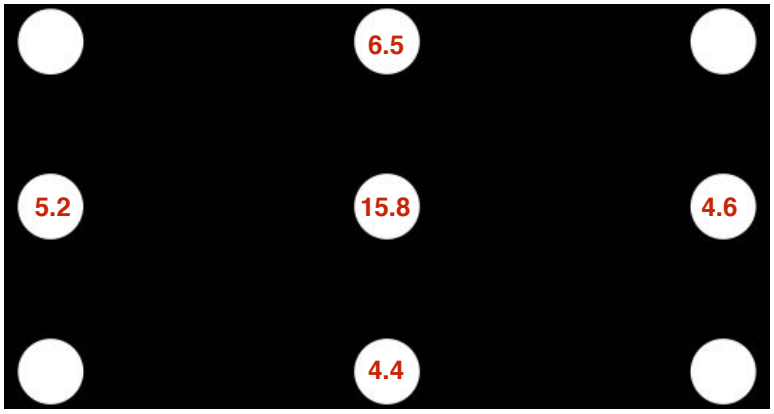
34’ wide screen
1.8 gain screen

	20200123 8:45am		SMPTE 16/.6K	14fL/2K
Center Brightness	14.4	fL	16	14
System Black (0.6K:1 or2K:1)	27	mNits	90	24
5 point average	8.9	fL	13.6	11.6
Theater Black	7.4	mNits		
Sequential Contrast	1,822		600	2,000
DCIC Contrast	650			



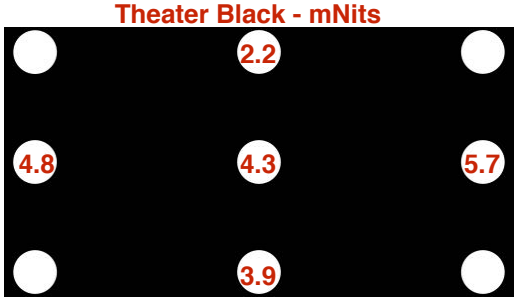
59’ wide screen
1.8 gain screen

	20200123 7:50am		SMPTE 16/.6K	14fL/2K
Center Brightness	13.9	fL	16	14
System Black (0.6K:1 or2K:1	44	mNits	90	24
5 point average	9.5	fL	13.6	11.6
Theater Black	2.8	mNits		
Sequential Contrast	1,090		600	2,000
DCIC Contrast	672			



50’ wide screen
2 gain screen

Theater Black - mNits



	20200123 9:05am		SMPTE 16/.6K	14fL/2K
Center Brightness	15.8	fL	16	14
System Black (0.6K:1 or2K:1)	43	mNits	90	24
5 point average	7.3	fL	13.6	11.6
Theater Black	4.3	mNits		
Sequential Contrast	1,250		600	2,000
DCIC Contrast	948			

Two Numbers?

- Old was: 14fL and 2K:1 contrast (sort of)
- New? 5 point average and system black?
  - 11fL and 40mN?

Average 5 point brightness (fL)	System Black (mNits)	Theater black (Center, mNits)	Reference Center Brightness (fL)	DCIC average Contrast
6.7	19.0	4.7	12.5	865
7.3	43.0	4.3	15.8	948
8.4	36.3	1.2	11.6	758
8.6	37.0	3.6	15.0	855
8.7	9.5	0.3	13.5	1058
8.8	18.8	0.2	17.1	677
8.9	27.0	7.4	14.4	648
9.5	43.5	2.8	13.9	672
11.0	59.8	1.8	18.0	717
11.5	113.0	0.7	20.9	573
11.7	10.0	0.3	12.8	1243
11.9	10.0	0.2	13.3	1271
11.9	39.4	1.3	17.5	902
12.0	50.0	0.7	13.4	527
14.1	44.0	3.7	26.5	1076
19.0	10.0	0.2	21.4	1244

Unofficial Results

- The center brightness is not a great indicator of picture brightness
  - Gain screens add significant variability
  - The “5 point average” seems to give better information
- People seem to “like” the image when the AVERAGE brightness is above 10fL
  - We need more subjective testing of images
- Theater black is better than expected - many achieving under 2 mNits
- System black is very important above 40 mNits is objectionable

Average 5 point brightness (fL)	System Black (mNits)	Theater black (Center, mNits)	Reference Center Brightness (fL)	DCIC average Contrast
6.7	19.0	4.7	12.5	865
7.3	43.0	4.3	15.8	948
8.4	36.3	1.2	11.6	758
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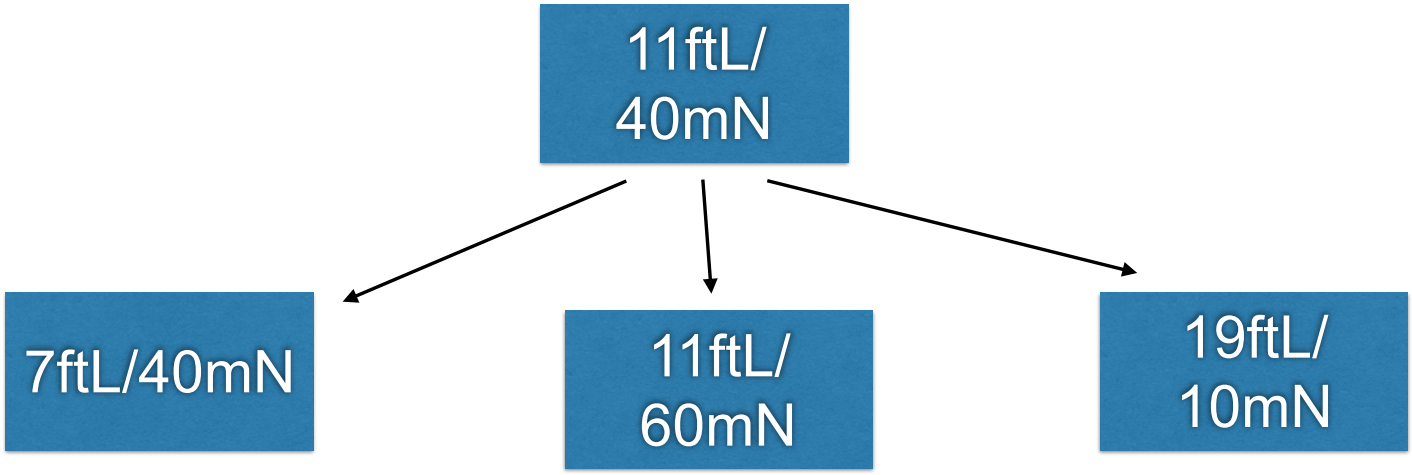
11.7	10.0	0.3	12.8	1243
11.9	10.0	0.2	13.3	1271
11.9	39.4	1.3	17.5	902
12.0	50.0	0.7	13.4	527
14.1	44.0	3.7	26.5	1076
19.0	10.0	0.2	21.4	1244

More Unofficial Results

- Pictures look good
  - **The goal is to make pictures look good, not the numbers**
- The eye is amazing at **ignoring** non-uniform illumination during normal image playback
- Pictures looked better on bigger screens
- Bigger screens did not need as high light levels to still look good

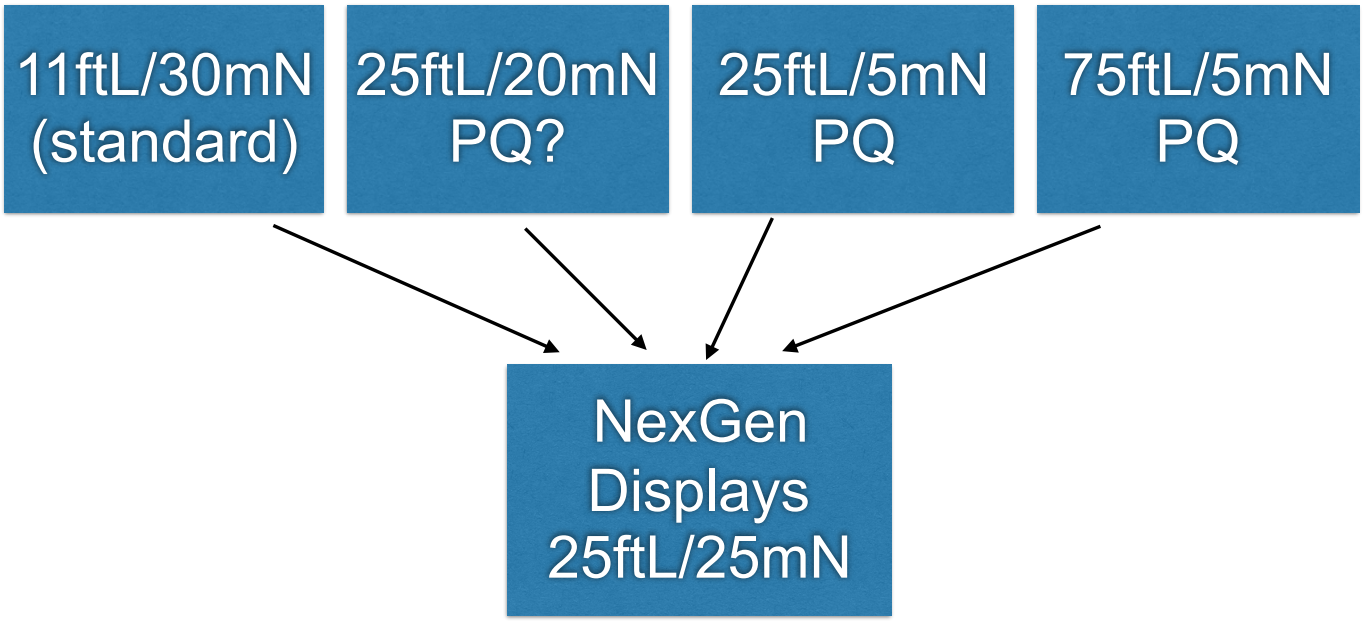
Today's Mastering



Future Displays

- New displays coming to market
  - –LED
  - –High brightness
  - –High contrast
  - –Advanced Technologies (probably under NDA)
- How to support new displays
  - –Too many masters, not enough time

Next Demo?



Conclusions

- Theatrical experience shows good pictures
- Should we revisit the SMPTE screen spec?
- Should we have another “level” of theatrical performance?
- Is it time for lunch?