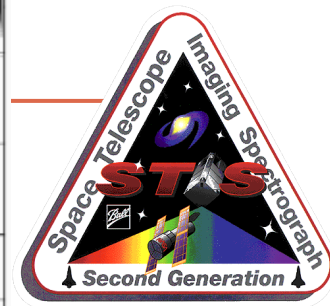
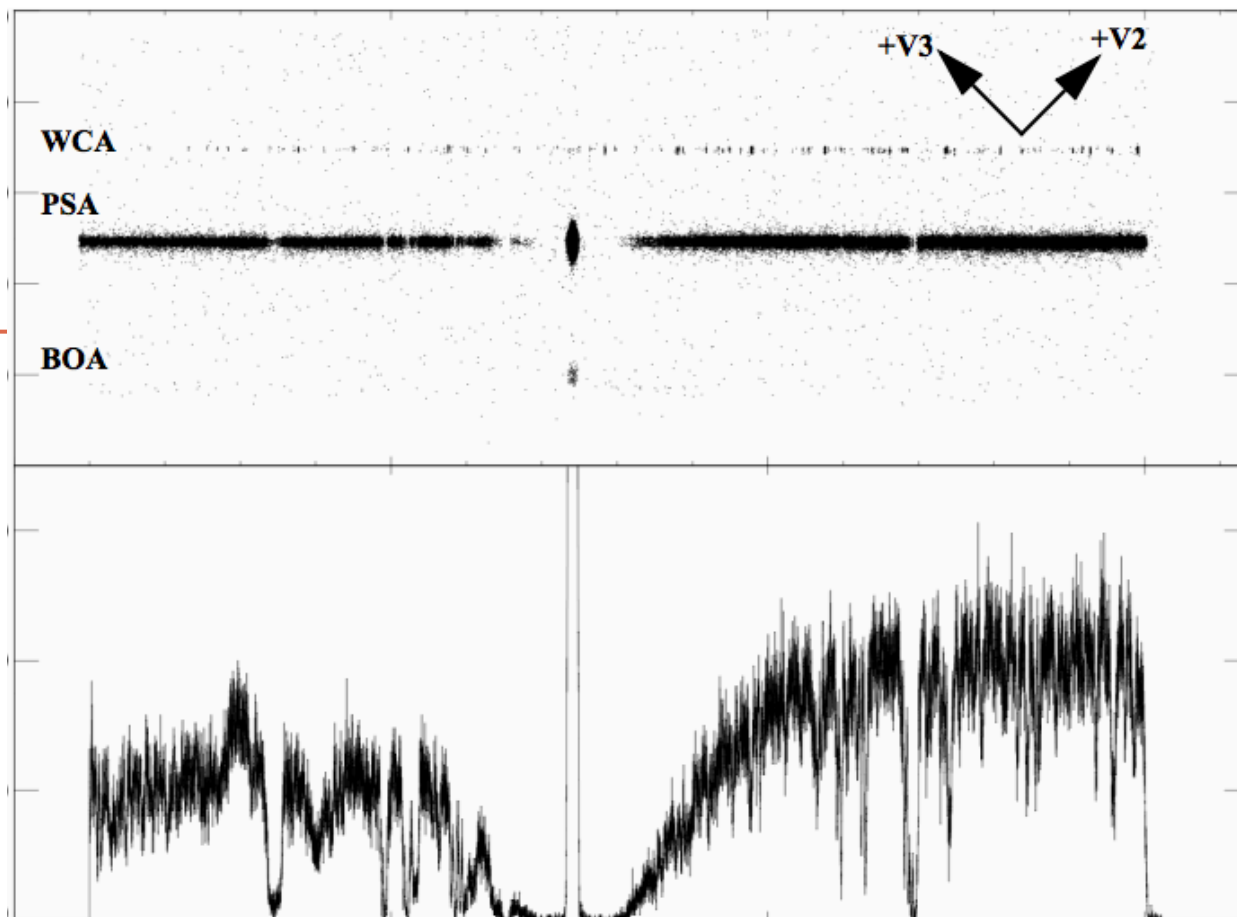
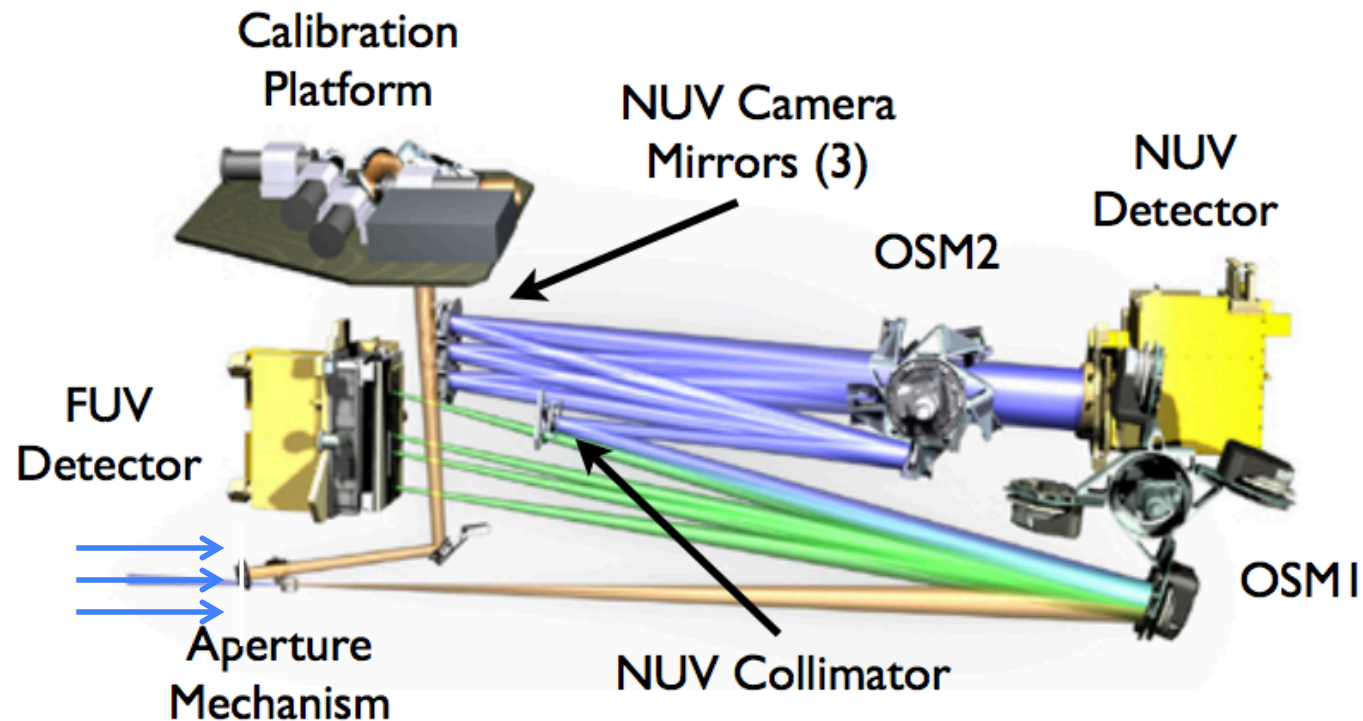


HST Spectrographs



Spectrograph components

- Aperture
- Collimator
- Disperser
- Detector



HST Spectrographs

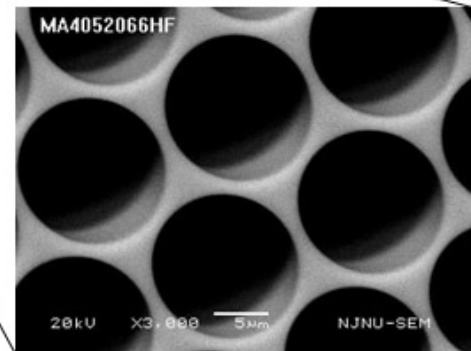
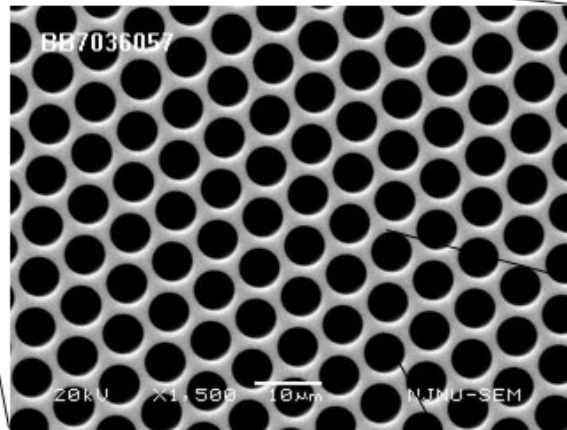
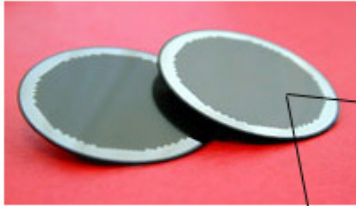
STIS SUMMARY

- Installed in February 1997
- Oldest operating instrument on HST
 - Oldest CCD in space!
- Failed in August 2004
- All modes repaired during SM4 (2009)
- All detectors are capable of imaging and spectroscopy
- Prime Orbits Usage: 14.3% in Cycle 23

COS SUMMARY

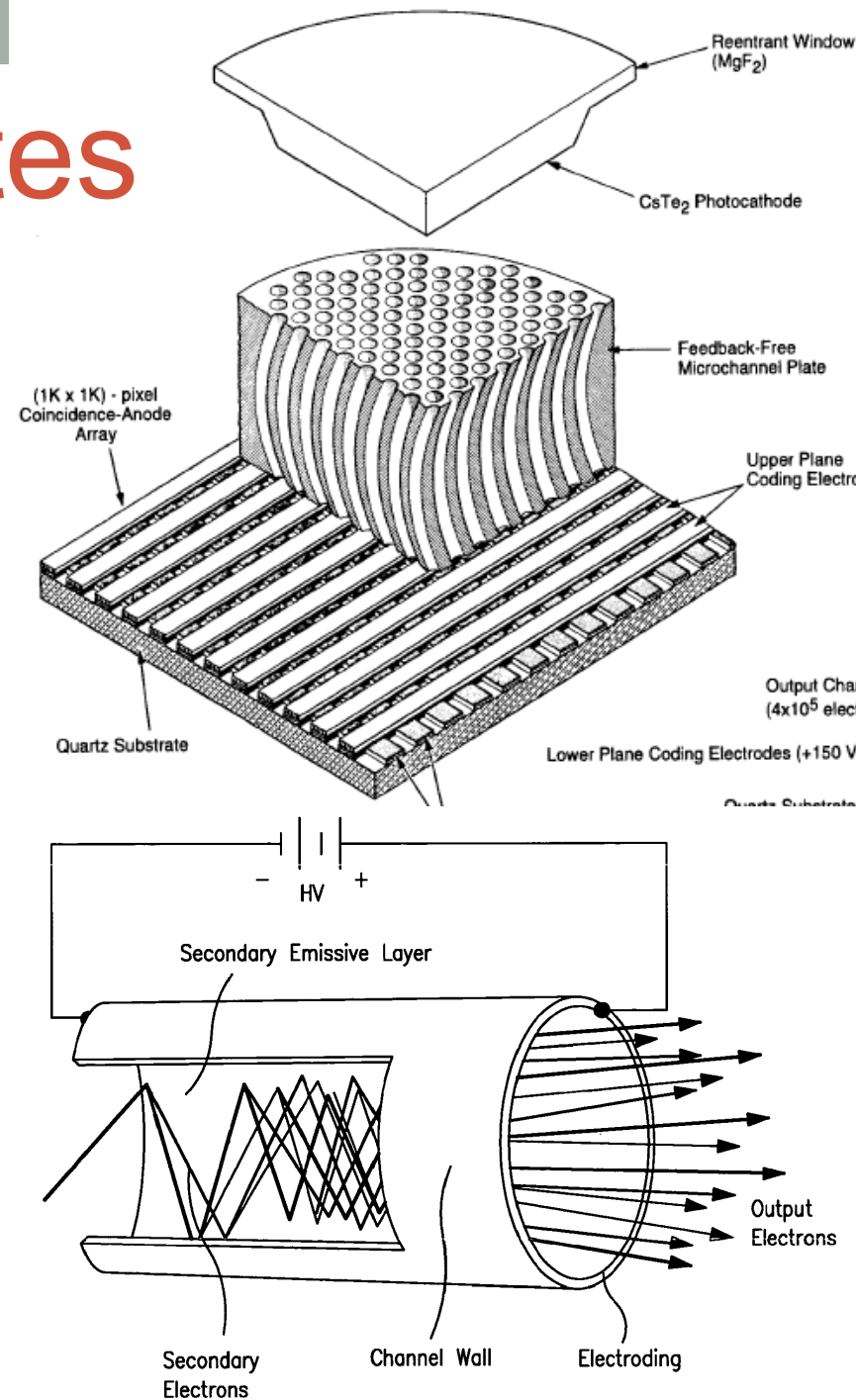
- Installed in May 2009
- First move of Lifetime Position to LP2 in July 2012
- Move to LP3 in Feb 2015
- In December 2012 new COS blue modes were implemented offering higher resolution (cenwaves 1055, 1096)
- NUV MAMA detector capable of imaging
- Prime Orbits Usage: 18% in Cycle 23

Microchannel Plates



Microchannel Plates

- Photons strike a CsI photocathode and produce photoelectrons
- A strong electric field accelerates the electrons allowing each channel to act as an electron multiplier
- Multiple anodes detect the output electron cloud and determine position and time of incidence
- There is an ion-repeller grid that reduces low-energy thermal ion noise
- Measuring the “pulse height”, or charge collected from an event, we can screen out background noise and CRs



Cosmic Origins Spectrograph

Detectors:

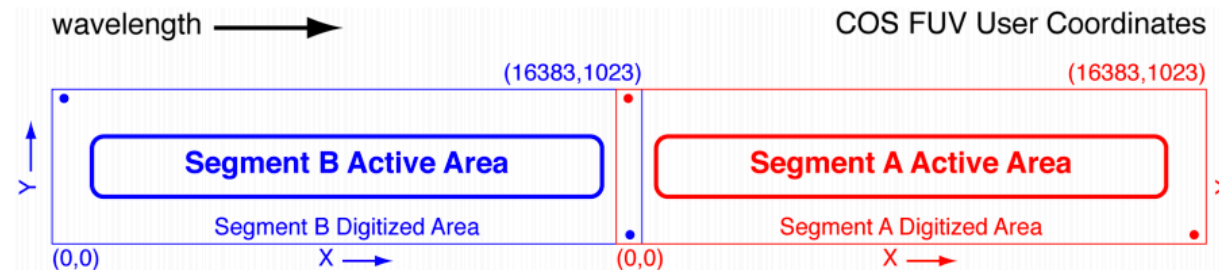
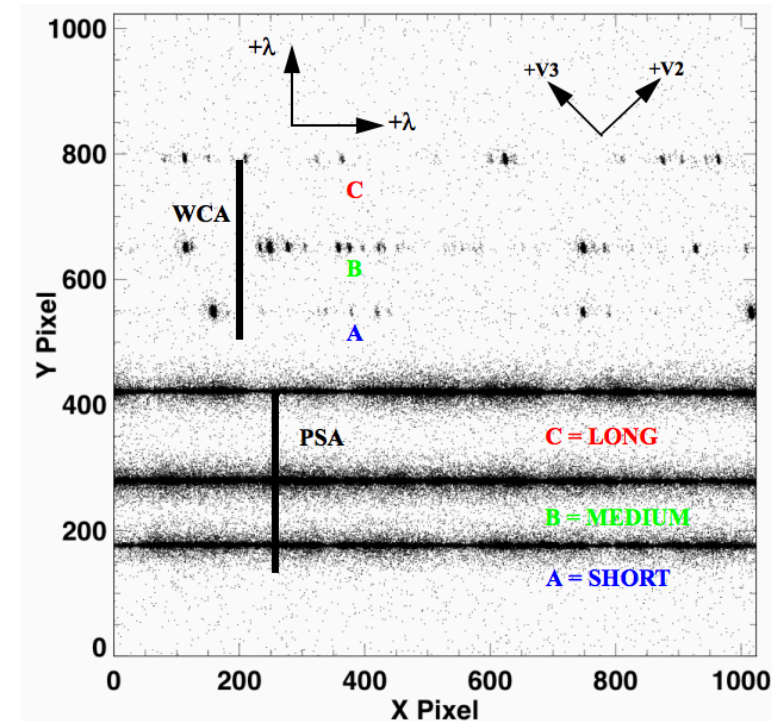
- FUV Cross-delay Line Anode (XDL)
 - Two detector Segments (A and B)
- NUV Multi-anode Microchannel Array (MAMA)
 - Three stripe Segments (A, B and C)

Wavelength range:

- 900 – 2,050 Å (FUV)
- 1,650 – 3,200 Å (NUV)

Spectral resolution:

- 1,500 – 21,000 (FUV)
- 2,100 – 24,000 (NUV)



Space Telescope Imaging Spectrograph

Detectors:

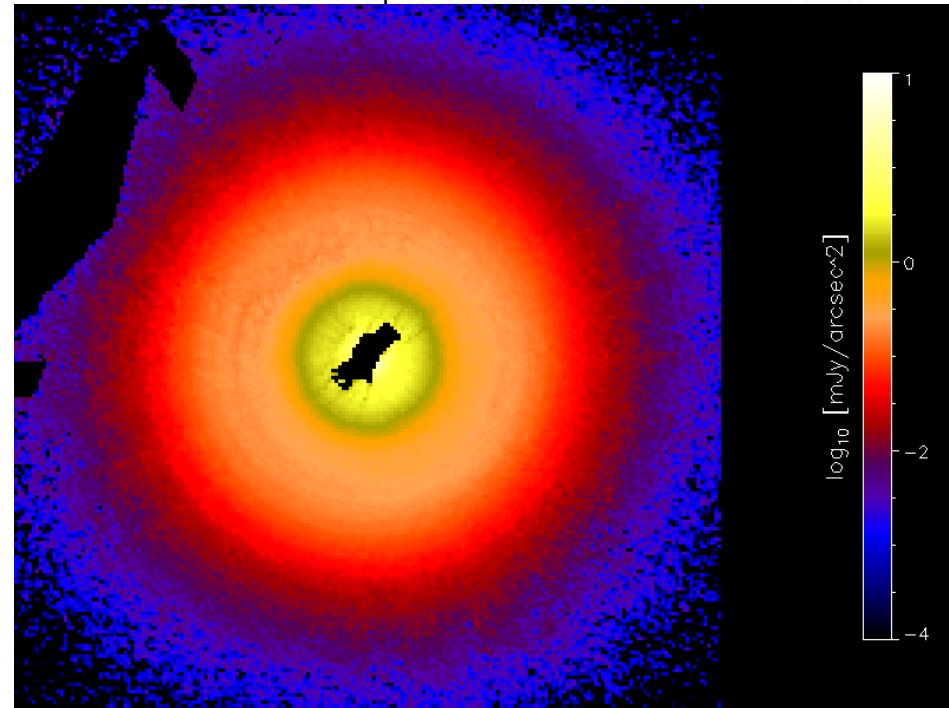
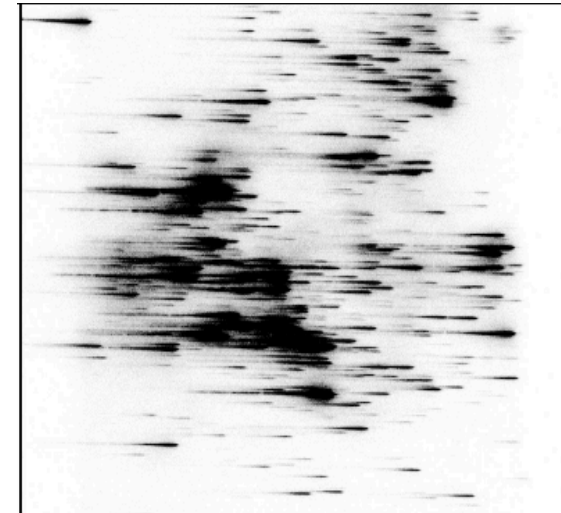
- FUV MAMA
- NUV MAMA
- Charged Couple Device (CCD)

Wavelength range:

- 1,150 – 1,700 Å (FUV)
- 1,650 – 3,100 Å (NUV)
- 2,000 – 11,000 Å (CCD)

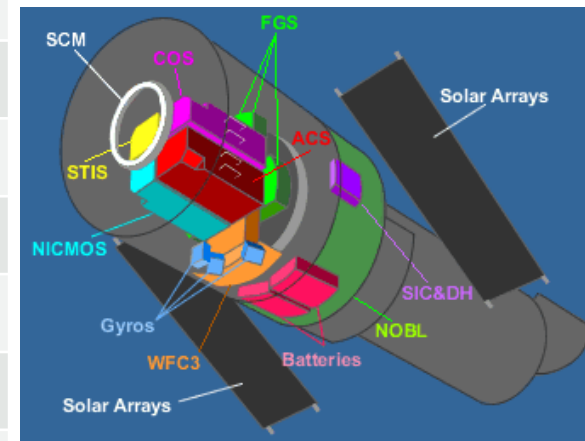
Spectral resolution:

- 1,000 – 114, 000 (FUV)
- 500 – 114,000 (NUV)
- 530 – 10,300 (CCD)



Battle of the spectrographs

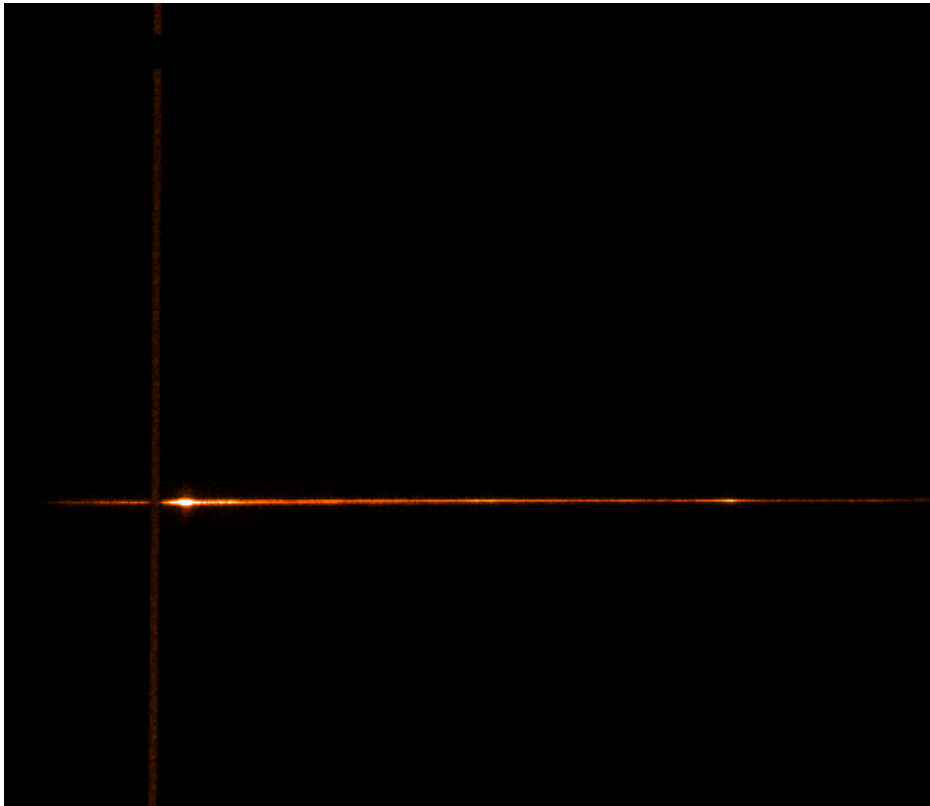
	COS	STIS
FUV throughput	✓	
NUV throughput	Bluer	Redder
NUV wavelength coverage		✓
NUV calibration		✓
NUV dark rate	Equal	Equal
Spatial resolution		✓
Sensitivity	✓	
Point-source observations	✓	
Bright objects		✓
Echelle gratings		✓
Optical and NIR		✓



Operating modes

- **ACCUM Mode**
 - Charge is accumulated during the exposure in response to photons.
 - The charge is read out at the end of the exposure
 - ACCUM is the mode of choice for all observations that do not require time resolution on minute or less scales.
 - Available for all COS and STIS detectors.
- **TIME-TAG Mode**
 - Used for high-time-resolution spectroscopy and imaging in the UV.
 - The detectors produce an event stream of AXIS1, AXIS2, and TIME data points, with a time resolution of 125 microseconds for STIS and 32 milliseconds for COS .
 - Only available for MAMAs and XDL detectors (not CCD).

ACCUM



TIME-TAG:

Column	1	2	3
Label	TIME	RAWX	RAWY
1	0.	14327	485
2	0.	12062	481
3	0.	10553	479
4	0.	7147	471
5	0.	3211	478
6	0.	5418	479
7	0.	9208	483
8	0.	8993	479
9	0.	7823	484
10	0.	4286	474
11	0.032	4975	480
12	0.032	2789	470
13	0.032	14483	482
14	0.032	13825	481
15	0.032	6764	560
16	0.032	7225	480
17	0.032	4814	487
18	0.032	7176	478
19	0.032	2933	479
20	0.032	7799	482
21	0.032	1505	480
22	0.032	3909	469
23	0.032	5849	478
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