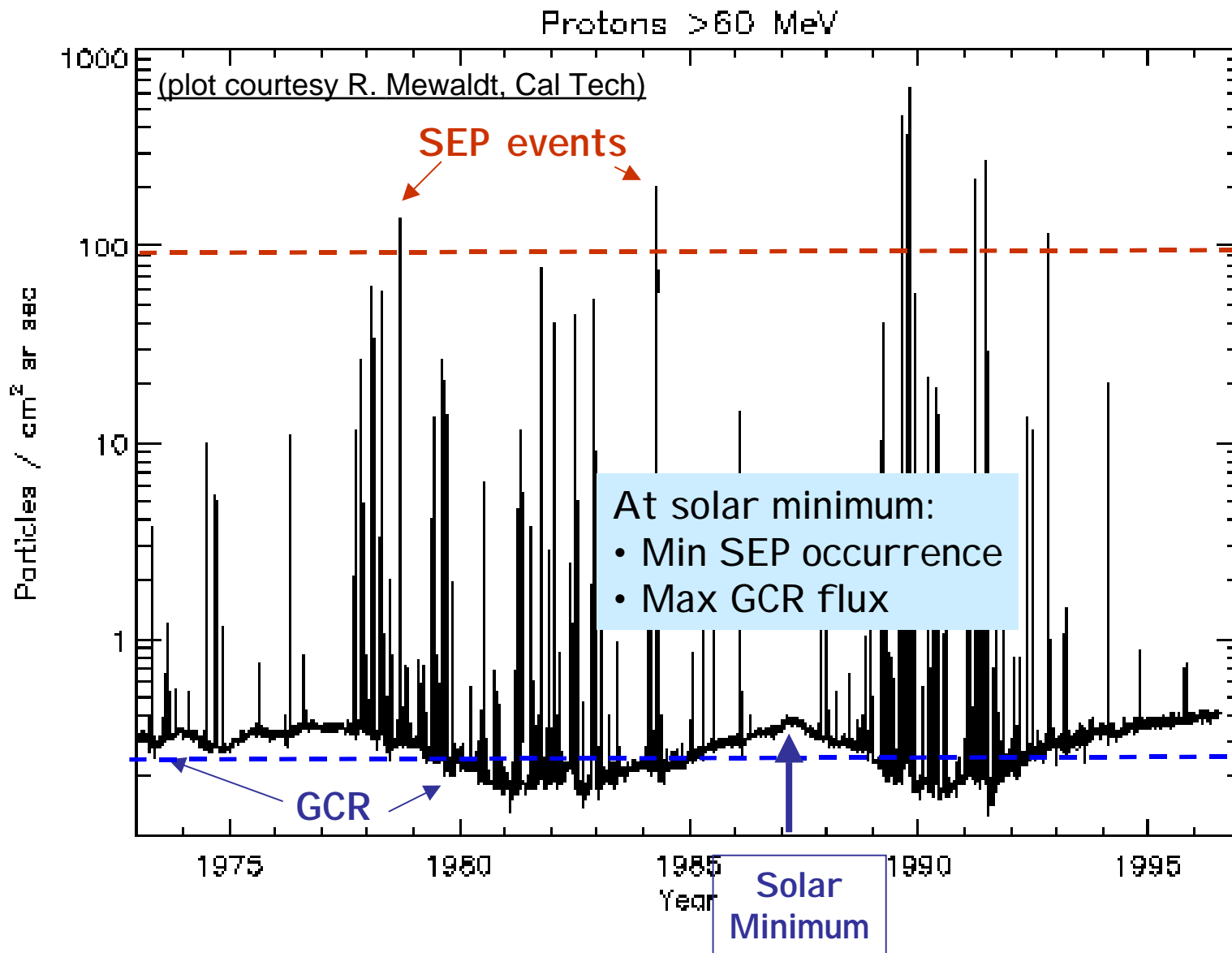


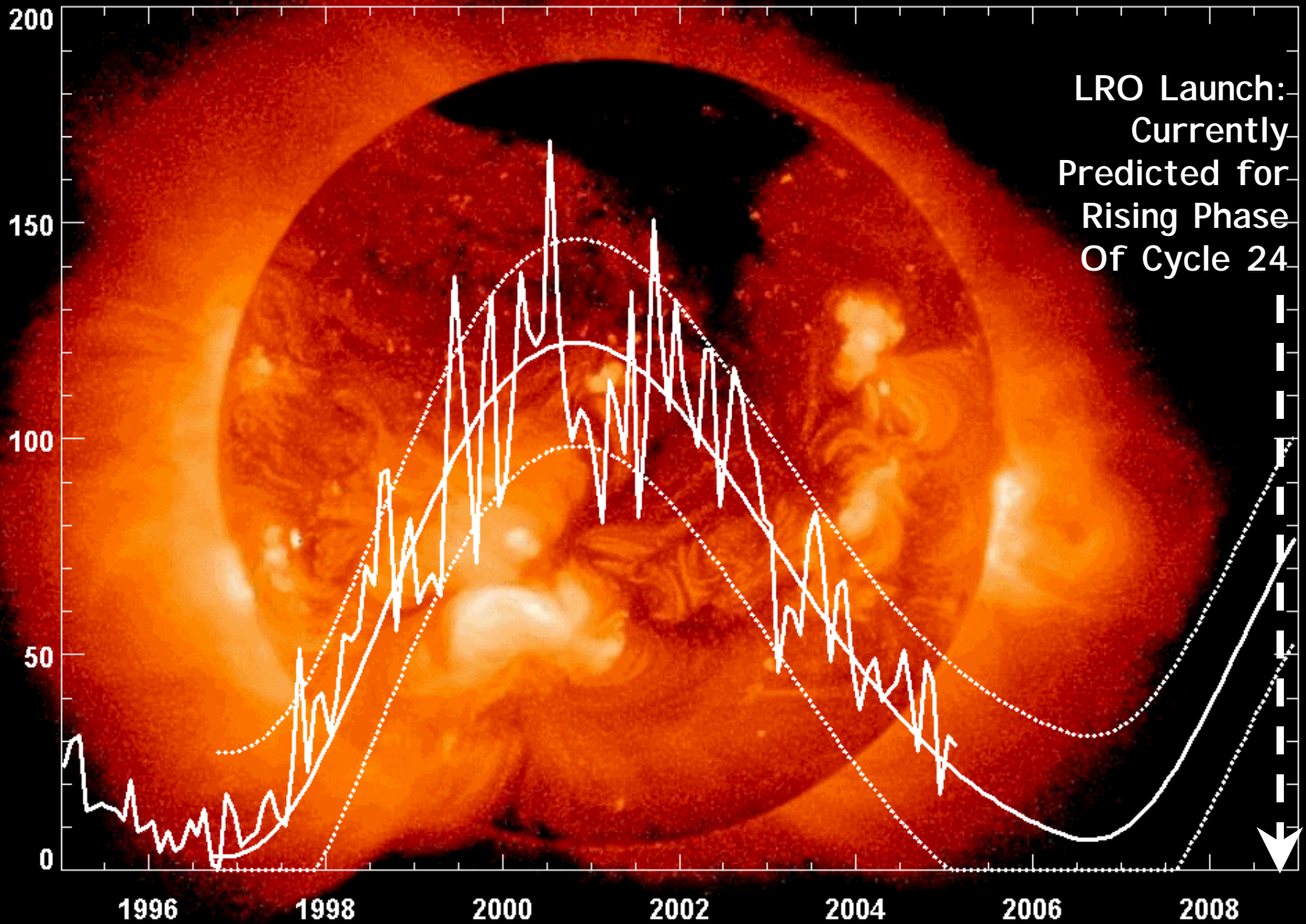
CRaTER-specific LRO Mission Duration Issues

- CRaTER measures effect of galactic cosmic rays (GCR) and solar energetic protons (SEP) – **prime CRaTER targets are *infrequent, large* SEP events**
- GCR flux is low-level but continuous and has weak solar cycle dependence – **longer mission linearly improves signal-to-noise ratio and hence LET spectrum, the prime CRaTER data product**
- Intense SEPs (>10 MeV p+) are episodic and approximately follow the solar cycle – **phasing of LRO launch during rising phase *minimizes(!)* chance of large SEPs; longer mission duration – or later launch – substantially increases probability of largest events**

SEP event occurrence varies with the solar cycle in anti-phase with weaker galactic cosmic ray fluxes

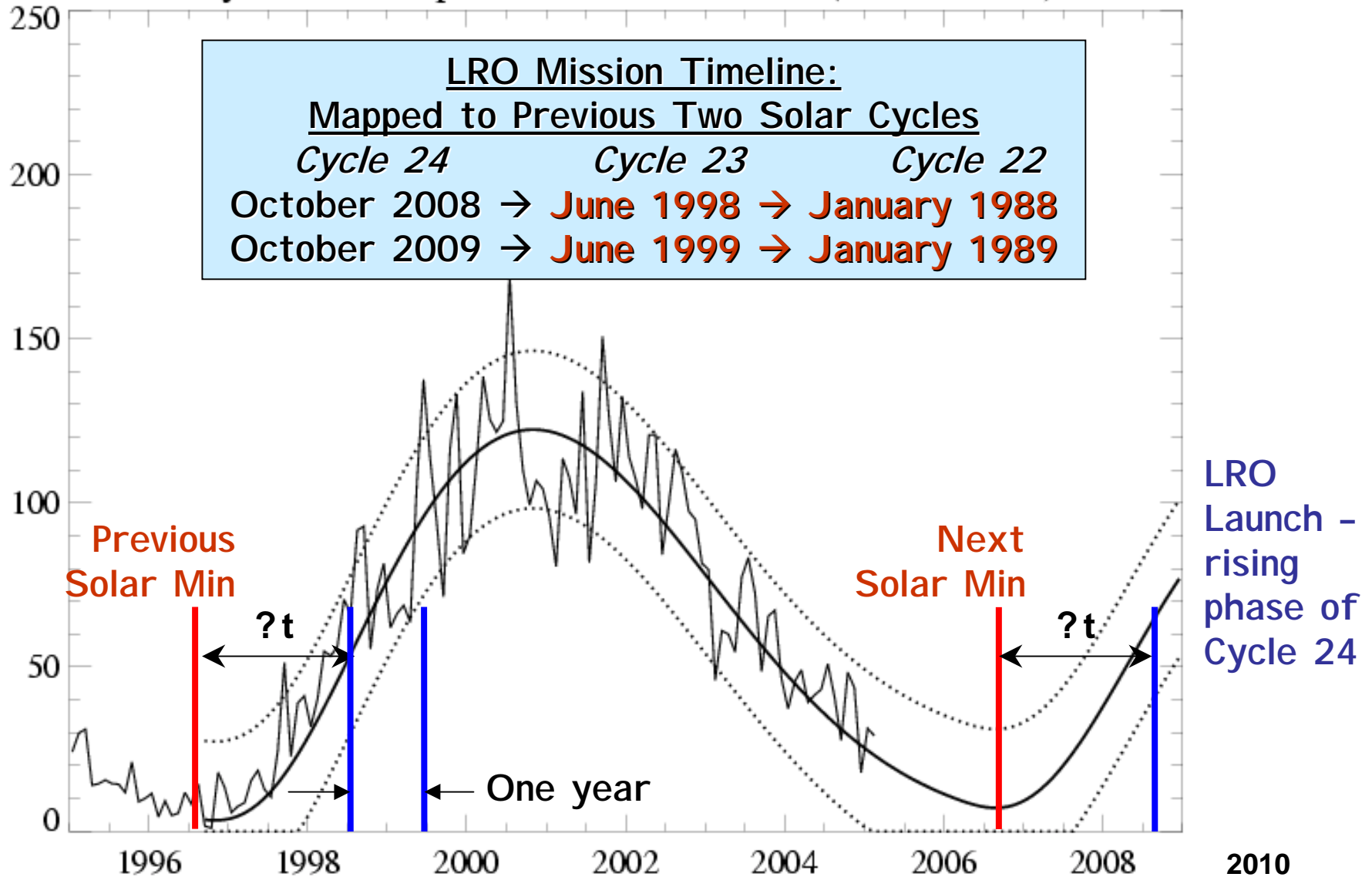


Cycle 23 Sunspot Number Prediction (March 2005)



LRO Launch:
Currently
Predicted for
Rising Phase
Of Cycle 24

Cycle 23 Sunspot Number Prediction (March 2005)



[Hathaway, Wilson, and Reichmann *J. Geophys. Res.* 104, 22,375-22,388 \(1999\)\]](http://science.msfc.nasa.gov/ssl/pad/solar/predict.htm)

<http://science.msfc.nasa.gov/ssl/pad/solar/predict.htm>

Probability of Large SEP Events During LRO:

Survey of Previous Two Solar Cycle's Energetic Proton Events – 1987 to 2003

Event definition used:

- Event onset: flux exceeds a threshold for 3 consecutive 5-min average points
- Event end: flux remains below threshold for 6 hours

Threshold Values:

- 10 pfu ($1/(\text{cm}^2 \text{ s sr})$) for >10 MeV protons
- 5 pfu for >50 MeV protons
- 1 pfu for >100 MeV protons

Satellites used:

- GOES 7: 1987 - 1995
- GOES 8: 1995 – 2002
- GOES 10: 1998 – 2003
- GOES 11: 2003

Priority for satellites: GOES 8, GOES 11, GOES 10

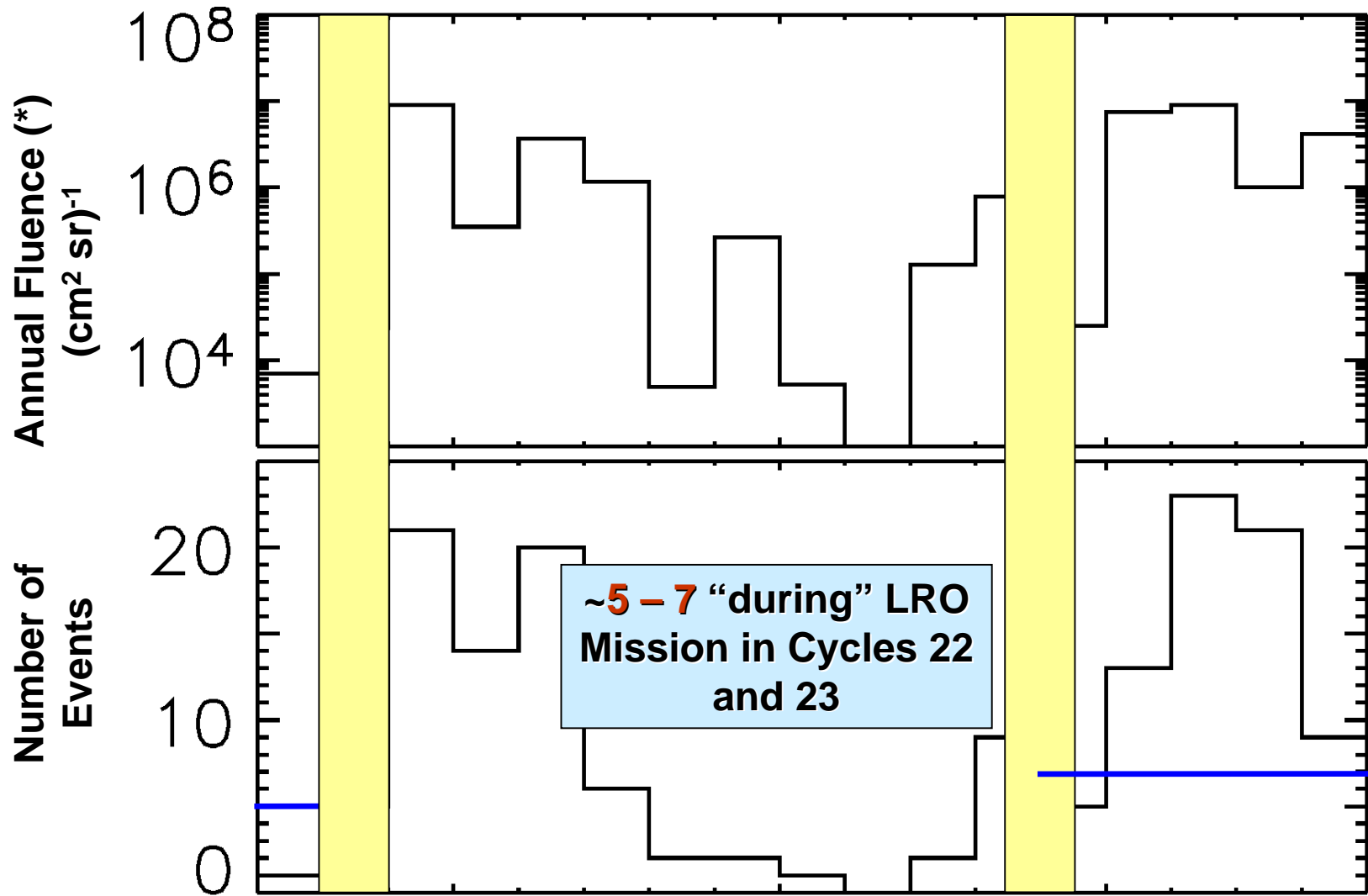
Total number of events:

>10 MeV: 153

>50 MeV: 56

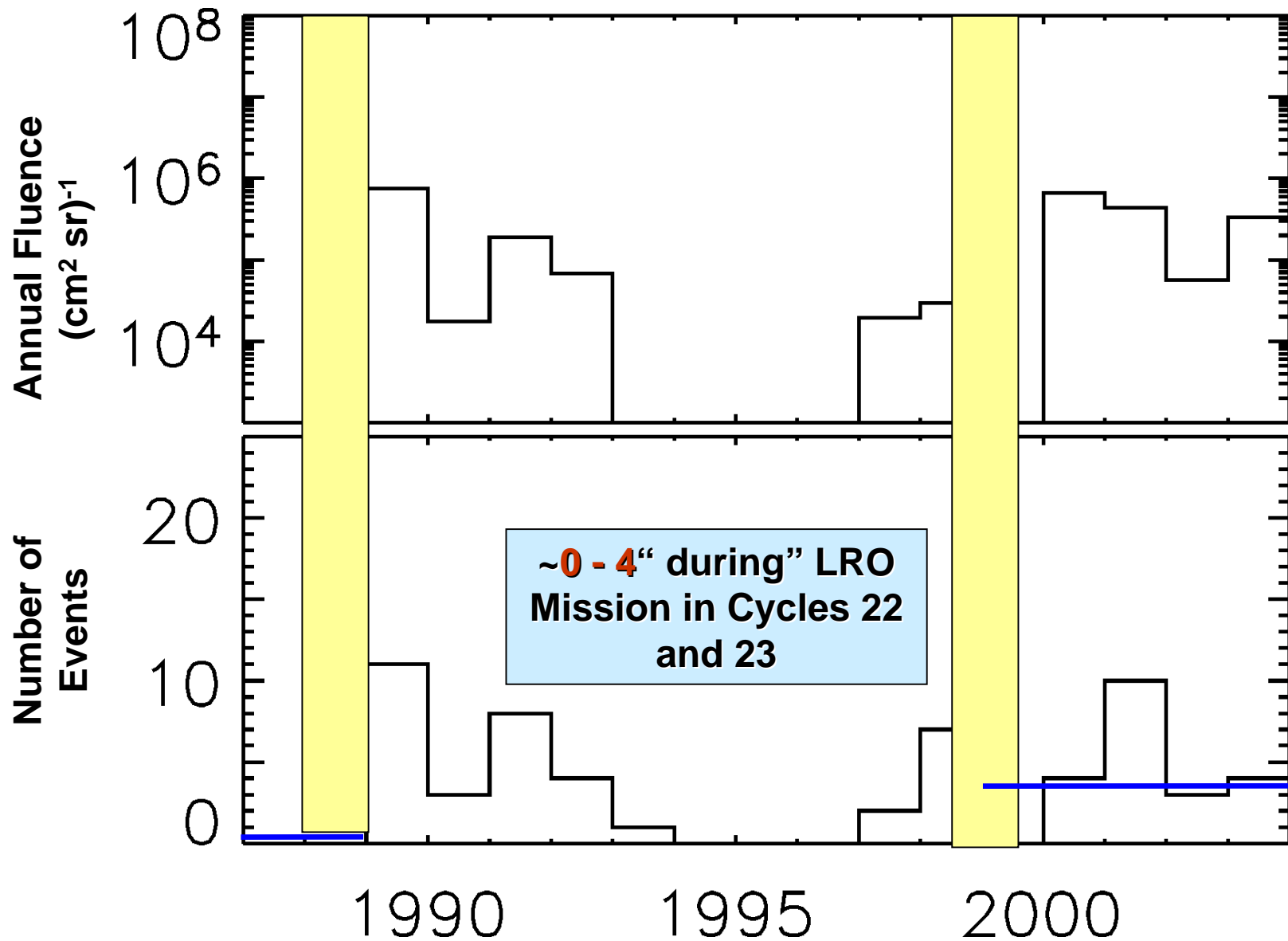
>100 MeV: 53

>10 MeV Events With Flux Exceeding 10 pfu

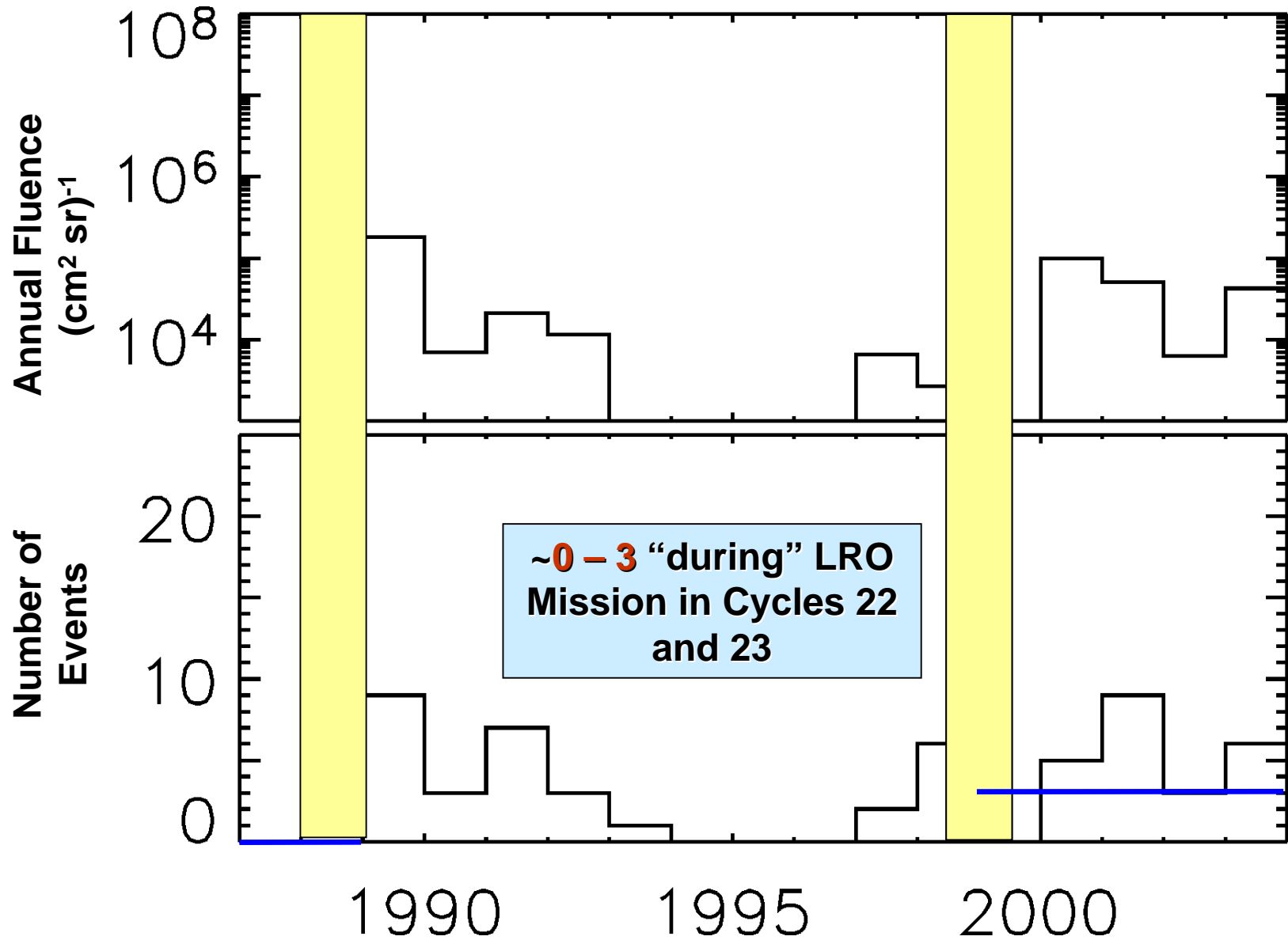


(*) Caution: Units aren't quite right!

>50 MeV Events With Flux Exceeding 5 pfu



>100 MeV Events With Flux Exceeding 1 pfu



Estimated Range of Number of Events as a Function of Mission Duration (assuming an October 2008 LRO launch; ranges based on Cycles 22/23)

Mission Duration (months)	Event Class		
	>10 MeV	>50 MeV	>100 MeV
9	4-6	0-4	0-3
12	5-7	0-4	0-3
15	8-10	3-4	3
18	10-16	4-6	3-6
24	15-24	5-10	5-10
36	39-55	13-23	13-21

- 12-month mission may yield NO large events!
- 18-month mission provides higher confidence of seeing at least a few large events
- Multi-year mission extended into solar maximum assures excellent coverage of even large events