Run 2019

Scheduling Physicist: Robert Pak

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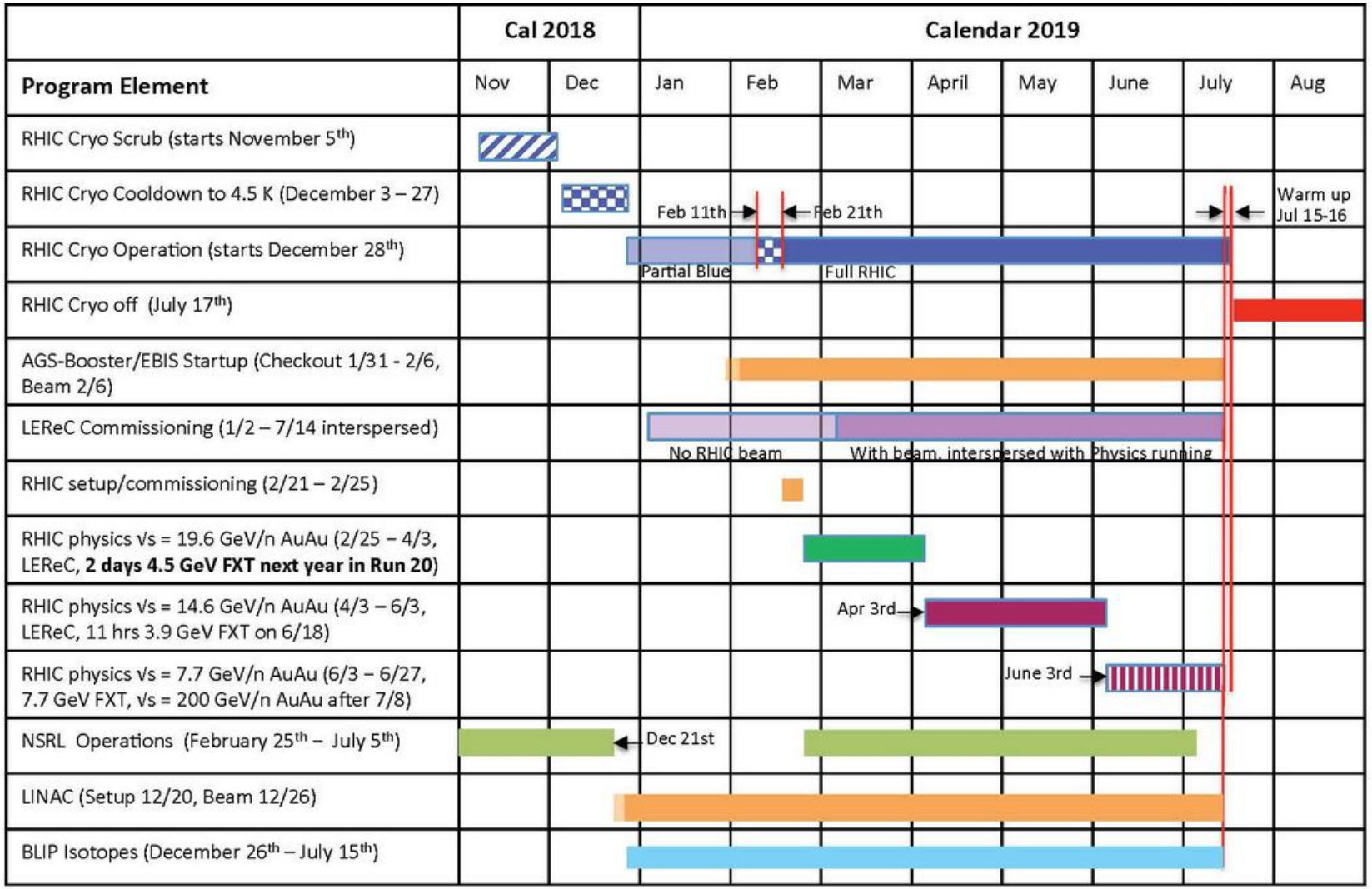
Run 2019 Planned Schedule



Note: Transition date from 7.7 GeV/n AuAu to 9.2 GeV/n AuAu is June 27th and FXT program is underway.

Run 2019 Schedule

- Blue Cooldown begins: 12/31/2018
- Blue 4.5K reached: 02/12/2019
- Yellow 4.5K cooldown begins: 02/16/2019
- Yellow 4.5K reached: 02/21/2019
- First circulating bunch (Au) in Blue: 02/19/2019
- First circulating bunch in Yellow (Au): 02/22/2019
- LEReC Running Start (Interleaved with physics throughout Run): 01/09/2019
- Physics Start for $^{197}Au^{79+}$ on $^{197}Au^{79+}$: 02/26/2019
- Fixed Target $^{197}Au^{79+}$ Start: 06/18/2019
- End Physics Operations: 07/12/2019
- Shutdown: 07/15/2019
- LEReC Running End: 07/15/2019
- Begin Cryo Warmup: 07/15/2019
- Cryo Warmup Complete: 07/22/2019

Mode Schedule

- Mode 1A: LEReC cooling commissioning with $^{197}Au^{79+}$ at 3.85GeV/nucleon
  - Beam operation: 07/09/2019 - 07/12/2019
- Mode 1B: $^{197}Au^{79+}$ on $^{197}Au^{79+}$ at 9.8GeV/nucleon
  - Beam operation: 02/18/2019 - 04/03/2019
- Mode 1C: $^{197}Au^{79+}$ on $^{197}Au^{79+}$ at 7.3GeV/nucleon
  - Beam operation: 04/03/2019 - 06/03/2019
- Mode 1D: $^{197}Au^{79+}$ at 7.3GeV/nucleon on fixed target ^{197}Au foil
  - Beam operation: 06/18/2019
- Mode 1E: $^{197}Au^{79+}$ on $^{197}Au^{79+}$ at 3.85GeV/nucleon
  - Beam operation: 06/03/2019 - 06/27/2019
- Mode 1F: $^{197}Au^{79+}$ at 3.85GeV/nucleon on fixed target ^{197}Au foil
  - Beam operation: 06/09/2019
- Mode 1G: LEReC cooling commissioning with $^{197}Au^{79+}$ at 4.59GeV/nucleon
  - Beam operation: 06/28/2019 - 07/15/2019
- Mode 1H: $^{197}Au^{79+}$ at 4.59GeV/nucleon on fixed target ^{197}Au foil
  - Beam operation: 06/28/2019 - 07/02/2019
- Mode 1I: $^{197}Au^{79+}$ on $^{197}Au^{79+}$ at 4.59GeV/nucleon
  - Beam operation: 07/02/2019 - 07/08/2019
- Mode 1J: $^{197}Au^{79+}$ at 31.2GeV/nucleon on fixed target ^{197}Au foil
  - Beam operation: 07/08/2019 - 07/09/2019
- Mode 1K: $^{197}Au^{79+}$ on $^{197}Au^{79+}$ at 100GeV/nucleon
  - Beam operation: 07/09/2019 - 07/12/2019

Run Coordinators

- **Chuyu Liu [RHIC and STAR Operations]**
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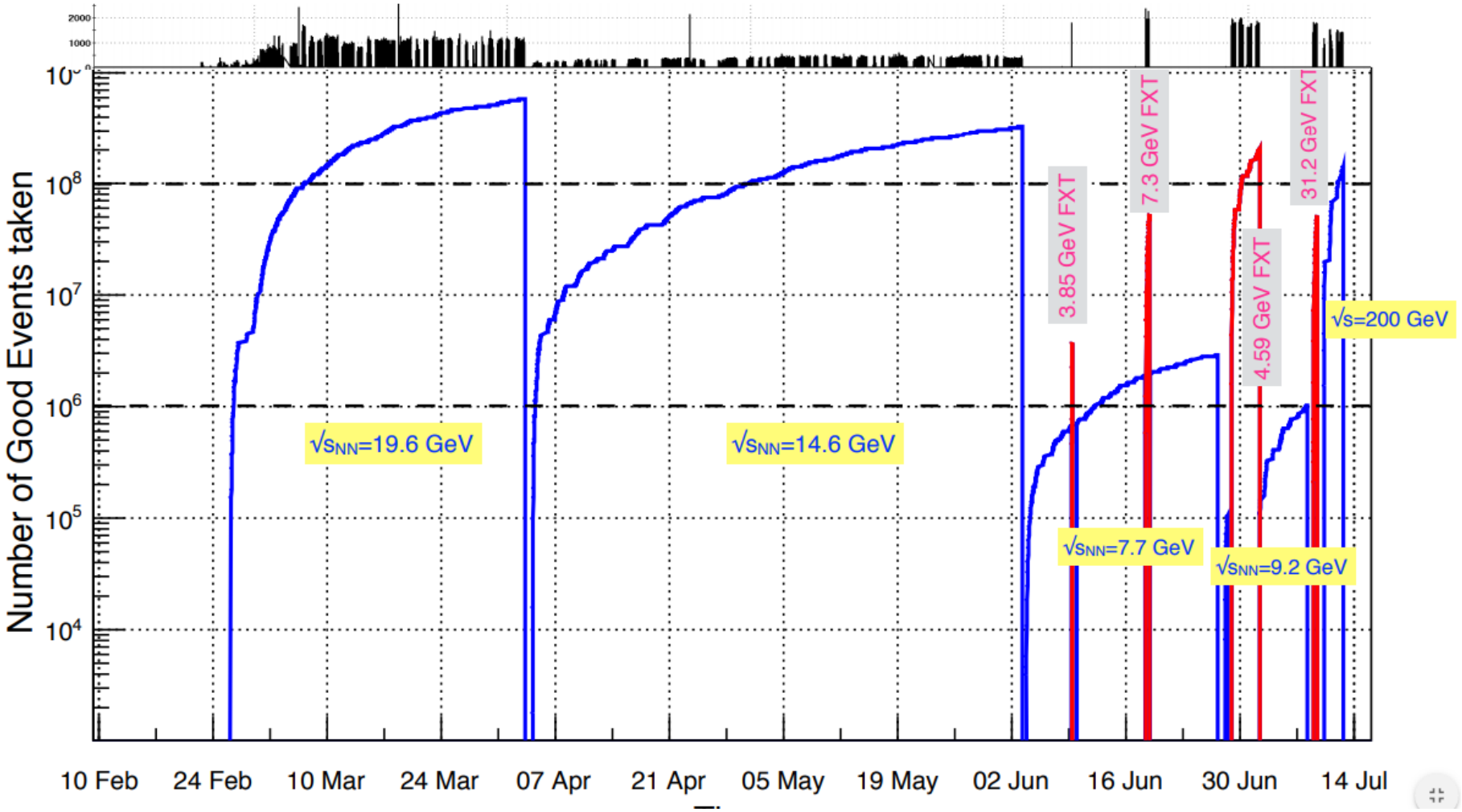
  - **Modes:** 1A, 1B, 1C, 1D, 1E, 1F, 1G, 1H, 1I, 1J, 1K
- **Alexei Fedotov [LEReC Operations]**
  - **Email:** fedotov@bnl.gov
  - **Office Phone:** (631) 344-5479
  - **Modes:** 1A, 1G
- **Dmitry Kayran [LEReC Operations]**
  - **Email:** dkayran@bnl.gov
  - **Office Phone:** (631) 344-5136
  - **Modes:** 1A, 1G

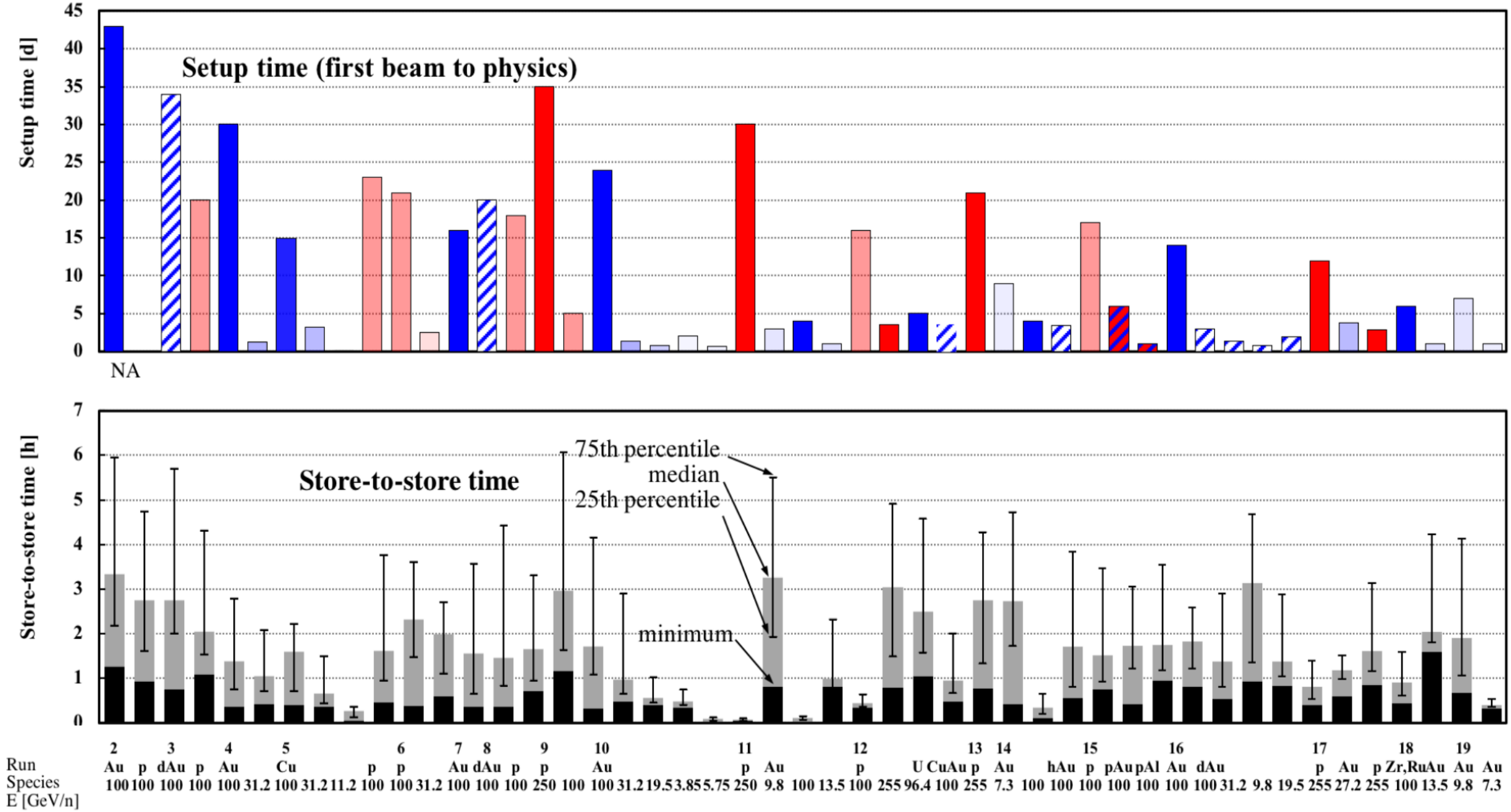
Run Overview

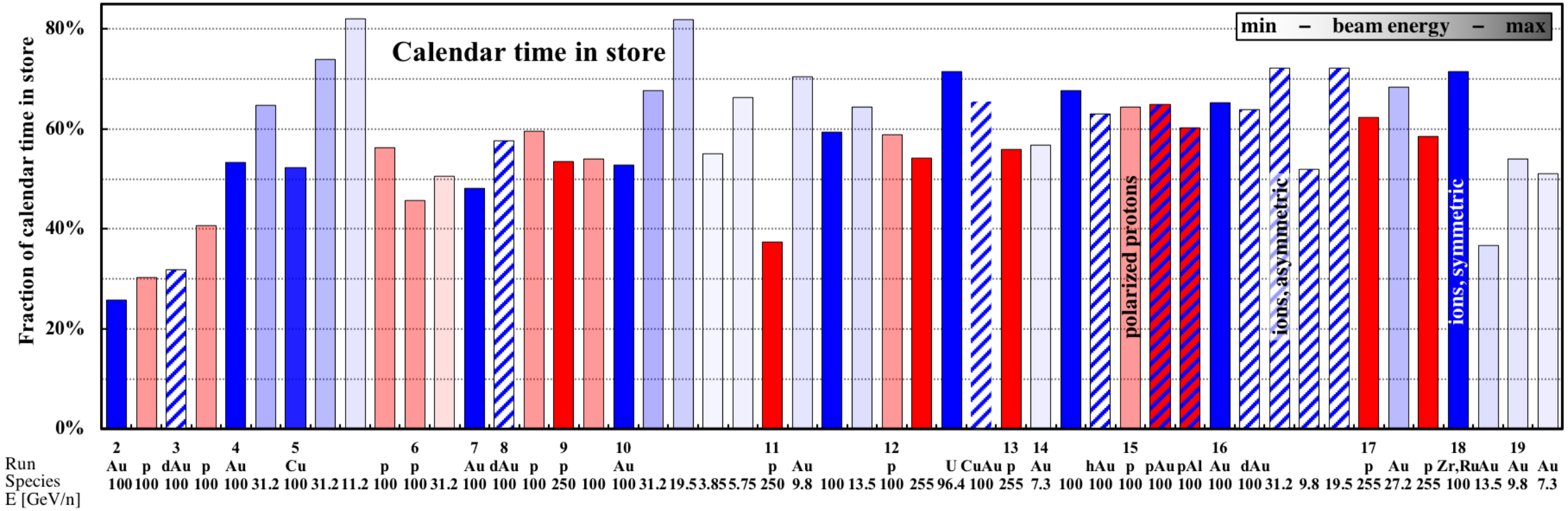
Good Events for All Modes



Basic Run Parameters

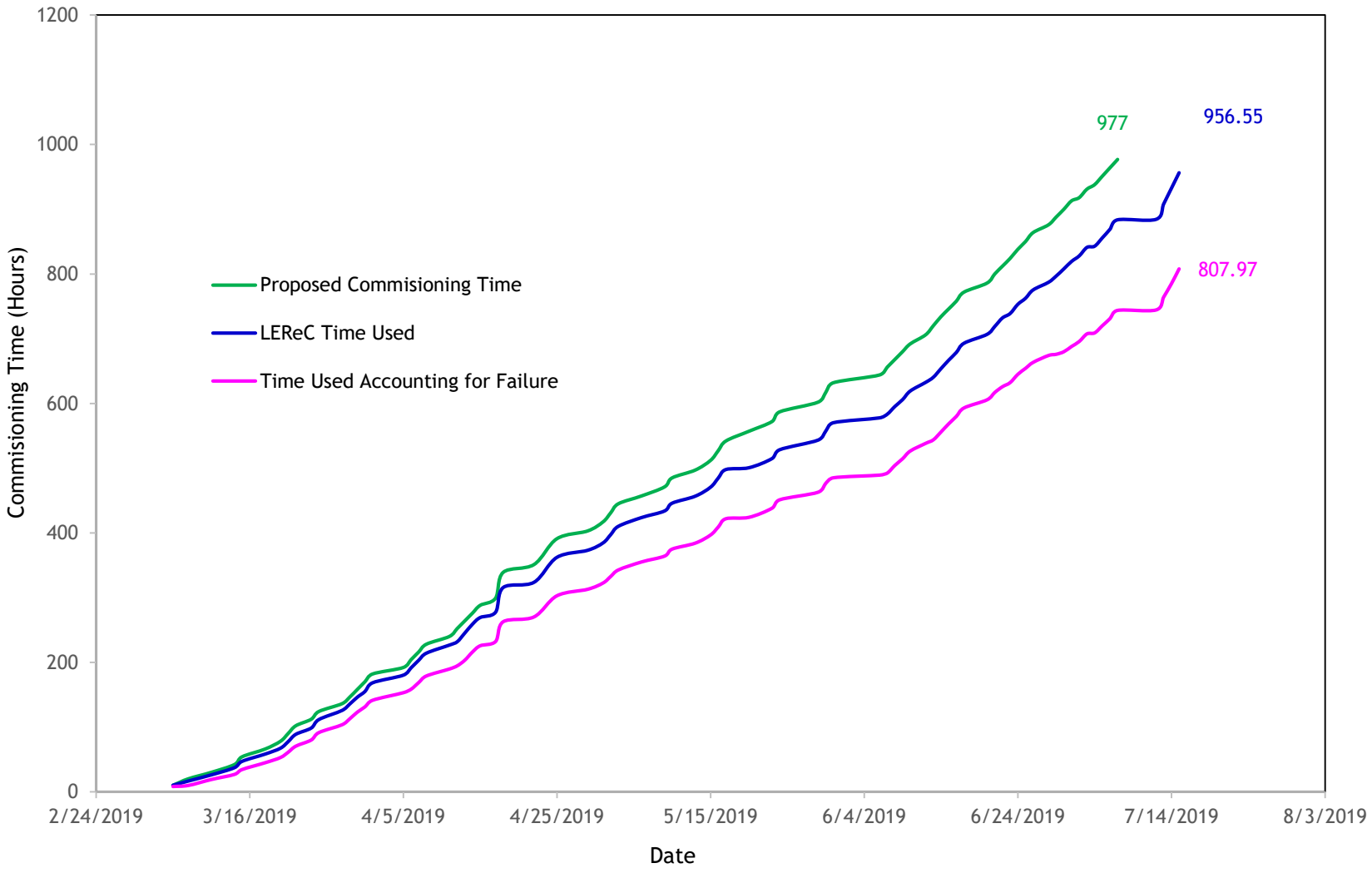
Mode Name	Energy/ Nucleon [GeV]	No. Bunches	Ions/bunch [10^9]	B* [m]	rms emittance [μm]	L_{peak} [$cm^{-2}s^{-1}$]	L_{store} avg [$cm^{-2}s^{-1}$]	STAR Luminosity [μb^{-1}]
1B	9.8	111	1.85	2.3	1.8→2.4	5.0×10^{26}	1.5×10^{26}	151
1C	7.3	111	1.75	3.0	2.2→2.45	2.1×10^{26}	7.9×10^{25}	132
1D	7.3	12	1.4	10	2.0→2.8			
1E	3.85	111	0.615	4.5	1.5→1.4	1.3×10^{25}	6.9×10^{24}	3.57
1F	3.85	12	0.73	10	1.25→1.25			
1H	4.59	12	0.65	10	1.25→1.75			
1I	4.59	111	0.8	4.5	1.5→1.8	25×10^{24}	17×10^{24}	
1J	31.2	12	0.9	5	1.8→4.2			
1K	100	111	0.85	0.7	1.35→2.0	12×10^{26}	10×10^{26}	80


Setup time (first beam to physics)
Setup time [d]
NA
Store-to-store time
Store-to-store time [h]
75th percentile
median
25th percentile
minimum
Run
Species
E [GeV/n]
2 Au 100
3 p 100 dAu 100
4 p 100 Au 100
5 31.2 Cu 100
31.2 11.2
p 100
6 p 100
31.2
7 Au 100
8 dAu 100
p 100
9 p 250
100
10 Au 100
31.2 19.5 3.85 5.75
11 p 250
Au 9.8
100 13.5
12 p 100
255 96.4
U 100
CuAu 255
13 p 255
14 Au 7.3
100 100
hAu 100
15 p 100
pAu 100
pAl 100
16 Au 100
dAu 100
31.2 9.8 19.5
17 p 255
Au 27.2
p 255
18 Zr,Ru 100
Au 13.5
19 Au 9.8
Au 7.3


Calendar time in store
min – beam energy – max
Fraction of calendar time in store
80%
60%
40%
20%
0%
polarized protons
ions, asymmetric
ions, symmetric
Run
Species
E [GeV/n]
2 Au 100
p 100
3 dAu 100
p 100
4 Au 100
31.2
5 Cu 100
31.2
11.2
p 100
6 p 100
31.2
7 Au 100
8 dAu 100
p 100
9 p 250
100
10 Au 100
31.2
19.5
3.85
5.75
11 p 250
Au 9.8
100
13.5
12 p 100
255
U 96.4
CuAu 100
13 p 255
14 Au 7.3
100
hAu 100
15 p 100
pAu 100
pAl 100
16 Au 100
dAu 100
31.2
9.8
19.5
17 p 255
Au 27.2
p 255
18 Zr,Ru 100
Au 13.5
19 Au 9.8
Au 7.3

LEReC Cooling

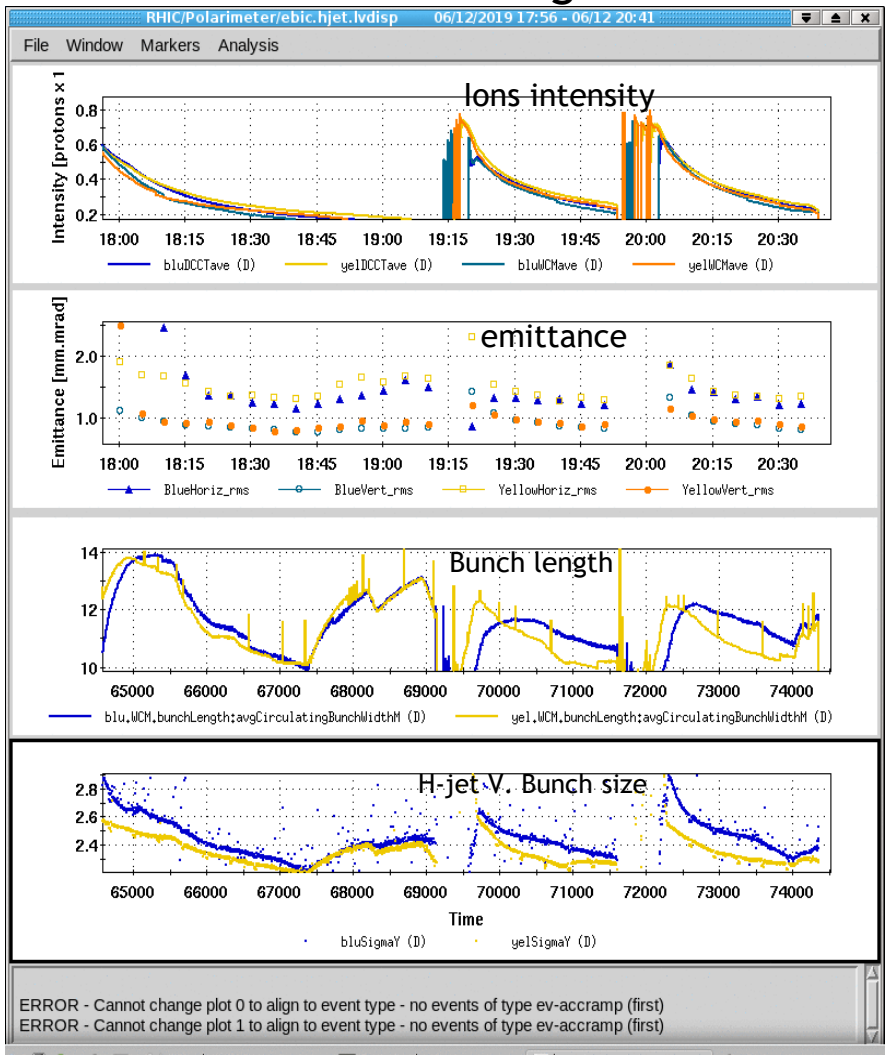
LEReC Time Used for 3.85 and 4.59 GeV



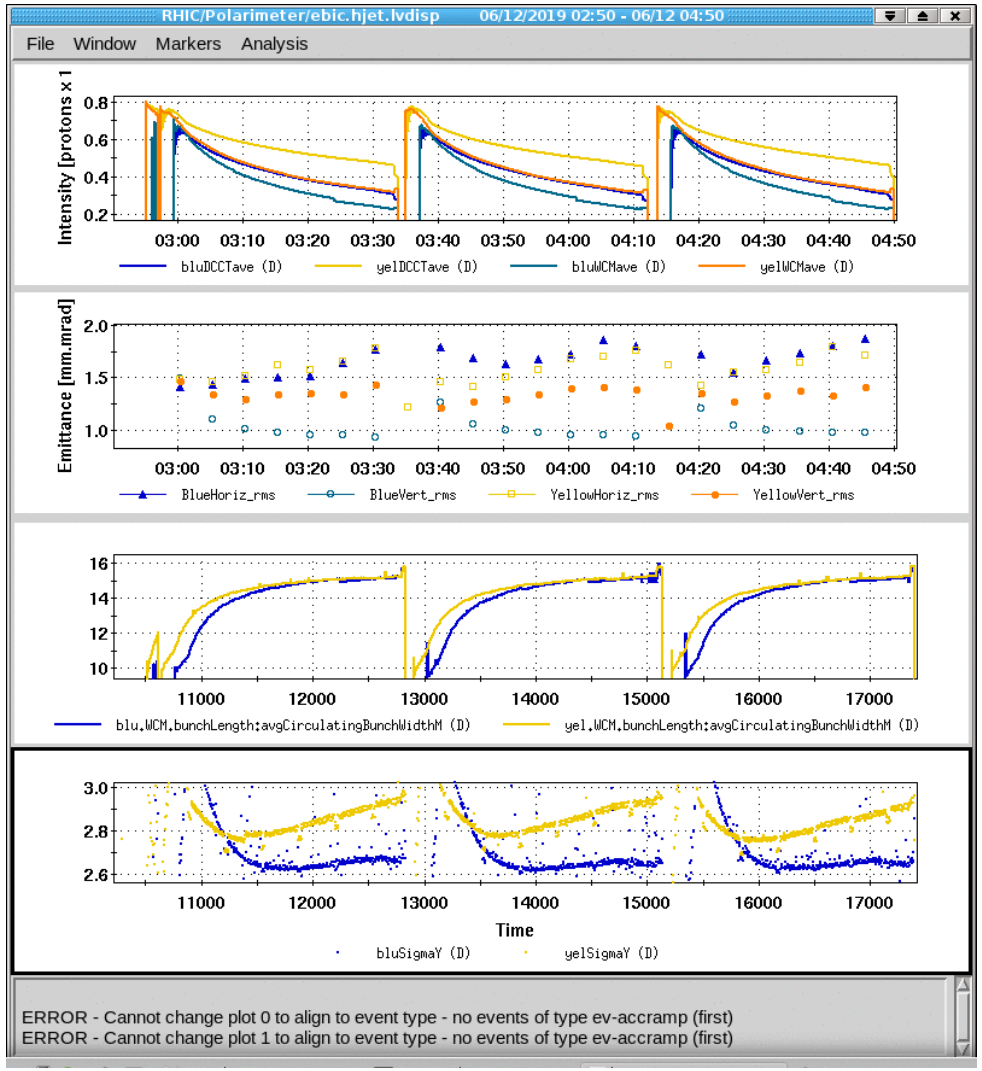
Images courtesy of A. Fedotov

LEReC 3.85 GeV Cooling

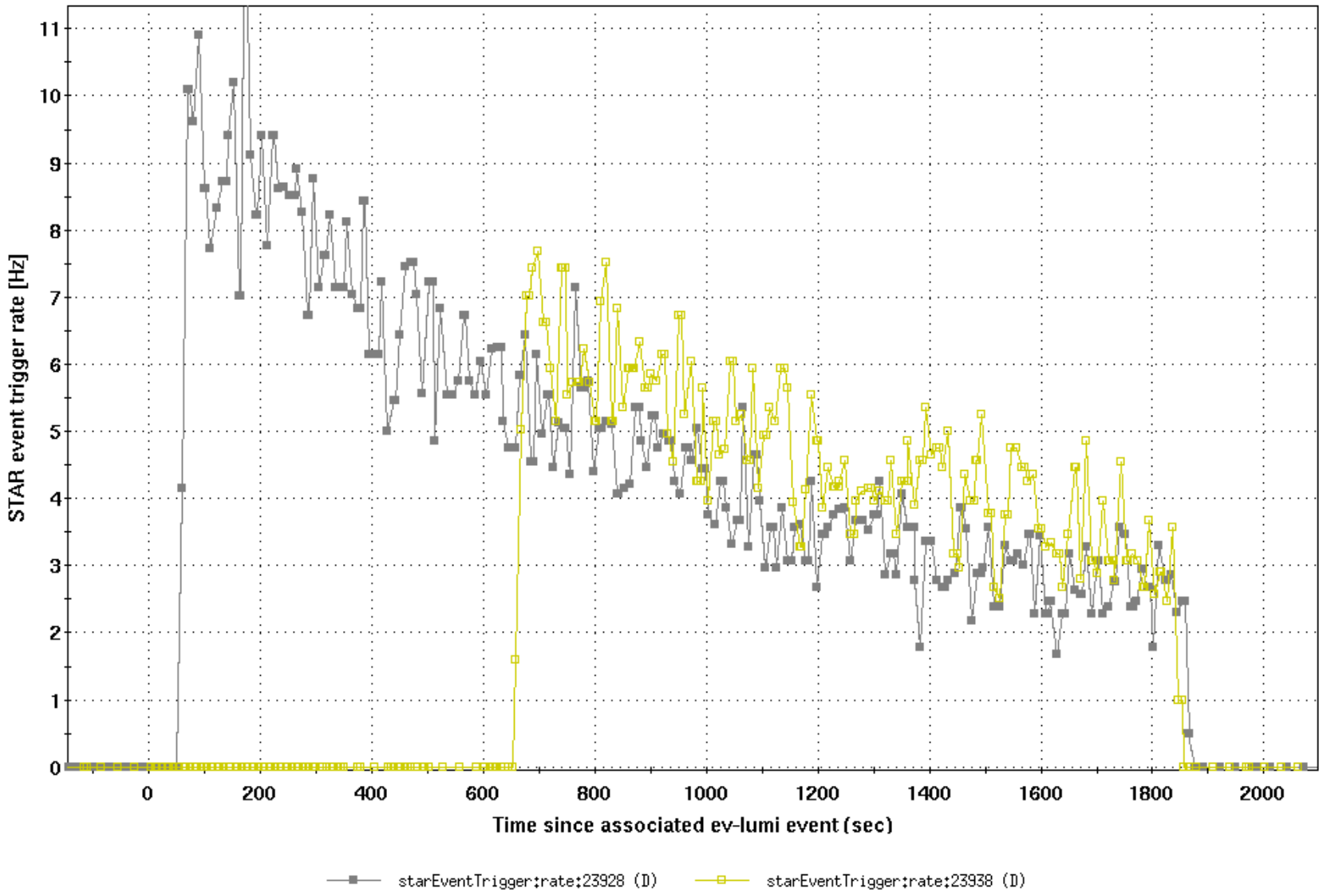
With cooling



No cooling

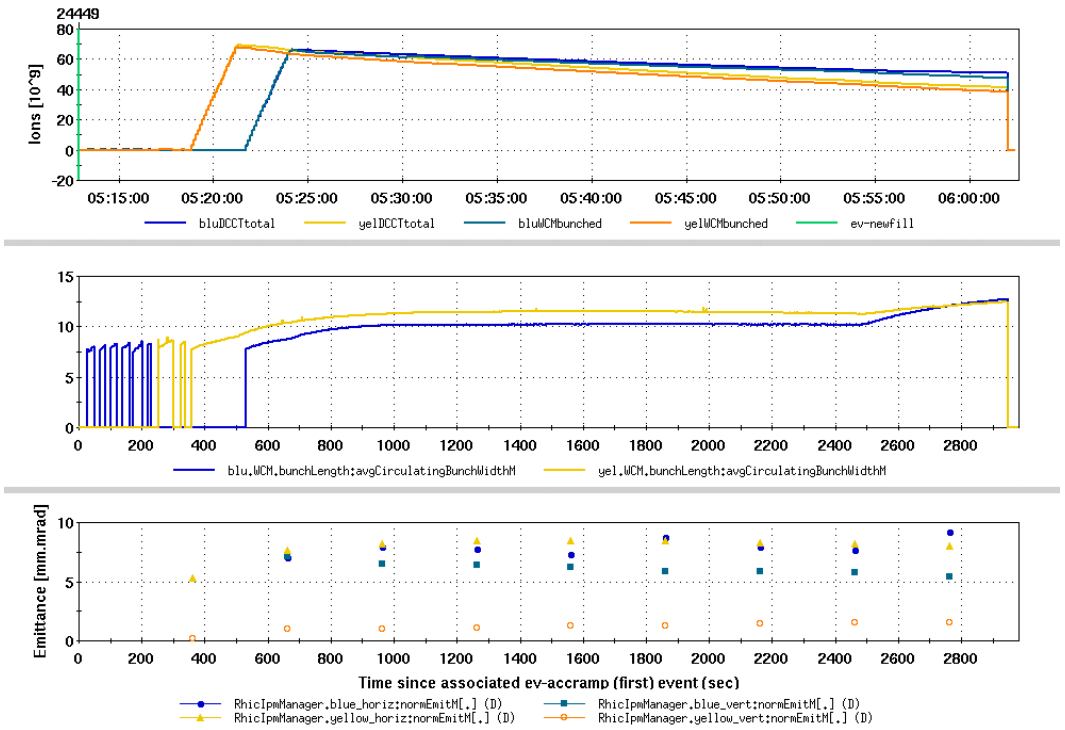


STAR Event Rate for 3.85GeV Example Store with cooling (yellow) vs without cooling (gray).

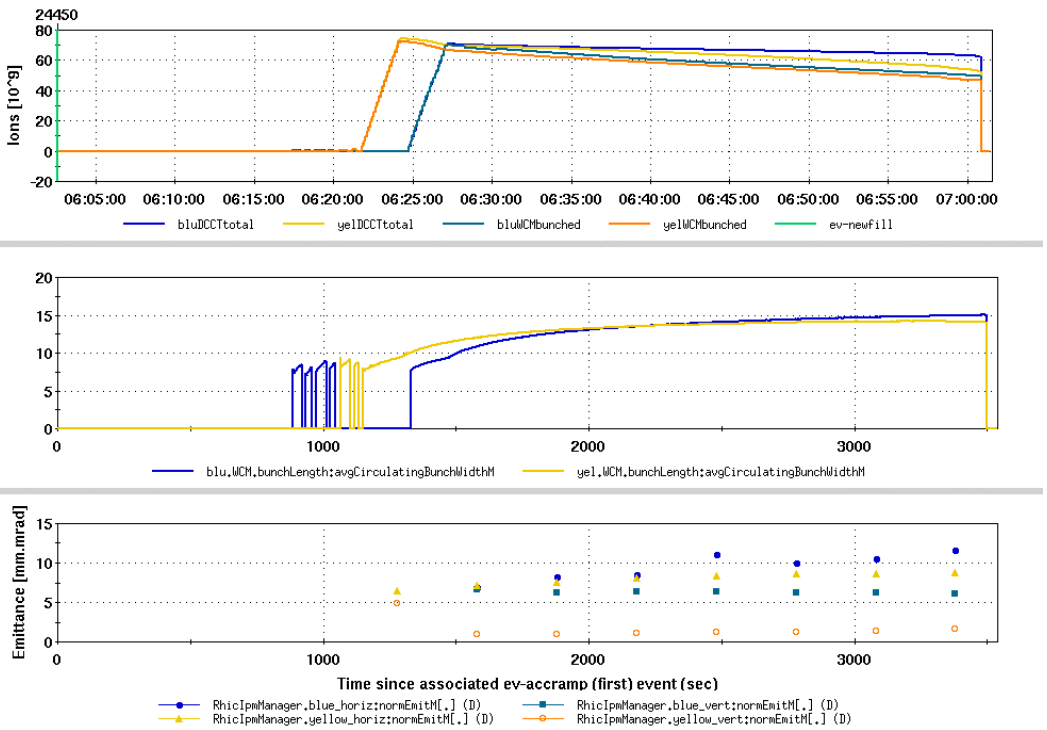


LEReC 4.59 GeV Cooling

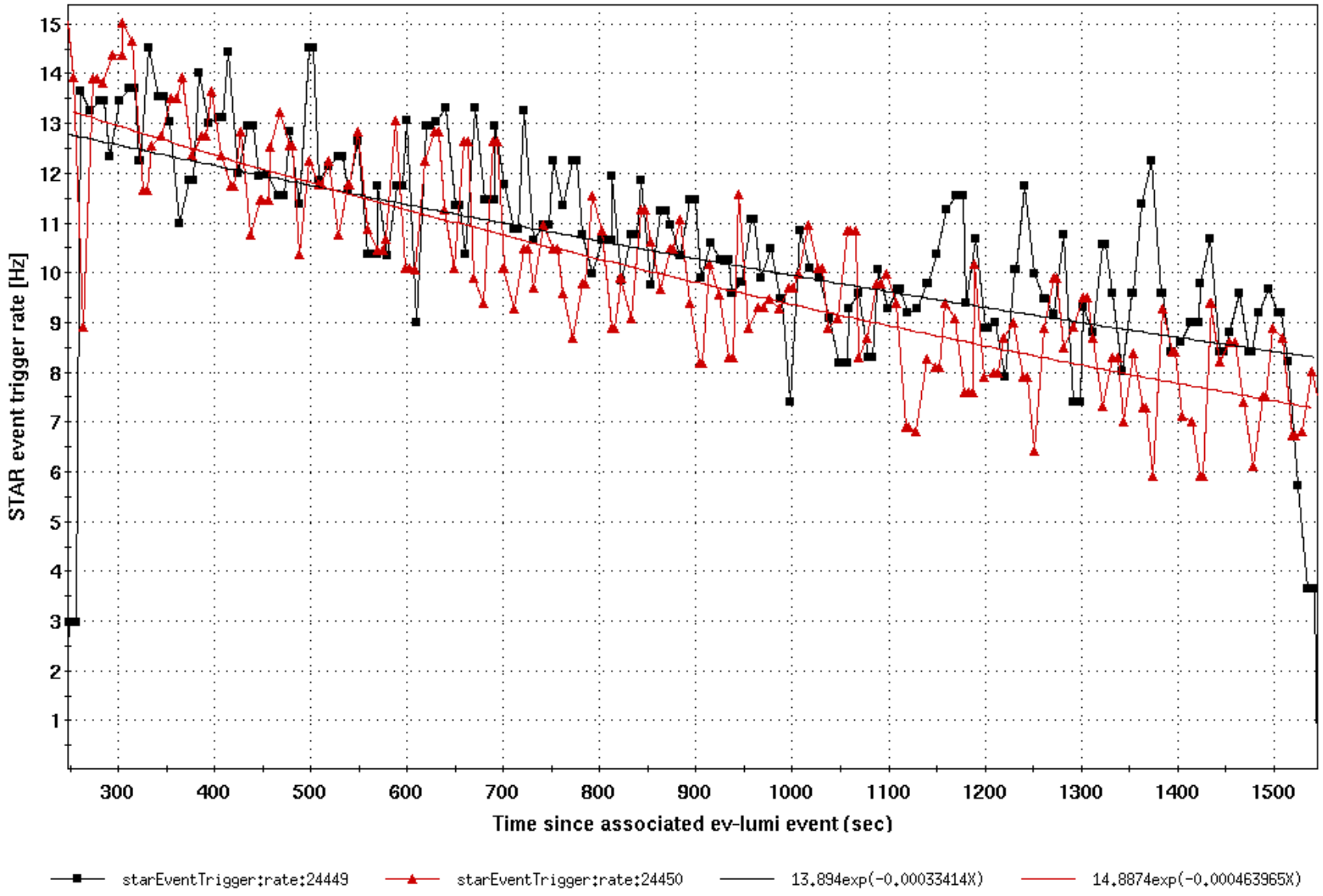
4.59GeV Store With Cooling



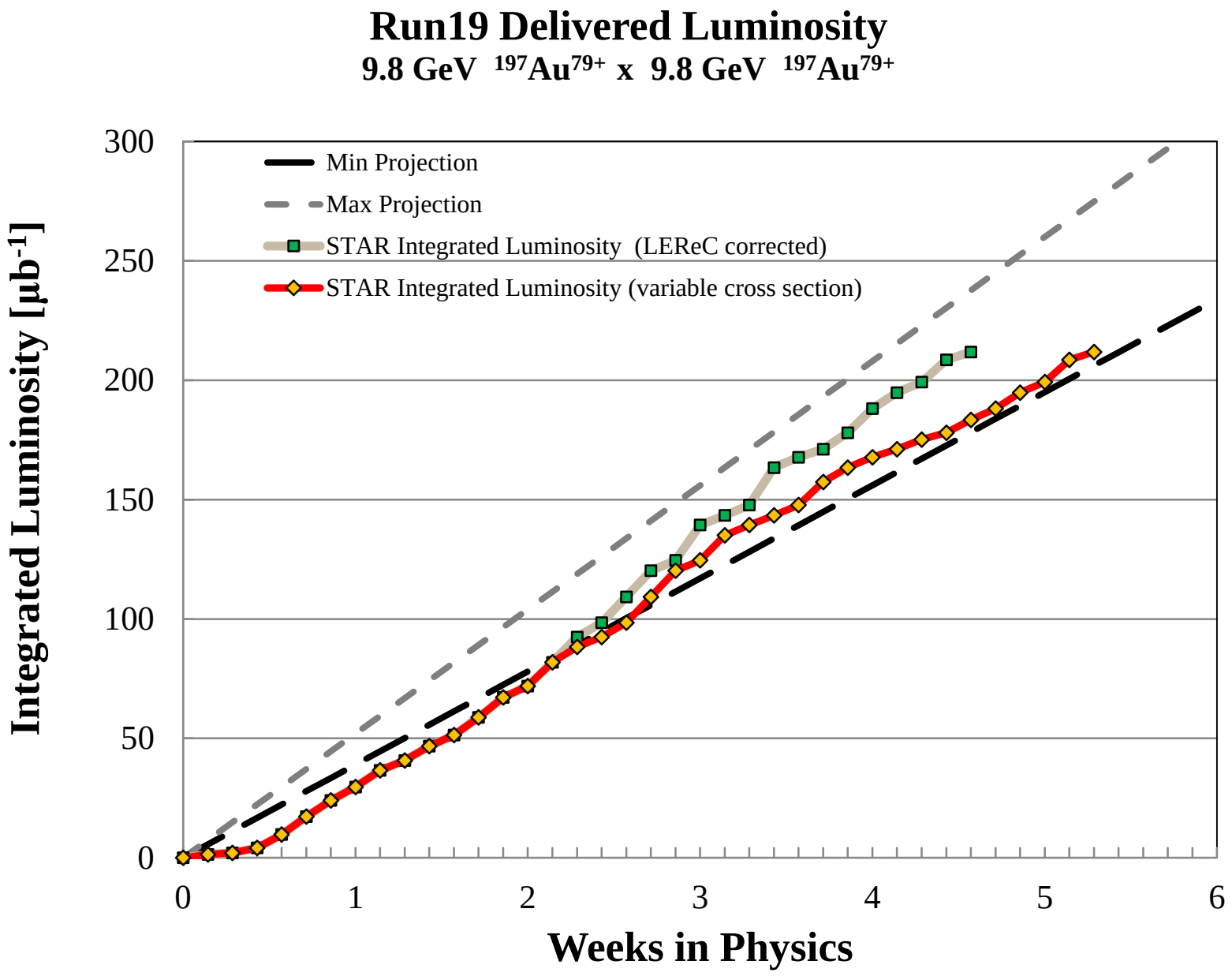
4.59GeV Store Without Cooling

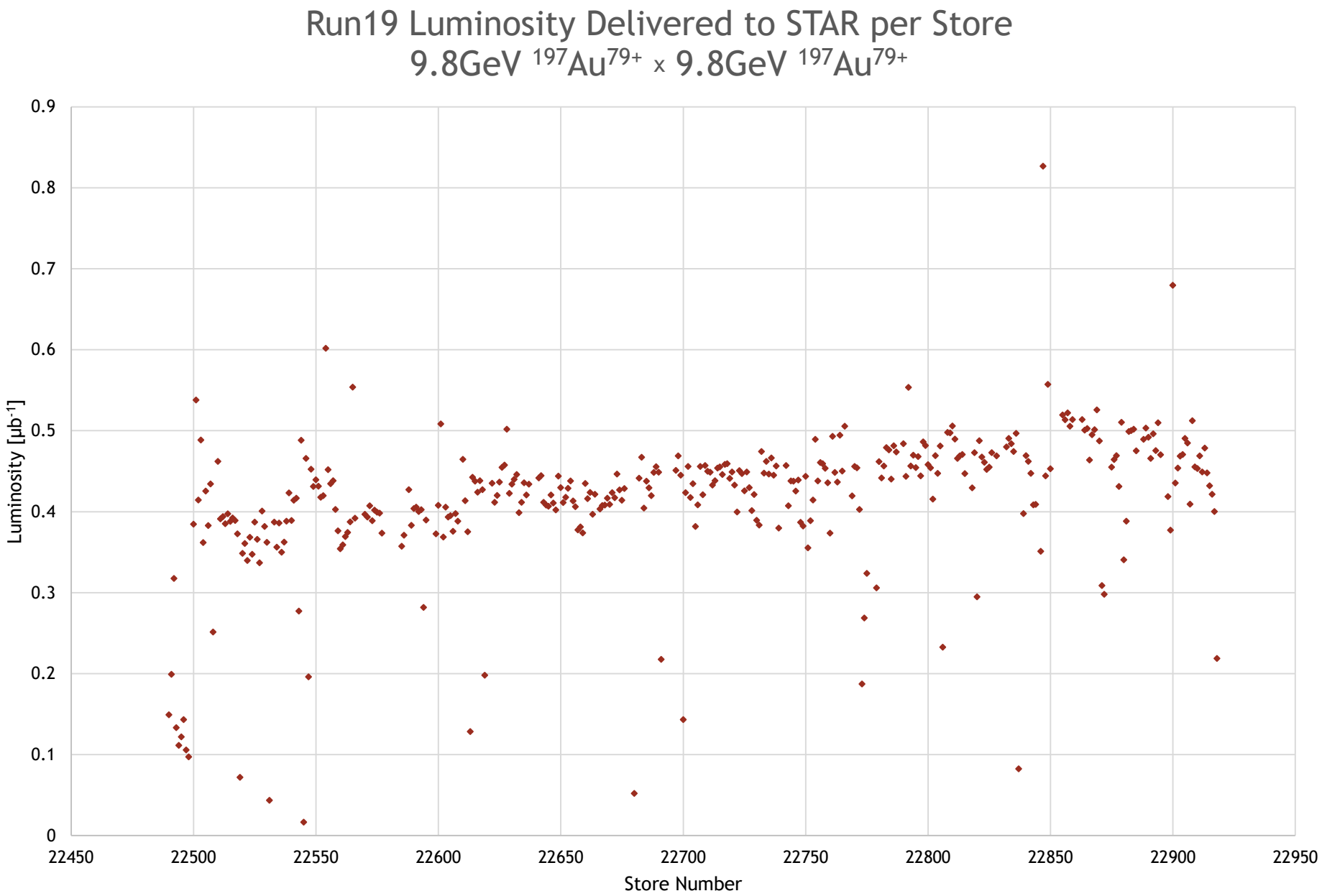


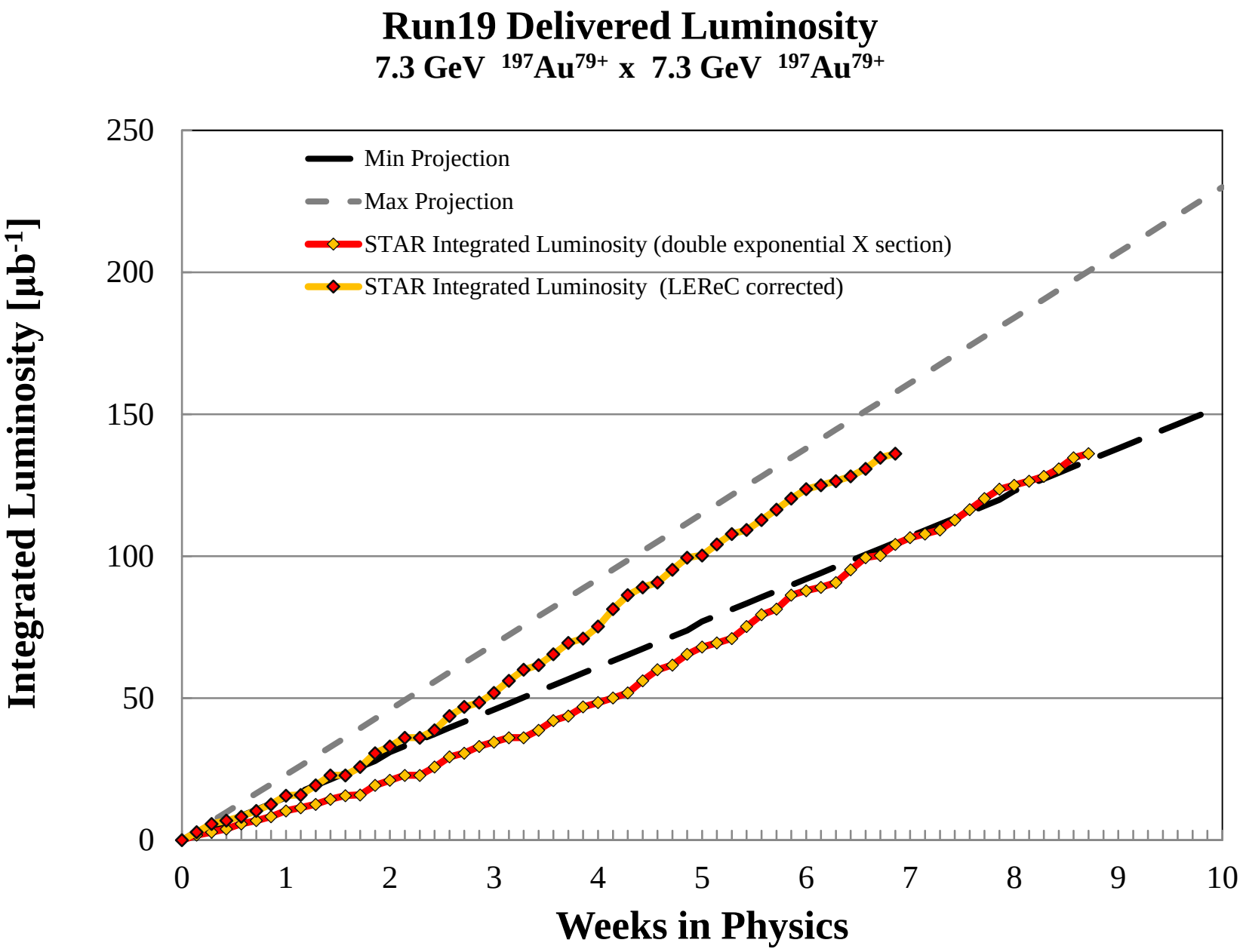
STAR Event Rate for 4.59GeV Example store with cooling (black) vs without cooling (red).

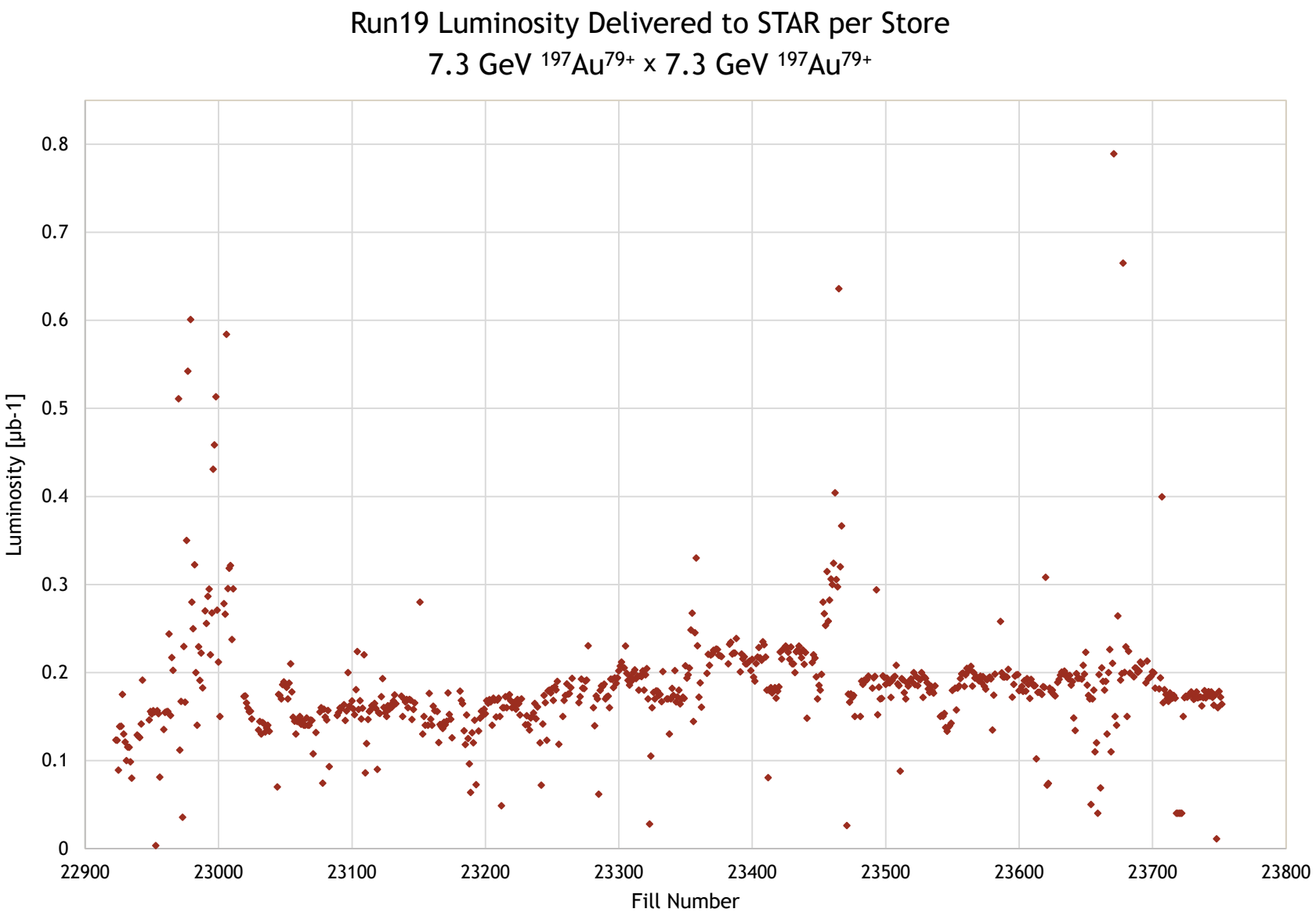


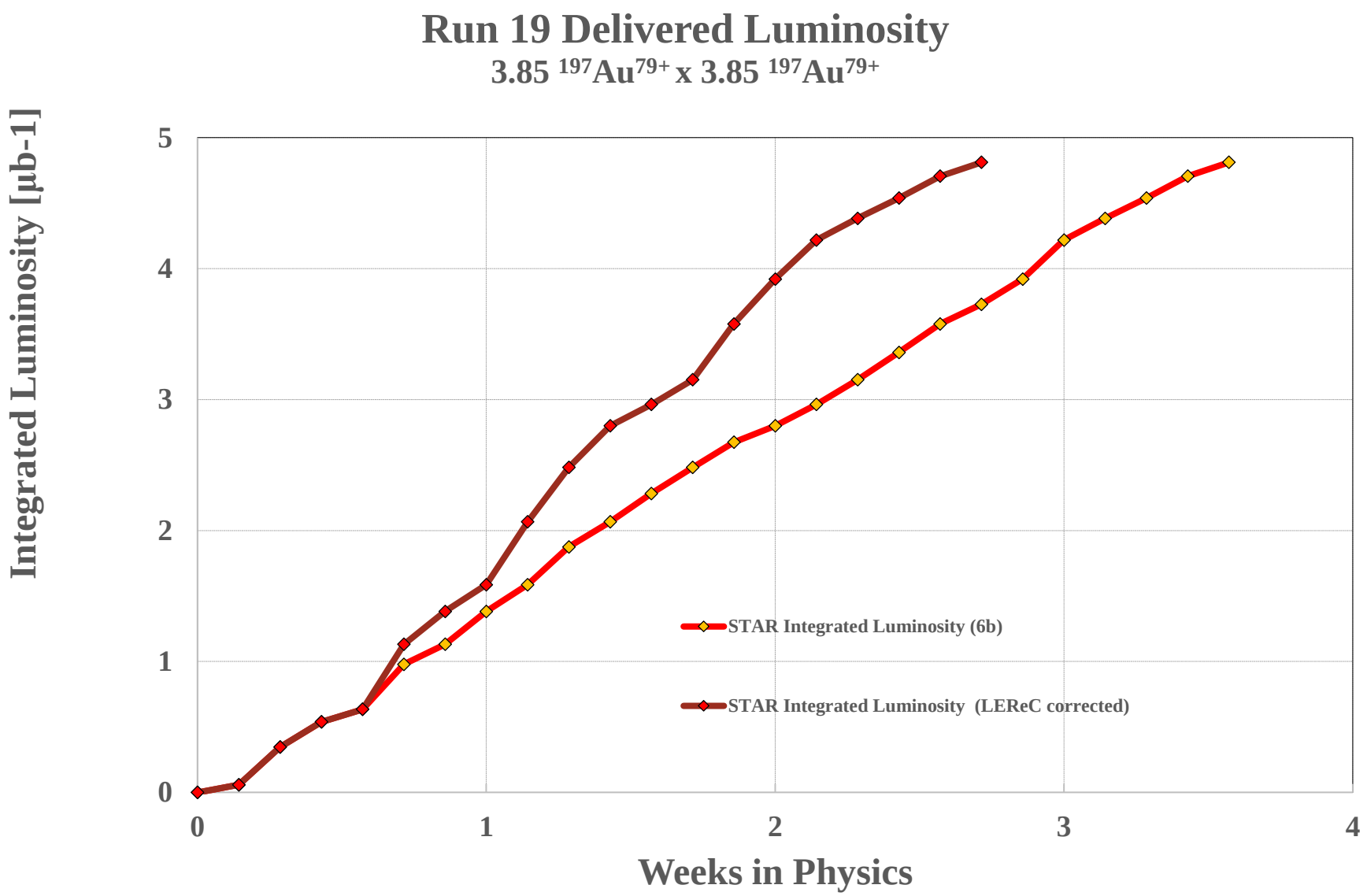
Luminosity for $^{197}Au^{79+}$ on $^{197}Au^{79+}$ Physics


Run19 Delivered Luminosity
9.8 GeV $^{197}Au^{79+}$ x 9.8 GeV $^{197}Au^{79+}$
Min Projection
Max Projection
STAR Integrated Luminosity (LEReC corrected)
STAR Integrated Luminosity (variable cross section)
Integrated Luminosity [μb^{-1}]
300
250
200
150
100
50
0
0
1
2
3
4
5
6
Weeks in Physics

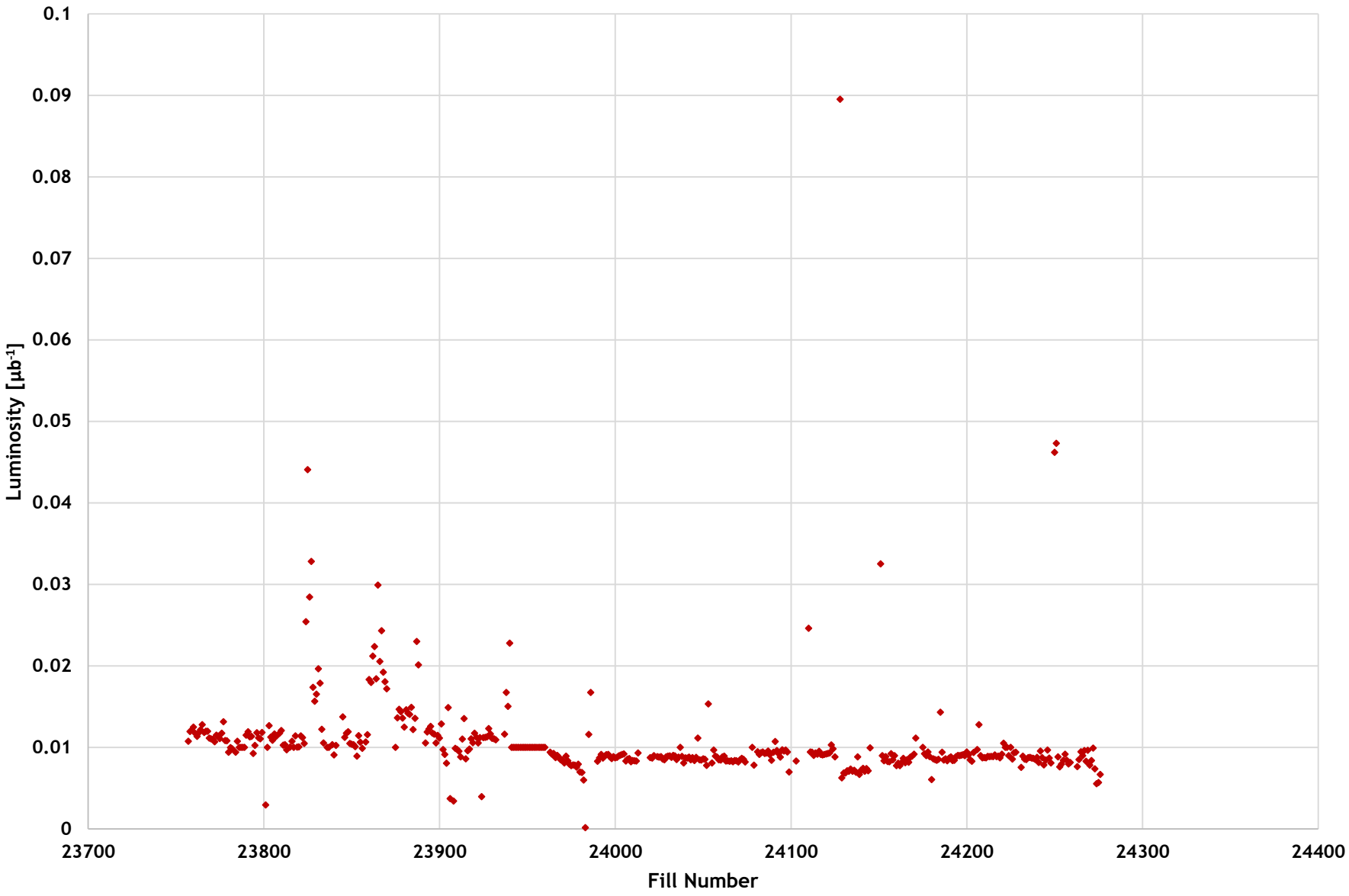

Run19 Luminosity Delivered to STAR per Store
9.8GeV $^{197}Au^{79+}$ x 9.8GeV $^{197}Au^{79+}$
Luminosity [μb⁻¹]
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
22450
22500
22550
22600
22650
22700
22750
22800
22850
22900
22950
Store Number


Run19 Delivered Luminosity
7.3 GeV $^{197}Au^{79+}$ x 7.3 GeV $^{197}Au^{79+}$
Min Projection
Max Projection
STAR Integrated Luminosity (double exponential X section)
STAR Integrated Luminosity (LEReC corrected)
Integrated Luminosity [μb^{-1}]
250
200
150
100
50
0
0
1
2
3
4
5
6
7
8
9
10
Weeks in Physics

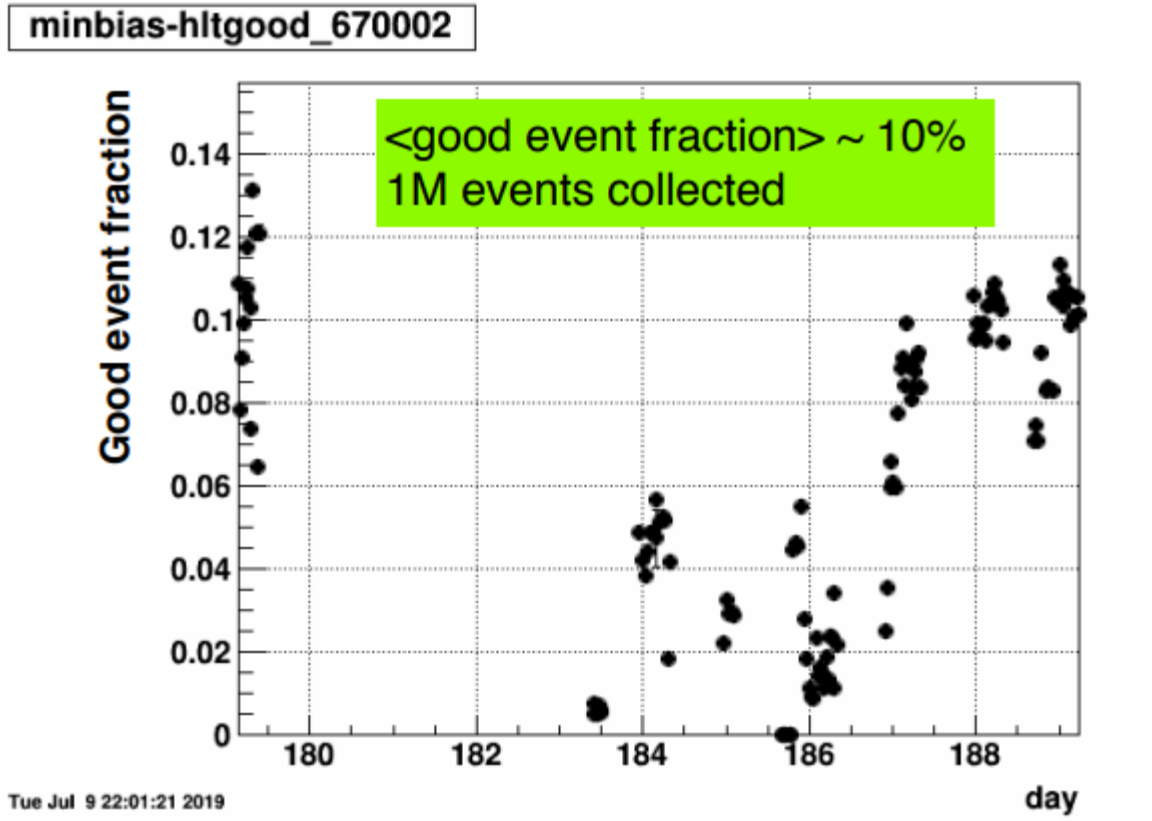

Run19 Luminosity Delivered to STAR per Store
7.3 GeV $^{197}Au^{79+}$ x 7.3 GeV $^{197}Au^{79+}$
Luminosity [μb-1]
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
22900
23000
23100
23200
23300
23400
23500
23600
23700
23800
Fill Number

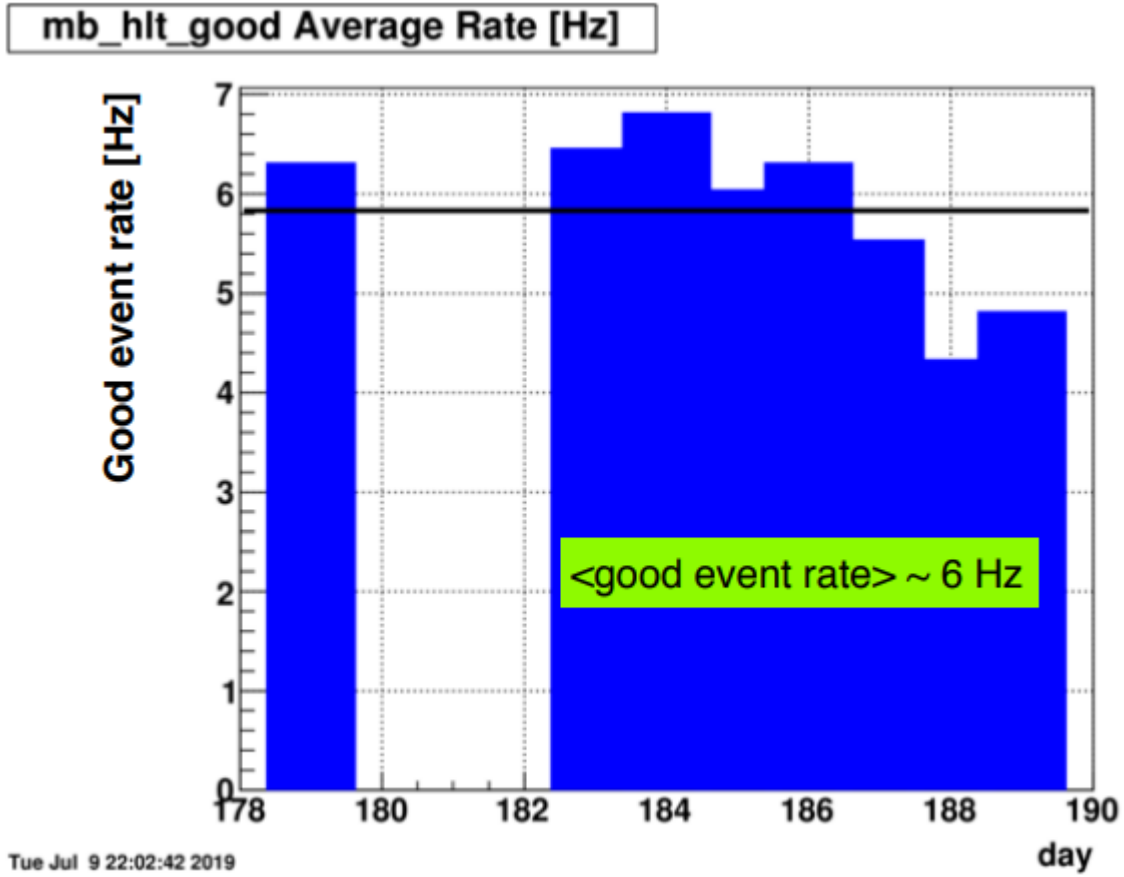

Run 19 Delivered Luminosity
3.85 197Au79+ x 3.85 197Au79+
Integrated Luminosity [µb-1]
5
4
3
2
1
0
0
1
2
3
4
Weeks in Physics
STAR Integrated Luminosity (6b)
STAR Integrated Luminosity (LEReC corrected)

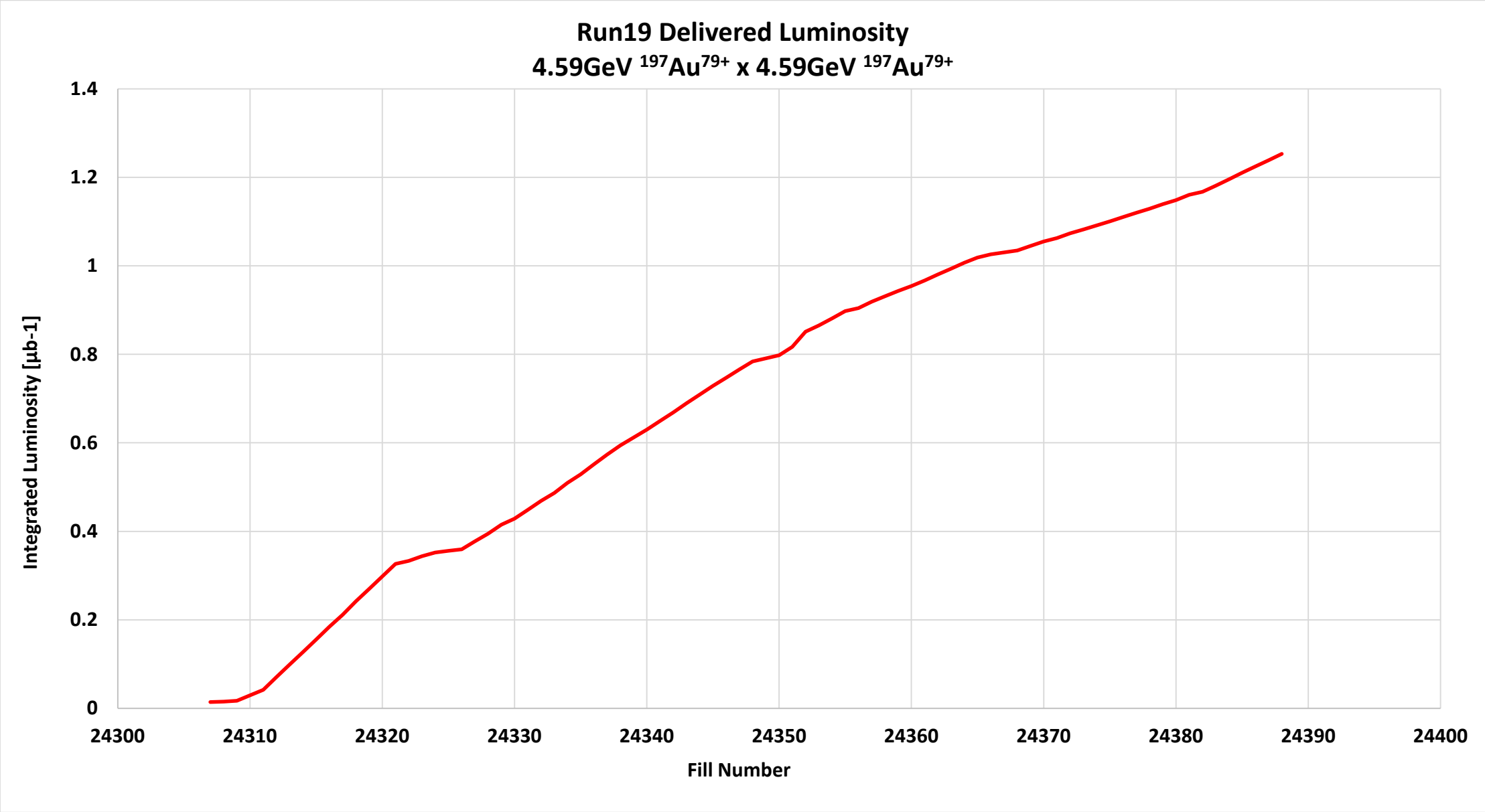
Run19 Luminosity Delivered to STAR per Store
3.85 GeV $^{197}Au^{79+}$ x 3.85 GeV $^{197}Au^{79+}$

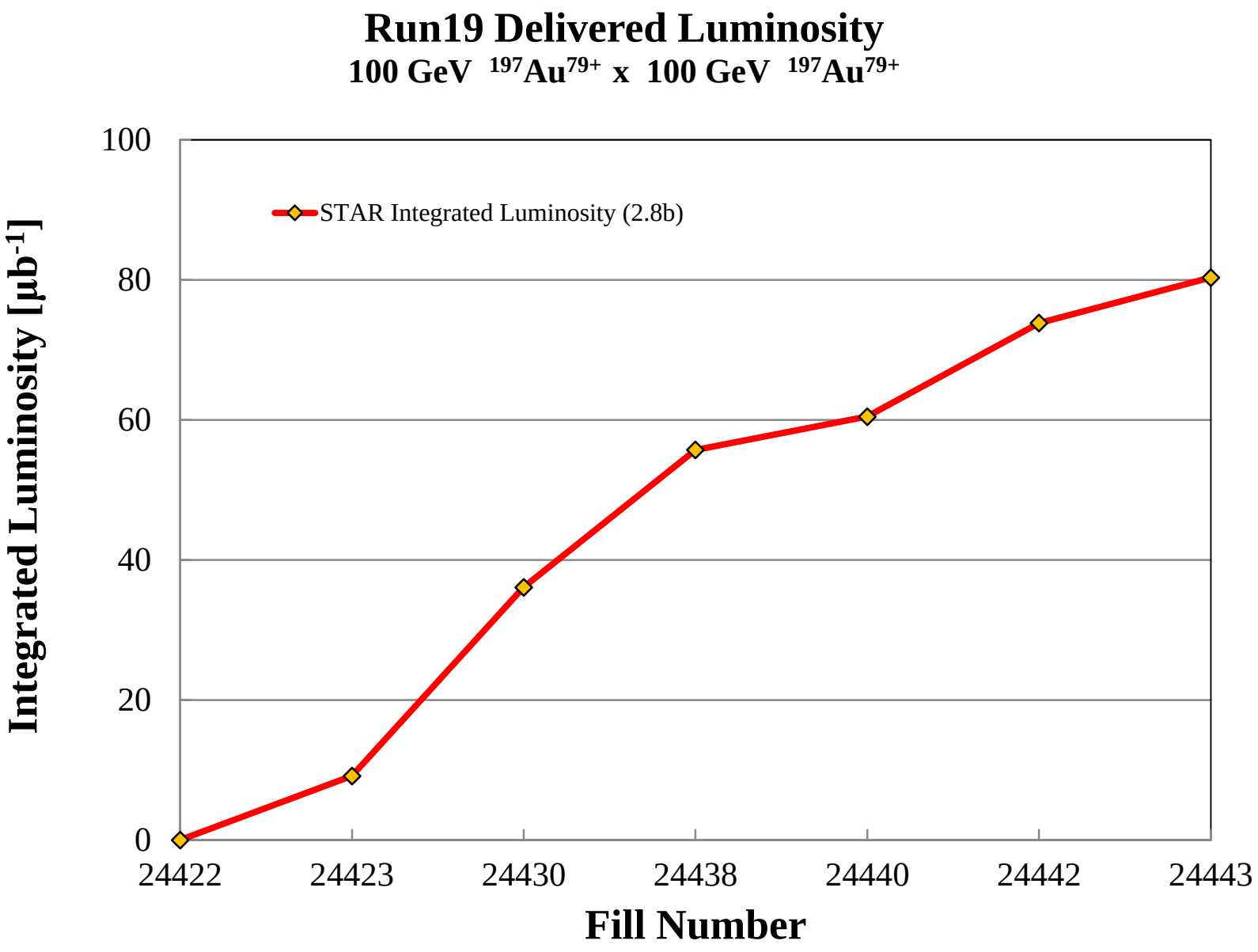


STAR 4.59GeV $^{197}Au^{79+}$ x 4.59GeV $^{197}Au^{79+}$ Analysis






Run19 Delivered Luminosity
4.59GeV $^{197}Au^{79+}$ x 4.59GeV $^{197}Au^{79+}$
Integrated Luminosity [µb-1]
1.4
1.2
1
0.8
0.6
0.4
0.2
0
24300
24310
24320
24330
24340
24350
24360
24370
24380
24390
24400
Fill Number

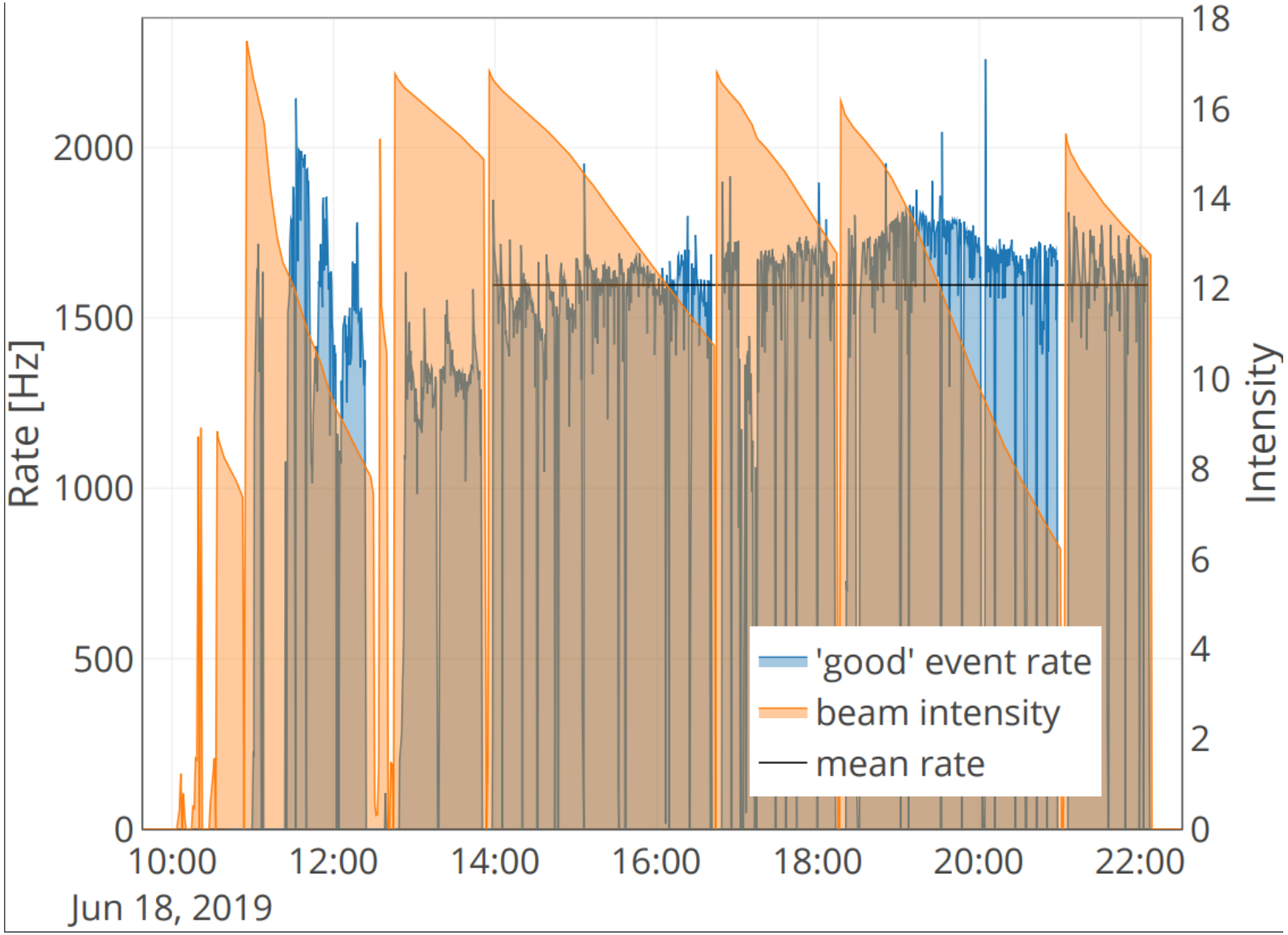

Run19 Delivered Luminosity
100 GeV $^{197}Au^{79+}$ x 100 GeV $^{197}Au^{79+}$
STAR Integrated Luminosity (2.8b)
Integrated Luminosity [μb^{-1}]
100
80
60
40
20
0
24422
24423
24430
24438
24440
24442
24443
Fill Number

$^{197}Au^{79+}$ Physics on Fixed Target ^{197}Au foil

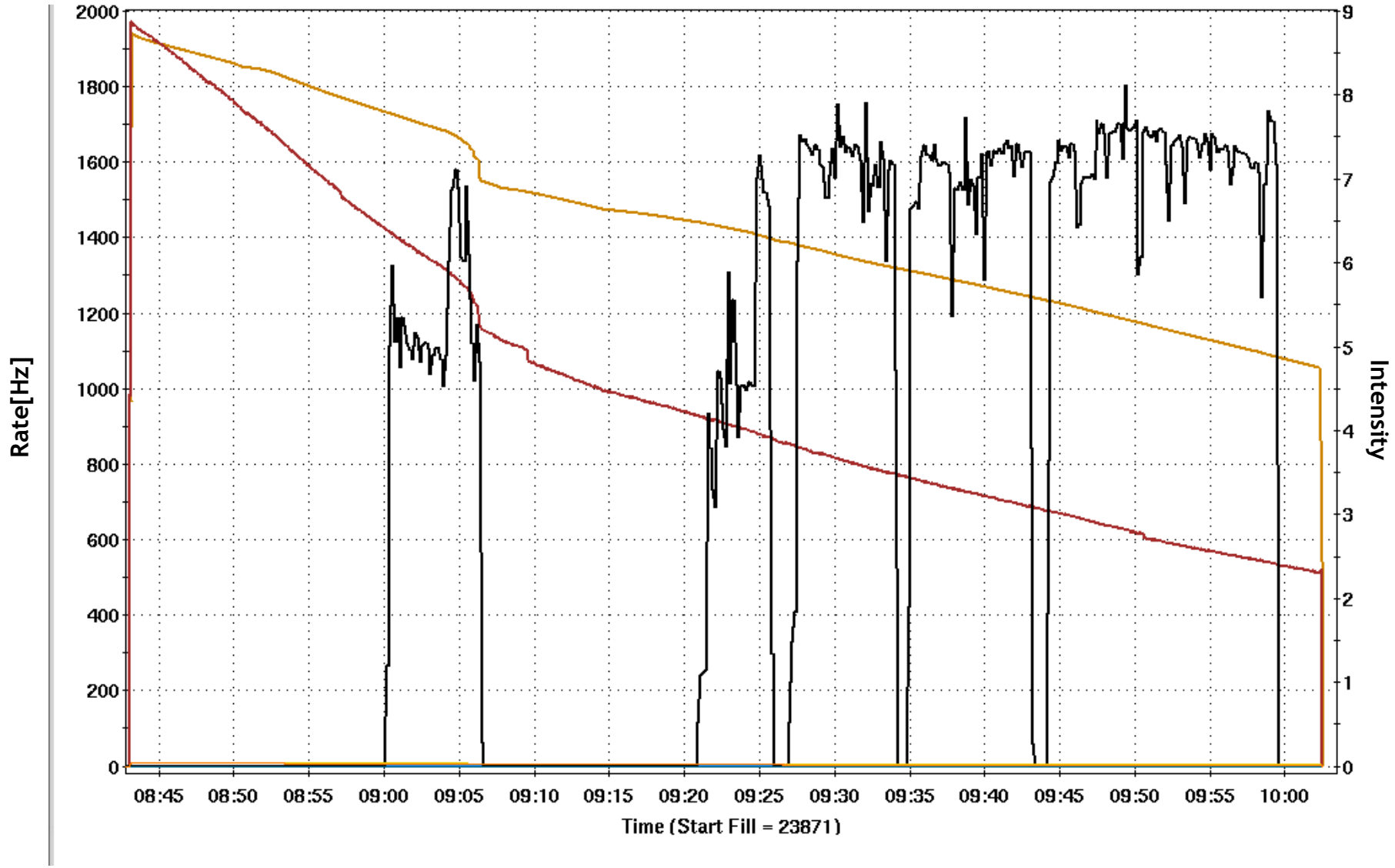
Basic Fixed Target Numbers

Energy/Nucleon	Time in Physics [Hrs]	Total Events
7.3GeV	11	52.7M
3.85GeV	2	3.71M
4.59GeV	48	200.6M
31.2GeV	12.75	50.6M

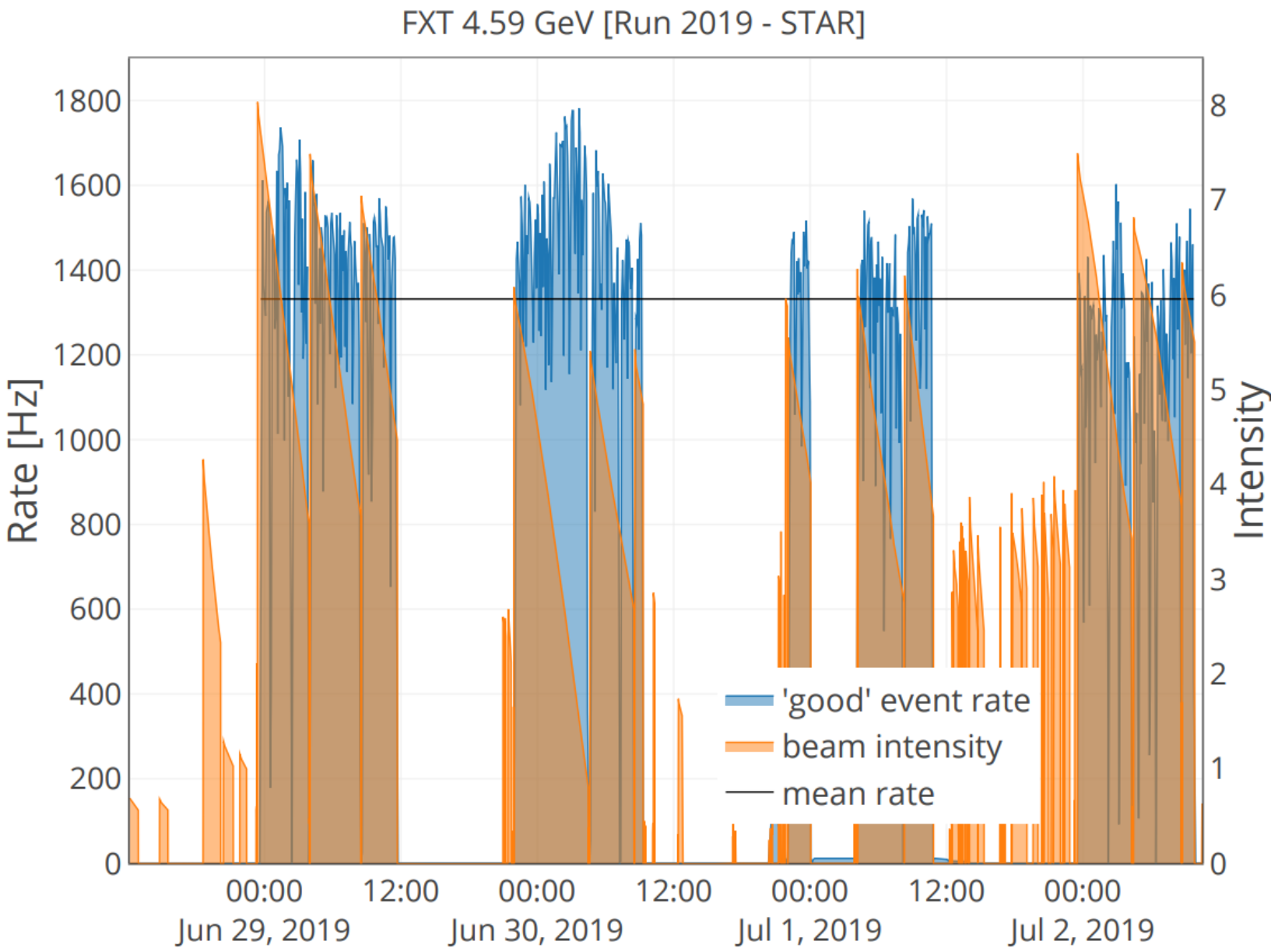
$^{197}Au^{79+}$ at 7.3GeV/nucleon on fixed target ^{197}Au foil



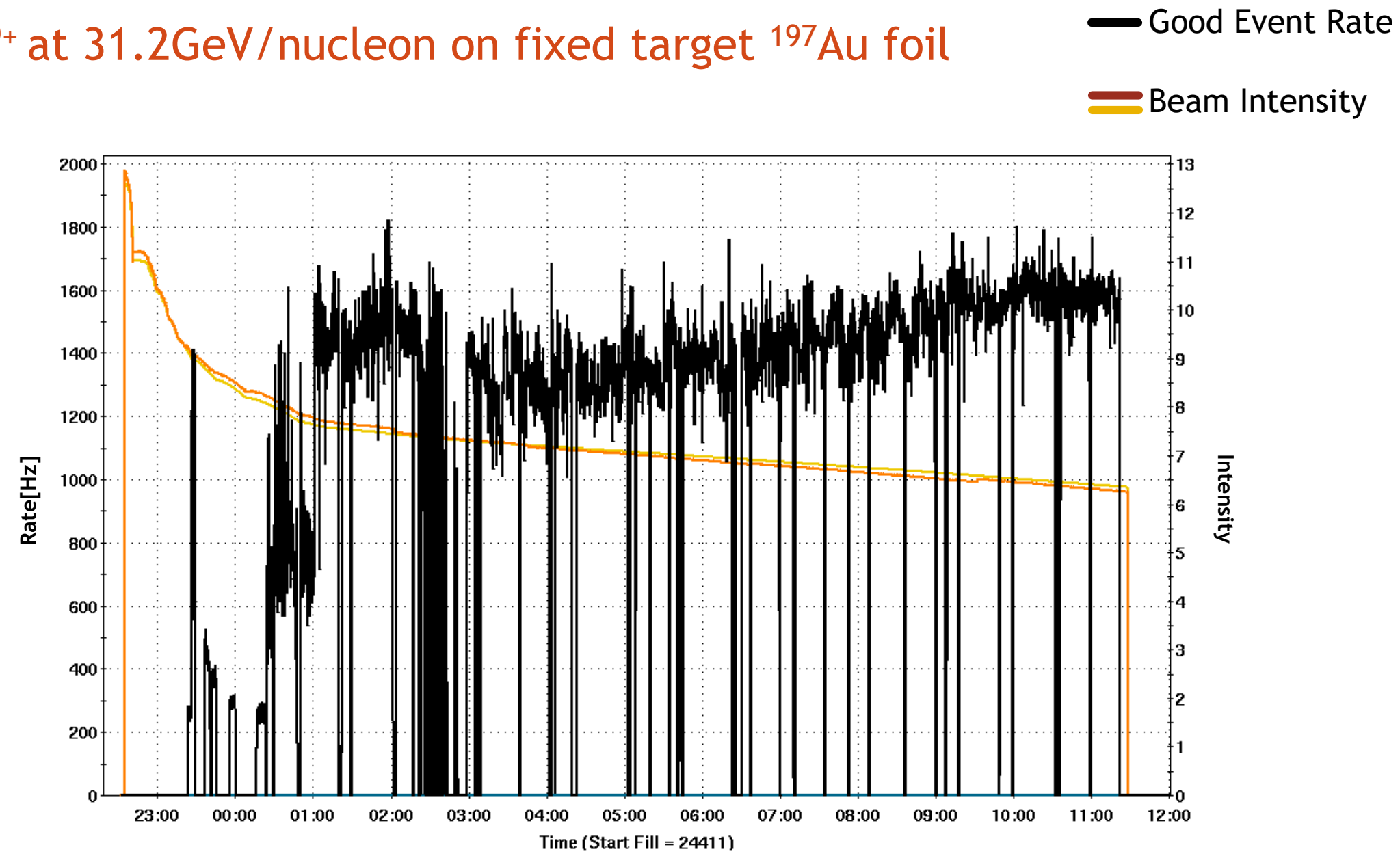
$^{197}Au^{79+}$ at 3.85GeV/nucleon on fixed target ^{197}Au foil



$^{197}Au^{79+}$ at 4.59GeV/nucleon on fixed target ^{197}Au foil



$^{197}Au^{79+}$ at 31.2GeV/nucleon on fixed target ^{197}Au foil

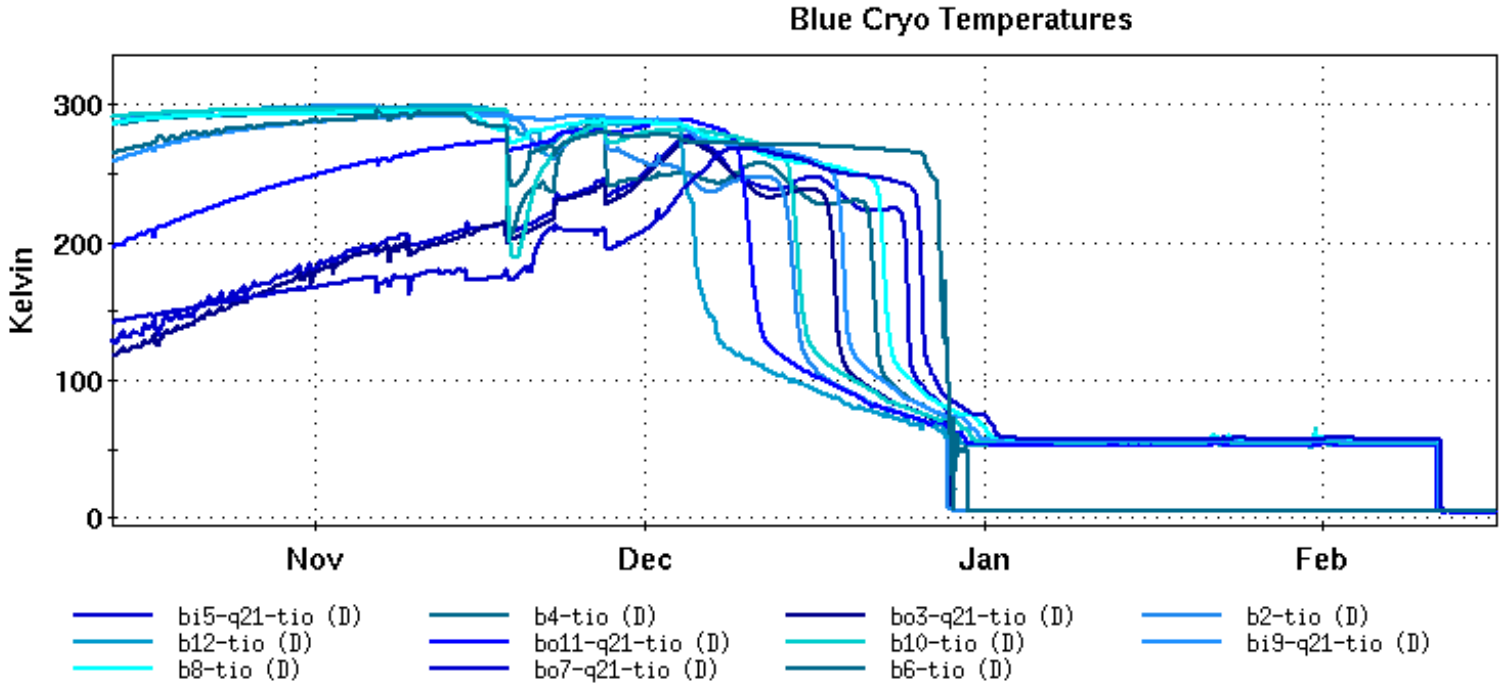


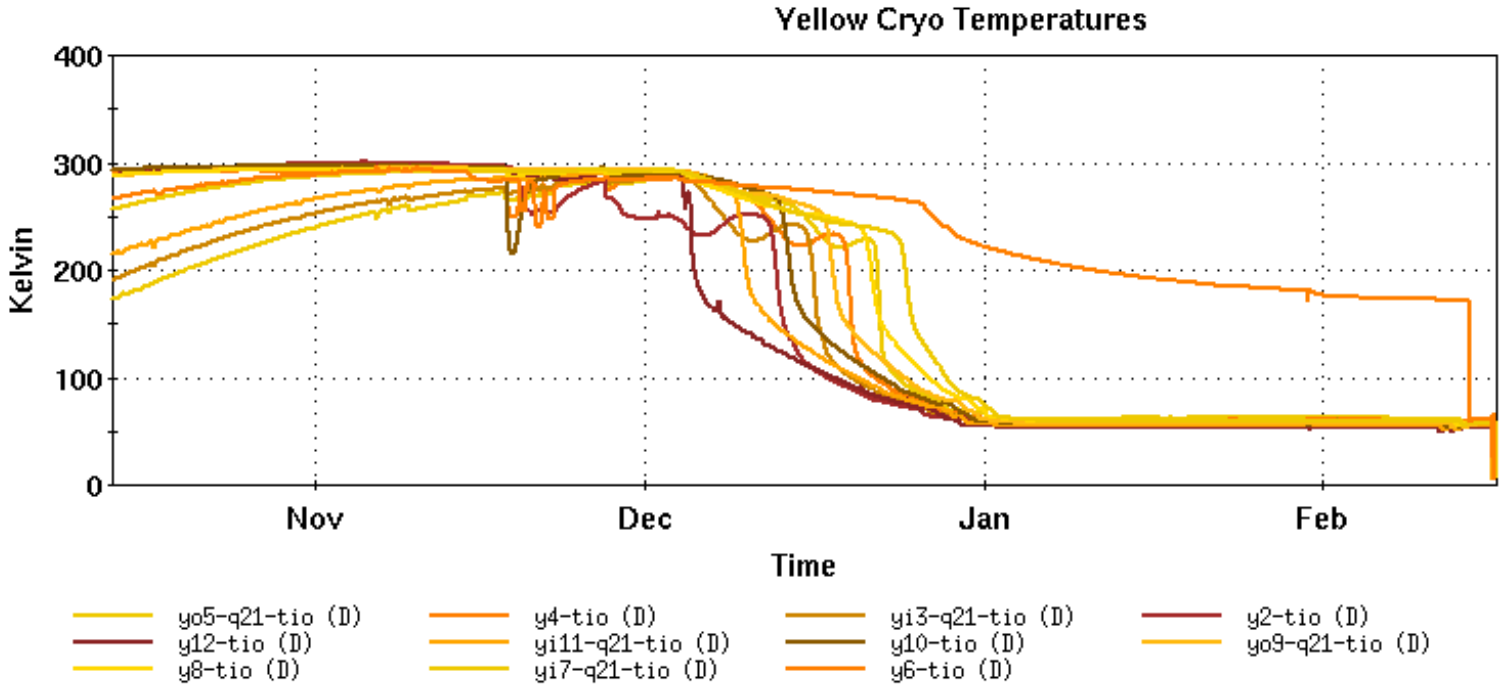
Power and Cryo Use

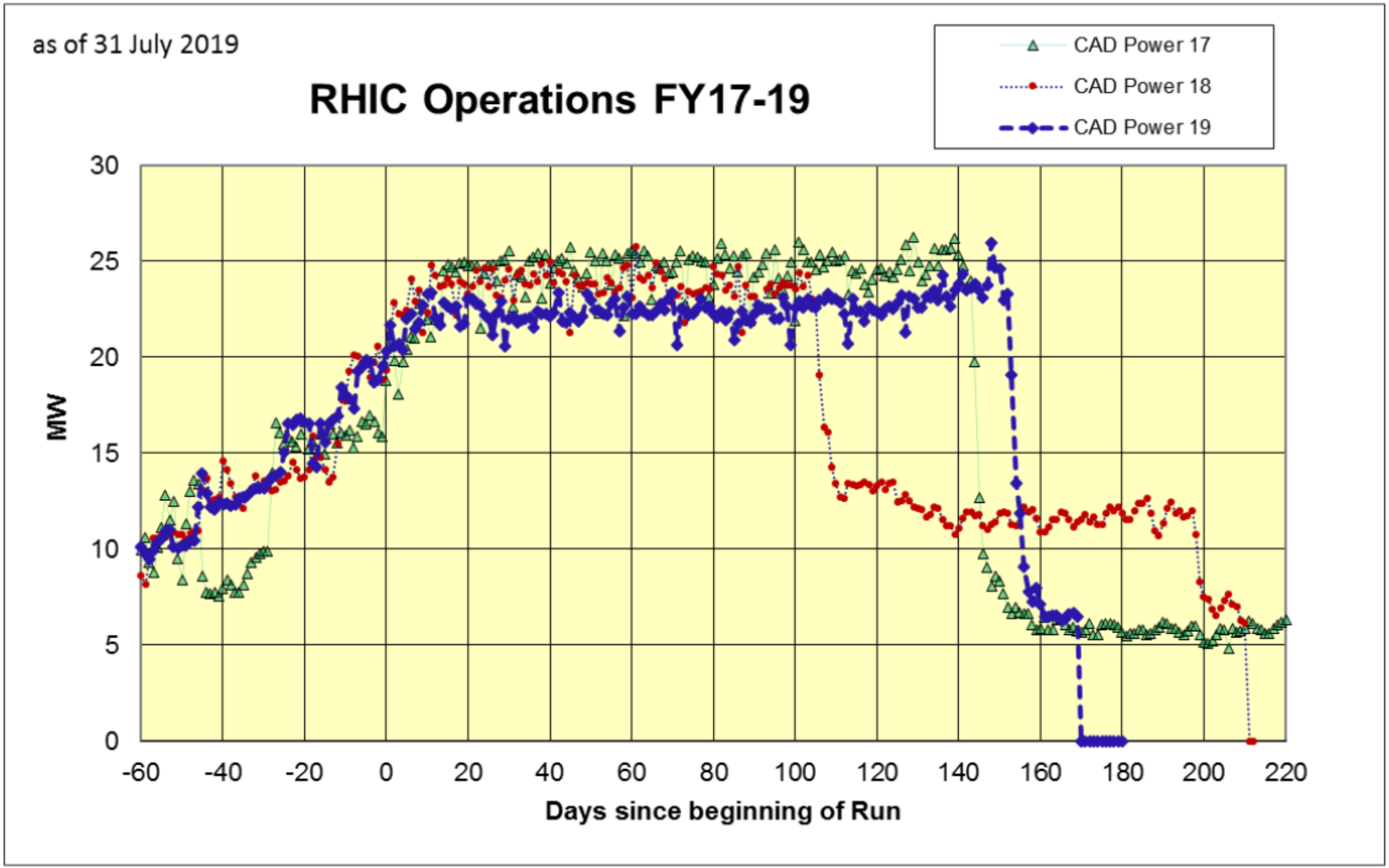
Power consumption data shown through 2019

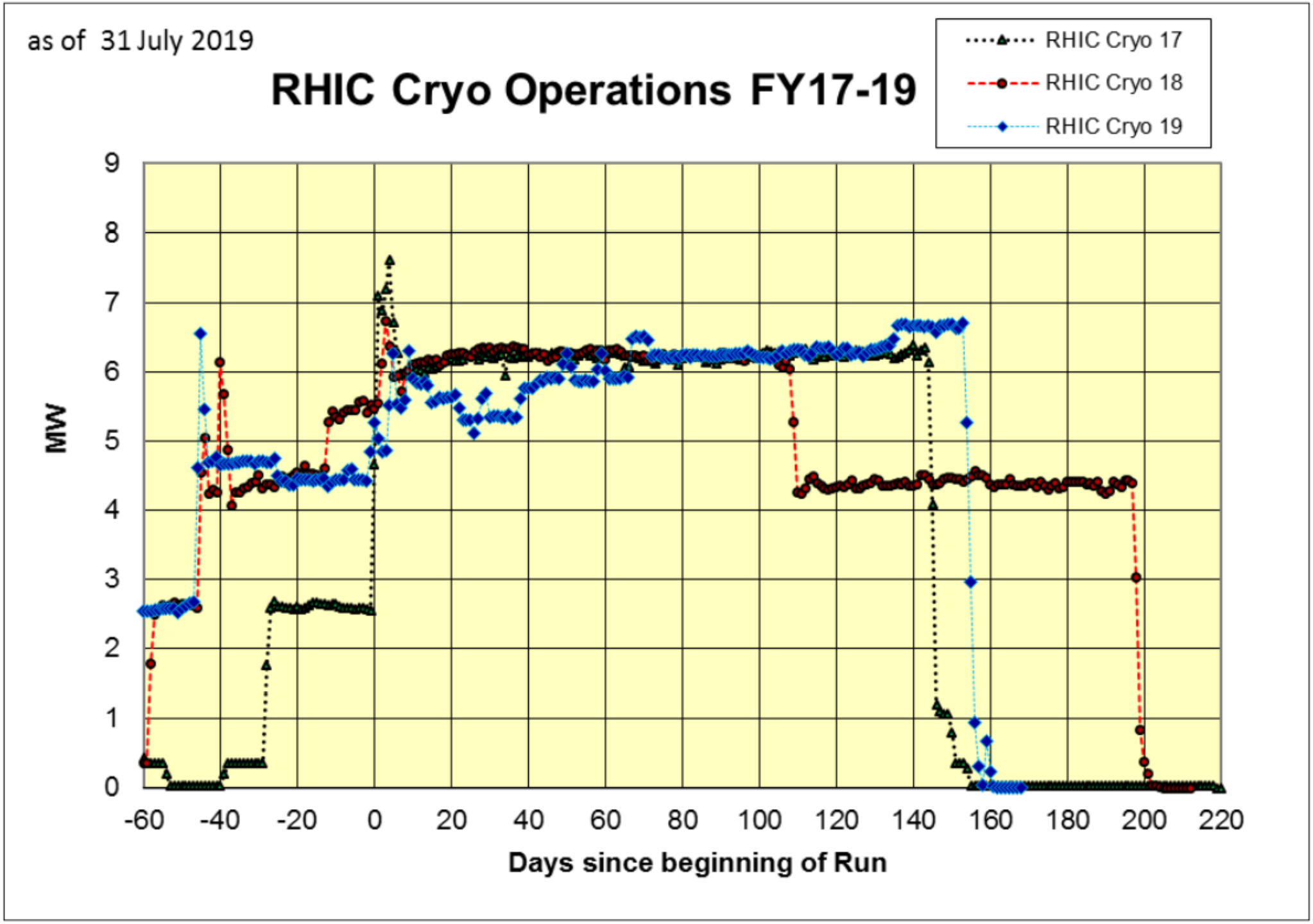
Cryo Cooldown

28.0 Total Cryo Weeks for Run19



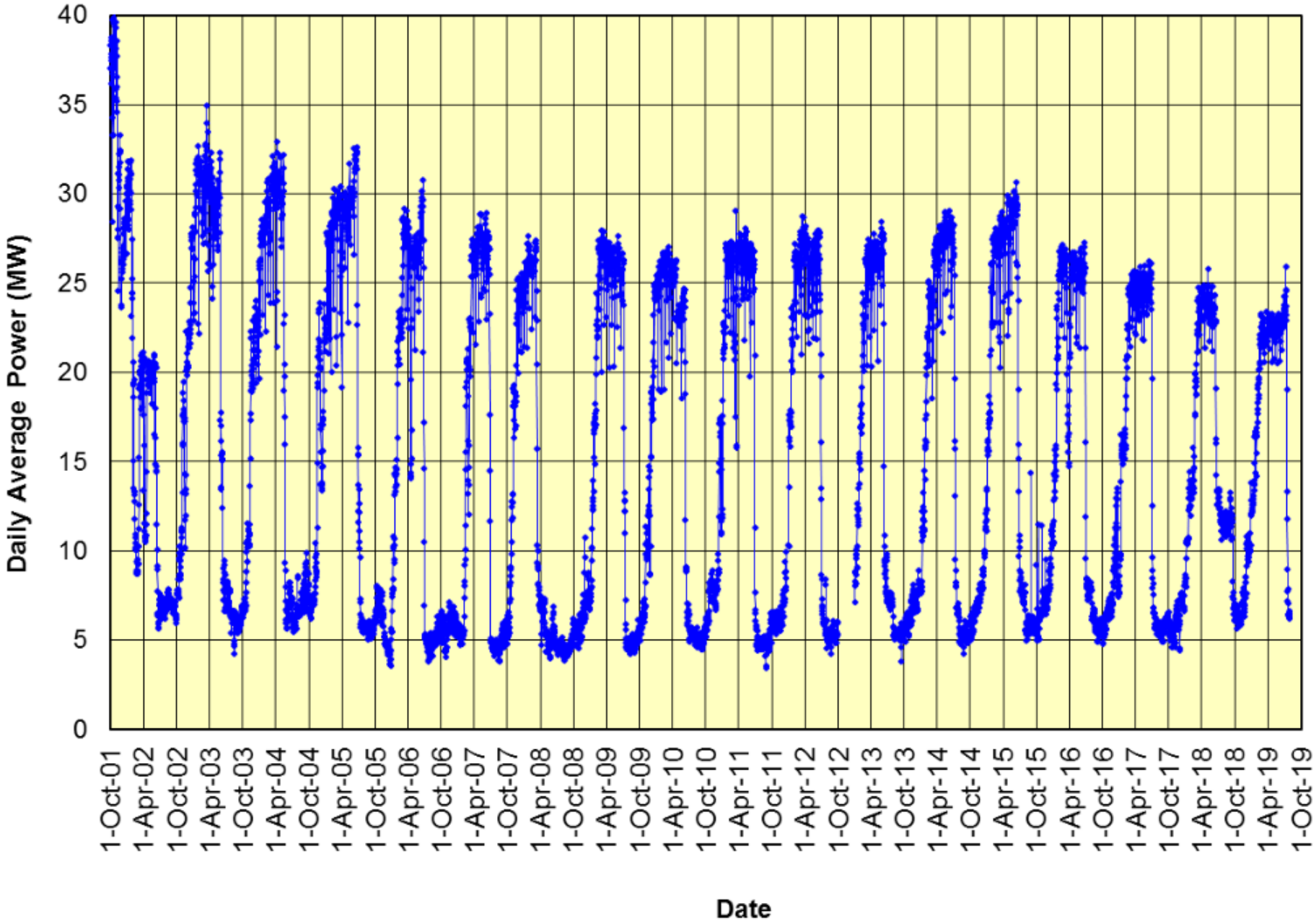



as of 31 July 2019
RHIC Operations FY17-19
CAD Power 17
CAD Power 18
CAD Power 19
MW
30
25
20
15
10
5
0
-60
-40
-20
0
20
40
60
80
100
120
140
160
180
200
220
Days since beginning of Run


as of 31 July 2019
RHIC Cryo Operations FY17-19
RHIC Cryo 17
RHIC Cryo 18
RHIC Cryo 19
MW
9
8
7
6
5
4
3
2
1
0
-60
-40
-20
0
20
40
60
80
100
120
140
160
180
200
220
Days since beginning of Run

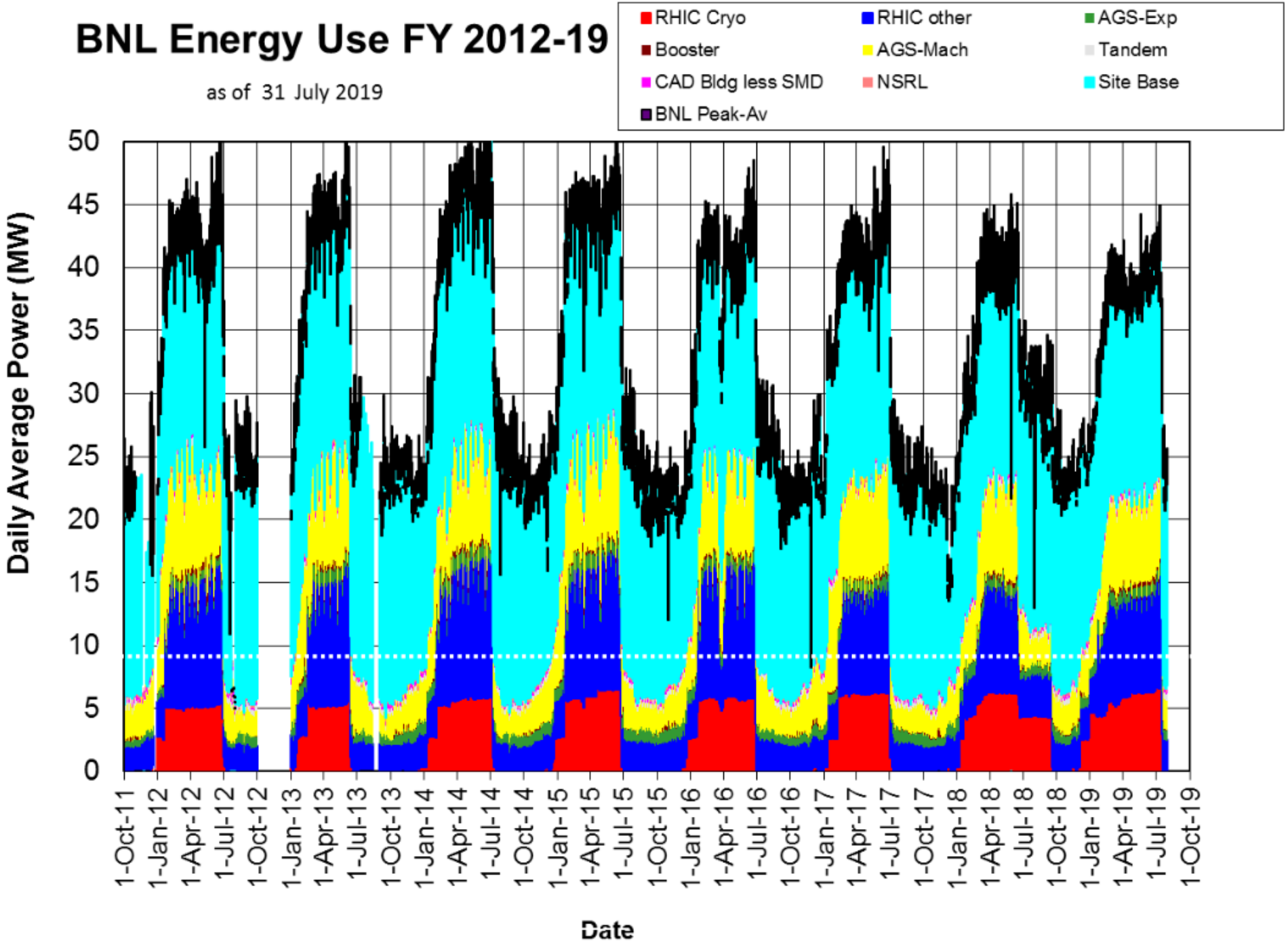
as of 31 July 2019

C-AD Energy Use FY 2002-19



BNL Energy Use FY 2012-19

as of 31 July 2019



Useful Websites

- RHIC Run Overview (FY01-FY19)
  - https://www.rhichome.bnl.gov/RHIC/Runs/index.html#Run-19
- RHIC Retreat Page (FY19)
  - https://indico.bnl.gov/event/6388/timetable/#20190731
- Store Statistics
  - https://www.agsrhichome.bnl.gov/AGS/Operations/Run19/
- Scheduling Physicist
  - https://www.c-ad.bnl.gov/esfd/Scheduling_Physicist/FY19_Collider-Accelerator_Schedule.htm
- RHIC Run19
  - https://www.rhichome.bnl.gov/AP/RHIC2019/

The End