

STAR Beam Use Request for Run23

$\sqrt{s_{NN}}$ (GeV)	Species	Number Events/ Sampled Luminosity	Year
200	Au+Au	20B / 40 nb ⁻¹	2023+2025
200	<i>p+p</i>	235 pb ⁻¹	2024
200	<i>p+Au</i>	1.3 pb ⁻¹	2024

Assuming 24 physics weeks / year

- Au+Au at 200 GeV
- High luminosity for rare probe/high-p_T physics + controlled low luminosity for minimum bias physics
 - Minimum bias : leveled ZDC rate at ~10 KHz (19 weeks)
 - High-p_T : ZDC ~ 100 KHz (29 weeks)
 - Mix two data taking modes depending on luminosity/beam condition to achieve the goal

Beam conditions for STAR

- Beam condition similar as Run 16 Au+Au at 200 GeV
 - Luminosity leveling with vertical offset when needed (as in Run 16, 18, 19, 21, 22)
 - abort gap at IP2,8
 - Run 16
 - Luminosity leveling at $55 \times 10^{26} \text{ cm}^{-2}\text{s}^{-1}$, ZDC at 65 kHz (earlier part of the store)
- Full crossing-angle of 1 mrad (Run 19 “3 days” Au+Au run with 1 mrad, Run 21 O+O with 1.65 mrad)
 - reduction of undesirable luminosity by $\sim 30\%$
- For Minimum-bias program: \sim ZDC at 10 kHz with leveling
 - $9.5 \times 10^{26} \text{ cm}^{-2}\text{s}^{-1}$ for ZDC 10 kHz
 - 20-17 weeks to get 20B events assuming “time in store” of 60%
 - RHIC projection: $\langle \mathcal{L} \rangle = 70$ initial, $125 \times 10^{26} \text{ cm}^{-2}\text{s}^{-1}$ in average: leveling of x5-10 suppression
 - likely need larger β^* (2m) to reduce hour-glass effect when luminosity is high
- For High- p_T program: \sim ZDC at 100 kHz
 - with 1 mrad crossing-angle, no need for leveling
 - 34-23 weeks to accumulate $\int \mathcal{L}_{\text{sampled}} \sim 40 \text{ nb}^{-1}$ with projection of $\int \mathcal{L}_{\text{delivered}}/\text{week} \sim 3 - 4.5 \text{ nb}^{-1}$

STAR Status and Schedule

- All subsystems ready/being ready for the beam - No outstanding issues
- 4/25: Shift start, TPC flammable gas flow
- 4/27 - : Cosmic data taking at Forward Full Field until beam operation
- 5/8 : RHIC cooldown start
- 5/16: First collisions expected for timing and trigger setup
 - ~1 day for timing and trigger setup/calibration before physics
- Start with minimum-bias physics. TPC speed upgrade (x2) commissioning for 2-3 weeks while initial data taking.