Pierre Auger Observatory performances

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1 Auger properties

The Surface Detector (SD) has a total aperture of approximatively 7 350 km^2.sr for zenith angles less than $60°$.

Detection efficiency

Energy (eV)	zenith $< 60°$	zenith $> 60°$
10^{18}	0	0
3×10^{18}	0.3	0.5 (70°) 0.75 (75°) 0.8 (80°)
10^{19}	0.98	1
3×10^{19}	1	1
10^{20}	1	1

Precisions (space angle containing 68% of events)

zenith angle (deg)	photon (deg)	proton (deg)	LPM (unconverted photons)
20	1.1	0.6	4.0
40	0.6	0.5	2.5
60	0.4	0.3	1.0
80	0.3	0.2	1.0

Energy resolution

Energy (eV)	resolution
$\leqslant 10^{20}$	12%
$\geqslant 10^{20}$	10%

2 Hybrid mode

Detection efficiency

Energy (eV)	efficiency	% of triggers that are stereo or better
10^{18}	0.35	0
3×10^{18}	0.79	24
10^{19}	0.98	68
3×10^{19}	0.99	88
10^{20}	1	95

The second column of this array shows the percentage of triggering showers that actually trigger 2, 3 or 4 eyes.

precision on the direction

Energy (eV)	direction error (deg)			core error (m)			R_p error (m)		
	50 %	68 %	90 %	50 %	68 %	90 %	50 %	68 %	90 %
10^{18}	0.50	0.73	1.55	35	61	155	20	35	97
10^{19}	0.35	0.51	1.10	35	50	120	16	28	76
10^{20}	0.35	0.51	0.90	30	49	100	13	25	64

precision on the energy and $X_{\max}$

Energy (eV)	energy error (%)			$X_{\max}$ error (g.cm^{-2})		
	50 %	68 %	90 %	50 %	68 %	90 %
10^{18}	9.5	13	21	21	38	74
10^{19}	4.5	6.5	13	14	25	62
10^{20}	2.5	5.5	17	12	24	69

Rates (based on AGASA (PRL v81, 1163 (1998)), for one year at one 3 000 km^2 site and a zentih angle $\leqslant 60°$

Energy (eV)	Surface array (only)	Hybrid (SD + one or more FD)
6×10^{17}	0	$\sim$ 45 000
10^{18}	0	30 000
3×10^{18}	15 000	4 700
10^{19}	5 150	515
2×10^{19}	1 590	159
5×10^{19}	490	49
10^{20}	103	10
2×10^{20}	32	3
5×10^{20}	10	1

FD rates assume a coincidence of 2 tanks with 4 VEM and 10% duty cycle.
SD rates assume a coincidence of 5 tanks with 4 VEM each.

The FD rate becomes 10% of SD rate above 10^{19} eV because the surface detector is fully efficient at that energy. One can see the advantage of the hybrid for the lower energy. The addition of events with zenith angle greater than 60° will add about 50% to the rates quoted above.