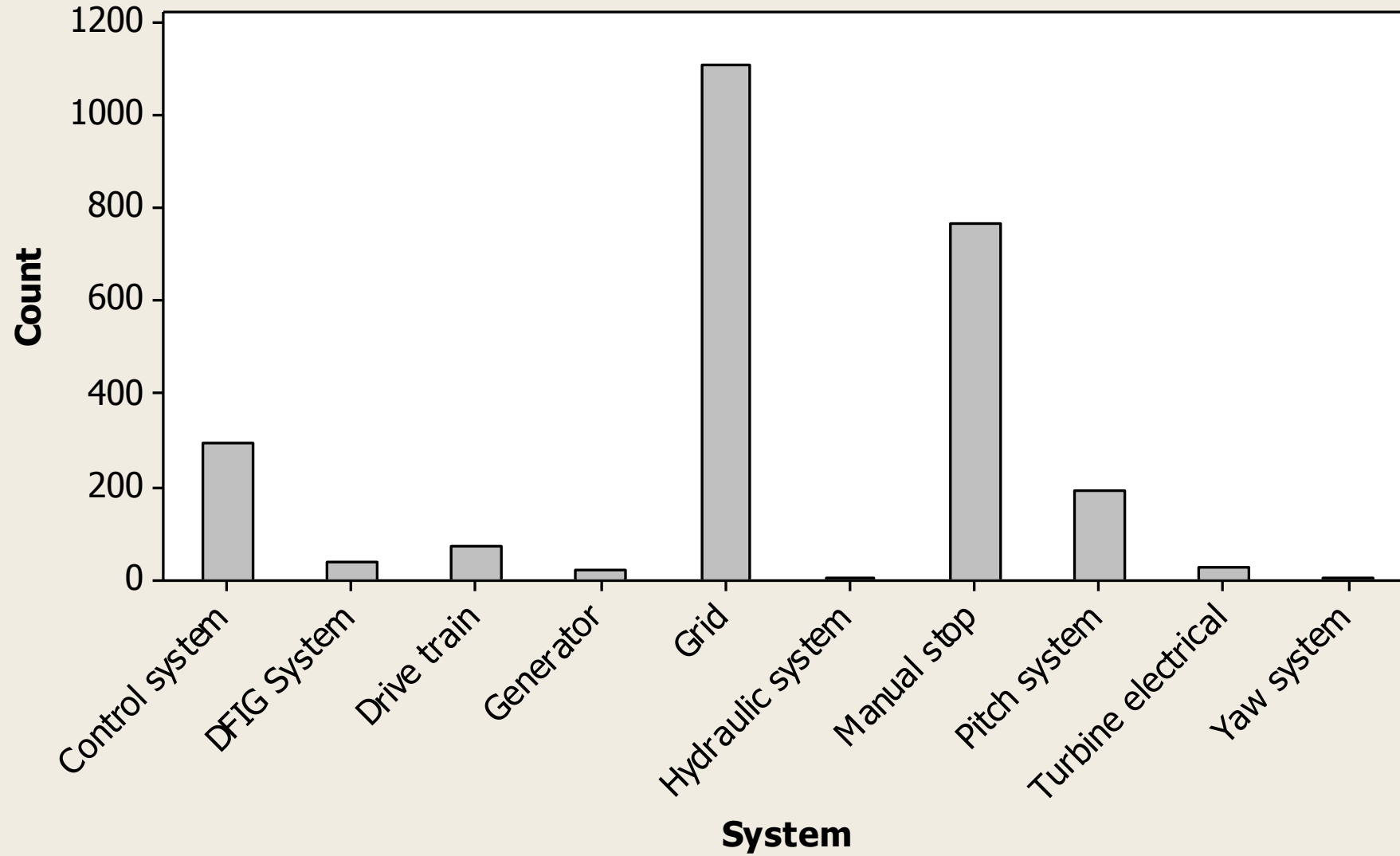


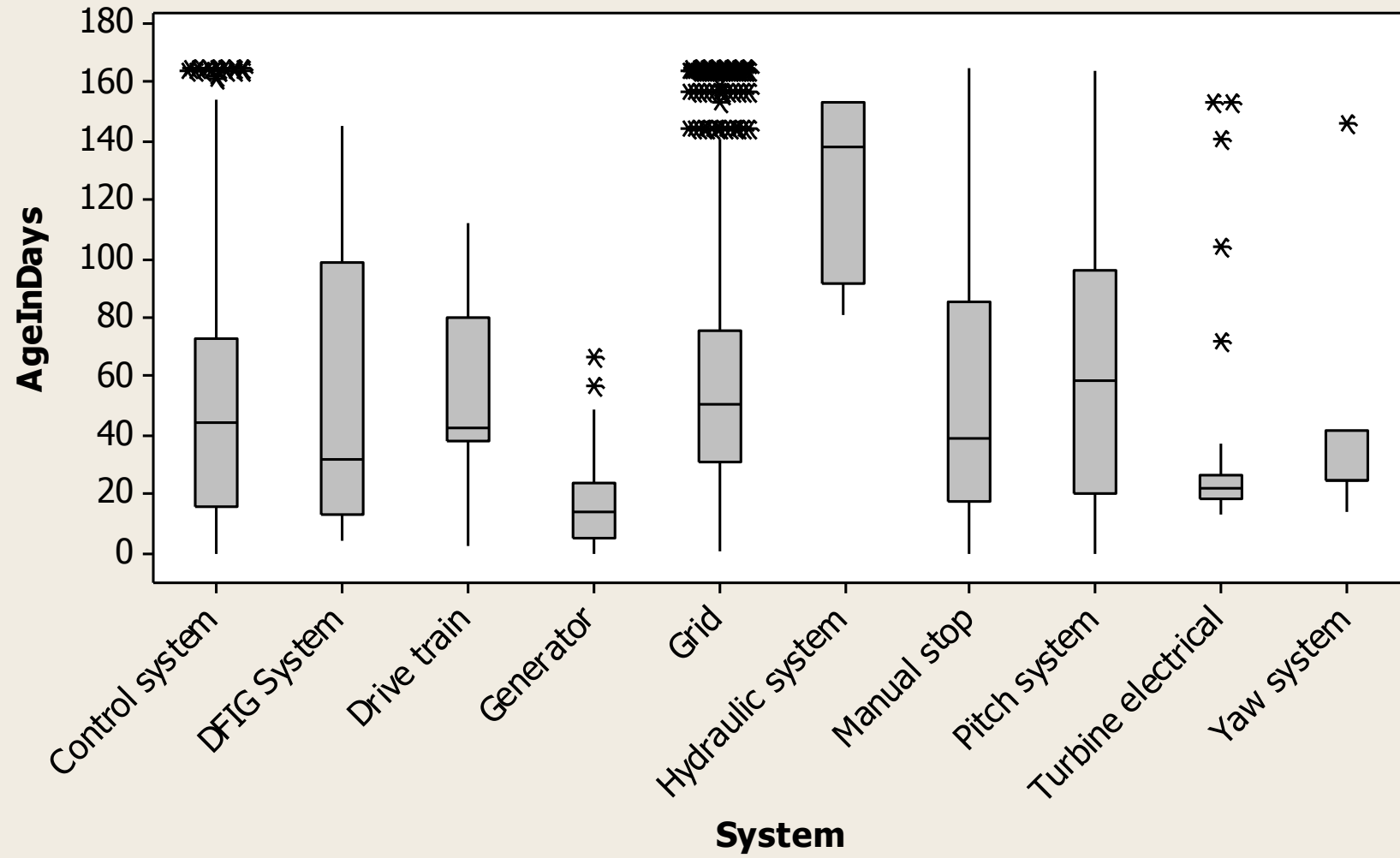
# Reliability Analysis

## Track 1.2

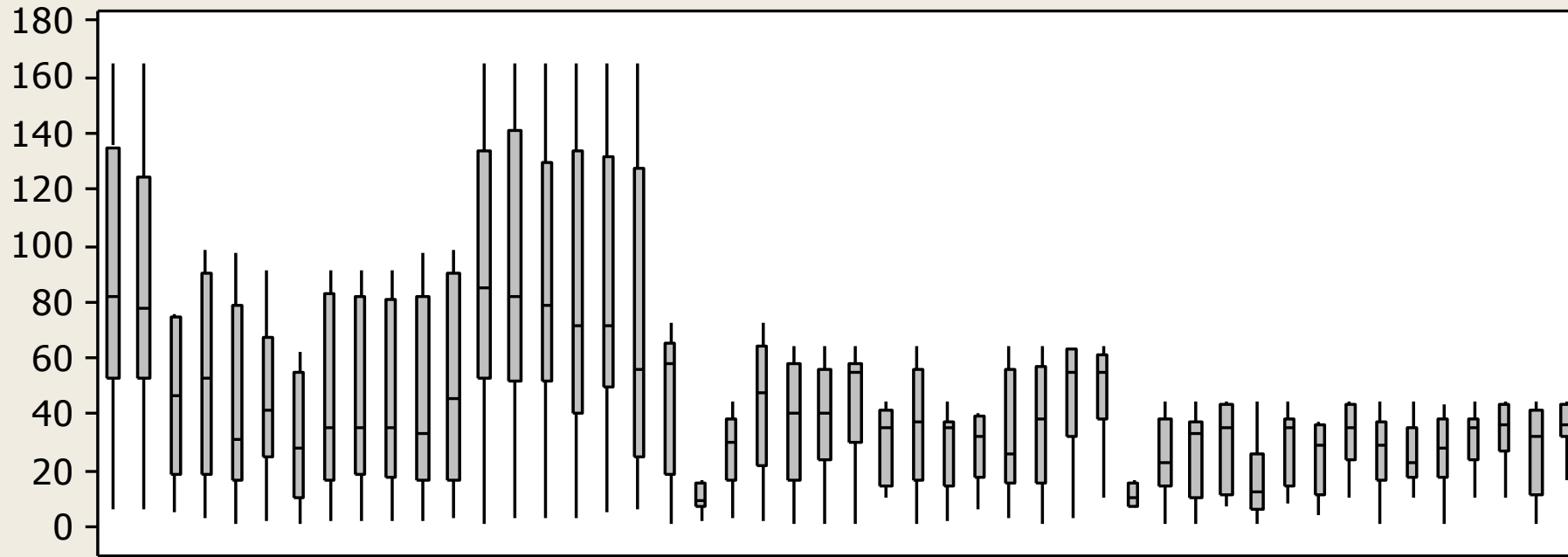
### Chart of System



### Boxplot of AgeInDays

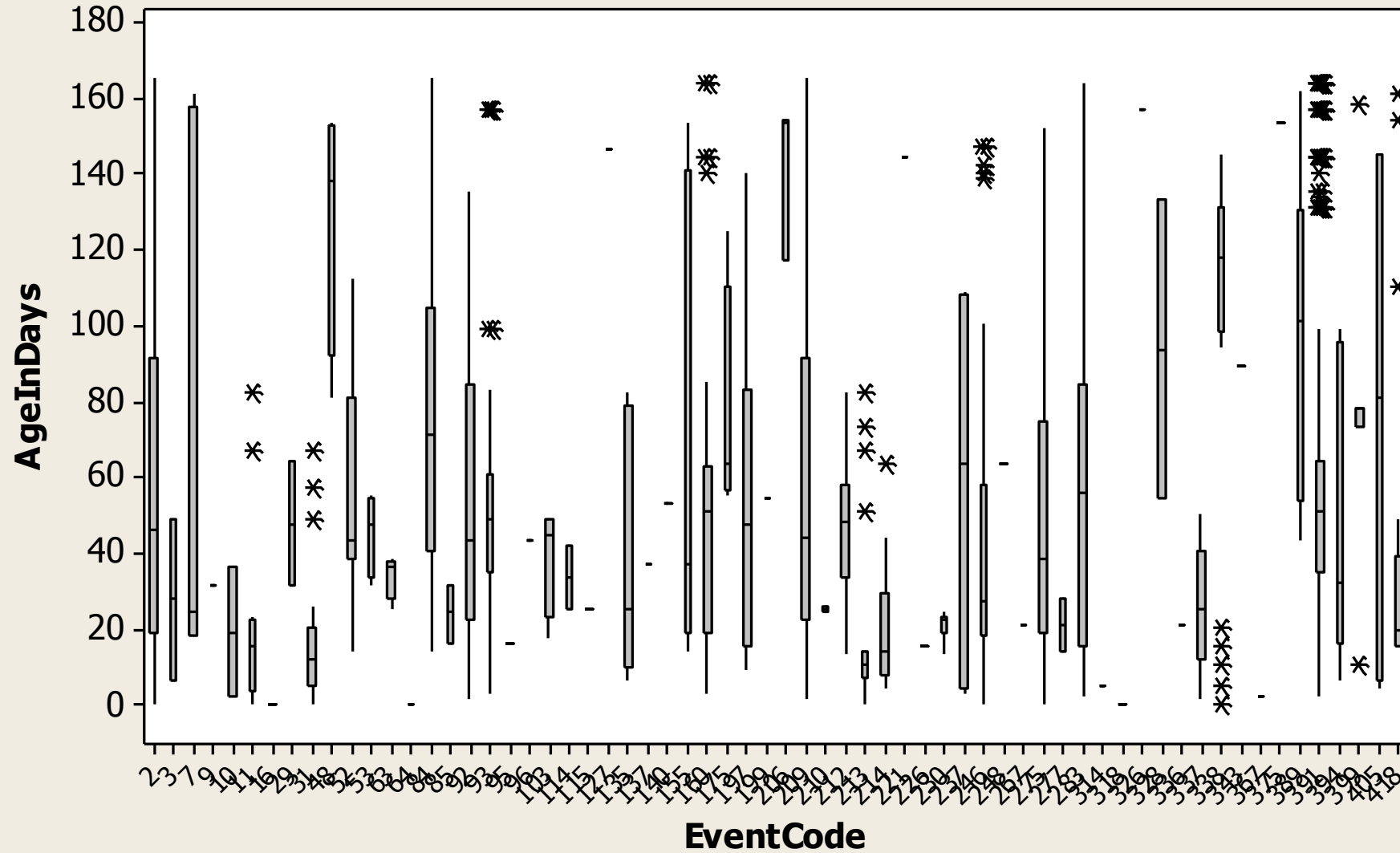


# Boxplot of AgeInDays



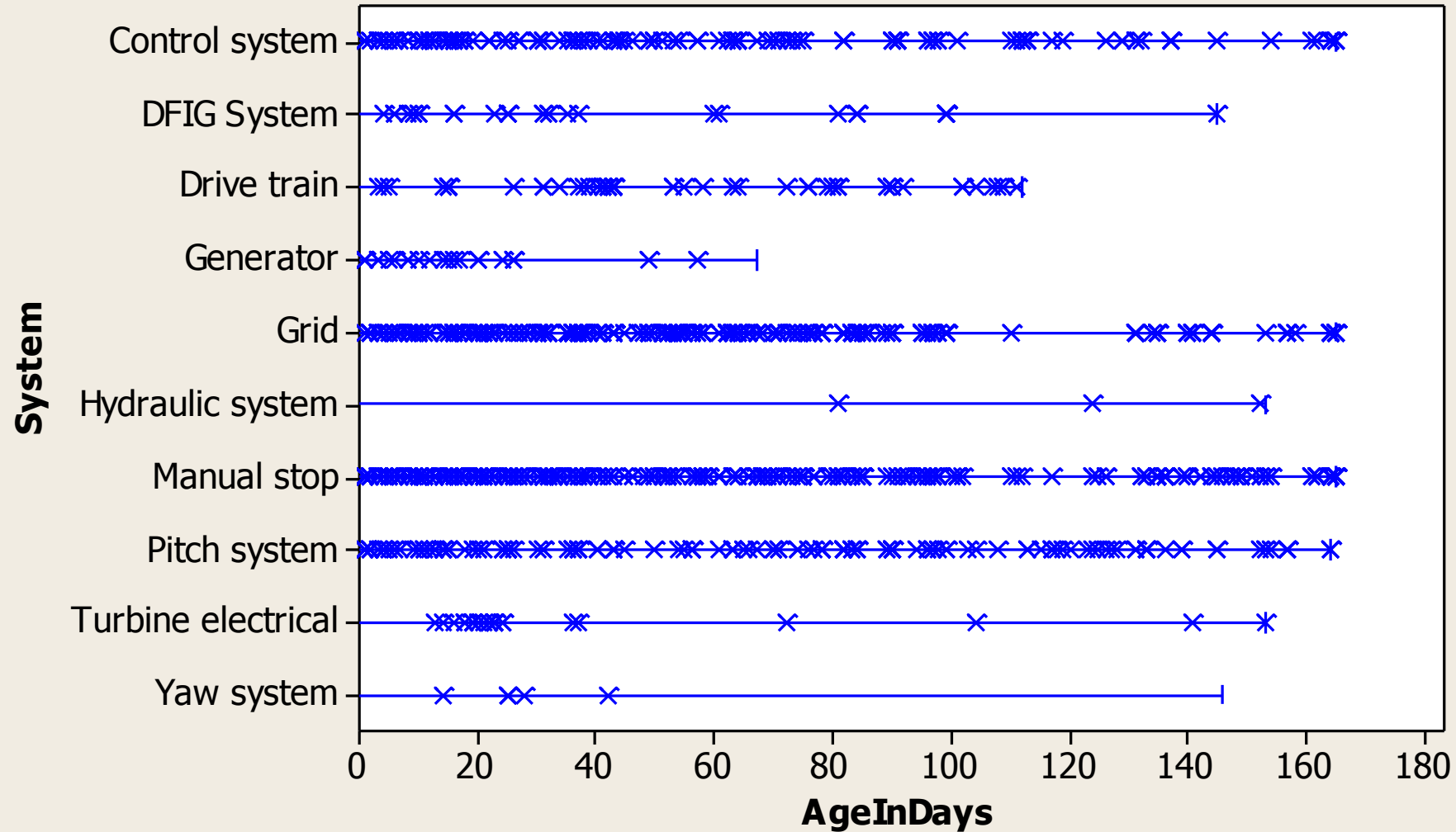
SAPFunctionalLocation

### Boxplot of AgeInDays



# Event Plot for AgeInDays

System Column in System

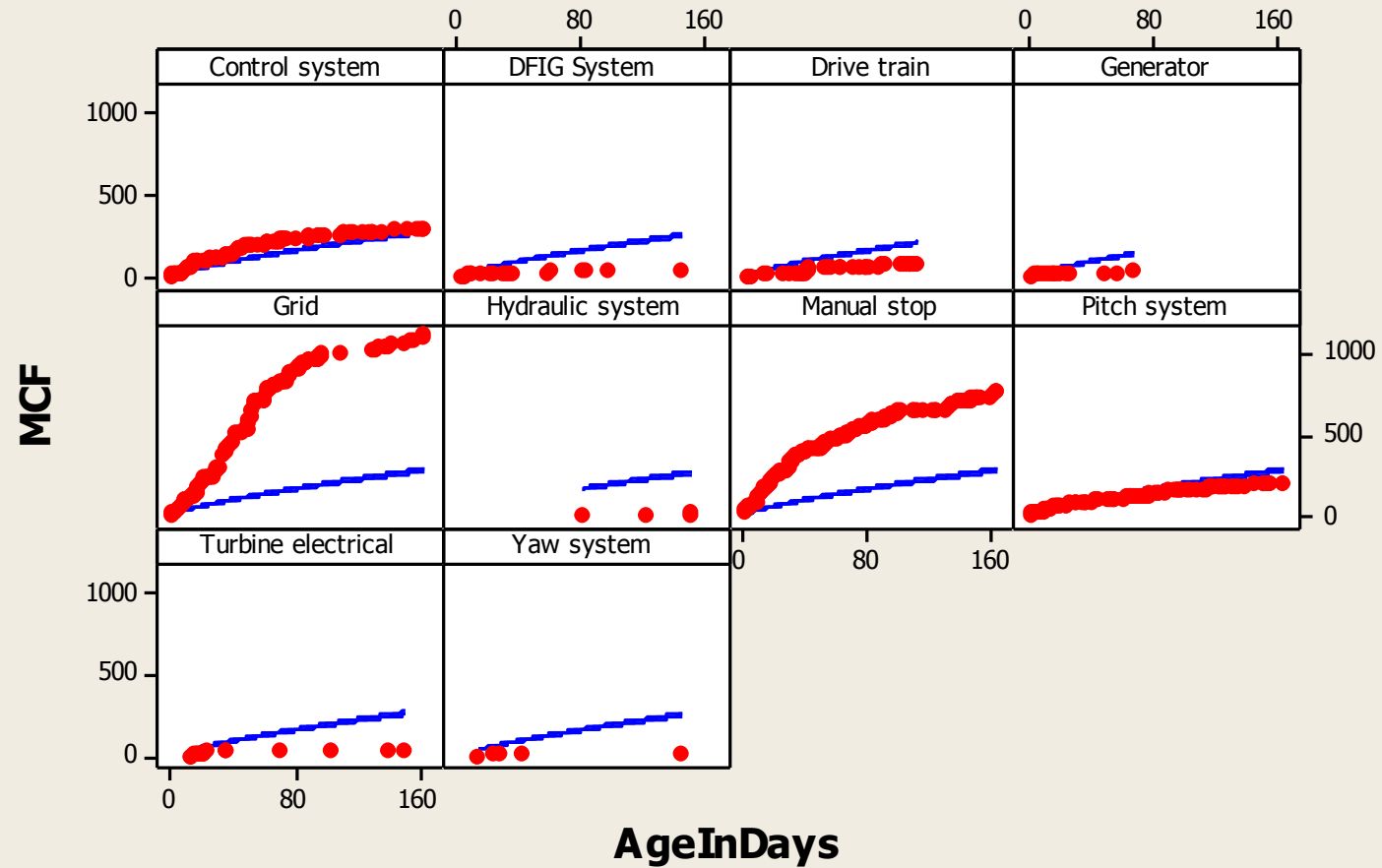


Operating hours also can be done

# Mean Cumulative Function for AgeInDays

95% CI

System Column in System

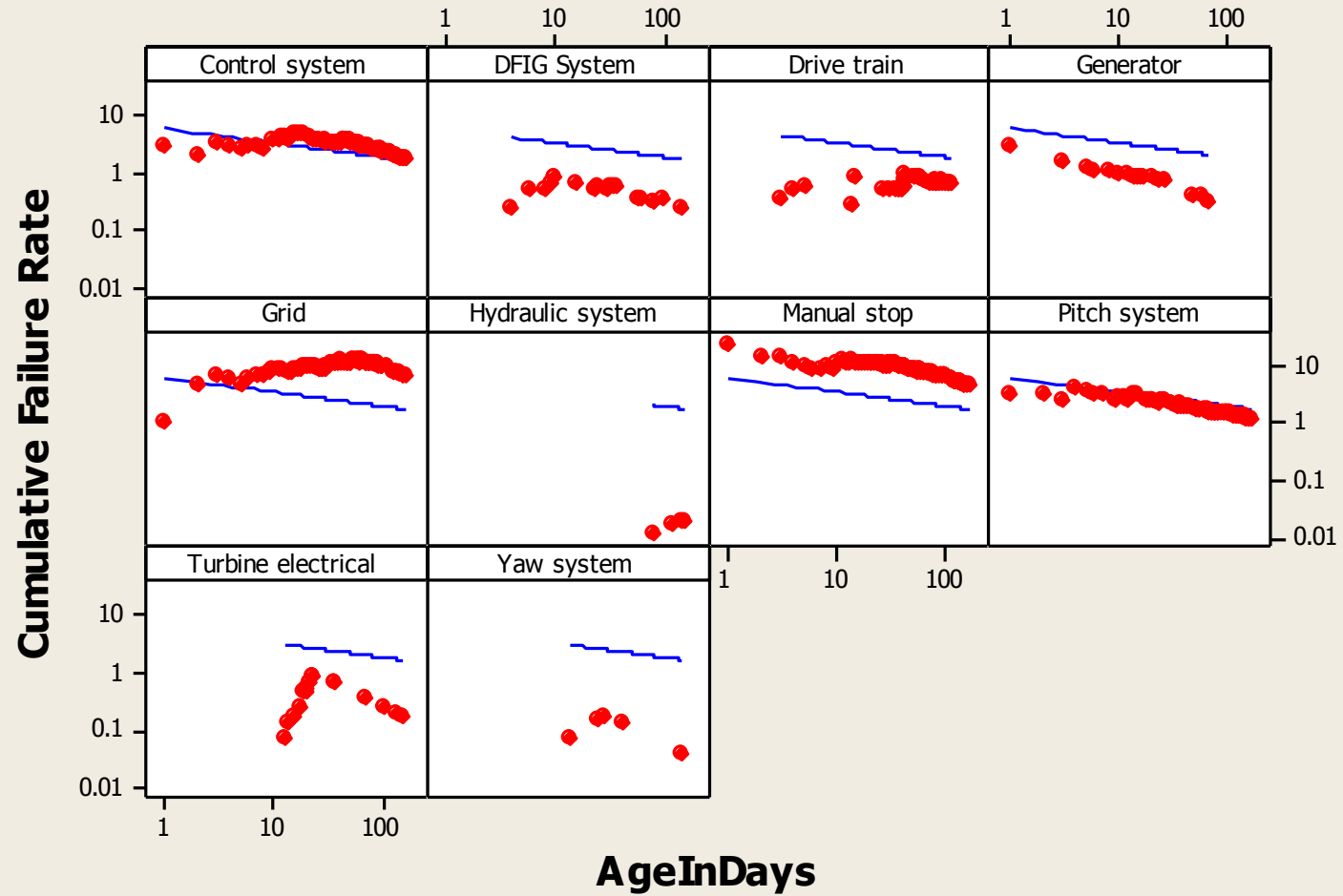


Parameter, MLE	
Shape	Scale
0.751569	0.0903866

Panel variable: System

# Duane Plot for AgeInDays

## System Column in System



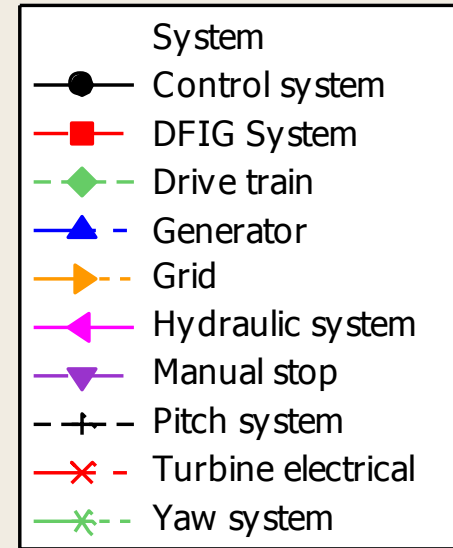
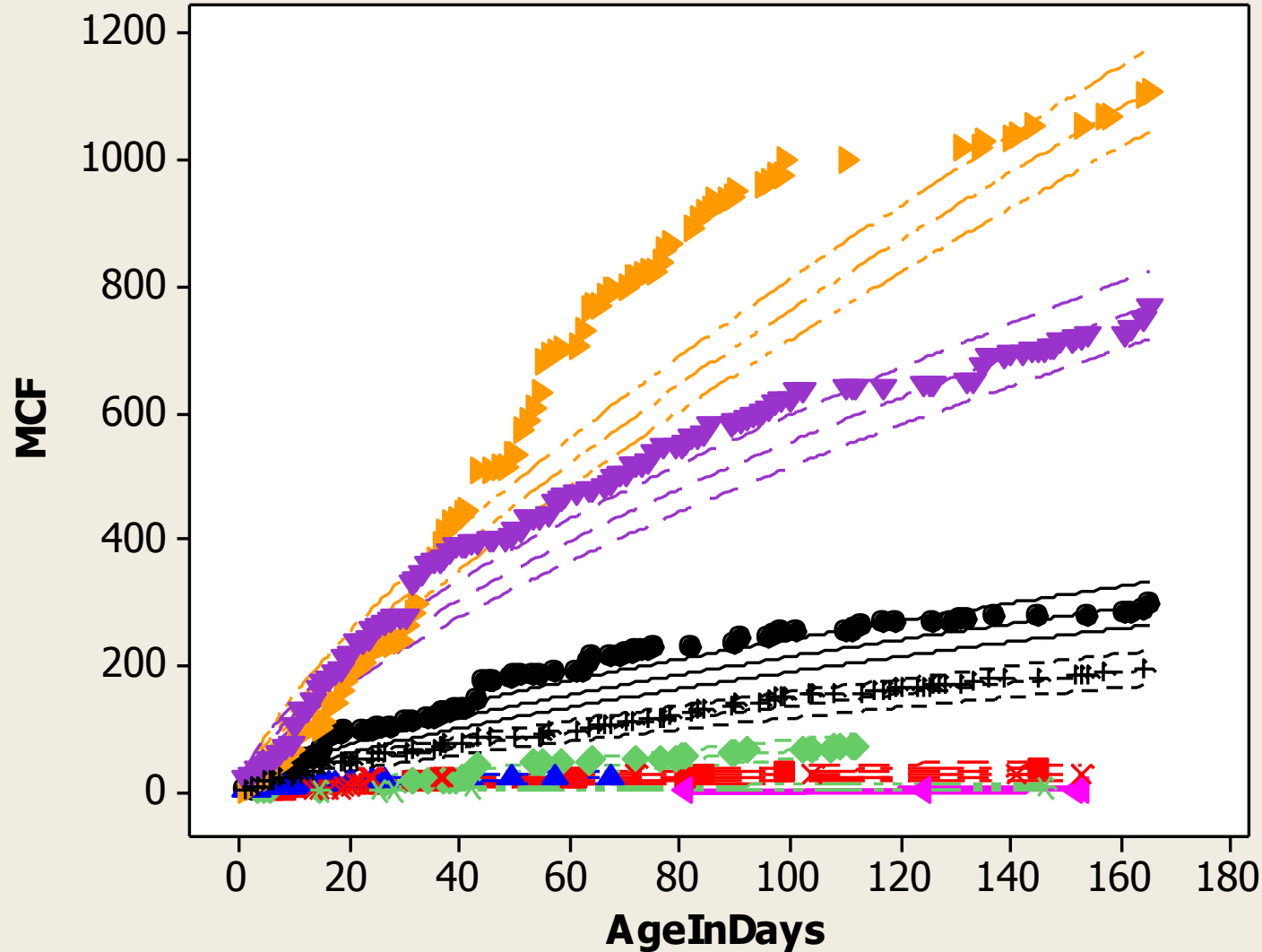
Parameter, MLE	
Shape	Scale
0.751569	0.0903866

Panel variable: System



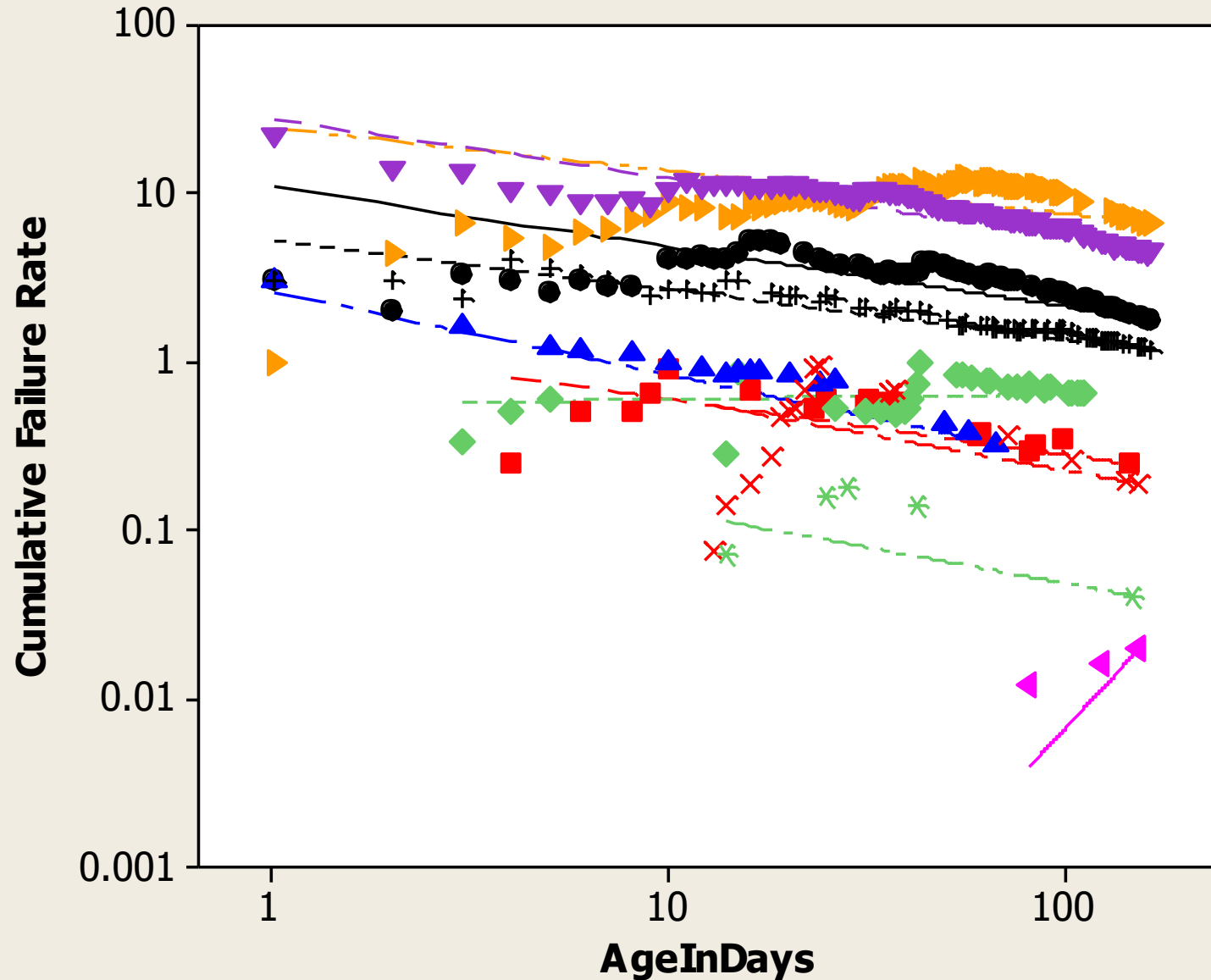
# Mean Cumulative Function for AgeInDays

95% CI



Parameter, MLE	
Shape	Scale
0.64601	0.025
0.66817	0.679
1.03358	1.764
0.50709	0.151
0.74542	0.014
3.51823	111.964
0.64869	0.006
0.70398	0.093
0.57222	0.426
0.56947	6.279

## Duane Plot for AgeInDays



- | System |                    |
|--------|--------------------|
| ●      | Control system     |
| ■      | DFIG System        |
| ◆      | Drive train        |
| ▲      | Generator          |
| ▶      | Grid               |
| ◀      | Hydraulic system   |
| ▼      | Manual stop        |
| + -    | Pitch system       |
| × -    | Turbine electrical |
| * -    | Yaw system         |

Parameter, MLE	
Shape	Scale
0.64601	0.025
0.66817	0.679
1.03358	1.764
0.50709	0.151
0.74542	0.014
3.51823	111.964
0.64869	0.006
0.70398	0.093
0.57222	0.426
0.56947	6.279

# PM and Reliability

MTTR & >24 hrs MTTR (Incl. Auto reset Alarms)

Area	Total WTG	MTTR	MTTR > 24hrs		MTBF	Last Week	
			WTGs	% of WTGs		MTTR	MTBF
Andhra Pradesh\Andhra Pradesh	135	2.79	2	1.48%	60.74	1.55	62.37
Karnataka\Central Karnataka	137	2.44	-	0.00%	37.85	2.28	56.77
Karnataka\North Karnataka	186	1.88	1	0.54%	56.34	1.06	87.31
Karnataka\South Karnataka	134	1.79	2	1.49%	34.07	2.87	81.63
Kerala\West Coimbatore	35	2.33	1	2.86%	65.48	0.39	113.24
Sri Lanka\Sri Lanka	18	1.51	-	0.00%	201.39	0.63	156.24
Tamilnadu\East Coimbatore	327	3.58	9	2.75%	62.49	4.25	138.92
Tamilnadu\North Tirunelveli	347	6.04	12	3.46%	41.47	4.43	110.31
Tamilnadu\South Tirunelveli	339	5.05	8	2.36%	63.63	3.29	128.93
Tamilnadu\West Coimbatore	229	3.79	6	2.62%	38.81	4.21	75.85
Gujarat\East Kutch	255	3.57	9	3.53%	61.34	2.11	132.01
Gujarat\East Saurashtra	192	4.30	5	2.60%	76.17	2.82	182.23
Gujarat\North Kutchh	229	1.47	-	0.00%	218.99	1.37	276.96
Gujarat\West Kutch	283	1.37	5	1.77%	46.22	1.15	79.49
Gujarat\West Saurashtra	207	4.62	2	0.97%	190.95	1.15	288.03
Madhya Pradesh\Madhya Pradesh	210	4.76	11	5.24%	26.63	3.41	40.89
Maharashtra\Central Maharashtra	103	3.54	-	0.00%	125.03	1.83	124.42
Maharashtra\Dhule	277	3.29	18	6.50%	19.02	2.35	21.84
Maharashtra\Nandurbar	272	5.33	32	11.76%	16.95	2.57	16.15
Maharashtra\South Maharashtra	282	1.95	4	1.42%	23.35	1.22	32.24
Maharashtra\West Maharashtra	295	1.70	6	2.03%	76.27	1.49	100.89
Rajastha\Central Jaisalmer	206	3.45	2	0.97%	15.81	1.74	21.11
Rajastha\Jodhpur	190	1.70	-	0.00%	26.52	1.42	37.54
Rajastha\North Jaisalmer	293	3.23	5	1.71%	39.97	2.10	51.47
Rajastha\South Jaisalmer	354	3.54	7	1.98%	20.65	2.10	29.32

Data downloaded on  
2<sup>nd</sup> Jun-16

**Highest MTTR: 6.04hrs(North Tirunelveli); Lowest: 1.37hrs(West Kutch)**  
**147 turbines (2.66%) are in more than 24hrs MTTR**

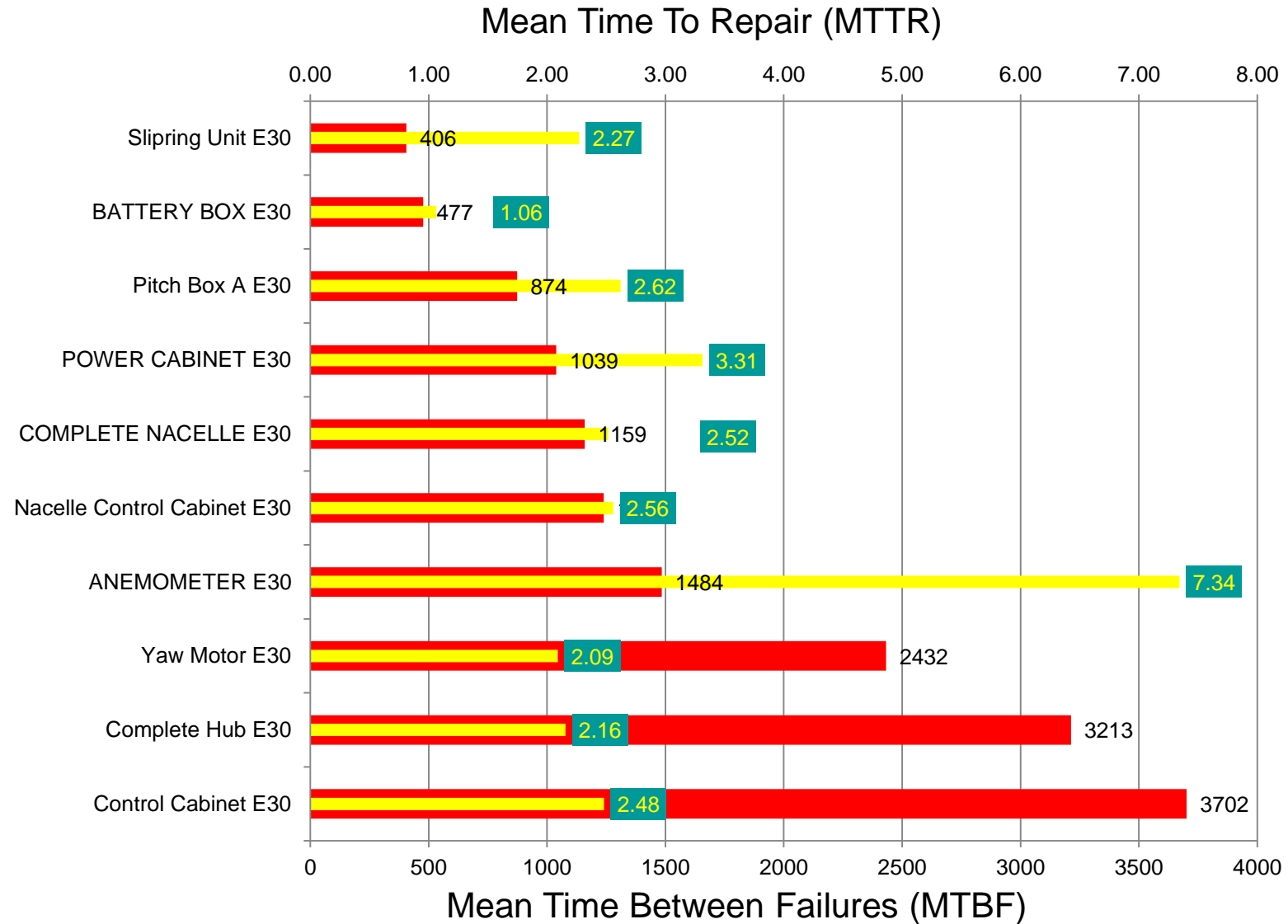
# PM and Reliability

MTTR & >24 hrs MTTR (Excl. Auto reset Alarms)

Area	Total WTG	MTTR	MTTR > 24hrs		MTBF	Last Week	
			WTGs	% of WTGs		MTTR	MTBF
Andhra Pradesh\Andhra Pradesh	135	2.70	2	1.48%	182.22	1.98	218.41
Karnataka\Central Karnataka	137	2.95	-	0.00%	123.00	3.41	165.25
Karnataka\North Karnataka	186	1.67	1	0.54%	111.40	0.91	172.58
Karnataka\South Karnataka	134	1.83	2	1.49%	71.48	3.41	190.21
Kerala\West Coimbatore	35	2.75	1	2.86%	93.31	0.67	160.52
Sri Lanka\Sri Lanka	18	2.33	-	0.00%	436.35	0.61	212.93
Tamilnadu\East Coimbatore	327	4.39	9	2.75%	127.88	5.66	248.71
Tamilnadu\North Tirunelveli	347	7.06	12	3.46%	69.46	5.50	229.24
Tamilnadu\South Tirunelveli	339	7.38	8	2.36%	158.25	4.45	282.12
Tamilnadu\West Coimbatore	229	4.49	6	2.62%	81.77	5.94	154.18
Gujarat\East Kutch	255	9.66	9	3.53%	272.40	4.18	433.52
Gujarat\East Saurashtra	192	6.79	5	2.60%	238.43	4.74	573.38
Gujarat\North Kutchh	229	1.79	-	0.00%	508.93	1.46	714.53
Gujarat\West Kutch	283	4.44	5	1.77%	346.64	3.21	542.99
Gujarat\West Saurashtra	207	4.87	2	0.97%	377.35	1.22	620.05
Madhya Pradesh\Madhya Pradesh	210	7.04	11	5.24%	99.35	3.02	129.03
Maharashtra\Central Maharashtra	103	2.91	-	0.00%	190.45	1.97	275.46
Maharashtra\Dhule	277	4.91	18	6.50%	55.99	3.18	67.17
Maharashtra\Nandurbar	272	8.26	32	11.76%	44.16	4.22	55.69
Maharashtra\South Maharashtra	282	3.27	4	1.42%	66.42	2.10	85.29
Maharashtra\West Maharashtra	295	2.08	6	2.03%	163.33	1.97	196.95
Rajastha\Central Jaisalmer	206	2.98	2	0.97%	32.73	1.40	45.63
Rajastha\Jodhpur	190	1.82	-	0.00%	105.60	1.09	174.02
Rajastha\North Jaisalmer	293	4.50	5	1.71%	141.65	2.01	154.23
Rajastha\South Jaisalmer	354	4.41	7	1.98%	75.54	2.02	93.10

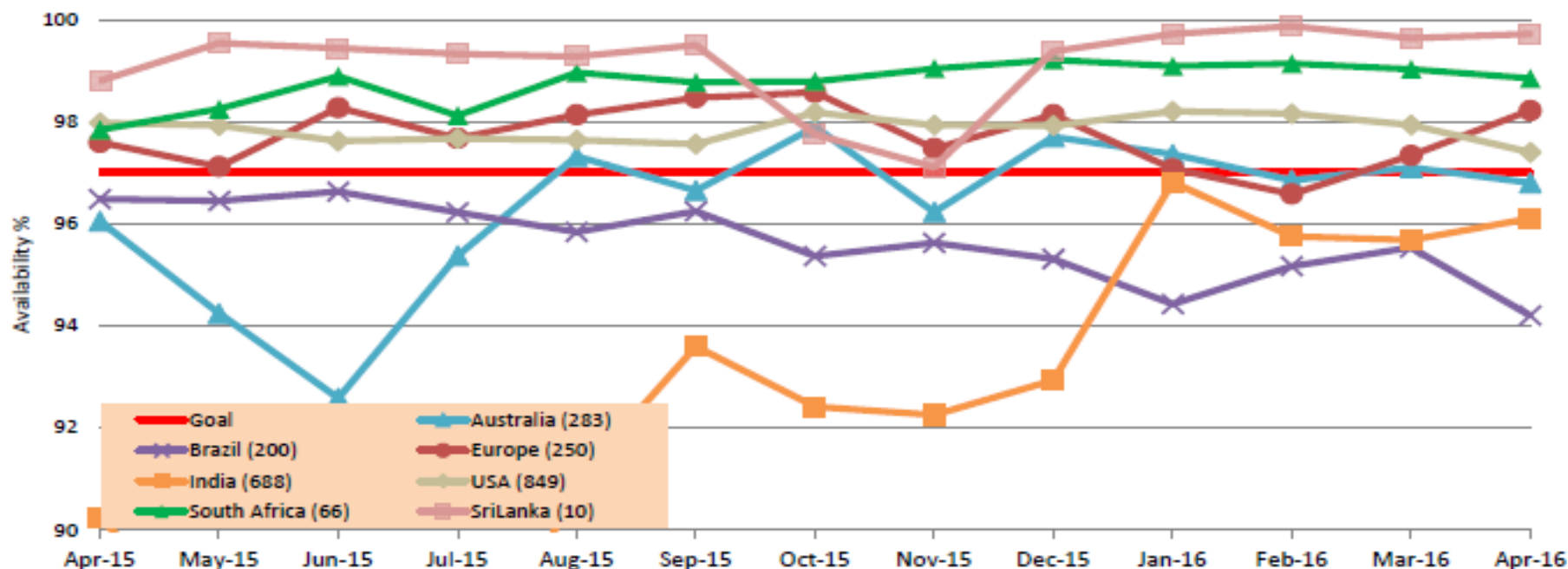
**Highest MTTR: 9.66hrs(East Kutch); Lowest: 1.67hrs(North Karnataka)**  
**147 turbines (2.66%) are in more than 24hrs MTTR**

# Relationship : MTBF, MTTR, WEC System



# S88 Turbine Availability

Suzlon Energy Ltd.

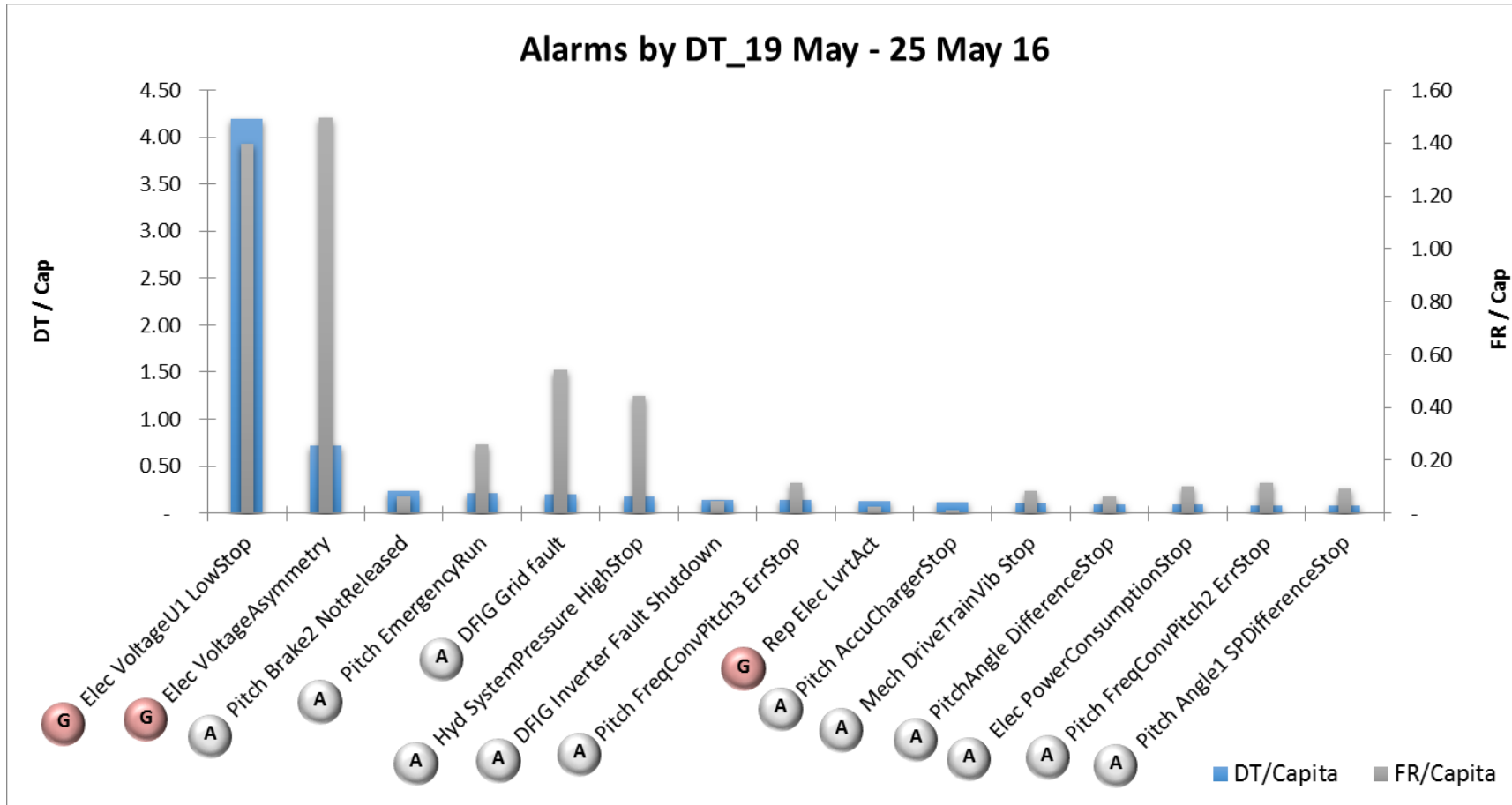


Main Reason	India	Brazil
Availability for the month	96.15%	94.20%
Availability loss due to non technical issues (Data N/A)	1.25%	0.03%
Availability Loss due to component failure (Blade, Gen Star-ring)	1.98%	1.04%
Availability lost due to Errors (Brazil: Pitch Err 29WTG's, SFS 6WTG's @ 45hrs per WTG to restore to operation)	0.62%	4.73%
<b>Grand Total</b>	<b>100.00%</b>	<b>100.00%</b>

**SUZLON**  
POWERING A GREENER TOMORROW

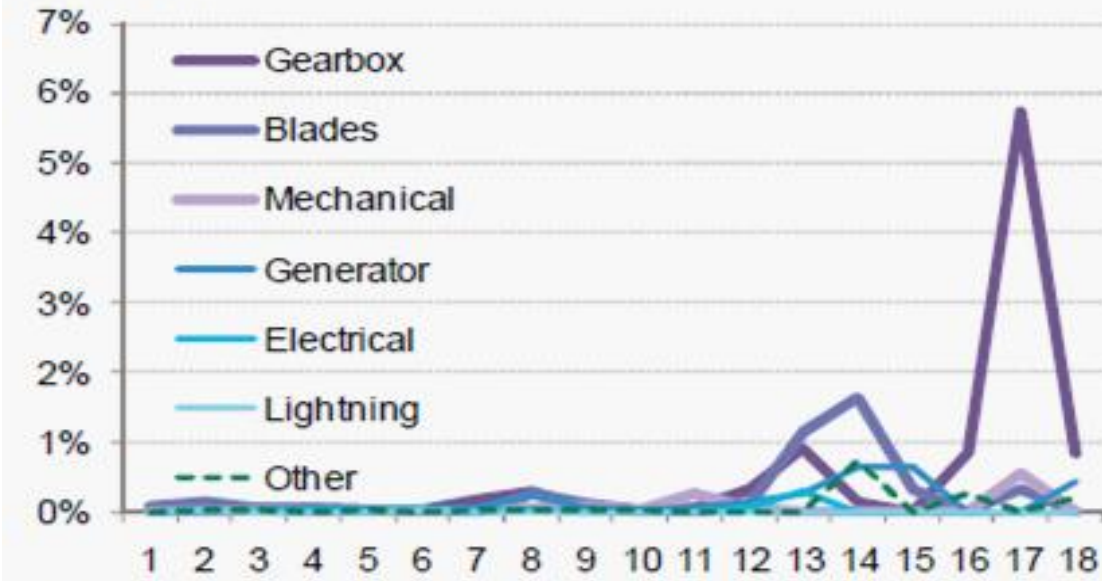
# Engineering

## Top Errors – North Karnataka



**G** Grid Alarms      **A** Action Required

**Figure 11: Unavailability rates through time by component failures (%)**



Source: Bloomberg New Energy Finance, Sciemus Notes: X axis represents

**Figure 10: Unavailability rates over full life by component failure (%)**

