# CMS RPC Detector and RPC HV Conditioning Analysis

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HSSIP Program

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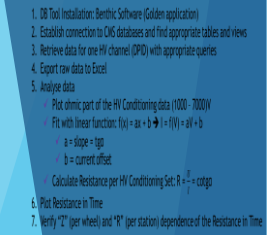
# Overview

1. DB Tool Installation: Benthic Software (Golden application)
2. Establish connection to CMS databases and find appropriate tables and views
3. Retrieve data for one HV channel (DPID) with appropriate queries
4. Export raw data to Excel
5. Analyse data
   - ✓ Plot ohmic part of the HV Conditioning data (1000 – 7000)V
   - ✓ Fit with linear function: f(x) = ax + b ➔ I = f(V) = aV + b
     - ✓ a = slope = tgα
     - ✓ b = current offset
   - ✓ Calculate Resistance per HV Conditioning Set: R = $\frac{U}{I}$ = cotgα
6. Plot Resistance in Time
7. Verify “Z” (per wheel) and “R” (per station) dependence of the Resistance in Time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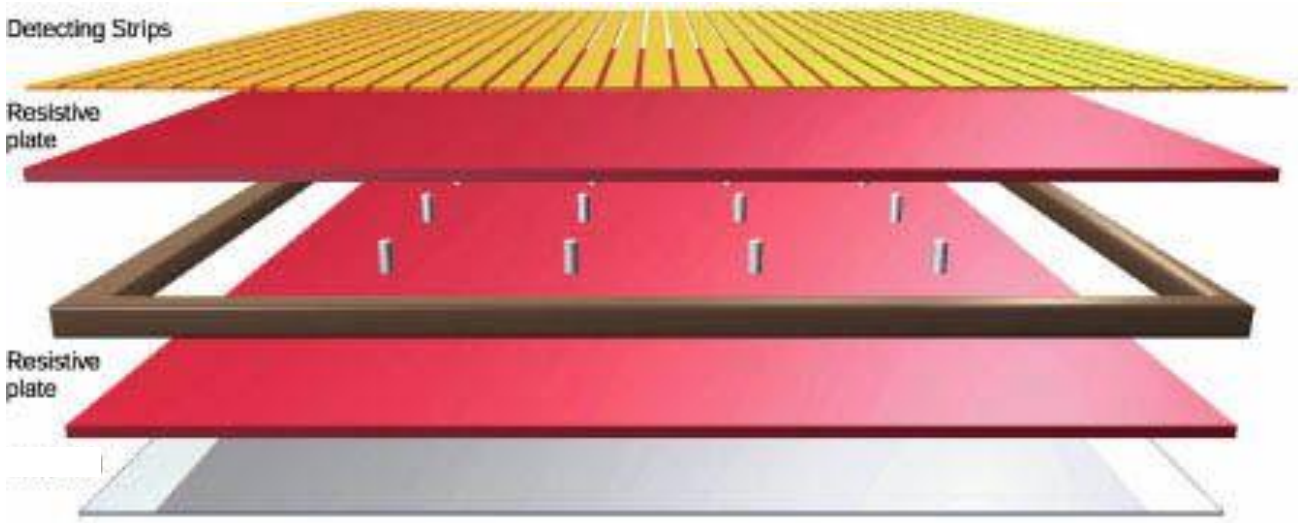
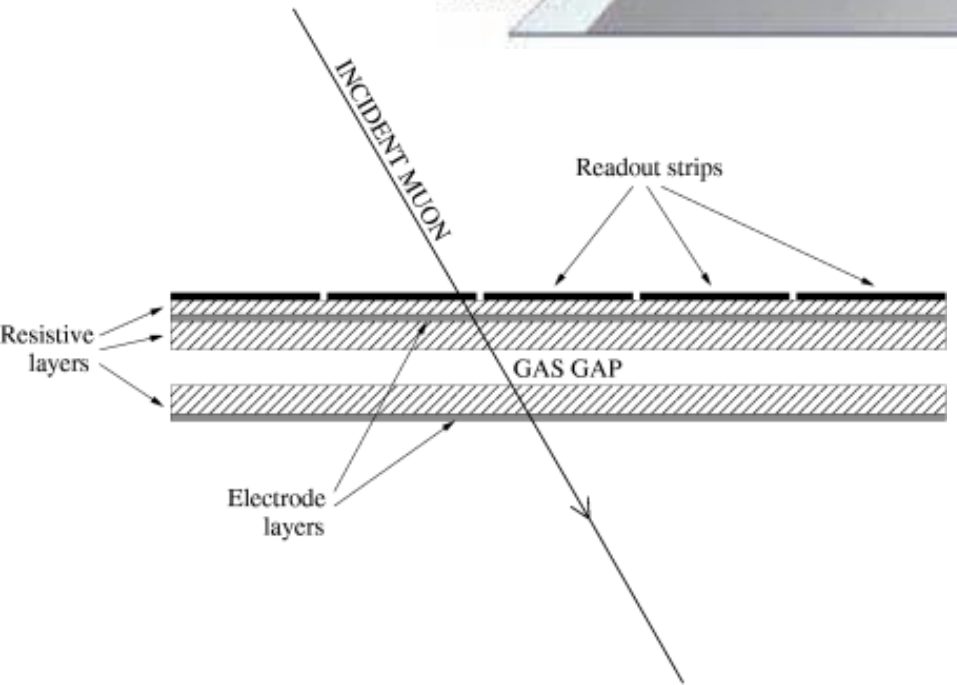
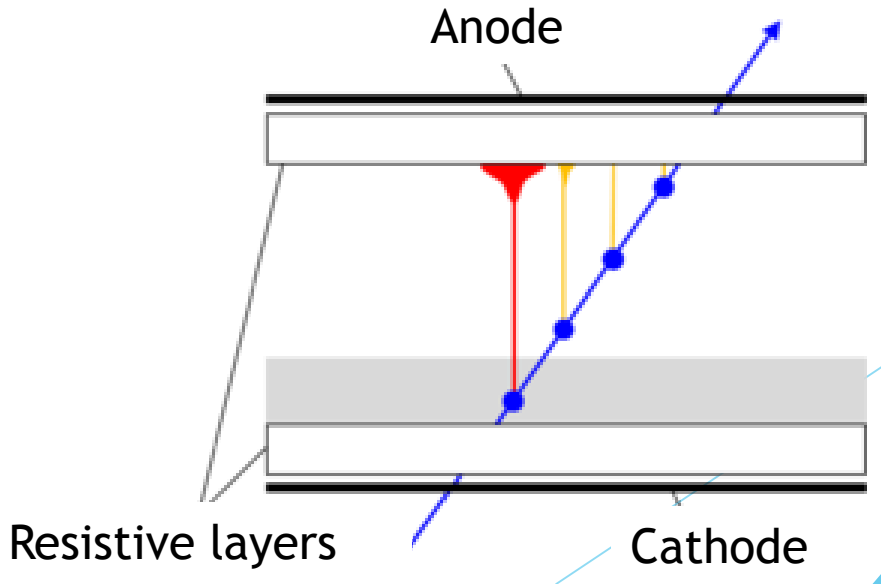
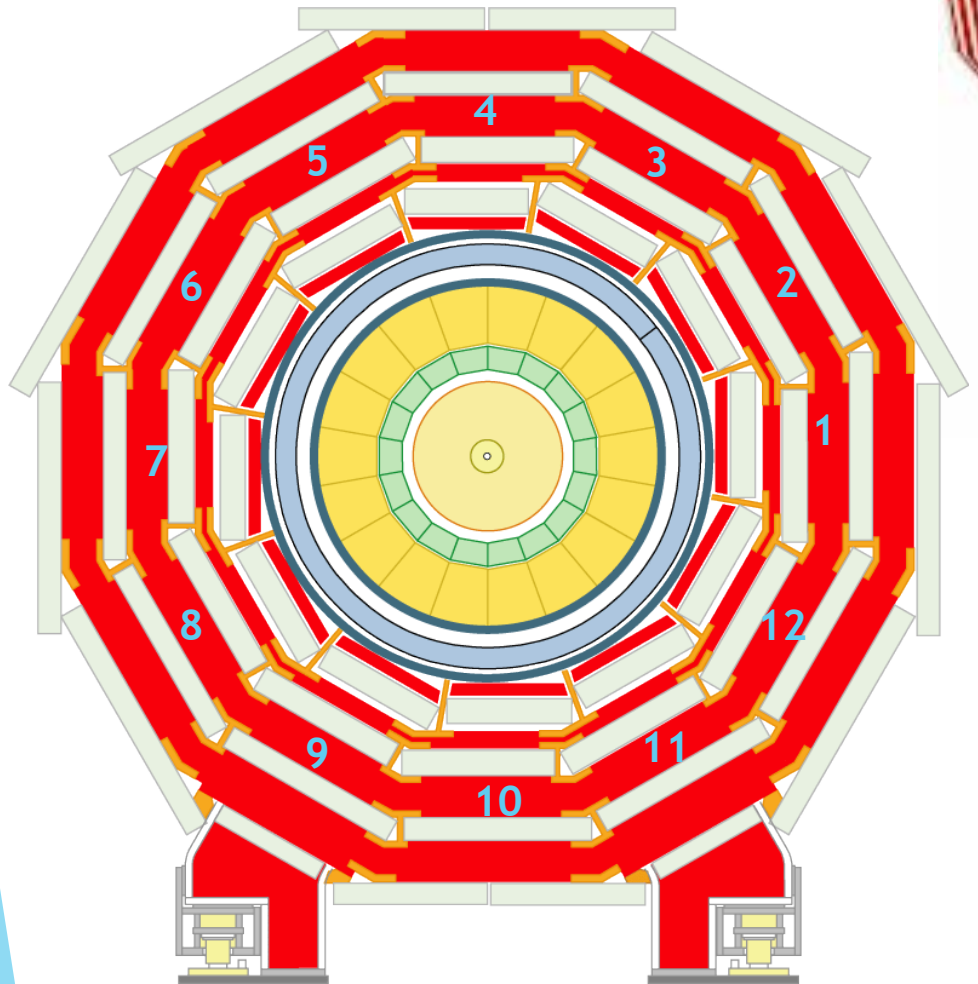
# RPC (Resistive Plate Chambers)

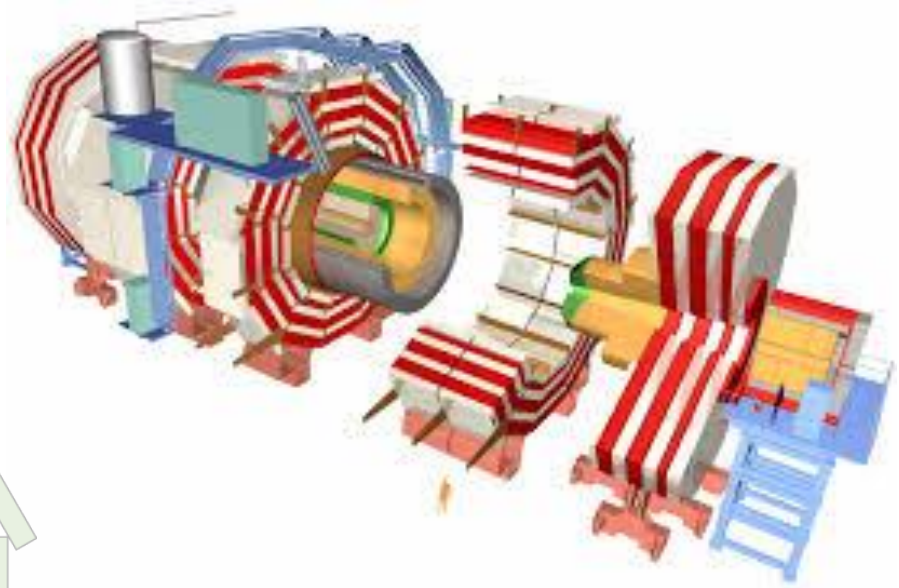


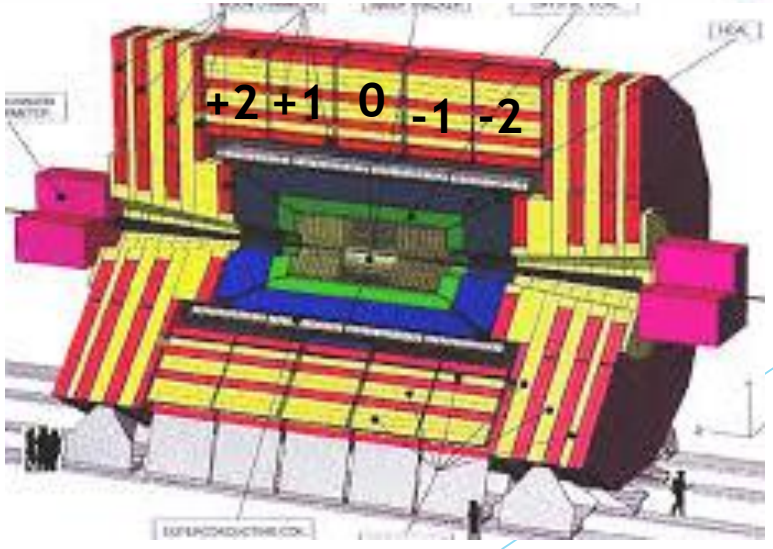



# Views of the CMS detector





# Golden application

CMS_RPC_COND@(DESCRIPTION=(ADDRESS= (PROTOCOL=TCP) (HOST=cmsonr1-adg1-s.cern.ch) (PORT=10121) )(ADDRESS=(PROTOCOL=TCP) (HOST=cmsonr2-adg1-s.cern.ch) (PORT=10121) )(LOAD_BALANCE=on)(ENABLE=BROKEN)(CONNECT_DATA=(SERVER=DEDICATED)(SERVICE_NAME=cms_omds_adg.c

File Edit Script Results View Tools Help

Query1 Query2 Query3

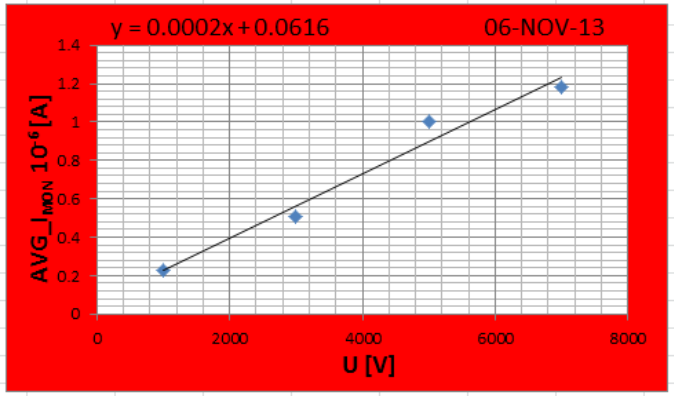
```
select * from CMS_RPC_COND.HVCONDITIONING_VIEW
 where DPID=324  and V_APPLIED < '7001' and START_DATE > '31-dec-10'
 order by start_date
```

| # | DPID | DATE | START_DATE | STOP_DATE | V_APPLIED | AVG_IMON |
|---|---|---|---|---|---|---|
| 1 | 324 | 06-NOV-13 10.10.17.000000 AM | 06-NOV-13 10.10.17.000000 AM | 06-NOV-13 11.37.53.000000 AM | 1000 | .2311487959115521 |
| 2 | 324 | 06-NOV-13 10.10.17.000000 AM | 06-NOV-13 11.39.06.000000 AM | 06-NOV-13 12.45.24.000000 PM | 3000 | .5071644045079156 |
| 3 | 324 | 06-NOV-13 10.10.17.000000 AM | 06-NOV-13 12.46.38.000000 PM | 06-NOV-13 02.16.04.000000 PM | 5000 | 1.0019567645044856 |
| 4 | 324 | 06-NOV-13 10.10.17.000000 AM | 06-NOV-13 02.17.01.000000 PM | 06-NOV-13 04.23.31.000000 PM | 7000 | 1.180568813410388 |
| 5 | 324 | 16-DEC-13 04.02.46.000000 PM | 16-DEC-13 04.02.46.000000 PM | 16-DEC-13 06.13.56.000000 PM | 1000 | .1504684340140483 |
| 6 | 324 | 16-DEC-13 04.02.46.000000 PM | 16-DEC-13 06.14.23.000000 PM | 16-DEC-13 08.13.11.000000 PM | 2000 | .2990434779000192 |
| 7 | 324 | 16-DEC-13 04.02.46.000000 PM | 16-DEC-13 08.13.34.000000 PM | 16-DEC-13 10.20.14.000000 PM | 3000 | .3533790101883768 |
| 8 | 324 | 16-DEC-13 04.02.46.000000 PM | 16-DEC-13 10.20.44.000000 PM | 16-DEC-13 11.27.23.000000 PM | 4000 | .6033107832855291 |
| 9 | 324 | 16-DEC-13 04.02.46.000000 PM | 16-DEC-13 11.28.07.000000 PM | 17-DEC-13 09.26.44.000000 AM | 5000 | .6106634943284194 |
| 10 | 324 | 16-DEC-13 04.02.46.000000 PM | 17-DEC-13 09.27.14.000000 AM | 17-DEC-13 10.17.16.000000 AM | 6000 | .7450033319067907 |
| 11 | 324 | 16-DEC-13 04.02.46.000000 PM | 17-DEC-13 10.18.06.000000 AM | 17-DEC-13 11.16.34.000000 AM | 7000 | .9043329304409135 |
| 12 | 324 | 15-APR-14 07.47.40.000000 PM | 15-APR-14 07.47.40.000000 PM | 15-APR-14 09.12.30.000000 PM | 2000 | .3476212311634911 |
| 13 | 324 | 15-APR-14 07.47.40.000000 PM | 15-APR-14 09.12.58.000000 PM | 15-APR-14 11.04.36.000000 PM | 3000 | .444670775736722 |
| 14 | 324 | 15-APR-14 07.47.40.000000 PM | 15-APR-14 11.05.03.000000 PM | 16-APR-14 07.58.40.000000 AM | 4000 | .6379283464018602 |
| 15 | 324 | 15-APR-14 07.47.40.000000 PM | 16-APR-14 07.59.07.000000 AM | 16-APR-14 10.16.09.000000 AM | 5000 | .7565587746978066 |
| 16 | 324 | 15-APR-14 07.47.40.000000 PM | 16-APR-14 10.16.45.000000 AM | 16-APR-14 11.34.49.000000 AM | 6000 | .9769427784480772 |
| 17 | 324 | 15-APR-14 07.47.40.000000 PM | 16-APR-14 11.34.49.000000 AM | 16-APR-14 12.19.38.000000 PM | 7000 | 1.0035874433759795 |
| 18 | 324 | 05-DEC-14 07.58.15.000000 AM | 05-DEC-14 07.58.15.000000 AM | 05-DEC-14 11.34.02.000000 AM | 1000 | .3720937503726659 |
| 19 | 324 | 05-DEC-14 07.58.15.000000 AM | 05-DEC-14 11.34.30.000000 AM | 05-DEC-14 12.44.09.000000 PM | 2000 | .4036116210821531 |
| 20 | 324 | 05-DEC-14 07.58.15.000000 AM | 05-DEC-14 12.44.23.000000 PM | 05-DEC-14 02.45.58.000000 PM | 3000 | .6006866185523034 |
| 21 | 324 | 05-DEC-14 07.58.15.000000 AM | 05-DEC-14 02.46.25.000000 PM | 05-DEC-14 03.49.59.000000 PM | 4000 | .7098846246449809 |
| 22 | 324 | 05-DEC-14 07.58.15.000000 AM | 05-DEC-14 03.50.27.000000 PM | 05-DEC-14 05.02.35.000000 PM | 5000 | .9018539742826723 |
| 23 | 324 | 05-DEC-14 07.58.15.000000 AM | 05-DEC-14 05.03.03.000000 PM | 05-DEC-14 06.05.35.000000 PM | 6000 | .9057784687075913 |
| 24 | 324 | 05-DEC-14 07.58.15.000000 AM | 05-DEC-14 06.06.03.000000 PM | 05-DEC-14 07.10.28.000000 PM | 7000 | .9246054141364153 |
| 25 | 324 | 10-FEB-16 11.13.29.000000 AM | 10-FEB-16 11.13.29.000000 AM | 10-FEB-16 02.17.09.000000 PM | 1000 | .15262144161469 |
| 26 | 324 | 10-FEB-16 11.13.29.000000 AM | 10-FEB-16 02.18.12.000000 PM | 15-FEB-16 10.57.06.000000 AM | 3000 | .3111233164481377 |
| 27 | 324 | 10-FEB-16 11.13.29.000000 AM | 15-FEB-16 10.58.24.000000 AM | 16-FEB-16 09.14.41.000000 AM | 5000 | .5280791287629473 |
| 28 | 324 | 10-FEB-16 11.13.29.000000 AM | 16-FEB-16 09.15.57.000000 AM | 22-FEB-16 09.28.46.000000 AM | 7000 | .663487271113718 |
| 29 | 324 | 12-SEP-16 03.15.33.000000 PM | 12-SEP-16 03.15.33.000000 PM | 14-SEP-16 06.44.14.000000 PM | 1000 | .3652429119622799 |

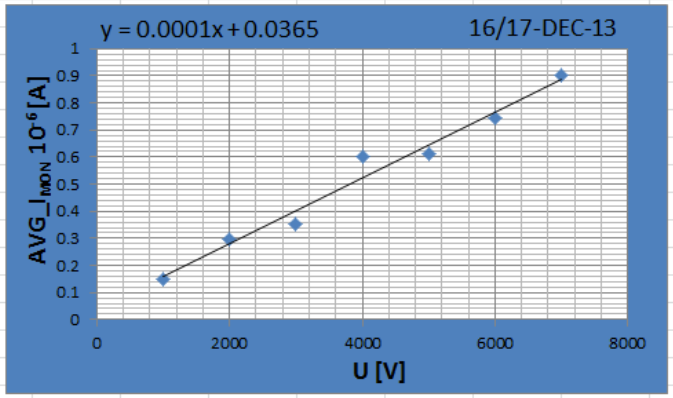
Done, ran 1 of 1 statements. Selected 49 records Script: 0.016 Secs

# Results: 2013 - 2014

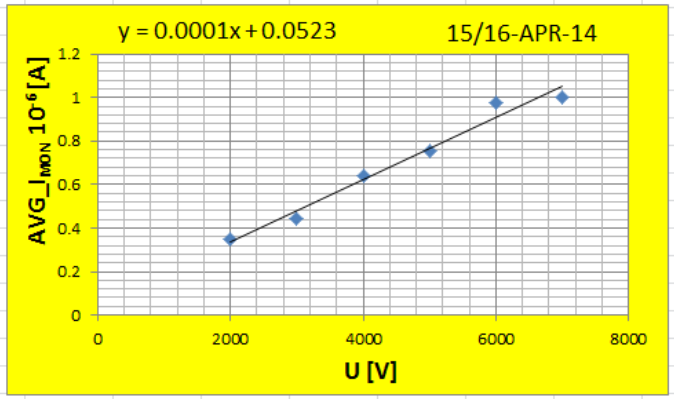
| DPID | DATE | START_DATE | STOP_DATE | V_APPLIED | AVG_IMON |
|---|---|---|---|---|---|
| 324 | 07-OCT-09 05.24.57.000000 AM | 07-OCT-09 05.24.57.000000 AM | 07-OCT-09 05.55.11.000000 AM | 3000 | 1.796912912 |
| 324 | 07-OCT-09 05.24.57.000000 AM | 07-OCT-09 05.56.24.000000 AM | 07-OCT-09 06.25.37.000000 AM | 4000 | 1.899999976 |
| 324 | 07-OCT-09 05.24.57.000000 AM | 07-OCT-09 06.27.36.000000 AM | 07-OCT-09 06.52.55.000000 AM | 6000 | 1.752139595 |
| 324 | 06-NOV-13 10.10.17.000000 AM | 06-NOV-13 10.10.17.000000 AM | 06-NOV-13 11.37.53.000000 AM | 1000 | 0.231148796 |
| 324 | 06-NOV-13 10.10.17.000000 AM | 06-NOV-13 11.39.06.000000 AM | 06-NOV-13 12.45.24.000000 PM | 3000 | 0.507164405 |
| 324 | 06-NOV-13 10.10.17.000000 AM | 06-NOV-13 12.46.38.000000 PM | 06-NOV-13 02.16.04.000000 PM | 5000 | 1.001956765 |
| 324 | 06-NOV-13 10.10.17.000000 AM | 06-NOV-13 02.17.01.000000 PM | 06-NOV-13 04.23.31.000000 PM | 7000 | 1.180568813 |
| 324 | 16-DEC-13 04.02.46.000000 PM | 16-DEC-13 04.02.46.000000 PM | 16-DEC-13 06.13.56.000000 PM | 1000 | 0.150468434 |
| 324 | 16-DEC-13 04.02.46.000000 PM | 16-DEC-13 06.14.23.000000 PM | 16-DEC-13 08.13.11.000000 PM | 2000 | 0.299043478 |
| 324 | 16-DEC-13 04.02.46.000000 PM | 16-DEC-13 08.13.34.000000 PM | 16-DEC-13 10.20.14.000000 PM | 3000 | 0.35337901 |
| 324 | 16-DEC-13 04.02.46.000000 PM | 16-DEC-13 10.20.44.000000 PM | 16-DEC-13 11.27.23.000000 PM | 4000 | 0.603310783 |
| 324 | 16-DEC-13 04.02.46.000000 PM | 16-DEC-13 11.28.07.000000 PM | 17-DEC-13 09.26.44.000000 AM | 5000 | 0.610663494 |
| 324 | 16-DEC-13 04.02.46.000000 PM | 17-DEC-13 09.27.14.000000 AM | 17-DEC-13 10.17.16.000000 AM | 6000 | 0.745003332 |
| 324 | 16-DEC-13 04.02.46.000000 PM | 17-DEC-13 10.18.06.000000 AM | 17-DEC-13 11.16.34.000000 AM | 7000 | 0.90433293 |
| 324 | 15-APR-14 07.47.40.000000 PM | 15-APR-14 07.47.40.000000 PM | 15-APR-14 09.12.30.000000 PM | 2000 | 0.347621231 |
| 324 | 15-APR-14 07.47.40.000000 PM | 15-APR-14 09.12.58.000000 PM | 15-APR-14 11.04.36.000000 PM | 3000 | 0.444670776 |
| 324 | 15-APR-14 07.47.40.000000 PM | 15-APR-14 11.05.03.000000 PM | 16-APR-14 07.58.40.000000 AM | 4000 | 0.637928346 |
| 324 | 15-APR-14 07.47.40.000000 PM | 16-APR-14 07.59.07.000000 AM | 16-APR-14 10.16.09.000000 AM | 5000 | 0.756558775 |
| 324 | 15-APR-14 07.47.40.000000 PM | 16-APR-14 10.16.45.000000 AM | 16-APR-14 11.34.49.000000 AM | 6000 | 0.976942778 |
| 324 | 15-APR-14 07.47.40.000000 PM | 16-APR-14 11.34.49.000000 AM | 16-APR-14 12.19.38.000000 PM | 7000 | 1.003587443 |
| 324 | 05-DEC-14 07.58.15.000000 AM | 05-DEC-14 07.58.15.000000 AM | 05-DEC-14 11.34.02.000000 AM | 1000 | 0.37209375 |
| 324 | 05-DEC-14 07.58.15.000000 AM | 05-DEC-14 11.34.30.000000 AM | 05-DEC-14 12.44.09.000000 PM | 2000 | 0.403611621 |
| 324 | 05-DEC-14 07.58.15.000000 AM | 05-DEC-14 12.44.23.000000 PM | 05-DEC-14 02.45.58.000000 PM | 3000 | 0.600686619 |
| 324 | 05-DEC-14 07.58.15.000000 AM | 05-DEC-14 02.46.25.000000 PM | 05-DEC-14 03.49.59.000000 PM | 4000 | 0.709884625 |
| 324 | 05-DEC-14 07.58.15.000000 AM | 05-DEC-14 03.50.27.000000 PM | 05-DEC-14 05.02.35.000000 PM | 5000 | 0.901853974 |
| 324 | 05-DEC-14 07.58.15.000000 AM | 05-DEC-14 05.03.03.000000 PM | 05-DEC-14 06.05.35.000000 PM | 6000 | 0.905778469 |
| 324 | 05-DEC-14 07.58.15.000000 AM | 05-DEC-14 06.06.03.000000 PM | 05-DEC-14 07.10.28.000000 PM | 7000 | 0.924605414 |
| 324 | 10-FEB-16 11.13.29.000000 AM | 10-FEB-16 11.13.29.000000 AM | 10-FEB-16 02.17.09.000000 PM | 1000 | 0.152621442 |
| 324 | 10-FEB-16 11.13.29.000000 AM | 10-FEB-16 02.18.12.000000 PM | 15-FEB-16 10.57.06.000000 AM | 3000 | 0.311123316 |
| 324 | 10-FEB-16 11.13.29.000000 AM | 15-FEB-16 10.58.24.000000 AM | 16-FEB-16 09.14.41.000000 AM | 5000 | 0.528079129 |
| 324 | 10-FEB-16 11.13.29.000000 AM | 16-FEB-16 09.15.57.000000 AM | 22-FEB-16 09.28.46.000000 AM | 7000 | 0.663487271 |
| 324 | 12-SEP-16 03.15.33.000000 PM | 12-SEP-16 03.15.33.000000 PM | 14-SEP-16 06.44.14.000000 PM | 1000 | 0.365242912 |
| 324 | 12-SEP-16 03.15.33.000000 PM | 14-SEP-16 06.44.50.000000 PM | 14-SEP-16 07.58.32.000000 PM | 2000 | 0.543939399 |
| 324 | 12-SEP-16 03.15.33.000000 PM | 14-SEP-16 07.58.32.000000 PM | 14-SEP-16 09.20.57.000000 PM | 3000 | 0.674523324 |
| 324 | 12-SEP-16 03.15.33.000000 PM | 14-SEP-16 09.21.31.000000 PM | 14-SEP-16 10.55.28.000000 PM | 4000 | 0.903549852 |
| 324 | 12-SEP-16 03.15.33.000000 PM | 14-SEP-16 10.55.55.000000 PM | 15-SEP-16 03.26.12.000000 AM | 5000 | 0.918721073 |
| 324 | 12-SEP-16 03.15.33.000000 PM | 15-SEP-16 03.26.48.000000 AM | 15-SEP-16 04.31.01.000000 AM | 6000 | 1.202857191 |
| 324 | 12-SEP-16 03.15.33.000000 PM | 15-SEP-16 04.31.01.000000 AM | 15-SEP-16 05.35.47.000000 AM | 7000 | 1.200000048 |
| 324 | 04-APR-17 01.51.45.000000 PM | 04-APR-17 01.51.45.000000 PM | 04-APR-17 03.49.35.000000 PM | 1000 | 0.322555975 |
| 324 | 04-APR-17 01.51.45.000000 PM | 04-APR-17 03.50.10.000000 PM | 04-APR-17 05.16.10.000000 PM | 2000 | 0.699999988 |



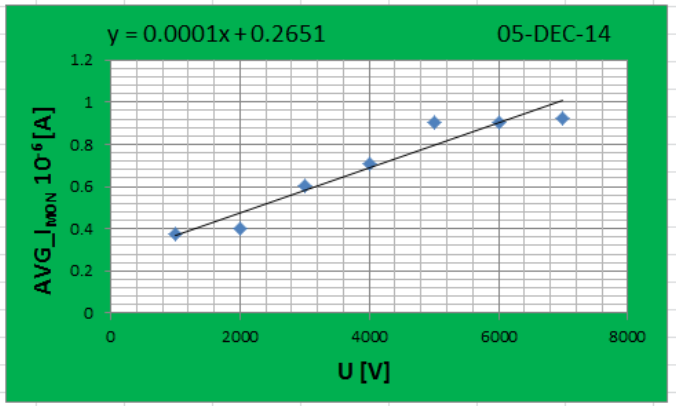

$$R = cotg\alpha = \frac{1}{tg\alpha} = \frac{1}{2 * 10^{-4} * 10^{-6}} = 5 * 10^{9} = 5G\Omega$$




$$R = cotg\alpha = \frac{1}{tg\alpha} = \frac{1}{10^{-4} * 10^{-6}} = 10^{10} = 10G\Omega$$



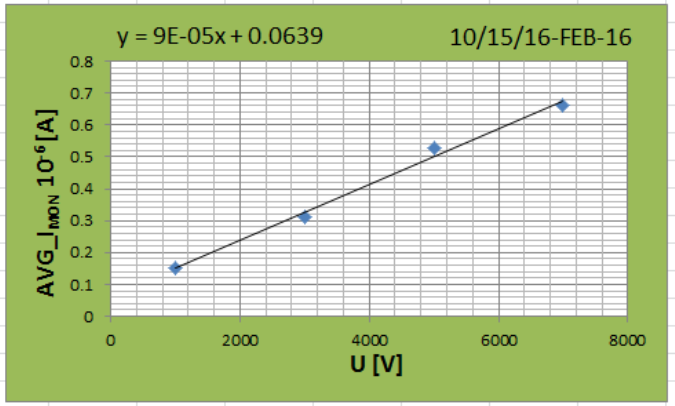

$$R = cotg\alpha = \frac{1}{tg\alpha} = \frac{1}{10^{-4} * 10^{-6}} = 10^{10} = 10G\Omega$$



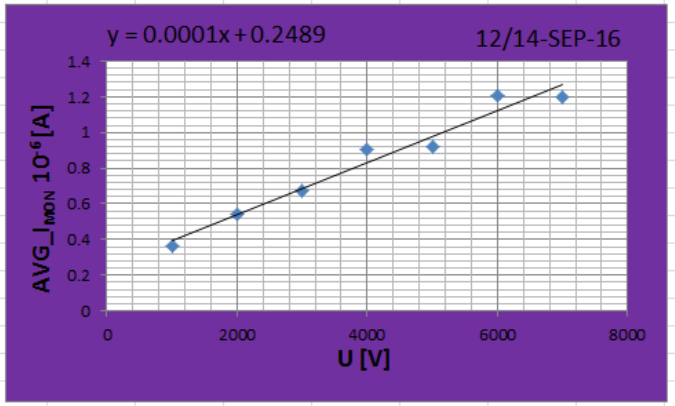

$$R = cotg\alpha = \frac{1}{tg\alpha} = \frac{1}{10^{-4} * 10^{-6}} = 10^{10} = 10G\Omega$$

# Results: 2016 - 2017

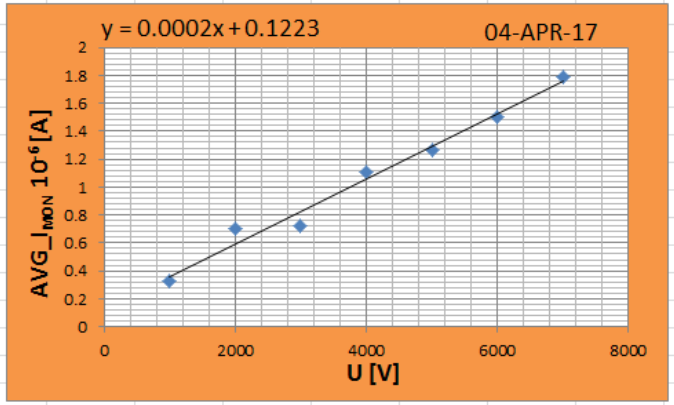
| | | | | |
|---|---|---|---|---|
| 324 | 15-APR-14 07.47.40.000000 PM | 15-APR-14 07.47.40.000000 PM | 15-APR-14 09.12.30.000000 PM | 2000 0.347621231 |
| 324 | 15-APR-14 07.47.40.000000 PM | 15-APR-14 09.12.58.000000 PM | 15-APR-14 11.04.36.000000 PM | 3000 0.444670776 |
| 324 | 15-APR-14 07.47.40.000000 PM | 15-APR-14 11.05.03.000000 PM | 16-APR-14 07.58.40.000000 AM | 4000 0.637928346 |
| 324 | 15-APR-14 07.47.40.000000 PM | 16-APR-14 07.59.07.000000 AM | 16-APR-14 10.16.09.000000 AM | 5000 0.756558775 |
| 324 | 15-APR-14 07.47.40.000000 PM | 16-APR-14 10.16.45.000000 AM | 16-APR-14 11.34.49.000000 AM | 6000 0.976942778 |
| 324 | 15-APR-14 07.47.40.000000 PM | 16-APR-14 11.34.49.000000 AM | 16-APR-14 12.19.38.000000 PM | 7000 1.003587443 |
| 324 | 05-DEC-14 07.58.15.000000 AM | 05-DEC-14 07.58.15.000000 AM | 05-DEC-14 11.34.02.000000 AM | 1000 0.37209375 |
| 324 | 05-DEC-14 07.58.15.000000 AM | 05-DEC-14 11.34.30.000000 AM | 05-DEC-14 12.44.09.000000 PM | 2000 0.403611621 |
| 324 | 05-DEC-14 07.58.15.000000 AM | 05-DEC-14 12.44.23.000000 PM | 05-DEC-14 02.45.58.000000 PM | 3000 0.600686619 |
| 324 | 05-DEC-14 07.58.15.000000 AM | 05-DEC-14 02.46.25.000000 PM | 05-DEC-14 03.49.59.000000 PM | 4000 0.709884625 |
| 324 | 05-DEC-14 07.58.15.000000 AM | 05-DEC-14 03.50.27.000000 PM | 05-DEC-14 05.02.35.000000 PM | 5000 0.901853974 |
| 324 | 05-DEC-14 07.58.15.000000 AM | 05-DEC-14 05.03.03.000000 PM | 05-DEC-14 06.05.35.000000 PM | 6000 0.905778469 |
| 324 | 05-DEC-14 07.58.15.000000 AM | 05-DEC-14 06.06.03.000000 PM | 05-DEC-14 07.10.28.000000 PM | 7000 0.924605414 |
| 324 | 10-FEB-16 11.13.29.000000 AM | 10-FEB-16 11.13.29.000000 AM | 10-FEB-16 02.17.09.000000 PM | 1000 0.152621442 |
| 324 | 10-FEB-16 11.13.29.000000 AM | 10-FEB-16 02.18.12.000000 PM | 15-FEB-16 10.57.06.000000 AM | 3000 0.311123316 |
| 324 | 10-FEB-16 11.13.29.000000 AM | 15-FEB-16 10.58.24.000000 AM | 16-FEB-16 09.14.41.000000 AM | 5000 0.528079129 |
| 324 | 10-FEB-16 11.13.29.000000 AM | 16-FEB-16 09.15.57.000000 AM | 22-FEB-16 09.28.46.000000 AM | 7000 0.663487271 |
| 324 | 12-SEP-16 03.15.33.000000 PM | 12-SEP-16 03.15.33.000000 PM | 14-SEP-16 06.44.14.000000 PM | 1000 0.365242912 |
| 324 | 12-SEP-16 03.15.33.000000 PM | 14-SEP-16 06.44.50.000000 PM | 14-SEP-16 07.58.32.000000 PM | 2000 0.543939399 |
| 324 | 12-SEP-16 03.15.33.000000 PM | 14-SEP-16 07.58.32.000000 PM | 14-SEP-16 09.20.57.000000 PM | 3000 0.674523324 |
| 324 | 12-SEP-16 03.15.33.000000 PM | 14-SEP-16 09.21.31.000000 PM | 14-SEP-16 10.55.28.000000 PM | 4000 0.903549852 |
| 324 | 12-SEP-16 03.15.33.000000 PM | 14-SEP-16 10.55.55.000000 PM | 15-SEP-16 03.26.12.000000 AM | 5000 0.918721073 |
| 324 | 12-SEP-16 03.15.33.000000 PM | 15-SEP-16 03.26.48.000000 AM | 15-SEP-16 04.31.01.000000 AM | 6000 1.202857191 |
| 324 | 12-SEP-16 03.15.33.000000 PM | 15-SEP-16 04.31.01.000000 AM | 15-SEP-16 05.35.47.000000 AM | 7000 1.200000048 |
| 324 | 04-APR-17 01.51.45.000000 PM | 04-APR-17 01.51.45.000000 PM | 04-APR-17 03.49.35.000000 PM | 1000 0.322555975 |
| 324 | 04-APR-17 01.51.45.000000 PM | 04-APR-17 03.50.10.000000 PM | 04-APR-17 05.16.10.000000 PM | 2000 0.699999988 |
| 324 | 04-APR-17 01.51.45.000000 PM | 04-APR-17 05.16.49.000000 PM | 04-APR-17 06.15.36.000000 PM | 3000 0.722200159 |
| 324 | 04-APR-17 01.51.45.000000 PM | 04-APR-17 06.16.11.000000 PM | 04-APR-17 07.34.16.000000 PM | 4000 1.103080237 |
| 324 | 04-APR-17 01.51.45.000000 PM | 04-APR-17 07.35.08.000000 PM | 04-APR-17 09.20.17.000000 PM | 5000 1.260500864 |
| 324 | 04-APR-17 01.51.45.000000 PM | 04-APR-17 09.20.43.000000 PM | 04-APR-17 10.46.29.000000 PM | 6000 1.501558847 |
| 324 | 04-APR-17 01.51.45.000000 PM | 04-APR-17 10.47.03.000000 PM | 05-APR-17 06.42.26.000000 AM | 7000 1.790065844 |
| 324 | 24-JUL-17 04.52.16.000000 PM | 24-JUL-17 04.52.16.000000 PM | 24-JUL-17 06.25.18.000000 PM | 1000 0.426954959 |
| 324 | 24-JUL-17 04.52.16.000000 PM | 24-JUL-17 06.25.52.000000 PM | 24-JUL-17 07.31.15.000000 PM | 2000 0.699999988 |
| 324 | 24-JUL-17 04.52.16.000000 PM | 24-JUL-17 07.32.05.000000 PM | 24-JUL-17 08.37.43.000000 PM | 3000 0.99238192 |
| 324 | 24-JUL-17 04.52.16.000000 PM | 24-JUL-17 08.38.16.000000 PM | 24-JUL-17 10.01.43.000000 PM | 4000 1.102363832 |
| 324 | 24-JUL-17 04.52.16.000000 PM | 24-JUL-17 10.02.17.000000 PM | 24-JUL-17 11.02.58.000000 PM | 5000 1.40271901 |
| 324 | 24-JUL-17 04.52.16.000000 PM | 24-JUL-17 11.03.23.000000 PM | 25-JUL-17 05.58.48.000000 AM | 6000 1.49067989 |
| 324 | 24-JUL-17 04.52.16.000000 PM | 25-JUL-17 05.59.21.000000 AM | 25-JUL-17 07.04.11.000000 AM | 7000 1.807634915 |



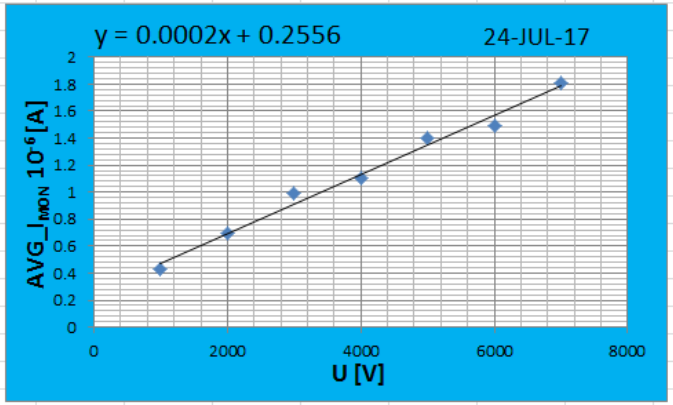

$$R = cotg\alpha = \frac{1}{tg\alpha} = \frac{1}{9 * 10^{-5} * 10^{-6}} = \frac{10^{11}}{9} = 11,1G\Omega$$




$$R = cotg\alpha = \frac{1}{tg\alpha} = \frac{1}{10^{-4} * 10^{-6}} = 10^{10} = 10G\Omega$$

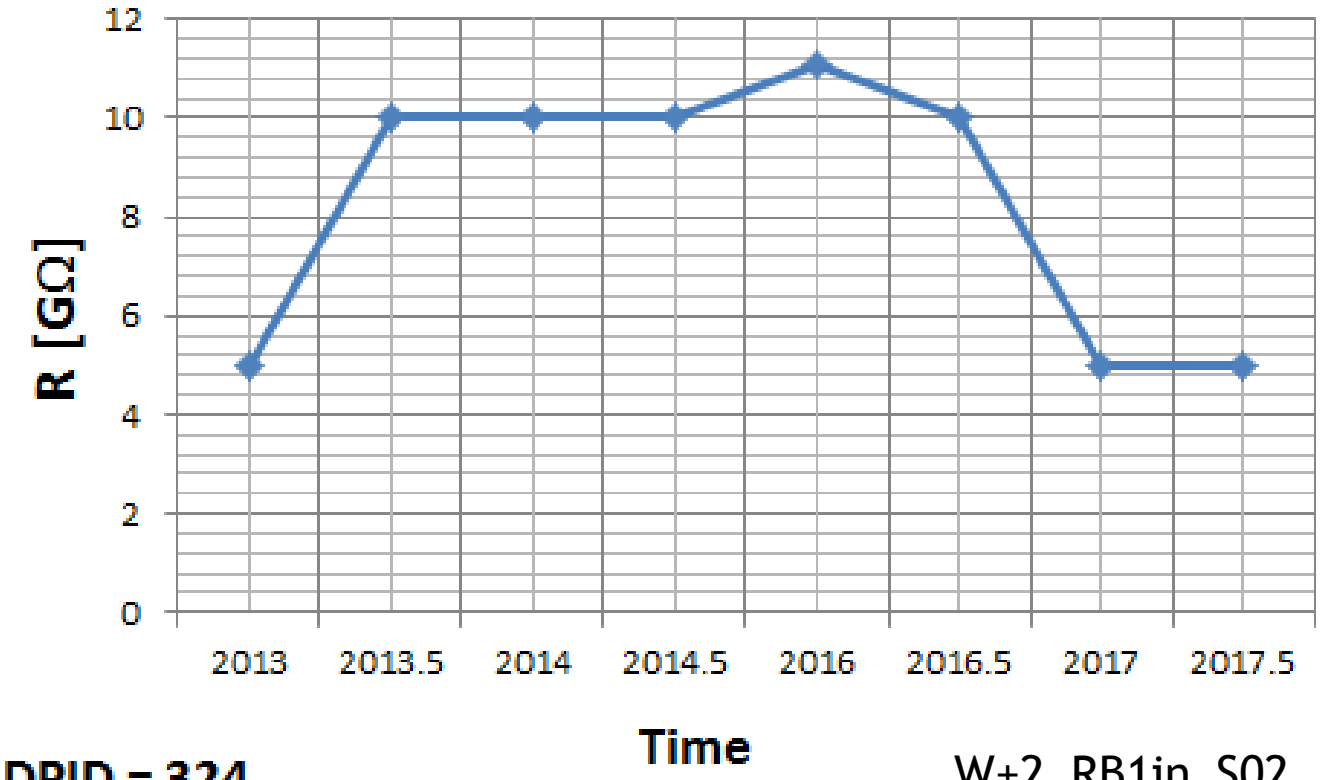



$$R = cotg\alpha = \frac{1}{tg\alpha} = \frac{1}{2 * 10^{-4} * 10^{-6}} = 5 * 10^{9} = 5G\Omega$$




$$R = cotg\alpha = \frac{1}{tg\alpha} = \frac{1}{2 * 10^{-4} * 10^{-6}} = 5 * 10^{9} = 5G\Omega$$

# Results: Resistance Evolution in Time




**DPID = 324**

W+2_RB1in_S02

# “Z” (per wheel) dependence

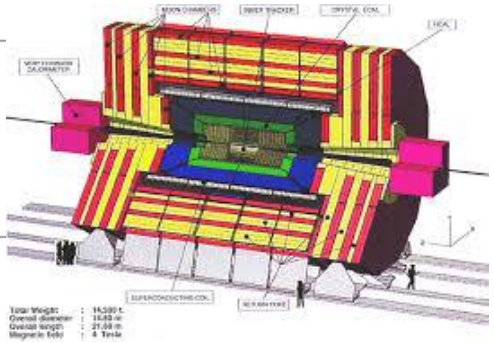
R [GΩ]

35
30
25
20
15
10
5
0

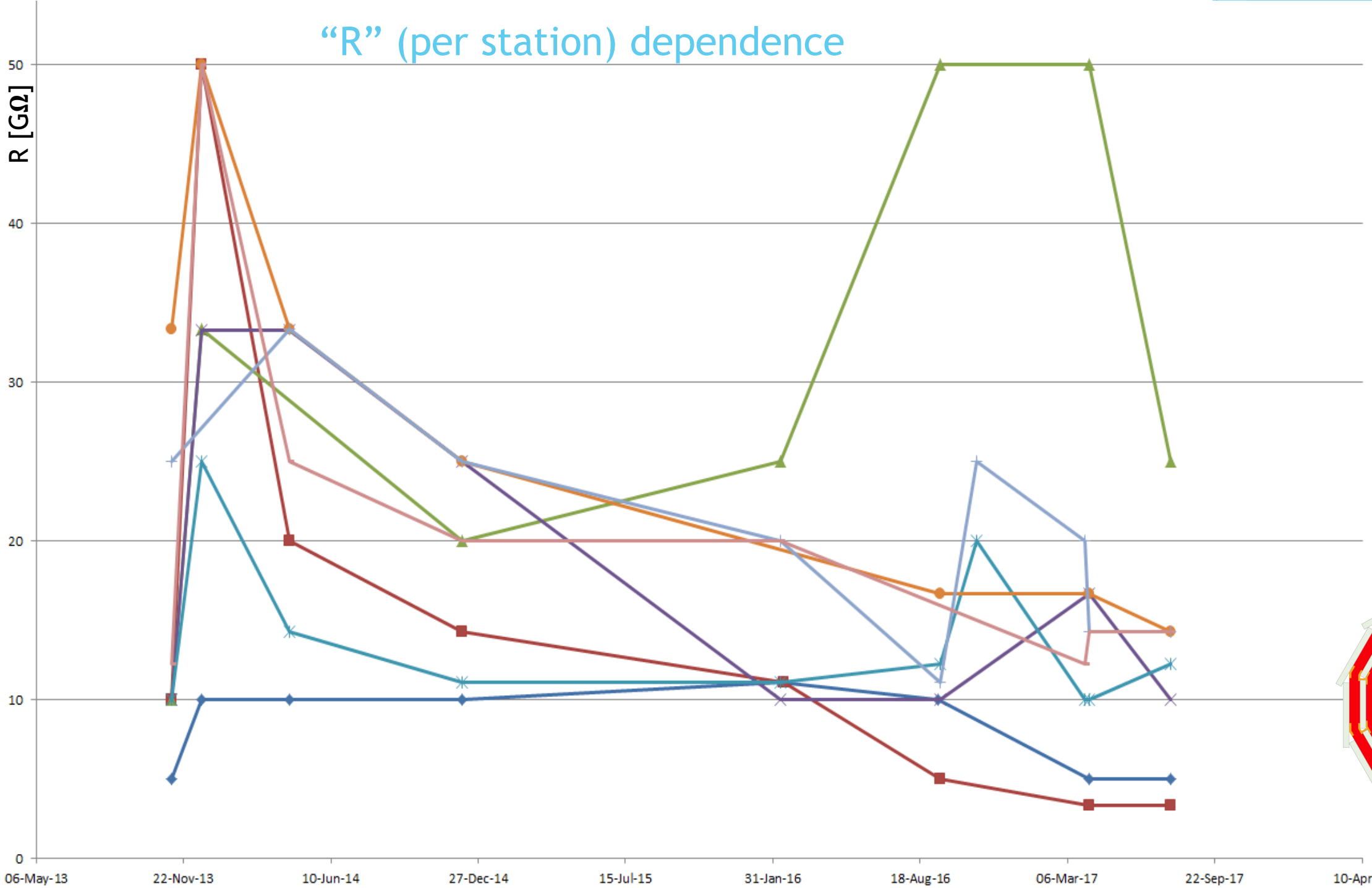
06-May-13
22-Nov-13
10-Jun-14
27-Dec-14
15-Jul-15
31-Jan-16
18-Aug-16
06-Mar-17
22-Sep-17
10-Apr-18

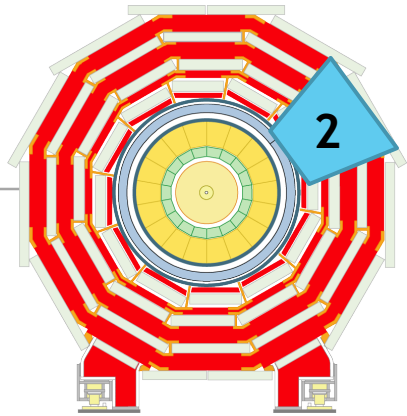
Time

W+2_RB1in_SO2 = 324
W+1_RB1in_SO2 = 2937
W0_RB1in_SO2 = 6425
W-1_RB1in_SO2 = 3047



# “R” (per station) dependence



# Conclusion

- Learn Benthic Software DB Tool
- Learn RPC construction and operation
- Recall basic SQL queries
- Extract data from CMS databases
- Analyse data: plot, fit, extrapolate, evaluate


Thank
you!