
CERN

R2E Annual Meeting
The Monitoring Calculation Working Group (MCWG)

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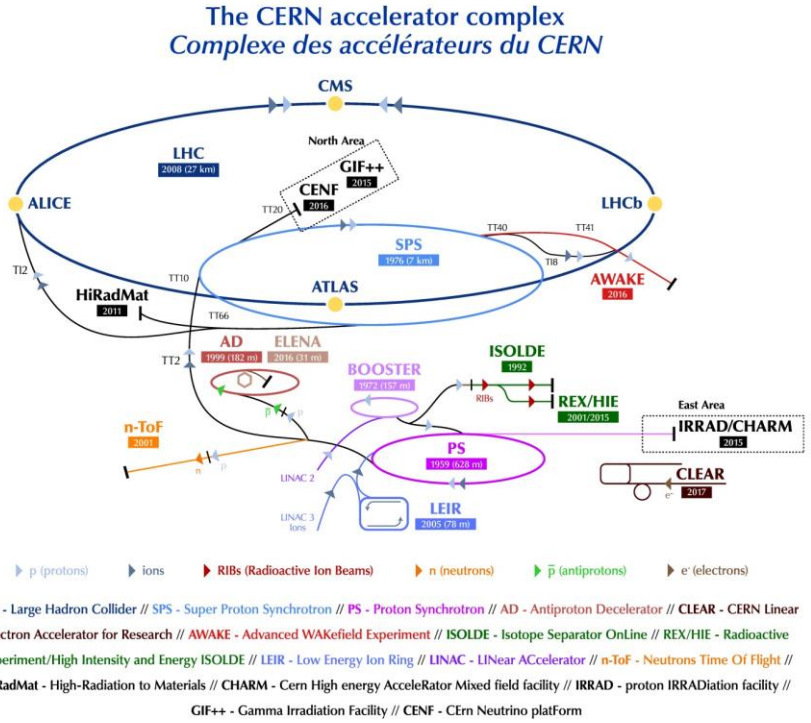
Y. Kadi, G. Lerner, G. Li Vecchi, C. Martinella,

MCWG

Accelerator operation and radiation fields

Continuous losses during accelerator operation creates a **mixed radiation fields** in the tunnels and adjacent caverns.

Radiation can negatively impact the life time and the functionality of the accelerator components and in worse case can lead to downtime of the machines.



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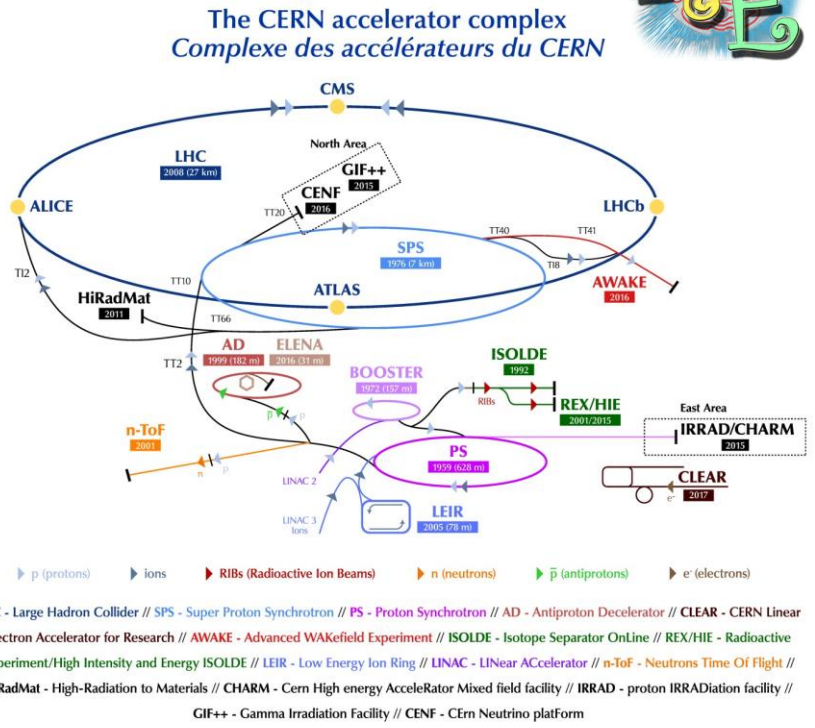


For optimal operation:

→ Qualified radiation tolerant systems

→ **Radiation fields need monitoring** ← **MCWG**

Mandate of the **Monitoring Calculation Working Group**

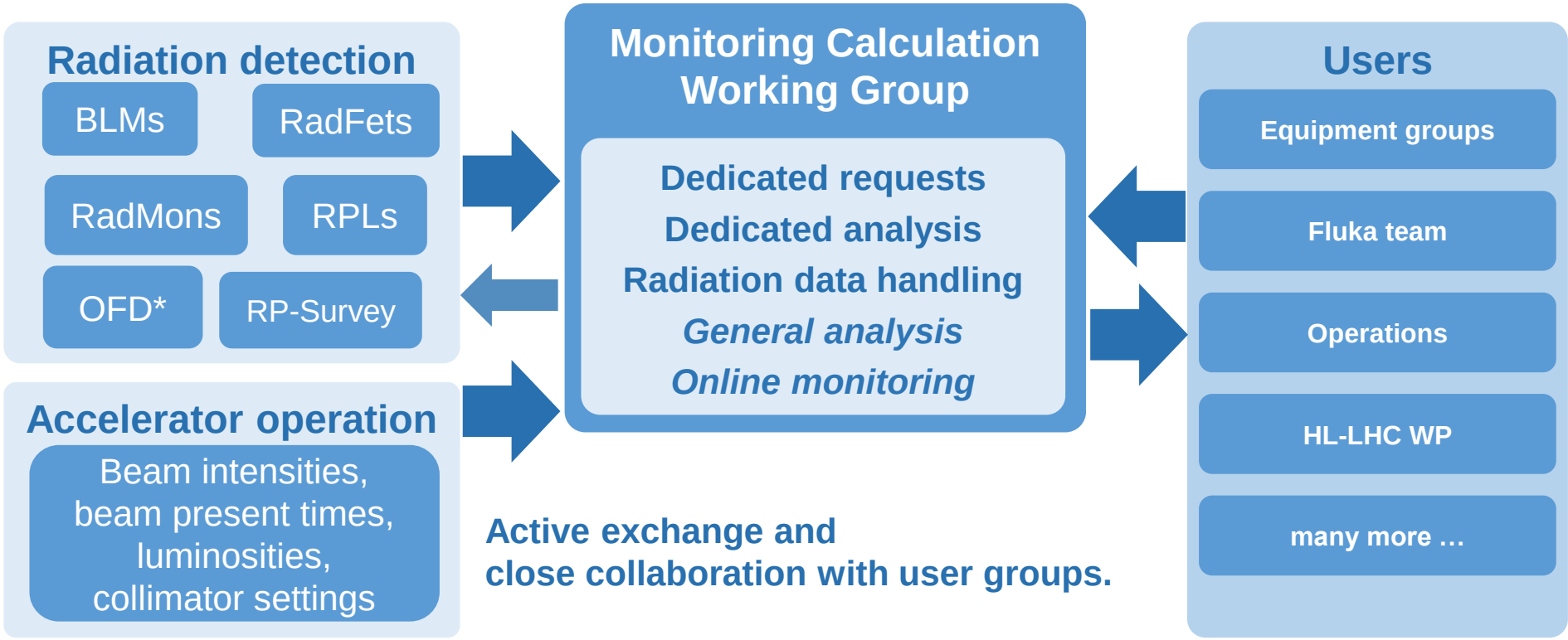
Evaluation and analysis of distribution and evolution of the radiation fields along CERN's accelerator complex.

Assessment of potential radiation risks resulting in requirements for handling existing equipment and future installations.

MCWG, from mitigation to prevention strategies

During **Run1** of the LHC the main task of the MCWG was to **react to electronic failures** and to **mitigate** these failures in the future.

For **Run2** the activities the focus changed to **prevention of radiation induced failures**, by **providing information about the radiation distributions** in order to minimize the risk of radiation induced failures.



* Optical Fibre Dosimetry project within the MCWG

Activities MCWG

Service

User Requests

Dedicated analysis of radiation levels at specific positions requested by the users.

Reports and **requirements** how to proceed.

Past:

Requests were handled 100% manually

- **Time consuming**
- **No reusability**
- **Not reproducible**

Very long response times to user requests.

Activities MCWG

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New activities

Optimisation

Internal Projects

Implementation of **automated analysis** for standardised routines.
Reduction of response time for user requests.

Operations

Online Monitoring

Monitoring the day to day operation with standardised analysis routines.
Notifications in case of unusual radiation level evolution or distribution.

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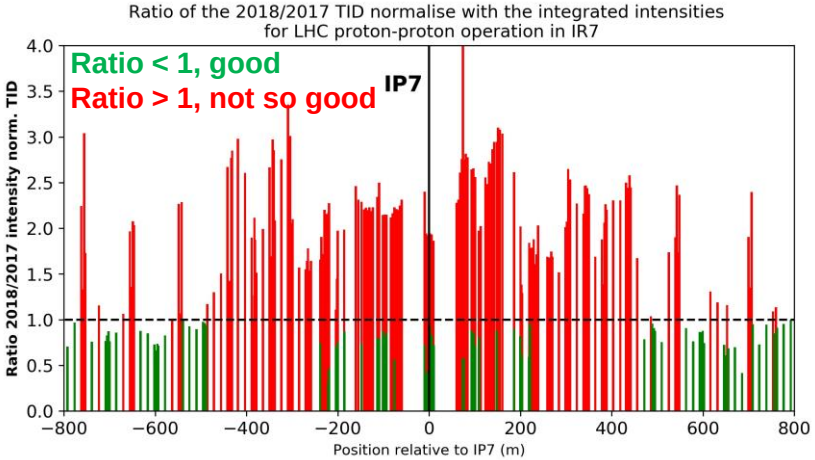
MCWG User requests highlights (2018)

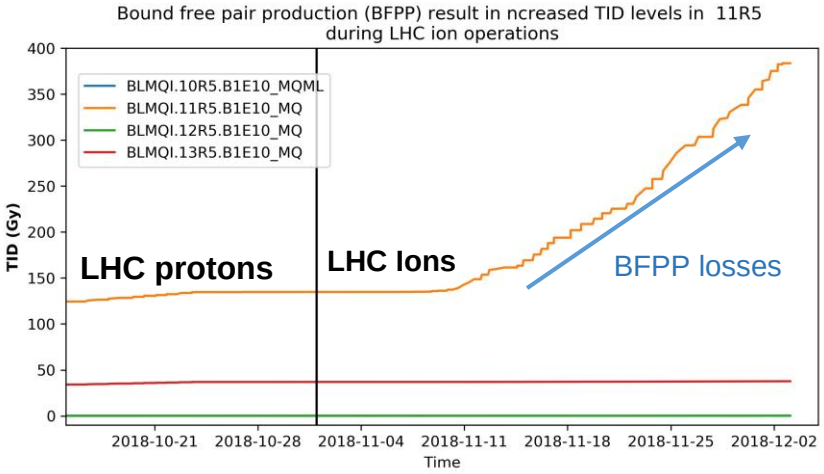
Increased normalised losses in IR7 for 2018 pp operation compared 2017*



- The ratio TID 2018/2017 normalised with the integrated intensity is > 1, direct implications for the HL-LHC Increased levels due to changes in the accelerator operations*

* **Update on the expected radiation levels for HL-LHC, G. Lerner**

LHC ion operations: Significant contribution to local TID levels due to bound free pair productions



Improvement and Optimisation of MCWG workflow and activities

- Strengthening the collaboration with LHC-operations, RadWG, FLUKA, etc. for improving our analysis approaches
- Development of MCWG analysis tools
  - Automated analysis
  - Standardised routines and algorithms
  - Automated notifications
  - SQL database
    Data sources included: BLMs, RadMons,
- Data quality assurance

Day to day monitoring following the accelerator operations

Since 2018:

Continuous standardised analysis of the radiation data in the LHC

- 3500 BLMs
- 300 RadMons

Monitoring the evolution of the dose distribution during the annual operation*

- Identifying the impact of changes in the accelerator operation on the dose levels
- Analysis of baseline levels and local radiation maxima
- Creation of reports including dose analysis and intensity calculations

Monitoring the radiation levels in the PSB and the PS by using OFD **

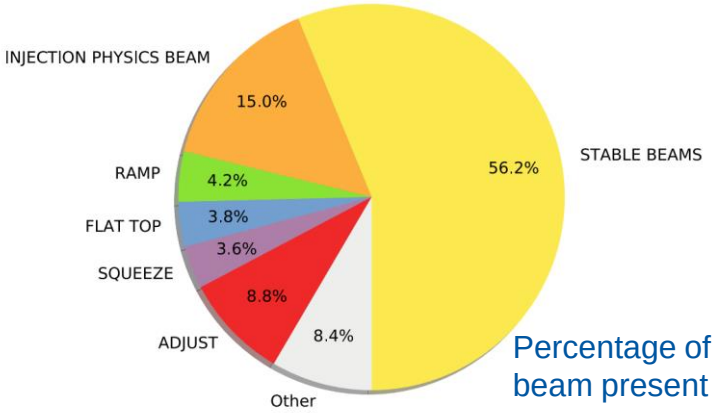
* Handling and analysis of radiation data sets, the advantages of automised calculations and fast accessibility of radiation measurements, K. Bilko

** Optical Fibre Dosimetry, D. Di Francesca

Day to day monitoring following the accelerator operations

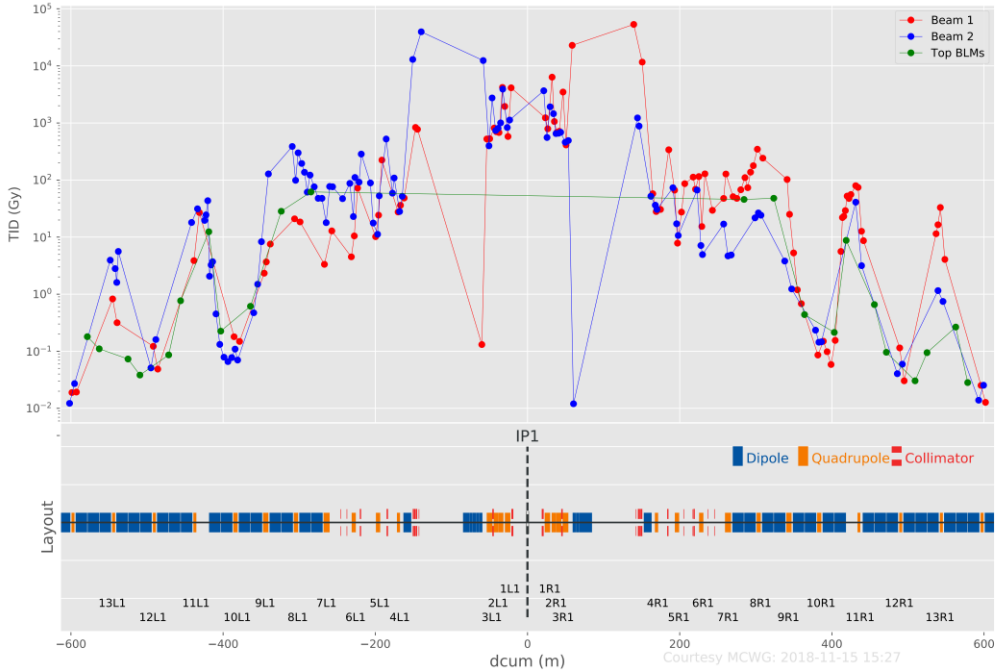
Creation of BLM based radiation reports allows to follow the LHC operations directly.

TID evolution analysis give indications if loss pattern change during the year

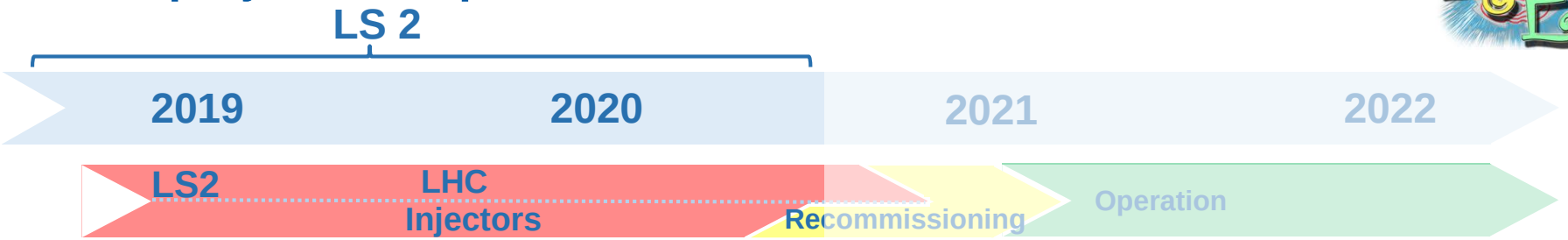


Percentage of beam present time

IR1 Dose distribution for the 2018 proton-proton run



Future projects and plans for the MCWG



Long Shutdown 2 activities:

Implementing all radiation data sets into the MCWG database infrastructure allowing fast and more detailed analysis of the radiation fields

- Improving the automated analysis routines
- Optimisation and automated notifications
- Data quality assurance

Adaptation of the MCWG tools to the Run 3 infrastructure

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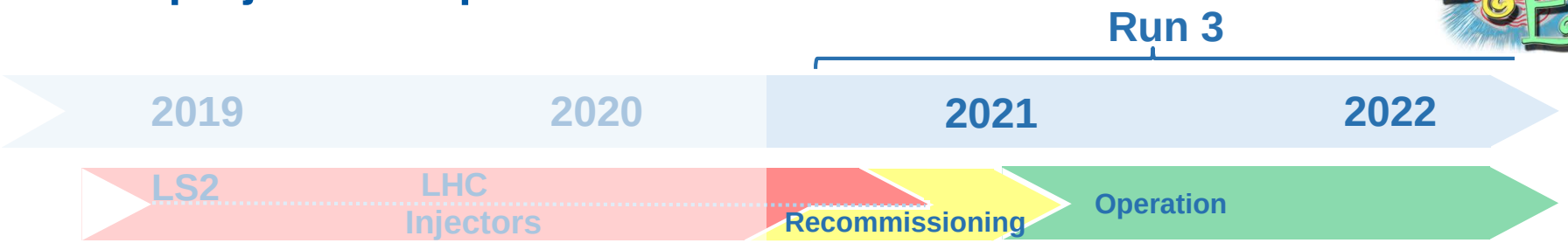


Run 3 activities:

Monitoring the radiation distributions during the accelerator operation after the shutdown

- **Providing regular reports on the radiation levels**
  - LHC, SPS, PS, PSB, transfer lines and experiments
- **Reacting to dedicated requests**
  - BLMs, RadMons, BatMons, RadFets, RPLs, OFD, RP-Surveys

Testing and optimisation of the MCWG tools to the Run 3 infrastructure

Core personnel of the MCWG

Name	Tasks
Ruben Garcia Alia	R2E project leader
Yacine Kadi	MCWG chairman, coordination
Oliver Stein (Fellow)	MCWG coordination, request coordination, radiation data analysis, development of analysis routines, requests
Kacper Bilko (Fellow)	Radiation data analysis, development of analysis routines, database maintenance
Giuseppe Lerner (Fellow)	Radiation data analysis, direct link to HL-LHC
Corinna Martinella (PhD)	Irradiation tests, RadMon analysis, requests
Diego Di Francesca (Fellow)	Optical Fibre based Dosimetry (OFD)*
Gaetano Li Vecchi (PhD)	Optical Fibre based Dosimetry (OFD)*
Keziban Kandemir (TECH)	Optical Fibre based Dosimetry (OFD)*

*** Separate presentation: Optical Fibre Dosimetry, D. Di Francesca**

Costs and budget of MCWG

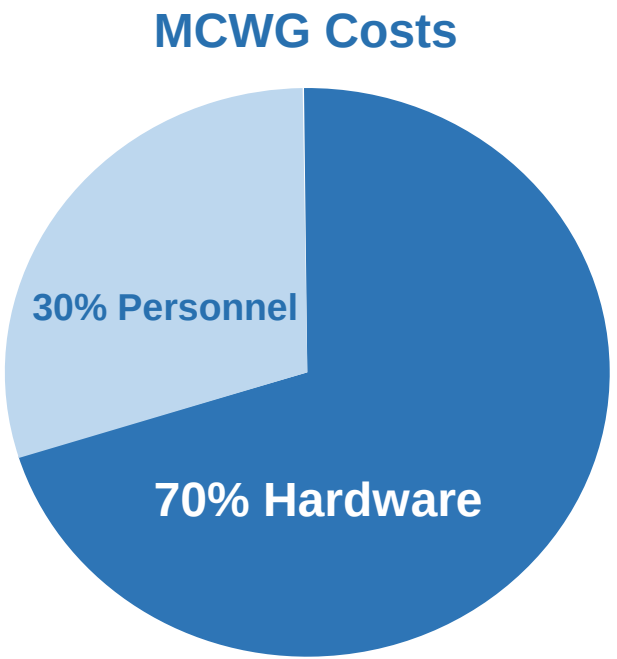
MCWG 100% financed by the R2E project

Personnel:

- Fellows, PhDs and Technical students

Hardware:

- R&D for optical fibre dosimetry
- Installation for optical fibres in the accelerators



Summary

The Monitoring Calculation Working Group (MCWG) is part of the Radiation to Electronics project (R2E)

- Multiple collaborations with R2E work packages and with other CERN groups

MCWG three columns:

- Service: Response to requests
- Operational: Monitoring the day to day operation
- Optimisation: Improvisation of the existing routines and new projects

Future:

- Centralisation of all radiation data sets
- Active monitoring of all accelerators
- Improving the radiation data analysis

Conclusion

MCWG direct link between equipment and simulation groups and the accelerator operation

MCWG became much more efficient during the past two years

- Faster Response to requests
- Standarised analysis routines
- Daily radiation reports following the accelerator operations

MCWG

Vital working group to ensure the radiation monitoring

Beside the daily routines, many new ideas and projects planned for LS2 and Run3

A lot of changes in the infrastructure expected during LS2

Recommissioning of the accelerator after LS2 will bring new radiation environments, which need to be understood

For an effective and productive monitoring the MCWG needs continuous optimisation

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To secure all the MCWG related activities in the future also the manpower needs to be secured as well!

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Recommissioning of the accelerator after LS2 will bring new radiation environments, which need to be understood

For an effective and productive monitoring the developed tools need maintenance and optimised

Thank you for your attention!

MCWG

Thanks to the MCWG members, the R2E project groups, the users and collaborators!

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