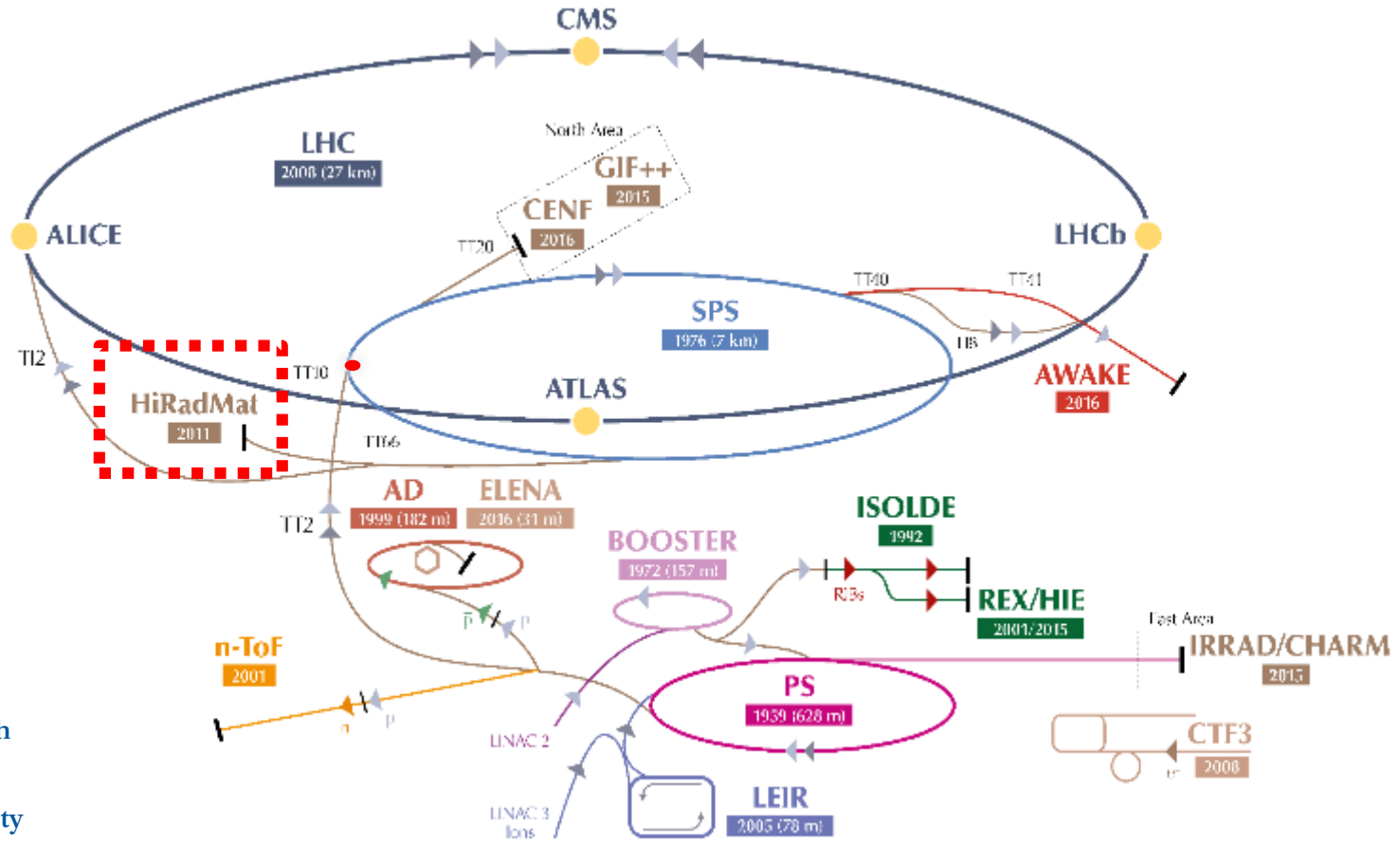
HiRadMat Facility Future Plans

Yacine Kadi, Fiona Harden, Aymeric Bouvard, Nikolaos Charitonidis,
CERN, EN/EA

HiRadMat Main Achievements

- 5 years of operation: 2012 & 2015-2018.
- over 40 experiments.
- > 70 publications
- 6 PhDs

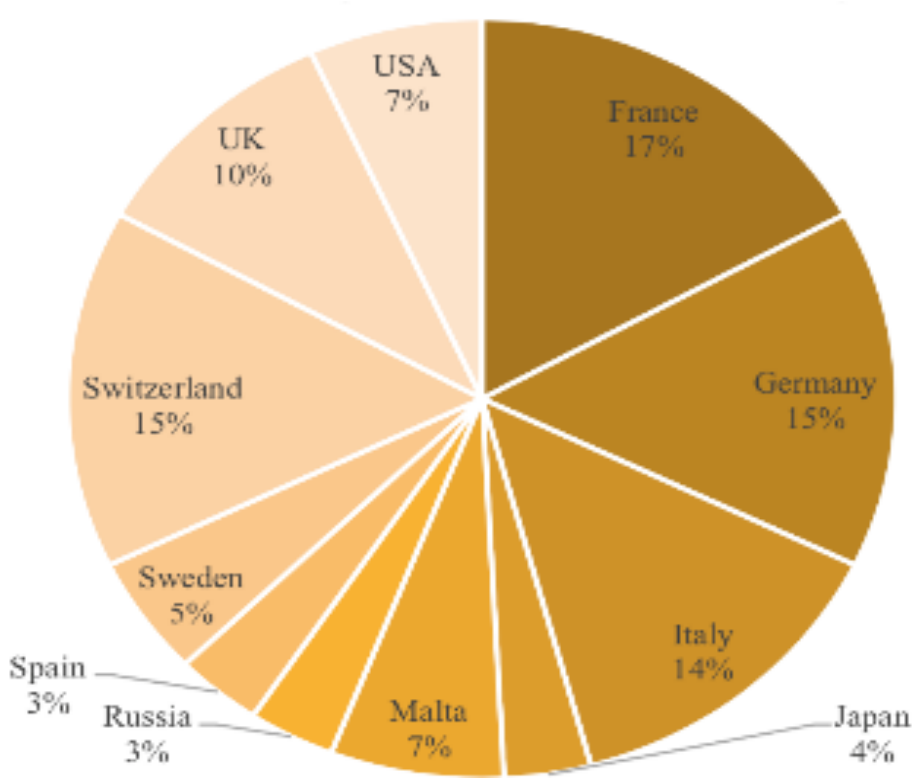


[1] http://lhc-collimation-project.web.cern.ch/lhc-collimation-project/HiRadMat.htm

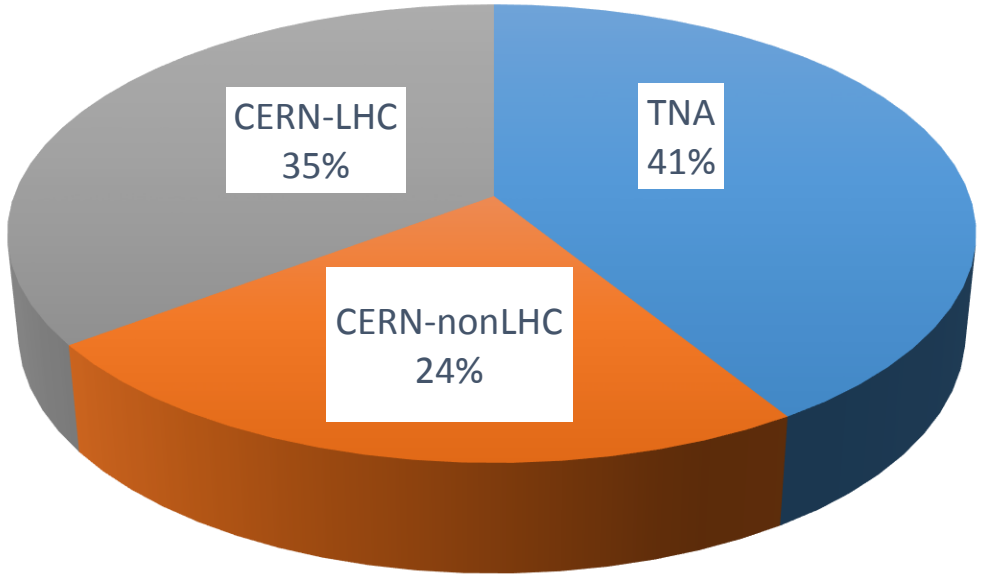
[2] R. Assmann et al. 2009 "User Requirements for a Test Facility with High Power LHC Type Beam", EDMS No: 1130296

[3] I. Efthymiopoulos et al. 2011 "HiRadMat: A new irradiation facility for material testing at CERN", Proc. 2nd Int. Particle Accelerator Conf. (IPAC'11) paper TUPS058 1665-67.

User statistics (2017, 2018)



Distribution of Transnational Access users with respect to their home institute



Distribution of HiRadMat users

ARIES – transnational access

- Has provided funding as part of the European Union's Horizon 2020 Research and Innovation Programme.
- Part of WP10 (Materials Testing).
- Project began in 2017.
- **4500 Transnational Access hours completed (2700 during EuCARD & -2).**

2017

50% of 2017 experiments applied for TNA:

- HRMT19: BLM2 (ESS, Lund, Sweden).
- HRMT41: ATLAS pixel (INFN Genova, IFIC Valencia, CAS China, PNPI Russia).
- HRMT21: RotColl (SLAC USA, U. Malta).
- HRMT36: MultiMat (U. Malta, Brevetti-Bizz SME Italy).

2018

40% of experiments applied for TNA:

- HRMT19: BLM2 (ESS, Lund, Sweden).
- HRMT47: ATLAS PixRad (INFN Genova, IFIC Valencia, CAS China, PNPI Russia). Linked with HRMT41.
- HRMT38: FlexMat (GSI Germany).
- HRMT43: BeGrid2 (FNAL USA, STFC UK, KEK/JAEA Japan).

ARIES WP10.1 (TA) – *Material Testing @ HiRadMat*

Status of contractual obligations (Milestones, Deliverables):

HiRadMat – CERN,	User-projects			Users supported	Units of access (1 h)
	Submitted	Selected	Supported		
M1-M18	6	6	6	38 (23*)	1608**
Foreseen for project (M1-M48)	5			20	200

* With financial support

** HRMT19-BLM2 (ESS-Lund): 616 hrs

Budget Situation

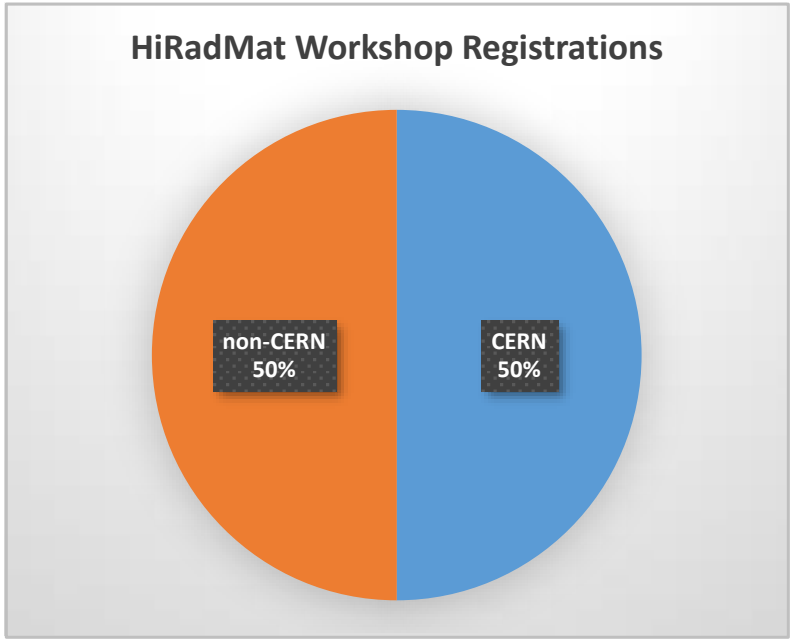
Allocated Budget (CHF)	
71745	
Users (CHF)	Management (CHF)
36360	35383

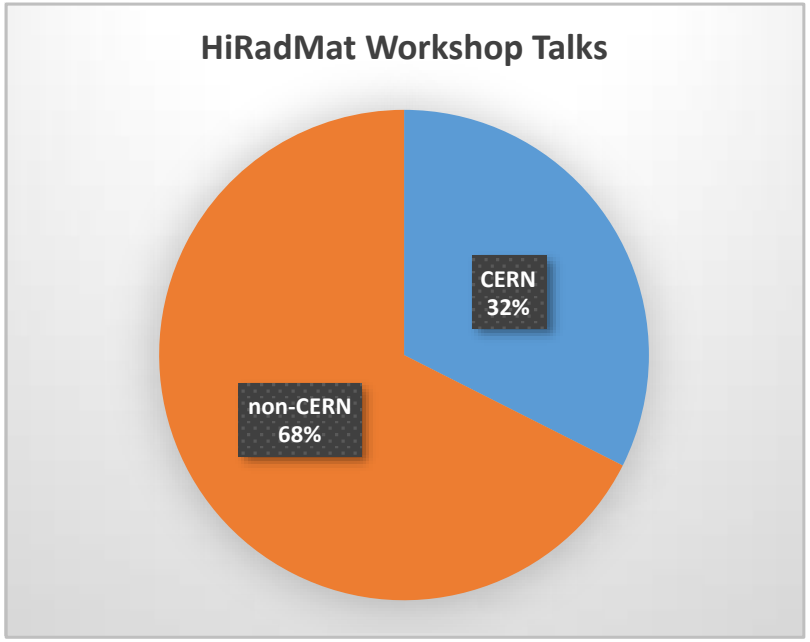
Users summary				
Number of users	Number of projects	Total subsistence (CHF)	Total Travel expenses (CHF)	Total acces units
38	6	50226.30	16133.80	1608

TOTAL user expenses (CHF)
66360.10
TOTAL SAB expenses (CHF)
7035.10
TOTAL Management expenses (CHF)
11096.25
TOTAL expenses HiRadMat (CHF) (users+SAB+management)
84491.40

HiRadMat Workshop, 10-12 July 2019

- Agenda is finalized => 37 talks (25 non-CERN)
- 75 people registered so far (EU, US, Japan, Russia)
- 20 institutions (CIEMAT, INFN, STFC, ESS, ITER, PSI, GSI, ANL, BNL, FNAL, FRIB, SNS-ORNL, J-PARC, RIKEN, TRIUMF, universities…)





Near Future @ HiRadMat

- **Submitted LoIs :**
  1. FNAL
  2. ESS
  3. J-PARC (3)
  4. UA9 Collaboration CERN/EN-STI
  5. CERN/TE-MPE (2)
  6. CERN/TE-ABT
  7. CERN/TE-MPE (2)
  8. RAL
  9. CERN/EN-MME
  10. AGH, ESSnuSB
- **More to come**
  1. CERN/EP-UAT
  2. GSI
  3. …

Near Future @ HiRadMat

- Options for operation after 2020 are currently being reviewed by CERN

- Secure budget for the operation after LS2 (2021-2024):
  - Operation cost = 260 kCHF/yr
  - Support to experiments = 20 kCHF/exp

For the Medium Term

- Required Resources for consolidation/upgrade of the facility:
  - General Services/Infrastructure
  - Surface Assembly Lab
  - Upgrade of Beam line & Dump
  - Remote handling cell for PIE and handling of pre-irradiated samples

➢ 1-2 MCHF (excl. handling cell)

General Considerations

- Minimum operation with existing beam conditions likely to remain possible
- Beyond that, facility requires a critical mass with outside partners in order to allow for continued operation and upgrades
- Important that technical/scientific proposals are reviewed in detail
- Main conclusions and proposals will be summarized in a document to be presented to management

A big Thanks to all the participants/contributors to this workshop

&

the groups involved with the HiRadMat operation:

This project has received funding from the European Union's Horizon 2020 Research and Innovation programme under Grant Agreement No 730871.


CERN

Back-up slides

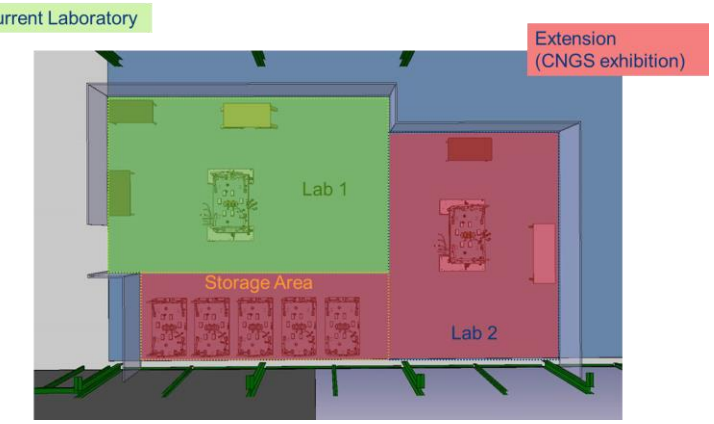
Future proposals

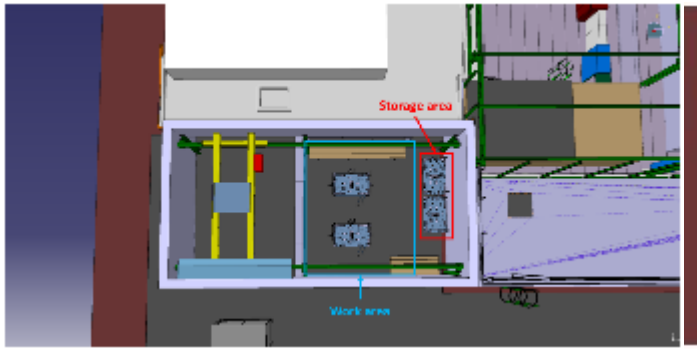
- Upgrade current surface lab proposal:
  - Increase size of lab area to accommodate increased number of users.
  - Increase surface space meaning 2 experiments can be fully accommodated at one time.
  - More storage, tools, working areas for users
  - Improve survey conditions
  - Improve space for transport logistics.

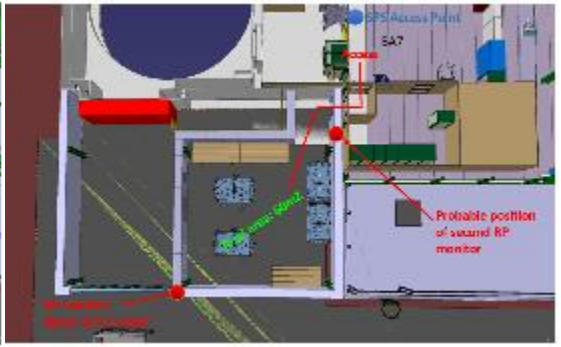
- New surface lab proposal
  - Better accommodate array of different experiments entering HiRadMat.
  - Possibility to temporally increase radiation protection classification to accommodate pre-irradiated experiments.
  - Lab design relevant for current (and anticipated future) needs – size, storage, table integrations, electronics, survey etc.)
  - Improved transport logistics (entering surface lab, installing in experimental area and exiting experimental area post-irradiation).

- Upgrade experimental area to enable HL-LHC type beams (**if significant need is justified**)
  - Beam windows & dump studies required.

- HiRadMat control room upgrades to meet user requirements – more user friendly.





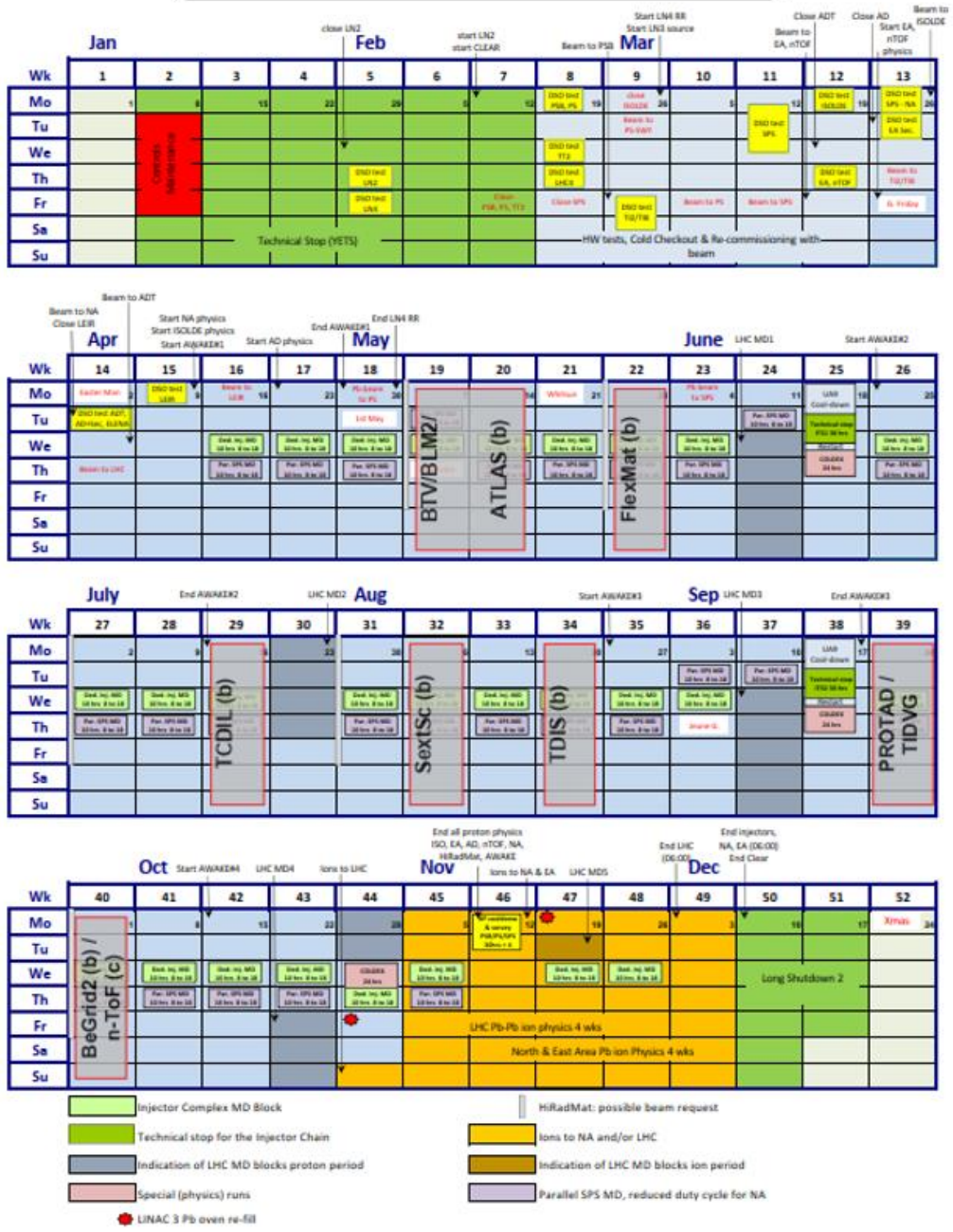


RS

March 20, 2018
ver. 1.3

Injector Accelerator Schedule 2018

Approved by Research board on 06.12.2017

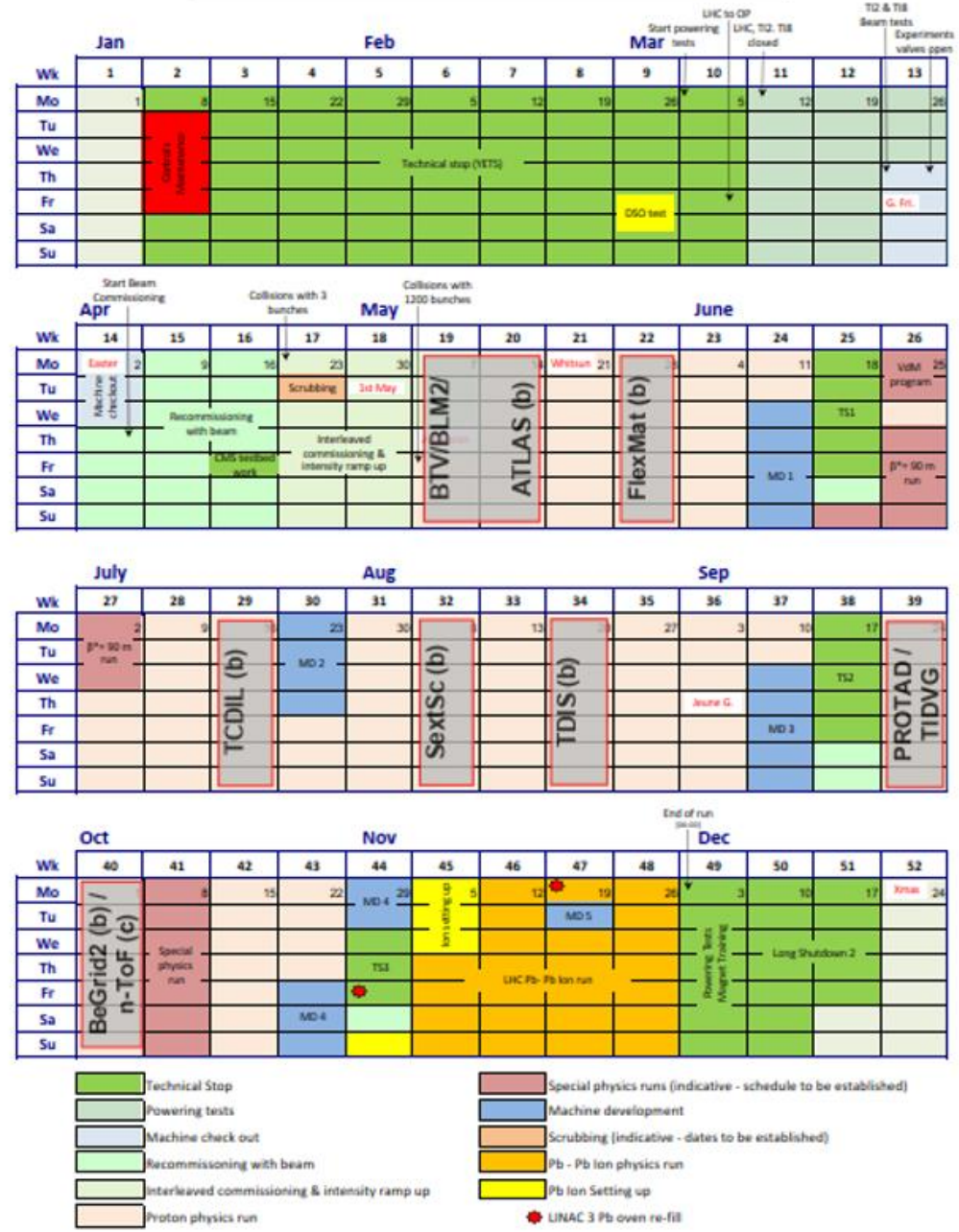


RS

March 21, 2018
ver. 1.2

LHC Schedule 2018

Approved by Research board on 06.12.2017



HiRadMat Super Cycle Information

- HiRadMat 'Long' Super Cycle:
  - HRM_LS = 22.8 s, SFTPRO = 10.8 s, MD cycle = 7.2 s (3.6 s potentially depending on planning).
  - TOTAL = 40.8 s (or 37.2 s).

- HiRadMat 'Short' Super Cycle:
  - HRM_SS = 8.4 s, SFTPRO = 10.8 s, MD cycle = 7.2 s (3.6 s potentially depending on planning).
  - TOTAL = 26.4 s (or 22.8 s).

Beam specifications

- Irradiation Facility for R&D using pulsed high energy, high intensity, proton beams. Ion beams are also possible.
- Facility has, so far, completed experiments on **materials testing, prototype & novel designs validation, beam monitoring devices, investigations at cryogenic temperatures and pre-irradiation materials analysis**.

HiRadMat Proton Beam	
Beam Energy	440 GeV
Pulse Energy (max)	2.4 MJ
Bunch Intensity	5.0×10^{9} to 1.2×10^{11} protons
Number of Bunches	1 to 288
Minimum Pulse Intensity	5.0×10^{9} protons (1b at 5.0×10^{9} ppb)
Maximum Pulse Intensity	3.5×10^{13} protons (288b at 1.2×10^{11} ppb)
Pulse Length (max)	7.95 µs
1 σ r.m.s. beam radius	0.5 to 2.0 mm (standard) [0.25 to 4.0 mm currently upon request]
Total allocated protons/year into facility	1.0×10^{16} protons (equivalent to approx. 10 experiments per year)

Ions

HiRadMat Ion Beam (data from 2015)	
Beam Energy	173.5 GeV/nucleon (36.1 TeV per ion)
Pulse Energy (max)	21 kJ
Bunch Intensity	3.0×10^{7} to 7.0×10^{7} ions
Number of Bunches	52
Minimum Pulse Intensity	3.0×10^{7} ions (1b at 3.0×10^{7} ions)
Maximum Pulse Intensity	3.64×10^{9} ions (52b at 7.0×10^{7} ions)
Pulse Length (max)	5.2 μs
Beam size at target	Variable around 1 mm^2