RADNEXT Work Package 10

Introduction to Transnational Access 2 & focus on alternative facilities

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https://indico.cern.ch/event/1095485/

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Introduction to WP10: Transnational Access Proton, heavy ion and alternative beams and irradiation

- WP10 – TA2 = Coordination of transnational access to heavy ions, protons alternative beams, in collaboration with the facility managers.
- TA is the cornerstone of the RADNEXT project:
  - More than 6000 beam time hours awarded (TA1+2), more than 3500h for TA2
  - Four years
  - More than 20 different facilities in Europe and Canada.
- Beam time awarded for RADNEXT users is free of charge (funded by European Union's Horizon 2020 research and innovation program under grant agreement No 101008126).
- Quarterly Call for Proposal with application form : https://radnext-ta-portal.web.cern.ch/
- Both academic and industrial groups are eligible for beam time (including SMEs).
- Next quarterly call for proposals will be open in **June 2022**.
- Many thanks to Andrea Coronetti, Salvatore Fiore & Ruben Garcia Alia for their support.

Introduction to WP10: Transnational Access Proton, heavy ion and alternative beams and irradiation

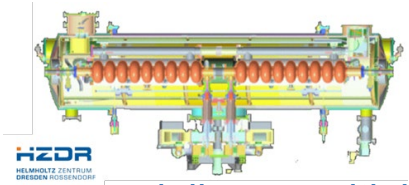
Facility/Country	Heavy ions	Protons	Alternative
CERN CHIMERA - Switzerland	✓		
GSI SIS18 - Germany	✓		
GSI UNILAC - Germany	✓		
GANIL France	✓		
UMCG PARTREC - The Netherlands	✓	✓	
RADEF - Finland	✓	✓	
UCLouvain - Belgium	✓	✓	
PSI - Switzerland		✓	
CNA - Spain		✓	
NPI CAS - Czech Republic		✓	
TRIUMF - Canada		✓	
HZDR - Germany		✓	Electrons, γ-rays
CLPU - Spain		✓	Electrons, X-rays
ESRF - France			Pulsed X-rays
CERN - CHARM Switzerland			Mixed field
UKRI-STFC - United Kingdom			Muons

WP10 Alternative facilities – beam allocation

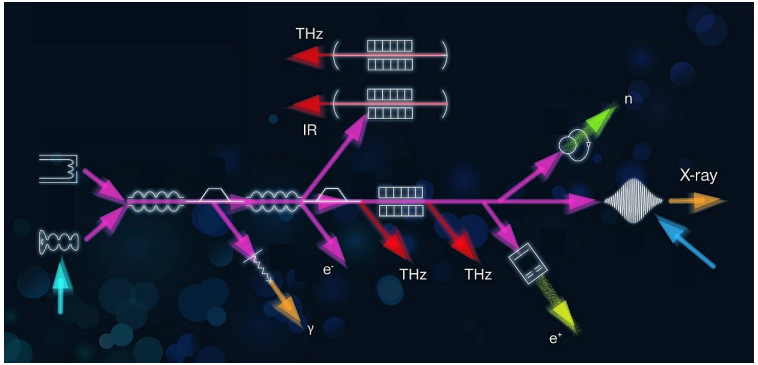
- Total number of hours provided to RADNEXT project and (assigned hours) after 4/12 CFPs.

Facility/Country	Hours	Beam type
HZDR – eELBE / Germany	**80 (0)**	Electrons
HZDR – gELBE / Germany	**80 (72)**	γ-rays
CLPU – LWFA/Betatron / Spain	**150 (48)**	Electrons/X-rays
ESRF / France	**288 (72)**	Pulsed X-rays
CERN - CHARM / Switzerland	**800 (240)**	Mixed field
UKRI-STFC – ISIS / United Kingdom	**140 (72)**	Muons

Focus on alternative facilities



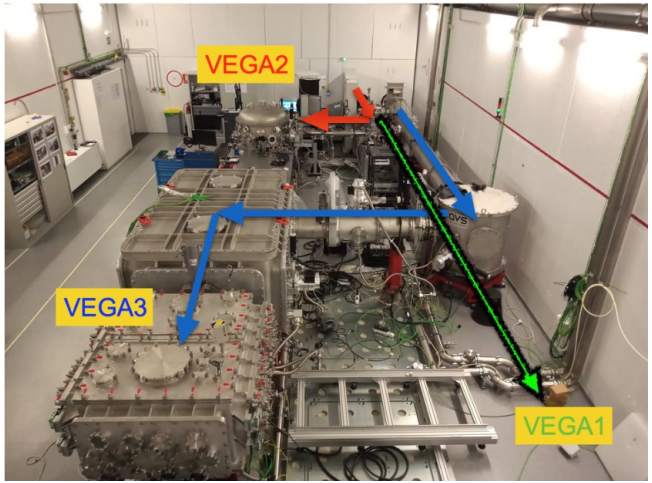
- HZDR-ELBE: Electron Linac for beams with high Brilliance and low Emittance delivers multiple secondary beams, both electromagnetic radiation and particles.
  - HZDR-γELBE: bremsstralung radiation
    - up to 20MeV in vacuum
    - pulse width between 1 and 5 ps,
    - pulse frequency is 26 / 2^n MHz, with n= 1 to 8
  - HZDR-eELBE: direct electron beam
    - up to 31 MeV in air
    - Various time structure from continuous wave to Single electron mode



- Location: Dresden, Germany
- More information at https://www.hzdr.de/db/Cms?pNid=3381 and https://www.hzdr.de/db/Cms?pNid=472
- Point of contact: Anna Ferrari (a.ferrari@hzdr.de)

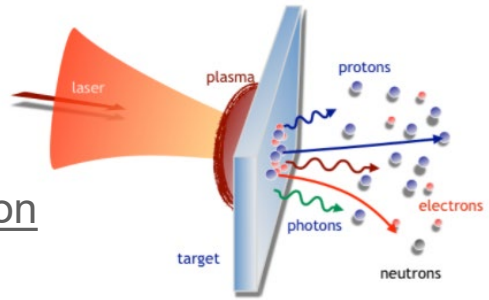
Focus on alternative facilities

- CLPU – Centro de lasers Pulsados
- VEGA2 PetaWatt Laser source
- Production of secondary particles
  - Protons (1-10MeV)
  - LWFA: electrons (100-500MeV)
  - Betatron: X-rays (up to 10 keV)



CLPU
CENTRO DE LÁSERES PULSADOS

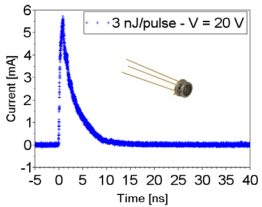
- Location: Salamanca, Spain
- More information at: https://www.clpu.es/en/vega_introduction
- Point of contact: Ana Santa Cruz (asantacruz@clpu.es)

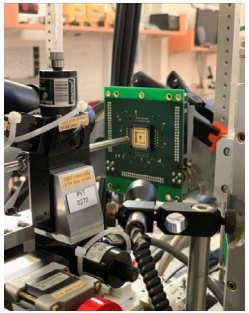


Basic proton acceleration scheme

Focus on alternative facilities

- ESRF: European Synchrotron Radiation Facility (ESRF),
  - Spot diameter 5-20µm
  - Pulse duration <100ps
  - Photon energy 5-30keV
  - High flux





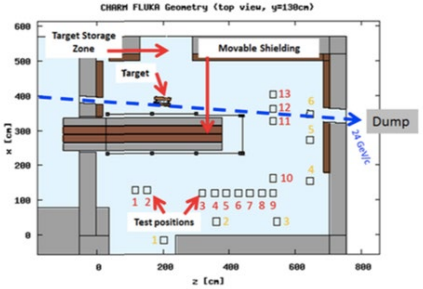
- Energy deposition equivalence proven in Si
- Requires Additional Local PAC Validation (September-March)
- Location: Grenoble, France
- More information at https://www.esrf.fr/
- Point of contact: Ennio Capria (ennio.capria@esrf.fr)

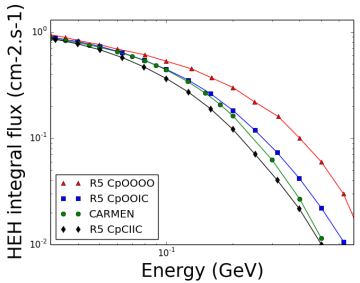
G. Augustin *et al.*, "Cross-Calibration of Various SEE Test Methods Including Pulsed X-rays and Application to SEL and SEU," *RADECS* 2019

Focus on alternative facilities

- CHARM: CERN High energy AcceleRator Mixed field facility,
  - Mixed (p+, n, …) spectrum 0-200MeV up to 24GeV.
  - Various irradiation conditions with DUT location and shielding combinations
  - Possibility to irradiate component, board, equipment (fault injection vs mission profile)

24GeV proton primary beam





Comparison of integral flux for space (CARMEN) and different configuration in position 5 normalized to the HEH flux at 20MeV

N. Kerboub *et al.*, "Comparison Between In-flight SEL Measurement and Ground Estimation Using Different Facilities," *IEEE TNS*, July 2019.

- Location: Geneva, Switzerland
- More information at https://kt.cern/technologies/charm-mixed-fields
- Point of contact: Salvatore Danzeca (salvatore.danzeca@cern.ch)

Focus on alternative facilities

- UKRI- STFC: UK Research and Innovation – Science and Technology Facilities Council
  - ISIS / RIKEN-RAL Muon Facility
  - Intense pulsed-muon beam
  - 0,6 - 33MeV

- Location: Rutherford Appleton Laboratory, Harwell Science and Innovation Campus, Didcot, United Kingdom
- More information at: https://www.isis.stfc.ac.uk/Pages/home.aspx
- Point of contact: Carlo Cazzaniga (carlo.cazzaniga@stfc.ac.uk)

Summary

- 6 alternative irradiation facilities available with a total of 1538 hours of beam time.
- Proton and heavy ions facilities to be presented by Arto Javanainen
- More information
  - https://radnext.web.cern.ch/transnational-access/
  - radnext.ta@cern.ch

Thank you for your attention.