CANDLE-15

Learning From the Past and Inventing the Future

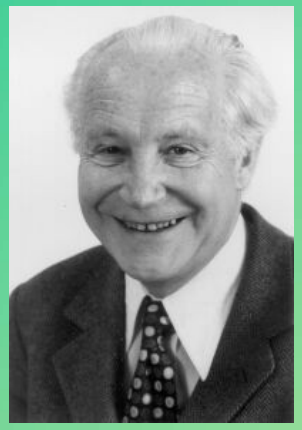
V. Tsakanov
CANDLE SRI

06 July 2017

Contents

- High Energy Physics
- Synchrotron Light Sources
- Advanced Accelerator Concepts
- Free Electron laser
- AREAL facility

60 years ago - a first-rate facilities of high energy physics – Electron Synchrotrons



W. Jentschke

DESY – ARUS

Germany Armenia

Sister Projects

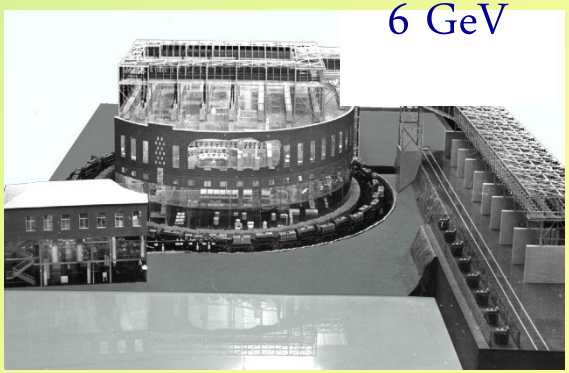
A. Alikhanian

7.5 GeV

DESY - 1964

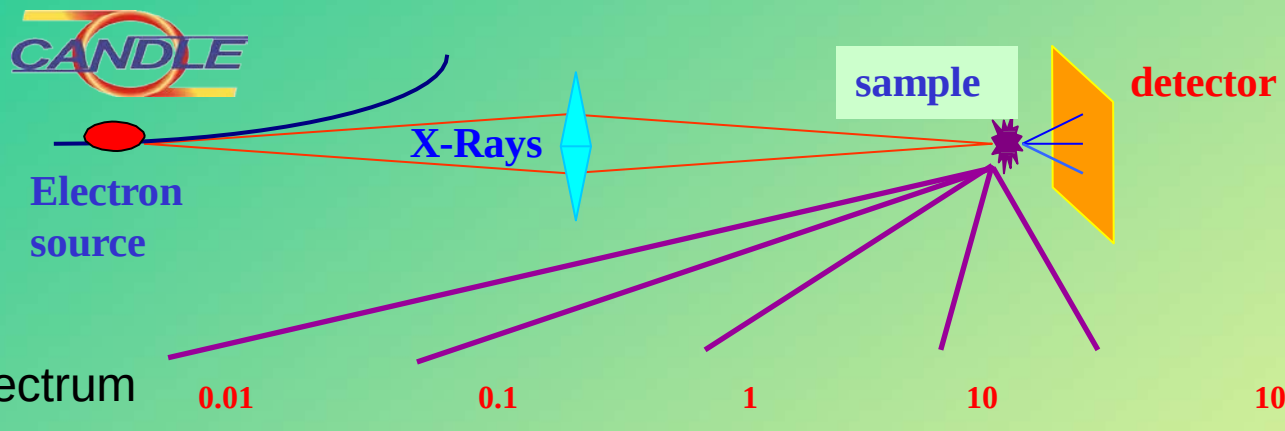
Ceramic Vacuum Chamber

6 GeV



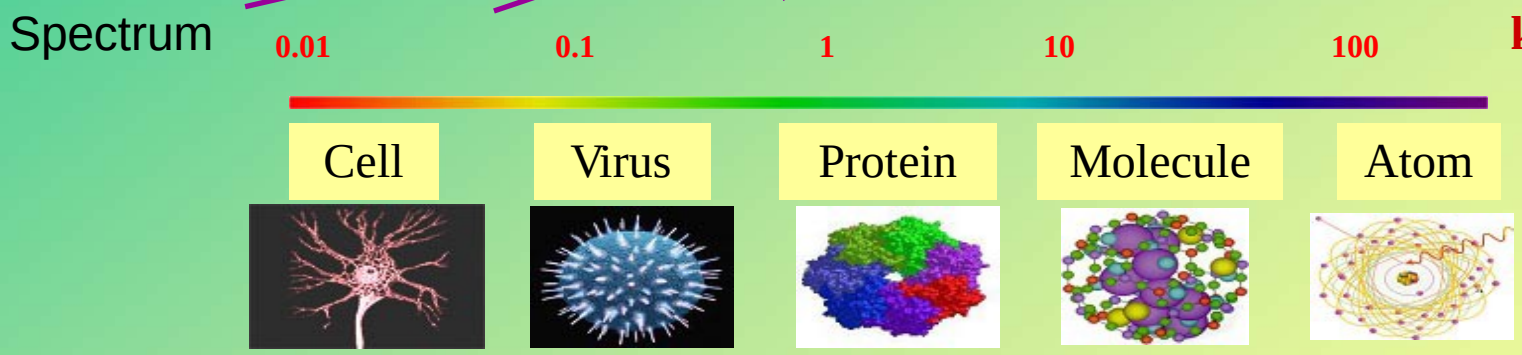
ARUS- 1967

Synchrotron Light



- High Brightness
- Continues Spectrum
- Tunability
- High Coherency

User Demands - 3-10 times



Science

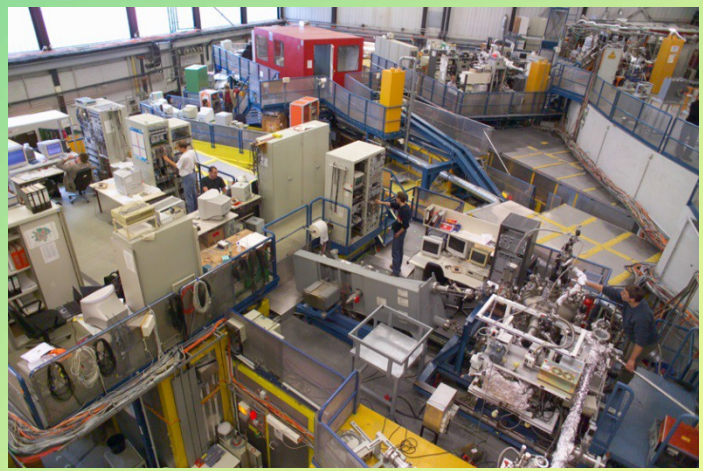
- Biology
- Physics
- Material Science
- Medicine
- Chemistry
- Environments

Industry

- Biotechnology
- Electronics
- New material
- Pharmacy
- Nanotechnology
- Microfabrication

Synchrotron Light

1974 - DORIS Storage Ring

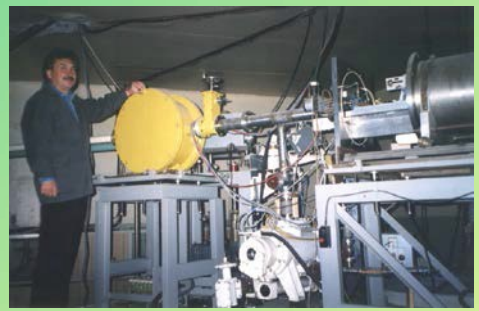


1974- European Molecular Biology Laboratory outstation

→ **1989 - HASYLAB**

ARUS

1972-1975 – 3 Synchrotron Radiation Sations

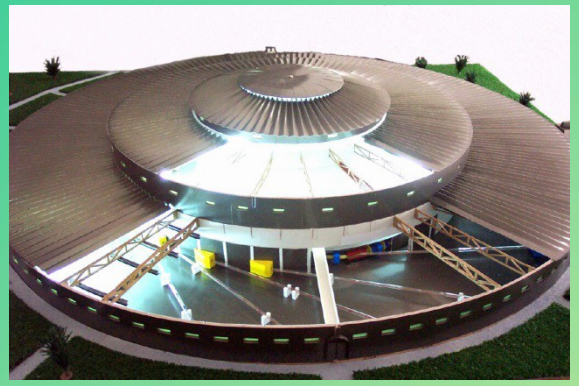


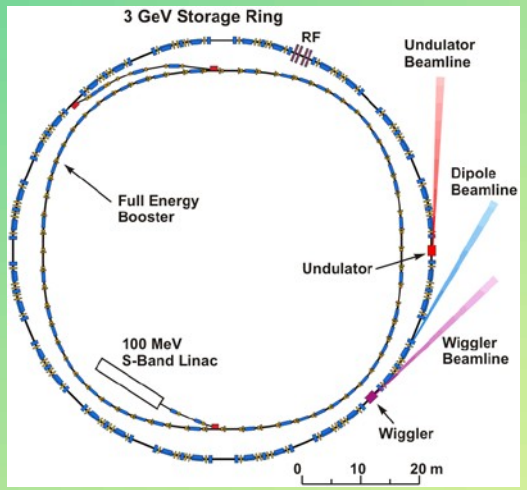
Lab. of Radiation Solid State Physics

Lab. of Radiation Biophysics

Solid State Dept of Yerevan State Univ.

2002 – CANDLE Synchrotron Light Source Project

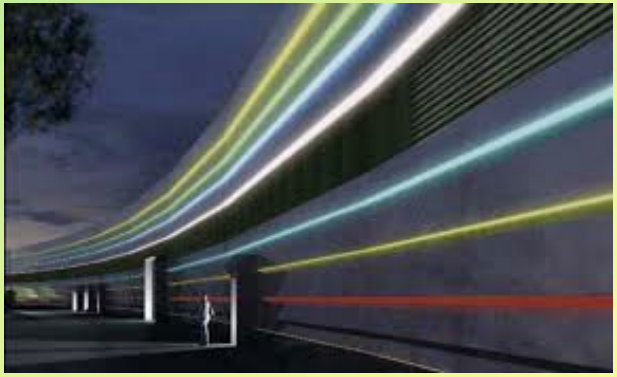




Energy	3 GeV
Current	350 mA
Circumference	216 m
Emittance	*8.4 nm*

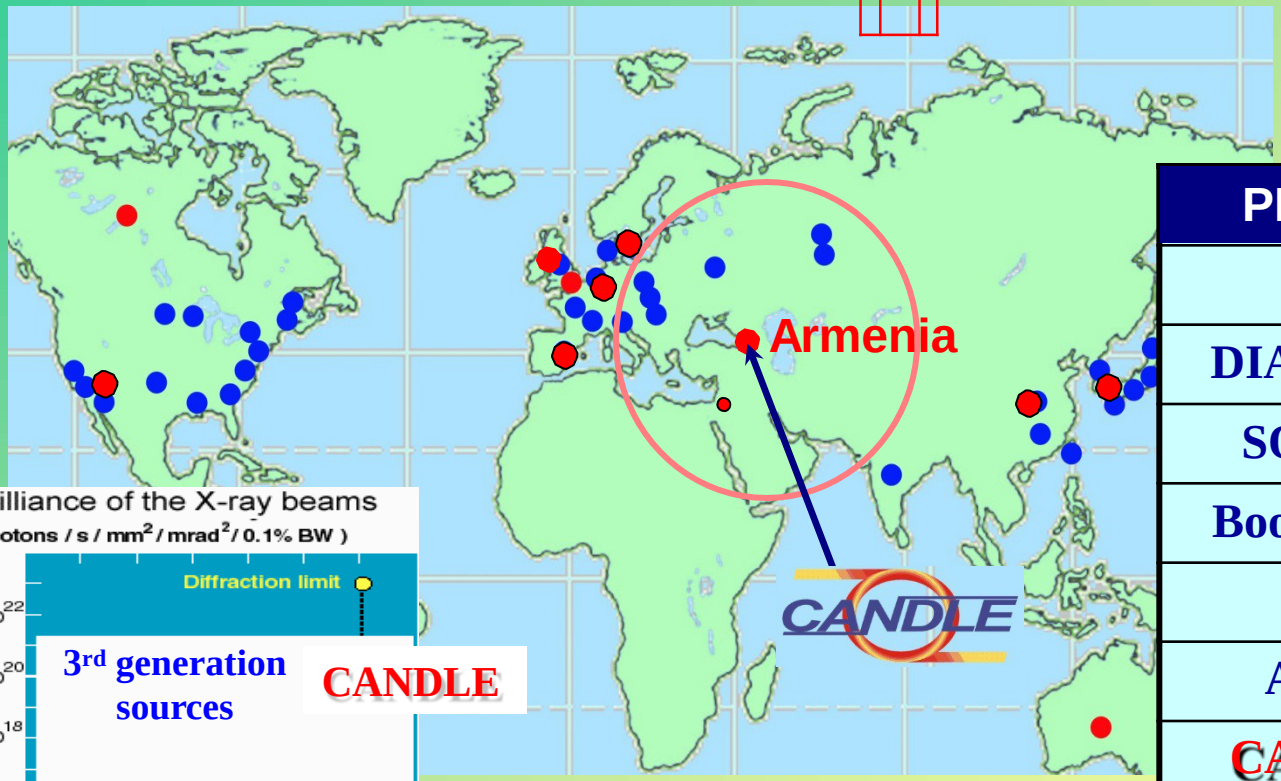
2004 – 2009 PETRA III Project –

Most Brilliant Light Facility in the world.

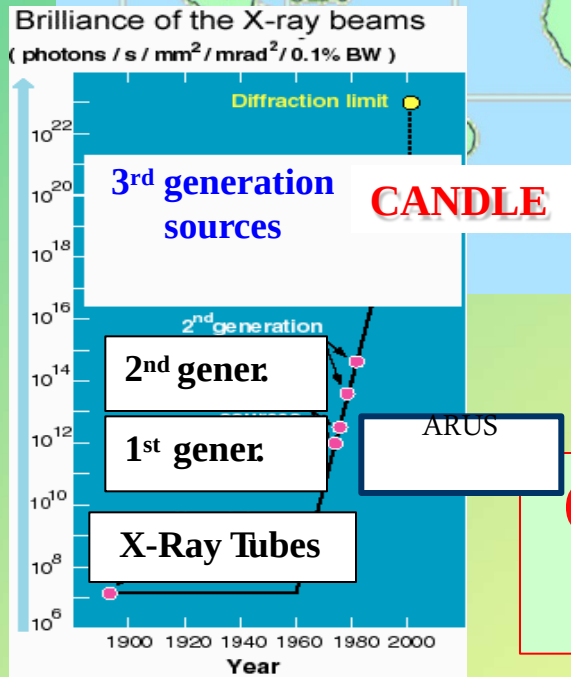


Synchrotron Light Sources

XXI century



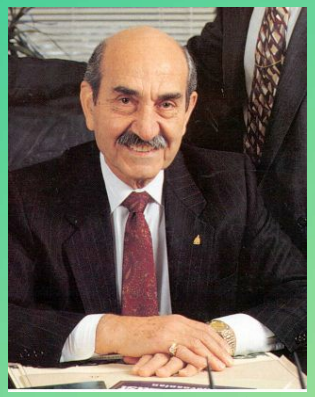
PETRA III - Germany	
SLS	Switzerland
DIAMOND	UK
SOLEIL	France
Boomerang	Australia
CLS	Canada
ALBA	Spain
CANDLE	Armenia



CANDLE will serve scientists of 3000 km radius region.

2002 – CANDLE Institute

J. Hovnanian



First President

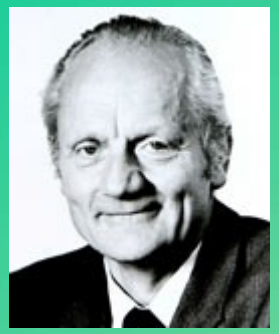
First Meeting

First Copy

First review

First New Year

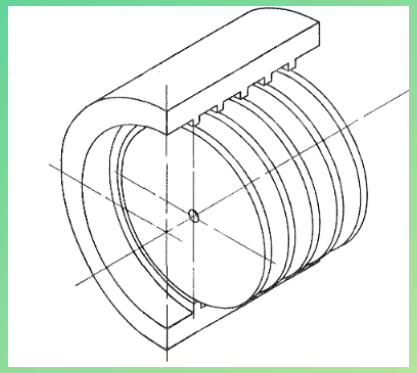
Advanced Accel;erator Concepts



G-A. Voss

1982-1988 - Voss-Weiland Wakefield Transformer Experiment

Th. Weiland



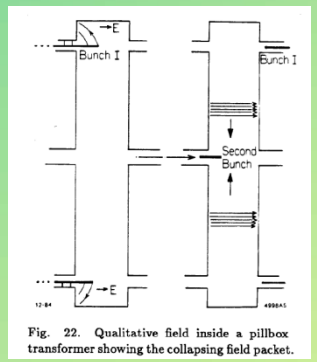
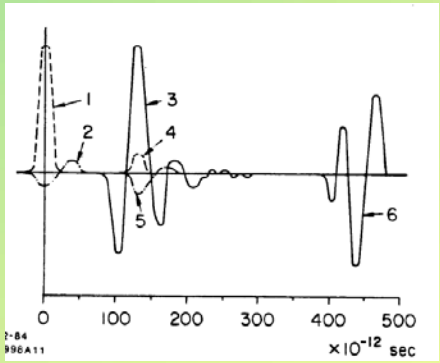


Fig. 22. Qualitative field inside a pillbox transformer showing the collapsing field packet.



1984-1988 Multi-Bunch wake field accelerator

YerPhI

E. Laziev

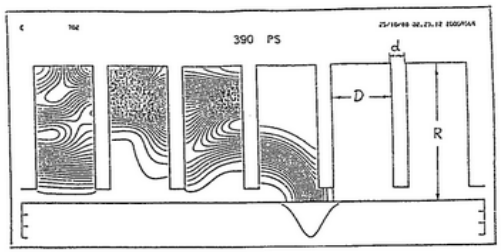
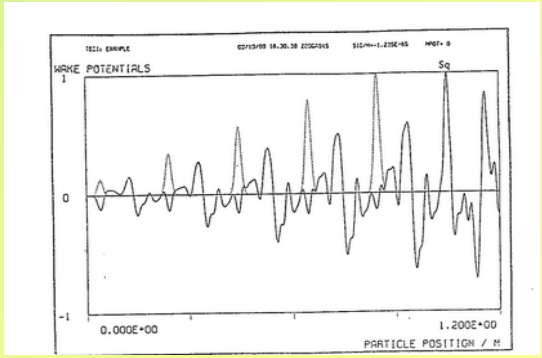


Fig.5 Geometry of the disk–loaded wavequide used in the TBCI calculations (R=5cm, D=2cm, d=0.5cm).



1980-1990 - LUE- 20 MeV Test Facility

Energy –20 MeV
Pulse lenght – 5 psec
Bunch charge – 300 pC
RF frequency- 3 GHz
Emittance – 20 mm-mrad

- **Wake Field Accel.**
- **Plasma WFA**
- **Laser-Plasma Accel**
- **Two Beam Accel.**
- **High Freq. Accel.**

1989 - International Workshop on Advanced Accelerator Concepts

A. Amatuni, B. Palmer, Th. Weiland, T. Katsouleas, J. Simpson, H. Henke,C. Pellegrini, R. Jameson, E. Laziev ,…

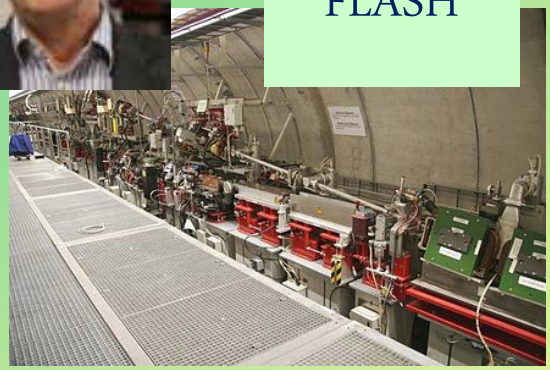
2010-2017

-Ultrafast beams -
Powerful Lasers
- Advanced Diagnostics
- Computer tecnology

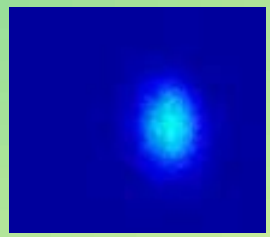
FREE ELECTRON LASER

1992-2017 - From Linear Collider to European XFEL

Prof. J. Rossbach



04 May 2017 - First laser light !



Congratulation !!!

2010 – 2014 From CANDLE to AREAL

DESY-PSI- CANDLE collaboration Workshop (2010)

Advanced Topics of Brilliant Light Facilities

2010

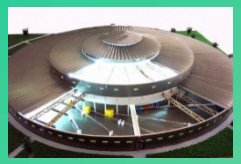
AREAL – Exit Scenario

Experts meeting with RA Prime –Minister

Exit Scenario

- Small facility + Limited investment
- State-of-the-art facility
- Scientific & Technology asset
- Multiple applications
- Training and Educ. Center
- International cooperation
- World class management

Project Development : Exit Scenario

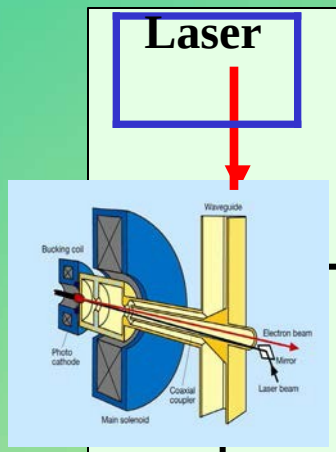


High Energy-CANDLE

Ultrashort time

AREAL

Laboratory for Ultrafast Science and Technology



AREAL – Advanced Research Electron Accelerator Lab

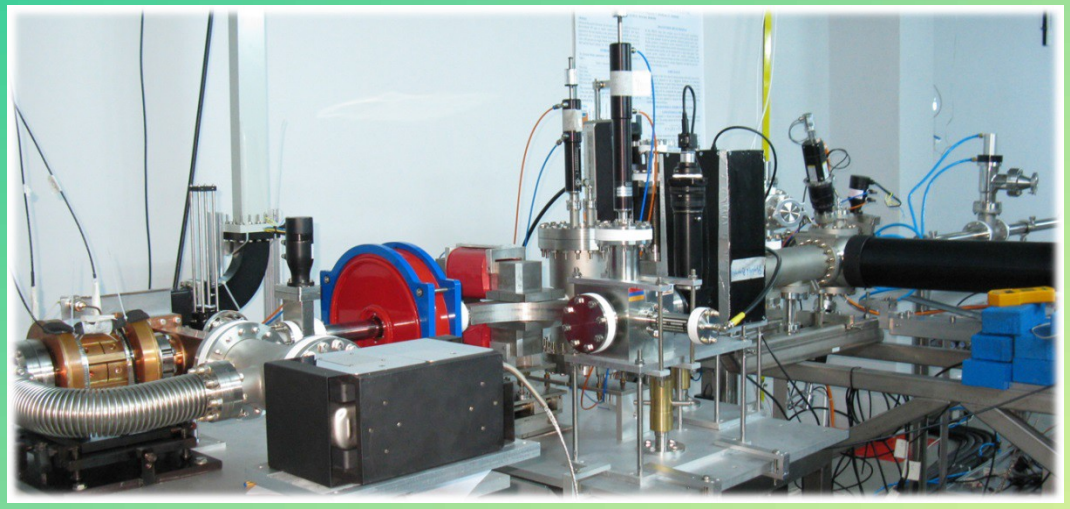
2011- DESY –CANDLE Cooperation

PSI-CANDLE cooperation

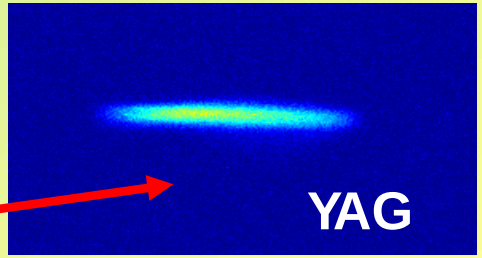
June 2012 - Visit of Prime-Mininister of RA

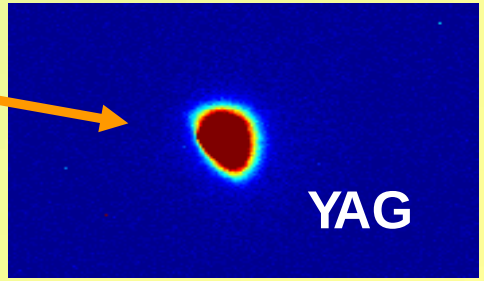
2013-2014- First Beam and Commissioning

17:32 - 20 Dec 2013 - First Beam – 36 pC charge



Charge	20 - to 236 pC
Energy	2.5- 4.5 MeV
Time structure	0.3 – 8 ps
Energy spread	< 1.7%
Beam profile (rms)	0.62 mm





22 July 2014 - AREAL Opening

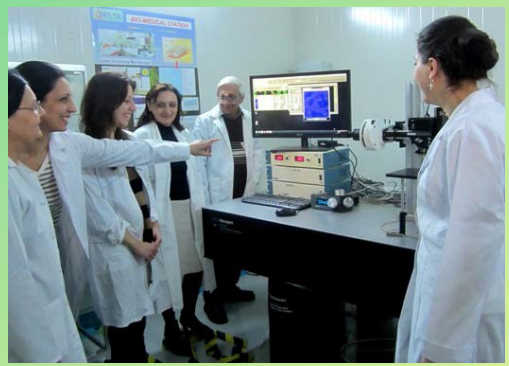
State Committee of Science

DESY

PAUL SCHERRER INSTITUT PSI

Opening DELTA Laboratory

10 Nov -2014



Microscopy Station

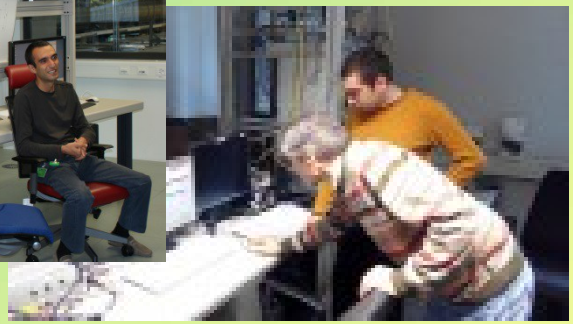
Microfabrication Station

International Cooperation

PSI

International Advisory Committee

Training



In kind Contributions

Fabrication & Procurement

Made in CANDLE > 50

Our Suppliers > 70 (~ 1 mln $US)

ROHDE&SCHWARZ

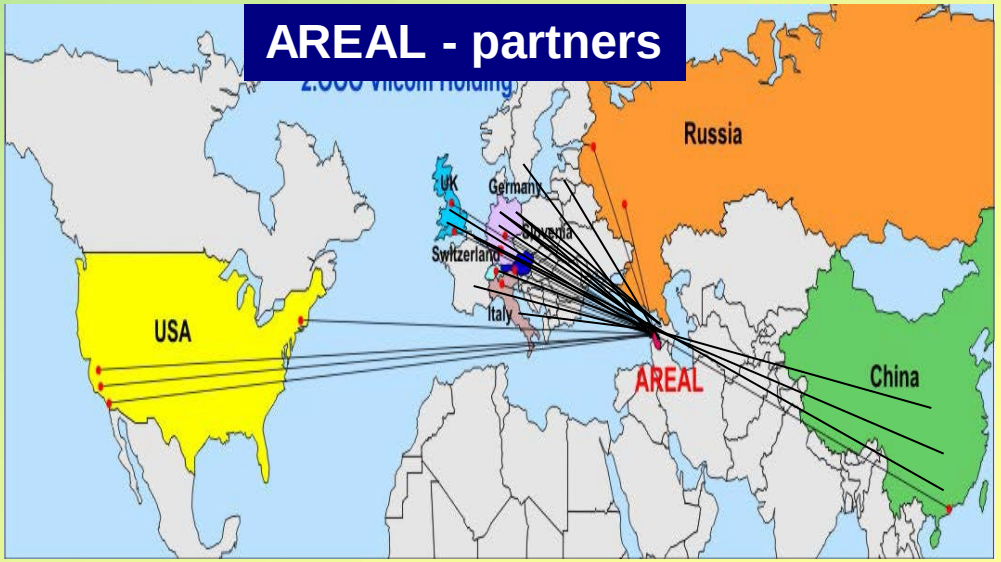
Gamma-Scout
Hand-Held Radiation Detectors

FRIATEC

10^-n mbar
VACOM®

LASOS
For worldwide photonics

PILZ-OPTICS

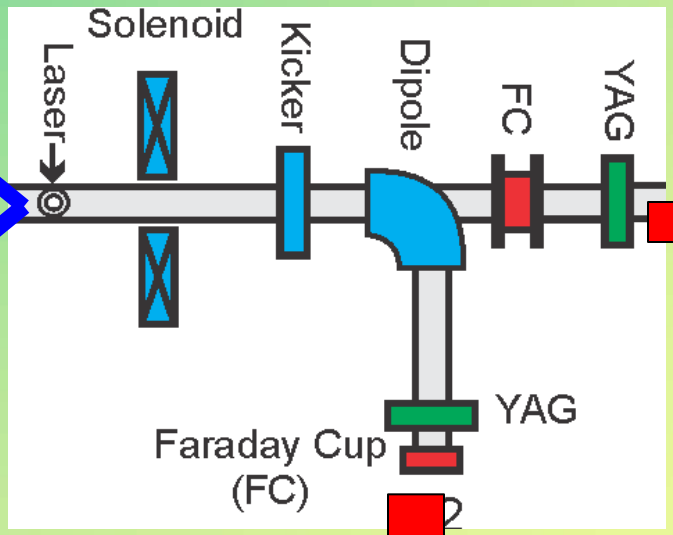


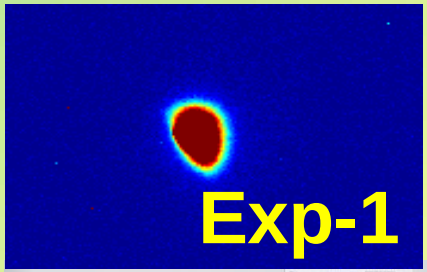
2015-2016 – 4 Experimental Stations

Nanotechnology

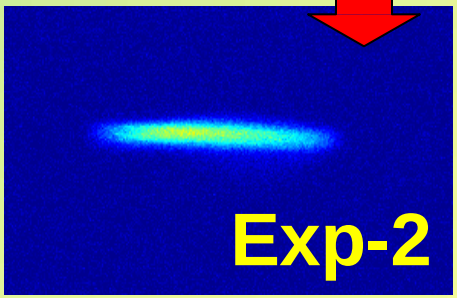
DELTA

AREAL-5MeV





Biomedicine



Advanced Technologies

Laser System

Ultrafast electronics

Civil engineering

Ultrahigh vacuum

Precise machining

Radiophysics System

High Diagnostics & Control

Magnet system

2015-2016 – Experimental program

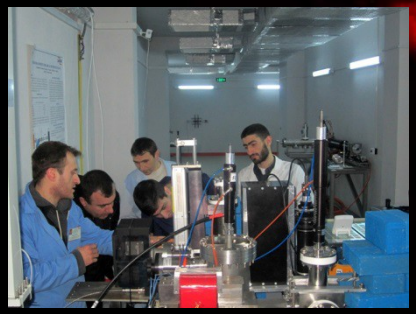
Proposals –18
Institutions –12
Scientists – 45

Molecular Physics

Genetics

Biology

Microelectronics



New materials

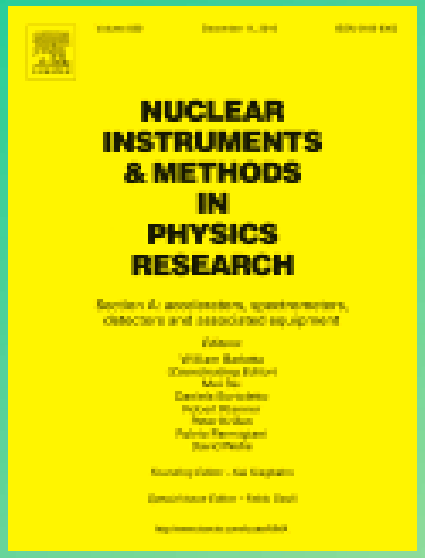
Solid State Physics

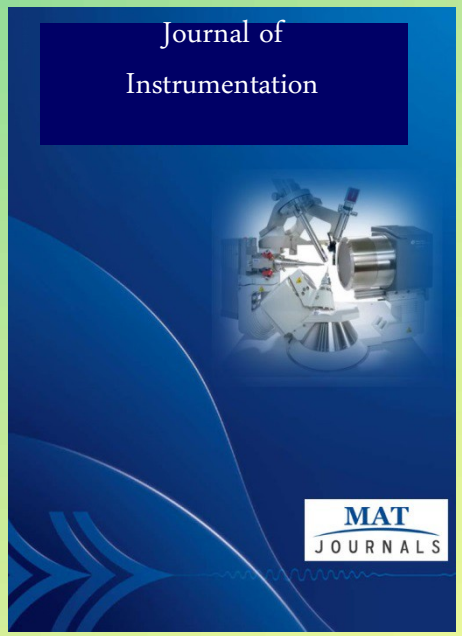
Oncology

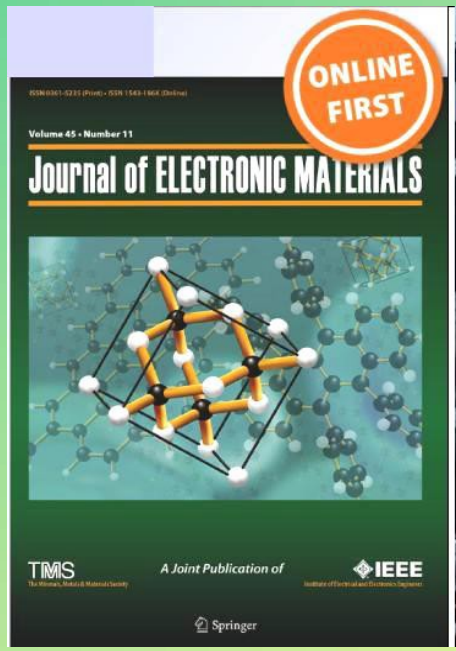
Microfabrication

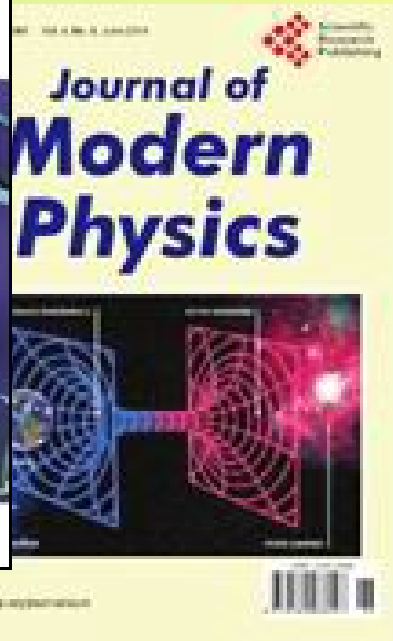
Yerevan State Univ
Engineering Univ.
Yerevan Phys. Inst
Inst. Mol. Biology
Inst. Phys. Research
Inst of Biotechnology
CANDLE Institute
Biomed. Inst (Russia)
Tbilisi State Un. (Georgia)

Publications







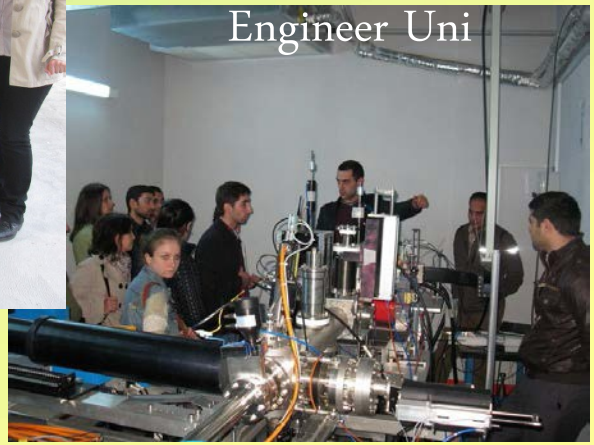


World class Training and Education

Medical Uni

Optical Society

Arm-Russ Uni



Engineer Uni

AREAL Highlights – 2016-2018

2015

Laser

IR

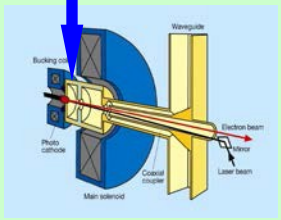
DELTA

MS

MF

UV

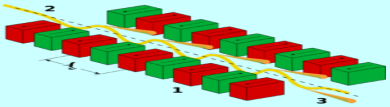
Gun



Free Electron LASER

50 MeV

Linac



Acc1

Acc2

ALPHA

H1

H2

BETA

Experimental Stations

DELTA Dedicated Experimental Lines for Time-resolved Analysis

ALPHA – Amplified Light Pulse for High-end Applications

BETA - Booster for Emerging Technology Accelerators

Armenian-German Science Day “From Theory to Practice”

5 October 2015

Undulator magnet for AREAL Free Electron Laser

DESY

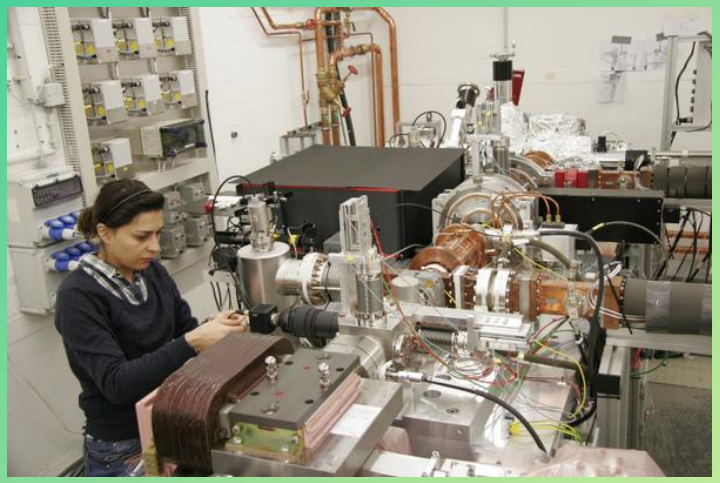
06 June 2017

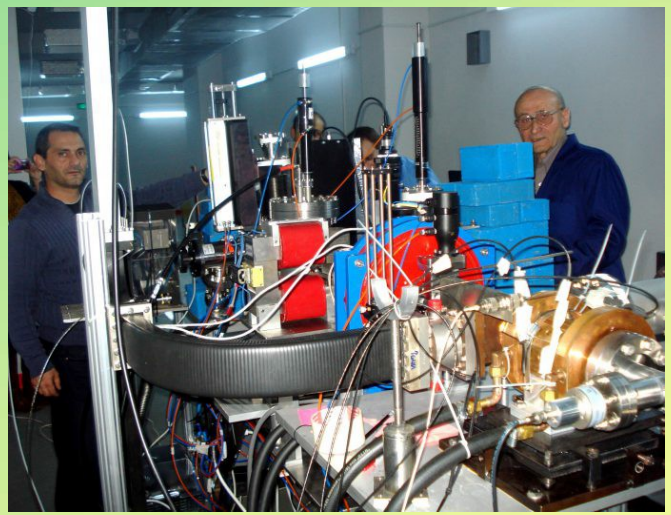
CANDLE

Sister Projects

2010 – 2012 REGAE

2011-2013 AREAL





RF photogun