Collaboration Research institutes – Industries

thx to R. Geometrante, E. Karantzoulis, Y. Papaphilippou, V. Skarda, …

Institutes → better accelerators (science and tech.)
Industries → financial return

Low Emittance Rings ~2018-2025
(beyond MAX IV – ESRF-EBS – SIRIUS)

APS-U, ALS-U, HEPS, PETRA IV,
SLS II, DLS II, ELETTRA 2.0, SOLEIL, ANKA, …
(Iran, Mexico, Thailand, African LS, …)
CepC, FCCee

100-200 Meuros (acc only) each → ~1 Beuro
200-500 Meuros (inc. beamlines) each → ~2 Beuro

Aims

What/Where are the needs/opportunities for R&D?

What/Where are the capabilities for R&D?

How can we fill the gaps?
How to improve the interaction/communication?

Initiate some discussion…

Technical challenges and R&D needed

Magnets (static and pulsed)

IDs

Vacuum

RF

Mechanical engineering

Diagnostics, Electronics (e.g. BPMs, feedbacks)

Technical challenges and R&D needed

Magnets

high gradient
small bore apertures (how small can we go?)

complex dipoles (DQ, DL)

precision machining (poles, mating surfaces, …)

measurements (stretched wire with small bores)
alignment (in situ)
…

Technical challenges and R&D needed

Pulsed magnets (injection in small apertures)

Kickers for swap out

- rise time (1-few ns)
- flattop (10^{-4})

Kicker for top-up

- 4 equal pulses

- Non-linear kickers

CW skew quadrupole

Technical challenges and R&D needed

IDs

CPMUs vs SCUs vs In-Vacs vs APD
EPUs
DELTA

NbTi – NB_3Sn

Field (phase errors)
Shimming and correction techniques
Radiation hardness
Cost

Technical challenges and R&D needed

Vacuum

smaller apertures
NEG or no NEG?
small chambers
complex geometries

polishing of internal surface (low SEY)
laser ablation

coating (conducting, e.g. kickers for top-up)

Technical challenges and R&D needed

RF

SS amplifiers vs klystrons ? (list in talks)

modularity – low phase noise – cost

efficiency – failure rate

Choice of frequency

100 MHz – 500 MHz – higher (e.g. 2 GHz)

how to fight IBS and improve lifetime? HCs

special harmonic cavities

e.g. VSR concept

cryomodule design – HOM reduction

reducing size longitudinally

Technical challenges and R&D needed

Mechanical engineering

- MAX IV blocks concept
- Precision girder machining (20 um over 3-5 m)
  - T-slot keyways vs dowels

- Girder motion
  - movers
  - by-hand

- high precision movement in monochromators
- narrow band-pass filter

- …

Technical challenges and R&D needed

Diagnostics-Electronics

- stability (> 100Hz)
- integration with beamlines

Measurement of small size beams

- from dipole, or V undulators

BPM

- high accuracy in different conditions,
  - e.g. t-b-t, single bunch, low current

Feedback systems

- LMFB, TMBF
- intra-bunch train

Interaction institutes-industries

Different interaction depending on institutes

- (plain) customer-manufacturer
- (various degrees of) R&D collaboration
- (active) knowledge transfer ($\rightarrow$ spin off)
- engaging with local industries
- …

Interaction 1: customer-manufacturer

(plain) customer-manufacturer

- specifications
- call for tenders out – bids in – contract placed
- design reviews – production – FATs
- delivery

Assume specs are written clearly

- responsibility assigned
- critical quantities to be met identified
- …

Assume manufacturer can deliver

- no major technology unknown
- …

Interaction 1: customer-manufacturer

customer-manufacturer – issues and improvements

- communications
  - common design reviews
  - monthly report (is there anything better?)
  - …
- delays
  - expeditors
  - …

Complaints from institutes? P. Lebasque's talk, Dieter's talk, …
Complaints from industries? …

Comments
Industry has knowledge and capabilities and customer buys it
Industry is protective of their know-how

Interaction 2: R&D collaboration

R&D collaboration

technology areas missing on both parties

there is the need on both side to work together to develop the technology

institute is willing to engage with industries at design/prototypes level and R&D from early stages

both increase their knowledge

Interaction 2: R&D collaboration

Advantage on both sides

institute benefits

- more providers push cost down
- sell knowledge through licencing

industry benefits

- can offer high tech product
- reduce R&D cost
- better delivery (on time and on budget)
- sell products to more institutes and customers
- open up markets worldwide
- sell knowledge through licencing

Interaction 3: active knowledge transfer

Active knowledge transfer

- institute developed knowledge-technology during many years; potential markets exist and the institute is interested in commercialisation (not all of them are)
- but no industries is capable
- there is scope to transfer to industry

- financial benefit for the institute
  - licence a technology
  - give IPR (intellectual property rights) right to manufacture (right might not be exclusive can be transferred to many industries)
  - competition $\rightarrow$ reduce cost

Interaction 3: active knowledge transfer

Spin off companies

direct knowledge flow from institute to company
that can extend it to other applications
(e.g. CERN incubation centres, Kyma-Elettra, …)
or direct(?) financial support

How does KT work? KT is different in different labs

prototyping together?

What can be industrialised?

How to engage with industry? Make them aware of KT?

Different personal approaches

giving away knowledge or not

Which institute want to transfer what?

Institute view? Industry view?

Interaction institutes-industries

- engaging with local industries

  strengthen/foster national industry with
  knowledge transfer
  (e.g. Brazil WEG, Iran MAPNA)
  France spin out (ESRF area)
  CERN?

  but large projects cannot do everything nationally

- …

To be discussed

First meeting to foster discussion and reflect on how to improve the collaboration between institutes and industries

Take stock of

- technical challenges and required R&D
- what industries are interested what capabilities
- where technology transfer can happen

- how to foster this exchange?
  - special committees/individuals
    - (e.g. industry liaison officers)

  - workshops/networks – invite industries
  - seconded PhD with EU support (Marie Curie netw.)
  - univ + lab + company e.g. PACMAN