Questionnaire report on ODA recipient countries – Africa perspective

Burying the Complexity: Re-engineering for the Next Generation of Medical Linear Accelerators for Use in Challenging Environments Workshop

Park Royal Hotel, Cheshire, United Kingdom

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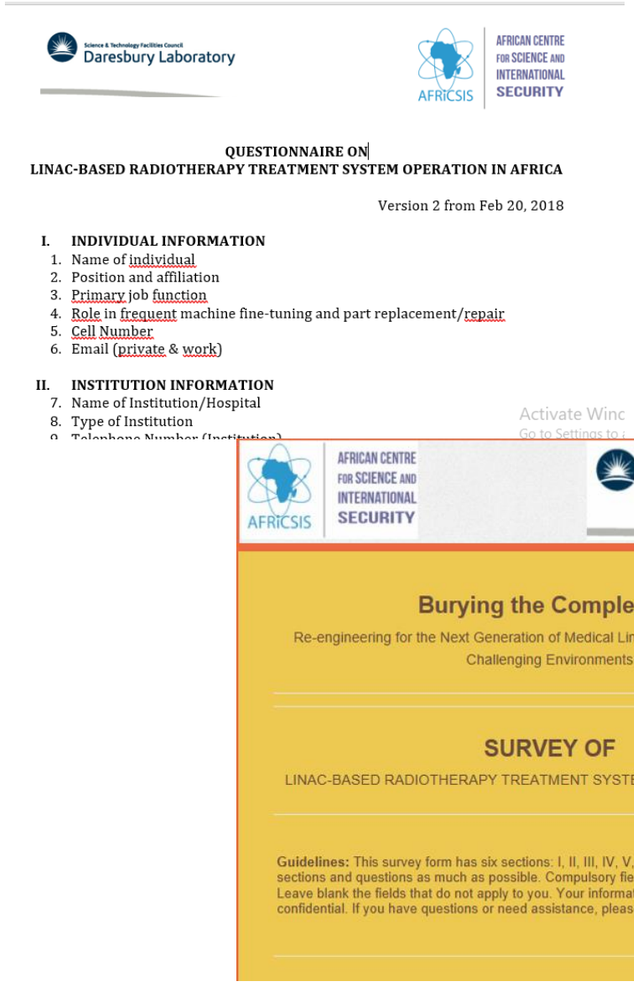
Objective

- to **better understand important existing RTT linac challenges** as dictated by operators from relevant ODA recipient countries in Africa, and
- to **identify key system requirements**, as a comparative benchmark and indicators for defining an agreed set of RTT specifications and design parameters
  - **for the development of rational and affordable future linac technology for use in challenging environments.**

Method

- Questionnaire
  - Topics development
  - Questions alignment
  - Online form (https://goo.gl/cssDRv)
- Audience
  - Professional societies
  - Geographic spread
  - 30 professionals via Emailing
- Feedback
  - 8 submissions, 5 countries, 5 subregions
  - Engineer, physicist, consultant, prof
- Institutions
  - University affiliated, public, private



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QUESTIONNAIRE ON
LINAC-BASED RADIOTHERAPY TREATMENT SYSTEM OPERATION IN AFRICA

Version 2 from Feb 20, 2018

I. INDIVIDUAL INFORMATION

1. Name of individual
2. Position and affiliation
3. Primary job function
4. Role in frequent machine fine-tuning and part replacement/repair
5. Cell Number
6. Email (private & work)

II. INSTITUTION INFORMATION

7. Name of Institution/Hospital
8. Type of Institution

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Burying the Complexity:

Re-engineering for the Next Generation of Medical Linear Accelerators for Use in Challenging Environments

SURVEY OF

LINAC-BASED RADIOTHERAPY TREATMENT SYSTEM OPERATION IN AFRICA

Guidelines: This survey form has six sections: I, II, III, IV, V, VI and VII. Please complete all sections and questions as much as possible. Compulsory fields are marked with asterik (*). Leave blank the fields that do not apply to you. Your information will be kept strictly confidential. If you have questions or need assistance, please email admin@africsis.org

Results – Equipment Service

Service Consideration	Input
Linac per institution	1-2
Fine tuning frequency	Private (4-6), Public (1-2)
Part replacement/equip repair frequency	2
Fine tuning/repair entity	In-house, manufacturer, 3rd party
Major challenges	Spare parts, power, tax, personnel, culture
Cost be linac (land, construction, equipment)	$4-5M
Frequently replaced parts	Field light, motion control knob system on treatment couch, hand control, Electronic Card Motors of MLC
Failure by irradiation disabled per year	2-7

Results – Power System Stability

Voltage stability

- ❑Unreliable mains
- ❑Fluctuating mains

Monitoring system

- ❑Dedicated auto-generator
- ❑UPS
- ❑Voltage stabilizer
- ❑Change phase detector system

Results – Operational Experience

Uptime clause	• 98%
Failure period, rad dos syst	• 1-2 years
Avge downtime per year	• 3-4 days, service work

- ❑ Expensive service contract
- ❑ Lack of trained local engineers
- ❑ Medical insurance system
- ❑ Low single energy linacs + features

Results – Expected needs

How to improve machine stability

- ❑Preventing maintenance/service
- ❑Cooling system
- ❑Less digitization
- ❑Dedicated stepdown transformer
- ❑Back up generator
- ❑Change over switch
- ❑Reliable and stable power supply
- ❑Training of locals

Need	Importance
Machine stability	Most/More
System operation	Most
Operational cost	Most
System efficiency	Most
Multi-leaf collimators system ability to run with fluctuating power supply	More
System robustness	More
System modularity	More
Maximum Photon Energy	More
Capital cost	Most
System performance	More
Max electron energy	Not/Important
Rotating gantry as opposed to fixed target or rotating patient	Important/more

Discussion

Design and development of gantry, collimators and couch might adapt to fluctuating power supply

- incorporate voltage regulations systems and UPS into the design of the machine or those things may be considered as an integral part of the machine. Treatment machines that can be powered with solar energy should also be considered.
- Robustness
- Compactness
- Training, training training...
- Collaboration between manufacturers, end users and other stakeholders.
- Training of end users on the functionality, usage and features of treatment machines.

Thank you