opi-generator

Generating OPI Screens for Control System Studio

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Presented at EPICS Collaboration Meeting, 24-28 April 2023, Fermilab

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U.S. DEPARTMENT OF ENERGY | Office of Science

This material is based upon work supported by the U.S. Department of Energy Office of Science under Cooperative Agreement DE-SC0000661, the State of Michigan and Michigan State University. Michigan State University designs and establishes FRIB as a DOE Office of Science National User Facility in support of the mission of the Office of Nuclear Physics.

What is “opi-generator”?

- The name of a Python project, could be installed via “pip install opigen”
- opi-generator is forked from cssgen
- Generating XML files for CS-Studio as OPI screens from Python scripts
- Consistent screen styles for both CS-Studio and Phoebus
- Managing screen styles in a unified approach, supports user-customization

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- CS-Studio : CS-Studio based on Eclipse
- Phoebus: CS-Studio based on Phoebus

Why “opi-generator”?

- Streamline the OPI screen development: unified styles, minimize the maintainece effort
- Generating OPI screens instead of “drawing” → pixel-level controllable
- Existing packages only tackle one platform, either CS-Studio (Eclipse) (cssgen) or Phoebus (phoebusgen)
- As of now, FRIB is using both CS-Studio and Phoebus, next Debian OS (12) does not work with CS-Studio (Eclipse)
- Last commit of cssgen is 6 yrs ago, not fully support CS-Studio (Eclipse), requires significant effort to make it work for most of the widgets, however “opi-generator” borrowed the idea of how it handles XML.
- Started to refactor “cssgen” to make it support both CS-Studio and Phoebus, opi-generator’s commit of defaec@2022/07/21
- Developed unittests, set up CI workflow for PyPI package publish, and use it to generate OPI files for both CS-Studio and Phoebus

A Simple Example

```
4  from opigen import Renderer
5  from opigen import widgets
6  from opigen.contrib import TextUpdate, Display
7
8  data = [
9      ('LS1_CA01:BPM_D1129', 'VA:LS1_CA01:BPM_D1129:X_RD', 'VA:LS1_CA01:BPM_D1129:Y_RD'),
10     ('LS1_CA01:BPM_D1144', 'VA:LS1_CA01:BPM_D1144:X_RD', 'VA:LS1_CA01:BPM_D1144:Y_RD')
11 ]
12
13 # widget position, size controls
14 height = 25
15 hgap, vgap = 5, 5
16 w_name, w_xpos, w_ypos = [200, 60, 60]
17
18 # name column
19 x_name, y0 = 5, 5
20 # xpos column
21 x_xpos = x_name + w_name + hgap
22 # ypos column
23 x_ypos = x_xpos + w_xpos + hgap
24
25 # screen as the root node
26 screen = Display(800, 600, "BPM Readings")
27 # place widgets
28 for name, xpv, ypv in data:
29     name_lbl = widgets.Label(x_name, y0, w_name, height, name)
30     x_rd_text = TextUpdate(x_xpos, y0, w_xpos, height, xpv)
31     y_rd_text = TextUpdate(x_ypos, y0, w_ypos, height, ypv)
32     screen.add_children([name_lbl, x_rd_text, y_rd_text])
33     # next row of widgets
34     y0 += height + vgap
35
36 # render the screen
37 r = Renderer(screen)
38 r.to_opi("01.opi") # for CS-Studio
39 r.to_bob("01.bob") # for Phoebus
```

Unified Styles: Font, Color, Banner, ...

- Control Fonts, Colors through configuration files, system-wide/user-defined (overrides), etc.
- Dedicated modules to produce the banner to embed

```
#
# lines starts with # or // will be skipped
# CS-Studio (.opi) supports both font size in pt and px
# Phoebus (.bob) only support px
#
# Name           Family             Style     size (boy), size (phoebus)
Title          = Liberation Serif - bold    - 24 pt, 28
Huge           = Liberation Sans  - bold    - 24 pt, 28
Header 1       = Liberation Sans  - bold    - 22 pt, 25
Header 2       = Liberation Sans  - bold    - 20 pt, 23
Header 3       = Liberation Sans  - bold    - 18 pt, 22
Header 4       = Liberation Sans  - bold    - 16 pt, 21
Header 5       = Liberation Sans  - bold    - 14 pt, 20
Default        = Liberation Sans  - regular - 13 pt, 18
Default Bold   = Liberation Sans  - bold    - 13 pt, 18
Label Small    = Liberation Sans  - regular - 13 pt, 12
Fine Print     = Liberation Sans  - regular - 12 pt, 11
Monospace      = Liberation Mono  - regular - 13 pt, 18
Monospace Bold = Liberation Mono  - bold    - 13 pt, 18
Groupbox Name  = Liberation Mono  - regular - 11 pt, 15
Small          = Liberation Sans  - regular - 10 pt, 13
Tiny           = Liberation Sans  - regular - 8  pt, 9
Tiny Monospace = Liberation Mono  - regular - 8  pt, 9
```

Unified Styles: Font, Color, Banner, ...

- Control Fonts, Colors through configuration files, system-wide/user-defined (overrides), etc.
- Dedicated modules to produce the banner to embed

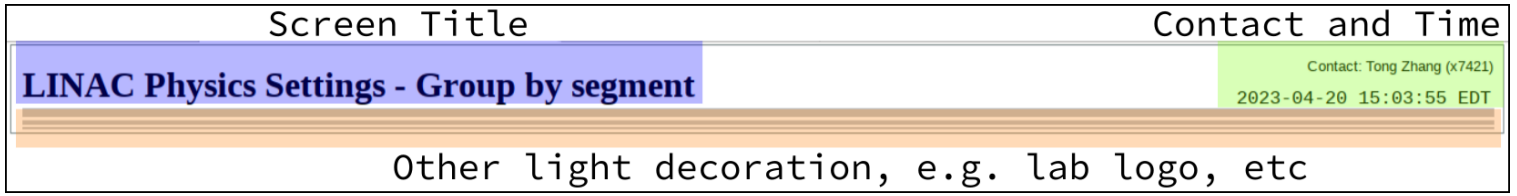
```
# Alarm colours
Minor = 255, 241, 0
Major = 255, 0, 0
Invalid = 255, 255, 255
Disconnected = 255, 255, 255

# Widget colours
Canvas = 200, 200, 200
Button: BG = 205, 205, 205
Button: On = 190, 190, 190
Controller: FG = 0, 0, 196
Related Display: FG = 128, 64, 0
Text: FG = 0, 0, 0
Exit: FG = 196, 0, 196
Monitor: BG = 64, 64, 64
Monitor: FG = 96, 255, 96

# LED colours
Red LED: On = 255, 0, 0
Red LED: Off = 96, 0, 0
Yellow LED: On = 255, 255, 0
Yellow LED: Off = 96, 96, 0
Green LED: On = 0, 255, 0
Green LED: Off = 0, 96, 0
Blue LED: On = 0, 255, 255
Blue LED: Off = 0, 96, 96
# ...
```

Unified Styles: Font, Color, Banner, ...

- Control Fonts, Colors through configuration files, system-wide/user-defined (overrides), etc.
- Dedicated modules to produce the banner to embed



Attribute Mapping

- Map attributes from CS-Studio (used in code) to Phoebus, e.g. “o.format_type = ...” → “<format_type></format_type>” (CS-Studio), while “<format></format>” (Phoebus)
- Support user-customization to cover missing attributes
- If only Phoebus is targted, one can rename LHS to any, e.g. the same as RHS

```
#
# Attribute map between CS-Studio and Phoebus
# DEFAULT section is shared by all widgets
#
[DEFAULT]
name = "name"
x = "x"
y = "y"
width = "width"
height = "height"
background_color = "background_color"
foreground_color = "foreground_color"
show_grid = "grid_visible"
horizontal_alignment = "horizontal_alignment"
vertical_alignment = "vertical_alignment"
pv_name = "pv_name"
format_type = "format"
enabled = "enabled"
visible = "visible"

[Line]
line_width = "line_width"
line_style = "line_style"
background_color = "line_color"

[Label]
text = "text"
transparent = "transparent"

[TextUpdate]
[GroupingContainer]
transparent = "transparent"

[ActionButton]
text = "text"

[ToggleButton]
on_label = "on_label"
off_label = "off_label"

[Byte]
numBits = "numBits"
startBit = "startBit"
on_color = "on_color"
off_color = "off_color"
bitReverse = "bitReverse"

[Led]
on_color = "on_color"
off_color = "off_color"
on_label = "on_label"
off_label = "off_label"

[EmbeddedContainer]
opi_file = "file"
resize_behaviour = "resize"

[TabbedContainer]
active_tab = "active_tab"
minimum_tab_height = "tab_height"
```

Generated Screens

ARIS Camera/Viewer Devices

Contact: Tong Zhang (x7421)

2023-04-20 15:01:28 EDT

Name	In?	Light		Controls	Type	Alias	x0 [mm]	y0 [mm]	σx [mm]	σy [mm]	ρxy	Intensity	Viola	/files/shared/ap/HLA/viola-config/
FS_F1S1:CAM_D1000	-	-	-	Acquire ▶ ■ ≡	CAM	PTG-0	0.000	0.000	0.000	0.000	0.000	0.000E0	Open	template_VD_D1000_v1.json
FS_F1S1:CAM_D1001	-	-	-	Acquire ▶ ■ ≡	CAM	PTG-1	-0.221	0.155	3.220	3.101	-0.003	4.539E9	Open	template_VD_D1001_v10_11holes.json
FS_F1S1:VD_D1184	-			Idle ▶ ■ ≡	VD	Wedge	-0.093	-0.919	15.875	22.003	-0.030	1.287E7	Open	template_VD_D1184_v8.json
FS_F1S2:VD_D1324	-			Idle ▶ ■ ≡	VD	DB0	-0.933	0.081	10.685	10.671	-0.006	9.825E10	Open	DB0_VD_D1324_v7.json
FS_F1S2:VD_D1466				Idle ▶ ■ ≡	VD	DB1	-0.930	-1.800	12.493	13.469	0.221	4.750E4	Open	DB1_VD_D1466_v12.json
FS_F2S1:VD_D1563				Idle ▶ ■ ≡	VD	DB2	3.763	-0.105	2.952	1.933	-0.869	1.785E7	Open	DB2_VD_D1563_v6.json
FS_F2S2:VD_D1660	-			Idle ▶ ■ ≡	VD	DB3	NaN	NaN	NaN	NaN	NaN	0.000E0	Open	DB3_VD_D1660_v7.json
FS_F3S1:VD_D1758				Idle ▶ ■ ≡	VD	DB4	2.155	-14.402	0.336	0.799	0.025	3.144E7	Open	DB4_VD_D1758_v7.json
FS_F3S2:VD_D1856				Idle ▶ ■ ≡	VD	DB5	2.156	-18.207	11.644	1.384	-1.000	2.111E4	Open	DB5_VD_D1856_v4.json

⇑ (CS-Studio) ⇓ (Phoebus)

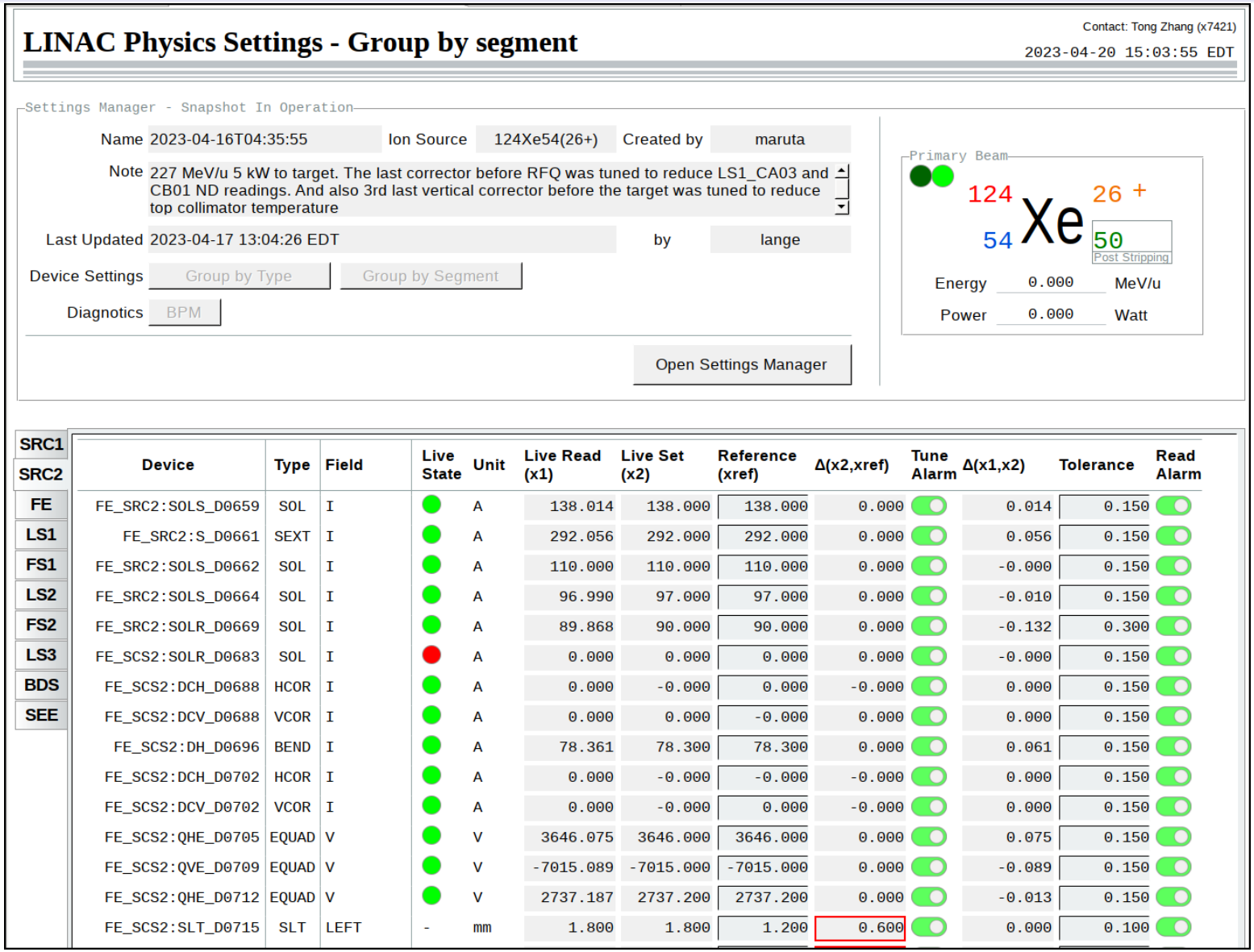
ARIS Camera/Viewer Devices

Contact: Tong Zhang (x7421)

2023-04-20 15:02:55 EDT

Name	In?	Light		Controls	Type	Alias	x0 [mm]	y0 [mm]	σx [mm]	σy [mm]	ρxy	Intensity	Viola	/files/shared/ap/HLA/viola-config/
FS_F1S1:CAM_D1000	-	-	-	Acquire ▶ ■ ≡	CAM	PTG-0	0.000	0.000	0.000	0.000	0.000	0.000E0	Open	template_VD_D1000_v1.json
FS_F1S1:CAM_D1001	-	-	-	Acquire ▶ ■ ≡	CAM	PTG-1	-0.221	0.155	3.220	3.101	-0.003	4.539E9	Open	template_VD_D1001_v10_11holes.json
FS_F1S1:VD_D1184	-	Off		Idle ▶ ■ ≡	VD	Wedge	-0.093	-0.919	15.875	22.003	-0.030	1.287E7	Open	template_VD_D1184_v8.json
FS_F1S2:VD_D1324	-	Off		Idle ▶ ■ ≡	VD	DB0	-0.933	0.081	10.685	10.671	-0.006	9.825E10	Open	DB0_VD_D1324_v7.json
FS_F1S2:VD_D1466		Off		Idle ▶ ■ ≡	VD	DB1	-0.930	-1.800	12.493	13.469	0.221	4.750E4	Open	DB1_VD_D1466_v12.json
FS_F2S1:VD_D1563		Off		Idle ▶ ■ ≡	VD	DB2	3.763	-0.105	2.952	1.933	-0.869	1.785E7	Open	DB2_VD_D1563_v6.json
FS_F2S2:VD_D1660	-	Off		Idle ▶ ■ ≡	VD	DB3	NaN	NaN	NaN	NaN	NaN	0.000E0	Open	DB3_VD_D1660_v7.json
FS_F3S1:VD_D1758		Off		Idle ▶ ■ ≡	VD	DB4	2.155	-14.402	0.336	0.799	0.025	3.144E7	Open	DB4_VD_D1758_v7.json
FS_F3S2:VD_D1856		Off		Idle ▶ ■ ≡	VD	DB5	2.156	-18.207	11.644	1.384	-1.000	2.111E4	Open	DB5_VD_D1856_v4.json

Generated Screens (cont'd)



LINAC Physics Settings - Group by segment

Contact: Tong Zhang (x7421)

2023-04-20 15:03:55 EDT

Settings Manager - Snapshot In Operation

Name: 2023-04-16T04:35:55 | Ion Source: 124Xe54(26+) | Created by: maruta

Note: 227 MeV/u 5 kW to target. The last corrector before RFQ was tuned to reduce LS1_CA03 and CB01 ND readings. And also 3rd last vertical corrector before the target was tuned to reduce top collimator temperature

Last Updated: 2023-04-17 13:04:26 EDT | by: lange

Device Settings: Group by Type | Group by Segment

Diagnotics: BPM

Open Settings Manager

Primary Beam: $^{124}_{54}Xe^{26+}$ 50 Post Stripping

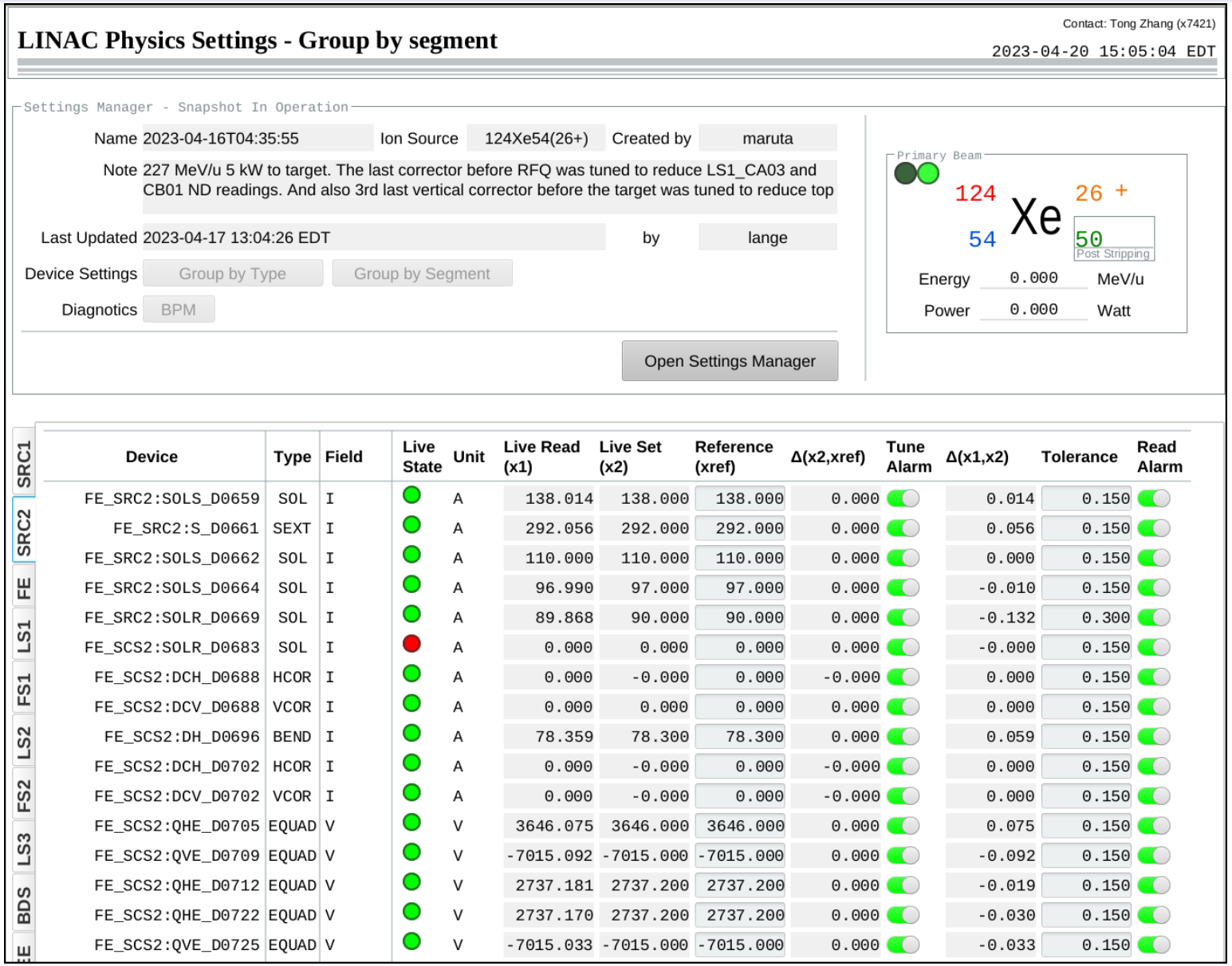
Energy: 0.000 MeV/u

Power: 0.000 Watt

SRC1 SRC2 FE LS1 FS1 LS2 FS2 LS3 BDS SEE

Device	Type	Field	Live State	Unit	Live Read (x1)	Live Set (x2)	Reference (xref)	Δ(x2,xref)	Tune Alarm	Δ(x1,x2)	Tolerance	Read Alarm
FE_SRC2:SOLS_D0659	SOL	I		A	138.014	138.000	138.000	0.000		0.014	0.150	
FE_SRC2:S_D0661	SEXT	I		A	292.056	292.000	292.000	0.000		0.056	0.150	
FE_SRC2:SOLS_D0662	SOL	I		A	110.000	110.000	110.000	0.000		-0.000	0.150	
FE_SRC2:SOLS_D0664	SOL	I		A	96.990	97.000	97.000	0.000		-0.010	0.150	
FE_SRC2:SOLR_D0669	SOL	I		A	89.868	90.000	90.000	0.000		-0.132	0.300	
FE_SCS2:SOLR_D0683	SOL	I		A	0.000	0.000	0.000	0.000		-0.000	0.150	
FE_SCS2:DCH_D0688	HCOR	I		A	0.000	-0.000	0.000	-0.000		0.000	0.150	
FE_SCS2:DCV_D0688	VCOR	I		A	0.000	0.000	-0.000	0.000		0.000	0.150	
FE_SCS2:DH_D0696	BEND	I		A	78.361	78.300	78.300	0.000		0.061	0.150	
FE_SCS2:DCH_D0702	HCOR	I		A	0.000	-0.000	-0.000	-0.000		0.000	0.150	
FE_SCS2:DCV_D0702	VCOR	I		A	0.000	-0.000	0.000	-0.000		0.000	0.150	
FE_SCS2:QHE_D0705	EQUAD	V		V	3646.075	3646.000	3646.000	0.000		0.075	0.150	
FE_SCS2:QVE_D0709	EQUAD	V		V	-7015.089	-7015.000	-7015.000	0.000		-0.089	0.150	
FE_SCS2:QHE_D0712	EQUAD	V		V	2737.187	2737.200	2737.200	0.000		-0.013	0.150	
FE_SCS2:SLT_D0715	SLT	LEFT	-	mm	1.800	1.800	1.200	0.600		0.000	0.100	

Generated Screens (cont'd)



LINAC Physics Settings - Group by segment

Contact: Tong Zhang (x7421)

2023-04-20 15:05:04 EDT

Settings Manager - Snapshot In Operation

Name 2023-04-16T04:35:55 | Ion Source 124Xe54(26+) | Created by maruta

Note 227 MeV/u 5 kW to target. The last corrector before RFQ was tuned to reduce LS1_CA03 and CB01 ND readings. And also 3rd last vertical corrector before the target was tuned to reduce top

Last Updated 2023-04-17 13:04:26 EDT | by lange

Device Settings: Group by Type | Group by Segment

Diagnotics: BPM

Open Settings Manager

Primary Beam: 124 Xe 26+, 54, 50 Post Stripping

Energy 0.000 MeV/u

Power 0.000 Watt

SRC1 | SRC2 | FE | LS1 | FS1 | LS2 | FS2 | LS3 | BDS | EE

Device	Type	Field	Live State	Unit	Live Read (x1)	Live Set (x2)	Reference (xref)	Δ(x2,xref)	Tune Alarm	Δ(x1,x2)	Tolerance	Read Alarm
FE_SRC2:SOLS_D0659	SOL	I		A	138.014	138.000	138.000	0.000		0.014	0.150	
FE_SRC2:S_D0661	SEXT	I		A	292.056	292.000	292.000	0.000		0.056	0.150	
FE_SRC2:SOLS_D0662	SOL	I		A	110.000	110.000	110.000	0.000		0.000	0.150	
FE_SRC2:SOLS_D0664	SOL	I		A	96.990	97.000	97.000	0.000		-0.010	0.150	
FE_SRC2:SOLR_D0669	SOL	I		A	89.868	90.000	90.000	0.000		-0.132	0.300	
FE_SCS2:SOLR_D0683	SOL	I		A	0.000	0.000	0.000	0.000		-0.000	0.150	
FE_SCS2:DCH_D0688	HCOR	I		A	0.000	-0.000	0.000	-0.000		0.000	0.150	
FE_SCS2:DCV_D0688	VCOR	I		A	0.000	0.000	0.000	0.000		0.000	0.150	
FE_SCS2:DH_D0696	BEND	I		A	78.359	78.300	78.300	0.000		0.059	0.150	
FE_SCS2:DCH_D0702	HCOR	I		A	0.000	-0.000	0.000	-0.000		0.000	0.150	
FE_SCS2:DCV_D0702	VCOR	I		A	0.000	-0.000	0.000	-0.000		0.000	0.150	
FE_SCS2:QHE_D0705	EQUAD	V		V	3646.075	3646.000	3646.000	0.000		0.075	0.150	
FE_SCS2:QVE_D0709	EQUAD	V		V	-7015.092	-7015.000	-7015.000	0.000		-0.092	0.150	
FE_SCS2:QHE_D0712	EQUAD	V		V	2737.181	2737.200	2737.200	0.000		-0.019	0.150	
FE_SCS2:QHE_D0722	EQUAD	V		V	2737.170	2737.200	2737.200	0.000		-0.030	0.150	
FE_SCS2:QVE_D0725	EQUAD	V		V	-7015.033	-7015.000	-7015.000	0.000		-0.033	0.150	

Thank You and Have Fun!