NEW ACCELERATOR BEAM CENTERLINE (ABC) PRODUCTION LINE AT VAREX IMAGING CORPORATION

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Abstract

• In January 2017, former component division of Varian Medical in Salt Lake City becomes independent public company, Varex Imaging Corp.

• Separation from Varian required establishing Accelerator Beam Centerline Production (ABC) on premises of HQ in Salt Lake City.

• In May 2016, 8 months prior to Varian spinning off Varex, it acquired assets of two small companies that I had founded in 2008 and 2011 and was running at the time (see picture).

• After 5 years since the acquisition, we are reporting on the key results.
ABC Nomenclature

ABC-12ER-X-E-M

1: Design
ABC = Accelerator Beam Centerline

2: Peak Energy
6 = 6 MeV
7 = 7 MeV
10 = 10 MeV
12 = 12 MeV
20 = 20 MeV

3: Energy Regulation (Optional)
ER = Energy Regulation

4: Band of Operation
X = X-Band
S = S-Band

5: Guide Output
X = X-ray (target)
E = Electron beam (window)

6: Modification (Optional)
M = Modified from typical design
SS = Small Spot Target Design
D = Diode electron gun
T = Triode electron gun
Establishing New Product Line at Varex

• “It is as simple as ABC” - Varex now owns this Trademark!

• All who are present are well aware - it isn’t so simple, really, but with a great team and a strong, competent leadership it is much easier. 😊

• During the first couple years, Varex continued production of the ABCs on premises of Bodycote in Fremont, CA.

• Varex has completed integration of ABC design and production at its Salt Lake Facility in 2018-2021, and we continuing to expand the capabilities.

• Presently, we have established a pilot design and production line at Varex; successfully produced, tuned and fully tested a number of new linacs; and continuing to design exceptional, “state-of-the-art” ABC models.

<table>
<thead>
<tr>
<th>Part Number</th>
<th>Model</th>
<th>Operating Energy Range, MeV</th>
<th>Max Dose Rate@1 m from target, cGy/min</th>
<th>Electron Beam Current, peak mA</th>
<th>Description</th>
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<tbody>
<tr>
<td>140459</td>
<td>ABC-3.5-2-E</td>
<td>1.7-3.9</td>
<td>200</td>
<td>0-310</td>
<td>For 3 MeV linac, tube or mode e-gun options fully tested</td>
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<td>145666</td>
<td>ABC-3.5-3-T</td>
<td>1.7-3.9</td>
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<tr>
<td>147034</td>
<td>ABC-5.5-E-T</td>
<td>2.5-6.4</td>
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<td>139933</td>
<td>ABC-7-8.5-X</td>
<td>3.2-8.0</td>
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<td>Replacements for Varian K-series, 1520 MeV, design data only</td>
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<td>142873</td>
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<td>0.9-1.3</td>
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<td>136813</td>
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<td>Implant negative application, mature product</td>
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</table>
Developed Key X-Band ABC Models

LEFT to RIGHT
- ABC-12ER-X-E for electron beam radiation therapy, a mature product for intraoperative and some other applications;
- ABC-1.8-X-X for security and NDT, a fully qualified unit (also tested at 2.5 MeV with higher power magnetron);
- ABC-2.5-X-X-DI two section 2.5 MeV linac with a symmetrical input through an integrated 3 dB coupler, a fully tested prototype, delivered up to 50 R/min@ 1 m, pulse rate 100 pps-800 pps.
Developed Key S-Band ABC Models

ABC-3ER-S-X
- 3 MeV, 300 R/min@1m
- 1-3 MeV
- 0-300 R/min@1m

ABC-5ER-S-X
- 5 MeV, 700 R/min@1m
- 3-6 MeV
- 0-800 R/min@1m

ABC-7ER-S-X
- 7 MeV, 500 R/min@1m
- 3-8 MeV
- 0-1000 R/min@1m

ABC-9ER-S-X
- 9 MeV, 3000 R/min@1m
- 6-12 MeV
- 0-3200 R/min@1m

- successfully tested at full power, ready for production

All units have broad energy, current, and dose rate regulation, upgraded and with some new features. Triode e-gun allows for complete beam shut down. Multiple energy mode in broad energy range.
Examples of Developed S-Band ABC Models

LEFT to RIGHT
• ABC-3-S-X for NDT and security screening;
• ABC-7ER-S-X, a 3-8 MeV energy regulated linac for security and NDT, smaller beam spot options are in works;
• ABC-10-S-E for a high power e-beam linac designed for sterilization (successfully tested without focusing system, now focusing coils being added).
THANK YOU FOR YOUR ATTENTION!
WITH GREAT APPRECIATION AND IN HONOR OF EVERLASTING MEMORY OF MY LATE MENTORS, COLLEAGUES, AND FRIENDS:
DR. IGOR SHCHEDRIN, MR. RUSSELL SCHONBERG, DR. THEODOR ROUMBANIS, MR. HANK DERUYTER, AND MANY OTHERS