Introduction
In last decade increasing demand for clinical F-18 Fluodeoxyglucose requires a greater F-18 fluoride production. From the other side increasing price of enriched O-
18 water compel us to find the most effective way of F-18 activity production. One of the possible way, how to optimize and increase yield of F-18, is to increasing
target current with retaining the same or less volume of enriched water. Optimization of F-18 production on IBA Large Volume cylindrical target is presented.

Methods and Results
Irradiations of [18O]H2O by 18 MeV proton beams with intensities 40-55 µA were performed on CYCLON 18/9, IBA cyclotron and on LV cylindrical IBA
target.

Table of Main parameters of LV cylindrical target.

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Target current</td>
<td>40-55 µA</td>
</tr>
<tr>
<td>Target volume</td>
<td>2.5 ml</td>
</tr>
<tr>
<td>Filling volume</td>
<td>2.0 ml</td>
</tr>
<tr>
<td>Target pressure</td>
<td>30-35 bar</td>
</tr>
<tr>
<td>Standard yield declare by IBA</td>
<td>5G/2h EOB</td>
</tr>
<tr>
<td>Window Burst Pressure</td>
<td>&gt;50 bar</td>
</tr>
</tbody>
</table>

Irradiated enriched water was transported to the hot cell using RDS (Radioactive Delivery System) system and was measured in Curiemometer 4 Isotope Calibrator made by PTW.
At the beginning it was necessary to satisfy several requirements:

- Target and water cooling

Using a simple two dimensional equation we can roughly estimate the equilibrium temperature inside the target:

\[
\Delta t = \frac{H T}{A k}
\]

where:

- \(\Delta t\) = the temperature rise in the target chamber over cooling water temperature
- \(H\) = is the heat load
- \(T\) = thickness of target metal wall
- \(A\) = area of metal in contact with target water
- \(k\) = thermal conductivity

In our case with heat load 720 W = 40 µA * 18 MeV – \(\Delta t\) = 78 °C. From the curve of boiling point of water as a function of pressure, we can observe

\(\Delta t\) = 212 °C at 20 bar or 243 °C at 35 bar respectively, which correspond max. heat load up to 90-95 µA of target current.

The saturated yields of F-18 for 40 µA to 55 µA target currents are given in

Table below. No systematic decrease in yields with increasing target current
was observed and yields were in line with the 230 ± 10 mCi/µA measured at acceptance test of target.

- pressure and filling water volume.

Filling water volume was from 2 to 2.15 ml to guarantee stop all beam in
water. Also during experiments for safety reasons the operating pressure was limited to 35 bar as the window rupture pressure is >50 bar for used
0.05 mm Havar foil. In this case increasing target volume with increasing
current was provided with longer tube.

Activities in the target at EOB

<table>
<thead>
<tr>
<th>Target current (µA)</th>
<th>Satur. yield (mCi/µA)</th>
<th>Activity EOB 1h (GBq)</th>
</tr>
</thead>
<tbody>
<tr>
<td>40</td>
<td>231</td>
<td>8.55</td>
</tr>
<tr>
<td>45.5</td>
<td>232</td>
<td>8.6</td>
</tr>
<tr>
<td>50</td>
<td>229</td>
<td>8.46</td>
</tr>
<tr>
<td>55</td>
<td>232</td>
<td>8.6</td>
</tr>
</tbody>
</table>

The [18F]FDG yields from productions using the TRACERlab-Mx module are shown in left Figure. All presented productions of F-18 were
prepared with LV target with 55 µA. No decrease in the yield was observed with increasing beam current. The lower yields in May 2014
were due to problems with impurity of enreached water [18O]H2O.

Conclusion
It has been demonstrated that it is possible to produce routinely
250 GBq / 2 br (6.8 Ci / 2 hr) of F-18 Fluoride using LV cylindrical
target (operating conditions: 55 µA, 18 MeV, 98% enriched water). As
the next step we want to test dual beam – 2 x 55 µA with two LV targets
and expected activity about 500 GBq of F-18 Fluoride in 2 hours is expected.