Status Report: Experimental investigation of beryllium. 9 October 2014

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## Experiments:

<table>
<thead>
<tr>
<th>Investigation of the as-received Be</th>
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<tr>
<td>Investigation of the existing proton Be windows</td>
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<td>- “real” GeV proton irradiation;</td>
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<td>- irradiated volume is big enough for microstructural investigations and micromechanical tests</td>
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<th>Simulation with ion irradiation experiments</th>
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<td>- flexibility of irradiation conditions</td>
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<td>- observations of the evolution of the microstructure;</td>
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<td>- reasonable correspondence of He/dpa ratio.</td>
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**Low energy in-situ irradiation:**
- easy variation of irradiation parameters;

**High-energy irradiation + PIE**
- microstructural and micromechanical tests data will be available
Characterisation of as-received Be

PF-60/VHP

Grain size
Texture
Precipitates
Dislocation structure

SEM + EDX + EBSD
TEM ( + APT)

Grain size (diameter), µm

Fraction

0  10  20  30

0.15
0.10
0.05
0.00
Characterisation of as-received Be

**Samples preparation**
- Mechanical polishing lab is organised.
- Polishing procedure up to “EBSD quality” is developed.
- PF60 – 4 samples are polished.
- S200F – 4 samples are polished.

**EDX and EBSD**
- PF60 – experiment are made. Quantification of the obtained results should be finished.
- S200F – will be characterised after the surface contamination test result.

**TEM and APT** – FIB at CCFE should be used.
- FIB trainings are finished. “Driving test” is next week.
- Be sample will be transferred to CCFE next week for the contamination test.
- Plan to start FIB of Be in late October – beginning of November

**Nanoindentation**
will be made after the nano-indenter repairing
**300 kW NuMI beam window**

(MARS calculations of Brian Hartsell, Fermilab)

- 120GeV proton beam
- about $3 \times 10^{13}$ protons per pulse, 0.5 Hz
- $1.57 \times 10^{21}$ protons during its lifetime
- 1.1mm beam sigmas, X and Y
- $T \approx 70^\circ C$

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**300 kW NuMI beam window**

The window can be accepted by the University. Will be shipped from Fermilab soon

1) to determine the exposed area by the dosimetry film.

2) SEM + EDX characterisation. **This year**

3) nano-indentation (nano-indenter doesn’t work now).

Then – transfer to CCFE for FIB samples preparation. **December-January?**
Low energy ion irradiation:

- FIB samples preparation at CCFE should be started.
- Be sample will be transferred to CCFE next week for the contamination test.
- Next step: preparation of samples. This year.

High energy ion irradiation:

- mechanical polishing procedure is developed;
- irradiation conditions are determined (multi-energy implantation).
- aluminium coating of the test sample (non-toxic) is delayed due to the technique failure. No updates since mid of September.