

Polarized Source Design Update

Alexandre Beaubien, PhD candidate

University of Victoria

The Belle II collaboration

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University
of Victoria



Conceptual Design of the Gun



Evaporation Chamber

Activation $\sim 10^{-9}$ Pa

Cathode Chamber

Gun $\sim 10^{-10}$ Pa

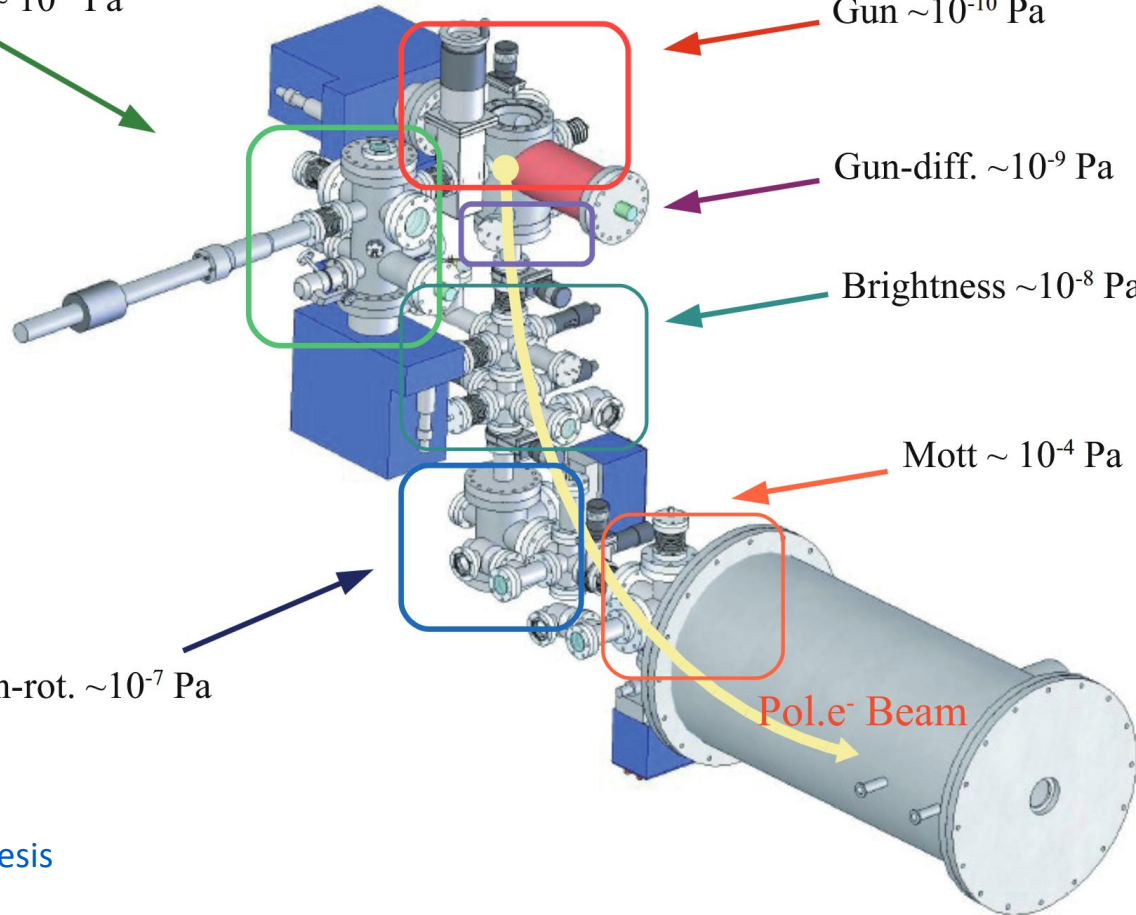
Gun-diff. $\sim 10^{-9}$ Pa

Brightness $\sim 10^{-8}$ Pa

Mott $\sim 10^{-4}$ Pa

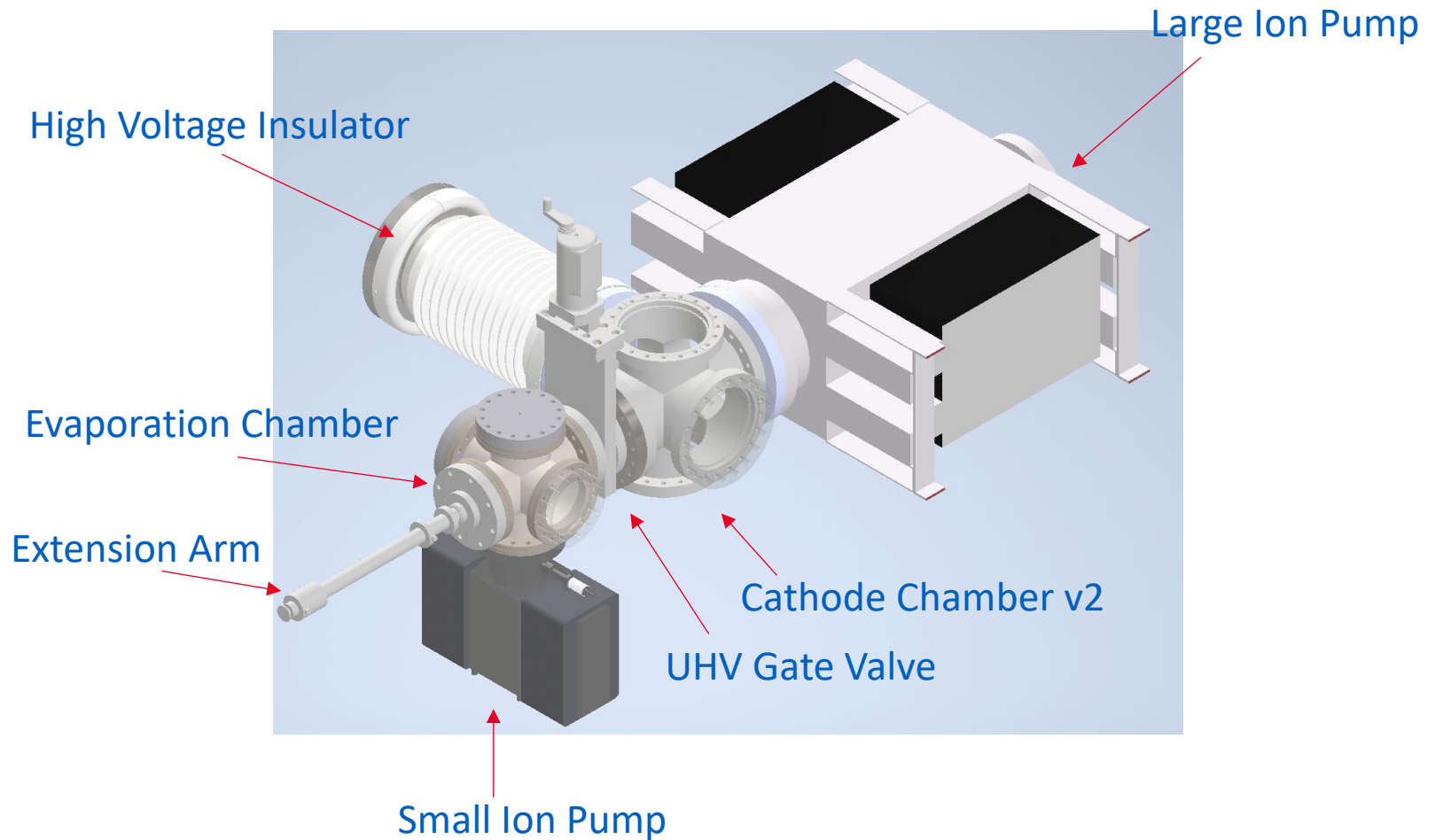
Spin-rot. $\sim 10^{-7}$ Pa

Pol.e⁻ Beam

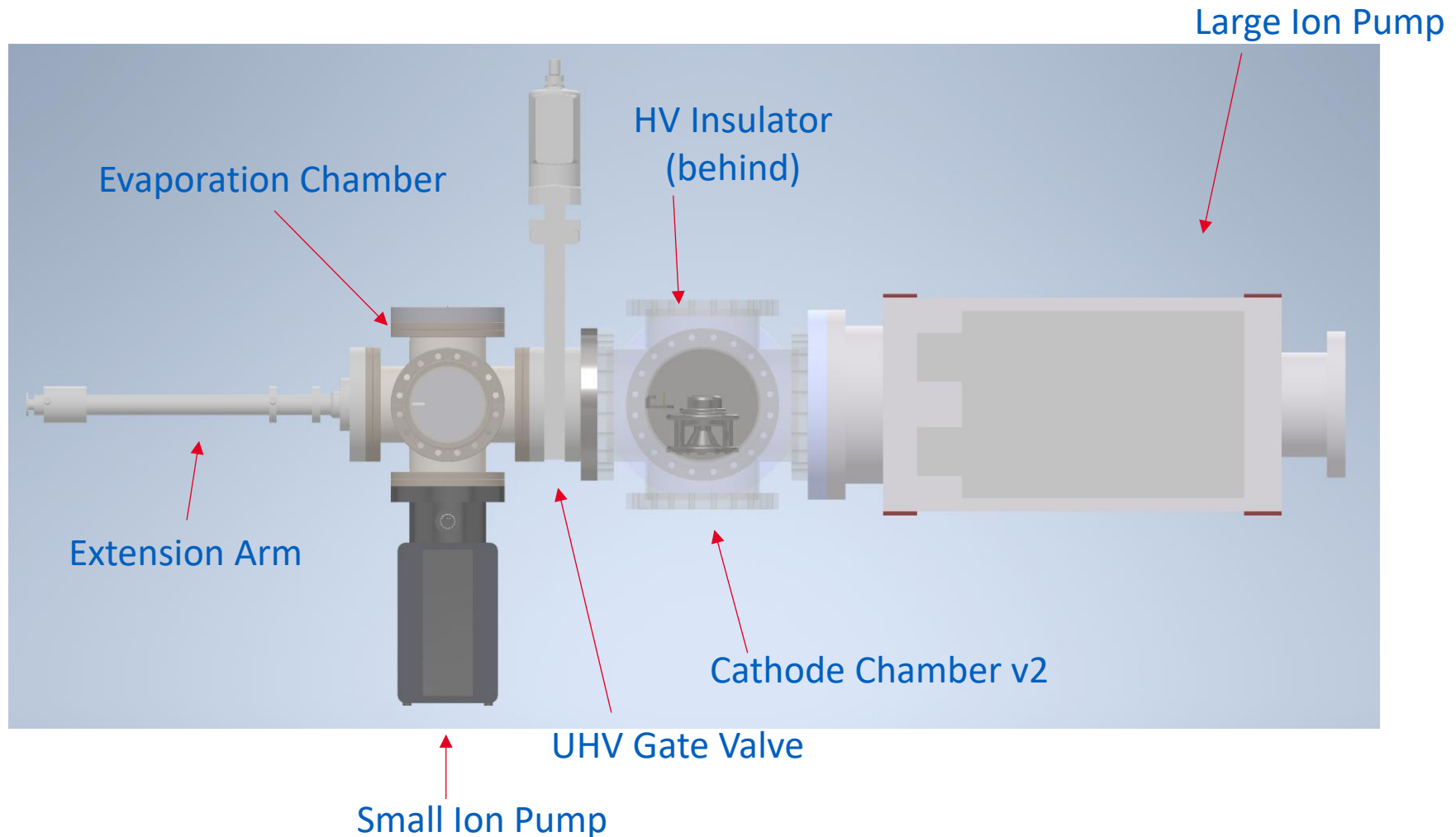


N. Yamamoto, PhD Thesis

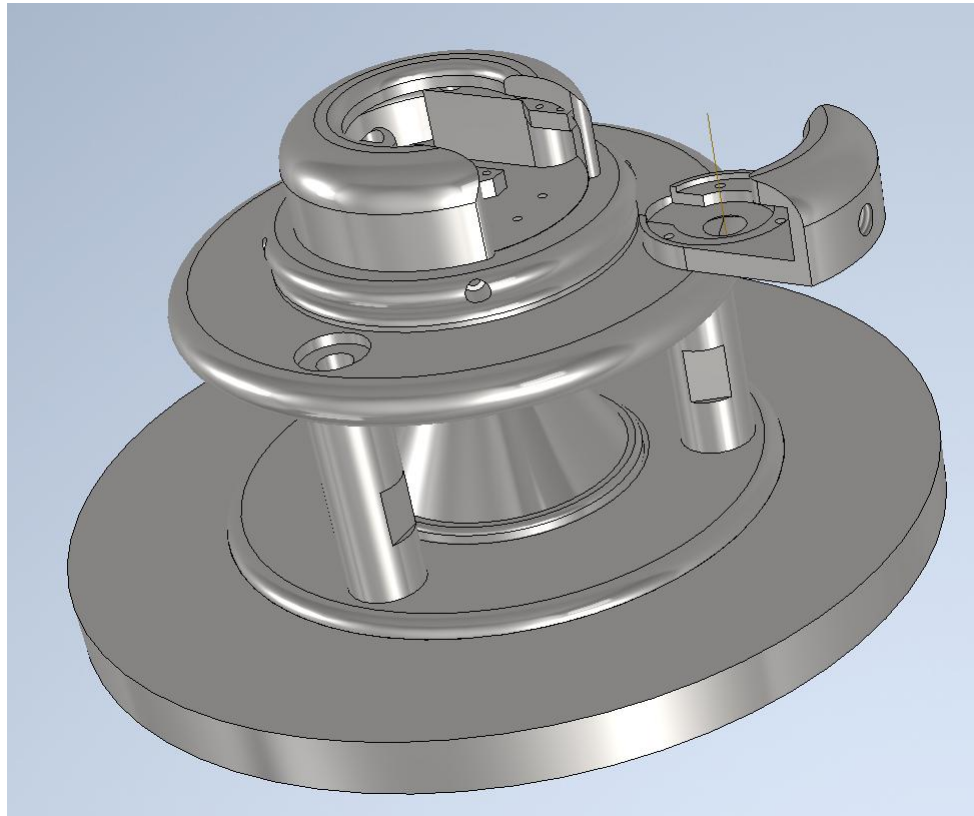
Polarized Electron Gun



Polarized Electron Gun — Profile

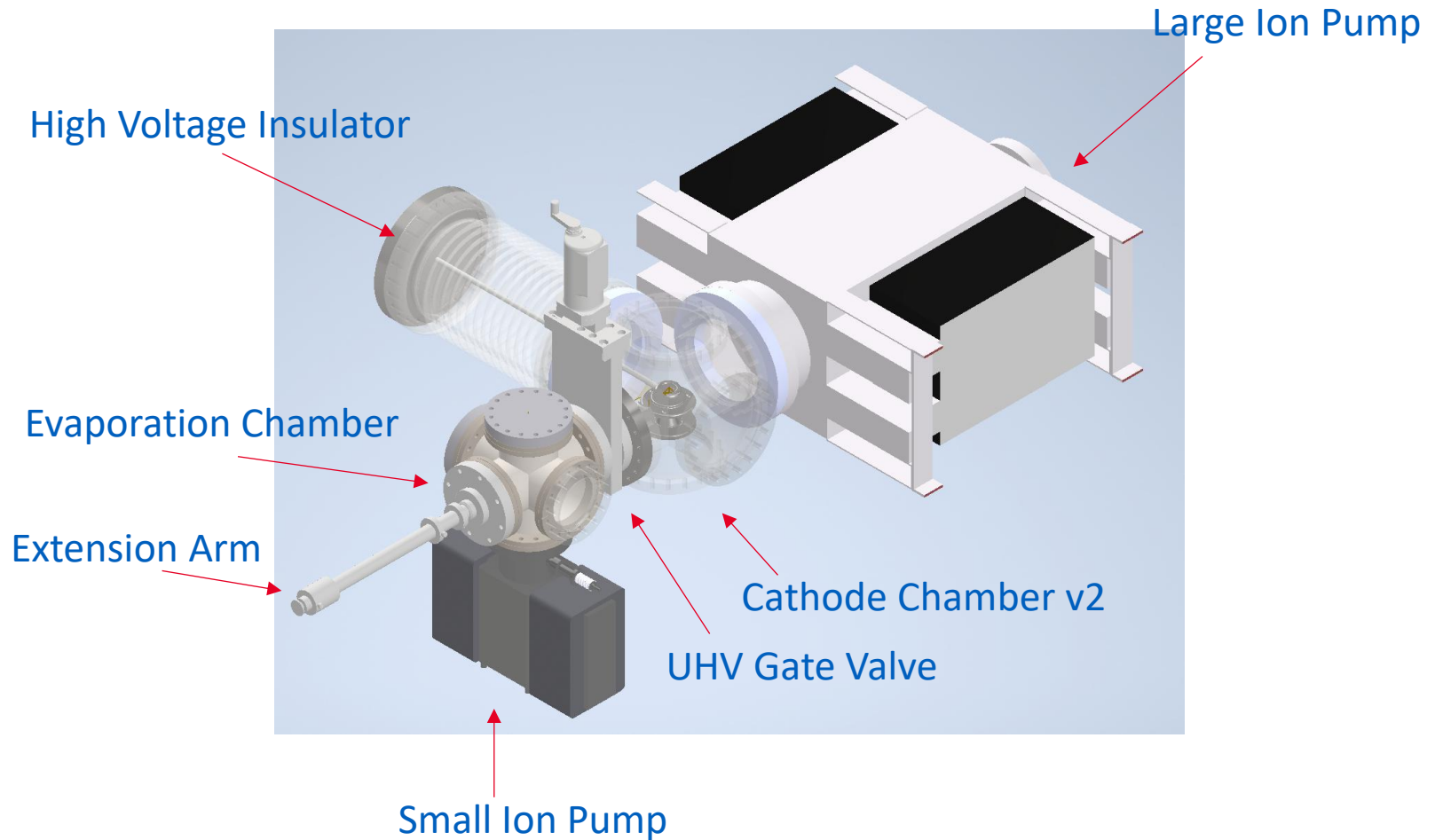


Cathode Holder



Design from: N. Yamamoto, PhD Thesis

Polarized Electron Gun — Holder



Photos of the Available Equipment



List of Components to Buy



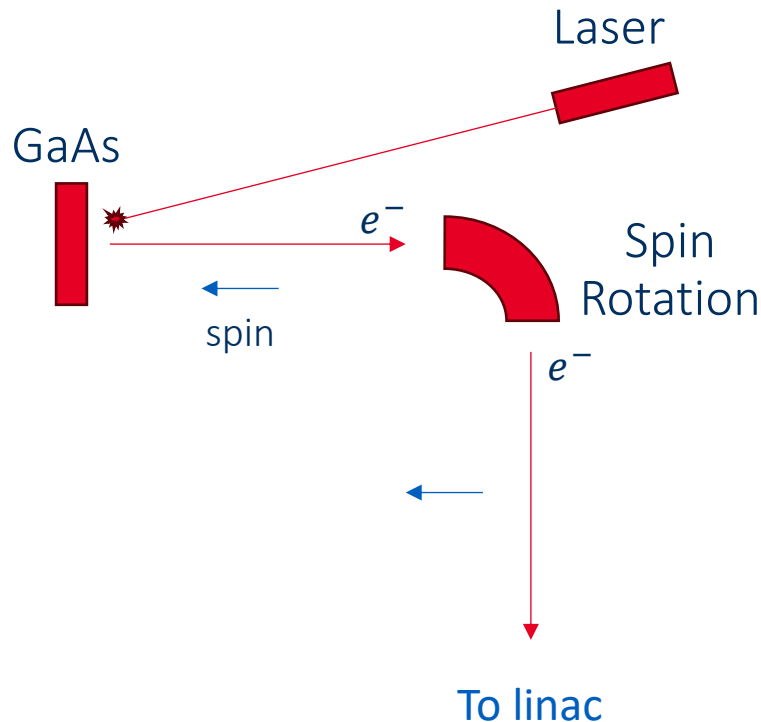
- **1 x ICF6 Cross** (ICF203 flange size, model **cr203-6-a**)
 - Cathode chamber
- **1 x ICF6 Cross** (ICF152 flange size, model **cr152-6-a**)
 - Evaporation chamber
- **2 x ICF203/ICF253** conversion flange
 - Cathode chamber – large ion pump
 - Cathode chamber – insulation chamber
- **1 x ICF152/ICF203** conversion flange
 - Cathode chamber – gate valve
- **1 x ICF70/ICF152** conversion flange
 - Evaporation chamber – extension arm
- **1 x ICF253** Blank Flange
 - Closing the insulation chamber

Spin Rotation Consideration

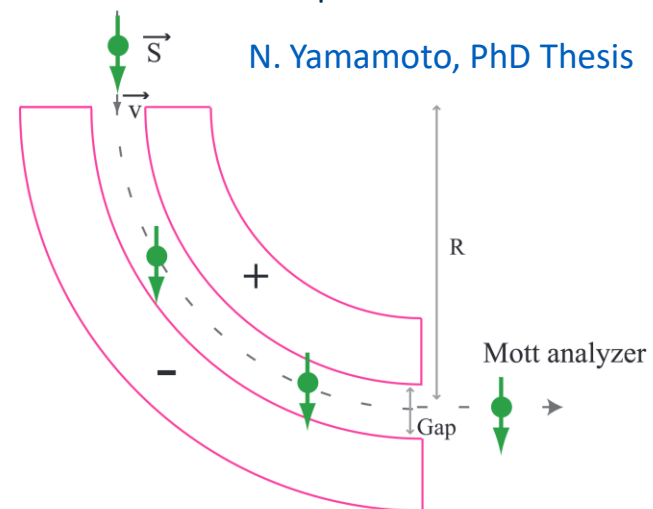


Prior to entering the RF cavities traversing the J-arc of the linac, the beam spin vector should be aligned to the vertical to avoid depolarization due to the bend in the linac. To achieve this, we consider the addition of a Wien Filter in the early stages of the linac, immediately after source generation and prior to entering the first RF cell. Although there exists four pairs of vertical bends before the pipe goes into the tunnel, the vertical polarization is re-established by the time the beam enters the HER, due to anti-symmetric structure of the bends, as shown in Figure 16.

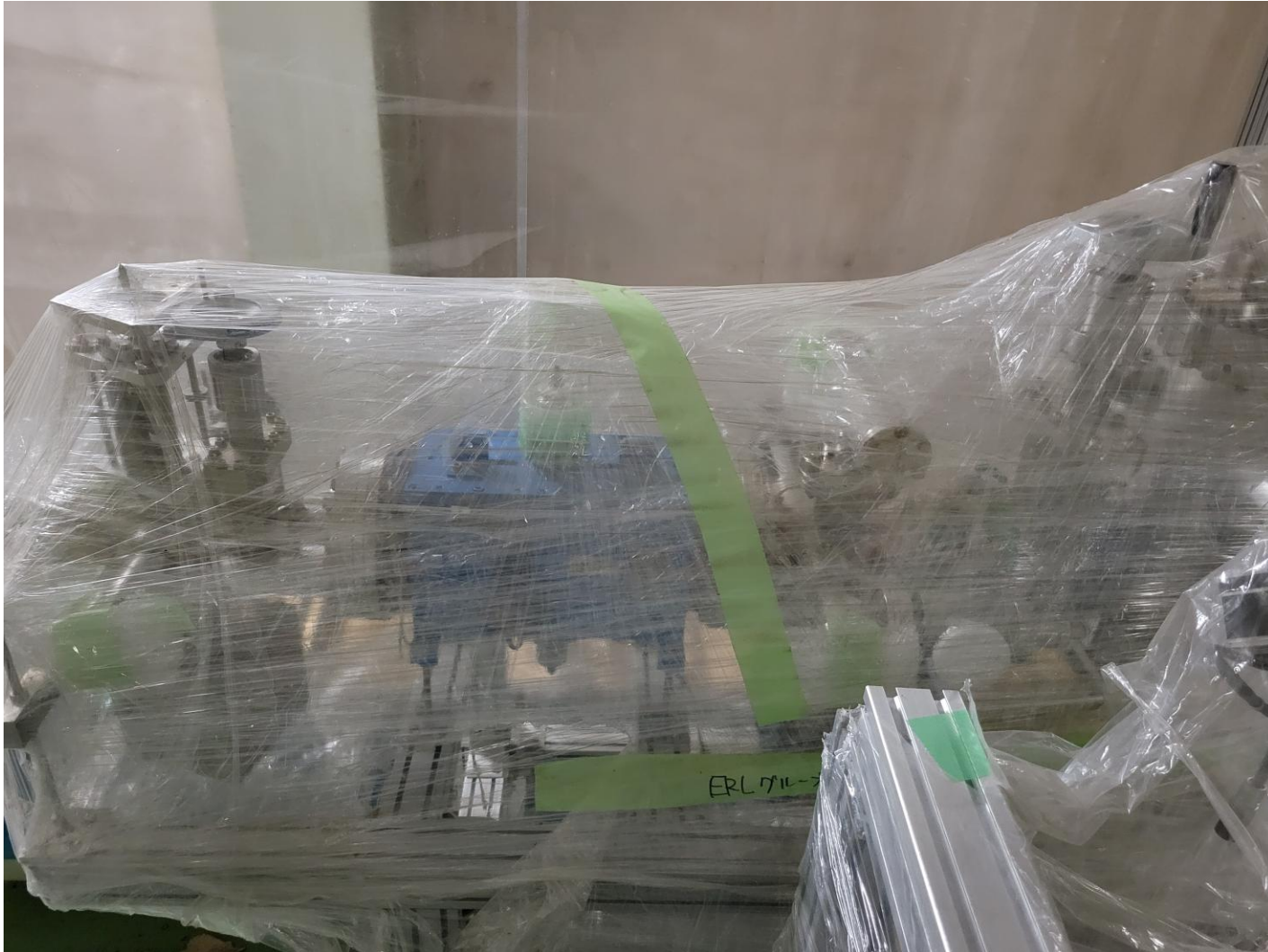
Snowmass 2021 White Paper on Upgrading SuperKEKB with a Polarized Electron Beam: Discovery Potential and Proposed Implementation
<https://arxiv.org/abs/2205.12847>



e.g., use 90deg rotation while the polarization is maintained to "rotate" the polarization



Wein Filter + Mott Polarimeter at KEK



Internal Schematics



Dimensions need to be measured

6.5.2 実際の Wien-filter

実際に使用した Wien-filter を図 6.6 に示す[30].

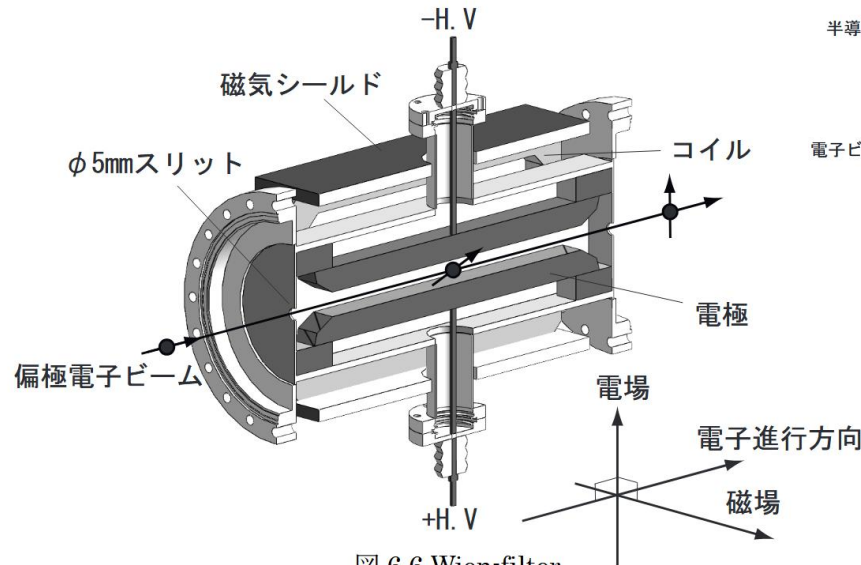


図 6.6 Wien-filter

6.6 Mott 散乱槽

Mott 散乱槽内部は図 6.7 のようになっている。

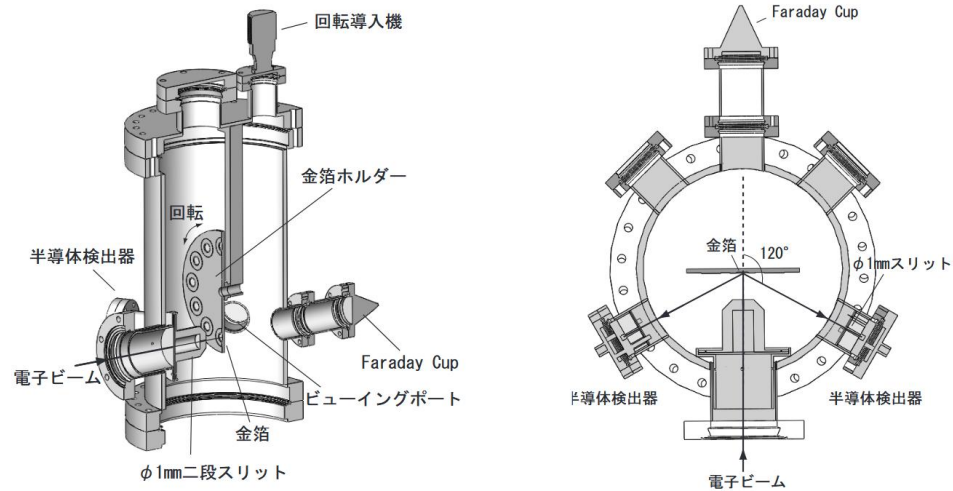
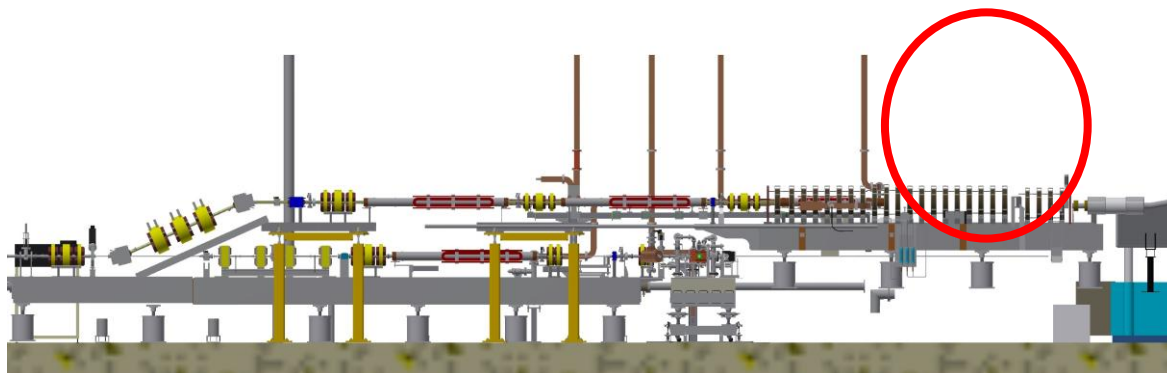


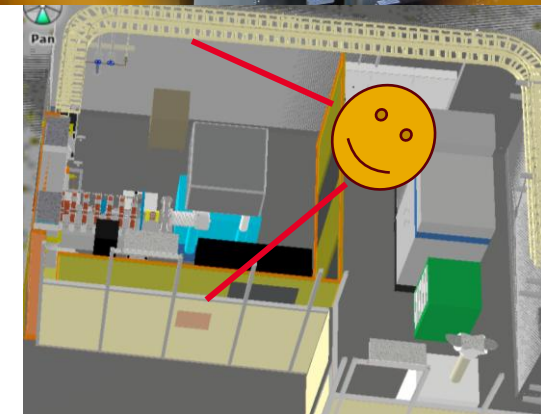
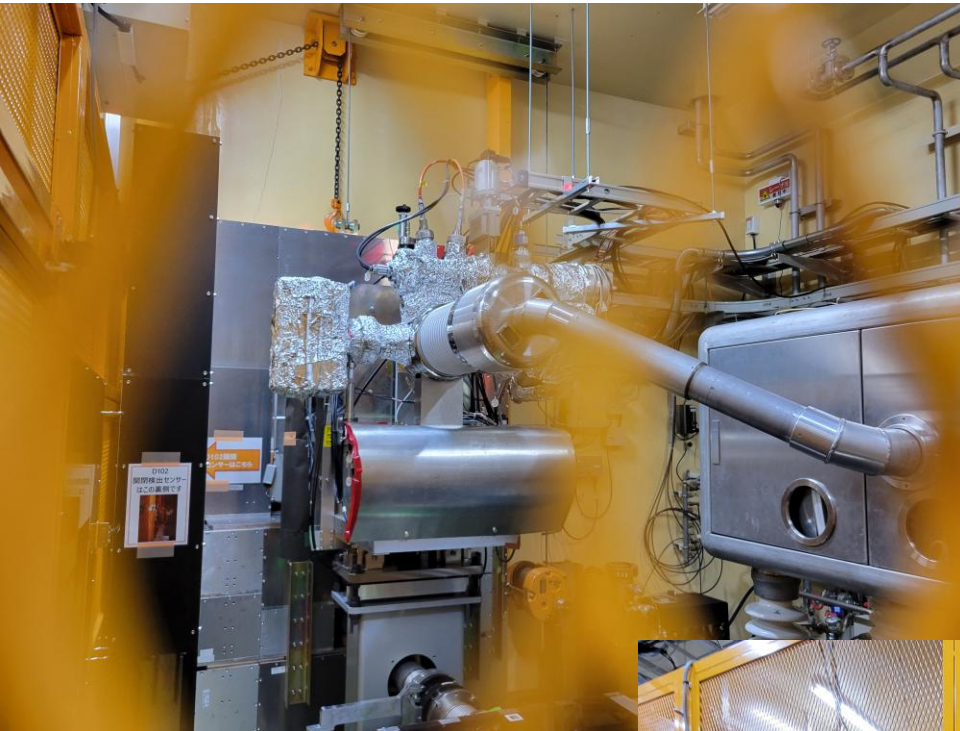
図 6.7 Mott 散乱槽

Kenichi Yasui, MSc Thesis

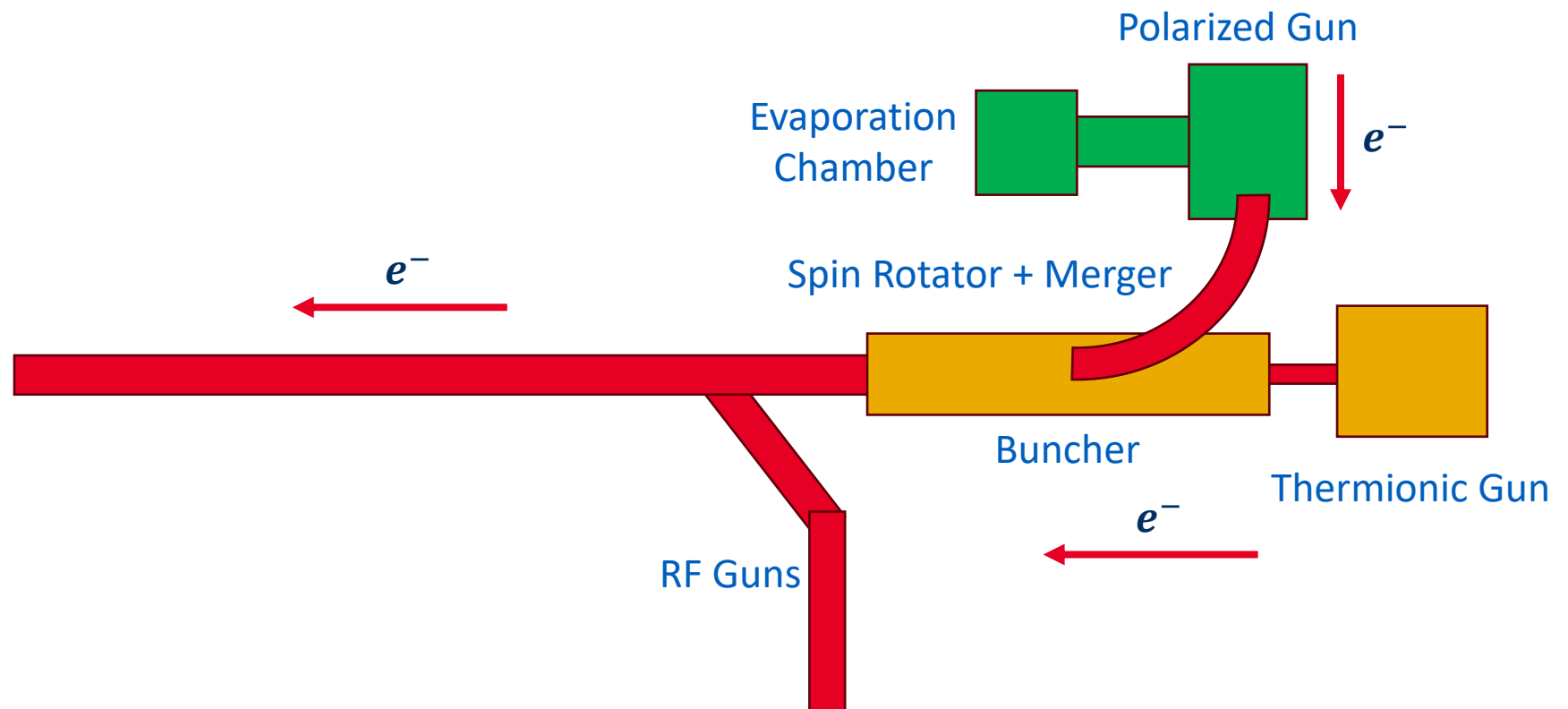
Injection Room Available Area



Injection Room Available Area



Schematic



Next steps



1. Order components and build chamber to test vacuum
2. Simulate the electrons using CST to understand cathode holder modifications needed
3. Add downstream elements to gun design:
 1. Mott polarimeter & Spin rotator