Tungsten Target Strip Development

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W-Targets

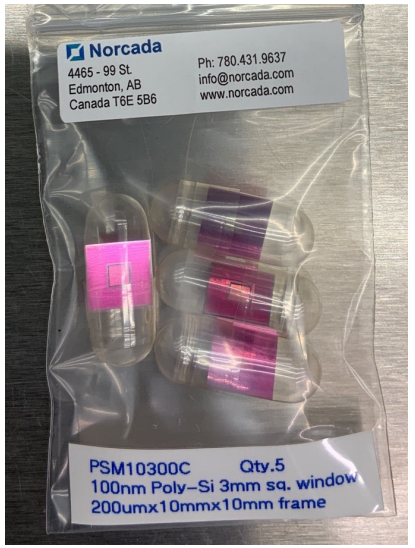
- The carbon target are already at sublimation point and the lifetime of few hundred seconds at RHIC
  - At EIC conditions will be extreme
- The choice of tungsten as polarimeter target material at the EIC is driven by the high melting point
  - Given that the target production is feasible and able to reach the desired dimensions
- Test the targets during the final years of RHIC operation
  - Require a safety review for the collider and installation in the accelerator vacuum
- Make use of *p*+*p* running during 2024
  - W-recoil particle can escape from the target without too much momentum smearing
  - Review and target installation would have to be ready by late 2023

Target Size

- Required target size is 2.5 cm x 10 µm x 50-100 nm
- Target thickness is expected to be less that 100 nm
  - limit the energy smearing of the recoil W through small-angle scattering in the target material itself
  - Decrease the energy loss and therefore the temperature of the target
- The mechanical rigidity, uneven dimensions, and differences between targets contribute significantly to the systematic uncertainty of the polarization measurement
  - Reproducible targets with the same dimensions, ideally with a near-symmetrical cross section

Micro-nano Fabrication Techniques

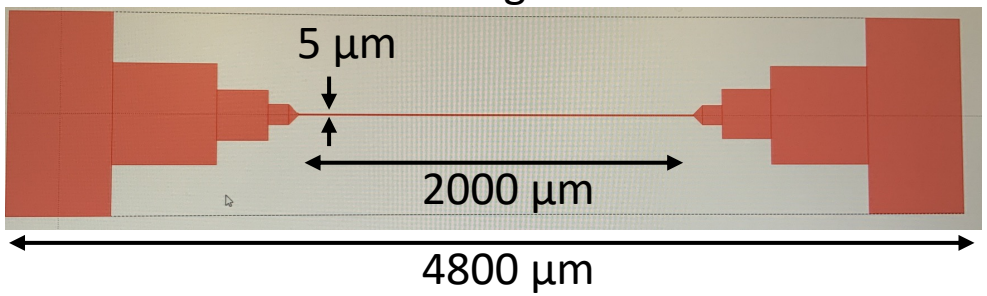
- Proof of concept and learning the techniques and the instruments
- Pattern on silicon nitride window
  - Easy to lift off the W-strip without damaging
  - Patterning using Electron Beam Lithography (EBL) tool
    - Resist: Positive PMMA 950 A4 (3000 rpm for 45 sec)
  - Followed by development
    - Bath in MIBK:IPA 1:3 for 90 sec, wash with Isopropanol 30 sec
- E-BEAM evaporator for depositing material on the pattern
  - Raw W is not available yet
  - Trying with Au
- Lift off the pattern
  - Microposit remover 1165
    - N-methyl-2-pyrrolidine (NMP)
  - This is where we are at…



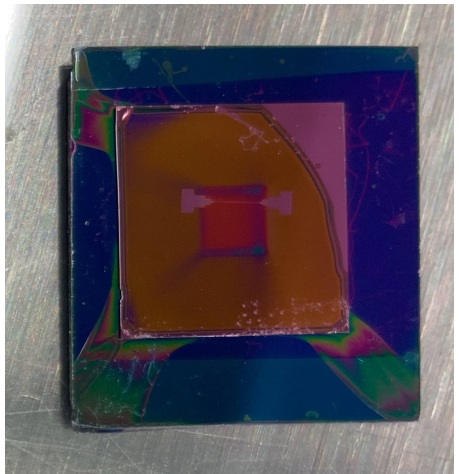
Positive resist: exposed areas clear away after development

Negative resist: exposed areas remain after development

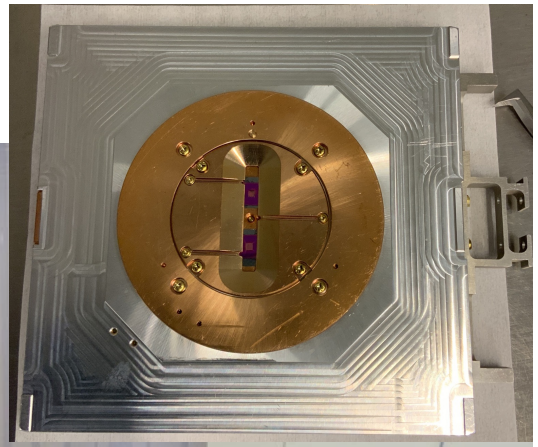
Initial design



After pattern development



EBL Tool



E-BEAM EVAP

Outlook

- Got all the user trainings and access reequipments at CFN
- Getting trained on the relevant equipment and getting used to 1000/100 clean room
- Made many attempts on producing small size targets
  - No success yet
- Needed extensive support from CFN staff to establish a method for the target production
- Raw W and silicon nitride windows need to be purchased
- Do we need to think about carbon nano tubes?