# Passive 18x snout on TANDM 90-348

## Experimental description

Energetic Neutron Platform Working Group and NIF Radiochemistry Group

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Carlos Esquivel: NSA mechanical design

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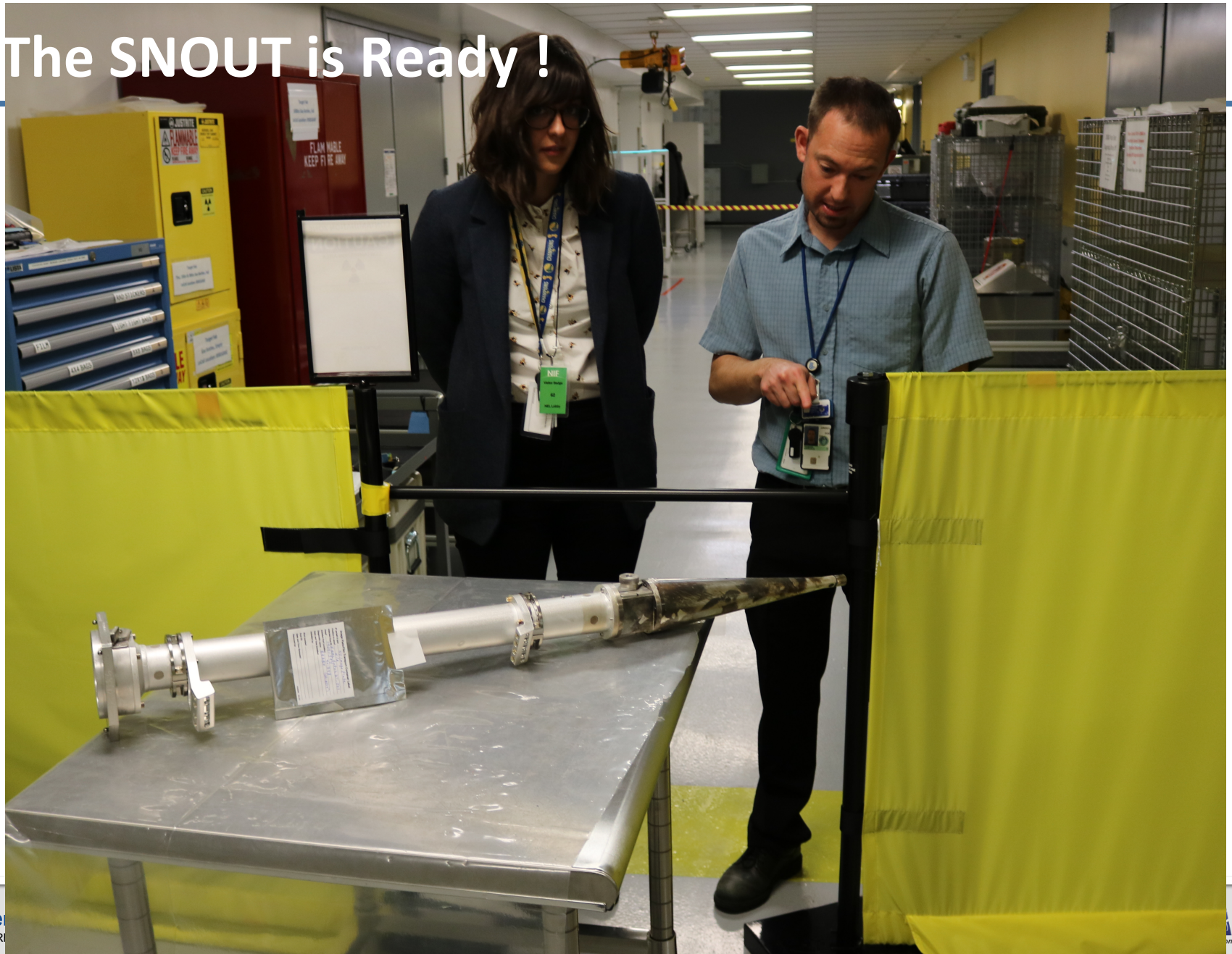
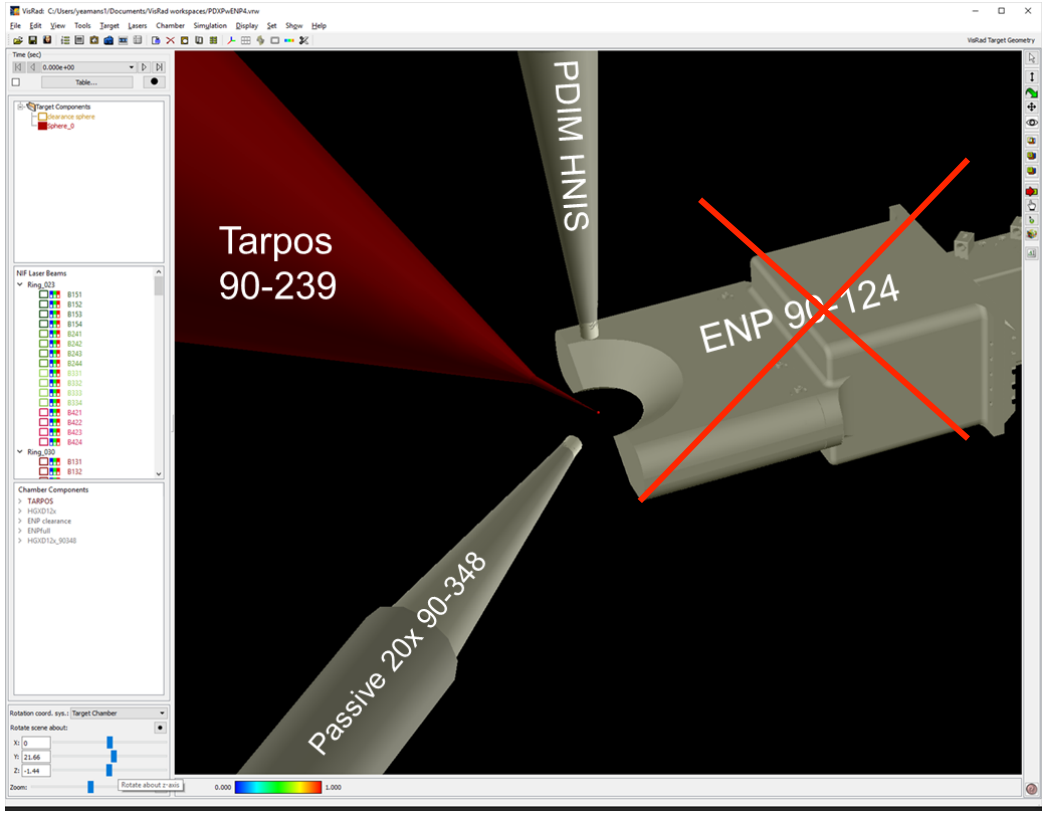
Lawrence Livermore National Laboratory

# The SNOUT is Ready !

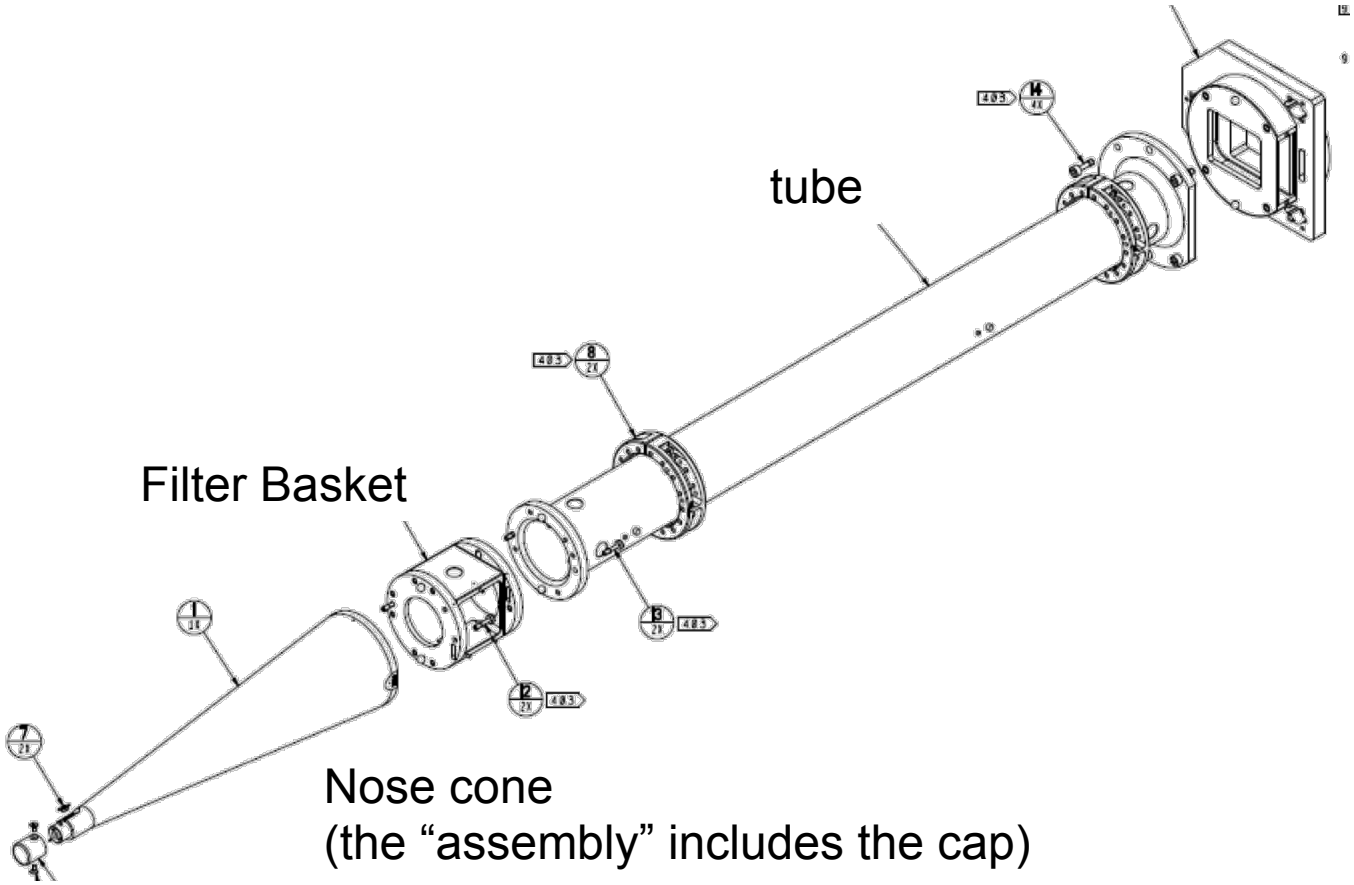


# Experimental Configuration Requested N_NED_ExPsh_DT_AAA 3/12/18

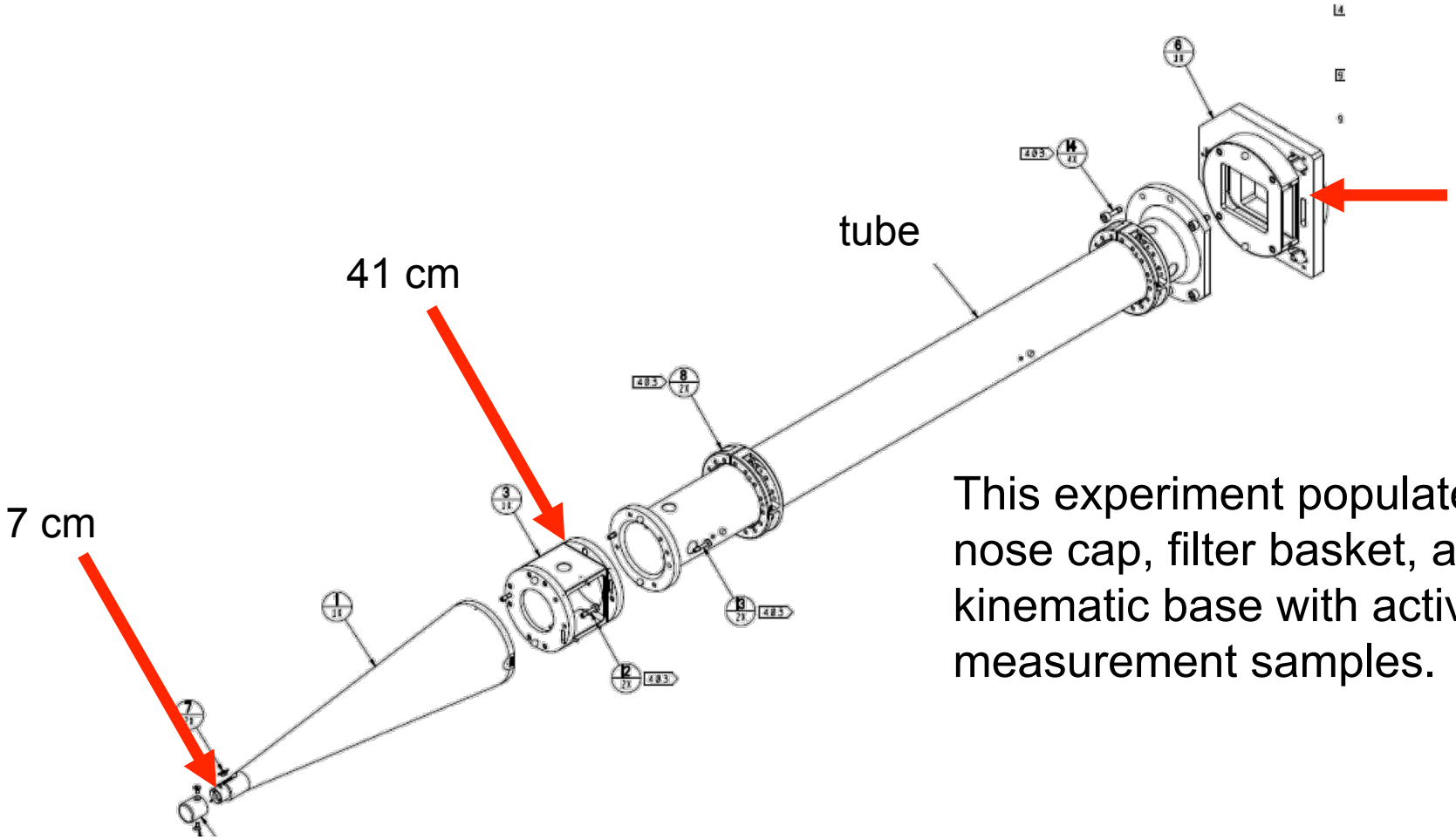



| positioner | DLP | TCC standoff (cm) |
|---|---|---|
| 0-0 | HNIS | 10 |
| ~~90-124~~ | ~~ENP 90-124~~ | ~~5.3~~ |
| 90-239 | Direct drive capsule target | 0 |
| 90-348 | Passive 18x | 6 |

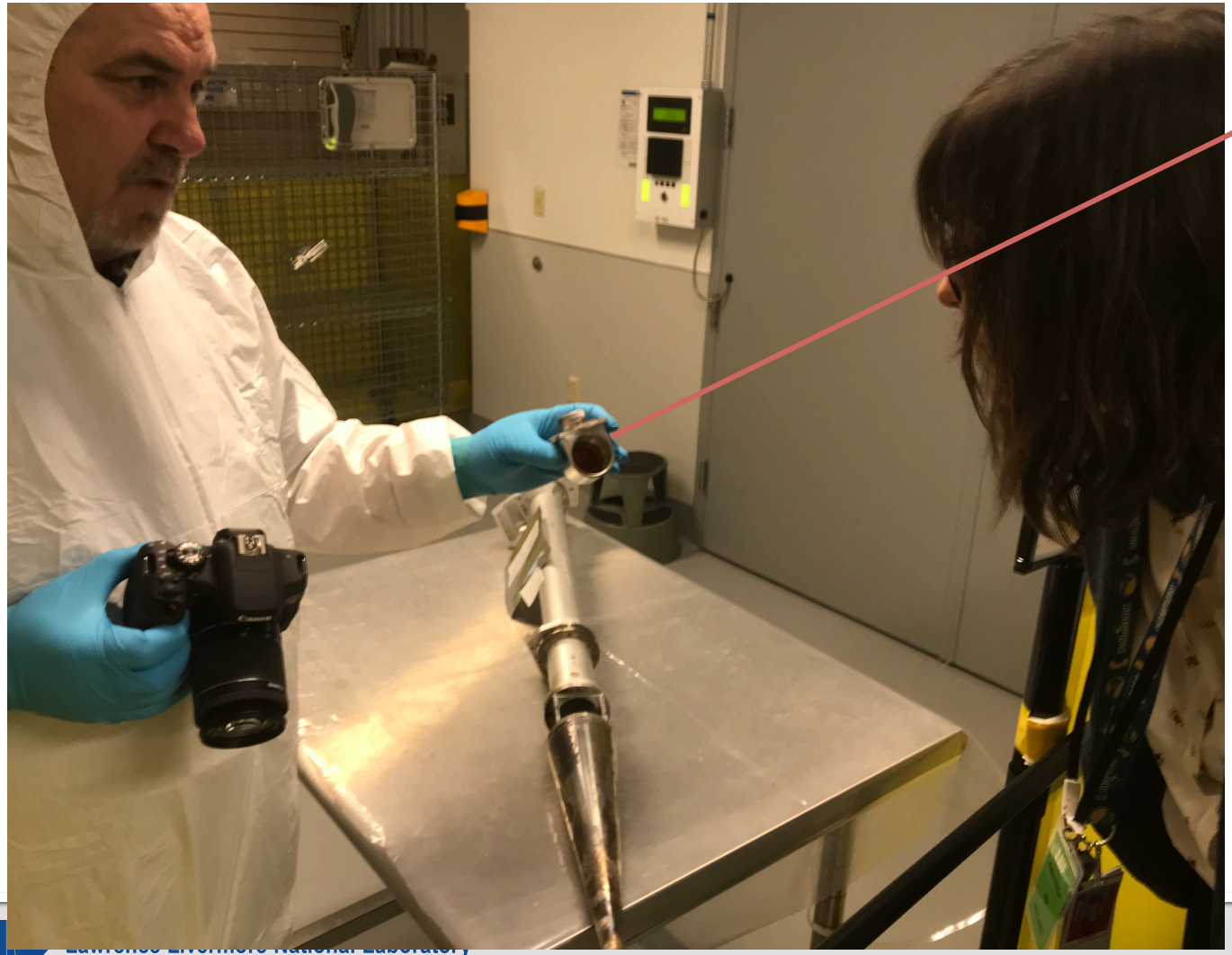
# Intro to NIF snout nomenclature



# Experimental Configuration Requested N_NED_ExPsh_DT_AAA.

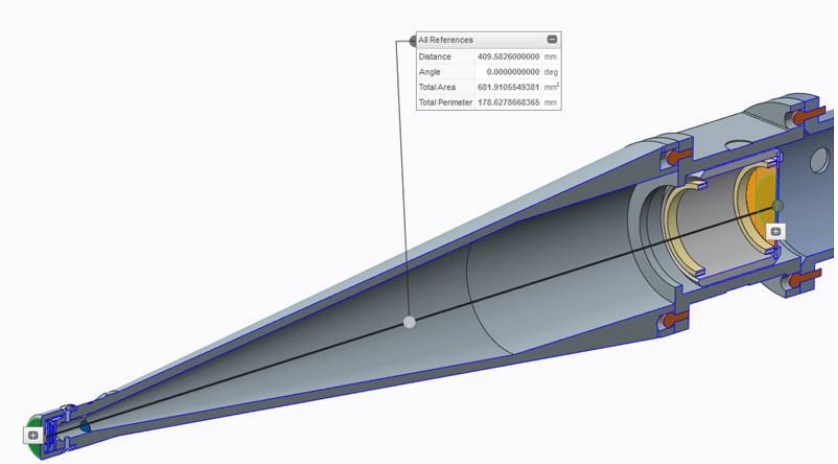


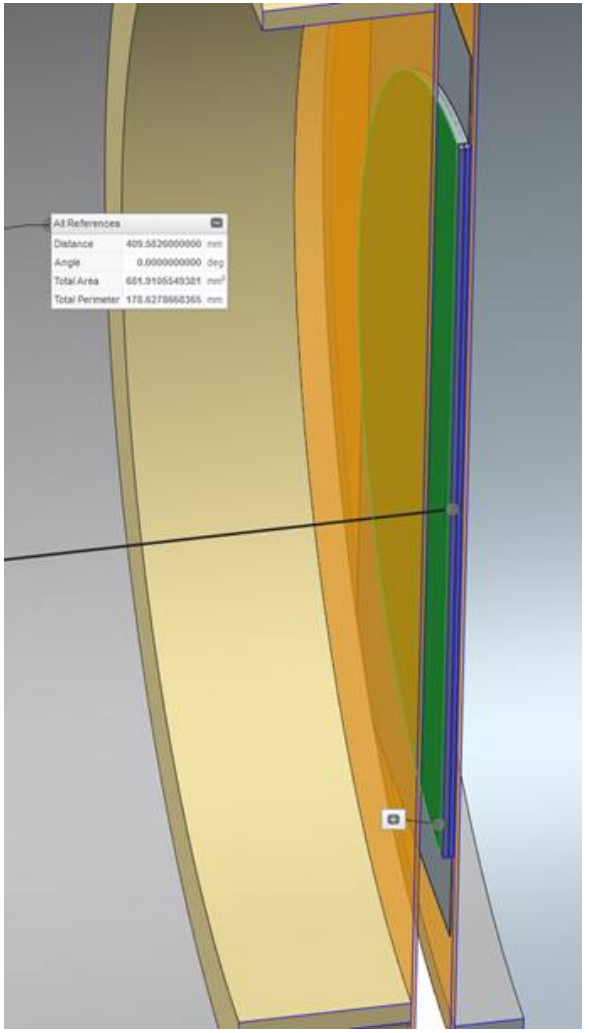

This experiment populates the nose cap, filter basket, and kinematic base with activation measurement samples.


Basket Foils

# Filter basket sample standoff

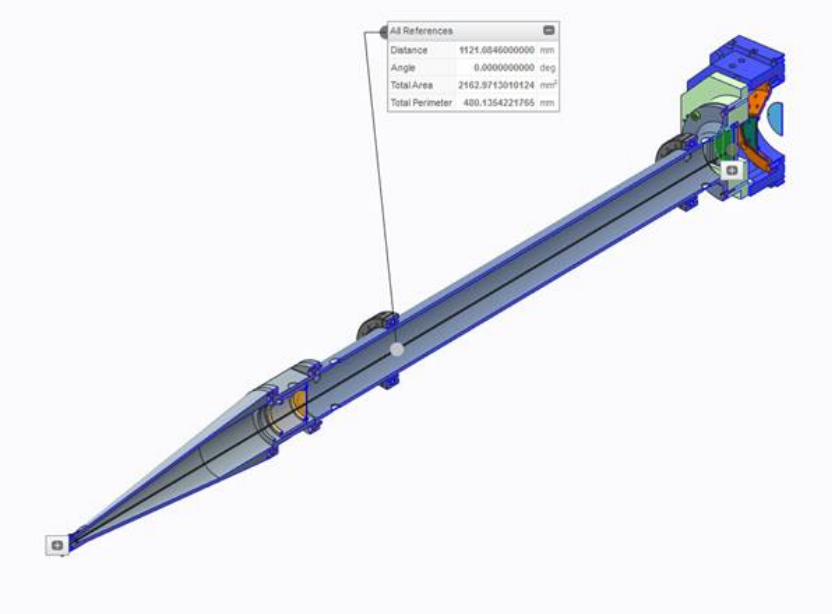
470.01 mm from TCC to the front surface of the filter basket stack

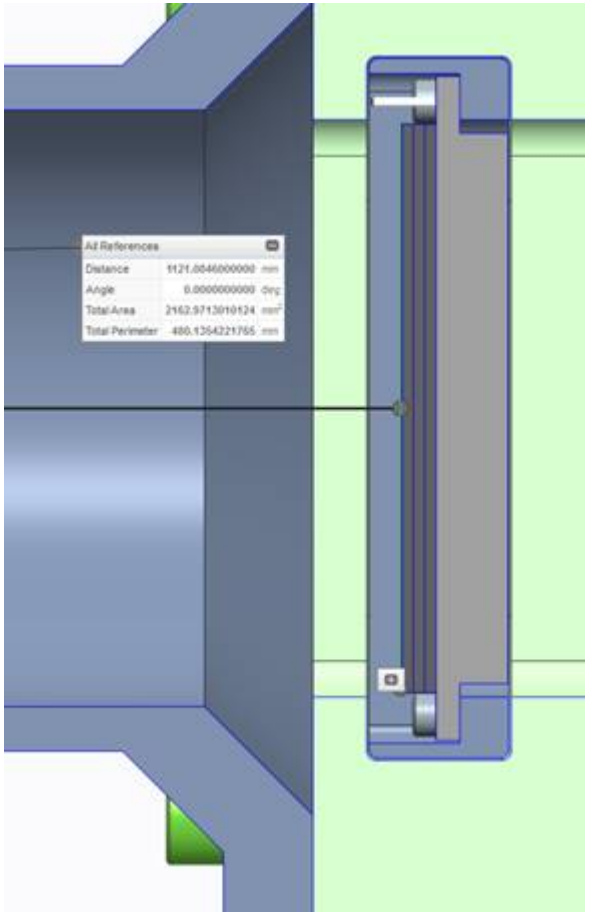


# Kinematic base sample standoff

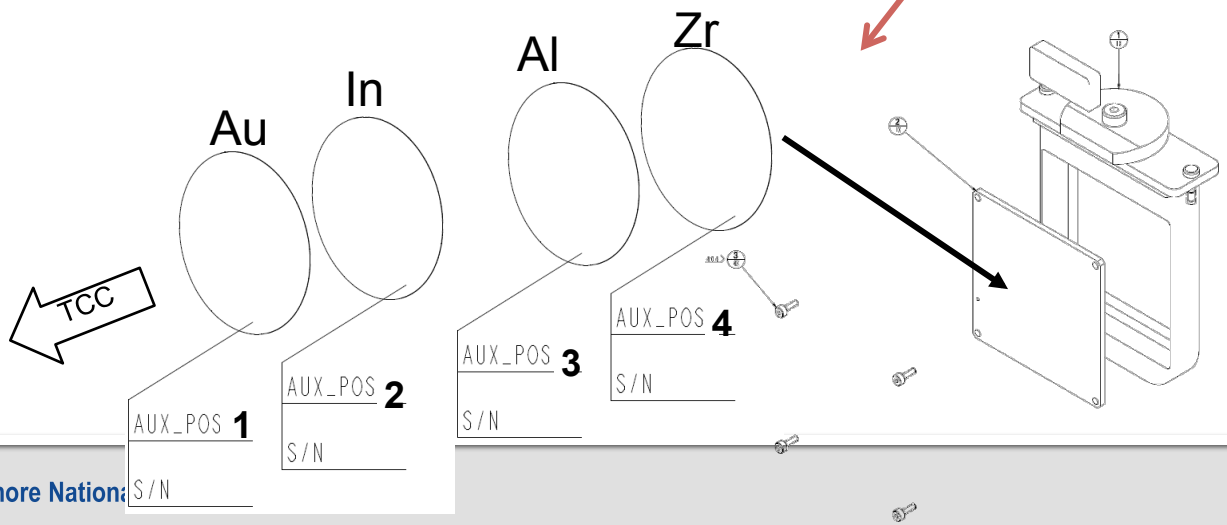
1181.23 mm from TCC to the front surface of the kbase stack.



# Passive 18x snout configuration
# We got them : *Kinematic base filtering with foils !!*

| QTY REQ D | DESCRIPTION | MATERIAL SPECIFICATION | ITEM NUMBER |
|---|---|---|---|
| 1 | Filter plate, 6.25 thk | Al 6-61-T6 | 6 |
| 1 | SRC witness sample plate, 1 mm Zr | Zirconium-702 | 5 |
| 1 | Activation sample, 1 mm thk Al | Aluminum | 4 |
| 1 | Activation sample, 1 mm thk In | Indium | 3 |
| 1 | SRC witness sample plate, 0.1 mm Au | gold | 2 |
| A/R | Tape, NIF vac approved | Kapton | 1 |



# Methodology 1 -

1. Design a NIF experiment that can be fielded in ~6 months with available resources and known materials.

2. Calculate (a MCNP simulation) f4 tallies on the sample volumes:
   a. All cells at zero density
   b. Measurement sample cells at real density, everything else in the universe at zero density
   c. Everything in the universe at real density

3. Convolve f4 tallies with reaction cross sections.

4. Calculate (F, h, e) for all samples and contribution from densities from 2a,b,c.

5. Make measurements of reaction products generated from a NIF 14 MeV source (IDEP, PDXP, DDEP).

6. Calculate (F, h, e) for all samples from data, using a single “absolute yield” measurement as the benchmark.

7. STASYL unfold of spectrum from measurements: determine sensitivity to converged solution on starting point.

# Methodology 2 -

- Proceed with the Methodology calculations (activation data, MCNP modeling, STAYSL unfolding …) for foils at tree Frog, pinhole, basket and at the kinematic base !
- MCNP Calculation done with full NIF mode

# What is being calculated: Expected signal levels

| location | Product nucleus | Standoff (cm) to center | $P_{rx}$ (per g target) | $p_{rx}/\Omega$ (per g target) | Sample mass (approx. g) | Product nuclei/ $10^{15}$ source neutrons |
|---|---|---|---|---|---|---|
| pinhole | In115m | 6.47 | 6.30E-07 | 2.05E-04 | 1.2 | 7.56E+08 |
| pinhole | Zr89 | 6.85 | 3.45E-06 | 0.0158 | 1.03 | 3.56E+09 |
| pinhole | Na24 | 6.66 | 4.88E-06 | 0.0211 | 0.3 | 1.46E+09 |
| pinhole | Au196 | 6.66 | 1.17E-05 | 0.0506 | 0.05 | 5.84E+08 |
| basket | In115m | 47.015 | 1.19E-08 | 6.54E-05 | 1.3 | 1.55E+07 |
| basket | Zr89 | 47.035 | 7.33E-08 | 0.0051 | 1.4 | 1.03E+08 |
| basket | Na24 | 47.025 | 9.79E-08 | 0.0067 | 0.5 | 4.89E+07 |
| basket | Au196 | 47.005 | 2.34E-07 | 0.0161 | 0.1 | 2.34E+07 |
| kbase | In115m | 118.673 | 1.87E-09 | 1.69E-05 | 13 | 2.43E+07 |
| kbase | Zr89 | 119.173 | 1.14E-08 | 0.0013 | 14 | 1.60E+08 |
| kbase | Na24 | 119.173 | 1.52E-08 | 0.0017 | 5 | 7.62E+07 |
| kbase | Au196 | 118.173 | 3.71E-08 | 0.0042 | 1 | 3.71E+07 |

# What is being calculated:

- Each (n,x) reaction gets its own calculated probability
- prx: reaction probability per source neutron emitted in 4pi
- prx/W: reaction probability per source neutron emitted into detector solid angle
- Multiplication target mass by prx and source yield to get: # product nuclei, which is the counting facility measurement and GAMANAL analysis
- Calculation MCNP results as reaction probability: to show the simulation converging on the measurement to demonstrate the necessary level of geometric and physics complexity and tuning