# Commissioning of EAR2

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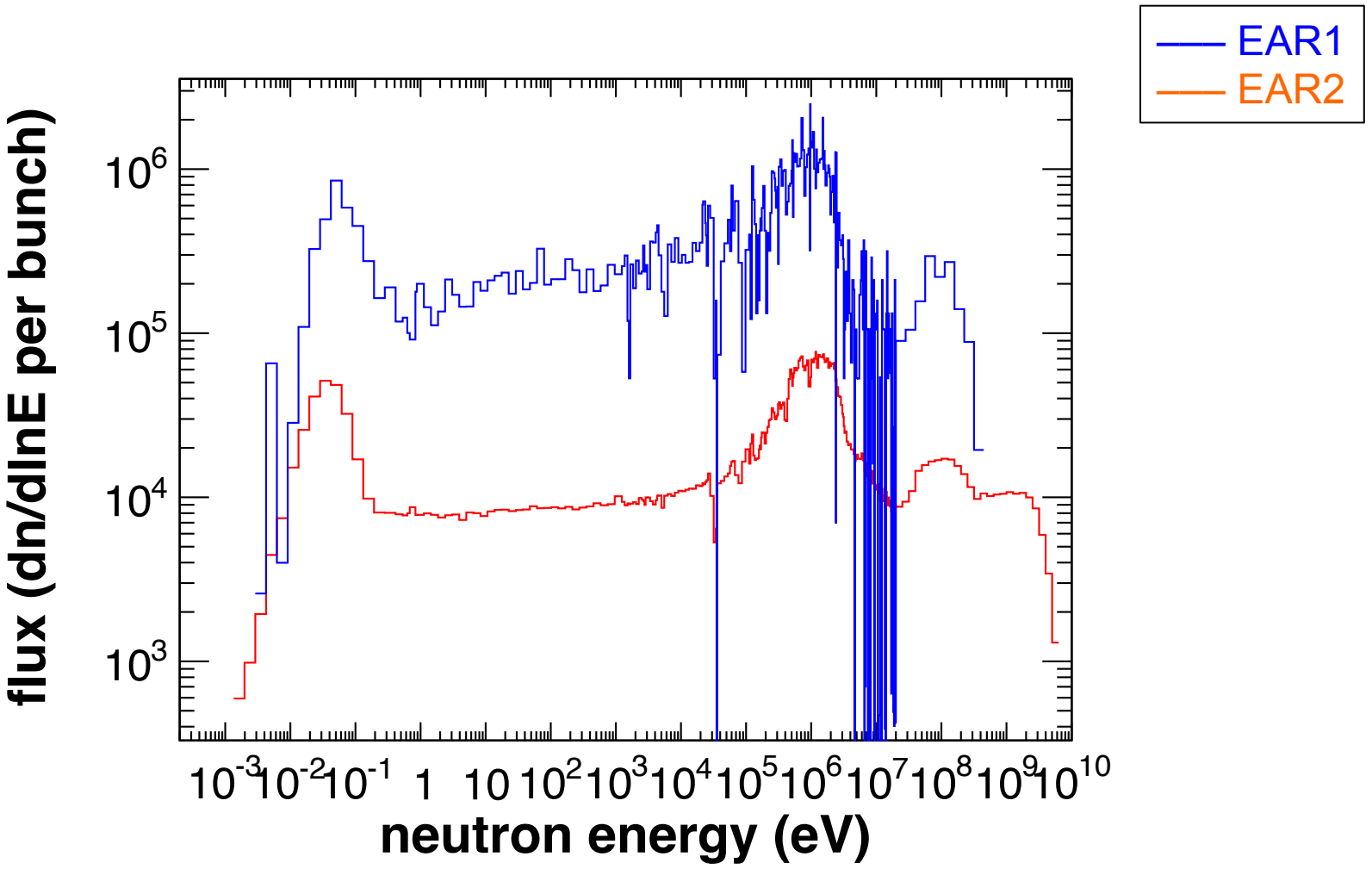
for the n_TOF Collaboration

# Commissioning goals

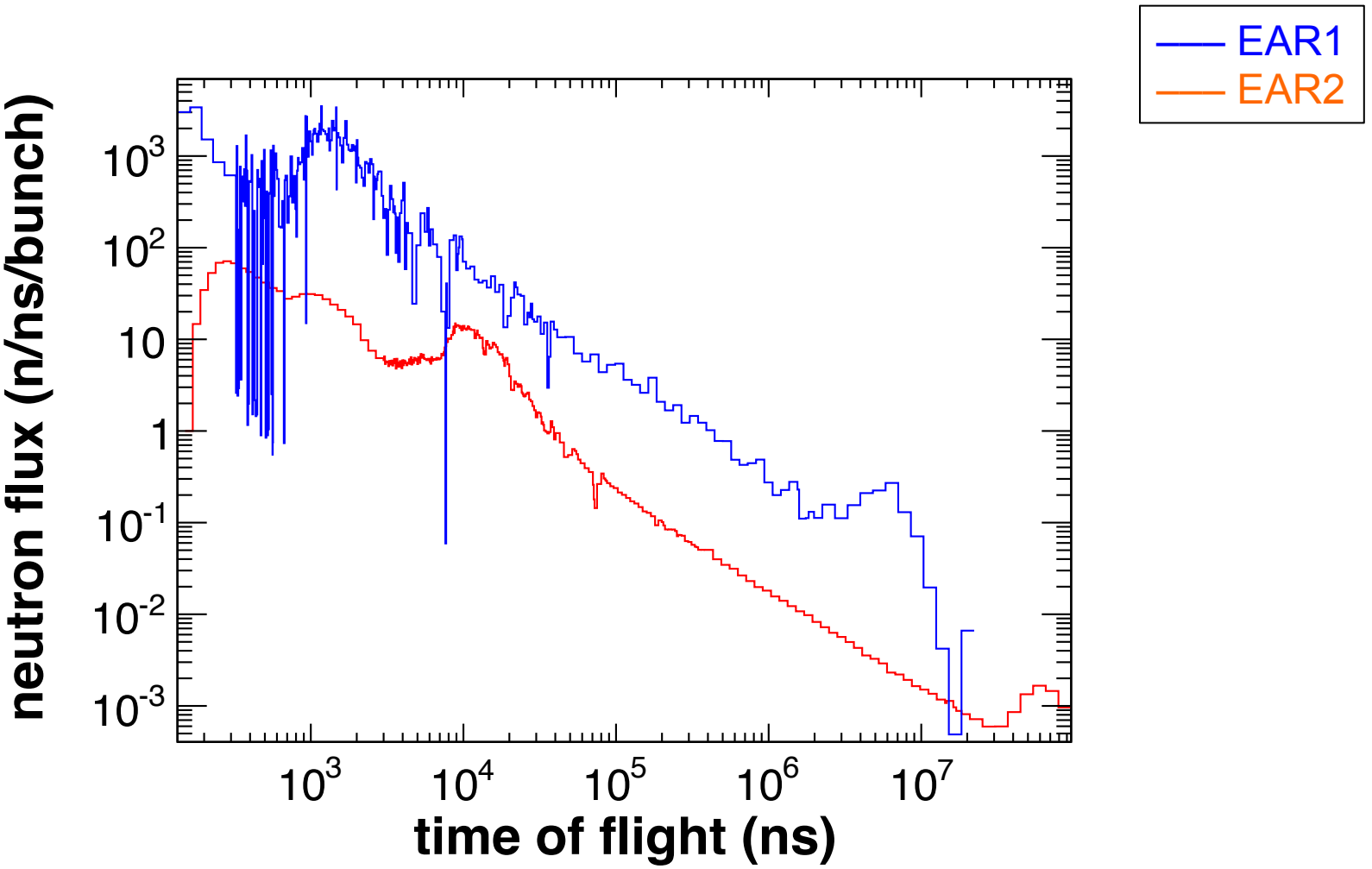
1. Determine neutron flux
2. Determine beam profile
3. Determine resolution function and TOF-$E_n$ calibration
4. Determine backgrounds (neutron, gamma)
5. Determine response of detectors

+ Reproduce well-known capture and fission cross sections

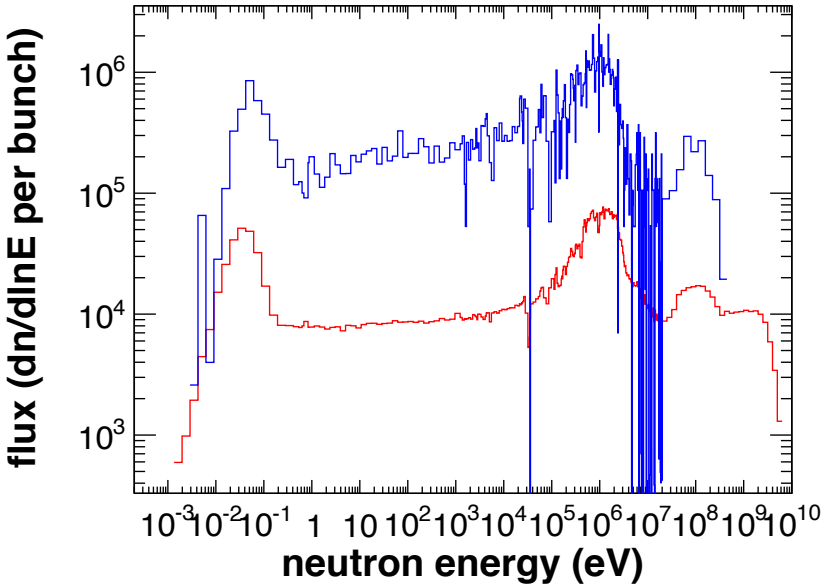
# Prior considerations

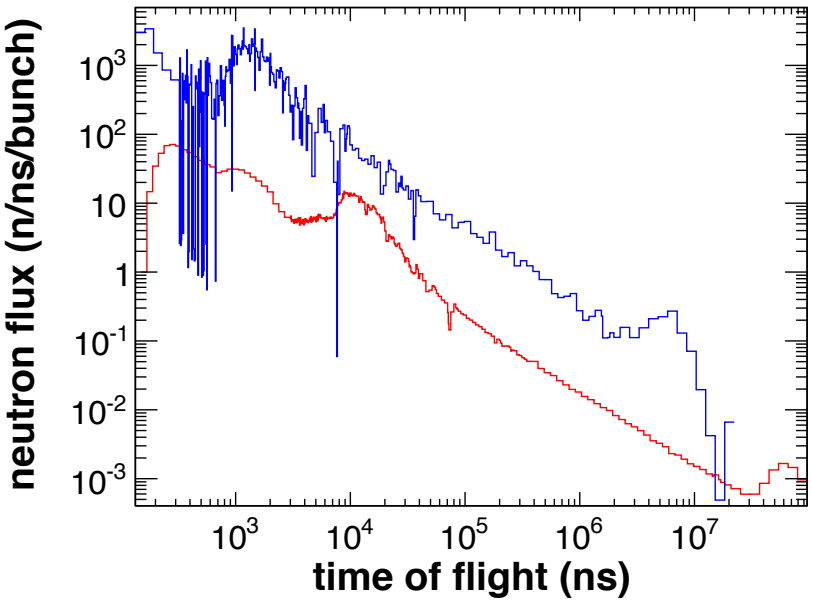


# Prior considerations



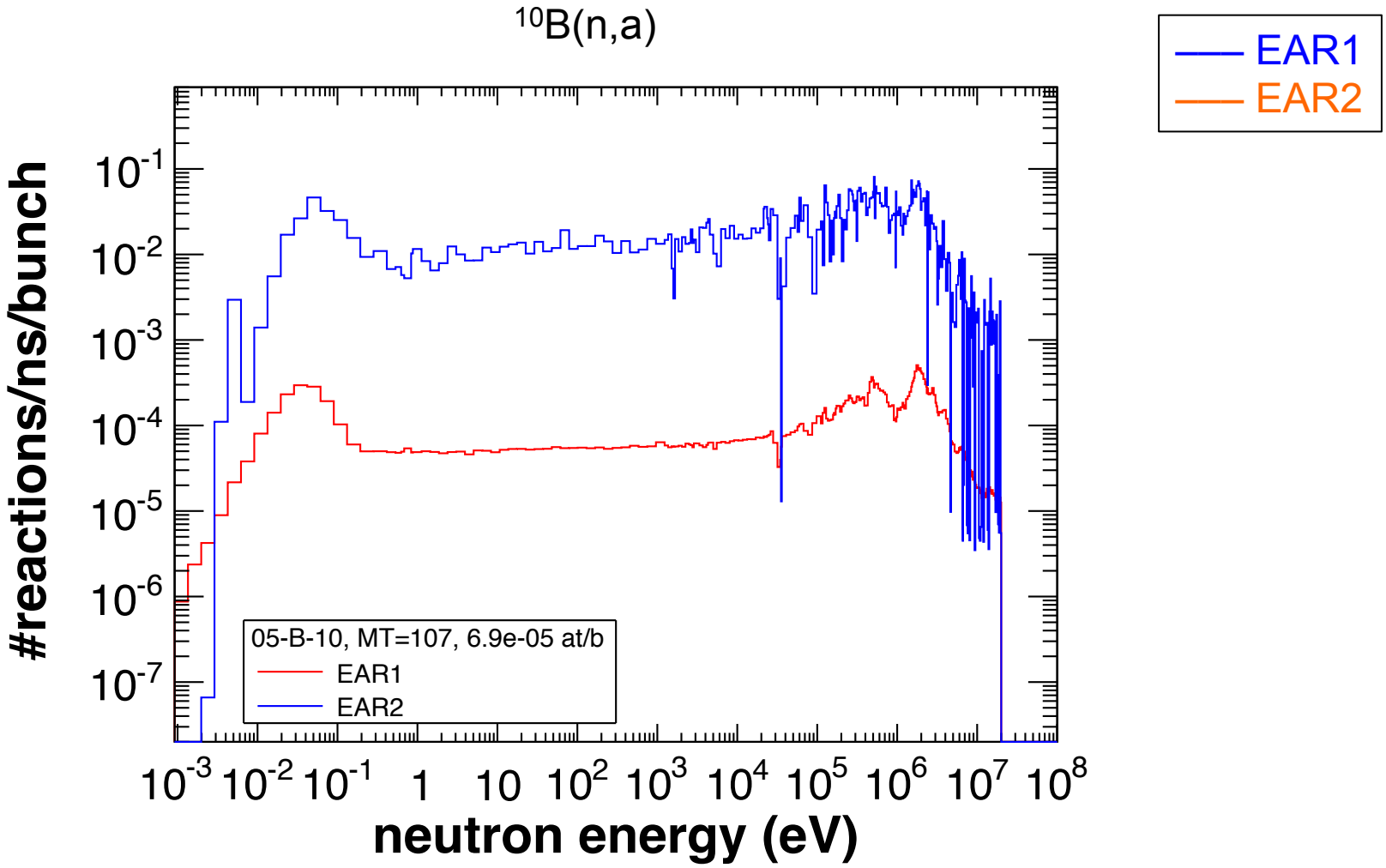
# Prior considerations




EAR1
EAR2

# Prior considerations



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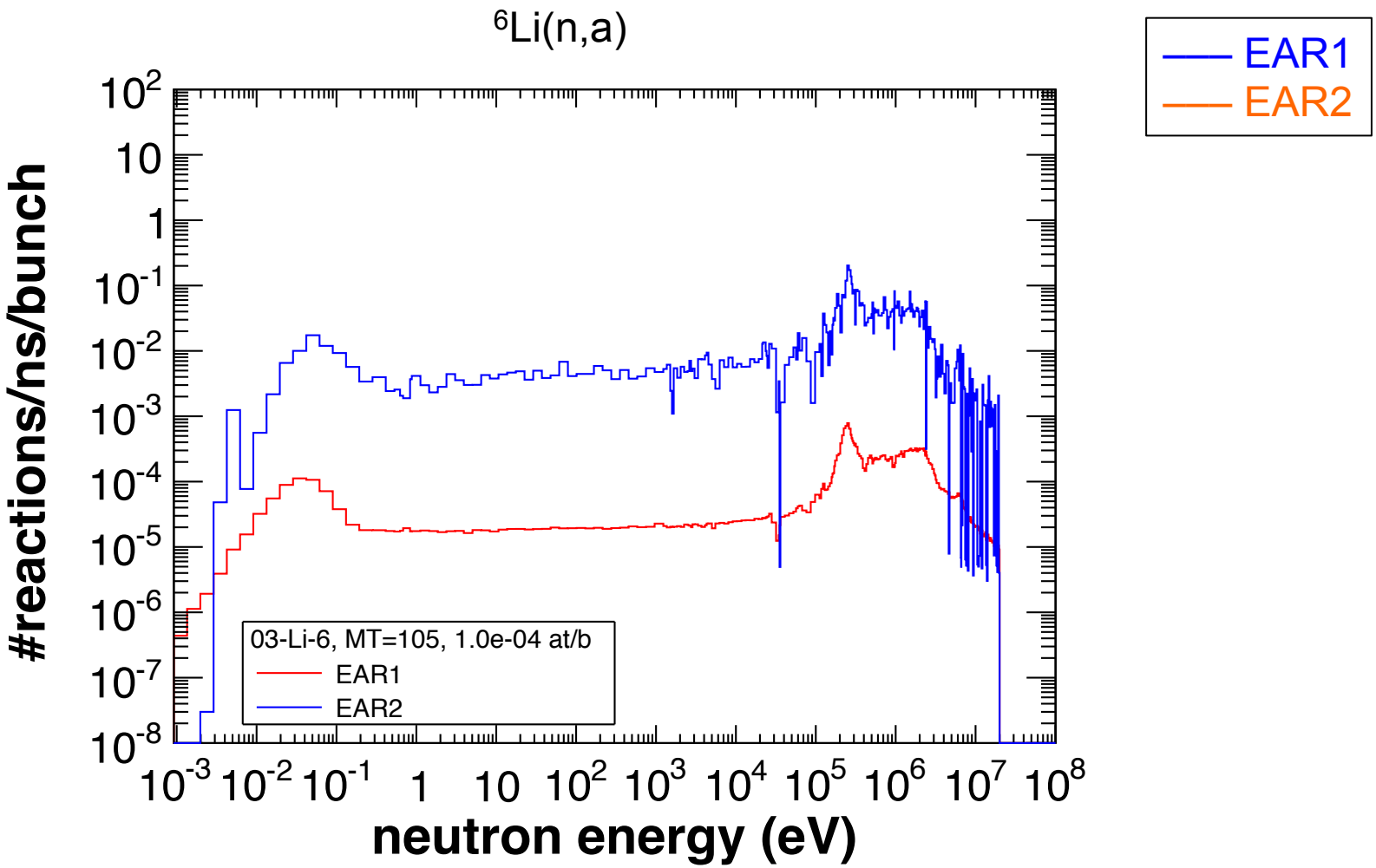

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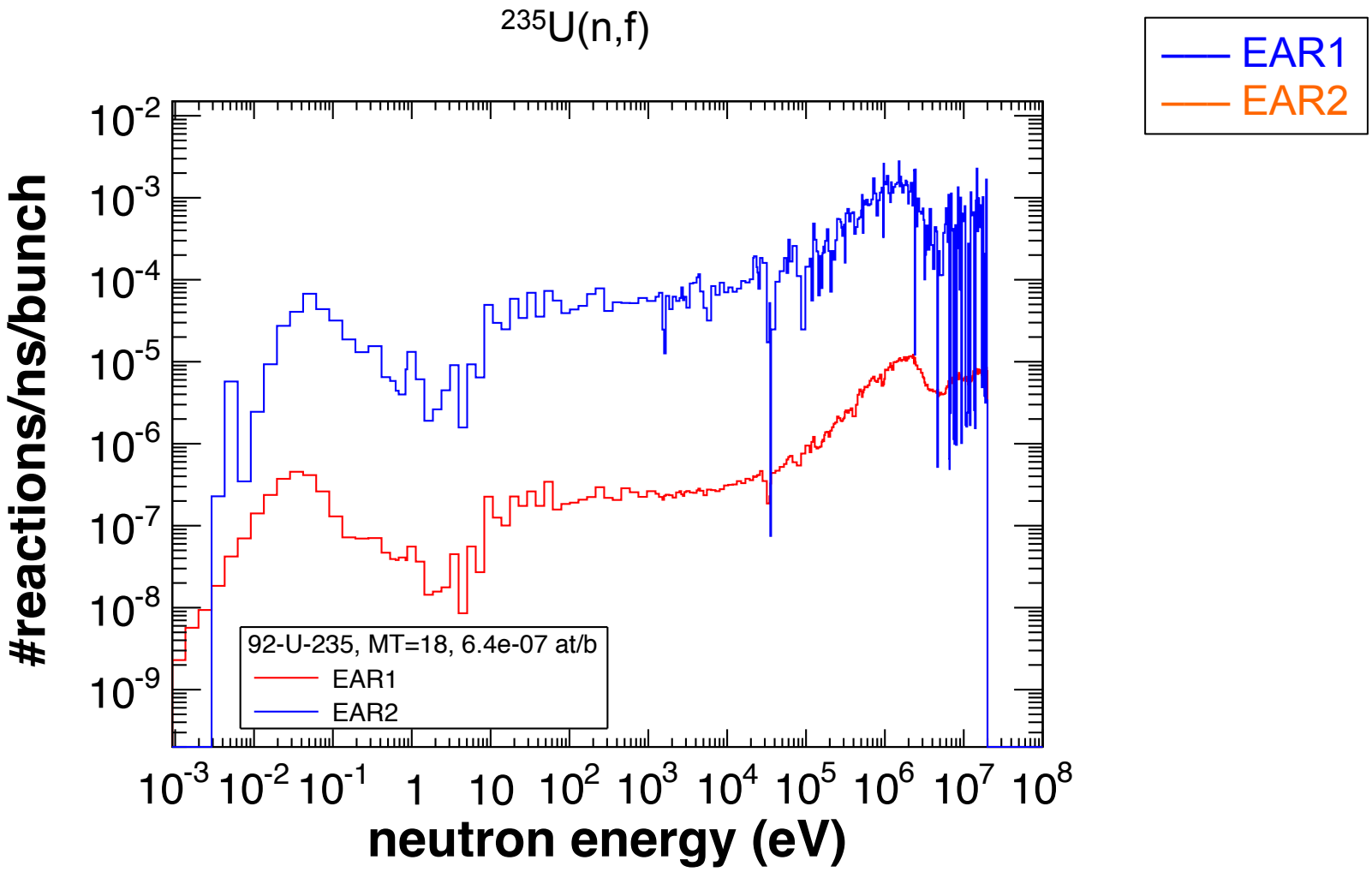

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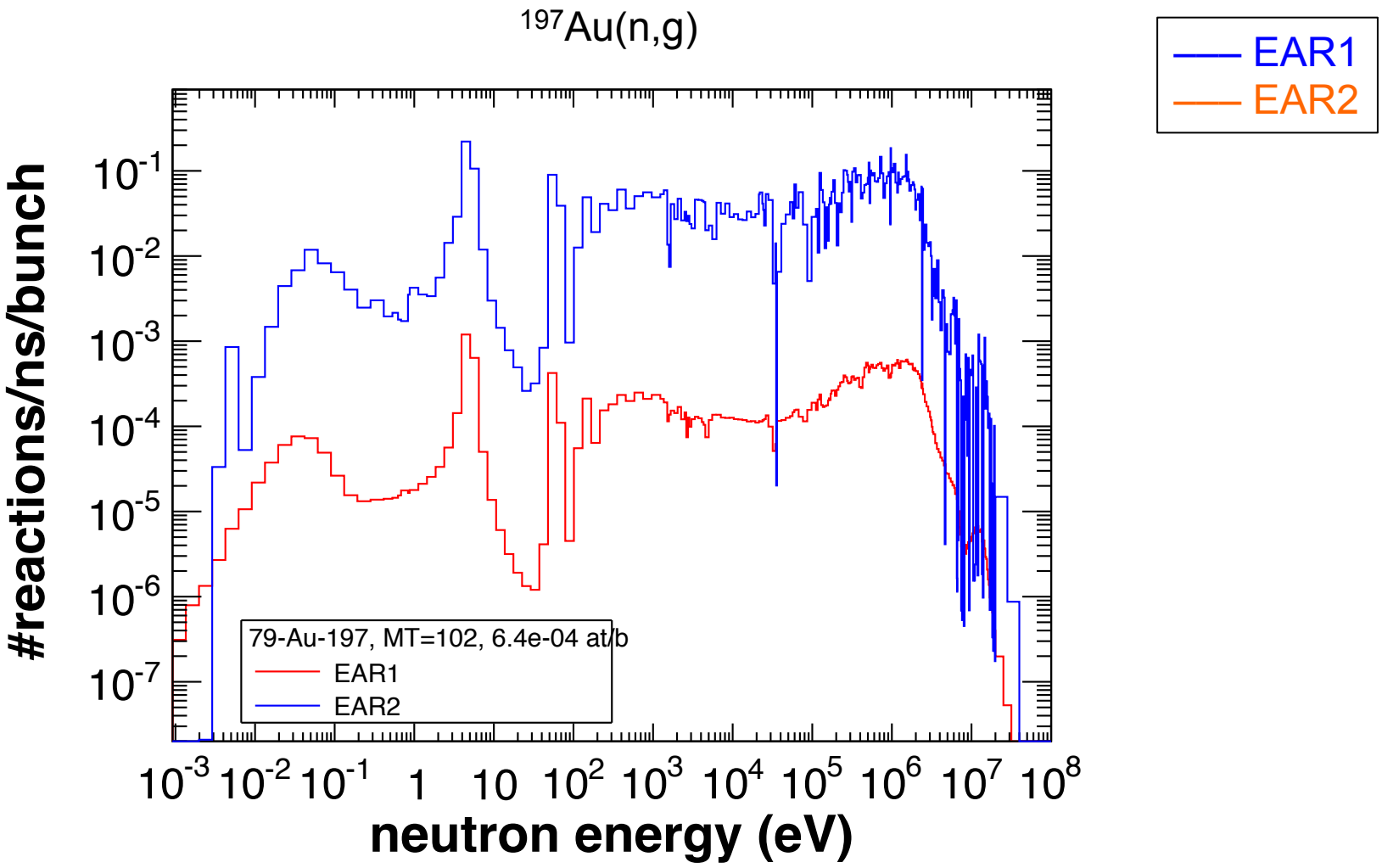


# Neutron flux

## Neutron flux measurements

- New PPAC ($^{235}$U, $^{10}$B, $^{6}$Li, (n,p)?)
- New MGAS ($^{235}$U, $^{10}$B, $^{6}$Li)
- New SiMon ($^{6}$Li)
- PTB ($^{235}$U), or calibrate PPAC/MGAS at PTB
- Activation of gold foils

**24 x $10^{17}$ protons**
- Adapt sample thicknesses
- Simultaneous measurements where possible
- Also use filters
- Two collimator setups

# Beam profile

## Beam profile measurements

- New transparent XY-MGAS
- New SiMon with $^{6}$Li inside strip-sandwich (dedicated beam)
- New PPAC
- CR39
- Beam halo with Au activation

**12 x $10^{17}$ protons**
- Adapt sample thicknesses
- Simultaneous measurements where possible
- Two collimator setups

# Resolution function

## Resolution function

- $C_6D_6$ with $^{54}Fe$, $^{56}Fe$ (high E), $^{238}U$ (low E)

## TOF-$E_n$ calibration

- $C_6D_6$ with $^{238}U$, $^{56}Fe$, $^{197}Au$, $^{32}S$, ($^{nat}Ir$, $^{193}Ir$, others)

**9 x $10^{17}$ protons**
• Two collimator setups

# Background

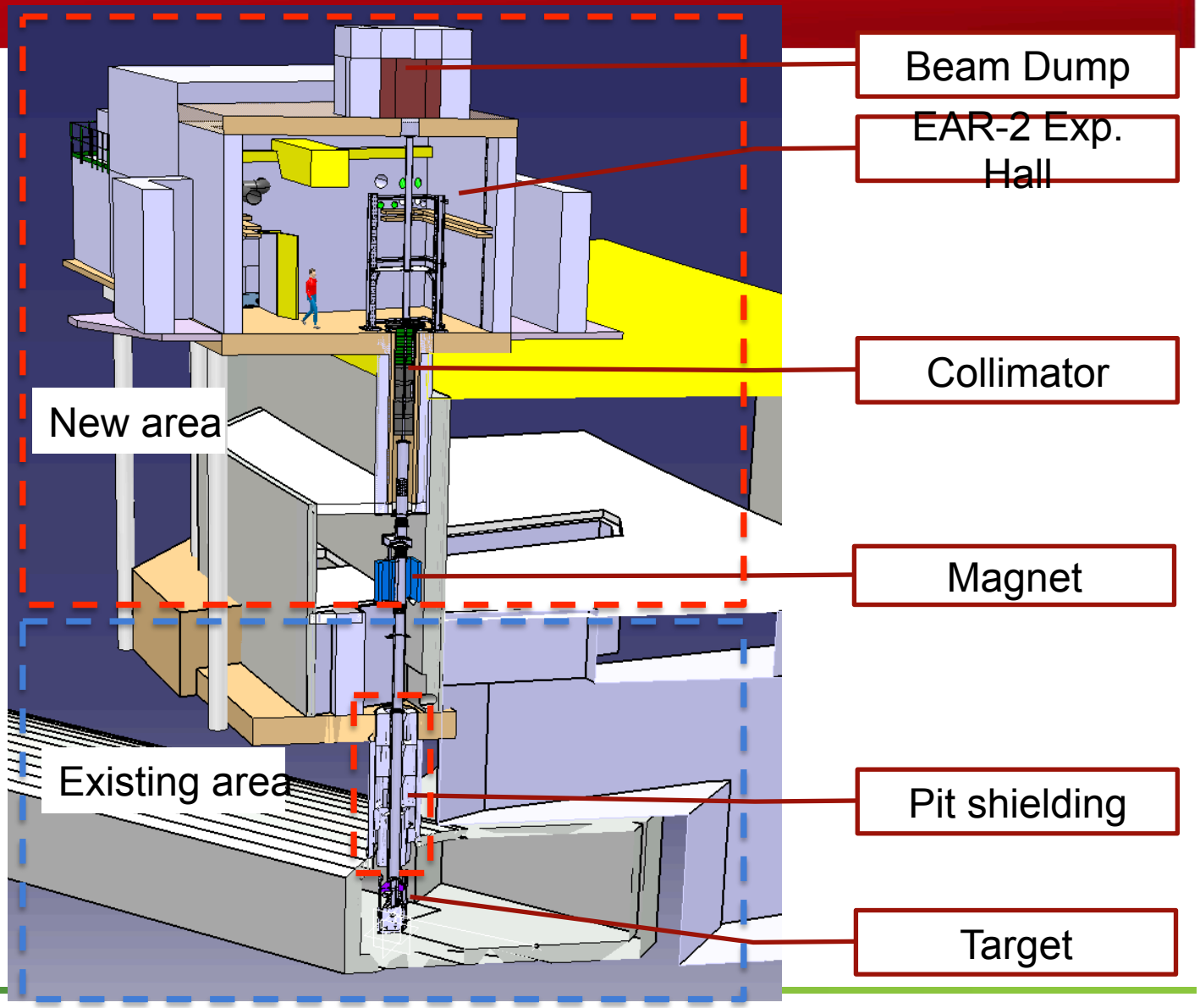
**Two type of measurements:**

- **Map background at several positions, outside beam**
  - neutrons (several detectors in parallel):
    $^{3}$He-array, CR39, PPAC/MGAS outside beam, $^{6}$Li glass, Timepix, BC501
  - gamma:
    $C_6D_6$, $LaBr_3$/$LaCl_3$/$CeBr_3$, HPGe, others

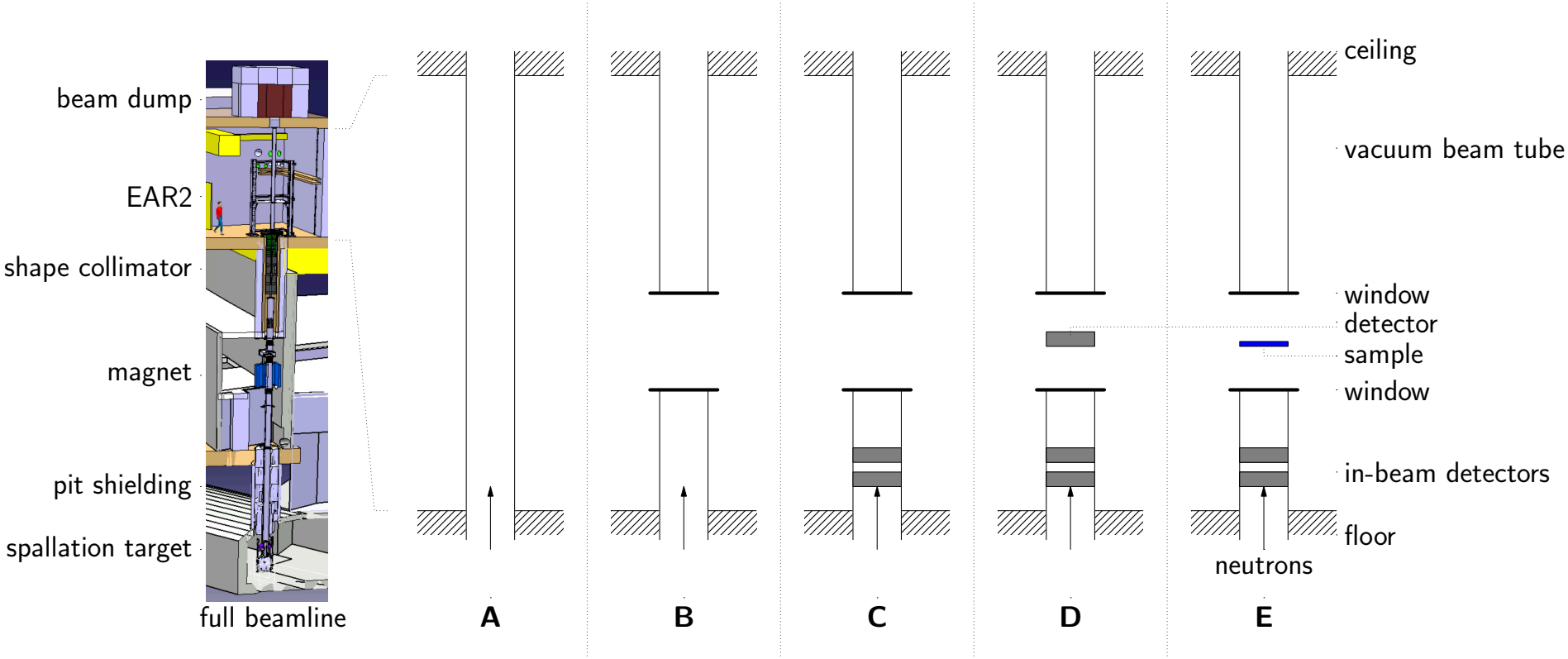
- **Background in measurement conditions (mainly capture)**
  - vary conditions of in-beam material, collimators etc.
  - sample or fission detector in-beam

**35 x $10^{17}$ protons**
- many different conditions

# EAR2 design


Beam Dump
EAR-2 Exp. Hall
Collimator
New area
Magnet
Existing area
Pit shielding
Target

# Background


beam dump
EAR2
shape collimator
magnet
pit shielding
spallation target
full beamline
A
B
C
D
E
ceiling
vacuum beam tube
window
detector
sample
window
in-beam detectors
floor
neutrons

## Detector response functions

- $C_6D_6$ (all types)
- $LaBr_3/LaCl_3$
- $BaF_2$
- (n,cp) detectors
- HPGe
- CsI, others?

**$8 \times 10^{17}$ protons**

# Cross section validation

## Cross section validation measurements

- $C_6D_6$ $^{197}Au(n,\gamma)$, $^{238}U(n,\gamma)$ or $^{56}Fe(n,\gamma)$
- PPAC $^{238}U/^{235}U$ (n,f)

# Summary, preliminary proton request

| | | x1e17 protons |
|---|---|---|
| 1. | Neutron flux | 24 |
| 2. | Beam profile | 12 |
| 3. | Resolution function | 9 |
| 4. | Backgrounds (neutron, gamma) | 35 |
| 5. | Detectors tests | 8 |
| 6. | Unforeseen | 10 |
| | **total** | **98** |