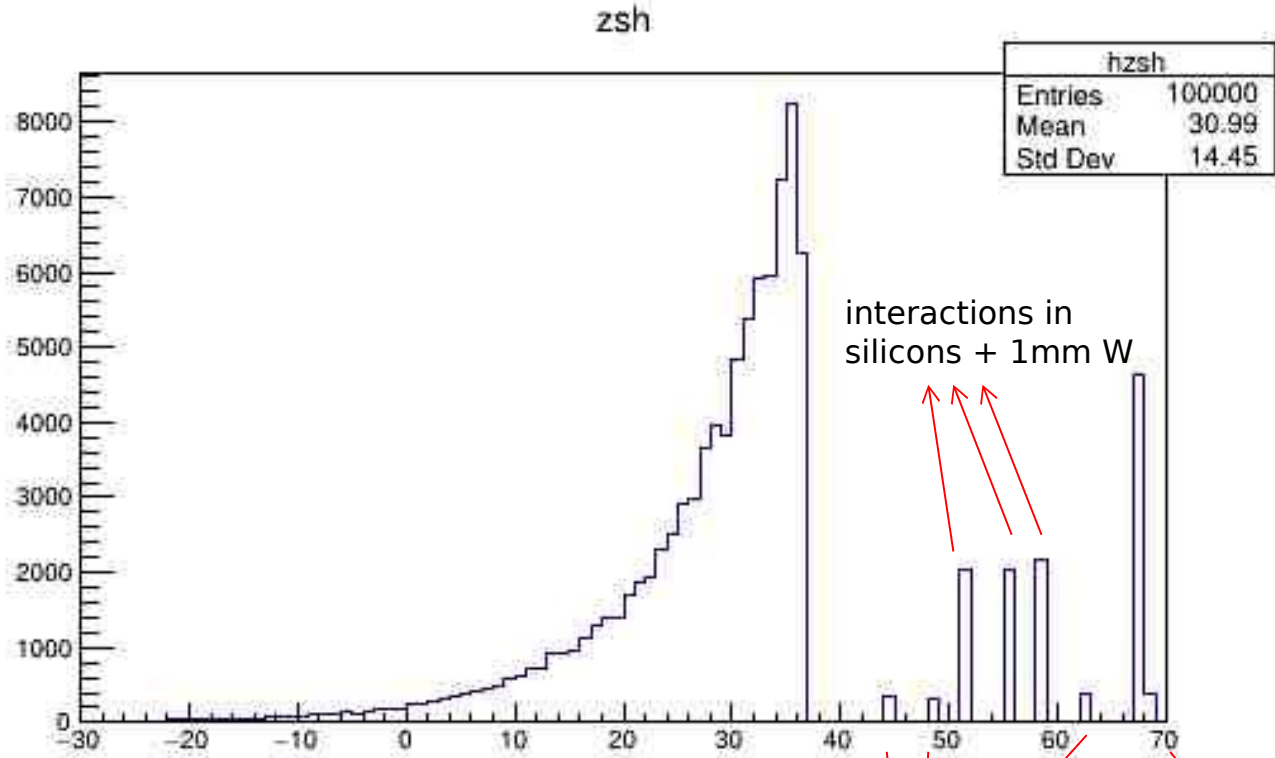


HERD design optimization

- Brainstorming → rough ideas, no quantitative performance studies yet
- Topics
 - Effect of tungsten on charge ID for nuclei
 - ^{12}C @ 1 TeV/n (FLUKA), 30 deg
 - Simplified baseline geometry
 - Rejection of Out-Of-acceptance (OOA) events
 - Performance for photons

fluka simulation **100 GeV/n** carbon **0 deg inclination**



total interactions in
3 x 1 mm W
5 %

Interactions in
1 cm scint plast
5 % !!

Z coordinate of the first interaction
(cm)

Interaction
Nucleus **c** on target **b**

$$1/L_{int}(cm) \propto (A_c^{1/3} + A_b^{1/3})^2 \frac{1}{A_b} \rho_b$$

calo

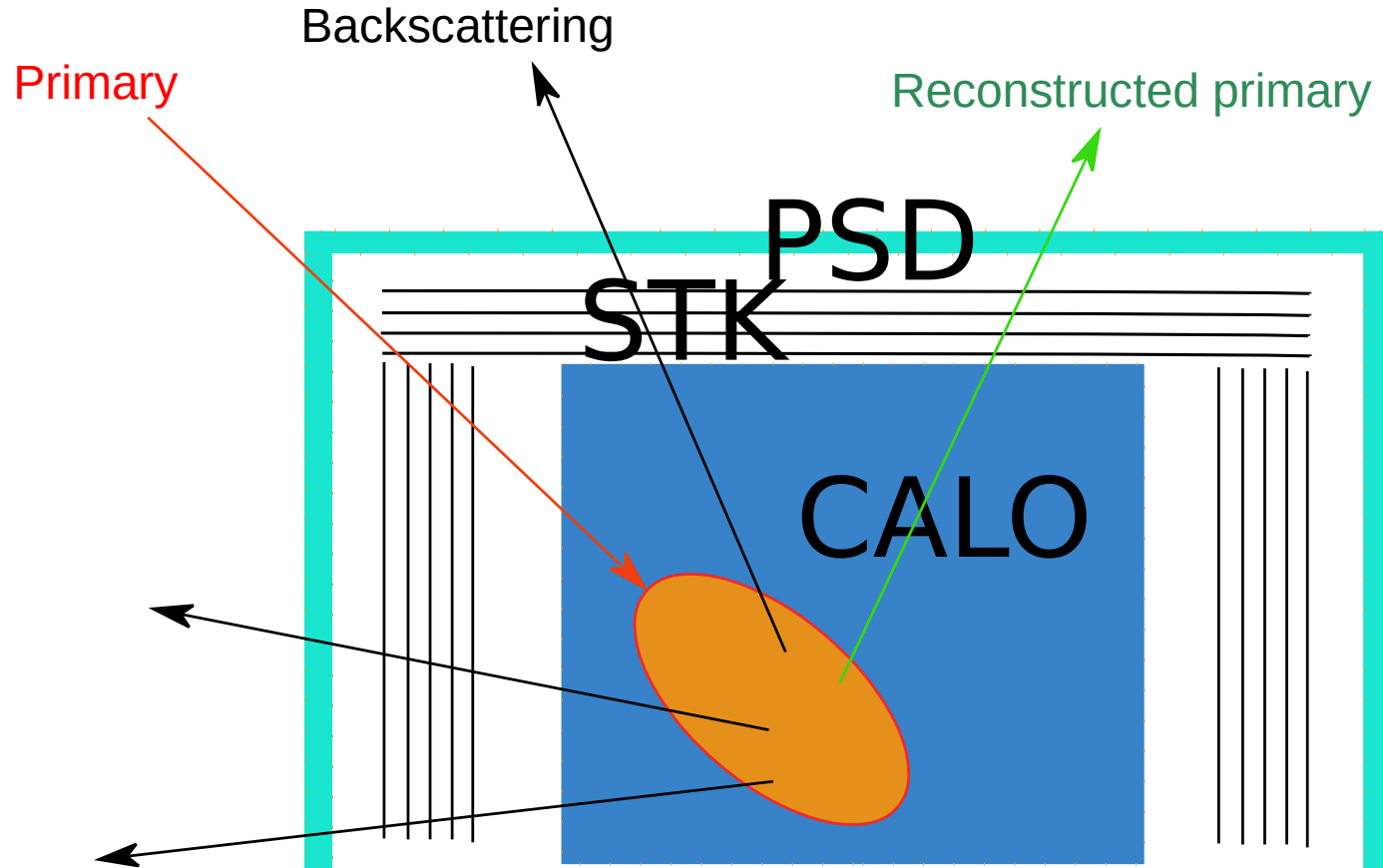
interactions
inside silicons

interactions
in PSD. 1cm scint plast.

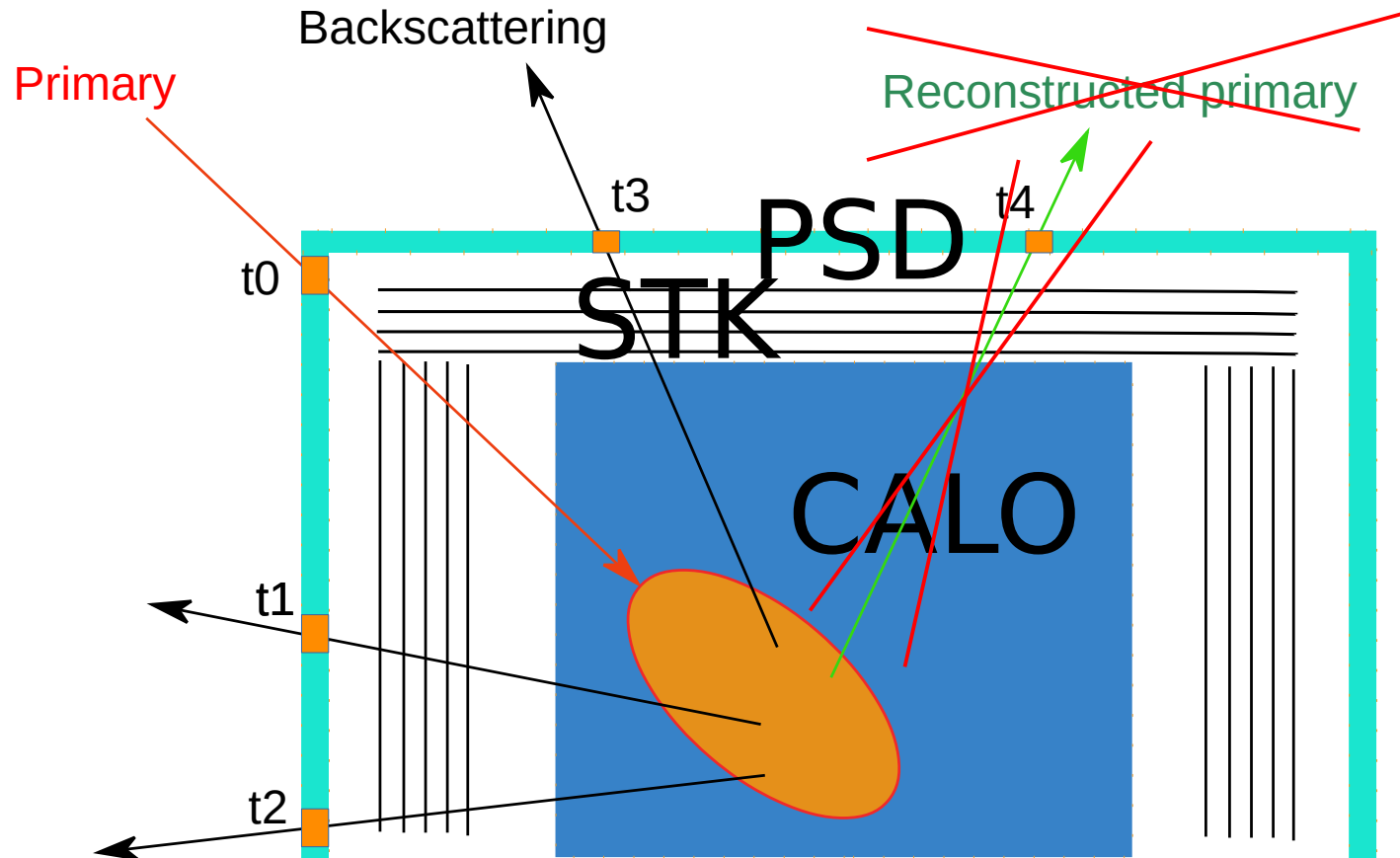
Slide from S. Bottai

Charge measurement must be done at the “top” of the instrument with a light, plastic-free® detector

OOA events



OOA events

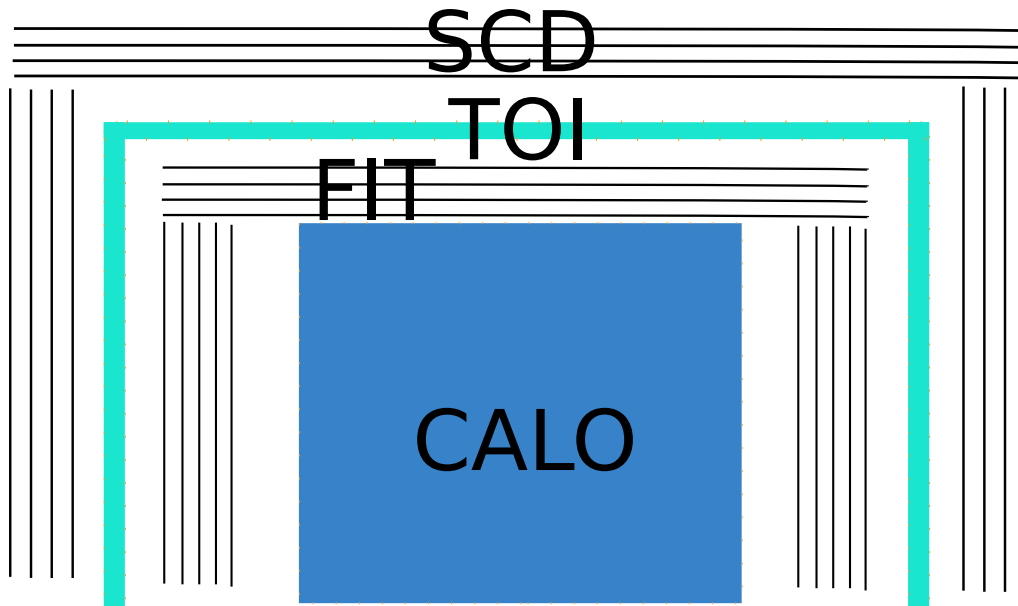


$$t_{\text{track}} \equiv t_4 \neq \min(t_i) \rightarrow \text{Reject track}$$

Photons

- Baseline:
 - robust concept
 - ◆ detrimental impact on charge ID
- TIC:
 - reduced impact on charge ID
 - ◆ small FOV
- Both:
 - ◆ energy range already explored by Fermi

Proposal



- Optimized for nuclei detection
- Performance ~ unchanged for electrons
- “Low” energy gamma physics ($100 \text{ MeV} \leq E \leq 1 \text{ GeV}$) (performance???)

- **Silicon Charge Detector (SCD):**
 - 6-8 layers of Si detectors on each side
 - Redundant measurement (event selection + efficiency measurement)
- **Time-Of-Impact (TOI):**
 - PSD + arrival time
 - Strong guidance for tracking
 - Rejection of out-of-acceptance events
- **Fiber Tracker (FIT):**
 - Tracking for charged particles on each side
 - Conversion and tracking for photons on each side
 - presentation by X. Wu at 7th HERD workshop, CERN, November 2018