TMD Monte Carlo for future analyses

- HERMES (weighted asymmetries… ?, new 2h results)

- COMPASS

- JLab6/12

- EIC, (DY experiments), …

$$\frac{d\sigma}{dx\,dy\,d\psi\,dz\,d\phi_h\,dP_{h\perp}^2} =$$

$$\frac{\alpha^2}{xyQ^2}\frac{y^2}{2\,(1-\varepsilon)}\left(1+\frac{\gamma^2}{2x}\right)\Bigg\{F_{UU,T} + \varepsilon F_{UU,L} + \sqrt{2\,\varepsilon(1+\varepsilon)}\,\cos\phi_h\,F_{UU}^{\cos\phi_h}$$

$$+\,\varepsilon\cos(2\phi_h)\,F_{UU}^{\cos 2\phi_h} + \lambda_e\,\sqrt{2\,\varepsilon(1-\varepsilon)}\,\sin\phi_h\,F_{LU}^{\sin\phi_h}$$

$$+\,S_{\parallel}\left[\sqrt{2\,\varepsilon(1+\varepsilon)}\,\sin\phi_h\,F_{UL}^{\sin\phi_h} + \varepsilon\sin(2\phi_h)\,F_{UL}^{\sin 2\phi_h}\right]$$

$$+\,S_{\parallel}\lambda_e\left[\sqrt{1-\varepsilon^2}\,F_{LL} + \sqrt{2\,\varepsilon(1-\varepsilon)}\,\cos\phi_h\,F_{LL}^{\cos\phi_h}\right]$$

$$+\,|\boldsymbol{S}_{\perp}|\left[\sin(\phi_h-\phi_S)\left(F_{UT,T}^{\sin(\phi_h-\phi_S)} + \varepsilon F_{UT,L}^{\sin(\phi_h-\phi_S)}\right)\right.$$

$$+\,\varepsilon\sin(\phi_h+\phi_S)\,F_{UT}^{\sin(\phi_h+\phi_S)} + \varepsilon\sin(3\phi_h-\phi_S)\,F_{UT}^{\sin(3\phi_h-\phi_S)}$$

$$+\,\sqrt{2\,\varepsilon(1+\varepsilon)}\,\sin\phi_S\,F_{UT}^{\sin\phi_S} + \sqrt{2\,\varepsilon(1+\varepsilon)}\,\sin(2\phi_h-\phi_S)\,F_{UT}^{\sin(2\phi_h-\phi_S)}\Bigg]$$

$$+\,|\boldsymbol{S}_{\perp}|\lambda_e\left[\sqrt{1-\varepsilon^2}\,\cos(\phi_h-\phi_S)\,F_{LT}^{\cos(\phi_h-\phi_S)} + \sqrt{2\,\varepsilon(1-\varepsilon)}\,\cos\phi_S\,F_{LT}^{\cos\phi_S}\right.$$

$$\left.+\,\sqrt{2\,\varepsilon(1-\varepsilon)}\,\cos(2\phi_h-\phi_S)\,F_{LT}^{\cos(2\phi_h-\phi_S)}\right]\Bigg\},$$

discussion round on

TMD Monte Carlo for future analyses

- HERMES (weighted asymmetries... ?, new 2h results)

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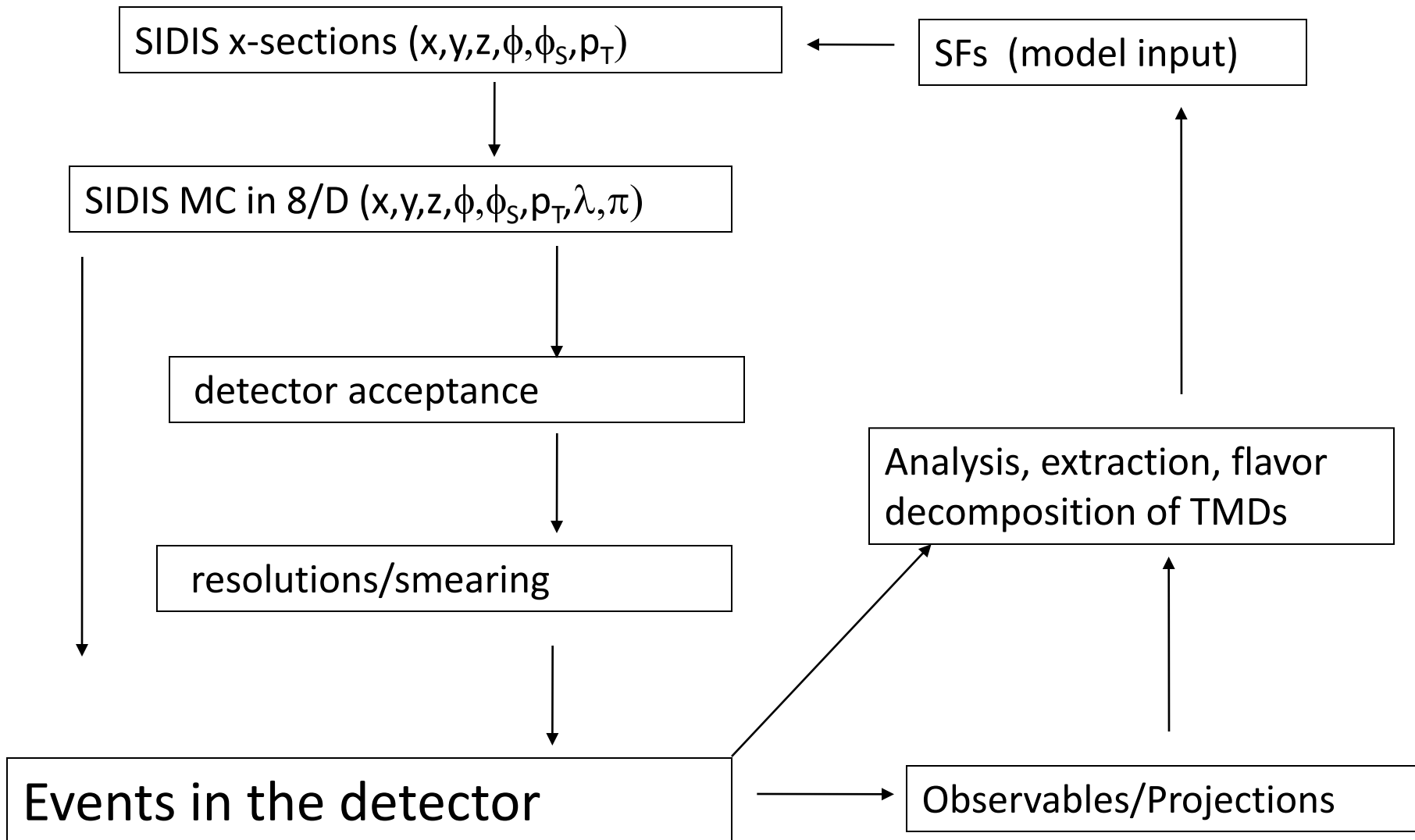- EIC, (DY experiments), ...
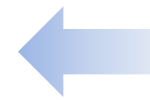
join the efforts !

- ➤ develop & test analysis chain & extraction method (fitting method, 1 vs nD analysis,...)
- ➤ estimate detector effects & possibly correct for (smearing, acceptance, ...)

- ➤ study sensitivity of observable to details of the underlaying model, parametrisations, assumptions
- ➤ same for phenomenologists: study extraction method, sensitivity to certain parameters, assumption ...
- ➤ global analyses
- ➤ projections for new measurements, standards of projections
- ➤ ....

Generators & FAST-MC

SIDIS x-sections (x,y,z,ϕ,ϕ_S,p_T) ← SFs (model input)

↓

SIDIS MC in 8/D $(x,y,z,\phi,\phi_S,p_T,\lambda,\pi)$

detector acceptance

resolutions/smearing

Events in the detector → Observables/Projections

Analysis, extraction, flavor decomposition of TMDs

Generators & FAST-MC → what to choose & how to proceed

SIDIS x-sections $(x, y, z, \phi, \phi_S, p_T)$ ⟵ SFs (model input)
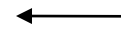
- *dedicated* generators

  - gmc_trans, TMDgen ... by Hermes

  - fast-MC ... by Clas
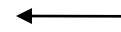
  - ...

  - NJLjet ... by MBCT

- *multipurpose (full)* generators

  - Pythia

  - Lepto

Generators & FAST-MC → what to choose & how to proceed

| SIDIS x-sections (x,y,z,ϕ,ϕ_S,p_T) | ← | SFs (model input) |

- **dedicated generators**

  - gmc_trans, TMDgen ... by Hermes

  - fast-MC ... by Clas

  - ...

  - NJLjet ... by MBCT →

  - 1 (and 2) hadr prod
  - flexible input
  - no rad corrections

  - multiple fragm
  - *specific model*
  - no rad corrections

- **multipurpose (full) generators**

  - Pythia

  - Lepto

  - many physics channels, sophisticated fragm.
  - rad corrections
  - no TMDs → but see Luciano's/Paul's 'polarized pythia'

  flexible enough for detailed TMD studies ?

Generators & FAST-MC → what to choose & how to proceed

SIDIS x-sections $(x, y, z, \phi, \phi_S, p_T)$ ← SFs (model input)

- *dedicated* generators

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  - NJLjet ... by MBCT →

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    • many physics channels, sophisticated fragm.
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    flexible enough for detailed TMD studies ?

NEED BOTH: → e.g. background and general acceptance studies with pythia/lepto

→ underlaying TMD physics: need TMD MC

discussion round on

TMD Monte Carlo for future analyses

→ see also summary of Harut's talk this morning – here some points for discussion, feel free to add more ! :

➢ develop a realistic/full TMD Monte Carlo

... seems too ambitious both technically and because of missing knowledge about most of the SF involved

→ go with 'polarized' pyhtia or similar approach for studies where full physics environment is needed

➢ continue development of dedicated TMD MC for 1 & 2 hadron production

▪ should we choose one of the existing ones and develop further in collaboration or go on individually ?

▪ *include rad corrections* (radgen/new 'radgen')

▪ input interface could be linked to TMD library (see next point)

➢ compile & maintain library for TMD PDF&FF models & parametrisations

→ create a collaboration of young motivated theorists & experimentalists

Alessandro, Alexei, Luciano, Silvia ... and Harut as honour member ;-)